ضوابط واشتراطات إعادة استخدام المياه في الزراعة

محاولة لفهم مسألة شائكة

دكتور أحمد جابر

أستاذ الهندسة الكيميائية بكلية الهندسة جامعة القاهرة

ورئيس مجلس إدارة المكتب الاستشاري كيمونكس مصر

Egyptian Water Partnership
الشراكة المائية المصرية

CEDARE
سيداري

نقابة المهندسين المصرية

المجلس العربي للمياه
Arab Water Council

ندوة

"إعادة إستخدام المياه من أجل تحقيق التنمية المستدامة"

الاثنين ١٣ ديسمبر ٢٠٢١

نقابة المهندسين - القاهرة – قاعة عثمان

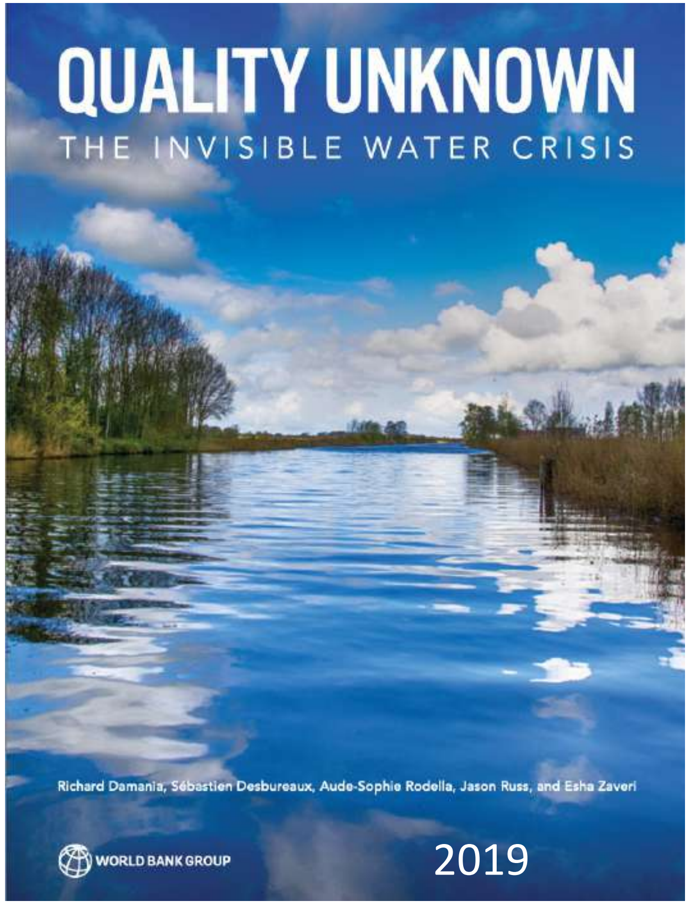
v3

Front Matters

The world faces an invisible crisis of water quality. Its impacts are wider, deeper, and more uncertain than previously thought and require urgent attention.
(WB, Quality Unknown: The invisible water crisis, 2019)

Water Quality is a Wicked Problem

- Measuring, understanding, and regulating water quality combine the ingredients of a "wicked problem"*.
- Solutions to wicked problems are ill defined, a solution in one place or moment in time may yield different results in another and may create new problems.
- The harmful effects of water pollution persist around the world, despite the presence of established policies and regulations to reduce pollution and significant investments in pollution control and treatment.

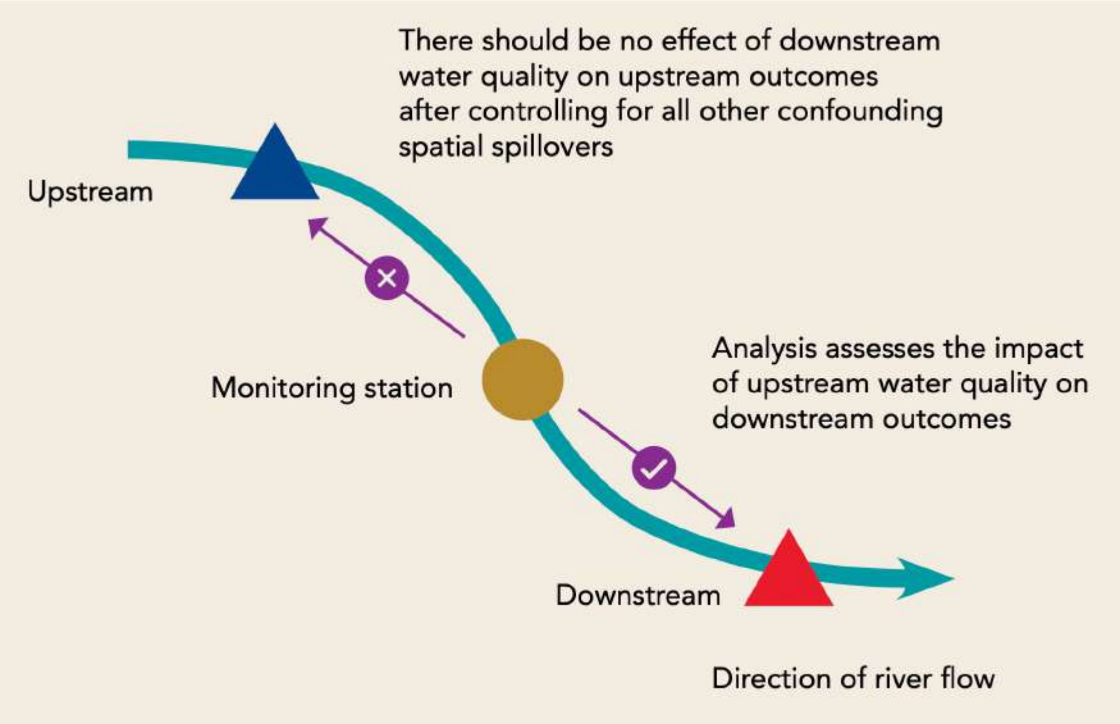


* Wicked problem is a term coined by Rittel and Webber in 1973 to describe complex problems with no optimal solution.

Using Streamflow Direction to Identify Impacts of Water Quality – a study

<u>Water pollution endangers economic growth</u>. The release of pollution upstream acts as a headwind that lowers economic growth downstream.

- When Biological Oxygen Demand (BOD) – a measure of how much organic pollution is in water and a proxy measure of overall water quality – passes a certain threshold, GDP growth in downstream regions is lowered by a third.
- In middle-income countries – where BOD is a growing problem because of increased industrial activity - GDP growth downstream of highly polluted areas drops by half



<u>The forces driving WQ challenges are accelerating.</u> Intensification of agriculture, land use changes, more variable rainfall patterns due to climate change and growing industrialization due to countries' development all continue to grow.

Purpose statement

- The purpose of this work is to highlight the differnce between planned water reuse and unplanned (defacto) water reuse.
- Water quality as a wikid problem is a major concern in developing and developed counteries. A brief introduction to three major water quality guidelines/regulation will be comapared to Egypt.
- Special focus is given on quality issues of agriculture drainage water as a resource for agriculture irrigation, an integrated project design approach is presented.

Outline

1. The Reuse Perspective
2. The Water Quality Perspective
3. Agriculture Drainage Quality Improvement Projects مشروعات تحسين نوعية مياه الصرف الزراعي
4. Concluding Remarks

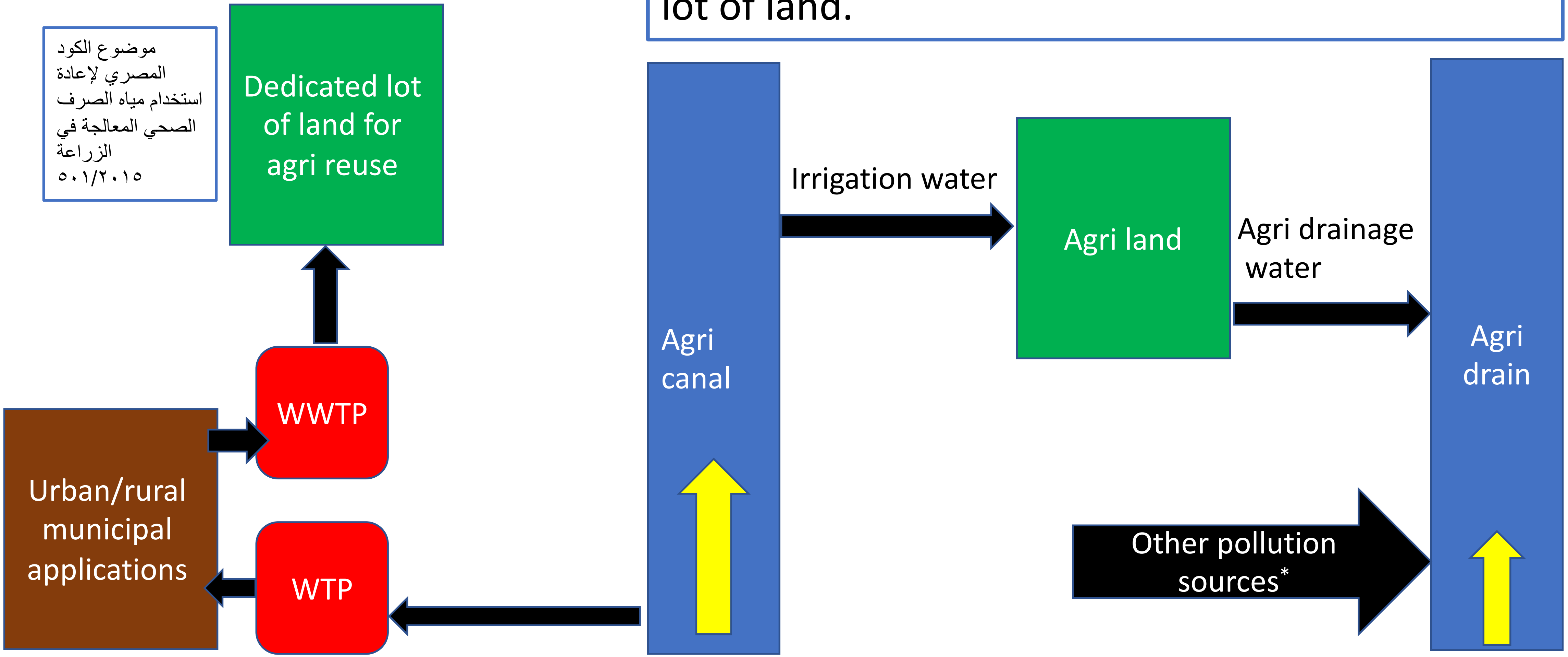
1. The Reuse Perspective

1. Planned water reuse
   (Wastewater with different degrees of treatment)

2. Unplanned water reuse (defacto reuse)

Planned water reuse

Planned reuse means that the effluent from a specific WWTP is used for irrigation in a specific lot of land.



