1. INTRODUCTION

What is the River Health Programme? The RHP is essentially a national initiative to assess and monitor the ecological state of the South Africa's rivers using standardised indicators to garner information on the long-term environmental trends of the country's freshwater resources. The RHP rests on the foundations of the biomonitoring of aquatic ecosystems, which has been defined as "the systematic use of biological responses to evaluate changes in the environment with the intent to use this information in a quality control programme" (Matthews *et al.* 1982).

Why is it important to implement the RHP in your province? The World Resources Institute says that freshwater systems are globally by far the most degraded ecosystem and that half of the world's wetlands were lost in the 20th century. This view is supported by the United Nation's Environmental Programme (UNEP). One of South Africa's most limiting resources currently is freshwater. South Africa's National State of the Environment Report of 1999, predicts that the demand for water will increase by close to 50% by the year 2030 from present requirements. It is hence essential that we begin to monitor and assess the state of our river systems NOW so that informed management decisions can be made to ensure that the goals of sustainable development can be met. The RHP is an ideal programme to make a significant and cost effective contribution to this.

There are currently seven biomonitoring indices of "ecosystem health" which are in various stages of development and use in RHP programmes nationwide. The primary indices, which are the most well known and widely used are: SASS (South African Scoring System) for the sampling of macroinvertebrates, which is used in conjunction with IHAS (Invertebrate Habitat Assessment System). The secondary RHP indices are the FAII (Fish Assemblage Integrity Index), IHI (Index of Habitat Integrity) and RVI (Riparian Vegetation Index) which are currently being used, but to a lesser extent. The tertiary RHP indices are the GI (Geomorphological Index) and HI (Hydrological Index), for which prototypes have recently been developed, but are not currently being applied routinely in the RHP. The WQI (Water Quality Index), although previously mentioned in the literature, has not been developed at this stage of the RHP.

Not only do these biomonitoring indices provide a useful set of tools for comparatively benchmarking existing ecological conditions and prevailing water quality, they can also be used to monitor the ecological recovery of rivers and sites after major chemical spills for example. In practice, however, biomonitoring lies somewhere between a science and an art. It relies on the use of scientifically proven and tested methodologies, but the actual interpretation of significance of the results also requires a certain "feel" that only comes with experience and familiarity with rivers being monitored.

However, the RHP is much broader than just the biomonitoring of rivers. The River Health Programme is a ***people-driven process*** which requires a ***team effort*** from committed individuals. It also requires communication, liaison, promotion, quality control, information management, reporting and management actions as key components amongst others (Figure 1).

What is meant by "implementation"? In a nutshell, "implementation" can be defined as: putting a theoretical concept (or core set of objectives) into practice or something tangible. It can also be described as "producing, carrying out, or executing, achieving and accomplishing". To achieve this, the following simple (yet crucial!) questions need to be asked:

- ***What is to be done?***
- ***Where is it to be done?***
- ***How and how often?***
- ***By who?***
- ***For who?***

Therefore, the first step in implementation is to decide on a core set of objectives or principles for your particular programme (the "what" component). To recap, the broad objectives of the RHP are as follows (Roux, 1997):

1. To measure, assess and report on the ecological state of aquatic ecosystems;

2. To detect and report on spatial and temporal trends in the ecological state of aquatic ecosystems;

3. To identify and report on emerging problems regarding the ecological state of aquatic ecosystems in South Africa.

Murray (1999) proposes a fourth objective which essentially extends the reporting function of the RHP to aquatic ecosystem management.

4. To ensure that all reports provide scientifically and managerially relevant information for national aquatic ecosystem management.

The key ingredients for successful implementation of the above objectives can be found on the shelves marked: a well thought out and realistic plan, sufficient budget, dedication, commitment to putting the implementation plan into practice, patience and of course enthusiasm. Some of these ingredients (and in some cases where to get them!) for your RHP are contained in this manual and of course from wise old sages living in your area.

However, this manual is not intended to be prescriptive. The recipe and ingredients for implementing your RHP put forward in this manual are intended only as factors to consider when designing your particular programme (Figure 1). You, as the prospective implementer, have the discretion to choose which aspects you may find useful to include in your RHP design. Additional considerations not mentioned in this manual may also be pertinent to your RHP.

