Bathing Water Pollution Risk Forecasting Update
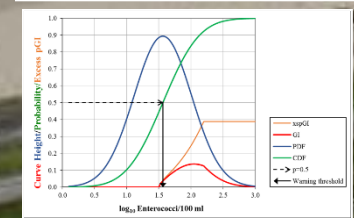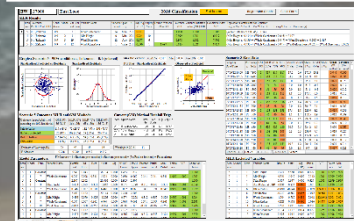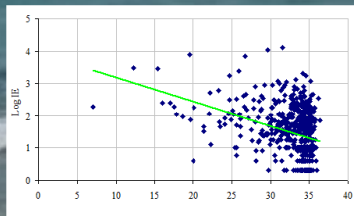
➔ Overview of PRF process

➔ Development work 2018/19

➔ 2020 Forecasting System

Dr Deborah Tyrrell

Technical Specialist – Marine Modelling

Environment Agency

December 2019

Environment Agency

Hartland Quay
North Devon
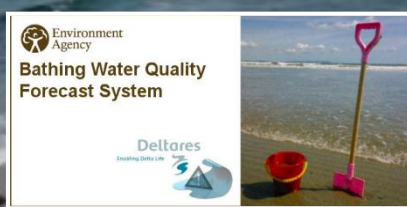
EA Pollution Risk Forecasting Process

MODELLING
Data management
Model build and validation
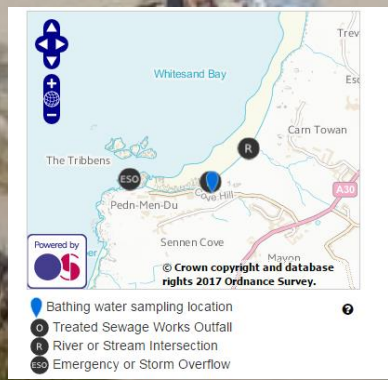Model export
In season tracking

FEWS SYSTEM
Real-time automated daily forecast
Data capture
Data visualisation and export

FORECAST DISSEMINATION
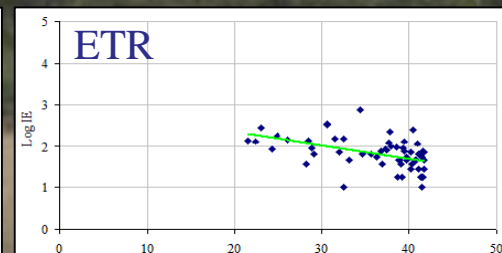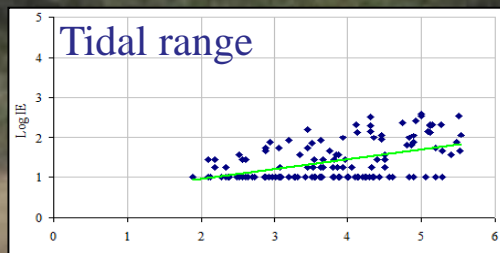Environment Agency
Data Explorer
Text messages
Email notifications

