over, administrative building code director. The material also may be used in partitions that the Indiana code requires to be noncombustible.

These treated wood products can be used in schools, hospitals, farm buildings, hotels, motels, bowling alleys, supermarkets, office buildings and all other types of commercial and industrial structures.

Today's permanently fire-protected lumber is manufactured by the use of tested and selected chemicals. These are impregnated in wood under high pressure in sealed cylinders. During this process the protective chemicals are driven deeply into the wood to provide permanent protection against fire. The chemicals will remain in the wood indefinitely as long as the surface is not exposed to running water. These new products should not be confused with mere fire-retardant surface coatings which provide protection for relatively short periods of time and which also require periodical reapplication.

After pressure impregnation, fire-protected lumber is kiln dried to remove excess moisture and the chemicals are left imbedded deep in the wood. When the lumber is shipped from the treating plant, its moisture content does not exceed 19 percent and it is ready for any building purpose.

The chemical salts fill the air spaces in the wood and thus reduce the amount of oxygen available for combustion. When the wood is exposed to sufficient heat the salt crystals melt and release noncombustible gases that smother the flames and retard their spread. Then as the area of the wood exposed to the fire begins to char, other salts fuse to form an insulating glaze over the wood.

Structural members of FRT wood retain a large part of their strength even under very high temperatures, thus preventing sudden collapse of the building. FRT wood also helps to keep contents fires small and localized until they burn themselves out or firemen arrive. Also smoke and heat are reduced to a large extent.

During World War II, because of steel shortages, the U. S. Navy built several huge blimp hangars of fire-retardant wood. That at Tillamook, Oregon, later was converted to a plywood factory. It caught fire in 1955 when shavings ignited in an exhaust duct and the flames raced up the asphalt roof. Despite the fact that fire department water streams were too weak to reach the fire, wooden rafters and decking resisted the flames until they went out leaving the building and equipment intact. Replacement would have cost approximately $7.5 million, but actual repair bills amounted to only $21,000.

Contrast that fire with the blaze that destroyed General Motors' Livonia transmission plant in 1953. That so-called "fireproof" building comprised a metal roof supported by steel trusses. In minutes the roof deck buckled and collapsed under heat of fire. The entire 34½-acre building and its contents were ruined with a loss of $55 million.

Factory Mutual Laboratories recently erected roof assemblies of (a) insulated metal and (b) fire-retardant wood for test purposes. These were subjected to direct flames from gasoline burners for 60 minutes. The metal deck began to buckle after 8 minutes and 10 seconds with ultimate distortion so severe that it would have caused a building to collapse. The wood deck remained structurally sound throughout the test although the decking charred through after 53 minutes.

A FEDERAL-AID PROJECT TO DEVELOP WATERFOWL WINTERING HABITAT IN A SOUTHERN MARYLAND WOODLAND

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For the past ten or twelve years the Maryland Game and Inland Fish Commission has carried on a program of development projects to increase the value of its tidal marshland as wintering habitat for waterfowl. All of this previous work has been accomplished on lands located on the lower portion of Maryland's Eastern Shore. In reviewing work done and opportunities for additional projects

in areas where development is needed it was decided to investigate possibilities in the southern portion of the Western Shore. The Commission owns very little marshland in this area of the State, therefore, any waterfowl development would have to be of the wooded swamp or green tree reservoir type. Under a now discontinued program of wetland construction on private lands, four small wooded impoundments were developed with satisfactory results even though all were located some distance from heavily utilized waterfowl areas. This encouraged serious consideration of a similar program at the Myrtle Grove Refuge in Southern Maryland. It was felt that this area, lying in close proximity to the Potomac River and extensive marsh areas of tidal streams, would become an important feeding and resting sanctuary for migrating waterfowl once proper impounding and management practices were established.

Myrtle Grove Game Refuge consists of 724 acres of land situated approximately one-half mile west of Ripley, in Charles County, fronting on Maryland Route 225 and extending two miles north to Mattawoman Creek. It lies within four miles of the Potomac River. The area is divided roughly into northern and southern halves by the cleared area around the home site and farm buildings and by topography sloping quite rapidly from the south to a broad flat plain which makes up the northern section. It is this northern portion of the Refuge with which the development plan is concerned.

