

**2017**  
***Region A Projected  
Irrigation Water Use***

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# Reasons for the Irrigation Review

- Large Differences with TWDB draft estimates
- TWDB Irrigation demand values increased substantially (**28.8%** in 2020) from those of the 2011 RWP values.
- TWDB results in **annual** difference in irrigation demand of **377,915 ac-ft** for 2020.
- Compounding that annual difference over a 50-year time horizon would cause a **severe distortion** in remaining aquifer water availability providing errant information for the region
- Primary TWDB differences can be attributed to an **average based methodology and/or errors in data used** that may be caused in part by a lack of understanding of the unique characteristics of the region

# Reasons for the Irrigation Review

- TWDB projected irrigation demands vary from -10% in Potter to a high of +259% in Hemphill with 8 of the counties (Hemphill, Roberts, Oldham, Lipscomb, Moore, Hall, Collingsworth and Childress) having increases exceeding 50% of the 2011 RWP estimates.
- Overall, majority of crop use estimates are **consistently higher** than those in the 2011 RWP plan
- For example, in 2005 the TWDB estimated 23 in/ac for corn in Hartley County while 31 in/ac for corn in adjacent county, Moore **raises a flag.** (Originally happened with TWDB survey method in 1999 which is why we originally developed new methodology ). Other crops grown (cotton, sorghum, soybeans, peanuts and alfalfa) had contradictory app. rates

# Reasons for the Irrigation Review

- Summary: TWDB agricultural water use estimate for Region A suggest a 28.8% and 39.5% increase in water use by **irrigated crops and livestock**, respectively, for 2020. This result is an estimated **annual difference in water demand of over 400,000 ac-ft.** (377,915 and 22,800 ac-ft).
- It should be noted that **part** of the difference maybe also be due to changing inventories, acreages and crop composition. If TWDB estimates are in error, compounding the annual difference over a 50-year time horizon would causes a severe distortion in remaining water availability resulting in some counties errantly being projected not to meet their DFC.

# TWDB Response Excerpts... Hardin

Given the limitations in available funding, the projection process used in this round of regional water planning needs to be as cost and resource efficient as possible. The goal of the initial draft TWDB projections was to provide Regional Water Planning Groups with a credible starting point while allowing for legitimate refinements based on additional information including

Based on TWDB staff's knowledge of the previous Region A projections and your letter and attachment, it appears that the key discrepancies between what the Region A RWPG considers appropriate and the current draft, TWDB livestock and irrigation projections hinge largely on the assumptions used to develop the base year (2010) data set. Based on your evaluation of the draft

**Once the Region A RWPG proposes supportable modifications to the base year (2010) demands, it will be a relatively simple effort for TWDB to recalculate the future demand projections from that new base. We anticipate that the resulting future projections will satisfy the planning group's concerns since the current TWDB draft projections rely on a future rate of demand change, from decade to decade, that is based directly on the projection methods developed by the Region A RWPG and incorporated into the Region A 2011 regional water plan during this most**

# *Our 2017 RWP Estimates*

- Utilizes an updated TAMA model (Marek et al.)
- Updated acreage values are principally based on FSA with known additions of non-FSA data (more & more...)
- Some crops were redistributed into other categories as changes in area ag. have occurred.

# TAMA Model

**... basically  
a water balance model!**

# **TAMA (Texas A&M –Amarillo)**

## **Crop Water Use Approach**

**Irrigation Water Pumped =**  
**Full Crop ET x (% Applied)**

- Effective Rainfall**
- Soil Profile Water Used**



# TAMA Model

Rearranging:

$$\text{IRR}_C = \text{ET}_C(P_T) - \text{ER} - \text{SSM}_D$$

## *TAMA Model*

$$IRR_{CTY} = \sum_{1}^{n} IRR_C$$

where:

$IRR_{CTY}$  = Total quantity of irrigation volume applied (pumped) to the crops grown within a in a given year or growing season, (ac-ft), per county .

“Results out equal quality of data in!!”

## *TAMA Model*

$$IRR_{REG} = \sum_{1}^{n} IRR_{CTY}$$

where:

$IRR_{REG}$  = Total quantity of irrigation volume applied (pumped) to the region or area of interest per given year or growing season, (ac-ft).

