Marine WQ Modelling

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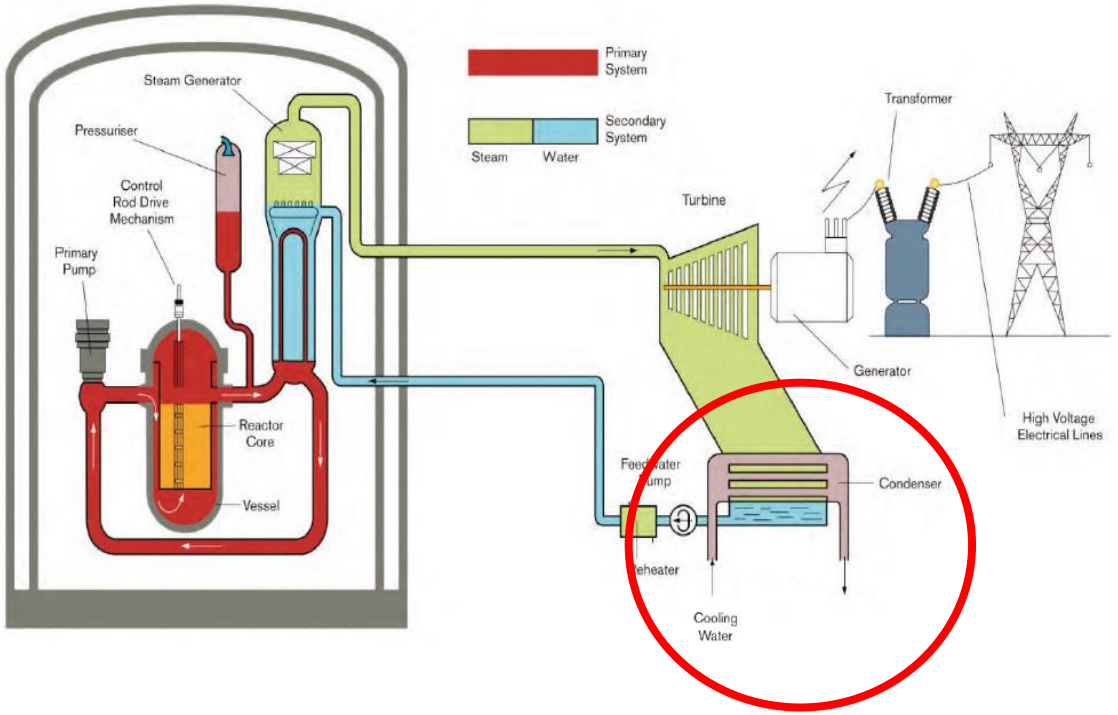
Marine Modelling Work Areas

- Nationally Significant Infrastructure Projects (NSIPs) – permitting, planning, HRA support
  - Nuclear New Build; other power stations & installations
  - Tidal Lagoon Power
- Eutrophication work (planning)
- Bathing water modelling (PRF system)
- Marine Water Quality: water company and other permitting & planning
  - ad hoc assessment of major marine developments involving modelling, eg. harbour works and dredging
  - Guidance – risk assessment (H1) and mixing zones

NNB Modelling

Figure 2.1.1 Conceptual diagram of the proposed Hinkley Point C power station



Note there is no radioactivity associated with this water – not going into further as that isn't in my remit

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Modelling Considerations

- The volume abstracted and discharged
- Mixing Zones – fully 3 dimensional
- The temperature differential (targets)
- Other chemicals (Cl2, Hydrazine) – EQSs, PNECs
- Ecological aspects (protected areas: SAC, SSSI, etc)
- WFD
- Climate change

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River Tay at Perth

Modelling Assessment

- Data used to set up model
- Calibration
- Validation
- Output & Scenarios used for Impact Assessment
- Independent Audit if needed
- Provide technical support to coastal processes, permitting, the HRA, the ES, etc.

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Thermal Plume

- Normal ~ 12.5ºC increase over ambient
- Worst case ~ 25ºC increase over ambient
- Compare with maximum ambient sea temperatures of about 20 to 21ºC

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Potential Impact from Cooling Water Abstraction

- How does the operator ensure that an abstraction of 130 m^3/s in the aquatic environment doesn't have a major impact?

