Challenges for the water environment of Jersey

Appendix A: Technical approach to status classifications

This document sets out the approaches taken to identifying the water bodies on Jersey and details how the classification assessments have been undertaken. Separate chapters are provided for the different classification elements.

1. Water body delineation, typology and identification of Priority Protection Areas

1.1 Introduction

This section sets out the method statement for the water body delineation, typology and identification of protected areas for the Jersey Integrated Water Management Plan (IWMP). The approaches are based upon approaches adopted for the Water Framework Directive (WFD) in England and Wales, adapted where appropriate and needed for the Jersey context.

1.2 Delineation

Water management areas

States of Jersey (SoJ) Environment Division currently define eight Water Management Areas (WMAs). These provide a suitable level of resolution for the IWMP and have been maintained as management areas, similar to "River Basin Districts" elsewhere.

Streams

To further define the individual water bodies, a delineation exercise has been undertaken using the 50m contour map of Jersey to build a digital elevation model (DEM). From this, individual stream "catchments" have been defined and these are the basic stream "water body" unit which will form the basis of the Jersey IWMP (termed "stream catchment water bodies"). Within these stream catchment water bodies, we have the streams themselves.

Watercourses less than 500m in length, and which have a small catchment outlet directly to the coastline were not delineated. Such small watercourses are highly intermittent and will frequently not contain water all year round from which to monitor the ecological and chemical status. These small waters do however fall within water body catchments and are therefore included in the IWMP as part of the catchment.

These new datasets have been cross checked against existing WMA and river line datasets supplied by the Department of Environment (DoE) and have also been subject to a check by the DoE team.

The individual stream water bodies within the eight catchments have then been assigned a unique numerical code for data management purposes. The naming convention is set out as follows: for example J108123 (J (Jersey) 1 (stream) 08 (catchment 08 which is Longueville, Queens Valle and South East) 123 (water body number assigned in order of length within WMA).

The purpose of using a semi-intelligent coding system rather than a random code is that when looking at the data in tabular format, it is easy to quickly visualise where on the island the water body is, and what water body category it is in.

Reservoirs and ponds

These water bodies have been delineated using existing GIS datasets from Jersey Water, and consist of the main water supply reservoirs on the island plus ponds of known ecological importance.

Based on input from the Natural Environment Team (States of Jersey) the ponds and reservoirs dataset was delineated. All drinking water supply reservoirs were included as water bodies, and furthermore, all ponds that fulfil two or more of the following criteria:

- are within an SSI boundary;
- have recent records (2003 or later) of protected species within 100m of them;
- have recent records (2003 or later) of biodiversity action species within 100m of them; or
- have recent records of toads breeding in them.

Ponds in urban areas were then excluded, which left a total of 51 ponds of known ecological importance in addition to the main water supply reservoirs. A further two ponds were added to this (including St Ouen's Pond).

Similarly to the river water bodies, the reservoirs and ponds have been assigned an IWMP water body code as follows: E.g. J2086 (J (Jersey) 2 (reservoir) 08 (catchment 08 which is Longueville, Queens Valle and South East) 6 (water body number assigned in order of size).

Groundwaters

The bedrock of Jersey has relatively low groundwater storage and conductivity but is nonetheless widely used for small scale abstraction. Sands and gravels within superficial deposits offer more favourable hydraulic properties but are of limited areal extend and thickness. Deposits occur behind St Ouen's Bay, within St Helier and behind the Royal Bay of Grouville, however the in the latter two areas the deposits are relatively thin or of poorer hydraulic properties that at St Ouen's Bay (Robins and Smedley, 1991).

Groundwater quality is a key issue on the island and this issue attracts attention from both stakeholders and the general public. The concept of groundwater bodies is often quite challenging to communicate effectively and so in terms of managing groundwaters through the IWMP it was decided to consider each WMA as having a different groundwater body. This will enable management interventions, compliance reporting and general measures progress to be demonstrated to stakeholders more effectively. The groundwater bodies have been coded based on their WMA code.

Coastal waters

To delineate coastal waters, a coastline buffer has been applied to the coastline to mark the outer limit of the coastal water at 3nm, with the inner limit being the mean high water mark. This coastal water ring has then been sub-divided into 4 individual coastal water bodies, the boundaries of which are roughly in line with the four corners of the island. Thus there are individual coastal water bodies for north, south east and west. A naming convention has been assigned as follows: CN = Coastal Water North; CS = Coastal Water South; CE = Coastal Water East; and CW = Coastal Water West

Transitional waters

No transitional water bodies will be delineated because typically the rivers meet the sea either abruptly (due to natural gradient) or because of flood defence barriers (pers comm. Kate Roberts, November, 2013).

1.3 Typology

The subdivision of water bodies into different types, i.e., typology, is typically based mainly on natural characteristics that might influence biological communities such as altitude, latitude, longitude, geology and size (Directive 2000/60/EC). Environmental standards are often type specific which is one reason for undertaking a typology exercise. At the start of the IWMP, it was suspected that the water bodies are all likely to be of the same type; however in the interests of being thorough, a typology exercise has been undertaken to a) confirm the assumption and b) to gain a more thorough understanding of the streams on Jersey.

Longitudinal profiles have been generated for the watercourses along the island, allowing the overall gradient and gradient changes along a watercourse to be identified, which are related to physical / geological transitions along the watercourse.

Figure 1 shows that there is a general trend in channel gradients, with watercourses less than 1km long having steep gradients typically greater than 0.10 m / m. An inflection point occurs at this point with watercourses longer than 1km having shallower gradients. Whilst watercourses longer than 1km long typically have shallower gradients, the gradients often vary along these longer watercourses, from which multiple reaches can be delineated.

The watercourses can be delineated into 5 watercourse types:

1. Steep shoreline watercourses less than 1km long – one reach type
2. Shallow shoreline watercourses less than 1km long - one reach type
3. Moderate sloped watercourse with no change in gradient – one reach type
4. Variable sloped watercourse with a shallowing gradient transition between 15 – 45mAOD – two reach types
5. Variable sloped watercourse with a steepening gradient transition at 45mAOD – two reach types

In addition, where present, reservoirs would split the watercourse up further.

Most of the streams on the island fall within 2 of these types, as can be seen in Figure 2 below which shows the streams coloured by type.

Although it could be considered more pragmatic to reduce the number of types down further, the five types have been retained; the reason being that it is important to understand the relative types of different water bodies if proxy data is to be used through the IWMP (e.g. if a water course is lacking ecological monitoring data, it may be possible to use another water body of the same type as a data “donor”).

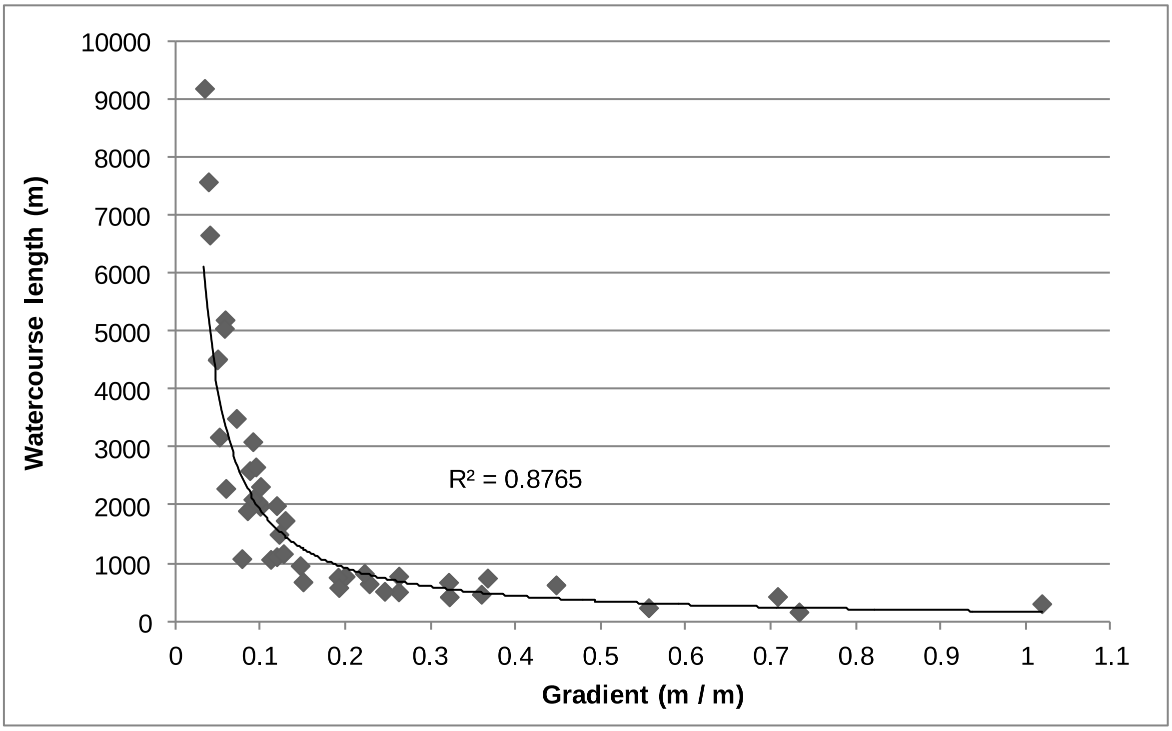

Figure 1: States of Jersey water course length and average gradient

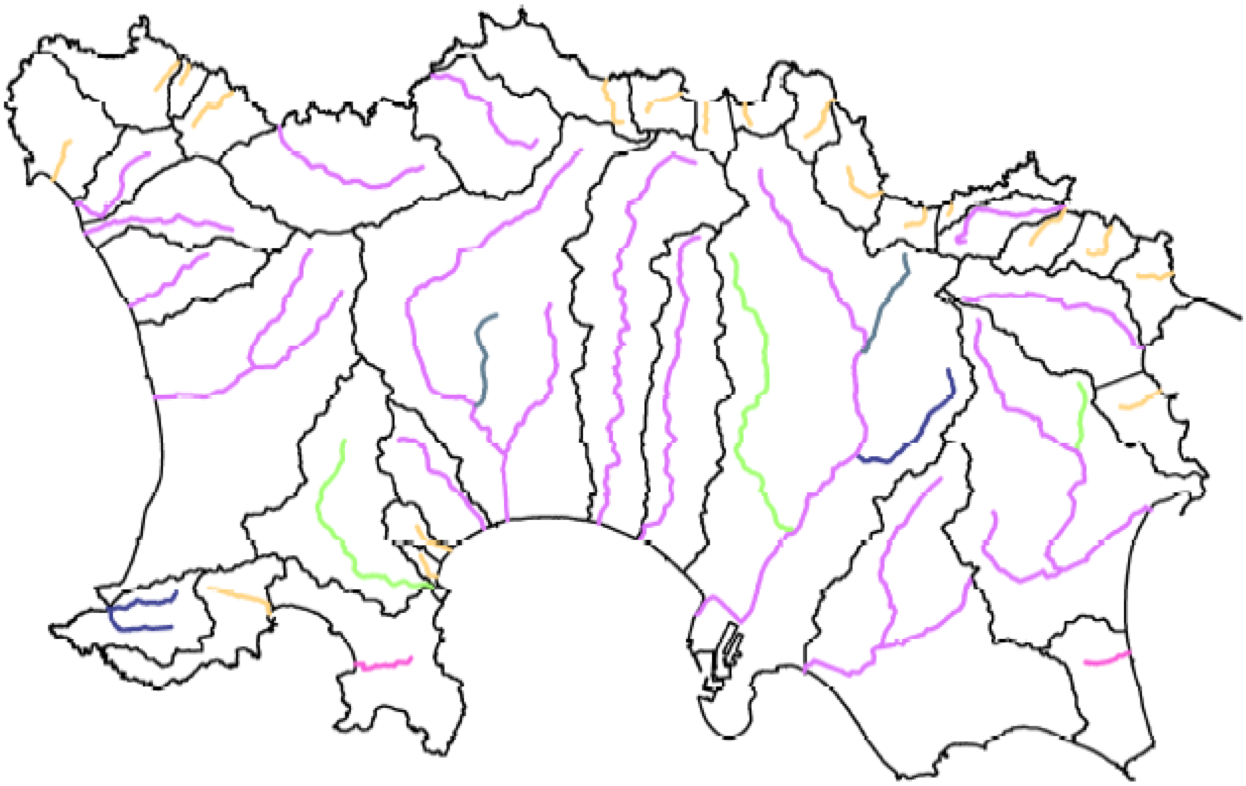

Figure 2: States of Jersey water course typology map

1.4 Priority Protection Areas

Protected Areas Register

The WFD requires a Register of Protected Areas to be established – for England & Wales this consists of an MS Access database and, where appropriate, the water body datasets have a "protected area" attribute. However, due to the size of Jersey (there will be fewer Protection Areas) and for simplicity of data management in the future, pragmatic approach has been undertaken that simply marks up the protected areas on the Island within the GIS dataset attributes. GIS layers will distinguish different types of protected areas (for example with drinking water priority protected areas which will contain the main water supply reservoirs as well as the upstream catchment areas).

Protected areas will be defined in the following categories:

- Areas for the protection of habitats and species
- Water bodies used for the abstraction of drinking water
- Recreational waters
- Nutrient Sensitive Areas
- Areas designed to protect economically significant aquatic species

Under the Water Framework Directive protected areas have additional quality standards applied to them. Protected Areas are usually designated as requiring a higher degree of protection either for their surface water or groundwater, or to conserve habitats and species that directly depend on those waters. Across Europe, many of these Protected Areas include sites that are already designated under existing European Legislation. This isn't straightforward in Jersey where European legislation is not necessarily adopted and these areas are not already in existence. Realistically, resource implications are also paramount and there is a need to avoid additional layers of bureaucracy.

Because of these considerations a pragmatic approach has been adopted for the IWMP, with a system of **Priority Protection Areas** being identified, so that the sites with special features (either features of ecological or social importance) can be afforded priority for action in the future. This will help ensure that where resources are limited, we are targeting action according to local priorities.

Water bodies used for the abstraction of drinking water

This category consists of:

- The six main water supply reservoirs;
- The upstream catchments draining into these reservoirs
- The existing water protection safeguard zones; and
- The Island's groundwater bodies.

In this way, the water supply water bodies (surface and groundwater) and their upstream catchments can be considered separately for priority protection under the IWMP.

Nutrient Sensitive Areas

Jersey has a historic and widespread problem with nutrients, and because of the land use on Jersey the whole Island is potentially vulnerable to nutrient enrichment. As well as all streams and reservoirs / ponds, the groundwaters are equally vulnerable to nutrients. Under the Nitrates Directive, the whole Island would be designated as a Nitrate Vulnerable Zone. In addition to this, the coastal water of St Aubin's Bay would be designated as "Potentially Sensitive" as it is risk from nutrients, both through run off from land and from wastewater discharges to sea.

Areas for the protection of habitats and species

The approach taken to identifying ponds and reservoir water bodies in the IWMP is based on ecological significance for habitats and species; ponds were designated based on whether they are within an SSI, or have protected species / biodiversity action species records in or nearby. As such, all ponds are considered a Priority Protected Area. In addition to this, Ecological SSIs and where water bodies intersect these sites, are also designated for priority protection. In the marine environment, the Ramsar site off the south east corner of the Island is also designated for priority protection in order to conserve the important Seagrass habitats.

Recreational waters

This category of Priority Protection Area consist of:

- Existing designated bathing water beaches
- All coastal waters (which include bathing water beaches and recreational sea fishing areas)
- The main water supply reservoirs where fishing takes place.

Areas designed to protect economically significant aquatic species

This category is important in the coastal waters of Jersey which support an important shellfish industry and as such the areas used for the production of bivalves (e.g. clams, oysters, mussels and scallops) and gastropod (e.g. ormer, whelks etc.) molluscs have been identified as requiring priority protection.

In the freshwater environment, fishing is not considered economically important in the same way as in the coastal environment as it is only undertaken on a small scale within some stocked reservoirs. Therefore, no freshwater water bodies are considered under this category.

1.5 References

Directive 2000/60/EC of the European Parliament and of the Council: Establishing a framework for Community action in the field of water policy (the Water Framework Directive)

Robins, N., S. and Smedley, P., L. (1991) Hydrogeological and hydrogeochemical survey of Jersey. British Geological Survey Technical Report WD/91/15.

2. Surface waters biological status classification

2.1 Introduction

This section sets out the method for biological classification for stream water bodies, as part of the Jersey Integrated Water Management Plan (IWMP). Separate similar notes cover the biological classification methods for reservoirs and coastal waters. The method is based upon a review of proposed and adopted standards for the Water Framework Directive (WFD) in England and Wales, and France, adapted where appropriate and needed for the Jersey context.

The note is structured as follows:

- A summary of the English-Welsh and French standards for biological classification.
- The approach taken for the Jersey IWMP
- A summary of the monitoring programme requirements in order to support this classification scheme in the future
- Process for updating the classification method.

2.2 Biological classification approach

Standards from England, Wales and France

In England and Wales, biological classification for River Basin Management Planning Cycle 1 (RBMP1) was based on up to four quality element indicators:

1. Fish (Fisheries Classification Scheme 2 (FSC2))
2. Invertebrates (River Invertebrate Classification Tool (RICT))
3. Diatoms (DARLEQ)
4. Macrophytes (LEAFPACS)

Further information on the original and proposed revised methods can be found in UKTAG (2013a).

Fish and the FSC2 tool are generic pressure indicators, rather than being specific indicators like the other biological elements used in RBMP1. As explained in a review of potential standards for Jersey (CREH, 1997), fish species richness is generally low in UK waters and they are mobile, hence fish cannot provide a sufficiently sensitive or site specific method of biological monitoring.

The invertebrates RICT tool is similar to the methodology used on the island of Jersey, and is made up of two water quality metrics: Average Score per Taxon (ASPT) and Number of Scoring Taxa (N-TAXA). Both RICT metrics (ASPT and N-TAXA) are sensitive to organic enrichment and toxic chemical pollution, whilst N-TAXA is also sensitive to acute physical environmental disturbances such as channel maintenance activities and signal crayfish predation.

The diatom (DARLEQ) and macrophyte (LEAFPACS) indices are primarily sensitive to nutrient enrichment in its broadest sense (not just organic enrichment). Macrophytes are also sensitive to morphological and flow alterations although LEAFPACS does not currently account for these additional pressures. DARLEQ and LEAFPACS are most effectively used together to assess nutrient enrichment, although DARLEQ has been shown to be less effective in higher alkalinity waters > 120 mg/l $CaCO_3$, being most reliable in low alkalinity waters < 75 mg/l $CaCO_3$. Environment Agency internal guidance (personal communication Nina Fielding, 13/02/2014) suggests that when alkalinity is between the 75 – 200 mg/l $CaCO_3$ range, ideally both macrophyte and diatom sampling should be undertaken, however if resources are limited macrophyte sampling would be prioritised.

In France, biological classification for RBMP1 has followed a similar approach to England and Wales, although excludes macrophytes, relying instead on up to three quality element indicators:

1. Fish (Poissons – Indice Poissons Rivière)
2. Invertebrates (Invertébrés - Indice Biologique Global Normalisé**)**
3. Diatoms (Diatomées – Indice Biologique Diatomées)

Ministère de l'Écologie, du Développement durable et de l'Énergie (2012) explains that a standardised macrophyte index was not available in RBMP1, although macrophytes would be expected to be included in RBMP2.

Jersey IWMP biological classification

The biological monitoring programme (for stream watercourses) currently undertaken in Jersey waters consists of macroinvertebrate monitoring and the development of four metrics:

1. N-TAXA
2. ASPT
3. Biological Monitoring Working Party (BMWP)
4. Lincolne Quality Index (LQI)

A summary of the metrics and how they are used to assess biological quality on the island of Jersey is provided in CREH (1997) and Ecoscan (2004).

