

# Western Basin Groundwater Recharge Project

Duane Woodward – Hydrologist

Nolan Little – TBNRD





# **Groundwater Recharge and Wetland Habitat Enhancement Project Sponsors and Support group**

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- Rainwater Basin Joint Venture
- Central Nebraska Public Power & Irrigation District
- Tri-Basin Natural Resources District
- Ducks Unlimited
- USFWS – Rainwater Basin Wetland Management District
- NRCS – Lincoln, Aurora, York, Holdrege
- Nebraska Game and Parks
- Nebraska Department of Natural Resources





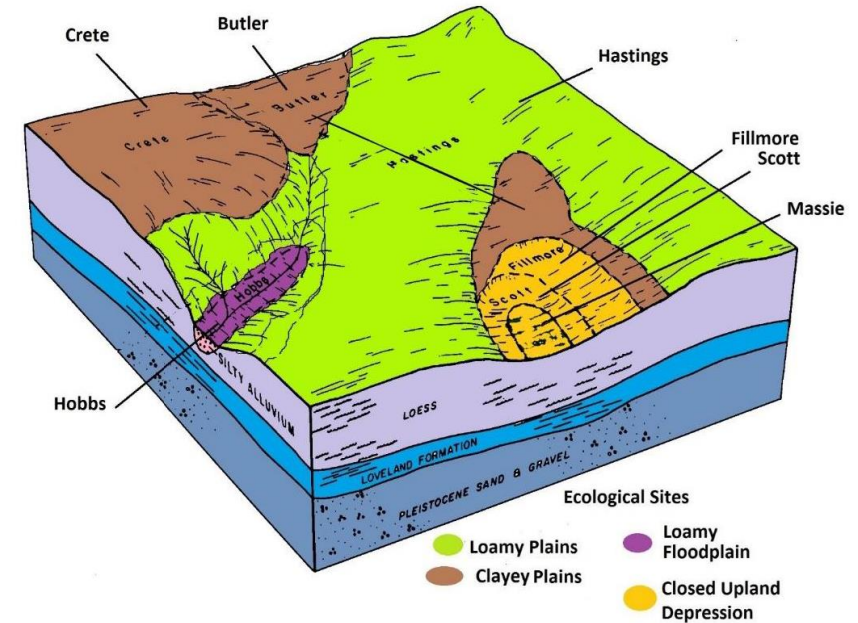
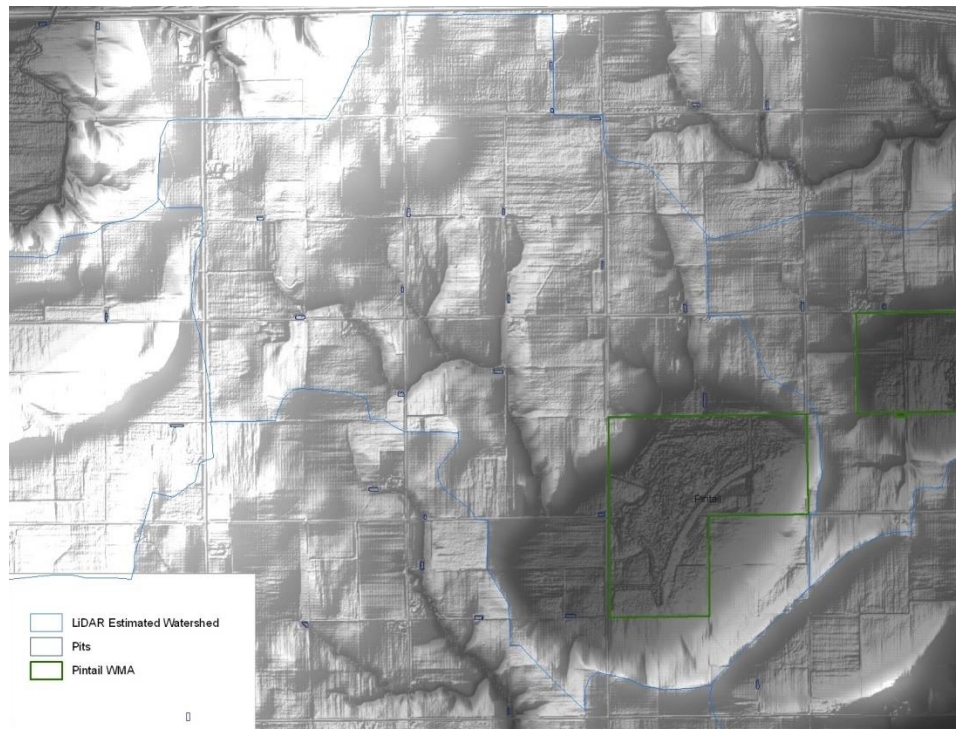
# Overview

- **Importance of playa wetlands for migrating waterfowl**
- **Habitat goals**
- **West basin habitat projects**
- **Monitoring methods**
- **Recharge and ecosystem goods and services**



# Rainwater Basin Wetland Complex

- North of Republican River / South of Platte River
- 6,100 square mile landscape
- Closed watersheds
- Fillmore, Scott, and Massie soils



Physiographic Image.—Block Diagram for Closed Upland Depression





**Feb 2008**



**April**



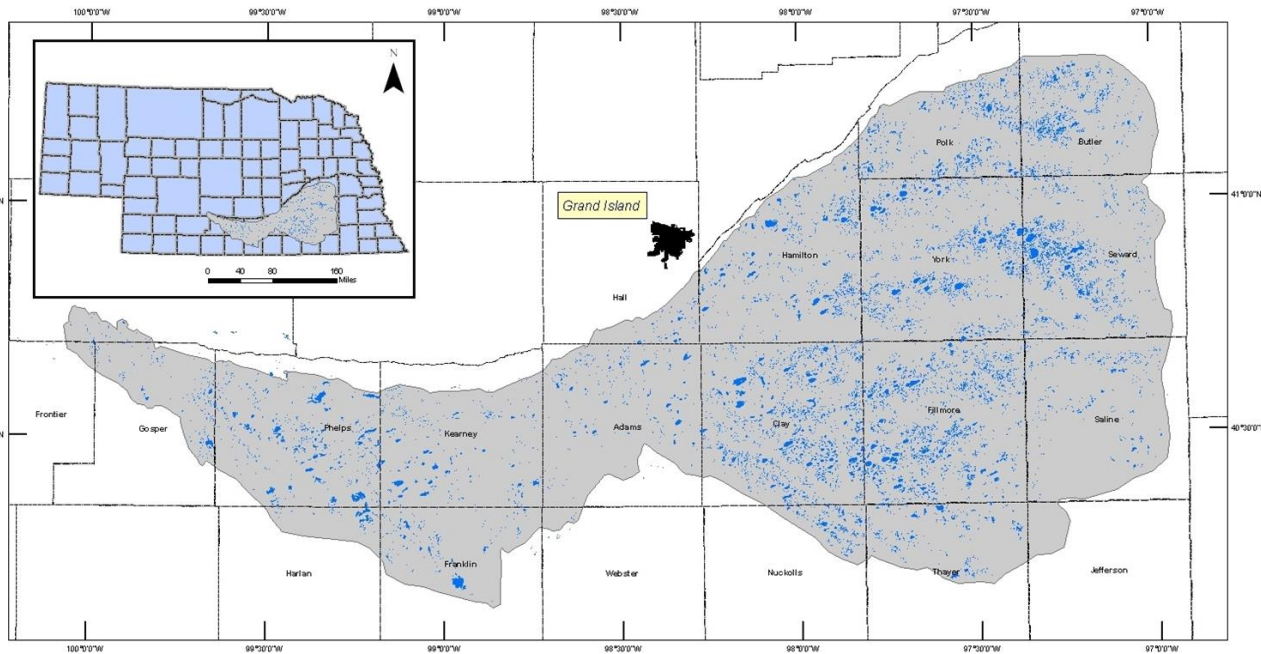
**June**

Rainwater basin Wetlands are ephemeral in function and pond water as a result of precipitation & surface runoff



**September**





**Historic**

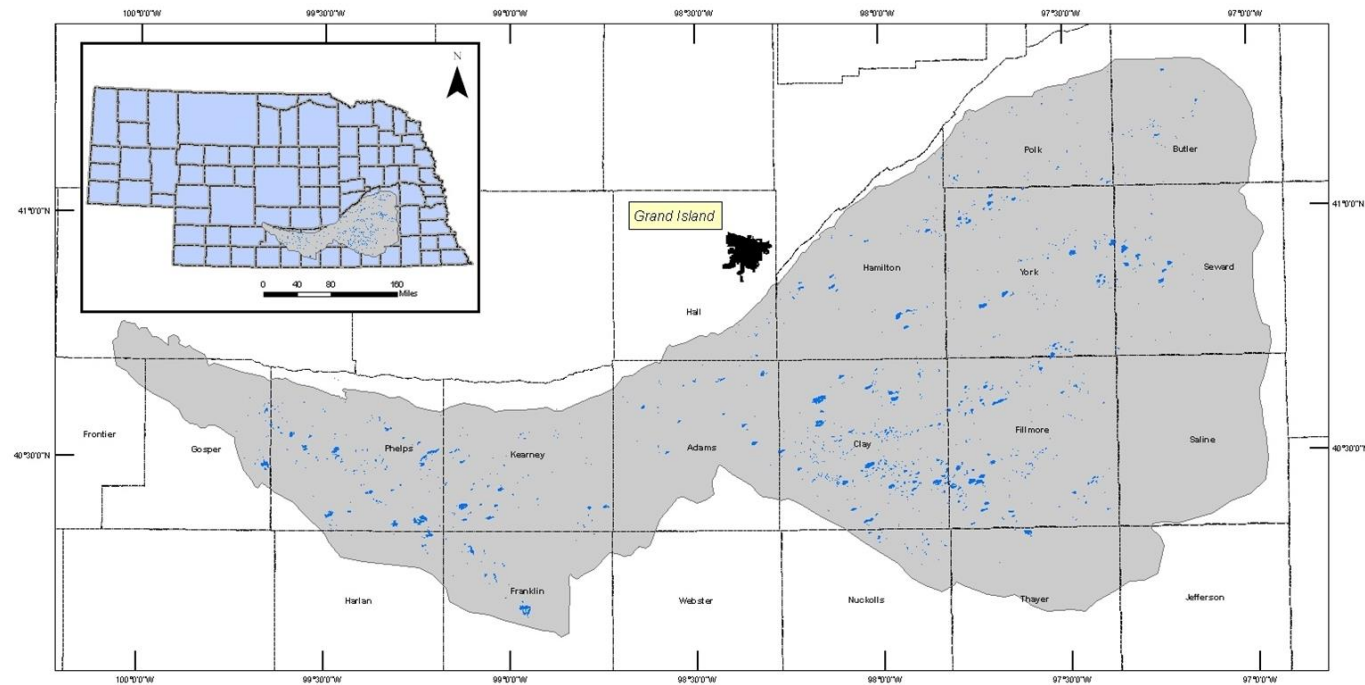
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**> 211,000 acres**  
**5% of the landscape**