BEACH MANAGEMENT
Beach signage
Electronic signs

http://environment.data.gov.uk/bwq/profiles/

Sennen Cove
Lands End

Water Quality Variables

Porthluney
South Cornwall
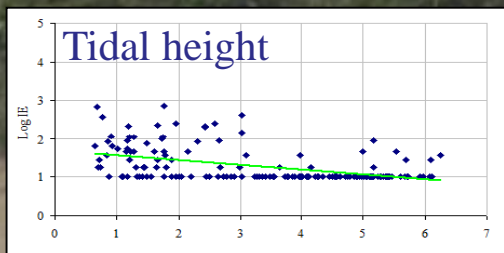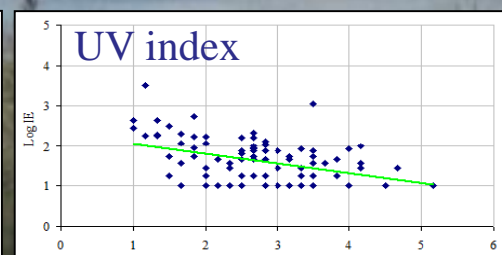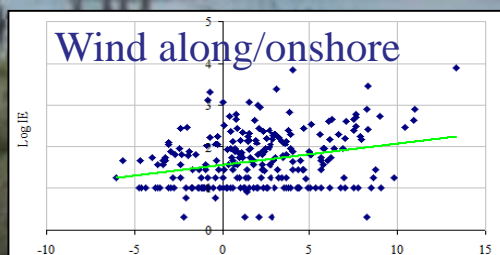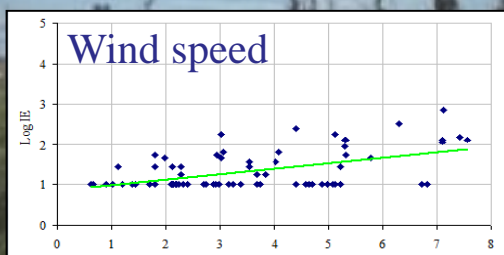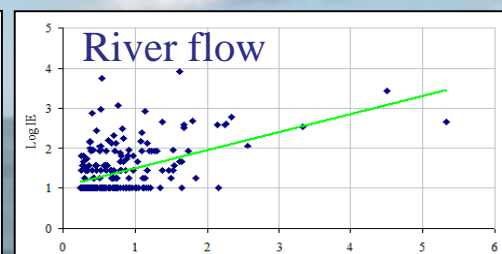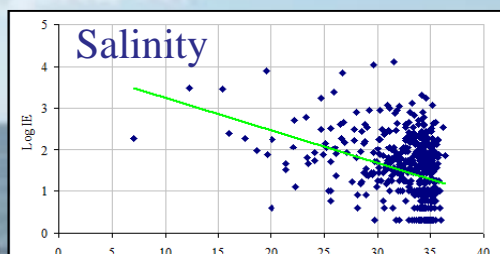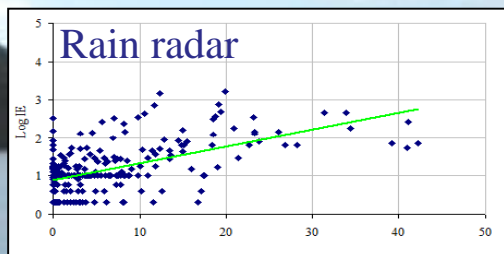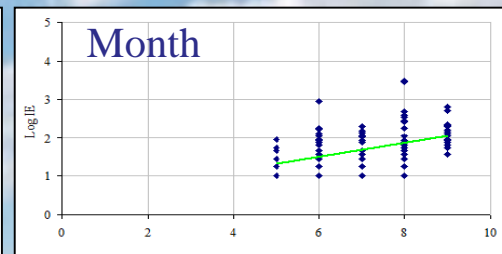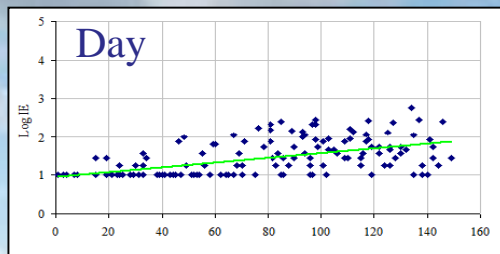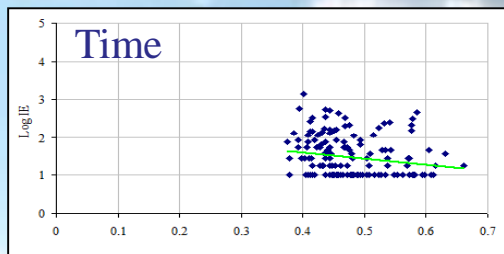
Multiple Linear Regression (MLR)

➡ Up to 40 variables are entered/removed in an automated stepwise process until you are left with the variables that best explain the distribution of intestinal enterococci (IE)

➡ Model $\text{Log}_{10}\text{IE} = (\text{Tide} \times 0.155) + (\text{Day} \times 0.003) + (\text{Rain} \times 0.033) + (\text{Wind} \times 0.027) + 1.111$