The underlying assumption is that each situation where implementation is required will be different, with its own unique set of practical considerations and conditions. Compounding this, is the capricious nature of reality - of ever changing circumstances and unpredictable eventualities. Prospective RHP implementers will probably encounter many obstacles (the majority of which are man made or from divine sources!) while on the implementation path. ***Perseverence, flexibility*** and ***patience*** are the qualities that you'll need to overcome these. Remember that opportunities present themselves in many different guises!

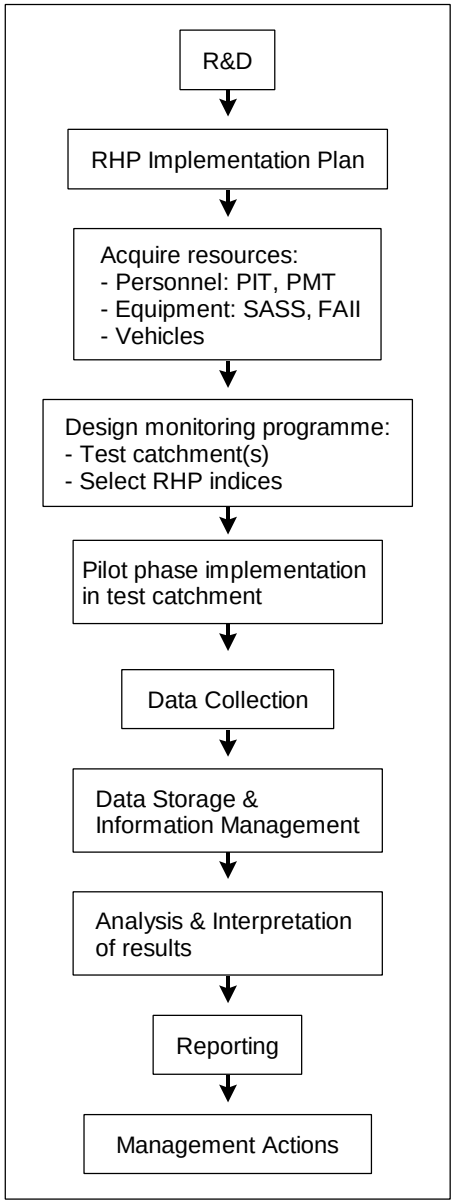

Figure 1. Fundamental steps to RHP implementation.

The RHP is a relatively new concept in environmental management in South Africa. As the programme has only recently emerged from the research and development phase, it can be expected that the RHP will take time to become fully integrated into environmental management strategies countrywide. Although there has been some implementation of the programme in some catchments in several provinces, full-scale countrywide implementation remains on the horizon. Hence it is envisaged that further practical insights into implementing the programme will emerge with time, as more RHP practitioners become involved in the programme and share their experiences with the wider RHP community.

2. LEGAL CONTEXT

Legal principles form the basis for the creation of Bills and Acts and other legal instruments which govern the activities of the nation. There are a number of Acts which are relevant to the broader environmental management field. For those who are not legally orientated, the good news is that there are only two Acts which are directly relevant to the RHP, namely the ***National Water Act (NWA) Act No. 36 of 1998*** and the ***National Environmental Management Act (NEMA) Act No. 107 of 1998.*** Both of these stem from ***Section 24 of the Constitution of South Africa (Act No. 108 of 1996)*** which states that citizens have a right to a clean and healthy environment and advocates the protection of the environment for the benefit of present and future generations through:

(i) the prevention of pollution and ecological degradation
(ii) promotion of conservation
(iii) securing of ecologically sustainable development and use of natural resources while promoting justifiable economic and social development

NOTE:
It is vital that those involved with implementing RHP become familiar with relevant Acts and take cognizance of the provisions and implications of these. These Acts are powerful legal instruments which can be used to justify stakeholder's investment in your RHP (particularly government departments) and your RHP to interested and affected parties for example.

2.1 NATIONAL WATER ACT (NWA)

The NWA is the main Act relevant to the RHP. The NWA, which came into effect in October 1999, heralded a major change in approach from controlled supply and demand management to participatory water resource management. Under the new Act, the National Government is the public trustee of the nation's water resources.

2.1.1 Sections of the NWA relevant to the RHP

Chapter 2: Water Management Strategies

Part 1: National Water Resource Strategy
The Act charges the Minister with establishing a National Water Resource Strategy (NWRS) through public consultation for the use, protection, development, management, conservation and control of the nation's water resources.