**Current**

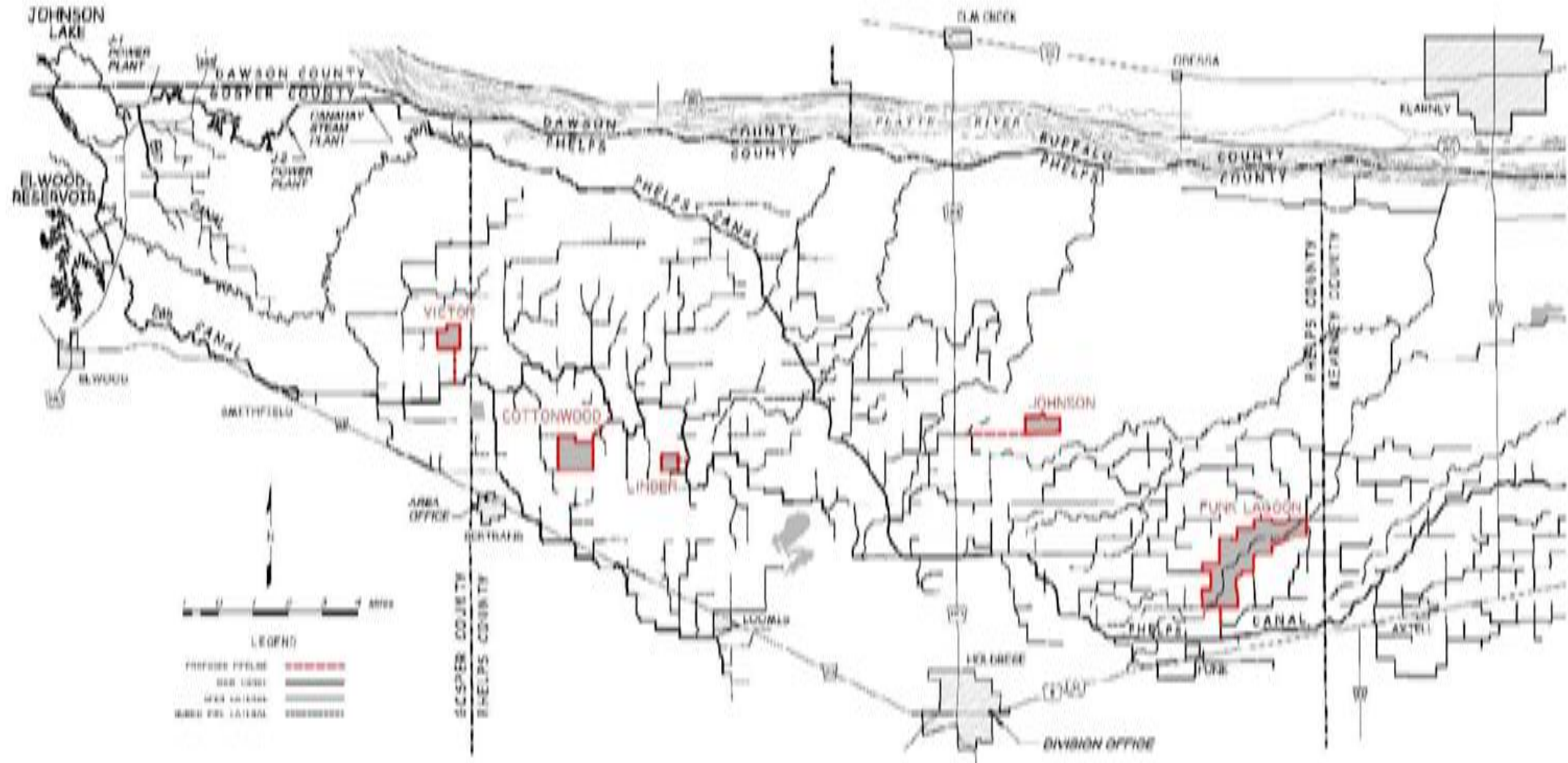
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**30 – 33,000 acres**  
**1% of the landscape**



# West Basin Recharge Projects

Cottonwood, Funk, Johnson, Linder, and Victor Lakes WPA projects





# West Basin Recharge Projects

## Multi-phased approach

- Supplemental water delivery infrastructure
- Watershed restoration
- Wetland restoration
- Management infrastructure
- Supplemental water deliveries



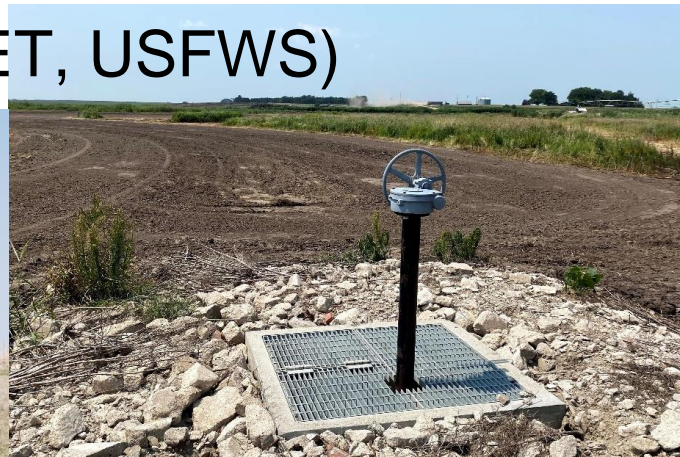


# Cottonwood WPA Project

Multiple elements since 2019 (\$1.164 million investments)

- Strategic acquisition (NAWCA, USFWS)
- Watershed Restoration
  - 50% of irrigation reuse pits filled - EQIP, NET, NAWCA, USFWS
- Wetland Restoration
  - 87,000 cubic yards of material removed
    - 8-12 inch cuts - NAWCA, NET, USFWS
- Supplemental Water Delivery Infrastructure
  - 24" water delivery pipeline (NE DNR)
- Grazing infrastructure - (NET, USFWS)

Cottonwood WPA





# Cottonwood WPA Project





# Groundwater Recharge and Wetland Habitat Enhancement Monitoring

- Summary of Recharge Events
- Data Collection
- Water Surface Survey
- Develop Elevation Area Capacity Curves
- Observation Well installation and monitoring
- Water Budget Computation
- Recharge return to Platte River

By Duane Woodward  
Engineering Hydrology Consultant





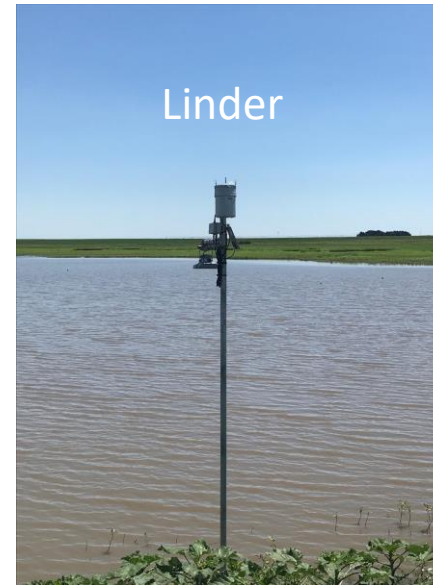
# Summary of WPA wetland Water Budget

Table 1.WPA Water Delivery and Recharge Summary November 2018 thru November 2022								
WPA	Date Start	Date End	Inflow	Evaporation	Seepage	Seepage rate	Seepage rate	Seepage rate
			AF	AF	AF	Feet/day	in / hr	Gal/Ac/day
Funk	11/19/2018	3/10/2019	2042	105	1810	0.051	0.026	156,895
Funk	5/19/2021	7/4/2021	550	105	445	0.68	0.34	2,077,029
Funk	9/1/2022	11/20/2022	1278	264	1110	0.112	0.056	343,470
Victor Lake	11/27/2019	2/24/2020	1099	30	1131	0.156	0.078	479,159
Victor Lake	3/18/2021	4/2/2021	373	19	349	0.263	0.132	807,861
Johnson	5/20/2021	7/4/2021	232	66	147	0.5	0.25	1,530,033
Johnson	10/13/2022	11/30/2022	163	14	149	0.829	0.414	2,543,425
Cottonwood	9/3/2022	10/24/2022	122	13	109	0.737	0.368	2,261,550



