NWFP Environmental Protection Agency

Environmental Assessment Checklists and Guidelines

Tube-well Construction for Agriculture and Irrigation Purposes

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1. Introduction

Due to over-pumping and increased pollution, the protection and management of freshwater resources is rapidly becoming a priority. With the rapid increase of population, the farmers are increasingly relying on the groundwater for irrigation. In the absence of any control on the installation of new water wells, no hydrological or environmental factors are taken into account when new water wells are installed.

1.1 Scope of Guidelines

The scope of this guideline is related to construction of tube-wells for irrigation purpose. It includes tube-wells

- Operated on diesel, electricity or wind energy
- Discharge capacity is more then 0.25 cusecs

As water from irrigation tube-wells are often also used for drinking and domestic purposes these guidelines also take into account these uses of the irrigation tube-wells.

1.2 How to use these Guidelines

The project proponent (the local government, municipal government, city government or the cantonment board) is obliged to use these guidelines. The project proponent has to fill in an environmental impact assessment form. The following steps are to be taken in this regard:

Step 1: Provide information on project [use **Section I**]

Step 2: Determine Applicability (*Are you sure that IEE or EIA is not required?*) [use **Section II**]

Step 3: Describe the physical, biological and social environment [use **Section III**]

Step 4: Assess potential impacts and applicable mitigation measures [use **Section IV**]

Step 5: Provide undertaking to the EPA on mitigation measures and compliance [use **Section V**]

Completed form is to be submitted to the NWFP Environmental Protection Agency for evaluation. NWFP EPA may request for additional information or decide to undertake visit to the proposed project site in order to assess the environmental impact of the proposed project.

1.3 Glossary

Act means the Pakistan Environmental Protection Act, 1997

Aquifer is a saturated geological unit (eg. sands, gravels, fractured rock) which can yield water to wells at a sufficient rate to support beneficial uses.
Contamination introduction of impurities in the environment

Cone of Depression (or "influence") is the draw-down of the water table or potentiometric surface that happens when a well is pumped. The drawdown cones of two wells close together may overlap so that if the wells are pumped simultaneously they will compete with each other for available groundwater (well interference).

Environment means (a) air, water and land; (b) all layers of the atmosphere; (c) all organic and inorganic matter and living organisms; (d) the ecosystem and ecological relationships; (e) buildings, structures, roads, facilities and works; (f) all social and economic conditions affecting community life; and (g) the inter-relationships between any of the factors in sub-clause (a) to (f).

Environmental Assessment a technique and a process by which information about the environmental effects of a project is collected, both by the developer and from other sources, and taken into account by the planning authority in forming their judgments on whether the development should go ahead.

Groundwater is water that occurs in the subsurface below the water table.

Gradient the property possessed by a line or surface that departs from the horizontal

Impact on Environment means any effect on land, water, air or any other component of the environment, as well as on wildlife harvesting, and includes any effect on the social and cultural environment or on heritage resources.

Mitigation Measure means a measure for the control, reduction or elimination of an adverse impact of a development on the environment, including a restorative measure.

Permeability is the ability of an aquifer or water-bearing formation to allow water to pass through it. Permeability is also known as effective porosity because it is a function of interconnected saturated pore spaces.

Potable Water is the water fit for human consumption.

Pollution the presence in the environment or the introduction into it, of substances that have harmful or unpleasant effects

Regulations means the Pakistan Environmental Protection Agency Review of Initial Environmental Examination and Environment Impact Assessment Regulations, 2000

Saturated Zone is the zone below and including the water table in which all pore spaces or fissures are totally filled with water. Also referred to as the phreatic zone.

Transmissivity means the rate at which groundwater can flow through an aquifer section of unit width under a unit hydraulic gradient. It is the average permeability of a section of the entire aquifer at a given location multiplied by the thickness of the formation.

Water Table - The top of the zone in which all pore spaces or fissures are totally filled with water.

