HOTSPOT LOCALISATION / ONLINE POLLUTION MAP & DATABASE

TID(Y)UP – Methodology – Waste localisation and strategy for collection
Work Package 1
Documentation for Output OT1.4. and Deliverables D.T1.2.3 & D.T1.2.4

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Table of contents

List of abbreviations

(in order of appearance)

TidyUp	project - Tid(y)Up! - F(ol)low the Plastic from source to the sea: Tisza-Danube integrated action plan to eliminate plastic pollution of rivers
DTP	Danube Transnational Programme
LP	lead partner
ICPDR	International Commission for the Protection of Danube River
THU	Természetfilm.hu Egyesület / Naturefilm.hu Society
TRCH	Transnational River Cleanup Handguide
HEPP	Hydroelectric Power Plant
HAEE	Hungarian Association of Environmental Enterprises
IO-BAS	Institute of Oceanology – Bulgarian Academy of Science
BOKU	Universität für Bodenkultur Wien / University of Life Sciences and Natural Resources, Vienna
UNS	Faculty of Technical Sciences, Novi Sad
ASRD	Agency for the Support of Regional Development Košice n.o.
OVF	Országos Vízügyi Főigazgatóság / General Directorate of Water Management
ARD	Agency of Regional Development Cross Border Cooperation ‘Transcarpathia’ of Zakarpatska Oblast Council
FLEX	Floating Exhibition
GWP	Global Water Partnership

1. About the pollution map

1.1. Context

Despite the advanced waste management and ambitious recycling objectives of the EU, studies indicate the presence of macroplastic and microplastic pollution in rivers of Europe. The DTP project '*Tid(y)Up! - F(ol)low the Plastic from source to the sea: Tisza-Danube integrated action plan to eliminate plastic pollution of rivers*' (further referred as: ***TidyUp***) is focusing on the improvement of water quality and reduction of plastic pollution in one of Europe's most heavily contaminated rivers, the Tisza - a tributary of the Danube -, and investigates plastic pollution and its effect on the Danube and the Black Sea.

The partnership of TidyUp carried out field surveys in order to identify polluted areas along rivers in the project area. This was necessary in order to organize effective pilot river cleanup actions. The other goal of this activity was to gather all necessary information and provide practical tools in order to create active, cooperating communities in the fight against the plastic waste contamination in rivers. One of these potential 'practical tools' is the online, responsive, up-to-date, riverine waste monitoring database, or to put it more simply, the so-called riverine ***pollution map***.

Fig. 1. *TidyUp partner PAPILIO's field coordinator standing on a macroplastic accumulation in April, 2022 in Ukraine on river Latorice, tributary of the Tisza. The organic waste (driftwood) is mixed with a lot of inorganic waste (plastics, metal, glass)*

1.2. Introduction

The novelty of the project TidyUp is that it provides tools, data, and the assessment of various methodology for understanding the sources, nature and dynamics of plastic pollution in rivers and delivers *practical help* for possible actions on local and transnational level. Nowhere is it more obvious than in the case of the pollution map, which is to provide an effective tool in all kinds of river cleanup operations.
When **DTP**-project TidyUp started, partners had the possibility to decide whether they want to create a new platform from scratch-, or to look for best practices in the project area in an effort to adapt existing practices. The PLASTIC Cup initiative of **LP THU** provided a potential candidate for the purpose. The experimental website of *Clean Tisza, Danube Map* highlighted some of the polluted areas along the Tisza and Danube rivers and was connected to an open-source smartphone application TrashOUT.
After discussing the matter in detail, partners came to the conclusion that the Clean Tisza, Danube Map can be considered as a preliminary version of the pollution map described in the TidyUp project application. It seemed worthwhile to further develop the site as it was meeting some very critical requirements from the project management side, such as:

- instead of being a static website, Clean Tisza, Danube Map was already connected to a database of an open-source waste monitoring application;
- the map was fine-tuned to the riverbed of the Tisza and Danube showing plastic accumulations only on the shores or in the floodplains;
- TrashOUT, the open-source smartphone application on which the website was built, was among the leading waste monitoring applications worldwide, launched and developed by a Slovakian NGO within the EU;
- the smartphone application was free, stable, easy to use and enabled users to register polluted areas without any specific technical background.

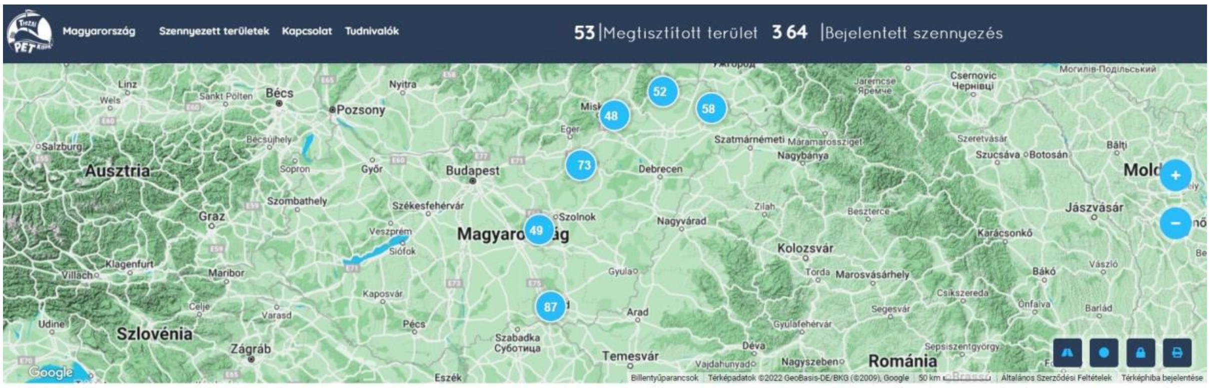


Fig. 2. The Clean Tisza Map at the beginning of TidyUp project. The promising website showed the biggest plastic accumulations along the Tisza river, at that time only on Hungarian territory in Hungarian language.
[Https://tisztatiszaterkep.hu/#/en/](https://tisztatiszaterkep.hu/#/en/)
Set your preferred country in the upper left corner.

