



EH demosite in Lyon periurban area

Pascal Breil, Ph. Namour, Michel Lafont, Isabelle Braud, Flora Branger,
Laurent Schmitt, O. Navratil, Marylise Cottet, Benoît Cournoyer, Anne-Marie
Aucour, et al.

► To cite this version:

Pascal Breil, Ph. Namour, Michel Lafont, Isabelle Braud, Flora Branger, et al.. EH demosite in Lyon periurban area. Ecohydrology Workshop, Jan 2019, Birmingham, United Kingdom. hal-03790430

HAL Id: hal-03790430

<https://hal.inrae.fr/hal-03790430>

Submitted on 28 Sep 2022

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



United Nations
Educational, Scientific and
Cultural Organization



International
Hydrological
Programme



EH demosite in Lyon periurban area

IRSTEA-Lyon,

Pascal BREIL, *EcoHydrology*, Philippe Namour, *Biochemistry*, Michel Lafont*, *Hydro-Ecology*

Isabelle Braud, *Hydrology*, Flora Branger, *Hydrology*,....

University – Lyon2 (now University of Strasbourg)

Laurent Schmitt, *Hydro-Geomorphology*, Oldrich Navratil, *Hydro-Geomorphology*

Marylise Cottet, *Social sciences*,....

University – Lyon1

Benoit Cournoyer, *Microbiology*, Anne.M Aucour, *Geochemistry*....

INSA – Lyon & ENTPE

Bernard Chocat, *Urban hydrology*..... Jen Yves Perrodin, *Ecotoxicology*



Ecohydrology Workshop - 30-31/01/2019 – Univ. Birmingham, UK



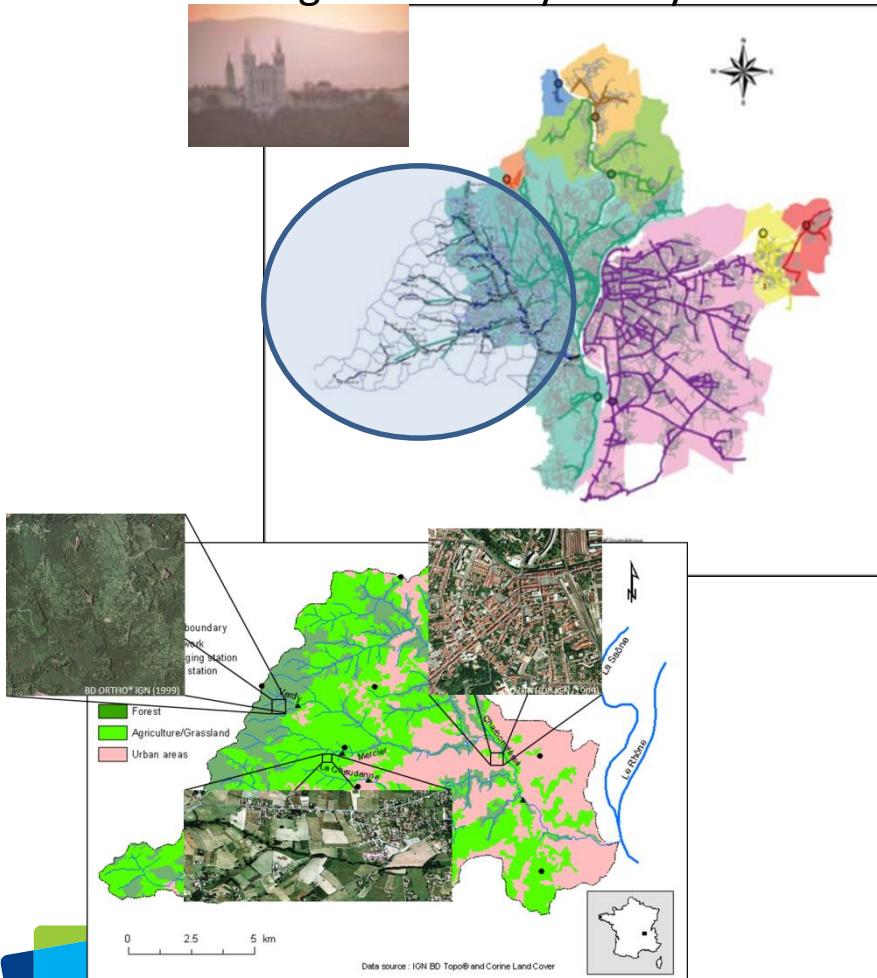
United Nations
Educational, Scientific and
Cultural Organization



International
Hydrological
Programme

Where?

Lugdunum....Lyon city



The Yzeron watershed has been an experimental site for Irstea-Lyon since 1994



Why?

1- How does the peri-urbanization process impact the flow regime in quality & quantity of water?

2- How can we mitigate these (-) impacts?



United Nations
Educational, Scientific and
Cultural Organization



International
Hydrological
Programme



(I) Watershed scale approach to understand the hydrological and ecological templates





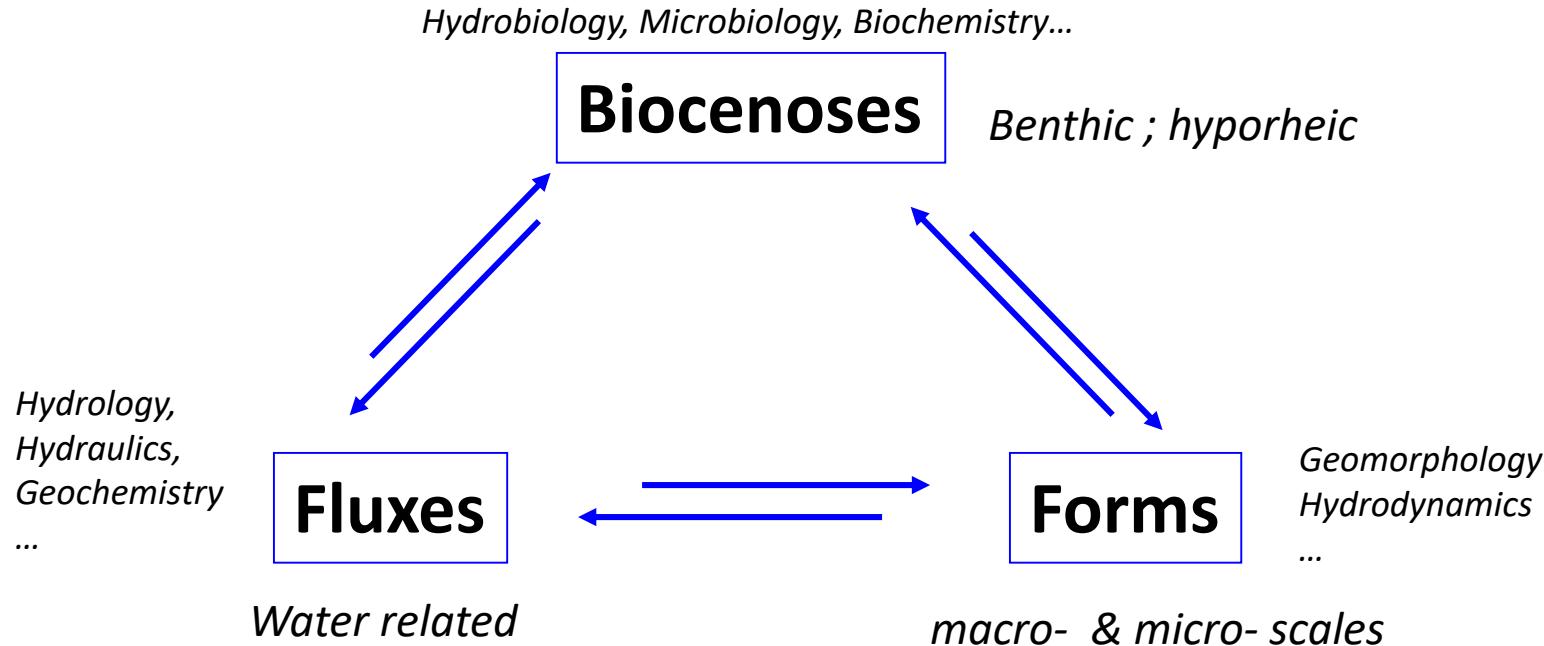
United Nations
Educational, Scientific and
Cultural Organization



