WATERBORNE TRANSPORTATION OF FOSSIL FUELS TO DERBY AND SHELTON:

An Evaluation of the Feasibility and Potential Effects of such Activity on the Natural Resources of the lower Housatonic River

Submitted to:
Connecticut
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prepared by:
Valley Regional Planning Agency
Derby, Connecticut
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CONNECTICUT COASTAL ENERGY IMPACT PROGRAM

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I. PROJECT OBJECTIVE

The purpose of this project is to study the feasibility of transporting fossil fuels by barge up the Housatonic River to Derby and Shelton, and to evaluate the possible impacts such an activity would have on the coastal zone environment.

II. PROJECT CONCEPTION

Two factors have contributed to the development of this project: the presence of two energy storage facilities (Figure 1) located near the banks of the Housatonic River, and the current dredging activities now taking place in the River.

One of the area's larger home heating oil suppliers, Petrol Plus, is located in Derby on the Housatonic River. Since World War II, the company has received all of its shipments of fuel by truck from New Haven. The present storage capacity at the Derby location is 500,000 gallons (two 250,000 gallon tanks). The company also has a one million gallon capacity storage operation in Naugatuck. Given the company's location on the River and its historic use of the River, plans are under consideration to re-establish the Derby docking facility to receive modern-day barges carrying oil, and to serve as a staging point for shipments to their facility in Naugatuck. In addition, if significant economies in transportation costs can be achieved, the Derby site may serve as a regional distribution point for other area dealers.

Above the confluence of the Housatonic and Naugatuck Rivers, and on the Shelton side of the River, a coal storage facility is located.[1] While the five coal silos have not been in use for many years, it is generally believed that sub-

1. At the onset of this project, the Petrol Plus company also owned the coal storage site in Shelton. Recently, the property was sold. The site is presently being used for equipment storage, although the coal silos still remain.

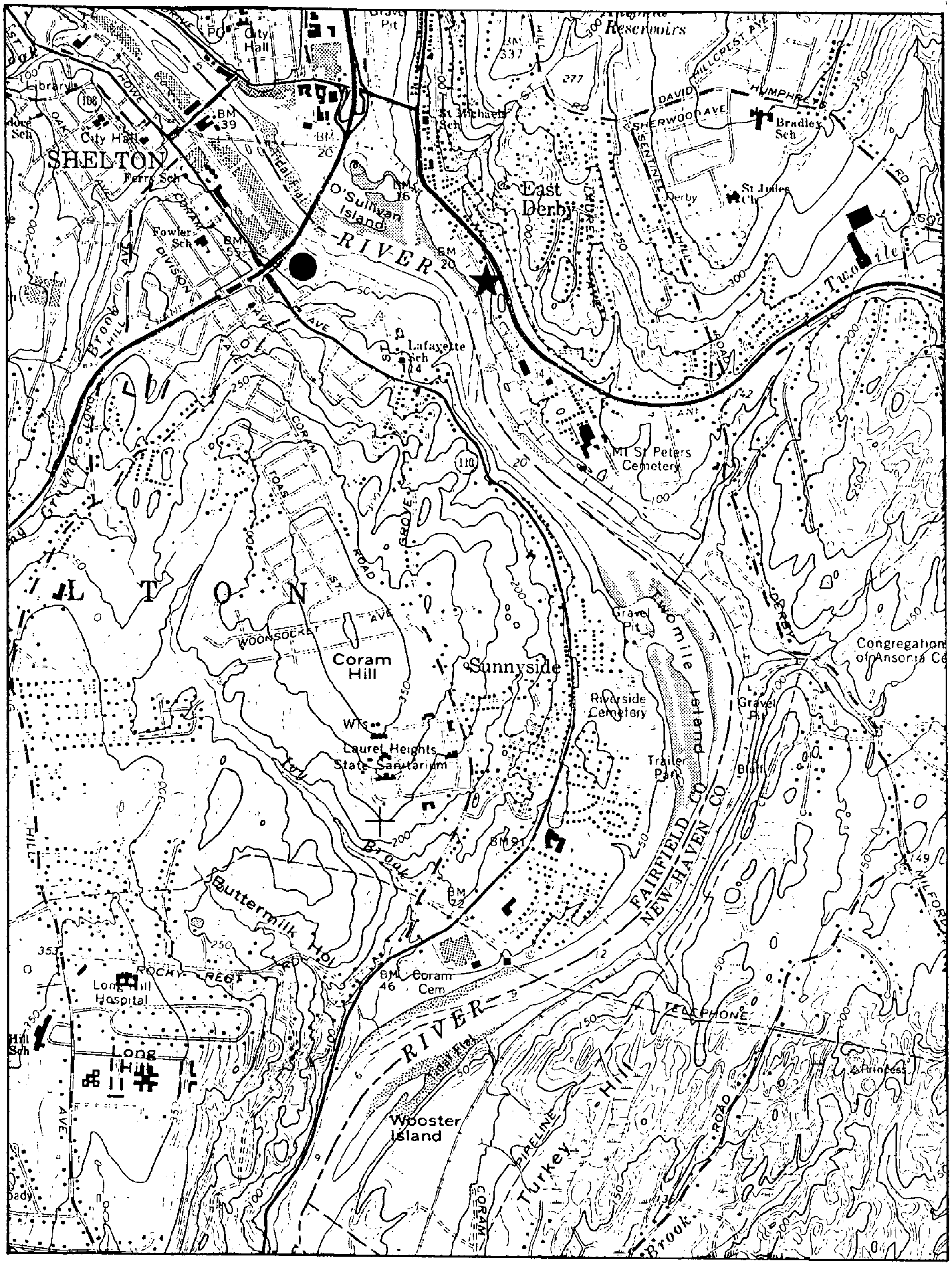

FIGURE 1

★ OIL TANKS

● COAL SILOS

stantial coal conversions, both industrial and residential, may occur in the near future if significant savings can be realized for the consumer, and if clean air requirements for burning coal can be met. The silos' proximity to the River, to area industries, and to several residential communities may increase the demand for their use as an energy storage facility once again.

The current dredging operations are being undertaken by two area companies: Dan Beard, Incorporated, and O & G Industries. Between them, they have a total of seven permits to remove sand and gravel from the tidal waters of the Housatonic River. The dredging operations extend from the Shelton/Derby Dam, which is north of both storage sites, southward to the Great Flats near the Shelton/Stratford border—a distance of approximately six miles.

III. REVIEW OF APPROVED DREDGING PERMITS AND MONITORING DATA

While the dredging permits will allow for the creation of a channel from the Great Flats to the dam (Figure 2), in the interest of this project, the concern is with the channel only as far north as the Route 8 highway bridge, which is just north of the Naugatuck and Housatonic Rivers' confluence. In this section of the River, the width varies considerably. Accordingly, the width of the dredged channel also varies, from approximately 200 feet to 500 feet,[2] depending not only on the width of the River but also on the maintenance of a 5-to-1 side slope (5 feet horizontal for each 1 foot vertical drop). The gentle side slope is extremely important to prevent shoreline erosion or slumping. The maximum depth at any point along the dredged channel is 25 feet below mean low water. The dredged section of the River approximates, in general location, the defined channels within the River.

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2. The exception to this width occurs over the high pressure gas line near Turkey Hill Brook. Further information is provided in Section IV.

FIGURE 2

■■■■ LIMITS OF CURRENT DREDGING OPERATIONS

Both companies are utilizing the barge-mounted bucket system to remove the material from the river bottom in their dredging operations. The material is then deposited on an adjacent barge, where it is moved, by tug, to one of two locations. Beard's barge is brought to Two Mile Island, where the sand and gravel is off-loaded and processed on site. O & G's barge is brought to the lagoon at the Shelton landfill site, where it is off-loaded and stockpiled.

Prior to the granting of State permits, both companies had to gather and present extensive environmental information regarding water quality data and sediment analysis. The Connecticut Department of Environmental Protection has classified the Housatonic River, from the dam to the mouth, as SCc, which is defined as water "suitable for fish, shellfish and wildlife habitat; suitable for recreational boating and industrial cooling; good aesthetic value."[3] It is not suitable for bathing or other water contact sports, and shellfish cannot be harvested for direct human consumption, due to the presence of high coliform bacteria as a result of combined sewers. Improving the sewage treatment should allow the goal of SB classification to be realized shortly.

As part of the permit application, field studies of the water quality were undertaken. The analysis defined temperature, turbidity and dissolved oxygen levels at various depths and at several river stations. As a result of these tests, there were no indications of serious pollution problems.

In the past, much attention has been focused on the pollution of the Housatonic River due to the presence of PCBs (polychlorinated bi-phenyls), which once entered the Housatonic River system from the General Electric Plant in Massachusetts. While the direct release of the PCBs has been stopped, the nature of the pollutants is such that they can become trapped in river bottom sediments

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3. Source: "Connecticut Water Quality Standards and Criteria" State of Connecticut, DEP, Water Compliance Unit.

and/or dissolve in the tissues of fish. For the permit, sediment samples (surface samples as well as core samples) were collected and analyzed to determine the existence of PCB pollution to evaluate the potential of releasing the PCBs into the water during the dredging process. The results of the testing indicated levels below the limits of detection. The sediment samples were also analyzed for oil and grease content, and concentration of metals, with the results indicating that the sediments are not highly polluted.