N-TAXA, ASPT and BMWP are all water quality pressure indicators, however, in order to understand how these scores relate to the severity of the pressures acting on the water body, an expected score would normally be included so that an Ecological Quality Ration (EQR) can be calculated. In the Jersey database, only ASPT includes an expected score for the island. In contrast, England and Wales also has EQRs for N-TAXA as well as ASPT. This is not a major problem since ASPT is an amalgamation of the BMWP and N-TAXA metric anyway. The macroinvertebrate monitoring approach currently undertaken on Jersey is therefore compatible with other approaches and has been maintained.

The LQI is a useful habitat / morphology quality indicator although there are no EU wide standards for its application, and therefore it is not recommended that this is included in the invertebrate quality element. However, it is a useful validation of the reasons for low ASPT EQRs and can be used to monitor the effectiveness of morphological measures along a monitoring reach.

The biological quality elements for fish, diatoms and macrophytes are currently not monitored on the island of Jersey. Rather than implementing monitoring to enable all the biological quality elements to be assessed, the most effective monitoring programmes and biological quality elements should be prioritised for Jersey's first IWMP.

- **Fish** are generic pressure indicators and whilst useful to understand the overall health of a river – it will not necessarily help identify the reason for a failure and therefore the measures required. In addition, it is unclear if any of the existing fish metric systems have suitable reference sites for the island of Jersey. Therefore, it is not recommended to include the fish quality element (and there is no data to support this in the first IWMP anyway).

- **Diatoms and macrophytes** can be used as nutrient enrichment indicators, allowing a wider assessment of water quality pressures compared with invertebrate monitoring (which is a good indicator of organic enrichment and toxic chemical pollution). WCA (2004) recommended that either or both of these biological quality elements should be included in a monitoring programme. The alkalinity of surface waters measured during the invertebrate sampling broadly ranges from 30 – 150 mg/l $CaCO_3$, whilst in the Water Quality Management Information System (WQMIS) it ranges from 5 to 375 mg/l $CaCO_3$ (average 80 mg/l $CaCO_3$ across the island)[1] making the use of macrophytes (>75 mg/l $CaCO_3$) and/or diatoms (< 75 mg/l $CaCO_3$) appropriate depending on the watercourse.

[1] Based on data (1961 – 2012) from all active surface water monitoring sites across the island in the WQMIS,

A comparison of both approaches is outlined in Table 1 below. Weighing up the advantages and disadvantages of using each approach suggests that macrophyte monitoring provides peripheral benefits to the island, which the diatom monitoring would not. In addition, the diatom monitoring methodology is still being developed somewhat and involves more specialised analysis, whilst the macrophyte survey techniques are well established and could therefore be implemented with confidence.

Summary of biological classification approach for the island of Jersey

- Maintain current macroinvertebrate monitoring programme and rely on this for the basis of the first IWMP (2015)
- Adopt macrophyte survey programme throughout the first IWMP cycle (2015-2020)

Table 1: Comparison of the macrophyte and diatom monitoring approaches

Macrophytes	Diatoms
Recommended when alkalinity > 75 mg/l $CaCO_3$	Effective when alkalinity < 75 mg/l $CaCO_3$
Field monitoring takes more time than diatom sampling	Field monitoring is rapid
Field monitoring requires a 100m reach for a survey; impractical when there is considerable shading along a watercourse	Field monitoring only requires a 10m reach for a sample; practical when there is considerable shading along a watercourse
Limited desk based processing required, making the overall approach more cost effective than diatom sampling	Expensive analytical approach (~£150 - £200 per sample), typically outweighing overall costs of the macrophyte survey
Well-developed methodologies for water quality assessment which could be adapted for use on the island	Methodologies still being operationally trialled by the Environment Agency
Macrophyte surveys can potentially be used to assess wider pressures e.g. morphology, flow, invasive species	Diatom sampling currently limited to assessing water quality pressures
Increases macrophyte ID skills of ecologists on the island	Limited increase in skills, unless laboratory analysis undertaken in-house. Some in-house experience already exists in saline diatom ID however.
Macrophyte surveys can be used more widely to support other initiatives on the island, such as the monitoring of plants under the Conservation of Wildlife (Protected Plants) (Jersey) Order 2009)	Limited

2.3 Monitoring to support biological classification

Current extent of monitoring in Jersey waters

The macroinvertebrate monitoring network from 2007 – 2013 composed of 73 stream sites (three of which have been discontinued) across the 8 Water Management Areas (WMAs). The monitoring approach taken is risk based; sites which are Good or High are monitored every 5 years; those that are less than Good, but generally improving, are monitored every 3 years.

The majority of the sites are paired with the water quality monitoring, however 9 sites currently have no paired water quality monitoring; BN-e, BN-w, LaH, BB-1, QV-n, QV-w1, RV2, B7, QV-w2 (although temperature, pH, conductivity, dissolved oxygen, calcium and alkalinity is measured during the macroinvertebrate survey).
All major flowing watercourses are monitored on the island, with most having multiple monitoring sites. For example St Peters Valley in “La Haule and St Peter's Valley” WMA has 14 monitoring locations. Smaller catchments which are dry for part of the year, or where access has been an issue in the past, or where there has not been 20m of suitable habitat for the survey, have no monitoring sites. For example the watercourse immediately to the west of the main St Peters Valley watercourse has limited access and poor habitat for undertaking the monitoring.

Monitoring programme and recommendations

Monitoring can be divided into three types, surveillance, operational and investigative monitoring.

- Surveillance monitoring is used to validate risk assessments and determine long-term changes.
- Operational monitoring is used to determine the status of water bodies identified as being at risk and how this changes as result of the programme of measures.
- Investigative monitoring is used to establish reasons for failure.

The recommended monitoring approach for each of these types is summarised in the sections below.

Surveillance and operational monitoring

Surveillance monitoring should be undertaken to establish the baseline of biological quality on the island of Jersey, and enable an adaptive and targeted operational monitoring regime to be established. This has already been undertaken for macroinvertebrates, with sites where ASPT is less than 'Good' and which are not improving in class being prioritised for regular monitoring (every 3 years; Spring and Autumn), and other sites monitored every 5 years (Spring and Autumn), as described in Section 3.1.

Ideally a core network of sites sampled annually, or specifically sampled during drought years, would be established, subject to funding availability. Maintaining spring and autumn monitoring at sites which are at Good is important to understand how long term climatic pressures (e.g. floods and droughts) may influence the EQRs.

The Environment Agency in England and Wales also undertakes summer macroinvertebrate sampling in some watercourses, although this has been shown to not necessarily provide beneficial information beyond spring and autumn samples only.

Monitoring programmes for other biological quality elements should also undergo a similar process. As a minimum, there should at least be a single monitoring location per catchment paired with a water quality site, although additional sites are likely to be required to monitor conditions upstream and downstream of acute pressure inputs to the watercourse or in different catchment typologies.

Some flowing watercourses are currently not monitored, therefore these should be added to the monitoring programme, where there are no constraints to do this (lack of flow, access, limited survey reach, financial constraint) with intensive monitoring in some catchments reduced and re-distributed across the island.

Investigative monitoring

Investigative monitoring is normally used to establish reasons for failure to achieve good status. The biological quality elements themselves may not be able to pin point the precise reasons since they respond to short, medium and long term pressures. Therefore, it is recommended that investigative monitoring is undertaken through water quality monitoring and catchment surveys (wet weather surveys and/or sediment surveys, rather than undertaking additional bespoke biological surveys). This monitoring would also be expected to investigate acute failures of the standards, under normal procedures by the Planning and Environment Department and enforced through the Water Pollution Law (Jersey) 2000.

2.4 Process for updating the classification method

The classification method may need to be revised, either when there is improved scientific understanding through research and monitoring, or with the benefit of experience in their practical application.
The biological standards in England and Wales and France are being revised in 2014. England and Wales are also considering the inclusion of additional invertebrate metrics under the WFD including the Lotic Invertebrate Flow Evaluation (LIFE; Extence *et al.* 1999) flow sensitive metric and Proportion of Sediment-sensitive Invertebrates index (PSI; Extence *et al.* 2013) sediment sensitive index.

The macroinvertebrate methodology used on the island has already undergone review and revision (CREH 1997 and Ecoscan 2004) and it is recommended that all biological standards are reviewed at the beginning of each IWMP cycle, to ensure each cycle uses the best available standards.

Additional biological quality elements can also be added one by one through the three IWMP cycles once there is confidence that they are workable on the island e.g. the fish biological quality element would require an investigation to determine the applicability of existing methods, and understanding what a 'reference' condition is for the island; diatom monitoring may prove more reliable and effective once the analytical methodologies are refined.

2.5 References

CREH (1997) Stream water quality on the island of Jersey. A report for the States of Jersey, Public Services Department.

Ecoscan (2004) An assessment of Water Quality Objectives. A report for the States of Jersey Planning and Environment Department.

Ministère de l'Écologie, du Développement durable et de l'Énergie (2012) Guide technique Évaluation de l'état des eaux de surface continentales (cours d'eau, canaux, plans d'eau)

UKTAG (2013) Final recommendations on new and updated biological standards.

WCA (2004) Scoping study to define the status of Jersey's freshwaters according to the requirements of the WFD. A report for the States of Jersey, Environment Division.

Extence, C.A., Balbi, D.M. and Chadd, R.P. (1999) River flow indexing using British benthic macroinvertebrates: A framework for setting hydroecological objectives. Regulated Rivers Research and Management, 15, 543-574.

Extence, C.P., Chadd, R., England, J., Dunbar, M.J., Wood, P., Taylor, E. (2013) The Assessment of Fine Sediment Accumulation in Rivers Using Macro-Invertebrate Community Response. River Research and Applications, 29, 17–55.

3. Chemical status classification

3.1 Introduction

This section sets out the outline method statements for chemical classification as part of the Jersey Integrated Water Management Plan (IWMP). It is based upon methods adopted for the Water Framework Directive (WFD) in England and Wales and adapted where appropriate and needed for the Jersey context.

The note is structured as follows:

1. A summary of the EU chemical classification approach and recommendations for the Jersey IWMP
2. A summary of the monitoring programme requirements in order to support this classification scheme both now and in the future
3. Process for updating the classification method/standards.

3.2 Chemical classification approach

WFD chemical classification

Chemical status is assessed using compliance with environmental standards for chemicals that are priority or priority hazardous substances; the latter being a subset of particular concern.

Chemical status is recorded as 'good' or 'fail', and in England and Wales is determined by the worst scoring chemical (i.e. on a one-out-all-out approach).

The chemical standards for EU Member States are established at the EU level rather than Member State level, and are applied across the EU. The list of substances is based on Annex II of the Directive on Environmental Quality Standards (Directive 2008/105/EC) (EQSD), also known as the Priority Substances Directive. This sets environmental quality standards (EQS) for the substances in surface waters (river, lake, transitional and coastal).

Table 2 (shown later) lists the identified 33 substances, or group of substances, shown to be of major concern for European Waters. Within this list, 11 substances were identified as priority hazardous substances and therefore subject to cessation or phasing out of discharges, emissions and losses within an appropriate timetable not exceeding 20 years. A further 14 substances were identified as being subject to later review.

The EU are currently reviewing their standards for chemical classification through the "Proposal for a Directive of the European Parliament and of the Council amending Directives 2000/60/EC and 2008/105/EC as regards priority substances in the field of water policy", see http://ec.europa.eu/environment/water/water-dangersub/lib_pri_substances.htm#prop_2011_docs. Another 15 chemicals are proposed as well as a revision of existing standards.

Jersey IWMP chemical classification

The Water Pollution Law (Jersey) 2000 provides a means to control pollution in Jersey waters, including the monitoring and the classification of waters, and the setting of quality objectives for classified waters. Under the Law, pollution includes *the introduction directly or indirectly into controlled waters of any substance, or energy, where its introduction results or is likely to result in harm to any living resource or aquatic ecosystem*.

The list of priority substances used under the WFD is based on a comprehensive review of substances identified as harmful to the environment, and which are present or are legacy substances in the EU. Therefore, this list is complimentary in maintaining the Water Pollution Law (Jersey) 2000; particularly regarding the control of high risk substances (schedule 2).

Environmental Protection report (2011) demonstrates that a large number of these priority substances in Table 2 were found in Jersey waters. In addition, the England and Wales Environment Agency's Significant

Water Management Issues review for RBMP cycle 2 indicate that the top two sources of priority substances for failing water bodies were ‘urban areas and transport’, and ‘agriculture and land management’. An examination of the sources / applications of these substances in Table 2 also suggest that it is reasonable to assume that all these substances are potentially present on the island of Jersey. These proposals were discussed with Jersey Water, which has taken a risk based approach to chemical monitoring on the Island. Through these discussions, it was decided that, for consistency, a similar risk-based approach should be taken to assessing and classifying chemical status under the IWMP. To this end, a risk assessment undertaken by John Fawell on behalf of Jersey Water has been used to screen out chemicals that are not thought to be a risk on the Island.

Table 2 provides the current standards of the substances under the chemical classification. This is based on Annual Average (AA) or Maximum Allowable Concentration (MAC) over the sampling period used to classify the water body. Proposed chemicals, EU watch list and UK Chemical Investigation Programme (CIP) chemicals also listed in the table.

In England and Wales, the first cycle of River Basin Management Plans (RBMP1) based the MAC on the ‘absolute’ maximum concentration measured during the sampling period. UKTAG (2013) have recommended that for RBMP2, England and Wales should adopt a risk-based rather than absolute approach for MAC. This would use the 95-percentile to define the MAC, and the number of failed samples required to give 95% confidence that a MAC is exceeded. The number of samples required to assign a ‘Fail’ for a MAC is shown in Table 3 below. This approach is pragmatic and ensures that action is undertaken when there is 95% confidence of failure. It does not however mean that MAC exceedances should be ignored when we are not 95% confident of a failure. Acute failures would be expected to be investigated under normal procedures by the Environment and Planning Department and enforced through the Water Pollution Law (Jersey) 2000.

Summary of chemical classification approach for the island of Jersey

- Apply the current WFD chemical classification AA and MAC standards
- Apply a risk based approach in the use of the MAC standards, based on the 95-precentile and 95% confidence of failure
- Investigate all MAC exceedances under investigative normal procedures by the Department of Environment and enforced through the Water Pollution Law (Jersey) 2000
- Monitor EU watch list, proposed new 15 priority substances and other CIP chemicals

3.3 Monitoring to support chemical classification

Current extent of monitoring in Jersey waters

The Water Quality Management Information System (WQMIS) contains water quality sampling data at 270 surface water monitoring sites, spread across all 8 Water Management Areas (WMAs). All the main flowing watercourses are monitored, although a small number of small watercourses which do not flow all year round are currently not.

An analysis of sites which contain data for chemical parameters which have been recently monitored (2008 – 2012) shows that this includes 101 monitoring sites (marine, groundwater and surface water) across the island, with sampling frequency generally of 2 - 3 samples per year as a minimum. Table 3 shows the chemicals monitored on the island, showing that 35 of the 57 chemicals have been monitored recently. Groundwater has historically been the most monitored (69 sites) followed by surface water locations (27) and marine (5). Marine spatial monitoring has been quite limited whilst WMA 4 (North East) is also sparsely monitored, with 2 monitoring locations.

Monitoring programme and recommendations

Monitoring can be divided into three types, surveillance, operational and investigative monitoring.

- Surveillance monitoring is used to validate risk assessments and determine long-term changes.
- Operational monitoring is used to determine the status of water bodies identified as being at risk and how this changes as result of the programme of measures.
- Investigative monitoring is used to establish reasons for failure. The recommended monitoring approach for each of these types is summarised below.

Recommendations are provided below for future plans and monitoring. It is acknowledged that in some cases, it will not be possible to achieve the recommendations set out below, particularly in the current planning cycle. Where necessary and appropriate, consideration will be given to filling these gaps in monitoring using proxy sites, expert judgement (see separate surface water classification summary method statement for more information), and existing risk assessments by Jersey Water and States of Jersey (WCA 2004). A confidence rating will be applied to reflect these circumstances.

Surveillance monitoring

Surveillance monitoring should be undertaken to establish the baseline for the presence in significant quantities of substances found in Table 2, and any 'watch list' substances (see section 4). The presence of these substances in significant quantities in a certain water body would mean that they would be included under the operational monitoring for that water body. Surveillance monitoring can use current risk assessments by Jersey Water and States of Jersey (WCA 2004) for prioritisation. The risk assessments found a range of chemicals which were not present in significant quantities on the island.

Based on WCA (2004), surveillance monitoring should be undertaken only for those substances which are not currently monitored by the Jersey Department of Environment in each water body. WCA (2004) recommended that surveillance monitoring should be undertaken for 3 – 6 months, however Environment Agency (2013) states that a statistically robust monitoring regime requires a minimum of 12 samples within the last three years, ideally 36 samples.

Therefore, it is recommended that a monthly sampling programme over a period of 12 months is undertaken. This would help capture any indications of variability as a result of annual hydrological and management practice cycles, whilst also achieving sufficient robustness. In addition to this monthly monitoring, it is recommended that event-based monitoring is also undertaken to capture runoff event based peaks of substance concentrations, which could be missed from the routine monitoring. This monitoring should extend to a minimum of a single groundwater and surface water location in each water body. The existing frequency of surface water monitoring is in accordance with the standards.

The Directive on Environmental Quality Standards now also sets out that biota and sediment monitoring should be performed at a minimum frequency of once every year for compliance with EQS, and once every three years for temporal trend analysis, unless technical knowledge and expert judgement justify another interval. More information on biota and sediment monitoring is provided in EU (2010).

Operational monitoring

Operational monitoring, from which the chemical classification is developed, should be based on those substances which are present in significant concentrations within the water body. Monitoring frequency of those substances should reflect their inter-annual variability in concentration, and therefore substances which vary less over time can be monitored less frequently. This monitoring should extend to a minimum of a single surface water location in each water body.

Ideally, 36 water samples would be collated in 3 years (i.e. monthly sampling) however with sufficient evidence and justification, sampling could be reduced to bi-monthly as recommended by WCA (WCA 2004). As a minimum, it is recommended that sampling frequency is maintained to reflect the Environment Agency standards of 12 samples within 3 years. This is broadly in line with the Directive on Environmental Quality Standards, which sets guideline monitoring of "every three years" in the water column.

For sediments and biota, it is recommended that existing coastal monitoring of biota and sediments is reviewed to identify common receptors which can be used to assess sediment and biological bio-accumulation of pollutants, before determining new sample types.

Where there was no monitoring data of a chemical, the risk assessments were used to classify a chemical, but with a low confidence.

Investigative monitoring

Investigative monitoring is used to establish reasons for failure. There have already been a large number of investigative monitoring projects on the island of Jersey e.g. CREH (1997, 2006). It would be expected that similar projects would be initiated to determine new reasons for failure that may become apparent through time.

This monitoring would also be expected to investigate acute failures of the chemical standards, under normal procedures by the Planning and Environment Department and enforced through the Water Pollution Law (Jersey) 2000.

Consideration of States of Jersey resources for monitoring

The monitoring recommendations set out are based on existing guidance from WCA and the EA as the required amount of data for classifications to be robust; however it is understood that the States of Jersey do not have the resources to undertake this level of monitoring. Therefore, consideration has been given to prioritising future monitoring strategy based on Jersey specific risks.

Jersey Water has undertaken a similar risk-based monitoring review in consultation with John Fawell. In June 2014 Atkins met with Jersey Water and John Fawell (June 2014) and it was agreed that a similar approach could be undertaken for monitoring through the IWMP. This risk-based approach agreed will be reflected in the IWMP monitoring plan.