2. Project Profile

2.1 Description

Groundwater occurs under most of the world's land surface, but there are great variations in the depths at which it is found, its mineral quality, the quantities present and the rates of infiltration (thus yield potential) and the nature of the ground above it (thus accessibility). In hilly areas it emerges from the ground in places as natural springs, otherwise wells have to be constructed and pumps or other lift mechanisms installed.

The main technology components of any groundwater irrigation scheme are the pump, motor, well and conveyance system. The options available under these three categories can be interchangeable but more often than not there is a link. For example, a shallow tube-well will almost always have a suction mode pump operating with an unlined canal for distribution, whereas a deep tube-well will usually have a force mode pump in operation with a combination of lined and unlined canals or buried pipe systems for distribution.

2.2 Environmental Aspects

The environmental aspects associated with the siting, installation, and operation of groundwater wells are discussed below.

Groundwater Well Siting

Two main factors that often determine where water wells are sited are the evidence of the presence of water and

the place where water is required. In case of private tube-well for irrigation purposes, the choice is often restricted to the land owned by the owner of the tube-well.

There are other import environmental and social factors that are often overlooked while deciding the location of the well. These include:

- The size of the aquifer and the effect on yield of other nearby wells, particularly dug wells
- Risk of contamination from surface sources of pollution
- (In case of a community well) a location that ensures that the benefit of the well can be equally and fairly distributed among the community members

Contamination

Ground water sources are usually bacteriologically pure, so disinfection is not necessary. However, groundwater aquifers can become bacteriologically polluted from sources of contamination such as latrines, garbage dumps, and corrals, and through poorly constructed wells. For example, a deep borewell that has been improperly sealed can serve as a conduit that transmits polluted surface water into the aquifer. It must be remembered that Groundwater may also be chemically contaminated, making it unfit for consumption without treatment.

Over-Exploitation of Water Resources

There are also limits to all groundwater resources, even when they appear to be plentiful. Over-pumping can result in a lowering of groundwater levels to a point where it is no longer feasible or possible to continue pumping.

Post Construction Restoration

During drilling of tube-wells, the surface around the well site is disturbed due to digging of the mud pit, concrete mixing, installation of the rig, and other construction debris. If the well is located on a public land, the site is often not fully restored.

Technology

Tube-wells are mostly based on conventional technology. The technology and the operating practices are not necessarily efficient. Studies have shown that significant savings could be made in fuel consumption (and, hence, costs) by making small changes to the existing technology used.

2.3 Mitigation Options

Groundwater Well Siting

The water well should be located such that it is protected from possible sources of contamination. At the same time, environmentally sensitive objects should be protected from the potential impacts of the well. The recommended minimum distances are as follows:

Feature	*Distance (m)*
Possible Source of Contamination	
Garbage dumps/refuse piles, car repair or fuel (petrol) sales outlets, industrial operations/storage facilities etc	100
Seepage pit or cesspool	50
Pit toilets, animal pens, barns, fields fertilized with dung	30
Septic tank, surface water body	15
Drain, ditch, house	7
Environmentally Sensitive Objects	

Feature	*Distance (m)*
Recognized wetland of ecological importance	500
Archeological remains or archeologically important building or structure	250
Shrines and large graveyards	100
Isolated graves	20

Other factors that must be taken into account while locating a tube well are:

- New tube-well should be at least 100 m from any existing tube-well, unless it is established by hydrogeological study that the new well will not affect the yield of the existing well
- New tube-well should be at least 100 m from any existing dug well, unless it is planned that dug well will be abandoned after the installation of the tube well
- As far as possible, locate water wells upgradient (uphill) of nearby potential sources of pollution, that is, the land should NOT slope from pollution sources towards water wells. If this cannot be avoided, try to locate wells as far to the side of the slope as possible, that is, not directly downslope of possible contaminant sources.
- In case of community wells, the water wells should be as close as possible to dwellings (but maintaining the safe distance identified above) because people use a lot less water if water wells are located far from their home.
- Ensure that the site is accessible year-round and that the access route to the water well is not susceptible to flooding.
- Ensure that the site has legal access, which is acceptable to users from a societal standpoint. Disputed private lands should be avoided. Having a water well on someone's property enhances its value and therefore a formal arrangement for access needs to be clearly made before the well is drilled