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Guidance & supporting documents

- Temperature Targets and Hazardous Pollutants OI
- BEEMS Reports
- Habitats Directive WQ TAG Papers
- WFD “clearing the waters for all”
- Cooling Water Options
- Screening for Intakes & Outfalls: a best practice guide
- Screening at intakes & outfalls: measures to protect eel

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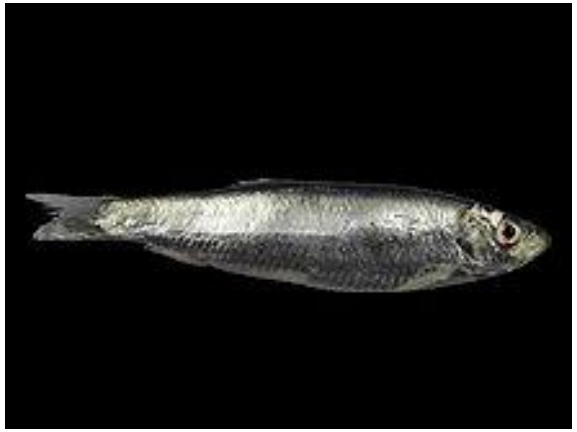
Fish – Entrainment and Impingement



It’s not just fish

Key components from the Original HPC Cooling water application

- Intake velocity (limited to a maximum of 0.3 m/s)
- Behavioural deterrents i.e. Acoustic Fish Deterrent (AFD)
- Screening arrangements
- Fish recovery and return system (FRRS)
- and…

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...while remembering that...

- the whole system has to work together
- including parts of the plant not regarded as FRRS
- nor even (previously) classed as plant with an ‘environmental protection function’

