3/1/2001

# Platte River Decision Support System

Purpose

A water decision support system is a product that allows managers to make better decisions by using the latest technology with the best information available to predict future surface water conditions. The U.S. Bureau of Reclamation and the Department of Natural Resources began discussing the possibility of creating a DSS for the Platte River in late 1999. The Department then began discussions with NRD's, Irrigation Districts, and other interest groups seeking support for such a product.

Current Status

The U.S. Bureau of Reclamation has included money for the PRDSS in their fiscal year 2003 budget request. Around October 1, 2001 we will know whether or not it was included in the final budget or if the budget request was reduced.

Before October 1, 2002 (when FY2003 begins) signed agreements between any cooperators working on or providing funds or expertise for the project need to be in place.

The Bureau will likely recommend using RiverWare for the model. It is possible that another model may be better suited for the Platte River and as of now it is undecided which model will be used. After work begins, it is expected to take at least 3 years to complete the project.

Expected Results

The DSS is envisioned to have 4 components:

1. A mid-range predictive model that will predict possible flows up to a month in advance using a one-day time step.
2. A short-range predictive model that will predict possible flows up to 48 hours in advance using a one-hour time step.
3. A forum for exchange of information concerning river flows and diversions.
4. A place where current river flows and diversions, along with predicted flows are displayed. (Most likely on NDNR webpages.)

Uses

Potential uses of the PRDSS include:

- Environmental managers will be able to determine when target flows are not likely to be met and release water from the environmental account.
- Irrigation districts may decrease the chances of have no water in their canal by identifying possible periods when there will not be sufficient natural flows in the river to meet their needs and order storage water.
- Public Power Systems will be able determine their possible future diversions and market their power accordingly.
- DNR will be better able to assist users of the river to forecast shortfalls, monitor environmental water, and track water as it flows across the state.

Current Work

Until any possible funding is finalized, the Department is exploring other possible options including creating our own model. One of the options being explored includes using ArcGIS Hydro Data Model, Hec-RAS, and Hec-HMS.

Other Notes

The DSS will not replace the Platte Water Accounting Program; PWAP will remain the accounting program used by the Department for accounting purposes.

The Department will remain responsible for administering flows on the river. The DSS will be a tool that the Department uses. The Bureau of Reclamation's role is just as a developer.

Any questions on the Platte River DSS should be directed to Jeff Shafer. Jeff's e-mail is: jshafer@dnr.state.ne.us and phone is: (402) 471-0586.

# Platte River DSS

DSS Vision

1. Data
    a. Improve River gaging stations
    b. Additional gages
    c. Collect hourly/daily weather data
    d. Data Clearinghouse
        i. Historic Data
        ii. Real-time Data
2. Daily Model
    a. Routing routine
    b. Run precipitation off watershed
    c. 7-day predictive capabilities with confidence levels
    d. Crop use model
    e. Water Accounting Program
    f. Require forecasts/rules from all parties involved
    g. Require DNR to be upfront with use
3. Long-Term Simulation Model
    a. Use to simulate a set of operation rules using historical or average condition data
    b. Includes: COHYST Data, Crop use changes, Conservation changes, and Conjunctive use

Potential Sub-Committees

1. Schedule and Sequence
2. Budget
3. Technical

Large Group Membership

1. DNR
2. NPPD
3. Central
4. FWS
5. USBR
6. NRD's?

SZ/July 14, 2000

# Irrigation Water Requirements Program (Beta Version 2.0)

This version of IWR was developed based on the *USDA National Engineering Handbook (NEH), Part 623, Chapter 2 "Irrigation Water Requirements"*. This reference was dated September 1993 (I got a copy of this reference from NRCS). This program is available for downloading from the USDA NRCS' website:

http://www.wcc.nrcs.usda.gov/nrcsirrig/Water_Management_Models/water_management_models.html

This program can compute monthly & seasonal irrigation water requirements for different crops using either one of the following three (3) methods:

- Radiation Method (Doorenbos-Pruitt, et al.),
- Temperature Method (FAO-Blaney Criddle), and
- Blaney Criddle TR21 Method (SCS).

The program can be set to automatically pick which method to use based on data availability.

In addition to the main IWR program, there are climate database management and crops database management portions. Climate data (Average month precipitation and temperature) can be downloaded from NRCS' site at

http://wccdmp.wcc.nrcs.usda.gov/water/wetlands.html

**My comments about the program**:

*Overall, the IWR program is very easy to use and the on-line help is very good. It should be suitable for our use if any one of those three methods was selected for our work.*

Radiation Method:

In the evaluation by Jensen, et al. (1990), the radiation method developed by Doorenbos and Pruitt (1977) was the most accurate method that depends on solar radiation and air temperature data (Penman-Monteith method may be more accurate, but requires more climate data). The radiation method is given by:

$$ET_0 == 0.012 + \left(\frac{\Delta}{\Delta + \gamma}\right) b_r \frac{R_s}{\lambda}$$

where:

$ET_0$ = evapotranspiration for clipped grass reference crop (in/d)

$\Delta$ = slope of the vapor pressure curve (mb/°F)

$$\Delta = 0.051\left(\frac{164.8 + T}{157}\right)^7$$

where T is air temperature (°F)

$\gamma$ = psychrometric constant (mb/°F)

$$\gamma = c_p \frac{BP}{0.622\lambda}$$

where $c_p$ is specific heat of dry air (lang/in/°F)

BP is mean barometric pressure (mb)

$\lambda$ is heat of vaporization (lang/in of water)

$b_r$ = adjustment factor depending on the average relative humidity and daytime wind speed

$R_s$ = incoming solar radiation (lang/d)

$\lambda$ = heat of vaporization of water (lang/in)

$$\lambda = 1{,}543 - 0.796T$$

where T is air temperature (°F)

Temperature Method:

According to Jensen, et al. (1990), the FAO-Blaney-Criddle method was the most accurate temperature-based method. It is described by:

$$ET_0 = c_e(a_t + b_t pT)$$

where

| | |
|---|---|
| $ET_0$ | = evapotranspiration for clipped grass reference crop (in/d) |
| p | = mean daily percent of annual daytime hours |
| T | = mean air temperature for the period (°F) |
| $a_t$ *and* $b_t$ | = adjustment factors based on the climate of the region |
| $c_e$ | = adjustment factor based on elevation above sea level |

Blaney-Criddle TR21 method:

See SCS Technical Release No. 21 for description of this method.

53000 Contract

Polk — WE will do a whole 1 County & firm up the Methodology and deliverables and give to them in about 6 months

Stanton — 4 copies of mapping activities Statement

Dundee — what we have & need to count or make

OTOE — STANTON County a Fast County

Nuckolls & Thayer Fast & Stanton as it becomes Avail