* In addition to municipal wastewater, pollution from industry, municipal solid waste which all contain Contaminants of Emerging Concern (CEC)

الاهتمام الفائق علي مستوي المنظمات المعنية والدول بموضوع إعادة استخدام مياه الصرف الصحي في الزراعة

1


water

MDPI

Review

Worldwide Regulations and Guidelines for Agricultural Water Reuse: A Critical Review

Farshid Shoushtarian and Masoud Negahban-Azar *

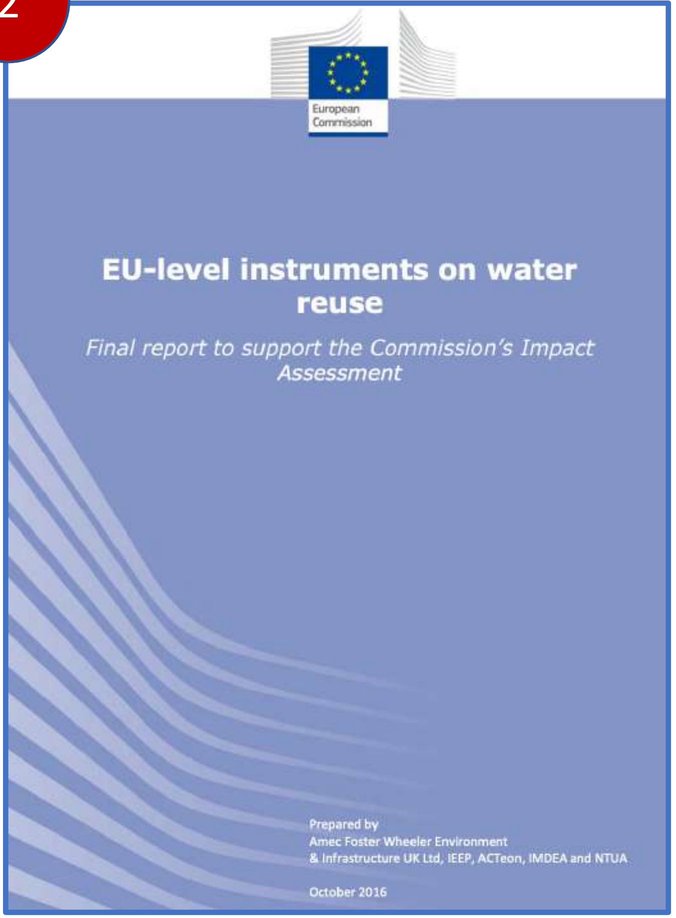
Department of Environmental Science and Technology, University of Maryland, College Park, MD 20740, USA; farshid@umd.edu

* Correspondence: mnazar@umd.edu; Tel.: +1-301-405-1188

Received: 18 February 2020; Accepted: 25 March 2020; Published: 29 March 2020

Water reuse is defined as the use of treated wastewater for beneficial use. Synonymous to water reuse are also water reclamation and water recycling.

2


European Commission

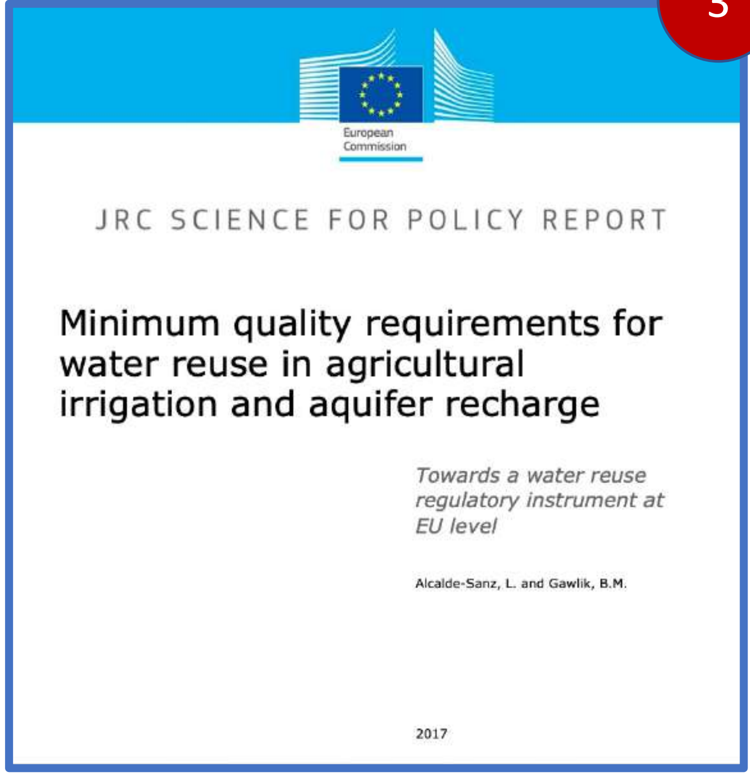
EU-level instruments on water reuse

Final report to support the Commission's Impact Assessment

Prepared by
Amec Foster Wheeler Environment
& Infrastructure UK Ltd, IEEP, ACTeon, IMDEA and NTUA

October 2016

3


European Commission

JRC SCIENCE FOR POLICY REPORT

Minimum quality requirements for water reuse in agricultural irrigation and aquifer recharge

Towards a water reuse regulatory instrument at EU level

Alcalde-Sanz, L. and Gawlik, B.M.

2017

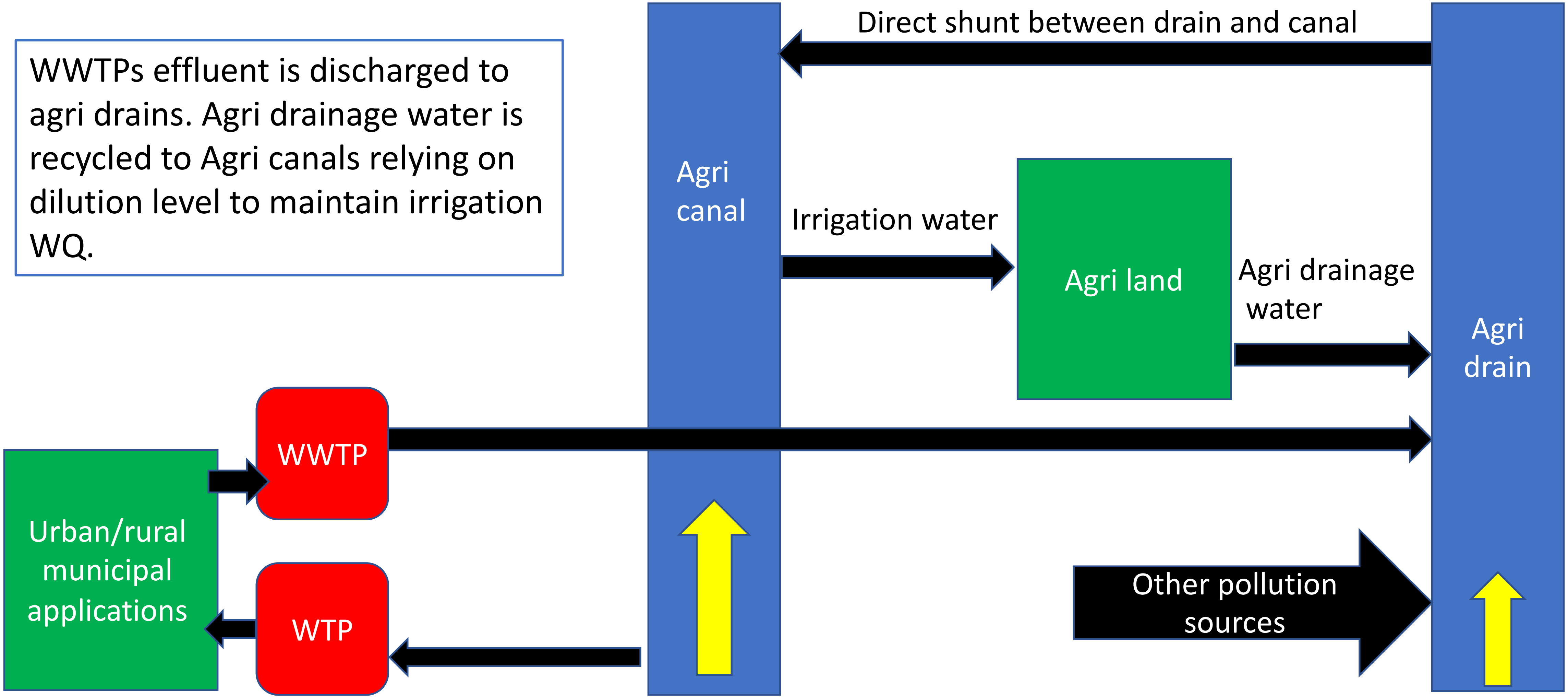
Study paper abstract (2020)

