NutzWasser

Providing an alternative water supply for safe and demand-oriented agricultural and urban landscape irrigation

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5 June 2023

GEFÖRDERT VOM
Bundesministerium für Bildung und Forschung

FONA
Forschung für Nachhaltigkeit

Eine Initiative des Bundesministeriums für Bildung und Forschung
WavE
Wassertechnologien: Wiederverwendung

More Frequent Droughts and Heatwaves across Europe

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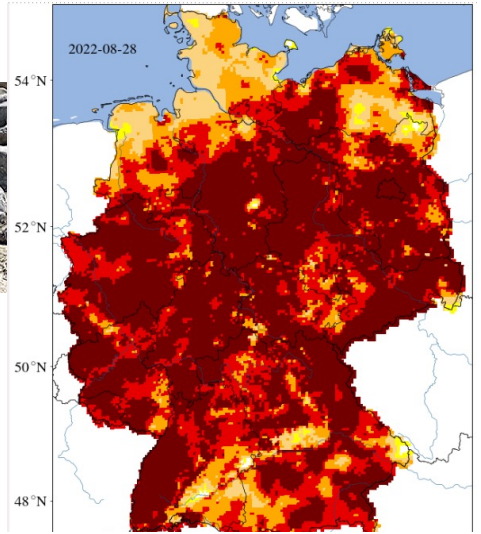
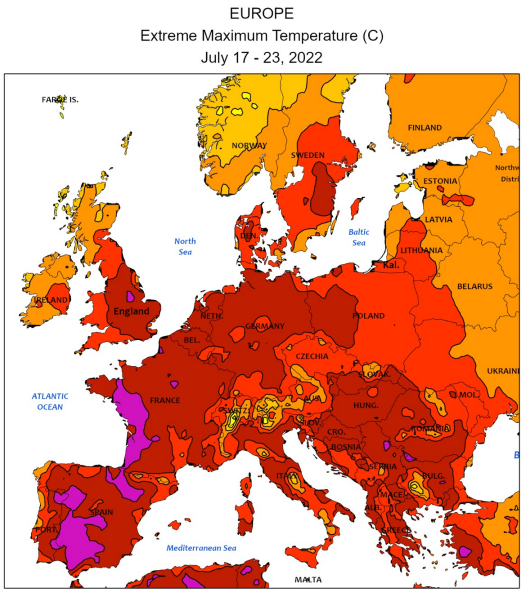
https://www.ufz.de/export/data/2/270352_rissbach800x450px.jpg

Dürre überall

Flüsse und Seen erreichen historische Tiefstände, weite Landstriche
Extremsommer auf der Nordhalbkugel ist auch aus dem All zu erken

05.09.2022, 07.51 Uhr





https://www.spiegel.de/wissenschaft/natur/duerre-in-deutschland-und-weltweit-der-rueckzug-des-wassers-a-380be8ea-f523-46aa-8ba4-78ce3843c2e6

Source: Süddeutsche Zeitung Oktober 2022

Drought Condition in Europe in Summer 2022

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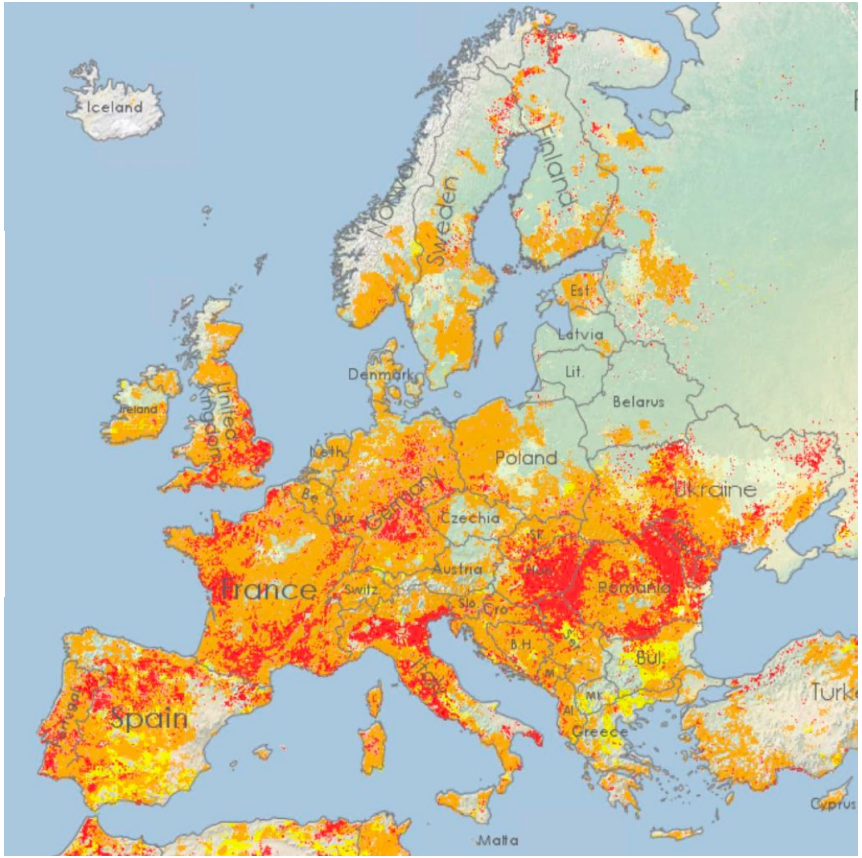
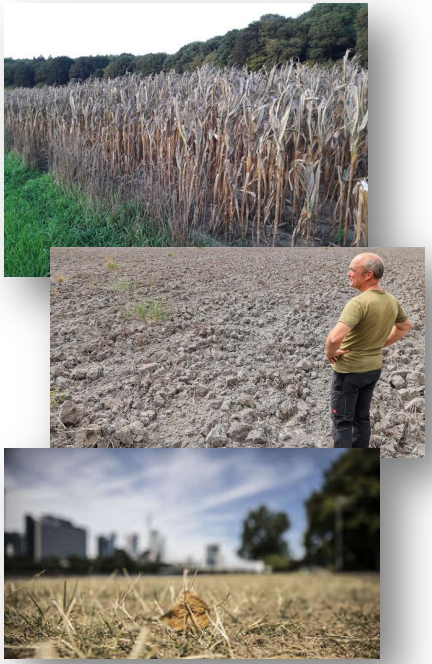
- Watch
- Warning
- Alert
- Full recovery
- Temporary soil moisture recovery
- Temporary fAPAR recovery





Source: JRC Global Drought Observatory 2022; Augsburger Allgemeine; Bundesministerium für Ernährung und Landwirtschaft; Frankfurter Rundschau

Impacts on Soil Moisture

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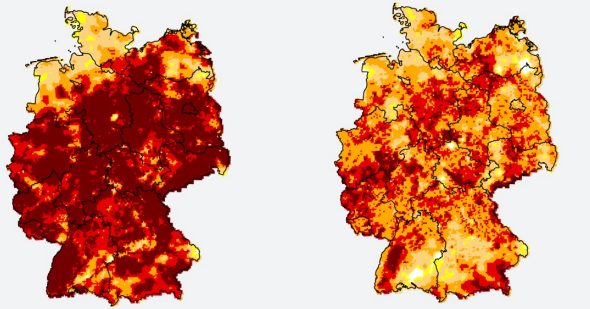
Drought monitor Germany

