# 9

# Checklist for project suitability

**IN THIS CHAPTER:**

- Principles of effective abstraction systems
- A checklist and sequence of questions to consider for successful implementation of small-scale community sand-abstraction systems
- A flow chart of suitable site and abstraction technology
- Evaluation of sand-abstraction

## SMAARTS checklist

Table 9.1 below represents a checklist of factors for consideration that are likely to ease and improve the abstraction of water from river sediment in an effective and sustainable manner.

- **Sustainability:** the technology must be such that end-users are able to understand and operate equipment for themselves and to supply their own solutions to keep it operational
- **Maintainability:** only basic procedures of installation, maintenance and repair should be used so that users are prepared to undertake maintenance work and to effectively respond to breakdowns
- **Acceptability:** a level of technology to which people are able to relate that ideally becomes a 'popular' technology where there is a sense of identity, ownership and responsibility

**Table 9.1.** SMAARTS test

| | |
|---|---|
| A checklist of sociological and technological requirements for a successful adoption of sand-abstraction: | **S**ustainability<br>**M**aintainability<br>**A**cceptability<br>**A**ffordability<br>**R**eliability<br>**T**ransferability<br>**S**uitability |

- **Affordability:** Pump parts should be affordable and available. Ideally fabricated from locally available or recycled materials which are unlikely to command great expense. Even better if the equipment itself can be locally fabricated
- **Reliability:** The equipment should be reliable and durable, ideally sturdy and consequently long-lasting
- **Transferability:** People should be able to associate with the technology, if necessary with appropriate technical training and sociological capacity building so that the technology can be successfully adopted in other localities. Ideally manufacture should be possible with only basic tools and without specialist equipment.
- **Suitability:** A suitable and effective technology with advantages which are clearly apparent in ease of abstraction, quantity or quality of water

## Community checks

### *Identify a suitable community*

The most successful water supply projects are those that are instigated by the beneficiaries. If the beneficiaries show little or no desire for a new, alternate water supply there will be little chance of a permanent, sustainable scheme.

### *Identify the users*

Although it may not be possible to restrict the number of people who use the water supply, experience has shown that 15 to 20 users is an optimum number. The more the group has in common the greater their solidarity and the greater the likelihood of successful and sustainable use. A group with a common purpose such as a small irrigation project has the greatest chance of success.

### *Assess the leadership and likely capacity of the community*

Solidarity understanding and agreement between users is all important. Any assistance that can be provided to help a group or community to work together successfully is time well spent.

## Sand river and site selection

### *Identification of suitable sand rivers*

A physical survey is required to determine whether or not the general conditions in the river valley are likely to be conducive for sand-abstraction development.

***Identification of a site***

A location must be identified on the river that gives the best chance of providing a permanent year-round water supply that is suitably sited for the convenience of users and water related projects. Chapter 3 provides additional information.

***Identify a suitable abstraction system***

A decision is required on which abstraction system and equipment is most suited to the site, the water yield and requirement, and the needs of the community. Relevant information is provided in Chapter 4.

## Abstraction equipment – materials and equipment

***Selection of a well-point or other abstraction system***

Equipment selection is critical. The well-point must have a suitable size aperture in order to develop a natural screen within the sediment. The ingress of too much sediment will clog the well-point and abstraction pipes and create excessive wear on the pump parts.

Table 9.2 gives an indication of the likely performance of the common types of well-point, however with differing materials and several manufacturers

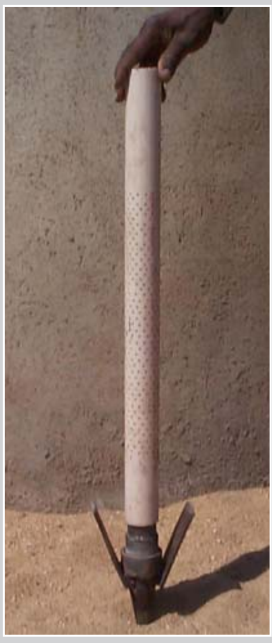
**Table 9.2.** SMAARTS ranking of well-points and no-fines concrete well-screens

| Well-point or caissons | Sustainability | Maintainability | Acceptability | Affordability | Reliability | Transferability | Suitability |
|---|---|---|---|---|---|---|---|
| Round aperture well-point | ★★★ | ★★★★ | ★★★★★ | ★★★★ | ★★★★★ | ★★★★ | ★★★★ |
| Longitudinal slot aperture well-point | ★★★ | ★★★★ | ★★★★ | ★★★★ | ★★★★ | ★★★★ | ★★★ |
| Transverse slot aperture well-point | ★★★ | ★★★★ | ★★★ | ★★★★ | ★★★★ | ★★★★ | ★★ |
| Synthetic textile covered well-point | ★★★★ | ★★ | ★★★ | ★ | ★★★★ | ★ | ★★★ |
| Infiltration gallery | ★★★ | ★★★★ | ★★★ | ★ | ★★★★★ | ★ | ★★★★ |
| No-fines concrete screen | ★★★★ | ★★★★ | ★★★★ | ★★ | ★★★★ | ★ | ★★★ |