The water quality data and sediment analysis accumulated before the dredging began serves as a baseline guide for the periodic monitoring taking place during the current dredging operations. As a requirement and condition of the State permits, monitoring for suspended solids and monitoring the water quality during the dredging operations must be documented and sent to the Department of Environmental Protection. Management of Resources and the Environment (MRE) has prepared the monitoring data reports for Dan Beard Incorporated and O & G Industries. Some of these reports were reviewed as a work element of this study. The conclusions of the monitoring data appear to be consistent and indicate that the dredging operations do not contribute to a significant increase in suspended sediment loadings within the River and that the operations are not adversely affecting the water quality of the River.

IV. GAS TRANSMISSION LINES

A major concern regarding the feasibility of this project has been the presence of two sub-aqueous natural gas pipelines which cross the Housatonic River in two separate locations.[4] It was believed that if the gas pipelines

4. A third natural gas pipeline, owned by Northeast Utilities, is buried in the Housatonic River beneath the Commodore Hull Bridge. Since this pipeline is just north of the two storage sites, it would not create a conflict with barge traffic.

were not buried deep enough, then the barges and tugboats could not safely cross them, and the expense as well as the environmental consequence of relocating the pipelines deeper could not be totally justified.

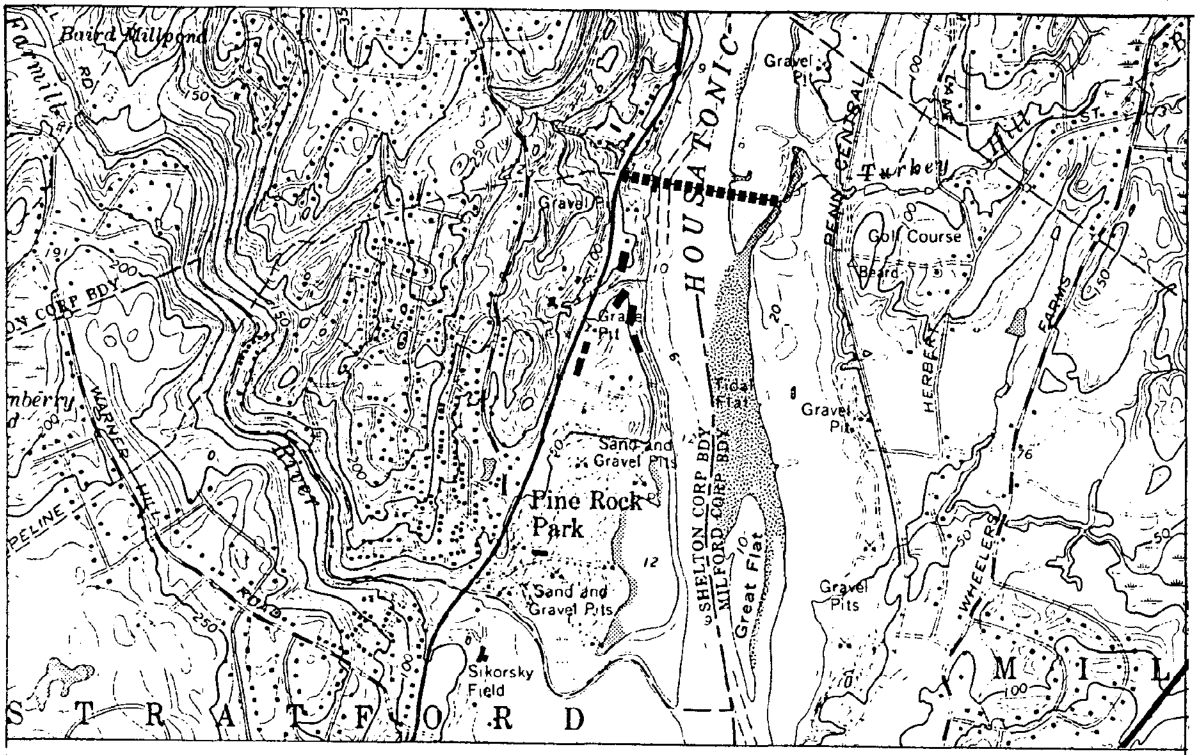
The pipeline which crosses the River between Shelton and Orange at Murphy's Boat Yard (Figure 3) is owned by the Tennessee Gas Company (Tenneco). It is located at least 16 feet below mean low water (MLW) for a width of 150 feet, and at least 14 feet below MLW for an additional 75 feet. The steel pipe was installed in 1951 and varies from 14" - 16" (inside diameter). It is anchored down with cast iron river weights, located approximately 35 feet apart along the length of the pipeline.

Due to an accumulation of silt in the vicinity of this pipeline, the depth of water is currently only 3 feet at MLW. Some of the larger recreational yachts that are moored at Murphy's Boat Yard cannot cross the pipeline at low tide. However, O & G Industries is presently dredging in this general vicinity and has permission to dredge above the pipeline to 10 feet below MLW for the width of the designated Federal channel (100 feet). While dredging to this depth, 6 feet of cover material will still be maintained over the buried pipe. The clearance above the pipe at mean high water (MHW) will be approximately 15 feet, at least for the width of the channel.

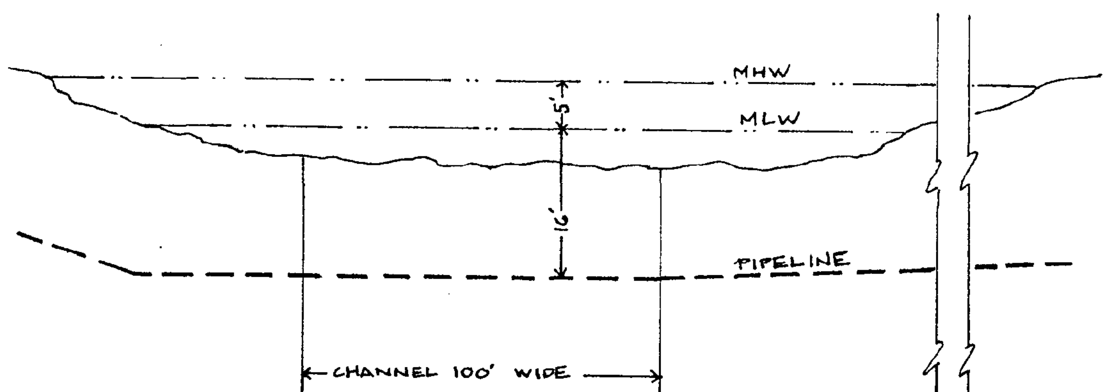
Warning signs, indicating the location of the gas transmission line, are clearly posted on both river banks.

The second pipeline is owned by the Southern Connecticut Gas Company and crosses the River between Stratford and Milford, just south of the Merritt Parkway/Route 15 bridge (Figure 4). It was installed in 1971 and is buried at least 15 feet below MLW for a width of 350 feet. The 16" diameter steel pipe is concrete coated for negative buoyancy.

No permits have been issued for dredging in this area at this time. However, the latest available soundings (U.S. Army Corps of Engineers, 1977) indicate the