➡ Warning issued when IE>63 cfu per 100ml

Multiple Linear Regression (MLR)
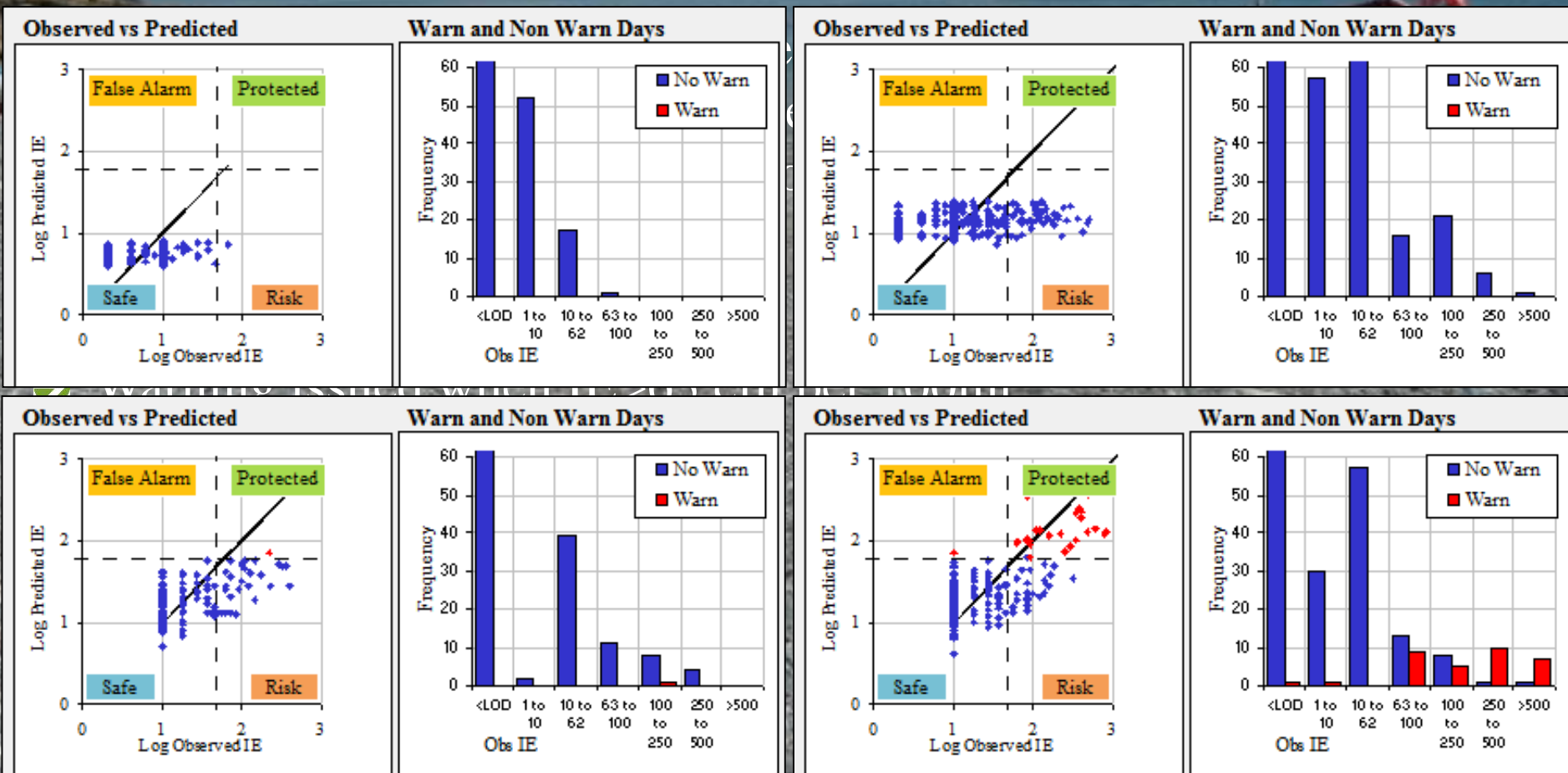
Assessing MLR Results

Score	Threshold/Alert	Quality Criteria
30	0	No. of models
10	Yes	Freshwater
1	<100	No. of samples
2	<20%	%age samples >limit of detection
1	>20% and ≤50%	
2	<5%	%age samples >10% health risk
1	>5% and <10%	
7	>30	Condition index
1	>15 and ≤30	
2	≤0.1	Adjusted r^2
1	>0.1 and ≤0.25	
2	>0.2	Min or Max 10% of probability plot
1	>0.1 and ≤0.2	
2	>0.3	Maximum of probability plot
1	>0.1 and ≤0.3	
10	0	%age correct warnings
2	>0% and <10%	
1	≥10% and >25%	

