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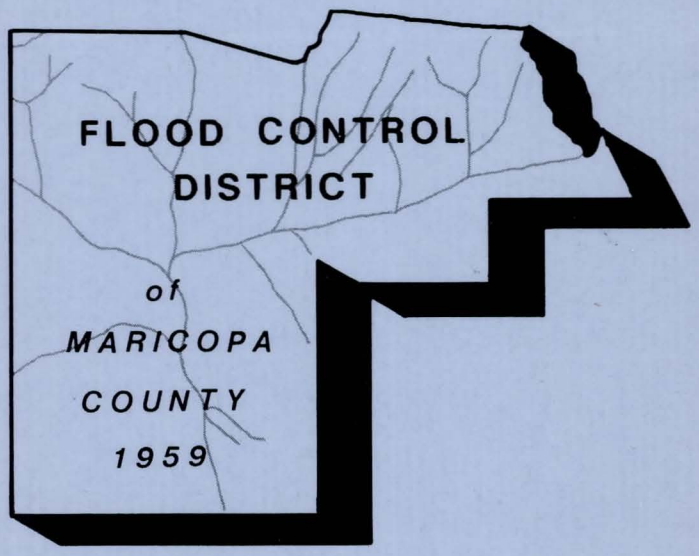
GROUNDWATER RECHARGE FEASIBILITY INVESTIGATION

Appendix E

Technical Memorandum No. 5

Evaluation of Planned and Proposed Flood Control Projects for Potential Recharge Benefits



Submitted by

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APRIL 1988

GROUNDWATER RECHARGE FEASIBILITY INVESTIGATION APPENDIX E

TECHNICAL MEMORANDUM NO. 5

EVALUATION OF PLANNED AND PROPOSED FLOOD CONTROL PROJECTS FOR POTENTIAL RECHARGE BENEFITS

Prepared for

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
PLANNING & PROJECTS
MANAGEMENT DIVISION

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April 1988

This Document Has Been Prepared Under the Direction
of a Professional Engineer Registered in the
State of Arizona

N22984.A0

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TECHNICAL MEMORANDUM

TO: Lionel Lewis/Flood Control District of Maricopa County

PREPARED BY: Richard Randall/CH2M HILL

DATE: April 5, 1988

SUBJECT: Maricopa Recharge Feasibility Investigation
Flood Control District of Maricopa County
Technical Memorandum No. 5
EVALUATION OF PLANNED AND PROPOSED FLOOD CONTROL PROJECTS FOR POTENTIAL RECHARGE BENEFITS

PROJECT: N22984.AO

INTRODUCTION

The Flood Control District of Maricopa County (FCD) currently has planned and proposed flood control projects at various stages of development. Certain of these projects have been given a cursory review and potential changes in design and/or operations which could promote incidental, beneficial recharge of groundwater have been identified. The activities, measures, and recommendations for promoting recharge

contained in this memorandum have technical and institutional considerations that have not been researched. Therefore, additional investigations are needed to determine their applicability and feasibility.

FLOODWATER RECHARGE ENHANCEMENT

Natural groundwater recharge generally occurs wherever precipitation and floodwaters have the opportunity to infiltrate permeable soils and stream channel deposits. The amount recharged is a function of the rate of infiltration, the wetted area where infiltration takes place, and the time period when the opportunity for infiltration exists. Thus, natural recharge can be promoted or enhanced by increasing any one of these three factors: 1) rate of infiltration, 2) wetted area, and 3) opportunity time for infiltration.

Many of the measures taken to accomplish flood control objectives ran counter to measures that would promote natural recharge. Runoff waters are often collected, conveyed, and disposed of in a manner that often reduces the chances for natural recharge. The following discussion contains ways of increasing natural recharge in accordance with the major influencing factors mentioned above.

INFILTRATION RATE

Initial infiltration rates are determined primarily by the permeability of the soils near the surface. Where inundation occurs for any appreciable length of time then clogging mechanisms will reduce infiltration rates. Clogging occurs most often due to suspended materials in the floodwater and increased microbial activity in the soil. A relatively constant, low rate of infiltration will typically

be observed after about 30 days of inundation. For this reason long-term infiltration rates in pits, such as abandoned gravel operations where floodwater is impounded for a long time, are often poor. Some important observations relative to infiltration rates are given below:

- Periodic drying cycles are essential to optimize infiltration rates.

