



## The effect of underground dams on the management of water resources and water deficit supply

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**Abstract:** Given the fact that Iran is located on the arid belt of land, in any case surface and groundwater resources are not available, for this purpose the efficient use and management of water resources are needs and goals of development. In this regard, the use of old and new techniques and the use of scientific methods is needed, in arid regions and locations where despite, having a rainy season, have dry season and low rainfall ,using underground dams can be supplied need of water of restricted areas and sparsely populated, through the alluvial of seasonal streams. The combination of this technology simple with aqueduct, for water shortages could offer a new way.

In this study, we tried that the first definition of underground dams, underground dams' history, advantages and limitations, and application and construction purposes should be provided.

The rest of this paper is investigated characteristics of the construction and exploitation of underground water reserves Dam .

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### Introduction

Due to the growing need for water and lack of access to sources of it in Iran, Maintain and use underground sources (groundwater), it seems essential that in the areas where have underground water and suitable, construction of underground dams is one of the desirable options. Underground dams due to their low cost, easy fabrication method, save of clean water and having many advantages over the surface dam , and particularly with regard to Iran's arid and semiarid climate can be a cost-effective method to use groundwater. When precipitation occurs, some of it is current (surface runoff), and to rivers and seas joins and some of it evaporates and is returned to the atmosphere and about six percent of it also influences to earth and forms underground aquifers. Without a doubt we can say that anywhere happen rainfall, groundwater resources are also available there. Groundwater are in fact part of surface water that naturally come to the surface through springs, or from underground aquifers by wells and canals and.... are extracted. These waters are one of the important sources of fresh water required are usually free of pathogenic organisms and requires no special treatment. Nowadays, land subsidence and change the quality of water resources, decrease underground water surface and advancing of water in the desert margins, from ruinous effects of uncontrolled exploitation of these precious resources are considered. In warm and

dry areas, groundwater due to low amount of rainfall and runoff from it and high evaporation rates are always very important.

### Materials and ways

The composition of the earth's surface in different areas, causes that water infiltration into the underground occur slowly or too quickly. If the composition of subsurface layers be such that water penetrates into deep , practically the water will lose and transferred to the inaccessible depths; In some areas of the Earth and in the depths less than 100 m of soil composition is such that water does not possible influence into the lower levels , and thus underground water table arise; in natural composition of soil layers in some areas soil vertical layers causes that the aquifer to convert between different sectors and the groundwater table is converted into multiple reservoir. Under normal conditions these layers act as a natural underground reservoir and Man with knowledge of the benefits of these natural dams is trying to build artificial barriers in way of the widespread tableclothes of water flowing underground and in fact, to build underground tanks. Creating wide vertical columns of water flows through or in underground tanks often have a depth less than 70 meters, is call underground block.

Compared with the conventional dams, underground dams across the river or creek for water supply are made, water the surface in the reservoirs upstream of the dam is gathered, but underground dams that block

the flow of underground water and stores water beneath the Earth's surface. As well as the collector structure that diverts the flow of underground water to be used. The use of underground water dams to store the surface water than conventional methods has advantages. One of the groundwater dams' comparative advantages compared to conventional the surface reservoirs to amount of losses, evaporation from water level is open, in this way evaporation losses reduced or even completely disappears. Once and for ever and it designed and built, then the storing of water for a long time is available. While with useful storage volume of the surface reservoirs due to sedimentation and plant growth is reduced and also regularly subjected with evaporation or damage caused by severe flooding river. Water stored in underground dams is less polluted and health hazards that there are at the surface reservoirs, is excluded. And also when be used the surface storage tanks, part of the land is occupied by reservoirs, if the land upstream of the dam reservoirs, underground water can be used for other purposes.

#### **History of underground dams:**

Dam engineering is an integral part of human civilization. Because the dams that have been constructed for water supply, no doubt of first man-made structures are considered and as evidence indicate in the cradle of civilization, Babylon - Egypt, Iran and East Europe. Dams have been served a minimum of five thousand years of human civilization. Examples of underground dams in Iran and the island of Sardinia built in Roman times. But the growth and development of underground dams began of the twentieth century and in the last three decades much progress has been among the countries of the world.

#### **Advantages and limitations of underground dams**

The use of underground dams to store surface water has several advantages compared to conventional methods. One of the comparative advantages of subsurface dams compared to conventional surface reservoirs, returns to amount of losses evaporation of the water level. In this way, evaporation losses dropped or even completely disappear. These dams are designed once and for all and then water supply is available for a long time, while the volume of useful storage surface reservoirs is reduced due to and plant growth sedimentation and also regularly subjected to evaporation or damage caused by severe flooding river. In underground dams that water is stored, water is less polluted and surface reservoirs health risks are ruled out. Also, when of reservoir level is used, part of the land is occupied by reservoirs, reservoirs upstream of the dam if the ground water table can be used for other purposes .

The risk of failure is much less of underground dams in comparison with surface dams. Also dams prevent the

influx of salt water or polluted water entering to basin waters that are healthy. These dams have the construction technology simpler and usually are closest to the place of consumption. The water distribution in these is much cheaper than the distribution of water in surface dams that is done by piping and water treatment plant.

In underground dams because of invisibility of operations control work such as quality control, transit of border control and water cutoff is difficult and requires precision and study a lot. Also the cost of maintenance and operation of facilities for water harvesting is relatively high. And if the depth of the body is more than 70 meters, project for execution and procurement of appropriate devices and digger is facing economic difficulties.