■■■■■■■■■■■■■■■ Location of Natural Gas Pipeline Crossing Housatonic River



Diagramatic Section

FIGURE 3

TENNESSEE GAS COMPANY NATURAL GAS PIPELINE

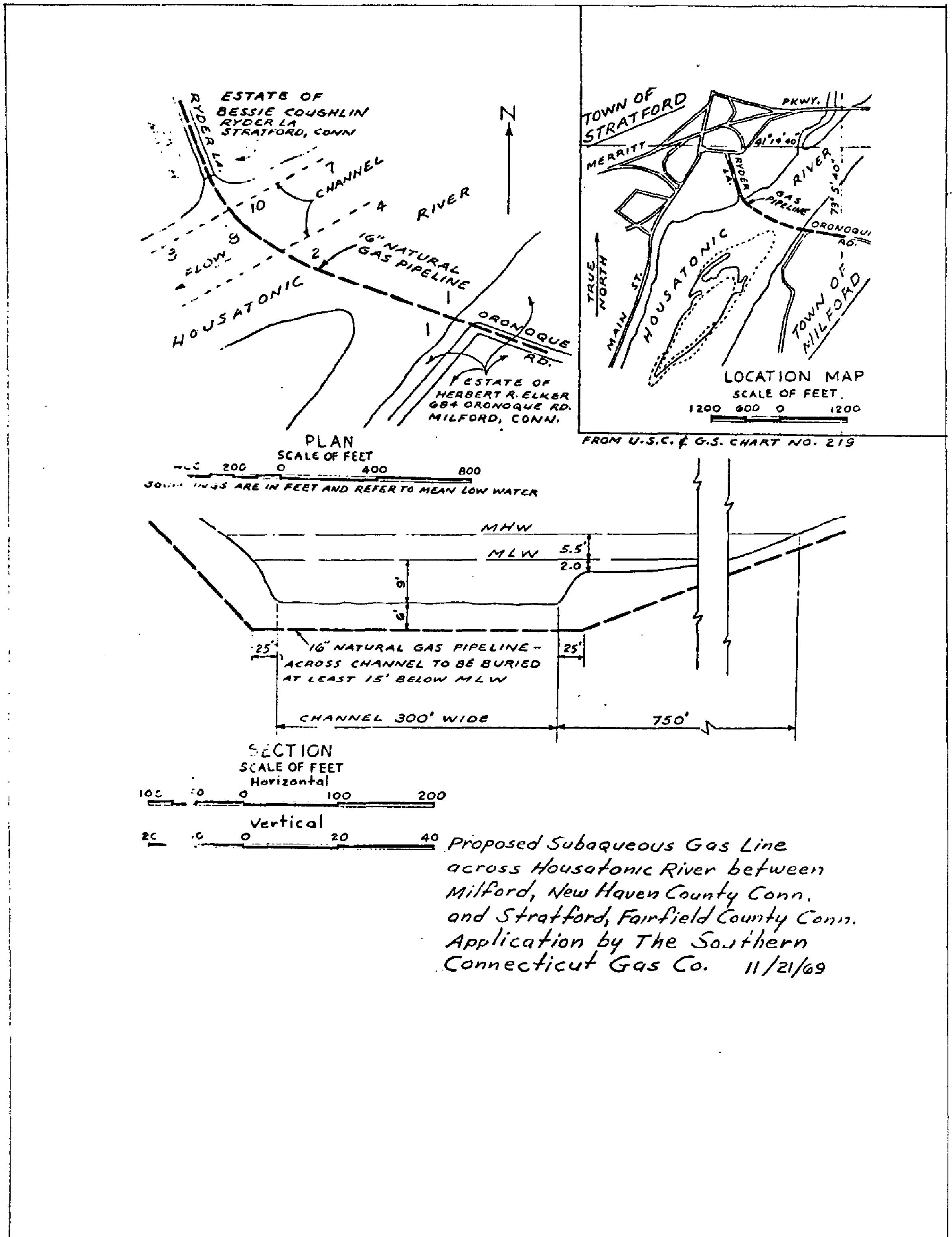


FIGURE 4

SOUTHERN CONNECTICUT GAS COMPANY NATURAL GAS PIPELINE depth of water over this pipeline is 8 feet at MLW, with an additional 5.5 feet at MHW. The amount of cover material above the buried pipeline is at least 7 feet presently.

Currently, there are no warning signs posted on the river banks to indicate the presence of this natural gas pipeline. A spokesman for the Southern Connecticut Gas Company insisted they were not required to post warning signs because this pipeline is not considered a high-pressure transmission line.[5] However, the same spokesman indicated that the Gas Company has included the costs of two such warning signs in their budget for next year. The posting of such signs would be justified in the event of any regular barge activity.

V. EVALUATION OF EXISTING NATURAL RESOURCES: FLORA AND FAUNA

To better understand the potential impacts of modifying the River system for the proposed barging activity, the natural resources of the lower Housatonic River have been identified. The information for this review was gathered from a variety of sources, including two U.S. Army Corps of Engineers reports (1973 and 1982), a permit application prepared by MRE (1979), and conversations with representatives of the U.S. Fish and Wildlife Service in Milford and the Aquaculture Division of the Connecticut State Department of Agriculture.

The Housatonic River rises in northwestern Massachusetts, flows in a southerly direction through Massachusetts and Connecticut for approximately 130 miles, and enters the north shore of Long Island Sound between Stratford and Milford. The Housatonic is the second largest river contributing to Long Island Sound, with a drainage area of 1950 square miles. This drainage area produces approximately 12% of the total surface water runoff into the Sound.

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5. Conversation on December 7, 1982 with Jeff Honcharik, an engineer with the Southern Connecticut Gas Company.

The estuary in the lower Housatonic mainstem is a result of the tidal influence of Long Island Sound. The River is tidal to the dam in Shelton/Derby, a distance of just over 14 miles. Salt water has been detected, in some years, as far upstream as the confluence of the Housatonic and Naugatuck Rivers. Mean tidal range is 6.7 feet at the mouth of the River, 5.5 feet at Stratford, and 5.0 feet at Shelton. Tidal currents at the mouth range from slack to 3.1 knots.

The lower Housatonic River is dominated by the Central Hardwoods-Hemlock association. Dominant species include Black, Red and White Oak. Other species which can be found on well-drained soils along stretches of the River include several species of Hickories, Hemlock, Tulip Poplar and Sassafras. The undergrowth varies from being virtually barren in spots to tangled masses of catbrier, greenbrier and poison ivy.

Some sections of the riverbanks are characterized by fresh water marshes which include, primarily, cattails and the common reed. Swampy areas, located at an elevation slightly above the marshes, include red maple, sumac, willows, and wildflowers such as Queen Anne's Lace and Purple Loosestrife. Several areas along the River's edge are characterized by beds of emergent grasses, which are important fish spawning areas. Located nearer the mouth of the mainstem are tidal marshes, where a variety of salt tolerant emergent grasses can be found.

The various marshlands of the Housatonic River are important waterfowl habitat. The southernmost marshland, Nells Island Marsh, consists of 630 acres of waterfowl habitat owned by the State of Connecticut. This is one of the most heavily hunted areas for waterfowl along the Connecticut coast, with an annual use estimated to be about 900 hunter-days. Nells Island also provides excellent habitat for shorebirds such as Virginia clapper, king and sora rail.

Located about one mile upstream of the Devon anchorage is another valuable waterfowl habitat that includes Popes Island, Long Island, Carting Island, Peacock Island and adjacent marshlands along the west bank of the River.

The marshlands and islands of the estuary are used by waterfowl for resting, nesting and feeding. The predominant species which use the area are mallards, black ducks and scaup. American golden eye, canvas back, and bufflehead are also seen in the estuary and, to a lesser extent, teal, baldpate, blue heron and osprey are seen. A large population of seagulls frequently nest on the Great Flats (located further upstream) during periods of heavy equipment operation at the adjacent Shelton landfill.

The lower Housatonic River is a biologically productive area for several species of fish, from freshwater forms in the upper reaches to saltwater forms near the mouth of the River. Species found in the River, either seasonally or year-round, include striped bass, snapper blues, white perch, American smelt, Atlantic mackerel, American eel, summer and winter flounder, tautog, sea bass and scup. During the warmer months of the year, sport fishing takes place in the harbor and along the shore, particularly for bass and snapper blues.

Many of the fish species found in the Housatonic River utilize the salt marshes for nursing or forage on organisms that do. In this way, the wetlands of the River play an integral role in the marine ecology of the Housatonic estuary.

The Housatonic River is also a very important habitat for the Eastern oyster. This oyster is able to tolerate relatively broad ranges in salinity and temperature. The Housatonic River estuary, along with New Haven harbor, is the most productive oyster area in Long Island Sound. Seed oysters are currently being harvested from the mouth of the Housatonic River to the Post Road Bridge (Figure 5). Because of the high coliform counts in the lower Housatonic River, shellfish cannot be harvested for direct human consumption. However, the estuary is still used to propagate oyster seeds or spats for subsequent transplant in clean grounds in SA classified water.

