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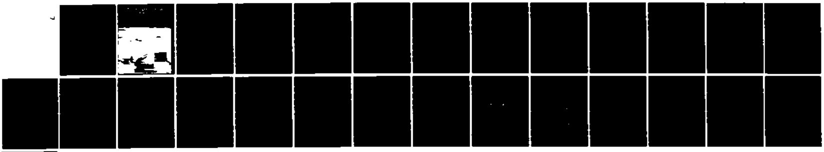

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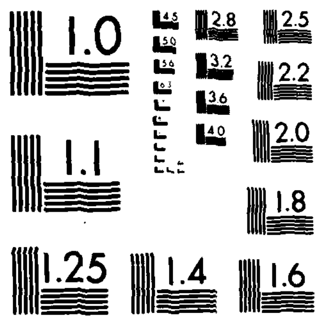

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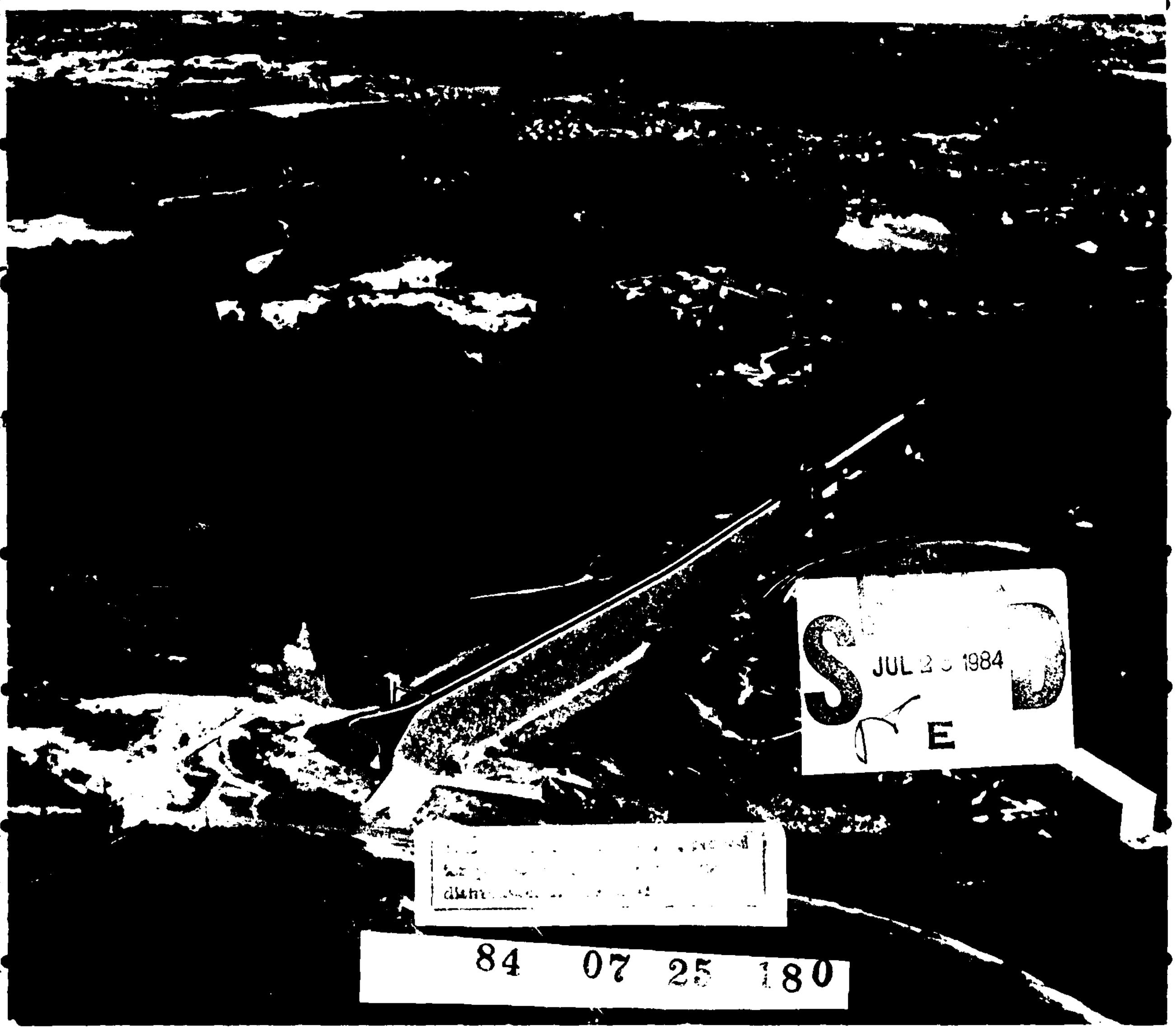
US Army Corps
of Engineers
New England Division

Drought Contingency Plan

September 1983

Hodges Village Dam, Oxford, Massachusetts



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This project is not considered to be a good location for storage of water for public water supply purposes during drought emergency. Under the existing conditions in the reservoir, a poor quality of water degraded by algae blooms and elevated levels of color, turbidity, iron, manganese, taste and odor will result. The stored water may be acceptable for industrial water supply or related activities.

THAMES RIVER BASIN

FRENCH RIVER WATERSHED

DROUGHT CONTINGENCY PLAN
HODGES VILLAGE DAM
OXFORD, MASSACHUSETTS

SEPTEMBER 1983

NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02254

DROUGHT CONTINGENCY PLAN

HODGES VILLAGE DAM

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DROUGHT CONTINGENCY PLAN
HODGES VILLAGE DAM

1. PURPOSE AND SCOPE

The purpose of this study and report was to develop and set forth a drought contingency plan of operation for Hodges Village Dam that would be responsive to public needs during drought periods and identify possible modifications to project regulation within current administrative and legislative constraints. This evaluation was based on preliminary studies utilizing readily available information. The scope of this drought contingency plan includes a description of existing water supply conditions, the possibility of reallocation of reservoir storage within specified limits, water quality evaluation, discussion of impacts on other project purposes, effects on the environment, and summary and conclusions.

2. AUTHORIZATION

The authority for the preparation of drought contingency plans is contained in ER 1110-2-1941 which provides that water control managers will continually review and, when appropriate, adjust water control plans in response to changing public needs. Drought contingency plans will be developed on a regional, basinwide and project basis as an integral part of water control management activities.

3. PROJECT AUTHORIZATION CONDITIONS

Hodges Village Dam was authorized by the Flood Control Act of 18 August 1941 (Public Law 228, 77th Congress). In addition, Section 4 of the Flood Control Act of 22 December 1944 (Public Law 534, 78th Congress) authorized recreational use of the reservoir area.