# Data Collection

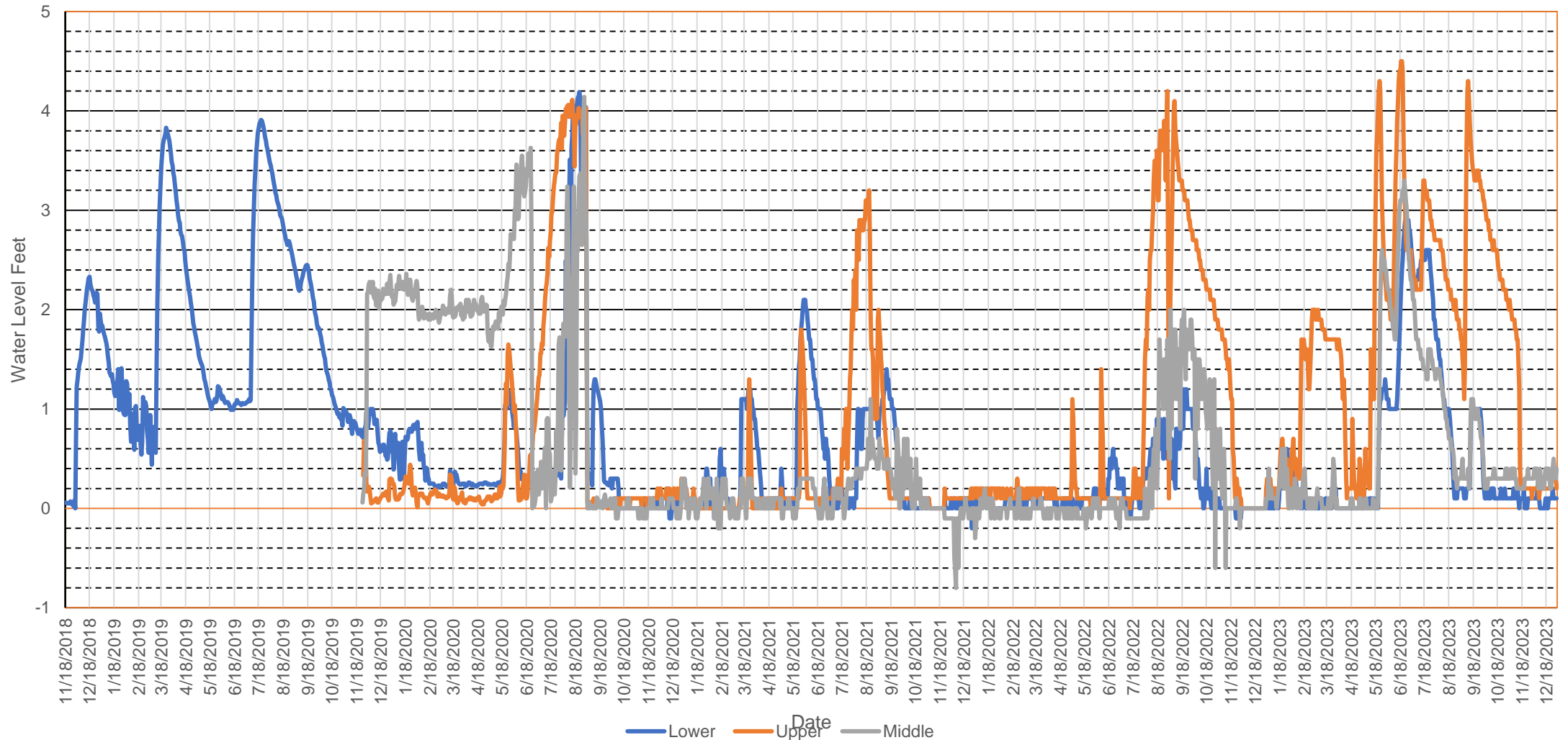
- Basin water level elevations
- Basin precipitation





# Funk Basin Water Levels

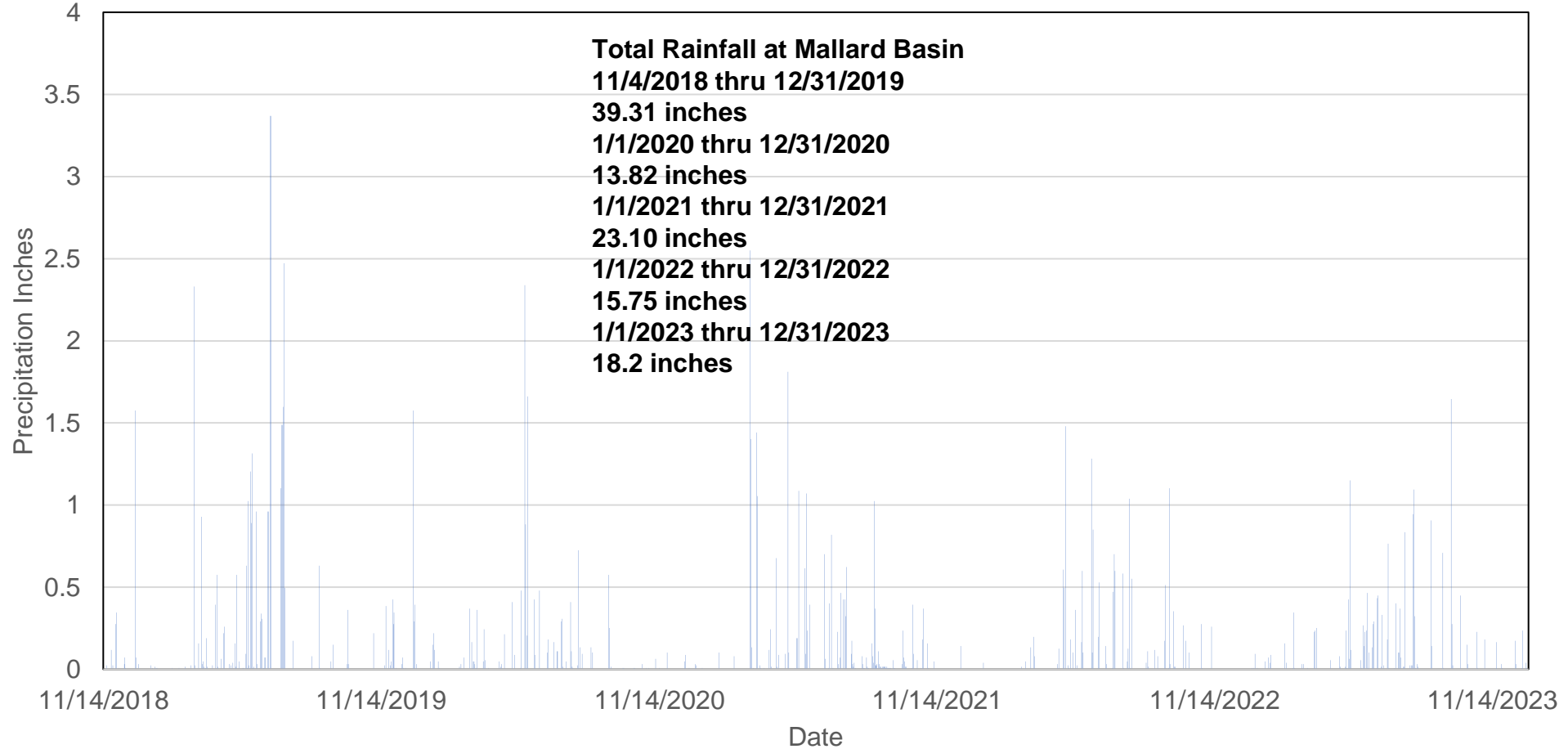
Figure 1. Water level in Lower, Middle, and Upper Funk Basin WPA





# Funk WPA Precipitation

Figure 2. Daily Precipitation in Lower Basin area at Funk Wetland









# Funk Wetland Upper Basin Elevation Area Capacity Graphs

## Funk Wetland Middle Basin Elevation Area Capacity Graphs

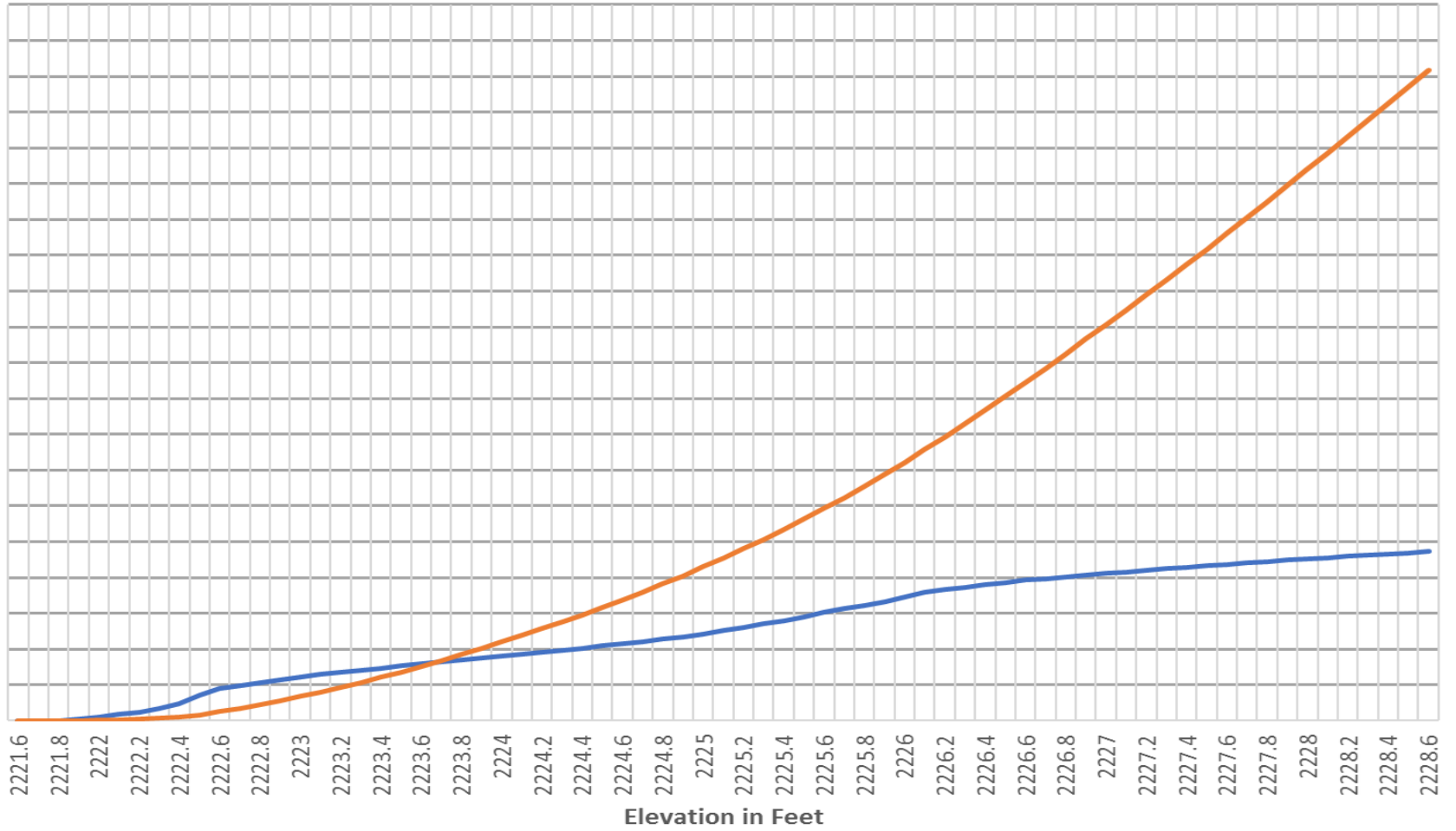
### Funk Wetland Lower Basin Elevation Area Capacity Graphs