1

- The main objectives of this study were to compile, evaluate, and compare 70 reuse regulations and guidelines.
- The comparison covers: US EPA, ISO, FAO), WHO, the United States (state by state), European Commission, Canada (all provinces), Australia, Mexico, Iran, Egypt, Tunisia, Jordan, Palestine, Oman, China, Kuwait, Israel, Saudi Arabia, France, Cyprus, Spain, Greece, Portugal, and Italy.
- The results showed that the regulations and guidelines are mainly human-health centered, insufficient regarding some of the potentially dangerous pollutants such as emerging constituents, and with large discrepancies when compared with each other. In addition, some of the important water quality parameters such as some of the pathogens, heavy metals, and salinity are only included in a small group of regulations and guidelines investigated in this study. Finally, specific treatment processes have been only mentioned in some of the regulations and guidelines, and with high levels of discrepancy.

Unplanned water reuse – configuration 1

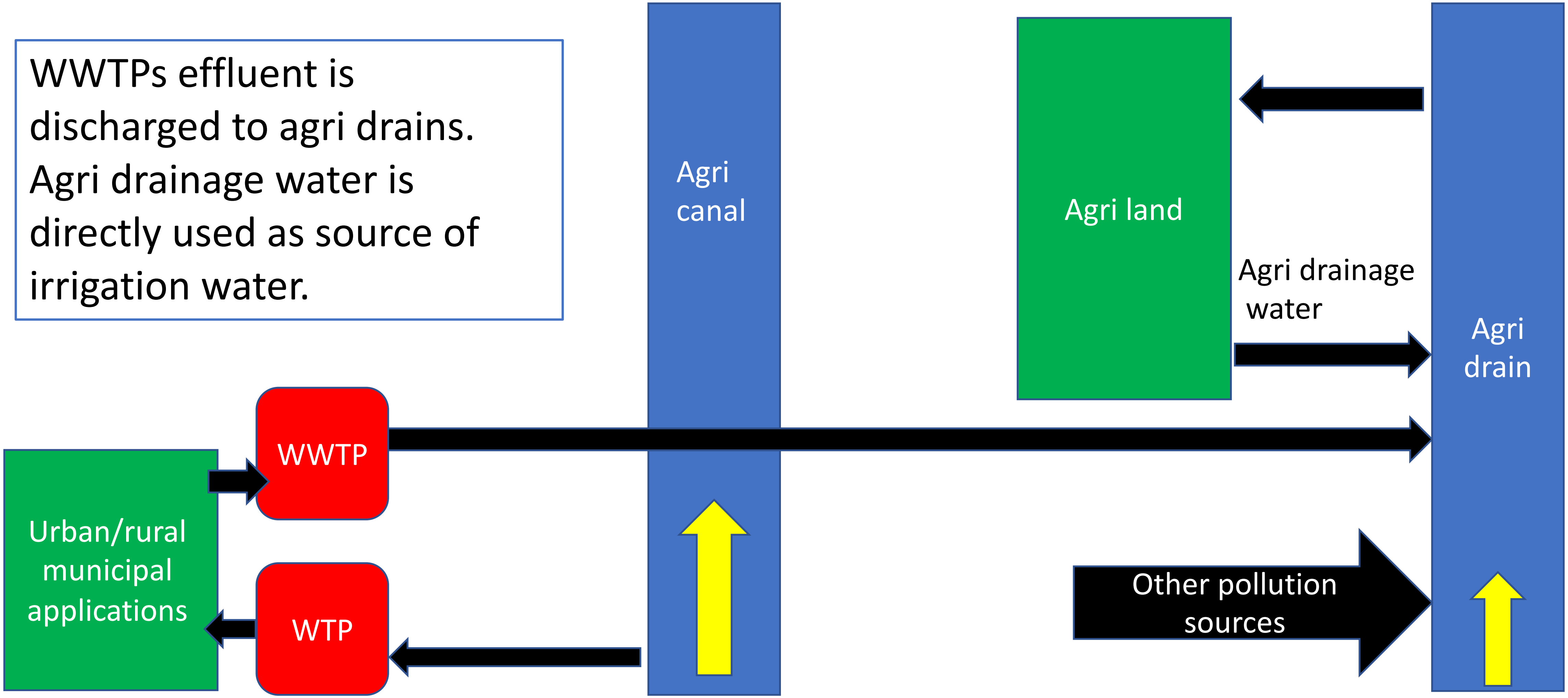
WWTPs effluent is discharged to agri drains. Agri drainage water is recycled to Agri canals relying on dilution level to maintain irrigation WQ.



ملحوظة هامة: تملك وزارة الري والموارد المائية في مصر خبرة هائلة في هذا الموضوع كما هو واضح من حجم النشر العلمي والمراجع المتوفرة

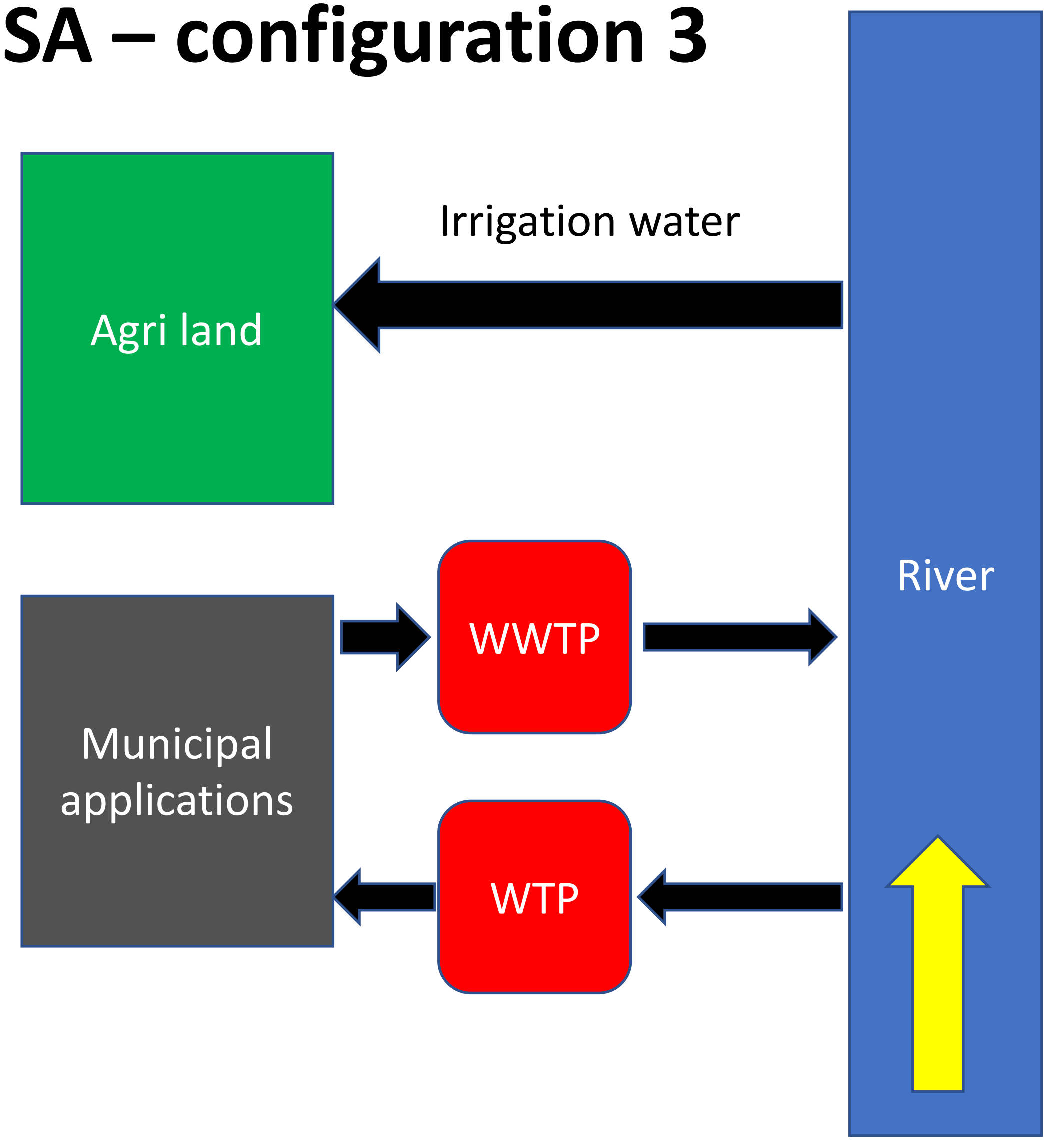
Unplanned water reuse – configuaration 2

WWTPs effluent is discharged to agri drains. Agri drainage water is directly used as source of irrigation water.