4. PROJECT DESCRIPTION

Hodges Village Dam, completed in 1959, in Oxford, Massachusetts, is located on the French River 15 miles upstream from its confluence with the Quinebaug River at Hodges Village. A map of the Thames River Basin is shown on plate 1. The reservoir has a total storage capacity of 13,250 acre-feet (4.3 billion gallons), equivalent to 8 inches of runoff from a drainage area of 31.1 square miles.

The outlet works consist of two 5 x 6-foot conduits having inverts at elevation 465.5 feet NGVD and each provided with one electrically controlled service gate 5' wide x 6' high. A capacity table is shown on plate 2, and a summary of pertinent data at Hodges Village Dam is contained on plate 4.

5. PRESENT OPERATING REGULATIONS

a. Normal Periods. During normal (non-flood) conditions, the gate openings are 0-3' and reservoir outflow equals inflow. This gate setting automatically restricts discharges so that significant reservoir releases will not occur during unexpected increases in runoff. No permanent pool is maintained during normal periods or during the winter season.

b. Flood Periods. The Hodges Village project is operated in concert with other projects in the basin to reduce flooding on the downstream French and Quinebaug Rivers. Operation for floods may be considered in three phases: phase I - appraisal of storm and river conditions during the development of a flood, phase II - flow regulation and storage of flood runoff at the reservoir, and phase III - emptying the reservoir during recession of the flood. The regulation procedures are detailed in the Master Water Control Manual for the Thames River Basin.

c. Operating Constraints

(1) Minimum Releases. A minimum release of about 10 cfs (6.5 mgd) is maintained during periods of flood regulation in order to sustain downstream fish life.

(2) Maximum Releases. The maximum nondamaging discharge capacity of the channel immediately downstream from Hodges Village Dam is about 525 cfs. Releases at or near this rate can be expected whenever peak inflows have exceeded this value and meteorological and hydrologic conditions permit.

6. MONITORING OF HYDROLOGIC CONDITIONS

The Reservoir Control Center directs the reservoir regulation activities at 28 New England Division flood control dams, and continually monitors rainfall, snowcover, and runoff conditions throughout the region. When any of these parameters have been well below normal for several months and it appears that possible drought conditions might develop, the Corps Emergency Operations Center (EOC) will be so informed. The EOC will then initiate discussions with the respective State agencies and other in-house Corps elements to review possible drought concerns and future Corps initiatives.

7. DESCRIPTION OF EXISTING WATER SUPPLY CONDITIONS

a. General. The area of concern is the south-central portion of Massachusetts, including portions of Worcester, Hampden, and Middlesex counties. Table 1 contains information about public water suppliers in the area based on information provided by the Massachusetts Department of Environmental Management. Of the 36 communities in the study area, 31 are served by public systems. No data is available for those communities dependent on private individual supplies.

b. Water Supply Systems. The primary objective of this analysis was to accumulate available data regarding water supply systems in the vicinity of Hodges Village Dam that could benefit from storage at the project, and to present the data in a manner portraying existing water supply conditions. Projections of future demands were not developed because this study addresses only modifications in the operational procedure at Hodges Village Dam in order to provide storage for water supply purposes when drought conditions exist, and not to meet normal water supply demands at some future date.

c. South-central Massachusetts Water Suppliers. As noted in table 1, the data given for each water supplier includes: community served, estimated population served by the system, source of supply (ground or surface water), average day and maximum day demands for 1980, estimated safe yield of the source, and any further information available on the source of supply. An analysis of the adequacy of existing sources during drought conditions has not been performed. The information has been accumulated to present a summary of the existing water supply conditions for the south-central Massachusetts area.

d. Population Projections. Population projections for communities in south-central Massachusetts are given in table 2 to show population trends for each community potentially affected by a prolonged dry period. The projections were developed by the Massachusetts Office of State Planning for the "208" Areawide Wastewater Management Program, TA LE 1

MAJOR WATER SUPPLIERS - SOUTH CENTRAL MASSACHUSETTS

Company or Agency	Town Served	Est. Population Served -1980	Source of Supply (SW or GW)	1980 Demands Avg. Day (MGD)	1980 Demands Max. Day (MGD)	Safe Yield (MGD)	Comments
Elm Hill Water District	Auburn	600					Supplied by Worcester(SW/GW)
Auburn Water District		9,501	GW	1.07	1.80	2.5	6 wells
Woodland Water District		540		0.027	0.041		Supplied by Worcester(SW/GW)
Blackstone Water Dept.	Blackstone	6,158	GW	0.37	0.63	0.78	2 Wells, 1 standby
	Brimfield		No Public Water Supply				
Brookfield Water Dept.	Brookfield	1,400	GW	0.078	0.117	0.40	3 Wells
	Charlton		No Public Water Supply				
Douglas Water Dept.	Douglas	2,611	GW	0.18	0.46	0.50	1 wellfield, 1 well
Dudley Water Dept.	Dudley	5,840	GW	1.2	1.81	1.0	1 wellfield, 1 well
East Brookfield Water Dept.	E. Brookfield	1,200	GW	0.12	0.292	0.9	1 well
Mass. American Water Co.	Grafton	5,332	GW	0.64	1.02	2.0	4 wells
South Grafton Water Dist.		2,810	GW	0.18	0.24	0.55	2 wells
	Holland		No Public Water Supply				
Hopedale Water District	Hopedale	2,226	GW	0.38	0.42	0.42 0.10	wellfield Milford Water Co.(SW/GW)
Hopkinton Water Dept.	Hopkinton	5,700	GW	0.571	0.837	1.11	3 wells
Leicester Water Supply Dist.	Leicester	2,700	GW	0.185	0.333	0.402	5 wells
Hillcrest Water Dist.		350	GW	0.154	0.175	0.236	3 wells
Cherry Valley & Rochdale W.D.		4,400	SW	0.32	0.70	0.375	Henshaw Pond
Milford Water Co.	Mendon	450	SW/GW				Included in Milford Syst.
Milford Water Co.	Milford	27,607	SW/GW	2.54	3.81	3.00	1.40 SW - Echo Lake 1.60 GW - wells Includes Mendon - 450 served Hopedale - 1667 served
Mass. American Water Co.	Millbury	5,366	GW	1.16	1.62	3.11	4 wells
Oakwood Heights Water Dist.		200		0.0074	0.011		Mass. American Water Co.
Maple Hillside Water Dist.		311		0.018	0.028		Mass. American Water Co.
	Millville		No Public Water Supply				

