



Scenario Analyses

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Sandia National Laboratories
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OUTLINE

- **INTRODUCTION**
- **BASELINE RUN**
- **SCENARIOS**
- **HANDS-ON**



GILA-SAN FRANCISCO DECISION SUPPORT TOOL

- **Coarse-grain hydrologic representation**
- **System dynamics framework**
- **Water balance features**
 - 2004 AWSA New Mexico CUFA compliance
 - Agriculture demand: crops, acequias, and ranching.
 - Non-ag demand: commercial, mining, and population
 - Potential flow considerations
 - Supplemental pumping from groundwater
 - Other: riparian zone

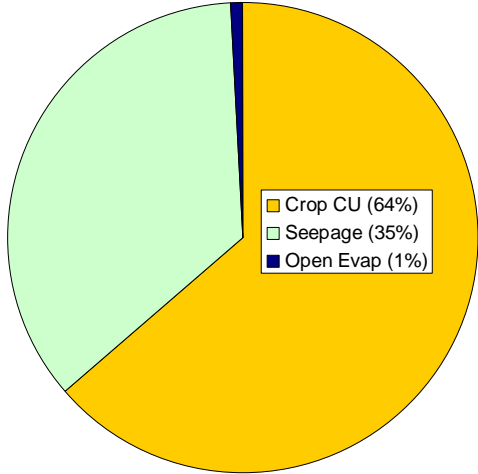


BASELINE RUN

- **2005-2032 period of projection based on historical gauged data.**
- **Water demand level at 2005 level.**
 - irrigated acreage
 - human demand
 - commercial
 - livestock
- **Twelve CUFA constraints applied in place.**

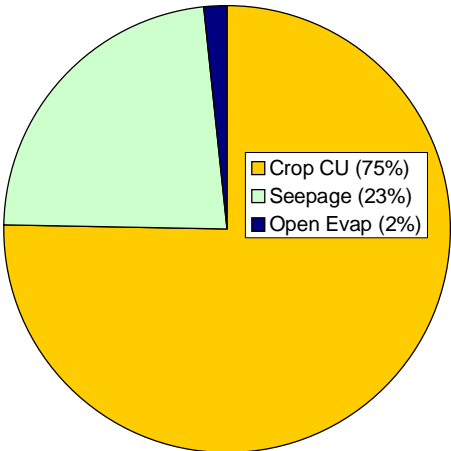
GSF Agriculture

Gila



Gila annual rate of ~10,000 AF/yr
 San Francisco rate of ~2,000 AF/yr

San Francisco



HOME

RESULTS: Water Demand

GSF Water Use Summary

GSF Agricultural SW Use

GSF GW Use

Mimbres/Animas GW Use

Executive Summary of Ag & Non-Ag Water Demand (AF/year)

Baseline Summary is the 2005-2026 summary based on default values of input parameters.

GSF SW Ag	11,998 AF/year	GSF GW Ag	3,824 AF/year	Mimbres GW	32,752 AF/year
	11,998 AF/year		3,824 AF/year		32,752 AF/year

GSF Non-Ag	12,153 AF/year	Mimbres Non-Ag	29,767 AF/year
	12,153 AF/year		29,767 AF/year

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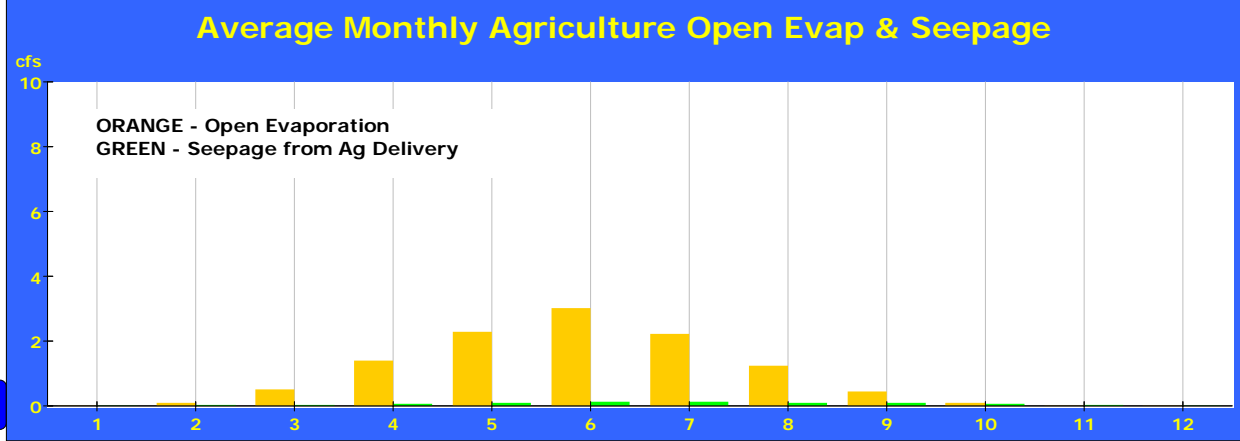
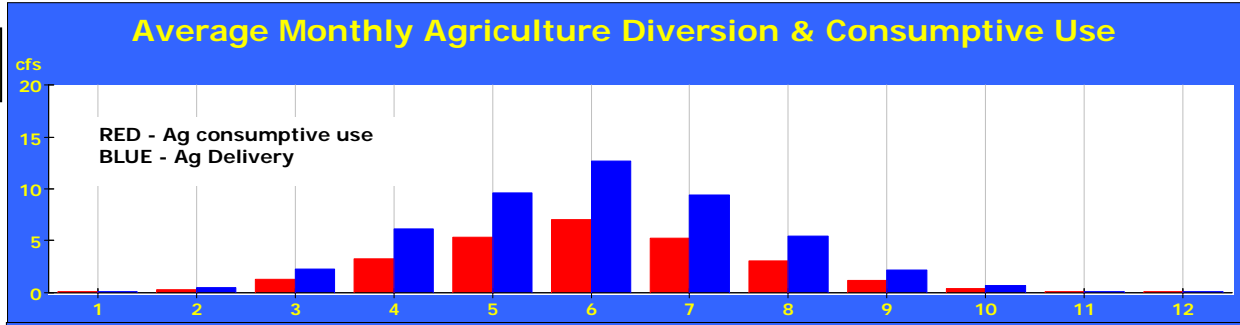
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Water Demand

Gila SW Agricultural Consumptive Use -
Monthly Average

1 1 2032

Graph Control
Gila-Redrock



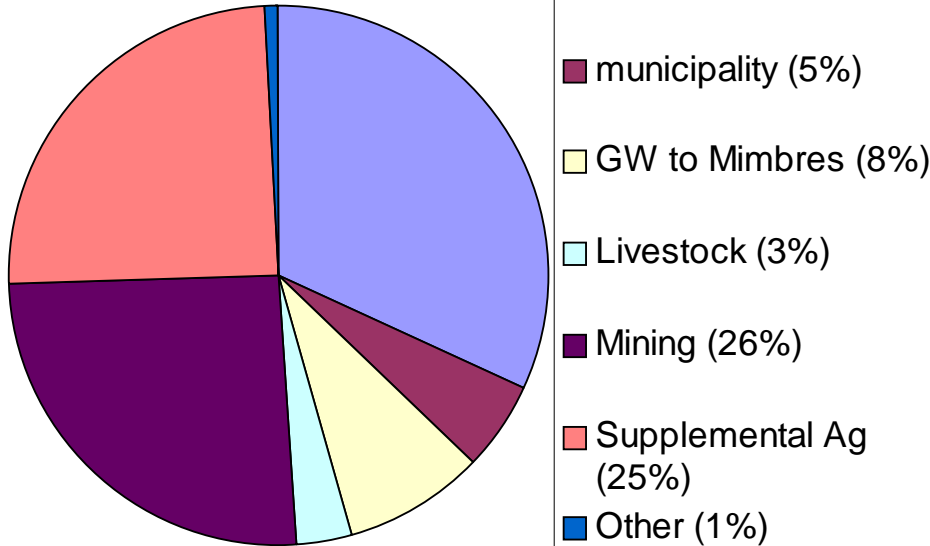
Return

GSF Non-Agriculture

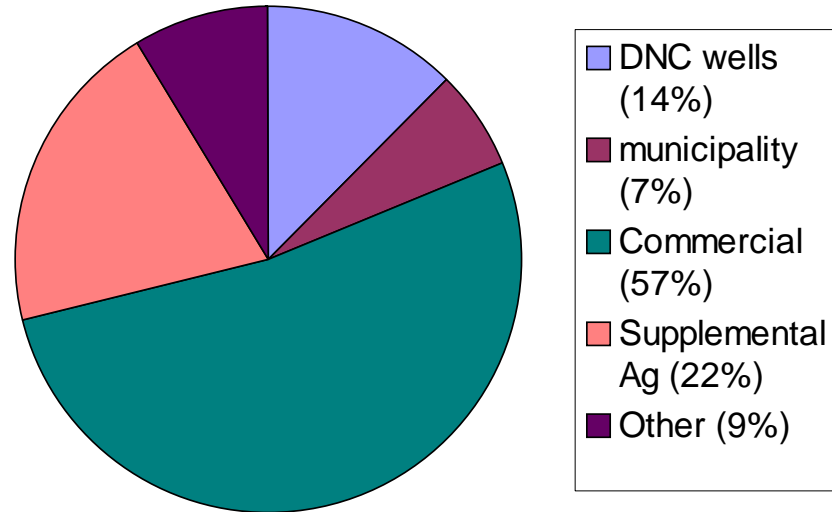
Gila annual rate of ~12,000 AF/yr

San Francisco rate of ~4,000 AF/yr

Gila

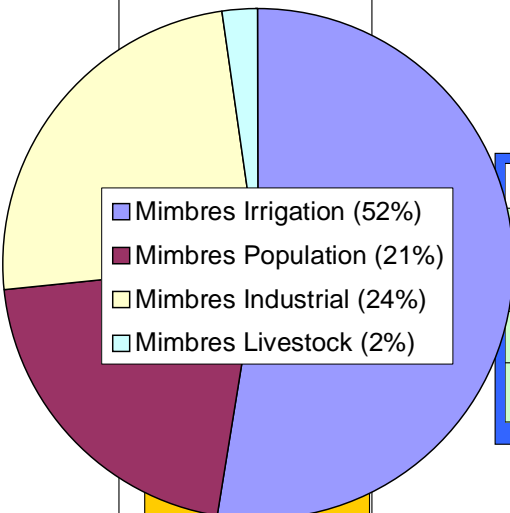


San Francisco



Mimbres/Animas/Lordsburg Water Use

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Mimbres Groundwater Demand

Mimbres GW	Annual Rate	Total Volume
Mimbres Irrigation	32,745 afy	891,037 AF
Mimbres Population	13,115 afy	313,179 AF
Mimbres Industrial	15,230 afy	396,311 AF
Mimbres Livestock	1,416 afy	36,835 AF

Animas Groundwater Demand

	Annual Rate	Total Volume
Animas Irrigation GW	10,857 afy	299,760 AF
Lordsburg Irrigation GW	4,555 afy	126,335 AF