Area in Acres and Storage in AcreFeet

Area in Acres and Storage in AcreFeet

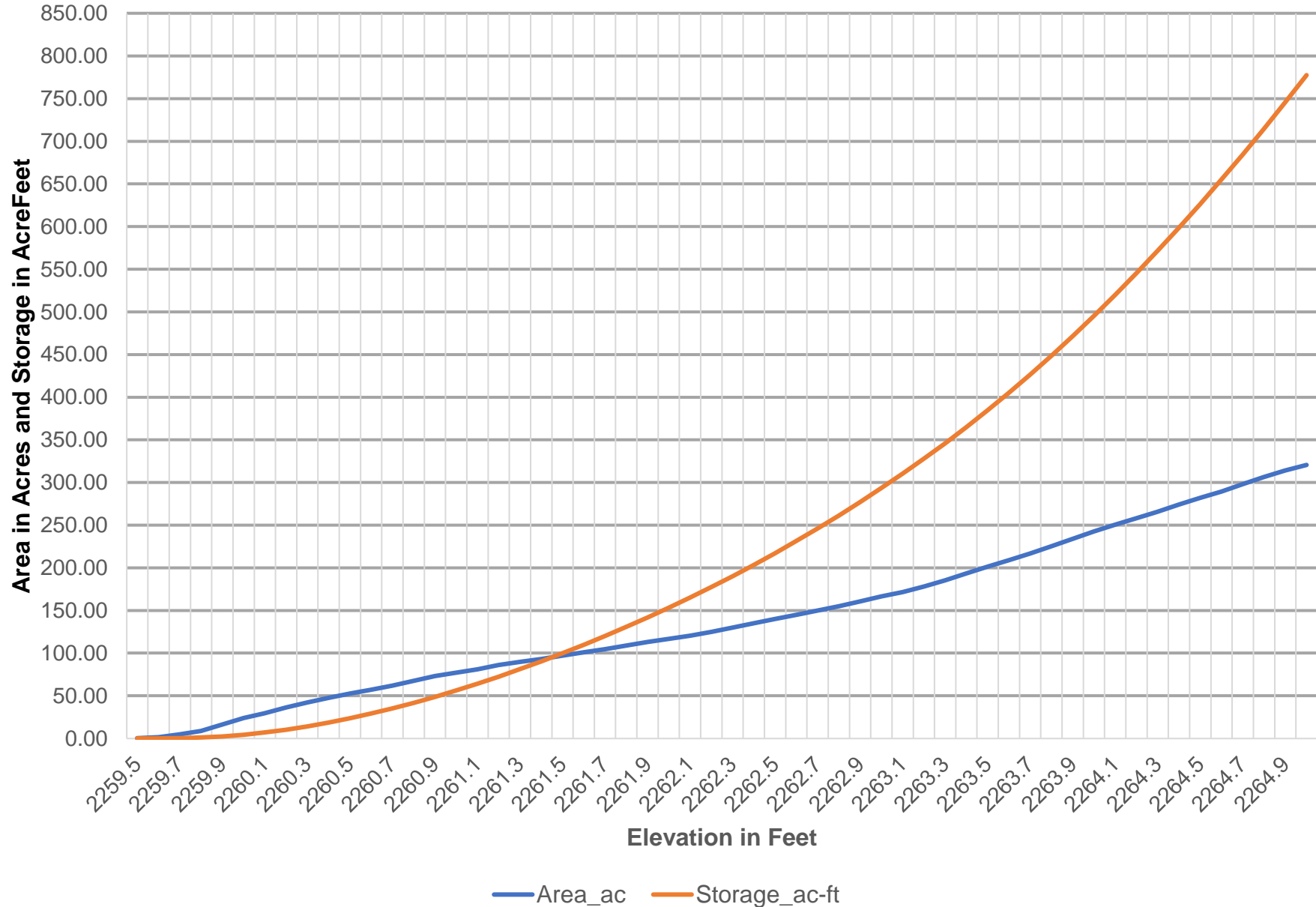
Area in Acres and Storage in AcreFeet

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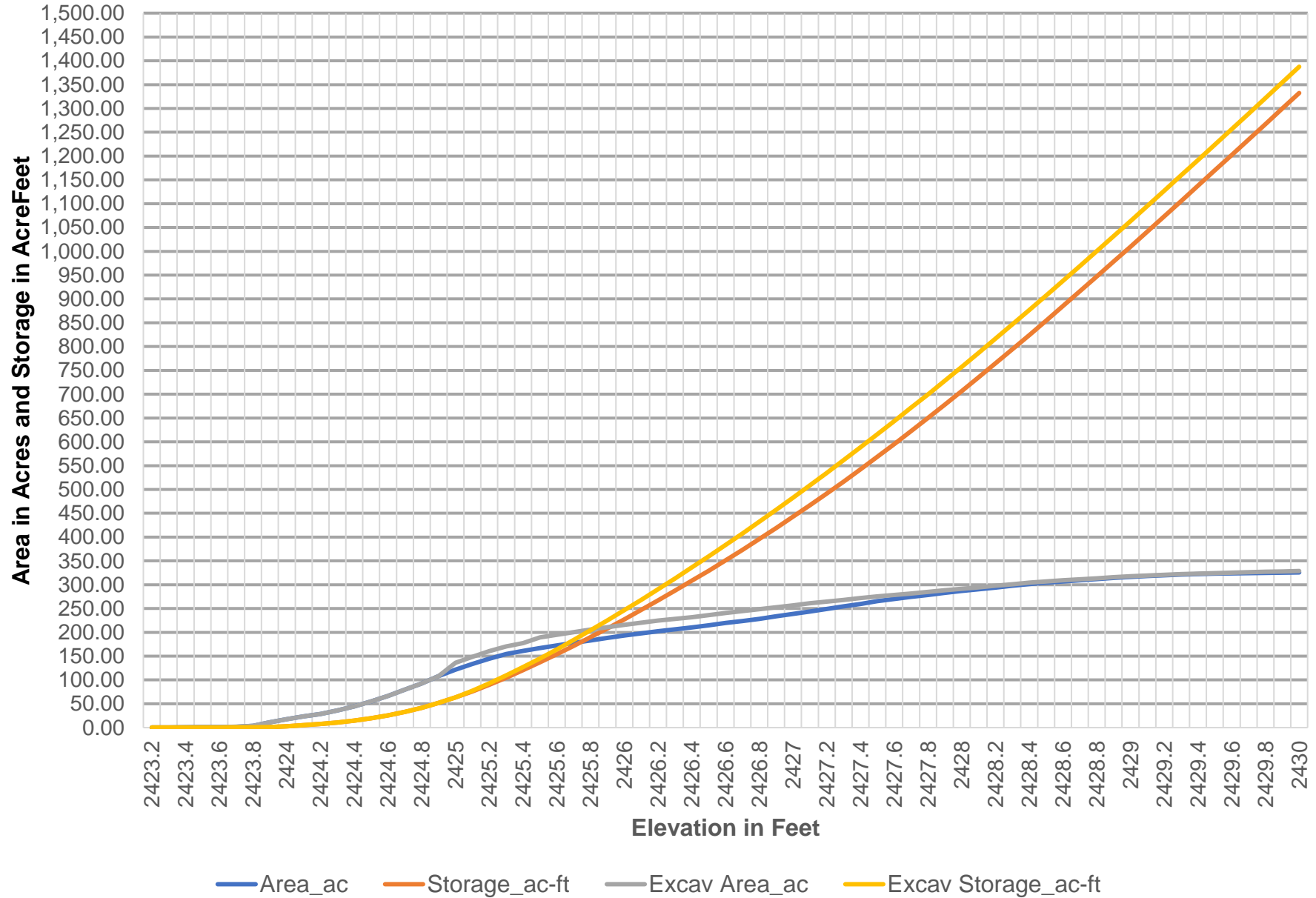
Area\_ac Storage\_ac-ft