TABLE 1 (Cont'd)
MAJOR WATER SUPPLIERS - SOUTH CENTRAL MASSACHUSETTS

Company or Agency	Town Served	Est. Population Served - 1980	Source of Supply (SW or GW)	1980 Demands Avg. Day (MGD)	1980 Demands Max. Day (MGD)	Safe Yield (MGD)	Comments
Monson Water Dept.	Monson	5,000	GW	0.95	1.70	1.73	2 wells, 1 standby
North Brookfield Water Dept.	N. Brookfield	3,600	SW	0.47	1.13	2.50	North Pond
Whitinsville Water Co.	Northbridge	10,340	GW	1.14	1.65	2.55	2 wellfields, 1 emergency
Oxford Water Co.	Oxford	6,070	GW	0.702	1.163	2.0	3 wells
Palmer Fire District	Palmer	5,300	SW/GW	0.62	1.00	0.90	0.65 - 2 wells, 0.25 - Graves Brk.
Bondsville Fire & Water Dist.		2,516	GW	0.274	0.46	0.50	3 wells
Three Rivers Fire Dist.		3,377	GW	0.32	0.52	0.58	2 wells
Thorndike Fire & Water Dist.		1,316		0.144	0.25		From Bondsville supply
Shrewsbury Water Dept.	Shrewsbury	20,407	GW	2.56	4.44	4.18	2 wells, Worcester system
Southbridge Water Supply Co.	Southbridge	16,665	SW	1.71	2.56	2.95	4 reservoirs
Spencer Water Dept.	Spencer	5,000	SW/GW	0.37	0.55	1.30	1.0 - 1 well, 0.30 - Shaw Pond
Sturbridge Water Dept.	Sturbridge	3,884	GW	0.674	1.21	1.22	2 wells
Manchaug Water Dist.	Sutton	850	GW	0.016	0.024	0.045	3 wells
Wilkinsonville Water Dist.		400	GW	0.10	0.15	0.282	1 well
Upton Water Dept.	Upton	2,215	GW	0.23	0.38	0.69	1 well, 1 wellfield
Uxbridge Water Dept.	Uxbridge	5,600	GW	0.67	0.97	2.1	3 wells
	Wales		No Public Water Supply				
Ware Water Dept.	Ware	7,200	GW	0.92	1.12	1.58	4 wells
West Warren Water Dist.	Warren	1,078	GW	0.3	0.6	0.60	1 well, 1 standby
Warren Water Dist.		2,644	GW	0.19	0.30	0.35	5 wells
Webster Water Dept.	Webster	14,200	GW	1.29	1.94	3.50	2 wells & wellfield
W. Brookfield Water Dept.	W. Brookfield	2,200	GW	0.25	0.52	0.58	2 wells
Westborough Water Dept.	Westborough	13,346	SW/GW	2.02	2.5	2.78	0.75 - Westborough Res. 2.03 - 5 wells
Worcester DPW	Worcester	161,799	SW/GW	25.67	35.90	29.0	26.80 - reservoir system 2.20 - wells (2)

Table 2
Population Projections - South Central Massachusetts

Town	Actual 1980	1985	1990	1995	2000	Percent Change 1980-2000
Auburn	14,845	15,050	15,250	15,475	15,775	[illegible]
Blackstone	6,570	6,725	6,825	6,925	7,025	6.9
Brimfield	2,318	2,508	2,681	2,794	2,875	24.0
Brookfield	2,397	2,575	2,625	2,675	2,750	14.7
Charlton	6,719	7,050	7,500	7,675	8,075	20.2
Douglas	3,730	3,850	3,925	4,100	4,200	12.6
Dudley	8,717	9,050	9,200	9,400	9,725	11.6
East Brookfield	1,955	2,050	2,150	2,200	2,300	17.6
Grafton	11,238	11,450	11,750	11,975	12,175	8.3
Holland	1,589	1,902	2,193	2,430	2,578	62.2
Hopedale	3,905	4,000	4,125	4,150	4,200	7.6
Hopkinton	7,114	8,300	9,400	9,700	10,000	40.6
Leicester	9,446	9,600	9,700	9,950	10,075	6.7
Mendon	3,108	3,350	3,450	3,625	3,725	19.9
Milford	23,390	24,700	26,000	26,300	26,600	13.7
Millbury	11,808	12,175	12,450	12,725	12,925	9.5
Millville	1,693	1,750	1,800	1,825	1,875	10.8
Monson	7,315	7,688	8,026	8,427	8,823	20.6
North Brookfield	4,150	4,225	4,300	4,325	4,375	5.4
Northbridge	12,246	12,450	12,650	12,950	13,225	8.0
Oxford	11,680	12,100	12,350	12,725	12,925	10.7
Palmer	11,389	11,731	12,048	12,265	12,424	9.1
Shrewsbury	22,674	23,650	24,225	24,925	25,400	12.0
Southbridge	16,665	16,775	16,875	16,975	17,125	2.8
Spencer	10,774	11,200	11,600	12,025	12,225	13.5
Sturbridge	5,976	6,325	6,575	6,725	6,975	16.7
Sutton	5,855	6,350	6,725	6,950	7,225	23.4
Upton	3,886	4,125	4,225	4,425	4,525	16.4
Uxbridge	8,374	8,575	8,675	8,750	8,850	5.7
Wales	1,177	1,326	1,475	1,596	1,671	42.0
Ware	8,953	9,311	9,600	9,782	9,939	11.0
Warren	3,777	3,800	3,850	3,975	4,025	6.6
Webster	14,480	14,625	14,875	15,100	15,200	5.0
West Brookfield	3,026	3,100	3,150	3,175	3,250	7.4
Westborough	13,619	14,275	14,825	15,625	16,050	17.9
Worcester	161,799	161,800	161,800	161,800	161,800	0.0
TOTAL	448,357	459,516	468,873	476,444	482,910	7.7

and updated in 1981. This information indicates areas of potential future growth in the south-central Massachusetts area.

8. POTENTIAL FOR WATER SUPPLY REALLOCATION

a. General. There are several authorities that provide for the use of reservoir storage for water supply at Corps of Engineers projects. They vary from the provision of water supply storage as a major purpose in new projects to the discretionary authority to provide emergency supplies to local communities in need. In addition, guidance contained in ER 1110-2-1941 directs field offices to determine the short-term water supply capability of existing Corps reservoirs that would be functional under existing authorities. Congressional authorization is not required to add municipal and industrial water supply if the related revisions in regulation would not significantly affect operation of the project for the originally authorized purpose.

b. Drought Contingency Storage. It has been determined that a portion of the existing flood control storage at Hodges Village Dam could be utilized for emergency drought contingency storage without having an adverse impact on the project's flood control function. This infringement could use storage to a pool elevation of about 477 feet NGVD (11.5-foot stage). This represents a volume of about 1,000 acre-feet, equivalent to 325 million gallons or about 8 percent of the total reservoir storage.

