

Smart Coasts
Sustainable
Communities

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PRIFYSGOL
ABERYSTWYTH
UNIVERSITY

Progress Meeting

- Three field work themes for summer 2011:
 - Black box modelling data acquisition
 - Source apportionment data acquisition
 - Tracer studies

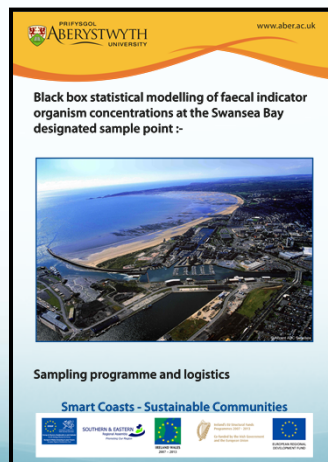
Schedule

* hydrometry equipment – for black box and source apportionment

Week Commencing	Black Box Modelling	Source Apportionment	Tracer Studies
04/04/2011			
11/04/2011		Installation*	
18/04/2011		Installation	
25/04/2011		Installation	
02/05/2011		Installation	
09/05/2011	Trial run	Installation	
16/05/2011	1		
23/05/2011	2		Local
30/05/2011	3		
06/06/2011	4		
13/06/2011	5		
20/06/2011	6		
27/06/2011	7		
04/07/2011	8		
11/07/2011	9	Trial run/setup	
18/07/2011	10	1	
25/07/2011	11	2	
01/08/2011	12	3	
08/08/2011	13	4	
15/08/2011	14	5	
22/08/2011	15	6	
29/08/2011	16	7	
05/09/2011	17	8	
12/09/2011	18	Extension	
19/09/2011	19	Extension	Local
26/09/2011	20	Extension	
03/10/2011			

Black box modelling

- A sampling and analysis protocol has been devised:



Black box modelling

- Sampling schedule (CCS Staff – Huw/Sam):
 - Half hourly sampling at Swansea DSP 08:00-17:00 BST
 - 3 days: Mon-Wed during each of the 20 weeks in the bathing season – 60 days
 - Extension of sampling to 19:00 during source apportionment study
 - Night time sampling during tracer studies
 - GPS location and sea temperature will be recorded
 - > 1200 sets of results

Black box modelling

- Sample volumes:
 - Analysis of EAW compliance data 2004-2010
 - No values above ULD
 - Relatively high proportion of enterococci values below the LLD - < 2 cfu/100 ml (i.e. 50 ml filtration)
 - 100 ml filtration: LLD < 1 cfu/100 ml
 - Triplicate filtration: LLD < 0.3 cfu/100 ml (i.e. 3 cfu/l)
 - Requires 600 ml + for 2 parameters
 - Conclusion: samples will be collected in one litre containers

Black box modelling

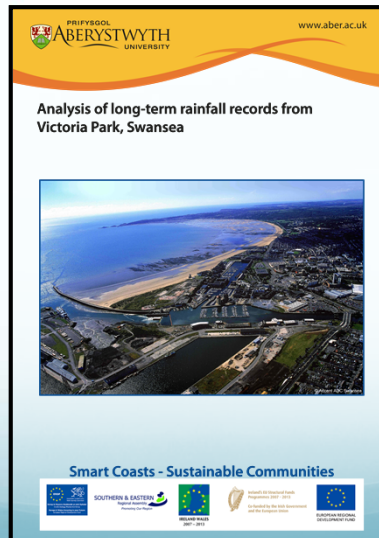
- Transportation and analysis
 - Samples transported to CREH *Analytical* in Leeds
 - Dedicated drivers from each end who will meet half way to exchange samples
 - Samples arrive at laboratory ca. 23:00
 - Analysis within 24 hours
- Samples will be analyzed at the field laboratory in Swansea during the Source Apportionment study

Black box modelling

- Analysis:
 - Confirmed intestinal enterococci (KAA) – cfu/100 ml
 - *Escherichia coli* (method under review: TBX or MGLA) – cfu/100 ml
 - Salinity (ppt) (also: conductivity (mS), TDS (mg/l) and Turbidity (NTU)
- Predictors:
 - Meteorological parameters - CCS station at West Cross
 - Hydrometric parameters - EAW stations and project stations due to be installed
 - Tidal parameters – Mumbles tide station

