



MINISTRY OF AGRICULTURE
RURAL DEVELOPMENT
AND THE ENVIRONMENT



ΙΑΤΡΙΚΕΣ ΥΠΗΡΕΣΙΕΣ ΚΑΙ
ΥΠΗΡΕΣΙΕΣ ΔΗΜΟΣΙΑΣ ΥΓΕΙΑΣ



REPUBLIC OF CYPRUS
MINISTRY OF HEALTH

Pancyprian wastewater surveillance system for SARS-CoV-2: the Cyprus Dashboard



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Sanitary Engineer, Water Development Department

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Research Engineer, KIOS Research and Innovation Center of
Excellence, University of Cyprus



March 15th, 2022, EU4S 7th Town Hall meeting



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REPUBLIC OF CYPRUS
MINISTRY OF HEALTH



nireas
International Water Research Center



ΚΟΪΟΣ
Research and Innovation Center of Excellence



Πανεπιστήμιο Κύπρου
University of Cyprus



THE CYPRUS INSTITUTE OF
NEUROLOGY & GENETICS

Pancyprrian sUrveilLance of SARS-CoV-2 in urban wastEwater

Systematically monitoring of urban wastewater in Cyprus for the presence of selected RNA genetic markers of the SARS-CoV-2 virus and its variants, to better understand the dynamics and spatiotemporal trends of the COVID-19 pandemic.

Partners:

University of Cyprus

Nireas – International Water Research Center

Dr. D. Fatta-Kassinos, Dr. G. Nikolopoulos, Dr. P. Karaolia, I. Iakovides, P. Loutsiou, A. Violaris



KIOS Research and Innovation Center of Excellence

Dr. M. Polykarpou, Dr. D. Eliades, P. Pavlou, M. Kyriakou

The Cyprus Institute of Neurology and Genetics (CING)

Molecular Virology Department - Dr. C. Christodoulou, Dr. I. Richter



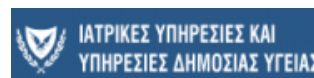
Water Development Department

Wastewater and Reuse Division - A. Larcou-Yiannakou, S. G. Michael



Medical and Health Services

Director - Dr. O. Kalakouta



Funding:

- Water Development Department, Ministry of Agriculture, Rural Development and the Environment
- Medical and Health Services, Ministry of Health Republic of Cyprus

Co-Funding:

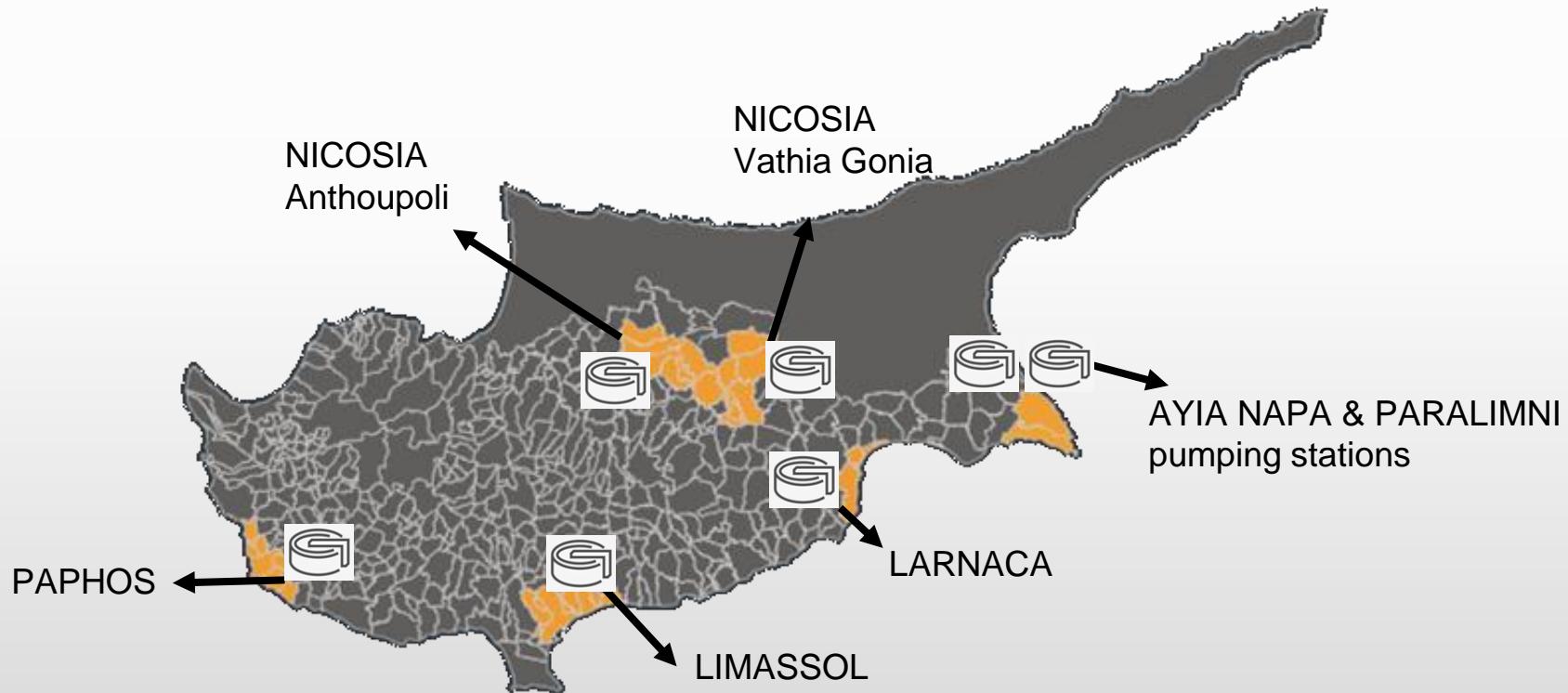
- European Commission Recommendation 2021/472



Objectives

1. Determination of the SARS-CoV-2 genetic fragments in urban wastewater
2. Epidemiological analysis of SARS-CoV-2 concentrations in urban wastewater
3. Identification of SARS-CoV-2 variants
4. Development of the SARS-CoV-2 monitoring platform (Dashboard)

Population
coverage:
~70%

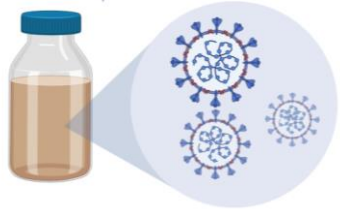


Objectives

- **Determination of the SARS-CoV-2 genetic fragments in urban wastewater**

Sampling:

Composite, 24-hour samples are collected from UWWTPs every Thursday and Monday (2 per week) and stored at 4 °C until analysis.



