

Annales Universitatis Paedagogicae Cracoviensis

Studia de Securitate 12(2) (2022)

ISSN 2657-8549

DOI 10.24917/26578549.12.2.2

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Water pollution in national and internal security

Zanieczyszczenie wody w bezpieczeństwie narodowym i wewnętrznym

Abstrakt

Bezpieczeństwo narodowe i wewnętrzne zależą od zaopatrzenia w wodę. Bez wody przemysł, rolnictwo, wojsko, instytucje bezpieczeństwa publicznego i ludność nie mogą funkcjonować. Ryzyko środowiskowe (określane również jako ryzyko ekologiczne) wynikające z zanieczyszczenia wód stanowi zagrożenie dla zdrowia, środowiska i gospodarki. Największy udział w zanieczyszczeniu wód ma działalność antropogeniczna, w tym rozwój przemysłu, intensyfikacja rolnictwa i hodowli zwierząt, ścieki komunalne, osuszanie bagien i składowisk odpadów. Przeciwdziałanie tym zagrożeniom powinno stanowić szczególny priorytet w dziedzinie bezpieczeństwa narodowego i wewnętrznego. W bezpieczeństwie środowiskowym jednym z głównych działań jest ochrona wód przed zanieczyszczeniem.

Słowa kluczowe: bezpieczeństwo narodowe, bezpieczeństwo wewnętrzne, bezpieczeństwo środowiskowe (ekologiczne), zanieczyszczenie wód

Abstract

National and internal security depends on the water supply. Without water, industry, agriculture, the military, public safety institutions and the population cannot function. The environmental risk (also referred to as ecological risk) from water pollution is a threat to health, the environment and the economy. The largest contributors to water pollution are anthropogenic activities, including industrial development, intensification of agriculture and livestock farming, domestic sewage, drainage of swamps and landfills. Counteracting these threats should constitute a special priority in the field of national and internal security. In environmental safety, the protection of water against pollution is one of the main activities.

Keywords: national security, internal security, environmental (ecological) security, water pollution

Admission

In the environmental safety policy, water protection is the entirety of policies, strategies and activities aimed at the sustainable management of fresh water resources. The aim is to protect the hydrosphere to meet present and future water needs.

National security depends as much on the energy produced as it does on the water supply. Without energy and water, industry, agriculture, the military, public safety institutions and the population cannot function. Agriculture and industry produce for the needs of the civil market and the country's defence. Both of these sectors of the economy require increasing amounts of clean water. Disruptions in delivery or deterioration of its purity may significantly affect national security. This is due to inappropriate human activity. The lack of water and its pollution pose an environmental threat to life, health and the sustainability of public order.

Poland is one of the poorest countries in Europe in terms of water. In the years 1946-2018, the average annual water resources per capita in Poland was 1,800 m³, and for Europe - 5,000 m³. In the years with lower rainfall, the average for Poland drops to 1,100 m³. The threshold of 1700 m³ is the limit of "water stress", a risk of water deficit. The average value of total precipitation for Poland is approx. 193-196 km³, half of which evaporates (Borek, 2020).

Water pollution can be surface (rivers, lakes, estuaries) or ground (underground). They are caused by substances rendering them unsuitable for food and industrial use (Water pollution, 2013). Water pollution is one of the major global environmental problems as it can lead to the degradation of aquatic ecosystems.

The sources of water pollution are of natural or artificial origin. Natural ones are caused by the presence of salt solutions, gases, organic substances and microorganisms in the water. Artificial (anthropogenic) include petroleum substances, fertilizers, chemical pesticides, dyes, chlorides, pesticides and farm waste: manure, slurry. There are also mentioned: nitrogen, lead, mercury, nitrates, phosphates, sulphur (Ibidem). Due to the durability of pollutants, they are divided into decomposable, non-degradable and permanent. They can be harmful both directly and indirectly.