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Assessing MLR Results
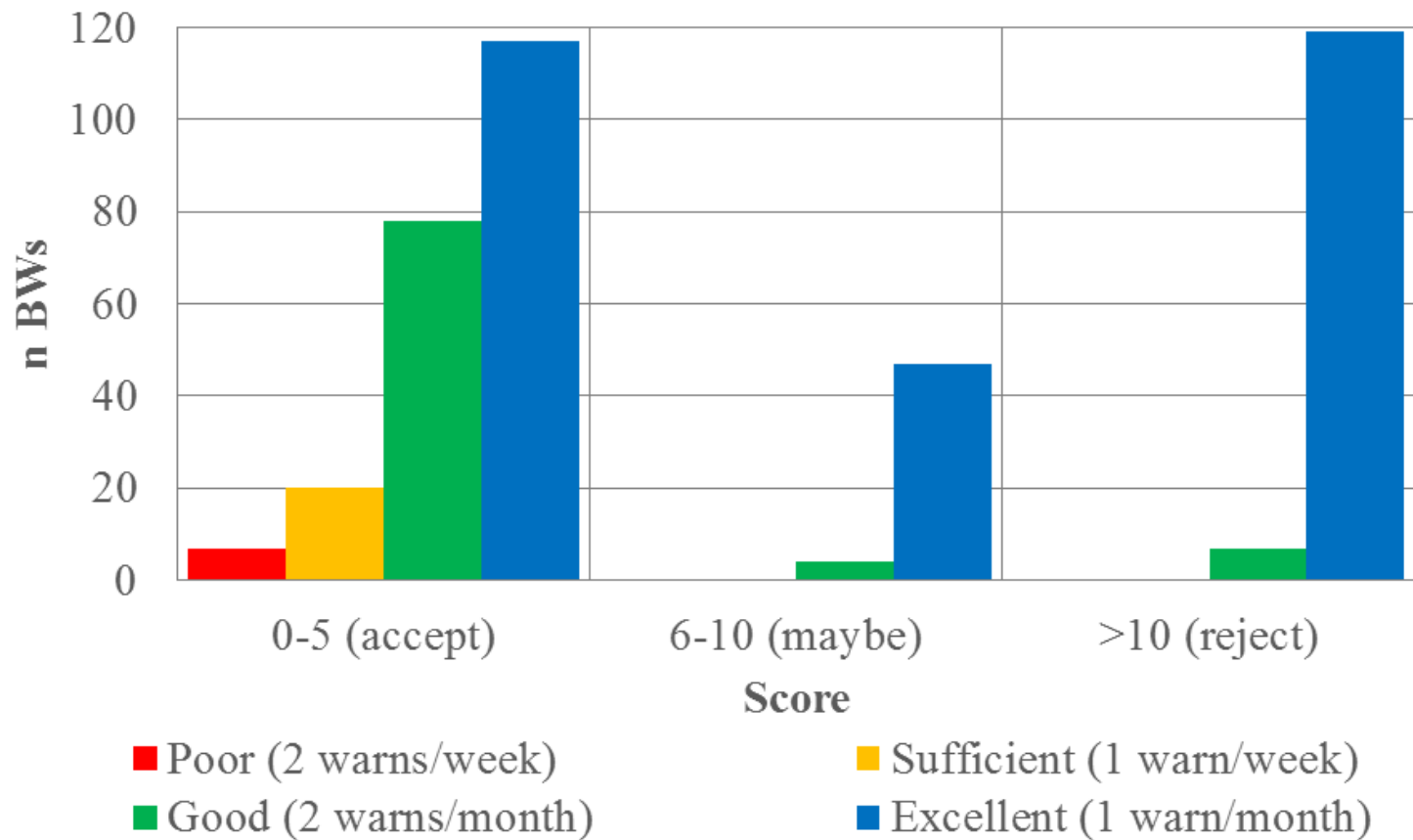
Local Expert Checks and Site Selection

➡ Do our models match local knowledge?

➡ Has the model selected appropriate variables that reflect potential polluting conditions.

