Setting up a system for monitoring the contamination of ground and groundwater in inhabited areas near the brownfield site

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Impact of former chemical plant on inhabitants

About „Zachem”

Assessment of Environemntal conditions

Monitoring system

Conceptual site model

Risk assessment

Guidelines

- ✓ stakeholders meetings - Regional expert group
- ✓ local trainings
- ✓ geo-information tool

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GENERAL DESCRITION OF THE ‚ZACHEM'

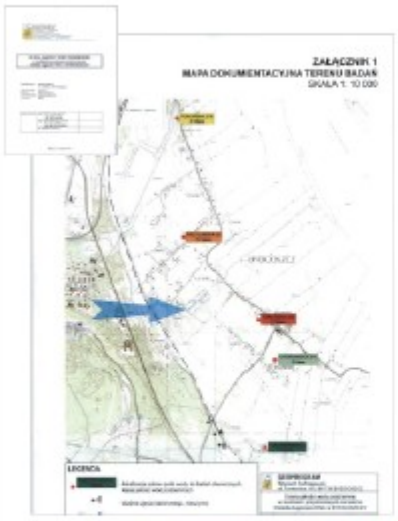
HISTORICAL BACKGROUND OF THE ‚ZACHEM'

CURRENT STATE OF THE ENVIRONMENT

COMPARISON OF ENVIRONMENTAL RESEARCH

POLLUTANTS

REAL THREAT TO LIFE AND HEALTH



ŁĘGNOWO

ŁĘGNOWO I

founded in 1954
1 985 inhabitants

ŁĘGNOWO II

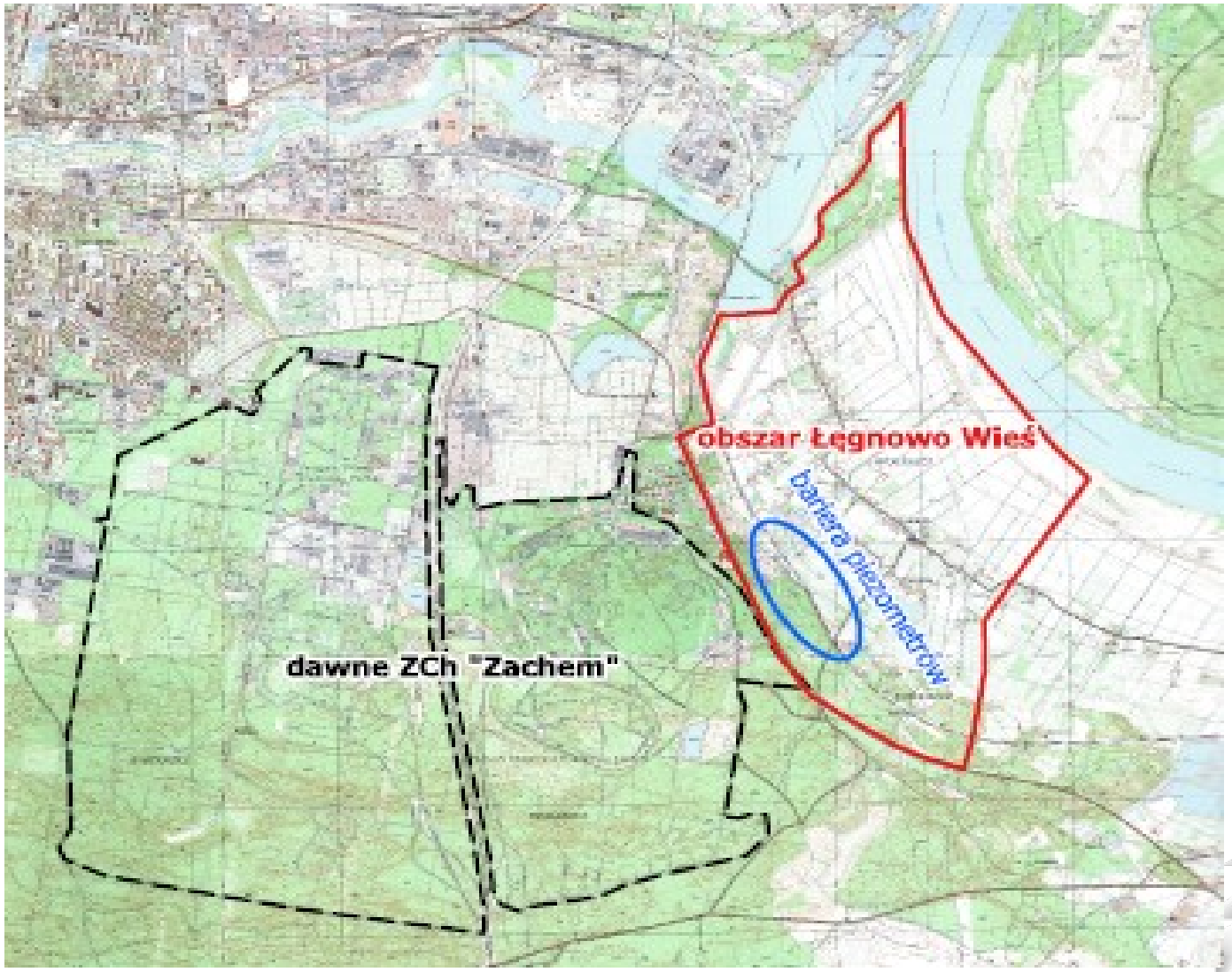
founded in 1977
814 inhabitants

STRONG CONTAMINATION OF SHALLOW GROUNDWATER:

