

WHAT IS A WATER BUDGET?

1

Water Budgeting vs Irrigation Scheduling

Water budgeting is usually an estimate of the amount of water to allocate to irrigation used for determination of:

- **Maximum Applied Water Allowance**
- **Estimated Applied Water Budgets**
- **Water Use Tracking**

2

Water Budgeting

- **Maximum Applied Water Allowance** (or a “do not exceed”)
 - set by regulatory agency
 - as measured by a water meter
- **Estimated Applied Water Budgets**
 - for a worst case (*zero rain*)
 - expected use (*normal rainfall*) basis
 - maximum water conservation
- **Water Use Tracking**
 - to compare actual monthly water use to one or more of the above

3

TCEQ Water Balance

- **Maximum Applied Water Allowance** (or a “do not exceed”)
- Based on the water use (or requirements) of the plant material selected

4

TCEQ Water Balance

- Terms used for plant water use include:
 - ▣ ET (evapotranspiration)
 - ▣ Consumptive use
 - ▣ Plant water requirements
 - ▣ Crop water requirements
- TCEQ uses ET

5

Evapotranspiration, ET

- Measurement of the total requirements of plants and crops
- The word **evapotranspiration** is a combination of the words “*evaporation*” and “*transpiration*”
- Very difficult to measure directly
- May be calculated from using weather data

6

Evapotranspiration, ET

- May be calculated from weather data
- Terms used in ET calculations:
 - ▣ E_{To} – reference evapotranspiration
 - ▣ K_c – crop coefficient
- These concepts are discussed in Wastewater Irrigation II

7

Effective Rainfall ($Rain_f$)

- The portion of rainfall that does not runoff, but becomes available for plant water use
- A simplified method to account for the complex relationships between infiltration and runoff during rain events.
 - ▣ combines the effects of slope, soil type, surface roughness (i.e., “*depressional storage*”) and other factors
 - ▣ Does not consider how wet or dry the soil is

8

Effective Rainfall ($Rain_f$)

- TCEQ used the term: Average Infiltrated Rainfall, calculated as:
average precipitation – average runoff

9

Effective Rainfall ($Rain_f$)

- For turfgrass irrigation (monthly calculations)
 - can assume $Rain_f$ is about 2/3 (67%) of normal rainfall
 - Or 1/3 of rainfall will runoff
- DO NOT use 2/3 for individual storm events or daily/weekly actual rainfall data

10

Irrigation System Efficiency

- In standard water balances, sometimes water requirements (WR) is adjusted for irrigation system efficiency
 - Application efficiency (AE)
 - spray/evaporative losses before the water reaches the ground
 - Distribution efficiency (also known as the distribution uniformity -DU)
 - how even the water is applied over the area

11

Irrigation System Efficiency

- For the TCEQ Water Balance
 - "Irrigation Efficiency" refers to Application Efficiency only
 - The lower the efficiency, the higher amounts of wastewater can be applied
- For sprinkler irrigation, spray/evaporative losses
 - typically range from 20-30%
 - or an efficiency of 70-80%

12

Definitions – Standard Water Balance

- Plant Available Water (PAW)
 - ▣ The amount of water in the effective root zone available for plant uptake
- Soil Water Holding Capacity (SWHC)
 - ▣ The amount of water that can be held or stored in the soil
- Managed Allowable depletion (MAD)
 - ▣ How dry the soil is allowed to become between irrigations (50% for most plants)

13

Soils

Typical Water Holding Capacity (inches of water per foot of soil)

Soil Texture	At Field Capacity	At Permanent Wilting Point	Soil Water Holding Capacity	Plant Available Water (@ MAD = 50%)
Sand	1.0-1.4	0.2-0.4	0.8-1.0	0.45
Sandy Loam	1.9-2.3	0.6-0.8	1.3-1.5	0.70
Loam	2.5-2.9	0.9-1.1	1.6-1.8	0.85
Silt Loam	2.7-3.1	1.0-1.2	1.7-1.9	0.90
Clay Loam	3.0-3.4	1.1-1.3	1.9-2.1	1.00
Clay	3.5-3.9	1.5-1.7	2.0-2.2	1.05

14

TCEQ – Water Balance

- Plant Available Water is not calculated
- MAD is ignored
 - ▣ (e.g., TCEQ rules do not require maintaining sufficient water in the root zone to prevent plant stress)

15

PREPARING A WATER BALANCE

16

Water Budgeting

App-Rate Software

- Software developed to assist TCEQ on establishment of application rates for wastewater disposal permitting
- Conducts a monthly water balance
- Determines if a chosen application rate will work
- Includes soil moisture tracking
- Used monthly ETo data
(<http://texaset.tamu.edu/etinfo.php>)
- Software is available as a free download at
<http://itc.tamu.edu>