Based on an all-season low flow duration analysis using 21 years of flow records for the gaging station on the French River at Hodges Village, it was determined that during a 10-year frequency drought period the volume of runoff could: a) fill the reservoir from invert elevation 465.5 to 477 feet NGVD in a 44-day summer period provided no releases were made from the dam. The storage at elevation 477 is equivalent to 1,000 acre-feet or 325 million gallons, b) fill the reservoir to elevation 477 in an 82-day summer period if a continuous release of about 3 cfs (0.10 cfs/sq. mi.) were maintained, or c) fill the reservoir to elevation 477 in about a three-week period in May if a continuous release of about 5 cfs were maintained. The water stored could be drawn directly from the reservoir or released downstream for municipal supply with proper treatment. Drought contingency storage versus flow duration at Hodges Village Dam is shown graphically on plate 3.

c. Effects of Regulated Flows. There is a possibility that curtailment of flows from Hodges Village Dam during the drought emergency could adversely impact on the flowage rights of downstream riparian users. At this time however, it is not possible to review all of the various drought emergency situations that could occur, nor is it within the scope of this report to identify all those with water rights. It is important to note that when a specific drought emergency situation does occur, the legal implications will need to be addressed.

9. WATER QUALITY EVALUATION

a. Water Quality Classification. The French River above and immediately downstream from Hodges Village Dam is rated class B by the Massachusetts Division of Water Pollution Control (MDWPC). Class B waters are designated for the protection and propagation of fish, other aquatic life and wildlife; and for primary and secondary contact recreation. Public water supply after treatment is not one of the uses given in Massachusetts Water Quality Standards for class B waters. However, a water which meets class B standards could be made potable with standard treatment processes.

The French River has been further designated as a warm water fishery. Technical requirements for class B warm water fisheries include a minimum dissolved oxygen concentration (DO) of 5 mg/l, a maximum temperature of 83°F, pH in the range of 6.5-8.0 standard units and fecal coliform bacteria not to exceed a log mean of 200 per 100 ml for a set of samples, nor shall more than 10 percent of the total samples exceed 400 per 100 ml during any monthly sampling period.

b. Existing Water Quality. Historically, the water quality along the length of the French River has ranged from fair at its origin in Sargent Pond to grossly polluted at Webster, Massachusetts and below. The causes of the water quality degradation were untreated and poorly treated municipal and industrial discharges.

Water quality in the French River has improved significantly in recent years. Charlton Woolen's discharge has ceased because the company went out of business. A significant source of nonpoint pollution, a road-salt stockpile near Rochdale Pond, Leicester, has been removed, but there is still a noticeable rise in chlorides in the river below this point. The untreated sewage outfall in Rochdale has been diverted to the newly-built Oxford-Rochdale District Wastewater Treatment Plant (WWTP).

The remaining significant point source discharges upstream from Hodges Village Dam, in addition to the Oxford Rochdale WWTP, are CWM Electro-Plating Company (formerly Worcester Tool and Stamping Company) which discharges treated plating waste to the river, and the Leicester WWTP which has inadequate treatment but which is planned to be upgraded to secondary treatment by means of spray irrigation to land above Sargent Pond.

Water quality data collected by the Corps of Engineers and the Massachusetts Division of Water Pollution Control show that the waters of Hodges Village Dam are of generally good quality but do not fully meet the requirements of the Massachusetts class B designation. Areas of concern are low pH level and elevated coliform, nutrients, and iron levels. When the Leicester WWTP is upgraded the nutrients and coliform should be reduced to background levels. However, the low pH and high iron levels are due to the effects of swamps and bogs in the watershed and acid precipitation; therefore, no change is expected in these parameters.

c. Soil Inundation Study. A study of the effect of inundating the soils in the Hodges Village reservoir area was conducted by the Corps Hydraulics and Water Quality Section, and reported in "Water Quality Control, Hodges Village Dam and Reservoir, Low Flow Augmentation Study", February 1982. It concluded that even if the nutrient levels in the river above Hodges Village Dam declined to background levels, and especially if they did not, large areas of the reservoir would need to be stripped of all organic material in order to maintain a high water quality in the impoundment. Of principal concern were the adverse water quality effects of algae blooms caused by high nutrient levels leached from the organic soils in the reservoir. Lesser concerns were high levels of color, iron, and turbidity and low DO levels in the depths of the pool.

d. Water Quality Requirements for Drought Storage. There are two requirements to be met: the waters must meet State standards for surface waters and must be of a quality suitable for domestic or industrial water supply use. Class B waters are not designated for use as public water supply. However, a water which meets class B standards could be made usable for public water supply without unusual treatment processes. The water quality required for industrial water supply depends on the specific industrial process involved.

e. Effects of Drought Storage. The impacts of creating a pool for drought storage at Hodges Village Dam will be very similar to the impacts of creating a pool for low flow augmentation. If the reservoir lands are stripped of organic material prior to inundation and the Leicester WWTP's effluent is upgraded, a high quality water will be stored in the reservoir. This water would meet class B standards and be usable for public water supply after adequate treatment. If the reservoir lands are not properly prepared for inundation or drought storage is begun before the Leicester WWTP's effluent is upgraded, a poor water quality degraded by algae blooms and elevated levels of color, turbidity, iron, manganese, taste and odor will result. Low levels of DO would occur in the deeper portions of the pool; however, the pool would be too shallow to stratify strongly and wind mixing would cause low DO levels to occur only intermittently. This water would still be usable for public water supply, but additional and possibly excessive treatment would be required. With or without additional treatment, the stored water would be usable for fire fighting and some industrial processes.

10. DISCUSSION OF IMPACTS

a. General. Any action resulting in a temporary change of a reservoir's storage volume will have impacts on other project purposes which must be evaluated before a storage reallocation plan can be implemented. An evaluation has been made of the impacts resulting from drought contingency storage on the flood control purpose of this project. Effects on recreation, sedimentation and the aquatic and terrestrial environments as well as the historic and archeological resources have also been addressed.

b. Flood Control. A review of the regulation procedures at Hodges Village Dam was undertaken to determine the volume of water that could be made available for drought contingency purposes. The water would be stored by temporarily utilizing existing flood control storage. It is recognized that major floods occur in every season of the year, thus any use of flood control storage would be continually monitored to insure there would be no adverse impacts on downstream flood protection.

At Hodges Village Dam the maximum pool elevation for drought contingency storage has been estimated to be elevation 477 feet, representing an infringement on the flood control storage of about 0.6 inch of runoff from the upstream 31.1 square mile drainage area.