- Use Summary
- GSF Agricultural SW Use
- GSF GW Use
- Mimbres/Animas GW Use

CUFA Summary

Ag Demand is Currently

- OFF
- ON

HOME

**RESULTS:
NM CUFA
Diversions**

Potential CUFA
Diversions

Test Summary

Water Bank

View Hydrographs
with CUFA diversion

Total Diversion

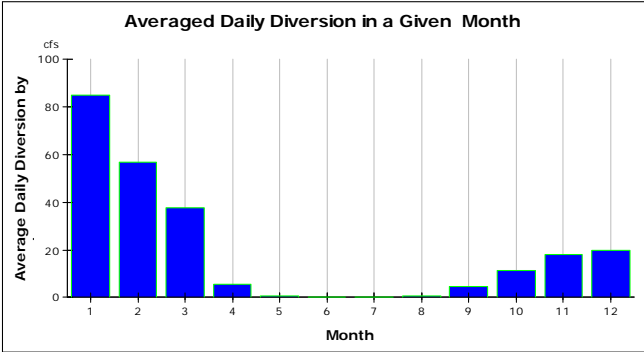
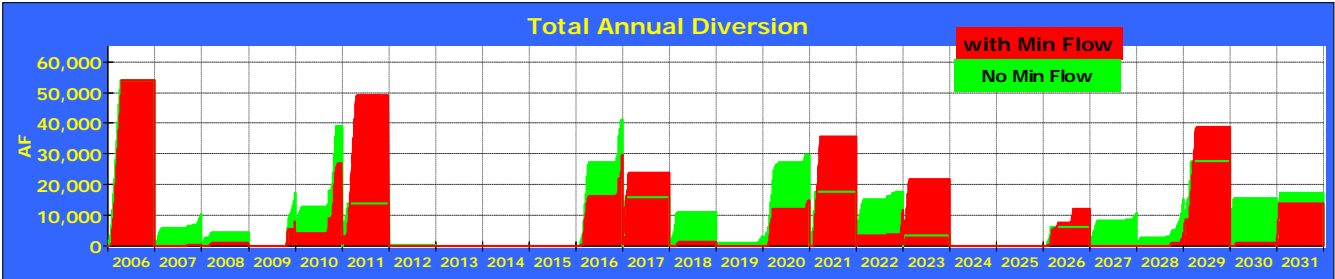
Gila Diversion

San Francisco
Diversion

CUFA Model
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National
Laboratories

Graphics

View Daily Table



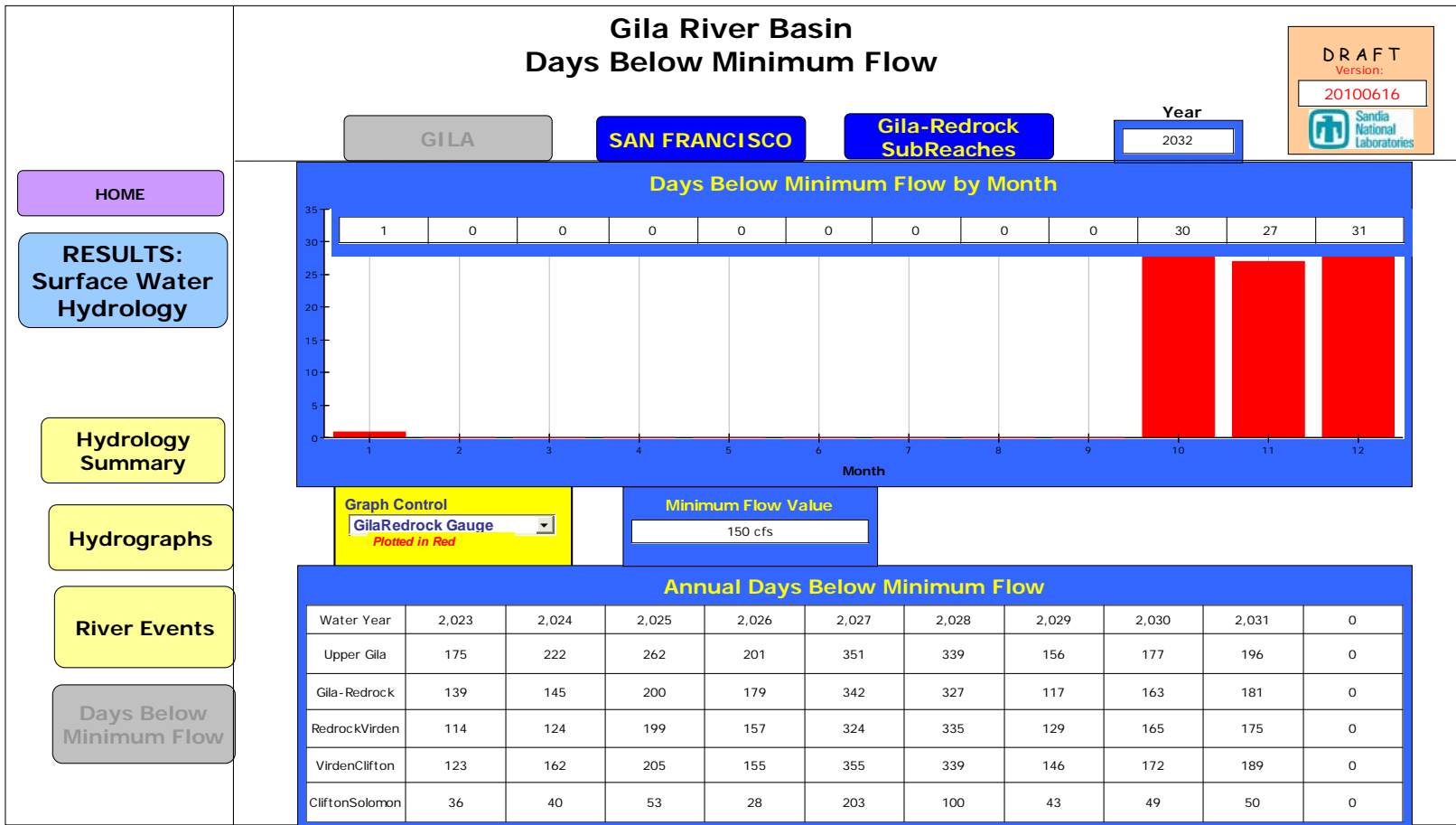
Average Annual Total Diversion

With Minimum Flow	No Minimum Flow
12,975 AF	13,812 AF

Detailed Annual Diversion by Reach if Qmin Considered vs. No Minimum Flow (AF)

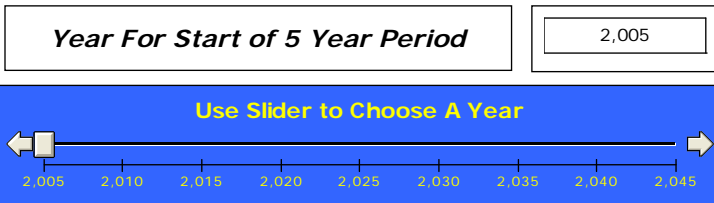
Time	Min Flow	No Min Flow
Jan 01, 2013	155 AF	279 AF
Jan 01, 2014	3 AF	0 AF
Jan 01, 2015	0 AF	0 AF
Jan 01, 2016	0 AF	0 AF
Jan 01, 2017	29,885 AF	41,071 AF
Jan 01, 2018	23,970 AF	15,917 AF
Jan 01, 2019	1,517 AF	11,222 AF
Jan 01, 2020	0 AF	3,032 AF

River Events

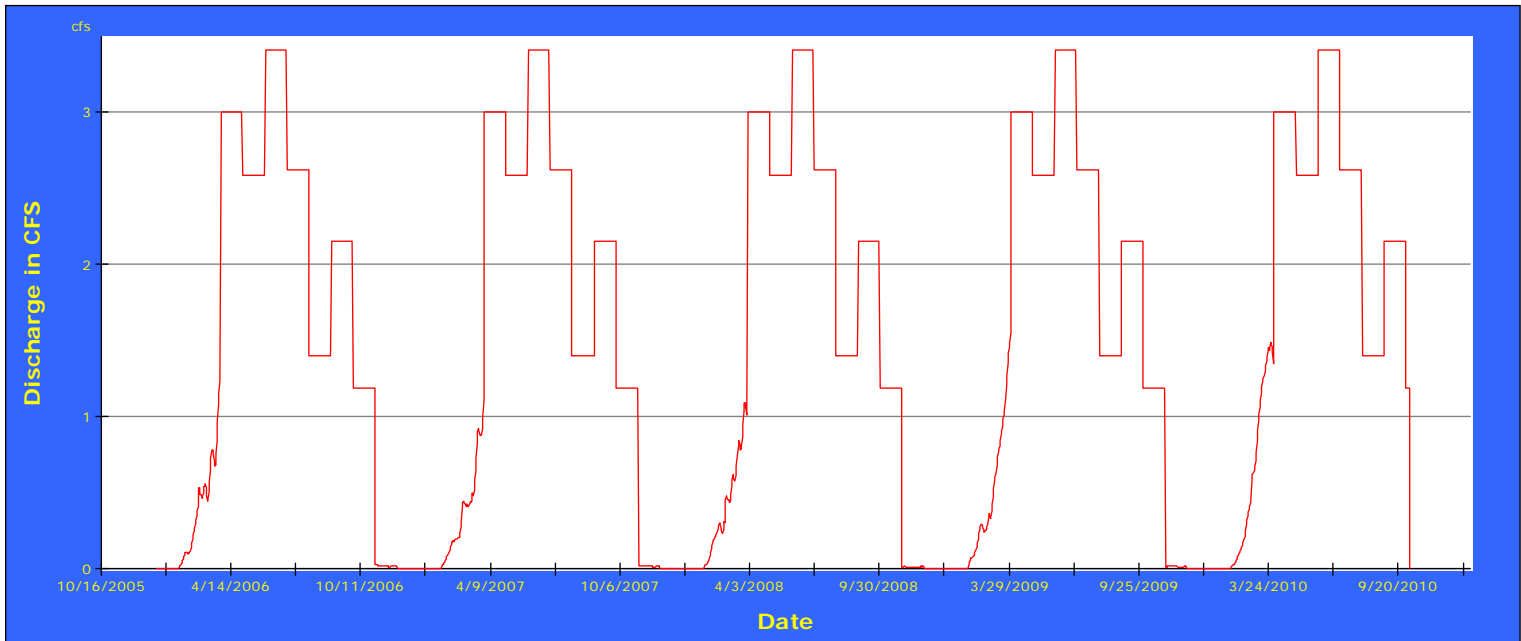


Ditch Diversion

Gila River basin Five Year Detail of Ditch Diversions



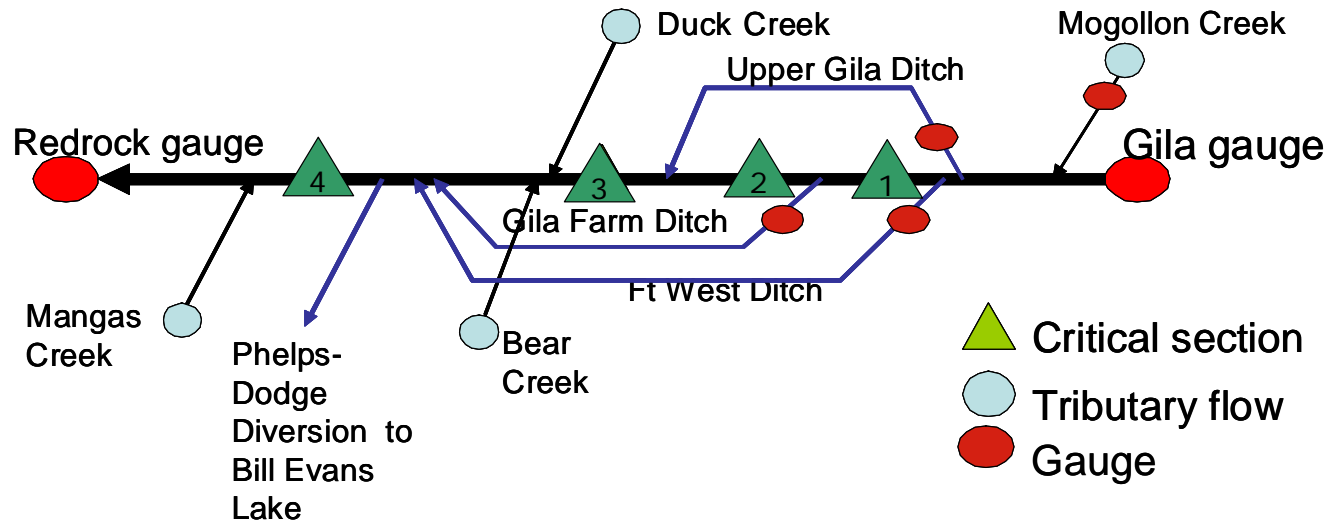
Graph of Diversions will start on October 1 of the chosen year, the beginning of the water year.



