benefits including the isolation of water resource impacts to areas and resources where historically impacts have occurred as a result of the construction and operation of the original projects. Reservoir expansion projects may provide the ability for water companies to enhance downstream flow releases if that capacity is planned and built from the outset of the project. Such projects can also avoid the impacts of building new civil works and conveyance systems to service the new groundwater withdrawals, and can use existing infrastructure to distribute water to the service areas. While optimization in certain cases may also cause negative environmental impacts, only those projects where the overall impacts associated with optimization are judged to be positive are the subject of this discussion. Unfortunately, federal agencies whose permit authorities focus principally on direct wetland and watercourse impacts associated with the construction of a project do not have the authority to fully evaluate secondary impacts related to stream flow issues and the proliferation of water supply wells dispersed widely across Connecticut's landscape. Therefore, these federal agencies have far less regulatory concern with the effect of new groundwater withdrawals upon streamflow or related environmental impacts associated with new well construction or with the construction of new conveyance systems to service those wells. Federal agencies have effectively blocked reservoir expansions because of direct impacts to riparian wetlands and have largely ignored the broader environmental benefit derived from limiting the proliferation of new water supply wells.

Federal agencies are constrained by their specific permitting authorities and tend to look narrowly at the immediate impacts of a project rather then a more global perspective to view the entire spectrum of environmental benefits and impacts. Connecticut would benefit from an expedited system designed to address water supply conflicts with federal permitting agencies.

V. TOWARDS A METHOD OF ALLOCATING WATER

A comprehensive water allocation system requires two things: (1) adequate scientific data to support a water allocation policy; and (2) adequate statutory authority to develop and implement such a system.

The Department proposes to develop and implement a comprehensive water allocation system as described below and in accordance with the proposed task force scope of work discussed later in this report. These efforts will enable the Department to develop a comprehensive water allocation system through development of a system for prioritizing water use requests, a means to designate an allocation, or set-aside, for the environment, and an efficient integrated water supply planning process. This proposal does not represent a completed proposal, but is rather a description of the issues and the direction the Department would work towards through discussions with stakeholders.

A. Continuing Development of Scientific Data

One of the major problems with the diversion permitting program is that essential scientific information necessary to engage in meaningful water use management and planning, as well as to make decisions on specific permits, is often incomplete. The information needed

Farm River, East Haven, CT, August, 1999. Poorly constructed gaging station at a registered diversion. The staff gage is high and dry even though there is water in the channel, and the staff is leaning over, making any data collected from this gage inaccurate.

includes applied research on watershed hydrology (i.e., the relationships among rainfall, storm water runoff, and ground and surface water flow), development of water use inventories, environmental monitoring, assessment of water resources, and identification of the causes of water resource degradation. Only with such information will the Department be able to understand the amount of flow necessary to maintain healthy aquatic communities in particular streams, as well as the amount of flow that should be reserved for future consumptive use.

It is important to point out such state-sponsored data collection efforts would benefit not only the state agencies involved in the planning process, but permit applicants as well. Permit applicants would have less data to collect to support their individual applications, saving time and expenses. Data availability will also significantly accelerate the Department's decision-making process on permit applications.

B. Development of an Allocation System

Water allocation is not merely a matter of dividing up the available water. The quantity of water available for consumptive diversions is unpredictable at any given time as stream flow varies daily, monthly, and seasonally. The challenge is to find an allocation method that can balance the needs of the competing users of water while also protecting the environment.

> A river is more than an amenity, it is a treasure. It offers a Necessity of life that must be rationed among those who have power over it....The different traditions and practices in different parts of the country may lead to varying results, but the effort always is to secure an equitable apportionment without quibbling over formulas.

The Department recommends as the best means of achieving those goals the allocation of water through "apportionment." Under this approach, available water is apportioned among competing uses, both consumptive and non-consumptive. The apportionment method takes into account stream flow standards and thus assures sufficient stream flow to support aquatic life and to satisfy community waste assimilation and recreational needs. Under this method, the Department would apportion available water in advance of any diversion permit, and then give the applicant some percentage of the amount apportioned for the applicant's type of use.

Shepaug Dam on the Shepaug River, Warren / Litchfield border, CT. Impoundments and dam structures such as this can be used to make releases to maintain streamflow during low flow periods.

Allocation by apportionment can be more readily accomplished in regulated watersheds, because such watersheds have water stored in upstream impoundments. This storage is essential for providing water releases to maintain instream flows during periods of low flow. Unless water stored upstream can be released during such periods, consumptive water use will exacerbate naturally occurring low flows in the stream.

