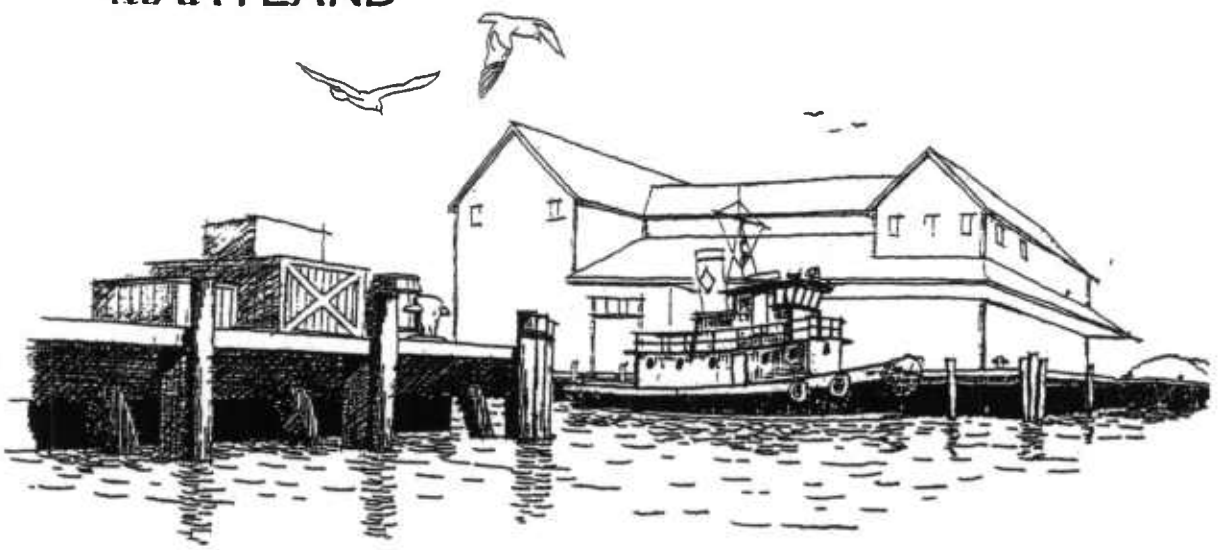
APPLICATION & SUPPORTING DOCUMENTS

FOR PERMITS TO CONSTRUCT

CRISFIELD DOCK & MARITIME PARK

CRISFIELD
SOMERSET COUNTY
MARYLAND



MAY 1988

Maryland Department of Natural Resources

Forest, Park and Wildlife Service
Tawes State Office Building
Annapolis, Maryland 21401

William Donald Schaefer
Governor

Torrey C Brown, M D
Secretary

Donald E MacLauchlan
Director

88-3-363

March 23, 1988

Sally B Moss
Environmental Concern
P O Box P
St Michaels, Maryland 21663

Dear Ms Moss:

This is in response to your letter to Donald E MacLauchlan in which you request information concerning the Crisfield Industrial Park There are no state or federally listed threatened or endangered plant or animal species present at this project site The Heritage data has not changed since the date of the last statement I do bring to your attention the fact that a colony of least terns occurs near the Coast Guard Station which is south of the project area Any activities taking place in the project area as your maps define it should not impact the colony

As for the copy of the original study report, I cannot help out We don't have one in our files If I can be of any additional assistance please feel free to call me

Sincerely,

James Burtis, Jr
Assistant Director

JB:epm

cc: Therres
Boone

Telephone: _____
DNR TTY for Deaf: 301-974-3683

EXHIBIT VIII-F

EXHIBIT VIII-G

Common and scientific names of invertebrates animals potentially occuring in or near tidal wetlands in the vicinity of the proposed Crisfield Dock & Maritime Park Crisfield Maritime Industrial Park.