# Johnson Wetland Elevation Area Capacity Graphs

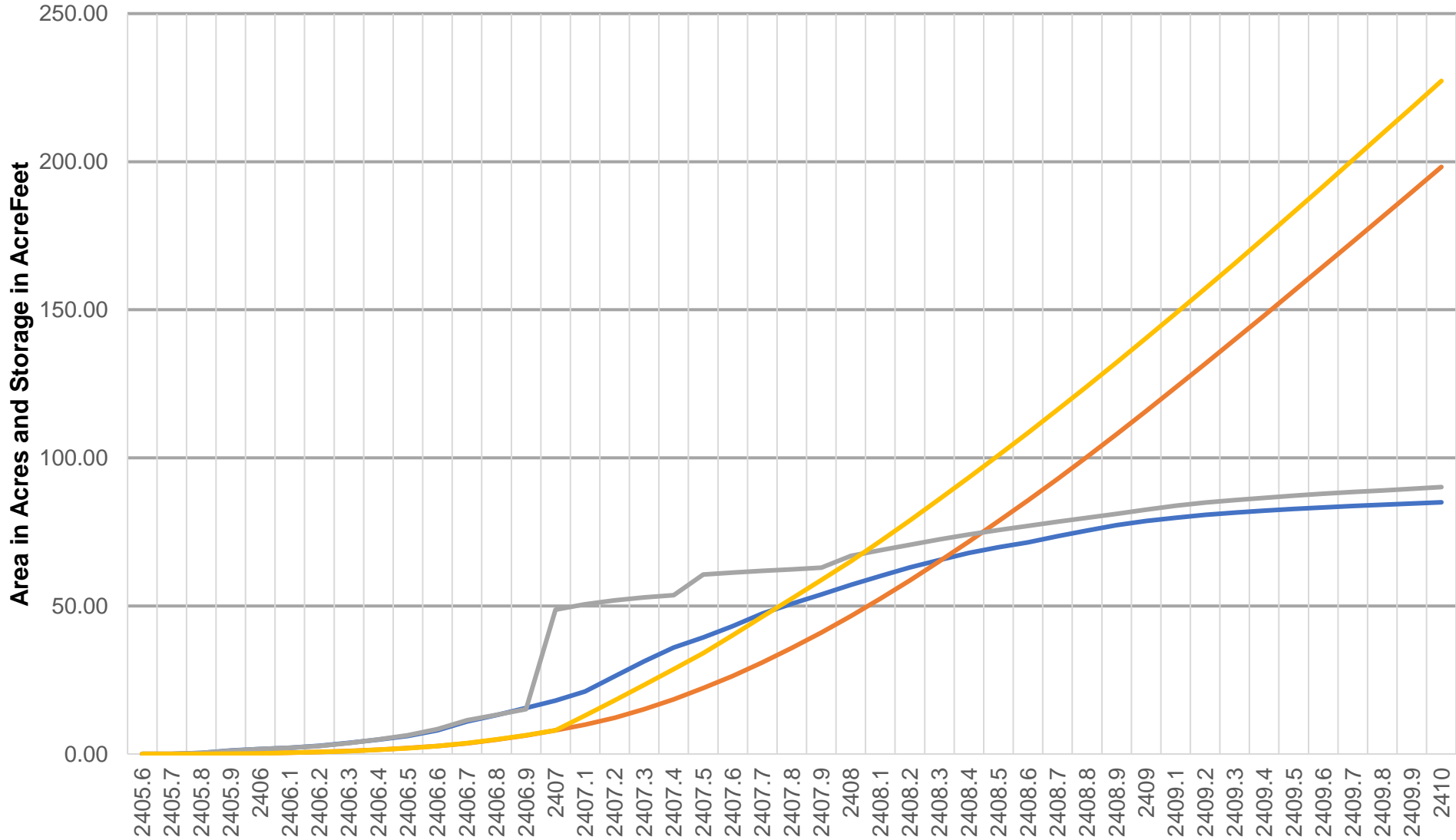




# Cottonwood Wetland Elevation Area Capacity Graphs



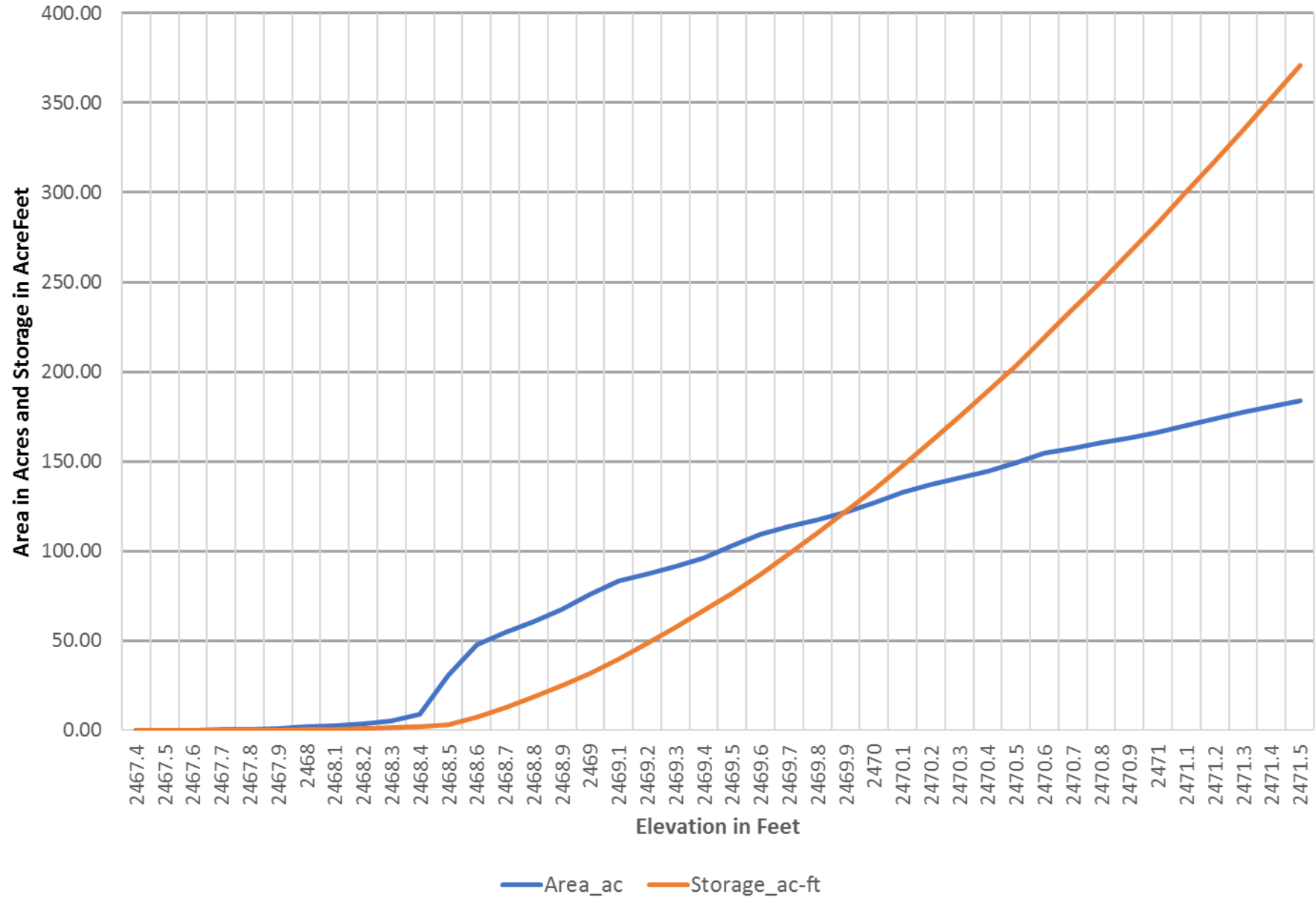
# Linder Wetland Elevation Area Capacity Graphs



— Area\_ac — Storage\_ac-ft — Excav\_Area\_ac — Excav\_Storage\_ac-ft



### Victor Lake Wetland Elevation Area Capacity Graphs



# Compute Basin Water Budget for each WPA

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Basin water budget is a daily computation of inflows ,  
outflows, and Change in storage.

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Inflows include Water delivery from canal and rainfall on  
Basin plus runoff into the basin

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Outflows include estimated water surface evaporation and  
seepage from the wetted basin

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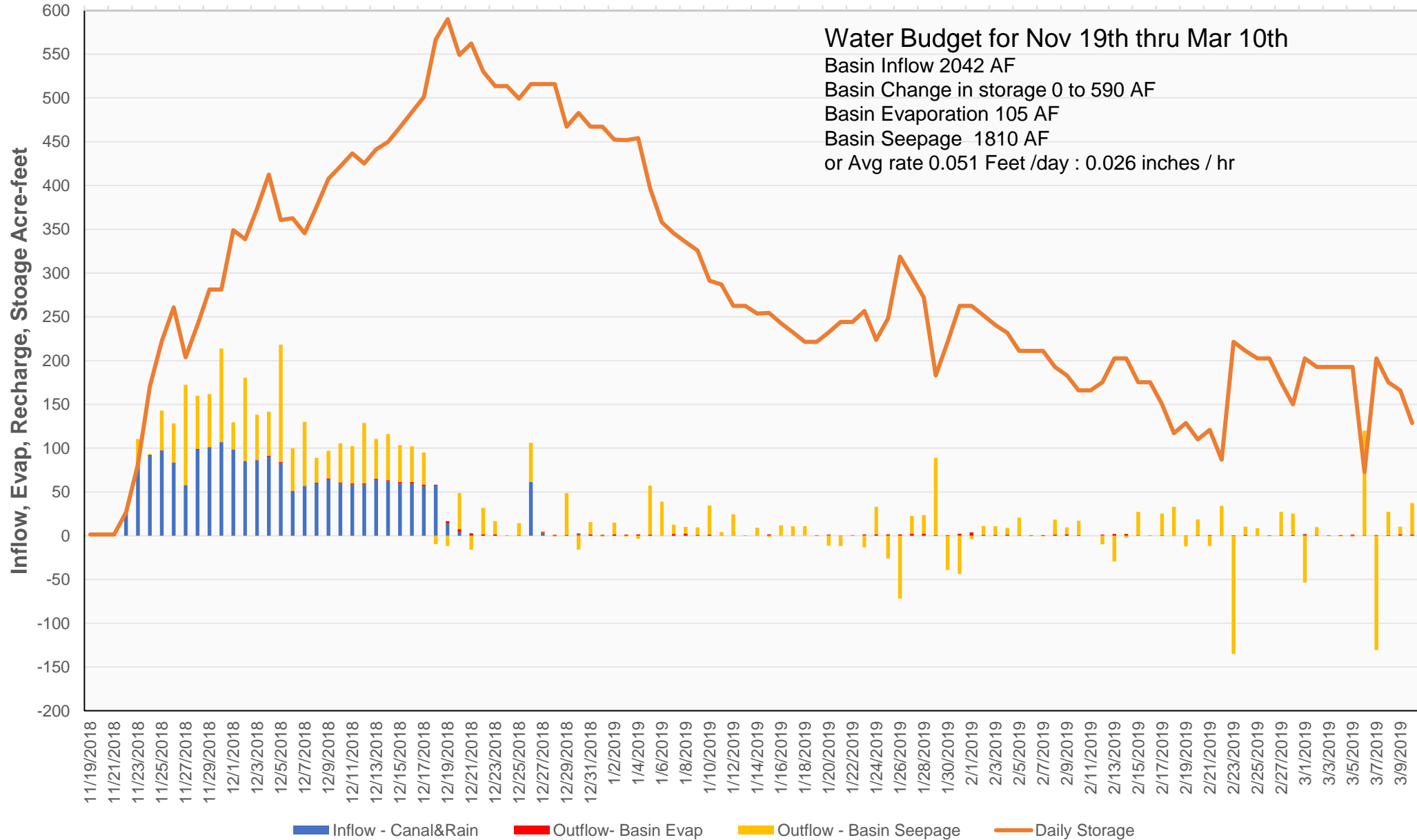
Measured daily water surface elevations are used with the  
EAC curves to compute the change in storage and area each  
day.