توجد دراسات جيدة في مصر عن أنماط أخري لإعادة استخدام مياه الصرف الزراعي

Unplanned water reuse (Defacto reuse) in the EU and USA – configuration 3



Characterization of unplanned water reuse in the EU

Final Report

Prepared by
Jörg E. Drewes, Uwe Hübner, Veronika Zhiteneva, Sema Karakurt

Chair of Urban Water Systems Engineering
Technical University of Munich
Am Coulombwall 3
85748 Garching, Germany

Technical University of Munich

for

the European Commission
DG Environment
Contract No. 070201/2017/758172/SER/EMV.C.1

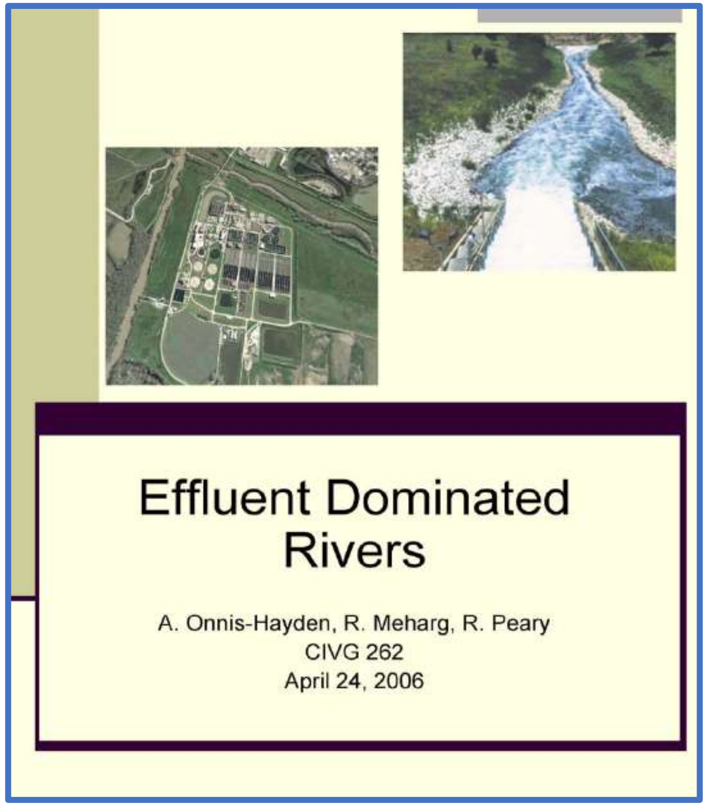
October 1, 2017

Defacto water reuse in Europe, impact on water quality

- The results of a risk study suggest that even high dilution ratios (10% and less wastewater effluents in the receiving streams) will result in a downstream water quality that will likely exceed the fecal indicator values of *E. coli* as specified in the EU Commission guidance document for good produce hygiene.
- While the survival of these pathogens will depend on local environmental conditions (i.e., biomass present; photolysis, etc.), it is very likely that any surface water that is being abstracted within a few hours to days downstream of this discharge point will be compromised and exceed background levels of pathogens by several orders of magnitude.

Defacto water reuse in Europe and effluent-dominated rivers in the US

- When the effluent from any WWTP is discharged to the aquatic environment, the water reenters the hydrological cycle. This un-planned or *de facto* water reuse scenario is widespread in Egypt as well as in many countries.
- Where wastewater effluents account for a substantial fraction of a river (effluent-dominated rivers), the source water quality might adversely impact downstream non-potable and potable use options, aquatic life, or local groundwater qualities.



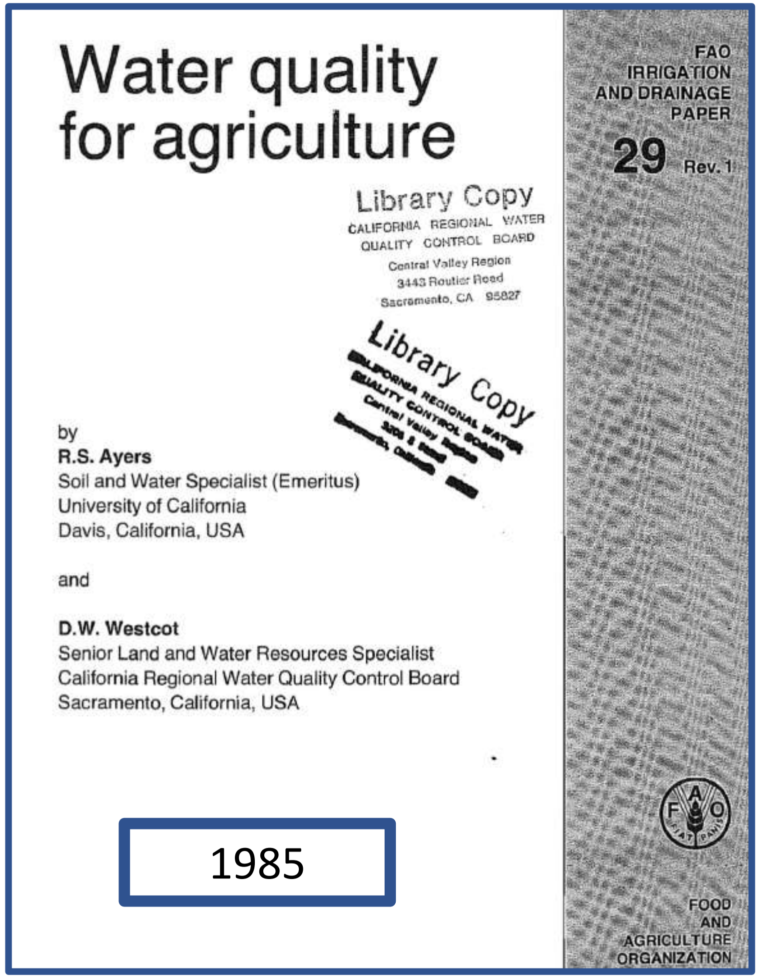
Defacto water reuse in Europe and effluent-dominated rivers in the US

- Multiple studies in the recent past have attempted to quantify the degree of wastewater contained in receiving streams using various methodologies to assess this impact.
- An evaluation of the spatial and temporal variations of *de facto* potable reuse across the USA has been published by in 2015.
- The study covered 2,056 surface water intakes operated by 1,210 drinking water facilities, each serving more than 10,000 people, representing approximately 82% of the nation’s population.
- This study revealed a high frequency of *de facto* reuse with 50% of the drinking water facilities being potentially impacted by upstream municipal wastewater effluent discharges.

Effluent-dominated rivers are defined as surface waters that consist primarily of discharged treated wastewater and runoff from urban and agricultural areas

2. The WQ Perspective

1. **FAO**
2. The EU Water Directive
3. USA Water Act
4. Egypt


Water quality for agriculture

FAO IRRIGATION AND DRAINAGE PAPER

29 Rev. 1

by
R.S. Ayers
Soil and Water Specialist (Emeritus)
University of California
Davis, California, USA

and

D.W. Westcot
Senior Land and Water Resources Specialist
California Regional Water Quality Control Board
Sacramento, California, USA

1985

FOOD AND AGRICULTURE ORGANIZATION

Risk type	Criteria	Condition	Impact from extreme levels
Chemical risks	Sodium (sodicity)	High sodium relative to calcium and magnesium content	Leads to swelling and dispersion of soil clays, surface crusting, pore plugging. Overall, it obstructs infiltration, creating permeability problems, and increasing runoff
	Salinity	Dissolved ions in pore water	Reduces water availability for plants (sodium ions compete with plants for water leading to 'physiological drought')
	pH and alkalinity	Measurement of number of hydrogen cations in solution	Low pH (acidic): accelerated irrigation system corrosion High pH (basic): formation of insoluble minerals leading to sodicity and impairment of irrigation systems
	Specific ions (chloride, boron, sulphate)	Electrically charged particles	Essential in small amounts but toxic in high concentrations
	Nitrogen	Nitrate ions	Inadequate nitrogen can lead to plant malnutrition, excessive concentrations can impair crop quality or cause excessive vegetative growth
	Heavy metals	Arsenic is the most common	See page **
Microbial risks	Microbiological pathogens	Total coliform and *Escherichia coli* (*E. coli*) are considered bacterial indicator species. Also the shiga toxin producing other *Escherichia coli* strains, *Salmonella* spp.. *Camplyobacter* spp., *Listeria* monocytogenes and protozoan parasites *Cryptosporidium parvum* and *Giardia duodenalis*	Severe risks to human and animal health

FAO 1985, Guidelines of parameters for interpretation of water quality for irrigation

- According to the Food and Agriculture Organization of the United Nations (FAO), the main water quality issues of surface water or groundwater use in irrigated agriculture are associated with salinity, specific ion toxicity, excessive nutrients, and a change of the water infiltration rate.
- The occurrence **of trace organic chemicals (e.g., pesticides, antibiotics)** could be an additional concern if they have the potential to accumulate in products. However, these quality issues are not specified in FAO guidelines.

