(PP5) PILOT ACTION REPORT

Version 1

Deliverable D.T3.5.6

MM

2019

Contents

1. Pilot Action title

Optimisation of soil and water monitoring for long-term maintenance of remediation effects.

2. Place/area of PA implementation

The Pilot Action site is a 16.44 ha brownfield area of a former wood preservation plant located close to the city centre, surrounded by streets and railway tracks, in the neighbourhood of the largest housing estate mostly of multifamily, city park and recreation and sports facilities such as swimming pool, sports hall and stadium. The project is located outside the areas covered by legal forms of environmental protection, including outside the areas belonging to the European ecological network Nature 2000. According to NUTS classification the terrain is located in the northern region, Kujawsko-Pomorskie voivodeship, subregion bydgosko-pomorski in the Functional Urban Area of Bydgoszcz and Toruń. In terms of morphology the site is located within the macro-region Pradolina Toruńsko-Eberswaldzka, Kotlina Toruńska unit, on the left bank of the Vistula river. In terms of hydrography it belongs to the Vistula catchment area. According to the planning documents the Pilot Action site is located in the zone of so-called ecological system including the existing natural system of the city and areas destined for transformation. The main directions of the land use are focused on maintaining urban green recreational function through the protection of the existing forest habitats and development of sport and recreational base.

3. Duration of PA implementation

The activities started in July 2017 and will end in mid-March 2019 with completing the D.T3.5.4 deliverable land management study. However, the main pilot action work was finished in November 2018.

4. Costs related to PA

The following costs were incurred for the implementation of PA:

- Conducting environmental monitoring and performing an external expert function on remediation of groundwater along with development of the method of neutralising pollutants below the groundwater level was awarded to Geo-Logik company through a tender procedure - the total costs amount to 508 297,50 PLN,
- Development of the land management study was awarded to Studium company through a tender procedure – the total costs amount to 111 038,25 PLN.

5. Background and challenges faced

5.1 Background

In 1879 a wood preservation plant was built. Dynamic development of railway trails in Europe increased demand for railway sleepers. Solec was a perfect spot. The proximity of the Vistula river provided cheap and constant supplies of timber to sawmills. A nearby important railway line guaranteed an additional route for delivery of wood, a safe transportation of impregnation oil for the preservation of wood and easy way to dispatch finished products. Regardless of the political situation the factory always had strategic importance and was one of the largest employers in the city. The activity of the factory prompted a number of adverse environmental effects. The imperfect technology of the day, rush, strained production timelines and overused, often breaking machines caused numerous oil spills to the ground. Wood was impregnated chiefly with creosote, i.e. an oily mixture of liquid and volatile organic compounds. Creosote oil protected wood from water, insects, fungi and more. The most important components of creosote are BTEX (benzene, toluene, ethylbenzene, xylenes), phenols, pyridine and polycyclic aromatic hydrocarbons (PAHs). In 2001 the production on site was terminated. The plant closure procedures lasted until 2005 when it was sold to a private company. After its closure

a large part of the land was not even suitable for further use for industrial purposes. All the buildings were demolished, the area was devastated and the remnants of the creosote oil were illegally removed (fires and pouring into the ground) which led to heavy contamination of the ground. As the land was in private hands interventions of authorities had no effect. In 2008 the Municipality of Solec Kujawski bought this completely degraded and strongly contaminated area to stop further devastation of land and environment. One of environmental studies conducted in 2009 suggested to extract and remove almost entire volume of the soil to a depth of 4 meters. This plan was impossible to achieve due to enormous costs and lack of a company that would accept such quantities of contaminated soil. In 2010 on the basis of additional geochemical studies and the first microbiological tests performed in the terrain, an alternative concept of land and groundwater bioremediation was proposed – using the indigenous (inoculated and multiplied) microorganisms capable of decomposition and reduction in the concentrations of several aromatic hydrocarbon compounds. This concept expanded by initial step of soil-washing was the basis to obtain funds from the European Union Operational Programme 'Infrastructure and Environment' to conduct a clean-up of the area. In years 2013-2016 reclamation was carried out removing strong contamination with PAH compounds, BTEX and phenols from soil and ground layer to a depth of about 5 meters. After three years of remediation the soil quality has improved greatly. The bioremediation process of the site is still undergoing, including the maintenance of the bioremediation heap – waste water is collected and purified in the microbiological-physical process during recirculation.