Based on a 10-year event, the anticipated rate of pool storage would exceed 0.1 foot per day over an 82-day period beginning in June. This condition assumes a flow of about 3 cfs (2 mgd) would be released downstream for the duration of the drought. Storage would probably take place during the months of June, July and August and would be drawn as needed in the following months. The storage may be held for a period of one month or longer at the 477-foot elevation before withdrawal.

c. Recreation. Passive forms of recreation within the drought storage pool area such as hunting and fishing presently enjoyed by the public will be lost for the drought storage period and several years following until such time as the fishery can be reestablished and the vegetation replaced. Recreation associated with the existing tree cover, such as hunting and bird watching will be lost permanently.

d. Project Operations. It is anticipated that it will be necessary to make frequent gate settings to build up the required storage while making a continuous minimum release. This requirement will continue after a pool of 11.5 feet is reached since no stoplog structure is available to maintain the pool. The pool level will be maintained by operation of the gates.

Significant cleanup efforts will be required in the reservoir after drawdown of the drought storage to remove debris, clear dead brush and trees. This material must be removed for aesthetic reasons and also to prevent it from clogging the intake and affecting flood control operations. Users of the proposed drought storage may be required to bear the expense of this removal and cleanup.

e. Effect on the Aquatic Ecosystem. The aquatic environment of the project area consists of the French River main stem and the impounded wetland just above the dam. The main stem is a moderate-sized warm water stream that generally ranges from 20-40 feet wide and from 2-4 feet deep. Streambank vegetation is generally thick and consists of a variety of riparian shrubs, trees and herbs. The warm water conditions and moderate instream cover provide habitat for largemouth bass, white sucker, sunfish, golden shiner and a variety of other warm water species. The impounded wetland above the dam creates a 2-3 foot deep pool which supports a variety of marsh vegetation. The impoundment and the river provide habitat for muskrat, mink, otter, waterfowl, wading birds and shorebirds.

Creating of the proposed temporary pool could impound up to 2.5 miles of the French River and the lower portion of its tributary, Wellington Brook. The stream habitat would be temporarily degraded by siltation and the influx of poorer quality water. Strict stream-associated vegetation and animals would probably be destroyed. Mobile forms such as fish, adult birds and aquatic mammals would be displaced from their existing habitats.

The impact on the fish population in the downstream French River would be related to the restricted downstream flows and the quality of the released water. Assuming a condition that drought storage would occur during the summer months, a minimum release of 3 cfs (2 mgd) would impose a low flow condition on the downstream main stem habitat throughout the duration of the drought. The lower stream levels and the poorer quality of the released water would further deteriorate the quality stream habitat in the downstream area.

f. Effects on the Terrestrial Environment. The terrestrial environment in the project area consists of the upland and wetland forest and shrubland adjacent to the stream and marsh habitats described above. Approximately 635 of the 873 acres held in fee are forested and consist mainly of white and red oak, white pine, hickories, red maple, birches and hemlock. Shrubland consist primarily of *Spirea* spp., dogwood, arrowhead, blueberry and alder; leather lead and laurel occur in the bog areas. An unusual Atlantic white cedar swamp is located east of the French River and north of the Rocky Hill recreational area. Wildlife that use these habitats include white-tailed deer, fox, eastern chipmunk, racoon, owls, hawks, woodpeckers and a variety of other small mammals, songbirds, reptiles, amphibians and invertebrates. The State of Massachusetts annually stocks pheasants at the project area for hunting.

The proposed temporary impoundment would inundate about 245 acres of wetland forest and shrubland habitats during the growing season.

The majority of the upland habitat in the reservoir area would not be inundated. A significant storage during the growing season would kill tree species such as sugar maple, birches, beech, white pine, hemlock and oaks. Red maple and alder would probably be able to survive only one flooded season. Past inundation of the red maple swamps has led to considerable tree fall at the project. Most of the white cedar trees would probably survive a one-time inundation of their root systems. However, if drought storage were to coninue during subsequent years, the trees could exhibit significant loss.

The anticipated loss of vegetation would temporarily degrade wildlife habitat for most of the impounded area. Newly born or hatched young and some adult wildlife would probably perish in the rising waters. Others would be displaced on adjacent land where the habitat would probably be unable to support the added individuals.

g. Historic and Archeological Resources. Examination of mid-19th century maps reveal no recorded historic period resources below elevation 477 feet NGVD, and no prehistoric resources are recorded within the project. However, as the project has never been subjected to an archeological survey, unrecorded prehistoric or historic resources may exist within the area affected by this drought contingency plan. An archeological reconnnaissance of this area is now underway as part of a low flow augmentation study. Therefore, should this plan proceed to more detailed study, results of the archeological reconnaissance survey will be included and further studies undertaken to determine what, if any, resources are affected and the severity of any impact upon them.

11. STUDY OF MODIFICATION OF HODGES VILLAGE DAM

a. General. A separate study is currently underway that would modify the operation and structural element of the Hodges Village Dam to provide low flow augmentation for water quality improvement in the French River. Modifications to Hodges Village Dam and Reservoir would consists of clearing woody vegetation and selective stripping of organic topsoil in the reservoir area, and modifying one of the outlet gates at the dam.