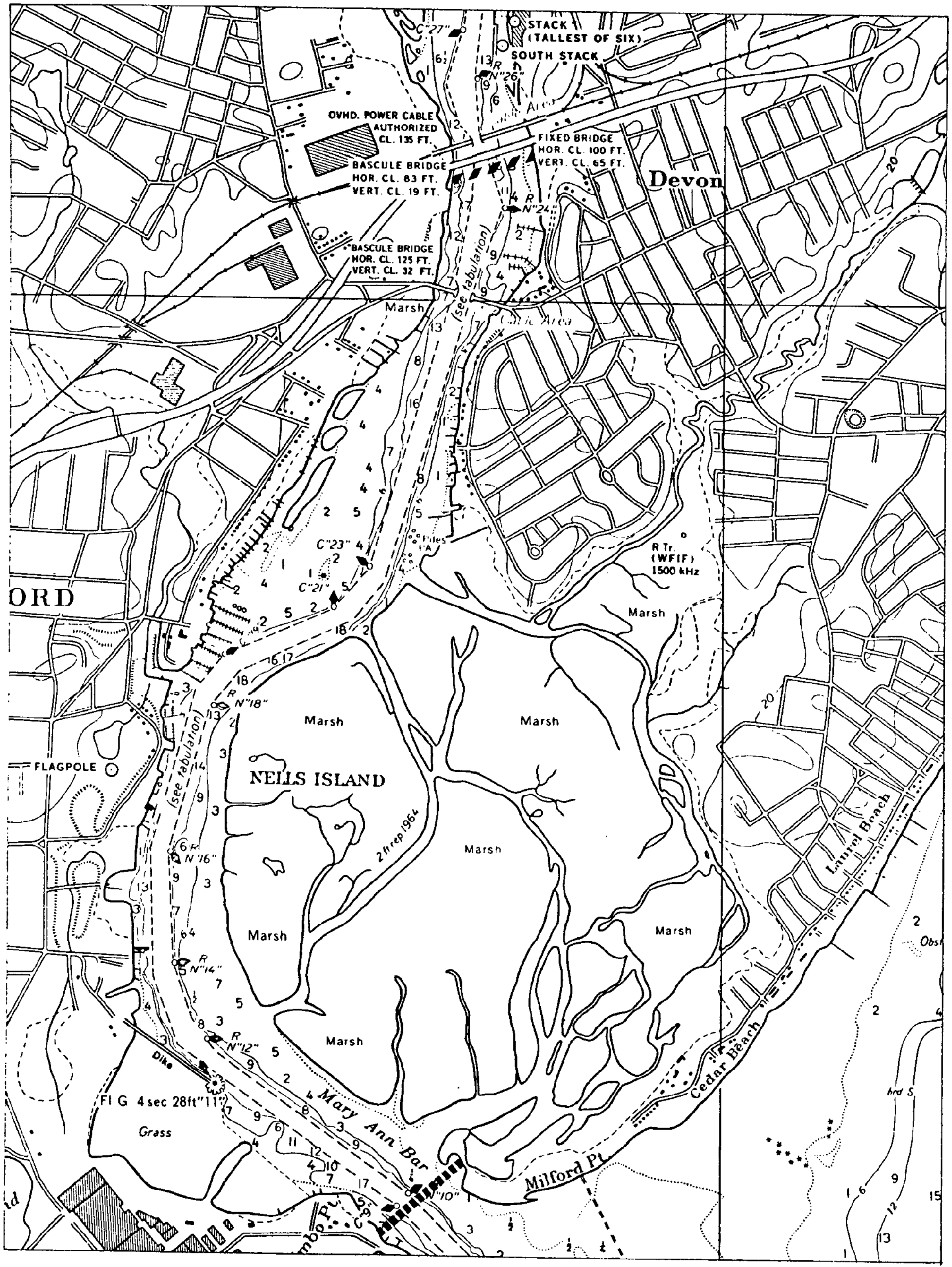

FIGURE 5

Upstream Limit of Oyster Beds

Upstream Limit of Starfish & Oyster Drill Population

The Eastern oyster can tolerate a range in salinity from 4 parts to 32 parts per thousand. Gonad formation, reproductive capability and growth are inhibited at either extreme. Low levels of salinity for prolonged periods of time, or flooding, can cause death to a great number of oysters. At high levels of salinity, predators such as starfish and oyster drills move in and attack the molluscs. Starfish kill oysters by opening the shell through suction exerted by its tube feet, inverting its stomach and digesting the oyster within its shell. The oyster drill attacks oysters by secreting a shell-softening agent and drilling a hole through the upper valve of the oyster with a specially adapted organ called a radula. The oyster spat has little chance of surviving its first year in drill-infested waters.

The estuarine environment, with its periodic and seasonal low levels of salinity to which the oysters are adapted, acts as an ecological barrier to oyster predators. Starfish and oyster drills generally need a higher level of salinity in which to survive than do oysters. In the summer months, when the oyster spat are most vulnerable, the minimum salinity level for survival is 12 to 15 parts per thousand for oyster drills and 16 to 18 parts per thousand for starfish, generally barring the predators from the productive seed beds in the Housatonic River. Figure 5 also indicates the present day upper limits of the starfish population in the Housatonic River.

The abundance of oysters in the Housatonic River dates back to the times of Pre-Columbian Indians. However, as the natural oyster population decreased in the early 1800's, oyster farming developed and, since the 1960's, has become a growing business.

As it is practiced in Connecticut, oyster farming consists of several distinct operations. First, cultch, or shells, are planted just after July 4th in the Housatonic. The naturally occurring oyster spats then attach themselves to the cultch. The oysters are then rebedded several times in the shallow, comparatively warm waters of the estuary to provide sufficient room for their growth. After a few months, the oysters are again transferred to deeper water beds. Finally, they are relocated to deeper oyster grounds in various areas of Long Island Sound where the water is classified SA. There, they grow and fatten and purify themselves until they mature to market size, generally within about four years.

After the seed oysters are harvested from the natural bed of the estuary, they are sold for approximately $5/bushel. With improved culture methods, oystermen are able to produce a minimum of 10 bushels of marketable oysters from one bushel of seed oysters. These market-size oysters are then sold for about $35/bushel.

Due to the economic importance of the oyster industry in the Housatonic estuary, any potential negative impacts which could result from this proposed activity must be evaluated, and will be explored in the following section.

VI. DREDGING AND SALT WATER INTRUSION

The existing Federal navigation project for the Housatonic River was adopted in 1871 and modified by enactments in 1888, 1892 and 1930. It provides for a channel 18 feet deep (MLW) and 200 feet wide from the mouth of the River for a distance of approximately 5 miles to the lower end of Culvers Bar, which is at the northern end of Devon. It further provides for a channel 7 feet deep (MLW) and 100 feet wide from Culvers Bar to Derby and Shelton, for a total distance of approximately 13 miles. Under the conditions of the Federal project, which was completed in 1957, the Army Corps of Engineers is responsible for the as-needed maintenance of this channel.

The lower 5 miles of the channel have been maintained and allow for the regular waterborne commerce of fossil fuels to the power plant in Devon. The upper limits of the channel have not been maintained. The primary reasons for this are the extremely high costs which are associated with maintenance dredging (and the absence of funding for such activities in Federal budgets), and the fact that commercial navigation upstream virtually disappeared 40 years ago with the increased dependence on trucks, thus making the maintenance of such a channel difficult to justify economically. Over the past few decades, the upper reaches of the River have become progressively more shallow, with controlling depths of only 3 feet (MLW) in some places.

With the ongoing dredging now taking place in the upper River channel, the feasibility of commercial navigation upstream once again became a distinct possibility. There remains one obstacle: the 3-mile section of the River between the Great Flats and Culvers Bar is not currently being dredged. Without dredging this section to a reasonable depth, the deep channel being created to the north does not function as a navigation channel since only very shallow draft vessels are able to reach the improved section.

This midsection of the River contains a number of tidal wetlands and marches and is considered environmentally sensitive. This does not preclude dredging in the area, as measures can be taken to minimize the impact. Since the marshes and shallow grass beds serve as feeding, nesting and resting grounds for various river fauna, broad setbacks from these areas should be proposed. Prior to any permitted dredging, either by private industry or by the ACOE, up-to-date environmental data regarding water quality and sediment analysis would have to be gathered for this specific section, similar to the information which was gathered for the sections upstream and for the lower 5 miles. The lower 5 miles have been maintained with no long-lasting or irreversible significant negative impacts.

Although the present-day upstream limit of oyster beds is the Post Road Bridge— more than a mile downstream of Culvers Bar—the impact to the oysters of any dredging upstream between Culvers Bar and the Great Flats must be considered. One specific concern expressed by the Department of Environmental Protection, Water Compliance Unit, and the Department of Agriculture, Division of Aquaculture, is the possibility of river hydrology modification as the result of salt water intrusion further upstream. In the previous section of this paper, it was reported that the Eastern oyster can tolerate broad seasonal variations in salinity. However, any permanent changes in the salinity levels could be destructive to the molluscs, since regular increased salinity levels over the oyster seed beds would also provide a suitable environment for the oyster predators.

A number of factors influence the degree of salt water stratification in an estuarine system, but the basic factor is the magnitude of the tidal current in relation to the River flow. Other parameters which determine the degree of stratification include the width, volume and depth of the estuary. Salt water wedges will occur when the ratio of River flow to tidal flow is very large; that is, the volume of River water entering the estuary between low and high tide is greater than the volume of seawater entering the estuary over the same time span. Wedges will also occur if the width of the estuary is not significantly greater than that of the River.

Figure 6 illustrates the various degrees of vertical salt water stratification. They vary from a highly stratified salt wedge estuary (Type D), which is described above, to a well-mixed estuary (Type A), in which the vertical mixing is so strong compared to the River flow that there is no vertical salinity gradient. A fjord-type estuary (Type C) is highly stratified, with fresh water flowing over a nearly uniform deep saline layer. This condition is not found anywhere on the Long Island Sound coast. Most New England estuaries are partially mixed (Type B).