In the northern area, the terrain is nearly flat with a gentle slope toward Mattawoman Creek. For approximately 1,200 feet north of the dwelling, average slopes fall between 4 and 10 percent. In the remaining distance to the Mattawoman, about 4,100 feet, slopes approximate 1% or less. Drainage in this area is poor despite numerous ditches evidently installed long ago to drain portions of the area for agriculture. Water standing in depressions and seepage spots is common.

The soils grade from silt loam on the higher portions through Oahlockonee gravelly loam to swamp type. Creek bottoms in many places exhibit a very dense clay material which probably underlies the entire area. In field borings at each of numerous separate locations, this clay subsoil occurred without fail. This impervious layer of underlying soil probably accounts for the poorly drained and swampy character of the area. It also is an excellent material for dike construction.

The predominating forest type is pin oak interspersed with thickets of red gum, birch, and a small amount of Virginia pine. Other species of lowland oaks are well distributed in good numbers. Ash, maple, holly, and beech occur to a minor extent. Ground vegetation consists of greenbriar, laurel, blueberry, and numerous species of grasses.

In January of 1960, engineering and wildlife management personnel of the Commission along with Francis M. Uhler from the Fish and Wildlife Service Patuxent Research Center made an extensive field reconnaissance of the flood plain to appraise the possibilities for development. This inspection resulted in the decision to proceed with the proposed project.

During the month of February, 1960, a field survey was made and a topographic map was prepared in some detail for the entire northern half of the refuge. After careful consideration of the natural drainage system and study of the contributing watersheds, six sites for impoundments were selected and structural plans prepared. Areas of the proposed ponds are given in the following table:

TABLE I

Site I	81 acres
Site II	32 acres
Site III	12 acres
Site IV	7 acres
Site V	4 acres
Site VI	8 acres
TOTAL	144 acres

In general, all impoundments feature earth fill dikes with a standard cross-section showing 8 feet of top width, 3:1 upstream slope and 2½:1 back slope. Depth was held to a maximum of 3 feet except for a very small portion of Site

I which was increased to 4 feet to gain additional surface area. Water-control structures consist of reinforced concrete drop boxes equipped with a double thickness of removable stoplogs. Corrugated metal pipe, bituminous coated, with diaphram anti-seep collars is used as conduit through the dikes.

In August, 1960, the proposed plans and the Preliminary Project Statement providing for construction of the 5 impoundments and thinning or clearing operations on some 50 acres was approved by the Bureau of Sport Fisheries and Wildlife. The entire project, requiring some 12,400 feet of dikes, would be completed over a period of five years.

At the same time, the Plans, Specifications, and Estimates for Segment 1 of the project were approved. This segment provided for construction of the ponds at Sites V and VI which were to be on 4 acres of cleared land and 8 acres of woodland, respectively. The work involved 2,100 feet of earth dike containing about 5,200 cubic yards of material, two control structures requiring approximately 8 cubic yards of concrete and 56 feet of 18 inch pipe, for both ponds. Approximately 2.5 acres of clearing was required.

Our estimates indicated a probable cost for the work of $2,725.00, to which was added a small amount for labor and supervision and 6% for contingency, making a project total of $3,000.00. Advertising this job in August produced bids from three contractors in the amounts of $13,120.00, $8,975.00, and $4,200.00. All of these bids were rejected and the project was amended to permit performance of the work by force account and rental of equipment. Negotiation with the low bid contractor resulted in the rental of a D-6 and a D-7 bulldozer at $10.00 per hour and $12.00 per hour, respectively. Installation of all piping and concrete work was done by Commission personnel. Final cost of the two impoundments was $3,400.00 exclusive of state labor.

In August, 1961, a contract was awarded for construction of the largest impoundment, 81 acres, as segment 2 of the project. Work involved in this segment included approximately 10 acres of heavy clearing, 4,700 feet of dike containing 17,500 cubic yards of earth, and 5 cubic yards of reinforced concrete with 48 feet of 18 inch pipe. Bid proposals were received containing lump sum prices for clearing and for construction of the control structure including pipe. The proposals also contained price per hour quotations for rental of a ¾ yard dragline and a D-6 bulldozer or equivalent. Basis of award was the total aggregate price using 200 hours as an arbitrary time requirement for each type of equipment. The low bidder was awarded a contract for $8,100.00 which reflected $6,000.00 for equipment rental. Abnormally dry working conditions made the use of a dragline unnecessary and the entire job was accomplished with bulldozers. However, equipment rental cost exceeded the estimate by $484.00, bringing the total construction cost to $8,584.00.