3.4 Process for updating the classification method

Existing standards may need to be revised when there is improved scientific understanding, either through research and monitoring or, when the benefit of experience in their practical application shows that existing standards are not as well matched to ecological quality as they could be. It is recommended that standards are reviewed at the beginning of each IWMP cycle, to ensure each cycle uses the best available standards. This could include the removal or inclusion of additional substances.

The EU are currently reviewing their standards for chemical classification through the "Proposal for a Directive of the European Parliament and of the Council amending Directives 2000/60/EC and 2008/105/EC as regards priority substances in the field of water policy", see http://ec.europa.eu/environment/water/water-dangersub/lib_pri_substances.htm#prop_2011_docs

The EU currently maintains a 'watch list' of potentially hazardous substances that could be added to the list used for WFD chemical classification. At present it is recommended that these watch list substances are included in the surveillance monitoring programme:

- Diclofenac
- 17-beta-estradiol
- 17-alpha-ethinylestradiol

The following CIP chemicals currently being investigated on the UK mainland should also be included in the monitoring programme since these chemicals are potentially harmful to the environment:

- Carbon-tetrachloride
- Aldrin
- Dieldrin
- Endrin
- Isodrin
- DDT total
- para-para-DDT
- Tetrachloro-ethylene
- Trichloro-ethylene

3.5 References

CREH (1997) Stream water quality on the island of Jersey. A report for the States of Jersey, Public Services Department.

CREH (2006) An Assessment of Surface Water Quality at Sites of Special Interest and in the Plémont, St Brelade and Waterworks Valley Catchments on the Island of Jersey. A report fot the States of Jersey Environment Division

Environment Agency (2013) Permitting of hazardous pollutants in discharges to surface waters. Operational instruction 17_13.

Environmental Protection (2011) Groundwater monitoring data. St Helier, Jersey: States of Jersey

EU (2010) Guidance document No. 25 ON CHEMICAL MONITORING OF SEDIMENT AND BIOTA UNDER THE WATER FRAMEWORK DIRECTIVE. COMMON IMPLEMENTATION STRATEGY FOR THE WATER FRAMEWORK DIRECTIVE (2000/60/EC). Technical Report - 2010 – 041.

https://circabc.europa.eu/sd/a/7f47ccd9-ce47-4f4a-b4f0-cc61db518b1c/Guidance%20No%2025%20-%20Chemical%20Monitoring%20of%20Sediment%20and%20Biota.pdf
WCA (2004) Scoping study to define the status of Jersey's freshwaters according to the requirements of the WFD. A report for the States of Jersey, Environment Division.

Table 2: WFD chemical classification substances

Priority Substance Name	Group	AA-EQS Inland surface waters	MAC-EQS Inland surface waters	AA-EQS Other surface waters	MAC-EQS Other surface waters	Sources/applications
		µg/l	µg/l	µg/l	µg/l	
Alachlor	PS	0.3	0.7	0.3	0.7	Agriculture - herbicide now banned in EU.
Anthracene	PHS	0.1	0.1	0.1	0.1	Anthracene occurs ubiquitously in the environment as a product of coal combustion and also occurs in fossil fuels.
Atrazine	PS	0.6	2.0	0.6	2.0	Agriculture, horticulture and forestry - broad spectrum herbicide.
Benzene	PS	10	50	8	50	Benzene is used in the production of many materials and products including: styrene, some types of rubbers, lubricants, dyes, drugs, synthetic detergents, insecticides, fumigants, solvents, paint removers and gasoline.
Brominated diphenylethers (PBDEs)	PHS		0.14		0.014	Flame retardants, most commonly found in polyurethane foam products and electronics. Sources include dust from treated fabrics & deteriorating foams in old furniture.
Cadmium and its compounds (depending on water hardness classes)	PHS	≤ 0.08 (Class 1)	≤ 0.45 (Class 1)	0.2	≤ 0.45 (Class 1)	Cadmium metal is used as an anticorrosive on steel, and the sulphide and selenite salts are commonly used as pigments in plastics. Cadmium compounds are also used in batteries and in the production of electric components.
		0.08 (Class 2)	0.45 (Class 2)		0.45 (Class 2)	
		0.09 (Class 3)	0.6 (Class 3)		0.6 (Class 3)	
		0.15 (Class 4)	0.9 (Class 4)		0.9 (Class 4)	
		0.25 (Class 5)	1.5 (Class 5)		1.5 (Class 5)	

Priority Substance Name	Group	AA-EQS Inland surface waters	MAC-EQS Inland surface waters	AA-EQS Other surface waters	MAC-EQS Other surface waters	Sources/applications
C10-13 Chloroalkanes	PHS	0.4	1.4	0.4	1.4	Chloroalkanes are used in widespread applications such as plasticisers in plastics (e.g. PVC), extreme pressure additives in metal working fluids, flame retardants and additives in paints.
Chlorfenvinphos	PS	0.1	0.3	0.1	0.3	Agriculture - insecticide now banned.
Chlorpyrifos (Chlorpyrifos-ethyl)	PS	0.03	0.1	0.03	0.1	Organophosphorous insecticide
1,2-Dichloroethane	PS	10	not applicable	10	not applicable	The major use of 1,2-Dichloroethane is in the production of vinyl chloride monomer.
Dichloromethane	PS	20	not applicable	20	not applicable	Widely used as a paint stripper and a degreaser, also has been used to decaffeinate coffee and tea.
Di(2-ethylhexyl)-phthalate (DEHP)	PHS	1.3	not applicable	1.3	not applicable	Used primarily as a plasticiser in many flexible PVC products. It is also used as a dielectric fluid in electrical capacitors and as a hydraulic fluid.
Diuron	PS	0.2	1.8	0.2	1.8	Used in industrial and domestic applications such as to control weed growth on railway tracks and it is on sale to the general public for the control of weeds on paths and drives.
Endosulfan	PHS	0.005	0.01	0.0005	0.004	Insecticide now banned in EU, but still used extensively in other parts of the world.
Fluoranthene	PS	0.0063	0.12	0.0063	0.12	Found in many combustion products, along with other PAHs
Hexachloro-benzene	PHS		0.05		0.05	Agriculture - no longer approved for agricultural use in the UK.
Hexachloro-butadiene	PHS		0.6		0.6	Chemical industry
Hexachlorocyclohexane (lindane)	PHS	0.02	0.04	0.002	0.02	Agriculture - insecticide now banned.
Isoproturon	PS	0.3	1.0	0.3	1.0	Agriculture - commonly used pre-emergence herbicide, now banned in UK.

Priority Substance Name	Group	AA-EQS Inland surface waters	MAC-EQS Inland surface waters	AA-EQS Other surface waters	MAC-EQS Other surface waters	Sources/applications
Lead and its compounds	PS	1.2	14	1.3	14	Lead is used in building construction, plumbing, solder, as a pigment in paint, lead-acid batteries, etc.
Mercury and its compounds	PHS		0.07		0.07	Mercury is used in the electrolytic production of chlorine and caustic soda, in batteries, fluorescent lamps, dental amalgams, as a catalyst and in explosives.
Naphthalene	PS	2	130	2	130	Naphthalene is mainly used as a precursor to other chemicals. The major sources of naphthalene in the aquatic environment are industrial effluents and oil spills.
Nickel and its compounds	PS	4	34	8.6	34	Nickel alloys are used as a plating base in chromium-plated taps and fittings used for domestic premises and some public buildings. Nickel compounds are also used as catalysts, pigments and in batteries.
Nonylphenol (4-Nonylphenol)	PHS	0.3	2.0	0.3	2.0	Used in the manufacture of non-ionic surfactants, as an additive in lubricating oils, as a component in fungicide and bactericides and it is also used in the manufacture of dyes, drugs, adhesives, rubber chemicals, phenolic resins and plasticizers. In the environment, nonylphenols arise from the degradation of the nonylphenol ethoxylates (nonionic detergents).
Octylphenol	PS	0.1	not applicable	0.01	not applicable	Similar applications as for nonylphenol.
Pentachloro-benzene	PHS	0.007	not applicable	0.0007	not applicable	A majority of the PeCB released into the environment is a result of backyard trash burning and municipal waste incineration.
Pentachloro-phenol	PS	0.4	1	0.4	1	PCP has been used primarily as a wood preservative and as a herbicide, fungicide, algaecide, insecticide, disinfectant and antimicrobial agent.

Priority Substance Name	Group	AA-EQS Inland surface waters	MAC-EQS Inland surface waters	AA-EQS Other surface waters	MAC-EQS Other surface waters	Sources/applications
Polyaromatic hydrocarbons (PAHs):	PHS					PAHs are formed during the incomplete combustion of organic material and are found as a mixture of individual compounds.
Benzo(a)pyrene	PHS	0.00017	0.27	0.00017	0.027	
Benzo(b)fluor-anthene	PHS		0.017		0.017	
Benzo(k)fluor-anthene	PHS		0.017		0.017	
Benzo(g,h,i)-perylene	PHS		0.0082		0.00082	
Indeno(1,2,3-cd)-pyrene	PHS		not applicable		not applicable	
Simazine	PS	1	4	1	4	Agriculture, horticulture and forestry - herbicide now banned in UK for non-agricultural uses.
Tributyltin compounds	PHS	0.0002	0.0015	0.0002	0.0015	Uses include wood preservation, bactericides in cooling water and in anti-fouling marine paints.
Trichloro-benzenes	PS	0.4	not applicable	0.4	not applicable	Trichlorobenzene has a variety of uses as an industrial solvent, insulating fluid, heat exchange medium, degreasing agent etc.
Trichloro-methane (chloroform)	PS	2.5	not applicable	2.5	not applicable	Used as a solvent in the pharmaceutical industry and in production of dyes and pesticides.
Trifluralin	PHS	0.03	not applicable	0.03	not applicable	Agriculture - commonly used pre-emergence herbicide.
Dicofol	PHS	Standards under review				Organochlorine former plant protection product and biocide, until recently authorised for use on fruit and vegetable crops. Possibly residual use.
Perfluorooctane sulfonic acid (PFOS)	PHS	Standards under review				Industrial chemical, used in hydraulic aviation fluids, photography, electroplating. Present in many existing products, especially textiles.
Quinoxyfen	PHS	Standards under review				Fungicide, used mainly on cereals, grape vines.
Dioxins and dioxin-like compounds	PHS	Standards under review				Dioxins: by-products of thermal combustion. PCBs: chlorinated organic compounds

Priority Substance Name	Group	AA-EQS Inland surface waters	MAC-EQS Inland surface waters	AA-EQS Other surface waters	MAC-EQS Other surface waters	Sources/applications
						formerly used to manufacture electrical equipment etc.; some also produced by combustion.
Aclonifen	PS	Standards under review				Herbicide, used on a range of arable crops.
Bifenox	PS	Standards under review				Herbicide, used to kill broadleaf weeds in cereal crops and grassland.
Cybutryne	PS	Standards under review				Biocide used as antifouling agent in coatings for boat hulls etc.
Cypermethrin	PS	Standards under review				Insecticidal pyrethroid plant protection product and biocide, used in arable farming, salmon farming, sheep dipping and wood preservation.
Dichlorvos	PS	Standards under review				Organophosphorus insecticide and biocide, used in grain/nut stores, insecticidal sprays/strips.
Hexabromo-cyclododecane (HBCDD)	PHS	Standards under review				Industrial chemical, used as flame retardant, especially in polystyrene, including insulation boards.
Heptachlor & heptachlor epoxide	PHS	Standards under review				Organochlorine insecticide, no longer authorised but secondary emissions possible.
Terbutryn	PS	Standards under review				Biocide, used especially in coatings for buildings, as preservative.
17alpha-ethinylestradiol (EE2)	EU Watch list	Standards under review				17alpha-ethinylestradiol (EE2) is widely used as the estrogenic component of oral contraceptives.
17 beta-estradiol (E2)	EU Watch list	Standards under review				17 beta-estradiol (E2) is used as the estrogenic component of contraceptives.
Diclofenac	EU Watch list	Standards under review				Diclofenac is a non-steroidal anti-inflammatory drug used to treat pain and inflammation.
Carbon-tetrachloride	CIP	Standards under review				Carbon tetrachloride was widely used as a dry-cleaning solvent, refrigerant and also in fire extinguishers.

Priority Substance Name	Group	AA-EQS Inland surface waters	MAC-EQS Inland surface waters	AA-EQS Other surface waters	MAC-EQS Other surface waters	Sources/applications
Aldrin	CIP	Standards under review				Pesticide – now banned in the EU
Dieldrin	CIP	Standards under review				Pesticide – now banned in the EU
Endrin	CIP	Standards under review				Pesticide – now banned in the EU
Isodrin	CIP	Standards under review				Pesticide – now banned in the EU
DDT total	CIP	Standards under review				Insecticide - now banned worldwide
para-para-DDT	CIP	Standards under review				Insecticide - now banned worldwide
Tetrachloro-ethylene	CIP	Standards under review				Used in dry cleaning and to degrease metal parts in the automotive and other metalworking industries.
Trichloro-ethylene	CIP	Standards under review				Commonly used as an industrial solvent.

PS = Priority substance, PHS = Priority hazardous substance, CIP = Chemical Investigation Programme
For cadmium and its compounds (No.6) the EQS values vary dependent upon the hardness of the water as specified in five class categories (Class 1:<40mg $CaCO_3$/l, Class 2: 40 to <50 mg $CaCO_3$/l, Class 3: 50 to <100 mg $CaCO_3$/l, Class 4: 100 to <200 mg $CaCO_3$/l, Class 5 ≥200 mg $CaCO_3$/l).
Where the MAC – EQS are marked as “not applicable”, the AA EQS values are considered protective against short-term pollution peaks in continuous discharges since they are significantly lower than the values derived on the basis of acute toxicity.

Look-up table for 95% confidence of failing a 95-percentile MAC standard

Number of samples	Required number of exceeding samples
4–7	>1
8–16	>2
17–28	>3
29–40	>4
41–53	>5

54–67	>6

Table 3: Chemicals monitored on the island

Chemical	Category	Monitored on the island	Notes
Alachlor	PS	✓	
Anthracene	PHS	✓	
Atrazine	PS	✓	
Benzene	PS	✓	
Brominated diphenylethers (PBDEs)	PHS		
Cadmium and its compounds (depending on water hardness classes)	PHS	✓	Unclear on what compunds are included in the monitoring programme
C10-13 Chloroalkanes	PHS		
Chlorfenvinphos	PS	✓	
Chlorpyrifos (Chlorpyrifos-ethyl)	PS	✓	
1,2-Dichloroethane	PS	✓	
Dichloromethane	PS	✓	
Di(2-ethylhexyl)-phthalate (DEHP)	PHS		
Diuron	PS	✓	
Endosulfan	PHS	✓	
Fluoranthene	PS	✓	
Hexachloro-benzene	PHS	✓	
Hexachloro-butadiene	PHS	✓	
Hexachlorocyclohexane (lindane)	PHS	✓	
Isoproturon	PS	✓	
Lead and its compounds	PS	✓	
Mercury and its compounds	PHS	✓	
Naphthalene	PS	✓	
Nickel and its compounds	PS	✓	
Nonylphenol (4-Nonylphenol)	PHS		
Octylphenol	PS		
Pentachloro-benzene	PHS		
Pentachloro-phenol	PS	✓	
Polyaromatic hydrocarbons (PAHs):	PHS	✓	Indeno(1,2,3-cd)-pyrene nalso monitored seperatly

Chemical	Category	Monitored on the island	Notes
Simazine	PS	✓	
Tributyltin compounds	PHS		
Trichloro-benzenes	PS		
Trichloro-methane (chloroform)	PS	✓	
Trifluralin	PHS	✓	
Dicofol	PHS		
Perfluorooctane sulfonic acid (PFOS)	PHS	✓	
Quinoxyfen	PHS		
Dioxins and dioxin-like compounds	PHS	✓	PCBs only, not other dioxin compounds
Aclonifen	PS		
Bifenox	PS		
Cybutryne	PS		
Cypermethrin	PS		
Dichlorvos	PS		
Hexabromo-cyclododecane (HBCDD)	PHS		
Heptachlor & heptachlor epoxide	PHS	✓	Heptachlor only
Terbutryn	PS		
17alpha-ethinylestradiol (EE2)	EU Watch list		
17 beta-estradiol (E2)	EU Watch list		
Diclofenac	EU Watch list		
Carbon-tetrachloride	CIP	✓	
Aldrin	CIP	✓	
Dieldrin	CIP	✓	
Endrin	CIP		
Isodrin	CIP		
DDT total	CIP	✓	
para-para-DDT	CIP	✓	
Tetrachloro-ethylene	CIP	✓	
Trichloro-ethylene	CIP	✓	

4. Physico-chemical status classification

4.1 Introduction

This section sets out the method for physico-chemical classification, as part of the Jersey Integrated Water Management Plan (IWMP). It is based upon a review of the proposed and adopted standards for the Water Framework Directive (WFD) in England and Wales, and France.

The standards have been adapted where appropriate and needed for the Jersey context. The note is divided as follows:

1. A summary of the English -Welsh and French standards for physico-chemical classification.
2. Recommendations for the Jersey IWMP
3. A summary of the monitoring programme requirements
4. Process for updating the classification method.

4.2 Physico-chemical classification approach

Standards from England, Wales and France

Physico-chemical standards are set at the Member State level, to reflect country specific conditions and pressures. At the EU level however, the Member States undertake an inter-calibration exercise to ensure that classifications are comparable across Member States. The quality elements for the physico-chemical classifications applied in England-Wales and in France are presented in Table 4 below.

Table 4: England-Wales and France physico-chemical parameters

England-Wales	France
Dissolved Oxygen	**Oxygen** a) Dissolved oxygen (Saturation) b) Oxygen saturation c) Biological oxygen demand (BOD) d) Carbon oxygen demand (COD)
Ammonia	**Nutrients** a) Orthophosphate b) Total phosphorous c) Ammonia d) Nitrite e) Nitrate
Soluble Reactive Phosphorus (SRP)	
pH	**Acidification (pH)**
Temperature	**Temperature**
(No salinity equivalent in England-Wales classifications)	**Salinity** a) Conductivity b) Chloride c) Sulfates

Further information on the standards can be found in UKTAG (2008, 2013a) and Ministère de l'Écologie, du Développement durable et de l'Énergie (2012). Note that there were no salinity standards in France when the guidance was updated in 2012, whilst in England and Wales, new SRP standards are being proposed (UKTAG 2013b).

The proposed revision of the SRP standard in England and Wales will generally lead to more stringent standards being adopted that are site specific, and more closely related to biological (macrophyte and diatoms) responses to SRP in rivers.

Table 5 below compares the standards from England-Wales and France. The table includes the proposed biologically-based SRP standards for England and Wales, rather than the current standards. The French physico-chemical standards also include alternatives for certain river types which would naturally fall outside the Good standards, these are summarised in Ministère de l'Écologie, du Développement durable et de l'Énergie (2012).

A comparison between the England-Wales and French standards, where applicable, shows the standards appear to be broadly similar for pH, dissolved oxygen, BOD and ammonia. The temperature standards at face value appear more stringent in the French standards compared with those for England – Wales, however, these are based on a 90th percentile value whilst the England-Wales standards are based on a 98th percentile standard, and therefore are not directly comparable.

SRP / orthophosphate standards between England-Wales and France are markedly different, which again reflects the statistical measure of mean concentrations in England-Wales and the 90th percentile value in France. Again, this does not make them directly comparable.

Table 5: Comparison of England-Wales (E/W) and French physic-chemical standards.