Wastewater discharged from industrial and municipal sewage systems is an important factor in water degradation in environmental safety. They are point pollutants, including waters used in industry and services. They are characterized by a high concentration and an organized method of discharge. The second group consists of diffuse pollutants, rinsed from agricultural and forest areas (fertilizers and pesticides, plant protection chemicals, manure and slurry) and municipal landfills. Water pollution from strip sources comes from communication routes and means of transport (lead compounds from exhaust gases and pollutants washed from roads).

Groundwater pollution

In terms of environmental safety, the greatest threat to groundwater is industrial and agricultural pollution. They occur when impurities are released into the ground and enter the aquifer. These pollutants, as well as sewage washed out from landfills and septic systems, enter the aquifer, making it dangerous for people. Removing pollutants from groundwater is difficult or impossible, and costly. Once polluted, an aquifer can be unusable for decades or even centuries. Contaminated groundwater spreads contamination far from its original source of pollution, penetrating

the hydrographic network (Michael, 2014). The use of contaminated groundwater poses a health risk through poisoning or the spread of disease.

The state of water purity in Poland is unsatisfactory (*Zanieczyszczenia wód w Polsce*, 2020). In Poland, there is a high degree of water pollution, which results in water deficit and unfit for consumption. The most polluted area is the Silesian Upland, which is mainly related to industrial activities. The assessment of the purity of water in Poland carried out in 2019 showed that the poor condition of water occurs in 91.5% of river surface water bodies, 88.1% of lake surface water bodies and 100% of transitional and coastal surface water bodies (GIOŚ, 2020). The most important environmental threats caused by water pollution:

- health threat,
- danger of damage to the environment,
- threat to the economy,

All these types of threats pose a particular threat to national and internal security. In environmental safety, the protection of waters against pollution is one of the top priorities.

Health threat

Virtually any water pollution is harmful to human life and other living organisms. The effects may appear immediately or over time. Water pollution affects health in several ways:

- industrial waste often contains toxic compounds that are harmful to the health of aquatic organisms and their consumers (e.g. humans),
- acid rain sulphates are harmful to living organisms in fresh and salt waters, they cause their mortality,
- heavy metals from industrial processes accumulate in watercourses and water reservoirs. They are toxic to aquatic flora and fauna and their consumers. They slow down development, cause birth defects, some of them are carcinogenic,
- microbial contamination from wastewater causes infectious diseases. They infect aquatic and terrestrial organisms through drinking water,
- biogenic elements (nutrients) getting into watercourses and reservoirs cause trophy (water fertility). This phenomenon is called water eutrophication. Phosphorus (including detergents) comes from wastewater discharges and the intensification of fertilization and the increase in soil erosion, mainly caused by deforestation. Nitrogen comes from the increasing emission of nitrogen oxides to the atmosphere and occurs in rainfall. Also, the fertilization of land in agriculture leads to an increase in its quantity. Rainfall leaches nutrients from the soil and flushes them into the waters. Eutrophication causes disturbances in aquatic ecosystems and even the disappearance of organic life (*Eutrofizacja*, 2012).

All these factors constitute a significant threat to national and internal security. They have an impact on the health of soldiers, civilian workers employed in the military sector and working in public security institutions. One should also remember about civilians employed in the strictly defence industry and partially working for the defence of the country. You can go for a long time without food, and not without

water. The military must have access to clean water for food. When the water is polluted, the armed forces are unable to function properly. In the event of mobilization, also the civilian population is drafted into the ranks of the army. A healthy one will ensure its proper functioning, having health problems resulting from consuming contaminated water will only worsen the crisis situation.

Danger of damage to the environment

Each water pollution affects the environmental safety and poses an environmental threat:

- the problem for the pollution of the aquatic environment is its acidification. The phenomenon of natural acidification of water is intensified by anthropogenic acidification,

- eutrophication resulting from anthropogenic activities. Its negative effects affect the condition of the ecosystems of watercourses and reservoirs and their edges. Eutrophication occurs on most lakes and rivers in Poland (*Zanieczyszczenie wód*, 2018),

- the water environment is negatively affected by its alkalization. It manifests itself in the form of an increase in the alkaline pH of the water, taking place through biochemical and chemical changes,

- water pollution with toxic metals. Their sources are natural (e.g. rock weathering, volcanic eruptions, forest fires) and anthropogenic (industry, communication),

- thermification – pollutants related to the inflow of heated water in amounts disturbing the thermal balance of the ecosystem,

- the supply of substances in the form of suspensions and slurries. They are allochthonous (transit) or autochthonous (local). These pollutants are manifested in the form of water turbidity and cause, among others, changing their exposure,

- the extreme pollution of the aquatic environment is the discharge of sewage and storage of waste within and/or in the vicinity of reservoirs. The consequence is damage to the environment of surface and ground waters.