International
Hydrological
Programme



EH dual regulation principle



Objective : Describe components and model their relationships





United Nations
Educational, Scientific and
Cultural Organization

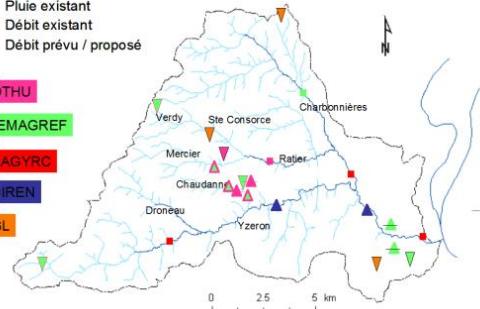


International
Hydrological
Programme

Hydrological fluxes



- ▽ Pluie existant
- △ Débit existant
- Débit prévu / proposé



Landuse change modeling

L'OCCUPATION DU SOL EN 2008



Sources: INSEE (INSEE2008), DREAL Rhône-Alpes (Rhone-Alpes), C. Etienne, Université de Lyon, 1999-2005 (DREAL2005)

SIMULER L'EFFET DES OUTILS DE PLANIFICATION

À HORIZON 2030
Évolution tendancielle
avec zonage
réglementaire
de la planification



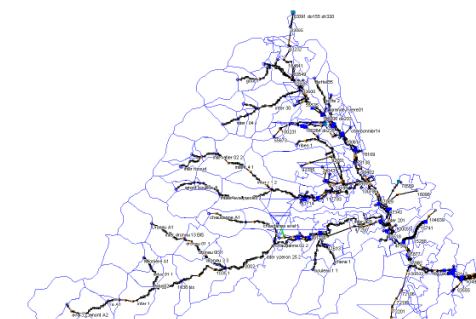
Sources: INSEE (INSEE2008), DREAL Rhône-Alpes (Rhone-Alpes), C. Etienne, Université de Lyon, 1999-2005 (DREAL2005)

4th-International-Symposium-on-Flood-Defence:
Managing Flood Risk, Reliability and Vulnerability
Toronto, Ontario, Canada, May 6-8, 2008¹

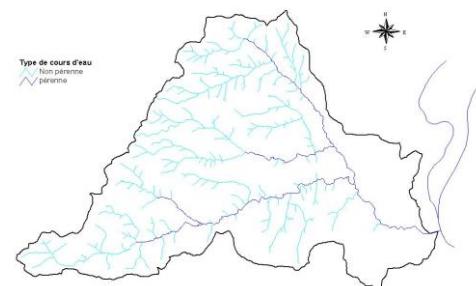
FLOOD REGIMES OF MID-SIZED AND MIXED LAND-USE CATCHMENTS: CAN WE ASSESS THE URBAN CONTRIBUTION?
¹ B. Radivojevic, P. Breil, B. Chocat³

EFFECTS OF COMBINED SEWER OVERFLOWS ON A PERIURBAN STREAM ECOSYSTEM: Methodological approach
P. Breil¹, M. Lafont², A. Vivier³, A. Ph. Namour³ and L. Schmitt⁴

Urban flow modeling CANOE model



Flood & Low flows simulation Wistoo; J2000 spatial models



The current issue and full text archive of this journal is available at
www.emeraldinsight.com/1752-8692.htm

**Assessing impact of global change
on flood regimes**

Biljana D. Radivojevic
Natural Science Sector, MAB and IHP Programmes, UNESCO, Paris, France
Pascal Breil

167

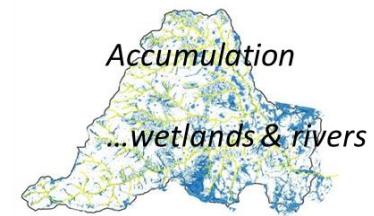
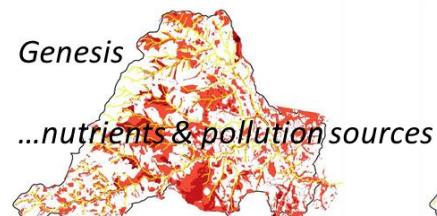
Impact of global
change on flood
regimes

Contents lists available at SciVerse ScienceDirect
Journal of Hydrology
journal homepage: www.elsevier.com/locate/jhydrol

Evidence of the impact of urbanization on the hydrological regime of a medium-sized periurban catchment in France

I. Braud^{a,*}, P. Breil^a, F. Thollet^a, M. Lagouy^a, F. Branger^a, C. Jacqueminet^b, S. Kermadi^b, K. Michel^b

Intense Overland Runoff Prediction, IRIP spatial model



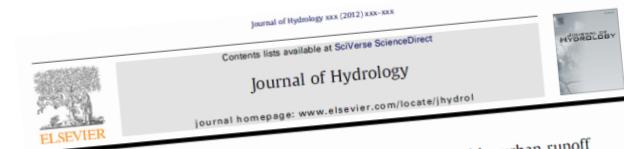
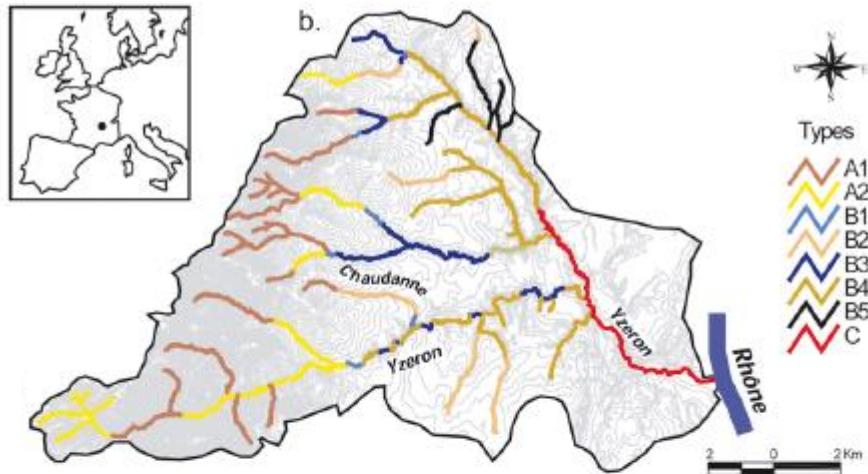