Potential Irrigation Problem				Units	Degree of Restriction on Use		
					None	Slight to Moderate	Severe
Salinity *(affects crop water availability)*[2]							
	EC_w			dS/m	<0.7	0.7 – 3.0	> 3.0
	(or)						
	TDS			mg/l	<450	400-2000	> 2000
Infiltration affects infiltration rate of water into the soil. Evaluate using ECw and SAR together)[3]							
SAR	= 0 – 3	and Ec_w	=		>0.7	0.7 – 0.2	<0.2
	= 3 - 6		=		> 1.2	1.2 – 0.3	< 0.3
	= 6 – 12		=		>1.9	1.9-0.5	<0.5
	= 12 – 20		=		>2.9	2.9- 1.3	< 1.3
	= 20 – 40		=		>5.0	5.0 – 2.9	<2.9
Specific Ion Toxicity *(affects sensitive crops)*							
	Sodium (Na)[4]						
	surface irrigation			SAR	< 3	3 – 0	> 9
	sprinkler irrigation			me/l	< 3	> 3	
	Chloride (Cl)[4]						
	surface irrigation			me/l	<4	4 – 10	> 10
	sprinkler irrigation			me/l	< 3	> 3	
	Boron (B)[5]			mg/l	<0.7	0.7 – 3.0	> 3.0
	Trace Elements (see Table 21)						
Miscellaneous Effects *(affects susceptible crops)*							
	Nitrogen (NO_3 - N)[6]			mg/l	<5	5 – 30	> 30
	Bicarbonate (HCO_3)						
	(overhead sprinkling only)			me/l	< 1.5	1.5 – 8.5	> 8.5.
	pH				Normal Range 6.5 - 6.4		

1. FAO
2. **The EU Water Directive**
3. USA Water Act
4. Egypt

The EU water framework directive – microbial contamination issues

- The EU Commission has recently asked the European Food Safety Authority (EFSA) to advise on the public health risks posed by pathogens in food of non-animal origin (FNAO), addressing the risk factors and the mitigation options including possible microbiological criteria (EU Commission, 2017).
- As a practical approach, this *'Guidance document on addressing microbiological risks in fresh fruits and vegetables at primary production through good hygiene'* suggests a risk assessment considering the source and the intended use of agricultural water defining the suitability for agricultural purposes.
- It has been recommended that microbial analyses of the potential water sources should be performed to determine the suitability of the water source for its use as agricultural water (EU Commission, 2017). The criteria of this guidance document to assess the suitability of different water sources are summarized in Table next slide.

Matrix to support microbial risk assessment of agricultural water (EU Commission, 2017)

Intended use of the water	Source of water[60]						Indicator of fecal contamination: *E. coli* [61]
	Untreated surface water/ open water channels[62]	Untreated ground water collected from wells[63]	Untreated Rain water	Treated[64] sewage/ surface/ waste water/ water reuse	Disinfected water [65]	Municipal water	
PRE-HARVEST and HARVEST							
Irrigation of FFVs likely to be eaten uncooked (i.e. ready-to-eat FFV) (irrigation water comes into direct contact with the edible portion of the FFV) Dilution or application of pesticide, fertiliser or agrochemicals and cleaning equipment for ready-to-eat FFV and direct contact.	x	x	▲	●	●	√	100 CFU/100ml
Irrigation of FFVs likely to be eaten uncooked (i.e. ready-to-eat FFV) (irrigation water does not come into direct contact with the edible portion of the FFV) Dilution or application of pesticide, fertiliser or agrochemicals and cleaning equipment for ready-to-eat FFV and no direct contact	x	x	▲	●	●	√	1,000 CFU/100ml[66]
Irrigation of FFVs likely to be eaten cooked (irrigation water comes into direct contact with the edible portion of the FFV). Dilution or application of pesticide, fertiliser or agrochemicals and cleaning equipment used in this FFV direct contact).	▲	▲	●	●	●	√	1,000 CFU/100ml
Irrigation of FFVs likely to be eaten cooked (irrigation water does not come into direct contact with the edible portion of the FFV). Dilution or application of pesticide, fertiliser or agrochemicals and cleaning equipment used in this FFV (no direct contact)	●	●	√	√	√	√	10,000 CFU/100ml
POST-HARVEST							
Post-harvest cooling and post-harvest transport for non-ready-to-eat FFVs. Water used for first washing of products in case of ready-to-eat products. Cleaning equipment and surfaces where the products are handled.	x	x	▲	●	●	√	100 CFU/100ml
Water used for washing of products likely to be eaten cooked (potatoes…) – non ready-to-eat FFVs.	▲	▲	●	●	●	√	1,000 CFU/100ml
ONLY POTABLE WATER[67]							
Final washing and ice/water for cooling applied for ready-to-eat FFV	x	x	▲	●	●	√	Microbiological requirements of potable water

Surface water quality in the EU

- An analysis of the water quality of Europe's rivers using the "Waterbase database" of the European Environment Agency and focusing on nine key parameters suggests that even in Europe, violations of international standards are common.
- More than 20 percent of 538 sub-basins on the continent with monitoring stations violated water quality standards in at least six of the nine parameters tracked between 2000 and 2012.
- Worse, nearly every country has had at least one violation of these nine parameters between 2000 and 2012 (Iceland, Malta, and Norway being the only exceptions), and some countries have more than 30 percent of their observations of these nine parameters violating standards over this period.

The Nine Parameters for EU rivers WQ:

Arsenic
BOD
DO
Lead
Hg
Nitrate
Nitrite
pH
Total ammonium

The EU Framework Directive – River Basin Specific Pollutants

Under the Water Framework Directive, chemicals posing the greatest risk of harm to or via the aquatic environment across the EU are classed as priority substances (or priority hazardous substances). Those considered as of concern at a national level are termed "River Basin Specific Pollutants". The 2008 Environmental Quality Standards Directive set the first list of priority substances: this list and the standards have been revised as an amendment via the 2013 Priority Substances Directive.

1. FAO
2. The EU Water Directive
3. **USA Water Act**
4. Egypt

US EPA Water Quality Standards handbook

https://www.epa.gov/wqs-tech/state-specific-water-quality-standards-effective-under-clean-water-act-cwa

The Clean Water Act (CWA) and 40 CFR Part 131 require states to adopt water quality standards (WQS) consisting of three key components: designated uses, water quality criteria, and an antidegradation policy.

EPA United States Environmental Protection Agency

Office of Water
EPA 820-B-14-008
September 2014

Water Quality Standards Handbook

2012

Water Quality Standards Handbook
Chapter 3: Water Quality Criteria

(40 CFR 131.11)

Table of Contents

Generally, criteria developed for human health and aquatic life will be sufficiently stringent to protect agricultural and industrial designated uses because those uses are generally less sensitive than human health and aquatic life designated uses. There could, nevertheless, be situations where such designated uses may require more stringent criteria to protect them. Salts could be a problem in crop water, for example. Hardness or other contaminants could cause issues at industrial facilities. States and authorized tribes may also establish criteria specifically designed to protect such designated uses and should ensure that they apply the criteria that are protective of the most sensitive use of the water body, as required by 40 CFR 131.11(a).

موقع جدير بالزيارة

EPA United States Environmental Protection Agency

Search EPA.gov

Environmental Topics | Laws & Regulations | Report a Violation | About EPA

CONTACT US

Water Quality Standards: Regulations and Resources

Example: Florida surface water quality standards

https://www.flrules.org/gateway/ChapterHome.asp?Chapter=62-302

1. FAO
2. The EU Water Directive
3. USA Water Act
4. **Egypt**

القانون ٤٨ لسنة ١٩٨٢ – تعديل بموجب القرار الوزاري ٩٢ لسنة ٢٠١٣

البيـــــــــــان	المعايير والمواصفات (ملليجرام / لتر ما لم يذكر غير ذلك)
المواد الصلبة الذائبة الكلية	لا يزيد عن ٥٠٠
الأكسجين الذائب	لا يقل عن ٦
الأس الإيدروجينى	٦,٥ – ٨,٥
الأكسجين الحيوى الممتص	لا يزيد عن ٦
الأكسجين الكيميائى المستهلك (دايكرومات)	لا يزيد عن ١٠
نتروجين عضوى	لا يزيد عن ١
النشادر NH_3 as (N)	لا يزيد عن ٠,٥
نترات NO_3 as (N)	لا يزيد عن ٢

باقي الجدول في ملحق ٢

المادة ٤٩

يجب أن تبقي مسطحات المياه العذبة التي يرخص بصرف المخلفات الصناعية المعالجة اليها في حدود المعايير والمواصفات التالية:

Egyptian Water Quality Standards – for all purposes including unrestricted irrigation

