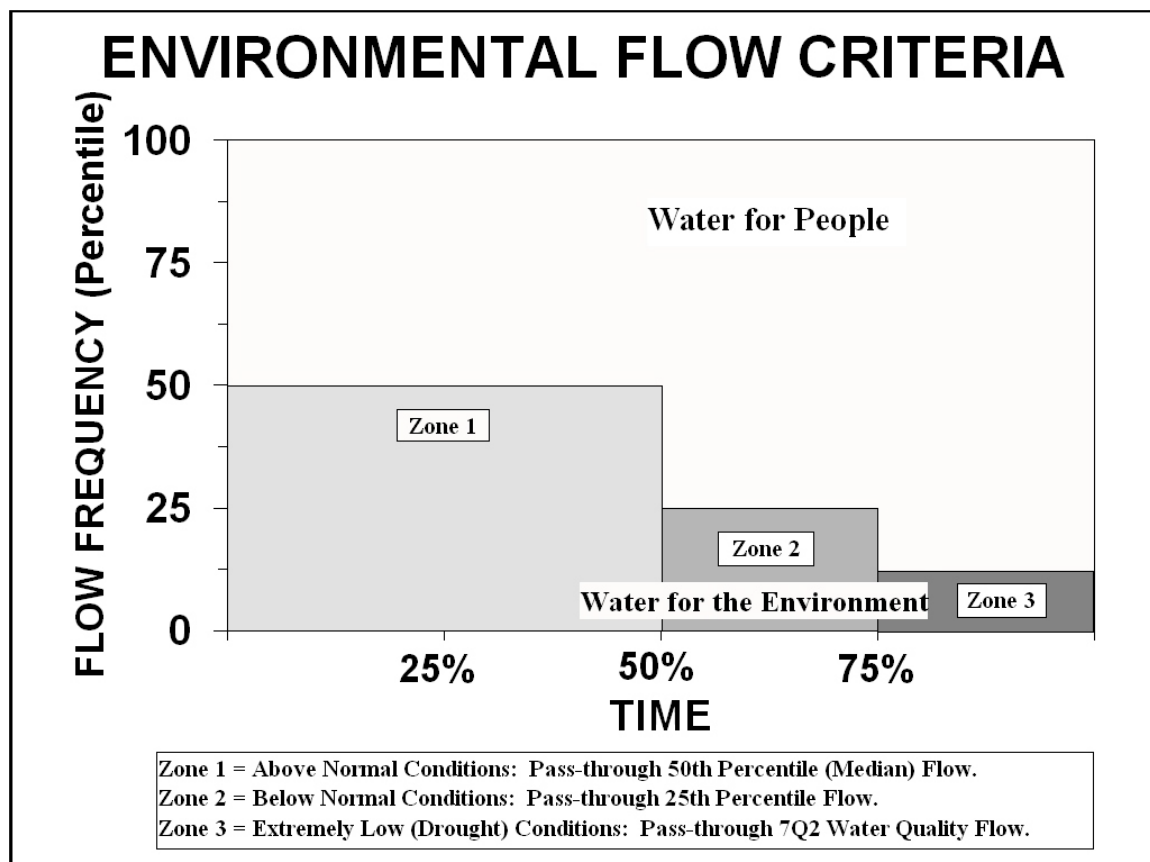


1997 Consensus Criteria for Environmental Flow Needs

State and regional water planning guidelines require use of TCEQ environmental flow standards or site-specific studies where available. If such studies are not available, then water planners should use the 1997 *Consensus Criteria for Environmental Flow Needs* (CCEFN) on all new surface water development WMSs requiring permit authorization. It applies to both instream flow and freshwater inflow needs. The criteria were developed through extensive collaboration among scientists and engineers from the State's natural resource agencies (i.e., TWDB, TPWD, and TCEQ), as well as academics, engineering consultants, and informed members of the public. Specifically, the criteria are composed of multi-stage rules for environmentally safe operation of impoundments and diversions during above normal conditions, below normal conditions, and the emergency conditions we call "drought" (Figure 1).

Figure 1. Environmental Flow Criteria



The primary goal of the CCEFN is to provide an indication during the planning process of the amount of water that may be available through the permitting process. They also provide balance by sharing the adverse impacts of drought so that neither human nor environmental needs unacceptably prevail over the other at all times. However, it should be recognized that the state and federal permitting processes may require different environmental flow constraints based on the results of intensive field studies or other permitting considerations.