United Nations
Educational, Scientific and
Cultural Organization



International
Hydrological
Programme

Hydro-geomorphological typology

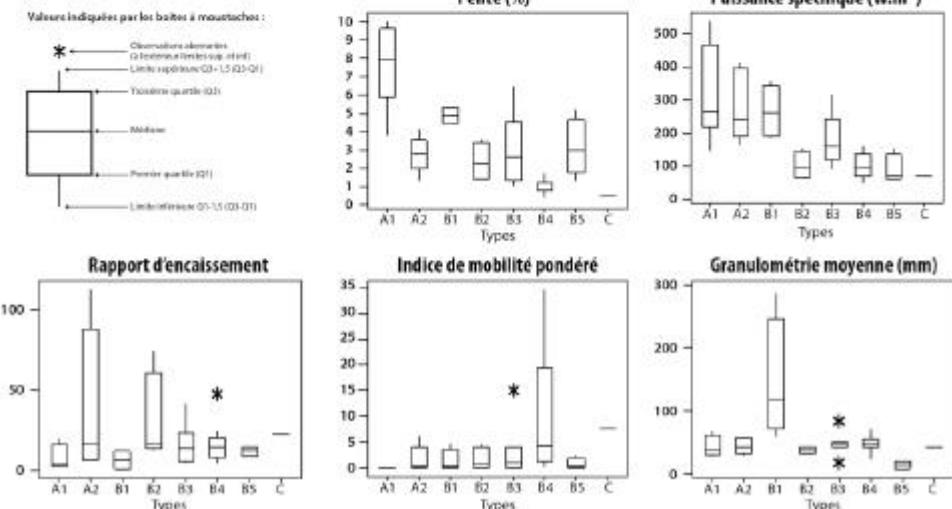


Hydrogeomorphic adjustments of stream channels disturbed by urban runoff
(Yzeron River basin, France)
O. Navratil^{a,*}, P. Breil^b, L. Schmitt^c, L. Grosprêtre^d, M.B. Albert^e



Evidence of the impact of urbanization on the hydrological regime
of a medium-sized periurban catchment in France

I. Braud^{a,*}, P. Breil^a, F. Thollot^a, M. Lagouy^a, F. Branger^a, C. Jacqueminet^b, S. Kermadi^b, K. Michel^b



HYDROLOGICAL PROCESSES
Hydro. Process. 24, 2452–2464 (2010)
Published online 20 April 2010 in Wiley InterScience
(www.interscience.wiley.com) DOI: 10.1002/hyp.7664

Test of three methods to detect the overbank flow from water level time-series analysis

O. Navratil,^{1,*} M. B. Albert² and P. Breil³



Using hydro-geomorphological typologies in functional ecology: Preliminary results
in contrasted hydrosystems
Schmitt Laurent^{a,*}, Lafont Michel^b, Trémolières Michèle^c, Jezequel Céline^{a,b}, Vivier Anne^b,
Breil Pascal^b, Namour Philippe^b, Valin Karine^a, Valette Laurent^a



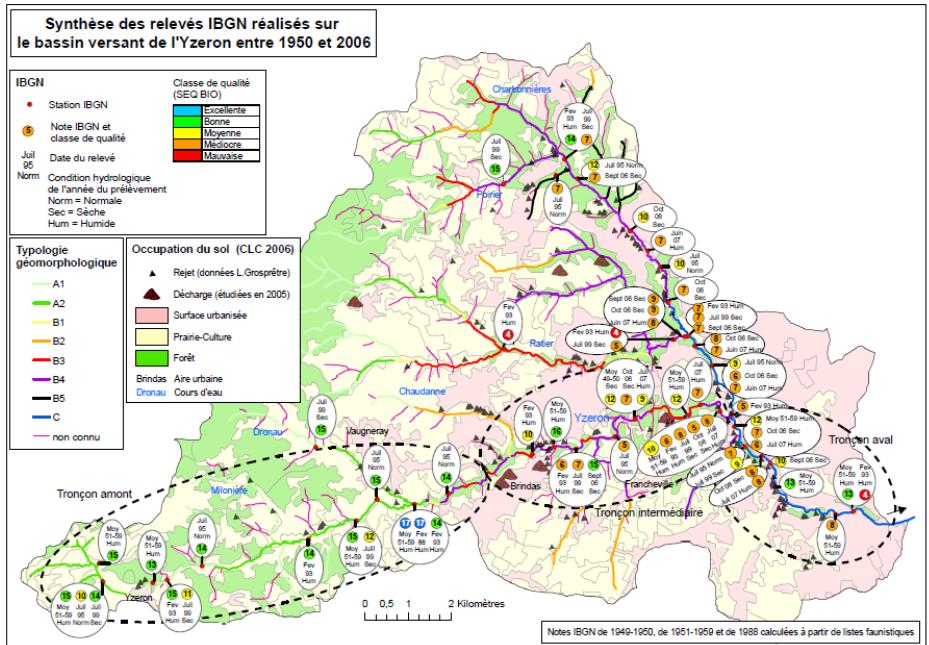


United Nations
Educational, Scientific and
Cultural Organization



International
Hydrological
Programme

Biocenoses status..& functions



Water Science & Technology Vol 56 No 9 pp 13-20 © IWA Publishing 2007

Bioassessment of wet-weather pollution impacts on fine sediments in urban waters by benthic indices and the sediment quality triad

M. Lafont*, L. Grapentine**, Q. Rochfort*, J. Marsalek**, G. Tixier*** and P. Breil*

© Springer 2006

Hydrobiologia (2006) 564:183–193
P.F.M. Verdonschot, H. Wang, A. Pinder & R. Nijboer (eds), Aquatic Oligochaete Biology IX
DOI 10.1007/s10750-005-1718-8

Surface and hyporheic oligochaete assemblages in a French suburban stream

Michel Lafont^{1,*}, Anne Vivier², Sylvie Nogueira¹, Philippe Namour³ & Pascal Breil⁴

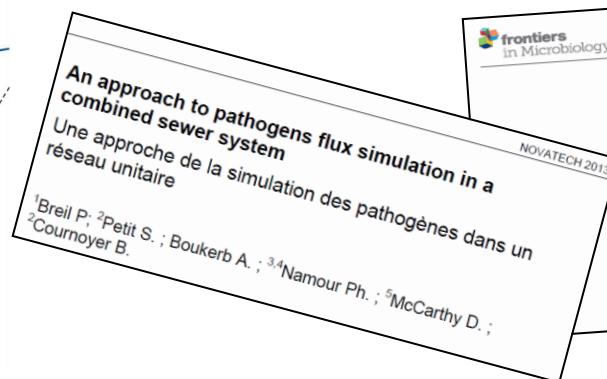
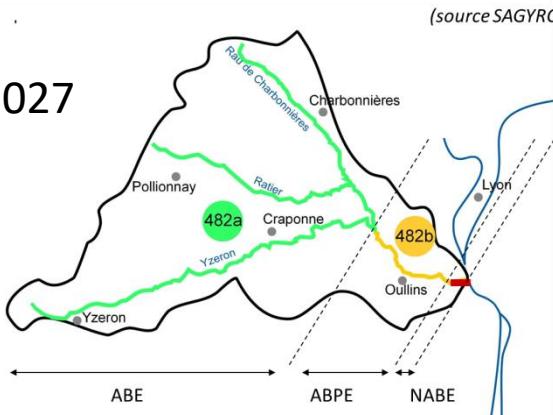
Journal of Water Resource and Protection, 2012, 4, 984-992
doi:10.4236/jwarp.2012.411114 Published Online November 2012 (<http://www.SciRP.org/journal/jwarp>)



