

Wastewater treatment Optimisation strategies

Pharmaceuticals and priority chemicals in the
Highlands and Islands environment

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DRAFT CLIMATE CHANGE PLAN

The draft third report on policies
and proposals 2017-2032

January 2017



Scottish Government
Riaghaltas na h-Alba
gov.scot

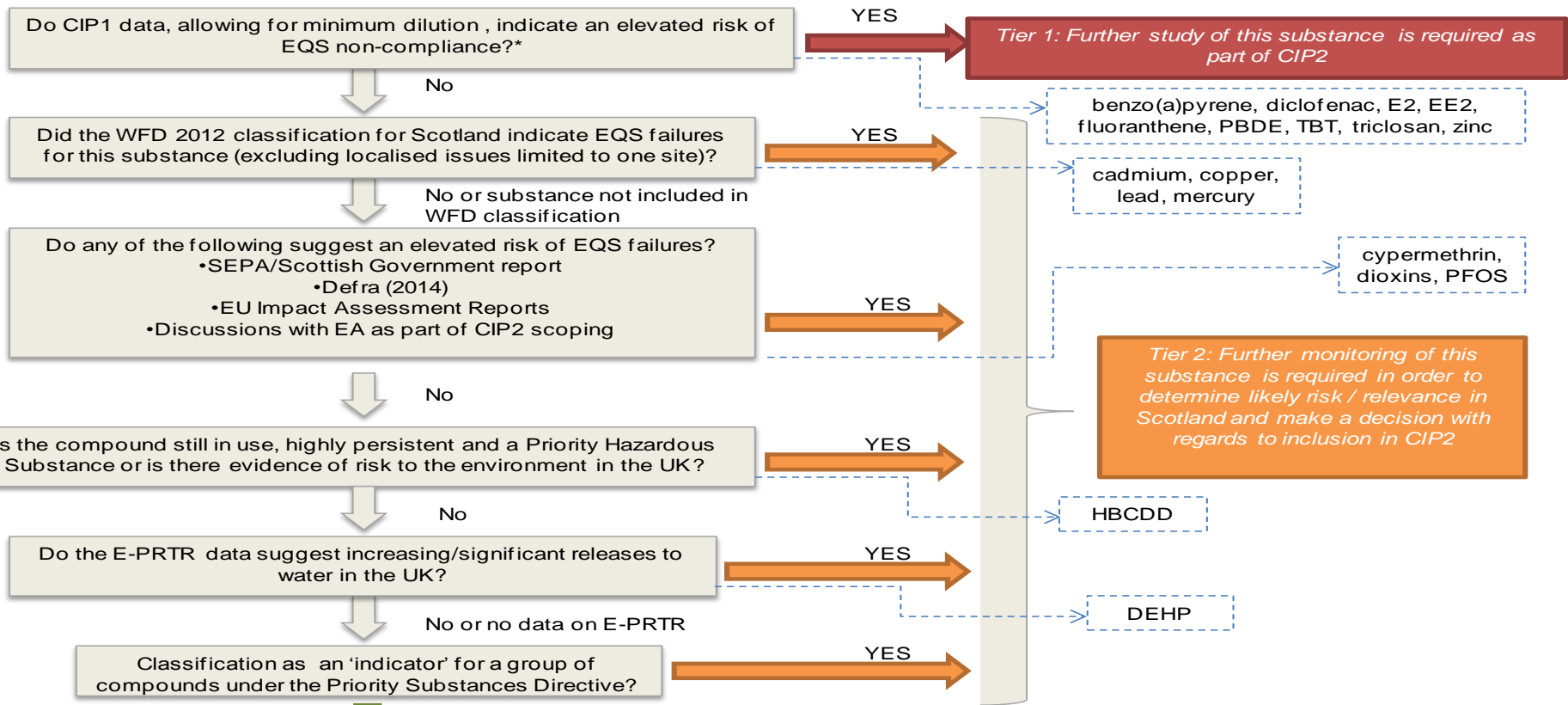
Reduce Carbon:

42% by 2020

66% by 2032

80% by 2040



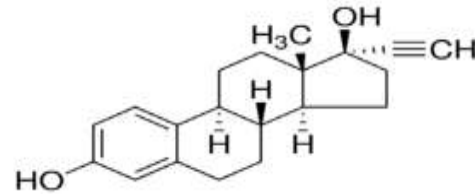
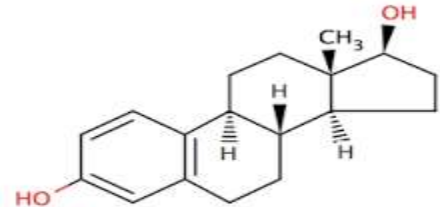
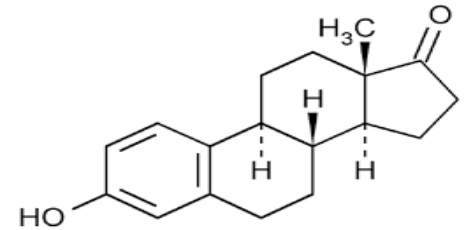


Notes
 E-PRTR: The European Pollutant Release and Transfer Register
<http://prtr.ec.europa.eu/PollutantReleases.aspx>
 Dotted arrows and boxes illustrate the **key** reason why different substances were assigned to Tier 1, 2 and 3 (but other reasons may apply too). See full templates for details.

*does not apply to diazinon and cypermethrin, for which CIP1 sites were selected based on known contamination issues – for these two substances the assessment is based on other background information.