Gemessen am 24.08.2022

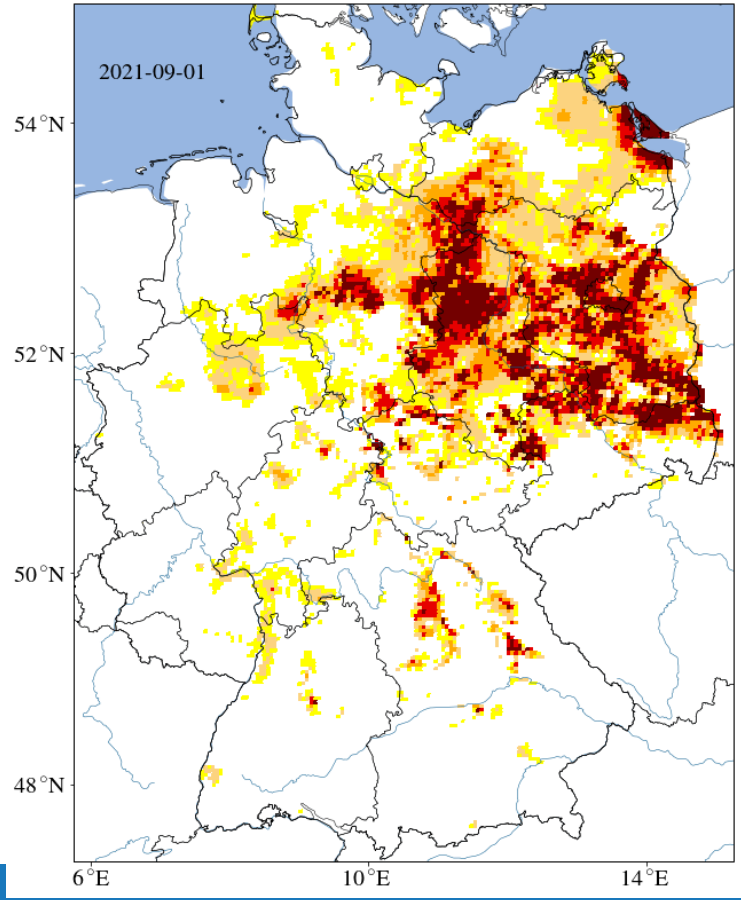
Gesamtboden (ca. 1,8m) | Oberboden (bis 25cm)



Infografik Dürremonitor Deutschland August 2022 DE

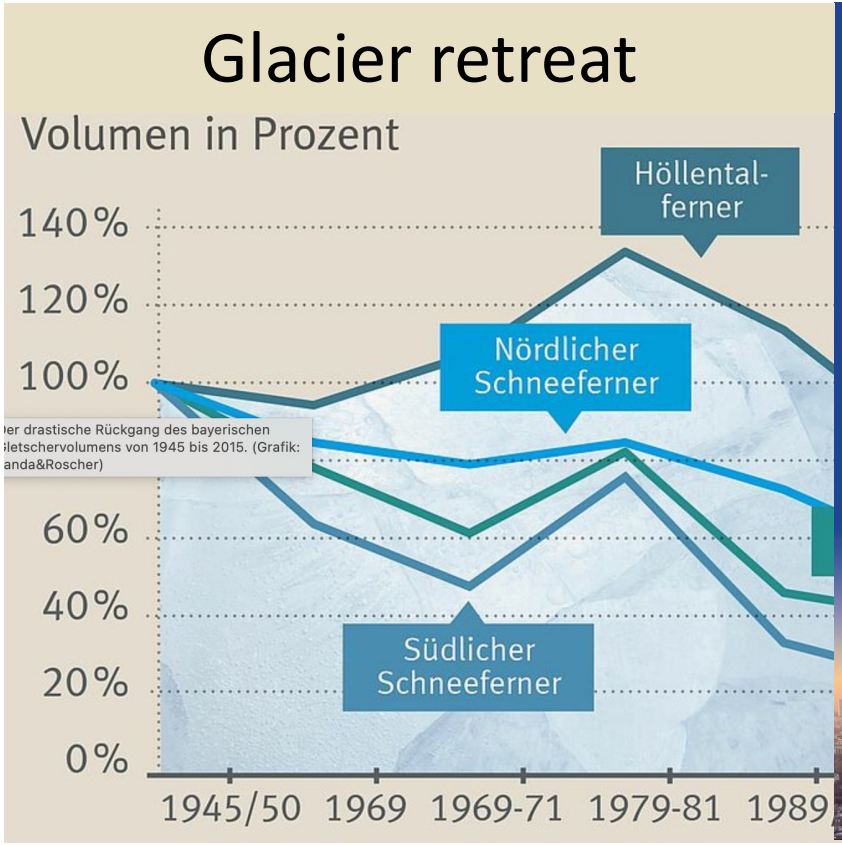
- ungewöhnlich trocken
- moderate Dürre
- schwere Dürre
- extreme Dürre
- außergewöhnliche Dürre

Quelle: Helmholtz Zentrum für Umweltforschung



Impacts on Glacier and Permafrost Soil

Glacier retreat

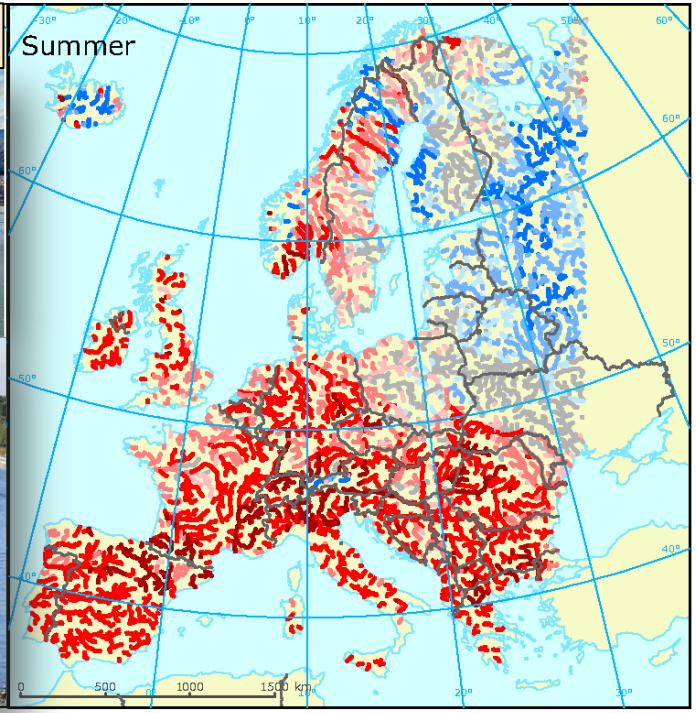


er drastische Rückgang des bayerischen
letschervolumens von 1945 bis 2015. (Grafik:
anda&Roscher)

Source: European State of the Climate Report 2023; BUND Bayern 2021; Info24service, National Geographic