Salinity profiles prepared by Management of Resources and the Environment in 1979 indicate that the Housatonic is a partially mixed estuary (Type B). The tidal force in the upstream direction is the dominant force compared to the downstream River flow. Because it is tidally dominated, the force with which salt

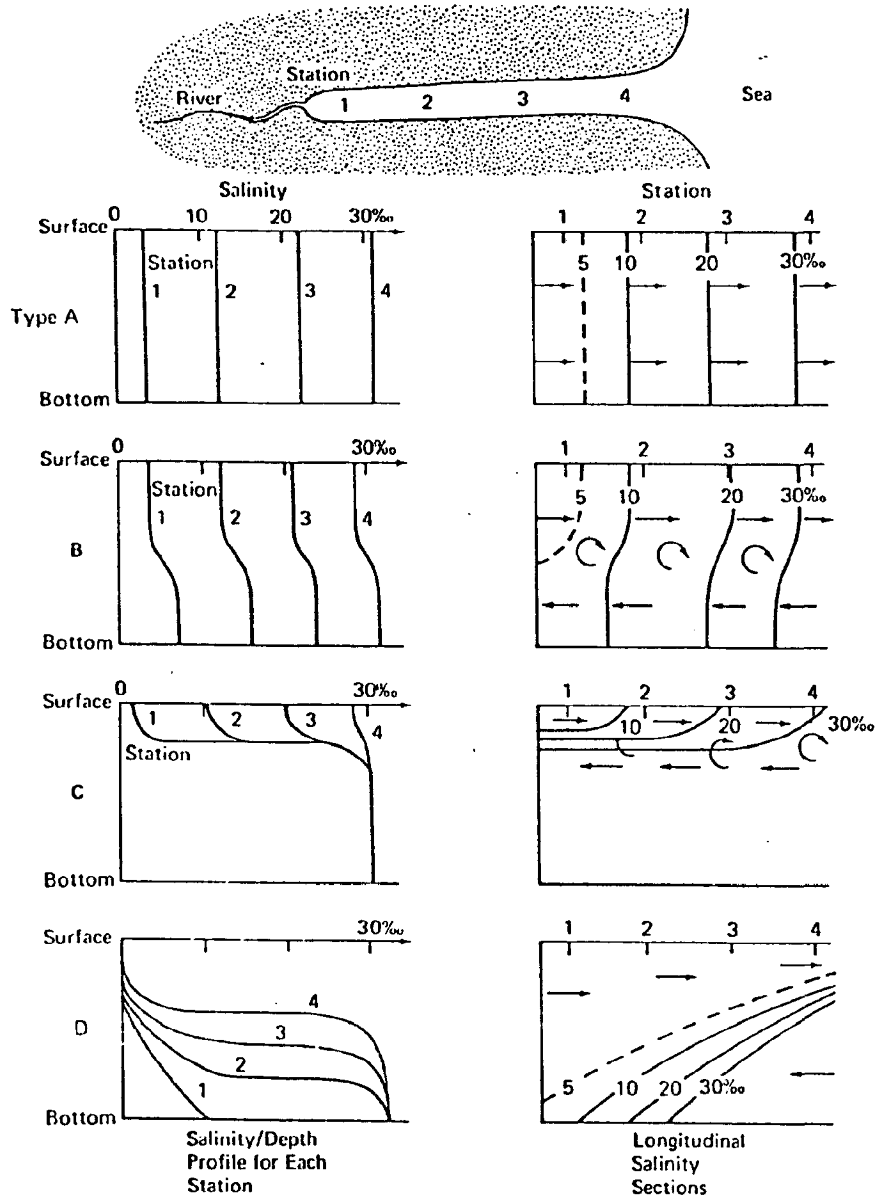

Figure 6. Longitudinal salinity distribution and resulting net flow patterns for (a) a well-mixed estuary, (b) a partially mixed estuary, (c) a fjörd-type estuary, and (d) a salt-wedge estuary.

Source: Introduction to Physical Oceanography, John A. Knauss, (Prentice-Hall, Inc.) 1978.

FIGURE 6

VERTICAL SALT WATER STRATIFICATION

water can enter the estuary is determined by factors affecting the tide. Due to its morphology, the mouth of the estuary will only allow a certain amount of water to pass through during any one tidal cycle. Therefore, MRE concludes, the distribution and concentration of salinity in the upper reaches of the estuary is controlled largely by the downstream factors rather than modifications of the channel upstream.

While variations in the freshwater flow will cause variations in the upstream limit of detectable salinity, it should not cause changes in the salinity distribution flow patterns described above. Research into the variables that affect the intrusion of salt water into fresh water has not reached a point where exact predictions can be made. However, it is apparent that the tidal forces are dominant while the downstream River flow forces are secondary. In view of this, it appears that any changes in River salinity over the oyster beds as a result of dredging would be negligible.

While the turbulence from barges and tugs has a tendency to mix fresh and salt water, the forces exerted by even the largest tugs are microscopic in comparison to the volume of water and the forces exerted by the tide. Therefore, increased barge and tug traffic will have no effect on the salinity of the River and, in turn, shall not affect the oyster industry.

VII. CONFORMANCE OF PROPOSED ACTIVITY WITH COASTAL ZONE MANAGEMENT PROGRAMS AND POLICIES

Recognizing the importance of coastal areas and the intense pressure for development in these areas, the U.S. Congress passed the Coastal Zone Management Act (CZMA) in 1972 (Public Law 92-583). While the Act authorized that a Federal grant-in-aid program be administered by the Office of Coastal Zone Management, it was substantially amended in 1976 to allow for more local and State control of coastal management decisions. The Act and its amendments affirmed a national interest in the effective protection and development of the coastal zone by providing assistance and encouragement to coastal states to develop and implement rational programs for managing their coastal areas.

The CZMA provided the basic requirements and guidelines to states for developing coastal management programs of their own. The Connecticut Coastal Management Act (CCMA) of 1978, adopted by P.A. 78-152 and amended by P.A. 79-535, establishes such a comprehensive coastal resource management program in Connecticut. The Act delineates a coastal management boundary, establishes specific coastal policies, standards and procedures to direct the implementation of the program, and defines management responsibilities for agencies at both the State and local levels of government. In Connecticut, the Department of Environmental Protection is responsible for the administration, supervision and coordination of the overall program implementation.

The Act establishes a two-tiered management boundary, appropriately called the nearshore tier and the inland tier. The primary nearshore tier is bounded by the limit of the State's jurisdiction in Long Island Sound on the seaward side. On the landward side, this tier is bounded by a continuous line delineated by a one-thousand foot linear setback measured from the mean high water in coastal waters, a one-thousand foot linear setback measured from the inland boundary of State regulated tidal wetlands, or the continuous interior contour elevation of the one hundred year coastal flood zone, whichever is farthest inland. This line represents the coastal boundary.

The secondary inland tier includes the area that is landward of the coastal boundary and is delineated by the inland boundary of thirty-six coastal communities. In the vicinity of the Housatonic River, the boundary of this tier is the inland border of Stratford, Shelton and Orange.

The proposed waterborne transportation of oil and/or coal barges, and any additional channel dredging which may eventually be undertaken, would occur within the nearshore coastal boundary. The coal storage facility is located within the inland tier, while the oil storage tanks are located outside both of these boundaries, as would be any oil off-loading docking facilities. All major uses and activities undertaken within the first tier could have significant impacts on the coastal water; therefore, the primary focus of the coastal program is on this area and, more specifically, on the following areas defined as: those areas the management of which is necessary to control uses which have a direct and significant impact on coastal waters; areas of particular concern; waters containing a significant quantity of seawater; salt marshes and wetlands; beaches; inter-tidal areas, areas subject to coastal storm surge, and areas containing vegetation that is salt tolerant and survives because of conditions associated with proximity to coastal waters; and islands.

The initial step in assuring consistency with the coastal policies of any use or activity subject to the management program is to determine which coastal resources may be affected. The second step in assuring consistency with the coastal use policies is to determine if there are specific policies which relate directly to the proposed use or activity. The applicable coastal land and water resource policies, together with the applicable coastal use policies, indicate the criteria and standards with which the proposed activity or use must be consistent.

The coastal resources that could possibly be affected by the proposed activities include shellfish concentration areas, islands, tidal wetlands and some freshwater wetlands. The general locations and characteristics of these resources were reviewed in Section V. The coastal uses include waterborne transportation, dredging, energy storage and docking facilities. While the last two uses will not occur within the coastal boundary, their uses must be considered as they could potentially pollute the air or affect water quality within the management area.

Barge transportation is consistent with the policies if it is operated according to safe operating procedures in order to avoid oil or coal spills during transit and during off-loading.

Dredging which is required to make the channel fully navigable is consistent with the policies for the aforementioned coastal resources, with the exception, perhaps, of shellfish concentration areas. Dredging may be consistent with the policies pertaining to shellfish concentration areas if specific conditions are met. Any improvements to the three-mile section located north of the shellfish beds fall into the category of maintenance and enhancement dredging in the CCMA guidelines, and these guidelines are identical to those for shellfish concentration areas and estuarine embayments. The conditions for policy conformance are as follows:

1. The dredging is staged so as to avoid impacts to shellfish or finfish populations during critical breeding periods;
2. The best available technologies are used to reduce controllable sedimentation and prevent adverse impacts to water quality;
3. Significant impacts on contiguous shellfish concentration areas are avoided;
4. The activity is timed so as to avoid reductions in dissolved oxygen concentrations which may result in fish kills; and,
5. The channel or basin is not substantially enlarged from the original project dimensions.

Policies related to dredging are established in P.A. 79-535, Section 2(c)(1)(C&D). The Act requires Federal and State agencies to encourage, through the State permitting program for dredging activities, the maintenance and enhancement of existing federally maintained navigation channels, basins and anchorages and to discourage the dredging of new federally maintained navigation channels, basins and anchorages. These agencies are also required to reduce the need for future dredging by requiring that new or expanded navigation channels, basins and anchorages take advantage of existing or authorized water depths, circulation and siltation patterns and the best available technologies for reducing controllable sedimentation.

Connecticut General Statutes (CGS) Section 25-10 directs the Commissioner of Environmental Protection to regulate the taking and removal of sand, gravel and other materials from lands under tidal and coastal waters with due regard for the preservation or alleviation of shore erosion, the protection necessary for shellfish grounds, finfish habitats, the preservation of necessary wildlife habitats, the development of adjoining uplands, the rights of riparian property owners, the creation and improvement of channels and boat basins, the improvement of coastal and inland navigation of all vessels including small craft for recreation purposes and the improvement, protection or development of uplands bordering upon tidal and coastal waters, with due regard for the rights and interests of all persons concerned.