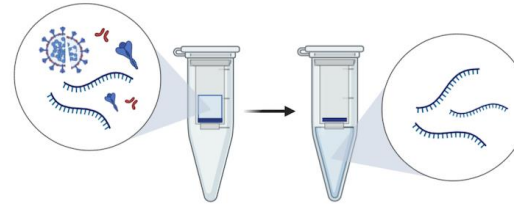
Centrifugation:

Centrifugation of samples followed by their pre-concentration to a smaller volume (filtration by specialized filters)



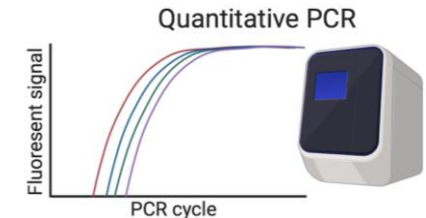
RNA extraction:

RNA is extracted from the pre-concentrated samples using RNA extraction kit (breaking of the viral cell membranes and release viral RNA).



Reverse Transcription PCR:

Genetic markers N2 and E are analysed using RT-qPCR for the quantification of their concentrations in the prepared samples.



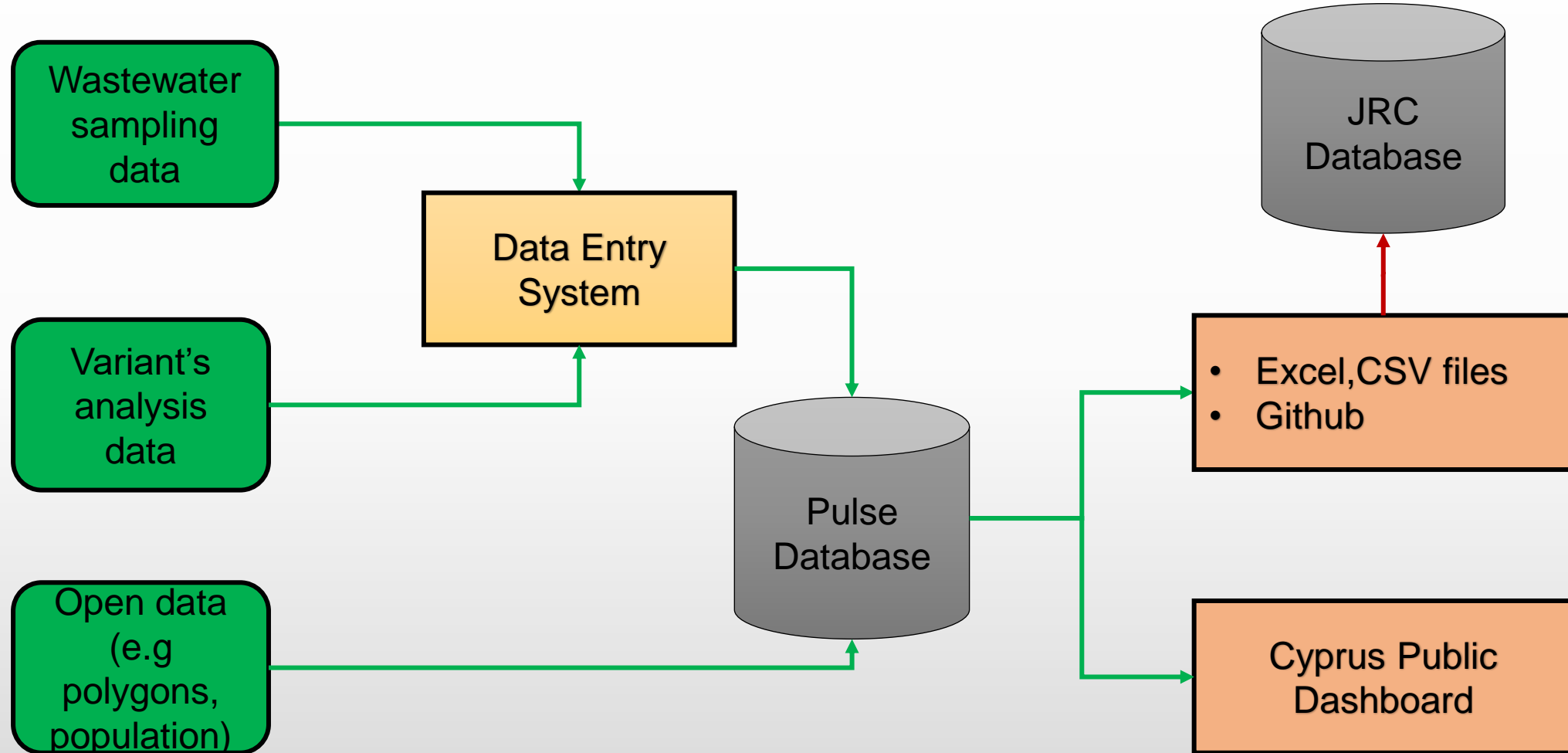
- **Epidemiological analysis of SARS-CoV-2 concentrations in urban wastewater**

- Statistical analysis of the SARS-CoV-2 concentrations in wastewater
- Correlations with the clinical epidemiological data obtained by the respective area served by each UWWTP

- **Identification of SARS-CoV-2 variants**

- Two (2) inlet samples of urban wastewater from each UWWTP per month (14 samples per month in total) are being analyzed with the use of Next Generation Sequencing (MiSeq system) followed by bioinformatics analysis.