Total organic carbon (TOC): **32,6 mg/dm^3**
Organic compounds: phenol, anilinae, Toluidine, phenanthrene (PAHs)




Obrazy z prezentacji p. dr Doroty Pietrucin z dnia 5.08.2017r.


obszar Łęgnowo Wieś
bariera piezometrów
dawne ZCh "Zachem"

http://bydgoszcz.wyborcza.pl/bydgoszcz/1,48722,18283193,Duze_ulatwienia__Miasto_przejmuje_drogi_na_terenie.html

BACKGROUND & CHALLENGES FACED

Pilot area

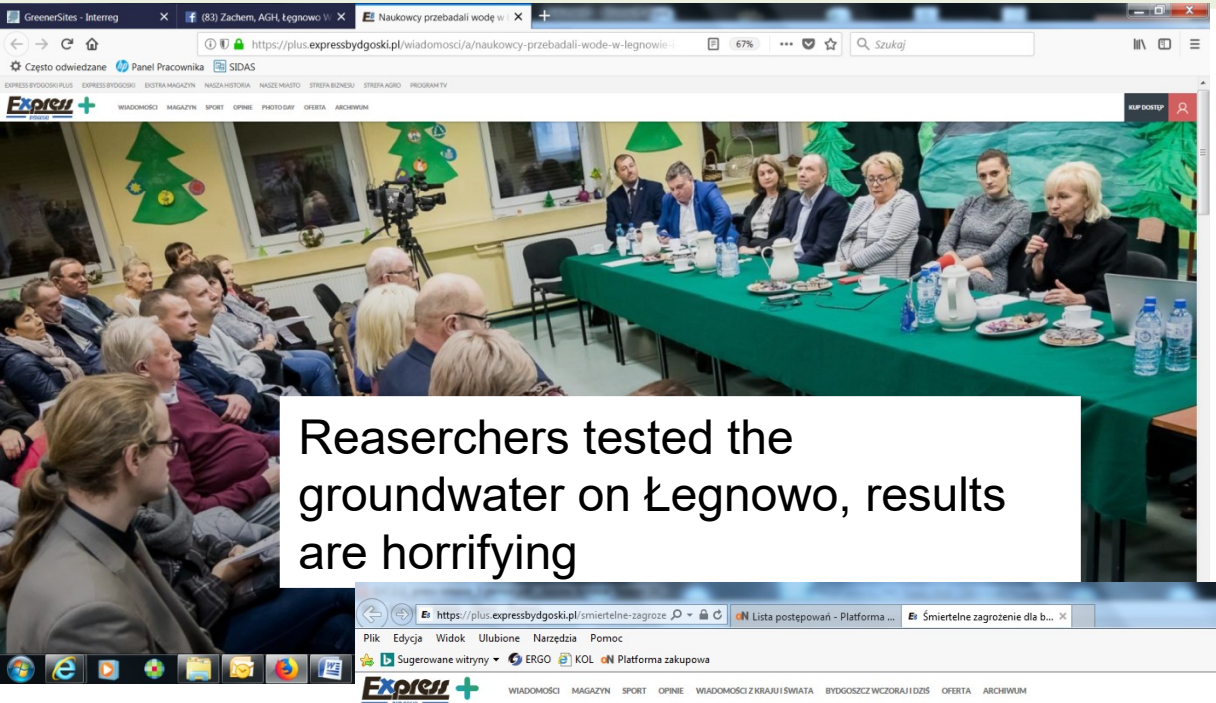
- Large accumulation of objects posing a potential threat to the environment or causing its degradation.

- Highly toxic substances getting into the soil and water causing its strong contamination.

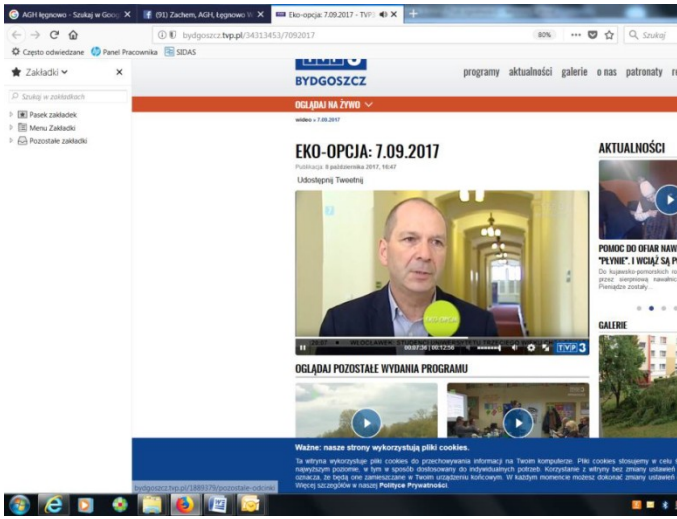
- The current state of environmental pollution is difficult to reliably determine due to the defective existing monitoring system.

- The long-term emission of pollutants to the environment, as well as the lack of actions preventing their migration, have caused that highly toxic, carcinogenic and mutagenic pollutants move outside the premises of Zakłady Chemiczne "Zachem" to inhabited areas (Łęgnowo and Plątnowo settlements), causing health hazards to residents due to shallowing

Media



Reaserchers tested the groundwater on Łegnowo, results are horrifying



Deadly danger for Bydgoszcz citizens

INVOLVEMENT OF STAKEHOLDERS
Associated partners

RDOŚ Regional Directorate of Environmental Protection,
WIOŚ Regional Inspectorate for Environmental Protection,
SANEPID District Sanitary and Epidemiological Station,
MWIK Municipal Waterworks,
AGH University,
Inhabitants of Łęgnowo.

