

***Technical Evaluation of the
Bottom-Up Program for
Springflow Protection***

***Changes in Spring Discharge and
Associated Groundwater and
Surface Water Supplies***

***Edwards Aquifer
Recovery Implementation Program
Funding Work Group***

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Objectives

- 1) Summarize expected changes in discharge from Comal and San Marcos Springs due to implementation of the Bottom-Up Program.**
- 2) Quantify expected changes in groundwater supplies available from the Edwards Aquifer during severe drought.**
- 3) Quantify expected changes in surface water supplies available in the Guadalupe – San Antonio River Basin and Guadalupe Estuary for human and environmental uses during severe drought.**

Topics of Discussion

- 1) Fundamental assumptions for long-term groundwater and surface water simulations under Baseline (without Bottom-Up Program) and Bottom-Up Program conditions.**
- 2) Comparisons of flows at selected locations.**
- 3) Comparisons of groundwater and surface water supplies.**

Fundamental Assumptions

- 1) Edwards aquifer model = MODFLOW**
- 2) Edwards permitted pumping at ~572 kacft/yr plus ~13 kacft/yr domestic & livestock plus ~ 7 kacft/yr federal exempt use**
- 3) Edwards critical period management (CPM) per SB3**
- 4) Surface water model = Guadalupe-San Antonio River Basin Water Availability Model (GSA WAM)**
- 5) Full authorized use of surface water rights with treated effluent as reported for 2006 accounting for contracted direct reuse**

Fundamental Assumptions (cont'd)

5) Simulation Periods:

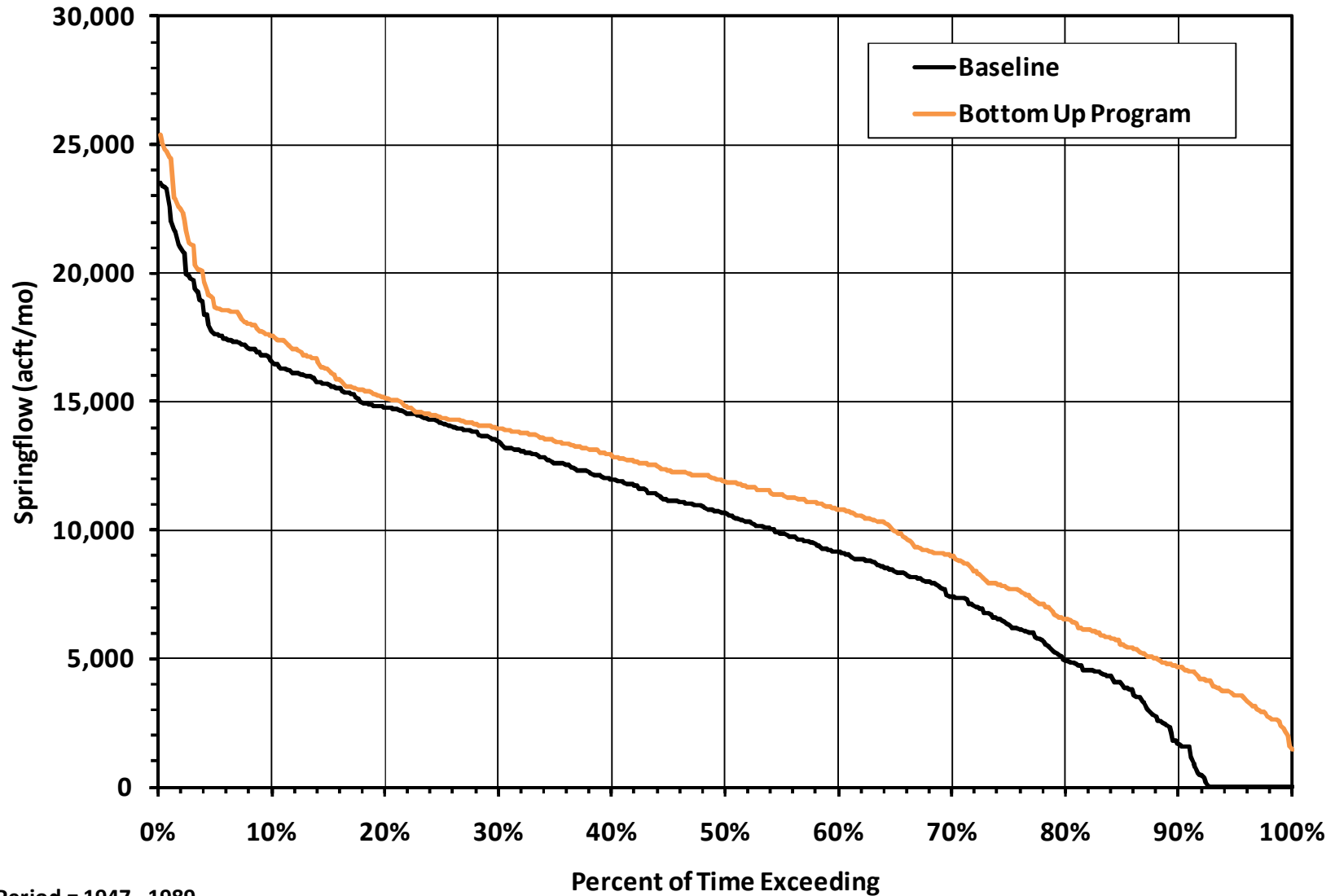
- a) MODFLOW = 1947 – 2000**
- b) GSAWAM = 1934 – 1989**
- c) Graphics in this package = 1947 – 1989**

6) Water supplies available to support power plant cooling reservoir operations (Braunig, Calaveras, & Coleta Creek) are reported as determined by TCEQ configuration of the GSA WAM and not in accordance with customary operations.