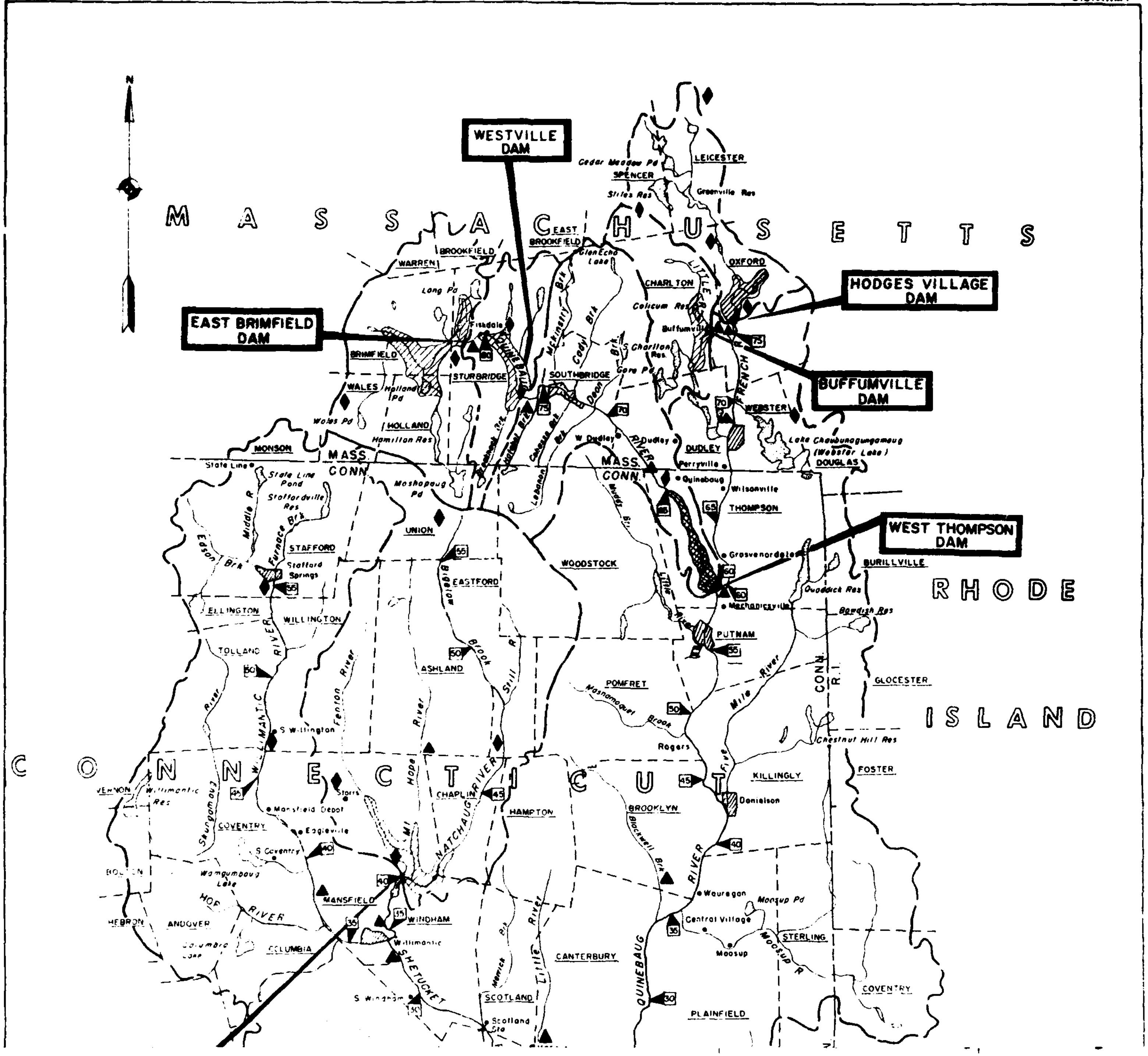
The U.S. Environmental Protection Agency has determined that low flow augmentation from Hodges Village Dam in combination with upgrading wastewater treatment plants in Leicester, Webster, and Dudley is the only practical means of achieving State standards for surface waters in the lower portions of the French River. If a high quality discharge is made from Hodges Village Dam between the end of May and the end of October so that the flow at the U.S. Geological Survey gage in Webster does not fall below 22 cfs (14.2 mgd), State standards can be met in the river. To meet this target, a release of approximately 10 cfs from Hodges Village Dam would be required during augmentation periods.

To provide for low flow augmentation, the reservoir would be filled to elevation 475.6 feet NGVD each spring (May) and releases would be made from storage during the summer months, drawing the pool down to elevation 472 feet NGVD by the end of October. A permanent 90 acre pool (190 acre-feet) at elevation 472 (stage 6.5 feet) would be maintained the rest of the year. The net flow augmentation storage, between elevation 472 and 475.6, would be about 485 acre-feet.

b. Effects of Drought Storage. If Hodges Village is to be operated for low flow augmentation in the future then there will be no drought contingency storage filling capability during the summer season without adversely affecting its low flow function. With spring filling to elevation 475.6, providing 485 acre-feet of storage, the Hodges Village project can provide a 99 percent dependable flow of about 11 cfs. If, in preparation for a drought contingency, the project was filled in the spring to elevation 477 feet NGVD, then the project could supply a 99 percent dependable yield of 3 cfs or a total project yield of about 14 cfs.

12. SUMMARY AND CONCLUSIONS

Hydrologic studies indicate it would be possible to utilize up to approximately 1,000 acre-feet equivalent to 325 million gallons of flood control storage for drought emergency purposes, without having a significant adverse impact on the project's flood control effectiveness. However, under existing conditions in the reservoir, a poor quality water degraded by algae blooms and elevated levels of color, turbidity, iron, manganese, taste and odor will result; therefore, this project is not considered to be a good location for the storage of water for public water supply purposes during a drought emergency. The stored water may be acceptable for industrial water supply or related activities.