At the beginning of the project the Clean Tisza, Danube Map was in a promising but preliminary stage. It highlighted only a few dozen polluted sites, exclusively on the Hungarian section of the Tisza and Danube rivers, approx. 15% of which has been restored. The website offered no language versions and contained no information about macroplastic deposits in other countries. Within just two years this had changed along a well-established concept of software development.

1.3. Priorities of software development

The main purpose of the pollution map was to create a reliable and up-to-date database on the quantity, location, size and composition of macro plastic accumulations not only in Hungary but within the entire TidyUp project area. To achieve this, the partnership had to create a platform that:

- is easy and free to use in all project countries;
- is providing an open access database and software background;
- has the potential to upgrade in size as well as in functions;
- can provide a useful tool for cleanup actions and research activities;
- can provide a useful tool for habitat restoration and prevention measures.

2. Monitoring riverine macroplastic accumulations

2.1. The vital importance of monitoring plastic pollution in rivers

Before going into details about a pollution map, the question may arise: why is it so important to create a database on macroplastic accumulations. Among the priorities of TidyUp is building up a knowledge and database, to help decision makers, authorities and local people to prevent and manage plastic pollution. This approach can contribute to the necessary cooperation and capacities only by precisely tracking the pollution and targeting hotspots and macroplastic accumulations.

Fig.3. *Typical hotspot site in Ukraine, Transcarpathia. Along the shores of the Black Tisza are hundreds of places like this, where the household waste gets released into the environment.*

Hotspots are sites where plastic pollution in rivers originates from. In Ukraine alone, there are thousands of illegal waste deposit sites where - in lack of other options - the population gets rid of their household waste. At times of flood, the hotspots release illegal waste into the river and the pollution is drifting away. Hundreds of kilometers later, as the river slows down, the plastic is washed up on the shores, forming smaller or larger plastic deposits, often called coastal macroplastic accumulations.

Macroplastic accumulations have effectively been monitored in the Tisza water catchment area in the last 3 years in the framework of projects like the EU funded Erasmus+ project *5 countries 1 river*; and others like the *Clean Water Happy Tisza* project; the *Tisza expedition* ranging from source to the Danube; and the citizen-science assignment called as the *Petcamino*. These ventures invited dozens of volunteers onboard who have spent thousands of hours on the field looking up, documenting and reporting on the macroplastic accumulations they discovered along the shores and in the floodplains. For reference, the Tisza is 962 kilometers long. In order to monitor both shores and to survey the floodplains in detail, volunteers had to cover a distance of over 4500 kms - all this by foot.

__Fig. 4.__ Bence Párdy, has by far covered the longest section of the Tisza during wintertime. Here he is standing in the middle of a macroplastic accumulation near Tuzsér, Hungary.

2.2 The waste retention capacity of hydroelectric power plants

On the Tisza river there are 3 dam plants established (Tiszalök, Kisköre in Hungary, Novi Becej in Serbia). The waste retention capacity of these facilities are relatively well known and documented. Although not built for such a purpose, dams do a great job in stopping the frequent pollution waves completely. As a result floating waste barriers / **floating waste jams** aka. 'screenings' are formed. Their formation, composition and dynamics are studied by TidyUp partner BOKU (Austria) and discussed in detail in other outputs of TidyUp. One can be shocked by the size of these jams but field data suggest that the waste retention capacity of **Hydro Electric Power Plant'**s can only be surpassed by another filter: the lowland floodplain forests.

__Fig.5.__ Plastic and driftwood accumulation after a flood in downstream Hungary, at the Kisköre hydroelectric power plant. The temporary structure can be 3 meters thick and reach more than a hectare in overall size.

2.3. The waste retention capacity of floodplain forests

In lowland Hungary the Tisza river meanders between two chains of interconnected dams, preventing annual floods from reaching nearby settlements and farms on both sides of the river. Back in historical times the floodplains of the Tisza covered more than a 100.000 hectares. Now only 30.000 hectares remain tightly secured between the dams[1]. Most of these areas are covered by floodplain forests which have a huge retention capacity - affecting dynamics of flooding water and plastic pollution - very much alike. In other words, thick vegetation acts as a trap for drifting plastic. No wonder the biggest macroplastic accumulations are formed here, under these trees.

[1] Changes in the landscape of Tisza lowlands, 2006, Agronomical Research Institute report - http://repo.aki.gov.hu/2882/1/ai_2006_5.pdf

Fig. 6. *Volunteer of the Plastic Cup initiative in the floodplain forest of Bodrog. Trees and thick vegetation filters out the drifting plastic from the polluted river.*

A personal survey of these extensive floodplain forests - especially during wintertime when the vegetation does not cover plastic deposits - does reveal plastic accumulations accurately. However, there are several disadvantages to the method. Among them is the obvious need for repetition: in order to keep the database up-to-date the survey has to be repeated on a regular basis. One can agree that this is not necessarily the best use of resources. For this reason TidyUp partners investigated other options.

2.4. Testing remote sensing protocols to monitor riverine plastic pollution

Alternate solutions to collect reliable data about macroplastic pollution might include remote sensing. The advantages of following pollution dynamics from a safe distance, in real time, possibly online, are obvious. To put theory in practice however, is more difficult than it sounds. The application's list of remote sensing technologies in waste monitoring includes methods like tagging and tracking plastic items in the environment; or the analysis of high resolution aerial photographs or satellite images.

2.4.1. Remote sensing - short and long distance application of GPS tags

GPS tagging of riverine plastic waste has been applied in the *Plastic Free Danube* project by TidyUp partner BOKU (Austria)[2]. On the Austrian section of the Danube, the survey successfully tracked plastic waste items of different sizes by individually tagging them. The preliminary results show that the main line of current has a major effect on the spatial pattern and the movement of plastic waste particles[3]. The GPS tags however had a limited

[2] https://www.viadonau.org/unternehmen/projektdatenbank/aktiv/plasticfreedanube/
[3] https://infothek.bmk.gv.at/gegen-die-plastikflut-in-der-donau/

battery capacity and provided a small time window for monitoring purposes. BOKU is currently testing other devices.