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Eutrophication Modelling

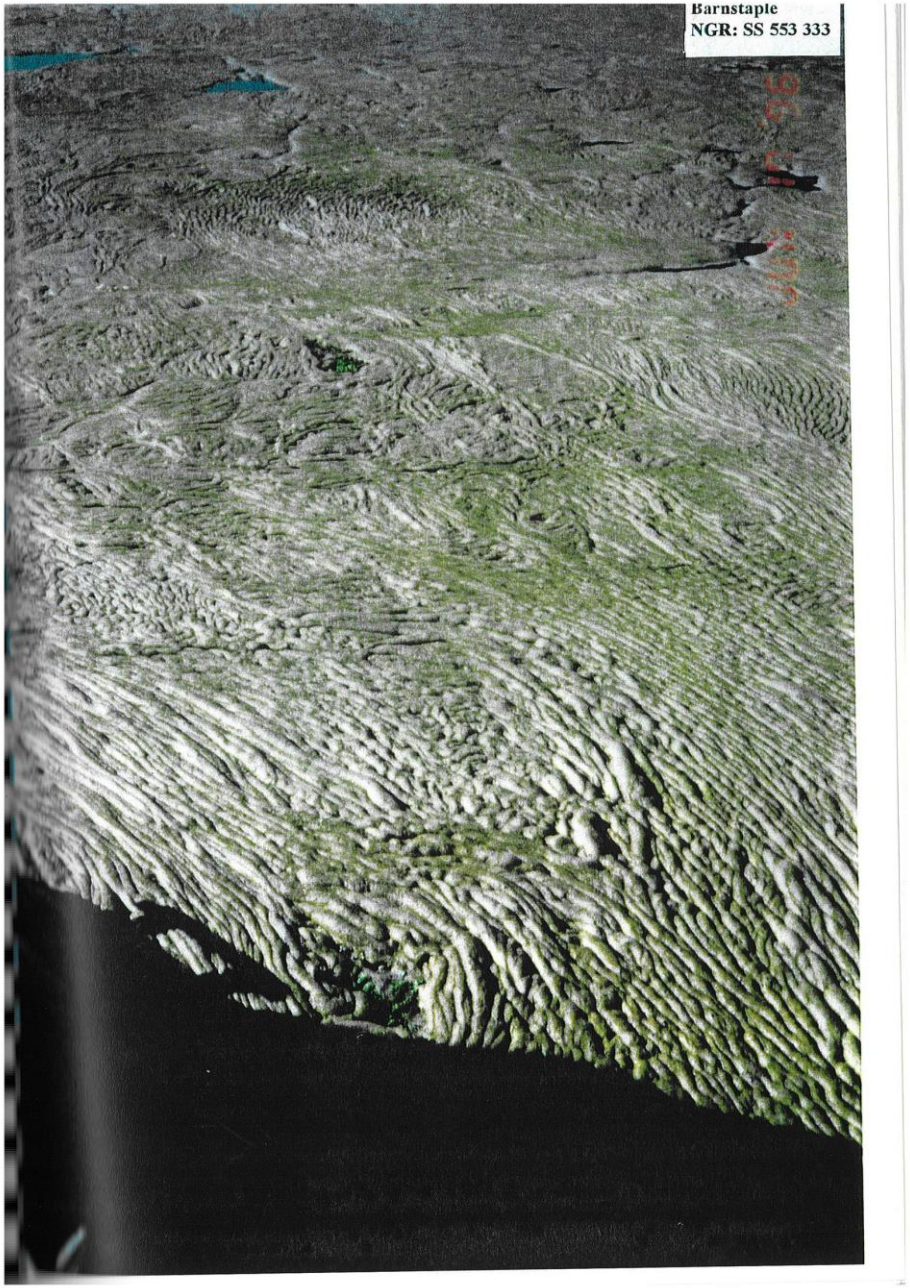
Eutrophication Work

- Nitrates Directive & 2016 Designations
  - TraC Polluted Waters (Eutrophic) Proformas
  - Appeals to designated NVZs
- Contribute to Strategic Monitoring Review for TRaC waters
- Contribute to PR19/24 nitrates work
- WFD & River Basin Management Plans
- WPZ reviews