Contamination

To protect the groundwater quality from getting contaminated, the following measures should be undertaken:

- The tube well should be purged and decontaminated before it is put to used
- Tube-wells and its pedestal should be sealed in a way that the diesel and other impurities do not mix with groundwater
- A concrete pad should be constructed around the well. The gradient of the pad should be away from the well bore
- Area around the well should be maintained to ensure that no pools of standing water are formed

Post Construction Restoration

If the well is located on a public land:

- All pits should be refilled
- All excess construction material and debris removed
- Recontouring should be undertaken
- Any damage to access track should be repaired

Technology

Few tips are provided that may improve the efficiency of the well.

- The use of bamboo and mosquito netting filters is more fuel efficient (and cheaper) than using PVC pipes with very narrow slot sizes (0.2 mm).

Diesel pumpsets

- Increasing the engine operating temperature through alteration of water-cooling system. For example, by fitting thermo syphon drum cooling increases operating temperature from 35 °C to 80 °C.
- Removing the check valve from the suction pipe to reduce hydraulic friction losses.
- With oversized engines, reduce the speed of the engine. For example, reduction from 1,500 to 1,100 rpm on a 5HP engine reduced fuel consumption from 1 l/h to 0.5 l/h with unchanged discharge.

Environmental Assessment Checklist

Section I: Project Description

File No _____ (To be filled by EPA)

Date _____

General Information

1. Project Name or Title_____
2. Project Proponent (Department or Organization) _____
3. Address _____
4. Telephone _____
5. Fax _____
6. E-mail _____
7. Representative of the Proponent_____
8. Designation _____
9. Name of the person who conducted this assessment _____
10. Designation _____
11. Qualification_____

Project Information

12. Well Location_____
13. Cost of the Well_____
14. Proposed Depth _____
15. Expected Yield _____
16. Expected Daily Discharge _____
17. Pump Size_____
18. Energy Source_____
19. Land Area Required: _____ m^2
20. Purpose of the Well_____
21. Brief Project Description _____

_____

_____

Please attach a plot plan of the proposed well site showing the location of the key structures, access, utilities, units, etc.

22. Who will maintain the well? _____

Construction

23. Who owns the proposed land for the project? _____
24. What is the present use of the land? _____
25. Are there any encroachers on the land? _____

    If yes, please specify

    Number of encroachers _____

    Will any compensation be paid to them? _____

26. Are there any structures on the proposed site now? ☐ Yes ☐ No
27. If yes, will any structure be demolished? ☐ Yes ☐ No
28. If yes, where the demolition waste will be disposed? _____
29. Are there any trees on the proposed site? ☐ Yes ☐ No
30. Will any tree be removed? ☐ Yes ☐ No

    If yes, how many? _____

31. Period of construction (start and end dates) _____
32. Is drilling work during the night planned? ☐ Yes ☐ No
33. What kind of drilling equipment will be used (percussion, rotary, etc.)? _____

    _____

Section II: Screening

1. Is the proposed well or any of the area that it will irrigate in an ecologically sensitive area? ☐ Yes ☐ No
2. Is the cost of the proposed well Rupees one million or more? ☐ Yes ☐ No

If the answer to any of the above questions is yes, then the project would require an initial environmental examination or an environment impact assessment. Refer to the Pakistan Environmental Protection Agency Review of Initial Environmental Examination and Environment Impact Assessment Regulations, 2000 for appropriate category.