On the Tisza water catchment area experts working for the *Zero Waste Tisza* project - funded by the Coca-Cola Foundation - were able to successfully tag multiple plastic bottles. After initial failures they found technical solutions to track the movement patterns of tagged bottles for months, over hundreds of kilometers. According to their experience, the 'migration' of plastic bottles is mainly driven by the main line of current (see BOKU results above), but due to their large surface and small weight, other factors such as wind, ice, and floating debris often affect their movements. The Zero Waste Tisza project was keen to help and provided the TidyUp with some trackers for testing.

Fig. 7. *Miklós Gyalai-Korpos, project coordinator of the Zero Tisza River project hands over a GPS tagges plastic bottle for experimentation purposes to Szabolcs Fülöp, chairman of TidyUp partner MULTISALVA (Romania)*

In order to further test GPS tag's capacity in monitoring macroplastic pollution in rivers, TidyUp project partner PAPILIO (Ukraine), MULTISALVA (Romania) and lead partner THU released GPS tagged plastic bottles in Ukrainian (Tisza river), Romanian (Szamos river) and Hungarian waters (Tisza river). The attempt was successful in Romania and Hungary but not in Ukraine, for two reasons. First, mobile network providers in Ukraine use a different system so the data forwarding functions of the transmitters did not work. Secondly, when bottles were not launched directly in the water but deposited in coastal macroplastic hotspots, experience showed that they were sent up in flames. Due to climate change water levels might be low for a long time and in the lack of flood, waste is not carried away by the river. In situations like this, the general thinking dictates that it's time to set the illegal waste dumps on fire.


Fig. 8. *GPS tagged plastic bottle held up by the Hydroelectric Power Plant in Kisköre (photo: Zero Waste Tisza River project)*

In conclusion, GPS tagging was successful to follow the dynamics of the plastic flood in the Tisza river water catchment area in Romanian and Hungarian waters. The method successfully revealed new-, and already registered coastal macroplastic accumulations. The collected data confirmed the great waste retention capacity of HEPPs. Further studies would require a significantly higher number of GPS tagged bottles, but the devices are relatively expensive. The other issue was when they were stuck in a certain place (most often in a floating riverine waste jam - the prerequisites of coastal macroplastic accumulations) the data came from a single location for weeks if not months. Not to jeopardize the experiment, trackers were not moved until batteries got depleted. Again, devices were too expensive for such a long idle time without any considerable contribution to the project. As per the application material of TidyUp, project partners investigated other remote sensing methods.

2.4.2. Remote sensing - analysis of aerial and satellite images

Experiments with the aerial footage were stopped when initial footage analysis showed that in most cases, coastal macroplastic accumulations cannot be seen with a normal camera due to the thick vegetation. Situation in wintertime was somewhat better but visual observation in the visible light spectrum was again jeopardized by strong shadows, and way too much influenced by weather conditions. TidyUp partners made attempts to carry out LIDAR observations but companies were not willing to experiment with this expensive technology in lack of a proper budget. As a result, TidyUp's further preliminary studies focused on the analysis of satellite images.
LP THU invited the experts of the Eötvös Loránd University of Sciences (ELTE, Budapest, Hungary) for a case study. With their help, Sentinel-2 and PLANETSCOPE satellite images were investigated with various methods in several locations (upstream and downstream regions including hotspots, macroplastic deposits and floating waste accumulations, aka.

jams). The preliminary results showed that based on satellite images made in preferably spring and summer, the analysis in 4 distinct wavelengths was reliable when trying to detect floating plastic accumulations. This way the floating debris in front of the Kisköre HEPP for example, could be separated from its environment by remote sensing. However, in the case of areas covered with vegetation - as in the case of coastal macroplastic accumulations - the detection required more research, time and a significantly higher number of satellite images.

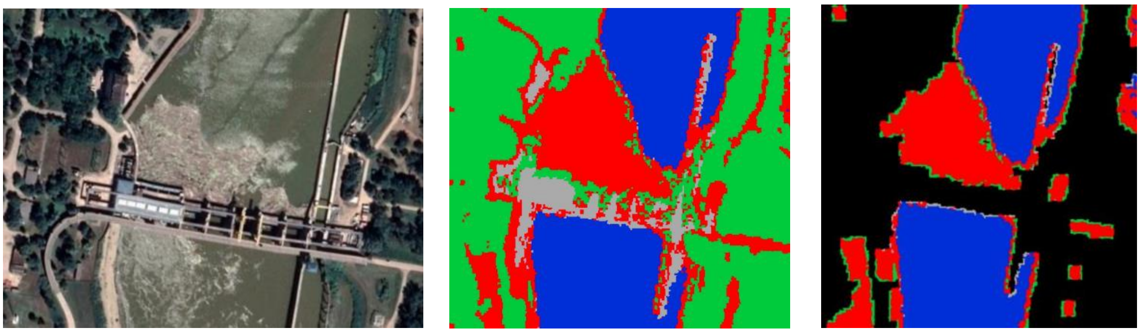


Fig. 9. *Remote detection of floating river waste accumulations at Kisköre HEPP.*

In TidyUp most of the partners were required to carry pilot cleanup actions of their own. For a river cleanup to be effective - according to the **Transnational RiverCleanup Handguide**'s (further referred as TRCH) recommendation -, an up-to-date database is required about the distribution of macroplastic accumulations. Despite the promising preliminary results, remote sensing methods could not help in monitoring the project area in proper time and its entirety. After a short consideration, partners of TidyUp decided to carry out the waste monitoring activity in the most reliable and affordable way, which was again the personal field survey.