PULSE Data Analytics Platform Architecture

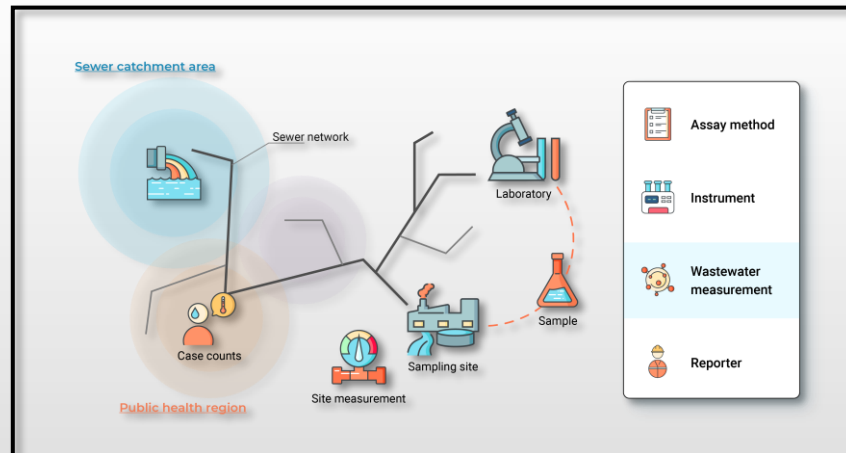


Data Templates

- Followed the Open Data Model (ODM) data templates (<https://github.com/Big-Life-Lab/PHES-ODM>)

Variables of concern:

- Sample
- Wastewater Measurement
- Site
- Site Measurement
- Reporter
- Lab
- Assay Method
- Instrument
- Polygon (region)
- Covid - Public Health Data



Nicolai N., Therrien J.-D., Maere T., Pileggi V., Swerdfeger H., Vanrolleghem P.A., Manuel D. (2021) Open Data Model for collecting, quality-ensuring and sharing of SARS-CoV-2 data and metadata, EU4S Sewage Sentinel System for SARS CoV-2 - 5th Town Hall Meeting, e-poster, <https://api.ltb.io/show/ABCWX>

PULSE tables

pulseapp_wwmeasure	
123 id	
ABC wwmeasureid	
ABC reporterid	
ABC sampleid	
ABC labID	
ABC assayMethodID	
datetime	
analysisdate	
reportdate	
ABC fractionAnalyzed	
ABC type	
123 value	
ABC unit	
ABC aggregation	
ABC index	
ABC qualityFlag	
ABC accessToPublic	
ABC accessToAllOrg	
ABC accessToPHAC	
ABC accessToLocalHA	
ABC accessToProvHA	
ABC accessToOtherProv	
ABC accessToDetails	
ABC notes	
ABC loginname	

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datetimeend	
ABC notes	
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ABC siteid	
ABC instrumentid	
ABC reporterid	
ABC type	
ABC collection	
ABC preTreatment	
ABC pooled	
ABC children	
ABC parent	
ABC sizeL	
ABC index	
ABC fieldSampleTempC	
ABC shippedOnce	
ABC storageTempC	
ABC qualityFlag	
ABC loginname	




polygon	
123 id	
ABC polygonID	
ABC name	
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ABC type	
ABC wkt	
ABC link	
ABC notes	

pulseapp_variants	
123 id	
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ABC siteID	
ABC polygonid	
ABC siteName	
ABC Lineage	
ABC VariantType	
ABC comment	
datetime	
datetimestart	
datetimeend	
ABC loginname	


Data Analytics Platform




- A user-friendly interface for the laboratory personnel




Project
Research
Team




University
of Cyprus



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International Water Research Center



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Add Sampling Data

View Sampling Data

View Measurements

ppavlos [pavlou.v.pavlos@ucy.ac.cy]

Logout

Add Sampling Data

Sample

covE

covN2

Location

Start time

mm/dd/yyyy

End time

mm/dd/yyyy

Sample notes

Analysis date

mm/dd/yyyy

Submit

Location

Anthoupolis-B

Ayia Napa

Larnaca

Limassol

Paphos

Paralimni

Vathia-Gonia-A

Sample

covE

covN2

Value (gc/L)

Value (PE)

Value (PE-BOD)

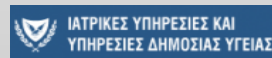
Value (PE-COD)

Value (PE-NH4)

Value (PE-Ntot)

Value (PE-Ptot)

Measurement notes



Data Analytics Platform



Data entry system

View Sampling Data

Export Data

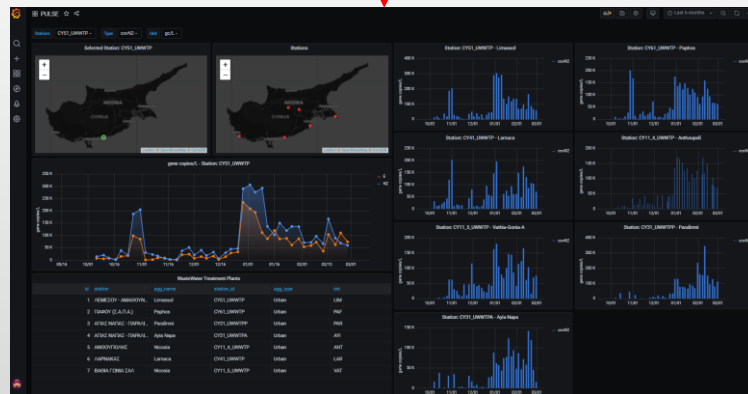
Show 25 entries

A/A	Location	Sample ID	Start Time	End Time	Notes
577	Paralimni	PAR_18102021	2021-10-17 00:00:00	2021-10-18 00:00:00	Influent samples
576	Paralimni	PAR_28102021	2021-10-27 00:00:00	2021-10-28 00:00:00	Influent samples
575	Ayia Napa	AYI_28102021	2021-10-27 00:00:00	2021-10-28 00:00:00	Influent samples
574	Ayia Napa	AYI_28022022	2022-02-27 00:00:00	2022-02-28 00:00:00	Influent samples
573	Ayia Napa	AYI_24022022	2022-02-23 00:00:00	2022-02-24 00:00:00	Influent samples
572	Paralimni	PAR_28022022	2022-02-27 00:00:00	2022-02-28 00:00:00	Influent samples
571	Paralimni	PAR_24022022	2022-02-23 00:00:00	2022-02-24 00:00:00	Influent samples