The CCEFN is commonly referred to as a "desktop" technique because it is based on a statistical analysis of hydrological records for a potential water development site. No fieldwork is required, but the results may not be as precise or reliable as those derived from field studies. It should be noted that intensive

field study and modeling assessment of the actual flow needs for environmental maintenance are generally required during the State and Federal permitting process. However, the CCEF N is considered adequate and appropriate for planning purposes. All new water resource developments are required to consider the ecological flow needs of riverine and estuarine fisheries, wildlife habitats, and water quality requirements.

Criteria for the Planning Process

Application of the CCEF N, as described below for different types of water development projects, provides for a priority to human needs during dry and drought conditions, while sharing of the adverse impacts of drought with the environment. The environmental flows specified below are representative of what may be required in the regulatory process. For planning purposes, the environmental pass-through requirements for all zones will be added to those for downstream water rights. The protection of downstream water rights will be accomplished by using the full recorded amount of the existing water rights in the WAM.

New Project On-Channel Reservoirs

As illustrated in Figure 2, the conservation storage of a new on-channel water supply reservoir would be divided into three zones for water management purposes as follows:

Zone 1

In Zone 1 of the reservoir, when the reservoir water level is greater than 80 percent of storage capacity, inflows will be passed up to the monthly medians that are calculated with naturalized daily streamflow estimates.¹

Zone 2

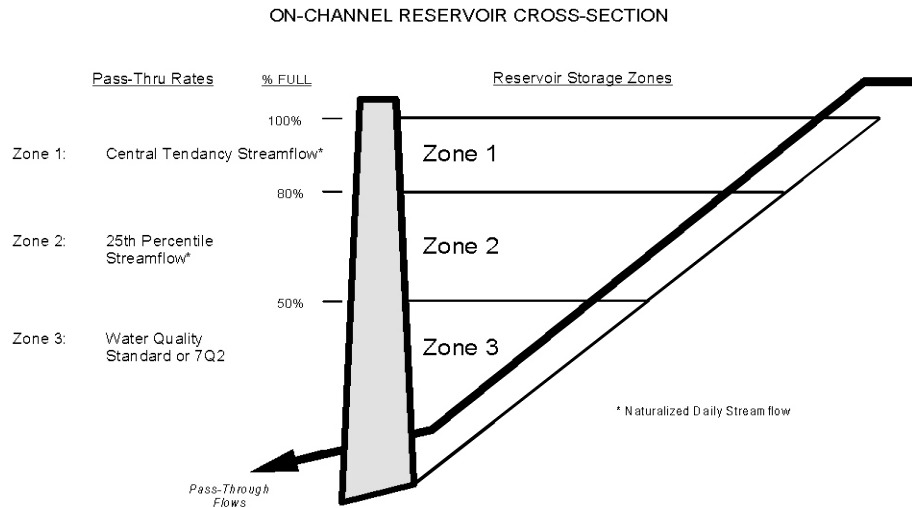
As dry conditions develop and the reservoir water level declines into Zone 2 between 50 and 80 percent storage capacity, inflows passed would be reduced to an amount up to the monthly 25th percentile flow values that are calculated with naturalized daily streamflow estimates.

Zone 3

As more severe drought conditions develop and the reservoir level declines into Zone 3 below 50 percent storage capacity, environmental pass-throughs would be further reduced to an amount up to the established water quality standard for the downstream segment. In lieu of any established water quality standard, the 7Q2 low flow value, as published in the TCEQ's Water Quality Standards, would be used as the default criterion for Zone 3 pass-throughs. If in Zones 1 and 2, the value necessary to maintain downstream water quality is higher than the medians or 25th percentiles, then the value necessary to maintain downstream water quality will be used instead of the other target flow values.

¹ Naturalized streamflow is the estimated amount of water that would have been present in a watercourse with no direct manmade impacts in the watershed. It is calculated by taking values of historically measured streamflow, adding amounts of estimated man-made losses from the upstream watershed caused by diversion and lake evaporation, then subtracting amounts of transfers.