3. Registering macroplastic accumulations on the field

3.1. Personal field survey - preparation for monitoring activities

As per the project description of TidyUp, "*Currently there are no standard methods and consistent data available on plastic pollution of rivers in the Danube Basin that would help harmonized actions of water management authorities and allow cooperation with other sectors. In TidyUp, project partners develop and launch a set of integrated actions, consult and provide tools (...) with the aim of monitoring and eliminating the plastic pollution*." One of the first integrated actions was the extension of pollution monitoring activities to other project countries. In order to start this field work, tutorial videos[4],[5] were produced on how to use the smartphone application TrashOUT and register the polluted sites. We also made sure the application is available not only in English and Hungarian but also in Slovakian, Romanian, Ukrainian and Serbian languages.

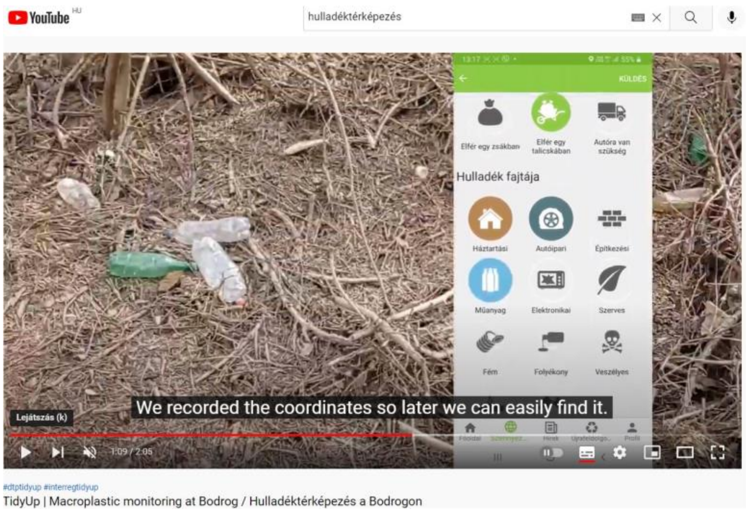


Fig. 10. *River waste accumulations are being registered on Bodrog river in TidyUp project using smartphone app TrashOUT. The tutorial video is subtitled in all project languages.*
Captured frame from the #interregtidyup playlist[6]

[4] https://youtu.be/fM278ywODEM
[5] https://youtu.be/yd9IBX5LDqk?t=152
[6] https://youtube.com/playlist?list=PL2F4YEGc6pgTSkU1ixovGXXGcj92g6nsV

3.2. Personal field survey - implementation of large scale pollution monitoring in floodplains

In TidyUp, pilot river cleanup actions were scheduled in all project countries, with the exception of Austria where there are no major macroplastic accumulations in the project area. At the initial joint river cleanup held in 06/2021 at the Tisza Lake (Hungary), parties had their first impressions on how a large-scale (multiple day and long distance) river cleanup operation looks like in reality. After learning the basics, the following partners were required to carry out macroplastic monitoring activities in their own countries.

- PP Institute of Oceanology – Bulgarian Academy of Science ERDF PP2 -
- IO-BAS BG, БЪЛГАРИЯ (BULGARIA)
- PP Multisalva Association ERDF PP3 - Multisalva RO, (ROMÂNIA)
- PP Faculty of Technical Sciences Novi Sad IPA PP1 - UNS RS, (SERBIA)
- PP For the nature- and environmental protection - PAPILIO ENI PP1 - Papilio UA, (UKRAINE)
- PP Agency for the Support of Regional Development Košice n.o. ERDF PP5 - ASRD SK, (SLOVENSKO)
- PP Agency of Regional Development Cross Border Cooperation "Transcarpathia" of Zakarpatska Oblast Council ENI PP2 - ARD Transcarpathia UA, (UKRAINE)

In TidyUp first the Slovakian partner ASRD started to use the TrashOUT, the waste monitoring application originally developed in Bratislava, Slovakia. During this activity, ASRD employees stuck to the protocol suggested by TRCH (another output of TidyUp). After the Slovakian section of Bodrog river, TidyUp partners carried out monitoring activities on sections of Túr, Bega, Tisza and Danube rivers. Once they were ready with the monitoring, results started to get processed via an automated process (for details see section 3.3. below) and LP THU was informed and asked to evaluate results.

Fig. 11. *Detection of macroplastic accumulation in a floodplain forest during a wintertime waste monitoring activity.*

Based on the common field experience and the instructions of the TRCH, large-scale multiple-day river cleanups were carried out in Ukraine, Slovakia, Romania, Serbia and Bulgaria on rivers like Tisza, Bodrog, Bega, Túr, Arges and the Danube. Actions included cleanup activities on water (with paddle boats and motorboats) and on dry land, mostly in the floodplain forests. All this was carried out based on the information uploaded and managed by the pollution map.

Fig.12. *Lifeguards secure the TidyUp river cleanup action in Tutrakan, Bulgaria in May, 2022.*

3.3. The flow of information between devices

Suppose our volunteer successfully found a new, never-before described macroplastic accumulation close to the river. Suppose he/she carefully reads the TRCH instructions and so she/he happens to have a charged smartphone in the backpack with the TrashOUT app installed. Once the registration of a newly discovered macroplastic accumulation is complete and SUBMIT is pressed, information starts to flow between devices, platforms and applications. To get a better understanding, the process is explained in the following sheet.

Activity	Description of data transfer
STEP 1. **Mobile device is switched on site, TrashOUT app launched, polluted site photographed, described, report is submitted**	Geolocation, ID, description and pictures are uploaded to TrashOUT servers via mobile network. In lack of signal the mobile device caches/stores the data and transfers again once it is back online.