Multi-Level Approach of the Ecotoxicological Impact of a Combined Sewer Overflow on a Peri-Urban Stream

Céline Becouze-Lareure^{1,2*}, Christine Bazin², Philippe Namour^{3,4}, Pascal Breil⁵, Yves Perrodin¹

WFD..2027



Human-Driven Microbiological Contamination of Benthic and Hyporheic Sediments of an Intermittent Peri-Urban River Assessed from MST and 16S rRNA Genetic Structure Analyses

Romain Marti¹, Sébastien Ribaut¹, Jean-Baptiste Aubin², Céline Colinon¹, Stéphanie Petit¹, Laurence Margolit¹, Michèle Gourmelon³, Laurent Schmitt⁴, Pascal Breil⁵, Marylise Cottet⁶ and Benoit Cournoyer^{1*}



United Nations
Educational, Scientific and
Cultural Organization

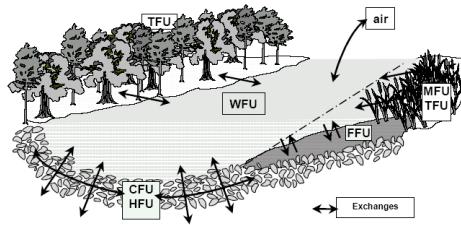


International
Hydrological
Programme

Biocenoses /forms & /fluxes



Functional Units

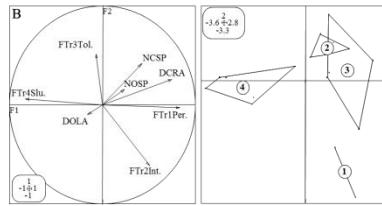


Functional Unit	
WFU	Water FU
MFU	Macrophyte FU
TFU	Terrestrial FU
FFU	Fine sediment FU
CFU	Coarse sediment FU
HFU	Hyporheic FU

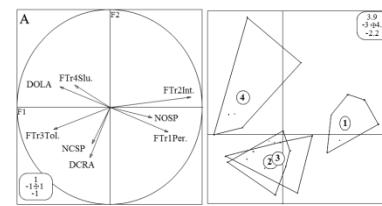
Functional traits

Biological FTrs	Oligochaete species characterizing each FTr
FTr1 "Permeability"	<i>Trichodrilus strandi, Stylodrilus herringianus, S. parvus, Rhyacodrilus ardierae, R. coccineus, R. falciformis, R. subterraneus, Haber speciosus, Pristina aequiseta, Pristinella jenkinsae, P. osborni, Cernosvitoviella atrata, Achaeta vesiculata, Marionina argentea, Haplotaxis gordioides</i>
FTr2 "Intolerance"	<i>R. ardierae, R. falciformis, R. subterraneus, C. atrata, A. vesiculata, M. argentea, Vévodovskyella comata, Eiseniella tetraedra</i>
FTr3 "Tolerance"	<i>Nais elonguis, P. jenkinsae, Dero digitata, Marionina riparia</i>
FTr4 "Sludge effect"	immatures of Tubificidae with and without hair setae, <i>Tubifex ignotus, T. tubifex, Limnodrilus hoffmeisteri, Bothrioneurum sp, Lumbricillus spp.</i>

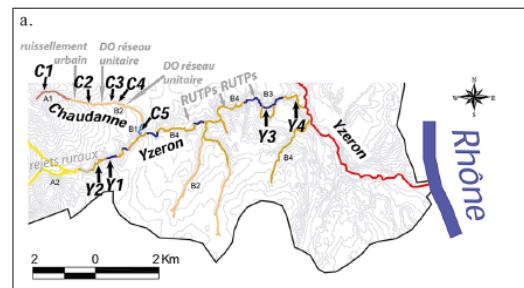
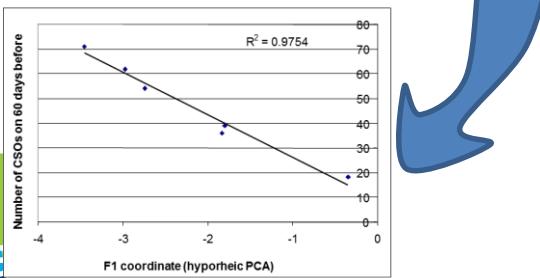
ACP on hyporheic sediments



ACP on benthic sediments



Hydrology –number of CSOs



Code du site	Rejets ruraux		Rejets urbains	
	Y1	Y3	Y2	Y4
Suf. bassin versant (km²)	33.3	57.7	33.1	59.0
% surf. urbanisée	4.4	17.2	4.3	18.3
Oligochètes	Eau de surf.	Hypothèses	Eau de surf.	Hypothèses
FTr1 (%)	6.1	7.3	4.7	6.3
FTr2 (%)	91	93	52	93
FTr3 (%)	60	66	67	96
FTr4 (%)	24	21	23	0
	0	0	1	2
Code du site	Rejets ruraux		Rejets urbains	
	Y1	Y3	Y2	Y4
Suf. bassin versant (km²)	33.3	57.7	33.1	59.0
% surf. urbanisée	4.4	17.2	4.3	18.3
Oligochètes	Eau de surf.	Hypothèses	Eau de surf.	Hypothèses
FTr1 (%)	6.1	7.3	4.7	6.3
FTr2 (%)	91	93	52	93
FTr3 (%)	60	66	67	96
FTr4 (%)	24	21	23	0





United Nations
Educational, Scientific and
Cultural Organization



International
Hydrological
Programme

Forms & Fluxes

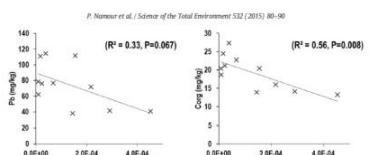
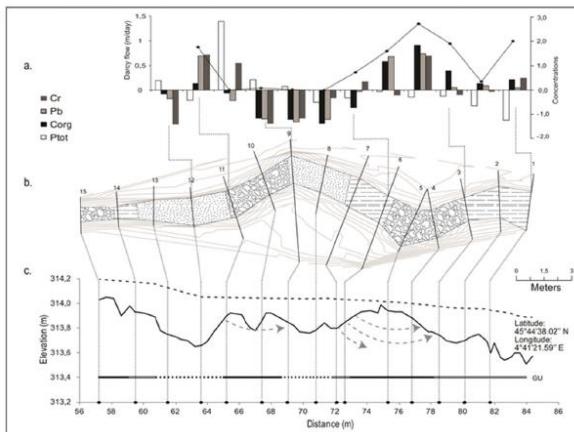
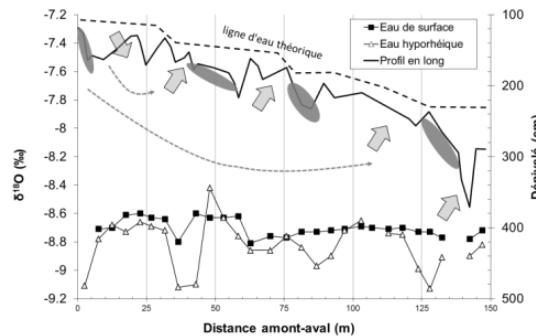


Fig. 8. Relationship between concentration of C_{org} and Pb with K values at the upstream reach with probability for R^2 to equal zero.



