

# ADOPT-A- RIVER PROGRAMME PHASE II: DEVELOPMENT OF AN IMPLEMENTATION PLAN COMMUNICATION STRUCTURES



**water affairs**

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Directorate: Resource Quality Services, Department of Water Affairs

## Republic of South Africa

# ADOPT-A- RIVER PROGRAMME PHASE II: DEVELOPMENT OF AN IMPLEMENTATION PLAN COMMUNICATION STRUCTURES

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## EXECUTIVE SUMMARY

The aim of the Adopt-a-River Programme is to create an understanding among stakeholders of the concepts of integrated water resource management and to encourage them to become actively involved in the protection and management of these water resources. For this reason, the Adopt-a-River Programme includes a range of activities, such as water quality monitoring, clean-up campaigns and alien plant eradication, which promote an integrated management of the nation's water resources.

The objective of this task is to develop the frameworks for two types of communication structures for the Adopt-a-River programme. The first component is aimed at developing an active communication framework to promote communication between Adopt-a-River coordinators and Adopt-a-River participants, and between participants. This includes communication and information dissemination aimed at specific stakeholders or potential stakeholders and with the purpose to create a response. Active communication and information dissemination includes activities such as telephone and email communication, newsletters, presentations, exhibitions, brochures, and the use of radio and/or television media.

In order to effectively communicate the data that will be generated through the Adopt-a-River Programme, the information must be analysed, interpreted and shared with relevant stakeholders. It is therefore central to the successful implementation and establishment of the Adopt-a-River programme that information is effectively shared to stakeholders in a manner which generates continued support and interest by the various stakeholders.

The Adopt-a-River Programme includes a broad range of stakeholders, ranging from the scientific community, national and local government, water resource managers and planners and the general public, who will make use of the information generated by the Adopt-a-River Programme. It is therefore necessary to tailor the information in such a way that it is specific to the needs of the targeted stakeholder group to ensure that it is understood and relevant.

This report provides an overview of communication skills and media which can be used to effectively communicate information on activities promoted by the Adopt-a-River Programme, such as water quality monitoring results, clean-up campaigns and alien plant eradication. This report provides guidance to the National and Regional Coordinators of the Adopt-a-River Programme in effective sharing of information to the diverse group stakeholders involved with the Adopt-a-River Programme in a manner that generates continued support and interest. It should be noted that this document will also be of value to the Adopt-a-River participants to enable them to communicate effectively with their stakeholders.

The purpose of this report is to highlight the different information requirements of the various stakeholders and how best to disseminate the information in a way that increases the chances that the message being communicated gets across clearly to the right people. The report provides an introduction to effective communication skills and a review of different communication media such as email communication, field days, newsletters, posters, radio and television. The report also identifies the potential stakeholders for the national, regional and

local coordinators and recommends appropriate media that can be used by them to communicate with their stakeholders.

The second component is aimed at developing a framework for passive communication between the Adopt-a-River coordinators and stakeholders and between different stakeholder groups. The internet provide an excellent platform for making information available that would support Adopt-a-River activities. This may entail developing a web-based communication and information system where information about monitoring protocols, data reports, research reports, etc. can be made available.

The Project Team has used experience gained and lessons learnt from previous projects of a similar nature to make practical recommendations regarding implementation of an appropriate communication structure.

Passive communication should focus on development of an appropriate and dedicated platform which allows individuals to access and review information at any stage. The three main components of the Adopt-A-River Programme that needs to be addressed by an appropriate passive communication medium are:

- Document repository promoting awareness creation (e.g. protocols, procedures, guidelines, methodologies/techniques and other training material related to establishing and managing an appropriate river monitoring programme)
- Ability to view river water quality related data (e.g. view river water quality data collected through National initiatives)
- Ability to load river water quality related data (e.g. stakeholders load on-site observations)

The above has been used as a basis to discuss typical aspects that need consideration.

The four key technical components of an on-line data management system include:

- Operating system (e.g. Microsoft Windows, Linux)
- Database (e.g. MySQL, Oracle)
- Programming language (e.g. Python, XML, C++)
- Web server (e.g. Apache)

Prior to development, implementation and operation of a data management system appropriate for passive communication, the most important question to ask is ***“What do we want to get out of it?”*** In particular, the following questions should be considered:

### **Resources**

- What resources are available to develop, maintain and operate the database (human, software, financial, etc)?
- Who will administer the database (e.g. governmental department, service provider)?

**Data Security and Storage**

- How will you control security (e.g. register, username and password, view vs. administration rights – avoid data editing/deletion)?
- What database storage capacity will be required (e.g. server size)?
- Where will data be stored (e.g. secure off-site location (data centre) and back-up (data centre, offshore or other local data centre), etc)
- What data (raw data, calculated data, both), documents (references, legislation, education, training), photos, etc will be stored?

**Data Entry**

- Who will enter data onto the database (volunteers, municipal staff, service providers, etc)?
- What data will be entered into the database (e.g. water quality, documents, contacts, etc)?
- What is the desired accuracy of the data entered (e.g. significant figures)?
- How will you control the integrity of the data (e.g. quality assurance and quality control, set range limits, set decimal places, programmed calculations, data checks, security, proper training, etc)?

**Data Use**

- Who will use the data (local government, provincial and national government, research organizations, public, etc)?
- What will the data be used for (e.g. provincial/national water quality reports, regulation, baseline information, etc)?
- What reports or outputs do you want from the system (documents, graphical displays, map displays, tabular displays, spreadsheets, statistics, etc)?
- Do you want to export data from the database (e.g. view, print or download information – graph, spreadsheet, etc)?

**Communication and Training**

- What links will be available (e.g. links to other organisations that participate river water quality management activities, links to Departmental web sites and staff, international websites, etc)?
- Will discussion forums be required (e.g. moderated discussion forums where participants can exchange ideas, raise issues, consult domain experts, etc)?
- Do you want to e-mail data, notifications or alerts (e.g. to individuals, organisations, etc)?
- How will database users be trained (individuals, groups (one-to-many), train-a-trainer, on-line vs. workshops, etc)?
- Is a Helpdesk required (assist with queries, issues, etc)?

Before planning and development an appropriate passive communication system for the Adopt-A-River Programme, the following critical decisions must therefore be made:

- Website only vs. on-line database/system (database and website front end)
- Start small, but ensure that the framework of the system can accommodate potential future requirements (without the need to re-design the entire system at high cost)
- Use of licensed software vs. use of free and opens source software (FOSS) (e.g. “Software Purchase” model or “Software as a Service” model)

- Adopt-A-River Programme is a standalone application with its own identity.

Bearing the above in mind, it is recommended that regardless of the system utilised, the following aspects have received serious consideration:

- No or little development time
- Robust, reliable, easy to use and proven system
- Up & running in a very short time period
- Already aligned with DWA and water sector initiatives
- Ideally, only need a computer with Internet access & web browser (think on-line banking, no software installation, automatic updates)
- Ability to connect to data from anywhere (remote facilities/offices, staff that are travelling, stakeholders, etc)
- A team is available to provide on-going support (training, maintenance, etc)
- The system is housed in a secure data centre with regular back-ups
- The system is up-to-date with latest water quality standards, guidelines and related legislation.
- Collaboration with/benefit from other water sector related developments
- As far as possible trial the system before implementation (i.e. no loss of capital (development/software purchase) if needs not met)

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## **1. AIMS AND OBJECTIVES**

The main aim of the Adopt-a-River programme is to create an understanding among all water users of the concepts of integrated water resource management, to encourage them to become actively involved in the protection and management of these resources. Specific objectives include:

- Promoting a volunteerism ethic in South Africa to benefit all levels of society.
- Empowering all users of water to protect their water resources and participate in water resources management as captured in Key Focus Area, 9.5 of the DWAF Strategic Plan.
- Facilitating the involvement of patrons and sponsors (influential individuals) in stakeholder empowerment and resource management strategies.
- Developing and making available the necessary tools for training and empowering local implementing agents and other role-players.
- Ensuring optimum efficiency, through involvement and linkages with other existing programmes and initiatives aimed at water resource protection and management.

A phased approach is being followed to develop the programme. Phase 1 was the initiation and development of a Strategic Framework document (DWAF, 2007). Phase 2 of the project (of which this task forms part) is the development of an Implementation Plan and the preparation for Phase 3 where pilot implementation on selected rivers will take place.

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## **2. PURPOSE AND METHODOLOGY**

The objective of this task is to develop the frameworks for two types of communication structures for the Adopt-a-River programme.

The first component is aimed at developing an active communication framework to promote communication between Adopt-a-River coordinators and Adopt-a-River participants, and between participants. This includes communication and information dissemination aimed at specific stakeholders or potential stakeholders and the purpose it to promote a response. The principles of "IEP", Inform, Educate, and Persuade, will be applied in the development of an active communication framework. Active communication and information dissemination include activities such as telephone and email communication, newsletters, presentations, exhibitions, brochures, and the use of radio and/or television media.

The second component is aimed at developing a framework for passive communication between the Adopt-a-River coordinators and stakeholders and between different stakeholder groups. The internet and the World Wide Web provide an excellent platform for making information available that would support Adopt-a-River activities. This may entail developing a web-based communication and information system where information about monitoring protocols, data reports, research reports, etc. can be made available.

The Project Team has used experience gained and lessons learnt from previous projects of a similar nature to make practical recommendations regarding implementation of an appropriate communication structure.

### 3. ACTIVE COMMUNICATION

#### 3.1 THE IMPORTANCE OF APPROPRIATE COMMUNICATION STRUCTURES

The aim of the Adopt-a-River Programme is to create an understanding among stakeholders of the concepts of integrated water resource management and to encourage them to become actively involved in the protection and management of these water resources. For this reason, the Adopt-a-River Programme includes a range of activities, such as water quality monitoring, clean-up campaigns and alien plant eradication, which promote an integrated management of the nation's water resources.

In order to effectively communicate the data that will be generated through the Adopt-a-River Programme, the information must be analysed, interpreted and shared with relevant stakeholders. According to Aristotle, "*if communication is to change behaviour, it must be grounded in the desires and interest of the receivers*". It is therefore central to the successful implementation and establishment of the Adopt-a-River programme that information is effectively shared to stakeholders in a manner which generates continued support and interest by the various stakeholders.

The Adopt-a-River Programme includes a broad range of stakeholders, ranging from the scientific community, national and local government, water resource managers and planners and the general public, who will make use of the information generated by the Adopt-a-River Programme. It is therefore necessary to tailor the information in such a way that it is specific to the needs of the targeted stakeholder group to ensure that it is understood and relevant.

To be truly effective, the information presented to the stakeholders must improve the understanding and knowledge of its users and contribute to effective decision making. Understanding what information stakeholders want is one challenge. The other is how stakeholders would prefer to receive the information. As we live in an era of information overload, it is impossible to read everything. For this reason, people generally prioritise the time spent reading an article based on the perceived value of the information. It is therefore essential to establish how stakeholders prefer to receive information and the manner in which it is presented as this increases the chances that the message gets across clearly to the right people.

#### 3.2 EFFECTIVE COMMUNICATION SKILLS

##### 3.2.1 Communication principles

To ensure that the information is communicated to the stakeholders effectively, the following communication principles should be considered:

- *Keep it standard.* Only deviate from the standard way of doing things when:
  - They are convincingly better than existing simple and standard methods; and

- They address the needs of target users more appropriately.
- *Keep it simple.* The simplest messages are often the most powerful and memorable.
- *Keep it scientifically sound.*
- *Keep it concise.* Use as few words as possible to communicate your message, but make sure it remains clear.
- *Keep it relevant.* Stick to the point of the message you wish to communicate.
- *Keep it targeted.* Tailor your message and media to the target user.
- *Keep it honest.*

### 3.2.2 Language

South Africa has 11 official languages, with English being the most universally used. However, in some areas, it may be necessary to translate the information presented in the document into the language more commonly used in that area to ensure that your message is understood clearly.

### 3.2.3 Level of knowledge

Depending on their background, nature of their work and exposure to water-related issues, the knowledge and awareness level of water related issues and concepts, such as water quality, vary amongst the stakeholders. The knowledge and awareness level typically ranges from basic to advance. Stakeholders with a basic level of knowledge and awareness include the general public (for example schools, Politicians and the readers of newspapers and general magazines). Stakeholders with an intermediate knowledge and awareness include the informed public (members of conservancies, special interest groups, non-governmental organisations and readers of conservation magazines), water resource managers, environmental managers, conservation managers and technical water resource managers. Stakeholders with an advanced knowledge and awareness include scientists, academics, technical and research officers.