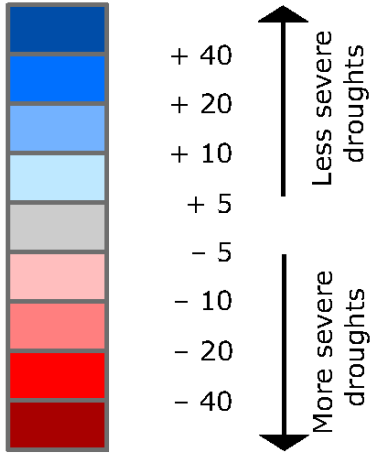
Impacts of Droughts on Stream Flows

River Rhine, Summer 2022



Relative change in mean annual and summer minimum 7-day river flow between 2071–2100 and 1961–1990

Change in %



Source: European Environment Agency 2022; dw.de; FAZ.de

Impacts on Groundwater Recharge Rates - Bavaria

Source: Landesamt für Umwelt 2017

Goundwater levels across Bavaria, Germany

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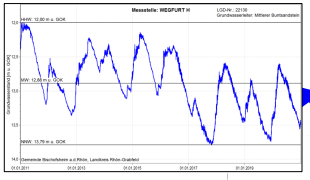
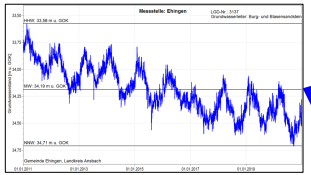
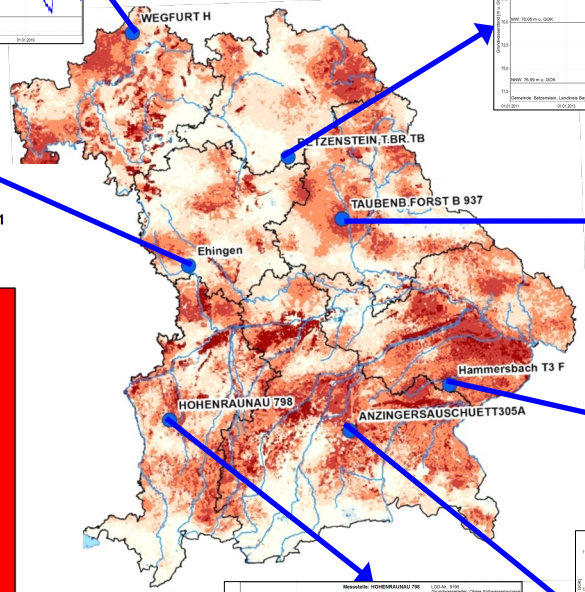
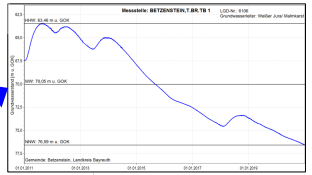
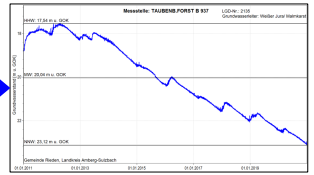
Monitoring: 2011-2020

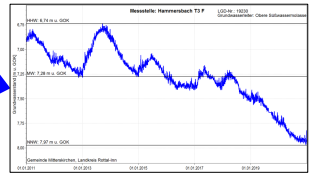


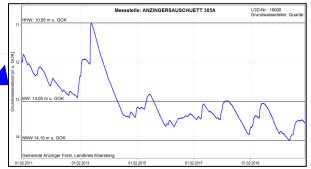


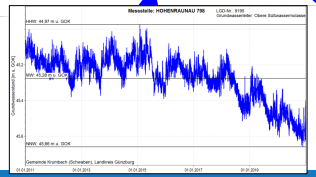








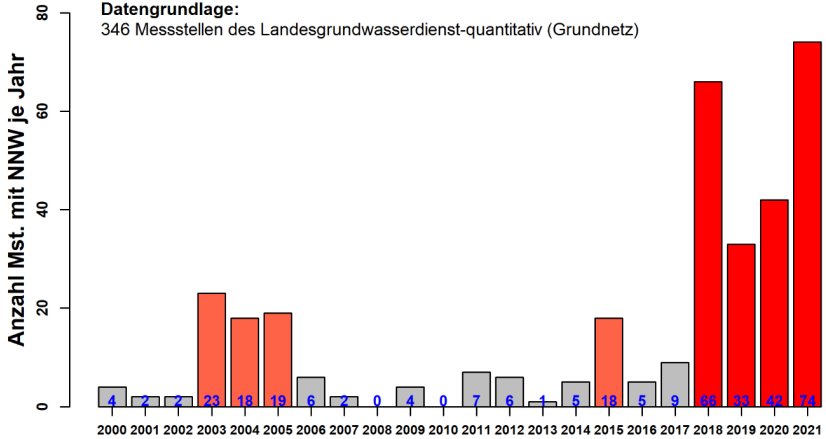




Lowest ever reported levels since 2000

Stand: 31.12.2021

Datengrundlage:
346 Messstellen des Landesgrundwasserdienst-quantitativ (Grundnetz)



Bayerisches Staatsministerium für Umwelt und Verbraucherschutz

Source: Prof. Martin Grambow, Bay. StUMV, November 2022

Increasing Number of Conflicts

- Increasing demand for agricultural irrigation
- Increasing demand for urban landscape irrigation
- Public water supply
- Cooling and process water demand
- Maintaining ecological base flows
- Fit-for-Purpose: Do we need drinking water quality for all purposes?

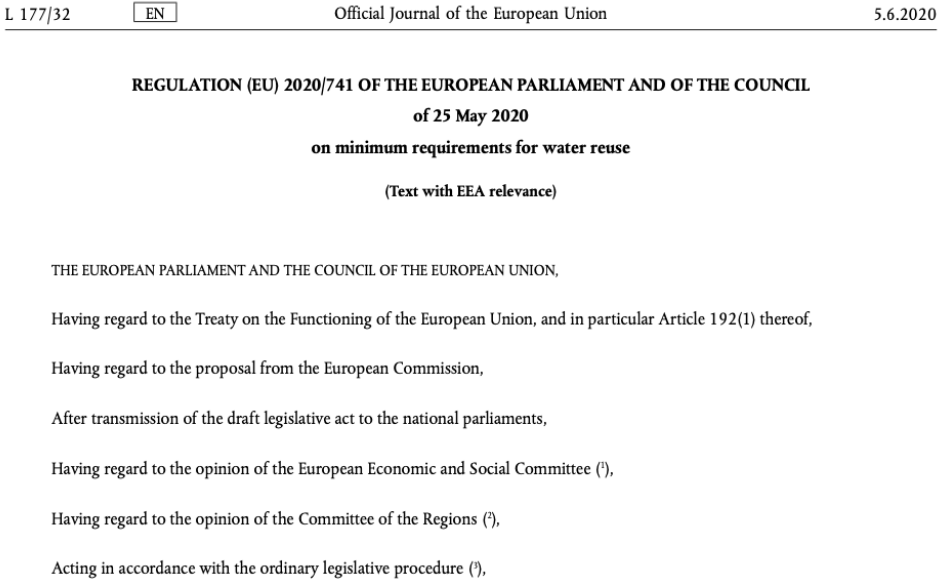





Source: MainPost 2017, bild.de, BR24

EU Regulation for Water Reuse, 2020

EU Water Reuse Regulation, 2020/741
May 2020



L 177/32 EN Official Journal of the European Union 5.6.2020

REGULATION (EU) 2020/741 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
of 25 May 2020
on minimum requirements for water reuse

