

processes which are already proven in practice. The construction of remedial facilities in water pollution control is the responsibility, to a considerable extent, of local authorities who may have limited financial resources. Often these authorities feel that they cannot afford the risk associated with trying new methods. It may very well be in the best public interest for the Federal government to design, construct, and operate full-scale facilities to develop and demonstrate new ways of pollution control. Such facilities could be built in cooperation with existing or new municipal installations or at Federal installations."

The Clean Water Restoration Act of 1966, which amended the Federal Water Pollution Control Act, provides for grants for the purpose (1) of assisting in the development of any project which will demonstrate advanced waste treatment and water purification methods or new or improved methods of joint treatment systems for municipal and industrial wastes, and (2) for research and demonstration projects for prevention of pollution of waters by industry including, but not limited to, treatment of industrial waste. This program is approximately one year old and there is ample evidence to indicate that the most significant contribution to the solution of water pollution by the development and application of new and improved technology will result from this program.

The Pulp Manufacturers Research League, Inc., in their 1967 Annual Report, made the following reference to grant support which they received from the Federal Water Pollution Control Administration:

"A fair estimate is that this League—Federal project will move ahead by as much as five years the time when pulp and paper mills will have a solid dollars and cents foundation upon which to base a yes or no decision for reverse osmosis. If this in-plant process proves as sound financially as it is already proved technically, the industry will have an effective and economical method for treating dilute effluents to a previously unattainable level of purity."

A complete listing of our grant and contract awards for projects authorized under this new legislation is available. As of January 25, 1968, 84 grants and contracts totaling \$33,257,950, including storm and combined sewer projects, have been awarded.

MAJOR WATER POLLUTION PROBLEMS

Figure 1 represents the total scope of the research and development efforts of FWPCA. Each of the elements is important in our drive toward total pollution control; however, some problems stand out because of their magnitude and the need for solutions in the near future:

1. Municipal waste treatment.
2. Industrial waste treatment and control.
3. Improved methods for measuring effects of pollutants (water quality requirements), including temperature effects.
4. Disposal of impurities (solids) removed from wastes.
5. Mine drainage.
6. Irrigation return flows.
7. Agricultural land runoff.
8. Storm and combined sewer discharges.
9. Lake, estuary, and ocean disposal of treated and untreated wastes.

We have discussed these problems before, but I would like to dwell on one of them to illustrate what can and should be done in solving the problem. Municipal waste treatment has been discussed in terms of providing technology which makes it possible to achieve *any* degree of waste treatment desired, in fact, to return a waste water to a quality at least as high as that of the water before use. The following illustrates some additional areas for research and development under that category:

1. Improved procedures to accomplish more effective operation of plants.
2. Methods for increasing the capacity and performance of existing plants.
3. Improved design and constructing procedures, including materials of construction.
4. Treatment plants which would occupy a minimum of land area.
5. New systems for combining the waste treatment-water purification steps of the water cycle.
6. Treatment systems which would result in valuable by-products.