Depending on the level of knowledge and awareness of the targeted stakeholder group, you may compile your document in the following manner to make sure your message is clear to the targeted group of stakeholders:

Knowledge and awareness level	Document structure
Basic	<ul style="list-style-type: none"> <li>• Smiley faces ( ☺ or ☹ )</li> <li>• icons</li> <li>• Graphics (photographs, illustrations)</li> <li>• Summary text and tables of data</li> </ul>
Intermediate	<ul style="list-style-type: none"> <li>• Graphics (photographs, illustrations)</li> <li>• One page summary</li> <li>• Technical Reports with trend data</li> </ul>

Knowledge and awareness level	Document structure
Advanced	<ul style="list-style-type: none"> <li>• Graphics (photographs, illustrations)</li> <li>• Summary text and tables of data</li> <li>• Spatial data</li> <li>• Technical / scientific reports</li> </ul>

### 3.2.4 Inform / educate / persuade (IEP)

The purpose of your data is to *inform* stakeholders of the results of the Adopt-a-River Programme. The data can be presented in different ways depending on the nature of the data and the targeted audience. For example, the data can be used to *educate* stakeholders on the conditions of the water resource. The data can be used to *persuade* stakeholders to take action. Not all communications with stakeholders need to include all three of the above elements, but a good understanding of when to emphasize each type of element can enhance your effectiveness.

**Inform:** There is a subtle difference between data and information. Data is a series of observations, facts or measurements which is used as a basis for reasoning, discussion or calculation. Information is the communication of knowledge or intelligence. If you want the stakeholders to act intelligently, you need to give them information.

**Educate:** An educational component is necessary as not all stakeholders have the same knowledge background, the issue may not be well known or the situation is complex. If possible, you should try to establish the detail of education required in order for the stakeholders to clearly understand the message that you wish to convey.

**Persuade:** You may need to persuade people to do the right thing, even if the stakeholders are aware of the problem and its cause. There are many reasons why people understand a problem, but don't react. They might be weary from previous fights over the water resource; the task might seem too daunting; they may have other priorities or it's going to cost them money. Find out what motivates the stakeholders and focus efforts in those directions. Motivation is different for each stakeholder. However there are some common strategies that work well:

- *Crisis:* This negative form of motivation is commonly considered to be a sure-fire tool.
- *Enthusiasm:* Good news and grand visions also gets good results with many people.
- *Guilt / public image:* Everyone wants to be loved. You can use the spectre of both positive and negative publicity to persuade people to do the right thing.
- *Self interest:* The bottom line. This is the best of all motivators. If you can show how your recommendation will make life more economical for business, increase tourism, etc, you may raise action to a new level.

Depending on your role in the Adopt-a-River Programme (i.e. National or Regional Coordinator or Local Group Leader) you may be required to interact with stakeholders at different levels of government, stakeholders from various industries or the general public. The use of the above-mentioned three elements will vary depending on which group of stakeholders you are required to interact with. This is illustrated in **Figure 1.1**.



**Figure 1.1: Example of communication lines and elements used**

It is envisaged that the role of the *National Co-ordinator* will be to inform, report back and to elicit support from the national organisations, such as the Department of Water and Environmental Affairs (DWEA): Head Office, the National Department of Environmental Affairs and Tourism (DEAT), politicians, the Department of Education and National Non-governmental Organisations. The National Co-ordinator will be required to persuade and lobby for funding from various non-government (such as industries and mining houses) and government organisations. The National Co-ordinator may also be required to persuade tertiary institutions to encourage students and lecturers to participate in the Adopt-a-River Programme. In terms of the educational aspect, the National Co-ordinator will train and provide support to the Regional Co-ordinator.

The *Regional Co-ordinator* will liaise with a more geographically focused group of stakeholders, such as the DWEA: Regional Office, Provincial DEAT, District and Local Municipalities, Metropolitans, Catchment Management Agencies (CMAs) and Regional NGOs. The Regional

Co-ordinator will also inform and report back to the National Co-ordinator about the Adopt-a-River activities being undertaken in that area. The Regional Co-ordinator will need to persuade and elicit support from politicians, district and local municipalities, metropolitans, funding organisations and local Adopt-a-River patrons to donate money, staff, resources and facilities to establish Adopt-a-River activities. The Regional Co-ordinator will be responsible for training and providing support to the Local Group Leader.

The *Local Group Leader* will provide feedback to the Regional Co-ordinator about the activities that he/she has undertaken and the outcome of the activities. The Local Group Leader will liaise with a more focussed group of stakeholders, which are directly associated with the water resource. This group of stakeholders includes the River Catchment Forums, Irrigation Boards, Water Users, general public and the volunteers. The Local Group Leader will need to persuade stakeholders to be more involved and to volunteer their time and resources to Adopt-a-River activities. The Local Group Leader will also need to co-ordinate volunteer activities and liaise with landowners to gain access to their properties, if required, to undertake the Adopt-a-River activity. The Local Group Leader will be responsible for training the volunteers.

### **3.3 COMMUNICATION MEDIA**

#### **3.3.1 E-mail communication**

E-mails are a fast and efficient means of communication and can be used to transmit attached electronic versions of brochures, technical reports, popular articles, etc. E-mails can be used as a formal means of communication with specific stakeholders, or they can be more general targeting a broad audience. ‘

If you are sending information via e-mail communication, you need to ensure that the size of the attached document is not too large as it will increase the download time. It is advisable that e-mail attachments are not larger than 500 KB. If you need to send larger files, it is advisable to use a web based file uploader service and send the link to the recipients. There are a number of free web based file uploader services that can be used to transfer large electronic files, such as “Transfer Big Files” (<http://www.transferbigfiles.com/>) and “You Send It” (<http://www.yousendit.com/>).

The disadvantage of using e-mails is that they can be filtered by an internet service provider which may recognise it as spam. The list of email addresses can go out of date soon and must be updated periodically. Viruses and worms can be transmitted via e-mails. E-mails are not 100% reliable and may not reach their intended recipient and you may not be notified of this.

#### **3.3.2 Field days**

Field days can provide a good opportunity for you to demonstrate what you do while out participating in an Adopt-a-River activity, such as water quality monitoring. Field days can be

used to recruit individuals to volunteer their time. It can also provide an informal opportunity where scientists can interact with water resource managers, politicians, elected representatives and other stakeholders. It also provides an excellent opportunity to talk and develop an understanding of each others' challenges. To maximise the success of your field day, in terms of group interaction, ensure that all invited attendees confirm their attendance/non-attendance to your invitation. You should also request contact numbers of attendees in case you need to change the location or date due to inclement weather. Depending on the duration and timing of the field day, it may be necessary to provide refreshments and food.

### **3.3.3 Information brochures, flyers and fact sheets**

Information brochures, flyers and fact sheets are excellent media to create awareness of the Adopt-a-River Programme. They are usually written in a non-technical manner to reach a wider audience. Information brochures and flyers are useful for providing general overviews and can also be used to capture and communicate Adopt-a-River success stories. They should also contain contact details for interested readers to follow up on. They are useful as handouts at exhibitions, presentations and meetings. Fact sheets are usually simple, one-page documents listing facts or statistics in a simple-to-read format for any audience. Depending on the quality of the print and use of colour, information brochures, flyers and fact sheets can be relatively cheap to produce in large numbers.

### **3.3.4 Meetings**

Meetings can be scheduled with any of the stakeholders that are involved with the Adopt-a-River Programme. In order to make the meeting effective, the following tips have been provided:

#### ***Before the meeting***

- Make an appointment.
- Gather a delegation.
- Be on time.

#### ***Preparing for the meeting***

- Establish your agenda and goals. Decide what kind of commitment you are asking for (i.e. resources, facilities, funding or support).
- Select someone to act as the group leader and make a list of points to be made and questions to be asked by each person. A rehearsal is a great idea, if you have time.
- Prepare materials. For greater impact, bring a packet to the meeting with materials such as: fact sheets, brochures, popular articles, or technical reports. Include your name and phone number so that the stakeholder can contact you for more information.

#### ***During the Meeting***

- Be concise and diplomatic. Keep your presentation short and to the point, as you will only be allotted a few minutes.
- Make clear exactly what action you wish the stakeholder to take. It is important to listen to the stakeholder, even if his or her view differs from your own. Don't be argumentative or confrontational.
- Put a local and personal angle on the issue. Be specific. Cite local statistics and give examples of applicable Adopt-a-River activities being undertaken.
- Press for a commitment.
- Don't be intimidated. If you are asked a question that you do not know the answer to, simply say that you don't know, but that you will find out. Get a fax number or email address and be sure to provide the necessary information as soon as possible.

### ***After the Meeting***

- Thank the stakeholder for their time, summarize the key points you made during your visit and include any information you promised to provide.
- Provide follow-up Information. If the stakeholder asked questions, or was particularly interested in one aspect, seize the opportunity to follow up with a letter, fact sheet, phone call, or second meeting.
- Build a relationship. A first visit should never be the end of contact. Make sure you or someone in your group stays in touch with the stakeholder.

### **3.3.5 Networking**

Networking takes place at professional societies, conferences, seminars, workshops, forum meetings, training and field-day demonstrations. The potential for interaction and discussion is created by individuals who share a common interest. Depending on your role in the Adopt-a-River Programme (i.e. National Co-ordinator, Regional Co-ordinator or Local Group Leader), you will be required to interact with different levels of government and non-government organisations. For example, the National Co-ordinator will interact with representatives from the DWEA: National Office, National DEAT, the Adopt-a-River Steering Committee, politicians and provincial NGOs. The Regional Coordinator will interact with the representatives from the DWEA: Regional Office, Provincial DEAT, district and local municipalities, metropolitans, CMAs and regional NGOs. While the Local Group Leader will interact with representatives from the River Catchment Forums, irrigation boards, water users, general public and the volunteers.

In order to increase the networking opportunity, you should take note of the following networking skills:

- Be on time.
- Take along your business card or a brochure with your contact details. You should also ask for the other person's business card so that you can follow-up on the discussion.
- Have a clear understanding of the aim of the discussion and your targeted audience. In some situations, your aim may be to elicit funding for Adopt-a-River activities and in

other situations your aim may be to inform people of the project to gain their support or to volunteer their time.

- Prepare a brief introduction on the Adopt-a-River Programme, which provides a concise summary of the programme and the activities being undertaken. Depending on the situation, you may wish to tailor your introduction to focus on specific information relevant to the target audience.
- Follow-up on conversations with either a telephone call or an email.
- Note down the details of the people that you have met and a couple of brief points detailing the discussion in a database. This will ensure that you have their contact details and remind you of their particular interests.

### **3.3.6 Newsletters**

Newsletters are generally written for a specific audience and cover timely topics that are of interest to a specific audience. Depending on the audience, newsletters can either be technical or non-technical. Newsletters can be distributed monthly, quarterly or annually either as hard copies or electronically. It is important that newsletters are distributed regularly so that those receiving it can begin to expect and look forward to receiving it.

The advantage of using newsletters is that they can contain colour images (such as photographs, maps and drawings), which makes them more accessible to the general public. However, colour images are expensive to print and may limit the electronic distribution of the newsletter via email. An example of a newsletter which is regularly emailed to members of the organisation is the Water Institute of South Africa (WISA) newsletter.

### **3.3.7 Popular articles**

There are a number of magazines published in South Africa which focus on environmental issues and water issues. These magazines include “Urban Edge”, “Resource”, WESSA Journal” and “The Water Wheel”. The advantage of using a magazine is that the message can be communicated to a group of “like-minded” readers who are interested in environmental and/or water related issues. Articles can be used to convey technical information from the water quality monitoring or it can be used educate readers in an informal way. Printed articles can also be kept as a permanent record by interested individuals. To ensure that feedback from interested readers can be provided, it is important to include contact details.

### **3.3.8 Posters**

Posters are a good way to advertise the Adopt-a-River Programme and to create awareness. Posters are also a good way to get people interested in the results of the activity. Posters can be designed for exhibitions at conferences, workshops, forums, schools, libraries or community notice boards. Posters should be creatively designed with minimal information so that it is visually appealing and it only takes a quick glance to absorb the message. Posters should also

include contact details to allow for people to request additional information or to volunteer their assistance.