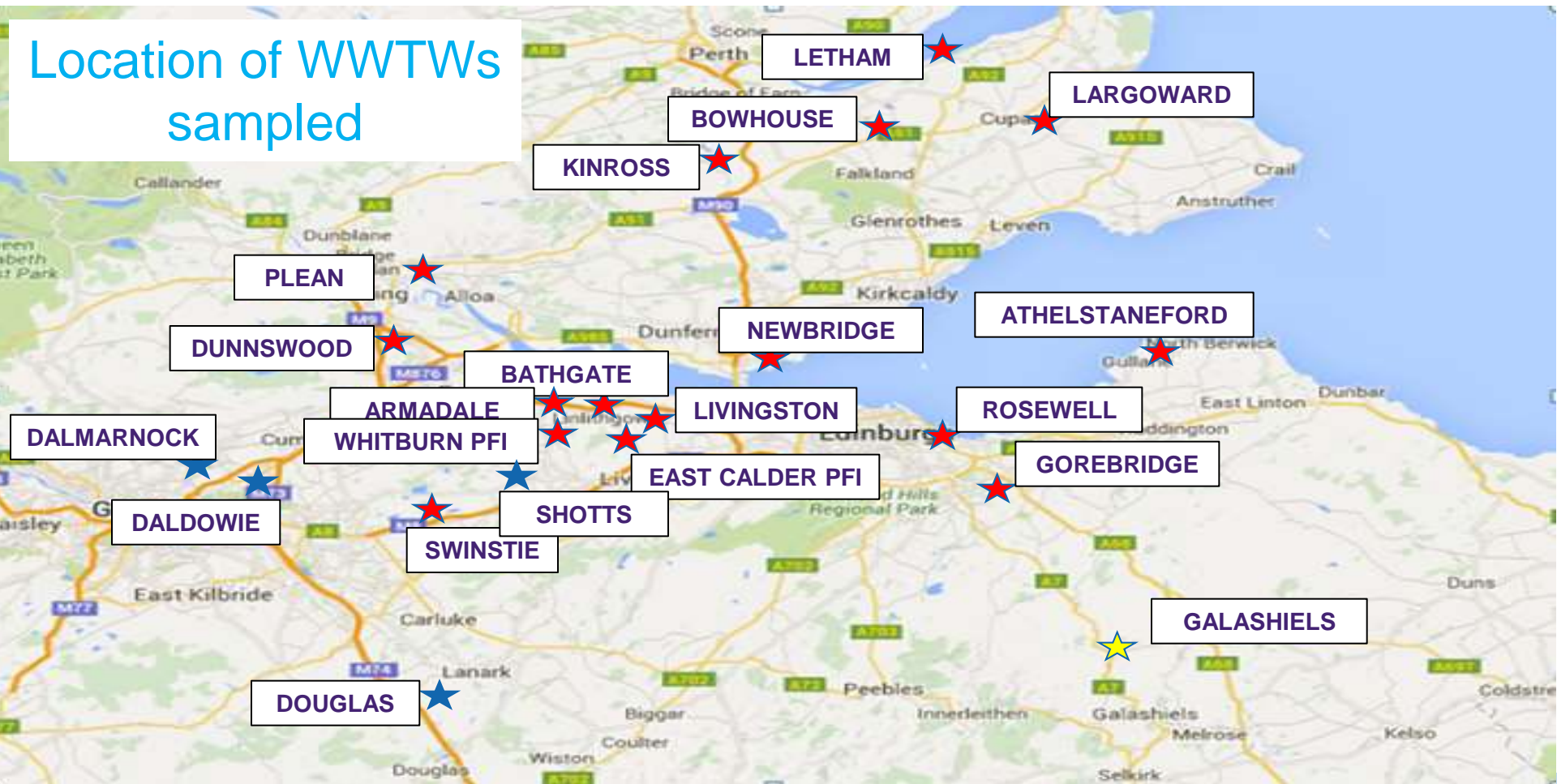
CIP2 Scotland substances analysed

Substance Category	List of Substances
Priority Substances	BDE 100, BDE 153, BDE 154, BDE 28, BDE 47, BDE 99, Benzo(a)pyrene, Cadmium, Cypermethrin, Di-2-(ethylhexyl) phthalate (DEHP), Dissolved Lead, Dissolved Mercury, Dissolved Nickel, Fluoranthene, Hexabromocyclododecane, Nonylphenol, Octylphenol, Perfluorooctane sulfonic acid, Total BDE, Tributyl Tin
UKTAG Substances	Dissolved Copper*, Dissolved Zinc*, Dissolved Manganese*, Triclosan
Watch List Substances	17-alpha ethinyloestradiol (EE2), 17-beta oestradiol (E2), Azithromycin, Clarithromycin, Diclofenac, Erythromycin, Oestrone (E1)
Additional Pharmaceuticals	1,2,3 Benzotriazole, 10,11-epoxy-Carbamazepine, Atenolol, Atorvastat, Carbamazepine, Ciprofloxacin, Fluoxetine, Ibuprofen, Metformin, Norethromycin, Norsertraline, ortho-Hydroxyatorvastatin, para-Hydroxyatorvastatin, Propanolol, Ranitidine, Sertraline, Tamoxifen, Tolytriazole, Trixylenyl Phosphate
Sanitary Determinands	Ammonia, Biochemical oxygen demand, Calcium, Phosphorus, Soluble Reactive Phosphate, Suspended solids, Total Chemical Oxygen Demand, Total organic carbon, Total organic carbon (filtered), Total Oxidised Nitrogen
Supporting Substances	Copper, Dissolved Cadmium, Dissolved Organic Carbon (filtered), Hydrogen ion, Lead, Manganese, Mercury, Nickel, Nonylphenol, Ethoxylates (NPEO1-3), PAH - total, Perfluorooctanoic acid, Zinc



Scottish Water
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Location of WWTWs sampled



Key stages in the project

- 24 month **sampling programme** at 20 WWTWs taking upstream, downstream, influent and effluent samples
- 10 month **sludge sampling** at a WTTWW
- **Analysing results** and **risk** to identify action
- **Process optimisation** and **catchment management**
- Identifying how substances will be dealt with in the **most sustainable way** and informing the **National Substance Strategy**



How to use the results - Decision tree

Prioritisation of substances and sites

Upstream concentration is below EQS/
PNEC and downstream and effluent are
above EQS/ PNEC



Recommend for process
optimisation

Upstream, downstream and effluent are
above EQS/ PNEC



Recommend for process
optimisation and
catchment management

Upstream above EQS/ PNEC but
downstream and FE is below EQS/ PNEC



Refer to SEPA for catchment
management

Substances found below EQS in effluent



Once enough data
confirm that sampling
no longer required

WFD Emerging Issues- Priority Substances



cypermethrin, insecticide in arable farming and forestry



HBCDD brominated flame retardants now only in wall insulation



Antibiotic currently on the EU Watch list which is used to treat bacterial infections



Oral diabetes medicine that helps control blood sugar levels



PFOS used in fabric protectors banned in 2009, still used in fire fighting foams



Fluoranthene Coal tar pitch and exhaust emissions, urban diffuse sources inc tarmac



Benzo (a) pyrene incomplete burning of fossil fuels, urban diffuse sources inc tarmac

14 substances recommended for process optimisation



PFOS used in fabric protectors & for fighting foams banned in 2009, still used in photographic coatings



cypermethrin, insecticide used in arable farming and forestry (Tully tubes) also for source control & sewer network management