[Return to Gila Diversion Graph](#)

Subreach feature

Gila-Cliff Area
Schematic Diagram of Gila-Redrock Subreaches



[Return to Subreach Minimum Flow](#)

[Return to Ag Acreage](#)



Analyses

- **Agriculture**
- **CUFA Water Rights**
- **Municipalities**
- **Hydrograph/Temperature**

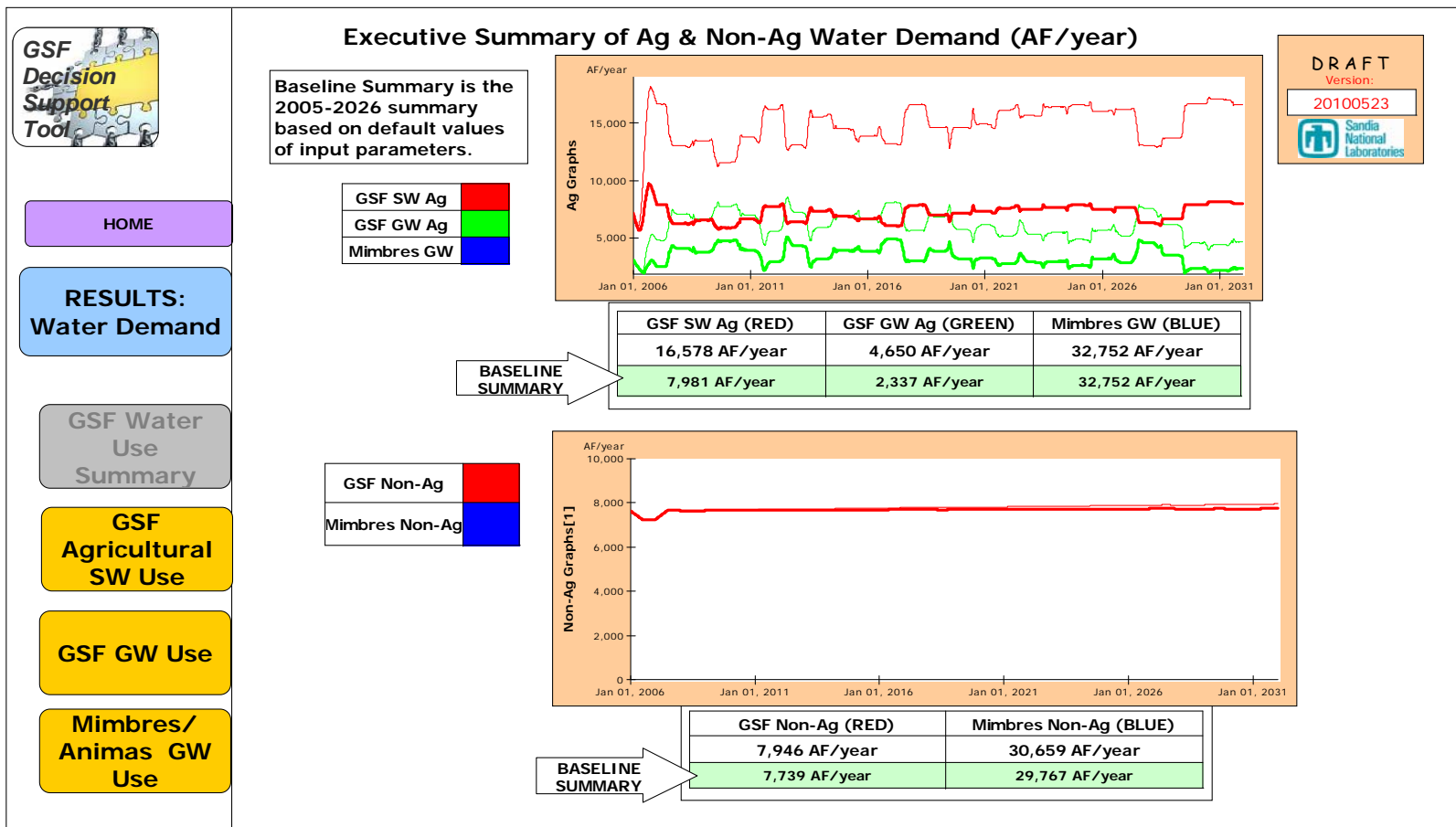


Analyses

- **Agriculture**
- CUFA Water Rights
- Municipalities

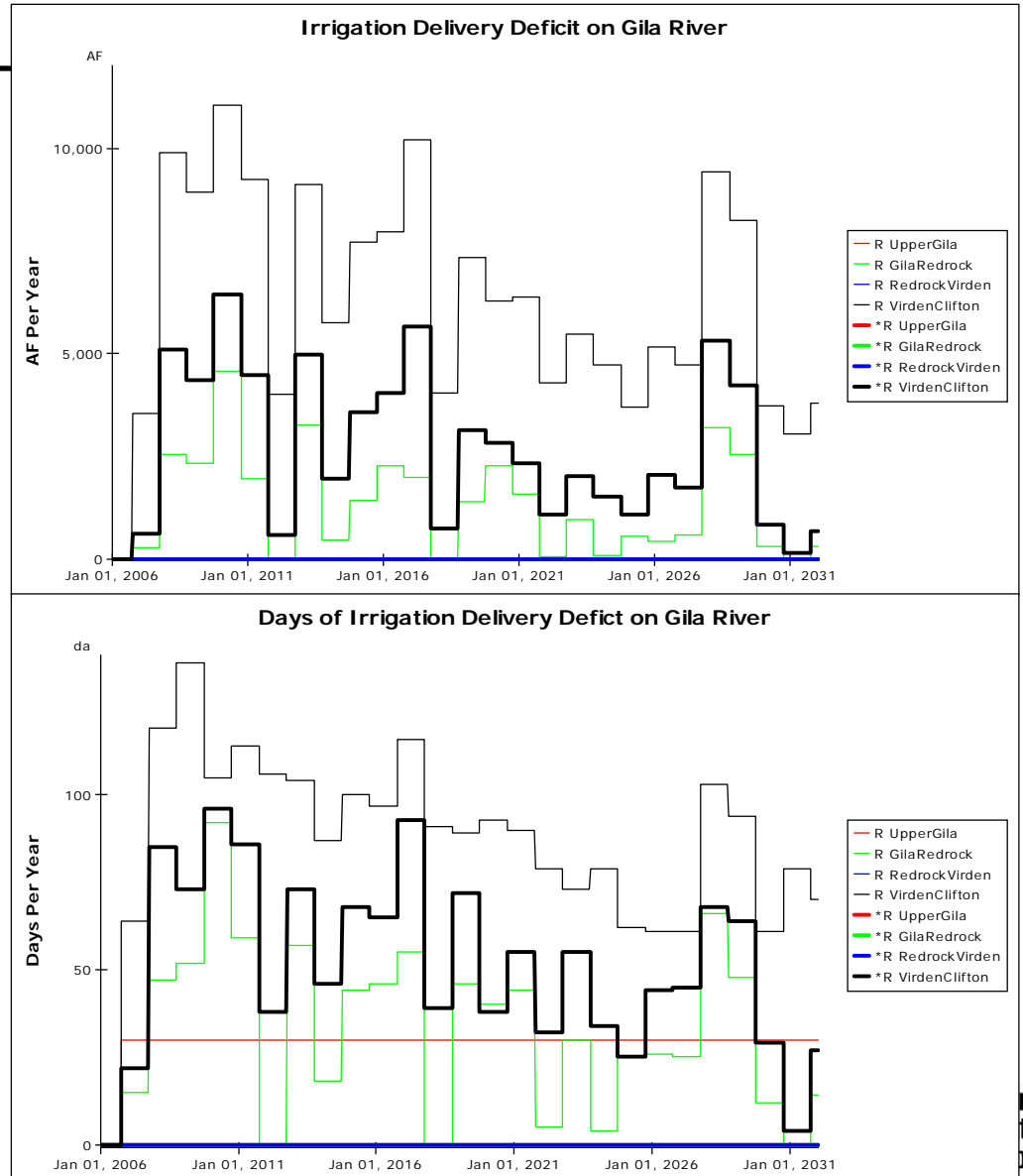
Base vs. High Use: Consumption

- Difference between high and current use is approximately **11,000AF/yr**, equal to unused mining rights in Gila



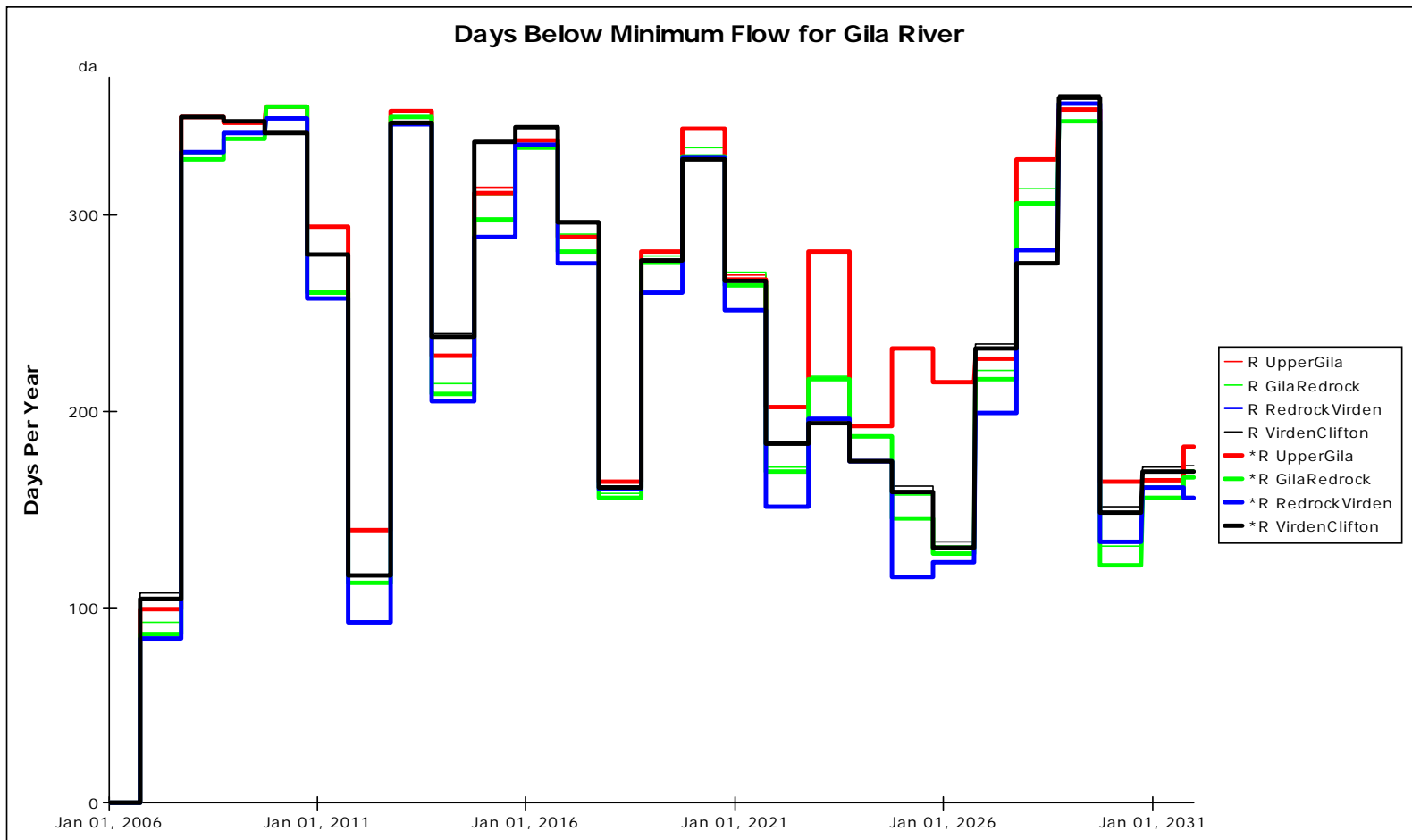
Base vs. High Use: Agriculture

- High Use
 - High growth municipal
 - Utilization of full decree acreage (except redrock-vidren)
- No CUFA diversions