### **3.3.9 Presentations**

Oral presentations at conferences, seminars, workshops, forums, community meetings, schools, outdoor / environmental shows and farm days are useful vehicles for communicating results and information regarding the monitoring programme. The advantage of presentations is that they can be interactive, allowing for questions and issues to be addressed on the spot.

Information on the activity can also be presented at training sessions (in-house or externally) to create a basic understanding of the concepts and the advantages and disadvantages of the different monitoring methods. Technical course can provide practical experience and the know-how of methodologies used.

### **3.3.10 Printed media**

Printed media, such as newspaper articles, can be a good way to share information in a more structured manner than radio interviews. The advantage of using printed media is that it provides a permanent record of the message. For this reason, care should be taken to ensure that the message is clear and accurate. Depending on the choice of newspaper, your audience may be a small target group (i.e. community based newspaper) or may include a broad group of readers who may not be aware or affected by the water resource in question (i.e. provincial or national newspapers). Depending on the message you wish to convey, you may either send a media release, arrange for an interview to be conducted or submit an advertisement. It is important to first find out what the costs are, as a wide variety of cost options may be available (varying from high rates for once-off use to discount rates for regular use).

### **3.3.11 Radio media**

Media reports are an important means for disseminating general information about the Adopt-a-River Programme. The advantage of using the radio is that it stimulates the imagination and speaks to millions of listeners. Depending on the radio station, the audience can be targeted (community radio) or a wider audience can be reached though regional or national radio stations.

#### ***Calling a talk radio show***

Listen to the show you're calling ahead of time to get an idea of the format and the host's personality.

#### ***Tips for Speaking with Confidence***

- Keep it simple. Talk in language that everybody understands, and don't get bogged down with jargon. Be prepared to make your points quickly and concisely.

- Keep it local. Bring in an anecdote about your region or your family.
- Remember your audience. Check your tone as well as your language.
- Challenge listeners. Ask them to act. Invite them to join the Adopt-a-River Programme.

### ***Making the Call***

When you call, be prepared for busy signals or being put on hold. With the larger shows, you may want to begin calling 10-15 minutes prior to airtime in order to get through, but whatever happens, don't give up!

### ***Some Helpful Hints:***

- Have a glass of water handy.
- Turn your radio down as soon as you begin to speak to the host so the feedback doesn't confuse you.
- Breathe; try to talk normally—not too fast or too slow.
- Your manner is as important as your message.

### ***Do:***

- Get immediately to the point;
- Talk slowly and succinctly;
- Be personal and passionate; and
- Address the host by name and thank him/her.

### ***Don't:***

- Be combative;
- Get defensive;
- Use too many statistics or acronyms; and
- Take the bait if asked a provocative question.

## **3.3.12 Technical reports**

Technical Reports are generally aimed at the individuals who have a scientific and/or technical background. Technical reports contain the detailed data interpretation and analysis in a structured format. These reports serve a purely technical audience and are usually intended for internal use and to some extent the wider scientific community. The sharing of information is thus limited to some extent to a selected audience.

## **3.3.13 Telephone communication**

Telephone communication can be used to deliver a more personal message to specific individuals or as a means to follow up on an earlier discussion. To ensure that the conversation remains salient, jot down the discussion points that you wish to cover during the course of your conversation. Telephone communication will be especially important for persuading people to

volunteer time of resources to the Adopt-a-River Programme. Telephone communication is generally targeted at a specific individual. If you need to convey your message to a larger group of individuals rather use an alternative means of communication, as telephone calls can become costly.

### **3.3.14 Television**

Television provides a good opportunity to visually communicate information on the project with a wide group of interested individuals. Depending on the nature of the programme an interview may be conducted, which may be good opportunity to present a short concise message, or a field visit can be filmed, which can be used to educate individuals. A popular television programme which has an environmental focus is 50/50. The disadvantage of television is that its transient and it's not targeted at a specific group of individuals. The audience is also limited by the fact that not everyone has access to a television and the viewing times of the programme may also be limiting. It's important to include contact details so that interested individuals follow up on the programme. You may even consider printing t-shirts with the Adopt-a-River logo to maximise the publicity opportunity.

### **3.3.15 Websites**

Websites are a good means of providing information at various levels. For example, you may write a short introductory abstract on the results of your activity and include a more detailed report which can be downloaded (documents which can be downloaded should be saved as .pdf files) by those who wish to have more information. Websites can also be updated whenever you have new information you wish to share. They are not costly to setup and manage and can be interactive, with members discussion forums. You can also provide as much information as you wish to share on the internet. The advantage of using a website is that the information is available to anyone who has internet access. This provides you with the opportunity to share information with a wider range of individuals. The disadvantage of using a website is that not everyone has access to the internet and not everyone has internet access with sufficiently fast connection to the internet to allow convenient downloading of large documents. A badly protected website also provides a window onto your computer system to hackers who may want to cause harm.

The business requirements of an Adopt-a-River website were developed as part of this implementation project. The report on the website design described in detail what features such a website should have to disseminate information about the programme to provide support to Adopt-a-River participants.

### **3.3.16 Text messaging**

In many rural areas, the main form of communication is via cell phone. In order to communicate with this group of stakeholders, it may be necessary to use a bulk SMS (or text messaging)

service. A bulk SMS service can be used for sending anything from a few hundred to thousands of SMS. The SMS can be sent directly from the service provider or it can be captured in an Excel spreadsheet (containing the cell number and message) and e-mailed or uploaded for immediate sending. There are a number of bulk SMS service providers, including Vodacom, MTN and BULKSMS. Before choosing a SMS service provider, you should investigate the different service providers and compare the costs.

### 3.3.17 Communication media suitability comparison

**Table 1** provides a comparison of different communication media discussed above in terms of their respective attributes, such as costing, frequency of reporting and ability to reach targeted audience.

**Table 1 Comparison of the suitability of various communication media for specific attributes**

Key: Hi = High Lo = Low	Keeping costs down	Regular reporting	Reaching technical audiences	Reaching non-technical audience	Reaching large audiences	Reaching targeted audiences	Conveying detail	Conveying very large datasets	Controlling quality of final product	Permanence of message	Engaging the target audience	Obtaining feedback	Urgent messages
E-mail attachments	Hi	Hi	Hi	Hi	Hi	Hi	Hi	Hi	Hi	Hi	Lo	Hi	Hi
E-mail messages	Hi	Hi	Hi	Hi	Hi	Hi	Lo	Lo	Hi	Hi	Hi	Hi	Hi
Field day	Hi	Lo	Hi	Hi	Lo	Hi	Hi	Lo	Lo	Lo	Hi	Lo	Lo
Information brochures	Hi	Lo	Lo	Hi	Hi	Hi	Lo	Lo	Hi	Hi	Lo	Lo	Lo
Flyers	Hi	Lo	Lo	Hi	Hi	Hi	Lo	Lo	Hi	Hi	Lo	Lo	Lo
Fact sheets	Hi	Lo	Hi	Lo	Lo	Hi	Lo	Lo	Hi	Hi	Lo	Lo	Lo
Networking	Hi	Lo	Lo	Lo	Lo	Lo	Lo	Lo	Lo	Lo	Hi	Hi	Lo
Newsletters	Hi	Hi	Hi	Hi	Hi	Hi	Lo	Lo	Hi	Hi	Lo	Lo	Lo
Popular articles	Hi	Lo	Hi	Hi	Lo	Lo	Lo	Lo	Lo	Hi	Lo	Lo	Lo
Posters	Hi	Lo	Hi	Hi	Lo	Hi	Lo	Lo	Hi	Lo	Lo	Lo	Lo
Presentations	Hi	Lo	Hi	Hi	Lo	Hi	Lo	Lo	Hi	Hi	Hi	Hi	Lo
Printed media (newspaper)	Hi	Lo	Lo	Hi	Hi	Lo	Lo	Lo	Lo	Hi	Lo	Lo	Hi
Radio media	Hi	Lo	Lo	Hi	Hi	Lo	Lo	Lo	Lo	Lo	Lo	Lo	Hi
Technical reports	Hi	Hi	Hi	Lo	Hi	Hi	Hi	Lo	Hi	Hi	Lo	Lo	Lo

Key: Hi = High Lo = Low	Keeping costs down	Regular reporting	Reaching technical audiences	Reaching non-technical audience	Reaching large audiences	Reaching targeted audiences	Conveying detail	Conveying very large datasets	Controlling quality of final product	Permanence of message	Engaging the target audience	Obtaining feedback	Urgent messages
Telephone communication	Hi	Lo	Hi	Hi	Lo	Hi	Lo	Lo	Lo	Lo	Hi	Hi	Hi
Television	Lo	Lo	Lo	Hi	Hi	Lo	Lo	Lo	Lo	Lo	Lo	Lo	Hi
Websites	Hi	Hi	Hi	Hi	Hi	Hi	Hi	Hi	Hi	Hi	Lo	Hi	Hi
Test messaging	Hi	Lo	Hi	Hi	Hi	Hi	Lo	Lo	Lo	Lo	Lo	Lo	Hi

### 3.4 WHO ARE THE STAKEHOLDERS?

The diversity of the stakeholders who will become part of the Adopt-a-River Programme is what will make this such an exciting and powerful project. It will bring together the enthusiasm of numerous individuals and organisations all ultimately contributing to the better understanding and management of the nation’s water resources. However, it is important to acknowledge that each of these stakeholders has a different agenda for being involved in the Adopt-a-River Programme. They also have different responsibilities at different levels (i.e. national, regional and local) and will thus have different application for the information generated through the Adopt-a-River Programme.

In addition to the various government departments, the Adopt-a-River Programme will also involve the general public, Water Users and educational institutions (both teachers and learners). Experience in the United States of America and Australia has shown that universities can play an important role in providing technical support to Adopt-a-River participants and volunteer efforts.

Each of these stakeholders groups will require different levels of information detail and will need to receive it in the most appropriate way to ensure that the message gets across clearly to the right people. This is one of the key challenges of the Adopt-a-River Programme: to communicate technical information in an effective and creative manner to this diverse group of stakeholders.

The stakeholders have been broadly divided into three categories, based on the interaction with the Adopt-a-River coordinator (i.e. National, Regional and Group Leader Co-ordinator).

The dissemination of information to the different categories will depend entirely on category into which the stakeholder falls and the level of information that they may request. **Table 2** provides an overview of the most likely choice of communication media per information user category.

**Table 1: Overview of communication media most applicable per user category**

Key: Hi = High Lo = Low	Email communication	Field day	Information brochures, flyers + fact sheets	Networking	Newsletters	Popular articles	Posters	Presentations	Printed media	Radio media	Technical reports	Telephone communication	Television	Websites
National	Lo	Lo	Lo	Lo	Lo	Lo	Lo	Hi	Lo	Lo	Hi	Hi	Lo	Lo
Regional	Hi	Lo	Lo	Hi	Hi	Hi	Hi	Hi	Lo	Lo	Hi	Hi	Lo	Hi
Local	Hi	Hi	Hi	Hi	Hi	Hi	Hi	Hi	Hi	Hi	Lo	Lo	Hi	Hi

### 3.4.1 National Stakeholders

The *National Co-ordinator* of the Adopt-a-River Programme will primarily interact with the National stakeholders, which include:

- DWEA: Head Office
- National DEAT
- The Adopt-a-River Steering committee
- Department of Education
- National NGOs

The type of information presented to each of the above mentioned stakeholders would depend entirely on their agenda. For example, a presentation to the Department of Education would be more focussed on persuading the Department to encourage tertiary institutions to provide technical support to the Adopt-a-River Programme. While a presentation to the DWEA: Head Office may be more focussed on informing the Department about the information generated by Adopt-a-River activities or to persuade the DWEA to provide staff and/ or resources to assist with a project. As the Adopt-a-River activities, such as volunteer monitoring, can complement formal national and regional monitoring programmes.

The most appropriate communication media includes:

- Presentation at a scheduled meeting. Information brochures and fact sheets can also be distributed at the meeting.
- Technical reports.
- Telephone communication.

The frequency of the information sent to national stakeholders will depend on the nature of the information communicated to them. For example, it may only be necessary to meet with the Department of Education on an annual basis. While it may be necessary to meet with the Adopt-a-River Steering Committee and the DWEA: Head Office at a more frequent interval.