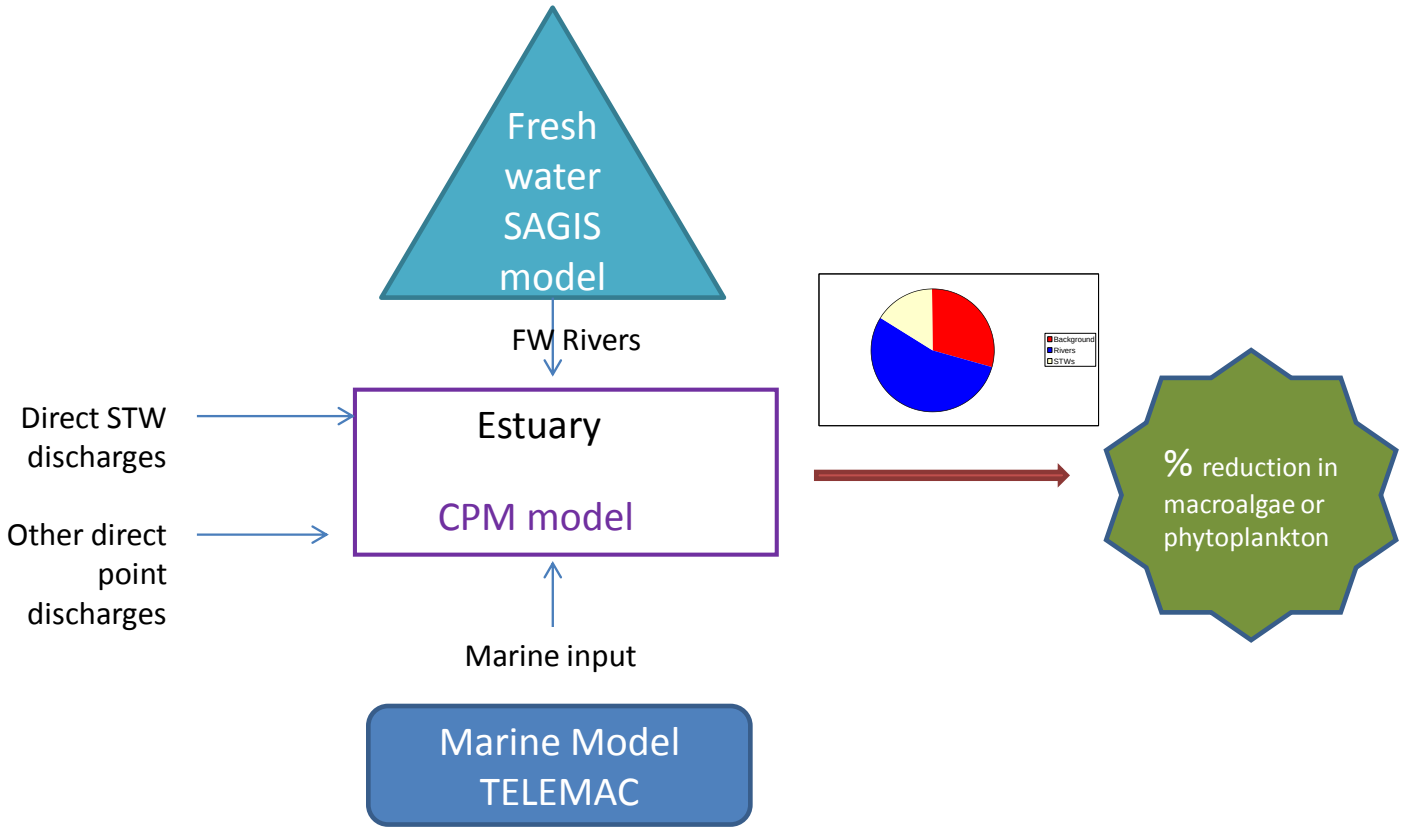
HOLES BAY JUNE 2011

ARNE BAY JUNE 2011

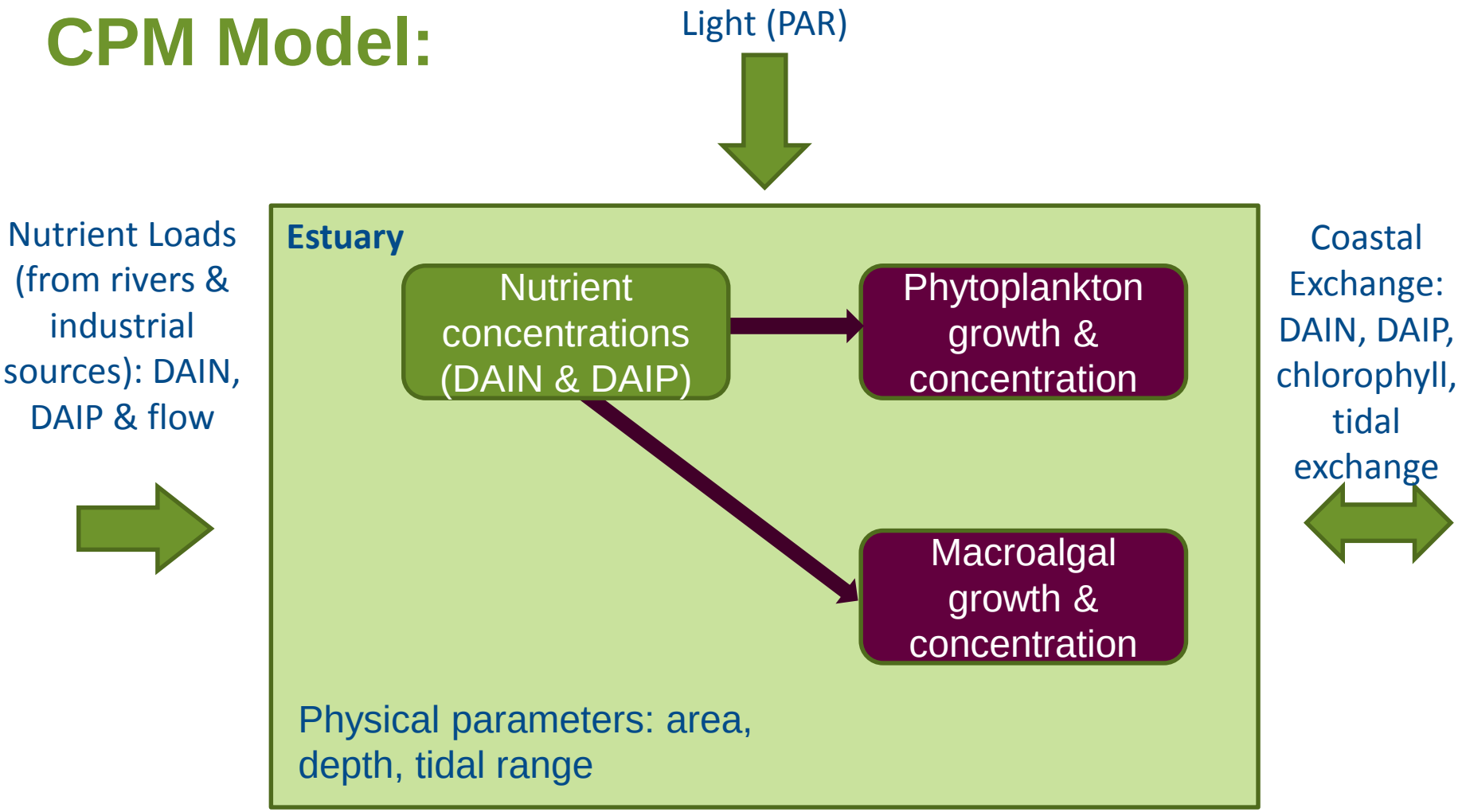
BRANDS BAY JUNE 2011


Barnstaple
NGR: SS 553 333

Modelling DIN in TraC waters



CPM Model:


Light (PAR)
Nutrient Loads (from rivers & industrial sources): DAIN, DAIP & flow