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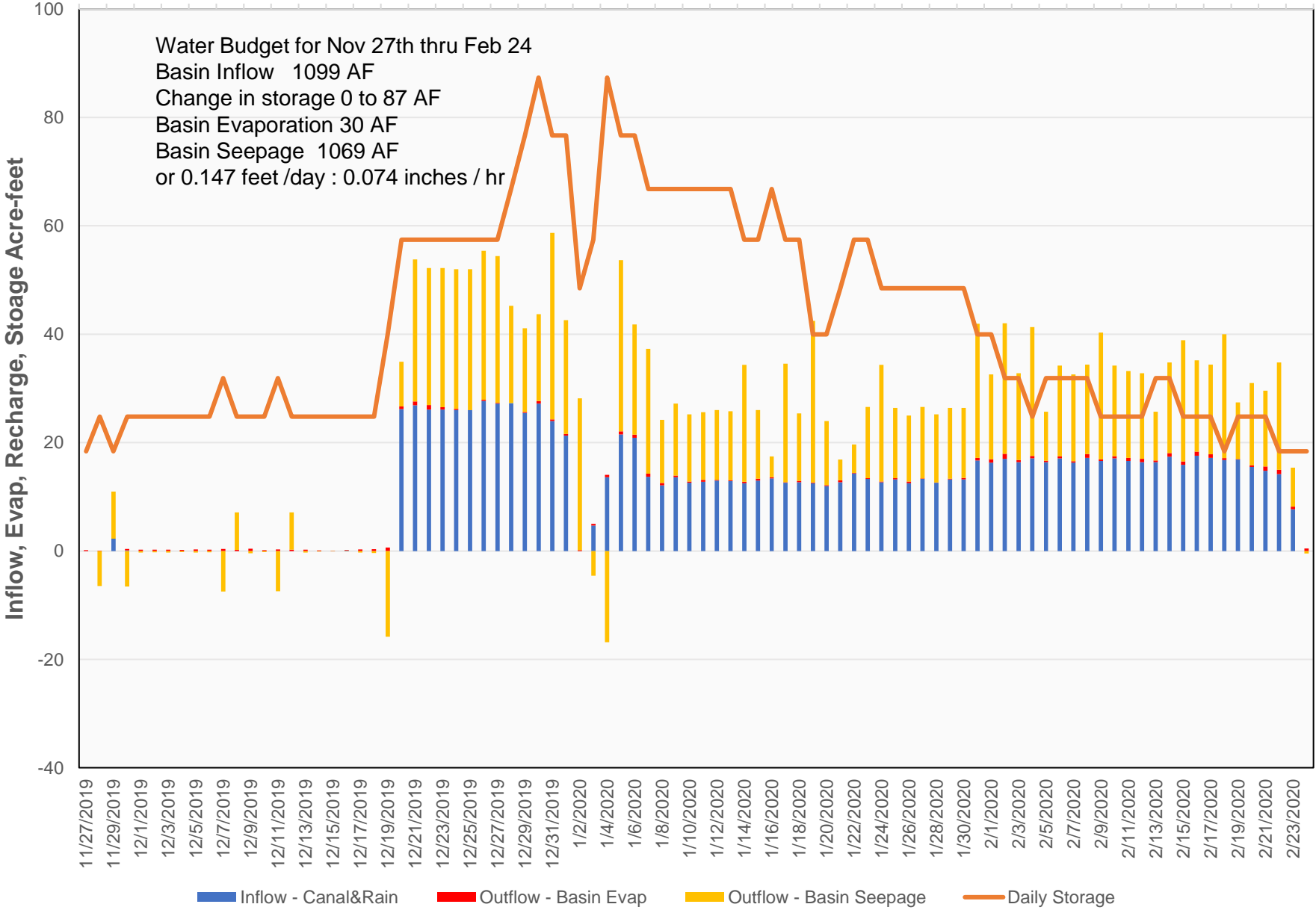
Results are shown in graphs.



# Funk WPA Daily Water Budget



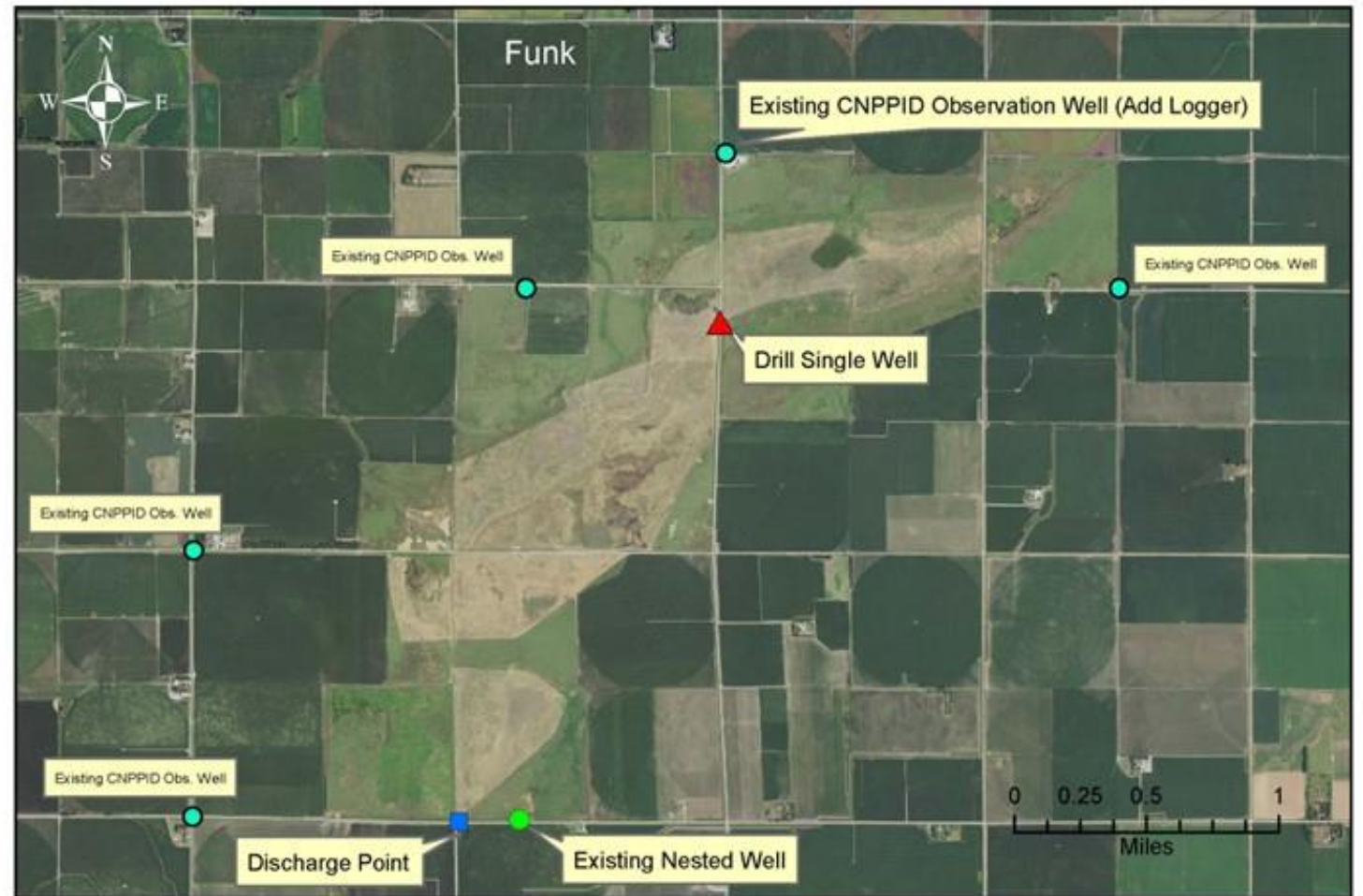
# Victor Lake WPA Daily Water Budget



■ Inflow - Canal&Rain    
 ■ Outflow - Basin Evap    
 ■ Outflow - Basin Seepage    
 — Daily Storage