### 3.4.2 Regional stakeholders

The *Regional Co-ordinator* of the Adopt-a-River Programme will primarily interact with the National stakeholders, which include:

- DWEA: Regional Office
- Provincial DEAT
- Provincial Premier
- District Municipality
- Local Municipality
- Metropolitans
- Catchment Management Agencies (CMAs)
- Irrigation Boards
- Water User Associations
- River Catchment Forums
- Working-for-Water
- Working-for-Wetlands
- Water Boards
- SANParks

The type of information and the structure of the method used to disseminate the information will, to a large extent, depend on the role of the stakeholder in water resource management. For example, the DWEA: Regional Office would be provided with more detailed technical information to inform them on the state of the water resources within that region. It may also be necessary to persuade the DWEA: Regional Office to provide staff and/or resources to assist with Adopt-a-River activities. Similarly, information presented to CMAs, Water User Associations and River Catchment Forums will be to inform these organisations on the state of the water resources and to encourage them to volunteer their time and resources to support Adopt-a-River activities. In contrast, information presented to the Provincial Premier and representatives from the municipalities and metropolitans will be less technical in nature and would be more focussed on persuading them to support the Adopt-a-River programme.

The most appropriate communication media includes:

- E-mail communication
- Networking

- 
- Newsletters
  - Posters
  - Popular articles
  - Presentation at a scheduled meeting to discuss the status of the water resources located within specific geographic boundaries. Information brochures and fact sheets can also be distributed at the meeting.
  - Technical reports
  - Telephone communication
  - Websites

The frequency of the information sent to regional stakeholders will be determined by their role in water resource management. Some stakeholders, such as the DWEA: Regional Office, CMAs, Water User Associations and Catchment Forums, should be informed at a more frequent interval (monthly or quarterly), while other stakeholders, such as the Provincial Premier and representatives from the municipalities and metropolitans, will only need to be informed at a six-monthly or annual interval.

### **3.4.3 Local group leader**

The Local Group Leader of the Adopt-a-River Programme will primarily interact with the following stakeholders:

- Water Users (such as farmers, recreational users, mining houses, industries, etc).
- Local communities – this group includes individuals from urban centres who may have access to the internet, television, radio and newspapers and individuals from rural centres who may have limited or no access to the internet, television, radio and newspapers. In order for the message to be received by the local community it is important to first establish what forms of communication media are most prevalent and if the documents need to be translated into a different language.
- Educational institutions, such as schools and tertiary institutions.
- Local Non-government Organisations.
- Volunteers.

The type of information and level of detail will depend on the targeted stakeholder group. For example, more detailed and technical information will be supplied to water users. It may also be necessary to encourage water users to volunteer the time and resources to Adopt-a-River activities. Information presented to local communities will be less technical and can be used to educate communities on water related topics and to persuade them to participate in Adopt-a-River activities.

The most appropriate communication media includes:

- E-mail communication

- Field days
- Information brochures, flyers and fact sheets
- Networking
- Newsletters
- Popular articles in local publications
- Posters
- Presentations
- Printed media (local newspapers)
- Radio media
- Television
- Website

The frequency of the information sent to tertiary information users should be more frequent: monthly and/or quarterly.

### **3.5 STAYING RELEVANT**

Information dissemination has to be an ongoing interactive process. This ensures that information stays relevant and useful or is adapted and updated to become more relevant. You should attempt to get feedback from stakeholders to check that the information is received is appropriate and the methods used to disseminate the information is effective. This can be done telephonically or through questionnaires, which can ask for feedback on specific aspects such as the style of the report, its content and value.

### **3.6 REFERENCES**

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## 4. PASSIVE COMMUNICATION

### 4.1 BACKGROUND

Passive communication is largely aimed at informing and educating Adopt-a-River coordinators, stakeholders and different stakeholder groups through a dedicated platform which allows these individuals to access and review information at any stage.

Before considering the appropriate platform for passive communication, it is necessary to first establish what the real purpose of the system is (i.e. **“What do we want to get out of it?”**). From review of the “Draft Strategic Framework for the Development of the Adopt-A-River Programme” (April 2007), it is clear that the three main components of the Adopt-A-River Programme that need to be addressed by an appropriate passive communication medium are:

1. Document repository promoting awareness creation (e.g. protocols, procedures, guidelines, methodologies/techniques and other training material related to establishing and managing an appropriate river monitoring programme)
2. Ability to view river water quality related data (e.g. view river water quality data collected through National initiatives)
3. Ability to load river water quality related data (e.g. stakeholders load on-site observations)

Considering the above, it is important to note that the starting point for passive communication within the Adopt-A-River Programme will probably initially focus on awareness creation (i.e. bullet point 1 above). Although awareness creation could be relatively easily achieved (e.g. via creation of a website with document archive and associated bulletin boards, etc), the additional future requirements of data input and data/information output (i.e. bullets 2 and 3 above), require a more comprehensive and well thought through process. The aim of this document is therefore to highlight all of the issues that need to be considered/taken into account before important decisions regarding the appropriate Way Forward are made.

### 4.2 DATA MANAGEMENT SYSTEMS

The above aspects require an appropriate data sharing/management system. The general data management system types include:

- Paper files
- Spreadsheets (e.g. Excel)
- Single-user (desktop) databases (e.g. Access)
- Multi-user (on-line) databases (e.g. MySQL)

Each of the above system types has its own advantages and disadvantages. Apart from data storage issues, analysis and interpretation of data in paper files are difficult and time consuming. In addition, sharing of information with multiple users may be problematic. Electronic data management allows the data to be stored logically, and shared/analysed easily. Numerous electronic data management options are available, and understanding the

advantages and disadvantages of each option is necessary to determine the most appropriate option for the needs of an Adopt-A-River Programme. Commonly used computerised data management options include spreadsheets and/or databases.

When considering the use of spreadsheets vs. database, it is important to note that although spreadsheets have become relatively sophisticated tools, they still fall far short of databases. Although spreadsheets are widely used for data analysis and interpretation, spreadsheets are often incorrectly used as long-term “databases”. As the data can be relatively easily compromised (e.g. manipulated or deleted), this cannot be considered a secure and viable long term solution. Sharing information, tracking changes, etc between different parties (internal and external) can also be difficult. In addition, duplication may be prevalent.

A database is simply an organized collection of information. Users record many types of information in databases such as inventories, projects, addresses, customers, and invoices. Recording lists of information in a database makes it easier to organize and retrieve it later. Before computers, users kept databases in file cabinets, in card files, and on graphed paper, even though they weren't always called databases. The key difference between these spreadsheets and other storage mediums versus databases is that the latter is relational in nature.

The following table summarises the main issues to consider when selecting and developing an appropriate data management system.

**Table 3: Issues to consider when developing an appropriate data management system**

Aspect	Paper files	Spreadsheets (e.g. Excel)	Single-user (desktop) Databases (e.g. Access)	Multi-user (online) Databases (e.g. MySQL)
Set-up and Costs	<ul style="list-style-type: none"> <li>• Very inexpensive</li> <li>• Good as a back-up to electronic data management system</li> </ul>	<ul style="list-style-type: none"> <li>• Inexpensive</li> <li>• Familiar to many</li> <li>• Easy for most to use</li> </ul>	<ul style="list-style-type: none"> <li>• Inexpensive</li> <li>• Fairly easy to use</li> <li>• Good for small datasets</li> </ul>	<ul style="list-style-type: none"> <li>• Costs can vary widely (inexpensive to expensive)</li> <li>• Need a programmer to set-up/develop</li> <li>• Likely need to train users</li> </ul>
Maintenance, security, back-up and data quality	<ul style="list-style-type: none"> <li>• Low chance of error from data recorded on data sheets</li> <li>• Can save copies of on-site/field and laboratory notes/data sheets</li> <li>• Maintenance, security and back-up dependant on amount of data collected and room to store it (i.e. may require large storage space)</li> </ul>	<ul style="list-style-type: none"> <li>• Electronic file back-up simple</li> <li>• Basic programming can be incorporated but easier to use with database with built in back-up capabilities</li> </ul>	<ul style="list-style-type: none"> <li>• Electronic file back-up simple</li> <li>• Can be programmed to meet specific needs (e.g. allow data entry, identify data input errors, generate template reports, share data, etc)</li> </ul>	<ul style="list-style-type: none"> <li>• Need a programmer to maintain database code over time</li> <li>• Electronic file back-up simple</li> <li>• Can be programmed to meet specific needs (e.g. allow data entry, identify data input errors, generate template reports, share data, etc)</li> </ul>
Entering and storing data	<ul style="list-style-type: none"> <li>• Similar to spreadsheets but dependant on amount of data to be stored</li> </ul>	<ul style="list-style-type: none"> <li>• Only one user can enter or modify data at a time</li> <li>• Good for storing small datasets</li> </ul>	<ul style="list-style-type: none"> <li>• Generally only one user can enter or modify data at a time (unless in network mode, but then a user could overwrite another users' data)</li> <li>• Data entry from a single computer</li> <li>• Can store large volumes of data</li> <li>• Training required for data loading (generally</li> </ul>	<ul style="list-style-type: none"> <li>• Multiple users can enter or modify data at a time</li> <li>• Data entry from any computer with internet access (if access granted – username/password)</li> <li>• Can store large volumes of data</li> <li>• Data loading training required for multiple users (generally at multiple locations)</li> </ul>

			only a few users)	
Searching and Sharing Data	<ul style="list-style-type: none"> <li>Depends on amount of data to be shared and degree of files organization</li> </ul>	<ul style="list-style-type: none"> <li>Not as user friendly as a relational database</li> <li>Good for mathematical and statistical analysis</li> <li>Relatively easy to draw graphs</li> </ul>	<ul style="list-style-type: none"> <li>Good for searching and retrieving data (i.e. query friendly)</li> <li>If data displayed on internet, generally static (i.e. responsible person needs to upload data/information manually)</li> </ul>	<ul style="list-style-type: none"> <li>Good for searching and retrieving data (i.e. query friendly)</li> <li>Data displayed via the internet is dynamic (i.e. user loads data and website is automatically updated)</li> <li>Training probably required for multiple users</li> </ul>

Considering the above, the main advantages of a database over a spreadsheet include:

- **Sharing**
  - Two or more parties can edit a database at the same time.
- **Security**
  - Sensitive information can be easily protected and users can be protected from making mistakes (e.g. deleting information, loading incorrect information).
- **Efficiency**
  - As databases are relational, tables can be linked thus minimizing duplication.
- **Reporting**
  - With a database, one can format the same data many ways in various reports.
- **Capacity**
  - Databases have capacity to hold much greater numbers of records.
- **Maintenance**
  - What makes spreadsheets simple to use (i.e. the programming and the formatting are together on one page with the data) also makes them hard to maintain. In contrast, and by way of example, users cannot change the format of the database.
- **Less duplication**
  - In spreadsheets this often includes duplication of existing information in a new spreadsheet or creation of “copies” of existing spreadsheets (which is the latest/correct version?).

Some of the above aspects are summarised in the following table.

**Table 4: Main differences between spreadsheets and databases**

Item	Spreadsheets	Databases
<b>Use of memory</b>	Data and calculations are RAM resident, if a file is not saved data is lost if power is lost to the computer.	Uses both RAM and hard drive memory, with most databases data is saved to the hard disk as soon as the data enterer leaves the

Item	Spreadsheets	Databases
		record.
<b>Organization of Data</b>	Data cells are independent, formulas can specify specific cells by name. Formulas access one cell at a time.	Data is organized by fields or records. Formulas or queries work on specified fields in a record, or on selected fields for all specified records.
<b>Calculations</b>	Fast, easy set-up and wide selection of financial and statistical functions	Limited to usual calculations but includes data arithmetic. Done in forms or reports.
<b>Charts</b>	Wide choice of charts/graphs which are easy to setup and easy to change.	Selection is good, but limited in comparison to spreadsheet. Data can be exported to spreadsheet to do a chart.
<b>Reports</b>	Prints tables as are. It is possible to link multiple spreadsheets, but databases make this far easier.	A report does not need to look like the table, each field can be placed anywhere on the form, and used multiple times. It is easy to combine data from more than one table into one report.
<b>Data Entry</b>	Has limited ability to design forms and create "look up" tables. (A look up table provides options from which the data enterer can select.). Not as easily done, or as flexible in this area as a database. Some validity checks possible.	Possess excellent ability to design special forms that show only fields needed and include instructions on how to enter the data. Can also contain read only fields. Forms can show only one record, or multiple records. Can also contain fields from more than one table. It is easy to provide validity checks on data to prevent some erroneous data by using look-up tables, drop down menus and other data validation features.
<b>Programming Languages</b>	Difficult to document, read and debug. Suitable for short subroutines or macros	Full featured programming language with excellent documentation and debugging capabilities.
<b>Queries</b>	Limited queries especially for multiple tables.	Can perform very complex data queries on one or multiple tables. Can use set theory.
<b>Relational Tables</b>	Can link spreadsheets, but has more limitations.	Links many different tables easily so appear to user as one table. Very useful in transforming complex data.