Source Apportionment

- Study timing – Rainfall analysis report

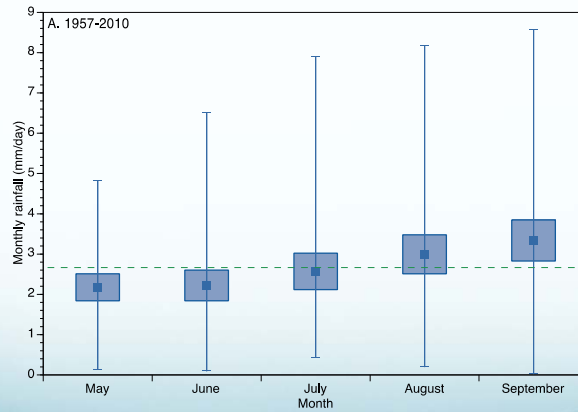


Rainfall Analysis

- 53 year record of daily rainfall for Victoria Park Swansea
- May – September
- Monthly Rainfall
- Monthly maximum daily rainfall – intensity
- Statistical analysis – robust ANOVA and non-parametric analogues – e.g. Kruskal-Wallis
- Statistical significance assessed at the 95% confidence level

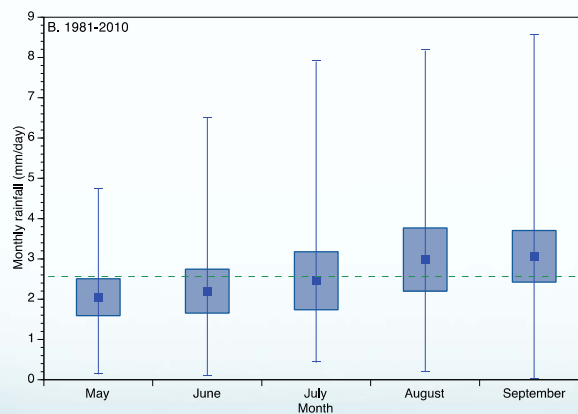
Rainfall Analysis

- Comparison of means – 53 years: Sept sig higher than May and June



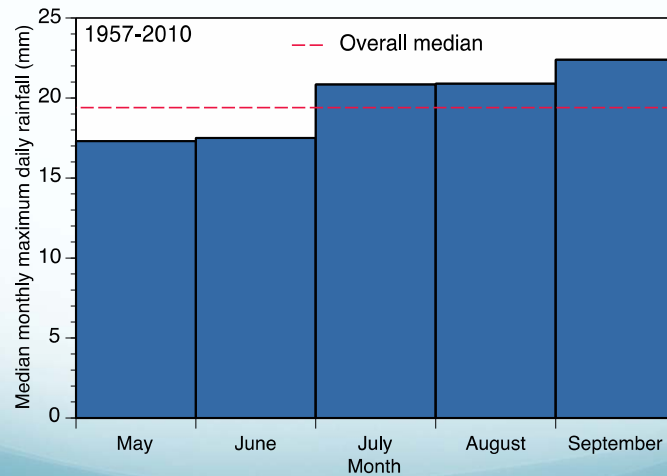
Rainfall Analysis

- Comparison of means – 30 years: no sig diffs



Rainfall Analysis

- Comparison of max daily rainfall – 53 years: May sig lower than Aug and Sept

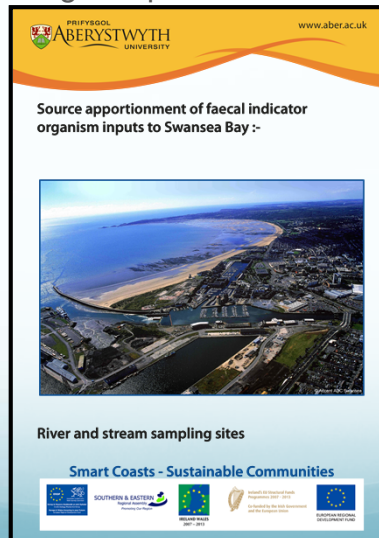


Rainfall Analysis

- The patterns suggest higher monthly rainfall in the late summer months – August and September compared with the early summer
- The maximum daily rainfall pattern is similar
- This probably relates to increased impact from Atlantic depressions in the late summer
- The source apportionment data collection has thus been scheduled for the later summer: mid-July to early-September
- This also leaves room for a possible study extension in to late September