(Text with EEA relevance)

THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION,

Having regard to the Treaty on the Functioning of the European Union, and in particular Article 192(1) thereof,

Having regard to the proposal from the European Commission,

After transmission of the draft legislative act to the national parliaments,

Having regard to the opinion of the European Economic and Social Committee ([1]),

Having regard to the opinion of the Committee of the Regions ([2]),

Acting in accordance with the ordinary legislative procedure ([3]),

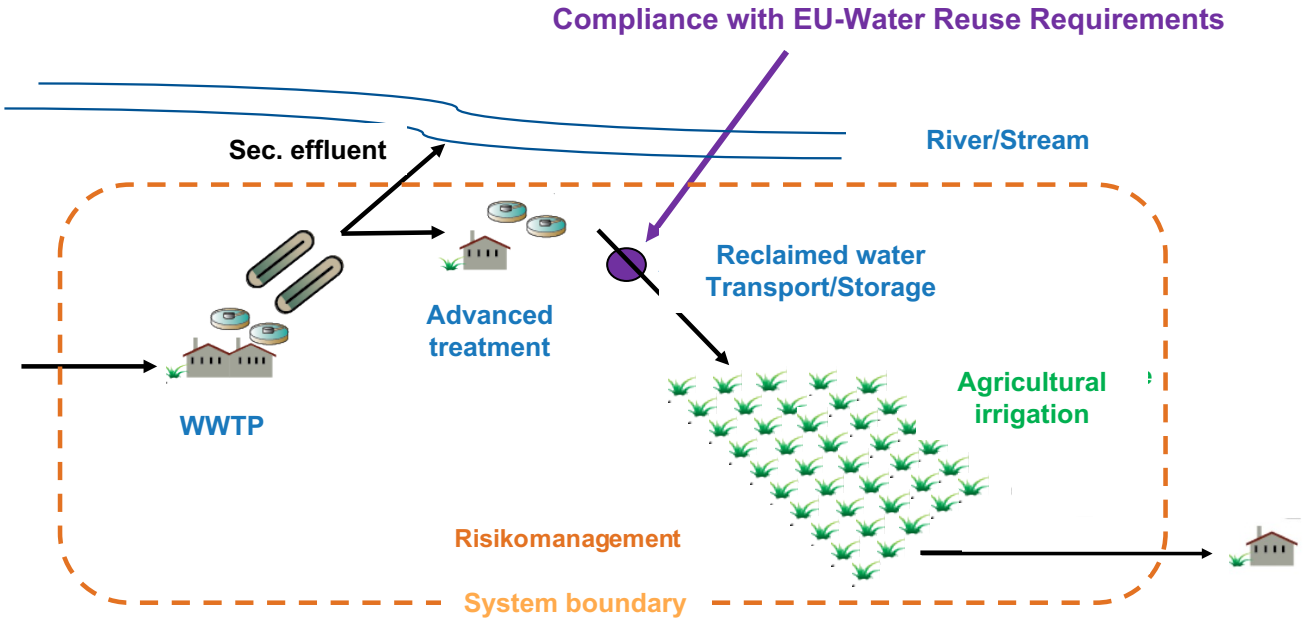
-> comply with rule by 26 June 2023

Key underlying principles:

- Introduction of **minimum requirements** for water reuse in agricultural irrigation
- Underlying **risk management plan**
  - Parametric values for quality of reclaimed water & monitoring requirements to address HEALTH risks
  - Key risk management elements addressing ENVIRONMENTAL risks & and potential additional health risks
  - System of permits and compliance checks

Risk Management Framework

- A system level approach



Comprehensive Risk Management Plan

Lower Franconia – an area with severe water scarcity

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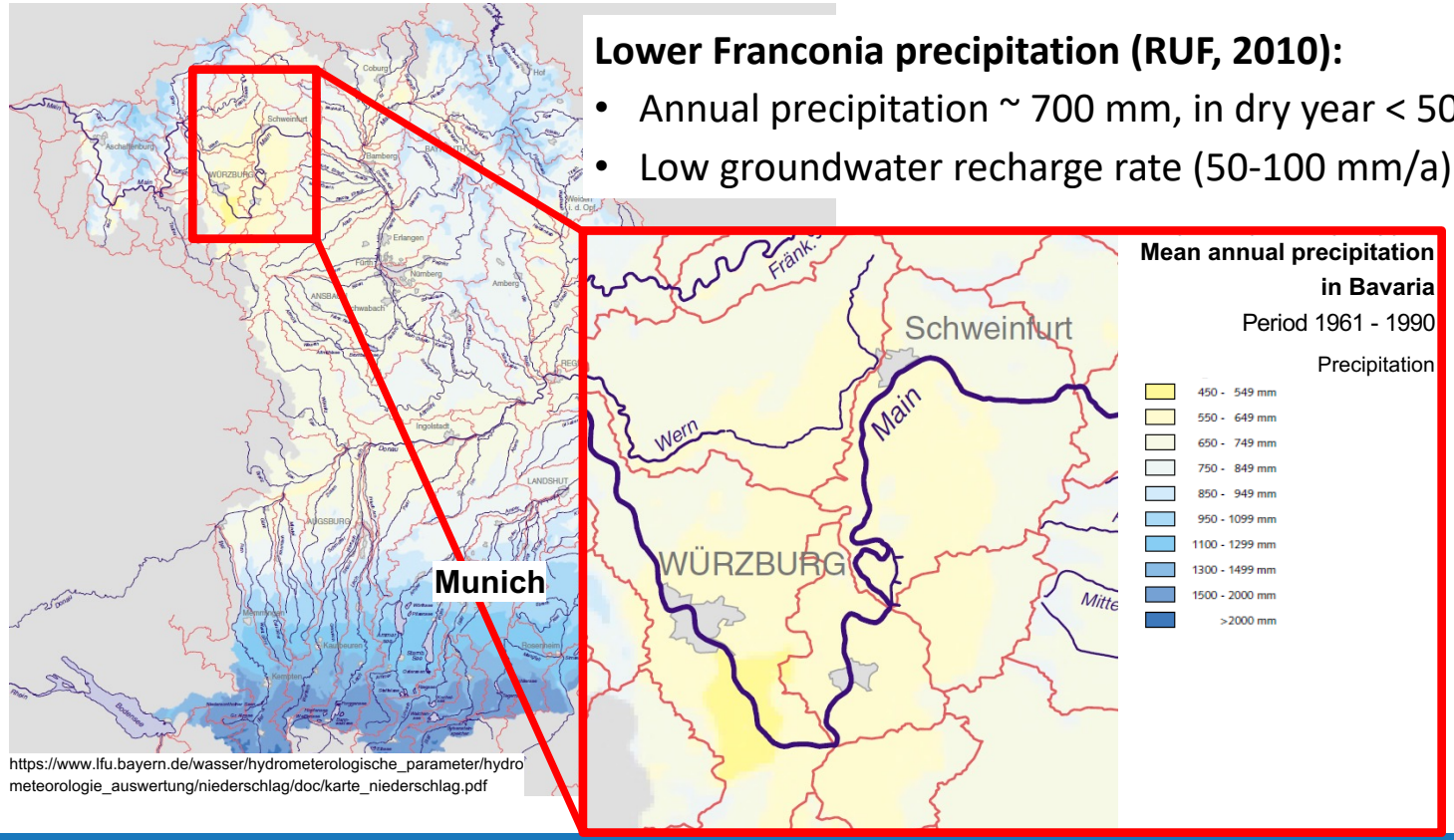

https://www.lfu.bayern.de/wasser/hydrometerologische_parameter/hydrometeorologie_auswertung/niederschlag/doc/karte_niederschlag.pdf