Figure 2. On-Channel Reservoir Cross-Section



In all zones, it is the State’s intent that flows passed for instream purposes would also reflect the needs of the associated bay and estuary system. Therefore, instream flows are not to be considered available for impoundment before they reach the receiving bay and estuary. In addition to passage of environmental flows, adequate flows will be passed through for protection of downstream water rights. In all zones, water that can be captured by reservoirs in excess of the environmental provisions is available for water supply storage, and no water will be released from storage to meet environmental targets when inflows are below these limits.

New Project Direct Diversions

As illustrated in Figure 3, the CCEFN for direct diversions from a river or stream that are recommended in the Regional Water Plan would be based on streamflow conditions just upstream of the diversion point, and would also be divided into three zones as follows:

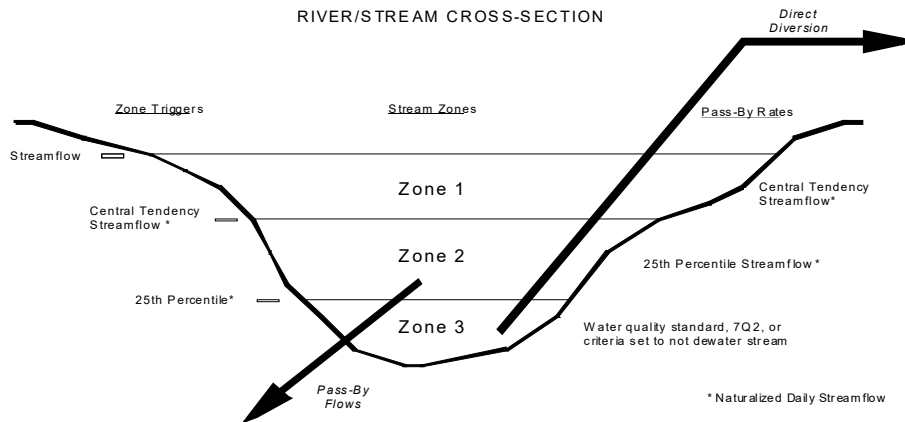
Zone 1

Zone 1 occurs when actual streamflow is greater than monthly medians calculated with naturalized daily streamflow estimates. When streamflow is within Zone 1, minimum flows passed will be the monthly medians that are calculated with naturalized daily streamflow estimates.

Zone 2

Zone 2 occurs when actual streamflow is less than or equal to medians, but greater than monthly 25th percentile values. When streamflow is within Zone 2, minimum flows passed will be the monthly 25th percentile values that are calculated with naturalized daily streamflow estimates.

Figure 3. River/Stream Cross-Section



Zone 3

Zone 3 occurs when actual streamflow is less than or equal to monthly 25th percentile values. When streamflow is within Zone 3, minimum flows passed will be the larger of: (1) the value necessary to maintain downstream water quality or (2) a continuous flow threshold to be determined by the water agencies (e.g., 10th percentile flow) that will not allow the diversion, by itself, to dry up the stream.

For perennial river/stream segments where a water quality standard has been established for a stream segment, that value will be used as the pass-by target. Where such a standard has not yet been established, the default planning criterion is the 7Q2 value as published in the TCEQ's Water Quality Standards. For Zones 1 and 2, if the value necessary to maintain downstream water quality is higher than the medians or 25th percentiles, this value necessary to maintain downstream water quality will be used instead of the other values.