Quality elements (units of measure), statistical measure in England-Wales, and France	**High**		**Good**		**Moderate**		**Poor/Bad**	
	E/W	**Fr**	**E/W**	**Fr**	**E/W**	**Fr**	**E/W**	**Fr**
Dissolved oxygen (mg/l), Fr 90th	-	8	-	6	-	4	-	3
Oxygen saturation (%), E/W 10th; Fr 10th	70	90	60	70	54	50	45	30
Biological oxygen demand (mg/l)*, E/W 90th; Fr 90th	*4*	3	*5*	6	*6.5*	10	*9*	25
Carbon oxygen demand (mg/l), Fr 90th	-	5	-	7	-	10	-	15
Orthophosphate / SRP** (mg/l), E/W mean annual, Fr 90th.	25	100	50	500	135	1000	900	2000
Total phosphorous (ug/l), Fr 90th	-	0.05	-	0.2	-	0.5	-	1
Ammonia (mg/l), E/W 90th; Fr 90th	0.3	0.1	0.6	0.5	1.5	2	2.5	5
Nitrite (mg/l), Fr 90th	-	0.1	-	0.3	-	0.5	-	1
Nitrate (mg/l), Fr 90th	-	10	-	50	-	-	-	-
pH (pH)*	6 - 9	6.5 – 8.2	6 - 9	6 - 9	4.7 (lower)	5.5 – 9.5	4.2 (lower)	4.5 - 10
Temperature (non-cyprinid) (°C), E/W annual 98th; Fr 90th	20	20	23	21.5	28	25	30	28

*BOD standards set in the UK are not used in the physico-chemical classification scheme but provided here for comparison.

** England-Wales standards based on high alkalinity lowland catchments. SRP standards are illustrative and will vary from site to site based on site specific altitude and alkalinity.

*** varies from 10th percentile for low acidity and 90th percentile for high acidity in both France and England-Wales.

Jersey IWMP physico-chemical classification

One of the aims of the physico-chemical classification for the Jersey IWMP is to represent the water quality parameters which the biology responds to, without making the system over-burdensome and complex.

In light of this, the two classification systems have been reviewed. In summary, the English-Welsh system is preferred since it is simpler and more in line with previous EU standards and associated evidence bases from which the standards were developed. Whilst the French system includes a wider range of quality elements, the overall ecological classification will account for these wide quality elements using Jersey's biological monitoring such as the existing macroinvertebrate monitoring programme. This is believed to be a more effective way of monitoring the ecological status of the island.

- **Oxygen:** Dissolved oxygen can be viewed as a reasonable surrogate for other oxygen based quality elements (BOD, COD), and therefore basing a standard on dissolved oxygen only is adequate. The French dissolved oxygen standards are higher; however the English-Welsh standards are comparable with the Freshwater Fisheries Directive standards, now adopted under the WFD. In addition, the macroinvertebrate ASPT metric used on Jersey will directly monitor any responses to high BOD and COD.
- **Temperature:** The English-Welsh standards are again comparable with the Freshwater Fisheries Directive standards, and therefore are supported by the evidence base used to develop the Directive.
- **pH:** The English-Welsh and French standards are similar and therefore the English-Welsh standards are adopted here to better align with the other quality elements adopted
- **Salinity:** There are currently no standards for surface waters. Salinity risks will be assessed through the groundwater classification and risk assessments.
- **Nutrients:** England and Wales use SRP to assess eutrophication risks in surface waters. This is generally accepted as the limiting nutrient in flowing watercourses on the UK mainland, and therefore limiting SRP should limit eutrophication of watercourses in many circumstances. In France, a wider suite of nutrients are assessed. Mainstone (2010) mentions that the relative influence of phosphorus and nitrogen in freshwater eutrophication processes is a continuing topic of scientific debate, although many studies suggest a subordinate role for nitrogen relative to phosphorus in rivers.

Therefore, the adoption of the England and Wales proposed SRP standard as a minimum is appropriate for Jersey. The biological monitoring programmes as part of the wider ecological classification will indirectly monitor the levels of SRP as well as the broader spectrum of nutrients.

Mainstone (2010) however does explain that combined enrichment from nitrogen and phosphorus leads to a more acute biological response compared with the enrichment from a single nutrient source. Nitrate is an important source of nutrients in Jersey's surface waters, coastal waters and groundwaters; the Nitrates Directive standard is occasionally exceeded, and algal blooms have historically impacted St Aubin's Bay. CREH (2007) have shown that the dominant component of dissolved available inorganic nitrogen is nitrate.

Therefore, adopting an additional nitrate standard would help reduce the impacts of combined enrichment and support wider initiatives (Nitrates Directive, Diffuse Pollution Project, St Aubin's Bay investigations) in Jersey to monitor and reduce nitrogen enrichment. The adoption of the French standards would not be onerous since the Good standard is equivalent to the Nitrates Directive standard of 50 Mg/l, and the quality element is already widely monitored around the island.

Summary of physico-chemical classification approach for the island of Jersey

- Adopt the England and Wales physico-chemical standards.
- Include the French physico-chemical nitrate standard in addition

4.3 Monitoring to support classification

Current extent of monitoring in Jersey waters

The Water Quality Management Information System (WQMIS) contains water quality sampling data at 270 surface water monitoring sites, spread across all 8 Water Management Areas (WMAs). All major flowing watercourses are monitored, although a small number of small watercourses which do not flow all year round are currently not.

An analysis of sites which contain data for the physico-chemical parameters which have been recently monitored (2008 – 2012) shows that this includes 85 stream monitoring sites across the island, with sampling frequency generally of 4 samples per year as a minimum. Table 6 below shows the number of elements monitored at the 85 sites. Nitrates, pH, ammonia and temperature are widely monitored, although the other elements less so, particularly orthophosphate / SRP.

Table 6: Number of physico-chemical element monitoring locations

Physico-chemical element	No sites where it is monitored out of the 85
Oxygen saturation (%)	35
Orthophosphate / SRP (mg/l)	16
Ammonia (mg/l)	59
Nitrate (mg/l)	82
Temperature	58
pH	84

Monitoring programme and recommendations

Monitoring can be divided into three types, surveillance, operational and investigative monitoring.

- Surveillance monitoring is used to validate risk assessments and determine long-term changes.
- Operational monitoring is used to determine the status of water bodies identified as being at risk and how this changes as result of the programme of measures.
- Investigative monitoring is used to establish reasons for failure. The recommended monitoring approach for each of these types is summarised below. In addition, notes on SRP monitoring are also provided.

Recommendations are provided below for future plans and monitoring. It is acknowledged that in some cases, it will not be possible to achieve the recommendations set below, particularly in the current planning cycle but also in future monitoring cycles (due to resource constraints). For the first IWMP, gaps in monitoring have been filled through the use of proxy sites and expert judgement (see separate surface water classification summary method statement for more information). A confidence rating has been applied to reflect these circumstances. Where no monitoring data exists to draw upon, a Not Assessed classification is assigned.

Surveillance monitoring

Surveillance monitoring should be undertaken to establish the baseline for physico-chemical elements. Environment Agency (2013) states that a statistically robust monitoring regime requires a minimum of 12 samples within the last three years, ideally 36 samples – this criteria matches the current minimum frequency of monitoring on the island. Therefore in future plans, it is recommended that a monthly monitoring programme is undertaken for a period of 12 months, for any quality elements which are not monitored. This would fully capture annual hydrological and management practice cycles, whilst also achieving sufficient robustness. In addition to this, it is recommended that event-based monitoring is also undertaken to capture runoff peaks of substance concentrations which could otherwise be missed from the routine monitoring. This monitoring should extend to a minimum of one surface water location in each water body.

Operational monitoring

Monitoring frequency of those substances should reflect the inter-annual variability of the substance's concentration, and therefore substances which vary less over time can be monitored less frequently. This monitoring should extend to a minimum of a single groundwater and surface water location in each water body.

At present it is recommended that sampling frequency is maintained at monthly intervals at new sites until there is sufficient evidence and confidence to reduce the sampling frequency without impacting on the robustness of the dataset. If sufficient evidence is provided, the sampling could be reduced to bi-monthly as recommended by (WCA 2004) or to 12 samples within 3 years suggested as a minimum requirement by Environment Agency (2013). The latter is also the minimum sampling frequency applied at most sites on the island of Jersey.

Investigative monitoring

Investigative monitoring is used to establish reasons for failure. There have already been a large number of investigative monitoring projects on the island of Jersey e.g. Diffuse Pollution Project and CREH (1997, 2006, 2007); . It would be expected that similar projects would be initiated to determine new reasons for failure that become apparent. This monitoring would also be expected to investigate acute failures of the standards, under normal procedures by the Department of Environment and enforced through the Water Pollution Law (Jersey) 2000.

SRP monitoring

Atkins (2013) highlighted that there are two principle issues with the current approaches to the determination of SRP in the UK:

- Sample pre-treatment might not be well controlled leading to data inconsistency between samples. A lack of uniformity in approaches to sample handling is likely to lead to bias and irreproducibility
- Fitness for purpose and variability of analytical methods: The WFD standard is for SRP, not Reactive Phosphorous or orthophosphate (as named in France). The three are different although the latter two terms are widely and mis-leadingly used to infer SRP.

Therefore, it is important on the island of Jersey that the correct monitoring protocols are used to ensure that SRP is measured rather than another form of phosphorous. SRP is determined using the phosphomolybdenum blue colorimetric method. The samples are filtered using a filter not smaller than 0.45 μm pore to remove gross particulate matter. (UKTAG, 2013a).

4.4 Process for updating the classification method

The method may need to be revised when there is improved scientific understanding, either through research and monitoring, or the benefit of experience in their practical application shows that existing standards are not as well matched to ecological quality as they could be, for example in the case of the proposed SRP standards.

It is recommended that method is reviewed at the beginning of each IWMP cycle, to ensure each cycle uses the best available standards. This could include the inclusion of additional quality elements. To date, an update on French standards have not been published although Ministère de l'Écologie, du Développement durable et de l'Énergie (2012) states that they would be revised in 2014. A proposal for revised standards in England and Wales has been published by UKTAG (2013a, 2013b). The proposed revisions include changes to SRP, acidification, specific pollutant and groundwater standards. Standards which are not discussed in UKTAG (2013a, 2013b) have not had revisions proposed and can be found in UKTAG (2008).

4.5 References

Atkins (2013) Phosphate determination in future investigation programme. Internal technical note to support the UK Chemical Investigation Programme (draft)
UKTAG (2008) UK environmental standards and conditions (Phase 1) Final report (SR1–2006)
UKTAG (2013a) Updated Recommendations on Environmental Standards River Basin Management Phase 3(2015-21)
UKTAG (2013b) Phosphorous standards for rivers - Updated Recommendations.
Environment Agency (2013) Permitting of hazardous pollutants in discharges to surface waters. Operational instruction 17_13.
WCA (2004) Scoping study to define the status of Jersey's freshwaters according to the requirements of the WFD. A report for the States of Jersey, Environment Division.
CREH (1997) Stream water quality on the island of Jersey. A report for the States of Jersey, Public Services Department.

CREH (2006) An Assessment of Surface Water Quality at Sites of Special Interest and in the Plémont, St Brelade and Waterworks Valley Catchments on the Island of Jersey. A report for the States of Jersey Environment Division
CREH (2007) Nutrient flux source apportionment for St Aubin’s Bay, Jersey, 2007. A Report to Transport and Technical Services, States of Jersey.
Mainstone, C.P. (2010) An evidence base for setting nutrient targets to protect river habitat. Natural England Research Reports, Number 034. Natural England, Sheffield.
Ministère de l’Écologie, du Développement durable et de l’Énergie (2012) Guide technique Évaluation de l’état des eaux de surface continentales (cours d’eau, canaux, plans d’eau)

5. Specific Pollutant status classification

5.1 Introduction

Standards for the most polluting substances, known as Priority Substances or Priority Hazardous Substances are derived at an EU level and will be listed in Annexes IX and X of the WFD. In addition, Annex VIII of the WFD requires Member States to identify and derive Environmental Quality Standards (EQSs) for other pollutants that are discharged to water in 'significant quantities'. These are called Annex VIII substances or, more commonly, Specific Pollutants.

This section sets out the outline method statements for a Specific Pollutant classification, as part of the Jersey Integrated Water Management Plan (IWMP). It is based upon methods adopted for the Water Framework Directive (WFD) in England and Wales, France.

The standards have been adapted where appropriate and needed for the Jersey context. The note is divided as follows:

1. A summary of the English -Welsh and French standards for Specific Pollutants.
2. Recommendations for the Jersey IWMP
3. A summary of the monitoring programme requirements
4. Notes on revised standards

5.2 Specific pollutant classification approach

Standards from England - Wales

The selection of Specific Pollutants in England and Wales and their standards has undergone a comprehensive review process, summarised in Environment Agency (2007). A candidate list of chemicals ('Universe of Chemicals') was drawn up based on existing regulatory obligations and commitments as well as national initiatives such as the Environment Agency's reviews on pharmaceuticals and veterinary medicines. The Environment Agency's Chemical Screening and Prioritisation method was then used to prioritise substances for consideration for EQS development. It is a method that meets the requirements of the IMPRESS guidance (EC 2003). Over 300 chemicals were originally reviewed from which 19 were then assigned standards. These were: Ammonia; Arsenic; Chlorine; Chromium(III); Chromium(VI); Copper*; Cyanide; Cypermethrin; Diazinon*; 2,4-dichlorophenol*; 2,4-dichlorophenoxyacetic acid (2,4-D); Dimethoate; Iron; Linuron; Mecoprop; Permethrin*; Phenol; Toluene*; and Zinc *

The UKTAG has reviewed standards for 11 Specific Pollutants (UKTAG 2013) for which it had previously recommended the continued use of old standards (see chemicals with stars (*) in the above list). The updated review has also developed standards for an additional 10 chemicals as follows: Benzyl butyl phthalate; Carbendazim; Chlorothalonil; 3,4-dichloroaniline; Glyphosate; Manganese; Methiocarb; Pendimethalin; Tetrachloroethane; and Triclosan.

Table 8 later in this document provides the current standards of the Specific Pollutants. This is based on Annual Average (AA) or Maximum Allowable Concentration (MAC) over the sampling period used to classify the water body.

Standards from France

A similar review process was undertaken in France, following the IMPRESS guidance (EC 2003), with 9 chemicals identified as Specific Pollutants (also see Table 8): *Chlortoluron; Oxadiazon; 2,4 MCPA*; Linuron; 2,4 D; Arsenic; Chromium; Copper; and Zinc.
Five of the specific pollutants are present within the England and Wales list; however the three herbicides *shown in italics* are not. To date, an update on French standards have not been published although Ministère de l'Écologie, du Développement durable et de l'Énergie (2012) states that they would be revised in 2014.

Standards for the Jersey IWMP

The Water Pollution Law (Jersey) 2000 provides a means to control pollution in Jersey waters, including the monitoring and the classification of waters and the setting of quality objectives for classified waters. Under the Law, pollution includes the introduction directly or indirectly into controlled waters of any substance, or energy, where its introduction results or is likely to result in harm to any living resource or aquatic ecosystem.

The list of specific pollutants in Table 7 and Table 8 are based on a comprehensive review of substances identified as harmful to the environment, and which are present or are legacy substances in England, Wales, and France. Therefore, this list is complimentary in maintaining the Water Pollution Law (Jersey) 2000; particularly regarding the control of high risk substances (schedule 2).

It is recommended that Jersey should make best use of the thorough review of Specific Pollutants undertaken by England and Wales, and France rather than undertake a fresh review following EC (2003). The similarities in land-use and industry between Jersey and neighbouring countries would suggest that the England and Wales list of specific pollutants (see Table 8), with the inclusion of the three additional herbicide chemicals assessed in France (Table 9) would make a comprehensive initial list. This list could then later be scaled back through a rapid review of known chemicals not used on the island, a review Jersey Water's risk assessments, and through surveillance monitoring described below.

In England and Wales, the first cycle of River Basin Management Plans (RBMP1) based the MAC on the 'absolute' maximum concentration measured during the sampling period. However, this approach can lead to instances where a one-off acute pollution incident or sampling error biases, potentially causing a failure of the standards. This can ultimately mean that the wrong decisions or mitigation measures to secure compliance are initiated.

UKTAG (2013) have recommended that for RBMP2, England and Wales should adopt a risk-based rather than absolute approach for MAC. This would use the 95-percentile, and the number of failed samples required to give 95% confidence that a 95-percentile is failed. The number of samples required to assign a 'Fail' for a MAC is shown in Table 8 below. This approach is pragmatic and ensures that action is undertaken when there is 95% confidence of failure.

It does not however mean that MAC exceedances should be ignored when we are not 95% confident of a failure. Acute failures would be expected to be investigated under normal procedures by the Environment and Planning Department and enforced through the Water Pollution Law (Jersey) 2000.

5.3 Monitoring to support classification

Current extent of monitoring in Jersey waters

The Water Quality Management Information System (WQMIS) contains water quality sampling data at 270 surface water monitoring sites, spread across all 8 Water Management Areas (WMAs). All major flowing watercourses are monitored, although a small number of small watercourses which do not flow all year round are currently not.

An analysis of sites which contain data for the specific pollutant parameters which have been recently monitored (2008 – 2012) shows that this includes 73 monitoring sites (marine, groundwater and surface water) across the island, with sampling frequency generally of 2 - 3 samples per year as a minimum. Table 7 focuses on surface water and marine sampling showing that a total of 12 out of the 32 specific pollutants (from France and England-Wales combined) are monitored in surface waters, and 8 of the 32 are monitored in the marine environment.

Table 7: Number of specific pollutant element monitoring locations

Chemical	Monitored	Surface water	Marine / Bathing	Notes
Arsenic	✓	3		
Chlorine	✓	1		
chromium(III)	✓	3		Total chromium measured
chromium(VI)	✓	3		Total chromium measured
Cyanide (Free)				Complex and total measured in groundwater
Cypermethrin				
2,4-dichlorophenoxyacetic acid (2,4-D)	✓	1	19	
Dimethoate				
Iron	?	3	8	Unsure if dissolved or iron measured
Linuron	✓	1	18	
Mecoprop	✓	1	19	
Phenol				Measured in groundwater
Benzyl butyl phthalate				
Carbendazim				
Chlorothalonil				Measured in groundwater
Copper	✓	4	5	
Diazinon				Measured in groundwater
3,4-dichloroaniline				
2,4-dichlorophenol				
Glyphosate				
Manganese	✓	4	29	
Methiocarb				
Pendimethalin				Measured in groundwater
Permethrin				
Tetrachloroethane (TCE)				
Triclosan				
Toluene				
Zinc	✓	4	5	
Chlortoluron	✓	1	18	
Oxadiazon				
2,4 MCPA				

Note – Ammonia excluded from the analysis which is widely monitored across the island

Monitoring programme and recommendations

Monitoring can be divided into three types: surveillance; operational; and investigative monitoring.

- Surveillance monitoring is used to validate risk assessments and determine long-term changes.
- Operational monitoring is used to determine the status of water bodies identified as being at risk and how this changes as result of the programme of measures.
- Investigative monitoring is used to establish reasons for failure.

Recommendations are provided below for future plans and monitoring. It is acknowledged that in some cases, it will not be possible to achieve the standards set below, particularly for the current IWMP planning cycle; in this case, gaps in monitoring have been filled through the use of proxy sites, expert judgement (see separate surface water classification summary method statement for more information), and existing risk assessments by Jersey Water and States of Jersey (WCA 2004). A confidence rating has been applied to reflect these circumstances.

Surveillance monitoring

Surveillance monitoring should be undertaken to establish the baseline for the presence, in significant quantities, of substances found in Table 8 and Table 9. The presence of these substances in significant quantities in a certain water body would mean that they would be included under the operational monitoring for that water body. Surveillance monitoring can use current risk assessments by Jersey Water and States of Jersey (WCA 2004) for prioritisation. The risk assessments found a range of chemicals which were not present in significant quantities on the island.

Based on WCA (2004), surveillance monitoring should be undertaken only for those substances which are not currently monitored by the Jersey Department of Environment in each water body. It is also recommended that to fully capture available data, this includes substances monitored by Jersey Water as part of their own risk based sampling of effluent and raw water.