Lower Franconia precipitation (RUF, 2010):

- Annual precipitation ~ 700 mm, in dry year < 500 mm
- Low groundwater recharge rate (50-100 mm/a)

Stakeholder Process
- inclusive, interactive, transparent

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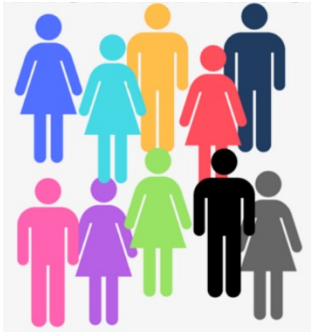
Establishment of a Stakeholder Process

- Potential users, representatives of agricultural, wastewater treatment facilities, drinking water supplier, regulatory agencies, environmental groups, etc.
- Development of a joint vision and discussion on concerns and requirements
- Identification of case studies for urban and agricultural irrigation



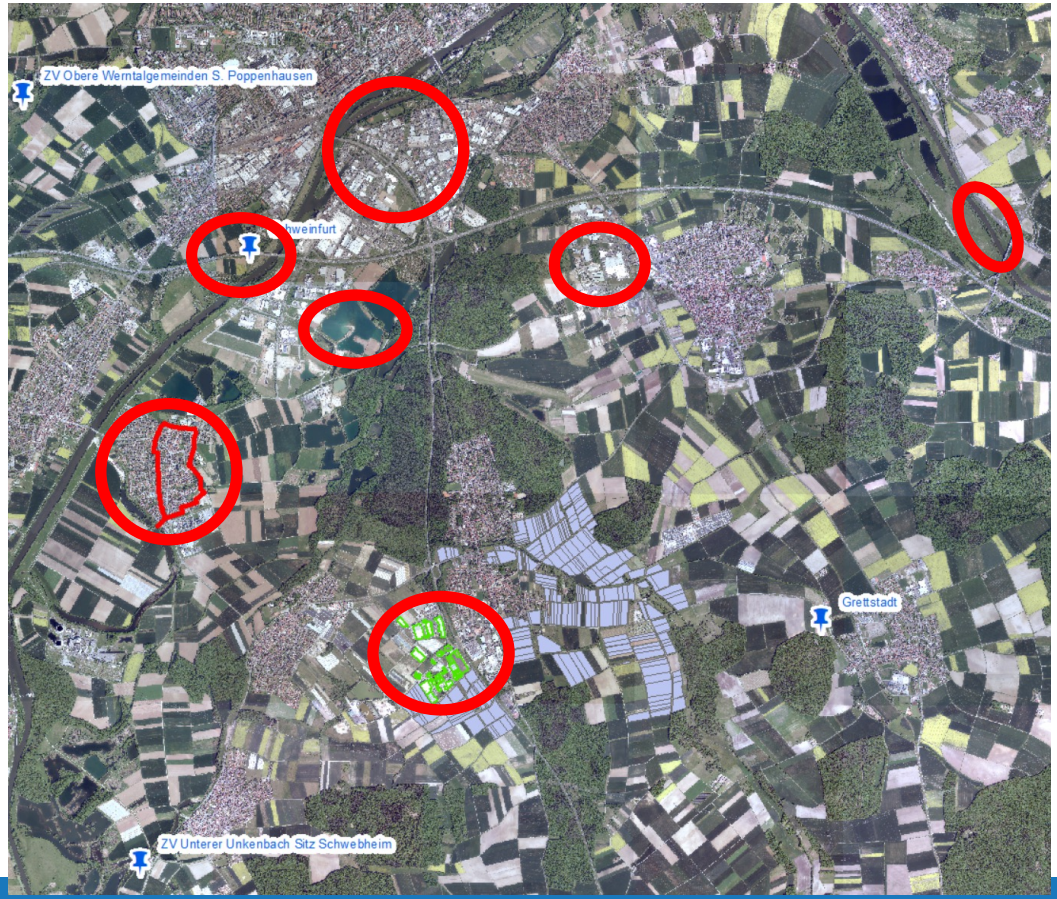
Estimation of water demand + alternative water resources

- Demand estimation using surveys, historic data, modeling
- Identification of potential alternative supplies by stakeholder engagement and by using other data

Concept development water reuse

- Identification using Stakeholder process
- Based on water demand estimates and alternative supply options

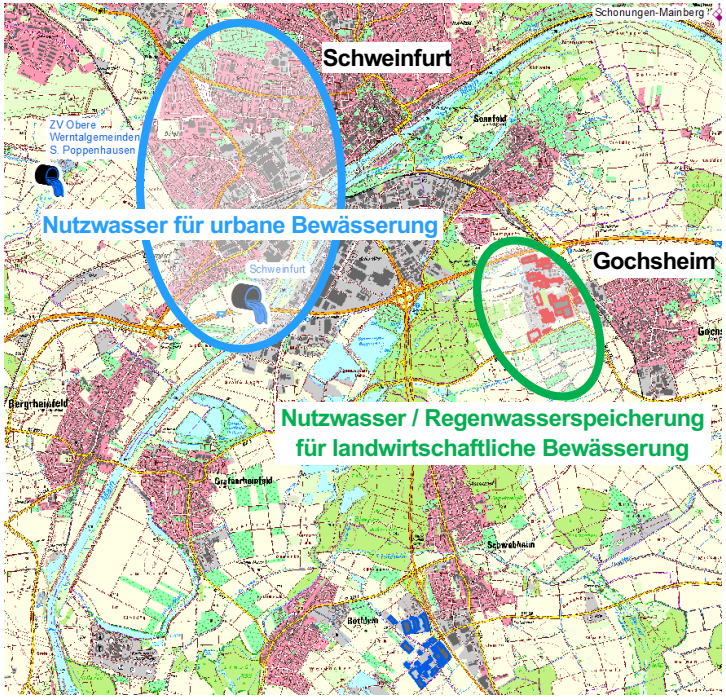
Possible Alternative Water Resources



Alternative Water Resources
Groundwater pumping facility Grafenrheinfeld
Industrial wastewater effluents
Stormwater
Bank filtration River Main
Schmachtenberg recreational lake
WWTP Schweinfurt – sec. effluent