Regional expert group
local meetings and exchange of information and documents which are necessary for the proper design of the monitoring system

City Council - monthly presentations

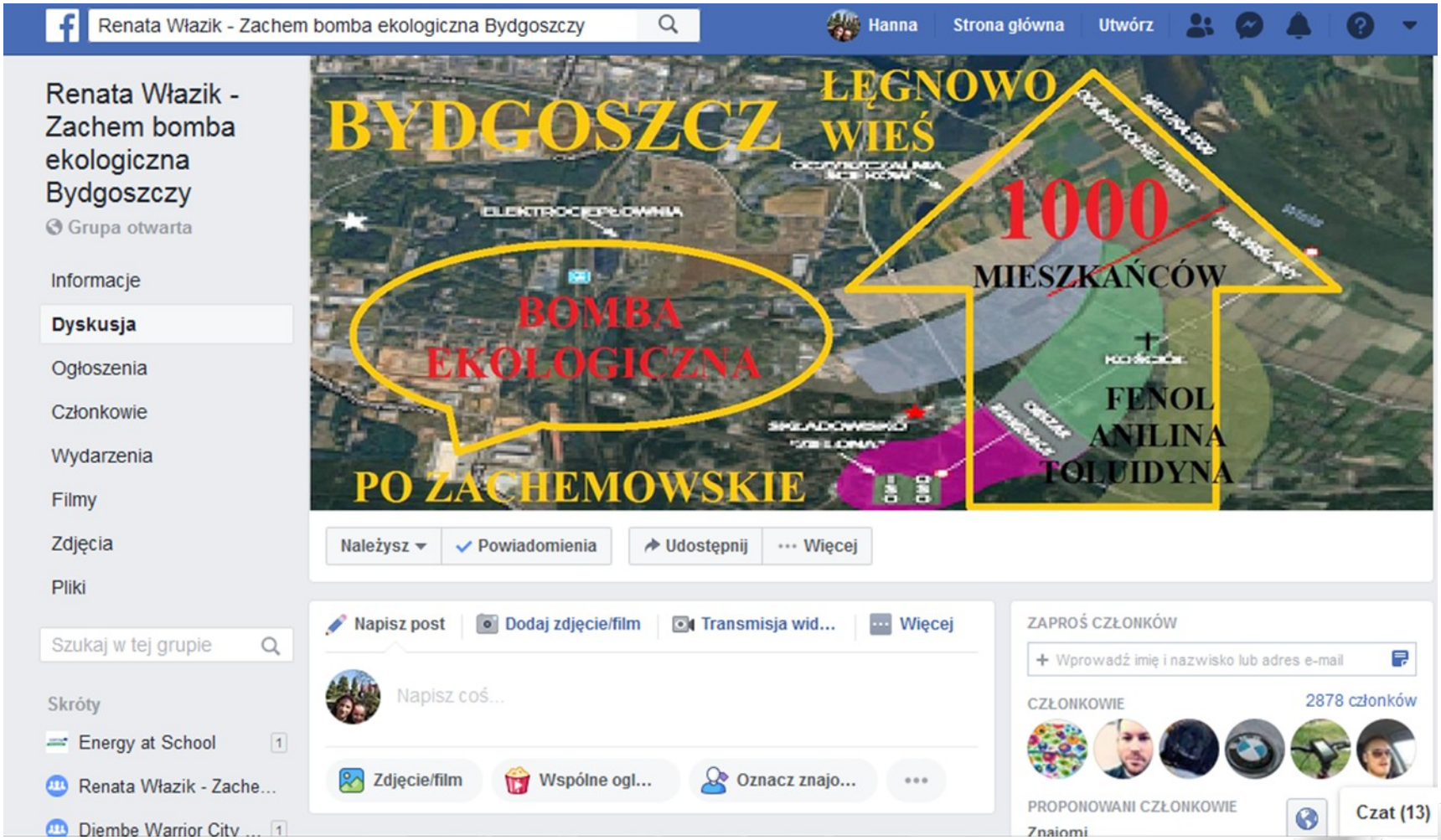
Meetings with inhabitants (organised by AGH UNI and RDOŚ)

Participation of stakeholders and AI in transnational training in Bydgoszcz

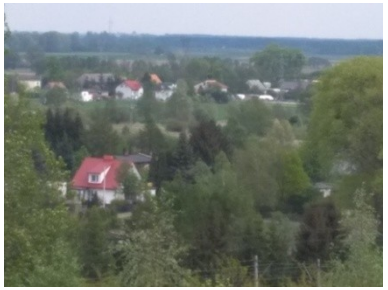
Participation of stakeholders and AI in local training