Segment three of this development project resulted in the completion of the 32 acre impoundment at Site II in September 1962. This job consisted of 7 acres of clearing, 3,650 feet of dike containing approximately 13,500 cubic yards of earth, and 5 cubic yards of reinforced concrete with 48 feet of 24 inch pipe. Bids were received in the same manner as the previous year except that a D-7 bulldozer was substituted for the dragline in the equipment rental, and a contract was awarded for a total cost of $6,750.00. Extremely dry conditions in the working area made excavation quite difficult. The D-7 bulldozer with cable blade was so ineffective in digging the hard clay material that two Caterpiller 955 Traxcavators were brought to the job at an hourly rate of $12.50. These machines working with the bulldozer proved to be a very efficient team and the excavation was completed for slightly less than the $4,700.00 allowed in the contract.

Management of the four completed impoundments will be on an annual drawdown basis, flooding only through the fall, winter, and early spring months. The remaining two ponds, which will be built within the next two years, contain few trees of importance as waterfowl food producers. Therefore, present intentions are to maintain permanent water levels in both after timber is cleared. This will serve the dual purpose of providing water areas for summer ducks and a ready supply of water to begin flooding impoundments I and II if necessary because of drought conditions.

SUMMARY OF DATA FOR COMPLETED IMPOUNDMENTS

	Site I	*Site II*	*Site V*	*Site VI*
Area Flooded (Ac.)	81	32	4	8
Maximum Water Depth (Ft.)	4	3	3	3
Length Dike (Ft.)	4,700	3,650	1,000	1,100
Embankment (Cu. Yd.)	17,500	13,500	2,180	2,030
Cost for Earth Work	$6,484.00	$4,700.00	$2,974.00*	
Cost Per Cubic Yard	$ .37	$ .35	$ .71*	
Clearing Cost Per Acre	$ 150.00	$ 200.00		
Cost of Structure and Pipe	$ 600.00	$ 650.00	$ 426.00†	
Total Cost‡	$8,584.00	$6,750.00	$3,400.00	
Cost Per Acre	$ 106.00	$ 211.00	$ 283.00	

* Includes clearing 1.5 acres.
† Two structures, does not include State labor, form lumber, or reinforcing steel.
‡ Does not include cost of seeding and mulching.

WILDLIFE APPURTENANCES FOR FLOODWATER RETARDING STRUCTURES

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In 1954, the Congress of the United States enacted Public Law 566, the Watershed Protection and Flood Prevention Act, in recognition of the need for a project-type approach to soil and water resource development, use, and conservation. This enactment also showed that Congress recognized that a means was needed to accomplish project-type programs not covered by those which are for development and flood protection of major river basins such as those handled by the Corps of Engineers and the small projects that local people can accomplish with their own resources.

It was the intent of the congress that Public Law 566 projects should be local undertakings with Federal assistance. The Act also encourages the close cooperation and assistance of State agencies.

Responsibility for the administration of the Act was given to the Department of Agriculture through the Soil Conservation Service. Since watershed protection and flood prevention are national problems concerning the welfare of all, Federal funds are used in the planning and application of necessary and justifiable measures. Financial or credit assistance on non-Federal lands is limited to those measures which (a) are primarily for flood prevention, drainage, irrigation, fish and wildlife development, municipal or industrial water supply, or other water management; (b) produce substantial benefits to groups of landowners, to communities, and to the general public; and (c) cannot generally be installed by individual landowners or small groups of landowners with the aid of available Agricultural Conservation Program or other cost sharing.

Public Law 566 is an expeditious tool for the intensive application of soil and water conservation on a small watershed basis. The conservation of our soil and water resources has many facets. Not only may certain problems be remedied by more than one measure either singly or in combiination but, conversely, some single remedial measures may be used for other than one purpose. This multiple-use is to be encouraged wherever possible. Generally speaking, the more uses served by a project, the better the project. In general, it is felt that floodwater damages should be reduced by floodwater retarding structures wherever sites are available. Full exploitation of these sites for multiple-use is desirable, since the ratio of cost to purpose can usually be lowered and also once a site is used for a single purpose, it is difficult to modify it for other purposes.