GROUND WATER IRRIGATION POLYGONS FOR RECHARGE CALCULATION

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Eastern Snake Plain Aquifer Model Enhancement Project
Water Budget Design Document Number DDW-009

PURPOSE OF DESIGN DOCUMENTS

Design documents are a series of technical papers addressing specific design topics on the Eastern Snake River Plain Aquifer Model (ESPAM) Enhancement Project. Each design document will contain the following information: topic of the design document, how that topic fits into the whole project, which design alternatives were considered and which design alternative is proposed. In draft form, design documents are used to present proposed designs to reviewers. Reviewers are encouraged to submit suggested alternatives and comments to the design document. Reviewers include all members of the Eastern Snake Hydrologic Modeling (ESHM) Committee as well as selected experts outside of the committee. The design document author will consider all suggestions from reviewers, update the draft design document, and submit the design document to the ESPAM Model Upgrade Program Manager. The Program Manager will make a final decision regarding the technical design of the described component. The author will modify the design document and publish the document in its final form in .pdf format on the ESPAM web site.

The goal of a draft design document is to allow all of the technical groups which are interested in the design of the ESPAM Enhancement to voice opinions on the upgrade design. The final design document serves the purpose of documenting the final design decision. Once the final design document has been published for a specific topic, that topic will no longer be open for reviewer comment. Many of the topics addressed in design documents are subjective in nature. It is acknowledged that some design decisions will be controversial. The goal of the Program Manager and the modeling team is to deliver a well-documented, defensible model which is as technically representative of the physical system as possible, given the practical constraints of time, funding and manpower. Through the mechanism of design documents, complicated design decisions will be finalized and documented. Final model documentation will include all of the design documents, edited to ensure that the "as-built" condition is appropriately represented.

INTRODUCTION

This design document describes the designation of portions of the study area into "Ground Water Irrigation Polygons" for the purpose of recharge calculation. The withdrawals associated with irrigation from ground water are a negative recharge and will be calculated according to the equation:

Net Recharge (ground water) = Precipitation - (ET x Adjustment Factor).

The ET adjustment factor will be applied according to the geographic location of the irrigated land being calculated and the application method used to apply water. Adjustment factor and application method parameters for irrigation from ground water will be carried as attributes of the ground water irrigation polygon map. This paper describes the construction of the ground water irrigation polygon map. Parameters for surface water irrigation will be carried as attributes of the aggregated surface water entity map, described in Design Document DDW-008.

CRITERIA

The goals in constructing the map were to adequately represent known differences between geographical areas and management practices, and to minimize the number of unique ground water polygons (to reduce data management concerns and model run times). Because these ground water irrigation polygons are only used for assigning ET adjustment and application method parameters for recharge calculation, no requirement was made that polygons be contiguous areas. Similarly, the ground water irrigation polygons assigned for recharge calculation were not based on current ground water management areas or measurement districts, nor is it contemplated that they would form the basis for any administrative boundaries or decisions.

Because both ET adjustment factor and percent sprinkler application are driven largely by cost of water, and because the primary cost of ground water is the energy cost for lifting water out of the ground, depth-to-water was used as the basis for delineation of the polygons. Relative to the range of depths on the plain, water level changes since 1980 are minor, so a single map was deemed adequate for the delineation. Figure 1 shows the depth-to-water map used, digitized from a paper map created by Lindholm and others (1988):