➡ Useful tools for planning investigations.
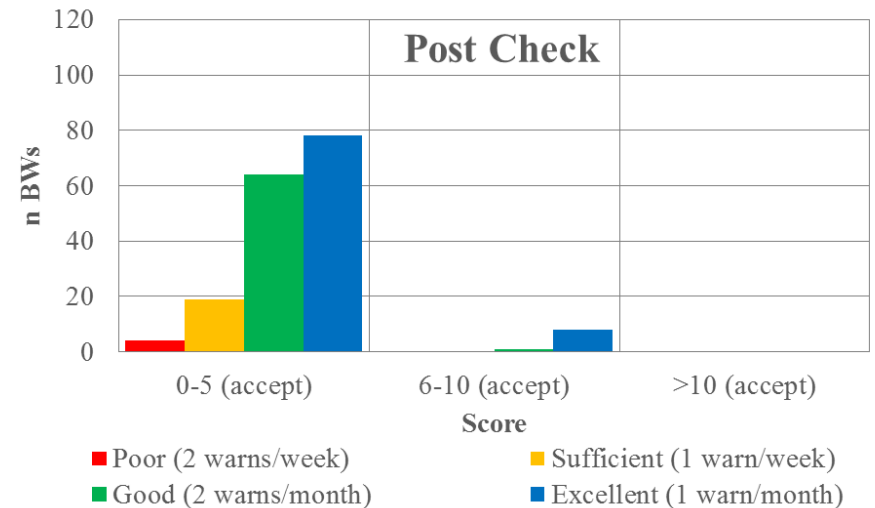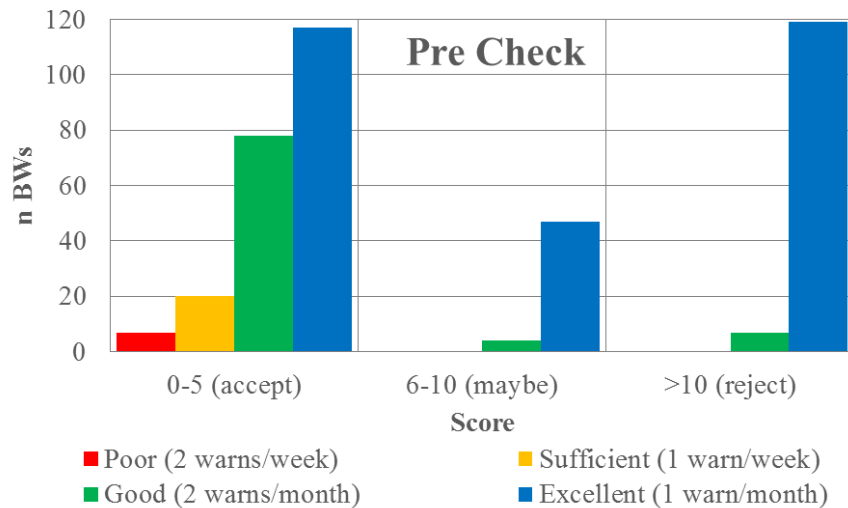
➡ We only accept the strongest models.

$$Log_{10}IE = (24hr\ Rain \times 0.04) + (3hr\ Onshore\ Wind \times 0.052) + (Tidal\ Height \times 0.071) + (6hr\ Rain \times 0.096) + 1.249$$