Participation of AI in study visits

Social involvement



Pilot activities



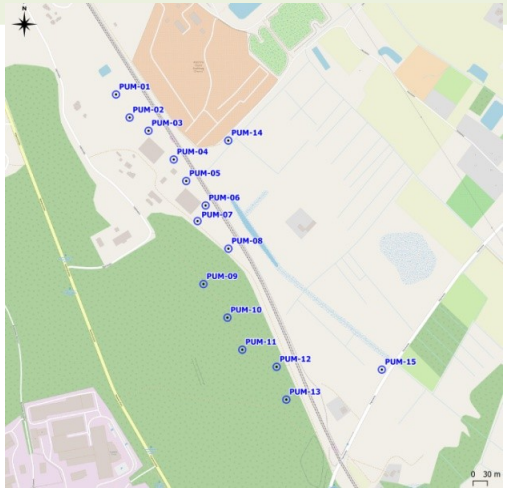
Env. Conditions - INVENTORY

51 individual individual wells and 20 piezometers within the Łęgnowo Wieś estate and its neighborhood, including the determination of location coordinates, measurements of technical parameters of piezometers, groundwater field measurements and conducting surveys in the field of usability of wells

44 monitoring wells in the field (piezometers and inactive wells) located in the area covered by the activities of the former Chemical Production Facility "Zachem", including the determination of location coordinates, measurements of technical parameters of piezometers and ground field measurements of groundwater,

18 analysis of groundwater from

New Piezometers



15 new piezometers 7,5 – 18 m

15 ground water probes and laboratory analysis for substances characteristic for Zachem

compared to 3 national regulations: for the groundwater, for potable water, waste water entering the ground

All samples were qualified as IV calss of water (not safiisfactory quality)

Specific substances were compared to *EPA's Regional Screening Levels i Dutch Target and Intervention Values.*

Extremely high concentrations were reported in relation to nitrobenzene, hydroxybiphenyl and toluenediamine, in 2 piezometers concentration exceeded over 1 up to 7 thousand times the admissible values.
Very high concentrations were exhibited by aniline (300-fold exceedances in 1 piezometer) and toluidine (500-fold in 2 piezometers)
Non samples met condition for potable water
In one piezometr the water exceeds 4000 norm for **naftalen**

Ground samples tests showed no contamination

Hydrogeological modelling

- 128 hydrogeological boreholes were inventoried, obtained and used, including In total : 83 piezometers, 33 deep wells and 12 dug (farm) wells.
- On the basis of the analysis of archival materials, 8 main groundwater pollution were identified, which were subject to further analysis using a numerical model, including inorganic compounds: **sulphates** and **chlorides** and organic ones: **phenol**, **aniline**, **toluidine**, **toluenediamine**, **chloroaniline** and **nitrobenzene**.
- Numerical studies on pollutants migration for particular substances were documented on numerous graphical annexes (60 Figures), for particular time steps (+25 years for sulphates and chlorides and +50 years for organic compounds).
- 2 scenarios were prepared for the case with no further contamination flow and with constant contamination input
- area of contaminated groundwater, in particular with organic compounds from the former chemical plant "Zachem", will gradually expand towards the built-up areas of Łęgnowo, causing the progressive degradation of groundwater.

Outbreaks of pollution

LEGEND:
- area of the active model
- area of the inactive model
- location of the outbreaks of pollution RDOŚ
- registration districts