- Mechanical renovation or removal of a clogging layer at the surface is required only in extreme cases where heavy buildup of clogging materials has occurred.

- Moving water tends to retain suspended materials thus reducing the rate of clogging.

- Longer detention times upstream will reduce the load of suspended materials and result in better recharge characteristics downstream. Flocculants can be added to the floodwater during detention to increase removal of suspended materials.

- Subsurface conditions, such as soil or aquifer materials with lower permeabilities, can be the controlling factor for long-term infiltration rates.

WETTED AREA

A consequence of conveying floodwater in natural or artificial channels is that wetted area is typically minimized. Suggestions for increasing the wetted area when constructing or maintaining floodway channels are given below:

- Create and maintain a uniformly flat channel bottom to cause the flows to spread.

- Use flatter slopes and drop structures in lieu of steeper slopes and narrower channels.

- Minimize the use of lined channel bottoms. Lining the sides of a channel, such as soil cement bank protection, generally has little impact on channel recharge rates.

- Use temporary in-channel levees to spread flows and/or create meandering flow paths.

- Divert flows to off-channel spreading basins.

OPPORTUNITY TIME

Increasing the time of inundation for a wetted area will add to the volume of recharge. However, as explained under infiltration rates, this works best during early times. Adding opportunity time after significant clogging has occurred will have minimal effect on recharge volumes. Suggested ways of increasing opportunity time for floodwater recharge are given below:

- Increase detention times for an initial increment of storage behind dams and floodwater retarding structures.

- Add hydraulic control structures within channels to detain flows.

- Use in-channel levees to detain flows.

EVALUATION OF SPECIFIC PROJECTS

Certain planned and proposed flood control projects and activities have been reviewed to identify potential changes in design and/or operations which could promote incidental, beneficial recharge of groundwater. These ideas and recommendations have been formulated without regard to many of the technical and institutional considerations that could be addressed. These issues will need additional investigation to determine whether a recommendation is applicable and/or feasible.

AREA DRAINAGE MASTER STUDIES AND PROGRAMS

Area drainage master studies (ADMS) are a tool for integrating the planning for drainage and floodwater management facilities into plans for residential and commercial development of large areas. These facilities include onsite retention, stormwater collection systems, retention basins, drainageways, and floodwater conveyance channels. Guidelines for planning these facilities to promote recharge include:

- Maximize areas where onsite retention is required and increase the use of retention basins.
- Avoid lining channel bottoms where permeabilities are expected to be high.
- Use shallow slopes and maximum widths for drainageways and channels.

SKUNK CREEK/NEW RIVER CHANNELIZATION

A channelization project for Skunk Creek and New River is in various stages of planning and engineering. Plans are being developed to provide an engineered channel with soil cement bank protection constructed on both sides. Several drop structures are also planned. Suggestions for recharge enhancement on this project include:

- Avoid lining the channel bottom.
- Design the drop structures adaptable to the addition of hydraulic control facilities, such as inflatable rubber dams, in the future.

FLOWAGE EASEMENTS

Flowage easements are being acquired along some reaches to mitigate potential damage suits due to flooding. In some areas it may be advantageous to include the right for the FCD to construct and operate recharge facilities within the privileges granted by the flowage easement. Perhaps existing easements could be renegotiated to include the rights to conduct recharge.

OPEN SPACE REQUIREMENTS

Certain flood control projects sponsored by the Army Corps of Engineers (COE) have included requirements that set aside areas of open space as an environmental impact mitigation measure. Perhaps these open space areas could take the form of recharge projects. The open water contained in the spreading basins and the enhanced growth of vegetation at the site could provide ideal habitat for water fowl and other wildlife.

GAGING STATIONS

The FCD is planning to install stream gaging and precipitation recording stations with telemetry equipment at various locations. The merits of collecting stream flow data for use in planning floodwater recharge projects needs to be factored into the site selection process. The need for continuous recording, especially during low flows, needs to be considered. The idea of using real time monitoring of flow events to operate recharge-related hydraulic control structures could also be considered.

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