INVERTEBRATES

Chrysaora quinquecirrha	Sea Nettle
Cyanea capillate	Winter Jellyfish
Aurelis auria	Moon Jellyfish
Mnemiopsis leidyi	Sea Walnut
Littorina irrorata	Marsh Periwinkle
Melampus bidentatus	Saltmarsh Snail
Nassarius obsoletus	Common Mud Snail
Mercenaria mercenaria	Quahog
Modiolus demissus	Atlantic Ribbed Mussel
Mya arenaria	Common Soft-shell Clam
Nereis spp.	Clam Worms
Capitella capitat	Tidemarsh Worm
Arenicloa sp.	Lug Worm
Limulus polyphemus	Horseshoe Crabs
Arachnida	Spiders
Hydrachnella	Water mites
Locustidae family	Grasshoppers

EXHIBIT VIII-G (continued)

Gryllidae family	Crickets
Ischnidemus badius	Hemipterans
Trigonotylus uhleri	"
Trigonotylus americanus	"
Rhytidolomia saucia	"
cymus breviceps	"
Prokelisia marginata	homopterans
Sanctanus aestuarium	"
Draeculacephala portola	"
Delphacodes detecta	"
Sanctanus sanctus	"
Amphicephalus littoralis	"
Spangbergiella vulnerata	"
Tumidagena terminalis	"
Neomegamelanus dorsalis	"
Hapalaxius enotatus	"
Chaetopsis apicalis	Dipterans
Chaetopsis fulvifrons	"
Conioscinella infesta	"
Dimecoenia austrina	"
Pelastoneurus lamellatus	"
Oscinella ovalis	"
Ceropsilopa costalis	"
Tomosvaryella coquilletti	"
Hippelates particeps	"

EXHIBIT VIII-G (continued)

Ades sollicitans	Saltmarsh mosquito
Anopheles bradeyi	Bradyleys mosquito
Culex salinarivs	Culex mosquito
Formicidae family	Formicid ant
Acartia clausi	Copepods
Acartia tonsa	"
Eurytemora affinis	"
Oithona brevicornis	"
Podon polyphymoides	"
Philoscia vittata	Isopod
Limnoria lignorum	Gribble Isopod
Orchestia sp.	Amphipods
Gammarus sp.	Amphipods
Crangon septemspinose	Sand shrimp
Palaemonetes pugio	Grass shrimp
Callinectes sapidus	Blue Crab
Uca minax	Red-jointed fiddler crab
Uca pugnax	Marsh fiddler crab

EXHIBIT VIII-H

Common and scientific names of vertebrates potentially occuring in or near wetlands in the vicinity of the proposed Crisfield Dock & Maritime Park.

VERTEBRATES

Anguilla rostrata	American eel
Fundulus heteroclitus	Mummichog
Fundulus majalis	Striped killifish
Paralichthys dentatus	Summer flounder
Pomatomus saltatrix	Bluefish
Morone saxatilis	Striped bass
Pseudopleuronectes americanus	Winter flounder
Leiostomus xanthurus	Spot (N)
Cynoscion regalis	Weakfish (N)
Brevoortia tyrannus	Menhaden
Auguilla rostrata	American eel
Trinectes maculatus	Hogchoker
Anchoa mitchelli	Bay anchovy
Menidia berylina	Tidewater silverside
Malaclemmys terrapin terrapin	Northern diamondback terrapin
Chelydra serpentina	Common snapping turtle
Branta canadensis	Canada goose
Anas platyrhynchos	Mallard
Anas rubripes	Black duck

EXHIBIT VIII-H (continued)

Anas acuta	Pintail
Anas strepera	Gadsvall
Anas discors	Blue-winged teal
Anas crecca	Green-winged teal
Aythya americana	Redhead
Aythya affinis	Lesser scaup
Bueephala albeola	Bufflehead
Circus cyaneus	Marsh hawk
Casmerodius albus	Great egret
Egretta thula	Snowy egret
Ardea herodias	Great blue heron
Rallus longirostris	Clapper rail
Catopirophorus semipalmatus	Willet
Tringa melanoleucus	Greater yellow legs
Limnodromus griseus	Short-billed dowitcher
Calidris minutilla	Least sandpiper
Larus argentatus	Herring gull
Larus atricilla	Laughing gull
Sterna birundo	Common tern
Sterna forsteri	Forster's tern
Corvus brachyrhynchos	Common crow
Telmatodytes palustris	Long-billed marsh wren
Hirundo rustica	Barn swallow

EXHIBIT VIII-H (continued)

Sturnus vulgaris	Starling
Agelaius phoeniceus	Red-winged blackbird
Quiscalus mexicanus	Boat-tailed grackle
Ammospiza caudacuta	Sharp-tailed sparrow
Ammospiza maritima	Seaside sparrow
Passerculus sandwichensis	Savannah sparrow
Melospiza melodia	Song sparrow
Myotis lucifugus	Little brown bat
Procyon lotor	Racoon
Mephitis mephitis	Striped skunk
Microtus pennsylvanicus	Meadow vole
Ondatra zibethicus	Muskrat
Peromyscus leucopus	White-footed mouse
Mus musculus	House mouse
Sylvilagus floridanus	Eastern cottontail
Rattus norvegicus	Norway rat