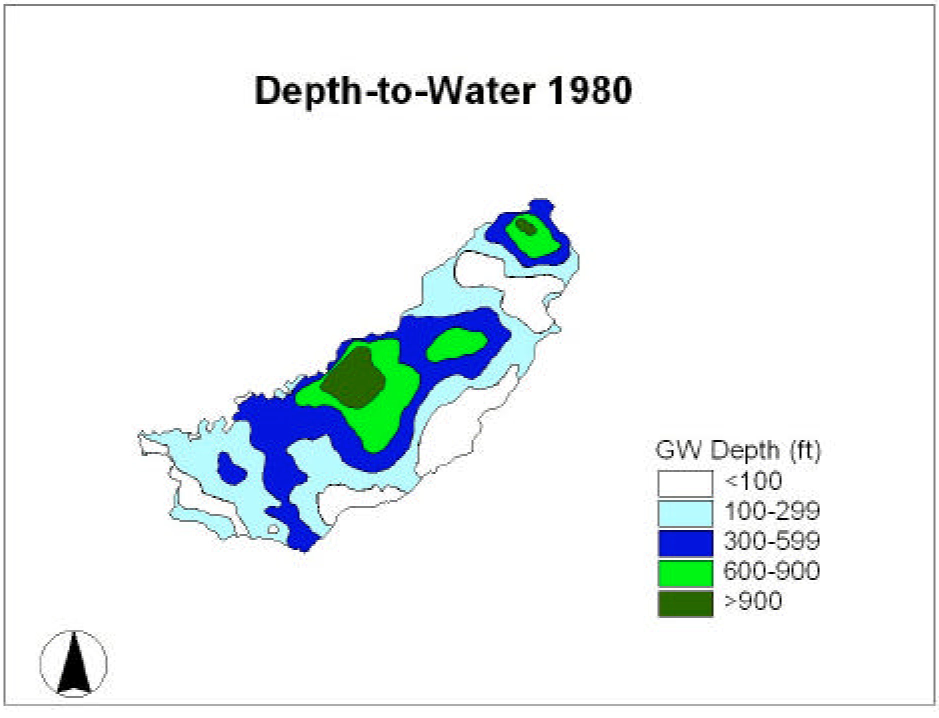

Figure 1, Depth-to-Water

The Mud Lake area and the US Bureau of Reclamation project known as the "A & B Irrigation District" were the first large-scale applications of ground water on the plain (Goodell 1988). These developments pre-dated the widespread use of sprinklers, while most other ground water development post-dated the use of sprinklers. Informal field observations show that the Mud Lake area still has a different mix of application method relative to other ground-water areas. The same thing is true of the A & B irrigation district (Temple 2002). For this reason, these two areas were partitioned into their own, unique ground water irrigation polygons.

Because of the possibility of regional cropping and climatic differences affecting adjustment factors and application method, areas of similar depth were partitioned into northeast and southwest polygons. Using a classification of year-2000 LANDSAT data (IDWR 2002), a comparison was made of row-crop percentages by proposed polygon. This test indicates that there is little or no correlation between depth to water and row crop percentage, but strong correlation between northeast and southwest geographic location.[1] This test confirms the decision to split the polygons. To preclude implying knowledge about future irrigation in non-irrigated areas of the central plain, these central non-irrigated lands were assigned to a separate ground water irrigation polygon, labeled "non-irrigated" in Figure 2. Finally, to reduce the total number of polygons created, some small areas

[1] Crop mix will not be determined by ground water polygon but by county-based National Agricultural Statistics Service data, as described in Design Document DDW-001.

that are currently not irrigated but are nearby to irrigated areas were aggregated into adjacent polygons of different depth-to-water.

RESULT

The resulting map is shown in Figure 2:

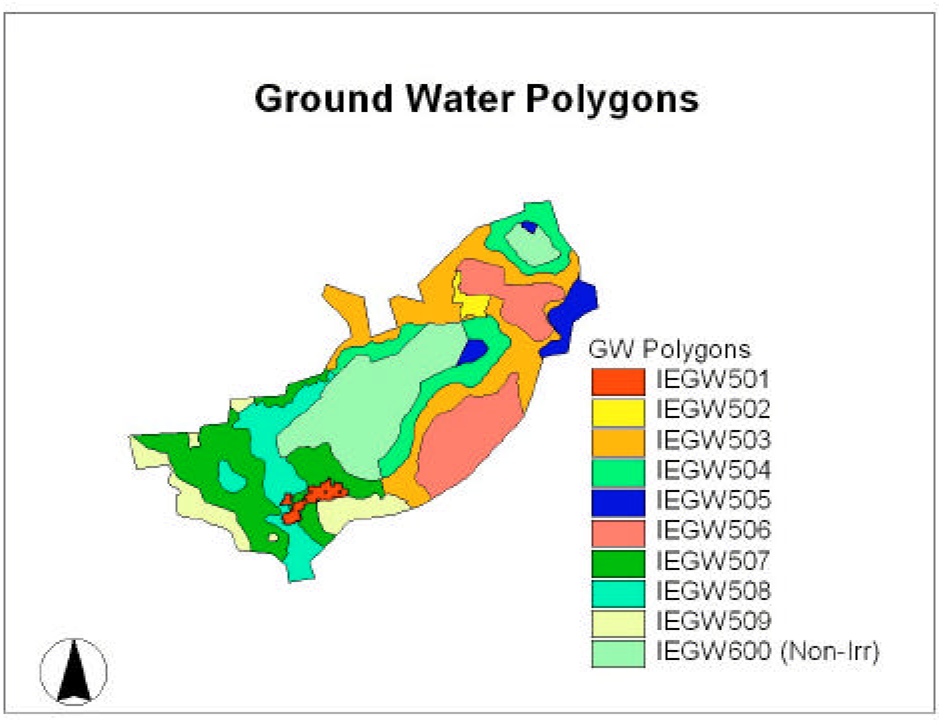

Figure 2, Ground-Water Polygons

DESIGN DECISION

The GIS file "Gw_polygons.shp" illustrated in Figure 2 will be used to delineate ground water polygons for recharge calculations. The polygon boundaries will be held constant throughout the calibration period, though the recharge tool will accommodate different boundaries for future use in scenario generation. The parameters for *application method* and *ET adjustment* for ground water irrigation will be attached as attributes of the GIS file. The determination and use of these parameters will be discussed in Design Documents DDW-002, DDW-010, DDW-021 and DDW-022.

REFERENCES

Goodell, S.A. 1988. Water Use on the Snake River Plain, Idaho And Eastern Oregon. USGS Professional Paper 1408-E. Washington. 51 pages.

Idaho Department of Water Resources. 2002. ESPAC2000. GIS shapefile of land cover.

Linholm, G.F., S.P. Garabedian, G.D. Newton, and R.L. Whitehead. 1988. Configuration of the Water Table and Depth to Water, Spring 1980, Water Level Fluctuations, and Water Movement in the Snake River Plain Regional Aquifer System, Idaho and Eastern Oregon. Map. USGS. Hydrologic Investigations Atlas HA-703.

Temple, D. 2002. A & B Irrigation District. Personal communication.