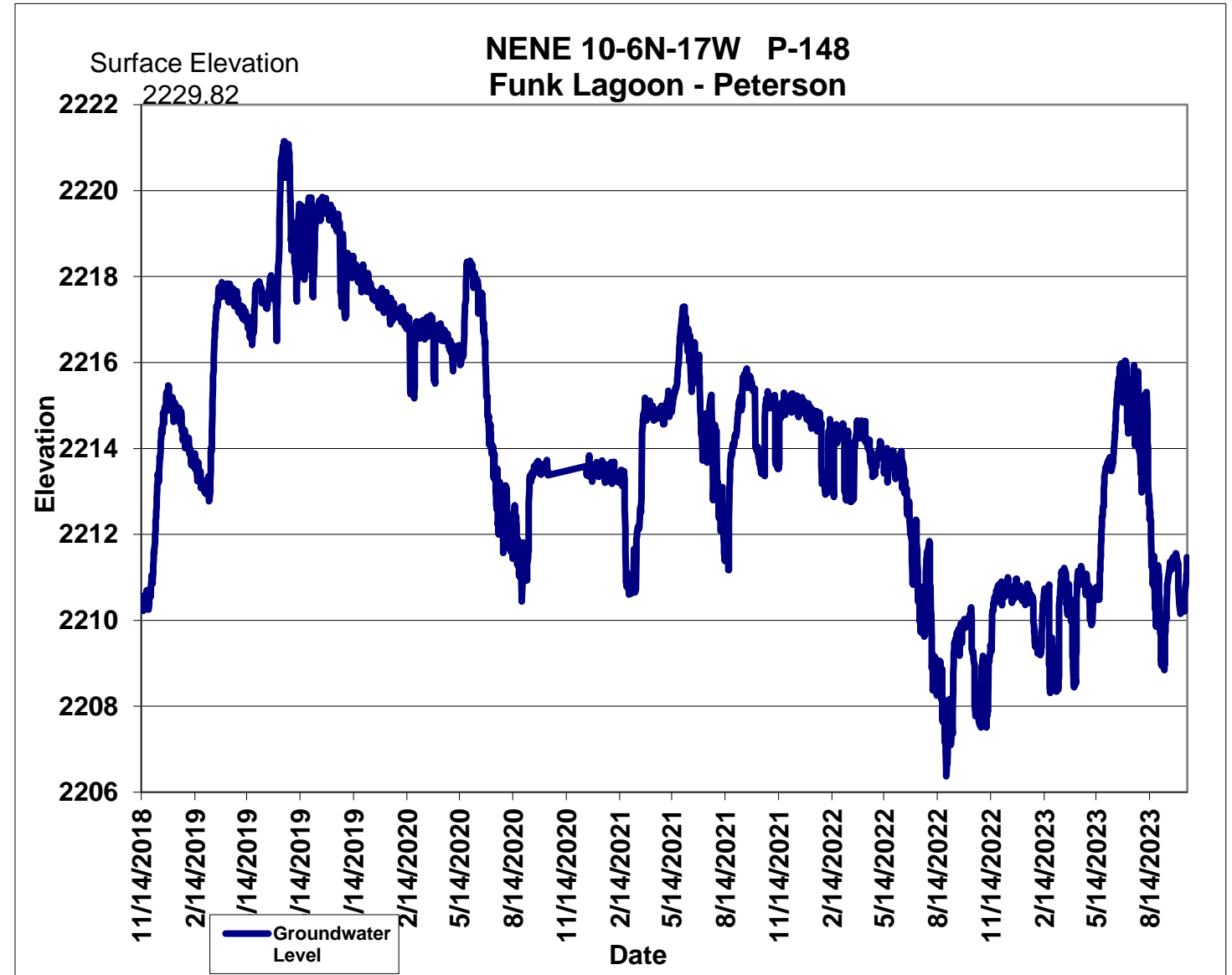


# Observation Well location map Funk WPA



# Observation Well installation and monitoring

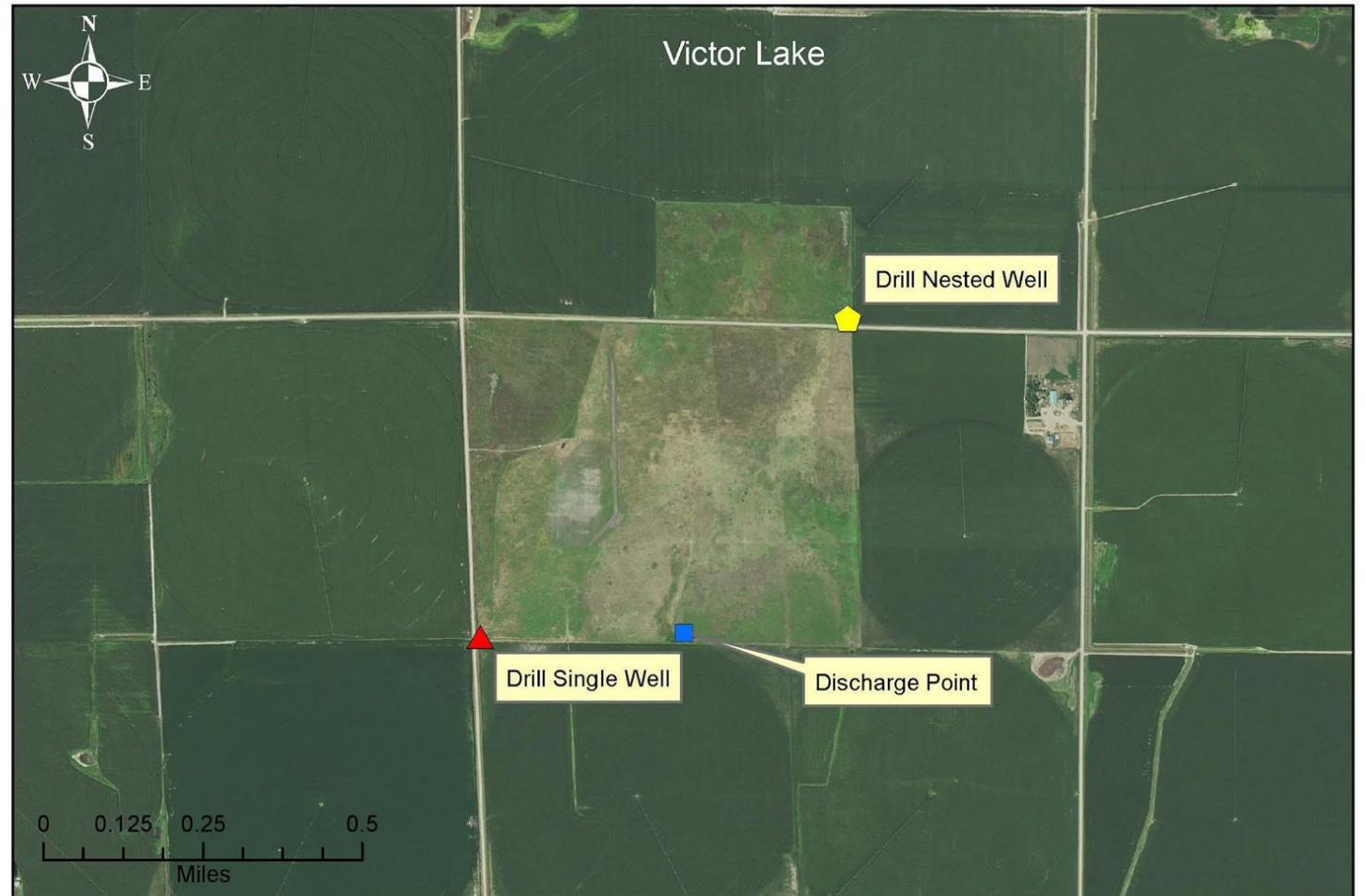
- Installation of wells complete at Victor Lake, Linder, Johnson and Funk
- Cottonwood complete except for 1 well. Need to determine better location for it.
- Water depth monitors installed and collecting data.
- Elevations surveyed at each well for Measuring point, and Land Surface datum
- Work to be done includes review water level data and set max levels for Basin recharge.





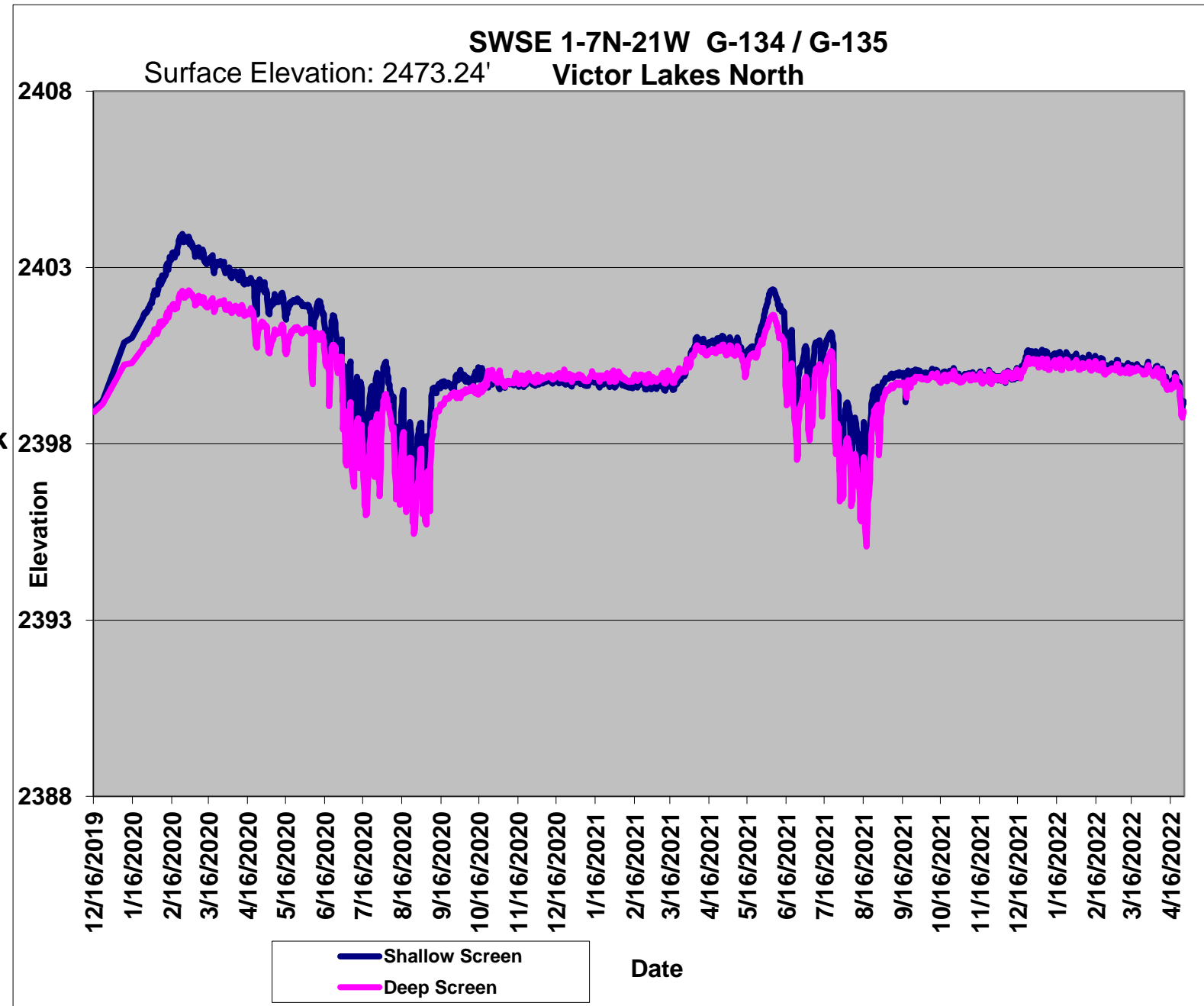
# Observation Well location map Victor Lake

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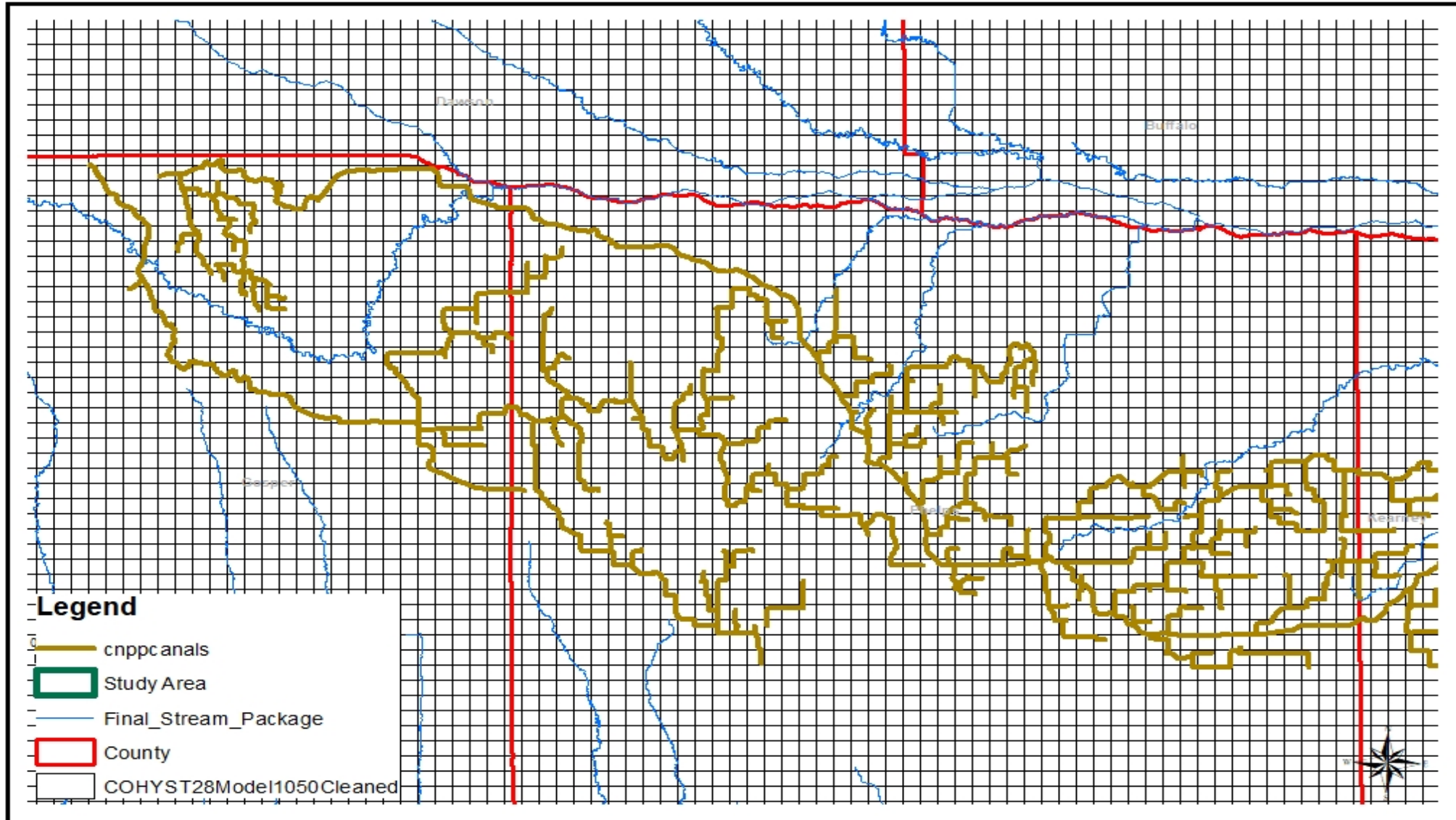
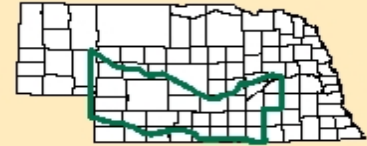