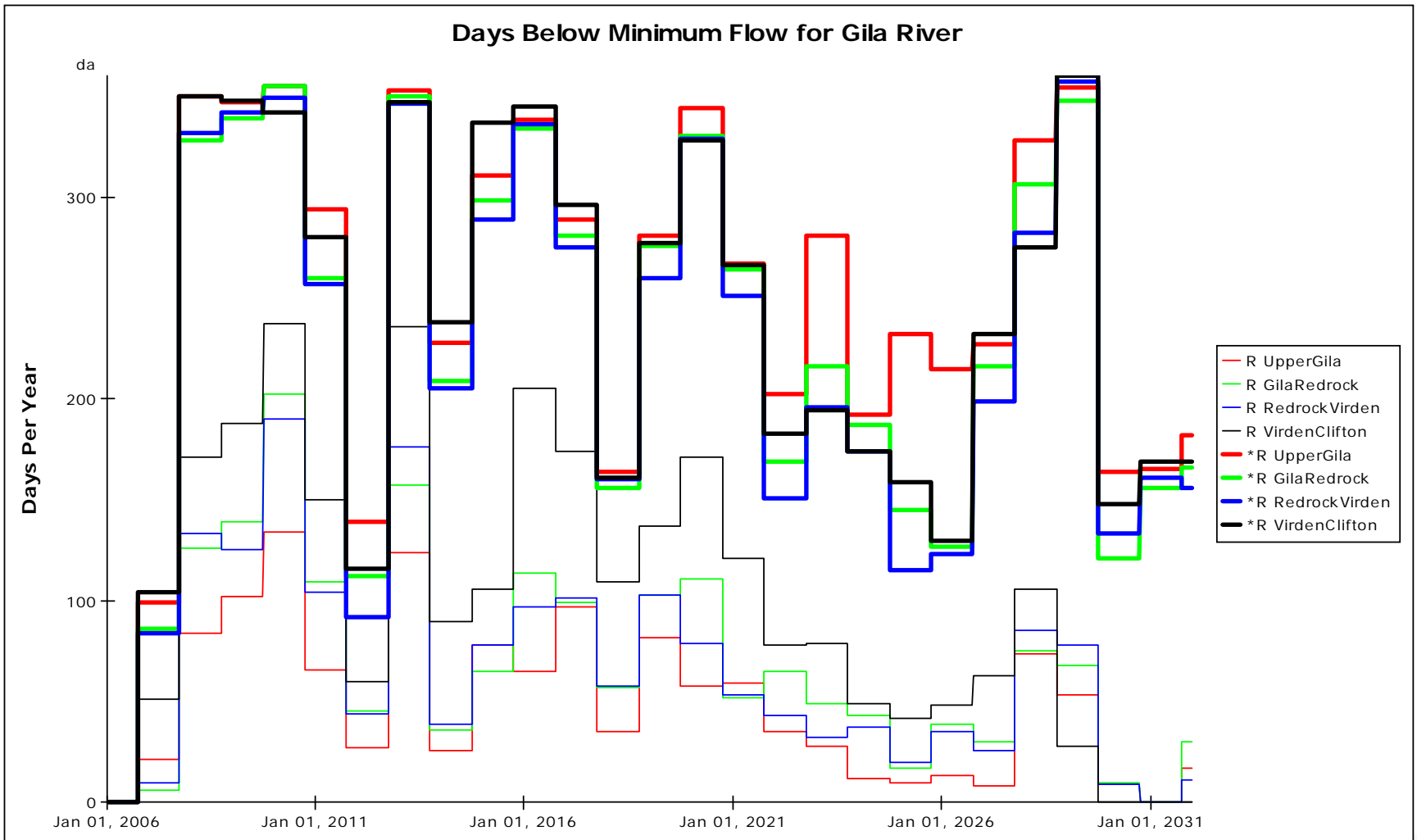
Base vs. High Use: Minimum Flows

- Difference between high and current use is approximately 11,000AF/yr, equal to unused mining rights in Gila
- Minimum Flows = 150cfs



Base Case Minimum Flows 150cfs

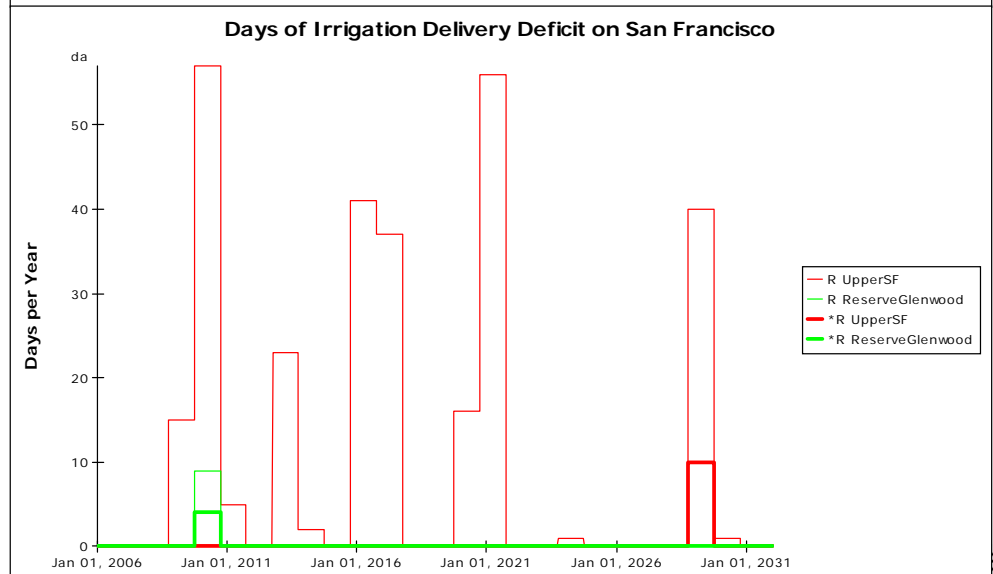
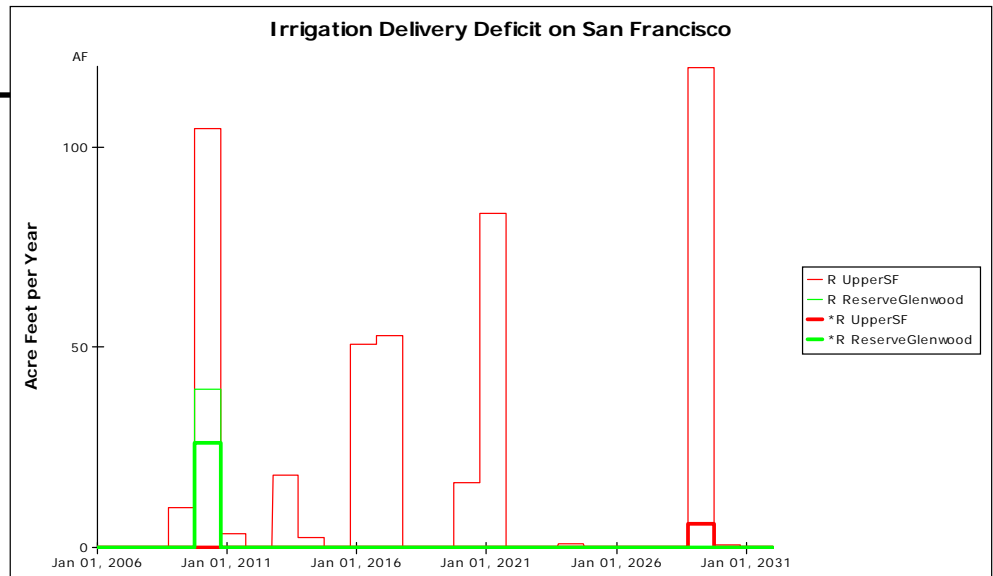
Base Case Minimum Flows 50cfs



Base vs. High Use: Agriculture

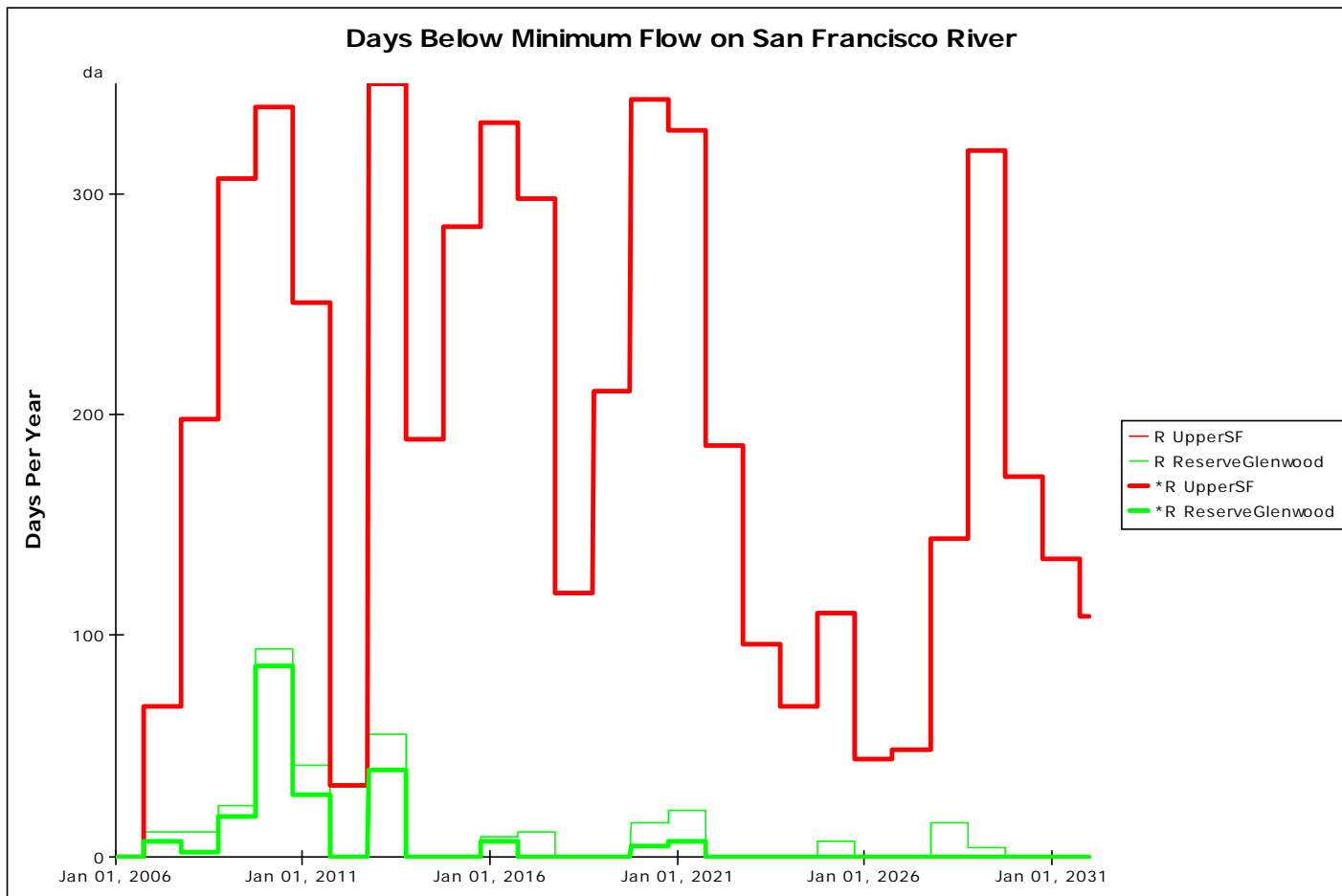
- High Use

- High growth municipal
- Utilization of full decree acreage (except Redrock-Virden)