5.2 Challenges faced

On the basis of other cases of old wood preservation plants in Europe we know that this type of contamination such as creosote oil can diffuse deep into aquifer and it causes permanent pollution of groundwater. After a successful completion of remediation work on the surface and in the area of land heavily contaminated with creosote (07.2013-07.2016), currently a major problem for the environment is indicated to be a poor quality of groundwater. Existing here earlier for decades, hot spots created so-called secondary hot spots in the saturation zone, before they have been removed or significantly reduced. They cause the current long-term contamination of groundwater. In several carried out drillings presence of dense non-aqueous phase liquid (DNAPL) was indicated. It was detected that the DNAPL is very slowly migrating from the area of former contamination sources. Because this process has been going for decades, the plume of concentrated pollutants has flown out of the brownfield area and threatens to degrade the areas designated for housing. Also, it pollutes strongly the groundwater

flowing into the Vistula River, the longest and largest river in Poland astride which city of Solec Kujawski lies.

Main challenges identified:

- Maintaining proper pace of soil quality improvement in bioremediation process,
- Extensive, comprehensive diagnosis and cutting off afflux of contaminated waters from other brownfields,
- Improvement of groundwater quality flowing out from the brownfield,
- Monitoring of concentration, direction of migration of groundwater contamination,
- Diagnosis of social needs and elaborating accurate development conception of the recovered urban space taking into consideration constraints.

6. PA objectives

The overall objective of the pilot action was to establish an environmental monitoring system of brownfield soil and water in order to monitor the effectiveness of the undertaken remediation techniques but also to develop the method of neutralising pollutants below the groundwater level. Several specific sub-objectives were identified:

- Monitoring of the soil improvement and the ground stored up as a bioremediation heap,
- Monitoring of the type, quality and quantity of pioneer plants – indicators allowing to assess the pace of soil remediation,
- Monitoring of the groundwater quality in the surrounding areas,
- Determining the migration paths of contaminants in groundwater and identifying methods of blocking/neutralizing contaminations,
- Defining optimal method of using/developing the site during the transitional period and terminally.

7. Activities carried out

The activities carried out within the pilot action consisted in establishing an environmental monitoring system of soil and water of the former wood preservation plant brownfield in order to monitor the effectiveness of the undertaken remediation techniques and elaborating documents focusing on data obtained from the performed monitoring. Information obtained from laboratory analyses of uptaken samples directly contributed to identify an innovative and sustainable solution of neutralising pollutants below the groundwater level - the nano-carbon barrier adsorbing harmful organic compounds and creating in water-bearing stratum natural conditions for bioremediation of contamination.
In detail, the Municipality of Solec Kujawski carried out the following actions:

1. <u>Environmental monitoring research and Report on improvement of remediation</u>

The action carried out within the GreenerSites project relate to the remediation performed using funds from the European Union Operational Programe “Infrastructure and Environment”. The aim of the monitoring research was to guarantee maintenance of quality and durability of already undertaken remediation. The research was performed by the external expert dr Wojciech Irminski, owner of the Geo Logik company who was contracted through the tender procedure. The research focused on soil and water. In total six monitoring campaigns for groundwater and two campaigns for soil were carried out. Additional piezometers were placed allowing samples uptake. The samples of soil were sent for an examination to laboratory of ALS Group in Prague (Czech Republic), whereas the passive samplers were lent, delivered and examined in laboratory of University of Tubingen (Germany). The obtained results allowed to trace the main plumes of groundwater pollution and in case of soil quality control they showed a gradual progress of environmental self-purification initiated by recultivation and biodegradation process by hydrocarbons. 6 periodic reports from laboratory analyses and one final

report on improvement of remediation were delivered. Monitoring effects combined with data obtained from additional drillings, results of geophysical analyses and tests with carbon nano-particles carried out in a specialised laboratory are serious material which allows to determine the location, span and thickness of the passive nano-carbon barrier. The tested method will contribute to effective remediation of groundwater.