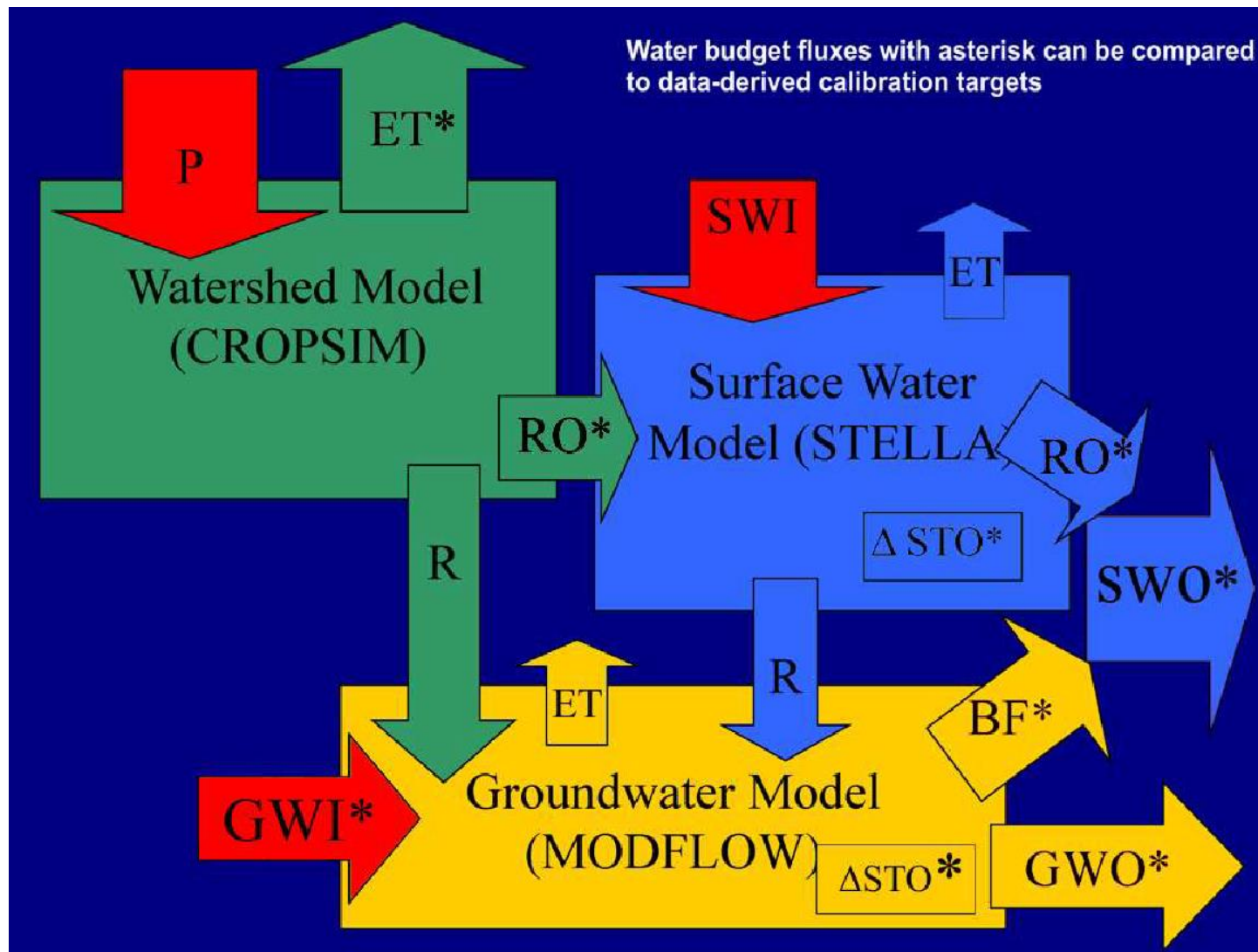
# Observation Well monitoring

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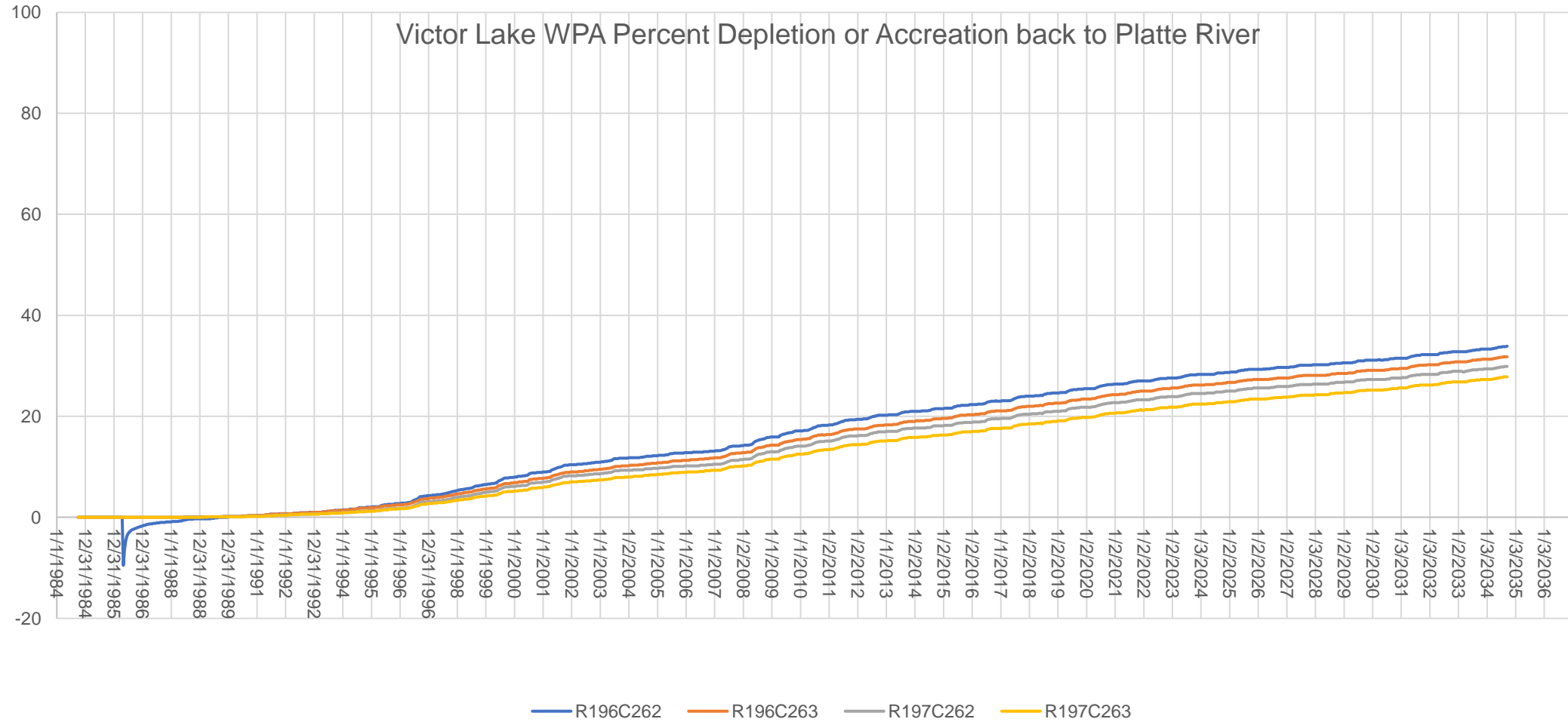








# Stream Accretion from Groundwater Recharge



# Cottonwood WPA Outcomes

## Benefits beyond birds

- 320 restored wetland acres can
  - Recharge 421 million gallons of water
  - 2,585 irrigated acres with 6" allocation
  - Drinking water for 12,825 individuals – based on USGS 90/gallons/day/person
  - 7x more than population of Gosper County
  - 10% instream flow contribution to Platte River over the next 15 years

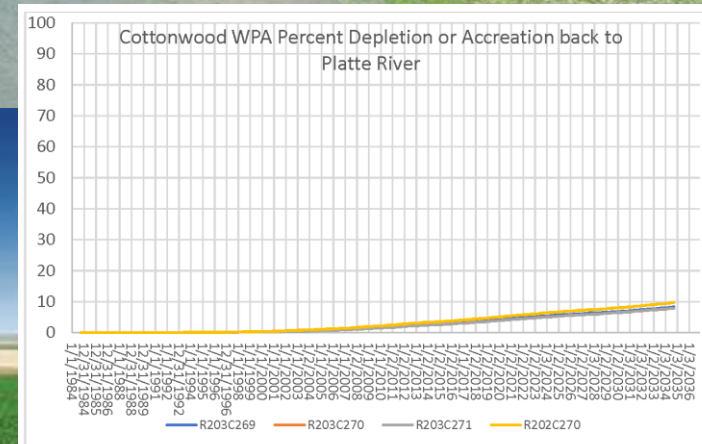


Figure 19. Cottonwood WPA SDF curves.