STEP 2. **The new macroplastic accumulation is registered as an illegal waste deposit in the database of TrashOUT**	The registered macroplastic accumulation appears on the Map View of TrashOUT app and on the personal profile of the volunteer, as well as the organization he/she works on behalf of. If the volunteer had chosen PLASTIC Cup as its host organization, the deposit is automatically registered as a pollution site.
STEP 3. **A server to server interface starts working between TrashOUT and the pollution map's host KONASOFT**	Using a so-called JSON format and the API endpoint provided by TrashOUT, data is transferred to KONASOFT servers. Once a new entry is close to the riverbed of the Tisza and/or was submitted by a registered project volunteer, the site appears on the pollution map. The process is automated and takes a maximum of 15 minutes.
STEP 4. **The new entry appears on the pollution map**	The pollution map automatically creates filters based on the description provided by the volunteer on the field. The remarks given in the description section of TrashOUT become tags, keywords based on which the pollution map can select among the macroplastic accumulations.

Fig. 13. *Flow of information to the field to the pollution map*

4. Latest developments of the online pollution map

In 2 short years the Clean Tisza Map was developed into a multilingual, responsive, up-to-date online river pollution map. A single glance at the opening site reveals that the map now contains 15-fold more macroplastic accumulations, browsing is available in English and the search for polluted sites can be filtered not only to the composition, size of the plastic deposit but also to rivers and different countries like Ukraine, Romania, Slovakia, Hungary and Serbia. In the following section we give a report on the new features of the pollution map.

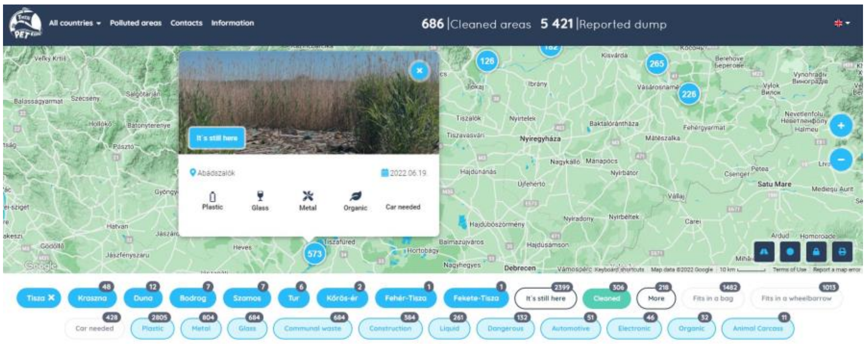


Fig. 14. *Opening site of the pollution map in June, 2022. No. of reported sites are now well over 5,000, functions are available in English.*

[Https://tisztatiszaterkep.hu/#/en/](https://tisztatiszaterkep.hu/#/en/)
Set your preferred country in the upper left corner.

4.1 Live tracking of pollution and project activities

Among the new features of the pollution map is the real-time live tracking of objects. The idea to track real-time events came up in connection with TidyUp's largest dissemination/communication output, the **Floating Exhibition**. FLEX is an awareness raising exhibition about the pollution of rivers and possible ways to tackle the problem. FLEX is unique from many aspects, one of which is that in more than 90% it was created using recycled and reclaimed materials. Attracting people to the river in order to learn about rivers opens up a wide array of possibilities in education, interactive learning and creative play. FLEX is going to be flexible and sustainable by all means. Its basic structure is modular, built of used marine transport containers, enabling "knowledge-transfer" not only on water but also by land. FLEX however, will spend most of its operative time on water, and will adapt to the particular conditions (weather, season, space) of each location. To reach as big an audience as possible it is important to provide people information not only about the exhibition but about the current position of FLEX; a feature that the pollution map will be able to fulfill. The other option to use the pollution map in live tracking mode is when following tagged plastic bottles in real time.

4.2. Extending the pollution map to entire project area

Of all the contributions of TidyUp to the development of the pollution map, the greatest by far is the **extension of the database** to other countries and other rivers. From small tributaries of the Tisza to the giant river of the Danube, a lot of natural waterways were added to the pollution map, a 5-fold increase in the lengths of represented rivers. Site developers used the riverbeds' geographical, hydrographical and morphological data provided by water authorities to represent the natural water bodies on the map as precisely as possible. After this upgrade, the above-detailed features of the pollution map is not limited to the Tisza river alone. The significance of this development is obvious as pollution, just like rivers, know no boundaries. New rivers given to the pollution map's database include:

- Black Tisza
- White Tisza
- Túr
- Latorica
- Kraszna
- Bodrog
- Bega
- Danube

4.3. Extending the pollution map to the microplastic survey

Another development of the pollution map was that besides macroplastic accumulations visible with the naked eye, the database will provide information about **microplastic** contamination as well. The first step towards this area of expertise is to highlight the location, description of TidyUp microplastic sampling sites. In the TidyUp project several sites along the rivers Danube and Tisza were tested with not 1 but 3 different kinds of methods. The comparison of results obtained with different monitoring techniques will be among the main outputs of the project.

Fig.15. *Icon highlighting microplastic sampling sites on the pollution map. Submissions from the Danube river include sites like Hainburg, Budapest, Bezdan, Pancevo, Ruse and Tutrakan.*

4.4. Pollution map data management-, and data extraction

At first glance the pollution map is not more than a visualisation of the biggest plastic deposits along rivers in the TidyUp project area. However, it provides many additional features, the most important of which is the so-called *Garbage Report* function. Suppose you are interested in the biggest macroplastic deposits along the river Bodrog in Slovakia. All you have to do is to choose 'Slovakia' from the drop-down menu in the top left corner and select the tag 'Bodrog' in the middle section. Hotspots will be shown on the map of course, but you will also be provided with an Excel download function. In the downloaded database you will find references about the exact location, size and other characteristics (composition, accessibility, etc.) of the given sites.