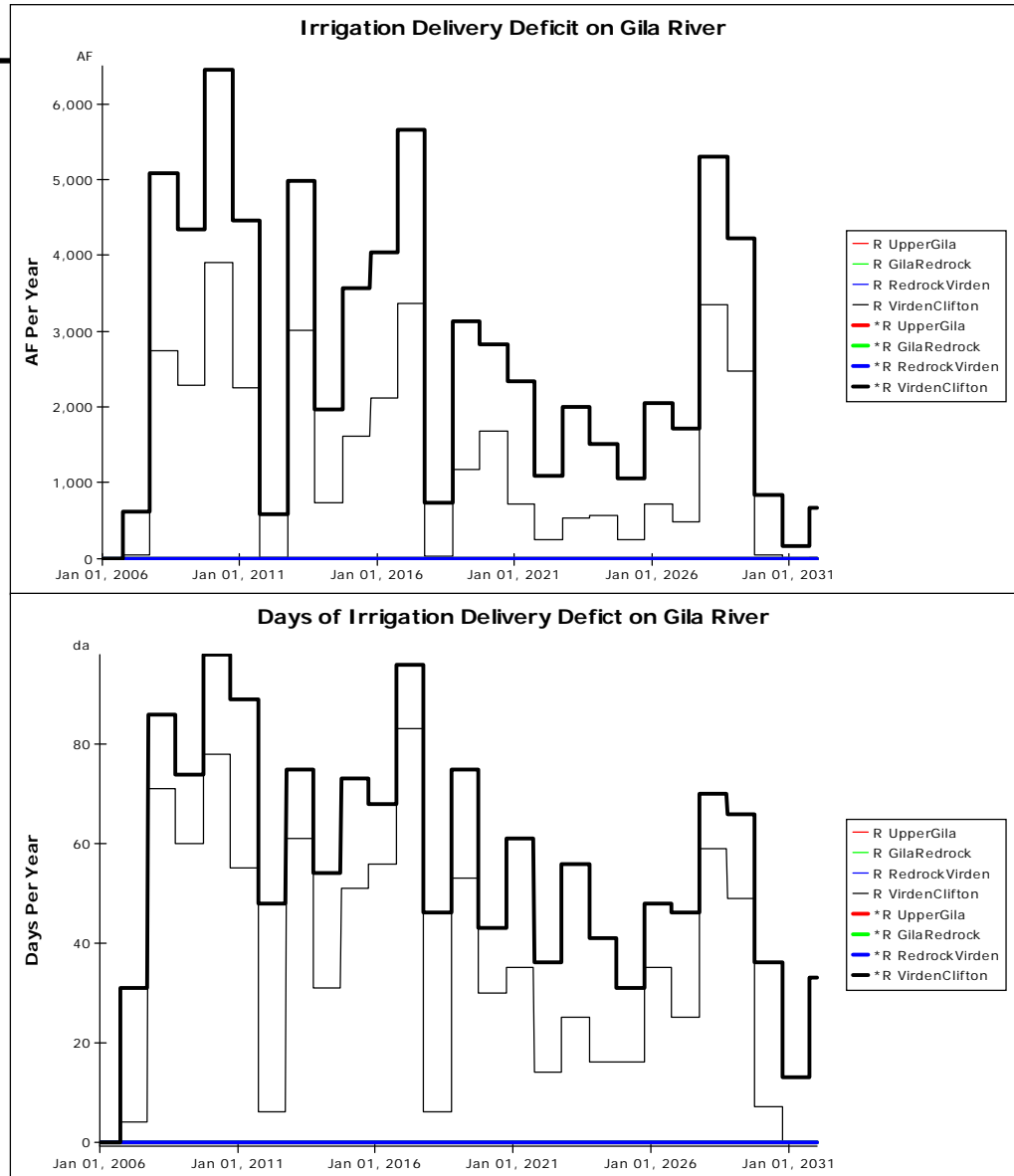
Base vs. High Use: Minimum Flows

- Difference between high and current use is approximately 11,000AF/yr, equal to unused mining rights in Gila
- Minimum Flows = 10cfs

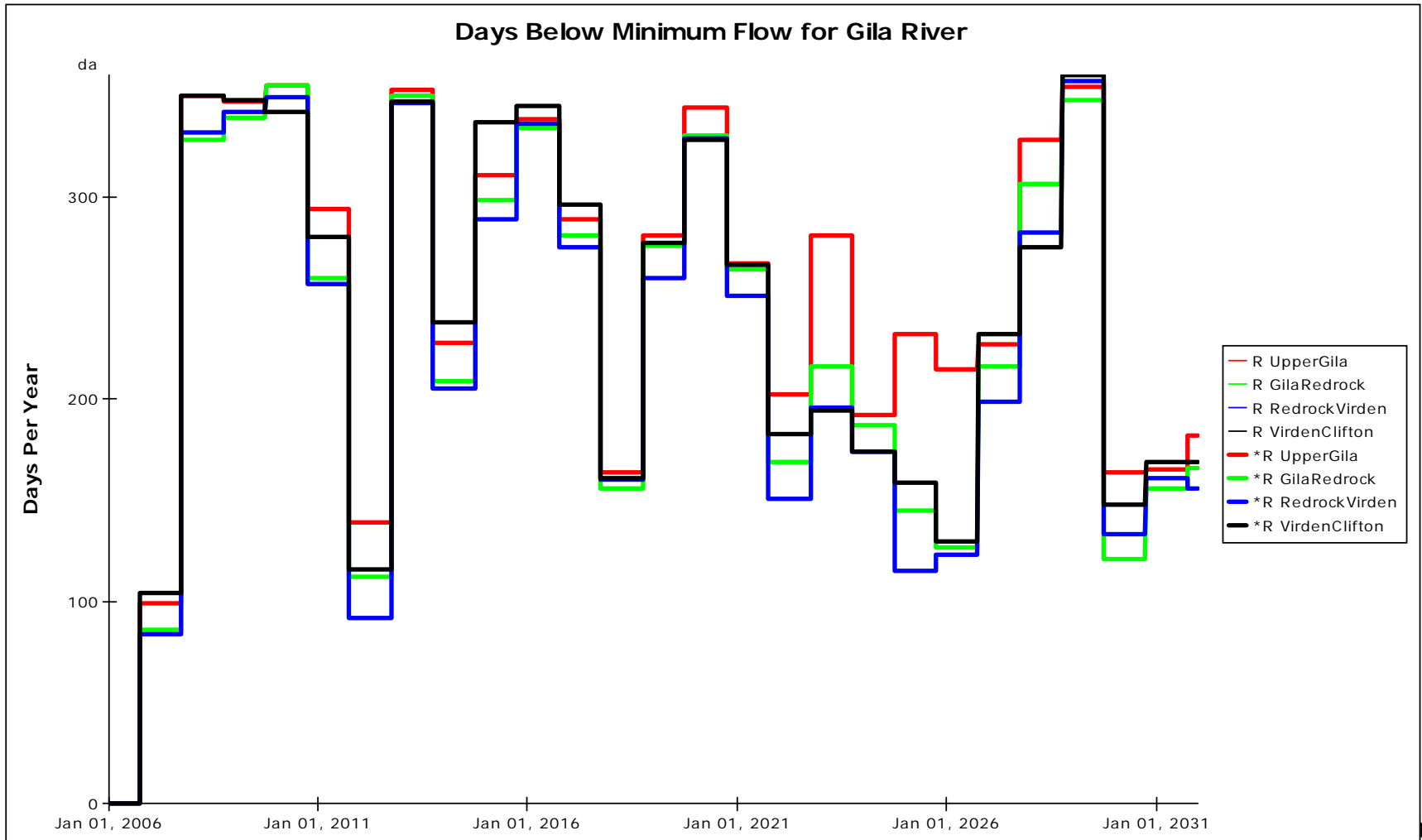


Base Case with Improved Ditch Efficiency

- Improved ditch efficiencies by 50% in Gila



Base Case with Improved Ditch Efficiency



Base Case with Improved Ditch Efficiency



HOME

**RESULTS:
Water Demand**

GSF Water
Use
Summary

**GSF
Agricultural
SW Use**

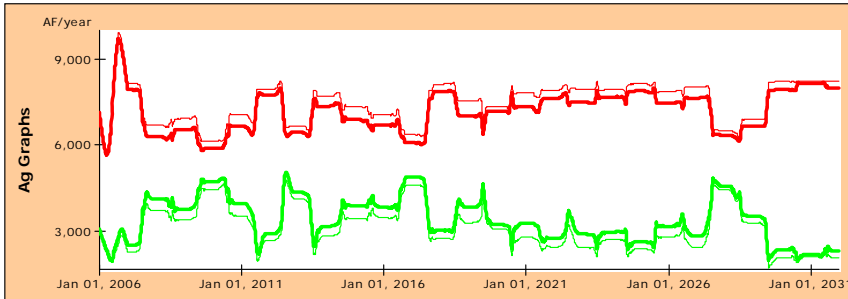
GSF GW Use

**Mimbres/
Animas GW
Use**

Executive Summary of Ag & Non-Ag Water Demand (AF/year)

Baseline Summary is the 2005-2026 summary based on default values of input parameters.