WCA (2004) recommended that surveillance monitoring should be undertaken for 3 – 6 months, however Environment Agency (2013) states that a statistically robust monitoring regime requires a minimum of 12 samples within the last three years, ideally 36 samples. Therefore, it is recommended that a monthly monitoring programme is undertaken over a whole year. This would fully capture annual hydrological and management practice cycles, whilst also achieving sufficient robustness. In addition to this monthly monitoring, it is recommended that event-based monitoring is also undertaken to capture runoff event based peaks of substance concentrations, which could otherwise be missed from the routine monitoring. This monitoring should extend to a minimum of a single surface water location in each water body.

Operational monitoring

Operational monitoring should be based on those chemicals which are present in significant concentrations within the water body. Monitoring frequency of those substances should reflect the inter-annual variability of the substance’s concentration, and therefore substances which vary less over time can be monitored less frequently. This monitoring should extend to a minimum of a single surface water location in each water body.

Ideally, 36 water samples would be collated in 3 years (i.e. each month) however with sufficient evidence and justification; sampling could be reduced to bi-monthly as recommended by (WCA 2004). As a minimum it is recommended that sampling frequency is maintained to reflect the Environment Agency standards of 12 samples within 3 years. This is broadly in line with the Directive on Environmental Quality Standards, which sets guideline monitoring of “every three years” in the water column.

Where there was no monitoring data of a chemical, the risk assessments were used to classify a chemical, but with a low confidence.

Investigative monitoring

Investigative monitoring is used to establish reasons for failure. There have already been a large number of investigative monitoring projects on the island of Jersey e.g. CREH (1997, 2006); it would be expected that similar projects would be initiated to determine new reasons for failure that become apparent.

This monitoring would also be expected to investigate acute failures of the chemical standards, under normal procedures by the Planning and Environment Department and enforced through the Water Pollution Law (Jersey) 2000.

5.4 Process for updating the classification method

The method may need to be revised when there is improved scientific understanding through research and monitoring, or where the benefit of experience in their practical application shows that existing standards are not as well matched to ecological quality as they could be.

It is recommended that standards are reviewed at the beginning of each IWMP cycle, to ensure each cycle uses the best available standards. This could include the removal or inclusion of additional substances.

5.5 References

CREH (1997) Stream water quality on the island of Jersey. A report for the States of Jersey, Public Services Department.

CREH (2006) An Assessment of Surface Water Quality at Sites of Special Interest and in the Plémont, St Brelade and Waterworks Valley Catchments on the Island of Jersey. A report for the States of Jersey Environment Division

Environment Agency (2007). Wilkinson H, Sturdy L, Whitehouse P. Prioritising chemicals for standard derivation under Annex VIII of the Water Framework Directive. SC040038/SR

Environment Agency (2013) Permitting of hazardous pollutants in discharges to surface waters. Operational instruction 17_13.

European Commission (2003) Analysis of Pressures and Impacts. Guidance Document No.3

Ministère de l'Écologie, du Développement durable et de l'Énergie (2012) Guide technique Évaluation de l'état des eaux de surface continentales (cours d'eau, canaux, plans d'eau)

UKTAG (2013) Updated Recommendations on Environmental Standards River Basin Management Phase 3(2015-21)

WCA (2004) Scoping study to define the status of Jersery's freshwaters according to the requirements of the WFD. A report for the States of Jersey, Environment Division.

Table 8: England and Wales specific pollutants

Specific pollutants	Standard	AA-EQS Inland surface waters (µg/l)	MAC-EQS Inland surface waters (µg/l)	AA-EQS Other surface waters (µg/l)	MAC-EQS Other surface waters (µg/l)	Sources/applications
Ammonia	Original	600 (90th percentile, total ammonia, lowland high alkalinity standard)	-	21 (un-ionised ammonia)	-	
Arsenic	Original	50	-	25	-	
Chlorine	Original	2	5	-	10	
chromium(III)	Original	4.7	32	-	-	
chromium(VI)	Original	3.4	-	0.6	32	
Cyanide ("Free" i.e. µg/l of HCN/l)	Original	1	5	1	5	
Cypermethrin	Original	0.0001	0.0004	0.0001	0.00041	
2,4-dichlorophenoxyacetic acid (2,4-D)	Original	0.3	1.3	0.3	1.3	
Dimethoate	Original	0.48	4	0.48	4	
Iron	Original	1000	-	1000	-	
Linuron	Original	0.5	0.9	0.5	0.9	
Mecoprop	Original	18	187	18	187	

Specific pollutants	Standard	AA-EQS Inland surface waters (µg/l)	MAC-EQS Inland surface waters (µg/l)	AA-EQS Other surface waters (µg/l)	MAC-EQS Other surface waters (µg/l)	Sources/applications
Phenol	Original	7.7	46	7.7	46	
Benzyl butyl phthalate	New	7.5	51	0.75	10	PVC plasticiser occurring in a wide range of industrial and domestic products.
Carbendazim	New	0.15	0.7			Fungicide used in horticulture and agriculture.
Chlorothalonil	New	0.035	1.2			Fungicide used in agriculture, horticulture and amenity turf.
Copper	Revised	1µg/l bioavailable	-	3.76µg/l dissolved, where DOC ≤ 1 mg/l) or 3.76 + (2.677 x ((DOC/2) - 0.5)) µg/l dissolved where DOC > 1mg/l	-	Widespread use in domestic and industrial applications.
Diazinon		0.01	0.02	0.01	0.26	Organophosphate insecticide, with agricultural, horticultural and veterinary uses (sheep dip).
3,4-dichloroaniline	New	0.2	5.4	0.2	5.4	Industrial intermediate
2,4-dichlorophenol	Revised	4.2	140	0.42	6	Industrial intermediate
Glyphosate	New	196	398	196	398	Herbicide
Manganese	New	123µg/l bioavailable				Metal naturally occurring in the environment. Manganese is mainly used in alloys production.
Methiocarb	New	0.01	0.77			Carbamate insecticide and molluscicide.
Pendimethalin	New	0.3	0.58			Agricultural herbicide

Specific pollutants	Standard	AA-EQS Inland surface waters (µg/l)	MAC-EQS Inland surface waters (µg/l)	AA-EQS Other surface waters (µg/l)	MAC-EQS Other surface waters (µg/l)	Sources/applications
Permethrin	Revised	0.001	0.01	0.0002	0.001	Pyrethroid insecticide, including some household uses.
Tetrachloroethane (TCE)	New	140	1848			Industrial solvent and intermediate.
Triclosan	New	0.1	0.28	0.1	0.28	Biocide (antibacterial); widely used in domestic products and personal care products.
Toluene	Revised	74		74		Industrial solvent and intermediate
Zinc	Revised	11.9µg/l bioavailable		7.9µg/l dissolved		Widespread occurrence in domestic and industrial applications.

Where the MAC – EQS are marked as “not applicable”, the AA EQS values are considered protective against short-term pollution peaks in continuous discharges since they are significantly lower than the values derived on the basis of acute toxicity.
"Bioavailable" means the fraction of the dissolved concentration of copper likely to result in toxic effects as determined using the Metal Bioavailability Assessment Tool. "DOC" means the annual mean concentration of dissolved organic carbon in mg/l.

Table 9: Specific pollutants from France in RBMP 1

Specific pollutant	MAC (ug/l)
Chlortoluron	5
Oxadiazon	0.75
2,4 MCPA	1
Linuron	1.5
2,4 D	0.1
Arsenic	Baseline + 4.2
Chromium	Baseline + 3.4
Copper	Baseline + 1.4
Zinc (>24 mg/l CaCO3/l)	Baseline + 7.8

Table 10: Look-up table for 95% confidence of failing a 95-percentile MAC standard

Number of samples	Required number of exceeding samples
4–7	>1
8–16	>2
17–28	>3
29–40	>4
41–53	>5
54–67	>6

6. Hydromorphology status classification

6.1 Introduction

This section sets out the method used for the hydromorphology classification of surface waters (streams and reservoirs) and coastal water bodies under the Jersey Integrated Water Management Plan (IWMP). The EU approach is described, followed by recommendations for the States of Jersey.

6.2 EU approach

Morphology - Heavily Modified and Artificial Water Bodies

EU Member States are required to designate Heavily Modified / Artificial Water Bodies (HM/AWB) under the Water Framework Directive (WFD). A HMWB is defined in the WFD as a "body of surface water which as a result of physical alterations by human activity is substantially changed in character" (European Commission, 2000). Further clarification is given in Common Implementation Strategy (CIS) Guidance Note 4 (CIS 4, Europa, 2003) and (Environment Agency 2009) which state that for a water body to be designated as heavily modified, it must be:

- Physically altered by human activity;
- Substantially changed in character (i.e. both a large and long-term change);
- Designated under Article 4(3) of the WFD (i.e. it must be formally designated).

A water body can only be formally designated as heavily modified if the changes to its hydromorphological character needed to deliver good surface water status **would have a significant adverse impact on one or more of a series of 'uses'.** The UKTAG guidance (UKTAG 2008) consolidates the Article 4(3) uses further into four main groups (with the wider environment considered in all cases):

1. navigation, including port facilities, or recreation;
2. activities associated to water storage;
3. water regulation, flood protection or land drainage; or
4. other equally important sustainable human development activities.

The 'wider environment' is considered to include the natural and human environment including archaeology, heritage and landscape. Specifically, this includes designated sites (including, those for nature conservation and landscape designations), Scheduled Monuments and listed structures. In addition, significant local factors which would be likely to cause implementation of the measure being stopped at a later date are also considered.
The important sustainable human development activities cover a large number of activities, including fishing, coastal protection, transportation, infrastructure, non-drinking water supply and mining. The top two activities in Member States (Ecologic Institute 2009) are urbanisation and agriculture (including forestry).

The target condition for HMWB set by the WFD is Good Ecological Potential (GEP). A water body is at GEP when there are '*only slight changes in the values of the relevant biological quality elements as compared to the values found at Maximum Ecological Potential (MEP)*' (Annex V, European Commission, 2000). The MEP is considered as the reference conditions for HMWBs. It describes the best approximation to a natural aquatic ecosystem that could be achieved given the constraints set by the requirements of the HMWB's use.
Two approaches emerged for setting GEP, referred to here as the 'CIS 4 Approach' and the 'Prague Approach' (Ecologic Institute 2009). The 'CIS 4 Approach' is based on setting targets for 'biological quality elements' in the form of MEP. The MEP for HMWBs relates to the values of biological quality elements after all mitigation measures have been implemented that do not have a significant adverse effect on the use. GEP represents a state in which the ecological potential of a water body is falling only slightly short of MEP without significant adverse effects on the wider environment or on the relevant water use or uses.
The 'Prague approach' is more pragmatic; rather than setting a target defined in terms of biology it is based solely on an assessment of mitigation measures. It starts by identifying all mitigation measures that would lead to ecological improvement, but would not compromise either the uses of a HMWB or the wider environment. Then all measures are excluded that, in combination, are predicted to deliver only slight ecological improvement.

GEP is then defined as the biological values that are expected from implementing the remaining mitigation measures. Hence only measures that are predicted to lead to significant improvements are implemented in attaining GEP. MEP would be reached if all measures were in place which don't have a significant adverse effect on use; both those that lead to slight and significant ecological improvements.

The Environment Agency, as the competent authority for the delivery of the WFD in England and Wales, elected to adopt the 'Prague Approach' for determining GEP, at least for the first round of River Basin Management Plans. Generic checklists of mitigation measures appropriate to groupings of the uses set out in Article 4(3) were developed (UKTAG, 2008). The group headings were: Ports and Harbours, Impoundments for Water Storage and Supply, Inland Navigation and Flood Risk Management. These checklists are the backbone of a national programme to determine the status of HMWBs across England and Wales. They are being used to assess each HMWB to determine:

- which mitigation measures need to be 'in place' on a HMWB for it to achieve GEP;
- which of those mitigation measures are already 'in place', and;
- which of those mitigation measures are 'not [already] in place'.

The outcome of this assessment is recorded in the Annex C tables of each of the England and Wales RBMPs as a list of measures 'in place' and 'not in place' for a HMWB. The hydromorphological characteristics of a water body are deemed to support the achievement of GEP or better where all mitigation measures on the relevant checklists relevant to the identified impacts have been implemented except those which:

1. are not practicable given the characteristics of the water body;
2. have a significant adverse impact upon the use; or
3. have a significant adverse impact upon the wider environment.

An economics test also follows, with measures taken forwards which are determined to be cost beneficial.

Hydrology - Water resource assessment

Note that the pressures, impacts and mitigation measures described above broadly reflect physical pressures, not hydrological pressures which are addressed separately in England and Wales under a quantitative water resource assessment process, see the Environmental Flow Indicator (EFI) description for more information (Environment Agency 2013).

High status test

Under the Water Framework Directive (WFD), the hydromorphological quality elements are considered to support the biological quality elements to Good Ecological Status (GES). These hydromorphological quality elements are hydrology – the quantity and dynamics of flows, currents and wave exposure; and morphology – the structure and substrate of rivers, lakes, reservoirs and inter-tidal zone. In effect, hydromorphology does not drive the classification to GES, however it becomes important when considering High Status.

In order for a water body to be classified as High status, two hydromorphology requirements must be met:

1. A hydrological/tidal regime that reflects totally, or near totally undisturbed conditions
2. Morphological conditions that reflect totally, or near totally undisturbed conditions

6.3 Recommendations for States of Jersey

Morphology - Heavily Modified and Artificial Water Bodies

The process of designating HM/AWBs in EU member states, and setting mitigation measures has led to significant inconsistency across Europe and the development of overly-complex tools and processes. In addition, water bodies which are not designated do not have a mitigation measure list, even though they may equally require measures to support GES.

Therefore it is recommended that the States of Jersey does not adopt the HM/AWB designation process. Instead, it would be more pragmatic to accept that all catchments have a degree of modification, and that the IWMP should seek to address the physical mitigation measures in all catchments, where appropriate and where there is a case to do so, related to specific features of interest.

Table 11 below outlines a list of pressures, impacts and mitigation measures which can be used to classify pressures on the island and then develop suitable mitigation measures.

Table 11: Pressures, impacts and mitigation measures.

Pressure (physical modification)	Potential Impacts	Mitigation Measures
Bank & Bed reinforcement / in-channel structures Hard protection e.g. Steel piling, vertical walls and gabion baskets. Includes hard bank protection in a state of disrepair.	Loss of riparian zone / marginal habitat / loss of lateral connectivity / loss of sediment input	Removal of hard bank reinforcement / revetment, or replacement with soft engineering solution
		Protect and enhance ecological value of marginal aquatic habitat, banks and riparian zone
		Protect and restore historic aquatic habitats
	Loss of sediment continuity (lateral) - build up of sediment in the channel	Removal of hard bank reinforcement / revetment, or replacement with soft engineering solution
		Protect and enhance ecological value of marginal aquatic habitat, banks and riparian zone
		Protect and restore historic aquatic habitats
Bank & Bed reinforcement / in-channel structures Dams, sluices, weirs and gravel traps	Loss of biological continuity - interference with fish population movements	Operational and structural changes to sluices and weirs
		Install fish passes
	Adverse impacts on the level regime necessary to maintain lake habitats and their associated aquatic plants and animals in the impounded water body	Ensure the seasonal pattern of water levels during each year is managed so as to enable the establishment and retention of aquatic plant and animal communities in the shore zone of the impoundment.
	Loss of sediment continuity (longitudinal) - build up of sediment upstream, reduced bedload downstream	Removal of structure
Channel and shoreline alteration Realignment / re-profiling / regrading	Loss of morphological diversity and habitat	Retain marginal aquatic and riparian habitats
		Increase in-channel morphological diversity, e.g. install in-stream features; 2 stage channels
Channel Alteration Culverts	Loss of morphological diversity and habitat	Re-opening existing culverts
		Alteration of channel bed
	Continuity	Re-opening existing culverts
		Alteration of channel bed
Floodplain and shoreline flood protection modification Flood banks and flood walls	Loss of riparian zone / marginal habitat / loss of lateral connectivity / loss of sediment input	Flood bunds (earth banks)
		Set-back embankments (a type of managed retreat)
		Improve floodplain connectivity

Pressure (physical modification)	Potential Impacts	Mitigation Measures
Operations and maintenance Sediment management (including dredging), removal/clearance of urban trash and woody debris	Direct loss of / impact on aquatic habitats / hydromorphology	Sediment management strategies (develop and revise) which could include a) substrate reinstatement, b) sediment traps, c) allow natural recovery minimising maintenance, d) riffle construction, e) reduce all bar necessary management in flood risk areas
	Transfer of fine sediment downstream / prevention of shoreline sediment migration	*See above*
Operations and maintenance Vegetation control	Transfer and establishment of alien invasive species	Appropriate techniques to prevent transfer of invasive species e.g. appropriate training of operational staff
Deposition of material	Smothering of existing floral and faunal and habitats; Alteration of coastal processes; Alteration of natural sediment dynamics; Alteration of bathymetry	Sediment management strategies
Urbanisation	Changes to vegetation, hydrology and sediment supply	Educate landowners on sensitive management practices
Land drainage activities Pipes, inlets, outlets and off-takes	Hydromorphological alterations of water and sediment inputs through artificial means	Appropriate techniques to align and attenuate flow to limit detrimental effects of these features
Land drainage activities Artificial water level management	Manipulation of water levels resulting in loss of habitats and access to habitats, increased erosion and impacts on riparian habitats and vegetation (at low water level), drowning of riparian habitats and vegetation (at high water level)	Appropriate water level management strategies, including timing and volume of water moved
Boat Movement Surface water disturbance and turbulence created by passage of hull	Bed scour / Sediment mobilisation / macrophyte disturbance (propeller action)	Lateral zoning to concentrate boats within a central track
	Transfer and establishment of alien invasive species	Awareness raising / information boards (invasive species)
Other navigation structures Maintenance areas / docks / dry docks / marinas / slipways / rowing steps	Invasive species transfer	Awareness raising / information boards (invasive species)
	Source of fine sediment / deposition of fine sediment	Awareness raising / information boards (boat wash / sources of fine sediment)

The modification pressures have been spatially delineated on the island so that the total length, area and number of pressures can be summarised for each catchment. In addition, each catchment water body and each coastal water body has been assigned a morphological pressure severity rating of slight, moderate or severe and a confidence level to understand the certainty (high, medium, low) that there is a problem to solve.

This will allow a focus of measure implementation on pressures which have the highest severity and greatest certainty of impact, and a focus of investigative monitoring to increase confidence of an impact where there is low certainty.

Following the 'Prague approach' it is recommended that all pressures are excluded that, in combination, are predicted to only have a slight impact on the catchments or where measures would compromise economically important Protected Areas (in effect this is similar to the HM/AWB adverse impact on use approach). Measure implementation would then go through an additional economics test.

The information required to delineate the physical pressures was captured from:

1. Spatial data on land use and water courses
2. Consultation with States of Jersey representatives.

Hydrology - water resource assessment

The Planning and Environment Department have established a permitting and licensing system for water resources but do not currently undertake integrated quantitative assessments at a water body or larger scale. **Establishing a fully integrated water resources assessment framework and associated 'tools' goes beyond what is achievable in the first IWMP**. What has been undertaken for the first IWMP is a conceptual water resource assessment which splits the hydrological impact into slight, moderate or severe. This is considered a first-pass based on available information. In the first IWMP we will be recommending that this situation is improved upon by data gathering, data management (database) and assessment so that a more robust water resource assessment can be undertaken in future iterations of the Plan. We will be providing high level recommendations for improving hydrological flow data, monitoring and data management through the monitoring strategy as part of the first IWMP.