PostgreSQL database

id	location	datetime	datetimestart	datetimeend	abc notes	abc sampleid	abc siteid	abc type	abc collection
476	Larnaca	2022-02-01 15:44:19	2022-01-19 00:00:00	2022-01-20 00:00:00	[NULL]	LAR_20012022	CY41_UWWTP	rawWW	cpTP24h
480	Vathia-Gonia-A	2022-02-01 15:48:35	2022-01-19 00:00:00	2022-01-20 00:00:00	[NULL]	VAT_20012022	CY11_5_UWWTP	rawWW	cpTP24h
484	Paralimni	2022-02-01 15:53:53	2022-01-20 00:00:00	2022-01-20 00:00:00	[NULL]	PAR_20012022	CY31_UWWTP	rawWW	cpTP24h
493	Larnaca	2022-02-10 13:04:54	2022-02-02 00:00:00	2022-02-03 00:00:00	Influent samples	LAR_03022022	CY41_UWWTP	rawWW	cpTP24h
564	Larnaca	2022-03-03 10:54:38	2022-02-27 00:00:00	2022-02-28 00:00:00	Influent samples	LAR_28022022	CY41_UWWTP	rawWW	cpTP24h
567	Vathia-Gonia-A	2022-03-03 10:57:28	2022-02-23 00:00:00	2022-02-24 00:00:00	Influent samples	VAT_24022022	CY11_5_UWWTP	rawWW	cpTP24h
570	Paphos	2022-03-03 11:00:27	2022-02-27 00:00:00	2022-02-28 00:00:00	Influent samples	PAF_28022022	CY61_UWWTP	rawWW	cpTP24h
497	Vathia-Gonia-A	2022-02-10 13:11:04	2022-02-02 00:00:00	2022-02-03 00:00:00	Influent samples	VAT_03022022	CY11_5_UWWTP	rawWW	cpTP24h
501	Paralimni	2022-02-10 13:14:57	2022-02-02 00:00:00	2022-02-03 00:00:00	Influent samples	PAR_03022022	CY31_UWWTP	rawWW	cpTP24h
449	Ayia Napa	2022-01-25 18:46:47	2022-01-16 00:00:00	2022-01-17 00:00:00	[NULL]	AYI_17012022	CY31_UWWTP	rawWW	cpTP24h
445	Paralimni	2022-01-25 18:42:32	2022-01-16 00:00:00	2022-01-17 00:00:00	[NULL]	PAR_17012022	CY31_UWWTP	rawWW	cpTP24h
441	Paphos	2022-01-25 18:35:54	2022-01-16 00:00:00	2022-01-17 00:00:00	[NULL]	PAF_17012022	CY61_UWWTP	rawWW	cpTP24h
437	Vathia-Gonia-A	2022-01-25 18:21:35	2022-01-16 00:00:00	2022-01-17 00:00:00	[NULL]	VAT_17012022	CY11_5_UWWTP	rawWW	cpTP24h
433	Anthoupolis-B	2022-01-25 18:15:13	2022-01-16 00:00:00	2022-01-17 00:00:00	[NULL]	ANT_17012022	CY11_4_UWWTP	rawWW	cpTP24h
427	Limassol	2022-01-25 17:43:46	2022-01-16 00:00:00	2022-01-17 00:00:00	[NULL]	LIM_17012022	CY51_UWWTP	rawWW	cpTP24h
505	Limassol	2022-02-11 11:27:43	2022-01-30 00:00:00	2022-01-31 00:00:00	Influent samples	LIM_31012022	CY51_UWWTP	rawWW	cpTP24h

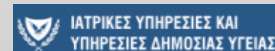
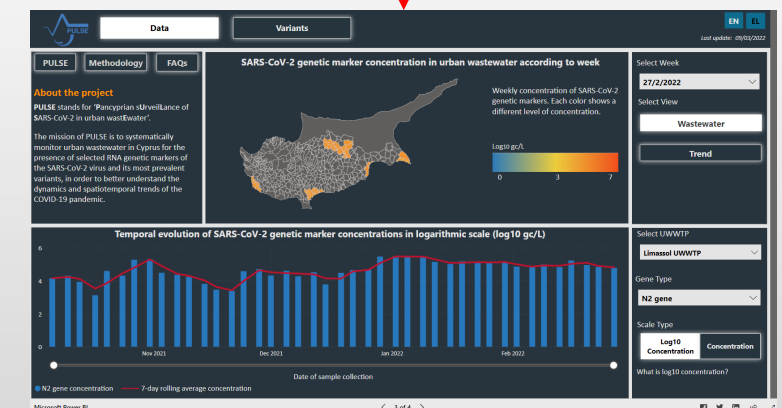
Internal Dashboard



Excel, CSV files

id	location	datetime	datetimestart	datetimeend	notes	sampleid	siteid	type	collection
476	Larnaca	1/2/2022	19/1/2022	20/1/2022		LAR_20012022	CY41_UWWTP	rawWW	cpTP24h
480	Vathia-Gonia-A	1/2/2022	19/1/2022	20/1/2022		VAT_20012022	CY11_5_UWWTP	rawWW	cpTP24h
484	Paralimni	1/2/2022	19/1/2022	20/1/2022		PAR_20012022	CY31_UWWTP	rawWW	cpTP24h
493	Larnaca	10/2/2022	2/2/2022	3/2/2022	Influent samples	LAR_03022022	CY41_UWWTP	rawWW	cpTP24h
564	Larnaca	3/3/2022	27/2/2022	28/2/2022	Influent samples	LAR_28022022	CY41_UWWTP	rawWW	cpTP24h
567	Vathia-Gonia-A	3/3/2022	27/2/2022	28/2/2022	Influent samples	VAT_24022022	CY11_5_UWWTP	rawWW	cpTP24h
570	Paphos	3/3/2022	27/2/2022	28/2/2022	Influent samples	PAF_28022022	CY61_UWWTP	rawWW	cpTP24h
497	Vathia-Gonia-A	10/2/2022	2/2/2022	3/2/2022	Influent samples	VAT_03022022	CY11_5_UWWTP	rawWW	cpTP24h
501	Paralimni	10/2/2022	2/2/2022	3/2/2022	Influent samples	PAR_03022022	CY31_UWWTP	rawWW	cpTP24h
449	Ayia Napa	25/1/2022	16/1/2022	17/1/2022		AYI_17012022	CY31_UWWTP	rawWW	cpTP24h