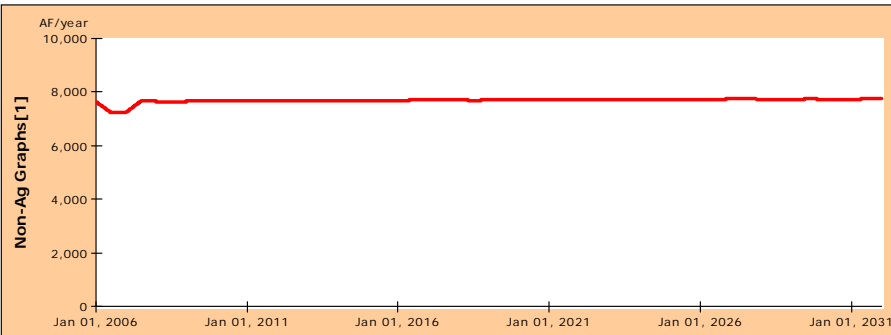
GSF SW Ag	Red
GSF GW Ag	Green
Mimbres GW	Blue



GSF SW Ag (RED)	GSF GW Ag (GREEN)	Mimbres GW (BLUE)
8,229 AF/year	2,088 AF/year	32,752 AF/year
7,981 AF/year	2,337 AF/year	32,752 AF/year

BASELINE SUMMARY

GSF Non-Ag	Red
Mimbres Non-Ag	Blue



GSF Non-Ag (RED)	Mimbres Non-Ag (BLUE)
7,739 AF/year	29,767 AF/year
7,739 AF/year	29,767 AF/year

BASELINE SUMMARY

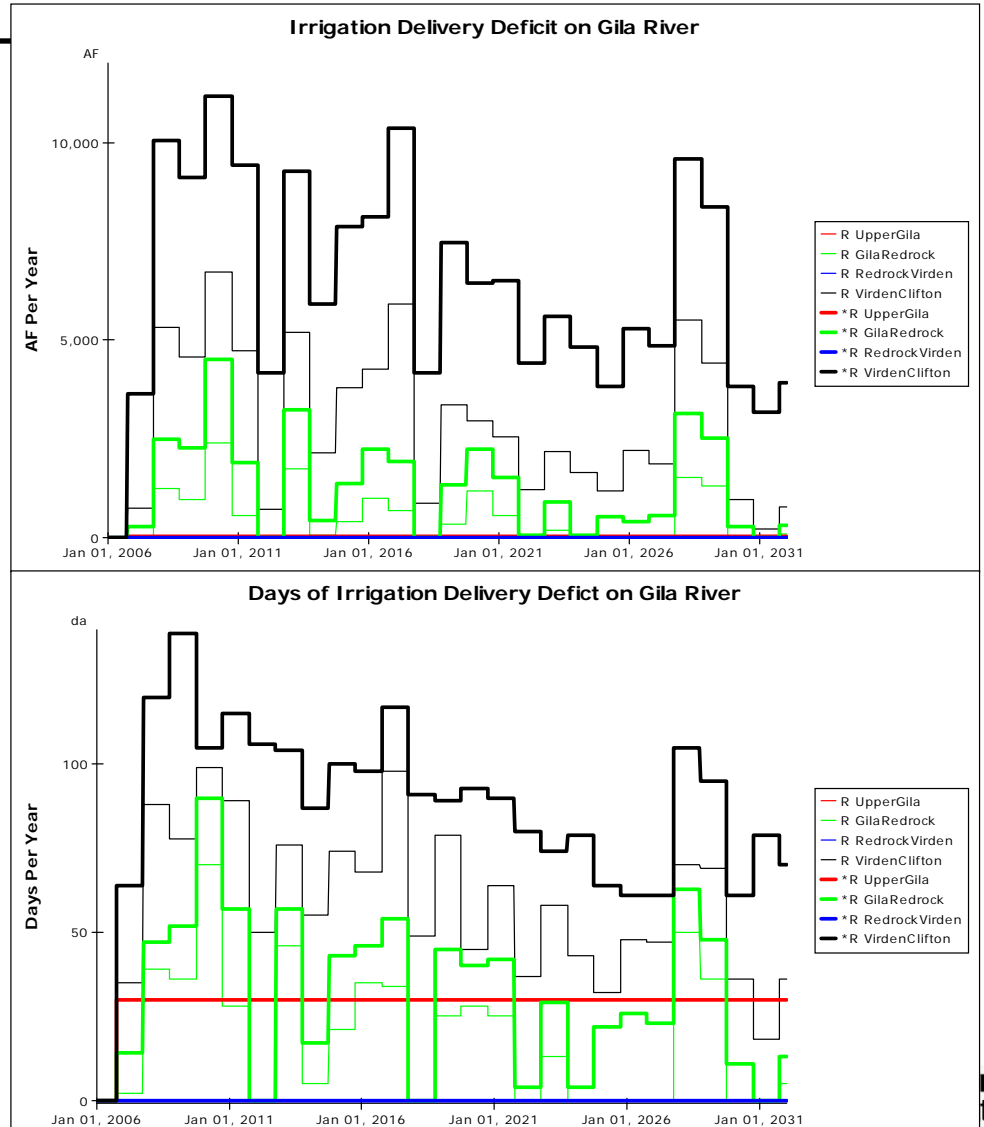
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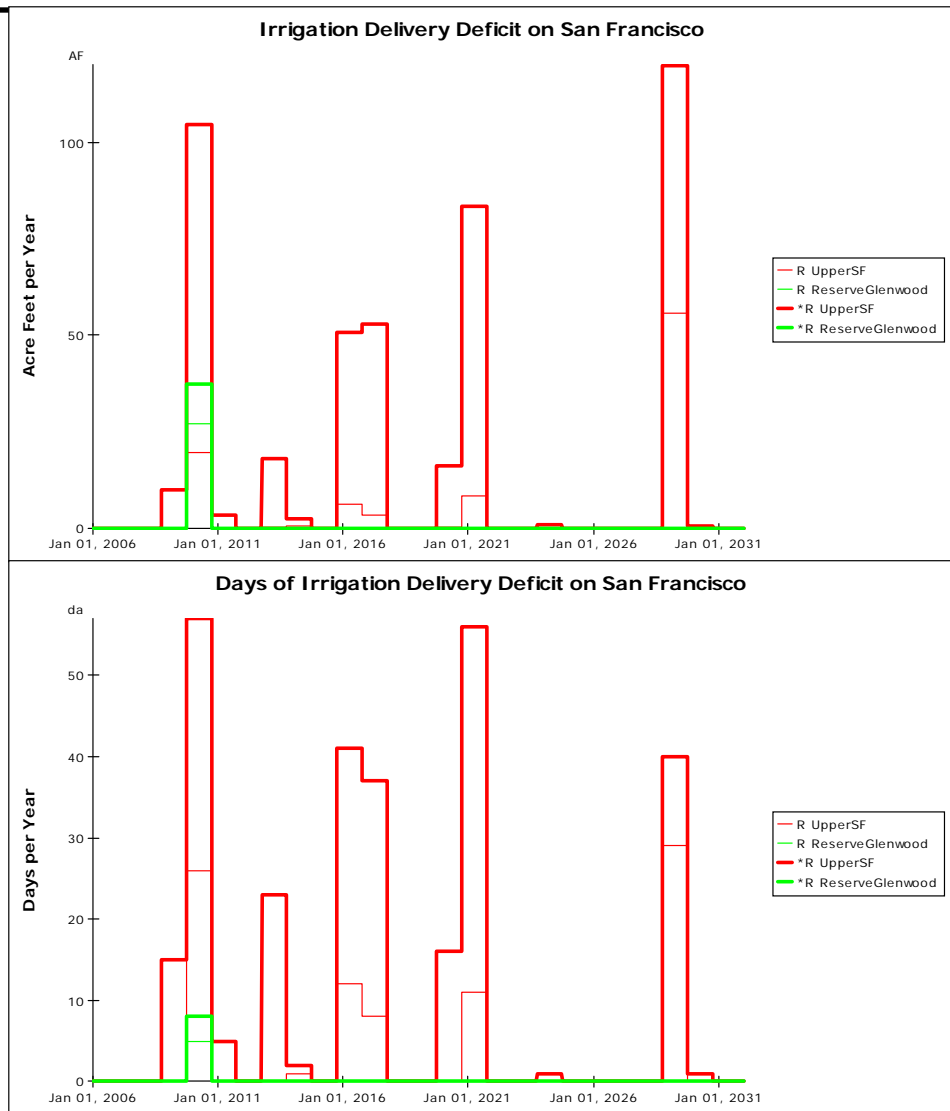
High Use Case with Improved Ditch Efficiency

- Improved ditch efficiencies by 50% in Gila



High Use Case with Improved Ditch Efficiency

- Improved ditch efficiencies by 50% in San Francisco



High Use Case with Improved Ditch Efficiency

GSF
Decision
Support
Tool

HOME

RESULTS:
Water Demand

GSF Water
Use
Summary

GSF
Agricultural
SW Use

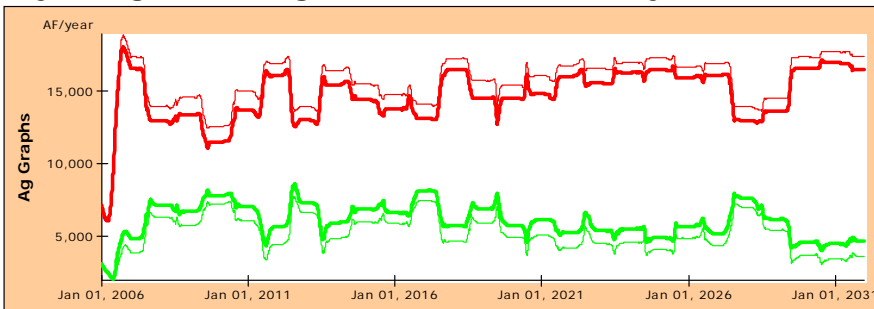
GSF GW Use

Mimbres/
Animas GW
Use

Executive Summary of Ag & Non-Ag Water Demand (AF/year)

Baseline Summary is the 2005-2026 summary based on default values of input parameters.

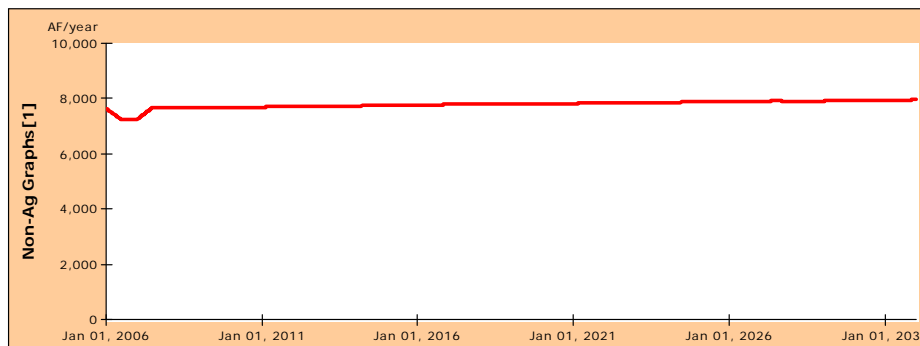
GSF SW Ag	Red
GSF GW Ag	Green
Mimbres GW	Blue



GSF SW Ag (RED)	GSF GW Ag (GREEN)	Mimbres GW (BLUE)
17,382 AF/year	3,635 AF/year	32,752 AF/year
16,514 AF/year	4,693 AF/year	32,752 AF/year

BASELINE
SUMMARY

GSF Non-Ag	Red
Mimbres Non-Ag	Blue



GSF Non-Ag (RED)	Mimbres Non-Ag (BLUE)
7,946 AF/year	30,659 AF/year
7,946 AF/year	30,659 AF/year