القانون ٤٨ لسنة ١٩٨٢ – تعديل بموجب القرار الوزاري ٩٢ لسنة ٢٠١٣

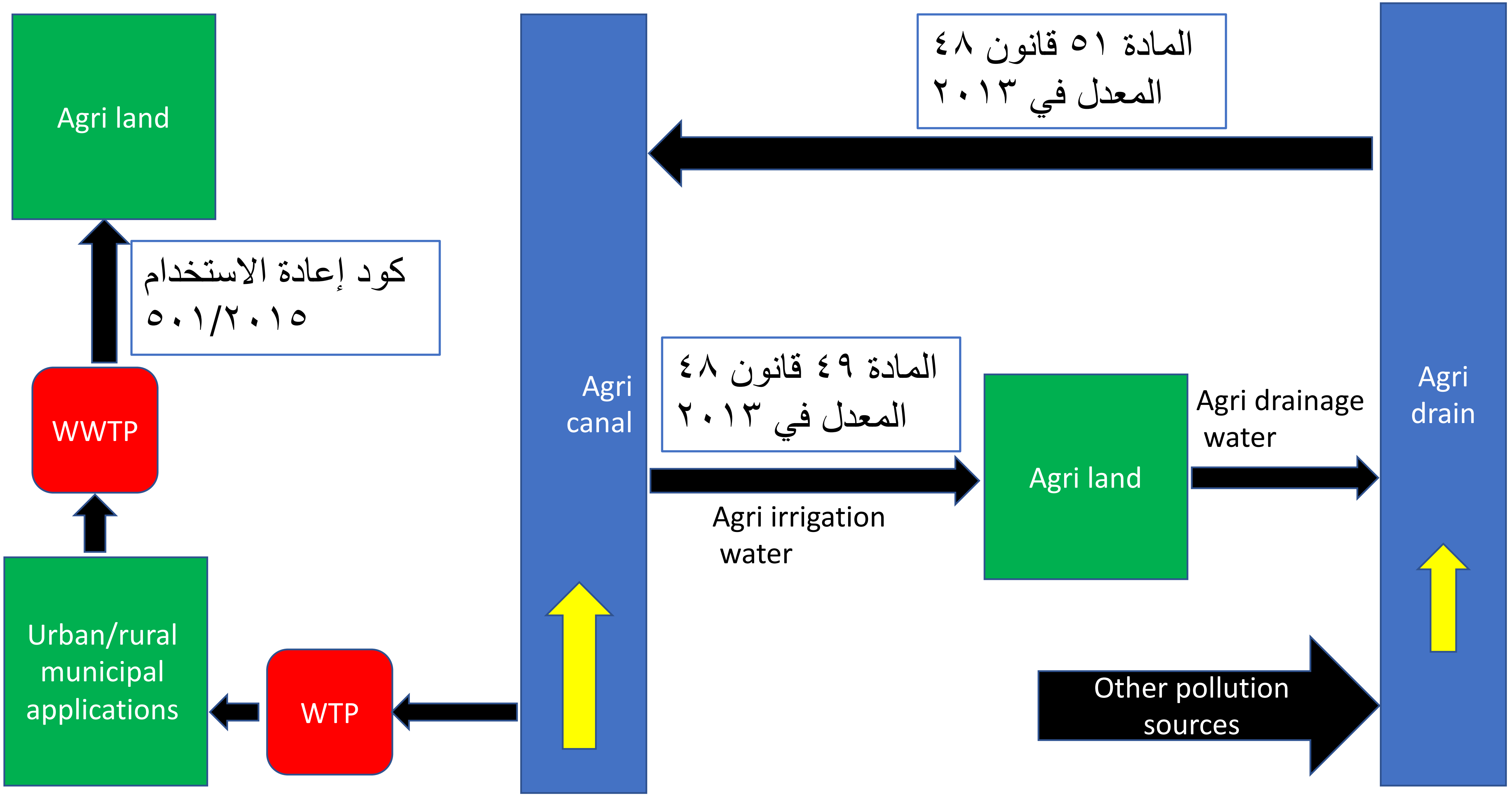
المادة ٥١

يجب أن تتوافر في مياه المصارف قبل رفعها الي مسطحات المياه العذبة المخصصة لأغراض الزراعة فقط المعايير الآتية:

البيـــــــــان	المعايير والمواصفات (ملليجرام / لتر ما لم يذكر غير ذلك)
المواد الصلبة الذائبة الكلية	لاتزيد عن ١٠٠٠
درجة الحرارة	لاتزيد عن ٣ درجات مئوية عن المجرى المائى المستقبل
الأكسجين الذائب	لا يقل عن ٥
الأس الإيدروجينى	لا يقل عن ٦,٥ ولا يزيد على ٨,٥
الأكسجين الحيوى الممتص	لايزيد على ٣٠
الأكسجين الكيميائى المستهلك (دايكرومات)	لا يزيد على ٥٠
النتروجين الكلى (TN) as N	١٥

باقي الجدول في ملحق ٢

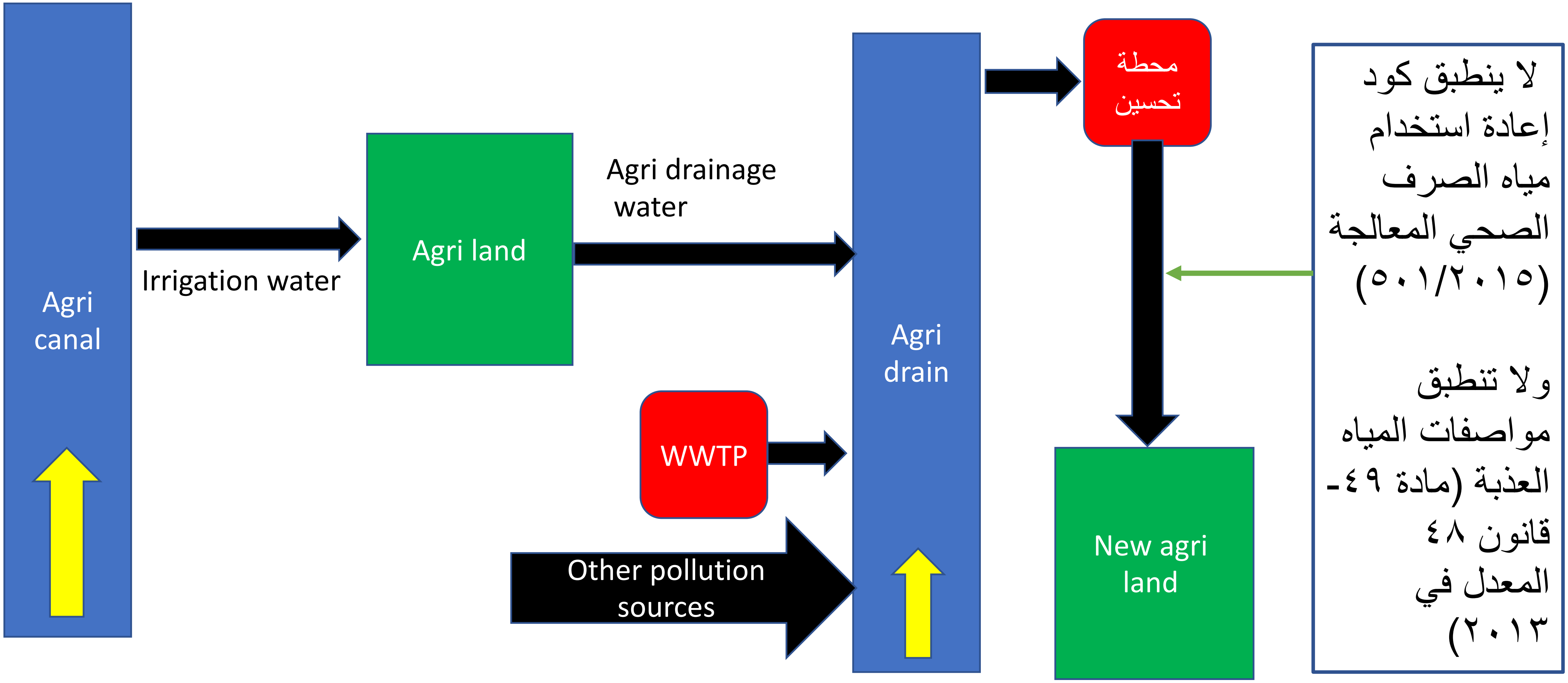
Applicable Egyptian water quality regulations 1



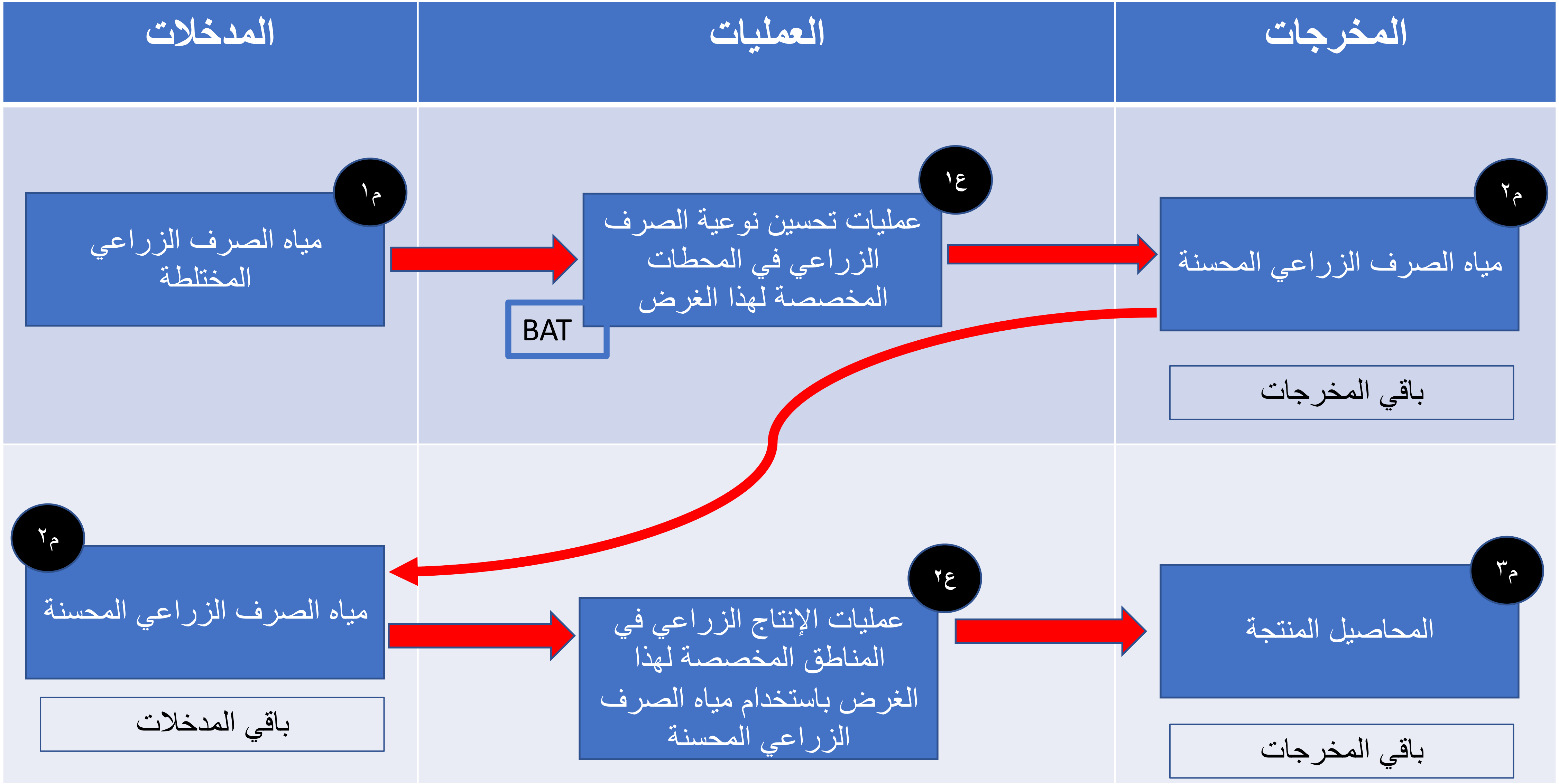
3. Agriculture Drainage Quality Improvement Projects