EXHIBIT VIII-I

HOP POINT

FECAL COLIFORM LEVELS

1986 THRU 1987

DATE	FECAL COLIFORM (MPN/100 mls.)
03/19/86	7.3
04/10/86	93.0
04/17/86	1.0
04/22/86	93.0
05/07/86	3.6
06/11/86	1.0
06/24/86	93.0
07/01/86	43.0
07/09/86	3.0
07/30/86	15.0
08/04/86	39.0
08/21/86	43.0
09/17/86	9.1
10/09/86	9.1
11/18/86	1.0
12/03/86	23.0
04/08/87	7.3
04/20/87	3.6

EXHIBIT VIII-I (continued)

05/07/87	1.0
05/13/87	43.0
05/21/87	23.0
06/03/87	7.3
06/10/87	240.0
06/30/87	9.1
07/14/87	75.0
07/27/87	3.6
08/19/87	240.0
08/27/87	3.6
09/01/87	460.0
09/30/87	43.0

SECTION IX

SECTION IX - ENVIRONMENTAL ASSESSMENT ELEMENTS

A. GEOLOGY AND SOILS

The soils and topography throughout the project site will be altered as a result of filling for creation of fast land and dredge spoil disposal. Elevations which presently do not exceed four feet will upon completion of the project range between six to seven feet. Dredge spoils will be the major component of fill used for the project.

The anticipated composition of dredge material excavated as part of navigational channel improvement and barge turning basin construction will consist of approximately 90% granular sand and 10% silt.

Proper soil erosion and sediment controls will be utilized throughout construction of this project. No impact to the geology and soils within areas adjacent to this project is therefore expected.

B. HYDROLOGY

The proposed project will result in filling 3.42 acres of shallow water mainly composed of a portion of the existing open water embankment and a tidal creek, approximately 15' wide,which fronts the project site west of Collins Avenue. Approximately 15 acres of subtidal lands composed of shallow water and existing navigational channel will be deepened to 8 to 12 feet below mean low water. Shallow water areas presently range between 1 foot above to 5 feet below mean low water. Most of the impacted area is between two to four feet deep. Existing navigational channel depth is listed at 6 1/2 feet.

Aside from the alteration of water areas to uplands little other negative impact to the water column is expected. Due to the tidal nature of the Little Annemessex River, its large width at the point of the project and the low lying surrounding topography, the ability of the river to store or discharge flood waters is not at issue.

In fact, since the project location was the lowlying entry point for storm induced flooding of Crisfield in March 1984, implementation of the project may reduce impact of storm events on Crisfield by providing a secured elevated breakwater against prevailing westerly winds and waves.

No significant impact to groundwater hydrology is expected to result from this project.

C. VEGETATION

No significant upland vegetation will be impacted by the proposed project. As a result of project implementation the direct loss of the following zones of vegetated wetlands will occur. These zones as classified in this report are listed in order of their productivity and significance to the marsh/ estaurine system.

ZONE	IMPACT ACREAGE	PREDOMINANT VEGETATION TYPE
Low Marsh	1.45	Saltmarsh cordgrass
Intermediate Marsh	4.50	Mixed saltmarsh cordgrass and salt hay
High Marsh	6.35	Mixed salt hay and saltgrass Common reed and high tide bush also frequent.
Other	2.48	Common reed, debris filled or other degraded areas.

Occurrence of submerged aquatic vegetation is limited to one species on the western shoreline of the Little Annemessex River.

The closest occurrence of Ruppia maritima to the project site is approximately 500 yards to the west. This area is sufficiently distant from the project and proposed navigational channel improvements so that no impact to submerged aquatic vegetation will result from this project.

In terms of the primary production contribution of plant material and detritus provided to the marsh/estaurine system by the wetland areas lost as a result of this project, yearly production of 15 to 20 tons is reasonable. Due to the isolation and limited tidal flushing of 4.95 acres west of Collins Avenue the relative value of this area to the marsh/estaurine is reduced. 5.95 acres of low and intermediate marsh zones represent the most significant loss in biomass production as well as wildlife habitat.