Contents lists available at ScienceDirect

Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv

Stream pollution concentration in riffle geomorphic units
(Yzeron basin, France)

Philippe Namour ^{a,b,*}, Laurent Schmitt ^c, David Eschbach ^c, Bertrand Moulin ^d, Guillaume Fantino ^d,
Claire Bordes ^a, Pascal Breil ^e

2632

© IWA Publishing 2013 Water Science & Technology | 68:12 | 2013

Nitrogen patterns in subsurface waters of the Yzeron stream: effect of combined sewer overflows and subsurface-surface water mixing

A. M. Aucour, T. Bariac, P. Breil, P. Namour, L. Schmitt, R. Ghouma
and P. Zuddas

La zone hyporéique, une composante à ne pas négliger dans l'état des lieux et la restauration des cours d'eau
Thibault Datry ^a, Marie-José Dole-Olivier ^b, Pierre Marmonier ^a, Cécile Claret ^c,
Jean-François Perrin ^a, Michel Lafont ^a et Pascal Breil ^d

Ingénieries n° 54 - p. 3 à 18
Juin 2008

Ann. Limnol. - Int. J. Lim. 48 (2012) 253–266
© EDP Sciences, 2012
DOI: [10.1051/limn/2012009](https://doi.org/10.1051/limn/2012009)

Available online at:
www.limnology-journal.org

The role of organisms in hyporheic processes: gaps in current knowledge, needs for future research and applications

P. Marmonier^{1,8}, G. Archambaud², N. Belaidi³, N. Bougon⁴, P. Breil⁵, E. Chauvet^{6,7}, C. Claret⁸,
J. Cornut^{6,7}, T. Datry⁴, M.-J. Dole-Olivier¹, B. Dumont², N. Flipo⁹, A. Foulquier^{1,4}, M. Gérino^{6,7},
A. Guilpart¹⁰, F. Julien^{6,7}, C. Maazouzi¹, D. Martin¹, F. Mermilliod-Blondin¹, B. Montuelle^{4,11},
Ph. Namour^{4,12}, S. Navel¹, D. Ombredane¹⁰, T. Pelte¹³, C. Piscart¹, M. Pusch¹⁴, S. Stroffek¹³,
A. Robertson¹⁵, J.-M. Sanchez-Pérez^{6,7}, S. Sauvage^{6,7}, A. Taleb³, M. Wantzen¹⁶
and Ph. Vervier^{6,7,17}





United Nations
Educational, Scientific and
Cultural Organization



International
Hydrological
Programme



After a decade of research in the Yzeron watershed, we reached the following conclusions :

- The self-purification capacity of a river system is unequally distributed;
- In our lotic system, the main bioreactor is the hyporheic zone;
- The main drivers are (I) the river geomorphology and (II) the connection to a ground water table;



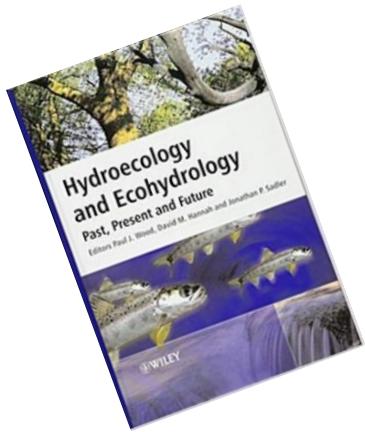
United Nations
Educational, Scientific and
Cultural Organization



International
Hydrological
Programme



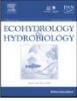
(II) Problem solving approach



Contents lists available at ScienceDirect

Ecohydrology & Hydrobiology

journal homepage: www.elsevier.com/locate/ecohyd



Editorial

Synthesis and conclusions to the International Symposium on Ecohydrology, Biotechnology and Engineering: Towards Harmony between the Biogeosphere and Society on the basis of Long-Term Ecosystem Research



Brian Moss^{a,*}, Giovanni Bidoglio^b, Robert Pietrowsky^{c,d}, Pascal Breil^e,
Patrick Bourgeron^f, Johannes Cullmann^g, Giuseppe Arduino^h, Iwona Jasserⁱ,
Artur Magnuszewski^j, Daniel Orenstein^k, Graham Piper^l, Sławomir Ratajski^m,
Jun Xia^{n,o}, Kinga Krauze^p, Iwona Wagner^{p,q}, Maciej Zalewski^{p,q}

Contents lists available at SciVerse ScienceDirect

Ecohydrology & Hydrobiology

journal homepage: www.elsevier.com/locate/ecohyd



Original research article

The role of ecohydrology in creating more resilient cities

Iwona Wagner^{a,b,*}, Pascal Breil^c

Ecohydrology & Hydrobiology xxx (2016) xxx-xxx

Contents lists available at ScienceDirect

Ecohydrology & Hydrobiology

journal homepage: www.elsevier.com/locate/ecohyd



Editorial

Measuring, modelling and managing the natural processes related to water flows. Social values of the related ecosystem services





United Nations
Educational, Scientific and
Cultural Organization



International
Hydrological
Programme

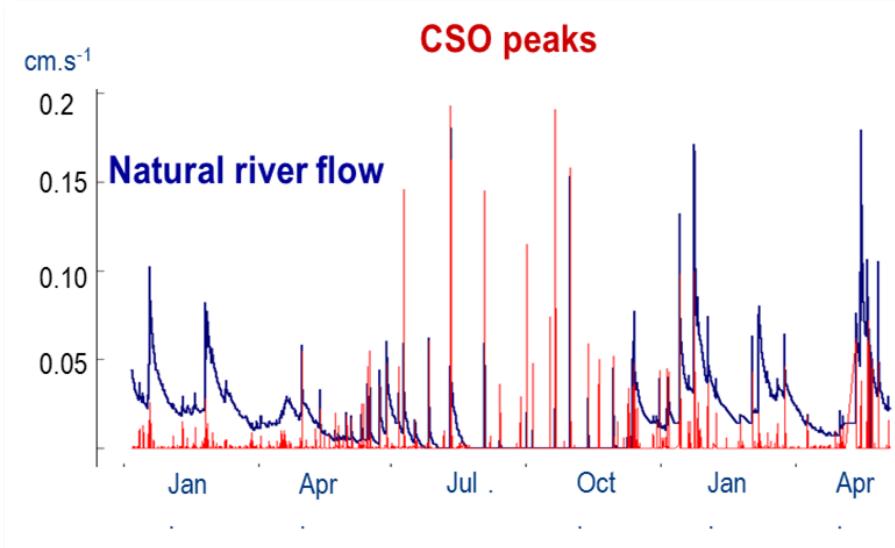
Low dilution capacity rivers , head waters, seasonal, intermittent..