In particular, following activities were carried out as part of environmental monitoring:

- Uptake of groundwater samples for laboratory analyses of PAH and BTEX content – in total 72 probes in 6 measurement campaigns,
- Measurement of PAH and BTEX content using passive samplers in key wells and piezometers - in total 100 passive samplers were used,
- Uptake of soil and subsoil samples for laboratory analyses of PAH and BTEX content – in total 82 samples were analysed in two measurement campaigns,
- 10 monitoring points were placed in total, extending groundwater monitoring network. Drillings (18 pieces) were carried out till depth of approx. 15-22 meters to define the depth and type of aquitard,
- 2 mega-samples of soil (20 kg) and 1 mega-sample of water (20 litres) were uptaken to carry out laboratory tests on effectiveness of sorption of pollutants by nano-carbon particles,
- Sorption tests were carried out in a specialised laboratory in the USA,
- A network of geophysical measurements was planned and geophysical research was carried out. Thanks to the obtained results geological structure was defined,
- 6 periodic reports from laboratory analyses and one final report were developed.

2. Land management study

Elaboration of the land management concept of the site was awarded to company from Warsaw, through a tender procedure. The document include three different investment variants which could be developed in the area, including economic and technical specifications. Representatives from different Municipality departments participated in a meeting with the contractor in the aim of developing a final version of the document with chosen variant. Further consultations were held via e-mail and telephone. The chosen option contains such solutions like: picnic area, a football stadium, pump track, area for dogs, a playground, a sledge hill for which a bioremediation heap will be used and astronomical observatory. The deadline for the submission of the document is the end of March, as due to the lack of offers the tender procedure had to be re-announced thus affecting delays in delivering the deliverable. The aim of the action is to provide citizens with sports and recreational infrastructure. Creating sports and leisure base in the city centre will not only provide an area where families, teenagers, tourists could relax, do sports and spend their free time but will also improve the city's image.

3. Brownfield database

Obtained data about the brownfield (results from soil and water samples analyses) were presented on paper as an information card. Gathered information complements and updates the description contained in the information card from 2017, prepared at the beginning of the project. Moreover, such information like pollutants, number and location of piezometers, soil and water samples results and ownership will be also presented in an online database (GIS). The web GIS tool developed in WP1 was installed on the server of the Regional Directorate of Environmental Protection responsible for taking remediation decisions and all related contamination issues at regional level. Data about brownfields is scattered and not sufficient. As in Poland does not exist official catalogue of contaminated areas, including brownfield, such database will help institutions, as well as private investors and actors to

obtain information about the area of interest. The geo-information system was developed in order to support brownfield regeneration by helping institutions to better use available data and manage environmental problems in a more effective way. The tool's database will be constantly updated in order to provide up to date information about the brownfield.

4. Preliminary analysis

This report elaborated by the external expert is an analysis of the state of art of the environmental situation of the brownfield covered by the project, as well as neighbouring areas. In particular, the report provides the state of remediation procedures carried out so far in the area, identifying the critical issues and obstacles.

8. Technical specifications and solutions tested

- Based on the numerous piezometric measurements stability of the groundwater direction flow was confirmed, which allows to design more accurate location of passive nano-carbon barrier,
- Based on the soil and subsoil results (82 samples) further improvement of the soil quality was noticed after one year – pollution concentrations generally decrease, although in some places bioremediation process requires support,
- Based on the analyses of groundwater samples from the inflow area of groundwater (Garbary Street) and from the outflow area (Kujawska Street) the direction of the plumes in deep water-bearing layer was confirmed and clarified. These plumes flow towards the Vistula river, but can also have an impact on the environment quality of the terrains underneath which they flow,
- Based on the passive analyses, the periodic variability of pollution concentrations in groundwater was demonstrated, the direction of plumes was confirmed, the repeatability of indications of different samples were analysed and the variety of PAH and BTEX concentration was determined,
- Based on the results of geophysical analyses and carried out drillings a quite precise morphology image of impermeable sediments lying beneath contaminated water-bearing layer was obtained. This facilitates identification of preferred migration routes of concentrated pollutants – crucial factor in groundwater remediation planning,
- Based on the laboratory analyses, sorption degree of BTEX and PAH combination on a special mixture of soil and carbon in the form of nano-particles was determined. The effectiveness of analyses shows possibilities in implementing this method of reducing migration of organic pollutants in groundwater.