MASSACHUSETTS
CONNECTICUT
RHODE ISLAND
WESTVILLE DAM
EAST BRIMFIELD DAM
HODGES VILLAGE DAM
BUFFUMVILLE DAM
WEST THOMPSON DAM
N
LEICESTER
SPENCER
Cedar Meadow Pd
Stiles Res
Greenville Res
OXFORD
CHARLTON
Colicum Res
Buffumville
EAST BROOKFIELD
BROOKFIELD
WARREN
Long Pd
Fiskdale
BRIMFIELD
STURBRIDGE
SOUTHBRIDGE
WALES
Holland Pd
HOLLAND
Hamilton Res
Wales Pd
MONSON
MASS.
CONN.
State Line
State Line Pond
Staffordville Res
Moshapaug Pd
UNION
STAFFORD
Stafford Springs
ELLINGTON
WILLINGTON
TOLLAND
WEBSTER
DUDLEY
Perryville
Quinebaug
Wilsonville
THOMPSON
Lake Chaubunagungamaug (Webster Lake)
DOUGLAS
W Dudley
Dudley
WOODSTOCK
EASTFORD
Grosvenordale
Mechanicsville
BURRILLVILLE
Quaddick Res
Bowdish Res
PUTNAM
POMFRET
GLOCESTER
Chestnut Hill Res
FOSTER
KILLINGLY
Danielson
ASHLAND
CHAPLIN
HAMPTON
BROOKLYN
Rogers
Storrs
Mansfield Depot
Eagleville
S Willington
S Coventry
COVENTRY
VERNON
Willimantic Res
BOLTON
Wangumbaug Lake
HEBRON
ANDOVER
Columbia Lake
COLUMBIA
MANSFIELD
WINDHAM
Willimantic
SHETUCKET
S Windham
SCOTLAND
Scotland Sta
CANTERBURY
PLAINFIELD
Wauregan
Central Village
Moosup
Moosup Pd
STERLING
COVENTRY
QUINEBAUG RIVER
NATCHAUG RIVER
WILLIMANTIC RIVER
HOP RIVER
Fenton River
Mt Hope River
Still R
Bigelow Brook
Mashamoquet Brook
Blackwell Brk
Five Mile River
Moosup R
Little River
Furnace Brk
Edson Brk
Middle R
Skungamaug River
Muddy Br
Lebanon Brk
McKinstry Brk
Cady Brk
Cohasse Brk
Merrick Brk
Little R
FRENCH
CONN R.I.
35
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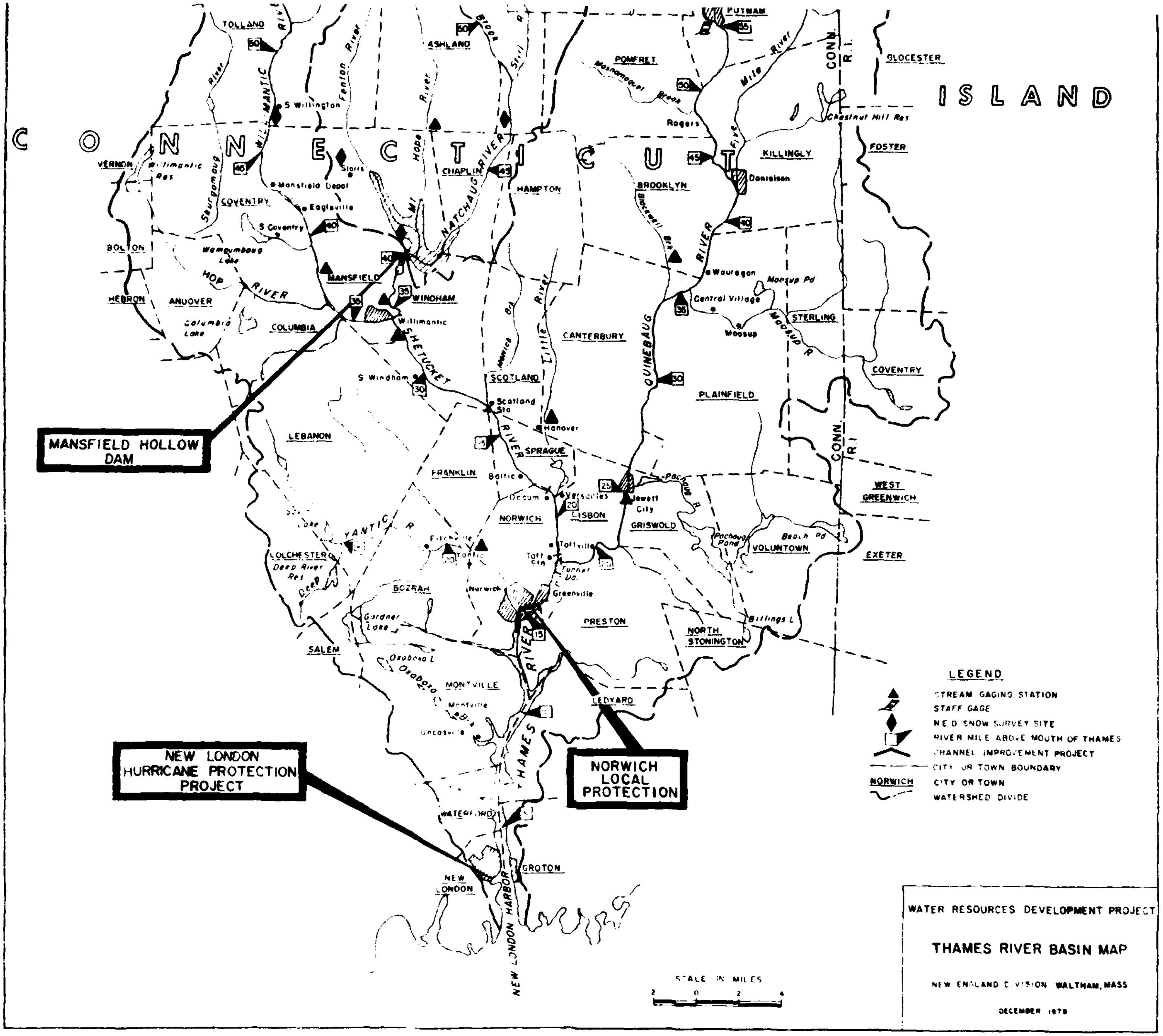
CONNECTICUT
ISLAND
MANSFIELD HOLLOW DAM
NEW LONDON HURRICANE PROTECTION PROJECT
NORWICH LOCAL PROTECTION
LEGEND
STREAM GAGING STATION
STAFF GAGE
N E D SNOW SURVEY SITE
RIVER MILE ABOVE MOUTH OF THAMES
CHANNEL IMPROVEMENT PROJECT
CITY OR TOWN BOUNDARY
NORWICH
CITY OR TOWN
WATERSHED DIVIDE
SCALE IN MILES
WATER RESOURCES DEVELOPMENT PROJECT
THAMES RIVER BASIN MAP
NEW ENGLAND DIVISION WALTHAM, MASS
DECEMBER 1979

PLATE 1

HODGES VILLAGE RESERVOIR
AREA AND CAPACITY
DRAINAGE AREA - 31.1 SQ. MI.

Elev. (msl)	Stage (feet)	Area (acres)	Capacity	
			Acre-Feet	Inches
465.5	0	0	0	
466.5	1	2	1	0
467.5	2	7	6	0
468.5	3	15	17	0.01
469.5	4	30	40	0.02
470.5	5	52	80	0.05
471.5	6	77	145	0.09
472.5	7	103	235	0.14
473.5	8	130	350	0.21
474.5	9	161	500	0.30
475.5	10	197	675	0.41
476.5	11	230	890	0.54
477.5	12	260	1,130	0.68
478.5	13	288	1,410	0.85
479.5	14	316	1,710	1.03
480.5	15	340	2,040	1.23
481.5	16	363	2,390	1.44
482.5	17	385	2,765	1.67
483.5	18	406	3,160	1.90
484.5	19	427	3,575	2.15
485.5	20	447	4,010	2.42
486.5	21	466	4,470	2.69
487.5	22	487	4,945	2.98
488.5	23	506	5,440	3.28
489.5	24	526	5,960	3.59
490.5	25	544	6,490	3.91
491.5	26	563	7,050	4.25
492.5	27	582	7,620	4.59
493.5	28	600	8,210	4.95
494.5	29	619	8,820	5.31
495.5	30	638	9,450	5.69
496.5	31	657	10,100	6.08
497.5	32	675	10,760	6.48
498.5	33	693	11,450	6.90
499.5	34	712	12,150	7.32
500.5	35	730	12,870	7.75
501	35.5	740	13,250	8.00

NOTES: Gate Sill Elev. = 465.5
Spillway Crest Elev. = 501.0
1" Runoff = 1,660 A.F.