Comal Springs

5,000 acft/mo = ~83 cfs

Comal Springflow

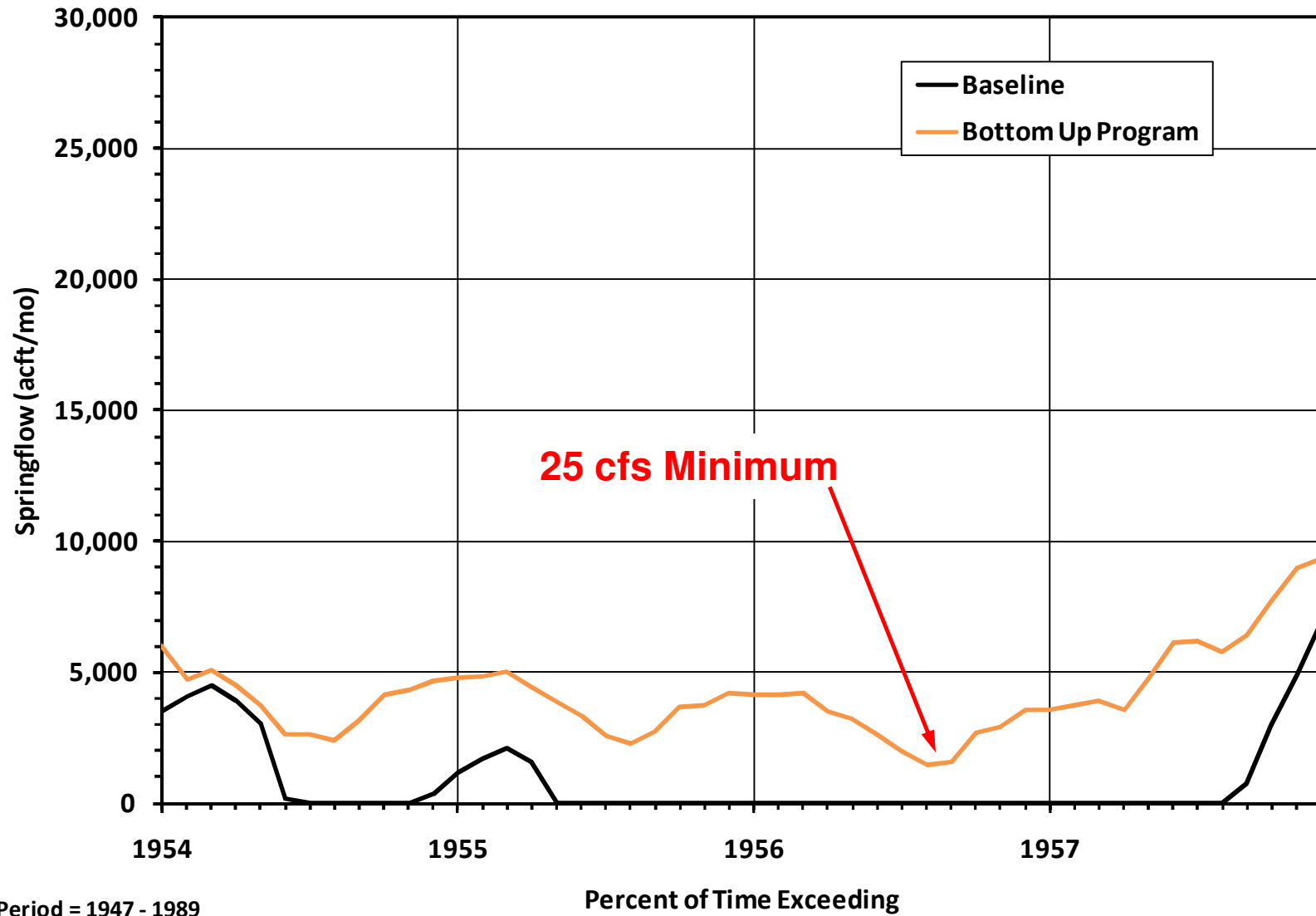


Period = 1947 - 1989

Comal Springs

5,000 acft/mo = ~83 cfs

Comal Springflow

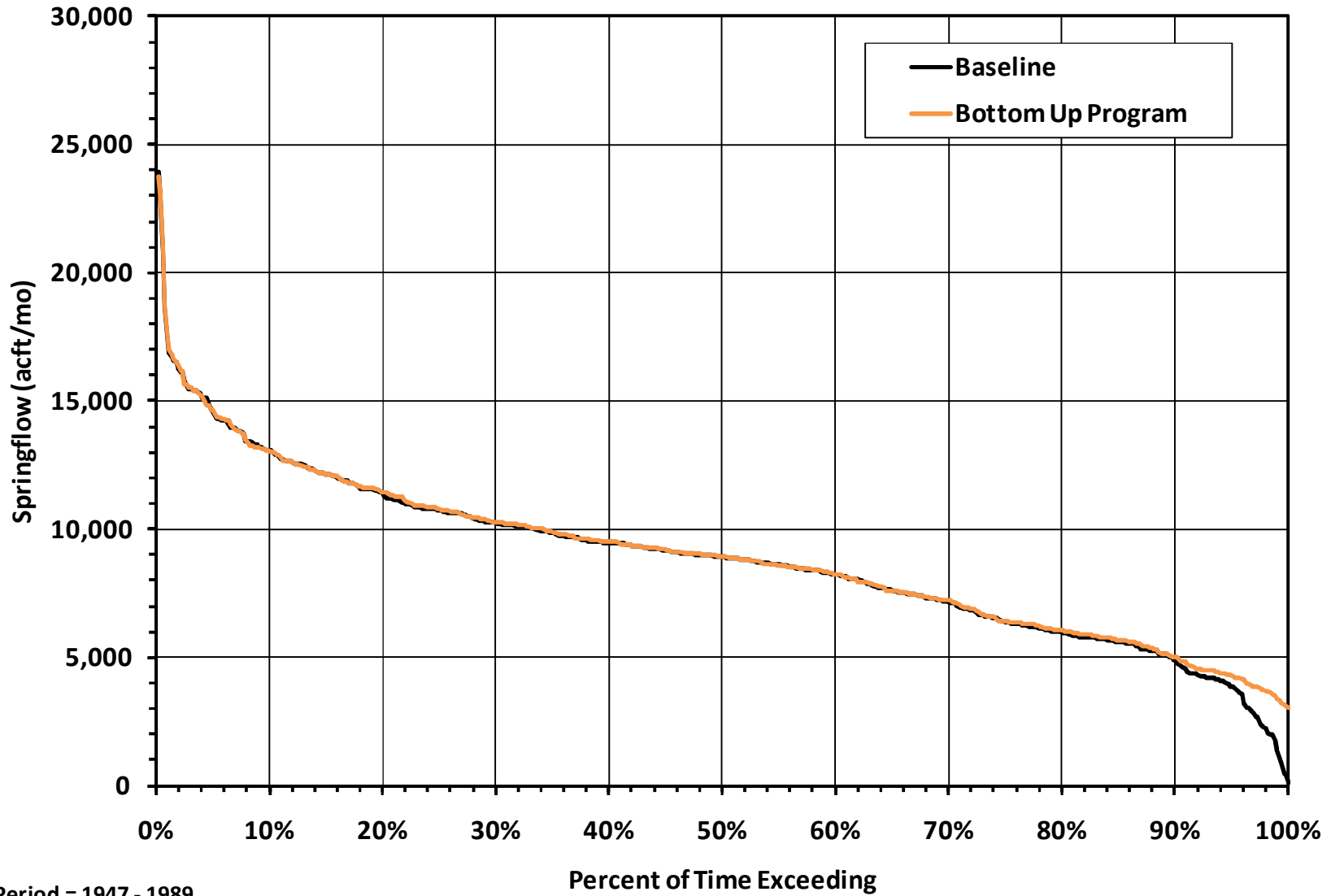


Period = 1947 - 1989

San Marcos Springs

5,000 acft/mo = ~83 cfs

San Marcos Springflow

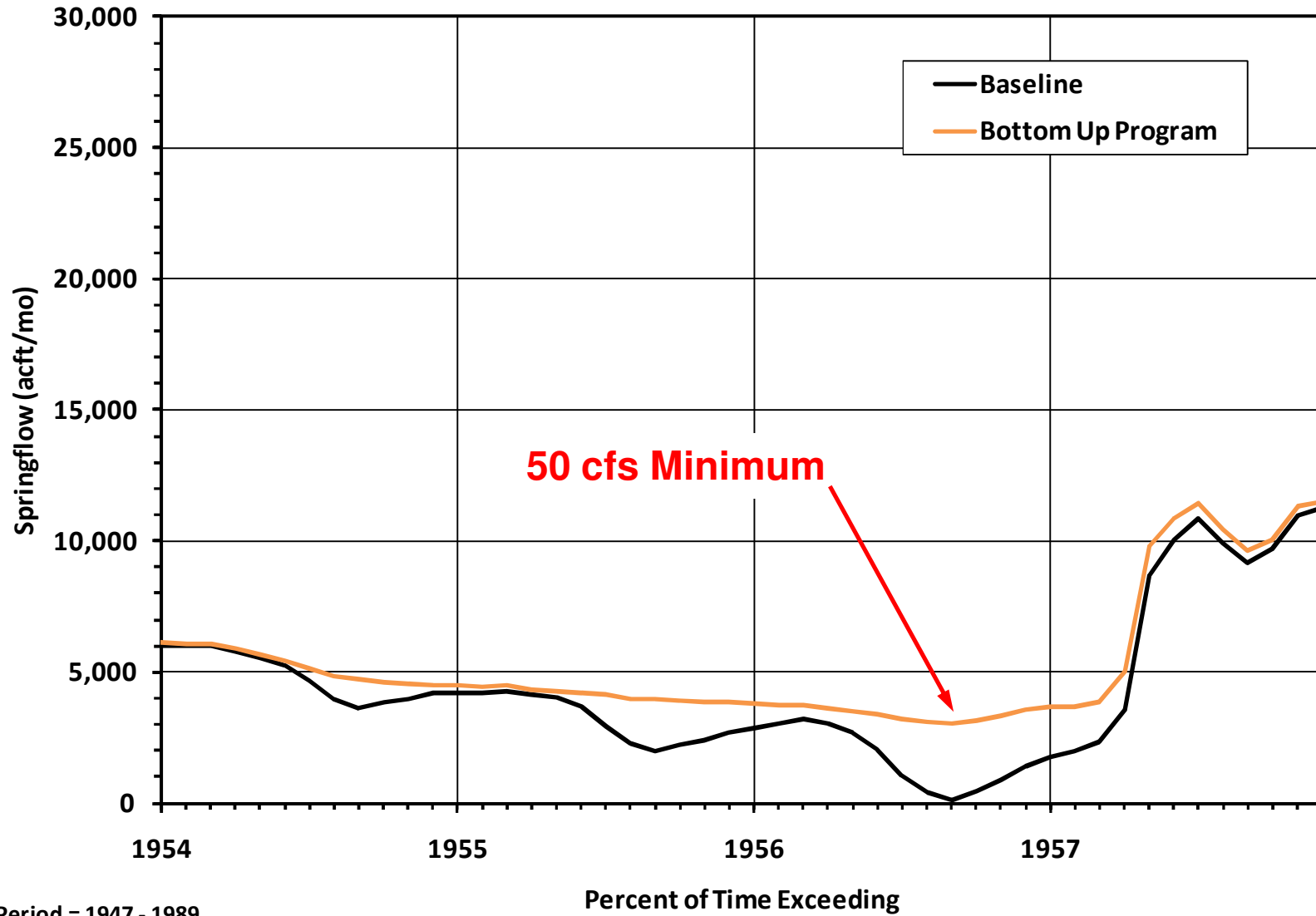


Period = 1947 - 1989

San Marcos Springs

5,000 acft/mo = ~83 cfs

San Marcos Springflow

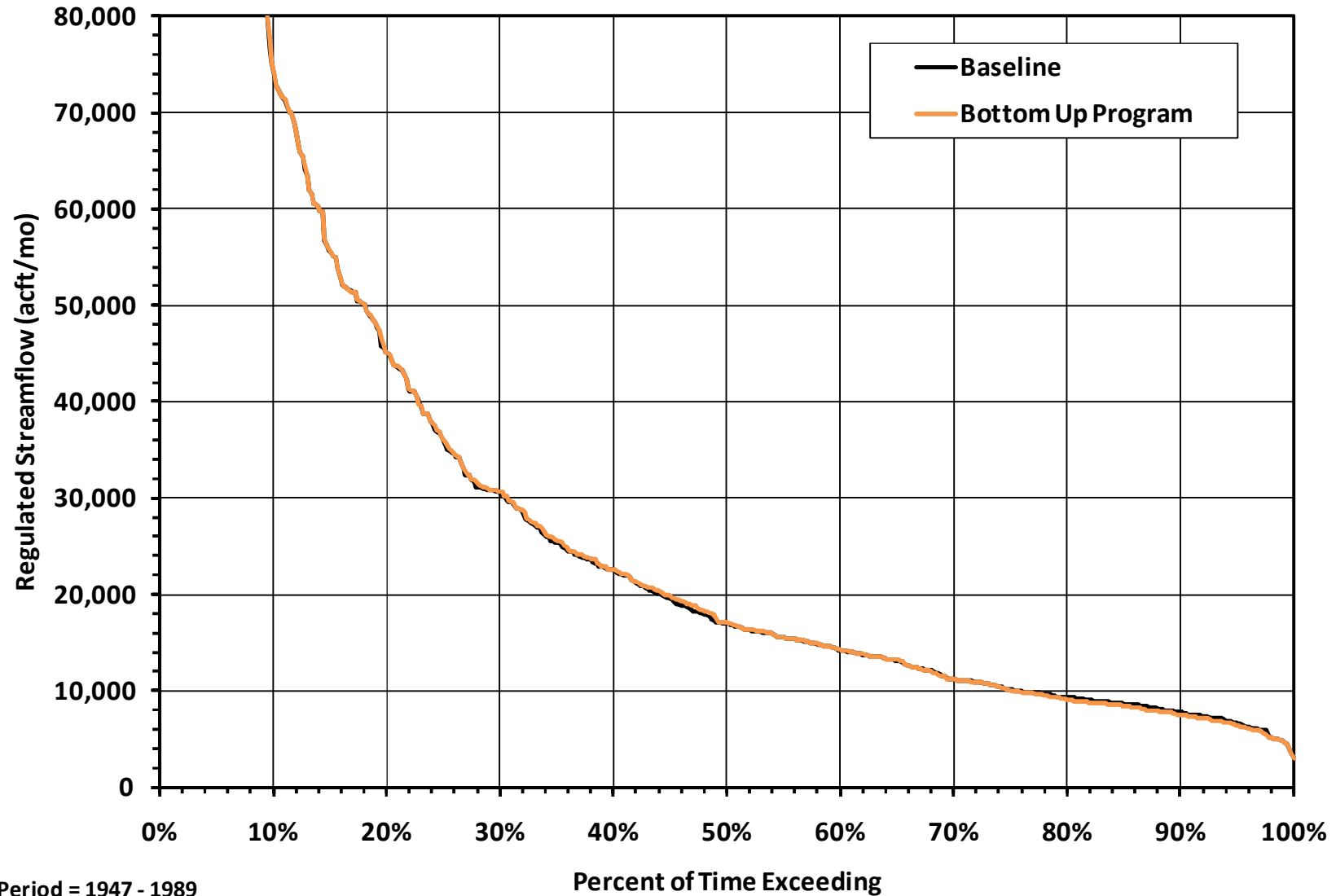


Period = 1947 - 1989

San Antonio River at Goliad

5,000 acft/mo = ~83 cfs

San Antonio River at Goliad

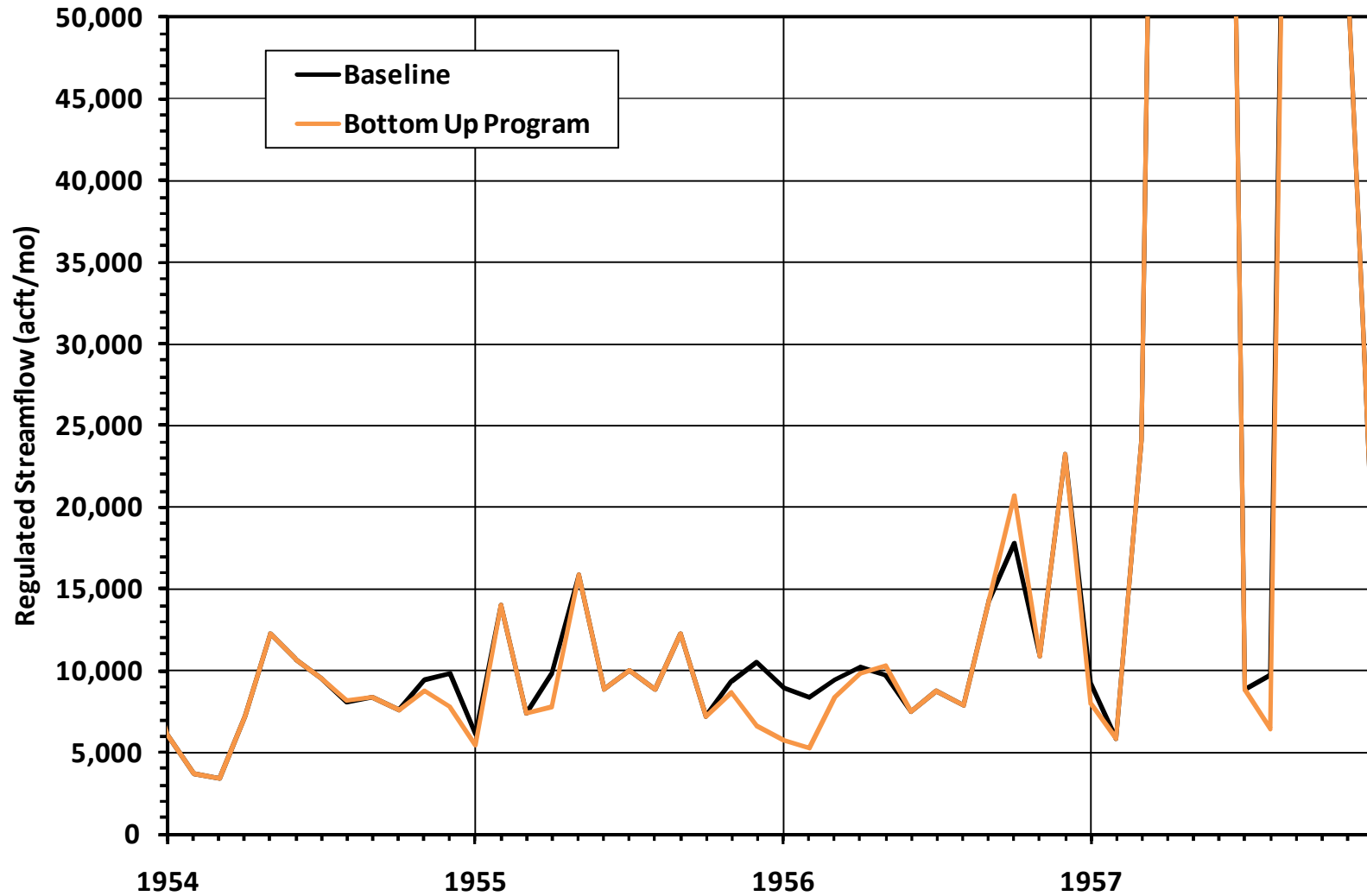


Period = 1947 - 1989