مشروعات تحسين نوعية مياه الصرف الزراعي

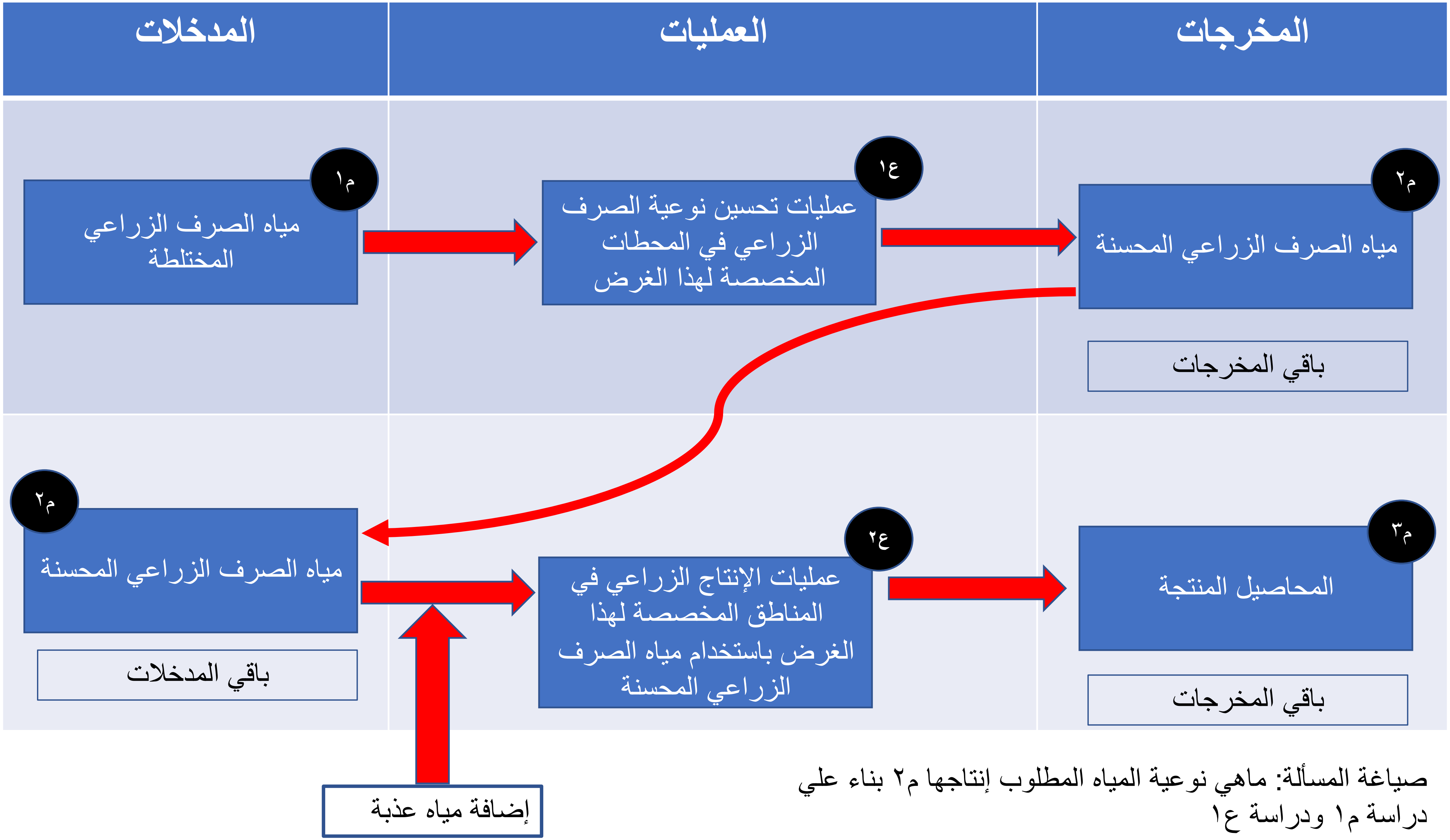
الحالة الخاصة لمحطات تحسين مياه الصرف الزراعي



FOCUS is on the treatment process ع١

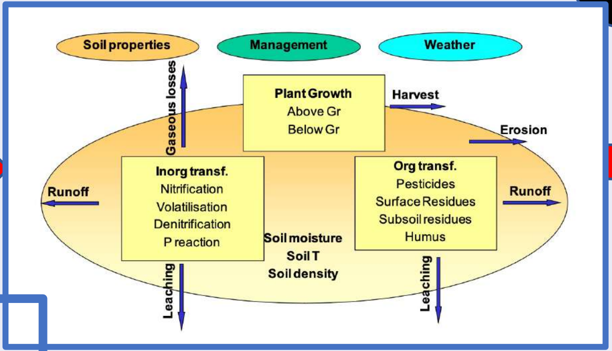


صياغة المسألة: ماهي نوعية المياه المطلوب إنتاجها م٢ بناء علي دراسة م١ ودراسة ع١



صياغة المسألة: ماهي نوعية المياه المطلوب إنتاجها م٢ بناء علي دراسة م١ ودراسة ع١

FOCUS is on the agriculture processes ع٢

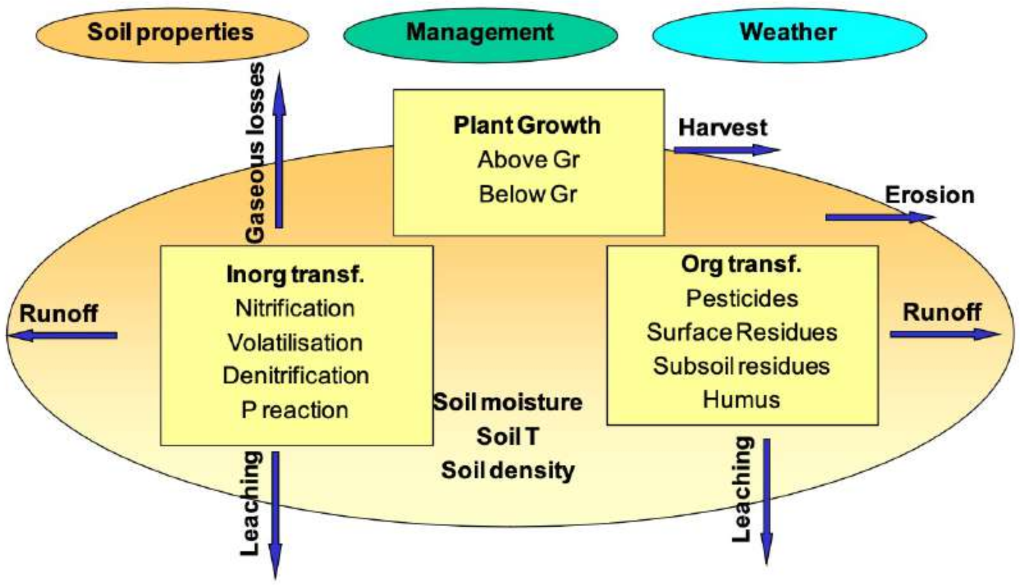
المخرجات	العمليات	المدخلات
م٢ مياه الصرف الزراعي المحسنة باقي المخرجات	ع١ عمليات تحسين نوعية الصرف الزراعي في المحطات المخصصة لهذا الغرض BAT	م١ مياه الصرف الزراعي المختلطة
م٣ المحاصيل المنتجة وعمليات التصنيع الزراعي التالية باقي المخرجات	ع٢  BAT	م٢ مياه الصرف الزراعي المحسنة باقي المدخلات

إعادة صياغة المسألة: ماهي نوعية المحاصيل التي يمكن انتاجها م٣ بناء علي دراسة م٢ ودراسة ع٢

The Integrated Project Design Approach 1

Evey major agriculture drainage improvement project has to be designed as series of operations and products. In each operation, the Best Available Technology (BAT) will be applied. Crop mix together with agro-industerial operations have to be designed in each project depending on multiple parameters.