Erosion



Deposits





United Nations
Educational, Scientific and
Cultural Organization

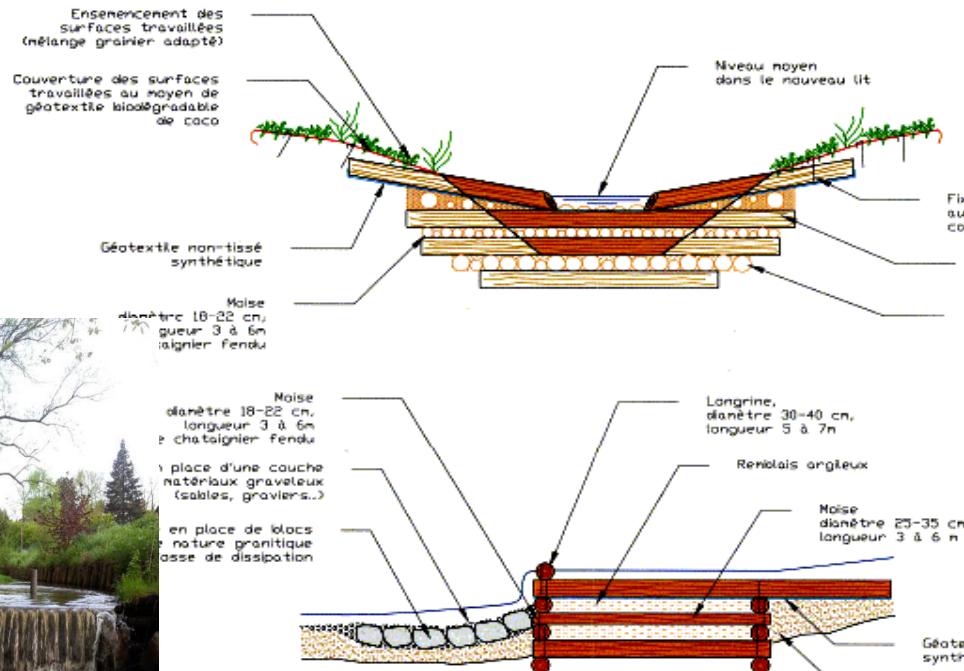


International
Hydrological
Programme

Increase the self purification capacityartificial riffle

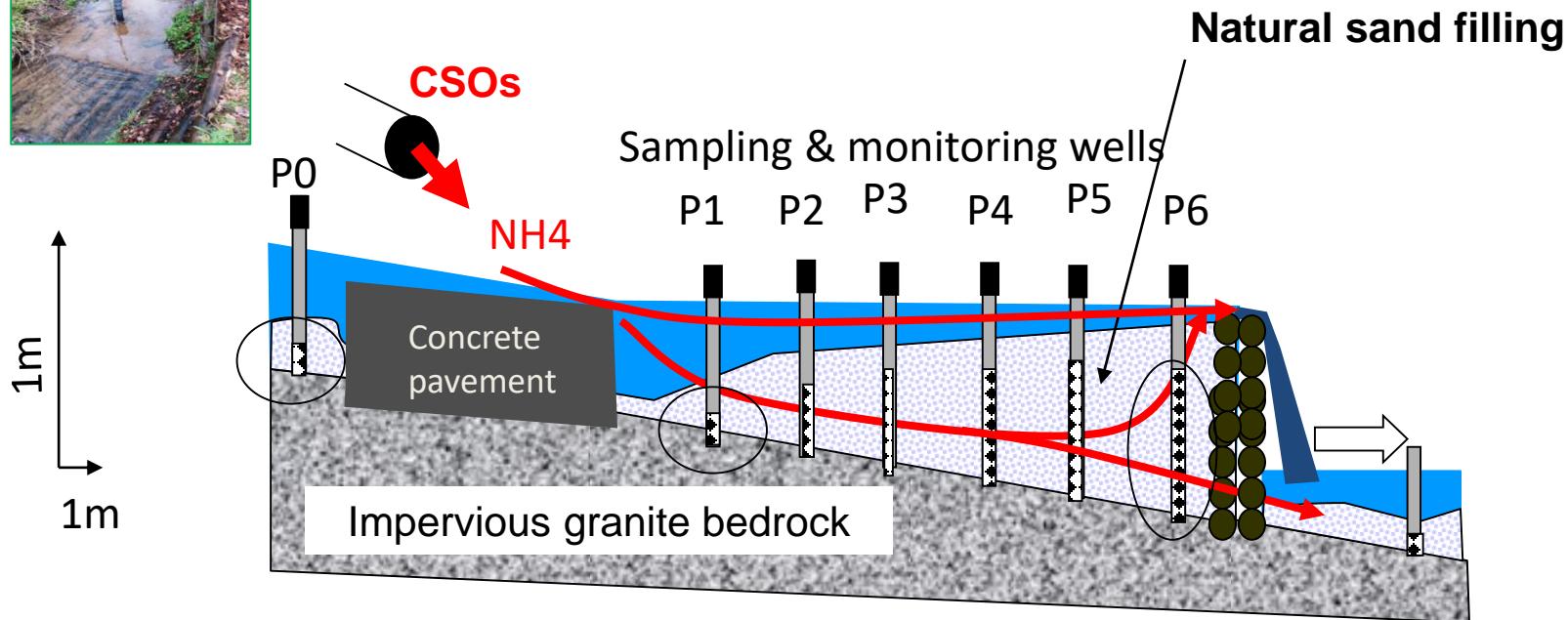


Coupe type d'un seuil en bois





Monitoring design



10 minutes time step
Multi-parameters loggers:

Electrical conductivity
Temperature
pH & redox potential
Dissolved oxygen
Water pressure

Weekly sampling
for water quality analysis of

NH_4 > CSOs source
 NO_3 > NH_4 nitrification or fertilizer origin
 NO_2 > NO_3 denitrification
 DOC > Dissolved Organic Carbon (CSOs & nat.)
 PO_4 > Phosphate (CSO, agriculture)



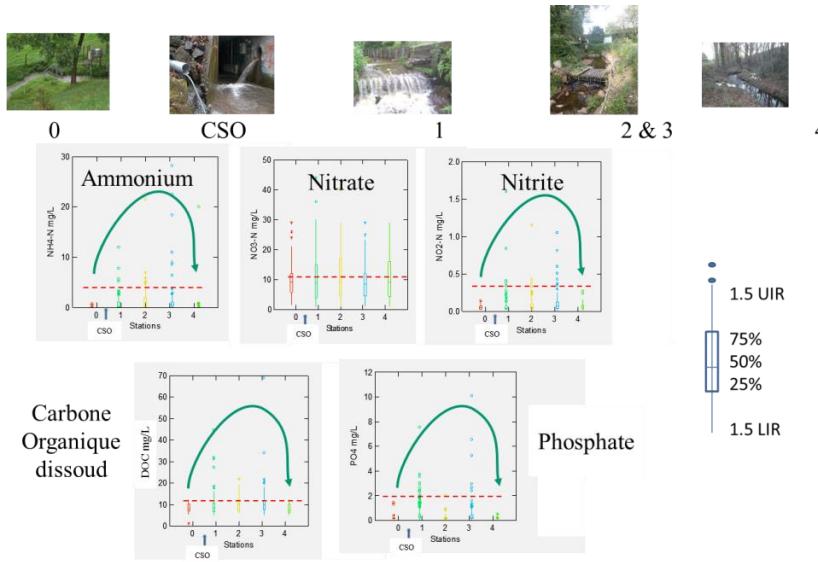
United Nations
Educational, Scientific and
Cultural Organization



International
Hydrological
Programme

Proof of concept....

biodegradation process / uptake..