Within Somerset County wetland types characterized by saltmarsh cordgrass (6,901 acres) and mixed salt hay/salt grass marshes (13,236) acres are estimated by the Department of Natural Resources to total 20,137 acres. Irregardless of their relative productivity or other values the total wetland area impacted by this project represents 0.073 percent of these wetland types. Considering the lower Eastern Shore counties composing most of the shoreline areas of the Tangier Sound segment of the Chesapeake Bay, both Somerset and Dorchester County wetlands form

the regional setting. Over 45,000 acres of these two wetland types exists in the project region. Wetland area lost by implementation of this project is 0.032 percent of this regional total. Since the value of any particular acre of tidal wetland is highly dependent any number of variables including location, surrounding land types and uses, tidal inundation, vegetation type and diversity, the impact of any single wetland loss to the ecosystem may be much higher, or lower, than the percentage presented.

In the case of this proposed project, the area of impact is within a developed town center. The specific project location is the only undeveloped area with adequate access to existing navigational channels which is still proximate to the town center. Development of the site as a maritime industrial park is compatible with existing surrounding uses. Economic and other public interest needs in regard to keeping Crisfield as a economically and culturally viable Eastern Shore community must also be considered in the determination of acceptable environmental loss.

D. FISH, SHELLFISH AND WILDLIFE

The proposed project does not impact any upland areas of significance to wildlife populations.

In regards to wetland impacts the project site is generally not a critical nursery, breeding or feeding area for any terrestrial mammal population. This fact is due in a large part to the developed surroundings of the project site, the relative size and isolation of the wetlands affected by the project and the limited degree of tidal influence on at least part of the project area.

In respect to relative significance of wetland habitat the most significant impact will be the loss of the low and intermediate marsh types (5.95 acres) dominated by salt marsh cordgrass and mixed saltmarsh cordgrass/ salt hay vegetation.

These wetlands provide good production of a variety of invertebrate species important to the marsh/estaurine food chain such as snails, amphipods, isopods and a variety insects. Without detailed study the invertebrate production of this 5.95 acre wetland area cannot be established. However, there is no reason to expect the production would not compare favorably with other similar wetland types in the project vicinity.

Past fishery data for the project site and the Little Annemessex River indicates that shallow water and salt marshes along this segment of the river are utilized primarily as a fish nursery grounds. It is noted that Leiostomus xanthurus (spot), and Anchoa mitchilli (bay anchovy) are the most commonly occurring

species utilizing this area. Filling of open shallow water area will cause a direct loss of 3.42 acres of fish habitat.

Secondary impact caused by proposed dredging will also result. In order to create a turning basin suitable for barges water depth of the embayment which fronts the project site will be increased from 2 to 4 feet, to 8 to 12 feet below mean low water. The existing navigational channel will be widened and deepened from 6 1/2 feet to 12 feet mean low water. These proposed depths are still considered part of the shallow water habitat zone. The water column will still be available as fish habitat.

The diversity and density of benthic populations present at the site is not known. At the project site local populations of benthic organisms may continue to be impacted by the presence of Crisfield sewage treatment outfall pipe.

If dredging depths are not excessive, as in this case, areas impacted by dredging can be expected to be recolonized by these organisms. However, population assemblages, species diversity and individual population densities will be altered.

A detailed in the Section IX-C, Vegetation, Somerset County and the Tangier Sound region contains 45,000 acre of the saltmarsh cordgrass and mixed salt hay/saltgrass wetland types similar to

those impacted by the project. 20,137 acres exist in Somerset County alone. Local to the project vicinity Janes Island State Park and Jersey Island are composed of approximately 3,400 acres of tidal wetlands.

The loss of 14.78 acres of wetland, irregardless of it's specific value, will clearly not be a significant limiting factor to any fish shellfish or wildlife population. Future cumulative impact to these wetland type will be extremely limited. The extrodinary circumstances which allow consideration of the Crisfield Maritime Industrial Park by environmental regulatory agencies will not commonly occur.

Many conditions are unique to Crisfield itself, exampled by social, economic and geographical circumstances. Others are directly related to the site location and its surroundings. Availability of developable areas with existing infrastructure, waterfront and navigation channel access, and compatibility with surrounding land uses is limited in Crisfield. It is also limited regionally. In order to maintain Crisfield as a viable Eastern Shore community fish, shellfish, and wildlife losses resulting from implementing this particular project may be a necessity.

SECTION E - WATER QUALITY

The proposed project will be designed in accordance with the Maryland best management practices for stormwater collection and treatment and soil erosion and sediment control. This will occur during construction and after completion of the project. Occupants of the proposed facility will be required to place additional stormwater management controls tailored to their specific use of the site, if necessary. Quality of water discharged from dredge spoil disposal sites will be in accordance with Maryland standards.