A good example of the value of upstream water storage is the Farmington River Watershed. There, the large storage capacity of the Metropolitan District Commission ("MDC") reservoirs and the United States Army Corps of Engineers' multi-use reservoir in the upper watershed allow MDC to satisfy its customers' drinking water needs while maintaining adequate flow along the main stem of the Farmington River.

In unregulated watersheds, stream flow naturally varies through the year, with highest flows in late winter and spring and lowest flows in the summer and early fall. In these waters, it is very difficult to augment natural stream flow. In unregulated watersheds, a water allocation

method that apportions flow is impossible to implement consistently without a management method that requires reduction of consumptive uses during low flow periods. During low flow periods the natural flow in the streams often falls to a level below that necessary to accommodate instream uses. As a result, streams may dry up during such periods as water is taken out to meet consumptive needs. The consumptive uses of the water are thus provided at the expense of instream requirements and a healthy aquatic community.

C. Allocation Priorities

An allocation method that allocates water by apportionment must include a means to prioritize the types of diversions that are permitted. For example, the diversion of water for a public water supply well may be a higher priority than a diversion for landscaping. Such a prioritization method must consider present as well as *future* water needs. The Department proposes to develop such a prioritization method in conjunction with other interest groups and stakeholders as a component of managing water use and the future allocation of water.

D. Development of An Allocation for the Environment

Another step in developing a water allocation methodology is to preserve the necessary amounts of water to safeguard the environment. Without set asides for the environment, streams, rivers, lakes, and other water bodies may suffer impairment and degradation during sustained periods of low flow. There may not be enough water to support fisheries and the aquatic life on which they depend, wildlife, and all of the other aspects of the natural environment which are water-dependent, as well as the recreational resources and natural beauty that make Connecticut so attractive to its residents and visitors. With careful planning, however, Connecticut can meet the needs of its citizens without sacrificing the quality of its natural environment.

> The fish communities in streams subject to water diversions were found to vary in response to available flow. Trout and other intolerant stream dwelling fish prevail in Misery Brook, the Muddy River, Patton Brook and Sodom Brook only during years of ample precipitation. During years with average or below average precipitation, a shift in the species composition is observed with more stress-tolerant species being found in greatest abundance.
>
> -- Findings of Quinnipiac River Study, Appendix D.

The Department believes that the best method for determining how much water is necessary to preserve the health of a particular water body is through the development of instream flow standards for Connecticut water bodies. An instream flow standard will identify the quantities of water that are needed to maintain aquatic resources at a given location along a stream segment throughout the year. An instream flow standard does not maximize the protection or preservation of aquatic resources, but rather will quantify the flow volumes necessary for sustaining aquatic resources. The Department therefore recommends that instream flow standards be developed as part of an allocation methodology.

The application of an instream flow standard specific to Connecticut watersheds when used in conjunction with water quality standards will establish a goal or target for water quantities essential to maintain stream functions, including the assimilation of wastewater discharges and aquatic health and fisheries functions. Instream flow standards would be subject to modification based upon more detailed watersheds flow studies either performed by diversion permit applicants or by the Department, subject to available funding. Strict adherence to such standards is not anticipated, but rather the standards would be viewed as a target or goal for water management decision making. Similar to the water quality standards, it is envisioned that instream flow standards would be achieved over a period of time as unused registrations are retired; unauthorized diversions are discontinued or restricted as the result of enforcement; or water resource management activities occur. Water resource management and implementation of resource plans may include such activities as removal of fish passage obstructions, cooperative flow studies with watershed water users, reaching agreement on flow releases from upstream impoundments through the hydropower license renewal process, or flood control management planning. Within a given watershed or stream reach, the extent to which priority water uses occur or alternatives exist will also influence the difficulty and timeframe necessary for achievement of water quantity goals. In watersheds which meet their specific instream flow standard, the Department would issue permits which would effectively "reserve" a water allocation for priority water uses such as drinking water.

In many watersheds without upstream storage impoundments, and along smaller rivers with substantial ground water withdrawals that affect stream flow, additional allocations may not be possible during the natural yearly low flow period. Along these smaller tributary streams,

withdrawals during higher flow periods could potentially occur in an unrestricted manner. As discussed earlier however, this may be problematic for some water users because consumptive use demands are typically either steady year-round or highest during the annual low flow period.

In order to implement instream flow standards, stream flow would have to be continuously measured at a number of locations within the watershed or along designated streams with similar hydrogeological characteristics and, when flow reached specified levels below which adverse environmental effects would occur, withdrawals for consumptive uses would have to be progressively restricted or, if necessary, suspended. A commitment to funding stream gaging (*such as the US Geological Survey gage shown at right*) is essential, and requires a reversal of current trends. Connecticut has lost funding for 50 gaging stations in recent years and may be losing another ten this year.