# Note on ET & ETc equations and model accuracy

- Single source ET model:

$$ET_c = ET_{ref} * K_c \quad (\text{well watered conditions})$$

- Research is addressing through remote sensing efforts

$$ET_c = ET_{ref} * (K_c * K_s) \quad (\text{real world production})$$

*...process is still years away but getting there faster than I thought possible (- sorta like PC development)*

- =>Result: Planning values are getting better, faster and more accurate than ever before spatially and temporally.

# *TAMA Irrigation Methodology*

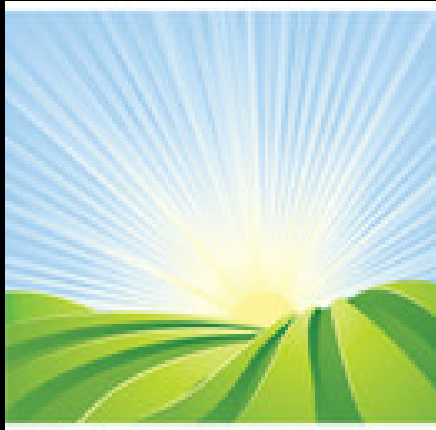
## *Data Requirements*

- 1. Crops grown per county*
- 2. County acreages of each crop (+ non-FSA)*
- 3. Seasonal crop ET per county*
- 4. % of ET applied by growers per county*
- 5. Effective seasonal county based rainfall per crop*
- 6. Seasonal based soil profile moisture used per crop per county*

## ***TAMA Irrigation Methodology***

### ***Data Changes for 2020-2070***

- In 2017 model, acreage basis was changed from 2006-2008 average values to a **2006-2010 average** to address longer term average based condition values.
- 2017 RWP did not restart the depletion  $f(x)$  % and 0.60 was maintained for 2070.
- 2017 planning estimates do **NOT** include or reflect the drought conditions of 2011.
- 2017 RWP estimates include category addition & ET adjustments plus future acreage changes by 2015



# Results Discussion



## *2020 Total Regional Irrigated Acres*

- 2011 RWP
- 1,237,426 ac  
(11 crop cats)
- 2017 RWP
- w/ miscellaneous cat.  
1,249,836 ac  
(12 cats)  
(12,410 ac addition)
- w/ misc + “coming” acres  
1,286,906 ac  
(49,480 ac addition)



# *2020 Total Regional Irr. Water*

- 2011 RWP
- 1,271,731 ac-ft  
(12.33 in/ac)
- 2017 RWP
- w/ miscellaneous  
1,306,664 ac-ft  
(12.55 in/ac)
  - increase of 34,933 ac-ft (+2.75%)
- w/ misc + coming acres  
1,377,417 ac-ft  
(12.84 in/ac) (+4.14%)  
(larger WU- higher value crop)