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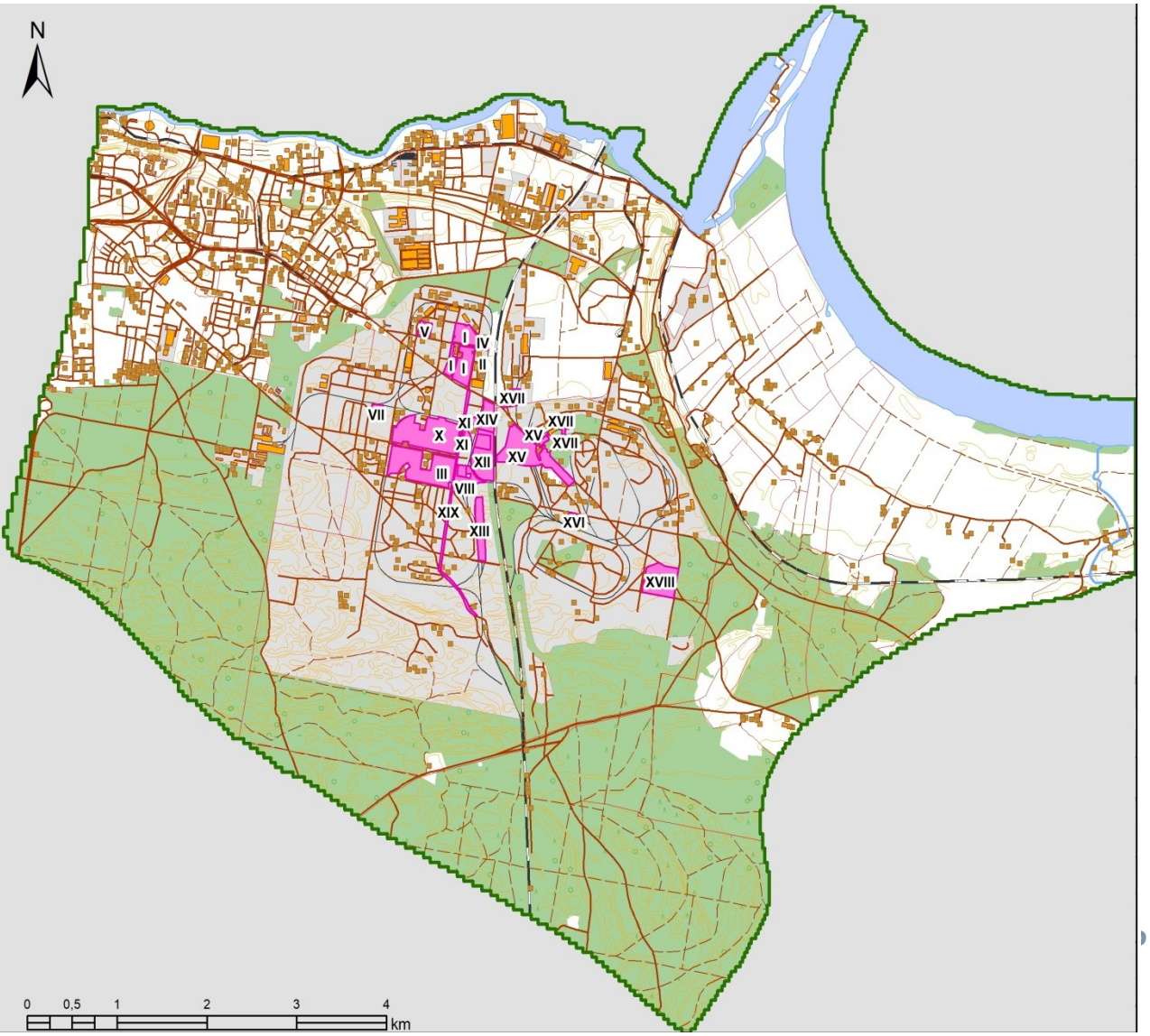
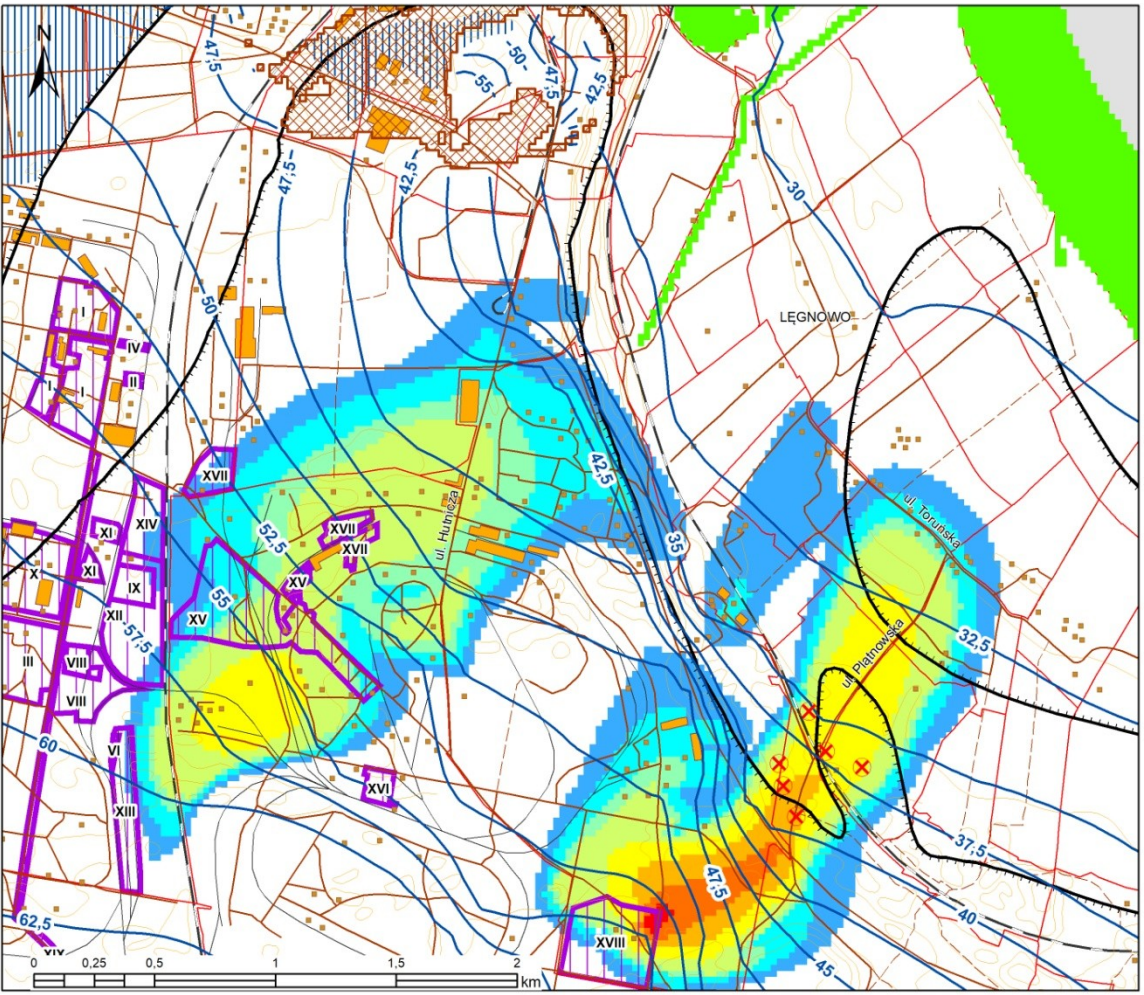