Nitrogen amount (mg/L)

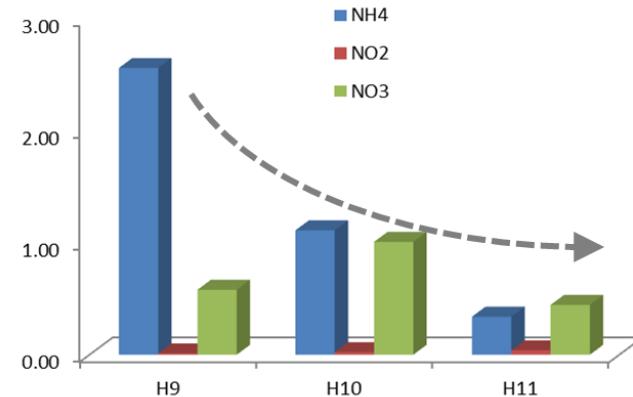
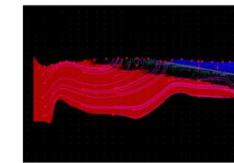
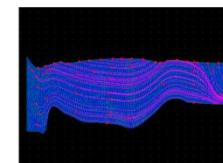
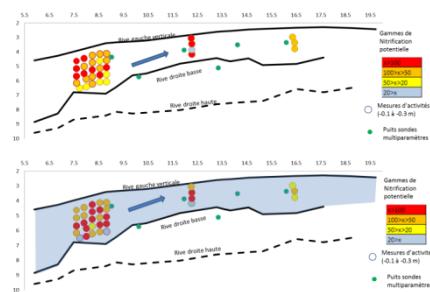


Figure 2 : System in operation on the field,



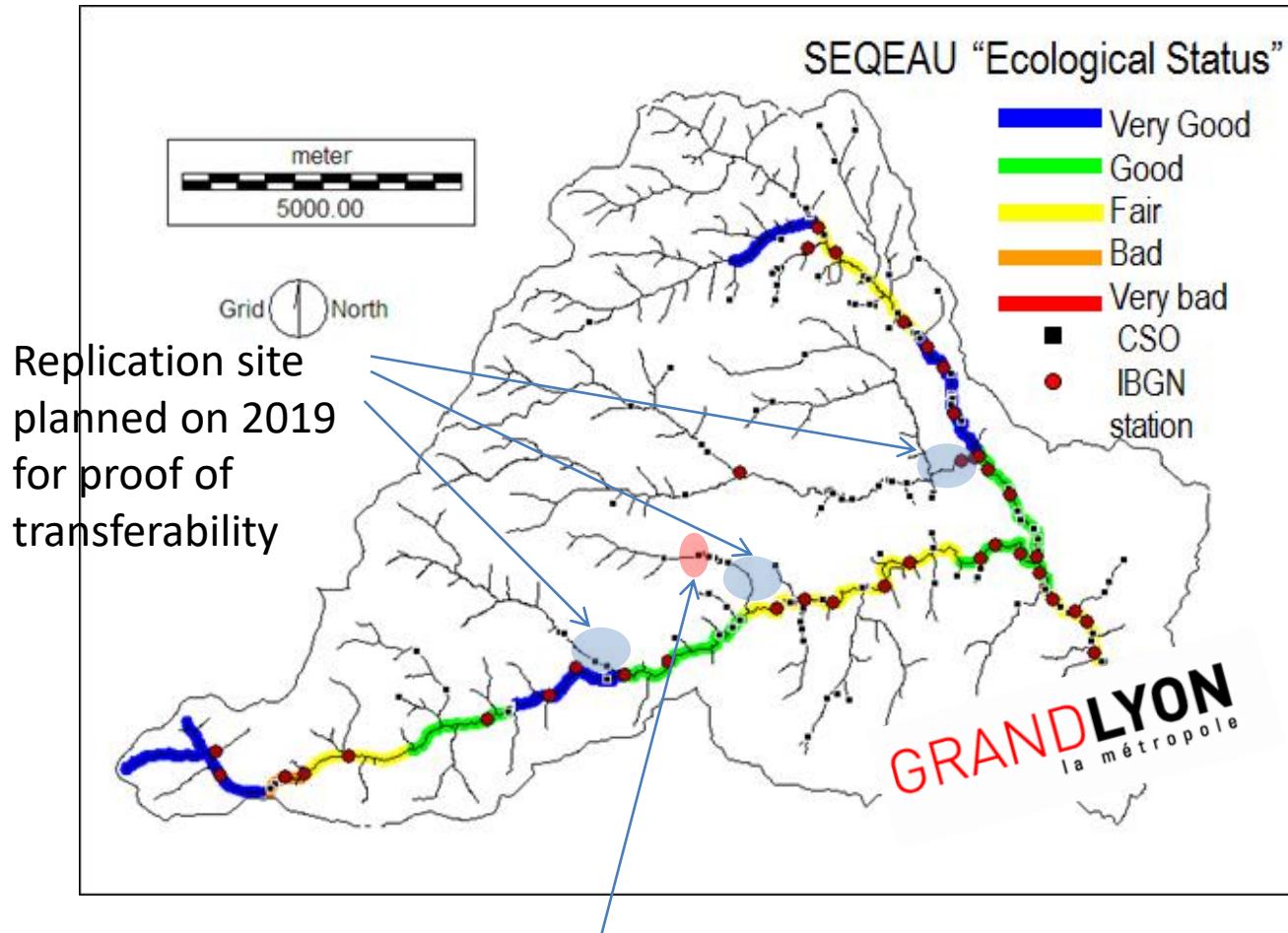


United Nations
Educational, Scientific and
Cultural Organization



International
Hydrological
Programme

Implementation strategy with the support of the river basin managers



Demosite – proof of concept running since 2006



Missions since 2000:
Flood, Drought, river resource
management
WFD objectives / good
ecological status...



Missions since 1974:
Sewer and waste
water system planning
and management.

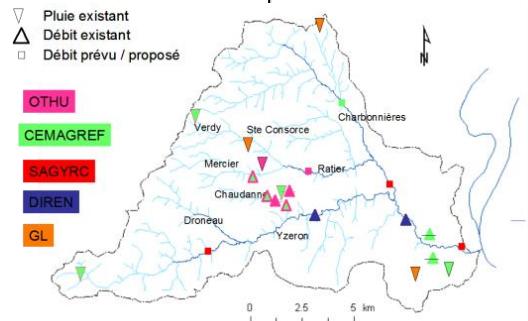


United Nations
Educational, Scientific and
Cultural Organization



International
Hydrological
Programme

The Lyon' EH demosite and research networks



www.graie.org/othu/

Field Observatory for Urban Water Management

OTHU Observatoire de Terrain en Hydrologie Urbaine

Présentation Sites Données Partenaires Recherches associées Productions/Outils

Better understand to better manage

This outdoor laboratory plans to acquire reliable data on urban wet weather effluents on their impact on rivers and environment. It will provide results, knowledge, and methodologies to assess the sustainability of urban water system and to support operational decision making.