Environmental Policy Integrated Climate (EPIC) crop model:
The model simulates crop production under different farming practices and operations including fertilization, irrigation application rates and timing. It considers nutrient losses to the environment (N leaching and runoff. In addition, it has been thoroughly evaluated and applied from local to continental scale.



Source: **JRC Science Hub (**https://ec.europa.eu/jrc), The potential of water reuse for agriculture irrigation in the EU, 2017

The Integrated Project Design Approach 2

Influent characterization

Treatment train options applying BAT

Effulent characterization (for each option)

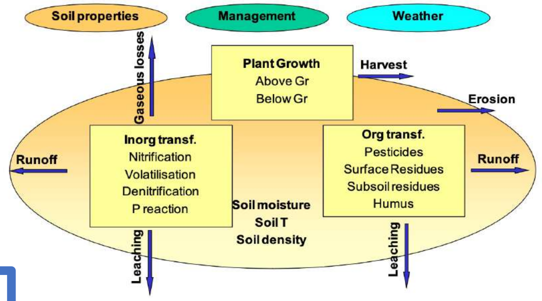
CAPEX and OPEX of each option

BAT

ع١

عمليات تحسين نوعية الصرف الزراعي في المحطات المخصصة لهذا الغرض

ع٢



BAT

Soil properties

Irrigation methods options

Weather study

Crop mix options

Agro-industrial options

CAPEX and OPEX of each option

4. Concluding remarks

Concluding remarks

- There is an urgent need to study and map “unplanned water reuse in Egypt”: magnitude and impact. Special attention should be given to “river basin specific pollutants” and “contaminants of emerging concerns”.
- This is a call to develop comprehensive “Egyptian water quality standards” following world best practice as referenced in the presentation.
- The “integrated project design approach” is recommended in dealing with agriculture drainage water quality improvement projects as explained in the presentation.

Annex 1: WQ most important parameters

BOD

BOD is one of the most widely used water quality indicators. It is a measure of the amount of oxygen that bacteria will consume in decomposing organic matter (Barnes, Meyer, and Freeman 1998). Therefore, it is often used as an umbrella proxy for overall water quality. It is highly correlated with other water quality indicators, such as dissolved oxygen and chemical oxygen demand, and is a good indicator of the amount of organic material in water.

Nitogrn

Nitrogen is an outlier pollutant in terms of scale, scope, trends, and impacts. It is possibly the largest global externality, rivaling carbon. In water, it can manifest as nitrate, nitrite, and ammonium nitrate, among other compounds, all of which are harmful for human health and ecosystems when present in sufficient concentrations. Although some impacts are well known, others are poorly understood. As will be discussed in chapter 4, its use as a nutrient is highly correlated with phosphorus, although the harmful health effects from consuming it in its oxidized states are better established.

EC

EC is directly related to the concentration of dissolved solids in the water. It is therefore a widely used proxy for salinity, which also correlates highly with pH. This is perhaps the world’s oldest and most widespread pollutant. Salt can be both a pollutant of poverty, caused by climate change, sea level rise, and geogenic factors, and a pollutant of prosperity, caused by overextraction of water and irrigated agriculture. Saline water can be disastrous for both agriculture and human health, particularly of young children

Other

These pollutants are by no means the only important contaminants for countries to track and control. Bacterial contamination from poor sanitation coverage; heavy metals like arsenic, fluoride, and lead (box 1.3); persistent organic pollutants such as DDT and industrial pollutants; and a range of others also pose large health and economic risks. However, in many ways, the pollutants tracked by SDG 6.3 represent the least common denominator of water pollutants. They are problematic in regions rich and poor, wet and dry, and urban and rural.

Annex 2: Law 48 (2013 amendments) articles 49 and 51

مواصفات مياه الري في المسطحات العذبة طبقا للمادة ٤٩ من تعديل القانون ٤٨ في ٢٠١٣

البيان	المعايير والمواصفات (ملليجرام/لتر ما لم يذكر غير ذلك)
المواد الصلبة الذائبة الكلية	لا يزيد عن 500
الأكسجين الذائب	لا يقل عن 6
الأس الإيدروجينى	8.5 – 6.5
الأكسجين الحيوى الممتص	لا يزيد عن 6
الأكسجين الكيميائى المستهلك (دايكرومات)	لا يزيد عن 10
نتروجين عضوى	لا يزيد عن 1
النشادر NH_3 as (N)	لا يزيد عن 0.5

البيان	المعايير والمواصفات (ملليجرام/لتر ما لم يذكر غير ذلك)
نترات NO_3 as (N)	لا يزيد عن 2
النتروجين الكلى (TN) as N	لا يزيد عن 3.5
الفوسفور الكلى (TP) as P	لا يزيد عن 2
شحوم وزيوت	لا يزيد عن 0.1
كبريتات	لا يزيد عن 200
الزئبق	لا يزيد عن 0.001

البيان	المعايير والمواصفات (ملليجرام/لتر ما لم يذكر غير ذلك)
حديد	لا يزيد عن 0.5
منجنيز	لا يزيد عن 0.2
نحاس	لا يزيد عن 0.01
زنك	لا يزيد عن 0.01
فلوريدات	لا يزيد عن 0.5
فينول	لا يزيد عن 0.002
زرنيخ	لا يزيد عن 0.01

البيـــان	المعايير والمواصفات (ملليجرام/لتر ما لم يذكر غير ذلك)
كادميوم	لا يزيد عن 0.001
كروم	لا يزيد عن 0.05
السيانيد الحر	لا يزيد عن 0.005
رصاص	لا يزيد عن 0.01
سيلينيوم	لا يزيد عن 0.01
البورون	لا يزيد عن 0.5
الموليبديوم	لا يزيد عن 0.07
النيكل	لا يزيد عن 0.02

البيـــــان	المعايير والمواصفات (ملليجرام/لتر) ما لم يذكر غير ذلك
المبيدات وتشمل:	
آلدرين، داى إلدرين Aldrin and dieldrin	لا يزيد عن 0.00003
الألكلور Alachlor	لا يزيد عن 0.02
الديكارب Aldicarb	لا يزيد عن 0.01
أترازين Atrazine	لا يزيد عن 0.002
بنتازون Bentazone	لا يزيد عن 0.03
كاربوفيوران Carbofuran	لا يزيد عن 0.007

البيـــــان		المعايير والمواصفات (ملليجرام/لتر ما لم يذكر غير ذلك)
كلوردان	Chlordane	لا يزيد عن 0.0002
2، 4 داى كلوروبروب	2, 4 Dichlororoprop	لا يزيد عن 0.03
فينوبروب	Fenoprop	لا يزيد عن 0.009
ميكوبروب	Mecoprop	لا يزيد عن 0.01
2، 4، 5 – ت	2, 4, 5-T	لا يزيد عن 0.009

مواصفات مياه المصارف المسموح بخلطها علي مياه الترع طبقا للمادة ٥١ من تعديل القانون ٤٨ في عام ٢٠١٣

البيان	المعايير والمواصفات (ملليجرام/لتر ما لم يذكر غير ذلك)
المواد الصلبة الذائبة الكلية	لا تزيد عن 1000
درجة الحرارة	لا تزيد عن 3 درجات مئوية عن المجرى المائى المستقبل
الأكسجين الذائب	لا يقل عن 5
الأس الإيدروجينى	لا يقل عن 6.5 ولا يزيد على 8.5
الأكسجين الحيوى الممتص	لا يزيد على 30
الأكسجيم الكيميائى المستهلك (دايكرومات)	لا يزيد على 50
النتروجين الكلى N as (TN)	15

البيان	المعايير والمواصفات (ملليجرام/لتر ما لم يذكر غير ذلك)
الفسفور الكلى (TP) as P	3
زيوت أو شحوم	لا يزيد على 3
الزئبق	لا يزيد على 0.001
حديد	لا يزيد عن 3
منجنيز	لا يزيد عن 2
نحاس	لا يزيد عن 1
زنك	لا يزيد عن 2

البيان	المعايير والمواصفات (ملليجرام/لتر ما لم يذكر غير ذلك)
فينول	لا يزيد على 0.05
زرنيخ	لا يزيد على 0.01
كادميوم	لا يزيد على 0.03
كروم	لا يزيد على 0.05
السيانيد الحر	لا يزيد على 0.01
الرصاص	لا يزيد على 0.1
النيكل	0.1
السيلينيوم	0.01
العدد الاحتمالى للمجموعة القولونية 100 سم^3	5000

المعايير والمواصفات (ملليجرام/لتر ما لم يذكر غير ذلك)	البيان
	المبيدات بأنواعها
لا يزيد على 0.003	ألدرين داى إلدرين Aldnin and dieldrin
لا يزيد على 0.2	الأكلور Alachlor
لا يزيد على 0.1	الديكارب Aldicarb
لا يزيد على 0.02	أترازين Atrazine
لا يزيد على 0.3	بنتازون Bentazon
لا يزيد على 0.07	كاربوفيوران Carbofuran

المعايير والمواصفات (ملليجرام/لتر ما لم يذكر غير ذلك)	البيان
لا يزيد على 0.002	كلوردان Chlordane
لا يزيد على 0.3	4.2 داى كلوروبروب 2.4 Dichloroprop
لا يزيد على 0.09	فينوبروب Fenoprop
لا يزيد على 0.1	ميكوبروب Mecoprop
لا يزيد على 0.09	2، 4، 5–ت 2, 4, 5– T