The method described here applies to surface waters. Potential impacts from groundwater abstractions on surface water flows are based on experience-based thresholds, used for many years in Environment Agency Anglian Region. In the groundwater method these impacts are averaged at the scale of the groundwater body, but in the surface water method they are applied at the water body scale. The key threshold is that if abstraction is >40% of recharge then it is considered likely that impacts on river flows and dependent ecology will occur.

1. **Slight** – the hydrological regime is close to natural with impact limited to modifications in land drainage and land-use, and/or groundwater abstraction within the water body is less than 40% of long term average recharge.
2. **Moderate** – the hydrological regime mimics natural response, although depressed by groundwater abstractions (greater than 40% of long term average recharge) and/ or public water supply surface water abstractions.
3. **Severe** – the hydrological regime is modified by a reservoir, significantly altering the quantity and dynamics of flow and/or groundwater abstractions are greater than 40% of long term average recharge and there is evidence of low flow ecological stress exacerbated by abstraction.

A conceptual example of these hydrological impact scenarios is provided in Figure 3. Similarly to the physical pressures – the severity of impact would be used to prioritise physical mitigation measures within the catchments.

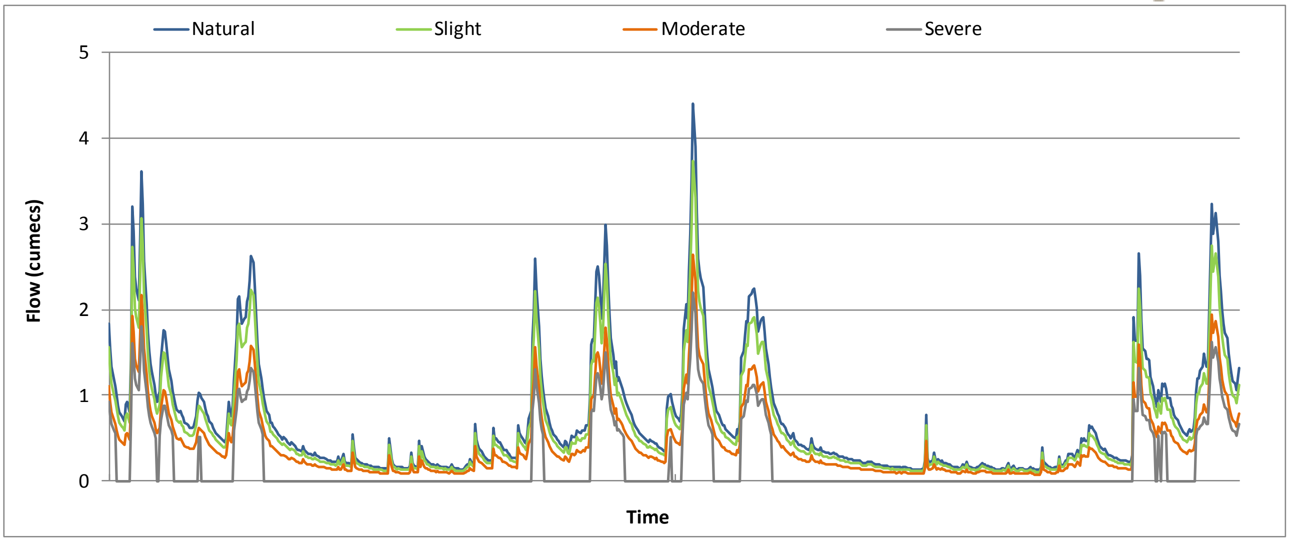

Figure 3: Conceptual example of hydrological impact severity, based on a natural flow time series from a granite base catchment (River Tiddy) in England

High status test

We would expect all catchments on the island to not pass the high status test either due to morphological or hydrological quality elements not being totally or near totally in undisturbed conditions.

6.4 Monitoring

Monitoring can be divided into three types, surveillance, operational and investigative monitoring.

- Surveillance monitoring is used to validate risk assessments and determine long-term changes.
- Operational monitoring is used to determine the status of water bodies identified as being at risk and how this changes as result of the programme of measures.
- Investigative monitoring is used to establish reasons for failure.

We recommend that surveillance and operational monitoring for hydromorphology is undertaken by proxy via the existing biological and physico-chemical monitoring programme, since hydromorphology supports GES. Investigative monitoring could be undertaken to increase the certainty of an impact e.g. wet weather surveys, fluvial audits, hydrological monitoring etc where biological and physico-chemical elements are not classified as Good.

6.5 Process for updating the classification method

The classification method may need to be revised, either when there is improved scientific understanding through research and monitoring, or with the benefit of experience in their practical application. It is recommended that standards are reviewed at the beginning of each IWMP cycle, to ensure each cycle uses the best available information.

The conceptual water resource assessment could be built upon in future cycles using a quantitative assessment. In the meantime, this requires the development of a hydrological database and model for the island for this to occur.

Measures may also need to be adapted over time as uncertainty will remain regarding the response of the ecology to a change in hydromorphology. This uncertainty can eventually be reduced through long term physical and biological monitoring, trials, and adapting the measures over time. This approach is analogous to the widely advocated spirit of adaptive management (e.g. Richter *et al*., 1997, Souchon *et al*., 2008, SNIFFER 2012, Mainstone *et al*., 2012), where good catchment management flow regime is achieved over time, as new information is made available.

6.6 References

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UKTAG (2008) Guidance on the Classification of Ecological Potential for Heavily Modified Water Bodies and Artificial Water Bodies, Final Report 9S4546.

7. Reservoirs and ponds status classification

7.1 Introduction

This technical note sets out the method for the classification of reservoirs as part of the Jersey Integrated Water Management Plan (IWMP). It is based upon a review of proposed and adopted standards for the Water Framework Directive (WFD) in England and Wales, and France. The standards have been adapted where appropriate and needed for the Jersey context. The note is divided as follows:

1. A summary of the English - Welsh and French standards for lake classification.
2. Recommendations for the Jersey IWMP
3. A summary of the monitoring programme requirements
4. Notes on revised standards

7.2 Reservoirs and ponds classification approach

Standards from England, Wales and France

In England and Wales, lake classification is based on 8 quality element indicators:

1. Phytoplankton
2. Phytobenthos
3. Macrophytes
4. Macroinvertebrates
5. Dissolved oxygen
6. Salinity
7. Acid neutralising capacity
8. Total phosphorous

The UK Pond Conservation Trust has also established three pond monitoring techniques; National Pond Survey, Predictive System for Multimetrics and Rapid Assessment.

In France, lake classification is also based on 8 quality indicators:

1. Total inorganic nitrogen
2. Nitrate
3. Orthophosphate
4. Total phosphorous
5. Transparency
6. Dissolved oxygen
7. Phytoplankton
8. Macroinvertebrates

Further information on the standards can be found in UKTAG (2008, 2013) and Ministère de l'Écologie, du Développement durable et de l'Énergie (2012). The standards for many quality elements are specific to the typology of the water body, and therefore vary with the characteristics of the individual lakes. In England and Wales, a lake's typology is based on catchment geology, size, depth and altitude (see UKTAG (2004) for more information). In addition to the above quality elements, Specific Pollutants and Hazardous Substances are also monitored within lakes (see accompanying separate method statements for these).

Jersey IWMP reservoir and pond classification

Number of ponds and reservoirs to monitor

The process of delineating ponds and reservoirs is described earlier in Section 1.2 and is not repeated here. All the main Jersey Water reservoirs have been delineated, along with a further 54 ponds of ecological importance, as identified in consultation with the States of Jersey Natural Environment Team.

It would be impractical to monitor the status of all the ponds and reservoirs on the island, and therefore future monitoring should be focused on those ponds and reservoirs which are used for the abstraction of drinking water, composing of Jersey Water's water supply reservoirs (Val de la Mare, Dannemarche, Millbrook, Grand Vaux, Queen's Valley, Handois), the reservoirs currently used for fishing and the reservoirs / ponds which are deemed to be the most ecologically important. More guidance on monitoring will be developed as part of the IWMP.

We understand that the National Environment Team already undertake some monitoring in ponds that are considered ecologically important, such as; Grosnez, Beauport, Les Creux. Through the IWMP, monitoring could also be extended to also include ponds which are being established as reference sites for a future pond macroinvertebrate monitoring programme to provide sufficient baseline data; namely La Carriere, Woodbine Corner, Beauport, Gorselands, Ponterrin Meadow, La Moye Point, Grosnez, Kempt Tower, Maison du Champs, and Grouville SSI.

What to monitor

Jersey Water's surface water reservoirs have been assigned Priority Protection Area status under the IWMP for their use in water supply (Drinking Water Priority Protection Areas), and Jersey Water's current risk based monitoring programme should be continued with the appropriate standards already in use for this purpose. This would allow the IWMP monitoring to focus on the remaining ponds on the island.

Both in France and in the UK, the scientific understanding of the natural composition and abundance of fish in lakes is incomplete and sampling of fish in lakes can be difficult. For these reasons, it has not yet been possible to develop methods for assessing fish status in lakes in England, Scotland, Wales and France, and therefore it is recommended that a standard for fish is not adopted on the island either.

The UK Pond Conservation Trusts' monitoring system is designed to broadly monitor pond health and organic pollution. With inorganic pollution from fertilisers being a major pressure on the island, the Pond Conservation Trust monitoring systems are not necessarily well adapted to it and therefore are not recommended for use in this case.

The addition of phosphorous to lakes is generally viewed as the main driver for changes in the composition and biomass of biological communities and drives the status of other quality elements in the England and Wales and French classification; common impacts are an increase in phytoplankton, and changes in distribution and species composition of macrophytes and phytobenthos. This can consequently reduce dissolved oxygen and lower water transparency, which can lead to changes in the communities of fish and invertebrates. Therefore, total phosphorous is a suitable proxy measure for a range of quality elements (dissolved oxygen, transparency and for the response of macrophytes, macroinvertebrates, fish and phyto-benthos to broad nutrient pollution pressures. It is recommended that this is used as the main nutrient pollution water quality indicator in ponds on the Island. The England and Wales classification for lakes has developed site specific total phosphorous standards for individual lakes largely based on geology and geographical location. Since the geology and geographical location of the island is closer to France (and Brittany), it is believed that the French standards in this case are more appropriate. A comparison of the Habitats Directive standards (ranging from 10 – 35 mg/l) with the French standards suggests that they are not unreasonably stringent or loose.

Catchment scale salinity and acidity risks are assessed through the current groundwater and surface water classification and risk assessments described later in this document; however, spot dissolved oxygen, conductivity (salinity proxy), nitrates, ammonia and pH (acidity proxy) measurements should also be undertaken as baseline monitoring from which future standards can be established if required.

Whilst total phosphorous monitoring would provide a good proxy for nutrient pollution pressures, it doesn't account for other acute water quality pressures such as the runoff of chemicals which are Priority Substances or Specific Pollutants. It would not be cost-effective to monitor the ponds for the range of these chemicals and therefore it is recommended that the Jersey amphibian monitoring programme is maintained to monitor this. Amphibians are highly sensitive to environmental disturbance, and rely on both aquatic and terrestrial habitats for survival, and so provide a proxy of threats to the pond habitat more generally (e.g. arable uses, associated with diffuse pollution etc). Amphibians could then also be used to trigger a wider water quality investigation including Priority Substances and Specific Pollutants.

Table 12: Pond water quality standards

Quality elements	High	Good	Moderate	Poor
Total phosphorous (ug P/l, annual average)	0.015	0.03	0.06	0.1

7.3 Monitoring programme

Current extent of monitoring in Jersey waters

The Water Quality Management Information System (WQMIS) contains water quality sampling data at 270 surface water monitoring sites, spread across all 8 Water Management Areas (WMAs). Although the monitoring is broadly limited to flowing surface waters and therefore most ponds and reservoirs are not monitored. Total phosphorus is monitored at three watercourse locations on the island, although not in any standing waters at present.

A separate water quality monitoring programme is also undertaken by the Natural Environment team and Jersey Water. Table 13 below shows the pond and reservoir monitoring locations (proposed) and what parameters (proposed) have been monitored there over the long term. Monitoring frequency is at least 4 time per year, and much more frequent in most cases. Nitrate is monitored at all the sites although total phosphorous is not. Salinity is not monitored at the water supply reservoirs although this would not be expected to be a pressure on water quality there. Top Pond is not monitored although the nearby and connected St Ouen's Pond is.

Table 13: Water quality parameters currently monitored in lake and reservoir locations

Pond / reservoir	Monitored by	Total phosphorous	Nitrate	Dissolved Oxygen	pH	Salinity	Ammonia
St Ouen's Pond	Department of Environment		✓	✓	✓	✓	✓
Top Pond	-						
Noirmont	Department of Environment		✓	✓	✓	✓	✓
L'Ouaisné Common	Department of Environment		✓	✓	✓	✓	✓
Les Landes	Department of Environment		✓	✓	✓	✓	✓

Monitoring programme and recommendations

Monitoring can be divided into three types, surveillance, operational and investigative monitoring.

- Surveillance monitoring is used to validate risk assessments and determine long-term changes.
- Operational monitoring is used to determine the status of water bodies identified as being at risk and how this changes as result of the programme of measures.
- Investigative monitoring is used to establish reasons for failure. The recommended monitoring approach for each of these types is summarised below.

Recommendations are provided below for future plans and monitoring. It is acknowledged that in some cases, it will not be possible to achieve the standards set below, particularly in the current planning cycle, where gaps in monitoring will be filled through the use of proxy sites and expert judgement (see separate surface water classification summary method statement for more information). A confidence rating will be applied to reflect these circumstances.
The recommendations are specific for ponds and exclude public water supply reservoir as these are already monitored by Jersey Water and that should continue to happen.

Surveillance monitoring

Surveillance monitoring should be undertaken to establish the baseline for the presence in significant quantities of total phosphorus. This would require monitoring over a period of a year where not already undertaken.
The French approach is based on monitoring 3 times in summer, when primary productivity is at its greatest and when the aquatic ecology is most active and sensitive to water pollution, particularly nutrient enrichment. Although this would be the most pragmatic approach for Jersey, it is understood that a more thorough picture of phosphate pressures is needed, including seasonal variations.

It is therefore recommended that monitoring is undertaken once per season (4 times a year) which would provide a more complete temporal picture of Total P and to inform the evidence base for the second IWMP. In most cases this could be less frequent than the current monitoring programme and so is more cost effective and the spare resource could be re-directed to other parts of the monitoring strategy. Monitoring 4 times a year seasonally is also in line with England and Wales recommendations (12 in 3 years) and where monitoring is at least 4 times a year (once every season) and in some cases monthly.
The amphibian monitoring programme would be used to trigger a wider sampling programme of Priority Substances and Specific Pollutants, where there is a significant decline in amphibian populations.

Operational monitoring

Monitoring frequency of those substances found in significant quantities should be maintained at 3 samples per year, in the summer. This can be scaled back to sampling every 3 years in ponds and reservoirs where standards are being met currently.

Investigative monitoring

Investigative monitoring is used to establish reasons for failure. There have already been a large number of investigative monitoring projects on the island of Jersey e.g. Diffuse Pollution Project and CREH (1997, 2006, 2007); . It would be expected that similar projects would be initiated to determine new reasons for failure that become apparent. This monitoring would also be expected to investigate acute failures of the standards, under normal procedures by the Department of Environment and enforced through the Water Pollution Law (Jersey) 2000.

7.4 Process for updating the classification method

Existing standards may need to be revised when there is improved scientific understanding through research and monitoring or the benefit of experience in their practical application. For example, there are ongoing studies on the island to understand the habitat requirements of the agile frog and common toad. Water quality standards could also be revised based on an understanding of water quality of ponds which currently support the agile frog and common toad. To date, an update on French standards have not been published although Ministère de l'Écologie, du Développement durable et de l'Énergie (2012) states that they would be revised in 2014.

7.5 References

CREH (2007) Nutrient flux source apportionment for St Aubin's Bay, Jersey, 2007. A Report to Transport and Technical Services, States of Jersey.
Ministère de l'Écologie, du Développement durable et de l'Énergie (2012) Guide technique Évaluation de l'état des eaux de surface continentales (cours d'eau, canaux, plans d'eau)
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States of Jersey

8. Coastal water status classification

8.1 Introduction

This document sets out the classification methodology for classifying coastal water bodies under the Jersey Integrated Water Management Plan (IWMP). It is intended to provide an overview of the process, since the methodology has been reported in detail in WCA (2013).

The Water Framework Directive (WFD) specifies the quality elements that are used to assess the ecological and chemical status of a water body. Quality elements are biological and chemical. Classifications indicate where the quality of the environment is good, where it may need improvement, and what may need to be improved. They can also be used, over the years, to plan improvements, show trends and to monitor success. There are two status classifications which are commonly reported, ecological and chemical:

1. **Chemical status** is assessed from compliance with environmental standards for chemicals that are priority substances and/or priority hazardous substances. Chemical status is recorded as 'good' or 'fail'.
2. **Ecological status** classification is composed of up to four different types of assessments: biology (rocky shore macroalgae, opportunistic algae, sea grass, imposex, benthin invertebrates, and phytoplankton), physico-chemical, specific pollutant and hydromorphology. Ecological status is recorded as high, good, moderate, poor or bad. 'High' represents 'largely undisturbed conditions'

8.2 Status classification

In England and Wales (UKTAG 2013a), the chemical and ecological status is determined by the worst scoring element – the one out all out approach. In coastal classification, however, physico-chemical and specific pollutant elements can only influence status down to moderate. Only biological elements can determine poor or bad status, as biological evidence is required to determine a measure of confidence. See Figure 4 below for the classification process.

In France (Ministère de l'Écologie, du Développement durable et de l'Énergie 2013), the approach is similar although is not driven by the lowest scoring element when the following three conditions apply:

1. A single physico-chemical or specific pollutant element is a class below all other elements
2. All biological and remaining physico-chemical or specific pollutant elements are at Good or High
3. The single physico-chemical or specific pollutant element is no more than one class below the other elements (i.e. Good for High status, Moderate for Good status)

This approach adopted in France is far more practical, and ensures that the biology drives the status classification in borderline Good or High situations, and avoids potential bias to reporting a low status. Therefore, this pragmatic approach is adopted for the island of Jersey.

Overall status is a composite measure that looks at both ecological status and chemical status. So, it takes into account all four assessment types under ecological status (biology, physico-chemical, specific pollutants substances and hydromorphology) as well as incorporating the results of the chemical status assessment (priority substances). The one-out-all-out rule is applied again here, so a water body must be good or better ecological status, and good (pass) chemical status assessment to be given a good overall status.

For the purposes of the Jersey IWMP, it was decided that it was inappropriate to use the coastal monitoring data for St Aubin's Bay to represent the other three coastal water bodies around the Island; each has a subtly different character and to use St Aubin's as a proxy is not appropriate. Therefore, the only coastal water body which has been assigned a classification output is the Southern Coastline coastal water, all the remaining coastal waters have been assigned as "Not Assessed". Monitoring through the duration of the first IWMP (2015-2020) should aim to improve upon this situation.

Jersey is not considered to have any transitional water bodies where rivers enter a coastal zone; therefore transitional water bodies are not assessed.