The environmental threat is currently one of the greatest threats to national and internal security. One of its components is water pollution. Water, along with oxygen and solar energy, the basic element of life on Earth, is increasingly polluted for anthropogenic reasons. A polluted environment has a negative impact on various manifestations of human activity, starting from the basis of food, i.e. agriculture, through the healthy functioning of society, to the defence of the country. Polluted water damages the environment to a greater or lesser extent. The contaminated environment becomes hostile to humans and adversely affects the entire life cycle, significantly weakening and shortening it.

Threat to the economy

Water pollution poses a significant threat to the economy:

- little or no polluted water is suitable for industrial purposes,

- the amount of harmful substances in the water is harmful to the needs of agriculture and breeding (Solan, Dmoch, 2009, pp. 327–329),

- water pollution has a negative impact on forest management,
- runoff of polluted inland waters into coastal waters and seas causes losses and prevents fishing.

In the case of the impact of water pollution in the economy, costs related to the need to purify water and prevent contamination should also be taken into account.

Virtually all sectors of the economy work for the security of the state, directly or indirectly. Some industries produce directly for the needs of the military sector, others provide it with products or semi-finished products. Agriculture and breeding provide the military and public safety institutions with essential food. A polluted water network has a negative impact on the economy and the agricultural sector. The country's defence industry is at risk, as is the human factor.

Anthropogenic water pollution

As already mentioned, water pollution can be natural or anthropogenic. Natural ones have existed for millions of years and did not pose a major threat to the natural environment. Nature has developed effective forms of defence and counteracting. Since the times of the industrial revolution, more and more anthropogenic water pollution has been observed on a global scale. Nature is unable to defend itself, the scale of destruction is getting bigger and faster. Most of the anthropogenic water pollutants are alien to the natural environment. It has not yet developed natural forms of defence. The main anthropogenic factors of water pollution include:

- industrial development,
- intensification of agriculture and breeding,
- domestic sewage,
- drainage of swamps,
- landfills.

Industrial development

Water in industry is used in open or closed circulation, in the form of raw, process or secondary water. Raw water is taken from municipal water supplies, own intakes, deep water intakes or the hydrographic network. Rainwater is also obtained. Process (technological) water is water treated in order to obtain a product that meets the requirements of the installation and application. Secondary water is not treated, it is used where there are less stringent quality criteria. Treated sewage is also used for savings.

Industrial water pollution can be harmful indirectly, reducing the amount of oxygen in the water. Direct pollutants include phenols from coking plants and gas plants, sulphuric acid and sulphates produced in fertilizer factories, artificial fibres and pulp mills, moreover, hydrocyanic acid from gas plants. The most important industrial pollutants are detergents, heavy metals, pesticides, surfactants, cyclic hydrocarbons and phenols. Phenol is an especially dangerous contaminant for drinking water. The producers of these pollutants are practically all branches of industry, with the largest share of chemical, petrochemical, textile, pharmaceutical, mining and power plants. These pollutants enter surface waters directly via industrial

wastewater, field runoff or polluted rainfall (Progressio, 2019). Industry in Poland and other developed and developing countries needs more and more water. The processed water discharged into rivers is too often polluted and cannot be reused. On the one hand, this poses a threat to human health and, on the other hand, also to the arms industry and its partners.

Intensification of agriculture and breeding

The enlargement of agricultural and breeding areas with a simultaneous increase in temperature causes an increased demand for water for agricultural purposes (Mss, 2008, pp. 659–666).

