

**Water and Environmental Programs
Engineering Success Stories**

State: Arizona

Borrower Name and Case No.: Green Valley Park

Engineering Firm: Moore and Associates

Rural Development Contact: Reed Petersen, State Engineer (602) 280-8748

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Abstract

The Green Valley Park Project in Payson, Arizona, is a ground water recharge site in a park setting. This allows citizens and visitors to receive the benefits of a new recreation site while water supply enhancement occurs in the background.

Introduction

Payson, Arizona, a small rural community located at the "Heart" of Arizona and a pleasant 90 minute drive from the Phoenix metropolitan area, is renowned for its beauty, recreational opportunities and, more recently, its dynamic business environment. At an elevation of 5,000 feet, the area enjoys a mild four season climate that attracts visitors from throughout the world the year around. With an average trade area population of some 35,000, (Payson recently exceeded 10,000 population) Payson offers the atmosphere of rural America, with the amenities of a metropolis. Payson experienced 65 percent population growth between 1980 and 1990 and continues to grow.

The local economy is dominated by the tourism and retirement industries, with a growing emphasis on manufacturing and service firms. Light industry that is compatible with the community's high quality of life is also encouraged. The Town of Payson provides domestic water service and the Northern Gila County Sanitary District (NGCSD) provides sanitary sewer service to Pavson's residents.

Groundwater is the Town of Payson's only drinking water source. As a growing community, Payson has experienced a decline in the ground water table. When demands for water increased, new wells were put into production to meet the increased

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needs. In major water production areas, the ground water level has dropped approximately 30.5 meters (100 feet) over the past 10 years. In non-production areas, the static water level has dropped 3.05 meters (10 feet) over the past 10 years. This decline in ground water elevation has prompted the exploration of ways to augment the ground water supply.

In 1983, the NGCSD constructed a new sewage treatment plant that used the Bardenpho Process. This treatment process, coupled with Payson's low industrial waste, provides a very high quality, low nutrient effluent. The NGCSD had been discharging the majority of its high quality treated effluent into the Verde River system. However, the Arizona Department of Environmental Quality has mandated the NGCSD put treated effluent to beneficial use rather than discharge it into the East Verde River for the benefit of downstream users. Only a small portion of the effluent was being used for ponds and irrigation at various locations throughout the service area. Working together, the Town of Payson and NGCSD developed a strategy to help resolve the declining water table and effluent issues.

In 1988 an Ad Hoc Committee studied additional uses of the NGCSD effluent within the Town of Payson. One proposal was to store the effluent in lakes for ground water recharge and recreational benefits. The lakes could also act as holding tanks for the excess effluent to be pumped to other reuse sites throughout the Town. The lakes would be surrounded by turf and landscaped to be watered by the stored effluent. The site for the lakes, Green Valley, was part of the proposal. An Intergovernmental Agreement (IGA) was struck between the Town of Payson and the NGCSD, and a Green Valley Park Governing Board was created. The Board further explored the feasibility of using the proposed Green Valley Park project as a ground water recharge area and to identify possible sources of funding for constructing the lakes and park.

The proposed lake/park is in a natural low lying area at the west end of Main Street in Payson. In 1989, the property for this project was owned by the U.S. Forest Service. The area, known as American Gulch, carries the storm runoff for a large part of Payson and the surrounding area. Several roads and overhead and underground utilities crisscross the site.

Design And Construction

Burgess & Niple, Inc., Engineers and Architects, was retained to prepare a feasibility study and construction cost estimate for the project. The feasibility study addressed the issues of using the NGCSD's treated effluent for landscape watering, roadway and utility relocation, and, more importantly, ground water recharge. This study showed how the proposed Green Valley Lake could provide effluent storage for pumping to other reuse customers, watering the landscaping of Green Valley Park and ground water recharge into the Town's declining water table. The ground water recharge could be accomplished actively with injection wells or passively with percolation. Several

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permits would also be required by the Army Corps of Engineers, Arizona Department of Environmental Quality and Arizona Department of Water Resources. The feasibility study showed that the Green Valley Park Ground Water Recharge Project could become a reality.

A lengthy master planning process was started to determine what elements would be addressed in the park in addition to treated effluent storage and ground water recharge. It was decided to use percolation as the initial ground water recharge method. After several public comment sessions, a final concept plan showing three lakes, realigned roads and park amenities was approved by the governing board. In 1991 final design was started on the dams, lakes, roadways, utility relocation and landscaping and irrigation for the Green Valley Park. With the site being in a major drainage area, design had to incorporate the effluent plus storm water runoff.

Although this construction will have an affect on flood control during small storms, flood control was not a major design parameter. In a small storm, the runoff will be detained behind the dam in the major lake. Approximately 11,700 cubic meters (9.5 acre feet) of storm water runoff will be detained in the lakes, assuming the lakes are at normal static elevation. A leveling weir will drain the lakes back to the normal static elevation. The dam design provides for larger storm runoff to overtop the spillway and flow into the stilling basin and down the American Gulch. No storm water runoff volume is expected to remain in the Green Valley Lakes.