**Table 9.3.** Appraisal of home made well-points and caissons

| Type of well-point | Installation method | Suitability | Performance |
|---|---|---|---|
| uPVC pipe, round apertures | Driven or digging-in | Good – easily manufactured, adaptable, durable | Good |
| uPVC pipe, slot apertures | Driven or digging-in | Poor – prone to breakage during installation, likelihood of slots clogging with fines | Acceptable |
| Steel, round apertures | Driven or digging-in | Moderate – expensive materials, adaptable, durable | Good |
| No fines concrete sheath | Digging-in | Good – easy manufacture, adaptable, durable | Not suitable in all situations |
| Type of caisson | | | |
| Large diameter uPVC pipe, round apertures | Digging-in | Good – easy manufacture, adaptable, durable | Good |
| Two basins | Digging-in | Moderate – easy manufacture, adaptable | Not suitable in all situations |

**Photograph 9.1.** Round aperture well-point



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of each type it cannot be considered definitive. Five stars score well, one star badly. The condition of the site also has considerable influence on the selection of the well-point or abstraction system.

Table 9.3 provides an appraisal of home-made well-points and small, uPVC and plastic caissons.

Of home-made well-points those with numerous round apertures have provided the best overall potential to date. Such well-points as shown in Photograph 9.1 (and also Figure 4.8) have shown that they can be used in a broad spectrum of conditions and are straightforward to fabricate and install.

### *Handpump selection*

Pumps are of course critical to a successful sand-abstraction scheme and must be matched to the quantity and flow of water available, the height to which the water must be raised and the power source available.

Basic requirements of handpumps:

- Simplicity, easily understood design and operation
- Low-cost manufacture and assembly, minimal use of specialist tools or equipment
- Manufacture from readily available materials
- Ease of maintenance, readily procured materials for replacement parts, easily manufactured and easy fitment of parts with no specialist tools
- Reliability and durability
- User understanding and acceptability

Summary of suitable low-tech handpumps:

- *Displacement pump – bucket pump*. A suction pump with a single valve in the base and with a valve in the piston which water passes through on the down stroke.

  These pumps that include the basic Rower pump and Treadle pump are suitable in most sand-abstraction handpump applications direct coupled to well-points and can be fitted to caissons, sand wells, offset wells and infiltration gallery collector wells.
- *Displacement pump – force pump*. A suction pump with two valves, one foot valve and one side valve where water does not pass through the piston. Sometimes called a force pump as water is expelled from

the pump cylinder by force.

These pumps that include the versions of the Rower pump, Treadle pump and the Dabane Trust Joma pump are suitable in most sand-abstraction handpump applications direct coupled to well-points and fitted to caissons, sand wells, offset wells and infiltration gallery collector wells.

- *Displacement pump – direct action pump*. Operates as a lift pump in water and is thus restricted to use in vertical well-points (tube-wells) in sand or gravelbeds, offset wells and infiltration gallery collector wells.
- *Direct lift – rope and washer pump*. A very simple and basic direct lift pump. The pump operates directly in water and due to the diameter of the driving wheel at the top has a width that generally restricts it to use on an offset well and infiltration gallery collector well. Excellent for simplicity but limited in its application.

Table 9.4 provides a simplified assessment of handpumps suitable for use on small-scale community based sand-abstraction schemes

### *Connecting pipes, suction and delivery piping*

Identification of suitable pipe work, the design and diameter of the well-point and the connecting pipe must be determined by standard flow calculations that include the volume of water that will be carried, the velocity of the water through the pipe, the length of the pipe and the material used in the pipe. The nature of the site will also determine a suitable material for connecting pipes.