9. Impact/results/experience (how many target groups/stakeholders were reached, pilot events)

Thanks to the GreenerSites project the Municipality of Solec Kujawski was able to monitor the effectiveness of the undertaken remediation and thus improve the quality of life of the city inhabitants. The implemented measures allow to assess the condition of the natural environment of the site, which is clearly improving. Implemented pilot action positively contribute to the improvement of the environment and general conditions of the FUA.

Regeneration of a very large area of the former wood preservation factory, located in the central part of the city is a priority for the Municipality and receives deep attention from the administration. Moreover, regeneration of the site improves the city's image. At the same time investor concerns in neighbouring areas decrease – on a plot at Kujawska street, opposite of remediated area three multifamily residential buildings appeared.

The needs analysis of the target group was made on the basis of meetings with the estate residents. Unfortunately, the meetings organised within the framework of GreenerSites project were not so popular among the inhabitants, thus the direct participation of the local community in the implementation of the pilot action was not so high. For this reason, it was decided to base on the

documents elaborated by the City residents or with their participation, although created earlier, for example Development strategy of Commune defining the needs of its inhabitants.

More active role as stakeholders played: the Regional Directorate of Environmental Protection, the District Office in Bydgoszcz, and the Provincial Fund for Environmental Protection and Water Management in Toruń - institutions associated with the environmental protection. They were interested in the implementation of the activities undertaken within the project due to their nature. The Municipality of Solec Kujawski could count on their support in dealing with the brownfield issues. The Provincial Fund for Environmental Protection and Water Management co-financed the remediation performed in the previous project and is currently monitoring its effects. The Regional Directorate of Environmental Protection also controls the undertaken actions, in particular relate to previously issued decision ordering the site regeneration and its monitoring. In the competences of the District Office lies issuing decisions permitting geological works. Within the framework of the GreenerSites project the Municipality of Solec Kujawski obtained such permission for performed environmental monitoring.

Achieved results:

- Thanks to analyses carried out within the project gradual improvement of brownfield soil condition was showed,
- Migration of concentrated organic pollutants (DNAPL Dense Non-Aqueous Phase Liquid) in groundwater at the depth of 8-18 meters was documented. The direction of plumes migration was showed,
- Geological structure of the brownfield area was defined, which provided information to design a barrier that will block migration of pollutants,
- The optimal method and substances for sorption and to stop PAH and BTEX migration in groundwater were defined,
- The method for neutralising pollutants below the groundwater level was designed/developed.

10. Contribution to project objective

Higher environmental performance of the brownfield of the former wood preservation plant was reached, thus contributing to an improvement of working and living conditions of Solec Kujawski citizens. By doing so, the undertaken actions directly contributed to the project goal “to improve the environmental management of unused or underused industrial areas (brownfields) through the definition of strategies, tools and actions based on a sustainable integrated approach to make involved Functional Urban Areas (FUAs) cleaner, healthier and more liveable places”.

11. Transnational added value - how Pilot Action contributed to other activities implemented by the project & added value for partners

Participation in the GreenerSites project was an opportunity for mutual learning and exchange of knowledge and experience. Thanks to different training opportunities like study visits, pilot site visits and training seminars provided within the project, PP5 acquired useful knowledge on brownfield management. At the same time, the Municipality of Solec Kujawski has shared with partners its technical know-how and experience gained through remediation activities of the former wood factory. Results from the pilot action might be beneficial for partners dealing with the same environmental issues.

12. Compliance with the sustainability principles

The implementation of the project allows to assess the impact of undertaken remediation of the former wood preservation plant on improving the quality of life while maintaining social equality, biodiversity and abundance of natural resources. The extended monitoring system allows to assess the

condition of the environment not only now, but also in the future, which is crucial considering an inflow of a plume from outside the pilot site.

While elaborating the land management concept of the pilot area, the priority was to reach a compromise between the land redevelopment and matters related to environmental protection. Taking this into account, solutions having a positive impact on the environment were introduced.