Demonstration Project: ‚Nutzwasser‘

- **Two demo-labs** to demonstrate viability of water reclamation and reuse:
  - Demand-oriented **agricultural irrigation** on 60 ha
  - Demand-oriented **urban landscape irrigation** within the City of Schweinfurt (football stadium, public green spaces, ice stadion)



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Nutzwasser Project- Scope and Partners

- Development and optimization of highly flexible and demand-oriented **management strategies** close to engineering practice for safe water reuse applications targeting **agricultural and landscape irrigation**

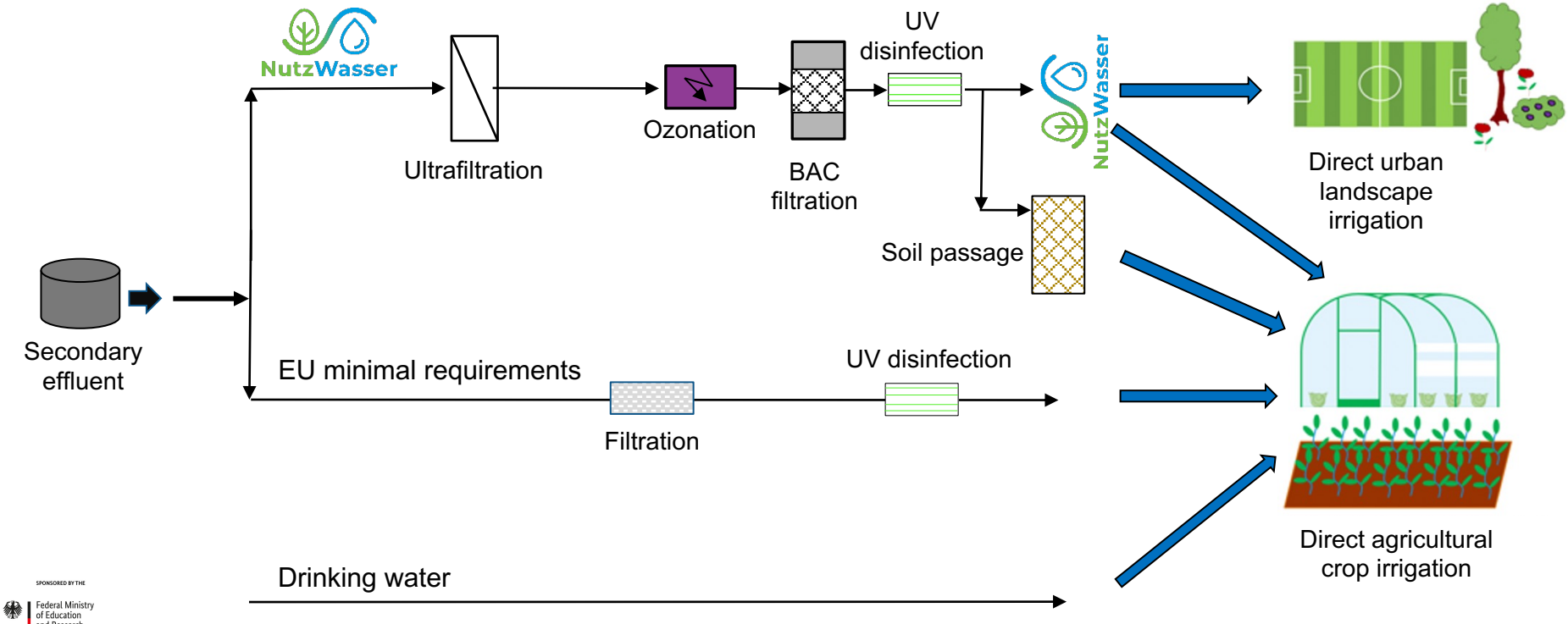
- Project partner:

Engineering practice

Regulatory and advising agencies

Research

On-demand Strategies for urban and agricultural Irrigation



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Multi-barrier Treatment Train

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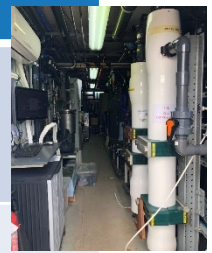
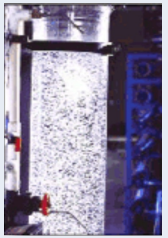
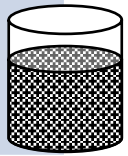
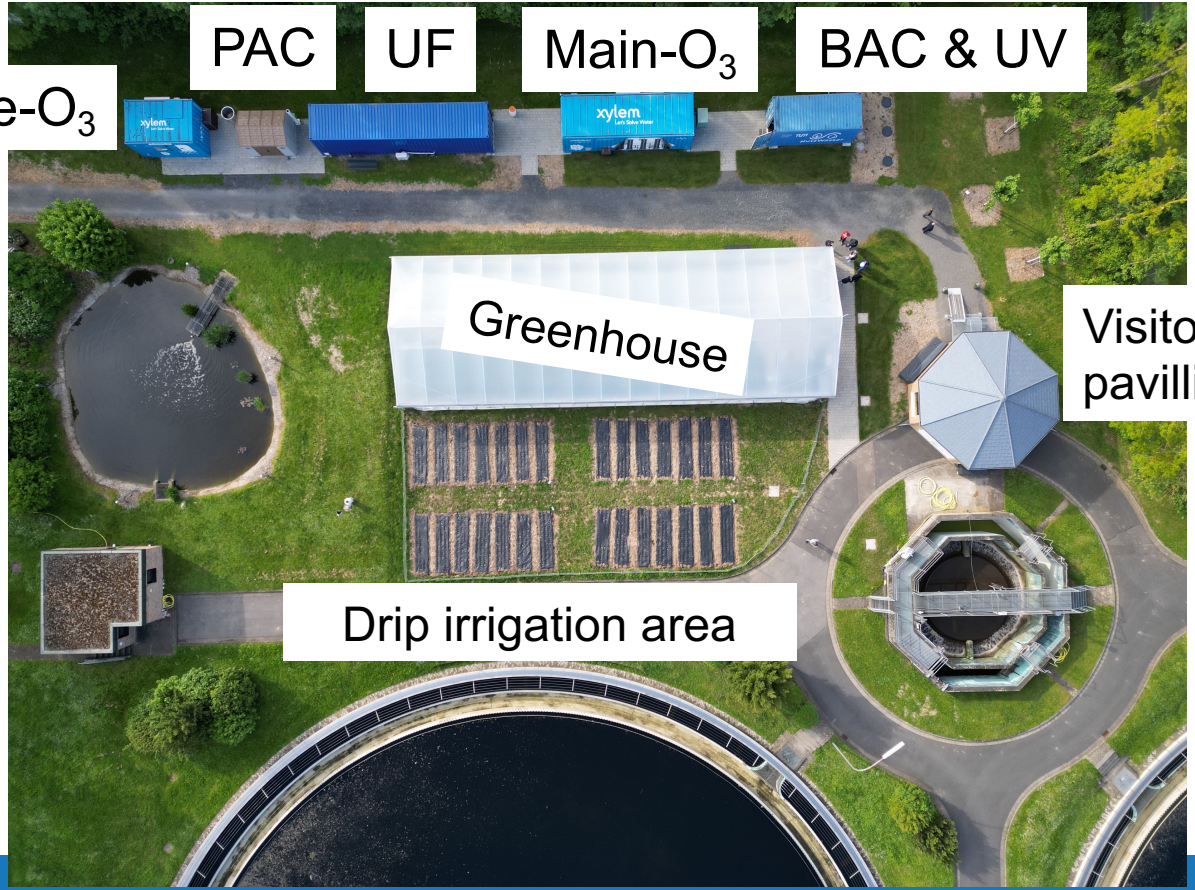
Relevant contaminants	Potential technical barrier
Pathogens Antibiotic resistance	Ultrafiltration Membranes (UF)
Pathogens Antibiotic resistance Trace organic chemicals	Ozonation (O_3)
Trace organic chemicals Oxidation by products	Granular activated carbon (GAC) Powdered activated carbon (PAC)
Pathogens Antibiotic resistance	UV Radiation