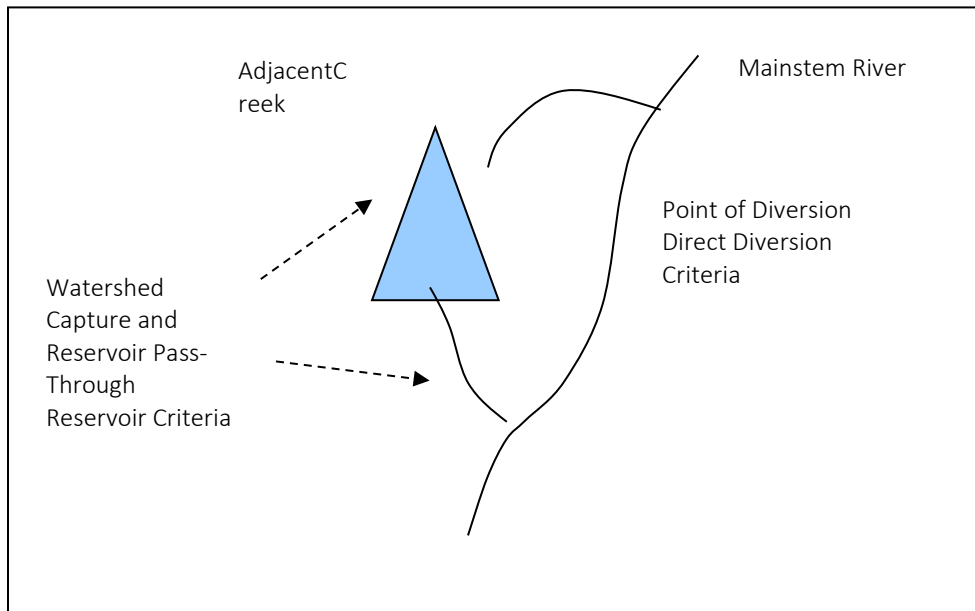
All Zones

The trigger values above are calculated with naturalized daily streamflow estimates. In addition to passage of environmental flows, adequate flows will be passed through for protection of downstream water rights. The above stepping procedure does not have smooth transition between zones, leaving brief periods when the instantaneous diversion rate is zero.

New Direct Diversions into Large Off-Channel Storage

In those cases where a large water supply project would divert its water from a river or stream into off-channel storage, a combination of the direct diversion and reservoir criteria would apply (Figure 4). The direct diversion criteria will govern the ability to divert water into the off-channel project. The reservoir criteria will address the ability of the reservoir to capture water from its own watershed, as well as define the reservoir's multi-stage operations that pass-through environmental flows, and flows for protection of downstream water rights.

Figure 4. Direct Diversions into Large Off-Channel Storage



Bay and Estuary Conditions

As a planning place-holder value, the Zone 1 reservoir pass-throughs or direct diversion pass-bys described previously will also provide freshwater inflow to the bays and estuaries. However, where inflow values adequate to meet the beneficial inflow needs as described in Texas Water Code §11.147 have been determined, those recommended inflow volumes will be used for projects within 200 river miles of the coast, commencing from the mouth of the river, as the basis for calculating the relative contributions of fresh water from the associated rivers and coastal basins during times of Zone 1 conditions. No other special provisions would be made for estuarine maintenance under Zone 2 or 3 conditions for either new reservoirs or large direct diversions except that the instream flows are not to be considered available for impoundment or diversion before they reach the receiving bay and estuary. Freshwater inflow needs analyzed by the water agencies may be determined by TPWD until that agency and the TCEQ jointly make a determination in accordance with Texas Water Code §11.1491.

The target flows in Zone 1 of the reservoir operating procedure should be established to provide the beneficial flows as defined in §11.147(a) of the Texas Water Code (i.e., the "salinity, nutrient, and sediment loading regime adequate to maintain an ecologically sound environment in the receiving bay and estuary system that is necessary for the maintenance of productivity of economically important and ecologically characteristic sport or commercial fish and shellfish species and estuarine life upon which such fish and shellfish are dependent").

In practical terms, that means it is not necessarily MinQ or MaxQ produced by the optimization model, but a point along that curve between these values that provides some margin of safety (comfort) in providing sufficient flows in Zone 1 to maintain average historic productivity on the fisheries. The state recommended freshwater inflow target is one that has been validated by comparing the seasonal distribution of estuarine salinity regimes with the patterns of abundance and distribution of selected estuarine-dependent plants and animals.

Bay and estuary pass-through requirements for a new water development project will be based on a pro-rata share of that location's contribution of flow to the estuary in question. Once the target amount

of water reaches an estuary during a month, no additional flows need to be provided for purposes of estuarine maintenance during that month. For the remainder of the month, environmental flows revert to the instream criteria.

Results of Inflow and Instream Studies – Use of State Determinations

When the results of freshwater inflow or instream flow studies are available, those criteria will be used in the planning process rather than any generic rule such as the CCEF. When established criteria are available and agreed to by TPWD and TCEQ, bay and estuary inflow requirements would be apportioned to each new project identified in the Regional Water Plan according to its proportional share (based on contribution hydrology), and as provided for by TCEQ. Where possible, this process seeks to restore seasonal flow patterns and minimize cumulative impacts from water development projects.