Combe Martin
North Devon
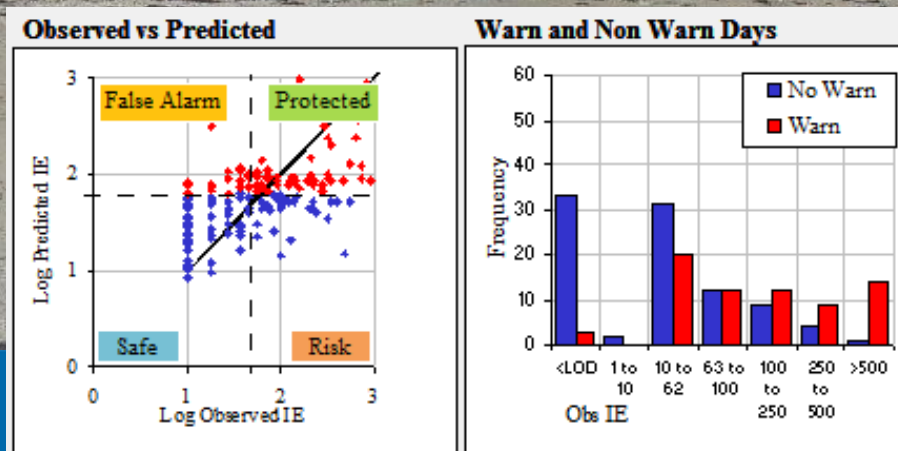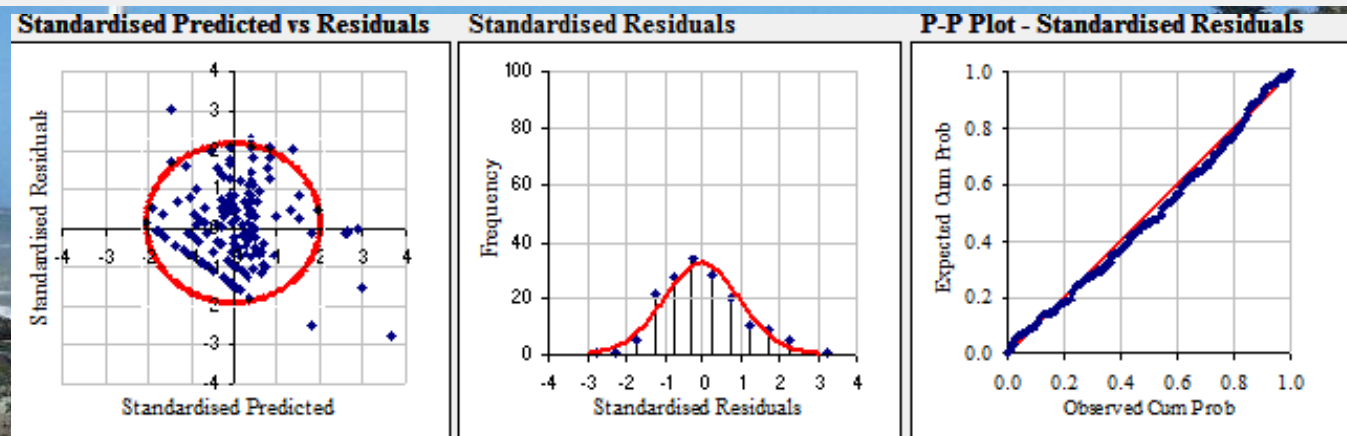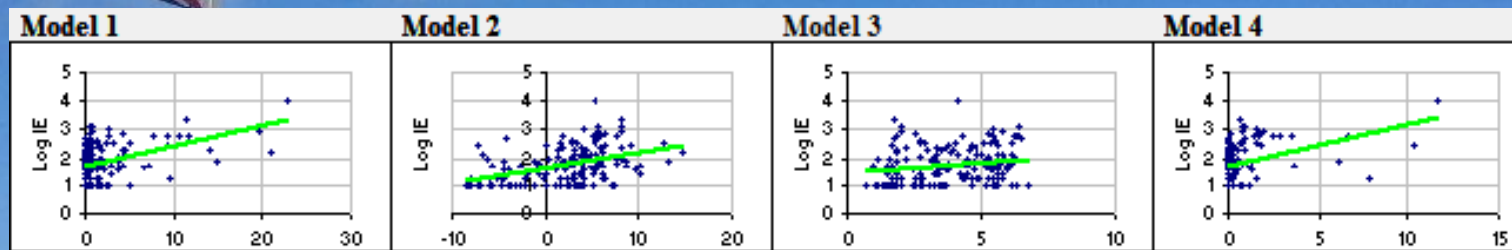
Within Day Bacti Variation

→ MLR equations used to calculate hourly IE levels throughout 2016 (dry) and 2017 (wet) bathing seasons