San Antonio River at Goliad

5,000 acft/mo = ~83 cfs

San Antonio River at Goliad



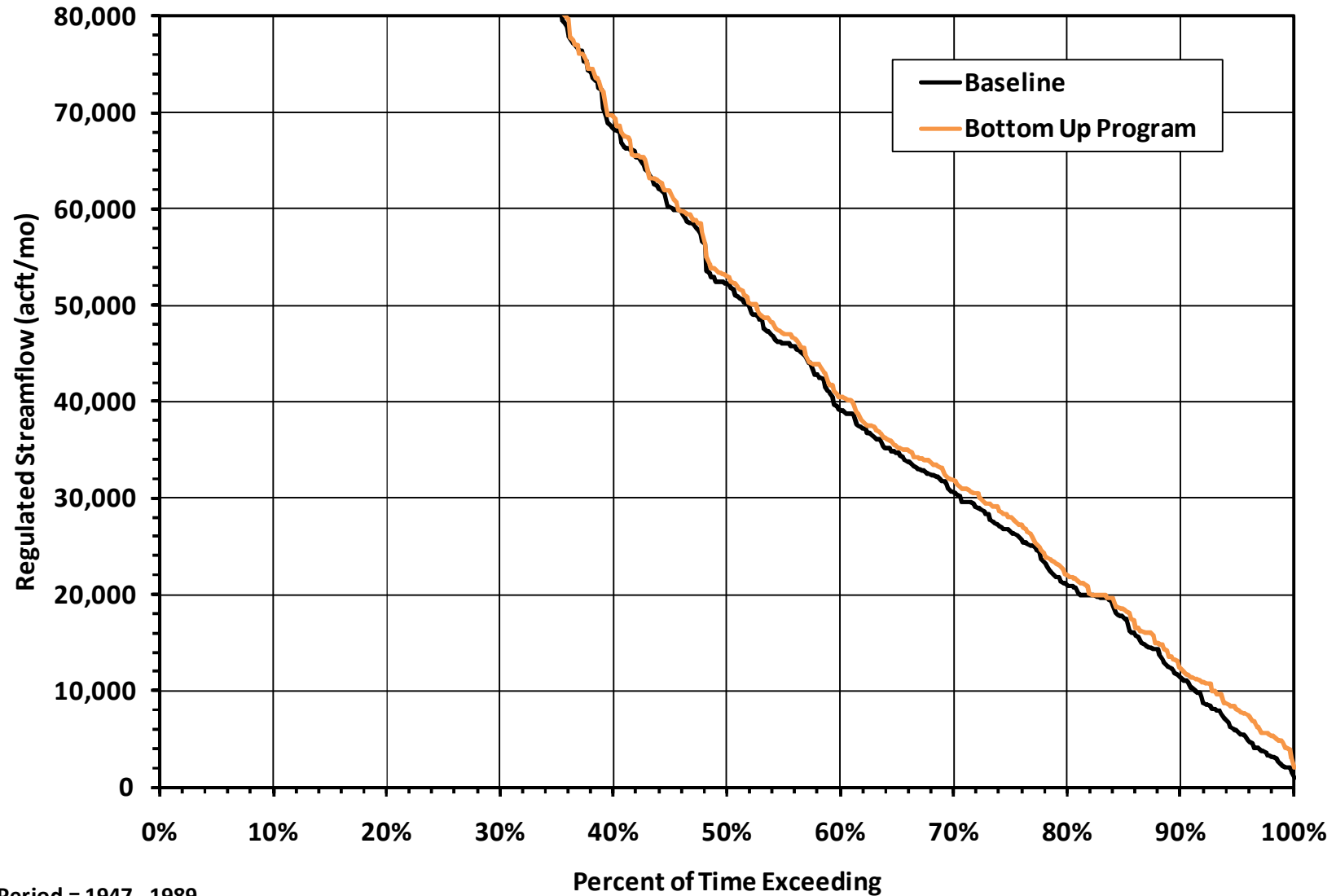
Period = 1947 - 1989

Percent of Time Exceeding

Guadalupe River at Victoria

5,000 acft/mo = ~83 cfs

Guadalupe River at Victoria

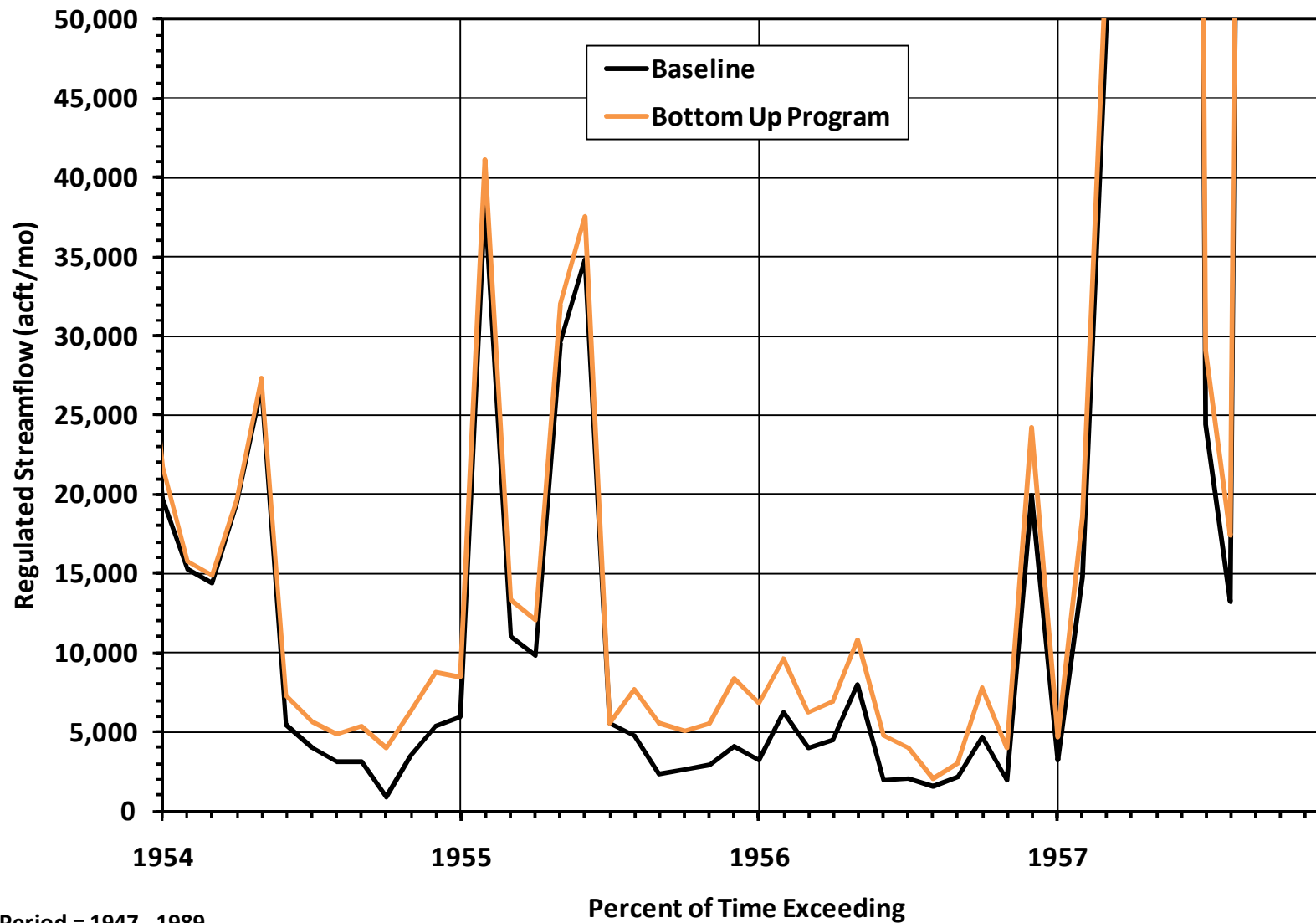


Period = 1947 - 1989

Guadalupe River at Victoria

5,000 acft/mo = ~83 cfs

Guadalupe River at Victoria

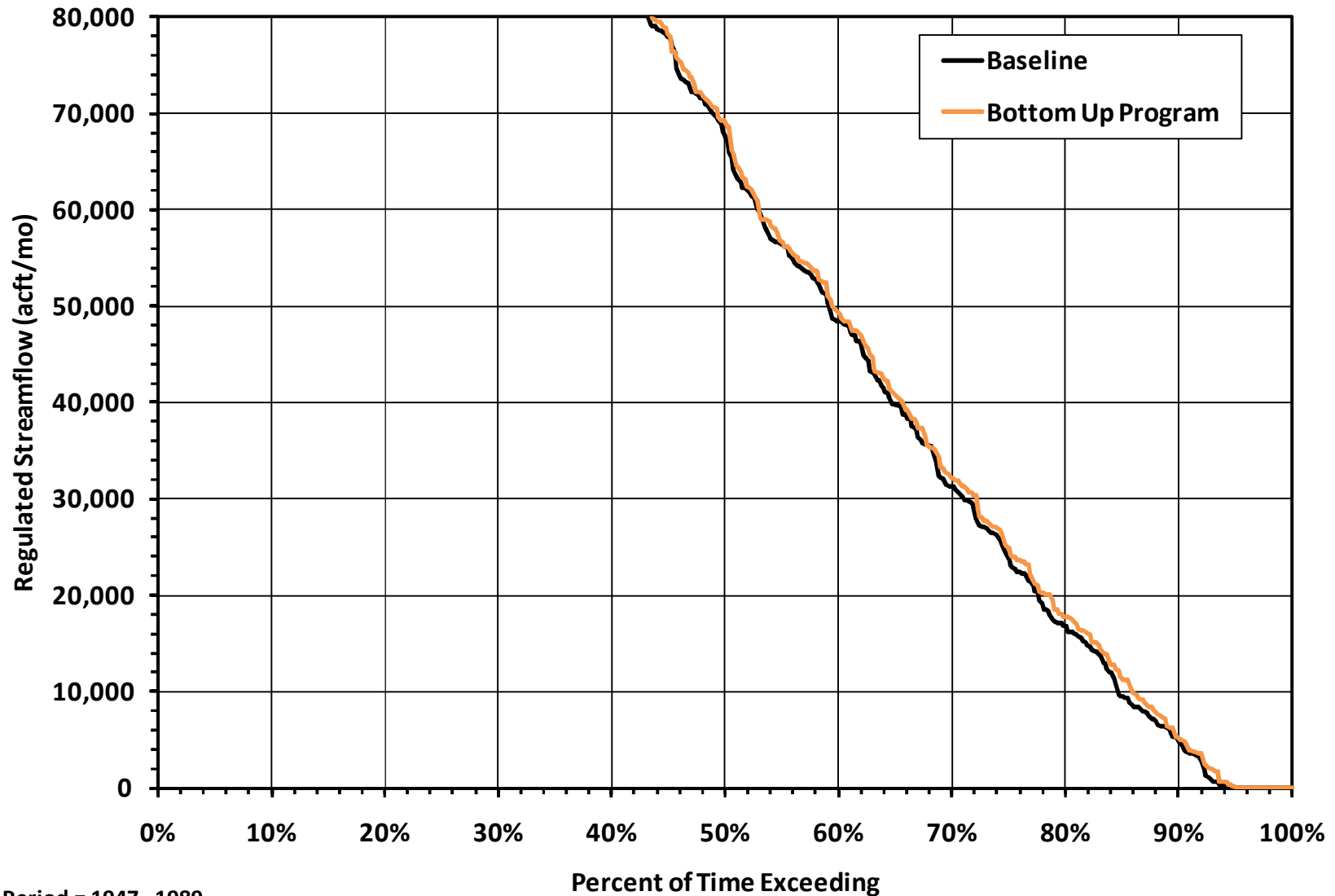


Period = 1947 - 1989

Freshwater Inflow to the Guadalupe Estuary

5,000 acft/mo = ~83 cfs

Freshwater Inflow into Guadalupe Estuary

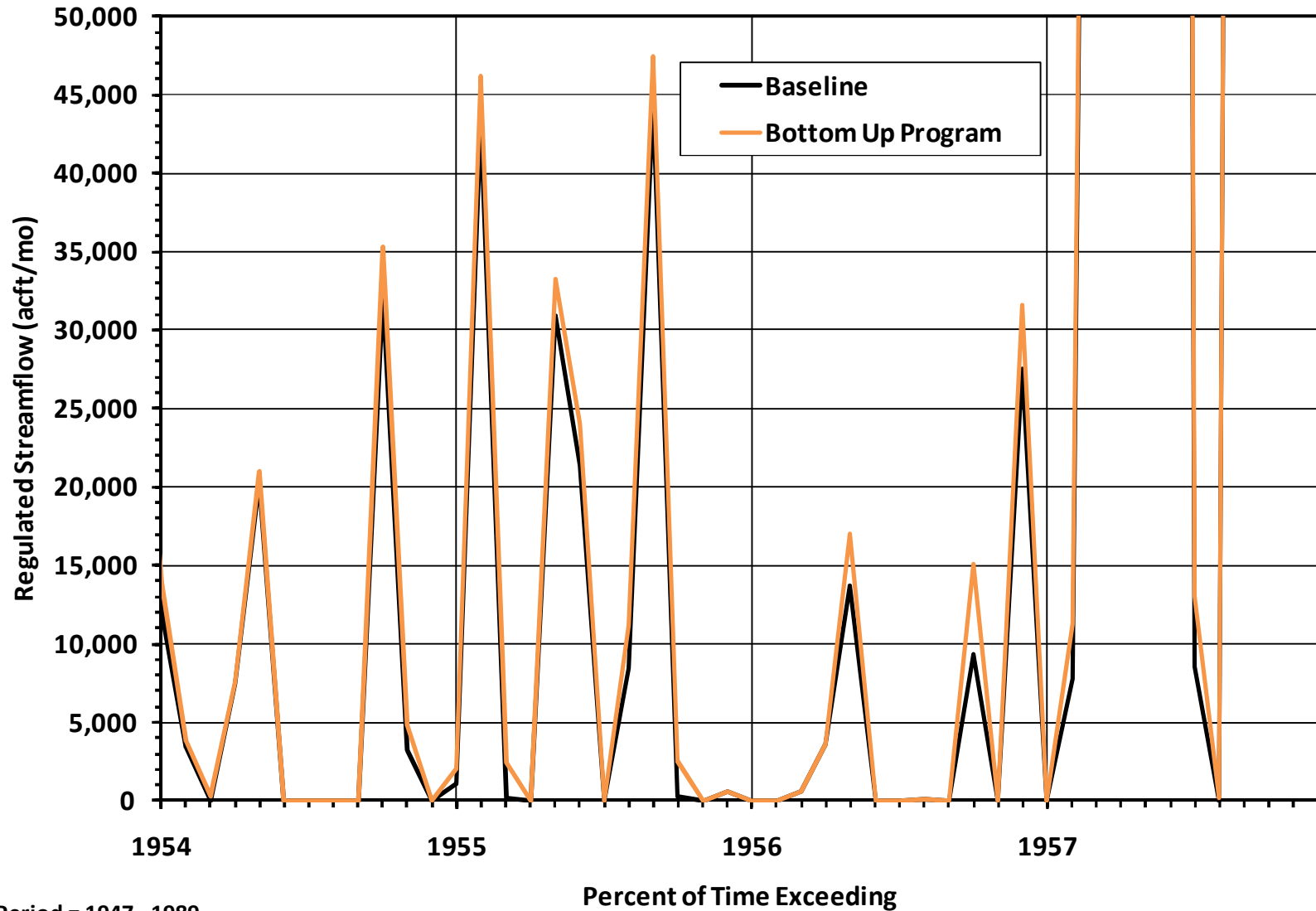


Period = 1947 - 1989

Freshwater Inflow to the Guadalupe Estuary