It is crucial to reactivate brownfields, thereby reducing land consumption. Brownfield reactivation offers an opportunity to eliminate contamination and paves the way for environmental protection. The carried out actions within the pilot, like usage of passive probes reducing installation costs and harmful effects of sample uptake (the minimum amount of water which needs to be extracted for analysis) and proposed innovative method of neutralising pollutants below the groundwater level, are compliant with environmental, economic and social sustainability.

13. Media coverage

A few press articles in relation to the pilot implementation were published in the local newspaper *Soleckie wiadomości z ratusza*.

One of the published articles http://www.soleckujawski.pl/sites/default/files/nr_334.pdf

Projekt rodzi projekt

ROZMOWA Z DR. **WOJCIECHEM IRMIŃSKIM**, NADZORUJĄCYM REKULTYWACJĘ TERENU PO DAWNEJ NASYCALNI (2013-2016), OBECNIE EKSPERTEM W PROJEKCIE GREENER SITES.

- Metoda zastosowana przy rekultywacji terenu po byłej Nasycalni była pionierska w naszym kraju i zakończyła się sukcesem. Na czym, w skrócie, ona polegała?

- Myślę, że przedsięwzięcie rzeczywiście zakończyło się sukcesem, ale jeszcze musimy poczekać na wyniki tegorocznych badań. Jest to trzecia seria pomiarów, wykonywana w ramach unijnego projektu GreenerSites, w którym uczestniczy Solec Kujawski. Dzięki temu gmina będzie mogła sprawdzić, czy metoda przyniosła pozytywne skutki. W wypadku Nasycalni innowacyjne było połączenie kilku metod i sam sposób rozpoznania problemu zanieczyszczeń. Rdzeń rekultywacji stanowiły procesy prania gruntu. Nie słyszałem, by w Polsce były one stosowane na taką skalę, przynajmniej w terenie. Ta część procesu służyła istotnemu obniżeniu stężenia zanieczyszczeń. To, co pozostało w gruncie, było już trudne do usunięcia metodami mechanicznymi. I w tym terenu. Po zakończenia prac wykonawca przedstawił Regionalnemu Dyrektorowi Ochrony Środowiska w Bydgoszczy raport z wykonania rekultywacji. Rok później, kiedy rozpoczęła się realizacja kolejnego projektu, czyli GreenerSites, postanowiliśmy zbadać, jak ma się środowisko w miejscu byłej Nasycalni. Tamte wyniki pokazały bardzo optymistyczny obraz – jakość środowiska od momentu zakończenia rekultywacji poprawiła się - średnio o 30 proc. spadły stężenia resztek zanieczyszczeń. We wrześniu tego roku pobrano kolejne próbki gruntu do zbadania. Wyniki poznamy w październiku.

- Trwający dalej proces oczyszczania nie daje żadnych negatywnych skutków?

- Nie daje. To proces naturalny, przebiegający w glebie. Podobnie funkcjonują takie same mikroorganizmy w naszych ogródkach, gdy rozkładają kompost.