Source Apportionment

- River and stream input sampling site assessment document nearing completion



Rivers and Streams

- 64 potential river and stream input sampling sites between Mumbles and Port Talbot have been investigated
- A few outstanding inputs in the Nedd and Tawe estuaries are under further investigation
- Potential sites for installation of hydrometric equipment were also investigated
- 4 geographic groups – Mumbles/Swansea, Tawe Estuary, Nedd Estuary, Aberafan/Port Talbot

Rivers and Streams

- Range from small culverted inputs:



Promenade
Terrace,
Mumbles

Rivers and Streams

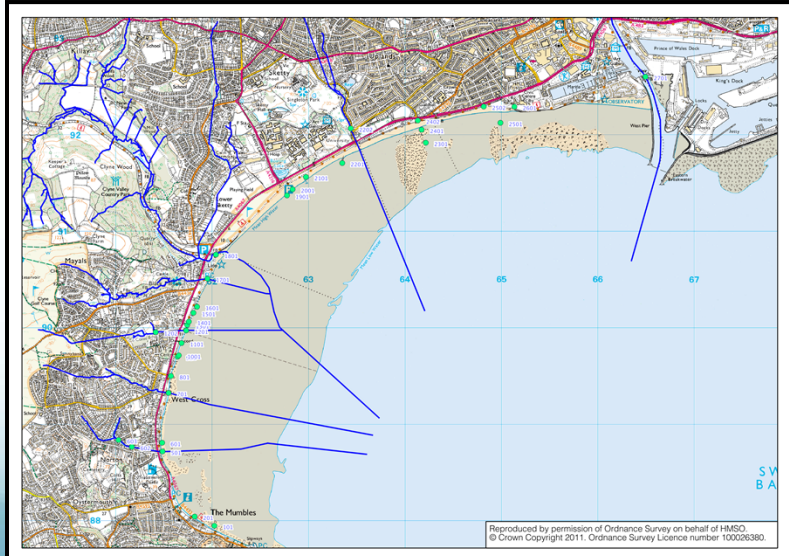
- to large rivers:



Afon Nedd,
Aberdulais

Mumbles - Swansea

- Many small inputs, tidally constrained



Mumbles - Swansea

- Some examples:



Washinghouse Brook



Clyne River



Llywynderw Drive



Brynmill stream

Mumbles - Swansea

- Hydrometry potential
 - Smaller inputs run in culverts – sewer monitoring
 - Open channel access to larger inputs e.g. Washinghouse Brook, Brynmill stream
 - Flood warning station at the Clyne River outlet



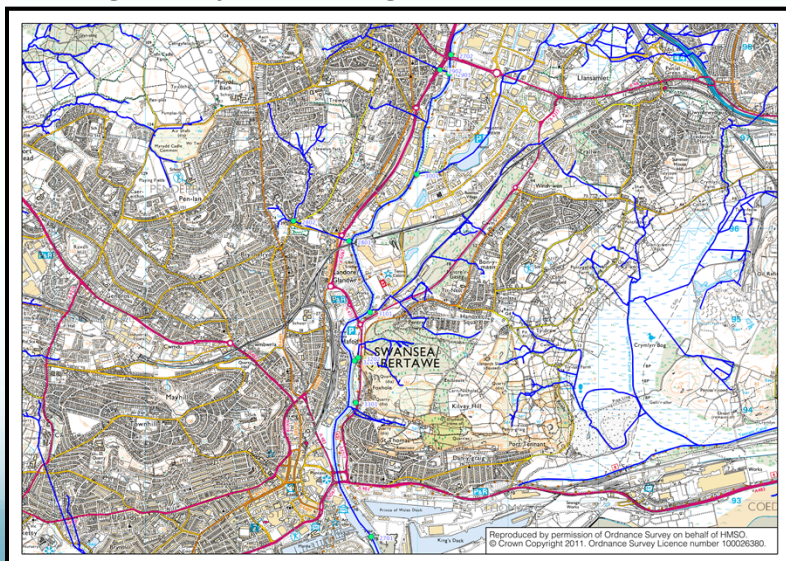
Norton



Brynmill

Tawe estuary

- Barrage to Wychtree bridge



Tawe estuary

- Some examples:



Tawe barrage



Wychtree Bridge



Nant Melyn



Copper Quarter SWO

Tawe estuary

- Hydrometry potential
 - Gauging stations at Ynystanglws and Morfa
 - Open channel access at most sites
 - Concrete channel sections e.g. Cwm Gelli, Pentrechwyth stream



Ynystanglws – Afon Tawe



Cwm Gelli

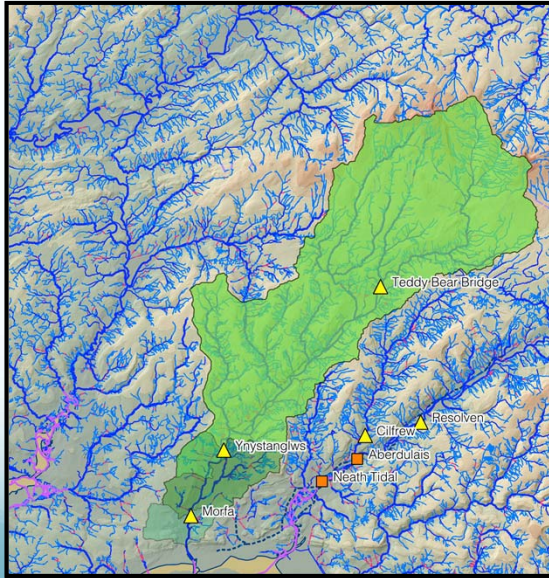
Tawe estuary

- Inputs to the estuary are relatively small
- Some channels have no open channel access–
Copper Quarter, Burlais Brook – manhole
chamber access to culverts?
- Some sites only accessible by footpaths
- Barrage is impacted at high tidal states
- Some “dirty” inputs e.g. Nant Melyn

Tawe estuary - options

- Full budget study of estuary inputs from Wychtree
to barrage outlet
- Focus on the barrage outlet only
- Focus on selected sites along the Afon Tawe
channel:
 - Barrage, New Cut (0m elevation), Morfa, Wychtree
- Target low tidal states
- Use Salinity/TDS to isolate fresh water component