In Poland, agriculture covers 60% of the earth's surface, consuming large amounts of water (*Ekspertyza*, 2012). It is an indispensable sector in the country's economy, also related to national security. In this situation, care for the renewal of water resources, their availability and quality is of key importance. The use of land for agriculture has a great impact on the water balance and the retention condition of the hydrographic network. The worsening problems with droughts and floods, both in Poland and in the world, are the result of, e.g. changes in water resources in rivers. About 70% of renewable water resources in Poland are used for agriculture (industry uses 20%, and 10% for municipal needs). The use of abstracted water is different: 70% is used by industry, 20% by municipal management and 10% by agriculture and forestry.

The pollutants from agriculture are mainly fertilizers and chemical plant protection products and slurry. Its use in fields and leakages from leaky septic tanks in farm bypasses cause an increase in nitrogen content and bacteriological contamination of groundwater (Chapin-Stuart, Matson, Vitousek, Chapin, 2011, p. 49).

The issue of water purity is of great importance for national security in the context of efficient and healthy agriculture. In Polish agriculture, there is an exceptionally high use of artificial fertilizers, pesticides and antibiotics. A common phenomenon is the excessive use of minerals. This causes the release of unfavourable nutrients (mainly phosphorus and nitrogen) to surface and ground waters. Water eutrophication occurs, algae blooms and cyanobacteria appear. In a short time, the water becomes rapidly depleted of oxygen. As a result, they become unfit for life, an ecological disaster occurs. Agricultural land, which was supposed to bring more and more abundant crops, may become inefficient due to water pollution. Agricultural production and market supplies will drop dramatically. The result may be empty warehouses and stores, social conflicts will arise, requiring the use of law enforcement forces and often the army. With the deteriorating supply of food, strategic stocks of food resources will be exposed, and supplies to the military sector and public security institutions will also be inadequate.

Domestic sewage

Domestic wastewater discharges used water from houses and apartments. Domestic wastewater is about 99.9% water, the rest, about 0.1%, contains a wide range of dissolved and suspended pollutants. Although they represent a very small fraction

by weight of the waste water, the nature of these pollutants and the large volumes of waste water discharged make the discharged domestic waste water a significant problem (Britannica, 2019).

Water pollution by household wastewater is mainly caused by flushing toilets, draining of kitchen and bathroom water contaminated with bacteria, viruses, washing and cleaning agents, including dirt and food debris. Remains of medicines are also important. For several years, preventing and treating domestic wastewater from polluting water has been one of the most important factors responsible for overall health in the United States. One of the elements of prevention is the creation of a sanitary sewage system.

Household sewage is the main source of pathogens (pathogenic microorganisms) and rotting organic substances. As pathogens are excreted in the faeces, all sewage from populated areas contains pathogens that pose a threat to public health. Another threat to the purity of the water is rotting organic matter. It is broken down in sewage by bacteria and other microorganisms. This leads to a reduction in the oxygen content of the water. Industrial water purification processes reduce pathogens, but do not completely eliminate them. Domestic wastewater is also a source of nitrates and phosphates, the excess of which in the water leads to its eutrophication (cultural eutrophication) (Britannica, 2022). There are 2.1 million sewage septic tanks in operation in Poland (the so-called cesspit). It is estimated that about 90% of them are leaky. Pollutants get into the environment, mainly into groundwater. On the one hand, the problem is the lack of ecological awareness in households, and on the other hand, the lack of effective and efficient economic and organizational solutions. Even houses located within the reach of the sewage network are often not connected to it, despite the existence of such an obligation (Rączka, Skąpski, Tyc, 2021, p. 16).