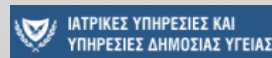
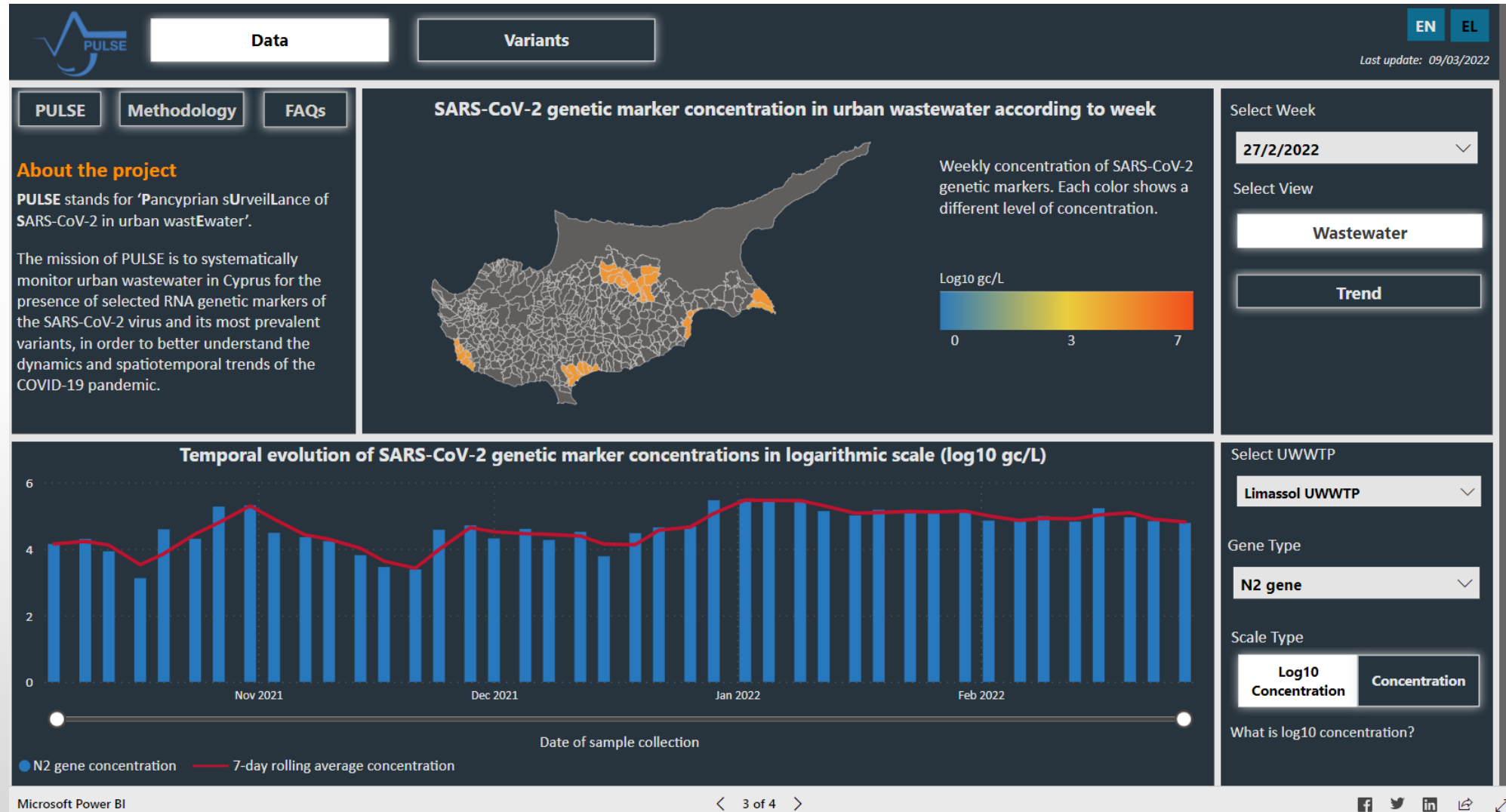
Public dashboard



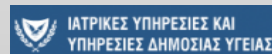
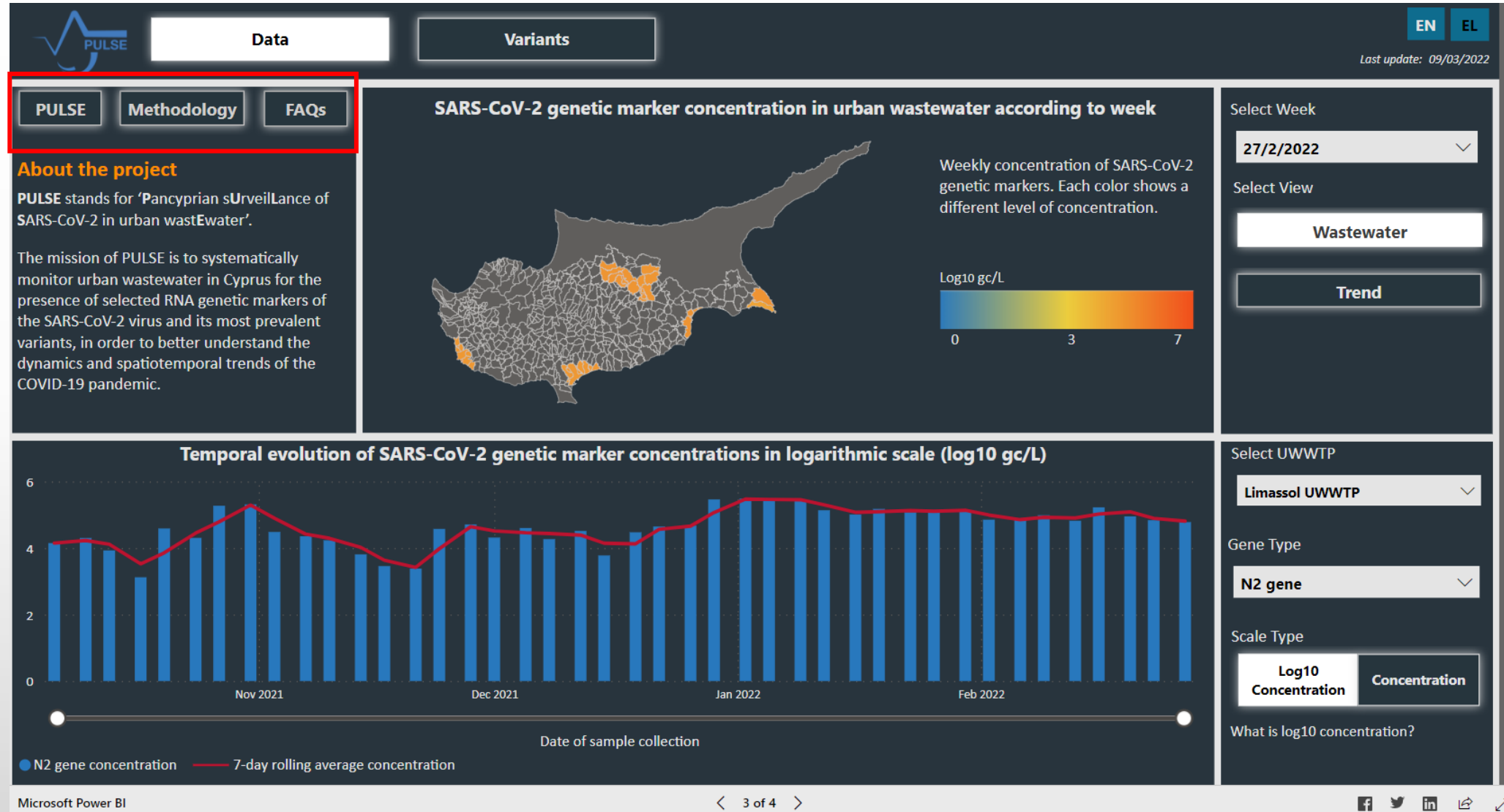
Public dashboard - Wastewater



