

## **Abstract**

For optimum operation of dam reservoirs in drought conditions, managing these recourses is of special importance. Therefore, it is necessary to identify the time of drought as soon as possible and take the required measures to reduce the consumption. The main parts of this study include the reservoir drought survey, determining the warning level of drought, and suggesting a managerial approach in supply section of Kardeh dam in Mashhad. To connect the drought survey system to the managerial scenario, the drought early warning system (DEWS) approach is used. The DEWS system is a combination of three main parts including drought survey through current situation of the reservoir, measuring the amount of water shortage in the future, and calculating a drought warning system to issue the required warnings. To design the above-mentioned system, the drought survey was conducted in five categories (no drought, weak drought, less than severe drought, quite severe drought, and too severe drought) according to the water reservoir level values using the K-means algorithm clustering method. Afterwards, the output level of water reservoir was predicted for next 1, 3, and 6 months using the artificial neural network and the water shortage values were evaluated. With regard to the current situation of the reservoir and water shortage values in the future, the drought alarm index (DAI) was calculated. Based on the results from DAI index, different warning levels were issued for the observed predictions. Finally, the reservoir exploitation model was simulated for the years from 2000 to 2012, and using genetic algorithm, optimizing the release reduction level was done relative to each DAI values. The results showed that managing the selected exploitation and applying the release reduction factors, the drought warning level was reduced for the years between 2000 to 2012.

**Keywords:** Genetic algorithm, Drought early warning system (DEWS), Mashhad Kardeh dam basin, Drought



University of Zabol  
Graduate school  
Faculty of Water and Soil  
Department of Water Engineering

**The Thesis Submitted for the Degree of Master of Science  
(in the field of Water Resources Engineering)**

Development of optimal operation model of  
the reservoir using drought early warning  
system in the Kardeh dam watershed of  
Mashhad

**Supervisors:**  
Dr. M. Delbari  
Dr. P. Afrasiab

**Advisor:**  
Dr. M. Delavar

**By:**  
Rohullah Bagheri Vanani

February 2013