For decades, significant domestic water consumption has been observed in developed countries (e.g. toilets, washing machines, dishwashers, garden irrigation). Scientific research conducted in the USA has shown that the most effective method of limiting water consumption is not reduced ways of using it (e.g. shorter baths or showers), but modifying toilets and washing machines (De Oreo, Mayer, Martien, Hayden et al., 2011, pp. 45-46). Between 1960 and 2014, domestic water use increased by 600%, much faster than in other sectors (*Świat wody*, 2020). In Poland, until the 1990s, water consumption in households was increasing, then it showed a downward trend. This situation continued until 2013. In recent years, there has been a gradual reduction in water consumption in cities (Izba Gospodarcza, 2018). It is doubtful, however, whether it results from the awareness of environmental protection, it is more the result of impoverishment of the society. Unfortunately, there is too much contamination in the drainage water. The amount of various types of cleaning agents and other detergents has increased rapidly in recent years. The problem is the discharge of personal care and household chemicals. Plastic materials and waste in contact with water can degrade slowly releasing harmful compounds to human health and ecosystems. With the not fully effective network of water treatment plants in Poland, the flow of domestic pollutants affects the purity of our waters, significantly contributing to the environmental threat.

Draining the swamps

In environmental safety, marshes (wetlands) play an important role in the hydrological cycle. They regulate the flow of water and contribute to its purification. They also weaken the damaging effects of floods.

Both the catchment areas as well as swamps and wetlands in Poland have been strongly transformed anthropogenically and improperly drained. This, combined with heavy rains, prolonged periods of drought and inadequate hydrological activities, means that most of the water is irretrievably lost with surface runoff. Draining swamps and wetlands, in addition to threatening biodiversity, leads to an increase in greenhouse gas emissions and increases the risk of drought. The rivers are no longer able to cleanse themselves. The wetlands were natural water filters. With their disappearance, the self-cleaning process of the hydrographic network ends.

Many types of inland wetlands form a protection zone that cleans the water from nutrients flowing from agricultural areas to surface waters. Swamp plants and microorganisms filter out nutrients. They contribute to the improvement of water purity. In Poland and Europe, most of such areas have been destroyed. The rivers have been deprived of their most important water purification mechanism. The restored wetlands is extremely important for the environmental safety of the hydrographic network. Revitalizing degraded marsh ecosystems to act as buffer zones will contribute to reducing greenhouse gas emissions and the risk of flooding, mitigating the effects of climate change.

Landfills

One of the biggest problems with litter is water pollution, which can be catastrophic. The combination of precipitation and putrefactive processes causes leachate, the composition of which depends on the type of waste.

There are three types of storage dumps in Poland: unorganized (unsecured, polluting groundwater), semi-organized (using the isolation of the deposited waste from the ground, do not protect the environment against leachate emissions) and organized (having a special location and meeting technical requirements).

Chemical, biochemical and physical processes take place in the mass of stored waste. They create harmful substances and compounds (gaseous, liquid and solid) in high concentration. Rainwater, infiltrating the landfill, dissolves these substances and flows out in the form of a highly contaminated leachate. The effluent pollutes the soil and enters surface and ground waters. The contamination area is many times larger than the landfill area. The so-called "wild dumps", in Poland very numerous in rural areas. Apart from ordinary garbage, they are also thrown away from hazardous waste (cans with remains of paints and oils, used batteries, expired medicines, etc.). Due to the lack of any safeguards, these dumps pose a significant environmental threat. In Poland in the years 2009-2018, an average of almost 12.5 thousand jobs were liquidated. wild dumps annually (*Plaga dzikich wysypisk w Polsce*, 2020). The rinsed pollutants easily get into surface and ground waters, causing their contamination. The aforementioned factors cause runoff of sewage to surface and ground waters, which is extremely dangerous for the environment.

Wastewater is a mixture of used water and various types of substances (solid, liquid, gaseous, radioactive) and heat, removed from urban and rural areas. In Poland, sewage is the main source of water pollution. They are the result of practically every human activity. By origin, they are divided into:

- living, economic and urban, e.g. from service establishments, laundries, hospitals, and residential buildings. They pose a biological, epidemiological and hygienic threat;
- agricultural, they come mainly from the run-off of over-fertilized farmlands and breeding establishments. They work similarly to domestic wastewater;
- industrial, manufactured in processing and production processes, they are produced by almost every branch of industry (including fuel and energy, chemical, textile, mining, metallurgy, tanning, cellulose and food industries). They constitute more than half of the total amount of sewage;
- radioactive, from facilities using radioactive elements (medical facilities, scientific institutions);
- rainfall, they arise when washing and watering city streets, during melting snow and as a result of acid rain.