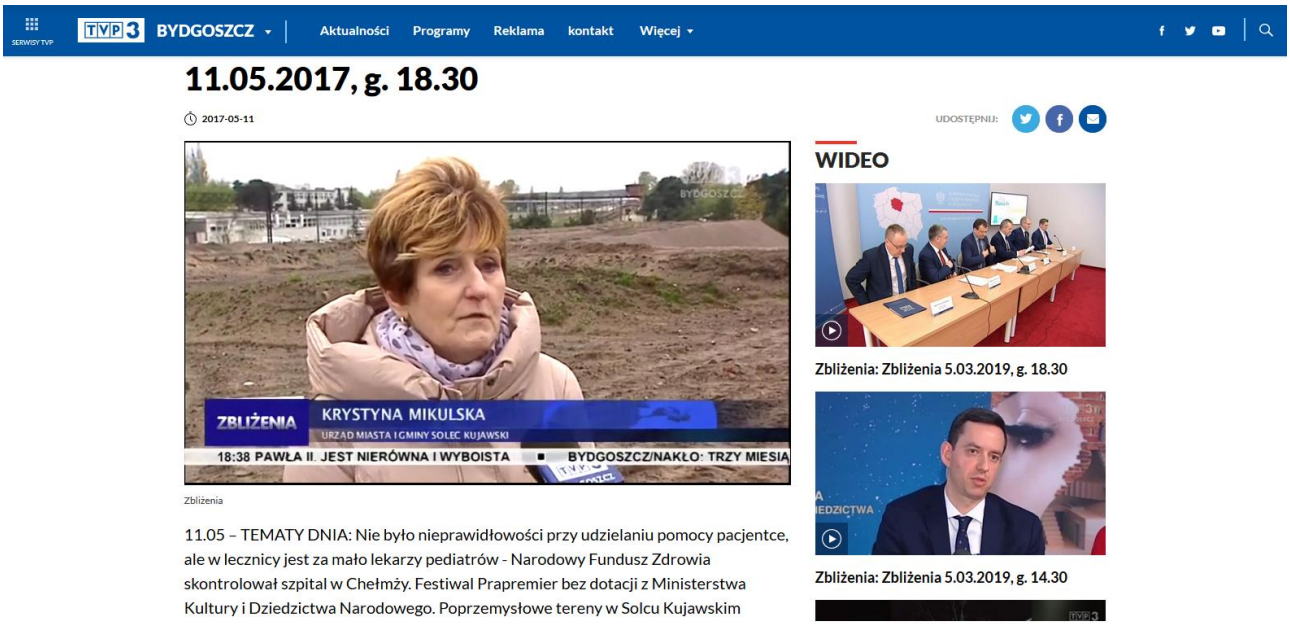
- Wróćmy do tego drugiego projektu, w którego ramach wykonywane są obecne badania. Proszę przybliżyć nieco jego ideę.

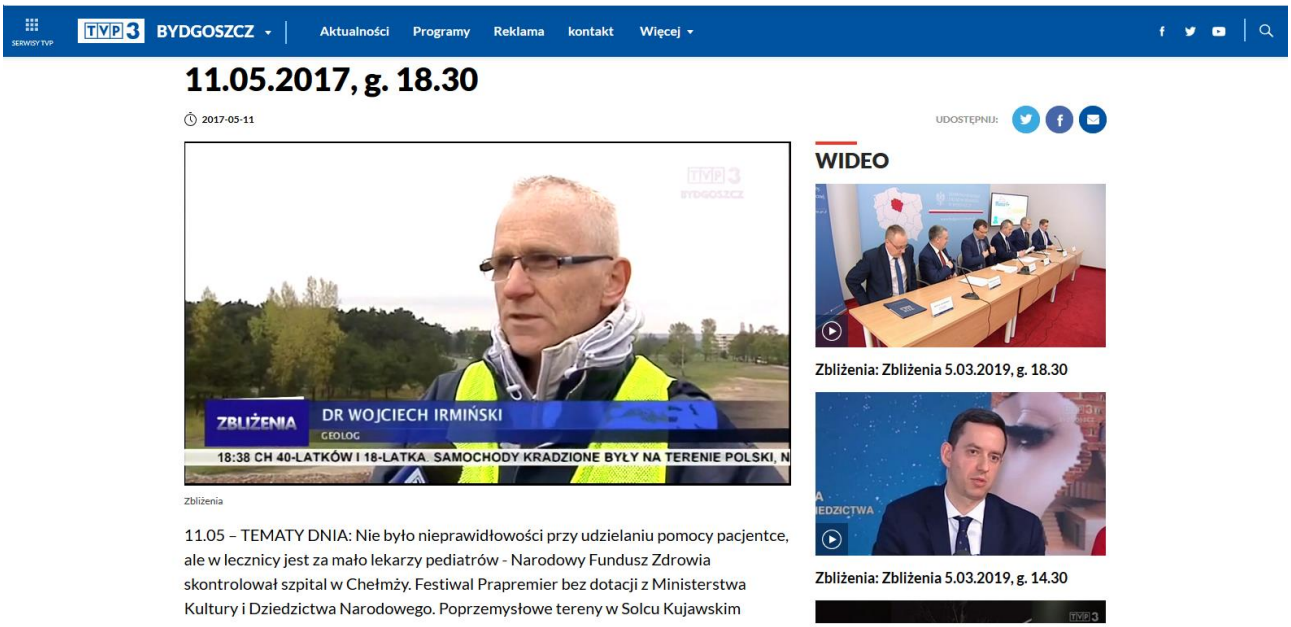
- Projekt GreenerSites ma pokazać dobre praktyki na przykładzie przeprowadzonych rekultywacji i remediacji zdegradowanych terenów. Takie miejsca nie mogą być pozostawione całkowicie bez kontroli. Trzeba też pamiętać o włączaniu