Section III: Environmental Profile

1. Describe the terrain of the project area: ☐ Flat or Level (Slope < 3%)
   ☐ Level to moderately steep (Slope 3%-30%)
   ☐ Moderately steep to mountainous (Slope > 30%)
2. Are there signs of soil erosion or landslide anywhere within 500 m of the proposed site?

   ☐ Yes ☐ No

   If yes, please describe (where, nature) _____
   _____
3. Is there any surface water body (river, canal, stream, lake, wetland) within 1,000 m of the proposed site?

   ☐ Yes ☐ No

   If yes, describe each water body:

Name (including type, ie, river, canal or stream)	**Dimensions**	**Status and Uses** (Is it polluted? Is domestic or other wastewater discharged to it? What are its uses, eg, agriculture, domestic, industrial, washing, fishery

4. Is there any other groundwater well on the proposed site or within 500 m of the proposed site?

   ☐ Yes ☐ No

   If yes, describe each well:

Type (Dug well, tube well, hand pump)	**Location** (Village, road, mohalla, etc. and distance from the site)	**Depth and Yield**	**Uses** (Drinking, agriculture, domestic, industrial, washing, livestock)

5. Are there any reserved forest or protected area within 1,000 m of the proposed site?

   ☐ Yes ☐ No

   If yes, please describe?_____

6. How are the general hygienic conditions of the project area?

   ☐ Generally clean

   ☐ Fair

   ☐ Poor

7. Is there any bad odor in the project area?

   ☐ Yes ☐ No

   What is the source of the odor?_____

8. Is there any site of cultural importance (graveyard, shrine, mosque, archeological site) within 1,000 m of the proposed scheme?

   ☐ Yes ☐ No

   If yes, please describe?_____

Section IV: Impact Assessment and Mitigation Measures

Potential Negative Environmental Impacts	*Tick, if relevant*	*Mitigation Measures*	*Tick, if proposed*	*Monitoring*
Well siting	☐	Minimum prescribed distances from potential sources of contamination will be maintained	☐	
	☐	Minimum prescribed distances from environmentally sensitive objects will be maintained	☐	
		Well will be at least 100 m from any existing tube-well OR It is established by hydrogeological study that the new well will not affect the yield of the existing well (*Please attach the study*)	☐	
		Well will be at least 100 m from any existing dug well OR The existing dug well will be abandoned after the installation of the tube well	☐	
		Well will be locate upgradient (uphill) of nearby potential sources of pollution	☐	
		The well will be as close as possible to dwellings	☐	
Contamination of water	☐	The tube well will be purged and decontaminated before it will be put to use	☐	
		Tube-wells and its pedestal will be sealed in a way that the diesel and other impurities do not mix with groundwater	☐	

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Potential Negative Environmental Impacts	*Tick, if relevant*	*Mitigation Measures*	*Tick, if proposed*	*Monitoring*
		A concrete pad will be constructed around the well. The gradient of the pad will be away from the well bore	☐	
		Area around the well will be maintained to ensure that no pools of standing water are formed	☐	
Post Construction Restoration	☐	All pits should be refilled	☐	
		All excess construction material and debris removed	☐	
		Recontouring should be undertaken	☐	
		Any damage to access track should be repaired	☐	

Section V: Undertaking

I, _____ (*full name and address*) as proponent for _____ (*name, description and location of project*) do hereby solemnly affirm and declare:

1. The information on the proposed project and the environment provided in Forms I, II and III are correct to the best of my knowledge
2. I fully understand and accept the conditions contained in the Guidelines for _____
   (*name, number and version of the guidelines*)
3. I undertake to design, construct and operate the project strictly in accordance with the project described in Form I, submitted with this undertaking.
4. I undertake to implement all mitigation measures and undertake monitoring stated in Form IV, submitted with this undertaking.

Date _____ Signature _____

Name _____

Designation _____

(with official stamp/seal)

Witnesses:

	Signature	Name	Address
1	_____	_____	_____
2	_____	_____	_____