In deciding whether a database is needed for the Adopt-A-River Programme, the most important questions to ask are:

- Does the information (e.g. guideline documents) and data (e.g. on-site observations) need to be stored long-term? YES
- Do multiple persons need to access the information/data? YES
- Do we need to ensure the information/data is secure (addition of documents, error in data entry, data corruption)? YES

Considering the above and the previous sections, it is clear that an appropriate database is required for the Adopt-A-River Programme. The database must not only enable storage of documents (e.g. guidelines) but also future storage of other data (e.g. on-site observations, water quality).

Although desktop databases are more secure than spreadsheets, accessing information from anywhere in the world is not possible. An on-line database therefore provides both secure

information/data storage/management, and the ability to access that data from anywhere in the world.

In the past, libraries were a central depository for this kind of information. The internet and the World Wide Web have, however, revolutionised passive communication around the world. Although South Africa (and the developing world) were initially relatively slow in using these platforms, interest and use thereof in South Africa is rapidly growing. In particular, experience with municipalities has shown that even in remote areas of South Africa (e.g. Northern Cape – Kgalagadi District) with limited access to libraries, internet access has been achieved. Therefore, when considering the need to passively communicate to parties throughout South Africa at any time of the day, it is clear that an on-line database is in all likelihood most appropriate for the South African context. It is therefore recommended that an on-line database (with an appropriate internet accessible front end) be considered for the Adopt-a-River Programme.

Although a simple webpage would be ideal for awareness creation through provision of documents, etc the ability to load/view on-site observations, river water quality data, etc will not be possible unless an effective link is established with an appropriate database.

Due to data view/data loading requirements presented in the “Draft Strategic Framework for the Development of the Adopt-A-River Programme” (April 2007), it is therefore **recommended that an on-line database accessible via a webpage (with the ability to store and retrieve both data and documents/information) and not just a webpage (only storing documents/information for retrieval) be considered.** Although it is noted that the initial Adopt-A-River website may not necessarily require data loading/viewing from the outset, it is important that the architecture of the data management system take this future requirement into account during the initial planning phase. This will ensure that re-engineering of the passive communication system (initially focused on awareness creation) is minimised/prevented.

The above is especially important if it is the objective of the Adopt-A-River Programme to have a national co-ordinated understanding of the various river initiatives throughout South Africa. By allowing users (e.g. volunteers, organisations) to use a “common” database platform allows consolidated views of areas/zones/catchments/etc by regional/national co-ordinators. If volunteers/organizations are allowed to operate in isolation, complex systems allowing consolidated views will not be necessary.

#### **4.3 COMPONENTS OF AN ON-LINE DATABASE**

On-line databases enable different users to upload data/information or search for data/information at the same time from different physical locations. Considering the requirements of the Adopt-A-River Programme, this form of database is considered most appropriate.

The four key technical components of an on-line database include:

- Operating system
- Database
- Programming language
- Web server

The operating system is the computer program that operates the hardware (e.g. hard-drive, keyboard) and software (e.g. Excel) of the computer, and is essential for orderly operation of the computer. The operating system responds to inputs from both users and equipment, and is responsible for both security and outputs to various devices (e.g. screens, printers, etc). Examples include:

- For purchase: Microsoft Windows
- Open-source: Linux

As noted earlier, the database is the collection of records stored in a structured manner that allows easy retrieval of desired data/information. Examples include:

- For purchase: Oracle
- Open-source: MySQL

The programming language allows instructions to be given to computers to execute required commands. Examples include:

- For purchase: Delphi
- Open-source: Python, C++

A web server accepts and responds to internet based requests or queries and displays outputs to a webpage. Examples include:

- For purchase: Microsoft Internet Information Server
- Open-source: Apache

As indicated above, some of the above technical components may require product purchase from commercial entities (e.g. proprietary software) whereas other components may be available as free and open source software (FOSS) products. For South African government departments (including Department of Water Affairs) the use of FOSS needs serious consideration.

#### **4.4 FREE AND OPEN SOURCE SOFTWARE USE IN SOUTH AFRICA**

On 22 February 2007 Cabinet approved a policy and strategy for the implementation of Free and Open Source Software (FOSS) in government. The “Policy on Free and Open Source Software Use for South African Government” (August 2006) notes that all new software developed for or by the government will in future be based on open standards and government will migrate all current software to FOSS. Open-source software can be shared by many users without a need for licences. The actual code can be accessed by anyone to make changes and adapt it to different situations. The main justification for use of FOSS is that it typically proves highly competitive (and frequently superior) across many categories of ICT including (i) cost (e.g. lower total cost of ownership, higher return on investment), (ii) security and (iii) technical performance levels (Policy). Other advantages include wider user and developer community offering support, and easier interoperability between applications.

In particular, the policy notes the following (“Policy on Free and Open Source Software Use for South African Government” (August 2006)):

- 1) The South African Government will implement FOSS unless proprietary software is demonstrated to be significantly superior. Whenever the advantages of FOSS and proprietary software are comparable FOSS will be implemented when choosing a software solution for a new project. Whenever FOSS is not implemented, then reasons must be provided in order to justify the implementation of proprietary software.
- 2) The South African Government will migrate current proprietary software to FOSS whenever comparable software exists.
- 3) All new software developed for or by the South African Government will be based on open standards, adherent to FOSS principles, and licensed using a FOSS licence where possible.
- 4) The South African Government will ensure all Government content and content developed using Government resources is made Open Content, unless analysis on specific content shows that proprietary licensing or confidentiality is substantially beneficial.
- 5) The South African Government will encourage the use of Open Content and Open Standards within South Africa.

The above important Cabinet decision must be taken into account when implementing an appropriate data management system for the Adopt-A-River Programme. It is therefore **recommended that a FOSS based on-line database system** should be implemented.

#### 4.5 DATA MANAGEMENT SYSTEM DEVELOPMENT AND IMPLEMENTATION

Development and implementation of an appropriate data management system requires consideration of:

- Set-up costs
- Maintenance
- Security
- Back-up
- Data quality
- Entering data
- Storing data
- Searching data
- Sharing data

Considering the anticipated phased approach to the Adopt-A-River Programme (for example, starting with awareness creation), some of the above components may not initially be required (e.g. entering data). However, as noted earlier, it is important that all initial and future requirements be considered from the outset. Considering this, and to ensure completeness, the following sections will attempt to address all of the above requirements through consideration of a number of key questions.

- **What resources are available to develop the database/system?**

In order to ensure a sustainable database that meets both initial needs (i.e. development and start-up of the programme) and is flexible to meet future needs (i.e. maintenance and enhancements) it is important to consider the resources required to achieve this. Resources in this context include:

- Software – Will we use proprietary/for-purchase software (with, for example, annual licence fees) or free and open-source software (FOSS)?
- Human – Do we have access to programmers (either internal or external) that have the required skills in the desired programming language?
- Financial – to enable the above

Various database/system development models can be considered including:

- Develop database/system from scratch (open source or proprietary software)
- Purchase “as is” database/system from a vendor (with possible modification to suit particular needs) (proprietary software)
- Utilise an existing database/system framework and modify to suit particular needs (open source software)

In addition to the above, it is also noted that traditionally government departments have utilised a “software purchase” model and not a “software as a service” model. In the “software as a service model”, payment is not made for the software itself, but rather for

the actual services rendered (e.g. setting-up, modifying or maintaining the database/system). Considering the likely constraints of the Adopt-A-River Programme (e.g. financial, human resources), it may be more feasible to consider a “software as a service” model, with the advantages of this approach summarised below:

**Table 5: Main advantages of using a software as a service approach**

	<b>Traditional Desktop Software Purchase</b>	<b>Software as a Service</b>
Flexibility	Limited	Highly customisable
Access	Internal network	Any internet point
Support	Vendor Lock in	Any service provider
Licence costs	High	Low or None

Considering the above, and the fact that no package exists that can be purchased to meet Adopt-A-River Programme requirements, the benefits of using an existing open source based on-line database/system framework (maintained by an external professional service provider team) and modifying it to meet the specific needs of the Adopt-A-River Programme include:

- No vendor lock in, any supplier knowledgeable in the platform can contribute and scrutinise the system.
  - Ideally, only need a computer with Internet access & web browser (think on-line banking, no software installation, automatic updates)
  - Ability to connect to data from anywhere (remote facilities/offices, staff that are travelling, stakeholders, etc)
  - Professional service provider team can assist with provision of on-going support (training, maintenance, etc)
  - No loss of capital (development/software purchase) if needs not met
- **What database storage capacity will be required?**

The server size required is obviously dependant on the number of documents/quantity of data that will be stored on the database. A dedicated server is recommended. A server could be purchased for use or a server could be “rented” by housing the database at a secure Internet Service Provider (ISP). Servers generally have significant storage capacity that can easily be upgraded and are generally available at a very reasonable cost (either purchase or renting).

By way of example, the electronic Water Quality Management System (eWQMS) which is currently used by all Water Services Authorities in South Africa for capturing and storing drinking-water quality records contains some 5 million records (drinking-water quality and related data for approximately a 3 year period). To-date, this has required storage capacity of 750 MB on a server at an ISP at a cost of approximately R3,000 per month or R36,000 per annum (Roche Compaan, March 2009).

For the Adopt-A-River Programme, it is anticipated that initial database storage requirements will not be significant (e.g. limited users accessing information/bulletin board, mostly downloading documents stored in archives) and although not a major cost, data storage costs still need to be budgeted for. The most significant cost will be the bandwidth used by the application. As the system becomes popular and is increasingly visited by members of the public, the bandwidth usage and cost will increase. Bandwidth costs currently vary between 8 to 12 cent per MB in the industry. A website with about 50 000 unique visitors a month could easily generate 100 GB of traffic a month. Although it is not anticipated that the Adopt-A-River Programme will initially receive such high traffic volumes, it is noted that for a high traffic site transferring 100 GB a month, the bandwidth cost can be as much as R12,000.00 per month (Roche Compaan, March 2009)..

- **Where will information/data be stored?**

Two options are noted:

- Housing data at the location where database/system administrators are located (i.e. on-site)
- Housing data at a secure ISP data centre (i.e. off-site) with appropriate back-ups (e.g. at another data centre (either local or offshore).

Again, by way of example, the eWQMS was initially hosted at the custodians of the system (i.e. Emanti Management). However, with increased use of the system by Municipalities throughout South Africa, a need arose to ensure that the Emanti Management server (and associated internet bandwidth (i.e. "internet speed")) was not a bottleneck for Municipalities to load data/access information. It was therefore decided to house the system at a secure ISP with appropriate back-ups to Emanti Management and DWA servers (through the DWA National Information System/Drinking-Water Quality Regulation System).

For the Adopt-A-River Programme, it is recommended that the database is housed at an appropriate and secure ISP from the outset to primarily ensure minimal restrictions related to bandwidth (a problem that remains in South Africa). Appropriate back-ups to servers of the custodians of the Adopt-A-River database (e.g. DWA) should also be in place. Due to probable DWA database firewall restrictions, it is not initially recommended that the Adopt-A-River Programme database be located within DWA systems. This could, however, be reviewed at a later stage (i.e. similar to the River Health Programme, which was initially hosted by CSIR and is now hosted by DWA).

As noted previously, although not a major cost, database hosting costs still need to be budgeted for.

- **What information will be stored?**

As noted previously, it is anticipated that passive communication will initially be achieved via awareness creation. The system developed will therefore need to contain an archive/repository of documents that may be of interest to Adopt-A-River Programme volunteers/organisations.

Information that will typically be stored includes:

- Legislation and policies
- Guidelines and procedures
- Other educational and training material
- Contact details of appropriate role players (organization names, contact persons, contact details – telephone, fax, e-mail, website address)
- Events, bulletin boards, etc

The above aspects this will need to be frequently reviewed and updated by a system administrator to ensure the system remains a reliable source of information (i.e. it remains relevant)

- **What data will be stored?**

Although it is anticipated that data storage may not be an immediate requirement, it is important that the system design/architecture has considered this important future requirement.