URZĄD STANU CYWILNEGO
Urodzenia
2014 r. – 22
2015 r. – 24
2016 r. – 31
2017 r. – 26
2018 r. – 17
Małżeństwa
2014 r. – 76
2015 r. – 88
2016 r. – 88
2017 r. – 84
2018 r. – 81
Zgony
2014 r. – 84
2015 r. – 61
2016 r. – 67
2017 r. – 77
2018 r. – 62
Rozwody
2014 – b/d
2015 - 37
2016 - 35
2017 - 34
2018 - 17
ORGANIZACJE POZARZĄDOWE
Kwota przyznanych dotacji
2014 r. – 585.141 zł
2015 r. – 548.500 zł
2016 r. – 362.943 zł
2017 r. – 446.250 zł
2018 r. – 608.137 zł (plan)
OCHRONA ZWIERZĄT I OCHRONA ŚRODOWISKA
Całkowity koszt realizacji zadań przewidzianych ustawą o ochronie zwierząt
2014 r. – 119.667,99 zł
2015 r. – 126.137,11 zł
2016 r. – 133.568,73 zł
2017 r. – 153.757,79 zł
2018 r. – 101.368,75 zł
(stan na 31 sierpnia 2018 r.)
Zapewnienie opieki bezdomnym psom

On the occasion of partner's meeting held in Solec Kujawski, regional TV *TVP3 Bydgoszcz* appeared. Journalist interviewed some of the participants: experts and the project representatives (Grzegorz Boroń PP9 and Krystyna Mikulska PP5). The news programme *Zbliżenia* was broadcast on 11.05.2017 at 18:30.

Link to the news programme https://bydgoszcz.tvp.pl/30566620/11052017-g-1830


TVP3 BYDGOSZCZ
Aktualności Programy Reklama kontakt Więcej
11.05.2017, g. 18.30
2017-05-11
UDOSTĘPNIJ:
ZBLIŻENIA
KRYSTYNA MIKULSKA
URZĄD MIASTA I GMINY SOLEC KUJAWSKI
18:38 PAWŁA II. JEST NIERÓWNA I WYBOISTA
BYDGOSZCZ/NAKŁO: TRZY MIESIA
Zbliżenia
11.05 – TEMATY DNIA: Nie było nieprawidłowości przy udzielaniu pomocy pacjentce, ale w lecznicy jest za mało lekarzy pediatrów - Narodowy Fundusz Zdrowia skontrolował szpital w Chełmży. Festiwal Prapremier bez dotacji z Ministerstwa Kultury i Dziedzictwa Narodowego. Poprzemysłowe tereny w Solcu Kujawskim
WIDEO
Zbliżenia: Zbliżenia 5.03.2019, g. 18.30
Zbliżenia: Zbliżenia 5.03.2019, g. 14.30


TVP3 BYDGOSZCZ
Aktualności Programy Reklama kontakt Więcej
11.05.2017, g. 18.30
2017-05-11
UDOSTĘPNIJ:
ZBLIŻENIA
DR WOJCIECH IRMIŃSKI
GEOLOG
18:38 CH 40-LATKÓW I 18-LATKA. SAMOCHODY KRADZIONE BYŁY NA TERENIE POLSKI, N
Zbliżenia
11.05 – TEMATY DNIA: Nie było nieprawidłowości przy udzielaniu pomocy pacjentce, ale w lecznicy jest za mało lekarzy pediatrów - Narodowy Fundusz Zdrowia skontrolował szpital w Chełmży. Festiwal Prapremier bez dotacji z Ministerstwa Kultury i Dziedzictwa Narodowego. Poprzemysłowe tereny w Solcu Kujawskim
WIDEO
Zbliżenia: Zbliżenia 5.03.2019, g. 18.30
Zbliżenia: Zbliżenia 5.03.2019, g. 14.30