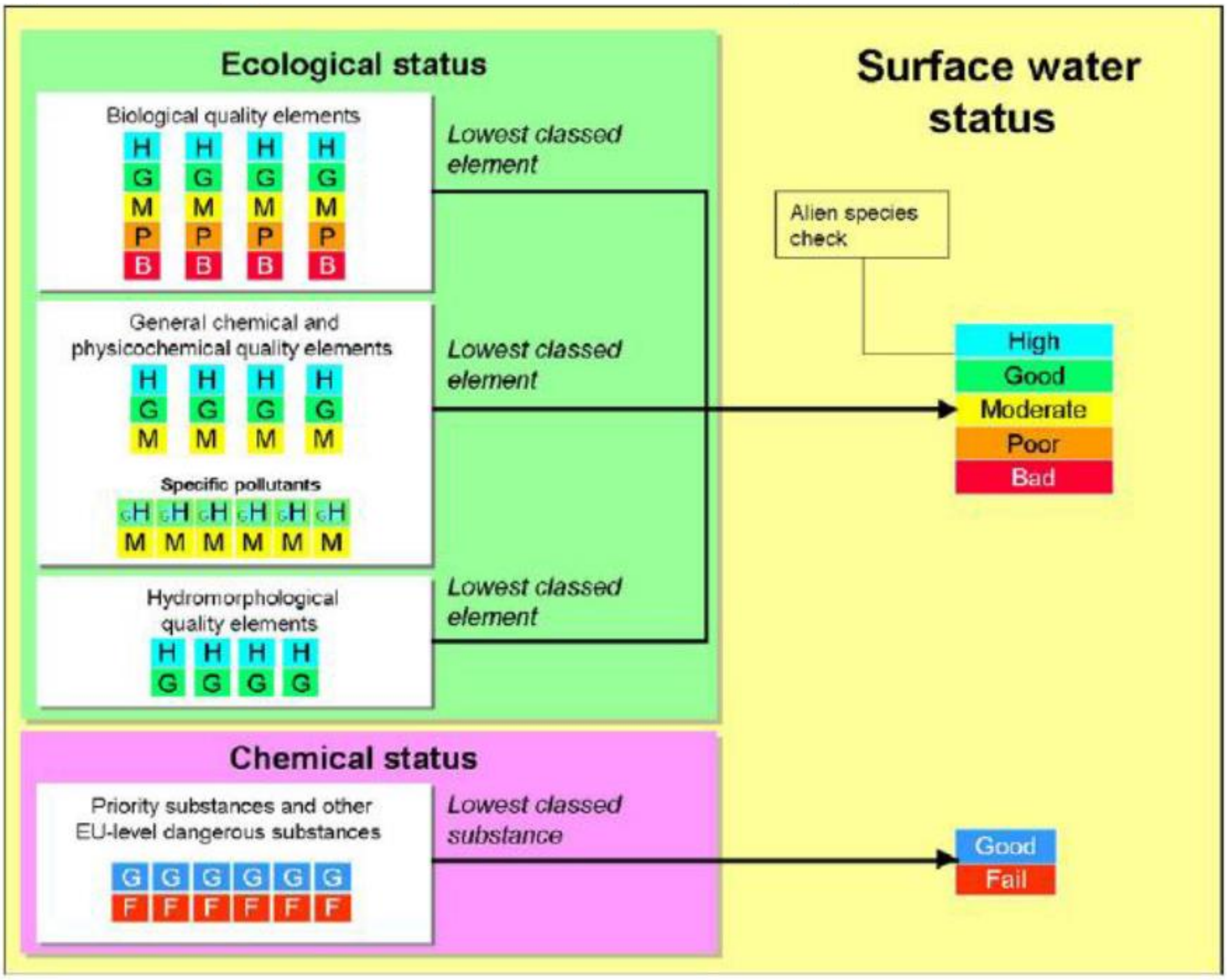

Figure 4: Classification status approach (UKTAG 2013)

High status test

A water body is only classified as high status if it has passed three additional tests for high status. The three tests are

1. A hydrological/tidal regime that reflects totally, or nearly totally undisturbed conditions
2. Morphological conditions that reflect totally, or nearly totally undisturbed conditions
3. No evidence of established populations of alien species with a high impact (see UKTAG 2014)

This information would be captured through consultation with SoJ and making use of available information and expert judgement.

8.3 Monitoring

Monitoring can be divided into three types, surveillance, operational and investigative monitoring. Surveillance monitoring is used to validate risk assessments and determine long-term changes. Operational monitoring is used to determine the status of water bodies identified as being at risk and how this changes as result of the programme of measures. Investigative monitoring is used to establish reasons for failure.
Surveillance monitoring has already been undertaken and reported in WCA (2013), with a suite of specific pollutants and priority substances recommended for additional monitoring. In addition to the existing surveillance monitoring, it is recommended that new priority substances and specific pollutants for IWMP Cycle

2 are also initially monitored to identify those present in significant quantities and which require further long term monitoring under an operational monitoring programme.

Because there is a rolling programme of monitoring combined with a fixed planning cycle, there are instances where data used in older classifications does not fall into the data window for more recent classifications. In these cases, coastal water bodies may be given a higher status class, as a new (higher status) element becomes the driving element of classification.

So that we don't give a false impression of improvement at a water body level, the result for the previously driving element is rolled forward into subsequent classification updates i.e. unless we have evidence to show otherwise, we should not ignore previously driving element results in subsequent rounds of classifications. The roll forward process is illustrated in Figure 5 below.

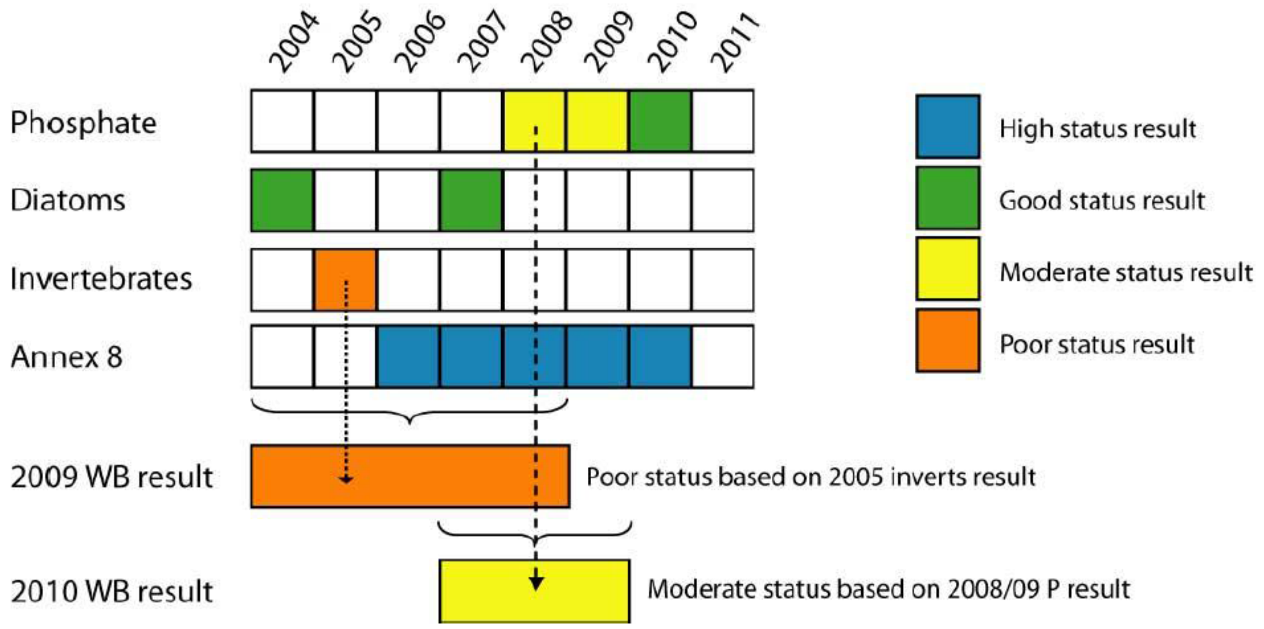

Figure 5: Illustration of the monitoring roll forward process (UKTAG 2013)

Multiple sites

As a minimum, a single monitoring site is recommended per coastal water body for each quality element. In some cases, additional sites will ideally be monitored to capture the varying character and pressures within an upstream catchment. In these circumstances, the average Ecological Quality Ratio (EQR) is used to represent 'typical conditions' for a catchment, not the very best or worst (this follows similar practices in France, and England and Wales).

8.4 Reporting confidence

Reporting confidence in a status classification does not affect or change the status; however it has proved important for prioritising strategic actions in large EU member states. Complex systems have been adopted to assign confidence that a catchment is not failing the quality standards, across hundreds of catchments in each member state. That has enabled actions to be prioritised in the right catchments.

On a small island such as the States of Jersey, a simpler approach is more suitable for assigning confidence - based on the amount of monitoring used to develop the status classification:

1. Low confidence – there is no data with which to classify a quality element and expert judgement and donor coastal water body have been used instead
2. Medium confidence – Only a single monitoring site available, where multiple sites are required in a coastal water body; or monitoring frequency does not meet the method statement standards.
3. High confidence – Monitoring frequency and distribution meets the method statement standards

8.5 Revising the classification and its standards

Existing standards may need to be revised when there is improved scientific understanding through research and monitoring or the benefit of experience in their practical application, shows that existing standards are not as well matched to ecological quality as they could be. It is recommended that standards are reviewed at the beginning of each RBMP cycle, to ensure each cycle uses the best available standards. This could include the inclusion of additional quality elements.

At present, there are no proposed updates to the coastal environmental standards (UKTAG 2013a) except for specific pollutants and priority substances. Therefore it is recommended that the current monitoring and classification approach is maintained to ensure consistency with the baseline results already collated. This approach can be reviewed once the UKTAG biological method statement updates are finalised, expected to be in March 2014, however at present UKTAG (2013b) reports no updates to biological classification which are expected to be significantly different from the current system.

8.6 References

Ministère de l'Écologie, du Développement durable et de l'Énergie (2012) Guide technique Évaluation de l'état des eaux de surface continentales (cours d'eau, canaux, plans d'eau)

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9. Groundwater status classification

9.1 Introduction

This section sets out the approach for classifying groundwater chemical and quantitative status for the Jersey Integrated Water Management Plan (IWMP). The principles are drawn from the EC Water Framework Directive (WFD) (2000/60/EC) and Groundwater (Daughter) Directive (2006/118/EC) (GWD) and the methods proposed in England in particular (Environment Agency, undated a) and undated b). The approach also takes into account the specific context in Jersey. For example, as noted, in Section 1, to help integrate future actions across surface and groundwater systems, 8 groundwater bodies have been defined that correspond with the 8 surface water Water Management Areas (WMAs) as having a different groundwater body.

An overview of the component tests for groundwater classification is provided in Figure 6, this is adapted from Environment Agency (undated a) and undated b)). The scheme includes three simplifications from the Environment Agency approach:

1. the drinking water protected area and general chemical assessment tests have been combined;
2. the tests for impacts on surface waters and wetlands (‘groundwater dependent terrestrial ecosystems’) and water balance are combined; and
3. saline intrusion is covered by a chemical test alone rather than separate chemical and quantitative tests.

These simplifications reduce the number of groundwater status tests from nine to four.

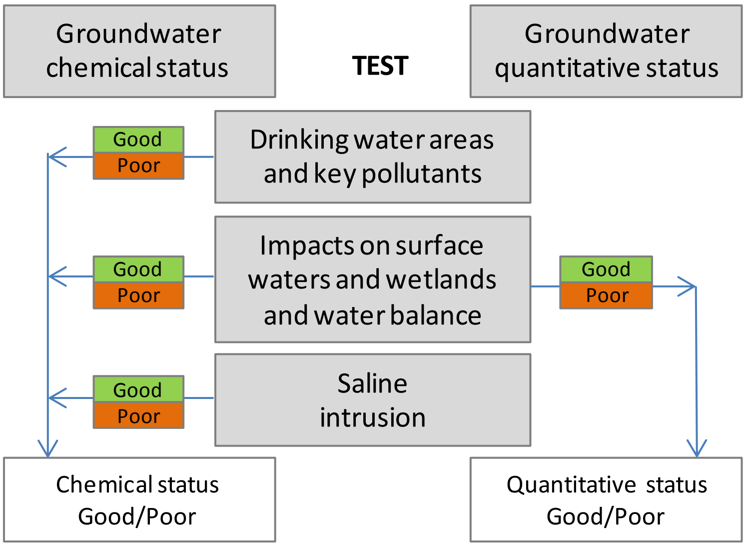

Figure 6: Overview of groundwater classification, adapted from Environment Agency (undated a)

9.2 Description of component tests

Chemical test: drinking water protected areas (DrWPAs) and key groundwater pollutants

This test combines two of the tests in the Environment Agency (undated a) scheme: the drinking water protected area test and the general chemical assessment test. In Jersey, the Water Pollution (Jersey) Law 2000 has a central objective of “the maintenance and improvement of the quality of water in and around Jersey by the prevention, control, reduction and elimination of the pollution of controlled waters.” The law includes the requirement to “have regard to the obligations imposed on the Company by the Water (Jersey) Law 1972 to supply wholesome water for human consumption and use.” As yet, no water catchment management areas have been implemented in Jersey and the issue of nitrates, in particular, is an ongoing concern for Jersey, as it is in many areas of the mainland UK.

Under the European Nitrates Directive, member states have introduced Nitrate Sensitive Areas and Nitrate Vulnerable Zones where particular attention is paid to pollution reduction measures. Under the WFD the Drinking Water Protected Area (DrWPA) objective requires that groundwater is protected specifically to avoid deterioration in water quality that would lead to an increased level of treatment at points of abstraction. Under the WFD, all water bodies that are used for the abstraction of more than 50 m^3/day of water intended for human consumption or for supplying more than 50 people are considered as DrWPAs so in England all groundwater bodies have been designated as DrWPAs.

With regard to the general chemical assessment test, this test covers the requirement of the WFD to identify groundwater bodies where widespread deterioration in quality has, or will, compromise strategic use of groundwater. In accordance with the GWD it focuses on nitrates and pesticides and because there is clear overlap with the drinking water protected area test, these have been combined. In January 2014, the EC proposed amendments to the GWD that are due to come into force after 2015 (T Besian, Environment Agency, pers. comm.). Annex I to the GWD contains Europe-wide environmental quality standards for nitrates and pesticides. Annex II provides a minimum list of other pollutants and indicators for which Member States should consider establishing quality standards called 'threshold values' (TVs) and guidelines on how to establish those TVs. The EC's review of the first cycle RBMPs confirmed that nitrates and pesticides are the most widespread groundwater pollutants of concern in the EC, so no new Europe-wide standards are proposed. However, inconsistency was found in the approaches to using and developing threshold values for other pollutants so new draft guidance has been issued.

For the DrWPA and key pollutants test, the classification scheme is summarised in Table 14. The proposed scheme is a more stringent test than the UK method where the water body is only at Poor Status if there is evidence for exceedance of a drinking water standard/threshold and an upward trend in the concentrations of the relevant pollutant(s). In the proposed test for Jersey the water body will be assigned Poor Status if there are predicted to be exceedances at more than 20% of monitoring points using a five year data set (2009-2013 inclusive). Trend analysis has only been carried out for nitrates; for this parameter, estimated concentrations in 2020 have been used for the status classification.

Table 14: Chemical status: Drinking water protected areas

Chemical Status: Drinking Water Protected Areas		
Status	**Confidence**	**Key Criteria**
Good	High	More than 80% of monitoring points indicate that there will not be an exceedance of a DWS or key parameter threshold value. Analytical and representativeness confidence are high (see footnote).
	Low	More than 80% of monitoring points indicate that there will not be an exceedance of a DWS or key parameter threshold value. Analytical and/or representativeness confidence is low (see footnote).
Poor	Low	More than 20% of monitoring points indicate that there will be an exceedance of a DWS or key parameter threshold value. Analytical and/or representativeness confidence is low (see footnote).
	High	More than 20% of monitoring points indicate that there will be an exceedance of a DWS or key parameter threshold value. Analytical and representativeness confidence are high (see footnote).

Analytical confidence is high if the limit of detection is at least a factor of two lower than the threshold value.
Representative confidence is high if the number of sites in the groundwater body is more than 4 (bearing in mind that the groundwater bodies are quite small relative to many groundwater bodies in Europe.

Chemical test: impacts on surface waters and wetlands

Groundwater seepages and baseflow are important for maintaining flows and water levels in some streams and wetlands. If these groundwater inputs are polluted, and are a contributory cause to the failure to achieve good status for the surface water body or wetland, then this test will result in Poor Status for the groundwater body. A comprehensive understanding of the volumetric and chemical interactions between groundwaters and surface waters can only be achieved with detailed monitoring programmes supported by modelling. This level of understanding is rarely possible. However, using baseflow separation techniques for stream hydrographs, and water budget and level information for wetlands, it is normally possible to estimate the volumetric importance of groundwater inputs. The recommended classification scheme for this test is summarised in Table 15. In this initial IWMP there was insufficient quantitative data to carry out this test. Based on discussions with staff from the Environment Division there is no clear evidence for groundwater chemical impacts on surface waters so this test has been passed at low confidence for all groundwater bodies.

Table 15: Chemical status: impacts on surface waters and wetlands

Status	Confidence	Key Criteria
Good	High	All overlying surface waters and wetlands are at good status for chemical parameters. Or, surface waters or wetlands that are at less than good status do not have significant inputs (>20% by volume under dry conditions) from groundwater or have monitoring evidence that groundwater chemistry does not breach surface water standards.
	Low	As Good/High but evidence is uncertain/ conflicting.
Poor	Low	Overlying the groundwater body there are surface water bodies or wetlands at less than good status for chemical parameters. Parameters causing failure have been detected above threshold values in nearby groundwater monitoring points and baseflow/seepage inputs are minor (<20% by volume under dry conditions) – or evidence is uncertain/conflicting.
	High	As for Poor Low but baseflow/seepage inputs are <20% by volume under dry conditions and evidence for potential impact is consistent.

Chemical test: saline intrusion

Saline intrusion can occur when the saline-freshwater interface in coastal regions is drawn inland and upwards by abstraction. Groundwater abstraction can also lead to upward movement of poor quality water from an underlying groundwater body. This test looks at parameters in groundwater that indicate intrusion is occurring, in particular, salinity and sulphate. Because Jersey is an Island, groundwater resources are vulnerable to saline intrusion and data presented on the hydrogeological map of Jersey (BGS, 1992) indicate that there may have been saline intrusion in the past.

The saline intrusion test is undertaken in two steps. Firstly, background levels are determined for each groundwater body. For each monitoring site, excluding any known contaminated sites, the mean value for 2009-2013 is calculated. In accordance with EC (2007) the background level for the individual water body is set at the 90%ile of the mean values. Implicit in this step is that 10% of sites within a groundwater body will be above the background level. To check whether these sites show any evidence for saline intrusion, all available data (typically back to 1990) are plotted to see if there is any evidence for an upward trend in salinity or sulphate.

If there is a sustained upward trend and some evidence that this could be linked to abstraction then the groundwater body is classified as Poor Status. If there no or little evidence for an upward trend and no evidence for a link to abstraction then the groundwater body is classified as Good Status (Table 16).

Table 16: Chemical status: saline intrusion

Status	Confidence	Key Criteria
Good	High	No monitoring points within the area at possible risk from saline intrusion show evidence for an upward trend in salinity or sulphate.
	Low	Some (less than 20%) of monitoring sites with elevated concentrations show upward trends but there is no evidence of a link to abstraction.
Poor	Low	Some (more than 20%) of monitoring sites with elevated concentrations show upward trends and there is uncertain evidence of a link to abstraction.
	High	Salinity or sulphate concentrations show consistent upwards trends and there is strong evidence of a link to abstraction.

Quantitative test: Impacts on surface waters and wetlands and water balance

The quantitative test is designed to identify groundwater bodies where abstraction has reduced the natural groundwater support to streams or wetlands to a point where it is likely to be having an impact on ecology. The scheme for quantitative groundwater tests in England is set out in Environment Agency (undated b). For **surface waters**, data in a country-wide water resources GIS system are combined to estimate the impact of groundwater abstraction on natural flows. Impacts are compared with environmental flow indicators (EFIs). For **wetlands**, a risk assessment based on data in the WRGIS, plus conceptual source-pathway-receptor considerations is followed where necessary by site-specific analysis. Finally, there is also a two-part **water balance** test. In the first part if abstraction is greater than long term average recharge the water body is classified at poor status; this is in accordance with the WFD but conceptually is not a very useful indicator of risk. In the second part the impacts of groundwater abstraction on surface water low flows are again assessed, but are summed at the scale of the groundwater body.