Part 2: Catchment Management Strategies
Every Catchment Management Agency (CMA) is required to develop a catchment management strategy for the water resources within its water management area. The RHP could conceivably contribute directly to the catchment management strategy of the CMA and indirectly to the national water resource strategy.

Chapter 3: Protection of Water Resources

Part 2: Determination of class of water resources and resource quality objectives:
A component of determining the class of water resources and resource quality objectives is consideration of: the characteristics and quality of the water resource and the instream and riparian habitat; the characteristics and distribution of aquatic biota. The RHP can play a direct role in both of these aspects.

Part 3: Determination of The Reserve (Ecological Reserve and Human Reserve):
The Ecological Reserve refers to the water quality and quantity required to protect the aquatic ecosystems of the water resource, which is related to the class of the water resource. The RHP can guide this process.

Chapter 7: Catchment Management Agencies

The NWA advocates the establishment of Catchment Management Agencies (CMAs) to oversee the management of the nineteen demarcated Water Management Areas (WMAs) in South Africa.
Catchment Management Agencies are composed of a number of River Forums, which in turn comprise representatives of Water User Associations (WUAs) and a number of other stakeholders from industry, government, local councils and communities. This is an exciting and novel development of taking water management to the people.

As River Fora and CMAs are catchment-based, they have the potential to play a significant role in implementing the RHP. In the future, CMAs may play the lead role in RHP implementation rather than the current provincial RHP arrangement.

Chapter 14: Monitoring, Assessment and Information

Part 1: Establishment of National Monitoring Systems
The Minister must establish national monitoring systems on water resources for the collection of appropriate information, *inter alia,* on the quantity and quality of water resources and the health of aquatic ecosystems. This is the most applicable aspect of the NWA to the RHP as the objectives of the RHP are almost identical.

Part 2: National information systems on water resources
This includes, *inter alia*, a water resource quality information system. The objectives of the National information system include the storage and provision of information for the protection, sustainable use and management of water resources. The national RHP can contribute significantly to this information system.

2.2 NATIONAL ENVIRONMENTAL MANAGEMENT ACT (NEMA)

The NEMA is essentially an enabling piece of legislation largely governing the sustainable use of the environment (including the aquatic environment) and the protection of ecosystems. It also advocates the principle of co-operative environmental governance between government departments and stakeholders, with integrated environmental management being the key underlying principle.

2.2.1 Relevant sections of NEMA for the RHP

Chapter 5: Integrated Environmental Management

The general objectives of this section include the identification, prediction and evaluation of the actual and potential impacts on the environment, risks, consequences and alternatives and options for mitigation of activities. This section also deals with the monitoring and management of environmental impacts , and the effectiveness of the implementation of mitigating measures. The RHP could contribute to this through the monitoring of sites where potential or actual environmental impacts are occurring.

Chapter 7: Compliance, Enforcement and Protection:

Part 2: Information, enforcement and compliance
Organs of State and individuals are entitled to access to information held by the State on the state of the environment and actual and future threats to the environment. The RHP therefore has an obligation to make its information available to relevant parties, particularly if this information is being held by an organ of State such as Nature Conservation and Water Boards.

NOTE:
These and other pieces of legislation (1993 onwards) are available on the internet on the South African government website: www.polity.org.za. It is strongly advocated that prospective RHP implementers become familiar with the key sections of the new legislation.

2.3 PROVINCIAL ORDINANCES

Provincial Ordinances may be relevant to your local RHP and it is worth investigating whether their are specific implications for your programme. The main provincial ordinances are the Cape Nature and Environmental Conservation Ordinance (No.19 of 1974), Transvaal Nature Conservation Ordinance (No.12 of 1983), Orange Free State Nature Conservation Ordinance (No.8 of 1969) and the Natal Nature Conservation Ordinance (No.15 of 1974). It is also worth noting that provincial ordinances promulgated in another province, can be applied within your own province. With the establishment of the new provinces of South Africa, it is anticipated that a range of new provincial ordinances will be promulgated in the near future. In some cases, ordinances from the erstwhile homelands (former TVBC States) are still valid (unless repealed). Depending on whether the geographical location of the catchment falls within the boundaries of a former TVBC State, these may be applicable to your RHP.