An important consideration is allowing users to capture “free text” (i.e. can type in anything) versus, for example, creating standard set conditions and obliging users to complete these set conditions (e.g. multiple choice or set questions). In some instances, users do not always understand what observations they should be capturing, and providing guidance (e.g. describe the condition of the river water – smell, clarity, etc) assists in guiding users what they should be looking for on-site. Also, having a set of “common” questions can allow national/regional strategic analysis of data (e.g. what percentage of volunteers stated that they noted a “rotten eggs” smell from the river system?)

Typical river related data that will be stored could include:

- Flow data
- Physical quality
- Chemical quality
- Biological quality
- Habitat condition

In general, users can enter various types of data, namely:

- Raw data (e.g. concentration of a determinant received from an on-site test)
- Calculated data (e.g. calculated value or score determined by dividing Determinant A by Determinant B)

In some instances, entry of a combination of both of the above types of data can be anticipated. In general, it is very advantageous for users to capture the raw data, as this both limits potential calculation errors by users, and allows new calculations to be made and scores to be updated if calculation methods/ratings change.

In addition, database design and development should also consider interpretation of, for example, “less than” (<) or “greater than” (>) symbols which are often associated with detection limits. As values captured in a database are often used to, for example, calculate compliance, accurate and appropriate interpretation of this data is important (e.g. is a value half of the detection limit (for “less than”) or twice the detection limit (for greater than”) used for the compliance calculation?).

- **Who will administer the database/system?**

Database administration refers to which individuals or organizations will have the right to update or edit the database/system (e.g. add data, delete data, configure the website, etc). Users are likely to include governmental departments, non-governmental organizations (NGOs), volunteers, service providers, etc, each with their own administrative requirements/functions.

Although it would be ideal to allow all volunteers/organizations to administer and manage their own individual system, if it is a requirement that a consolidated view of South Africa river systems and associated Adopt-A-River Programme initiatives is easily available, some degree of control will be required. In general, it is recommended at the onset that administrative access be restricted, until the database/website for the organization has been established/set-up. Following this, the following aspects can be considered:

- All users have view rights (observer) to most information contained on the Adopt-A-River Programme system (with possible need for registration and login details to access more sensitive information)
- Volunteers are given rights to enter data onto the Adopt-A-River Programme system (but, for example, cannot edit or delete data once it has been entered). **NOTE:** Restricting data editing/deletion is only important if the data feeds into other national programmes. This can also be managed via a full data audit trail (e.g. who entered the data, what date, what time, who edited the data, etc).
- Data coordinators (e.g. could be DWA regional coordinator, a volunteer organization coordinator) are given rights to enter data, edit data, delete data, etc

- System administrators are given the above rights and are also able to, for example, establish new websites, etc. Ideally, the system custodian should perform this function.
- Database administrators are given rights to modify the database itself (e.g. develop and add new features). A specialist service provider may be required for this function.

To explain the above, and by way of example, in the eWQMS:

- DWA (and other provincial/national governmental departments) have view rights to data/information on the eWQMS.
- WSAs have the ability to add data/information to the eWQMS. Current WSA functionality includes the ability to manage sample points (add new/edit existing), manage recipients/distribution lists for automated communications, manage required automatic notifications (e-mail, summary report), data entry (water quality, infrastructure, etc) and ability to add comments related to drinking-water failures and actions taken to address issues of concern (i.e. comments serve as an action record taken to address issues of concern).
- Emanti Management, as custodian of the eWQMS, has the aforementioned rights, but also the ability to edit/modify data, and establish new clients/websites.
- A specialist software company develops and maintains the eWQMS in accordance with Emanti Management requirements (which originate from user requested needs).

- **Who will enter information/data onto the database?**

Considering the previous section, data could be entered by:

- Volunteers/public (must be trained – either through structured programmes or via on-line training)
- Adopt-A-River Programme staff (regional or national coordinator)
- Local data co-ordinator
- Appointed service provider
- Etc

The information/data that can be entered by the above individuals will be determined by the access rights provided (i.e. linked to username/password). A key requirement for the database/system is that details of the person adding/editing information/data with a date/time stamp should be captured, to allow data tracing if issues/queries arise.

- **What is the desired accuracy of the data entered and how will the integrity of the data be controlled?**

The number of significant figures (analogous to decimal figures, but not entirely the same concept) entered into the database is dependant on the parameter/determinant being measured. By way of example, pH could be measured using:

- Laboratory meter (e.g. pH 7.15)
- Field test kit (e.g. pH 7.1)
- Litmus paper (e.g. pH 7)

As in the examples above, different methods have varying intrinsic accuracy. The database/system must therefore not display zeros or significant numbers that suggest data of higher level of resolution than realistically achievable.

Common strategies utilised to prevent data entry errors include:

- Setting range limits (e.g. pH ranges from 1 to 14)
- Using drop-down menus (e.g. select from a pre-defined list of options)
- System programming to auto-calculate values derived from data input (e.g. the required output is obtained by dividing Determinant A by Determinant B, but the user does not need to do the manual calculation – i.e. only input “raw” data)
- Allowing users to review and correct data before it is added to database
- Development of written instructions and proper training of users
- Volunteers can enter data but data checks are conducted by knowledgeable programme staff/data coordinators (e.g. programme staff/coordinators can analyse/view the data and perform appropriate follow-ups before the data is made available to all internet users – i.e. only publish once checks have been conducted).

Although the above strategies may result in a slight time-lag (from data loading to data publishing), this will ensure improved quality assurance and control, thus assisting greatly with confidence in the results presented.

- **How will security be controlled?**

Databases can have both internal and external security measures. This can include the need to enter a username and password to view data, edit data, delete data, etc.

Although the Adopt-A-River database system will include an abundance of free information, to load or access sensitive information (e.g. river water quality related data) it is recommended that users be given a username/password. Inclusion of this will provide valuable information related to both stakeholders (e.g. Who is accessing the system? Who is interested in river protection?) and system use (e.g. What features/data/information are being utilised most/least?). A particular user will be provided with a username/password, area view (e.g. catchment area, river system, etc) and associated appropriate functionality (e.g. ability to add data).

Ideally, the system should be housed at a secure data centre at an Internet Service provider (ISP) (e.g. Hetzner, Internet Solutions, SAIX) with additional further off-site back-ups. Typical security features of the data centre should include:

- Access restricted to registered contacts
- CCTV monitoring
- Complete power back-ups

In addition to the above, the system should preferably have a digital certificate (i.e. SSL certificate) to ensure secure access to the system website from a user's browser (e.g. similar to on-line shopping, where an "s" follows "http" in the web address and a padlock symbol appears at the bottom of the screen when entering secure data such as a credit card number). The above process encrypts data and thus helps protection from hackers during data transmission.

In summary, security measures to consider include:

- Users need to register and use passwords to edit/delete data (by way of example, volunteers/public should not be able to edit/delete data or perform other administration functions without a username/password)
- Data checking (by responsible and suitably skilled personnel) before data can be viewed via the internet)
- Regular back-ups
- Appropriate firewalls and other internet related security
- Record keeping/activity log of system use, access, etc.

- **Who will use the information/data?**

The main goal of the database system should be to enhance the Adopt-A-River Programme. It is therefore important that the system easily conveys information that raises awareness of the requirements for effective river management. Considering the aims of the Adopt-A-River Programme it is anticipated that users will include:

- Volunteers
- School groups
- Public
- Local government
- Provincial and national government
- Conservation organisations

When designing the database system, it is therefore necessary to ensure that it will be easily understood by the above (and any other) users. If, for example, the system is too complex and more orientated to users with scientific knowledge of the subject, less

knowledgeable users (e.g. volunteers) may feel inferior and become alienated from or frustrated with the system. As it is desirable to ensure maximum system usage by all user groups throughout South Africa, It is therefore recommended that the database system front-end (i.e. the website) primarily be easy to use/user-friendly.

- **What will information/data be used for?**

Considering the “Draft Strategic Framework for the Development of the Adopt-A-River Programme” (April 2007), it is clear that the Adopt-A-River Programme needs to primarily promote awareness creation to allow actions to be taken to improve river health (e.g. include protocols, procedures, guidelines, methodologies/techniques and other training material related to establishing and managing an appropriate river monitoring programme).

Considering the above, it is most appropriate that the information or data or be primarily used for education purposes. In addition, and dependant on the skills/knowledge of the organization/s and individual/s involved, the data collected could possibly be used for baseline information. To promote widespread buy-in and subsequent implementation it is, however, not recommended that the information be primarily used for Regulation purposes. Although DWA as Regulator could utilise information contained on the Adopt-A-River Programme to indicate possible issues of concern and guide/direct appropriate actions to address such concerns, the accuracy of the data/information contained on the database will not always be guaranteed (especially if a volunteer/public orientated Adopt-A-River Programme is established which almost certainly will include participants with very limited knowledge regarding accurate scientific research requirements/procedures, etc). Therefore although it is anticipated that only trained and appointed representatives of an organization will be able to enter data/information, errors may still arise. Placing additional restrictions on data input by stakeholder organizations (e.g. volunteers, public) may limit buy-in and widespread use. It is therefore recommended that river water quality data collected through any DWA National initiatives (i.e. scientific based programmes) be separated from river water quality related data collected by other stakeholder organizations (e.g. on-site observations or data collected by volunteers).

- **How will the information/data be used?**

Examples of data use include:

- Document search (anticipated initial functionality)
  - What documents does one want to search? Examples include:
    - Policy and legislation
    - Protocols
    - Guidelines
    - Training manuals

- Etc
- Activities information (e.g. Bulletin Board)
  - What activities does one want to search?
    - Upcoming river-based events in my area?
    - Feedback from past river-based events in my area?
    - Etc
- Data search (required future functionality)
  - What parameters does one want to search? Examples include:
    - Area or catchment name (e.g. Western Cape or CMA19)
    - River name (e.g. Berg River)
    - Sample site location (e.g. ABC Weir, Upper Berg River)
    - Determinant type (e.g. flow, physical (e.g. pH), chemical (e.g. ammonia), biological (e.g. total coliform bacteria), habitat (e.g. fish species))
    - Organisation name (e.g. Friends of the ABC River)
    - Etc
  - Searching options could include:
    - Simple search – search for a single unique identifier (e.g. river name – Berg River)
    - Dynamic search – narrow down a search after an initial selection (i.e. only display valid options within the selected category) (e.g. show all sample points within the Berg River)
    - Advanced search – multiple parameters can be chosen at the same time (i.e. without narrowing options down) (e.g. show Berg River and all sample points within the Berg River from a single command)
    - Typical outputs from a data search will include graphical or tabular displays (and can also contain statistical analysis)
- **What outputs are required from the database/system?**

In all likelihood the initial requirement for the system is a bulletin board, which will be used to convey information regarding the Adopt-A-River programme. Subsequently, it is anticipated that data analysis and reporting functionality will be required. The following typical outputs are noted:

- Bulletin board
  - National, regional and local activities (e.g. managed by appropriate system administrators at each level)
  - Past events, upcoming events, findings from volunteers, etc
- Documents
  - Policy and legislation, protocols, guidelines, training manuals, etc
- Contact details of appropriate role players
- Graphical and tabular displays

- Examples include:
    - Comparison of a single parameter over time at a site
    - Comparison of a single parameter over time between sites
    - Comparison of a single parameter over time at multiple sites/areas
    - Comparison of multiple parameters over time at a site
    - Comparison of multiple parameters over time between sites
    - Comparison of multiple parameters over time at multiple sites/areas
  - Statistical analysis of trends
    - This will help determine the structural layout of the data within the database (e.g. column organization)
    - Need to determine if a need exists for statistical analysis
    - Examples include determination of:
      - Average, mean, median, standard deviation, minimum, maximum, 95 percentile, etc
  - Spreadsheets
    - An output from the database into a spreadsheet format can be used for additional analysis or information sharing with parties who do not have access to the Adopt-A-River on-line database system
    - Examples include:
      - Spreadsheet export of all data over time at a site
      - Spreadsheet export of all data over time at multiple sites/areas
      - Etc
- **Do data need to be exported from the database/system?**

Data export can include consideration of:

- Screen views (i.e. only display on computer screen)
- Printing (i.e. only hard copy export)
- Information downloaded from system into spreadsheet/data file format (e.g. CSV file) for data exchange/transfer to other databases (e.g. export from Adopt-A-River Programme database/system for import into DWA database).