Triclosan found in toothpaste, soaps & cosmetics (voluntary action) - declining

E1 & E2 natural extreated by humans & animals

EE2 birth control pills

Sertraline anti depressant medication

Diclofenac – anti inflammatory gel & pill



HBCDD brominated flame retardants now only in wall insulation



Tributyl tin antifouling, wood preservatives, antibacterial agent in textiles



Clarithromycin & erythromycin - antibiotic



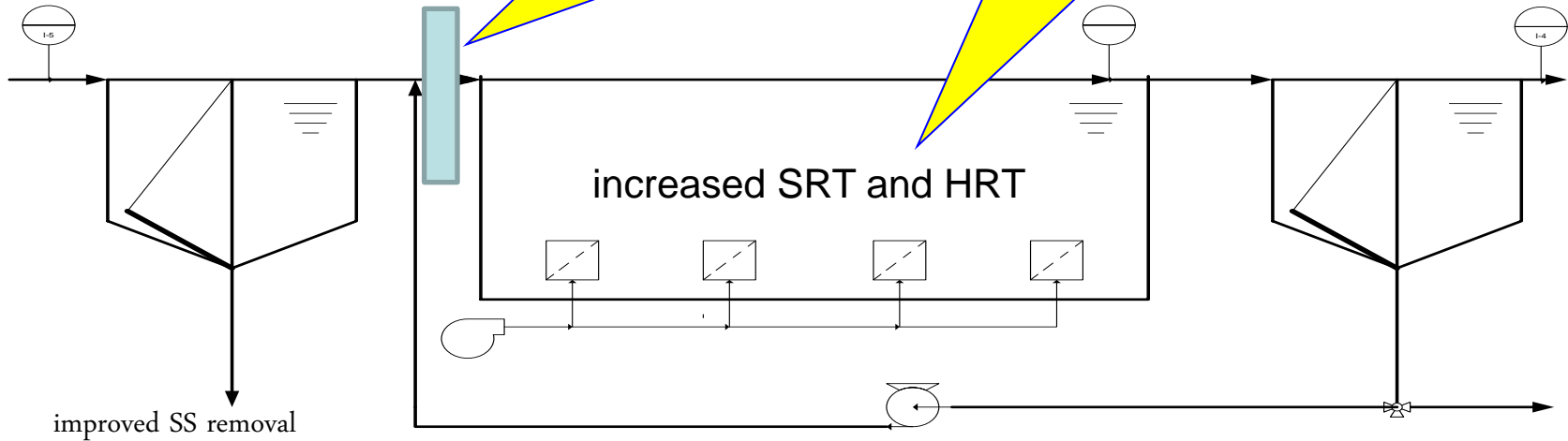
Propranolol – high blood pressure medication