Sources of contamination

- **I** Colouring Plant
- **II** Dye waste pit
- **III** Pressure Gauge Complex Installation
- **IV** Cooling central
- **V** PURINOVA area (formerT-7300)
- **VI** TDI tar extinguishing site - former graveyard
- **VII** Brine electrolysis area, brine reservoirs
- **VIII** Propylene warehouse
- **IX** EC ash and slag landfill
- **X** contaminated siteTDI/TDA
- **XI** EPI (epichloridine) installation area
- **XII** SOE - epichloridine sedimentary pond
- **XIII** storage area in Lisia Street
- **XIV** CSN (Central Neutralisation Station)
- **XV** Area of three aniline sludge storages (pits)
- **XVI** Area of Dinitrotoluene DNT installation
- **XVII** Area of the "old boiler house"
- **XVII I** Landfill complex in Zielona/Elektryczna
- **XIX** Brine pipeline route

Results of pollutant migration simulation



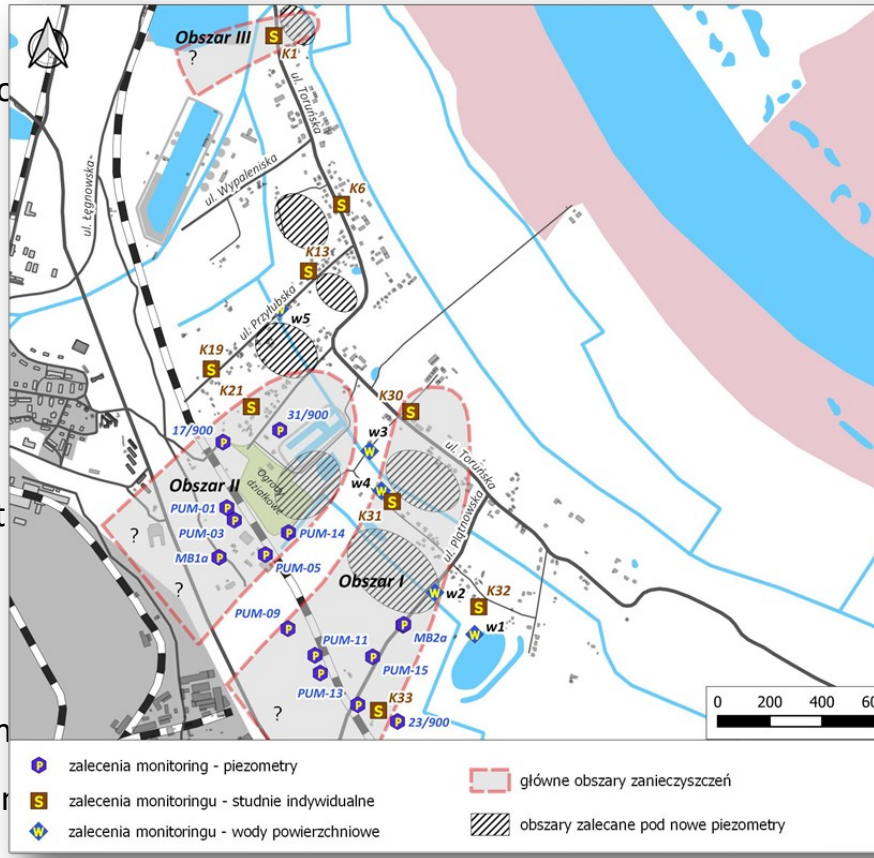
Phenols
time +10 years
2nd Scenario

Spatial distribution of phenols concentration (mg/L), transport mass simulation in the MT3D DMS package

- 10 - 50
- 1 - 10
- 0,1 - 1
- 0,05 - 0,1
- 0,01 - 0,05
- 0,001 - 0,01

Guidelines for monitoring

- Proposals for the designation of areas in the residential areas c the Łęgnowa Wieś estate, which due to the current state of knowledge should be covered by groundwater monitoring
- specification of the type and quantity of samples that are proposed to be adopted as part of the monitoring
- sampling methodology
- the proposed scope of analysis for soil and water environment monitoring
- frequency of sampling for analysis,
- presentation of monitoring results, including information on th possibility of monitoring data integration in the geoinformatior tool
- estimated cost of planned monitoring tests



Development of the monitoring system and adaptation of observation points

- 14 boreholes, 10 and 25 m
- Maintenance and adaptation of observation points to start monitoring (including piezometer protection, arrangements regarding the possibility of using piezometers and wells for monitoring purposes)

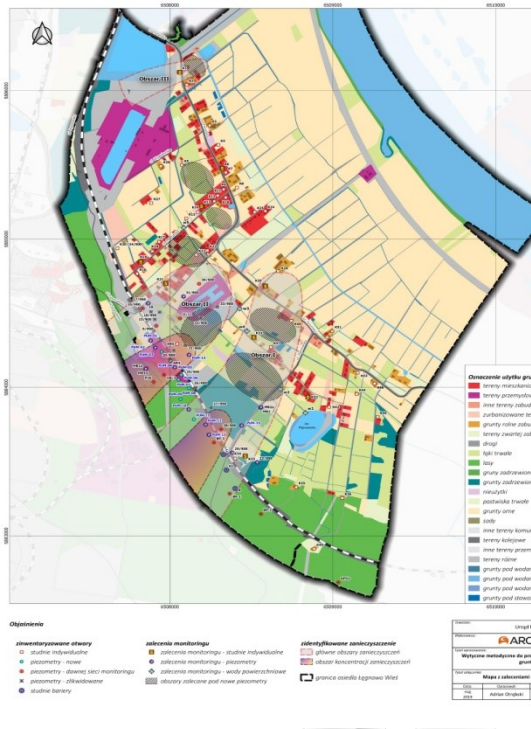
Implementation of monitoring

- Monitoring of groundwater in piezometers and existing wells, household wells and surface waters - including sampling and labolatory tests 41 points for groundwater in observation holes (28 analyzes)
- for groundwater water in farm wells (9 analyzes) for surface water (4 analyzes)