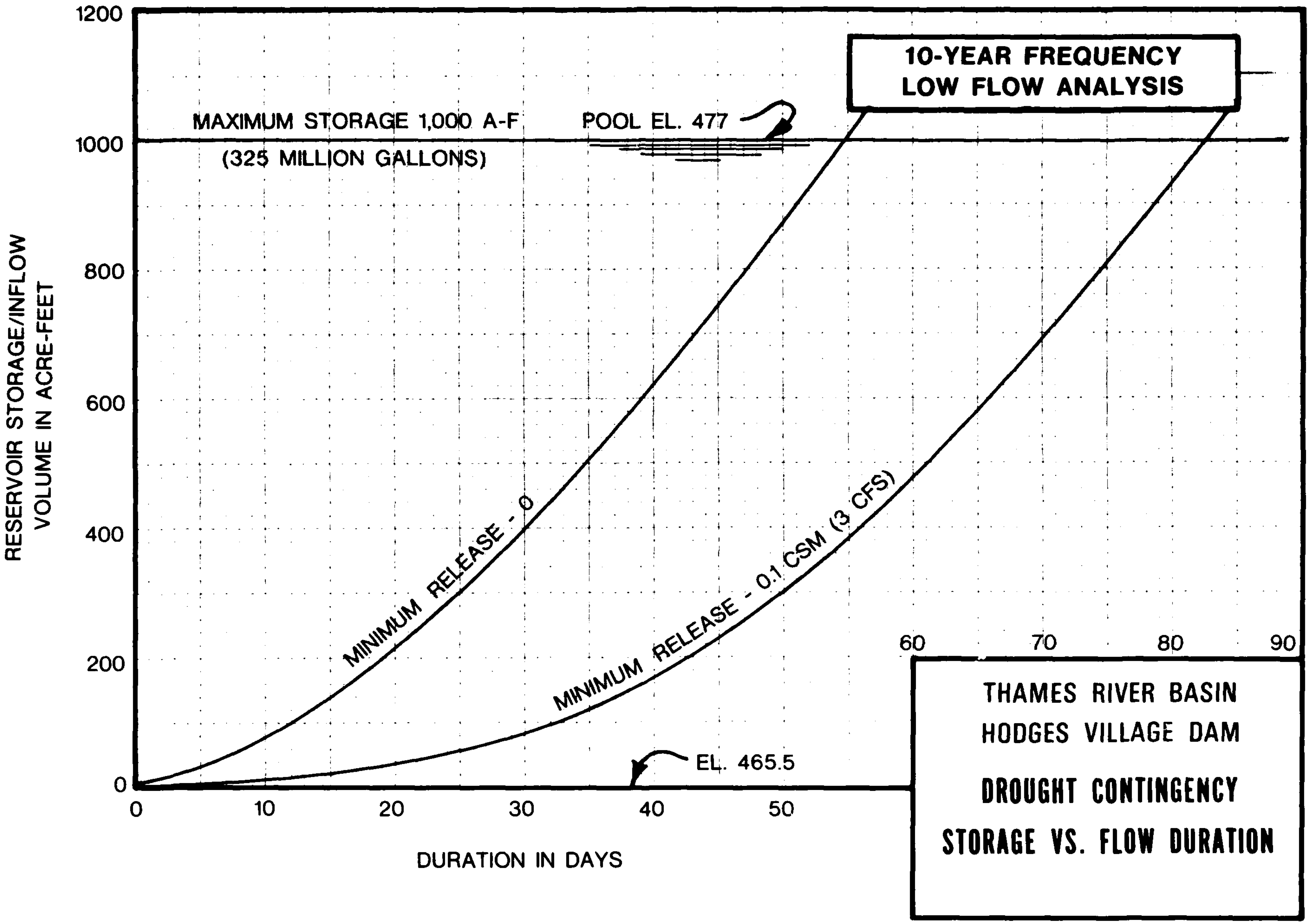
10-YEAR FREQUENCY
LOW FLOW ANALYSIS
MAXIMUM STORAGE 1,000 A-F
(325 MILLION GALLONS)
POOL EL. 477
MINIMUM RELEASE - 0
MINIMUM RELEASE - 0.1 CSM (3 CFS)
EL. 465.5
RESERVOIR STORAGE/INFLOW
VOLUME IN ACRE-FEET
DURATION IN DAYS
0
200
400
600
800
1000
1200
0
10
20
30
40
50
60
70
80
90
THAMES RIVER BASIN
HODGES VILLAGE DAM
DROUGHT CONTINGENCY
STORAGE VS. FLOW DURATION

PLATE 3

PERTINENT DATA
HODGES VILLAGE DAM

LOCATION — French River, Oxford, Massachusetts

DRAINAGE AREA — 31.1 square miles

STORAGE USES — Flood control

RESERVOIR STORAGE

	Elevation (ft msl)	Stage (feet)	Area (acres)	Capacity: Acre-Feet	Capacity: Inches on Drainage Area
Inlet Elevation	465.5	0.0	0	0	0.0
Spillway Crest	501.0	35.5	740	13,250	8.0
Maximum Surcharge	515.1	49.6	-	-	-
Top of Dam	520.0	53.5	-	-	-

EMBANKMENT FEATURES

Type — Rolled earth fill with rock slope protection

	Length (feet)	Top Width (feet)	Top Elevation (ft msl)	Height (feet)	Volume (cy)
Dam	2,140	22	520	54.5	126,000
Dike No. 1	1,205	16	520	15±	-
Dike No. 2	200	16	520	6±	-
Dike No. 3	720	16	520	16±	-
Dike No. 4	435	16	520	10±	-

SPILLWAY

Location	Right (west) abutment
Type	Chute spillway/concrete ogee weir
Crest Length (ft)	125
Crest Elevation (ft msl)	501
Surcharge (ft)	14.1
Maximum Discharge Capacity (cfs)	25,800
Spillway Design Flood	
Peak Inflow (cfs)	35,600
Peak Outflow (cfs)	25,800

OUTLET WORKS

Type	Two, Rectangular concrete conduits
Tunnel Dimensions (ft)	5.0 wide x 6.0 high
Tunnel Length (ft)	206
Service Gate Type	Slide gate, electric
Service Gate Size (ft)	Two, 5 wide x 6 high
Emergency Gate Type	None
Downstream Channel Capacity (cfs)	525 (non-growing season); 400 (growing season)
Maximum Discharge Capacity with Pool at Spillway Crest Elevation	1,760
Stilling Basin	None

LAND ACQUISITION

	Elevation (ft msl)	Stage (feet)	Area (acres)
Fee Taking	479	13.5	873
Easement	504	38.5	264

MAXIMUM POOL OF RECORD

Date	March 1968
Stage (ft)	23.4
Percent Full	43

UNIT RUNOFF

One Inch Runoff (acre-ft) — 1,660

OPERATING TIME

Open/Close all Gates — 6 min. (manual operation; 144 turns/in.)

PROJECT COST

Through September 1977 — $4,421,000

DATE OF COMPLETION — 1959

MAINTAINED BY — New England Division, Corps of Engineers
Maintenance of recreation areas is shared by the Town of Oxford, Massachusetts and New England Division, Corps of Engineers