Ranitidine – reduces stomach acid

What process optimisation may look like - large works

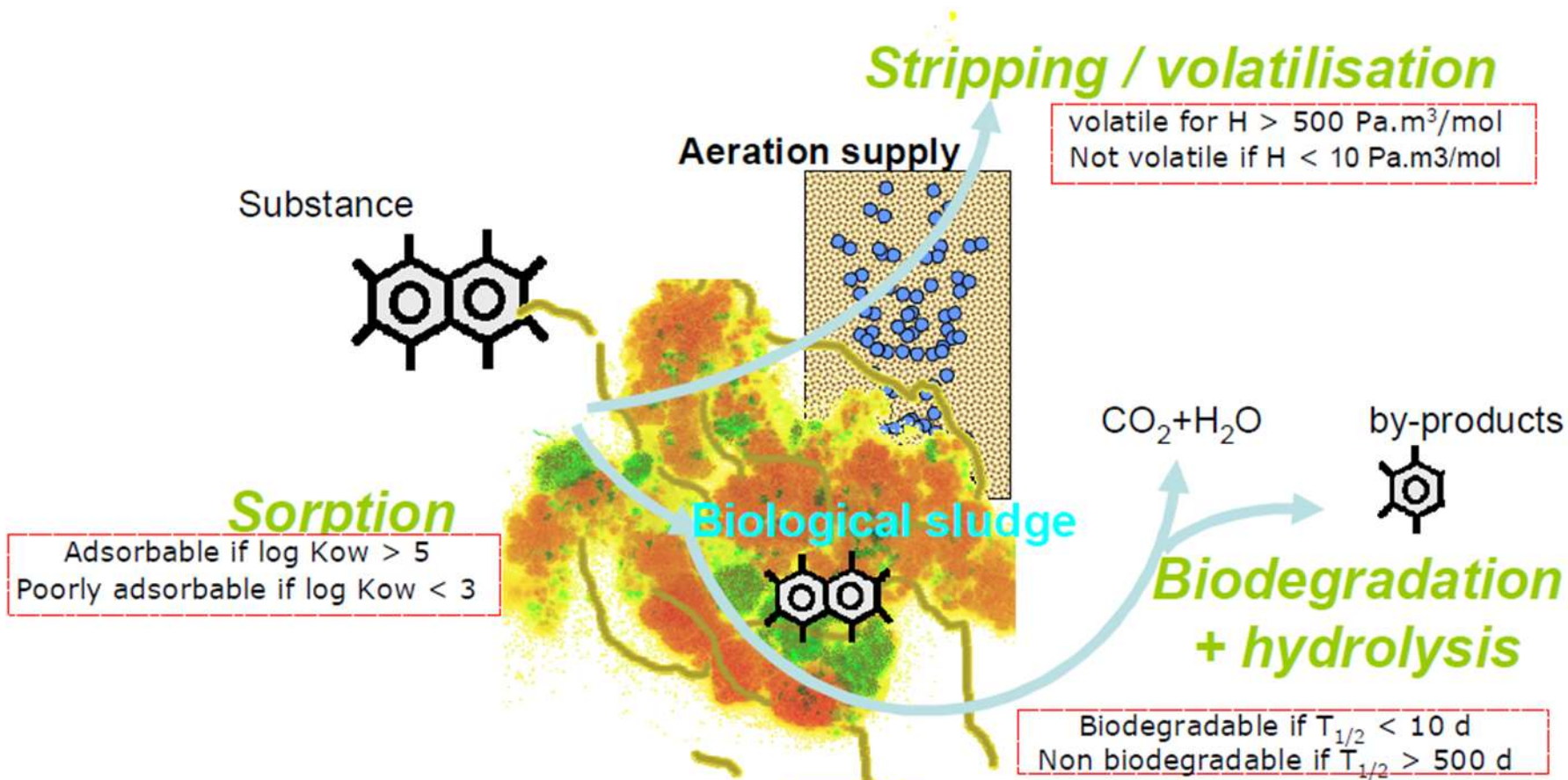
real-time flow measurement



Greater removals of biodegradable trace contaminants

Enhanced particulate bound hazardous chemical removal i.e. metals and nonylphenol

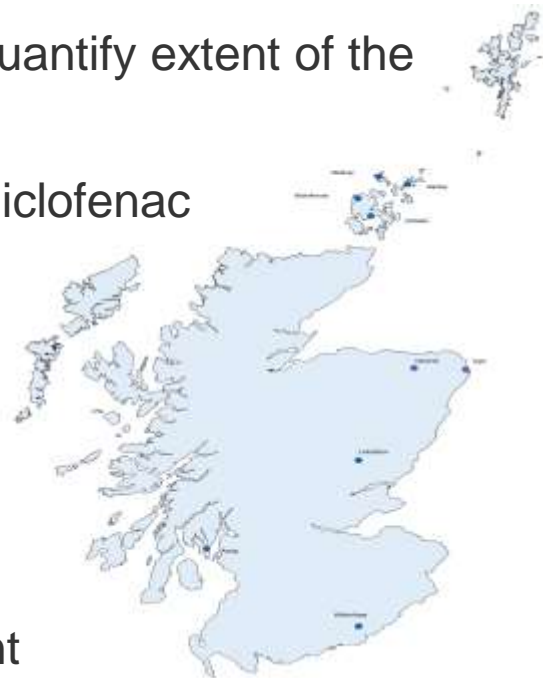
What process optimisation may look like



Potential source control options

Source control opportunities will be considered once we quantify extent of the problem

- Control levels, trader controls/treatment, cypermethrin, diclofenac
- Source separation
- Product substitution triclosan
- Green chemistry
- Customer education, safe disposal of medicines
- Catchment management, Sustainable Land Management