# ***2020 Dallam County-2017 RWP***

## **Crop acreages w and w/o misc. category**

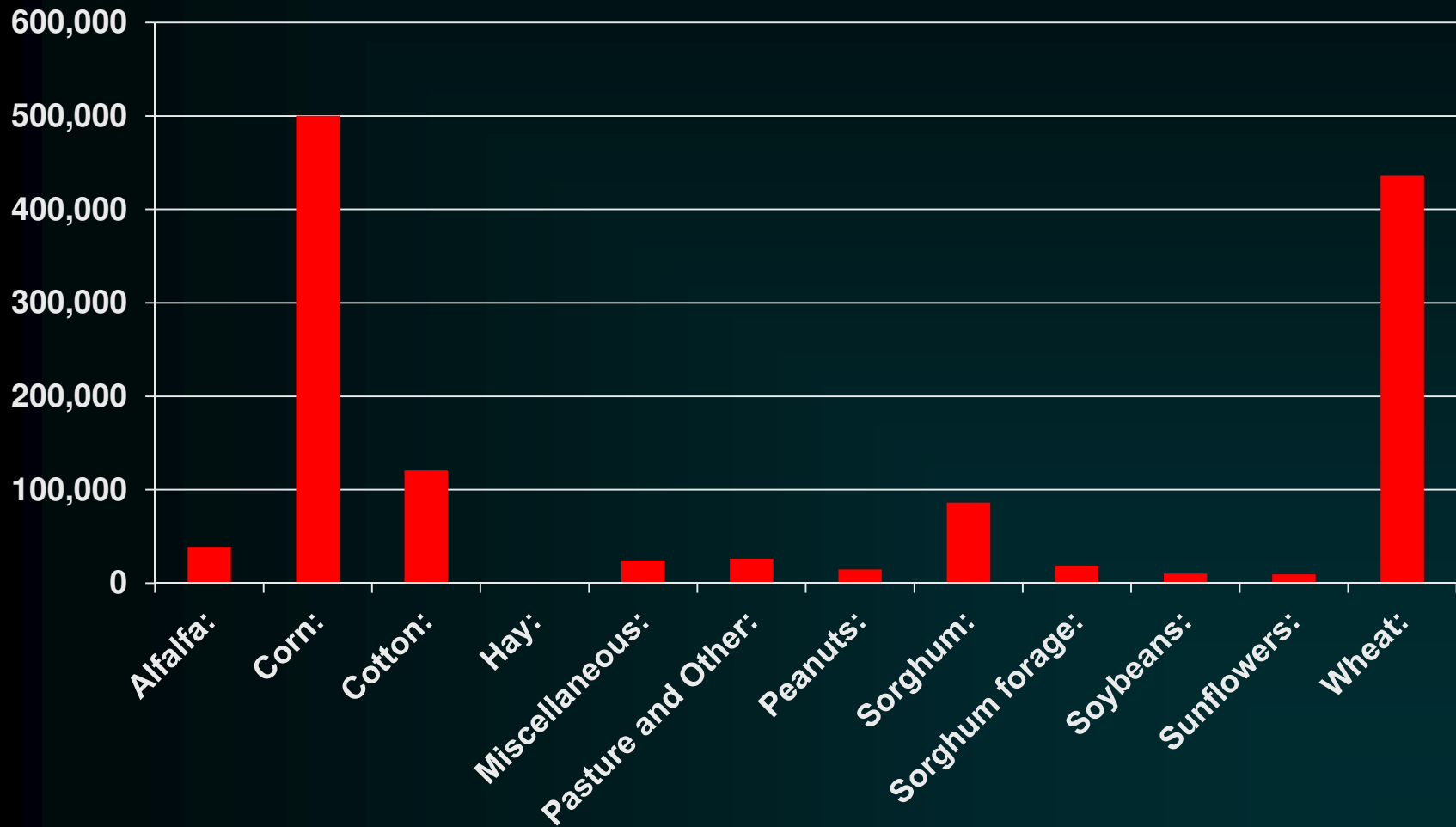
<b>Crop</b>	<b>Before new acres, acres</b>	<b>After anticipated new acreages addition, acres</b>	<b>Acreage changes, acres</b>
<b>Corn</b>	<b>120,134</b>	<b>same</b>	<b>-</b>
<b>Wheat</b>	<b>85,053</b>	<b>97,293</b>	<b>12,240</b>
<b>Miscellaneous</b>	<b>2,517</b>	<b>14,757</b>	<b>12,240</b>
<b>Alfalfa</b>	<b>2,953</b>	<b>15,193</b>	<b>12,240</b>
<b>Total</b>			<b>36,720 of 47,000 (new ground)</b>