Data export in a specified file format is probably the best solution. A programming language called extensible mark-up language (XML) should preferably be used to convert the data into a common format, thus allowing the information to be shared amongst many users regardless of the type of computer system or platform is used by each to store their own data. **NOTE:** If data exchange/transfer is required, it is important that a standard data exchange/transfer mechanism be developed. This will ensure that data/information is presented in a standardised format (e.g. CSV file) for easy export from the Adopt-A-River database/system. If this is not done, costs associated with data exchange/transfer can increase substantially.

- **What links will be available?**

Links both from and to the Adopt-a-River Programme will ensure maximum exposure and awareness creation regarding river management within South Africa. Examples include:

- Links to Adopt-a-River national/regional co-ordinators and staff
- Links to Catchment Management Agencies
- Links to local authorities (e.g. Municipal websites)
- Links to other organisations that participate in Adopt-a-River activities (e.g. WESSA)
- Links to national departmental websites (e.g. Department of Water Affairs)
- Links to international websites (e.g. US EPA)

- **Will bulletin boards/online discussion forums be required?**

Bulletin boards and associated online discussion forums are useful to share and examine new ideas, insights and perspectives, and therefore (theoretically), gain a greater understanding of the subject-at-hand. The advantage of bulletin boards/online discussion forums is that the discussion does not require the physical presence of a group gathered together at a pre-arranged time. This is especially helpful in collaborative projects (as the Adopt-A-River Programme is likely to contain) where it may be difficult to coordinate mismatched schedules, find an appropriate meeting location and distributing work for review between meetings. In addition, bulletin boards/online discussion forums could foster a sense of community (i.e. belong to or contributing towards a shared enterprise).

**NOTE:** The main difference between a chat room and an online discussion forum is in real-time participation, with a chat room requiring immediate feedback/response. This is not recommended for the Adopt-A-River Programme.

Whereas a bulletin board may be managed from a central location (e.g. by a system administrator), online discussion forums are dependant upon any participant entering their contribution into a form via a webpage, which will then be submitted to the Adopt-A-River Programme database/system). Once received, the database/system will process the form in the desired manner (e.g. adding the contents to the database, emailing contents subscribers, or attaching the contents to an accessible user group webpage).

Potential advantages of online discussion forums include:

- May generate ideas which may not arise during real-time discussions.
- Could elicit responses from organizations/individuals that are more comfortable contributing through such a forum.
- Can provide both individual points and whole online discussion threads.
- Organization/individual knowledge-base is expended through the back-and-forth engagement and interaction with other organizations/individuals sharing insights, perspectives, points-of-view, etc.

However, and as noted before, in order to ensure continued sustainability of a discussion forum, both domain experts (i.e. persons with appropriate technical knowledge) and database/system administrators (i.e. to ensure discussions are appropriate/not offensive) are required.

- **Are e-mail or short message service (sms) data, notifications or alerts necessary?**

Following data input, individuals (e.g. managers, regional coordinators) or organizations could easily be informed of issues of concern (e.g. pollution incident) via e-mail or sms at very short notice by utilising a pre-defined standard distribution list in the database.

By way of example, e-mail and sms notifications/alerts have been used in the eWQMS to inform WSAs of:

- The need to load monthly water quality data
- Water quality failures
- The ability to load water system risk assessment information
- New developments on the eWQMS

It is recommended that similar functionality be introduced to the Adopt-A-River Programme database/system.

- **Does the database need mapping capabilities?**

A web-based map linked to the database is a useful means to easily convey information to a wide array of users, and especially to volunteers/public. Such a map can serve as an online directory of monitoring and other activities including, for example, river water quality results. From the map, users could easily find data related to their water body of interest.

The use of Google Earth based views (with, for example, Global Positioning System (GPS) co-ordinates of sample points) is recommended. The advantages of such an approach include:

- Enhance usability of database/system (most users can relate to Google Earth satellite images of their area of concern)
- Already in use by DWA in other databases/systems (e.g. Water Management System (WMS), eWQMS) and therefore can piggy-back on existing effort (no need to re-invent, cost savings)

- **Would there be a need to upload photos?**

The ability for users to upload photos onto the database/system is again a useful means to easily convey information to a wide array of users, and especially to volunteers/public. Photos would be useful to easily communicate:

- Common issues of concern (i.e. this is what one should look out for).
- Current issues of concern or threats (i.e. this is what we saw last week).

- Actions taken to address any issues of concern (i.e. this is what we did to fix the issue)

The above need can be easily incorporated into previously noted functionality such as web-based maps, discussion forums, etc. Such a map can serve as an online directory of monitoring and other activities including, for example, river water quality results. From the map, users could easily find data related to their water body of interest.

● **How will database/system users be trained?**

Typical training approaches can include:

- Training individuals (one-to-one)
- Training groups (one-to-many)
- Train-the-trainer (train individual/s who are responsible for training other individuals within their organization)
- On-line training (e.g. complete an internet based course)

Each of the above training approaches will have certain advantages/disadvantages as shown in the following table.

**Table 6: Advantages and disadvantages of typical training methods**

Training individuals	Training groups	Train-the-trainer	On-line training
<ul style="list-style-type: none"> <li>● Easy to co-ordinate (e.g. only need to make arrangements with one individual)</li> <li>● Only one person within organization has knowledge (sustainability questioned)</li> <li>● Higher cost (e.g. if have to re-train new individuals)</li> </ul>	<ul style="list-style-type: none"> <li>● Users can learn and develop together (e.g. ask questions to other individuals after the training session)</li> <li>● Cost savings can arise (one workshop)</li> <li>● May be difficult to ensure all required persons are available for training on the same day</li> </ul>	<ul style="list-style-type: none"> <li>● Rapid mobilisation of system (e.g. can easily make arrangements to train a few individuals who take it forward)</li> <li>● Cost savings can arise</li> <li>● Some information may be lost during subsequent training</li> </ul>	<ul style="list-style-type: none"> <li>● Accessible – can be done from any location with internet access</li> <li>● Flexible – can be done at any time (accessible 24 hours a day 7 days a week) at the individuals required pace</li> <li>● Participating online is potentially less intimidating than in the classroom (e.g. instructors more approachable)</li> <li>● Some individuals find this training method difficult (i.e. need for human instructor)</li> <li>● Need internet connection with acceptable speed</li> <li>● Need formal course development and evaluation</li> </ul>

At this stage it is difficult to determine the most appropriate training method for users of the Adopt-A-River Programme database/system. Considering costs vs. impact, it is, however, suggested that “training groups” or the “train-the-trainer” approach be initially considered. Nevertheless, it can be anticipated that following the above approach will still required significant effort. Given this, and the likelihood that limited budget will be

available for training purposes, ensuring a system which is easy to use (with minimal training) and the provision of suitable on-line training material and are two key considerations.

- **What internet browsers will be used?**

An internet browser allows a user to access the web. Modern internet browsers are equipped with the latest features and technology to simplify, accelerate and enhance the user's internet experience.

In general, an internet browser should be simple, easy to use with help/support, secure, compatible with most/all web-pages and should be fast (**NOTE:** while the speed of the user's computer and internet connection account for most of the speed, not all browsers are the same with regards to how fast they start-up, process HTML and JavaScript).

Currently available and typically used internet browsers include (not an exhaustive list):

- Firefox
- Internet Explorer
- Google Chrome
- Opera
- Safari
- Maxthon
- Flock
- Avant Browser
- Deepnet Explorer
- PhaseOut

At present, the most commonly internet browsers (used by approximately 95% of internet users) are:

- Firefox
- Internet Explorer
- Google Chrome
- Safari
- Opera

It is therefore advisable that the system developed by the Adopt-A-River Programme at least be compatible with the above internet browsers.

- **Is a facility for web hosting required?**

Established participants may already have a database/website whereas organisations in rural or poorer areas may not have the infrastructure to set up their own database/website.

Considering the above, it is anticipated that in the Adopt-A-River Programme, that two types of stakeholder organizations will present themselves, namely organizations that:

- Have an existing database/website or want to develop and retain control over a database/website for capturing data/information related to their river based activities. In this instance, the Adopt-A-River Programme database/website will contain a link to such a system (e.g. a basic website link, data exchange/transfer mechanism). **NOTE:** If data/exchange transfer is required, it is important that a standard data exchange/transfer mechanism be developed. This will ensure that data/information is presented in a standardised format (e.g. CSV file) for easy import into the Adopt-A-River database/system. If this is not done, costs associated with data exchange/transfer can increase substantially.
- Collect data/information related to their river based activities, but do not have systems in place to capture or analyse such data. The Adopt-a-River Programme database/website should therefore provide the basic infrastructure for hosting a database for such an organisation. In this instance, it is anticipated that the organization/s will be allowed to directly use the Adopt-A-River Programme database/website at no additional cost to the organization (unless specific customisation is required).

- **Is a Helpdesk required?**

A Helpdesk may be required to assist with both:

- River and associated quality related queries/issues
- Database/website related queries/issues

In order to ensure success, it will be essential that the Helpdesk is appropriately manned (at least) during normal office hours (8 am to 5 pm). Although dedicated personnel may not initially be a necessity, with increased system use, appropriate measures are required to ensure that users needs/queries are addressed within an agreed upon time frame (e.g. respond within 8 hours and aim to address routine queries/issues within 24 hours).

#### 4.6 TYPICAL WEBSITE REQUIREMENTS

As noted previously, a key point to consider is whether a website only or a database and a website front-end are required. A quick internet search will reveal that in excess of 2,000 river/water volunteer monitoring websites (some potentially with a database that forms part of the system) exist. Although it is not the purpose of this task to review, discuss and comment on all of these websites/systems, general trends/needs/requirements can be easily deduced.

From review of international and limited local river monitoring and management programmes websites, the following section highlights the main aspects that a typical website for the Adopt-

A-River Programme (front-end or access point to the database for the general user) could contain:

- Home page
  - Central access or starting point
  - Must excite the user
  - Must clearly indicate direction to user as to what information is available
  
- About us
  - Must describe the Adopt-A-River Programme
    - Vision and mission
    - Aims and objectives
    - Background/history
    - Current projects/initiatives
    - Rules/code of conduct
    - Structure and staff (e.g. organogram with contact details)
  
- Get involved/Register
  - Provide detail of how to join or become involved with the initiative. Include details related to joining as:
    - Member
    - Volunteer
    - Donor
    - Observer
    - Etc
  - Ability to register (e.g. name, organization, phone number, fax number, e-mail address – not all required fields) and obtain login details (username and password) to allow:
    - Ability to load data/information (e.g. river water quality data, training material, guideline documents)
    - Access to organization specific information (e.g. organization specific documents that are potentially sensitive – minutes of meetings)
    - Access to sensitive information (if required) (e.g. river water quality results)
  - Considering the above, the following is noted:
    - In order to ensure maximum awareness creation and ease of access by users, and considering that some users may be reluctant to provide their contact details, it is recommended that the bulk of information (e.g. policy, training material, etc) should be made available without the need to register (or input of a username/password)
    - However, by requesting users to register and capturing the above information, market intelligence is also obtained regarding:
      - Who exactly is using the system?
      - How often are they accessing the system?

- Which web pages do they most frequently access?
  - Although the above information can also be obtained via normal web page statistics (e.g. 100 hits on the website from 45 unique users), the details or nature of the users accessing the system will not be known (e.g. who are these 45 unique users).
  - In addition, a list of relevant stakeholders for river based activities can easily be generated.
- Programmes, Projects and Initiatives
  - Listing of past, current and future projects
  - Details of achievements (e.g. 1 page brag-sheet)
- Data
  - Ability to load data (e.g. river water quality data, photos, etc)
  - Ability to view data (e.g. tables and graphs)
  - Ability to analyse data (e.g. statistics) and generate reports
- Links
  - Partners, information, other river monitoring websites, government departments (e.g. DWA), etc
  - Links to Departmental web sites and staff (not just Adopt-a-River staff but also to National, Regional, CMA and local authority staff. For example, if a pollution event is detected by the community based organisation, who do they contact and how?)
- Educational tools (e.g. for teachers)
  - Information on catchments, water quality, management of rivers, etc
- Training material/modules
  - How to use website, how to monitor, how to interpret data, etc
- Library
  - Newsletters
  - Press releases – current and archive
  - Photo gallery
- Water quality
  - Maps
- Bulletin board
  - Upcoming events – workshops, meetings, calendar, etc
- Discussion forum
  - Current and archive
- Contact us
  - Feedback (usefulness)
  - What else required
  - etc
- Site search
- Frequently asked questions (FAQs)
- Job postings

Ideally, the Adopt-A-River Programme database/system should be flexible to allow each of the above aspects to be enabled/disabled (as and where appropriate for different users/organizations/areas).