Reporting on monitoring works

- Completion of 3 quarterly reports and 1 annual report on monitoring - report preparation time

The cost of implementation of all work related to the preparation, development and implementation of monitoring the annual cycle is estimated at PLN 749 316.00 gross, c.a 200 000 EUR



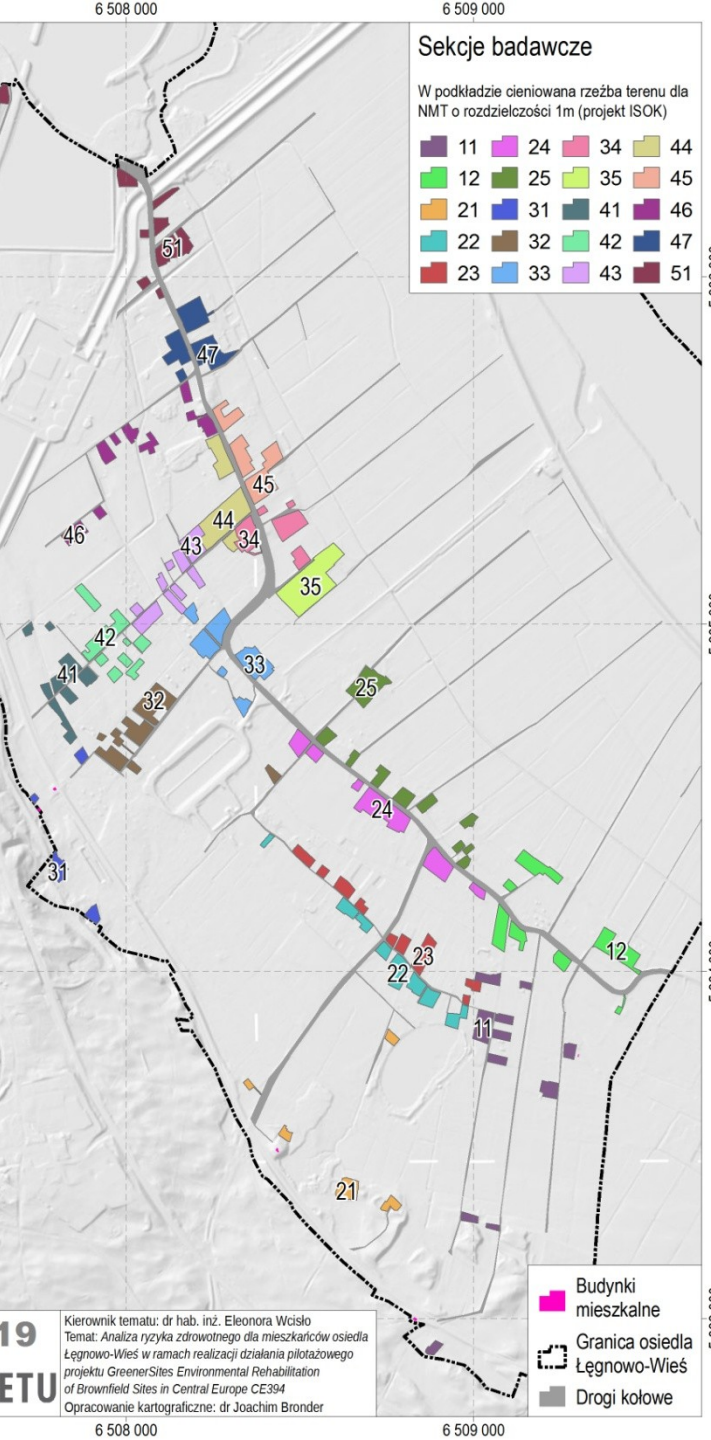
Ground tests on Łęgnowo -Wieś

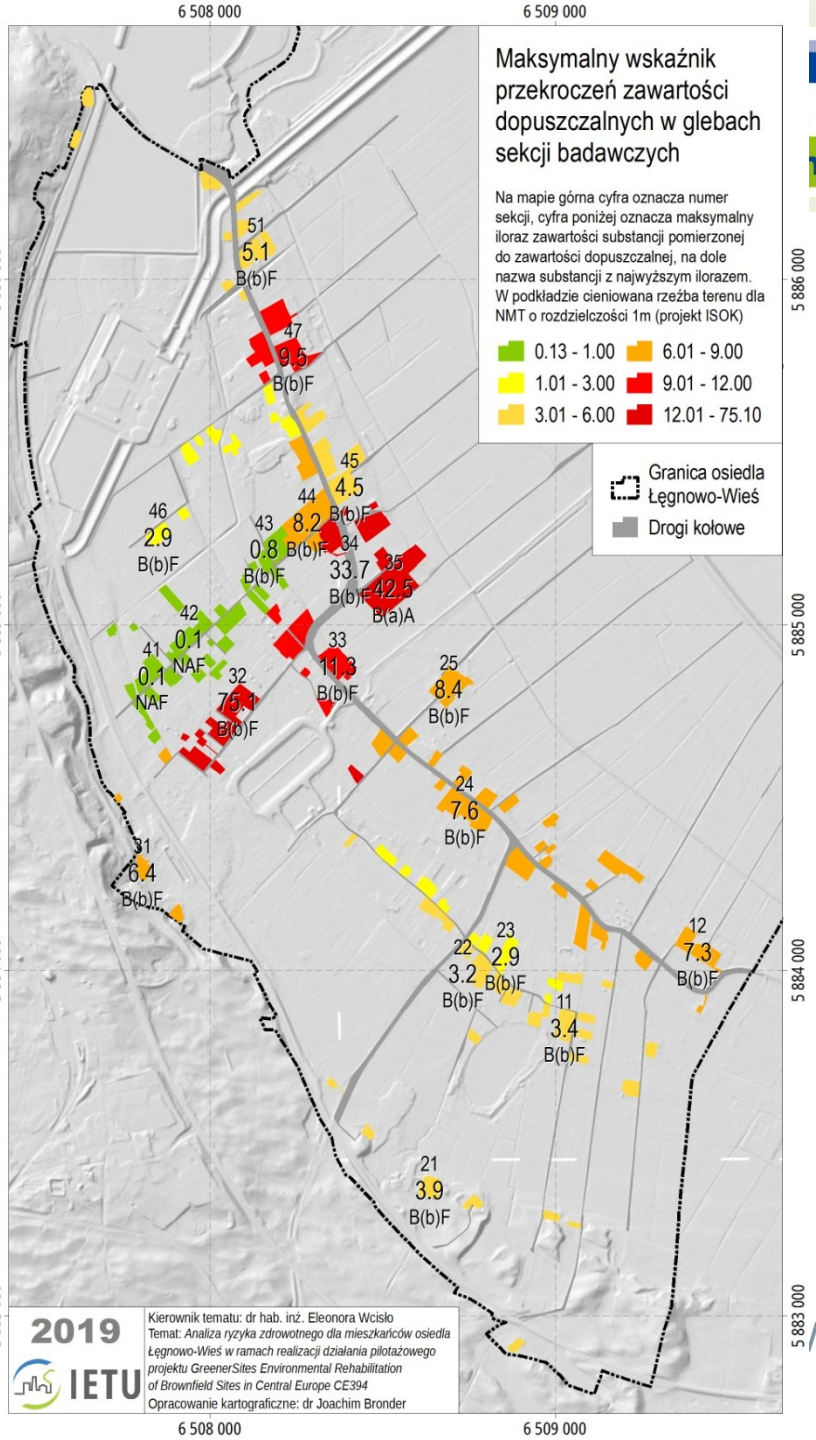
43 soil samples were transferred to laboratory analyzes, of which 26 surface samples (0.0-0.25 m.p.p.) and 17 samples from depth below 0.25 m.p.p.
The presence of the test substances in the soil characteristic of the production of old Zachem was not established - the obtained results show values below the method's determination.

Range of physicochemical analyzes performed: PAH, phenol, metals, 2-chlorophenol, toluene, aniline, chloroaniline, toluidine, 2-phenylphenol (hydroxybiphenyl), ethylene glycol, diphenylsulfone; nitrobenzene, dinitrotoluene (mixture of 2,4 / 2,6-), o-nitrotoluene; epichlorohydrin, toluenediamine (TDA), toluene diisocyanate (TDI), granulometric composition (total organic carbon, air porosity of the soil, soil water porosity, soil bulk density).

In the majority of sections in the soil layer, the permissible content of substances causing a risk to polycyclic aromatic hydrocarbons (PAHs) is noticed. The highest values for PAH in the surface layer are recorded in 3 sections.