Ladram Bay
South Devon
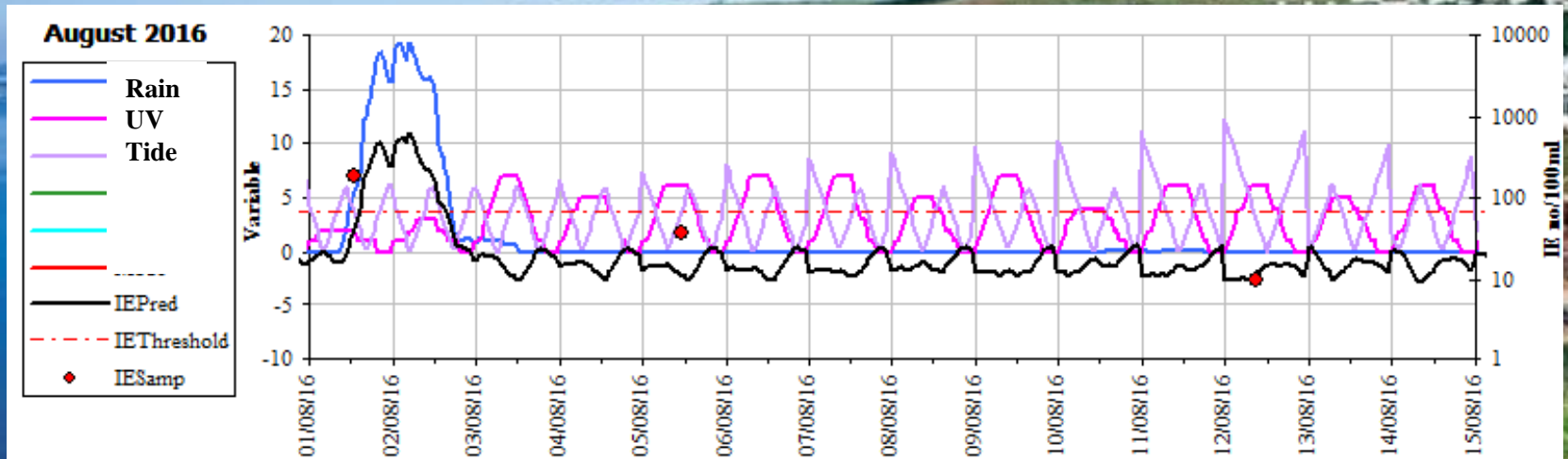
2020 BW Forecasting System
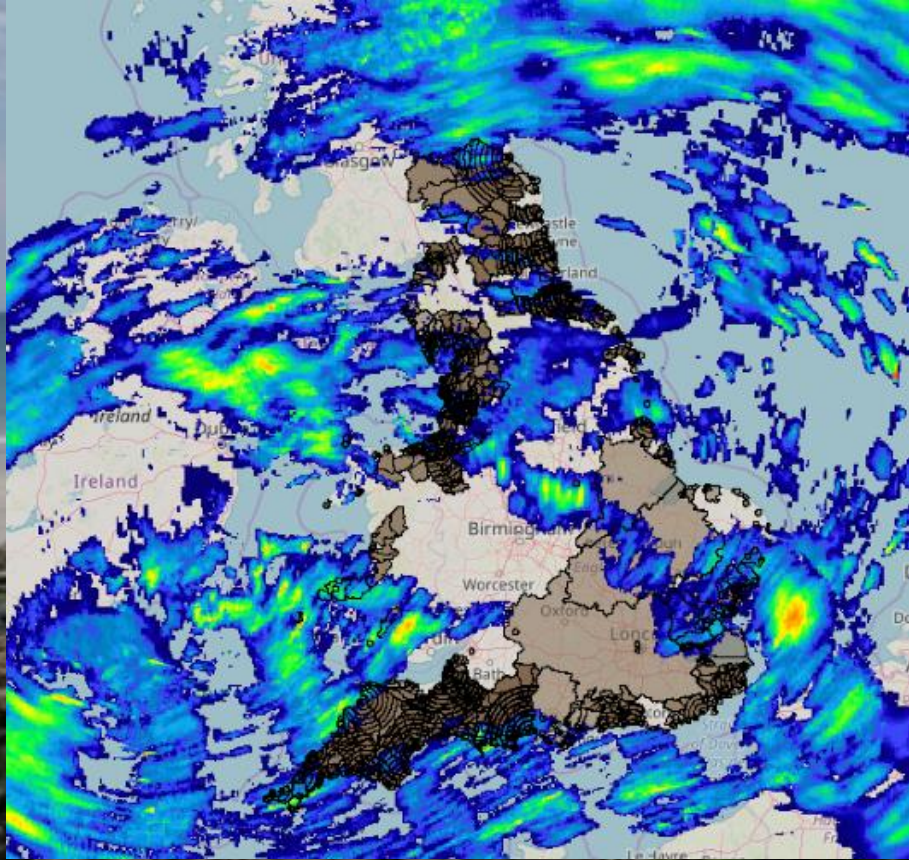
- Hosted on our new flood forecasting system
- Live and forecast data feeds
- Daily composite prediction at 08:30, using hourly forecast data up to 17:00
- Data capture, manual overides