5,000 acft/mo = ~83 cfs

Freshwater Inflow into Guadalupe Estuary



Period = 1947 - 1989

Benefits of Bottom Up Program

Water Rights Holder Benefits by Category (Based on Minimum Year)

| | Municipal (acft/yr) | Industrial / Steam-Electric (acft/yr) | Irrigation (acft/yr) | Other (acft/yr) | Hydroelectric (acft/yr) |
|-------------------------|---------------------|---------------------------------------|----------------------|-----------------|-------------------------|
| Surface Water Supplies | +2,677 | +15,608 | +3,142 | +105 | Varies * |
| Groundwater Supplies ** | +45,828 | +6,047 | +23,125 | N/A | N/A |

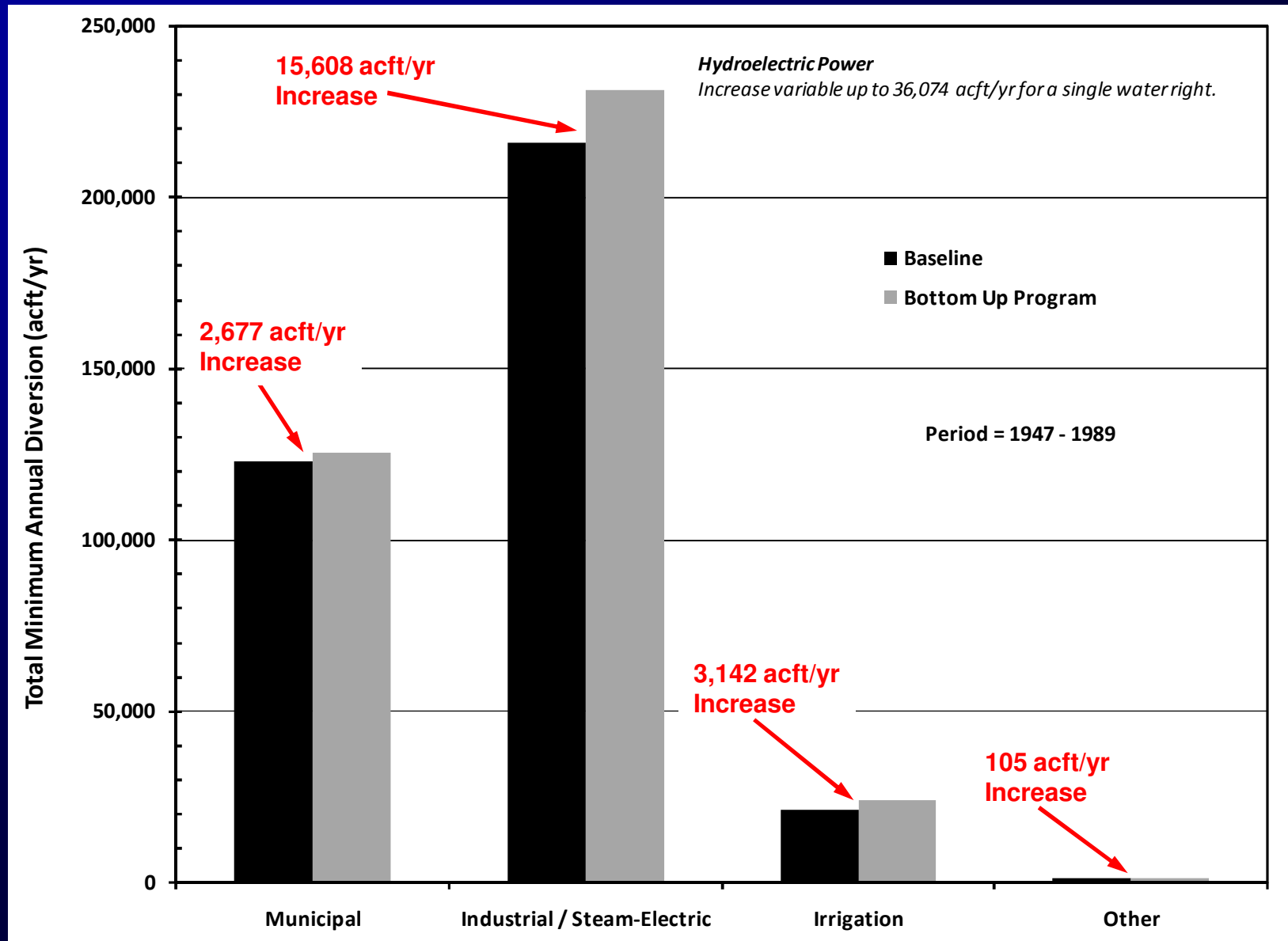