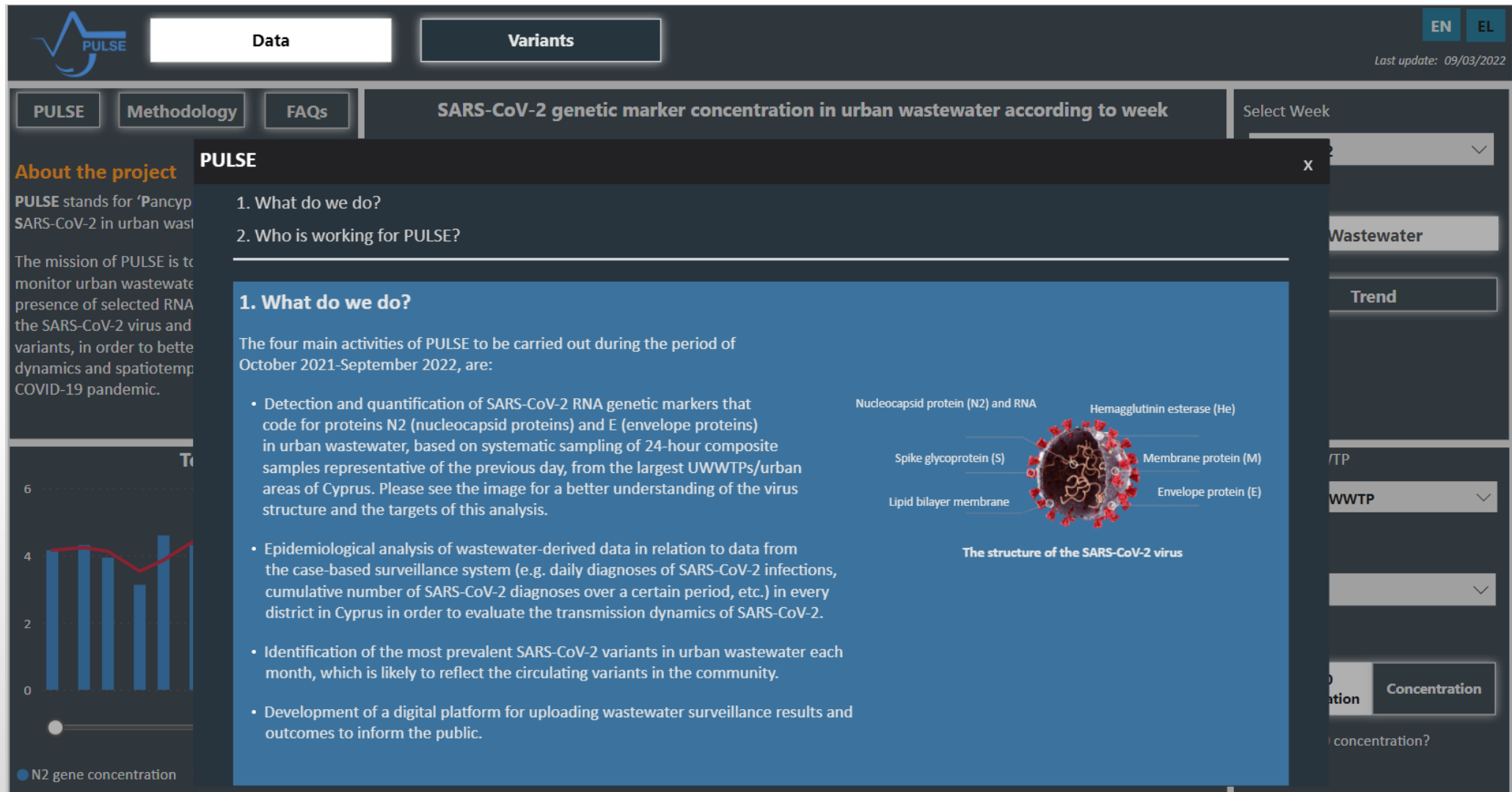
<https://covid-pulse.cy/>



Public dashboard - Information

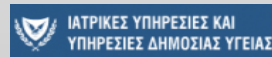


Public dashboard - Information

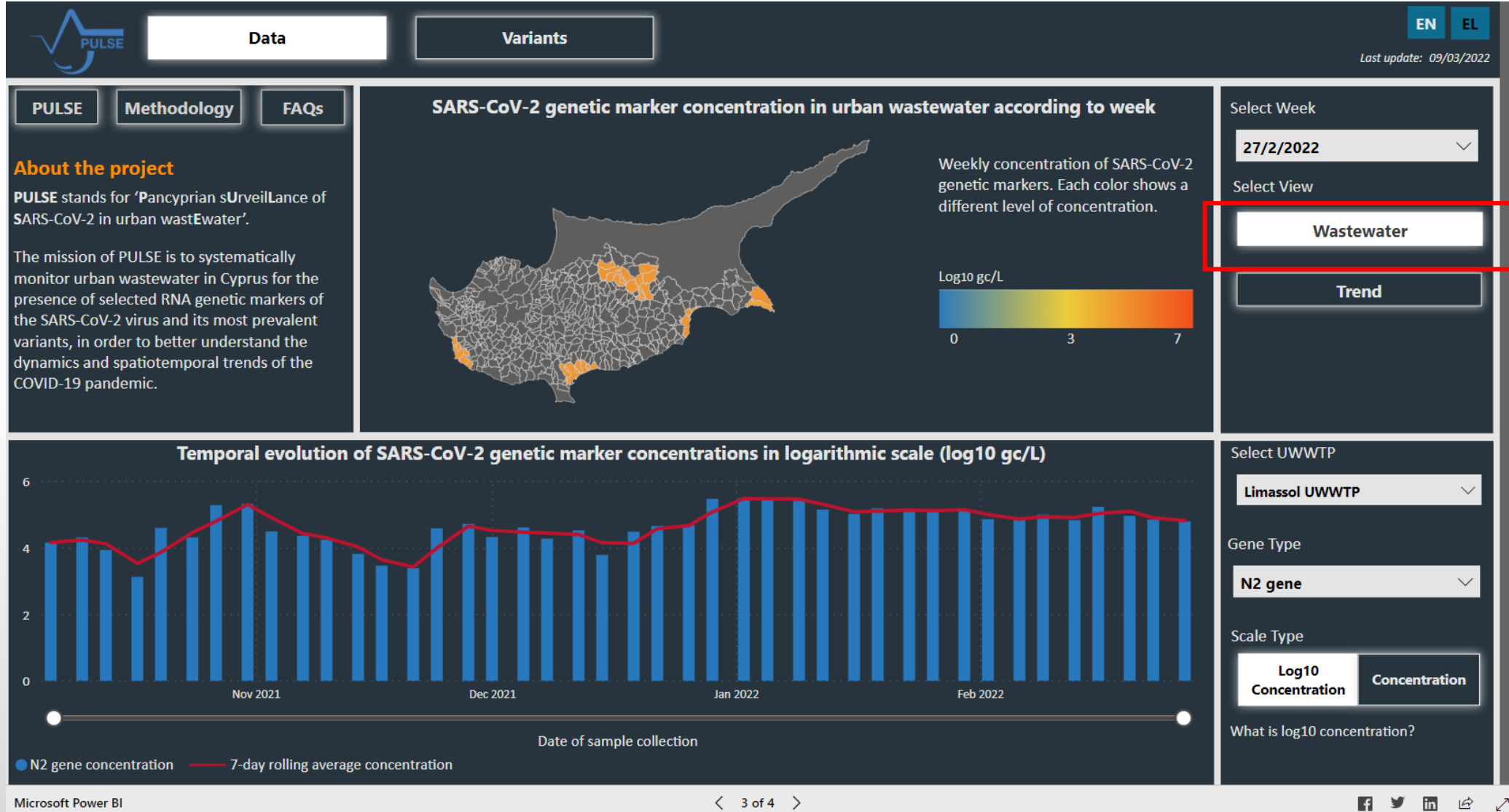


Microsoft Power BI

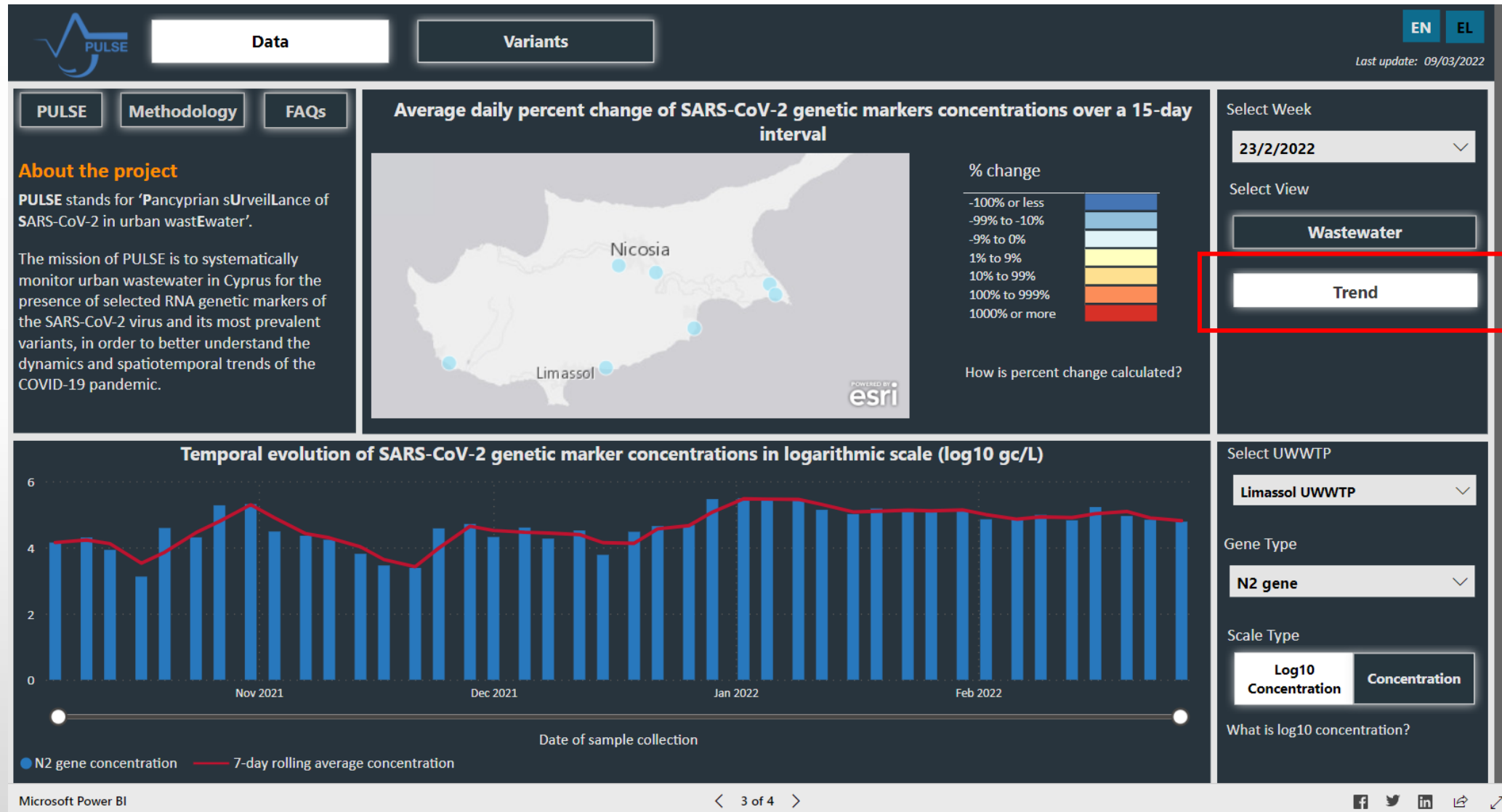
< 3 of 4 >



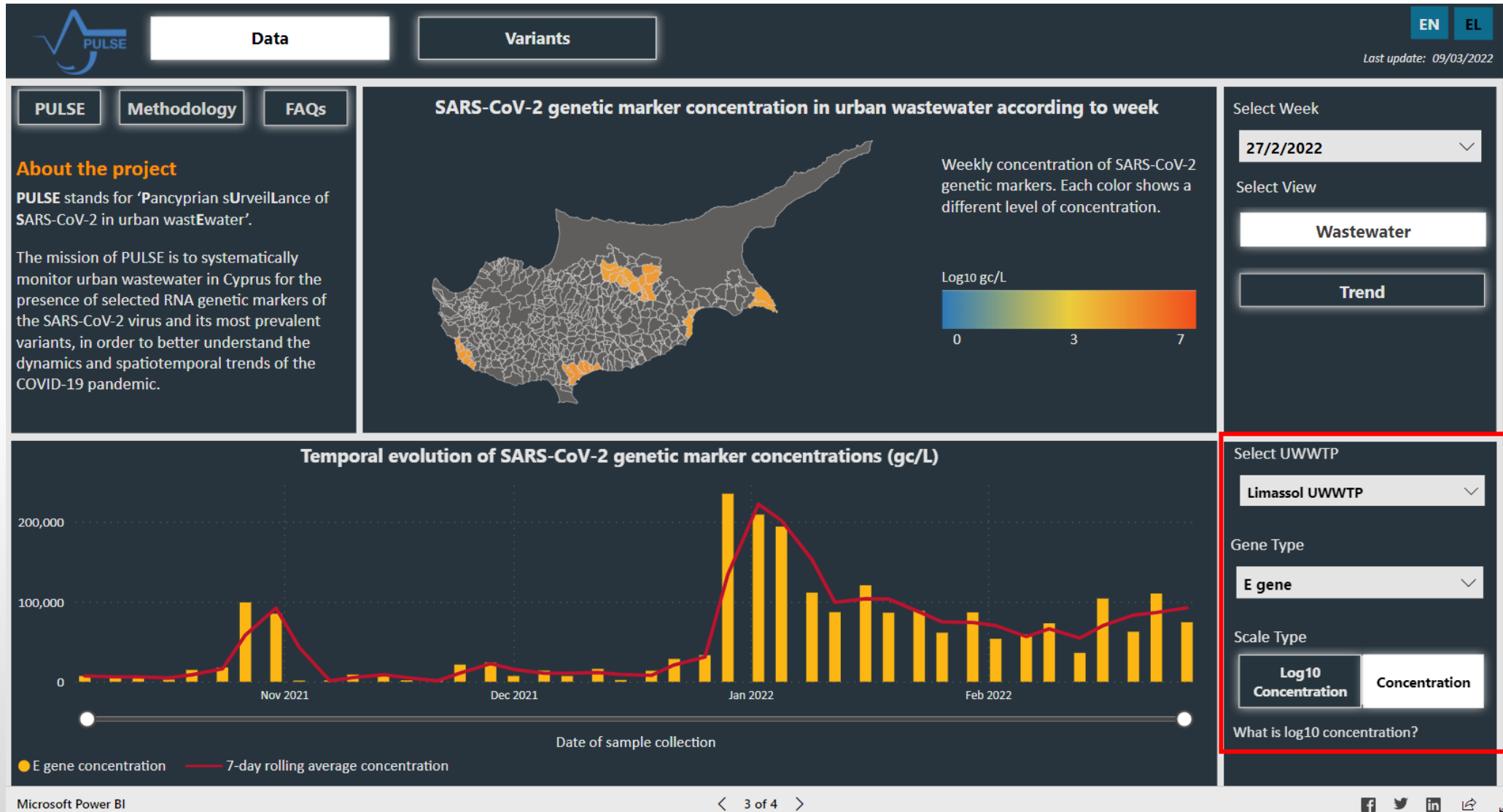
Public dashboard – Wastewater Map



Public dashboard – Trend Map



Public dashboard – Timeseries



Public dashboard – Variants



Data

Variants

EN

EL

Last update: 09/03/2022

PULSE

Methodology

FAQs

About the project

PULSE stands for ‘Pancyprian sUrveillance of SARS-CoV-2 in urban wastEwater’.

The mission of PULSE is to systematically monitor urban wastewater in Cyprus for the presence of selected RNA genetic markers of the SARS-CoV-2 virus and its most prevalent variants, in order to better understand the dynamics and spatiotemporal trends of the COVID-19 pandemic.

Why is the variants analysis important?