Steel piping is expensive and in time will rust, even galvanised piping is

**Table 9.4.** SMAARTS ranking of handpumps

| Handpumps | Sustainability | Maintainability | Acceptability | Affordability | Reliability | Transferability | Suitability |
|---|---|---|---|---|---|---|---|
| Piston/suction lift pump | ★★★★ | ★★★★ | ★★★★ | ★★★★ | ★★★ | ★★★★ | ★★★★★ |
| Piston/suction force pump | ★★★ | ★★★ | ★★★ | ★★★ | ★★★★ | ★★★ | ★★★★★ |
| Direct action | ★★★★ | ★★★★★ | ★★★ | ★★★★★ | ★★ | ★★★★★ | ★★ |
| Rope / washer | ★★★★ | ★★★★★ | ★★★ | ★★★★★ | ★★★★ | ★★★★ | ★★ |

vulnerable to rust at the threads. Rigid uPVC pipe is cheaper but has little flexibility and is liable to fracture if there is significant sediment transport through the river channel.

Low density polyethylene pipe (LDPE) is more expensive than rigid uPVC pipe but is easy to lay, has flexibility and in the appropriate grade or class can withstand atmospheric pressure.

### *Headworks*

To determine a suitable water-point headwork consideration must be given to the source and yield of the water supply and whether or not there is a particular requirement for the water, domestic, livestock or food production use. It must be decided whether or not the water requires transfer, to a water standpoint, to a livestock water trough or to a garden. Further considerations are what designs are available and what materials are available for the construction of:

#### *A clean domestic water supply*

A secure bucket stand which prevents contaminated water from entering buckets and containers that are used to transport water should be incorporated into the design

#### *Sump tanks*

Water should flow easily into any sump tanks that are used for the onward passage of water, without fouling the pump surrounds

#### *Livestock water troughs*

Adequate fencing will be required to protect the pump from damage by cattle jostling for water

#### *Water storage tanks*

Particularly if the water is to be used for irrigation

## Sanitation

Particularly when the water supply system is a component of a WATSAN based programme consideration should be given to:

Ensuring clean water is discharged into buckets and containers. A suitable delivery spout from the pump to the container will be required to ensure no contamination of water, no wastage of water and no pooling of water that will provide a breeding ground for mosquitoes.

The construction of washing sinks for clothes is a further possibility.

Toilets – very few toilets are provided with hand washing facilities, yet this is a fundamental requirement to reduce incidences of diarrhoea and the transfer of pathogens.

Hygiene – community toilets are often constructed at points such as business centres stores, gardens and schools but very few are equipped to meet the needs of women and girls in particular who periodically need discreet washing facilities.

### Training

Appropriate training will better prepare communities and better ensure the sustainability of the equipment.

Considerations are:

Is there a functioning water-point management committee in place, what practical training and capacity building might be of assistance.

- What is the capability of the group or community in practical pump operation and maintenance
- What planning and practical skills does the community have
- What tools and materials are readily available within the community

## Opportunities for sand-abstraction

Sand-abstraction together with other alternate sources is a water supply system that has very largely been overlooked by the established water supply industry. This is quite surprising when considering:

- The technology is based on borehole screen and pump equipment design. In the design of projects regular groundwater survey and design criteria are used
- The hydrogeology of sand-abstraction is also directly related to the groundwater and borehole industry
- It is a technology that is acceptable to end-users, based as it is on traditional water supply systems. This technology has up-graded traditional open unsafe sand well water supplies to sealed safe water supplies
- Preliminary assessments are easily carried out and installations can be effected by local artisans with a minimum of preparation or training
- Most of the materials and equipment for well-point and pump fabrication and for installation are generally available in industrially

developing countries. Fabrication procedures are not difficult and almost all components can be either sourced or fabricated locally

- In most situations sand-abstraction is a natural source of clean water
- With small-scale systems the technology is simple and basic to operate and manage, making it a sustainable source of water that most rural communities are able to operate and manage with minimal inputs
- There are instances of small-scale sand-abstraction systems in operation for at least 15 years managed entirely independently by groups of rural women. More than 100 successful small-scale schemes can be identified in western and southern Zimbabwe

## Technology evaluation and appraisal

As with any water supply system it is well worth conducting a technical appraisal before engaging in the development of a sand-abstraction scheme and again on project completion. If undertaken correctly sand-abstraction technology has the potential to meet the objectives below.

Some of the questions are:

- Does it meet users expectations?
- Has it been a technology that users have accepted? Is it a simple, straightforward technology that has not required professional or high-tech geophysical surveys or specialist equipment to install or maintain?
- Is it a sustainable technology that people have been able to operate, maintain, repair and manage satisfactorily for themselves? Has the scheme required outside assistance to keep it going?
- Has it been cost-effective?
- Have the users been innovative and used the system and the water wisely? Have they been able to find solutions for themselves and if necessary to make adaptations?
- How transferable is the technology? To what degree might other communities who can obtain or adapt suitable materials and resources use these to set up their own schemes, and what degree of assistance might they require?