BASELINE
SUMMARY

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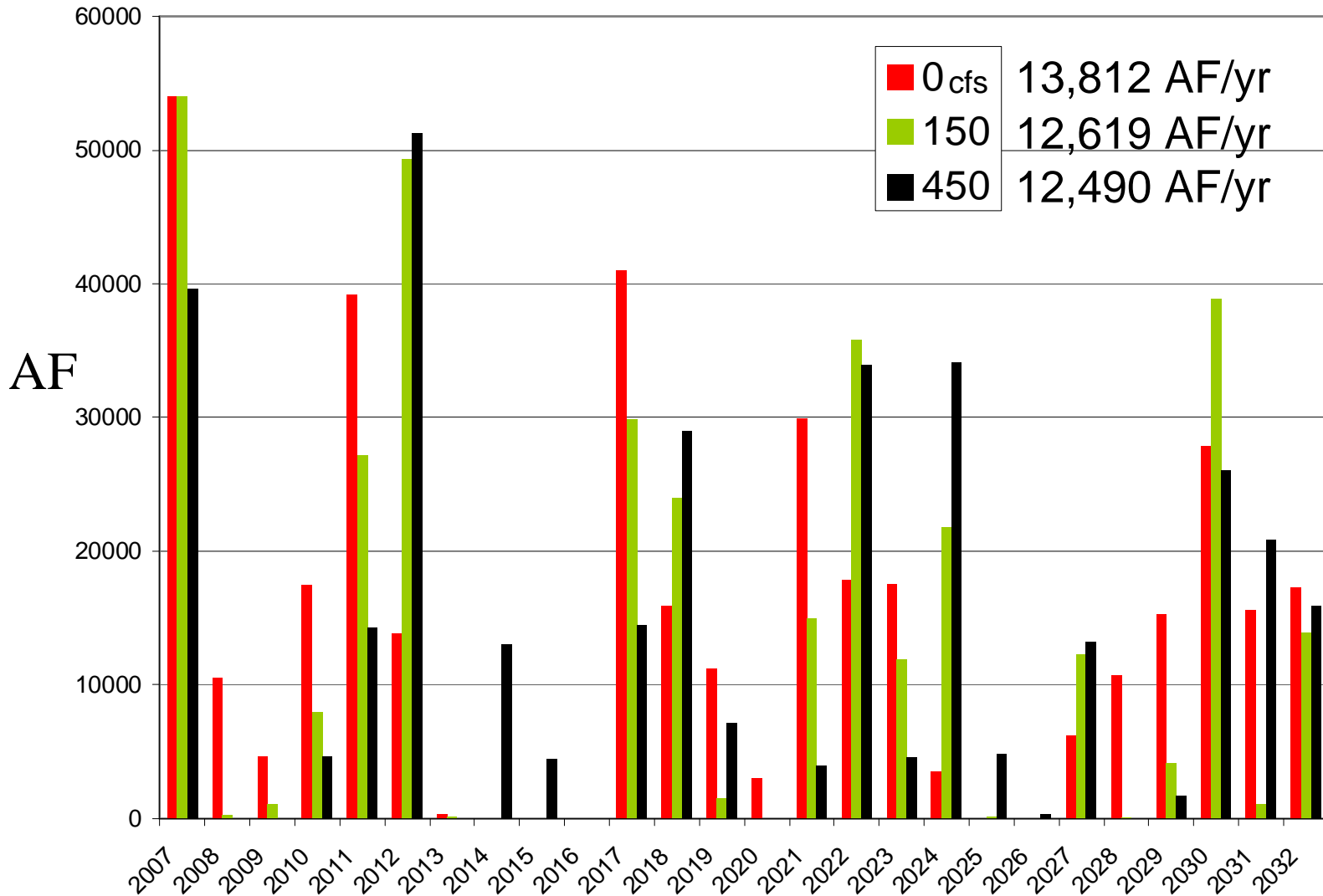




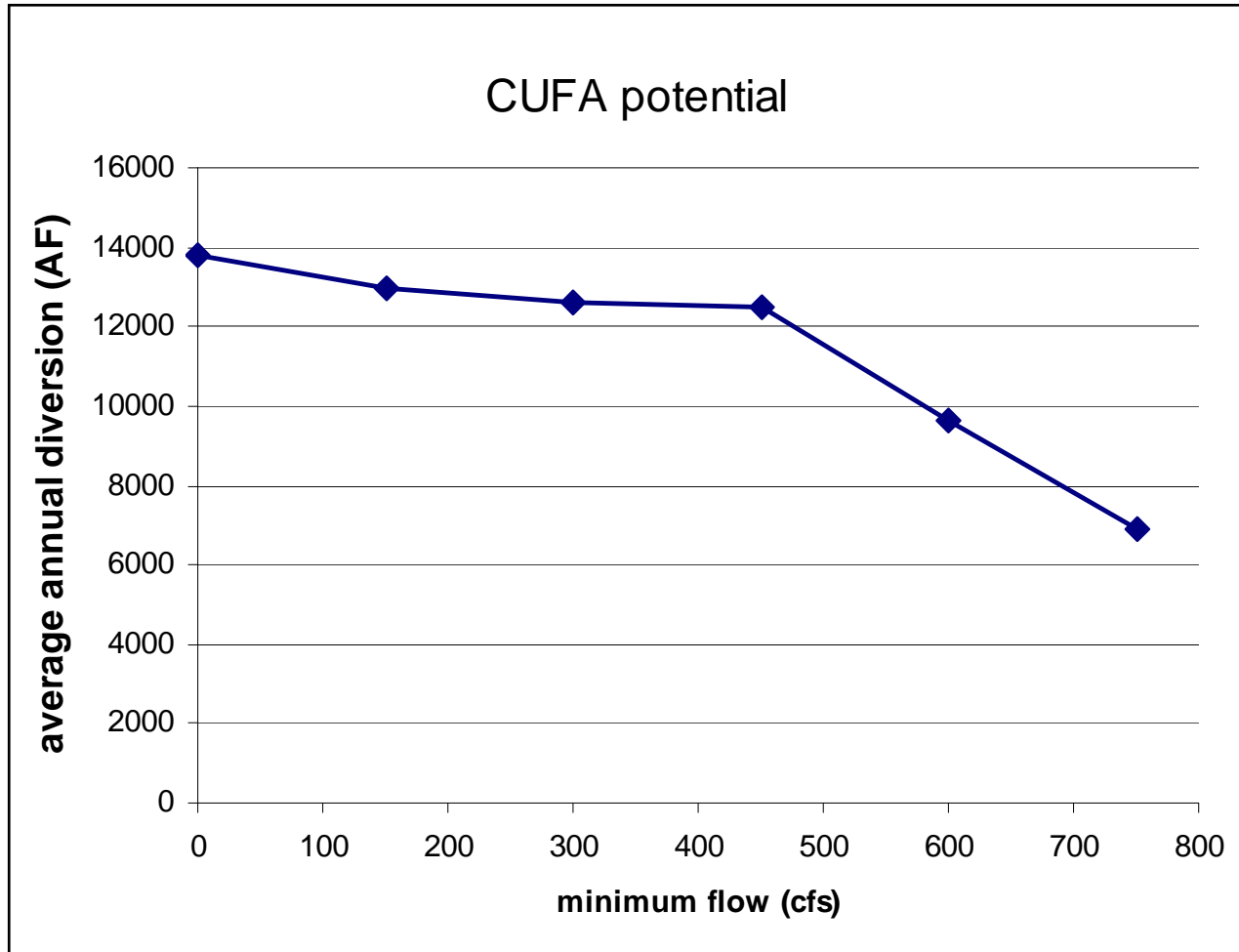
Analyses

- Agriculture
- **CUFA Diversion**
- Municipalities

CUFA Annual Diversion vs. Minimum Flow



Sensitivity of CUFA potential to Minimum Flow



CUFA Diversion Under High Use Conditions

Ag Demand is Currently

OFF
 ON

HOME

**RESULTS:
NM CUFA
Diversion**

Potential CUFA
Diversion

Test Summary

Water Bank

View Hydrographs
with CUFA diversion

Total Diversion

Gila Diversion

San Francisco
Diversion

Graphics

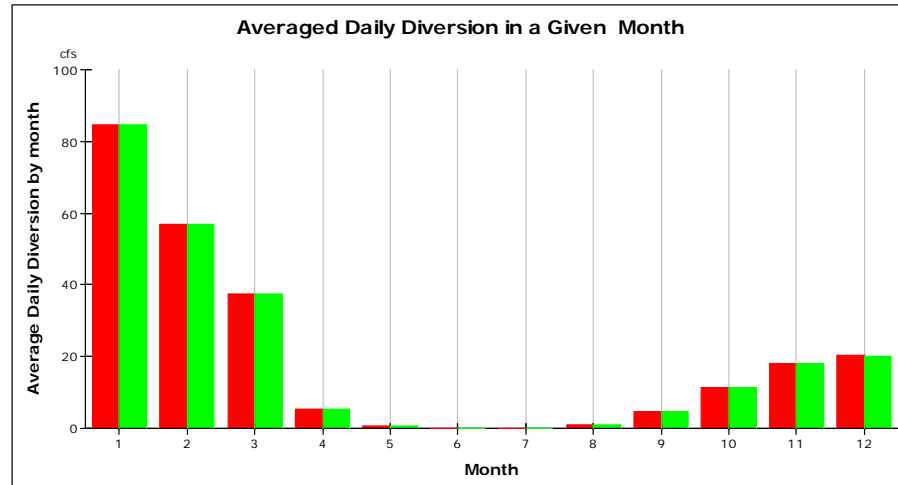
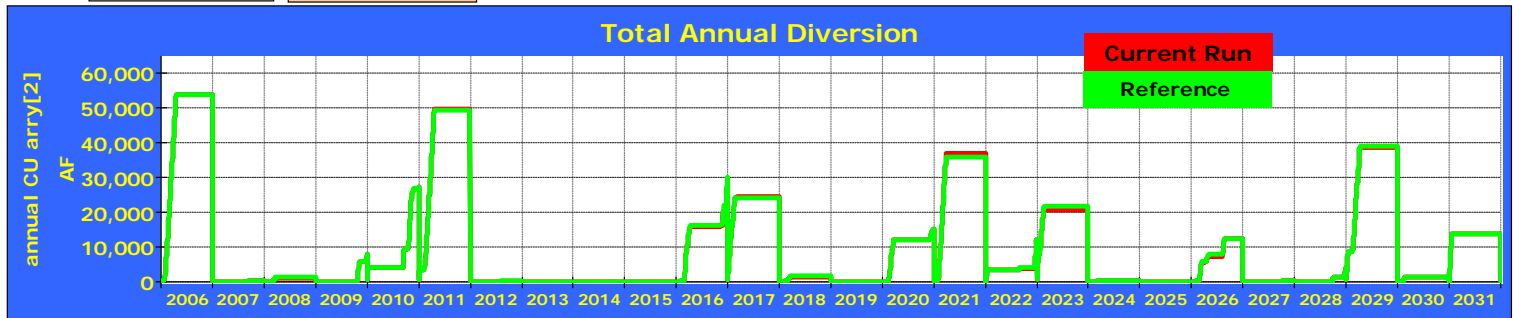
View Daily Table

CUFA Model

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Average Annual Total Diversion

With Minimum Flow	No Minimum Flow
12,937 AF	13,681 AF

Detailed Annual Diversion by Reach if Qmin Considered vs. No Minimum Flow (AF)

Time	With Min Flow	No Min Flow
Jan 01, 2026	0 AF	0 AF
Jan 01, 2027	6,274 AF	6,274 AF
Jan 01, 2028	10,716 AF	10,716 AF
Jan 01, 2029	15,228 AF	15,228 AF
Jan 01, 2030	27,926 AF	27,926 AF
Jan 01, 2031	15,586 AF	15,586 AF
Jan 01, 2032	17,306 AF	17,306 AF