* Individual hydroelectric water supplies on the Comal or Guadalupe River increase by up to about 36,000 acft/yr. Hydroelectric water supplies on the San Marcos River increases by about 19,800 acft/yr.

** Edwards groundwater supplies with a minimum monthly discharge from Comal Springs of 25 cfs increase by about 75,000 acft/yr (from about 245,000 acft/yr per Science Subcommittee to 320,000 acft/yr with the Bottom-Up Program).

Minimum Year (1956) Springflows and Streamflows

| | Comal Springs Discharge (acft/yr) | San Marcos Springs Discharge (acft/yr) | San Marcos River at Luling Streamflow (acft/yr) | Guadalupe River at Victoria Streamflow (acft/yr) | San Antonio River at Goliad Streamflow (acft/yr) | Freshwater Inflow to the Guadalupe Estuary (acft/yr) |
|-------------------|-----------------------------------|----------------------------------------|-------------------------------------------------|--------------------------------------------------|--------------------------------------------------|------------------------------------------------------|
| Baseline | 0 | 21,311 | 31,895 | 60,293 | 137,060 | 54,780 |
| Bottom Up Program | 36,102 | 41,130 | 49,312 | 90,261 | 132,898 | 68,002 |
| Increase | 36,102 | 19,819 | 17,417 | 29,968 | (4,162) | 13,222 |

Minimum Annual Diversions (Surface Water)