By determining the variants present in the wastewater, it is possible to detect the emergence of new virus variants in specific geographical regions and how these are spreading in the different regions under surveillance. It also allows for detecting variants that cause mainly asymptomatic infections, which are otherwise missed by clinical surveillance.

Table of detected SARS-CoV-2 variants in urban wastewater monthly

UWWTP	Date of detection	Lineage	Variant Type	Comment
Limassol UWWTP	23/1/2022	AY.4.7	Delta (B.1.617.2-like)	Mixture with Omicron variant
Larnaca UWWTP	23/1/2022	BA.1	Probable Omicron (BA.1 - like)	
Paphos UWWTP	23/1/2022	BA.1	Probable Omicron (BA.1 - like)	Mixture with Delta variant
Nicosia (Anthoupoli) UWWTP	19/1/2022	BA.1	Probable Omicron (BA.1 - like)	Mixture with Delta variant
Agia Napa Pumping Station	19/1/2022	undetermined	undetermined	
Nicosia (Vathia Gonias) UWWTP	19/1/2022	undetermined	undetermined	
Paralimni Pumping Station	19/1/2022	undetermined	undetermined	Mixture of Omicron and Delta variant
Limassol UWWTP	26/12/2021	AY.43	Delta (B.1.617.2-like)	Mixture with Omicron variant
Paralimni Pumping Station	26/12/2021	AY.43	Delta (B.1.617.2-like)	
Larnaca UWWTP	26/12/2021	B.1.617.2	Delta (B.1.617.2-like)	
Agia Napa Pumping Station	26/12/2021	BA.1	Probable Omicron (BA.1 - like)	
Paphos UWWTP	26/12/2021	BA.1	Probable Omicron (BA.1 - like)	
Nicosia (Anthoupoli) UWWTP	26/12/2021	undetermined	undetermined	
Nicosia (Vathia Gonias) UWWTP	26/12/2021	undetermined	undetermined	
Limassol UWWTP	19/12/2021	AY.127	Delta (B.1.617.2-like)	
Paphos UWWTP	19/12/2021	B.1.617.2	Delta (B.1.617.2-like)	
Larnaca UWWTP	19/12/2021	undetermined	undetermined	
Paphos UWWTP	15/12/2021	AY.5.4	Delta (B.1.617.2-like)	
Larnaca UWWTP	15/12/2021	undetermined	undetermined	
Paralimni Pumping Station	12/12/2021	AY.122	Delta (B.1.617.2-like)	

Select Period

10/17/2021

1/23/2022

Select UWWTP

All

Select Variant Type

All

Microsoft Power BI

4 of 4

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