The tools to apply the Environment Agency quantitative groundwater tests are not available in Jersey. In addition, the proposed classification approach for hydromorphology classification in Jersey does not use EFIs but rather a qualitative assessment of the departure from a natural flow regime. As a result, a practical method based on experience over 10 years and in the order of 50 sites in the UK (Grout, 1998; Atkins, 2010) (Table 17) has been adopted.

Table 17: Experience based criteria for potential impacts of groundwater abstraction on surface water flows and wetlands after Atkins (2010).

Abstraction as % of average recharge	Assessment
0-20%	Level of abstraction can generally be supported by recharge over the area. Some localised impacts of abstraction may occur.
20-40%	Level of abstraction may reach the upper limit of what can be supported by recharge over this area. This may become manifest as hydrological impacts on river flows, wetlands and other protected water features.
>40%	Level of abstraction unlikely to be supported by recharge over this area. Impacts on river flows and wetlands expected due to pressure on water resources.

Where there is a local evidence for impact, or non-impact, from a conceptual model or monitoring this should be used to supersede the screening assessment. The initial scheme for this test for Jersey, which may develop with time is summarised in Table 18.

Table 18: Qualitative Status: Impacts on surface waters and wetlands

Status	Confidence	Key Criteria
Good	High	Abstraction is less than 20% of long term average recharge (LTAR)
	Low	Abstraction is between 20% and 40% of LTAR and there is no evidence in dependent surface waters and wetlands for low flow stress
Poor	High	Abstraction is > 40% of LTAR and there is evidence of low flow stress, exacerbated by abstraction, in dependent surface waters or wetlands
	Low	Abstraction is > 40% of LTAR but there is no evidence of low flow stress in dependent surface waters or wetlands. Or, abstraction is between 20% and 40% of LTAR but there is some evidence of low flow stress exacerbated by abstraction

9.3 Monitoring

Current extent of monitoring in Jersey waters

The main focus of this assessment has been on recent data for the 5 year period (2009-2013). The Water Quality Management Information System (WQMIS) contains water quality sampling data at 69 groundwater monitoring for this period. For some parameters, where longer term trends are particularly important, for example nitrates and saline intrusion indicators, earlier data have also been considered.

Monitoring programme and recommendations

Monitoring can be divided into three types, surveillance, operational and investigative monitoring.

- Surveillance monitoring is used to validate risk assessments and determine long-term changes.
- Operational monitoring is used to determine the status of water bodies identified as being at risk and how this changes as result of the programme of measures.
- Investigative monitoring is used to establish reasons for failure. The recommended monitoring approach for each of these types is summarised below.

Recommendations are provided below for future plans and monitoring. It is acknowledged that in some cases, it will not be possible to achieve the recommendations set below, particularly in the current planning cycle. Where necessary, gaps in monitoring will be filled through the use of proxy sites and expert judgement (see separate surface water classification summary method statement for more information). A confidence rating will be applied to reflect these circumstances.

The WFD considers the water environment as a continuum. This is reflected in the groundwater status definitions and through the recognition of the role played by groundwater in maintaining the flow, quality and ecology of dependent surface waters. Monitoring should therefore be designed and refined in an integrated way to assist in: (a) maximising the information that can be derived; (b) increasing confidence in the conceptual understanding of the interaction between groundwater and surface water and; (c) reducing the uncertainty associated with risk and status assessment (UKTAG, 2007).

Surveillance monitoring

UKTAG (2007) recommends that the core suite of determinands for groundwater surveillance monitoring should comprise DO, pH, EC, nitrate, ammonium, temperature, and ‘a suite of major and trace ions’. In view of the requirements of the GWD, it is recommended that total pesticides are also included and, in view of the risk of saline intrusion, salinity and sulphate should be specifically included. Based on a more comprehensive review of past monitoring, and the results of risk assessments, additional indicators of human impacts may also be included. These may include indicators of general industrial activity, e.g. TCE and PCE and urban areas, e.g. Zn and B (UKTAG, 2007).

Groundwater levels should also be recorded. As this can be done relatively rapidly and cost-effectively, the level monitoring network may be more extensive than the groundwater quality surveillance network. The locations of preferred surveillance boreholes for level and quality will be agreed with specialists in the Environment Division, taking into account their knowledge of groundwater. With regard to frequency, UKTAG (2007) recommends twice per year, although if a review of historic data indicates very limited seasonal variability this could be reduced.

Operational monitoring

Operational monitoring’ programme is required to establish:

- the status of all groundwater bodies, or groups of bodies, determined as being at risk; and
- the presence of significant and sustained upward trends in the concentration of pollutants.

Operational monitoring has to be carried out for the periods between surveillance monitoring. In contrast to surveillance monitoring, operational monitoring is focused on assessing the specific, identified risks to the achievement of objectives.

Operational monitoring, from which the chemical status is determined, is likely to include a similar suite to that detailed in the surveillance monitoring. Monitoring frequency of those substances should capture key temporal controls and variability in concentration and, as for surveillance monitoring, should be based on a review of existing data. For the key issue of nitrates, specific periods of application along with soil moisture controls on recharge mean that intra-annual variability can be significant. There is already a reasonable understanding of this issue on the Island, but this needs to be taken into account when finalising the operational monitoring regime.

One of the key gaps in knowledge regarding the first round of groundwater classification is the concentration and trend of phosphates. Although some monitoring data exist these have been analysed at a detection limit of 100 µg/l whereas the recommended standard for good status in Jersey surface waters is 50 µg/l. As a result, analysis to a lower detection limit is recommended, in order to assess groundwater trends and their potential contribution to a failure to achieve good status in surface waters.

Investigative monitoring

Investigative monitoring is used to establish reasons for failure. There have already been a large number of investigative monitoring projects into groundwater on the island of Jersey. It would be expected that similar projects would be initiated to determine new reasons for failure that may become apparent through time. This monitoring would also be expected to investigate acute failures of the chemical standards, under normal procedures by the Planning and Environment Department and enforced through the Water Pollution Law (Jersey) 2000.

9.4 Process for updating the classification method

The groundwater classification method has been implemented and found to be broadly suitable for the level of information available in Jersey. With regard to groundwater quantitative status, new information on from abstraction licences and registrations has been analysed for the first time to provide a best estimate of abstraction quantities for each WMA. With regard to groundwater chemical status, a reasonably broad range of parameters are analysed regularly and with a good spread across the Island. Given the nature of activities, and potential chemical risks, the existing sampling programme is considered to be appropriate, the main recommendation is for analysis of phosphate to a lower detection limit.

The classification method should be reviewed at the beginning of each new IWMP cycle.

9.5 References

Atkins (2010). Site Options Plan Issue 2 Blo' Norton and Thelnetham Fens SSSI (Waveney and Little Ouse Valley Fens SAC). Report for the Environment Agency.

British Geological Survey 1992. Hydrogeological map of Jersey. 1: 25 000. British Geological Survey, Keyworth.

Environment Agency, undated a. Groundwater Chemical Status Assessment (Classification) and Trend assessment.

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European Commission (2007) Common Implementation Strategy Guidance Document No. 18: Guidance on Groundwater Status and Trends.

Grout M W, 1998. Strategy for Groundwater Investigations and modelling: A framework for managing groundwater resources. Environment Agency Anglian Region (unpublished).
UKTAG 2007, UK Technical Advisory Group On the Water Framework Directive. Guidance on Monitoring Groundwater.

10.Surface water status classification

10.1 Introduction

This section sets out the methodology for the overall classification of surface water bodies under the Jersey Integrated Water Management Plan (IWMP). It is intended to provide an overview of the final process and does not go into detail on the classification methods for component parts such as chemical, biological, physic-chemical, specific pollutants etc. as these have been described previously.

Classifications indicate where the quality of the environment is good, where it may need improvement, and what may need to be improved. They can also be used, over the years, to plan improvements, show trends and to monitor success. There are two overall status classifications which are commonly reported, ecological and chemical:

1. **Chemical status** is assessed from compliance with environmental standards for chemicals that are Priority Substances and/or Priority Hazardous Substances. Chemical status is recorded as ‘Good’ or ‘Fail’.
2. **Ecological status** is composed of up to four different types of classification assessments: biology, physico-chemical, specific pollutant and hydromorphology. Ecological status is reported as High, Good, Moderate, Poor or Bad, with ‘High’ representing ‘largely undisturbed conditions’

10.2 Overall status classification

In England and Wales (UKTAG 2013), the chemical and ecological classification operates on a “one out all out” approach, whereby the overall class is determined by the worst scoring quality element. Figure 7 below sets out the overall classification process.

There are however a couple of exceptions to this rule;

- physico-chemical and specific pollutant quality elements are only able to drive the overall status downwards to Moderate; and
- Only biological elements can determine Poor or Bad status.

In France (Ministère de l’Écologie, du Développement durable et de l’Énergie 2013), the approach is similar although the overall classification is not driven by the lowest scoring quality element when the following three conditions apply:

1. A single physico-chemical or specific pollutant element is a class below all other elements
2. All biological and remaining physico-chemical or specific pollutant elements are at Good or High
3. The single physico-chemical or specific pollutant element is no more than one class below the other elements (i.e. Good for High status, Moderate for Good status)

It is considered that the approach adopted in France is far more pragmatic, and ensures that the biology drives the status classification in borderline Good or High situations, and avoids potential bias to reporting a low status. Therefore, this approach has been adopted for the island of Jersey.

Overall status is a composite measure that looks at both ecological status and chemical status. So, it takes into account all four assessment types under ecological status (biology, physico-chemical, specific pollutants substances and hydromorphology) as well as incorporating the results of the chemical status assessment (priority substances). The one-out-all-out rule is applied again here, so a water body must be Good or High ecological status, AND Good (pass) chemical status assessment in order to be classified as Good overall status.

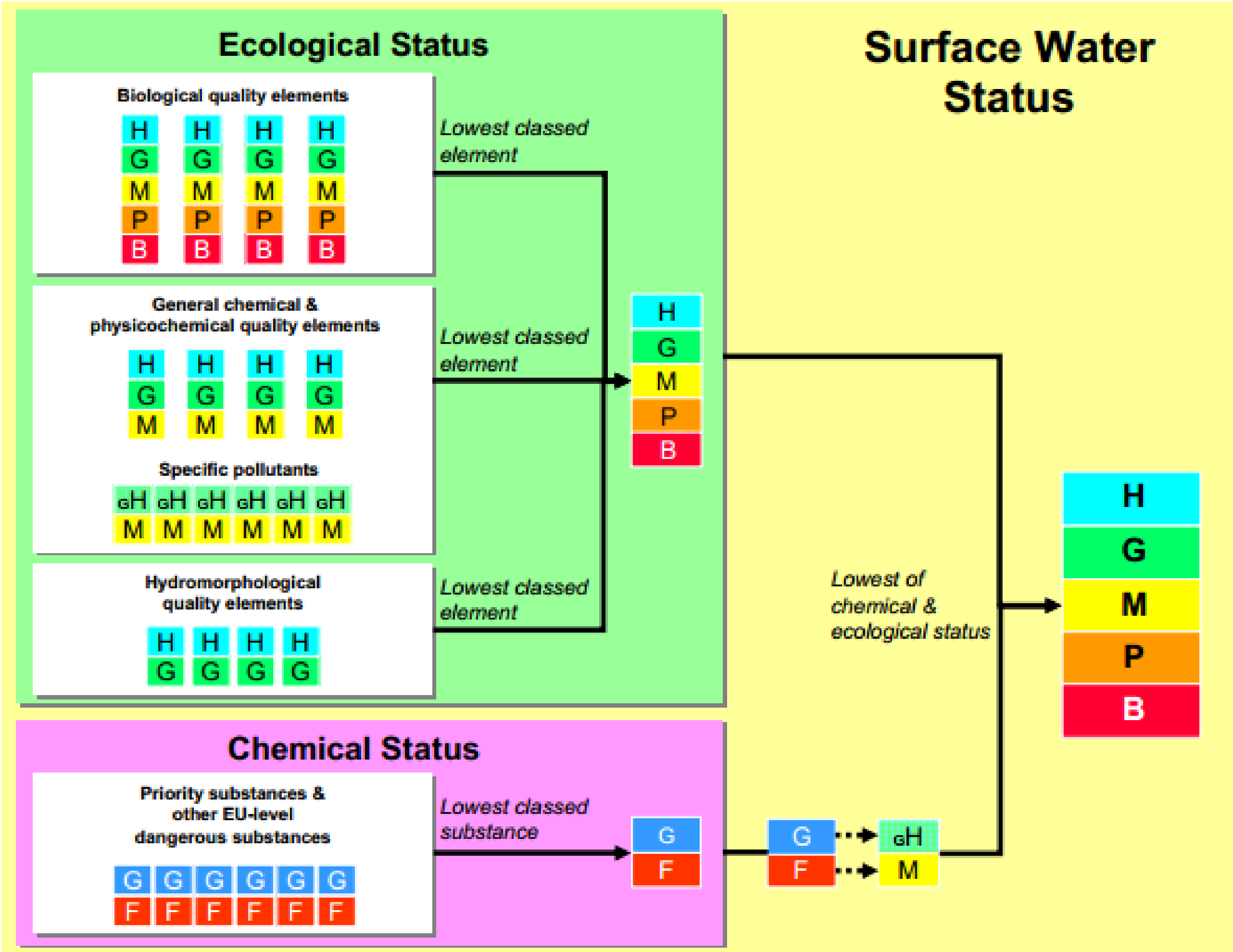

Figure 7: Classification status approach (UKTAG 2013)

High status test

In order for a water body to be classified as High status, three additional requirements must be met:

1. A hydrological/tidal regime that reflects totally, or nearly totally undisturbed conditions
2. Morphological conditions that reflect totally, or nearly totally undisturbed conditions
3. No evidence of established populations of alien species with a high impact

A hydromorphological method statement has been developed which assesses point 1 and 2 above (see Section 6). For point 3 above, there is very limited data available for Jersey; the existing alien species strategy and monitoring of the island could be used to identify the presence and absence of high impact species defined in UKTAG (2014), however a high status test has not been necessary for this first round of the IWMP.

10.3 Monitoring

Monitoring can be divided into three types, surveillance, operational and investigative monitoring.

- Surveillance monitoring is used to validate risk assessments and determine long-term changes.
- Operational monitoring is used to determine the status of water bodies identified as being at risk and how this changes as result of the programme of measures.
- Investigative monitoring is used to establish reasons for failure.

Specific monitoring programmes for chemical, specific pollutants, biological and physic-chemical quality elements are outlined in the individual method statements within the rest of this document, however in general a risk-based approach should be taken to determine where to monitor and at what frequency. This helps target resources where they are needed most in the environment. In practical terms it means reducing sampling where status is Good and High and focusing sampling where there is uncertainty or where the status is less than good. It is important however to not stop monitoring otherwise it is not possible to identify potential deterioration or long term trends that may become important in the future.

Because there is already an established rolling programme of monitoring, now combined with a fixed planning cycle under IWMP, there could be instances where data used in older classifications does not fall into the data window for more recent classifications. In these cases, water bodies may be given a higher status class, as a new (higher status) element becomes the driving element of classification. So that we don't give a false impression of improvement at a water body level, the result for the previously driving element is rolled forward into subsequent classification updates i.e. unless we have evidence to show otherwise, we should not ignore previously driving element results in subsequent rounds of classifications. The roll forward process is illustrated in figure 8 below.

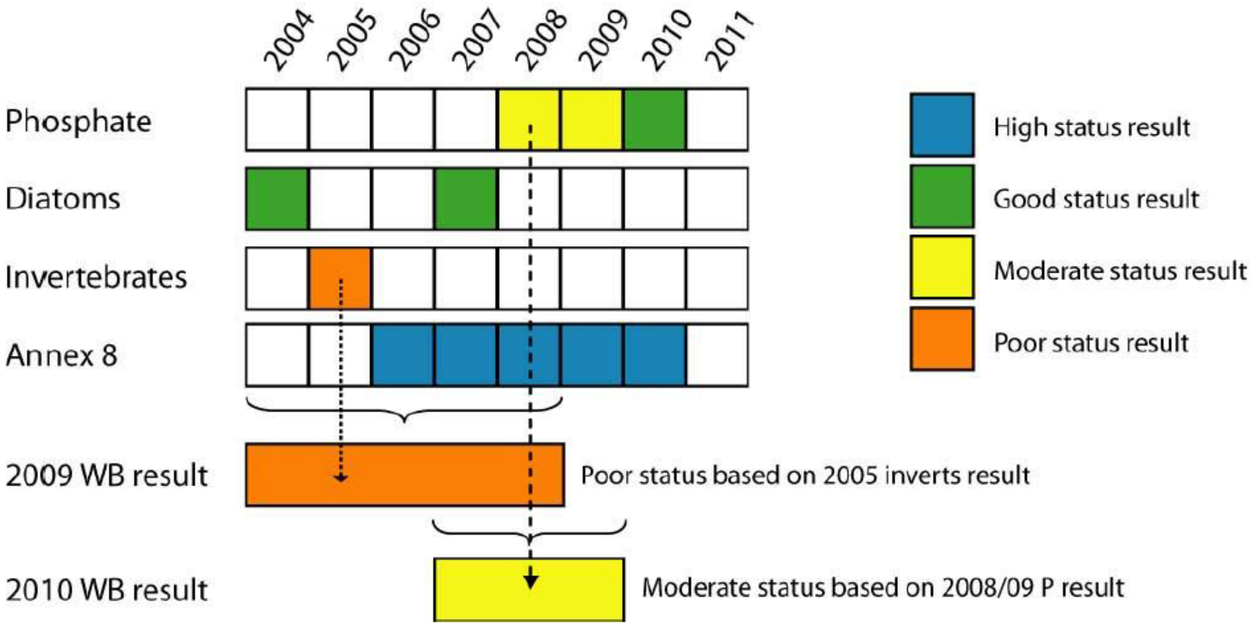

Figure 8: Illustration of the monitoring roll forward process (UKTAG 2013)

Multiple sites

As a minimum, a single monitoring site is required per catchment for each quality element. In some cases, additional sites will be required to capture the varying character and pressures within a catchment. In these circumstances, the average Ecological Quality Ratio (EQR) is used to represent 'typical conditions' for a catchment, not the very best or worst (this follows similar practices in France, and England and Wales).

10.4 Reporting confidence

Reporting confidence in a status classification does not affect or change the status; however it has proved important for prioritising strategic actions in large EU Member States, and may be useful for Jersey to consider alongside the classifications. Complex systems have been adopted to assign confidence that a catchment is not failing the quality standards, across hundreds of catchments in each Member State.

On a small island such as the States of Jersey, a simpler approach is more suitable for assigning confidence, based on the amount of monitoring used to develop the status classification:

Low confidence	There are no data with which to classify a quality element and expert judgement and donor catchments have been used instead
Medium confidence	Only a single monitoring site available, where multiple sites are required in a catchment; or monitoring frequency does not meet the method statement standards
High confidence	Monitoring frequency and distribution meets the method statement standards

Generally, measures would not be implemented immediately in low confidence situations. No-regret, low-cost actions could take place under medium confidence situations, and extensive and high cost options would require high confidence.

10.5 Process for updating the classification method

Existing standards may need to be revised when there is improved scientific understanding through research and monitoring or with the benefit of experience in their practical application which shows that existing standards are not as well matched to ecological quality as they could be. It is recommended that standards are reviewed at the beginning of each IWMP cycle, to ensure each cycle uses the best available standards. This could include the inclusion of additional quality elements.

10.6 References

Ministère de l'Écologie, du Développement durable et de l'Énergie (2012) Guide technique Évaluation de l'état des eaux de surface continentales (cours d'eau, canaux, plans d'eau)
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