The aforementioned State policies encourage improvement to the existing channel through the State sand and gravel removal permitting process. As mentioned previously, the section of the channel which has not been maintained and is not presently being dredged is adjacent to several tidal wetlands. It appears that commercial dredging, on a more reduced scale than the dredging operation upstream, could also be undertaken in this section without significant lasting impacts to the tidal wetland inhabitants, shellfish and finfish populations, and water quality through careful staging and monitoring of the dredging operation.

To accommodate oil off-loading, a new, relatively uncomplicated docking facility would have to be constructed at the site of the present storage tanks. Such a structure would appear to be consistent with CCMA policies which require that structures in coastal waters be designed, constructed and maintained to minimize adverse impacts on coastal resources, circulation and sedimentation patterns, water quality, flooding and erosion, to reduce to the maximum extent practicable the use of fill and to reduce conflicts with the riparian rights of adjacent landowners. The Commissioner of Environmental Protection may also regulate the erection of structures and the placement of fill with due regard for aquatic life, fish and wildlife, and the prevention or alleviation of shore erosion and coastal flooding (P.A. 79-535, Sec. 2).

Regarding oil storage, the CCMA prohibits the siting within the coastal boundary of new tank farms and other new fuel and chemical storage facilities which can reasonably be located inland, and requires any new storage tanks which must be located within the coastal boundary to abut existing storage tanks or to be located in urban industrial areas and to be adequately protected against floods and spills. The Act further requires that new storage facilities be developed so as to minimize the risk of spillage of petroleum products and hazardous substances and to provide efficient containment and clean-up mechanisms for accidental spills.

As mentioned previously, the existing storage tanks are outside the coastal boundary. There is sufficient level land at this site to accommodate additional tanks and containment areas, if the proposal to build additional tanks is acted upon. The site is zoned industrial and presently has industrial uses abutting it, and there is sufficient river frontage to accommodate a small off-loading facility. Prudent design of containment areas and flood control would be required.

VIII. NAVIGATION REQUIREMENTS FOR INCREASED BARGE ACTIVITY

The Housatonic River has historically played a major role in the development of the cities of Derby and Shelton. The riverbanks in both cities were used in the 1800's and the early part of the 1900's for a variety of water-related commerce. In the early part of the Housatonic River's navigation history, farm products from the Valley were brought to market by shallow draft barges.

River transportation was also important to the industries in the Valley, as a means of bringing in raw materials and delivering finished products. The Housatonic River was busier than the Port of New Haven until the 1850's, when roadway and railroad development improved connections to markets. By 1940, commercial navigation upstream had virtually disappeared.

Barge loading facilities were numerous on the Shelton side of the River. Most of the industries in Shelton had wharves alongside the factories. The dense industrial development in Shelton precludes this area for use as an oil storage area today. However, at the existing oil storage facilities on the other side of the River in Derby, there is sufficient flat land at the River's edge to develop docking facilities. The land here was historically used as a lumberyard, a shipyard and a coal storage area. Some of the deep river basin still remains. An on-site investigation of the area revealed remains of the old docking pilings and a lagoon at which steamboats once docked. There is also the remains of a jetty at Sow and Pigs Reef, which was built to control shoaling.

While there are some small self-propelled tankers presently operating in Long Island Sound and up the Connecticut River, barges and their accompanying tugboats are generally more popular in restricted channels, since small self-propelled tankers need more room to maneuver than most small barges. They also need more room to turn around, and require a deeper draft than barges after they have been unloaded.[6]

Barges can be propelled by tugboats in a number of configurations. In open water, they are frequently towed on long tow lines, but long tow lines give the tug very little control over the direction of the barge. Shortening the tow line gives the tug more control over the barge. The amount of directional control that the tug has over a barge on a shortened tow is still limited and this method is not usually used in river transportation, where the barge must be

6. This information was provided by Mr. Bill Waterman of the Morania Towing Company, New York.

turned frequently to follow the bends in the channel. The tug may also be pushed by the barge in two different manners. The tug can push the barge from directly astern of the barge. The second method is for the tug to tie up alongside the barge. This method is called moving the barge "on the hip".

Due to economies of scale, barges are getting larger, as are all other cargo hauling ships such as freighters and tankers. As far as could be determined,[7] the smallest oil-carrying barges presently operating in Long Island Sound have a capacity of approximately 20,000 barrels. (One barrel contains approximately 42 gallons; 20,000 barrels contain approximately 840,000 gallons.) Fully loaded, these barges require a draft of about 12 feet for safe passage. The accompanying tugboats also require about 12 feet of draft, although there are a few in operation which only require about 10 feet. These barges are generally about 40 - 45 feet wide and between 220 and 230 feet long. The horizontal clearances of the supports of the bridges spanning the Housatonic River are the controlling factors for the width of vessels using this River. The railroad bridge at Devon has the smallest horizontal clearance, which is 83 feet. Because of this narrow passage, tugboats will, most likely, push the barges from the stern.

The design criteria for ideal channel width is divided into three components. The interior component is the vessel maneuvering lane. On either side of the maneuvering lane are bank clearance lanes. The maneuvering lane usually varies from 160 to 200% of the beam. Since barges tend to yaw when being unloaded or when in brisk winds, 200% provides an added amount of safety. If the barge is 45 feet wide, the maneuvering lane should be 90 feet. Bank clearance lanes provide additional maneuvering safety and vary from 60 to 150% of the beam, depending on the substance of the bottom bank material. Since most of the bottom

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7. Oil companies along the Connecticut River which were contacted include Mercury Oil, Pittston Petroleum, and Chevron Oil. Towing companies in New York which were contacted include Red Star Marine Services, Morania Towing Company and Moran Towing and Transportation.

material in the Housatonic River is soft sand and gravel, 60% of the beam for each clearance lane is sufficient. Two clearance lanes, at 60%, are approximately 55 feet, for a total desired channel width of 145 feet.

Barges are generally box-shaped vessels. Most oil barges are raked at the bow so that a large flat surface is not presented toward the sea. This minor attempt to streamline the barge helps reduce friction with the water, making it easier to propel, and reduces pounding from the sea. The stern of the barge is usually designed to maximize contact with the tug for more positive control. Some barges have push knees which maximize contact with square ended tugboats. Other barges have notches into which the bow of the tug fits.

To take full advantage of the design characteristics of the barge, it should be turned around after it has delivered its cargo. A turning basin adjacent to the docking facility is needed; however, a large turning basin is not necessary for two reasons. First, a barge relieved of its cargo only requires about 3 - 4 feet of draft. Second, a tugboat can maneuver a barge in such a way that it can virtually turn on its axis. The draft of the tugboat remains the same, of course.

The present Rivers and Harbors Act makes no provision for a turning basin. The CCMA discourages the dredging of new federally maintained navigation channels, basins and anchorages. However, the Commissioner of Environmental Protection can regulate the creation and improvements of channels and boat basins.

The docking facility required to handle the proposed operation need not be very complex. Since the present storage capacity of the oil tanks is 500,000 gallons and the proposed expansion is an additional 500,000 gallons, it is assumed that there will not be a need to receive more than one shipment of oil at one time. It will take approximately 6 - 8 hours to off-load one fully-loaded barge. Therefore, the dock only needs to be long enough to accommodate one barge. A length of approximately 100 feet would be sufficient, but a length closer to 200 feet would provide more opportunity for secure mooring during the unloading operation. To insure firm contact between the barge and the dock during various cycles of the tide and also during various stages of the unloading operation, the top of the dock should be about 10 - 12 feet above mean low water. This would also provide additional protection during any flood waters.

The river bank in this area is only a few feet above mean high water. The land behind the dock will have to be filled in order to bring it up to the level of the dock. It is envisioned that the dock will be built by constructing a pile bulkhead which will retain the fill and serve as the structural base for the River side of the dock. A number of bollards (to which mooring lines are attached) will be built and firmly attached to the pile bulkhead (Figure 7).

The equipment at dockside for unloading #2 oil is relatively uncomplicated. The pumps, the hose, and the boom for swinging the hose are all contained on the barge. The dock will have fill-lines, which run to the storage tanks, and valves for turning off the flow of oil in the event that an oil leak is detected from the lines. Containment booms are also stored on and around the dock.

Even with expansion of the oil storage capacity in Derby, there should not be the need for oil shipments on consecutive days, which could potentially cause conflict between in-coming and out-going barges. There is the possibility that barges might meet south of Devon, the location of the power plant. In the event this situation might occur, it could be mitigated by coordinating barge arrivals and departures.

Approximately 2000 recreational boats base at the marinas, boatyards and private docks along the Housatonic River. Most of these recreational boats have very shallow drafts and can maneuver quite well. Should they meet, there is sufficient channel clearance to allow for the safe passage of both barges and boats. Barges generally travel at a slow 4 knots/hour, which allows recreational boaters plenty of time to establish a course out of the barge's path.