A research teams Federation
12 Research Units and Engineering Schools, 12 Research Institutes, 90 Researchers (20 PhD) being in 2015 Operational partners: Urban Community of Lyon, Water Agency, Ministries of Equipment, Ecology and Research, Aix-Marseille University

A long term and multidisciplinary approach
Climatology, Hydrology, Hydraulics, Soil science, Chemistry, Biology, science, Economy

Research actions linked to end-users needs
- Hydraulic and pollutants loads in urban catchments during dry and wet weather events
- Impact of discharges on soils, water bodies & aquifers
- Interaction between urban and rural areas
- Development of strategies for sustainable urban water management

An open and integrated approach of observation
Based on long term monitoring systems with on-line monitoring setting the global assessment of rainfall impact
5 experimental catchments in Lyon agglomeration, representative of Combined and separate sewers systems, CSO, retention and infiltration, impact of urbanization on soil infiltration and aquifer recharge

A strong effort devoted to results dissemination



www.za-inee.org/en/frontpage

Zones Ateliers LTER FRANCE

Home Presentation Publications Contact Conferences

Media Data and metadata Directory Focus

• UK • France

Les Zones Ateliers

Les Zones Ateliers (ZA) se focalisent autour d'une unité fonctionnelle (un fleuve et son bassin versant ou la biodiversité, de l'antarctique à l'Afrique subsaharienne, ou le littoral, ou encore la vie dans des environnements d'origine naturelle ou naturelle renforcée) et y développent une démarche scientifique spéculative et expérimentale sur les sites ateliers, pour y mener des recherches pluridisciplinaires sur le long terme des sites ateliers.

www.ozcar-ri.org/ozcar/philosophy/

OZCAR THE CRITICAL ZONE OBSERVATORIES RESEARCH AND APPLICATIONS

> Accueil > OZCAR > What is OZCAR research infrastructure?

What is OZCAR research infrastructure?

OZCAR (Critical Zone Observatories: Research and Application) is a national distributed research infrastructure associating most of the French observation sites dedicated to the observation and monitoring of the Critical Zone, CZ, the thin outer veneer of Earth's continents extending from the top of the vegetation canopy down to groundwater.

www.ozcar-ri.org/ozcar/philosophy/

OZCAR in the European context

OZCAR is actively contributing in building up a pan-European infrastructure integrating LTER (Long-Term Ecosystem Research), Critical Zone and Socio-Ecological Research observatories (eLTER RI) (<http://www.lter-europe.net/lter-esri>)

eLTER

ecohydrology-ihp.org/demosites/demosites/list

ECOHYDROLOGY WEB PLATFORM

Country: Croatia

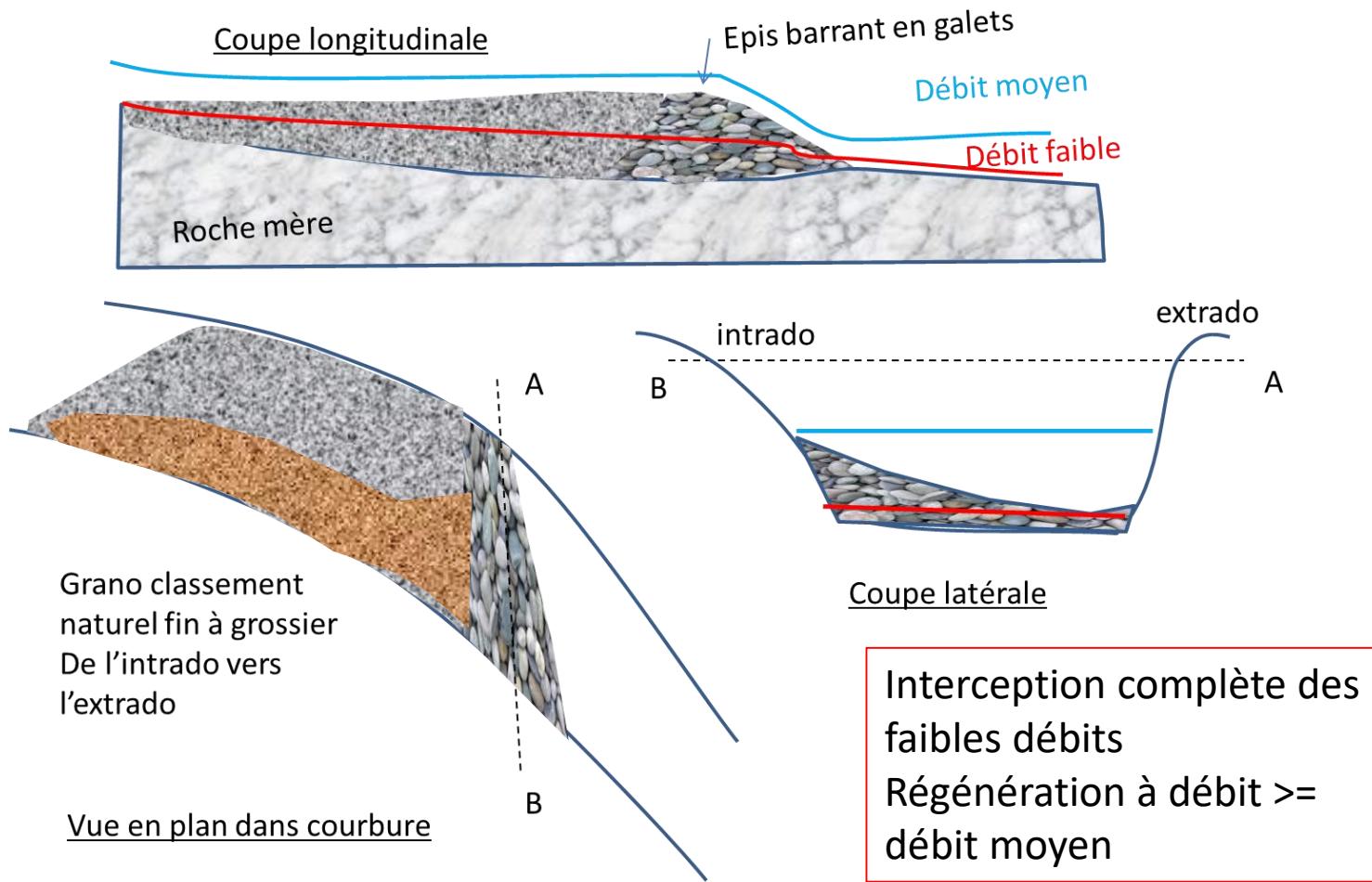
United Nations Educational, Scientific and Cultural Organization International Hydrological Programme ecohydrology programme

CLICK HERE

Updated in: 2017



Porous ramp principle



(Breil, 2018)