Tawe estuary - options

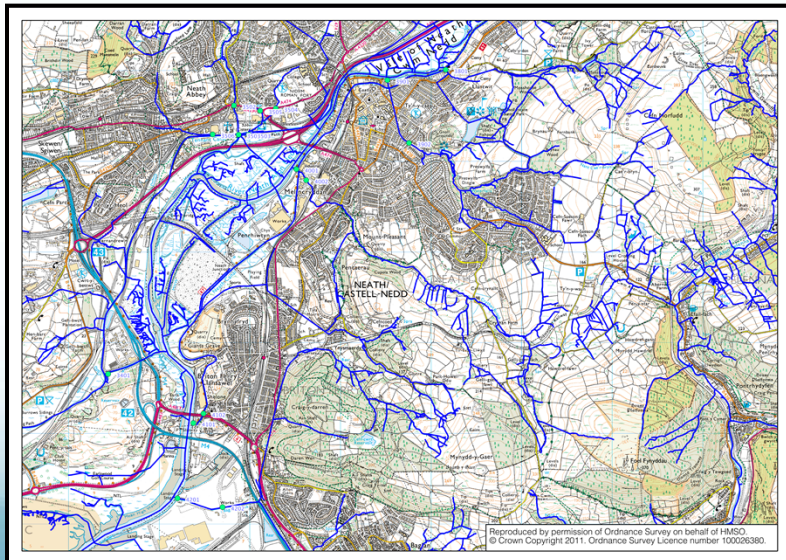


Ynystanglws: 228 km²
 Wychtree: 234 km²
 Morfa: 255 km²
 New Cut: 263 km²

% of New Cut area:
 Ynystanglws: 86.7 %
 Wychtree: 89.0 %
 Morfa: 97.0 %

Nedd estuary

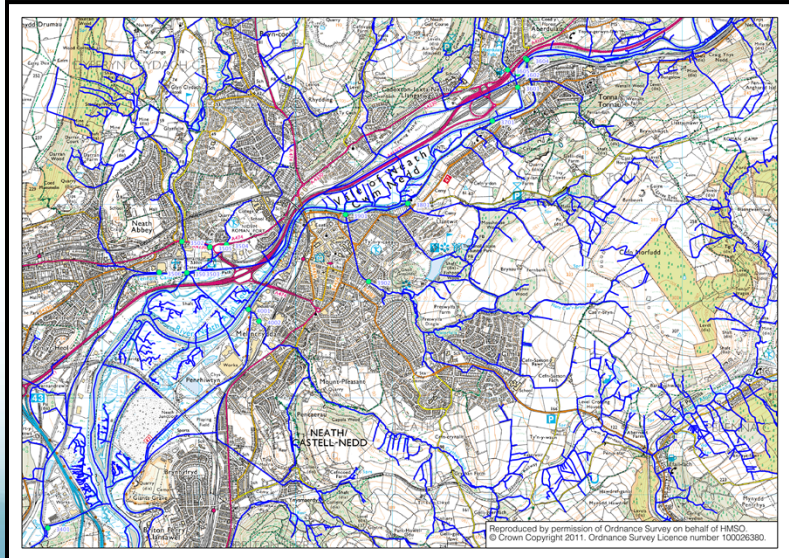
- Lower estuary: Baglan, Neath, Neath Abbey



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Nedd estuary

- Upper estuary: Llantwit, Tonna, Aberdulais



Nedd estuary

- Some examples:



Tennant Canal



Clydach Tributary



Baglan Brook



Cryddan Brook

Nedd estuary

- Hydrometry potential
 - Gauging stations at Resolven, Cilfrew, Aberdulais
 - Open channel access at most sites
 - Some culverted streams e.g. Gnoll Brook
 - Canal outlets - difficult



Resolven – Afon Nedd



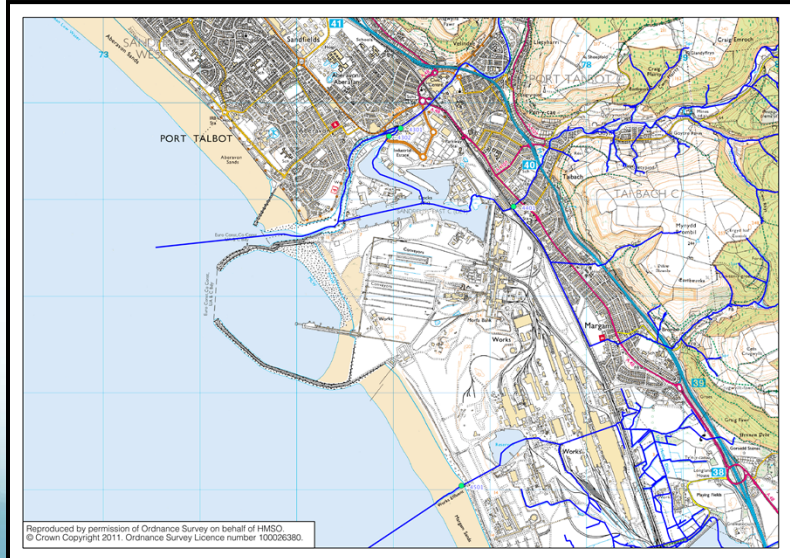
Gnoll Brook

Nedd estuary

- Some sites are tidally constrained – require sampling runs timed to coincide with low water
- Some sites have no open channel access– e.g. Gnoll Brook runs in a culvert under the Neath urban area
- Some sites are relatively remote and only accessible by footpaths e.g. canal tow paths
- Connections from the canal to the river – could be interesting
- A few sites are still being resolved – discrepancies between DRN and ground truth

Aberafan/Port Talbot

- Aberafan, Taibach, Tata steel works



Aberafan/Port Talbot

- Some examples:



Afon Afan – Green Park



Afan Dock Feeder



Ffwrdd Wylt - Taibach



Arnallt

Aberafan/Port Talbot

- Hydrometry potential
 - Gauging stations at Marcroft, Taibach
 - Arnallt runs in a culvert to the coast
 - Industrial abstraction – volumes?
 - Impact of the inner dock – volumes?



Marcroft – Afon Afan

Aberafan/Port Talbot

- Good access to the main rivers for sampling
- The Arnallt outfall is within the Tata steel works site
- Are abstractions from the rivers monitored?