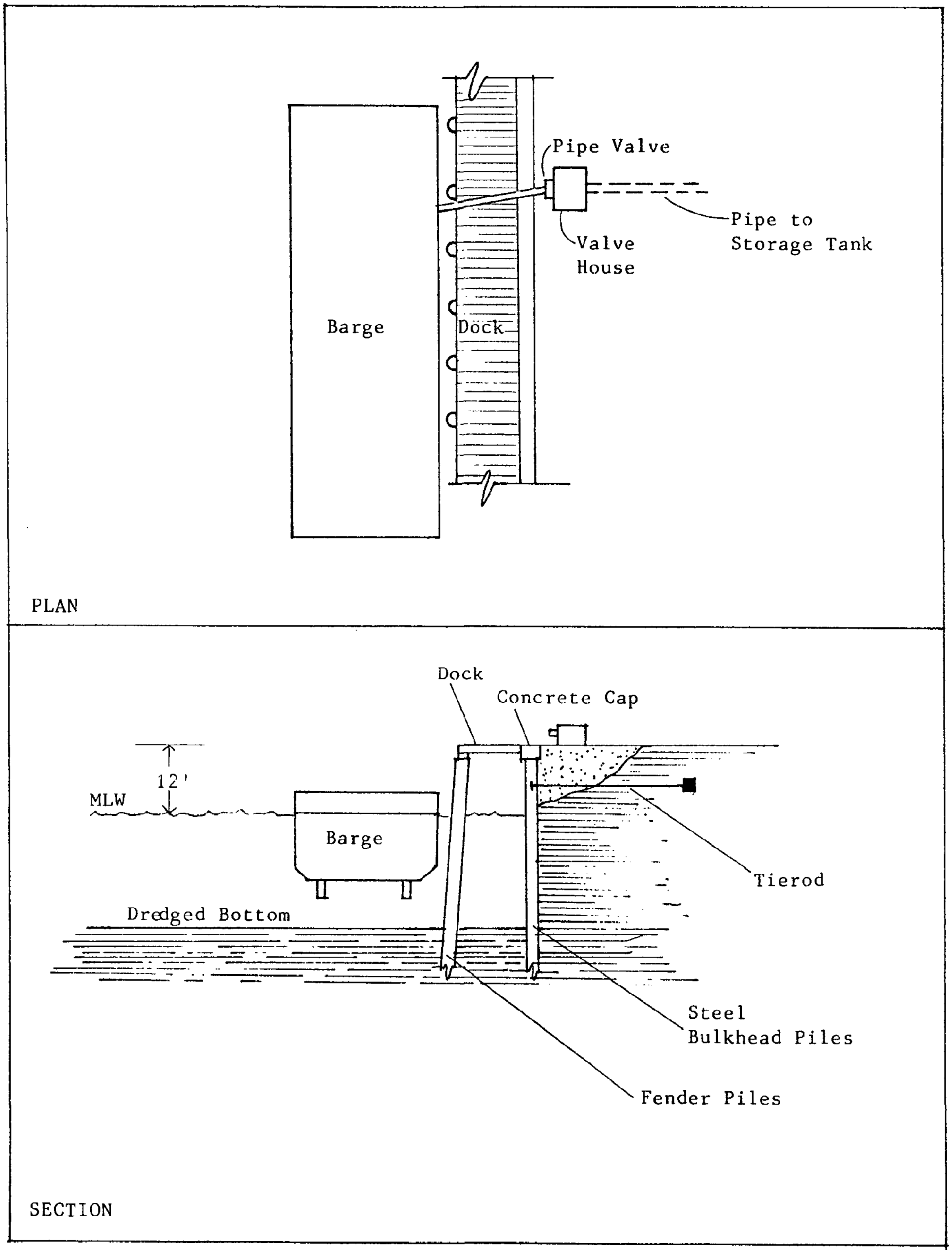

FIGURE 7

DOCKING FACILITIES DIAGRAM

It is also anticipated that the majority of #2 home heating oil shipments will be made during the colder weather months, when recreational boating activity is at a low level.

If barges use the River, upstream from Devon, the locations of the aids-to-navigation (nuns and cans) in the Housatonic River should be changed to reflect the wider channel configuration which is presently being dredged. There are a sufficient number of aids up to Moulthrops Bar. The last buoy, Nun #68, is at Moulthrops Bar. Beyond this point, there are approximately two miles of River channel without aids-to-navigation. In this stretch of the River, the channel takes a turn as it passes the Coram Hill area of Shelton, and it takes another slight turn just north of Two Mile Island Bar. An additional six navigational aids in this section of the River would properly mark the channel for maneuvering.

Due to the relatively low concentrations of salt water, the upper stretches of the Housatonic River are susceptible to freezing during periods of the winter. This problem was identified early in the study and considered an obstacle to navigation and the proposed activity. Depending on the severity of the winter, the River develops patchy ice conditions north of the Route 15 bridge in Stratford during the months of January and February. Data on ice conditions for the Housatonic River during the winter of 1982 was obtained from the U.S. Coast Guard. The first ice conditions were reported on January 13 and the last on January 28. The bodies of ice reported ranged in size from small (1 - 10 yards in width) to medium (10 - 50 yards in width).

The Office of Policy and Management, Energy Division, coordinates requests for icebreaking assistance. The Coast Guard will dispatch an ice cutter if necessary. However, after speaking with some private oil terminal facilities along the upper reaches of the Connecticut River and with a towing company operator in New York, it was learned that barges and tugboats can often handle the ice conditions alone. Frequently, the tugboat can push the barge right through the ice. If this is not possible, the tug can temporarily disconnect the towing line, move ahead and break up the ice.

IX. OIL SPILLS: IMPACTS AND PROCEDURES FOR MITIGATION

The threat of oil polluting the environment is always a major concern when dealing with the transportation of large quantities of oil over land or water. Over the years, accidents involving oil tankers and pipelines have increased the public's awareness of the risks and damages associated with oil spills. However, since millions of barrels of oil are consumed daily in the United States, the potential for, and the impacts from, oil pollution must be realized and addressed.

The prevention of oil spills will significantly reduce the problem of oil pollution. The government has developed safety codes and guidelines which pertain to the transportation equipment and the transfer method for oil products. Industries, in conforming with government codes, have had to improve their operational procedures, as well as improve their methods of transferring and handling oil. It has been estimated that approximately 75% of all oil spills can be attributed to human error, either directly or indirectly.[8] Of these spills, most occur at the point of loading or unloading oil products. To reduce the number of accidents which are the result of human error, personnel involved in the transporting/transferring of oil products must be very thoroughly trained. Cleanup technology must be as efficient as possible, since a rapid cleanup of oil spills will minimize the damage to the environment.

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8. Source: Basics of Oil Spill Cleanup with Particular Reference to Southern Canada (M.F. Fingas, W.S. Doyval and G. B. Stevenson), Ministry of Supply and Services of Canada, 1979.

The effects of oil spills may be acute or chronic in nature. Acute effects on the biota are those that result from a single infusion of oil into the marine environment from an accidental spill, while chronic effects are those that occur from the release of oil, or its derivatives, either continuously or often enough that the biota does not have time to recover between doses.

There are many factors that influence the extent of biological damage from an oil spill, including oil type and dosage, oceanographic and meteorological conditions, turbidity, season and, obviously, the type of habitat that is affected.

The chemical composition of #2 fuel oil is such that it contains a high proportion of aromatic compounds. Because of this characteristic, #2 fuel oil will generally cause biological damage through toxicity. On the other hand, heavy fuel oils and some crude oils may cause damage to intertidal organisms due to their physical capacity to smother or dislodge them from shoreline surfaces.

Currents, wave action, and coastal formation all combine to influence the dosage of a particular spill. Wave action, especially in a large open area will often dilute the spilled oil, thereby reducing its toxicity somewhat. Because estuaries are generally confined and relatively shallow bodies of water, the wave actions may not be sufficient to dilute the spilled oil. A storm will usually increase wave actions and dilute the spilled oil, but occasionally, the wave action may intensify the problem if the surf drives the oil ashore into the sediments and the surrounding marshland. In this case, the oiled marshland and sediments become an oil reservoir for perhaps months.

The season of the year in relation to the life cycle of a given organism can frequently determine whether the effect of a spill is severe or relatively light. For example, if a spill occurred in the Housatonic River while seabirds were nesting in the marshes, the mortality rate could be very high. At some other time of the year, the mortality rate would be much lower. Newly set oyster spats would be vulnerable to an oil spill, yet at other stages of development, these organisms have been found to be hardy. Tainted oysters may be removed to unpolluted areas for several months of purification to make them marketable.

Oil will generally be removed from the intertidal zones by wave action. If oil becomes stranded in marshy areas, it may enter the sediments and affect the food web. Emergent grasses and plant life of marshes appear to be somewhat resistant to moderate doses of oil pollution. However, repeated coatings of oil have proved lethal to the plants.

The impacts of oil pollution on seabirds varies with the specie. Diving sea ducks, including scaup which are present in the lower Housatonic River, may be severely damaged. These birds spend most of their lives on the surface of the sea, dive to collect their food, and are weak fliers. If they dive into floating oil, they become completely coated with oil. Fortunately, the birds have great reproductive capabilities; rapid recovery of the population could be expected.

Many species of fish appear to be resistant to oil pollution, which might be attributed to their surface and gills which are coated with a slimy mucous that is somewhat oil repellent.