Reclaimed Water – Demo Lab Schweinfurt



Reclaimed Water - Demo Lab Schweinfurt

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Ceramic Ultrafiltration

Ozon

BAC Filtration

UV Disinfection

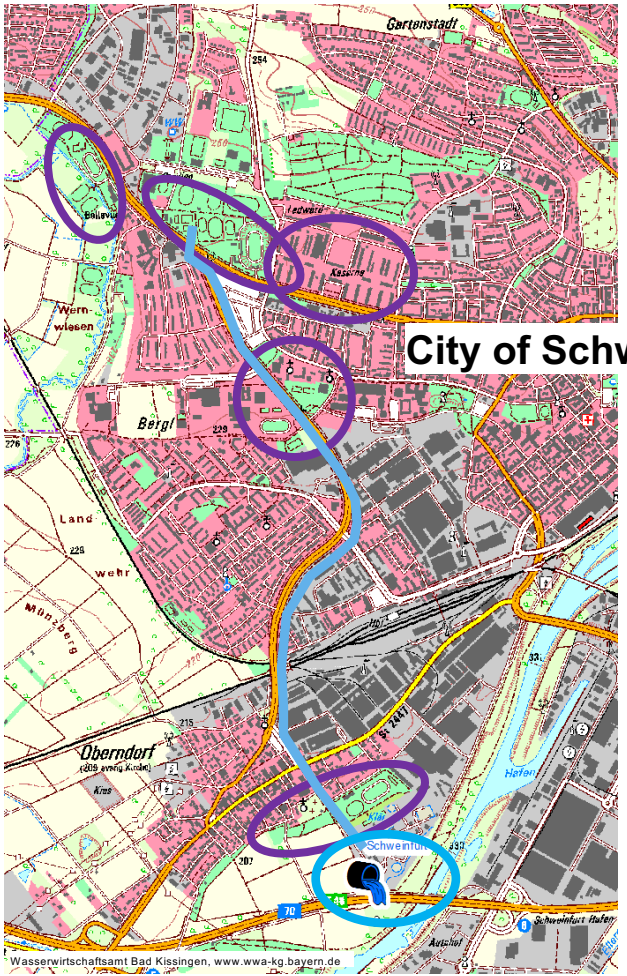
Reclaimed Water – Demo Lab Schweinfurt

Parallel application:
Sprinkler and drip irrigation

Demo Lab City of Schweinfurt

Direct urban applications:

- On demand irrigation of football stadium, public green spaces, ice stadion
- Transport via pressurized pipeline (DN 75) in main sewer line
- Subsurface storage



City of Schweinfurt

Demo Lab Gochsheim: On-demand agricultural irrigation

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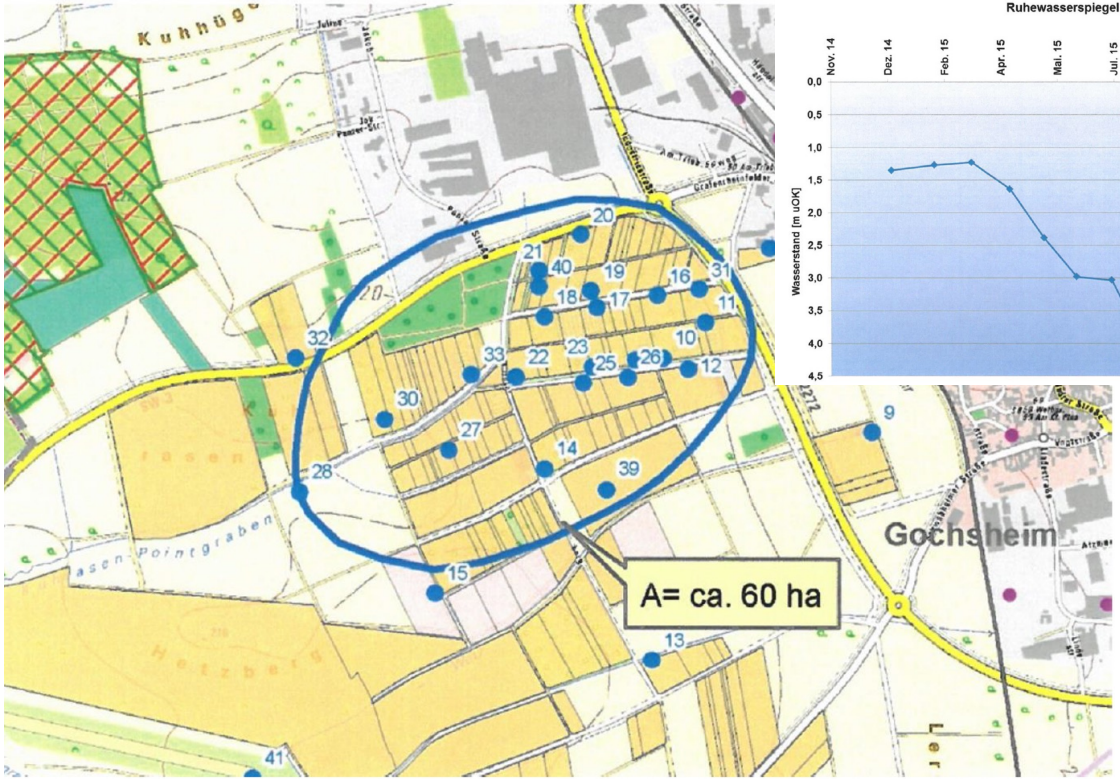

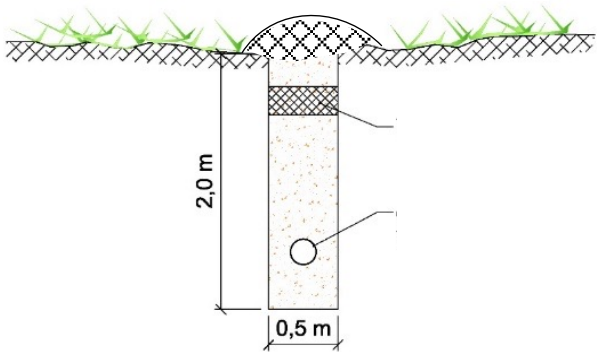

Rapid infiltration trenches

On-demand Irrigation via Internet of Things (IoT)