Coverack
South Cornwall

2020 Site List

Manager	BWs	2019	2020
East Devon	8	6	6
Teignbridge	7	3	3
Torbay	15	7	6
South Hams	17	9	8
City of Plymouth	2	2	2
Cornwall	81	24	33
Torridge	2	0	0
North Devon	10	7	6

| Beach Manager	BW	2019	PRF old	PRF new	Warn per BS	Score
West Dorset	Lyme Regis Front Beach	G	Y	Y	24	1
East Devon	Seaton (Devon)	E	Y	Y	3	3
East Devon	Beer	E	Y	Y	5	5
East Devon	Sidmouth Town	E	Y	Y	6	3
East Devon	Ladram Bay	G	Y	Y	12	1
East Devon	Budleigh Salterton	E	Y	Y	11	1
East Devon	Exmouth	E	Y	Y	8	1
Teignbridge	Dawlish Town	G	Y	Y	17	1
Teignbridge	Teignmouth Town	E	Y	Y	8	3
Teignbridge	Shaldon	E	Y	Y	9	0
Torbay	Watcombe	E	Y	Y	6	3
Torbay	Babbacombe	E	Y	N	0	15
Torbay	Torre Abbey	E	Y	Y	4	4
Torbay	Hollicombe	G	Y	Y	7	2
Torbay	Paignton Preston Sands	E	Y	Y	7	2
Torbay	Paignton Paignton Sands	G	Y	Y	12	2
Torbay	Goodrington	S	Y	Y	8	4
South Hams	Salcombe North Sands	E	Y	Y	4	2
South Hams	Salcombe South Sands	E	Y	Y	6	3
South Hams	Hope Cove	E	N	Y	4	3
South Hams	Thurlestone North	E	Y	N	0	14
South Hams	Bantham	E	Y	Y	7	2
South Hams	Bigbury-on-Sea South	E	Y	Y	5	1
South Hams	Challaborough	E	Y	Y	5	3
South Hams	Mothecombe	G	Y	Y	15	2
South Hams	Wembury	E	Y	Y	13	1
South Hams	Bovisand	E	Y	N	3	4
City of Plymouth	Plymouth Hoe East	G	Y	Y	12	1
City of Plymouth	Plymouth Hoe West	E	Y	Y	6	2
Cornwall	Seaton (Cornwall)	E	Y	Y	18	1
Cornwall	Millendreath	E	Y	Y	2	5
Cornwall	East Looe	G	Y	Y	42	0
Cornwall	Readymoney Cove	E	Y	Y	10	2
Cornwall	Polkerris	G	Y	Y	9	2
Cornwall	Par Sands	G	Y	Y	21	2

Beach Manager	BW	2019	PRF old	PRF new	Warn per BS	Score
Cornwall	Shorthorn Beach	E	Y	N	3	7
Cornwall	Portmellon	E	Y	Y	8	2
Cornwall	Gorran Haven Little Perhave	G	Y	Y	12	1
Cornwall	Porthluney	G	Y	Y	28	1
Cornwall	Porthcurnick	G	Y	Y	7	5
Cornwall	Maenporth	G	Y	Y	8	3
Cornwall	Porthallow	E	Y	Y	6	4
Cornwall	Coverack	E	N	Y	6	3
Cornwall	Kennack Sands	E	N	Y	3	8
Cornwall	Poldhu Cove	E	N	Y	6	5
Cornwall	Marazion	E	Y	Y	6	2
Cornwall	Long Rock	G	Y	Y	9	4
Cornwall	Penzance	G	Y	Y	11	3
Cornwall	Wherry Town	E	Y	Y	5	3
Cornwall	Gwithian Towans	E	N	Y	3	5
Cornwall	Perranporth	E	N	Y	2	7
Cornwall	Crantock	G	Y	Y	10	2
Cornwall	Porth	S	Y	Y	32	0
Cornwall	Mawgan Porth	E	N	Y	5	2
Cornwall	Porthcothan	E	N	Y	6	2
Cornwall	Harlyn Bay	E	N	Y	1	5
Cornwall	Trevone Bay	E	Y	Y	3	5
Cornwall	Polzeath	E	Y	Y	4	5
Cornwall	Trebarwith Strand	E	N	Y	6	4
Cornwall	Crackington Haven	E	Y	Y	7	3
Cornwall	Widemouth Sand	E	N	Y	2	7
Cornwall	Summerleaze	E	Y	Y	14	1
Cornwall	Crooklets	E	Y	Y	12	4
North Devon	Saunton Sands	E	Y	N	2	6
North Devon	Croyde Bay	G	Y	Y	10	2
North Devon	Woolacombe Village	E	Y	Y	5	2
North Devon	Combesgate Beach Woolacor	E	N	Y	3	4
North Devon	Ilfracombe Wildersmouth	P	Y	N	105	1
North Devon	Ilfracombe Hele	G	Y	Y	12	3
North Devon	Combe Martin	P	Y	Y	67	0
North Devon	Lynmouth	E	Y	Y	2	6

Environment Agency