Because oil spills in estuaries have been relatively small, the full biological effects have not been well studied. The Oceanic Society in Stamford is currently conducting an inventory of nearshore marine life in Western Long Island Sound. The eastern border of their study area extends to the Housatonic River. The baseline data which they are gathering should provide additional insight into the impacts of oil spills on the marine environment.

The best way to mitigate the impacts of oil pollution is to prevent spills from happening. So long as there is the potential for human error in handling petroleum products, attention must be directed toward the development and maintenance of oil spill combat capabilities at local as well as state levels.

If the oil company located in Derby was to expand as an area energy storage and transfer site, it would need to be licensed by the Department of Environmental Protection as an oil terminal facility. As such, the company would have to file an Operations Manual with the U.S. Coast Guard, as required by Federal Regulations.

The Operations Manual serves as the contingency plan for the facility. The purpose of a spill response plan is to identify and maintain the communications networks, manpower and equipment necessary to stop, contain and clean up any spill which might take place within the area covered by the plan. This pre-emergency planning is a vital tool in the prevention of spills and, if needed, in the clean-up of spills.

In the event an oil spill is detected, the Oil and Chemical Spill Unit of the Department of Environmental Protection must be contacted. The Department currently responds to approximately 100 oil and chemical spills per month.[9] The majority of these spills occur on land and not in water.

The Department's oil spill response capability has been significantly enhanced by the establishment of seven oil spill cooperatives along the Lower Connecticut River area and along the coast. The oil spill cooperative located at the High Street Firehouse in Milford is the closest one to the Derby oil storage tanks. Each of these oil spill cooperatives maintain hundreds of feet of oil containment bars and workboats. Since the adverse impacts of an oil spill in water are minimized when the oil is prevented from spreading beyond the spill site, containment bars are put into the water as quickly as possible to contain the spill. Because the actions of the initial respondants to any spill have a large impact on the ultimate public safety and the environmental aspects of the incident, the Department has also been involved in the training of local

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9. Information regarding the responsibilities of the Oil and Chemical Spill Unit of the Department of Environmental Protection was provided by Mr. Charles Zieminski.

response personnel (primarily fire and police departments) associated with each of the oil spill cooperatives. If a spill occurring in water is particularly large, the Oil and Chemical Spill Unit may request assistance from an environmental contractor, who would provide vacuum trucks to pump oil from the water's surface.

The importance of pre-planning and adequate training of all personnel associated with oil handling and spill response cannot be overemphasized.

X. COAL

Barges have historically been used to bring coal to coastal communities in Connecticut, where it was burned by industry and where it was locally distributed for residential use. Anthracite coal consumption for domestic heating peaked in the early 1920's and then declined steadily with the increased availability of cheap oil and natural gas. Oil and natural gas have many advantages over coal as a home heating fuel; both are cleaner to use, and neither require the constant tending of a coal-fired furnace.

With the shortages and rapid price increases of petroleum products in the early 1970's, coal gained in popularity as a method of home heating. Today, about one percent of all residences in Connecticut use coal as a primary heating source, each house consuming between 3 and 4 tons of anthracite coal annually.[10] An additional one percent of the homes in Connecticut use coal as a secondary heating source, each one consuming between ½ and 2 tons of coal annually. The estimated annual consumption of anthracite coal in the Valley region is between 1,000 and 1,500 tons. The total statewide consumption of anthracite coal in Connecticut ranges between 20,000 and 40,000 tons annually, (The figure used by officials in Pennsylvania, where the coal comes from, is 20,000. The figure used by the Connecticut Office of Policy and Management, Energy Division, is 40,000.)

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10. These figures were provided by the Office of Policy and Management, Energy Division.

The coal is shipped almost exclusively by truck from the coal fields of Pennslyvania to over one hundred small independent coal dealers in Connecticut. The lack of any cooperative bulk purchasing by the dealers, combined with poor rail connections due to weight restrictions on Hudson River railroad bridges (on the route from Pennslyvania coal fields to Connecticut), has resulted in the shipment of coal by higher cost trucking.

The process of transporting coal over water and unloading coal barges can contribute to changes in water quality due to the interaction of water with dust fallout and coal spillage.

Coal stockpiles and storage areas that are exposed to the environment are a potential source of water pollution. Coal storage piles produce effluents during and after precipitation, resulting from the drainage and runoff of water. The precipitation drains and leaches soluble pollutants from the coal, which may drain into the River and affect aquatic life. These pollutants include trace metals. Trace elements are essential to all life systems, yet excess amounts are toxic. The chronic input of trace metals from coal pile runoff may lead to increased concentrations in harbor sediments or marine organisms.

The extent to which the air quality would be affected by coal transfer operations would depend on the equipment and the storage. Air emissions in the form of fugitive dust (particulate matter) may occur from any open storage piles or from spillage during transfer.

Since the proposed energy site in Shelton employs silo storage systems, the particulate emissions would be low from the facility. Any additional open coal storage piles for reserve supplies could significantly increase the particulate emissions, as could truck loading for consumer delivery.

The average capacity of a coal barge is 1,500 tons. One barge has a capacity equivalent to that of 15 railroad hopper cars or 60 trailer trucks. While a single barge could be used, the true economics of barge transportation of coal are realized when a multiple barge-tow is used. A tow may consist of up to 15 barges, for a total capacity of 22,500 tons of coal. A single barge contains more coal than is presently used by the Valley region annually for domestic heating. Unless one of the area industries proximate to the site actually proposes to convert to coal, or unless domestic coal use gains substantially in popularity, developing a coal off-loading facility on the Housatonic River in Shelton does not appear feasible at this time.

XI. SUMMARY AND CONCLUSIONS

The existence of oil and coal storage facilities located in Derby and Shelton on the Housatonic River, and the on-going commercial dredging occurring in the Housatonic River stimulated interest in the feasibility of resuming barge shipments of fuels to Derby and Shelton. The following points represent the findings of this feasibility study.

1. The environmental monitoring of current dredging activities indicates that the operations are not adversely affecting water quality in the Housatonic River.

2. The two sub-aqueous natural gas pipelines which cross the Housatonic are located deep enough so as not to constitute a major navigation barrier for proposed barge and tug traffic.

3. The lower Housatonic River is a highly biologically productive area that supports a wide variety of flora which provide areas for resting, nesting and feeding for the many species of fauna, including oysters.

4. A section of the Housatonic from Culvers Bar to the Great Flats, a distance of approximately three miles, is presently a navigation barrier between the maintained five-mile channel downstream and the currently dredged channel upstream. Dredging in this area would be needed in order for barges to operate from Long Island Sound to Derby and Shelton.

5. With careful staging and monitoring, dredging this section of the Housatonic should not produce significant negative impacts to the environment nor affect the levels of salinity and, in turn, should not adversely affect the oyster industry. The turbulence from barges and tugs is also not expected to affect the levels of salinity.

6. Barge transportation of fossil fuels is consistent with the State's coastal management policies if operated according to safe operating procedures in order to avoid oil or coal spills during transit and during off-loading.

7. Fully loaded oil barges and accompanying tugs require a channel depth of approximately 12 feet and a channel width of approximately 150 feet for safe navigation. An amendment to the Federal Rivers and Harbors Act pertaining to the upper Housatonic River should be pursued to reflect the channel dimensions appropriate to modern river transportation safety standards. An oil off-loading dock facility and a barge turning basin would be needed at the location of the Derby oil storage tanks.

8. Additional aids-to-navigation (such as buoys) would be needed north of Moulthrop's Bar.

9. Patchy winter icing of the River does not represent a serious limitation to the resumption of river fuel shipments.

10. Major oil spill prevention and clean-up preparedness efforts must accompany any resumption of river fuel shipments.

11. Due to the lack of demand for coal at this time, bulk shipment of coal on the Housatonic River does not appear feasible.

While this study examined the environmental aspects of the resumption of river fuel shipments, the economics of such action have yet to be addressed and would be a logical next step to this study. The economics of fuel transportation by barge are dictated by two factors: barge costs and the amount of fuel carried. A barge that is fully loaded costs the same as one that is light-loaded to 50% capacity. In such a case, the unit cost of transporting oil by the light-loaded barge would be twice that of the fully-loaded barge. As indicated in the report, the economics of scale have resulted in increased barge sizes over the past few decades. The smallest oil barges in operation in the Sound have a capacity greater than the present storage facilities in Derby. To realize the full economic benefits of barge transportation over other methods of transportation, the capacity of the storage facilities need to be increased. An expanded storage facility would be of regional importance in the event of an energy shortage or emergency.

The financing of such a capital intensive project would probably require State aid and assistance in some form. The Department of Economic Development and related commissions (such as the Connecticut Development Authority) should be contacted to determine what State assistance might be available for such a project.

Another avenue which could be explored is the possibility of creating a Valley Port Authority. Enabling legislation in the Connecticut Statutes permits one or more municipalities to form a Port Authority. Such an Authority would have the ability to obtain staff and conduct business, including financing the construction and operation of docks and other port-related facilities. The idea of creating a Port Authority should be presented to Valley municipal representatives and to the owner of the oil tank facilities. If there is genuine interest in this concept, it should be pursued further.

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