# 2020 Dallam County-2017 RWP

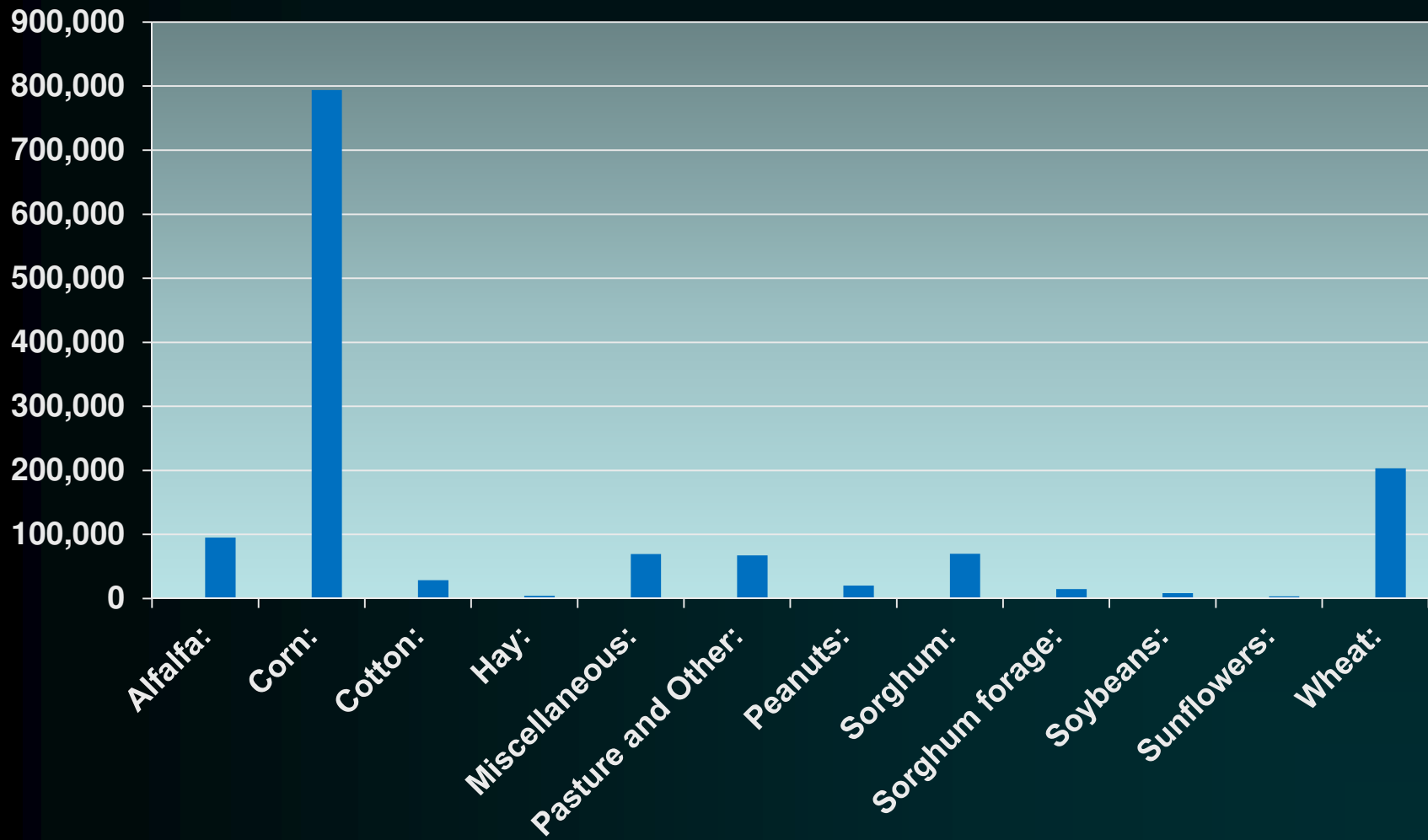
## Water Demand w/ & w/o misc. category adds.

Crop	Before new acreages, ac-ft	After anticipated new acreages addition, ac-ft	Irr. Water Demand Increase, ac-ft
Corn	191,490	same	-
Wheat	44,780	51,223	6,443
Miscellaneous	7,089	41,559	34,470 (14.9 in/ac)
Alfalfa	7,200	37,039	29,839
County Total (includes all adds & adjustments)		262,518	340,360 (29.7% increase of 77,842 ac-ft)