CUFA Diversion Under Base Conditions: Gila and SF Diversions

Ag Demand is Currently

OFF
 ON

CUFA Model

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Total Diversion

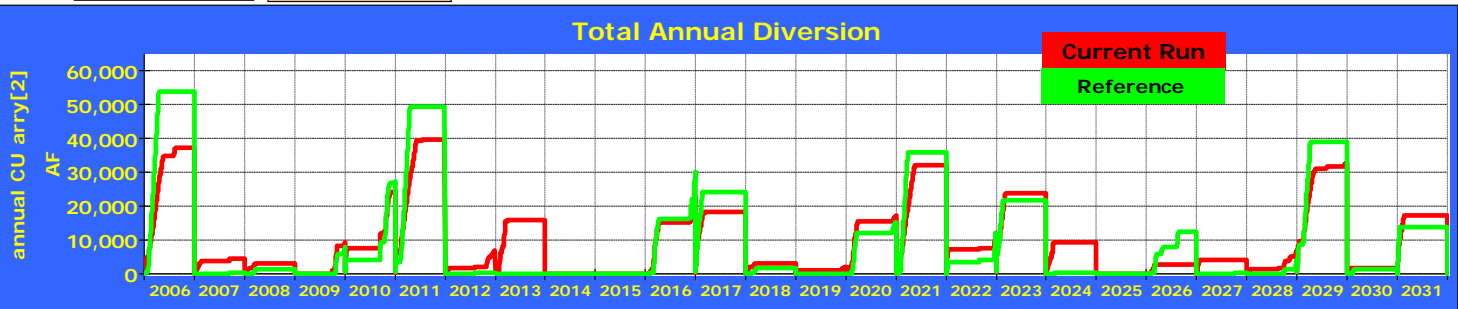
Gila Diversion

San Francisco Diversion

Graphics

View Daily Table

Total Annual Diversion



Current Run
Reference

HOME

RESULTS:
NM CUFA
Diversion

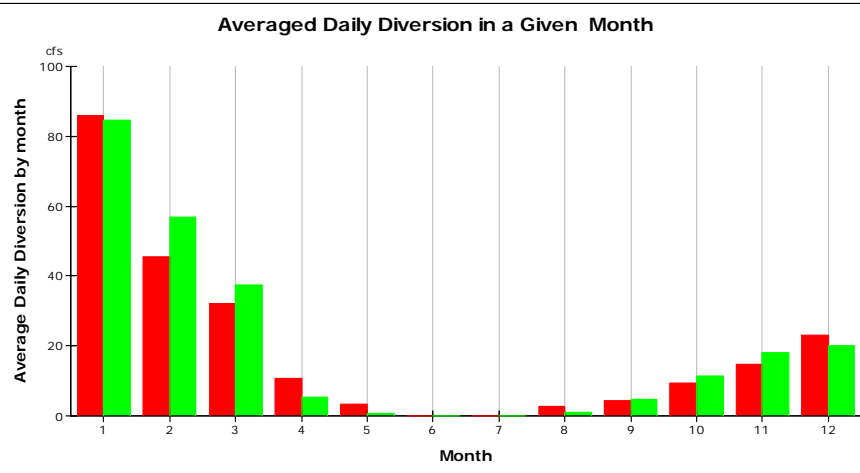
Potential CUFA
Diversion

Test Summary

Water Bank

View Hydrographs
with CUFA diversion

Averaged Daily Diversion in a Given Month



Average Annual Total Diversion

With Minimum Flow	No Minimum Flow
12,594 AF	13,199 AF

Detailed Annual Diversion by Reach if Qmin Considered vs. No Minimum Flow (AF)

Time	With Min Flow	No Min Flow
Jan 01, 2026	0 AF	0 AF
Jan 01, 2027	2,860 AF	2,844 AF
Jan 01, 2028	10,008 AF	10,008 AF
Jan 01, 2029	12,915 AF	12,915 AF
Jan 01, 2030	30,883 AF	30,883 AF
Jan 01, 2031	6,544 AF	6,544 AF
Jan 01, 2032	17,306 AF	17,306 AF

CUFA Diversion Under Base Conditions: Max Yearly 24K

Ag Demand is Currently

- OFF
- ON

HOME

RESULTS:
NM CUFA
Diversion

Potential CUFA
Diversion

Test Summary

Water Bank

View Hydrographs
with CUFA diversion

Total Diversion

Gila Diversion

San Francisco
Diversion

Graphics

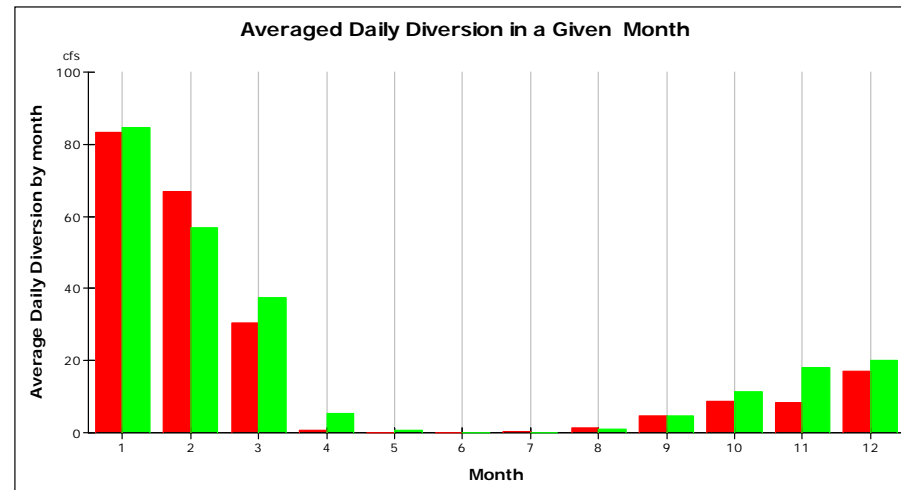
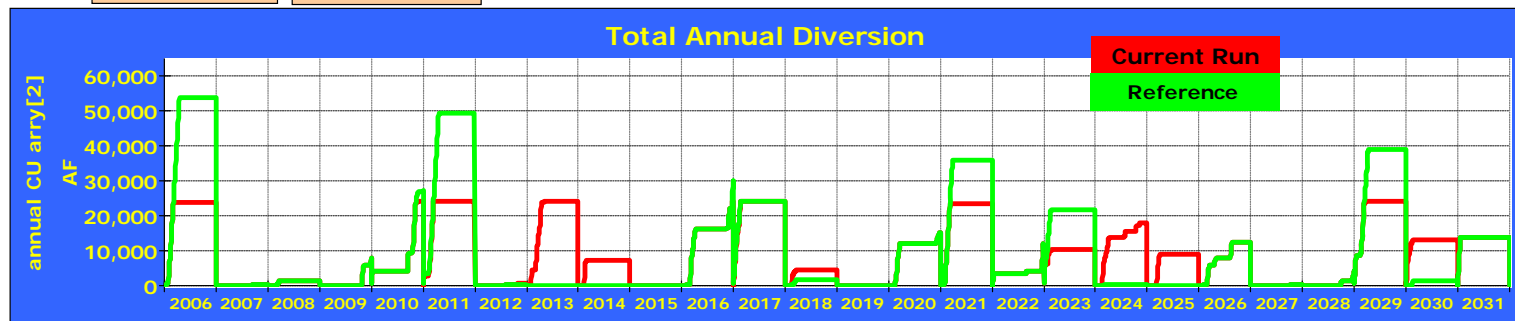
View Daily Table

CUFA Model

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Average Annual Total Diversion

With Minimum Flow	No Minimum Flow
11,781 AF	12,522 AF

Detailed Annual Diversion by Reach if Qmin Considered vs. No Minimum Flow (AF)

Time	With Min Flow	No Min Flow
Jan 01, 2013	11,204 AF	11,204 AF
Jan 01, 2014	23,916 AF	23,916 AF
Jan 01, 2015	7,145 AF	7,145 AF
Jan 01, 2016	0 AF	0 AF
Jan 01, 2017	23,797 AF	23,797 AF
Jan 01, 2018	3,255 AF	3,255 AF
Jan 01, 2019	10,993 AF	10,993 AF
Jan 01, 2020	3,032 AF	3,032 AF

CUFA Diversion Under Base Conditions: Max Yearly 24K Gila/SF Diversions

Ag Demand is Currently

OFF
 ON

HOME

**RESULTS:
NM CUFA
Diversion**

Potential CUFA
Diversion

Test Summary

Water Bank

View Hydrographs
with CUFA diversion

Total Diversion

Gila Diversion

San Francisco
Diversion

Graphics

View Daily Table

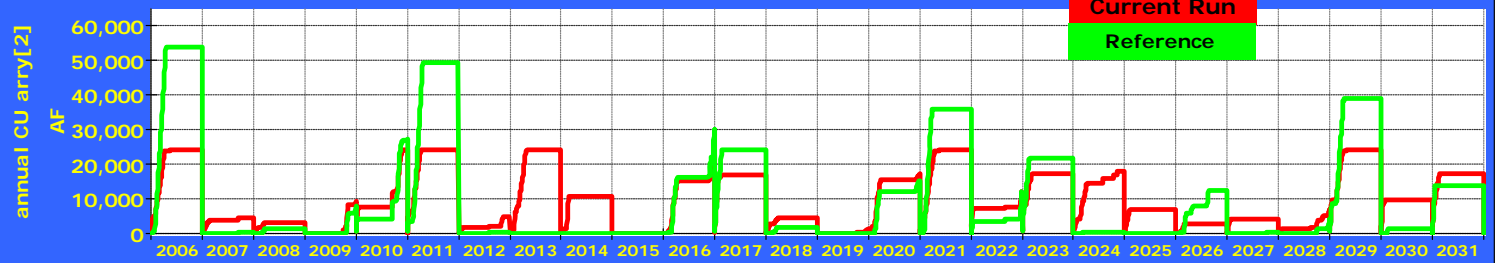
CUFA Model

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Version:

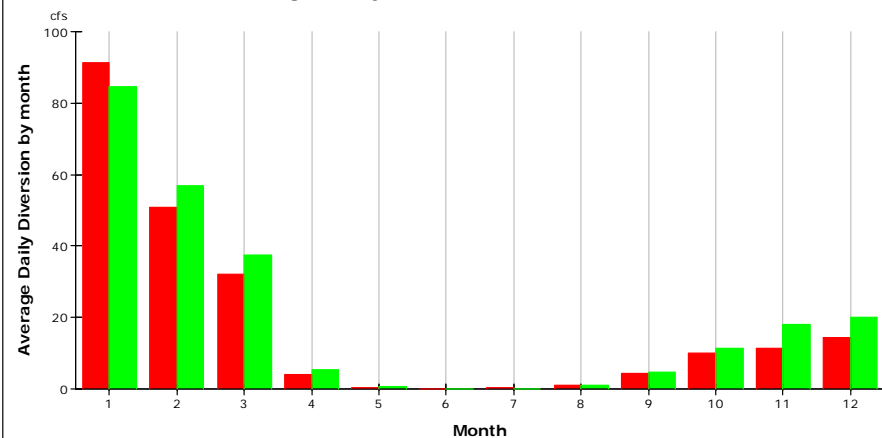
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Total Annual Diversion



Averaged Daily Diversion in a Given Month



Average Annual Total Diversion

With Minimum Flow	No Minimum Flow
12,083 AF	12,471 AF

Detailed Annual Diversion by Reach if Qmin Considered vs. No Minimum Flow (AF)

Time	With Min Flow	No Min Flow
Jan 01, 2026	4,671 AF	4,671 AF
Jan 01, 2027	2,860 AF	2,844 AF
Jan 01, 2028	10,008 AF	10,008 AF
Jan 01, 2029	12,915 AF	12,915 AF
Jan 01, 2030	12,314 AF	12,314 AF
Jan 01, 2031	6,248 AF	6,248 AF
Jan 01, 2032	17,341 AF	17,341 AF



Analyses

- Agriculture
- CUFA Water Rights
- **Municipalities**



Municipality

- Pumping from Gila Basin to Silver City can potentially increase from ~1,000 AF to ~3,000 AF.

County	City	Total Water Rights	Population Served	Meter Connections	System Production (ac-ft)
Catron	Reserve	177	468	303	100
Grant	Silver City	4,604	13,376	6,685	2,874
Grant	Santa Clara	515	1,944	714	229
Grant	Bayard	467	2,536	945	336
Hidalgo	Viriden	26	146	42	---
Grant	Hurley	---	2,075	736	---
Luna	Deming	4,444	16,418	5,249	4,075

source: 2005 DBSA regional water planning report