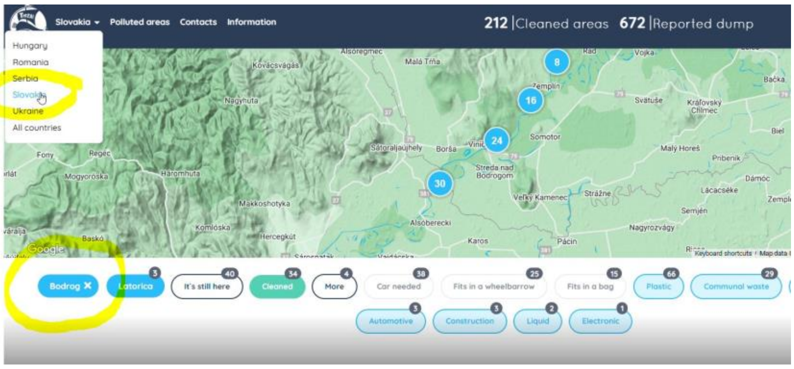


Fig.16. *Selection of country of interest from drop-down menu, then selecting the required river (in this case the Slovakian section of the Bodrog).*

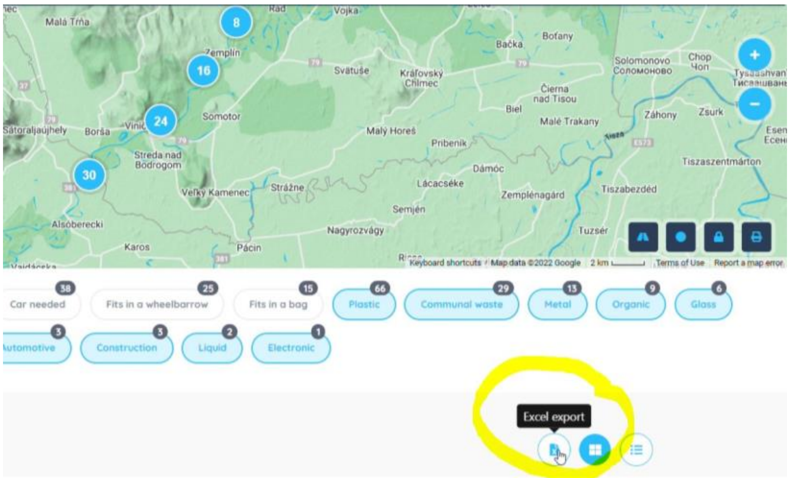
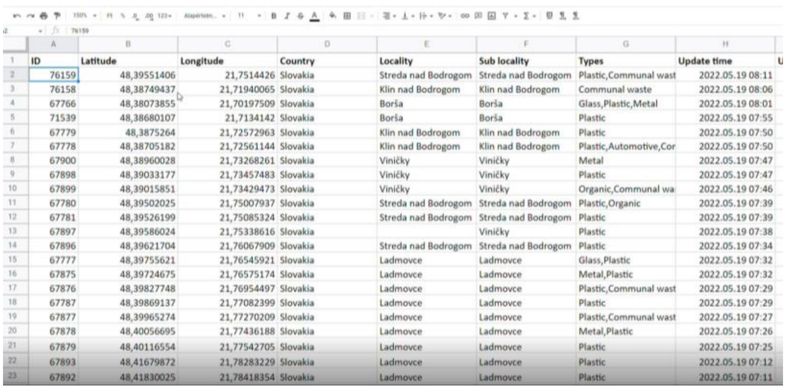


Fig.17. *Once the selection complete, choose the 'Excel export' option right below (highlighted in yellow).*

[*Https://tisztatiszaterkep.hu/#/en/*](https://tisztatiszaterkep.hu/#/en/)

Set your preferred country in the upper left corner.