SLM locations



Source to Sip

The importance of protecting drinking water sources



Catchment activities

can greatly impact our source water



Pesticides & fertilisers

can make their way into our catchment water sources and alter the water quality



Our treatment works

remove these harmful substances but this is cost and energy intensive



This also helps deliver

real environmental improvements



It would also help

enhance and maintain a high quality of drinking water

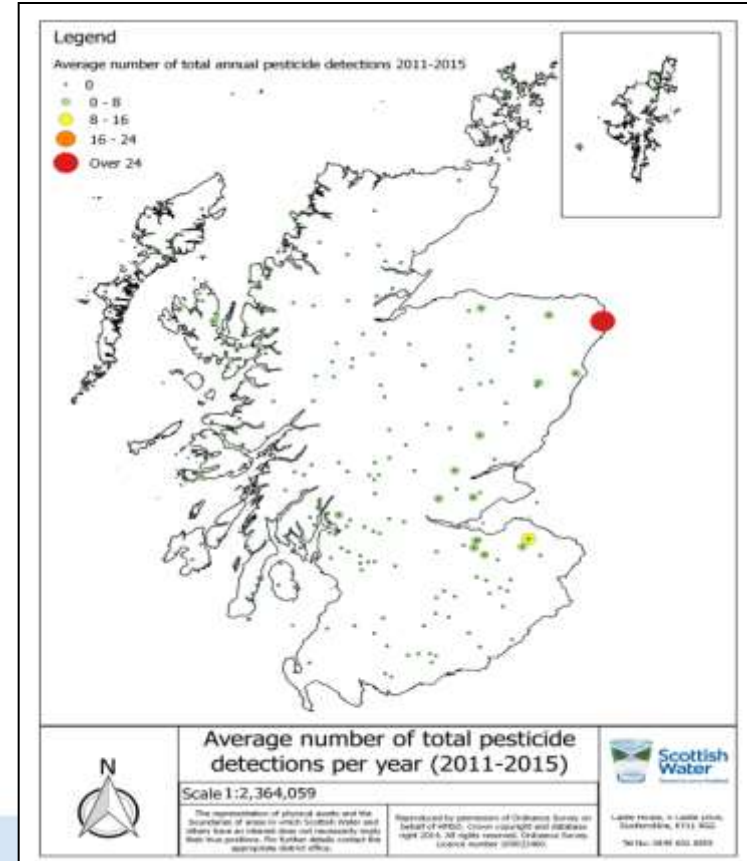


Protecting our water

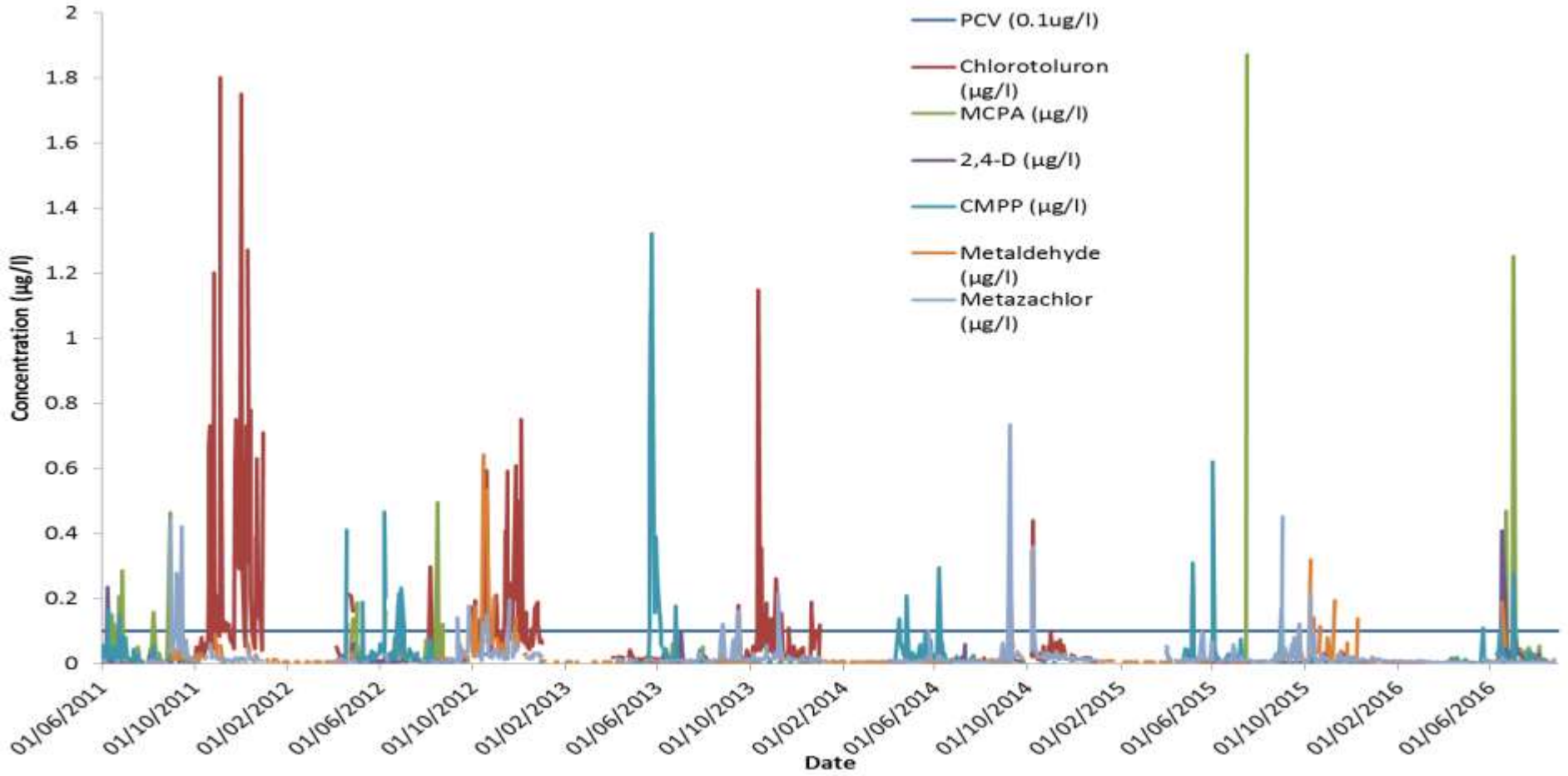
sources will provide even greater value for money for our customers

Pesticide issue for Scottish Water

- Two catchments closely monitored for a range of pesticides