2.4 LEGAL POWERS OF THE RHP

As the RHP is basically a tool for monitoring of the ecological and environmental condition of rivers, it does not have any legal standing in itself i.e. it is not specifically mandated by any South African Act. What this means is that the results obtained from the various biomonitoring indices (eg SASS4 score) cannot *per se* be used in a court of law as evidence to prosecute an organisation or individual. However, the RHP can invoke certain legal principles contained in NEMA and NWA, such as the Polluter Pays Principle and Duty of Care Principle, where there is irrefutable evidence of environmental degradation or a violation of permit conditions.

3. RESEARCH AND DEVELOPMENT

The success of most projects depends on thorough background research and development and a well thought out plan. The RHP is no exception. It should include a literature review and practical assessment of local conditions and organisations which could contribute and benefit from the RHP.

Fortunately, for your review of pertinent literature, there is a large body of RHP scientific research that has been done covering the theoretical (and some practical) aspects of the RHP. The following list of documents and references are a good starting point for research and guidance:

- **$** National Aquatic Ecosystem Biomonitoring Programme (NAEBP) reports, particularly pertinent is NAEBP report series no.6: *Overview of the design process and guidelines for implementation* (Roux, 1997). Appendix A is a comprehensive list of useful reading.
- **$** RHP Newsletters - regular newsletters of the latest developments and news from the national NCC and experiences of other provinces
- **$** Water Research Commission reports
- **$** SA Waterbulletin articles
- **$** SASS4 Manual (Thirion *et. al.*, 1995)
- **$** Scientific articles on indices - especially the Fish Assemblage Integrity Index (FAII) and South African Scoring System (SASS4)
- **$** RHP website: www.csir.co.za/rhp/ and www.riverhealth.co.za (for mini SASS)
- **$** DWAF website: www-dwaf.pwv.gov.za.

Practical R&D considerations:

- **$** Your R&D should include an investigation of available resources, expertise and organisations which could play a significant role in your RHP.
- **$** A thorough examination of maps of your area (both 1:250 000 and 1:50 000 scales) is recommended. This will provide valuable information on distances, road and potential access points as well as yielding information on surrounding land-use and developments within river catchments.
- **$** An initial reconnaissance exploration of your area is also an important part of the initial R&D for your programme.
- **$** Further revelations may come to light during public participation which is bound to yield useful information about local conditions (see public participation section).

NOTE:
Research and development is an ongoing process and should continue even after your initial RHP plan has been formulated and implementation has commenced. R&D is essential to continuous improvement of your RHP.

After doing some initial research, the prospective RHP implementer may feel a bit overwhelmed and possibly a bit daunted. Do not pay homage to these feelings. There are many people out there who are doing it and who are willing to offer support, advice and guidance. They are just a phone call away!

4. REGISTERING YOUR PROVINCIAL RHP PROGRAMME

4.1 REGISTRATION WITH THE NATIONAL RHP NCT

It is important to register your provincial RHP programme with the National Coordinating Team (NCT) and report to this body on a regular basis. The NCT is there to lend support to the provincial endeavours and communicate the latest developments to the provinces.

4.2 REGISTRATION WITH DWAF IWQS

If it is envisaged that the DWAF - Institute of Water Quality Studies (IWQS) laboratory will be performing routine chemical analysis of water samples (for heavy metals and other components) for your provincial programme, it needs to be registered with IWQS. In this way, your RHP monitoring programme will be incorporated into DWAF's electronic Water Management System (WMS) and will form part of the national water monitoring programme. In addition, registered programmes receive priority with their laboratory and analysis of samples will be assured.

5. RIVER HEALTH CHAMPION

The provincial River Health champion has the overall responsibility for implementing the RHP within his or her province. At present, RHP champions are based at the provincial government environment department or parks board or water board.

5.1 ROLES AND RESPONSIBILITIES OF THE RIVER HEALTH CHAMPION

- **$** Implementation and co-ordination of the provincial RHP
- **$** Forming and leading the Provincial Implementation Team (PIT)
- **$** Formulating the RHP Implementation and Business Plans
- **$** Reporting to the National Coordinating Team (NCT)
- **$** Attending National Coordinating Committee (NCC) meetings
- **$** Training and skills development of the PIT and PMT
- **$** Co-ordinating the RHP with neighbouring provinces and/or WMAs
- **$** Liaising and promoting of the programme to other relevant stakeholders.