ID	Latitude	Longitude	Country	Locality	Sub locality	Types	Update time
76159	48,39551406	21,7514426	Slovakia	Streda nad Bodrogom	Streda nad Bodrogom	Plastic,Communal wast	2022.05.19 08:11
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67766	48,38073855	21,70197509	Slovakia	Borša	Borša	Glass,Plastic,Metal	2022.05.19 08:01
71539	48,38680107	21,7134142	Slovakia	Borša	Borša	Plastic	2022.05.19 07:55
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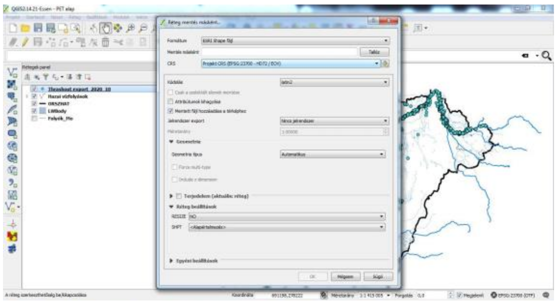
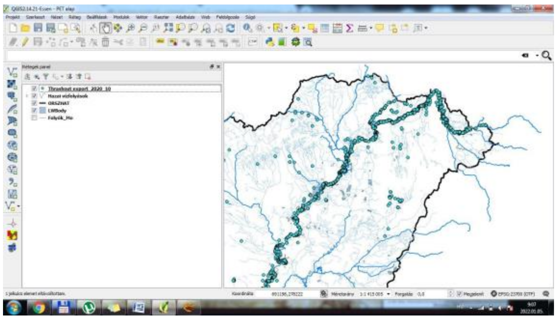
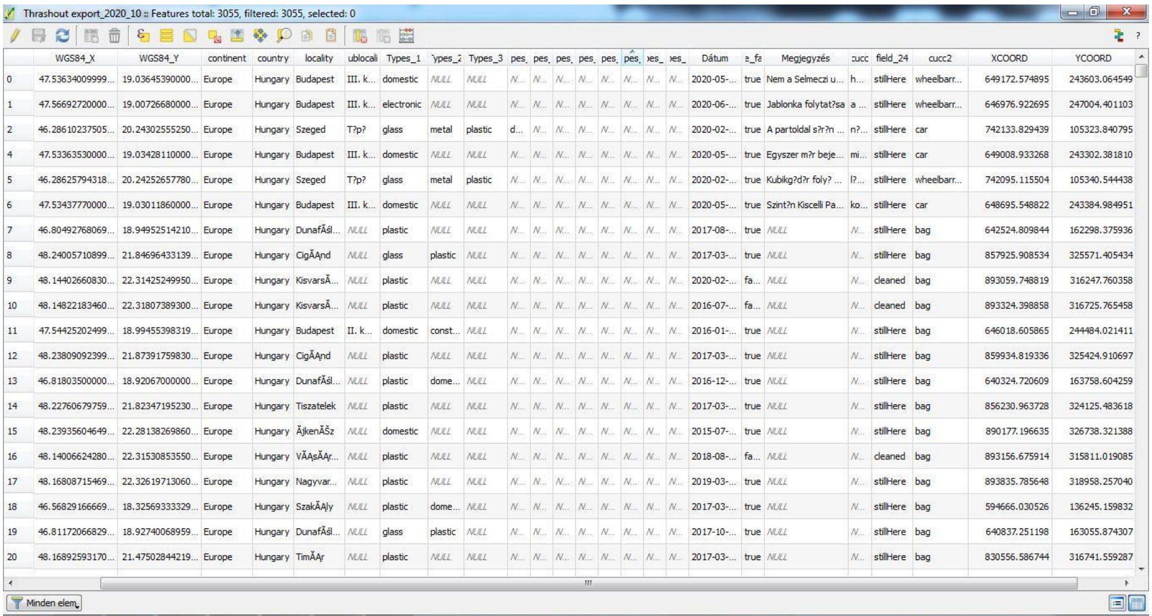
67780	48,39502025	21,75007937	Slovakia	Streda nad Bodrogom	Streda nad Bodrogom	Plastic,Organic	2022.05.19 07:39
67781	48,39526199	21,75085324	Slovakia	Streda nad Bodrogom	Streda nad Bodrogom	Plastic	2022.05.19 07:39
67897	48,39586024	21,75338616	Slovakia		Viničky	Plastic	2022.05.19 07:38
67896	48,39621704	21,76067909	Slovakia	Streda nad Bodrogom	Streda nad Bodrogom	Plastic	2022.05.19 07:34
67777	48,39755621	21,76545921	Slovakia	Ladmovce	Ladmovce	Glass,Plastic	2022.05.19 07:32
67875	48,39724675	21,76575174	Slovakia	Ladmovce	Ladmovce	Metal,Plastic	2022.05.19 07:32
67876	48,39827748	21,76954497	Slovakia	Ladmovce	Ladmovce	Plastic,Communal wast	2022.05.19 07:29
67787	48,39869137	21,77082399	Slovakia	Ladmovce	Ladmovce	Plastic	2022.05.19 07:29
67877	48,39965274	21,77270209	Slovakia	Ladmovce	Ladmovce	Plastic,Communal wast	2022.05.19 07:27
67878	48,40056695	21,77436188	Slovakia	Ladmovce	Ladmovce	Metal,Plastic	2022.05.19 07:26
67879	48,40116554	21,77542705	Slovakia	Ladmovce	Ladmovce	Plastic	2022.05.19 07:25
67893	48,41679872	21,78283229	Slovakia	Ladmovce	Ladmovce	Plastic	2022.05.19 07:12
67892	48,41830025	21,78418354	Slovakia	Ladmovce	Ladmovce	Plastic	2022.05.19 07:11

Fig.18. *The downloaded Excel sheet shows every macroplastic accumulation in the selected area, registered in this case by TidyUp partner ASRD before the Bodrog river cleanup.*

In this free feature we believe hides the greatest potential of the pollution map as for replicability. In Tid(y)Up, project partners decided not to develop a new map/application but to cooperate with the software designers of one existing interactive map to be able to reach a bigger audience, and to further broaden a database. At the beginning of the project only the Tisza was featured in the application, but as a result of the project the most polluted estuaries and the southern parts of the Danube also included on the map. The whole partnership is dedicated to further promote the pollution map by not only showing polluted sites but promoting possible solutions and the application at dissemination events.