The occurrence of polycyclic aromatic hydrocarbons in the soil may result from the proximity of the road or low emission (burning with coal) within the estate.





- 31,1 ha
- 20 sections
- more than 400 single samples

OGŁOSZENIA

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GREENERSITES REHABILITACJA TERENÓW POPRZEMYSŁOWYCH W EUROPIE ŚRODKOWEJ

Projekt GreenerSites jest międzynarodowym projektem finansowanym z Europejskiego Funduszu Rozwoju Regionalnego, w którym udział bierze 11 partnerów, w tym Miasto Bydgoszcz.

Głównym celem projektu jest poprawa zarządzania niewykorzystanymi terenami poprzemysłowymi. Planowane działania pilotażowe w Bydgoszczy polegają na badaniu wpływu terenu zdegradowanego (byłych Zakładów Chemicznych ZACHEM w Bydgoszczy) na tereny sąsiadujące (LEGNOWO WIEŚ) poprzez wykonanie monitoringu środowiskowego, oceny ryzyka zdrowotnego oraz modelu hydrogeologicznego terenu.

286 860 Euro — budżet Miasta Bydgoszczy
243 831 Euro — dofinansowanie unijne z funduszu EFRR
06.2016 - 07.2019 — termin realizacji projektu

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Strona programu Interreg Central Europe www.interreg-central.eu
Strona programu Europa Środkowa www.europasrodkowa.gov.pl

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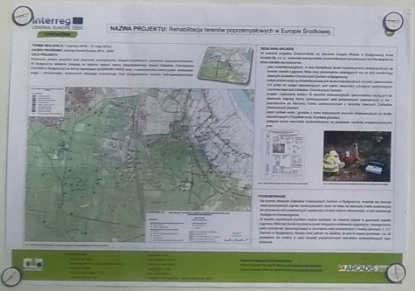

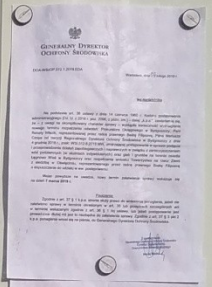
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