NOTE:
With the coming into effect of the nineteen Water Management Areas (WMAs) - along major drainage lines or water sheds - and the associated Catchment Management Agencies (CMAs), the RHP Champion may become CMA- based rather than provincially based. However, the RHP Champion's roles and responsibilities will probably remain the same.

6. FORMING THE PROVINCIAL IMPLEMENTATION TEAM (PIT)

The RHP requires a team effort to get it up and running provincially. The PIT is *THAT* team of dedicated individuals which drives the RHP programme in your province. It is the "board of directors" of your RHP.

There are no fixed rules concerning the appointment of PIT members or the PIT's size and composition. However, the PIT should comprise of the major role players and stakeholders in water management in your province. Individual PIT members also have an additional role of garnering support for the programme from their organisations and conveying information to and from the PIT. Hence a good strong and representative PIT is imperative for your RHP to be successful. The PIT should meet regularly to review progress and discuss pertinent issues.

6.1 IDEAL COMPOSITION OF THE PIT

- The RHP champion (leader)
- Other staff from within the Champion's organisation (environmental officers or aquatic scientists)
- Provincial Environmental Affairs officers
- Regional DWAF representatives
- Representatives from the relevant River Forum or Water Users Association within your Catchment Management Agency
- Water Board representatives
- Environmental officers from industries within the catchment with an interest or impact on rivers within the province
- Staff and students from local universities
- Environmental consultants (if the budget allows!)
- Representatives from environmental NGOs
- Representatives from local communities.

6.2 ROLES AND RESPONSIBILITIES OF THE PIT

- Implementing the RHP according to available capacity and expertise and provincial requirements
- Researching biomonitoring needs and requirements
- Identifying important rivers for the RHP
- Selecting monitoring and reference sites
- Coordinating the programme and liaising with relevant authorities
- Obtaining support for the RHP from major stakeholders in the province such as government, river fora, industry, NGOs, farmers and local communities
- Securing and attracting funding
- Managing the programme (resources and infrastructure)
- Training of monitoring personnel
- Promoting the RHP in your province/WMA
- Setting of standards of rivers being monitored
- Quality control
- Storage and management of information
- Analysing results and detection of environmental trends
- Disseminating information and reporting to stakeholders, government and CMAs
- Management actions within the catchment
- Communication between RHP initiatives in other provinces.

Based on the above list, it is suggested that clear roles and responsibilities be assigned to each PIT member. In addition, a signed memorandum of understanding between key government departments and other collaborating organisations within the PIT which clearly spells out the roles, functions and responsibilities of each organisation is a useful document for successful RHP implementation. This also assists these government departments in justifying their RHP expenditure to top management and even their auditors.

An alternative to the PIT is the **"community-of-practice" (COP)** for co-ordinating collaborative RHP efforts. The COP is a less formal arrangement than the PIT consisting of a guiding team, strategic partners and tactical partners which share resources, expertise and take on set roles and responsibilities (Roux, 2000). The Mpumalanga Parks Board took the COP route to successfully implementing their RHP programme.

NOTE
As with the case of the River Health Champion, the PIT may in the near future become the Water Management Area (WMA) Implementation Team rather than be provincially based. It will probably form part of the Catchment Management Agency Committee.

7. FORMING THE PROVINCIAL MONITORING TEAM (PMT)

The PMT is a pivotal component of your RHP, as this is the group of people who actually go out and do the biomonitoring of the selected rivers. This team consists of the technicians and trained monitoring staff which may be part of the PIT if this is more expedient. However, if it is not, then it is imperative that the PMT liaise with the PIT on a regular basis to report on findings, site conditions etc.

7.1 SELECTION OF SUITABLE MONITORING PERSONNEL - APTITUDES, INTERESTS AND BACKGROUND

Literacy and a valid drivers licence are about the only “qualifications” needed for monitoring staff as well as enthusiasm and commitment. A broad knowledge and interest in the environment is a strong recommendation. Willingness to work in the field is another important consideration. For this reason, nature conservation or Parks Board staff are ideal candidates.

7.2 IMPORTANT CONSIDERATIONS FOR FIELD PERSONNEL

$ Fieldwork is potentially hazardous. The occupational health and safety of field workers must be borne in mind at all times. Make sure that adequate measures to protect field workers have been taken and that your RHP field activities comply with the requirements of the Occupational Health and Safety Act (Act No 85 of 1993). Apart from the possibility of jeopardising the safety of your PMT staff, failure to do so may result in costly legal action if an accident occurs while in the field.