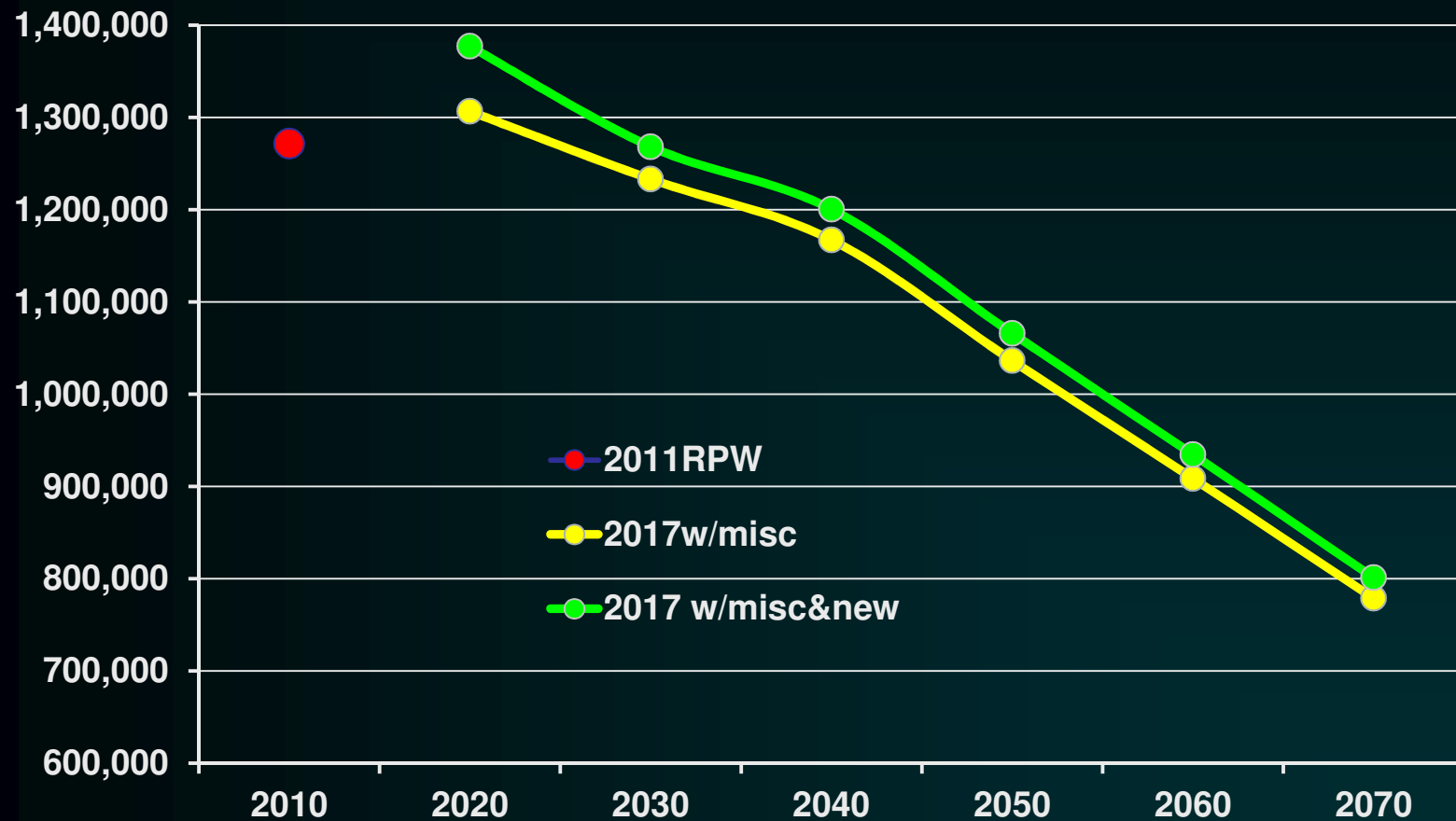
# 2020 Reg. Irr. Crop Acreages, ac



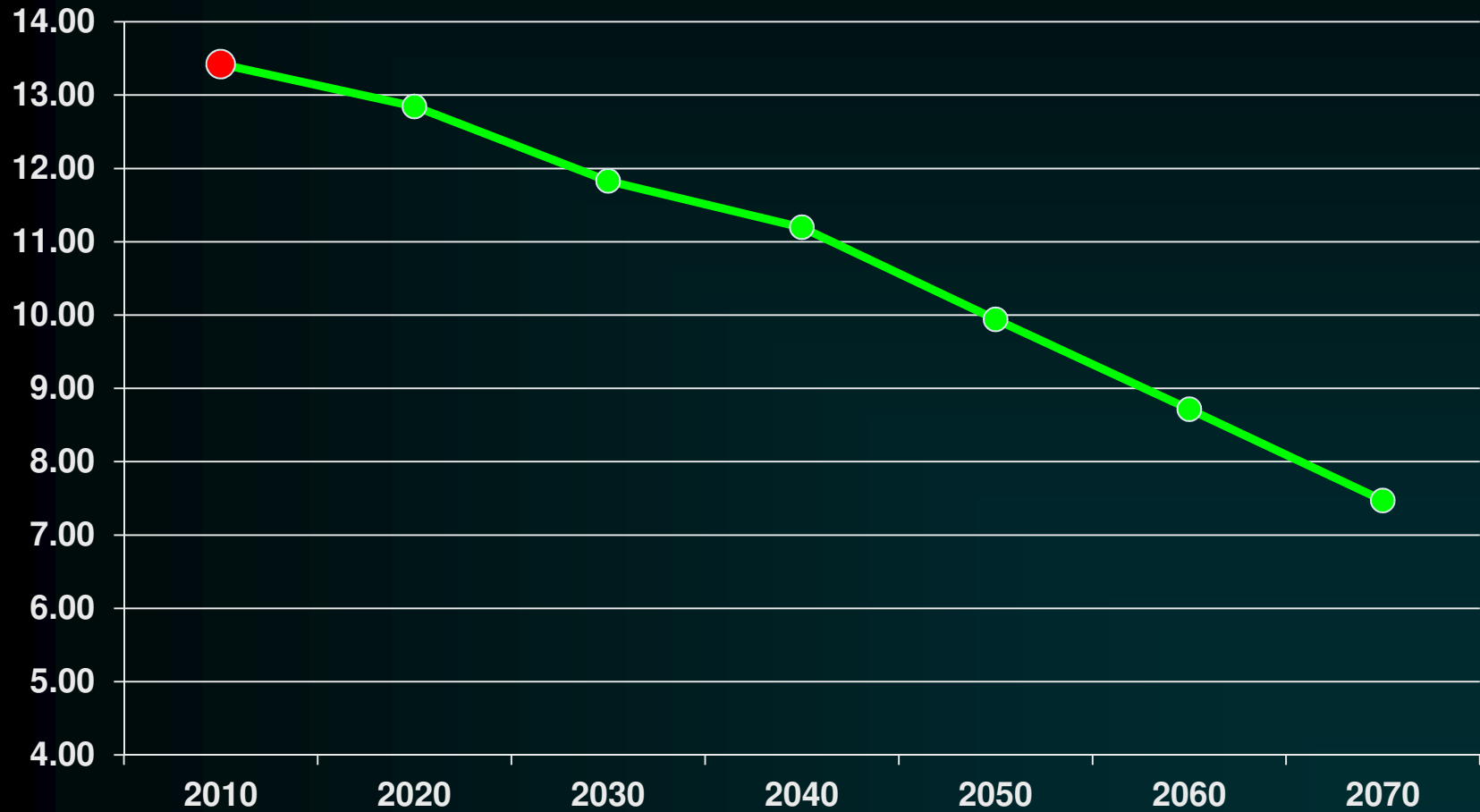
# 2020 Reg. Crop Water Use, ac-ft



# Total Reg. Irrigation Water, ac-ft



# Regional Water pumped per irrigated acre, in.



# 2017 RWP TAMA based Results

- Some acreage changes have occurred
  - misc acres have increased with time- (no ignore)
  - Dallam has considerable new acre increases
- Overall, the updated 2017 estimated water values are still considered adequate and agree with past TAMA values and trends.
- TAMA based data set results do not support TWDB draft estimates, as provided.



# *Conservation through technology*



*now... livestock #'s w/Steve*

## TAMA Model

$$P_T(ET_C) = IRR_C + ER + SSM_D$$

where:

$P_T$  = Percentage of crop ET pumped on a seasonal basis, (in),

$ET_C$  = Crop ET (or water use) for maximum production potential, (in),

$IRR_C$  = Irrigation applied (pumped) on a seasonal basis to a crop, (in),

$ER$  = Effective rainfall computed from seasonal rainfall occurring during the crop season, (in),  $SSM_D$  = Differential seasonal soil moisture used in crop production which is extracted from the soil profile, (in).