Source Apportionment

- Industrial inputs
- Potential faecal indicator organism sources from “permitted” discharges
- General Electric gas turbine power station at Baglan – discharge to Nedd estuary
- Intertissue paper mill – Baglan outfall
- Tata steel works – long sea outfall

Source Apportionment

- Industrial inputs – FIO cfu/100 ml
- Power station FE: FC 81, FS < 10
- Intertissue FE: FC 45, FS < 10
- Tata steel works
 - LSO: FC 28, FS <10
 - Stock Yard: FC<10, FS<10
 - Abbey Beach OF: FC<10, FS<10
 - Arnallt OF: FC 28, FS 36
- These concentrations are low
- More results required to confirm

Source Apportionment

- Consented discharges - infrastructure
- Visits made to:
 - Swansea STW
 - Afan STW
 - Port Tawe PS (CSO 989)
 - Knab Rock
 - Sandfields PS
- Other sites visited:
 - Baglan PS, Aberdulais PS, Newbridge Rd. PS
 - CSOs 301 & 401 Mumbles
 - Swansea STW EO, Elbe Cresc.OF, Baldwin Cresc.OF
 - Swansea Docks OF

Infrastructure

- Some examples:



CSO 401



Elbe Crescent PS OF



Swansea Docks OF



Newbridge Rd PS

Infrastructure

- Many outfalls are remote e.g. Crymlyn Burrows
- CCS now have a team of confined spaces trained samplers
- This team can access sites such as Knab Rock and Port Tawe PS for sampling and will be responsible for most infrastructure sampling
- A dedicated program of infrastructure site visits is now required – particularly the network in the Nedd estuary e.g. Baglan PS to determine potential sampling sites
- Likely sites with information on CSO spill volumes and duration remain to be ascertained

Infrastructure

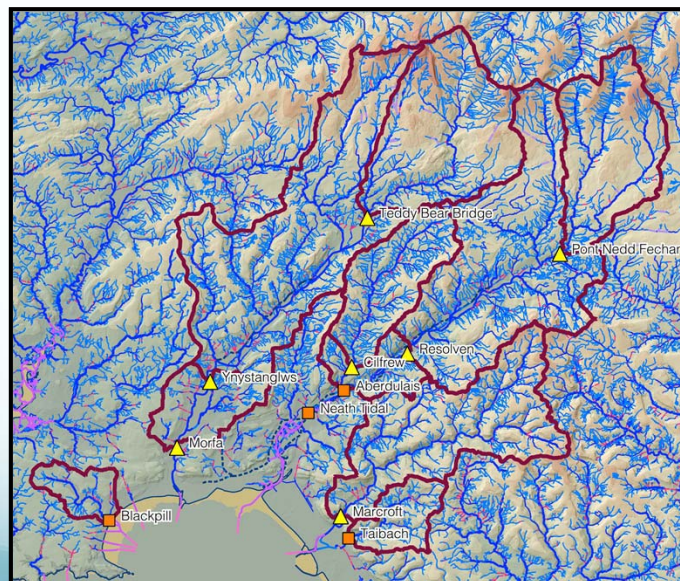
- Non-water company discharges
- An up-to-date list of potential FIO sources from non-water company inputs is required
- A starting point is the list in the preliminary “desk study” report
- Requires scrutiny to remove any inputs for which consents have lapsed etc. e.g. fish farm in Swansea Docks
- A program of site visits will follow from this

Source Apportionment

- Field laboratory – Guildhall Swansea
- Parameters:
 - FIOs: Intestinal enterococci, *E. coli*
 - Salinity (ppt) (also: Conductivity (mS, μ S), TDS (mg/l)) and turbidity (NTU)



Hydrometry



Hydrometry

- Good existing coverage of larger catchments
- Additional sites that will be useful to the project:
 - Morfa – influenced by the barrage - ultrasonic
 - Clyne River flood warning station – level, telemetry, spot gauging
 - Afon Nedd at Aberdulais – logger, level, spot gauging
 - Ffrwd Wylt at Taibach – level, spot gauging, telemetry
 - Cwmavon – backup for Marcroft – Q, telemetry
- Afan Green Park Survey – examined flow to docks