	WGS84_X	WGS84_Y	continent	country	locality	ublocali	Types_1	ypes_2	Types_3	pes_	pes_	pes_	pes_	pes_	pes_	es_	es_	Dátum	e_fa	Megjegyzés	cucc	field_24	cucc2	XCOORD	YCOORD
0	47.53634009999...	19.03645390000...	Europe	Hungary	Budapest	III. k...	domestic	NULL	NULL	N...	N...	N...	N...	N...	N...	N...	N...	2020-05-...	true	Nem a Selmeczi u...	h...	stillHere	wheelbarr...	649172.574895	243603.064549
1	47.56692720000...	19.00726680000...	Europe	Hungary	Budapest	III. k...	electronic	NULL	NULL	N...	N...	N...	N...	N...	N...	N...	N...	2020-06-...	true	Jablonka folytat?sa	a ...	stillHere	wheelbarr...	646976.922695	247004.401103
2	46.28610237505...	20.24302555250...	Europe	Hungary	Szeged	T?p?	glass	metal	plastic	d...	N...	N...	N...	N...	N...	N...	N...	2020-02-...	true	A partoldal s?r?n ...	n?...	stillHere	car	742133.829439	105323.840795
4	47.53363530000...	19.03428110000...	Europe	Hungary	Budapest	III. k...	domestic	NULL	NULL	N...	N...	N...	N...	N...	N...	N...	N...	2020-05-...	true	Egyszer m?r beje...	mi...	stillHere	car	649008.933268	243302.381810
5	46.28625794318...	20.24252657780...	Europe	Hungary	Szeged	T?p?	glass	metal	plastic	N...	N...	N...	N...	N...	N...	N...	N...	2020-02-...	true	Kubikg?d?r foly? ...	l?...	stillHere	wheelbarr...	742095.115504	105340.544438
6	47.53437770000...	19.03011860000...	Europe	Hungary	Budapest	III. k...	domestic	NULL	NULL	N...	N...	N...	N...	N...	N...	N...	N...	2020-05-...	true	Szint?n Kiscelli Pa...	ko...	stillHere	car	648695.548822	243384.984951
7	46.80492768069...	18.94952514210...	Europe	Hungary	DunafĂśl...	NULL	plastic	NULL	NULL	N...	N...	N...	N...	N...	N...	N...	N...	2017-08-...	true	NULL	N...	stillHere	bag	642524.809844	162298.375936
8	48.24005710899...	21.84696433139...	Europe	Hungary	CigĂĄnd	NULL	glass	plastic	NULL	N...	N...	N...	N...	N...	N...	N...	N...	2017-03-...	true	NULL	N...	stillHere	bag	857925.908534	325571.405434
9	48.14402660830...	22.31425249950...	Europe	Hungary	KisvarsĂ...	NULL	plastic	NULL	NULL	N...	N...	N...	N...	N...	N...	N...	N...	2020-02-...	fa...	NULL	N...	cleaned	bag	893059.748819	316247.760358
10	48.14822183460...	22.31807389300...	Europe	Hungary	KisvarsĂ...	NULL	plastic	NULL	NULL	N...	N...	N...	N...	N...	N...	N...	N...	2016-07-...	fa...	NULL	N...	cleaned	bag	893324.398858	316725.765458
11	47.54425202499...	18.99455398319...	Europe	Hungary	Budapest	II. k...	domestic	const...	NULL	N...	N...	N...	N...	N...	N...	N...	N...	2016-01-...	true	NULL	N...	stillHere	bag	646018.605865	244484.021411
12	48.23809092399...	21.87391759830...	Europe	Hungary	CigĂĄnd	NULL	plastic	NULL	NULL	N...	N...	N...	N...	N...	N...	N...	N...	2017-03-...	true	NULL	N...	stillHere	bag	859934.819336	325424.910697
13	46.81803500000...	18.92067000000...	Europe	Hungary	DunafĂśl...	NULL	plastic	dome...	NULL	N...	N...	N...	N...	N...	N...	N...	N...	2016-12-...	true	NULL	N...	stillHere	bag	640324.720609	163758.604259
14	48.22760679759...	21.82347195230...	Europe	Hungary	Tiszatelek	NULL	plastic	NULL	NULL	N...	N...	N...	N...	N...	N...	N...	N...	2017-03-...	true	NULL	N...	stillHere	bag	856230.963728	324125.483618
15	48.23935604649...	22.28138269860...	Europe	Hungary	ĂjkenĂŠz	NULL	domestic	NULL	NULL	N...	N...	N...	N...	N...	N...	N...	N...	2015-07-...	true	NULL	N...	stillHere	bag	890177.196635	326738.321388
16	48.14006624280...	22.31530853550...	Europe	Hungary	VĂĄsĂĄr...	NULL	plastic	NULL	NULL	N...	N...	N...	N...	N...	N...	N...	N...	2018-08-...	fa...	NULL	N...	cleaned	bag	893156.675914	315811.019085
17	48.16808715469...	22.32619713060...	Europe	Hungary	Nagyvar...	NULL	plastic	NULL	NULL	N...	N...	N...	N...	N...	N...	N...	N...	2019-03-...	true	NULL	N...	stillHere	bag	893835.785648	318958.257040
18	46.56829166669...	18.32569333329...	Europe	Hungary	SzakĂĄly	NULL	plastic	dome...	NULL	N...	N...	N...	N...	N...	N...	N...	N...	2017-03-...	true	NULL	N...	stillHere	bag	594666.030526	136245.159832
19	46.81172066829...	18.92740068959...	Europe	Hungary	DunafĂśl...	NULL	glass	plastic	NULL	N...	N...	N...	N...	N...	N...	N...	N...	2017-10-...	true	NULL	N...	stillHere	bag	640837.251198	163055.874307
20	48.16892593170...	21.47502844219...	Europe	Hungary	TimĂĄr	NULL	plastic	NULL	NULL	N...	N...	N...	N...	N...	N...	N...	N...	2017-03-...	true	NULL	N...	stillHere	bag	830556.586744	316741.559287

Fig.19. *Real life application of the pollution map. Data export and conversion of coordinates into EOV format as per the request of Hungarian National Parks before a country-wide cleanup operation.*

The pollution map now highlights 5000+ 'hotspots' most of them revealed during the obligatory preparation surveys carried out by each partner before their pilot river cleanup actions. Thanks to the valuable input of Tid(y)Up partners, the cleanup interventions could target the most heavily polluted areas of the Tisza, Bodrog, Bega, Túr and Danube rivers. With a simple change in settings, users can filter to the biggest macroplastic deposits within project countries. For reference as for the number of hotspot entries, Hungary (3500+) is followed by Romania (950+), Slovakia (650+), Serbia (130+) and Ukraine (120+) as per last Tid(y)Up report. The map proved useful already within the project when making the final decision on the location of the Serbian cleanup action, as IPA Partner PP1 planned its cleanup action at a site that has been cleaned before the event, but another much more contaminated site has been found in the vicinity based on the info provided by the map – and based on that the initial location has been changed by the event organizers.

5. Further improvements of the pollution map

To achieve not only a scientific database but a satisfying user experience, the pollution map needs some further improvements. A solution-focused approach can lead to other changes in the structure of the website. A proper multilingual tutorial video on the applicability of the pollution map is much needed. Just as important is the indication of positive examples and best practices, one of which will hopefully be the river friendly catering qualification. The pollution map will soon feature River Guard centers established in the Tisza basin; zero waste pontoons floating on riverine waste; adopted river sections as well as river friendly schools and NGOs in the project area.

Translation of every single button/expression into every project language is expected within the Tid(y)Up project term (as per now language can only be changed to English). Macroplastic deposits should be uploaded in multiple locations along the Danube riverbed and possibly by some tributaries of the Danube other than the Tisza. An easy to remember URL can also improve overall outreach.

To involve third parties into the pollution mapping effort, to encourage local people, NGO's to register and repost river pollution should be another goal when further developing the pollution map. In that regard the recent software development of TrashOUT provides a great help as the app is able to register polluted sites even without mobile network signal and upload the collected data once the device is back online.

Fig.20. *Roll-up of the TidyUp project*