Estuary
Nutrient concentrations (DAIN & DAIP)
Phytoplankton growth & concentration
Macroalgal growth & concentration
Physical parameters: area, depth, tidal range
Coastal Exchange: DAIN, DAIP, chlorophyll, tidal exchange

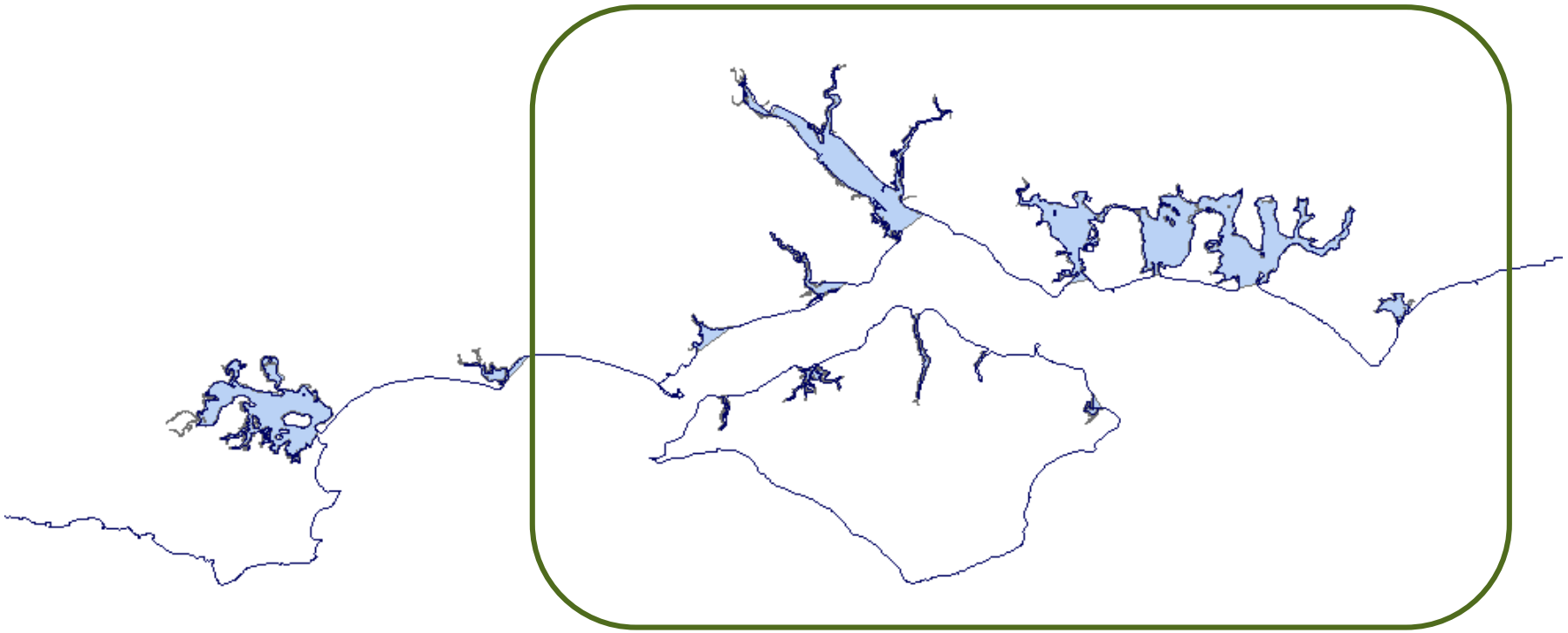
WFD CHL tests:

	Low Salinity (0-25ppt)	High Salinity (> 25ppt)
Average Chl-a concentration	<= 15	<= 10
Median Chl-a concentration	<= 12	<= 8
% Chl-a < 10 ug/l	> 70%	> 75%
% Chl-a < 20 ug/l	> 80%	> 85%
% Chl-a > 50 ug/l	< 5%	< 5%

WFD Macroalgae tests:

	Values at Good/Moderate Threshold
%cover in AIH	15
Biomass per m2 AIH	500
Biomass per m2 AA	500
%entrained in AA	5
AA (ha)	50
AA/AIH (%)	15

Map of Southern Estuaries



	2007	2008	2009	2010	2011	2012	Baseline
Portsmouth	400.23		538.00		308.09		417.40
Pagham	449.39		358.92		592.46		454.44
Langstone			463.31		268.56		333.44
Chichester			278.00		369.48		367.16
Chichester East			861.17		1052.35		866.56
Chichester Total			411.18		486.65		417.91
Medina		666.82				864.88	891.85
Newtown		710.99					721.80
East Yar						1166.92	1279.64
West Yar						1069.28	1144.12
Wootton Creek						632.08	640.30
Hamble		503.24		820.91			899.82

Scenario Results

Newtown

N & P Offshore Reduction (%)	Freshwater/Direct Reduction (%)			
	0	10	25	50
0	721.80	667.27	587.75	464.69
10	668.98	614.48	534.92	412.19
25	589.11	534.36	454.69	332.94
50	453.24	398.36	319.07	201.19

Medina

N & P Offshore Reduction (%)	Freshwater/Direct Reduction (%)			
	0	10	25	50
0	891.85	850.90	789.52	664.42
10	813.55	772.58	711.15	605.98
25	695.74	654.57	592.94	489.72
50	496.79	455.22	393.03	289.67

West Yar

N & P Offshore Reduction (%)	Freshwater/Direct Reduction (%)			
	0	10	25	50
0	1144.12	1075.87	977.71	822.89
10	1049.38	981.26	883.38	725.39
25	908.28	838.37	737.54	578.92
50	645.52	589.97	497.04	339.35

Wootton Creek

N & P Offshore Reduction (%)	Freshwater/Direct Reduction (%)			
	0	10	25	50
0	640.30	600.84	541.89	444.79
10	589.23	549.79	490.88	393.98
25	512.28	472.79	413.96	317.83
50	382.97	343.76	285.72	192.58

East Yar

N & P Offshore Reduction (%)	Freshwater/Direct Reduction (%)			
	0	10	25	50
0	1279.64	1150.46	968.61	692.15
10	1223.46	1091.59	910.09	638.18
25	1143.60	1003.46	819.44	552.16
50	1026.42	882.20	673.52	388.27

Hamble

N & P Offshore Reduction (%)	Freshwater/Direct Reduction (%)			
	0	10	25	50
0	899.82	789.29	624.39	368.89
10	861.76	750.94	585.66	330.27
25	804.20	693.02	526.47	272.25
50	706.41	592.96	423.06	177.04

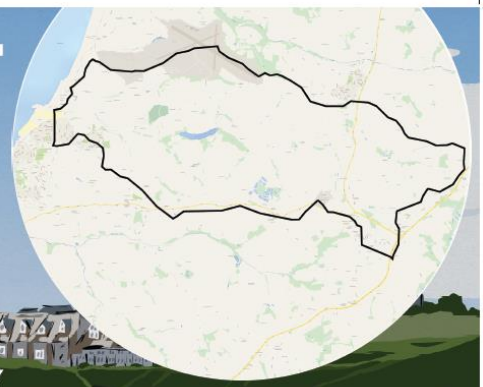
Bathing Water Modelling

Bathing Water Modelling

- Pollution Risk Forecasting System – Debbie Tyrrell
- Modelling to assess the cost & feasibility of improving bathing water classifications through agricultural measures – Grace Wong

PORTH'S COASTAL CATCHMENT

The Coastal Catchment is the area of land that can influence the water quality at Porth.
This includes far reaching urban and rural areas linked to the coast by networks of sewers, streams and rivers.