Surface Water Rights - Municipal

| Owner | Water Right | Authorized Permitted Diversion (acft/yr) | Use Type | Baseline - Minimum Annual Diversion (acft/yr) | Bottom Up Program - Minimum Annual Diversion (acft/yr) | Increase in Minimum Annual Diversion (acft/yr) |
|--------------------------------|-------------|------------------------------------------|-----------|-----------------------------------------------|--------------------------------------------------------|------------------------------------------------|
| GUADALUPE-BLANCO RIVER AUTH | C2074 | 90,000 | Municipal | 87,675 | 89,400 | 1,725 |
| SEGUIN MUNICIPAL UTILITIES | C3839 | 7,000 | Municipal | 6,454 | 7,000 | 546 |
| GUADALUPE-BLANCO RIVER AUTH | C3896 | 1,500 | Municipal | 99 | 216 | 117 |
| GUADALUPE-BLANCO RIVER AUTH | C3896 | 1,300 | Municipal | 0 | 86 | 86 |
| JOHN F BAUGH | C3888 | 320 | Municipal | 112 | 158 | 46 |
| STATE BANK & TRUST COMPANY | C3895 | 580 | Municipal | 37 | 78 | 42 |
| COMAL CO FRESH WSD #1 | P4491 | 120 | Municipal | 23 | 60 | 37 |
| W L LIPSCOMB ET AL | C3860 | 260 | Municipal | 145 | 174 | 29 |
| CITY OF SAN ANTONIO | C2162 | 100 | Municipal | 72 | 100 | 28 |
| PRESBYTERIAN MO-RANCH ASSEMBLY | C1932 | 60 | Municipal | 40 | 50 | 10 |
| TEXAS PARKS & WILDLIFE DEPT | P4106 | 25 | Municipal | 3 | 11 | 8 |
| CAMP MYSTIC INC | C2445 | 14 | Municipal | 11 | 14 | 3 |
| GARY A DITTMAR | C3833 | 5 | Municipal | 5 | 5 | 0.4 |

13 Municipal Water Rights had an increase in Minimum Annual Diversion. All are listed.

Surface Water Rights – Industrial / Steam-Electric

| Owner | Water Right | Authorized Permitted Diversion (acft/yr) | Use Type | Baseline - Minimum Annual Diversion (acft/yr) | Bottom Up Program - Minimum Annual Diversion (acft/yr) | Increase in Minimum Annual Diversion (acft/yr) |
|-------------------------------|-------------|------------------------------------------|----------------|-----------------------------------------------|--------------------------------------------------------|------------------------------------------------|
| CITY OF SAN ANTONIO | C2162 | 36,900 | Steam-Electric | 32,739 | 36,900 | 4,162 |
| CITY OF SAN ANTONIO | C2161 | 12,000 | Steam-Electric | 6,484 | 10,591 | 4,106 |
| GBRA - Exelon | C5178 | 75,000 | Steam-Electric | 47,642 | 51,363 | 3,721 |
| E I DU PONT DE NEMOURS | C3861 | 33,000 | Industrial | 26,117 | 29,365 | 3,248 |
| MISSION VALLEY TEXTILES, INC | C3829 | 500 | Industrial | 289 | 500 | 211 |
| SOUTH TEXAS ELECTRIC COOP INC | C3859 | 1,900 | Steam-Electric | 456 | 589 | 133 |
| STRUCTURAL METALS INC | C3837 | 34 | Industrial | 21 | 34 | 13 |
| SOUTHWEST TEXAS STATE UNIV | C3866 | 60 | Industrial | 22 | 31 | 9 |
| CITY OF SAN ANTONIO | C2162 | 11 | Steam-Electric | 8 | 11 | 3 |
| TOMMIE SMITH BLACKBURN | C1969 | 15 | Industrial | 9 | 11 | 2 |
| DARRELL G LOCHTE ET AL | C1997 | 2 | Industrial | 1 | 1 | 0.2 |

11 Industrial or Steam-Electric Water Rights had an increase in Minimum Annual Diversion. All are listed.

Surface Water Rights - Irrigation

| Owner | Water Right | Authorized Permitted Diversion (acft/yr) | Use Type | Baseline - Minimum Annual Diversion (acft/yr) | Bottom Up Program - Minimum Annual Diversion (acft/yr) | Increase in Minimum Annual Diversion (acft/yr) |
|------------------------------|-------------|------------------------------------------|------------|-----------------------------------------------|--------------------------------------------------------|------------------------------------------------|
| GBRA - Irrigation | C5178 | 11,000 | Irrigation | 5,830 | 7,771 | 1,941 |
| WILLIAM K ANDERSON ET UX | P5107 | 518 | Irrigation | 23 | 140 | 118 |
| KING RANCH INC | C3848 | 1,800 | Irrigation | 1,694 | 1,800 | 106 |
| SEGUIN MUNICIPAL UTILITIES | C3839 | 200 | Irrigation | 121 | 200 | 79 |
| KENNETH W WHITEWOOD ET UX | C2006 | 320 | Irrigation | 51 | 109 | 58 |
| HARRY J WRAY | C2025 | 155 | Irrigation | 48 | 100 | 51 |
| MIGUEL CALZADA URQUIZA ET UX | C3899 | 1,180 | Irrigation | 168 | 215 | 47 |
| BOENING ENTERPRISES | P3994 | 1,056 | Irrigation | 24 | 70 | 45 |
| ERWIN KLEMSTEIN | C2050 | 136 | Irrigation | 31 | 75 | 43 |
| ZARCO FOWARDING, INC | C2052 | 232 | Irrigation | 37 | 79 | 42 |

151 Irrigation Water Rights had an increase in Minimum Annual Diversion. The Top 10 are listed.

Surface Water Rights - Other

| Owner | Water Right | Authorized Permitted Diversion (acft/yr) | Use Type | Baseline - Minimum Annual Diversion (acft/yr) | Bottom Up Program - Minimum Annual Diversion (acft/yr) | Increase in Minimum Annual Diversion (acft/yr) |
|-----------------------------|-------------|------------------------------------------|---------------|-----------------------------------------------|--------------------------------------------------------|------------------------------------------------|
| TEXAS PARKS & WILDLIFE DEPT | C3869 | 500 | Fish Hatchery | 418 | 500 | 82 |
| JIM STORY | STORY | 400 | ? | 0 | 20 | 20 |
| SHELTON RANCH CORPORATION | C2003 | 10 | Mining | 6 | 8 | 3 |
| DARRELL G LOCHTE ET AL | C1997 | 20 | Mining | 10 | 10 | 0.1 |