Landfills are a significant problem in environmental safety. This applies to both developed and developing countries. Unorganized and semi-organized landfills are the greatest threat to the purity of water. The pollutants washed away from them get into surface and ground waters. The hydrographic network becomes polluted, which seriously affects national security. The situation regarding landfills in Poland and their impact on environmental safety should be considered unsatisfactory.

Countermeasures

In order to reduce water pollution, use low-waste technologies, e.g. closed systems, improve methods of sewage and waste treatment: introduce biodegradation and photodegradation promoters as well as microfiltration. The rules on the free use of pesticides should be tightened. Sewage, waste and industrial by-products should be recycled. It is imperative to strengthen water pollution control through appropriate infrastructure and management. This should include industrial and agricultural wastewater treatment plants. Appropriate supervision of the municipal runoff must include a reduction in speed and quantity of flow. Water pollution requires ongoing evaluation and revision of water resource policy at all levels, from local to national. It is important to use new technologies that enable more effective protection of the environment, including water. A suitable undertaking is the restoration, that is, increasing the naturalness of regulated rivers.

It is very important for environmental, regional and national safety to maintain land cover with permanent vegetation (including forests, mid-field trees, green belts, permanent grasslands). The aim of water protection is to undertake hydrological activities based on nature, such an example is the restoration and creation of buffer zones. They are specific ecotones that constitute a natural border between two ecosystems, e.g. vegetation belts between agricultural land and water or wetland areas. Trees and reed rushes retain agricultural pollution by incorporating

organic compounds into their tissues, using nitrogen and phosphorus from fertilizers. A typical example of agricultural landscape trees supporting the water purification process are willows. Thanks to an extensive root system, they limit the leakage of nutrients into rivers. Planting trees and other vegetation helps to cleanse the waters and improves their quality (APGW, 2022). The preservation of wetlands also plays a significant role.

It should be noted that in the case of environmental safety, the possibility of using deep waters for industrial and agricultural purposes is problematic and risky. Their resources and the rate of renewal are not known exactly, and they constitute a very important source of drinking water for life.

Water retention is important, depending on natural factors (e.g. forest cover, type of soil) and anthropogenic factors (forms of management and hydrotechnical infrastructure of the catchment area). In order to maintain water resources and the proper functioning of the hydrographic network, it is desirable to maintain the proportion between transformed and natural areas (including natural river valleys and wetlands). Improper spatial development planning is an environmental threat. As a rule, the maintenance of floodplains is not taken into account and they are earmarked for the development of housing infrastructure or agricultural lands. Often these are areas where there are regular inundations or floods. Both before and after 1990, the majority of drainage investments in Poland were carried out in an inappropriate manner. In order to increase environmental safety, some of the faulty drainage systems should be removed and the remaining ones modernized (e.g. channel retention). As a result, the water level will be raised and some of the retention capacity will be recovered. This will be more effective than the construction of a few expensive and easily damaged large retention reservoirs in wartime conditions.

Summary

In the era of a changing climate and limited water resources, care for access to clean water should be the subject of interest and efforts in the field of national and internal security.

Protection of waters against pollution is one of the priority tasks for environmental safety. In Poland, the purity of water discharged from industry must be taken care of. Discharge of contaminated substances from agricultural and livestock areas should be absolutely eliminated. Agricultural practices that hold water in the soil must be started. Introduce supervision of domestic sewage. It is imperative to retain water in the soil, and to restore transformed river systems and drained valleys. Improper melioration and drainage of swamps should also be stopped. It is extremely important to introduce strict supervision over landfills. Otherwise, there will be no water for the economy and society. It will be disastrous for national and internal security.