#### **5- 2.Characteristics of underground dam construction site**

Narrow V-shaped valleys and alluvial mountain overlooking the alluvial fans are the best areas for construction of underground dams.

Geologically, a thick layer of alluvial layer and impermeable layer of bedrock close to the surface along with the movement of groundwater in the direction of the hydraulic gradient, as the best potential mapping of underground dams considered as in good condition. Underground dams can be also built at output of plains or at fault. The best areas for construction of underground dams must have a groundwater's outflow tract. Among the important issues in determining the appropriate focus for underground dam construction is Geophysical studies to determine the morphology of the bedrock in the area around the river and the thickness of alluvium.

#### **The physical conditions of underground dam construction site**

##### **Province:**

Need to block water groundwater arise mainly of irregular rainfall. Therefore, blocking groundwater means the bridge between the months have rainfall for coping with seasonal drought conditions.

##### **Topography:**

The topography situation in terms of features construction of underground dams and access to large reservoirs to the conditions of proper nutrition and less leakage losses, is largely determinative. In mountainous areas with steep slopes, the possibility of finding an acceptable relationship between storage volume and height of the dam is difficult. Therefore, for the construction of underground dams should at least topographic slope that varies regularly with local hydrological conditions be available. Usually in location of the construction of dams about 2.0 to 4 percent gradient required. But in some cases exceptions dams were built on slopes of 10 to 16 percent.

**Hydrology:**

Often beds covered with sand or gravel of rivers are suitable for construction of underground dams. In the deeper layers of the river water or inside rocks that in place have been weathered. Despite the fact that storage and flow characteristics are not appropriate, the construction of the dam was successful. Aquifers that have fine-grained materials usually in them adequate water within the soil space exists but the possibility of exploiting it for reducing the discharge is limited. But in aquifers with coarse aggregate storage and operation of its existing water is suitable with this explanation that to prevent seepage losses in their dams should be done carefully.

**Scales:**

Mechanical and chemical weathering has notable effects on sediment characteristics. The low rate of chemical weathering in dry climates, leading to coarse-grained sediments. The amount of erosion mainly depends rainfall intensity, slope and land use. Therefore is contrary to what agricultural engineering and hydraulics have considered. Sand dam design engineers welcome of steep slopes covered with low plants in the field. Large deposits, which must be collected behind the dam, sediment transported are as bed load. Therefore, it is essential that rainstorms created of the initial start of rainfall be enough severe which leading to cargo of load of bed.

**Geology:**

Stone floor and walls of the tank must be such that water does not pass. This by providing geotechnical operations, including the drilling of exploratory boreholes and test of site of the construction of the dam and in the dam area is possible.

In short we can say that the location of underground construction of the dam must meet the following requirements:

1. areas have arid or semi-arid, 2 - slope less than 5%, 3 - bed material with high permeability, 4 - There are impermeable layer near the surface of the Earth, 5. low as possible distance underground dams up to consumer location. 9. Lack of saline soils or rock salt in the range of dams, 10. Lack of latch on boulders worn or split rocks due to water leakage in the them.

**Exploitation of water reserves in underground dams**

In order to use the water stored in the dam reservoir underground several methods such as digging wells, gravity methods or a combination of both methods are used. A well that water will extract from underground dams, in the dam reservoir is constructed. To avoid destruction by the flood, usually dig wells close to the edge of the river. If the site of operation of the dam is in the area downstream of the dam and topography also is provided, extracting water from the dam reservoir is gravity. By deriving gravity can be avoided the

problems of installation, repair and maintenance of pumps.

**Underground dam's impact in the sustainable management of water resources**

Due to the fact that underground dams prevent of loss of groundwater and surface water permeable and increase the usable groundwater resources, cause sustainable use of groundwater resources and a result of sustainable agricultural development in various areas, especially areas facing water shortages. On the other hand due to imbalances that exist in the country, especially in arid and semi-arid groundwater that caused of it , and reducing groundwater levels in different fields caused by it , increasing underground reserves of underground water using establish other dams, can be help to balance in the areas of groundwater and groundwater regular and stable country.. On the other hand, the increase groundwater storage, which may be accompanied by the construction of the dam and water spreading associated with watershed management projects, prevent erosion and reduce the effects of flooding .It should be noted that the use of underground dams compared to surface dams for many reasons such as reduced or cut off water evaporation losses and a longer shelf life and even permanent underground dams, sustainable use of water resources to follow.

**Conclusion**

Country Iran due to its geographical location and being in semi-arid and dry, the water crisis in the category has huge water problem. Lack of water resources is the most important issues that should be taken into serious consideration the private sector planners and investors. Lack of rainfall or rising water demand and consumption are articles which everyone is aware of them and acknowledge, competent that authorities with knowledge of this over the years develop plan efficient in this area, which can create relatively a stable sit Sadly unrealized and occasional country, particularly growers will face with the water crisis and drought. Underground dams due to low cost, easy fabrication methods, storage of clean water, and many advantages compared to surface dams and particularly with regard to Iran's semi-arid and dry weather can be a cost-effective and simple method to use of groundwater. We hope that by cost a lot of in dam construction sectors in our country, construction of such dams also be considered in advance. And we have been a pioneer in the use of groundwater in the world. And now also we are one of the world's largest dam builders and also are ahead of other countries in this field and Vanguard for the next few years.

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