The storm water runoff entering the Green Valley Park lake system has a large potential for transporting silt into the park. The upper lake is designed as a sedimentation basin to accommodate the silt from the runoff. This lake is designed to be dried up periodically to allow for sediment removal. Under normal operations, effluent will be pumped into the upper lake and then flow hydraulically into the second lake and then into the main lake through connecting pipes. During storms, runoff will overtop the level control weir in the upper lake and flow directly into the main lake.

The dam is earth fill construction capped with gabions varying in thickness from 6 to 18 inches. The gabions are covered with 6 inches of top soil and then either sod or deeded grass is placed over the top soil. A stilling basin is constructed on the downstream side of the dam to direct the storm water flows to the American Gulch just as before construction.

Concurrent with the project design, the Green Valley Park Governing Board was exploring possible financing sources for the project's construction phase. Grants were received from the Arizona State Land Improvement Fund and the Arizona Heritage Fund. In 1992 a \$3 million bond issue was passed by the Town's electorate by a 2:1 margin. A portion of the bond money was used to begin the initial construction phases while the Governing Board continued to look for other funding sources. In 1994, USDA-Rural Development agreed to refinance the bond issue with a \$2.49 million loan

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and to provide an additional \$1.5 million grant for the construction of this project. The remainder of the project was funded by the Town's Water Department and the NGCSD.

In 1993 the park property was transferred to the Town as part of the Payson III Land Exchange. The first construction phase was also completed in 1993. This phase relocated an existing sanitary sewer line that was in conflict with the future main lake and extended reuse supply lines from the NGCSD treatment plant to the site.

In 1995 a contract was let for the construction of the three lakes, remaining utility relocation, landscaping and park amenities. This construction project was completed in September 1996 with a final cost of about \$6 million. In October 1996, the Arizona Game and Fish Department completed an initial stocking of about 1,250 pounds of rainbow trout. The size of the fish ranged from 1/2 to 2 1/2 pounds. The Town is continuing to work with the Game and Fish Department to have the lakes stocked periodically.

Ground Water Recharge

As construction proceeded in early 1996, the excavation of the lakes was completed. The soils in the bottom of the lakes varied from the very porous decomposed granite to an organic clay material. Since the main objective of this project is to add water to the ground water table, it was imperative that the lake bottom be permeable. Therefore, in areas of clay, additional excavation was done to get into the more porous strata.

The NGCSD began to fill Lake 1 in February 1996. This lake was the only one filled initially. Once Lake 1 was filled, groundwater levels were monitored in the Mountain View Well immediately south of Lake 1. The Mountain View Well was being heavily pumped at the time as a major supply well. The static water level in the well was declining. After Lake 1 was filled, the static water level continued to decline but at a slower rate. On July 18, 1996, effluent began flowing into Lake 3 with the lake reaching full capacity by September 1, 1996.

There were two existing wells down gradient from Lake 3, the Country Club #2 Well and the Dam Well. Country Club #2 is a production well that was not been used at the time. The Dam Well is an observation well to monitor ground water levels. A third well, the Lake Drive Well, was drilled down gradient from Lake 3 in September 1996. Static water levels have been monitored before and after the filling of lake 3.

Monitoring data shows that within three weeks after filling Green Valley Lake 3, the static water surface in the wells immediately down gradient began to respond. This response is attributed to lake percolation since there was only minimal precipitation during this time period.

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Green Valley Park was officially dedicated on October 19, 1996. Dozens of people use the park daily for walking, fishing, boating, picnicking, skating on the sidewalks and general recreation and relaxation. This project is already a major asset to Payson and the surrounding area.

The Green Valley Park provides three lakes having a total surface area of 53,012 square meters (13.1 acres), 69,604 square meters (17.2 acres) of grass, trees and shrubs, three picnic ramadas, two public restrooms, 6.12 km (3.8 miles) of walking paths, boating and fishing facilities, picnic and outdoor cooking facilities, paved parking areas and a complete irrigation system and pump station for the landscaped areas. The Green Valley Park master plan also indicates the future construction of a multi-use building with a concession area, a larger fishing dock and enhanced landscaping as the need arises and funds for construction are available.

Along with the protection, preservation and replenishment of the limited local water supplies and an increased opportunity for leisure time and recreation activities, the Green Valley Park Project offers other regional benefits such as street improvements, Main Street redevelopment and an aesthetically pleasing area that adds to the betterment of the quality of life in the community. The park is also an excellent example of how a project may be constructed to perform its intended engineering functions and still be aesthetically pleasing to the environment.

(This paper was presented at an Arizona Hydrological Society Conference in Prescott, Arizona, in 1966 and at a national ASCE Water Resources Conference in Houston, Texas, in April 1997 by LaRon G. Garrett, P.E., Public Works Engineer, Town of Payson, and Reed J. Petersen, P.E., USDA-Rural Development Engineer)