 - River Ugie and River Deveron
- Large number of applications for aerial spraying of asulam
- Recent concerns regarding detections of MCPA

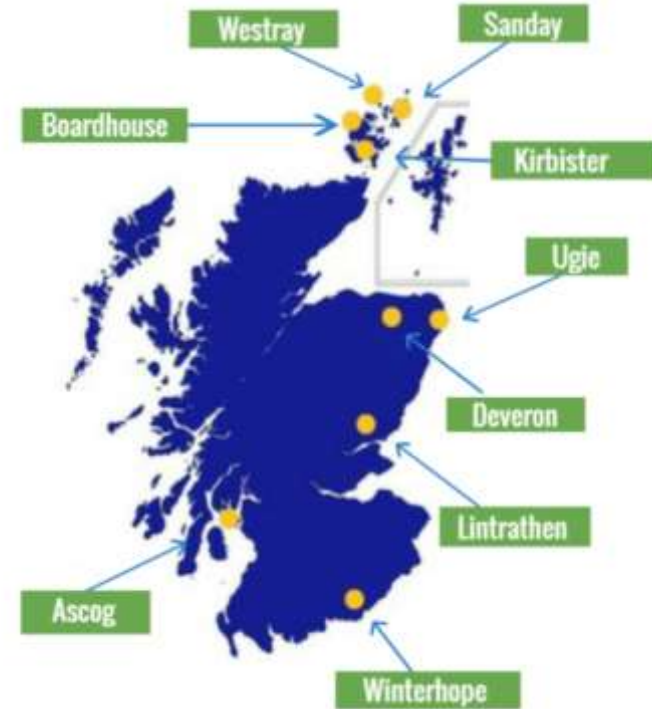


The Ugie raw water intake: pesticide data



SLM incentive scheme

- Sustainable Land Management Incentive Scheme
 - Started in April 2012
- Assists with the finance of measures that will improve and protect drinking water quality
 - Finance rate of 75 - 100%
 - Mixture of fixed rates and actual costs
- Cannot be used to meet regulatory compliance
- Offers a range of capital and management items



**Scottish
Water**

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Pesticide sprayer loading areas



Bio-beds



Bio-filters



Fencing



Gateway resurfacing



Thank You