The Department therefore recommends the development of watershed-specific allocations that will provide for seasonally-variable environmental needs. The following allocation method is recommended as the most *practicable* approach:

(1) Develop a *Connecticut Aquatic Base Flow Methodology* based on watershed-specific interdisciplinary studies of instream flow needs. Use the protocols outlined in the publications, *August Median Streamflows in Massachusetts*, U.S. Geological Survey, Water-Resources Investigations Report 97-4190, and *The Instream Flow Incremental Methodology – A Primer for IFIM*, internal publication of United States National Biological Survey, Fort Collins, Colorado, in developing such a methodology. The objective would be to develop a series or matrix of watershed characteristics and flow studies from which to establish seasonally varying instream flow standards specific to Connecticut's geomorphology and climate. Seasonally varied flow standards would be established.

(2) Until the Department has developed *a Connecticut Aquatic Base Flow Methodology*, the Department recommends application of *the New England Aquatic Base Flow Policy* (NEABF). The NEABF policy, developed by the U.S. Fish and Wildlife Service (1981), specifies instream flow needs for summer, fall/winter, and spring periods, thus it is reflective of the natural hydrograph in providing for seasonally variable instream flows.

(3) Upon development of a *Connecticut Aquatic Base Flow Methodology*, water can be apportioned for further consumptive uses after the instream flow allocation has first been reserved for the environment.

(4) The Department would also develop criteria to allow for additional diversions to meet priority water needs during emergency periods such as critical water shortages caused by drought conditions provided, conservation was implemented first.

(5) For watersheds which do not currently meet the instream flow standard as established by the proposed *Connecticut Aquatic Base Flow Methodology*, the instream standard would serve as a water resource management goal or target and be subject to further refinement subsequent to an Instream Flow Incremental Flow study of uses and priorities within the watershed.

When combined with an inventory of registered and permitted diversions, this approach to water allocation would lead to more predictable decisions for persons contemplating proposed consumptive use diversions.

E. Encouraging Development of Alternative Water Supplies and Supply Sharing

The Department proposes to adopt policies that encourage the development of Class B[7] waters sources for non-potable drinking uses. Connecticut allows only the use of Class A water for drinking and other domestic uses and the Department recommends

> "Although the total statewide yield of existing water supply facilities is adequate to meet existing and much of the future demand, the supplies are not evenly distributed throughout the state. Thus, new sources and interconnections will be needed to meet local supply deficiencies."
>
> *State of Connecticut Plan of Conservation and Development*, page 55.

[7]Class B means fishable, swimmable, but not drinkable.

that the current public water supply standard, which prohibits wastewater discharges to drinking water supply resources, be maintained. However, there are many Class B waters such as the Connecticut River, the Thames River, and the Housatonic River which could provide additional supply for industrial use, power plant cooling water and irrigation. By encouraging the development of such resources for non-drinking water purposes, the state could stop or prevent the use of millions of gallons of Class A water per day for non-potable needs.

As Connecticut's population spreads outward to the suburbs and more rural areas, there is an increasing need for public water supply in areas traditionally served by private residential wells. In many urban areas water demand has decreased, often as the result of the shift from manufacturing and intensive water use industries to high-tech, low water use industries. As a result, public water suppliers may have water reserves which could meet some of the increased suburban and rural need, although the suppliers are often reluctant to share that water with neighboring towns.

Connecticut's largest cities – including Stamford, Bridgeport, Waterbury, Hartford, Meriden, Wallingford, New Britain, New London, Groton, and Danbury—historically developed large drinking water reservoirs. The water is aggressively protected from pollution sources, and can be delivered through gravity-fed pipes. Effective sharing of these large centralized water supply systems could minimize additional costly infrastructure investment and avoid environmental impacts associated with development of new water supply sources. Such supply sharing must be carefully considered. The State should avoid costly water main extensions to serve areas more effectively served by private wells or by a new diversion which may pose little environmental impact. An example is the recent agreement between the Metropolitan Water Commission of Hartford to supply water via an interconnection to the Town of Portland. The amount desired by Portland was a small amount of MDC's total supply but resulted in the avoidance of capital investments by Portland to build a water filtration plant and possible impacts to vernal pools and wetlands associated with development of wells. Interconnections between water utilities and regional water planning needs to be encouraged to promote efficiencies, prevent drinking water emergencies, and to discourage inappropriate scattered development, specifically not recommending the expansion of water systems into rural/suburban area.