Hydrometry

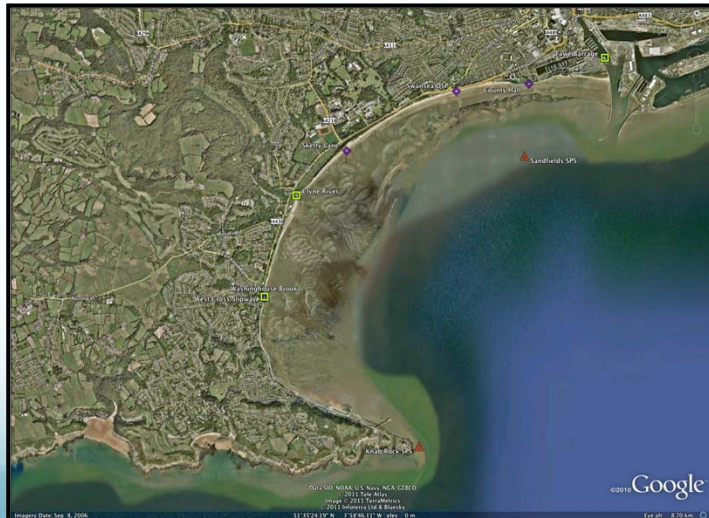
- The project has equipment for monitoring at 15 additional sites
- Candidate areas not covered:
 - Mumbles-Swansea foreshore – black box & source apportionment
 - Washinghouse Brook, Brockhole stream, Brynmill stream, Clyne non-tidal reach?
 - Tawe estuary – depends on whether detailed source apportionment is required behind the barrage
 - Cwm Gelli, Pentrechwyth, Nant-y-Fendrod, Nant Melyn
 - Nedd estuary
 - Target largest catchments – Afon Clydach, Baglan Brook, Cryddan Brook, Gnoll Brook
 - Upgrade Aberdulais to telemetry?

Hydrometry

- Equipment: 5 x A. Ott units, 10 x Frog units
- Deployment:
 - A. Ott units to be deployed locally to Swansea DSP - provide predictor variable data for black box modelling (i.e. before bathing season):
 - Washinghouse Brook, Brockhole stream, Clyne River (x2)?, Brynmill stream
 - Frog units to be deployed in the Tawe estuary (x 4, if necessary) and Nedd estuary (x 6, or all 10) – before source apportionment period
- Staff gauge boards to be installed at sampling and hydrometric sites
- Sewer monitoring? Additional “Diver” units?

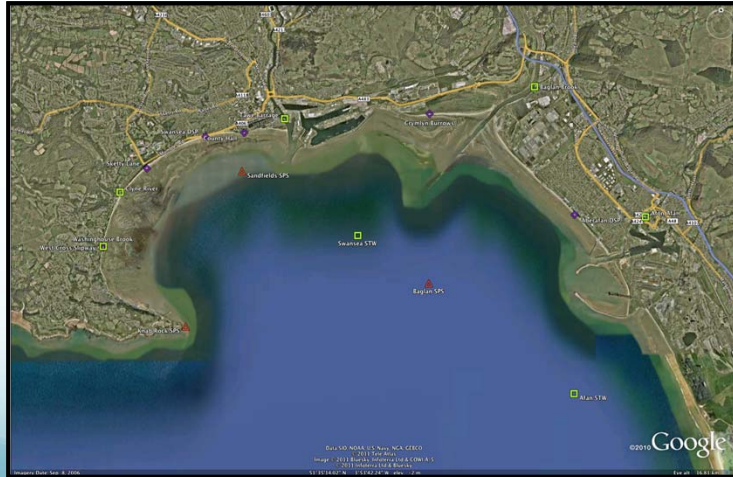
Tracer Studies

- Local studies to investigate connectivity to the Swansea DSP



Tracer Studies

- Remote studies to investigate connectivity to the Swansea DSP and offshore dilution/dispersion



Tracer Studies

- Two Local tracer studies scheduled for 2011
- Two remote tracer studies scheduled for 2012

The next phase....

- Finish river and stream site investigation
- Select final river and stream sampling sites
- Select final hydrometric monitoring sites
- Install hydrometric monitoring equipment
- Further infrastructure site visit program - Nedd estuary, Aberafan/Port Talbot
- Non-water company infrastructure investigations
- Investigate infrastructure flow/duration data availability
- Further FIO study of industrial inputs?