$ First Aid - it is essential for monitoring staff to attend a course on basic first aid. First Aid kits must be supplied to each biomonitoring team.

$ Ability to swim - often assumed or overlooked, but a very real concern for RHP monitoring personnel.

$ Physical fitness - ideally monitoring staff should be reasonably fit and willing to spend long hours in the field. Sampling often requires long trips over rough terrain and can be strenuous.

$ Security of vehicles and equipment - an important consideration, especially out in remote areas.

$ Knowledge of the area being monitored is a definite advantage for monitoring personnel.

$ ***Warning!! Monitoring personnel must never go out into the field alone!!*** Ideally monitoring staff should work in pairs. This reduces the workload and time spent at each site, and if an emergency situation arises, two people will be in a better position to deal with it than one.

8. TRAINING AND SKILLS DEVELOPMENT

Depending on their assigned roles and responsibilities, the different people involved with your RHP will require different forms of training, It is assumed that members of the PIT would generally have some environmental management experience and knowledge, but may benefit from attending a course on the theoretical aspects of biomonitoring and the objectives of the RHP. It is recommended that PIT members become familiar with the RHP indices (particularly SASS and IHAS) as well.

Members of the PMT obviously require more “hands-on” practical training to perform their biomonitoring tasks effectively. It is advised that training begin with SASS and IHAS. Biomonitoring (particulary SASS) requires a fair amount of training for staff to become familiar with the wide array of aquatic invertebrates and to identify them accurately and consistently. On-site training is preferred, so that staff gain experience with sampling techniques and protocols.

In addition, PMT staff require training in the use of water quality instruments, such as pH meters, dissolved oxygen and conductivity meters and taking water samples. Because the RHP demands spatial and navigational skills of monitoring staff, competency in the use of a Global Positioning System (GPS) and the ability to read and interpret maps is essential. If digital cameras are to be used for the recording of the site, then a basic course in how to use the camera and fundamentals of photography is also required. Skills in using these instruments will become honed with time and experience in the field.

The PMT staff should attend a course in basic First Aid before going out into the field. These courses are offered by a variety of organisations such as the St Johns Ambulance Association.

It is also beneficial for PMT to become familiar with the theoretical aspects of the RHP, especially criteria for site selection, advantages and limitations of the different indices etc. Information sharing and capacity building is the name of the game!

NOTE:
For a list of expertise and organisations offering training in the Indices of Ecosystem Health, see the section on “Organisations offering support for the RHP”.

9. COMMUNICATION

Communication is especially crucial where a “multi-disciplinary” team is setting out to achieve a common objective in a coordinated fashion, such as the RHP. Successful implementation of your RHP *will depend on an efficient and reliable flow of information* between the various participants. Ironically, despite technological advancements such as email and cellular phones, communication is often taken for granted or neglected, leading to misunderstandings and a range of avoidable problems.

Attention should be given to the intended flow of communication, tools available to inform those involved, language and what needs to be communicated to or by whom. It is also important to use the medium of communication which is best suited to the situation at hand, given budget and technological constraints.

The two major forms of communication are internal (e.g. between members within your provincial RHP, such as the PIT and PMT) and external (e.g. to/from your provincial RHP to/from external stakeholders and interested and affected parties). In addition, communication between your RHP and adjacent RHP initiatives should also be included in your RHP communication strategy to coordinate monitoring activities of shared catchments.

9.1 INTERNAL CHANNELS OF COMMUNICATION

This includes the important issues of day-to-day communication essential for coordinating the PMTs monitoring activities and circulating minutes of PIT meetings to all your RHP participants. Important channels of internal communication include:

- **$** National RHP NCT/NCC to/from Provincial Champion
- **$** Provincial Champion to neighbouring Provincial Champion
- **$** Provincial Champion to/from PIT
- **$** PIT to/from PMT.

9.2 EXTERNAL CHANNELS OF COMMUNICATION

This aspect should address the flow of information to and from your RHP and external “clients” of the programme. These include:

- **$** RHP Champion or PIT to/from funding organisations
- **$** PIT members to/from their respective organisations
- **$** PIT to/from relevant River Fora or Catchment Management Agencies
- **$** PIT to/from interested and affected parties.

NOTE:
See sections on liaison, promotion and marketing and reporting for more details.