DIFFUSE POLLUTION

Pollutants running off farmland and roads are one of the major issues in this Catchment. Improved land management can protect bathing water quality.

PROTECTING SEWERS, IMPROVING WATER QUALITY

Sewers are designed to take the 4 P's from homes and businesses to sewage plants (poo, pee, paper and puke). Sanitary products and fats, oils and greases block sewers, resulting in sewage spills.

Install a Water Butt in your garden.

Turn the tap off when brushing your teeth.

Fit a Hippo in your loo.

DIVERTING WATER AWAY FROM SEWERS

Excess water in the sewers overpowers the system, resulting in sewage spills.

MISCONNECTIONS

Properties mistakenly connected to the surface drains rather than sewers can pollute the seas with untreated sewage.

PAVEMENTS TO PEBBLES

Keep pollutants out of road drains as they are often linked back to beach drains.

BATHING WATER QUALITY

Bathing water quality is tested weekly during the bathing season (May - Sept.) by the Environment Agency. The results are posted on the Cleaner Coastal Catchments website.

NFC TAP HERE

CLEANER COASTAL CATCHMENTS

SURFERS AGAINST SEWAGE
www.sas.org.uk

Environment Agency

www.CleanerCoastalCatchments.org.uk

For more information on all these issues please visit the Cleaner Coastal Catchments website

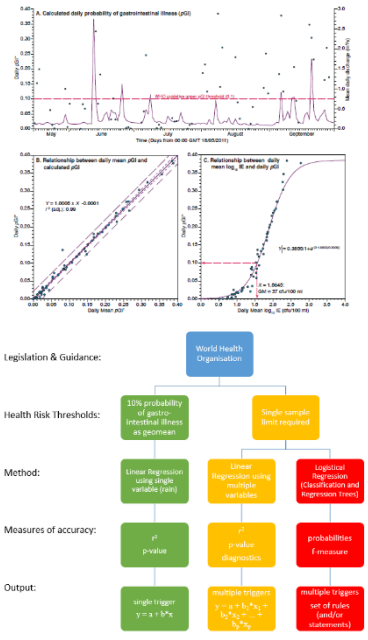
EA Pollution Risk Forecasting System

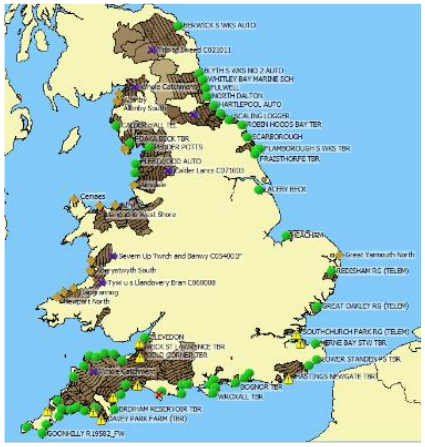
MODELLING
Data management and processing;
Model build and validation;
Model export.

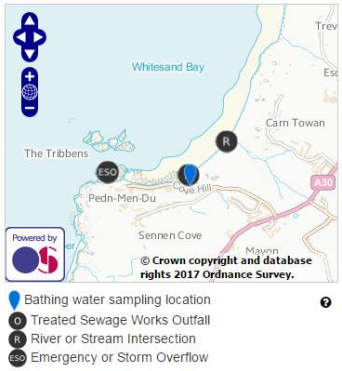
FEWS SYSTEM
Real-time automated daily forecast;
Data capture;
Data visualisation & export.

FORECAST DISSEMINATION
EA Data Explorer;
Text messages;
Email notifications.

BEACH MANAGEMENT
Beach signage;
Electronic signs.







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Permitting and Other work

- Guidance on: Risk assessment (H1) and required modelling
- WQ and Installations
- Pre-application work
- Permit determination

Questions & Answers