4 Other Water Rights had an increase in Minimum Annual Diversion. All are listed.

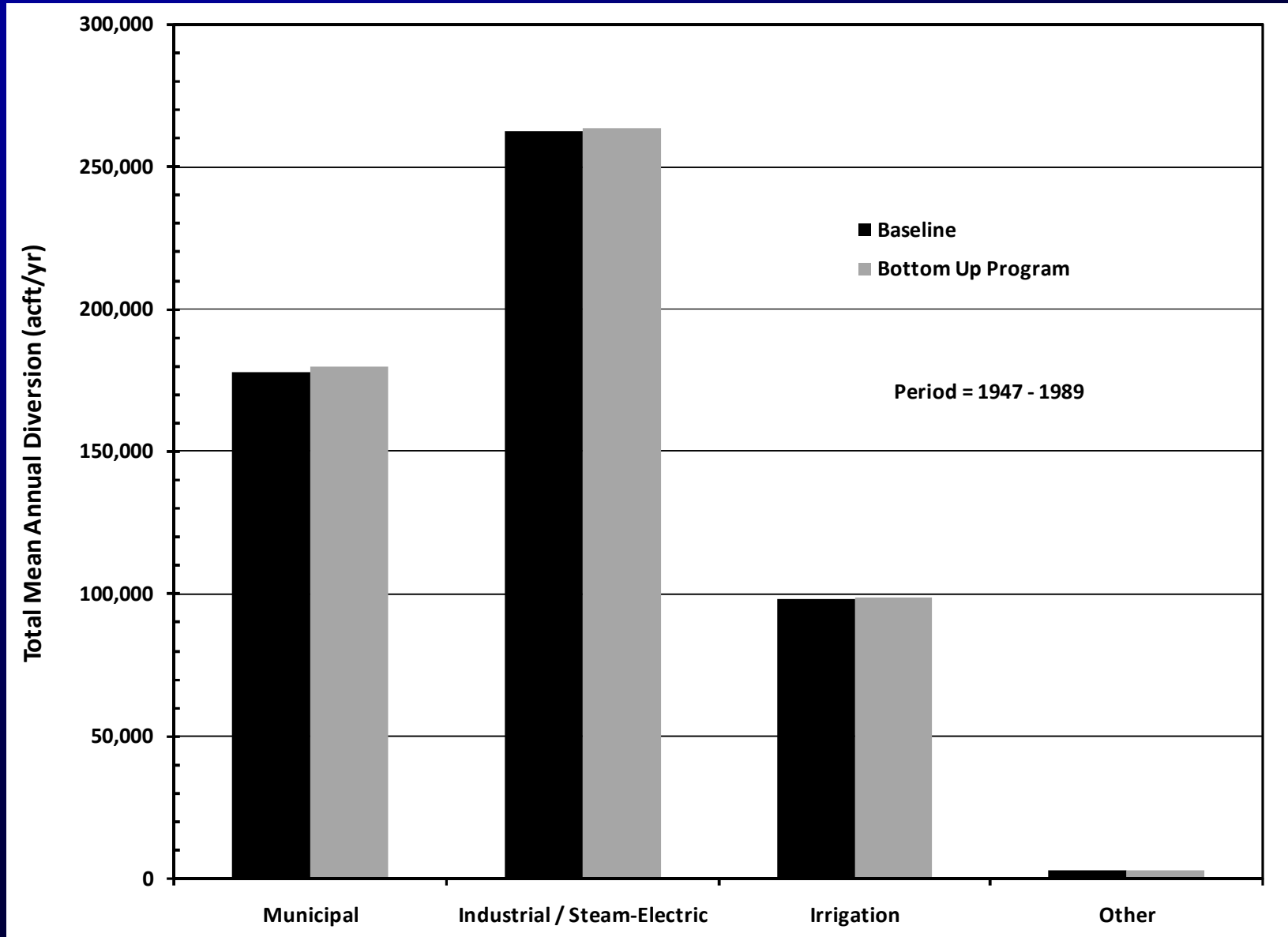
Surface Water Rights - Hydropower

| Owner | Water Right | Authorized Permitted Diversion (acft/yr) | Use Type | Baseline - Minimum Annual Diversion (acft/yr) | Bottom Up Program - Minimum Annual Diversion (acft/yr) | Increase in Minimum Annual Diversion (acft/yr) |
|----------------------------|-------------|------------------------------------------|---------------|-----------------------------------------------|--------------------------------------------------------|------------------------------------------------|
| NEW BRAUNFELS UTILITIES | C3824 | 124,870 | Hydroelectric | 2,511 | 38,585 | 36,074 |
| GUADALUPE-BLANCO R A TP-1 | C5488 | 663,892 | Hydroelectric | 1,321 | 24,964 | 23,643 |
| GUADALUPE-BLANCO R A TP-5 | C5488 | 624,781 | Hydroelectric | 2,333 | 25,960 | 23,626 |
| GUADALUPE-BLANCO R A TP-3 | C5488 | 659,995 | Hydroelectric | 1,310 | 24,766 | 23,456 |
| GUADALUPE-BLANCO R A TP-4 | C5488 | 655,323 | Hydroelectric | 1,305 | 24,662 | 23,358 |
| GUADALUPE-BLANCO R A H-4 | C5172 | 585,599 | Hydroelectric | 4,608 | 27,358 | 22,751 |
| GUADALUPE-BLANCO R A H-5 | C5172 | 574,832 | Hydroelectric | 4,892 | 27,292 | 22,400 |
| SOUTHWEST TEXAS STATE UNIV | C3865 | 64,370 | Hydroelectric | 22,137 | 41,991 | 19,854 |
| CITY OF GONZALES | C3846 | 796,363 | Hydroelectric | 0 | 1,554 | 1,554 |
| CUERO HYDROELECTRIC, INC. | C3853 | 538,560 | Hydroelectric | 0 | 1,392 | 1,392 |

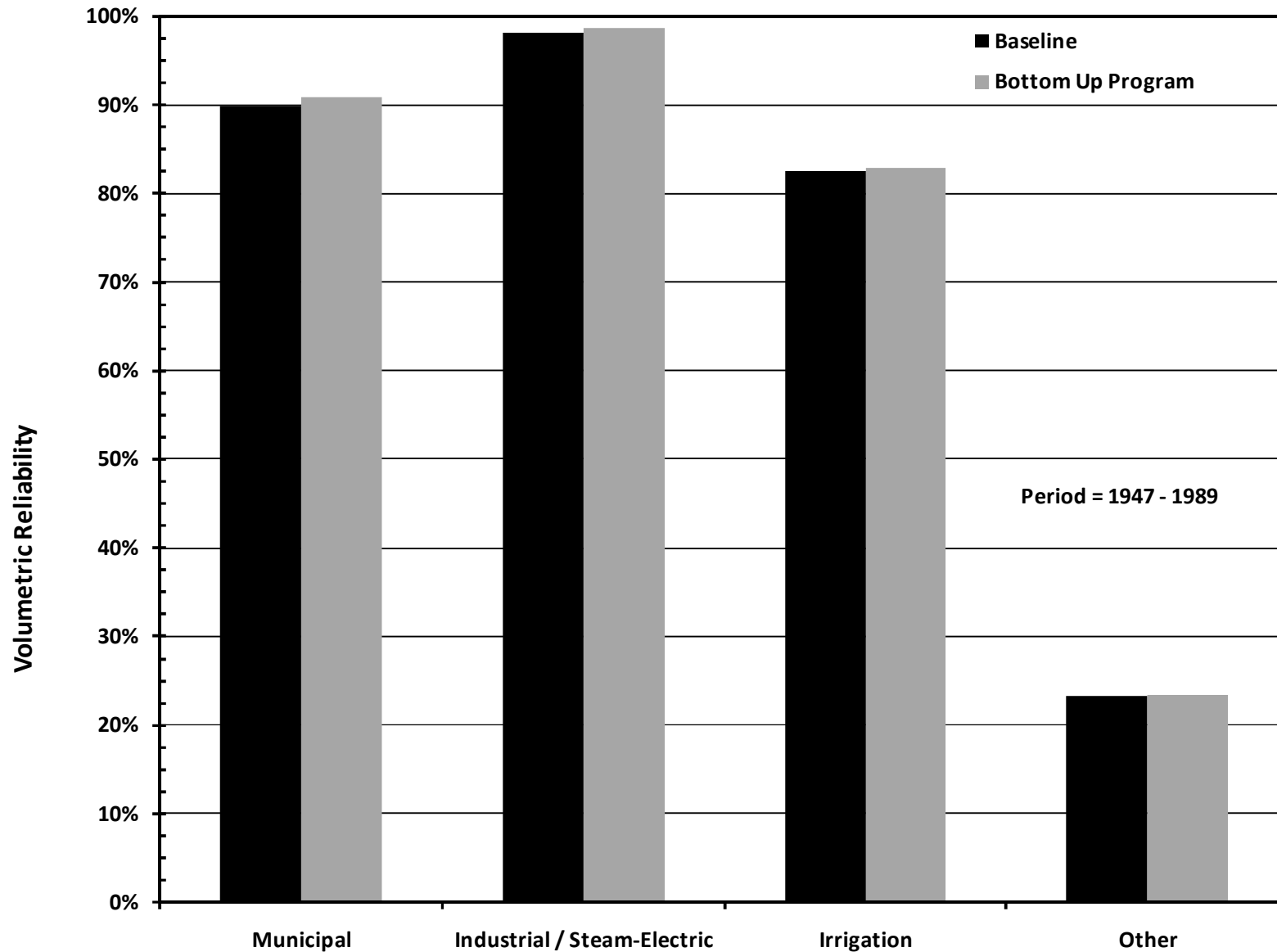
10 Hydroelectric Water Rights had an increase in Minimum Annual Diversion. All are listed.

Note: Minimum Annual Diversion values reported in this table are unappropriated streamflows passing through hydropower facilities and do not include concurrent appropriated streamflows passing through hydropower facilities while in delivery to downstream senior water rights.

Mean Annual Diversions (Surface Water)



Volumetric Reliability (Surface Water)



Discussion



***Questions &
Answers***