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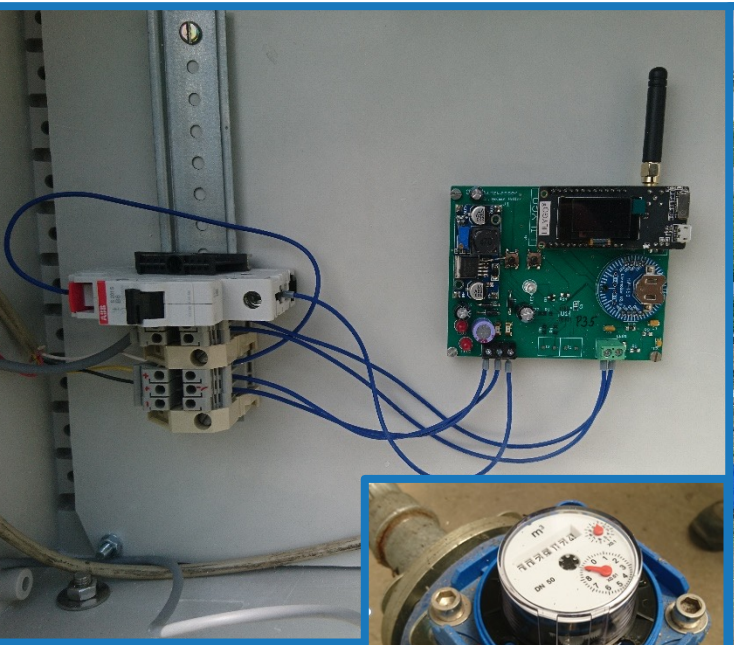

Irrigation Management via Internet of Things (IoT)

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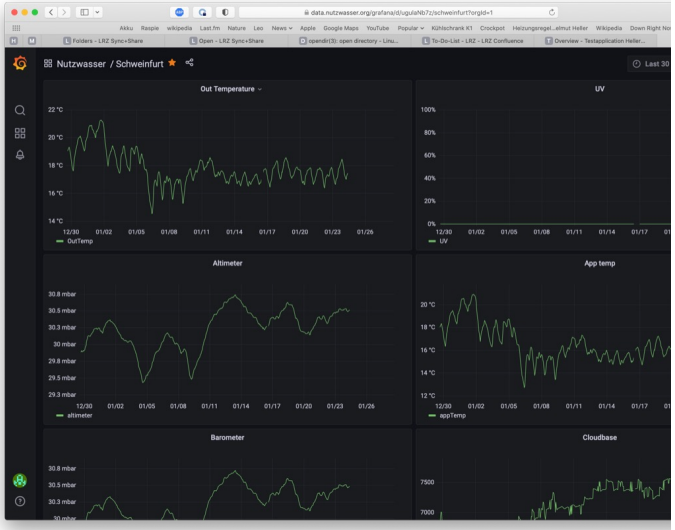
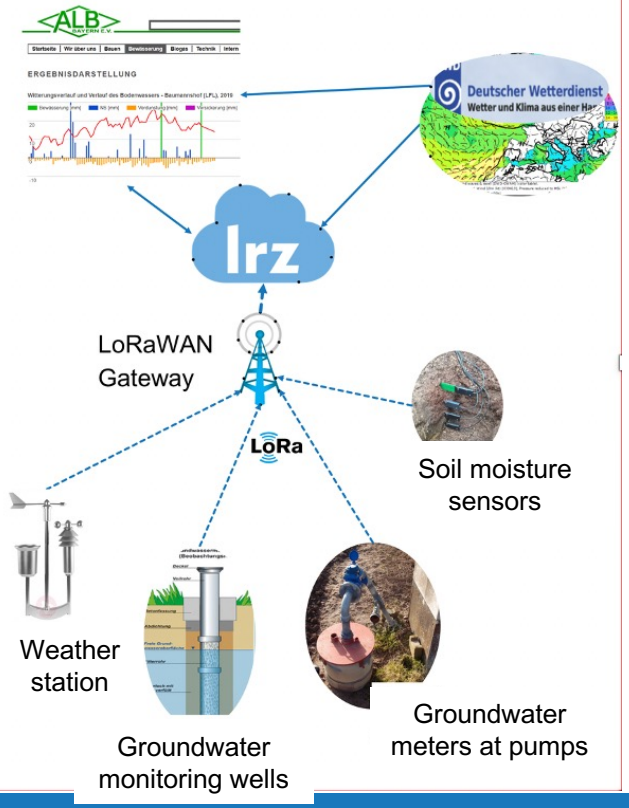
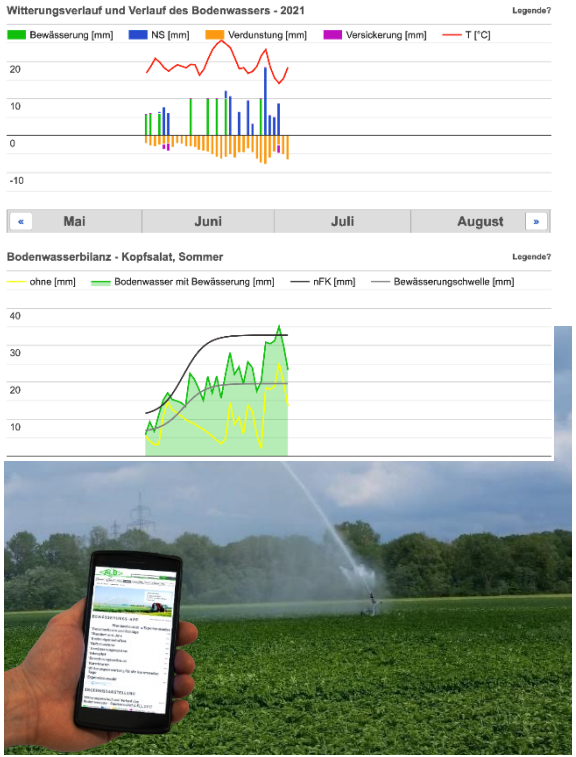
Data transfer and storage to Cloud



Cloud-based Determination of Irrigation Demand



Irrigated crop: Letuce



Challenges for Water Reuse Implementation

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MANAGEMENT

TECHNOLOGY

Outlook

- Water reuse can be a safe alternative water supply option
- Implementing risk management plans requires a different attitude for operators, regulatory agencies and users
- Risk management is always site specific
- Irrigation has to consider best practices and agronomic rates, which requires administrative and technological adjustmens
- Seasonality of irrigation requires flexible approaches for treatment and storage
- Synergistic effects due to new requirements of revised UWWTD

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Thank you!

www.nutzwasser.org

Technische Universität München

TZW Technologiezentrum Wasser

IWW Zentrum Wasser

Regierung von Unterfranken

SCHWEINFURT Zukunft findet Stadt

COPLAN AG

BGS UMWELT

ALB BAYERN E.V.

HOLINGER

Leibniz-Rechenzentrum der Bayerischen Akademie der Wissenschaften

xylem

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FONA Forschung für Nachhaltigkeit

Eine Initiative des Bundesministeriums für Bildung und Forschung

WavE Wassertechnologien: Wiederverwendung