References

- Chapin-Stuart, F., Matson, P.A., Vitousek, M.P., Chapin, M.C. (2011). *Principles of terrestrial ecology*. New York, Springer.
- Michael, A.S. (2014). *Groundwater: Hydrogeochemistry, Environmental Impacts and Management Practices*. Nova Science Publishers Inc.
- Moss, B. (2008). Water Pollution in Agriculture. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 363 (1491).
- Rączka, J., Skąpski, K., Tyc, T. (2021). *Zasoby wodne w Polsce – ochrona i wykorzystanie*. Fundacja Przyjazny Kraj.
- Solan, M., Dmoch, M. (2009). *Zanieczyszczenie wód powierzchniowych substancjami pochodzącymi z rolnictwa*. Gospodarka Wodna, Sigma-Not.
- GIOŚ (2020). *Syntetyczny raport z klasyfikacji i oceny jednolitych części wód powierzchniowych wykonanej za rok 2019 na podstawie danych z 2014–2019*. Warszawa.
- Szanujmy wodę nie tylko od święta* (2022). <https://apgw.gov.pl/pl/news/show/200>, accessed 24.03.2022.
- Newseria BIZNES* (2022). <https://biznes.newseria.pl/news/polska-jednym-z-pastw>, accessed 24.03.2022.
- Borek, R. et al. (2020). *Woda w rolnictwie. Ekspertyza*. Accessed 8.02.2022, https://pl.boell.org/sites/default/files/2020-11/Ekspertyza_Woda-w-rolnictwie.pdf.
- De Oreo, W.B., Mayer, P.W., Martien, L., Hayden, M., et. al. (2011). *Analysis of water use in new single family homes*. Aqua craft Inc. Water Engineering and Management.
- Ekspertyza. *Woda w rolnictwie* (2012). <https://koalicjazywaziemia.pl/ekspertyza-woda-w-rolnictwie/>, accessed 11.01.2022.
- Eutrofizacja* (2012). <https://www.fdpa.org.pl/eutrofizacja>, accessed 14.01.2022.
- Zanieczyszczenia wód w Polsce* (2020). <https://harmonyh2o.com/wymieniane-wod-w-polsce/>, http://przyjaznykraj.pl/wp-content/uploads/2021/06/Fundacja_Przyjazny_Kraj_Raport_Zasoby-wodne-w-Polsce, accessed 23.03.2022.
- Industrial Water and Water Pollution* (2018). <https://www.water-pollution.org.uk/industrial-water-pollution>, accessed 12.01.2022.
- Izba Gospodarcza. *Wodociąg polski* (2018). <https://www.igwp.org.pl/index.php/nasza-aktywnosc/analizy-ekonometryczne/317-zuzycie-wody-z-wodociagow-w-gospodarstwach-domowych>, accessed 6.02.2022.
- Progressio, P. (2019). *Znaczenie wody w przemyśle*. <http://www.outsourcingportal.eu/pl/znaczenie-wody-w-przemysle>, accessed 8.03.2022.
- Plaga dzikich wysypisk w Polsce* (2020). <https://sozosfera.pl/odpady/plaga-dzikich-wysypisk-w-polsce>, Accessed 11.02.2022.
- Świat wody. Blog. (2020). *600% wzrost zużycia wody w gospodarstwach domowych w ciągu ostatnich 50 lat*. <https://swiatwody.blog/2020/03/28/600-wzrostu-zuzycia-wody-w-gospodarstwach-domowych-w-ostatnie-50-lat/>, accessed 13.02.2022.
- Wastewater treatment – Primary treatment* (2019). *Encyclopædia Britannica*. <https://www.britannica.com/technology/wastewater-treatment/Primary-treatment>, accessed 15.03.2022.
- Water pollution | Definition, Causes, Effects, Solutions, Examples, & Facts* (2022). *Britannica*. <https://www.britannica.com/science/water-pollution#ref1084519>, accessed 14.03.2022.

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Water pollution (2013). <https://www.hsph.harvard.edu/ehep/82-2/>, accessed 27.01.2022.

Zanieczyszczenie wód (2018). http://ibrbs.pl/mediawiki/index.php/Zanieczyszczenie_wód, accessed 14.01.2022.

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