As noted previously, and in order to maintain users’ interest in the Adopt-A-River Programme, a key requirement is to ensure that the system is continuously updated and enhanced. This will require financial resources (i.e. sufficient budget) and human resources (e.g. sufficient staff, sufficient skills).

Finally, it is important to note that although existing South African websites/systems could be used as a basis/platform (e.g. eWQMS, DLIST, WESSA), in order to promote sustainability and independence, it is **important to provide the Adopt-a-River Programme with its own identity (i.e. one could utilise the “shell” of existing websites/systems as a basis/platform but dress it up to meet Adopt-a-River Programme requirements, look and feel, etc)**. It is also not advisable to strongly associate the Adopt-a-River Programme with a particular entity. This will prevent potential conflicts including, for example: “DWA will use what I say to regulate me” or “this is run by ABC and I don’t like them”, thus leading to potential organizations/volunteers not partaking.

Therefore, although it is useful and cost effective to utilise frameworks/code of existing websites/systems as a basis, it is strongly encouraged that the Adopt-a-River Programme be considered as a stand-alone application (i.e. not contained within an existing website/system) with its own identity/branding, but with the ability to import (receive) or export (send) data/information to other databases/systems.



**Basic Adopt-a-River Programme Database/System Specification**

Once agreement/client buy-in has been obtained for aspects discussed in the aforementioned sections, a basic business requirement that can be used by an IT service provider team to develop the web based communication and information system appropriate to the Adopt-a-River Programme can be developed.



Considering the above, and when developing the on-line database/system, the following key points must be noted:

- Where possible, share (try to utilise existing data systems to manage/store Adopt-A-River data)
- Double the anticipated timeline and budget (if sharing is not possible)
- Where will information/data be stored?
- How will information/data be retrieved from the system?

- What outputs does one want from the system?
- Think about the data that might be collected:
  - What data will be collected?
  - What parameters will be monitored?
  - What units will results be reported in?
  - How does one want to sort the data?
- Make sure system users are involved in the creation of the system (e.g. programme co-ordinators, volunteers, etc). This will ensure user buy-in and that actual needs are met (i.e. system sustainability).
- Ensure that system developers collaborate with experts (e.g. river protection experts, water quality experts)
- As system programmers/developers do not speak the same language as system users/programme co-ordinators, make sure that the team includes a “business analyst” (i.e. a person who understands the business (e.g. river systems) and can communicate requirements effectively from users to programmers/developers (i.e. speaks both the water and IT business languages and can effectively communicate ideas to ensure needs are met).
- Develop a System Requirements Specification Document which includes aspects related to (i) data, (ii) hardware, (iii) integration, (iv) people and (v) processes, and also considers costs and timeframes associated with development and implementation of features/functions. Also include development of Use Case Analysis and User Interface Design documents. The development of the above documents, although time-consuming, will ensure that needs are defined upfront and that requirements are met. This protects both the client (i.e. have specifications been met?) and the developer (i.e. from requirements scope creep).
- No system is perfect the first time. Design the system such that it can be modified and evolve to meet user needs (i.e. need for flexibility, undergo iterative enhancements)
- Ensure good communication at all stages to ensure requirements are met.
- The system should preferably be easy to use, robust, reliable and secure (e.g. similar to other popular applications)
- Use learning’s from similar initiatives (What has worked? What has not worked?)
- Create step-by-step guides or user manuals for the system (preferably electronically so that they can be easily shared).

Bearing the previous sections in mind, the following section highlights how a national system for water quality management has been utilised by municipalities, DWA, and other water sector role players. The use of the eWQMS database and associated website as a platform for the Adopt-a-River Programme could potentially be considered (with appropriate modifications to ensure the Adopt-a-River Programme system has its own identity, etc – analogous to dressing a mannequin with a different set of clothes).

#### **4.7 THE ELECTRONIC WATER QUALITY MANAGEMENT SYSTEM (EWQMS)**

In March 2006, the former DWAF together with IMESA initiated a challenging pioneering project for the national deployment of the eWQMS to all Water Services Authorities (WSAs) in South Africa. This initiative is well supported by the South African Local Government Association (SALGA), and initially focused on drinking water quality management (DWQM), with a recent extension to include effluent discharge management (EDM). The roll-out team consisted of the former DWAF (Project Sponsor), IMESA (ensuring that the eWQMS was appropriate to municipal engineering environment), and PSPs (including Emanti Management who developed and maintain the tool, ILISO Consulting, and CSIR) who assisted with the intensive WSA interaction required during the initial roll-out and establishment of eWQMS at WSAs. The national deployment of eWQMS has assisted in substantially improving WSA DWQM and has provided a live “two way” data link between WSAs and DWA. The flow of data between WSAs and DWA has assisted the former DWAF’s Drinking Water Quality Regulatory System (DWQRS) (and DWA National Information System (NIS)) to function on real time, high quality DWQ information thus enabling DWA to both regulate and support the national provision of safe drinking water.

The internet accessible eWQMS is a comprehensive Water Quality Management system. It is a novel Open Source Software based system which is able to guide (i) regulatory compliance, (ii) the timeous supportive intervention in water quality failures, (iii) infrastructure improvement, and (iv) staff capacity development. The eWQMS can be accessed as follows: [www.ewqms.co.za](http://www.ewqms.co.za).

eWQMS undergoes continuous development based on user and sector data and information requirements. Requested new features/functions are captured and prioritized for development, to ensure that the eWQMS continues to meet sector needs. In addition, basic system maintenance and continuous and regular interaction with users is required to ensure that responsible officials are responding to issues of concern, understand and utilize the various features/functions of the eWQMS, and that the eWQMS meets their needs. This approach has ensured that (i) DWA receives credible drinking water and wastewater quality related data and information, and (ii) the eWQMS remains functional and relevant to the sector.

Emanti Management is the developer and custodian of the eWQMS. Emanti Management is the custodian of this open source software based system and utilises a professional service provider team to develop and maintain the system. The eWQMS is made available to clients using the “software as a service” and is currently being used by all Municipalities in South Africa. The eWQMS team currently has strong links with DWA Water Services and has recently established links with DWA Water Resources to enable views of processed data from the Water Management System (WMS) to be displayed for Municipal use (e.g. maps of river water quality).

The eWQMS is a well proven comprehensive Water Quality Management tool, which has been successfully used by WSA’s, Regional and National DWA offices, and the public. The eWQMS has been found following detailed assessment by DWA’s IT support team to be fully compatible with and compliant to DWA Water Services National Information System and DWA Regulatory

System requirements. National progress with eWQMS has received National Awards from the Department of Science and Technology, and International Awards from the International Water Association

The following main features are described:

- **System Access**

The system is usually accessible via the internet for full use (including via DBSA's LGNET), providing considerable costs and operational efficiency benefits over local application based systems. Nevertheless, the system can run as an independent local application if required.

- **System Compatibility**

The system can be set up to run off existing water quality management systems, such as LIMS systems.

- **Security**

The eWQMS is housed at a secure data centre in Cape Town at an ISP named Hetzner, with additional further off-site back-ups. Access to the data centre is restricted to registered contacts, and the data centre includes CCTV monitoring and complete power back-ups. The eWQMS Team is currently in the process of purchasing a digital certificate to ensure secure access to the eWQMS website from a users browser (i.e. SSL certificate). Although free information is available, to access water quality and other data on the eWQMS a username/password is required. A particular user will be provided with a password and area view (e.g. town, district, provincial or national). Furthermore, limited detail "public" views of DWQ can be set up if required.

- **Water Quality Management**

A key functional requirement is easy water quality data loading and interpretation. The system can interpret data against a range of standards, but defaults to SANS 241. The system is capable of interpreting wastewater and river water quality data. Current functionality includes:

- **Management Dashboard** [summarised monthly view of legislative compliance and identification of areas requiring urgent attention; easy colour coding to show compliance (green), failure of SANS 241 Class 1 (yellow), and failure of SANS 241 Class 2 (orange/red)].
- **Overview** (map-based interface with "period based" summary of bacteriological, physical and chemical water quality).
- **Quick Analysis** (quick links to regularly used operational efficiency and legislative compliance tables/graphs and trend analysis)
- **Detailed Analysis** (dynamic Tables and Graphs with full flexibility)
- **Reports** (archive of water quality management reports in Adobe Acrobat format).

- **Data Entry** - mostly via internet and/or Excel, but patches exist and can be developed for to link to existing systems such as LIMS / UNIX / etc for specific clients)
- **Automation** (auto-notification by e-mail of failures, generation of auto-reports and summary reports for feedback to the full range of participating parties)
  
- **Infrastructure**

Captures WSA infrastructure details related to abstraction points, treatment systems, storage facilities (e.g. reservoirs), reticulation/point of use (e.g. sampling points), DWQM Programmes (frequency of monitoring, parameters, etc) and laboratories utilised.
  
- **Risk Toolbox**

Contains water services related risk assessment tools including:

  - Strategic Assessment of Water Quality Management (Gap Analysis)
  - Water Research Commission “Supply System Assessment Tool”
  - Water Research Commission “Waste Stabilisation Pond System Assessment Tool”
  - Water Research Commission “Small Drinking Water System Risk Assessment Tool”
  
- **Administration**

Current WSA functionality includes the ability to manage sample points (add new/edit existing), manage recipients/distribution lists for automated communications, manage required automatic notifications (e-mail, summary report), data entry (water quality, infrastructure, etc) and ability to add comments related to drinking-water failures and actions taken to address issues of concern (i.e. comments serve as an action record taken to address issues of concern).
  
- **Guiding Information**

Current functionality includes a convenient repository of drinking-water related information including: abstraction, treatment, storage, reticulation and point of use, Water Quality Monitoring and Management Programmes, water quality parameters, their effects and how to rectify issues, laboratories and References including National Water Act, Water Services Act, Compulsory National Standards for DWQ, National DWQM Framework, etc.

The above highlights some of the existing features/functions of the eWQMS. These features/functions could be modified to meet Adopt-A-River Programme specific requirements.

Considering the above, the advantages of the Adopt-A-River Programme utilising the eWQMS as a platform include:

- Robust, reliable, easy to use and proven system

- Already aligned with DWA and water sector initiatives
- Ideally, only need a computer with Internet access & web browser (think on-line banking, no software installation, automatic updates)
- Ability to connect to data from anywhere (remote facilities/offices, staff that are travelling, stakeholders, etc)
- eWQMS team provides on-going support (training, maintenance, etc)
- eWQMS housed in a secure data centre with regular back-ups
- Up-to-date with latest water quality standards, guidelines and related legislation.
- Benefit from water sector related eWQMS developments
- No loss of capital (development/software purchase) if needs not met

#### 4.8 CONCLUSIONS

Before considering the appropriate system for passive communication, it is necessary to first establish what the real purpose of the system is (i.e. (Who are the users? How will they use data? What will the data be used for? **What do we want to get out of it?**).

From review of the “Draft Strategic Framework for the Development of the Adopt-A-River Programme” (April 2007), the three main components of the Adopt-A-River Programme that needs to be addressed by an appropriate passive communication medium are:

- Document repository promoting awareness creation (e.g. protocols, procedures, guidelines, methodologies/techniques and other training material related to establishing and managing an appropriate river monitoring programme)
- Ability to view river water quality related data (e.g. view river water quality data collected through National initiatives)
- Ability to load river water quality related data (e.g. stakeholders load on-site observations)

Considering the above, it is important to note that the starting point for passive communication within the Adopt-A-River Programme will probably initially focus on awareness creation. Although awareness creation could be relatively easily achieved (e.g. via creation of a website with document archive and associated bulletin boards, etc), the additional future requirements of data input and data/information output, necessitate a more comprehensive and well thought through process.

The above has been used as a basis to discuss typical aspects that need consideration. Before planning and development an appropriate passive communication system for the Adopt-A-River Programme, the following critical decisions must be made:

- Website only vs. on-line database/system (database and website front end)
- Start small, but ensure that the framework of the system can accommodate potential future requirements (without the need to re-design the entire system at high cost)

- Use of free and open source software (FOSS)
- “Software Purchase” model or “Software as a Service” model
- Adopt-A-River Programme is a standalone application with its own identity

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