As part of the project the applicant also intends to upgrade existing stormwater management outfalls which presently discharge through the project site. The most important of these is a stormwater outfall which discharges runoff collected in the median of Maryland 413. Measures to trap sediments and oils from this discharge are proposed.

One function tidal wetlands perform is enhancement of water quality. Benefits are achieved through regular contact of surface waters with plant and soil surfaces. In regard to this project loss of low and intermediate marsh types (5.95 acres) have the most significance.

The relative rate of effectiveness in both quantitative and

qualitative measure for various wetland types has yet to be precisely defined. In general, it is accepted that nutrients, especially nitrogen, are absorbed by plants and microorganisms on plant surfaces, soil surfaces and in subsurface soil sediments. Nutrients removed and recycled as plant tissues in spring and summer are released to the water column when plants die back in fall. Nutrients held by microorganisms are released as these organisms die back in winter months. A benefit to this cycle is that complex organic and inorganic substance are reduced to simpler non-polluting compounds.

Water quality benefits provided by wetland vegetation have an element of seasonal variability. A more stable sink for nutrients and inorganic substances is provided by wetland soil. The level of retention provided, however, is much lower than other plant and organism uptake.

Data also demonstrates that wetlands play a significant role in increasing the dissolved oxygen levels and decreasing biological oxygen demand of their adjacent waters.

Due to the flushing and dynamic movement of waters caused by the tide cycle, the waters of Little Annemessex River come in contact with large acreages of wetland. Janes Island State park is composed of over 3,000 acres of tidal wetlands. Jersey Island

immediately south of the project is made up of 400 acres. Over 66,000 acres of coastal marshland is present in Somerset County. For this reason it is likely that the loss of wetlands caused by this project will not have a significant measurable effect on water quality of the Little Annemessex River.

F. OUTDOOR RECREATION

the proposed project will not adversely affect outdoor recreation uses within Somerset County or Crisfield. Due to the location of the site it is not a suitable area for hunting. Recreation or commercial use of the waters proximate to the site received no significant use as a fishing area. This is due to location of surrounding industrial uses and the proximate location of the Crisfield sewage treatment outfall pipe.

Implementation of the proposed project will not negatively affect any existing tourist locations within the Town. However, a positive secondary effect is more likely. Economic and social benefits which will be provided to Crisfield as a result of implementing this project will provide needed stability to the local economy. This stability will allow Crisfield to maintain and expand the current level of tourism and outdoor recreation uses it presently provides.

G. IMPACT TO WATER QUALITY DEPENDENT INDUSTRIES

Impact on the water quality dependent industries by this project will not be an issue. Crab shedding operations located at the small boat harbor are distant from the proposed activity.

Dredging for the proposed project will have some short term turbidity impact to the local segment of the Little Annemessex River. However, once navigational channels are deepened a second source of turbidity will be reduced. Suspension of sediments in the water column resulting from prop wash when barges are moved into the Steuart Transportation facility will be reduced. The project will conform with best management practices for both construction and dredging. Individual users of the proposed facility will be required to implement a secondary stormwater collection and treatment program specific to their use of the site, if necessary.

Due to the proximity of the existing sewage/water treatment plant outfall pipe, relocation of intakes for crab shedding operations

near the Steuart Transportation facility has been discussed as one possible mitigation alternative.

Crisfield recognizes the importance of the commercial seafood

industry to its present economy. The city has in the past and will in the future continue to work with these industries to meet their needs. Their important contribution to the local economy must be maintained. This is evidenced, in part, by Crisfield active pursuit of approval for this project.

H. POTENTIAL MITIGATION ALTERNATIVES

Alternatives to offset adverse environmental impact resulting from project implementation is not a limitation. A variety of alternatives exist. Refitting portions of the local existing drainage infrastructure with apparatus for sediment and oil collection is presently proposed and could be expanded. Improvements to the local sewage treatment facility and its discharge outfall is another option to mitigate water quality impacts.

The applicant is willing to pursue measures to mitigate environmental losses. Generally, it is not the procedure of the regulatory authorities to actively review mitigation proposals until public benefit and project location alternative are reviewed. Once these criteria are satisfied it is the applicants intention to work with the environmental agencies involved with project approval to development a multifaceted mitigation proposal.

SECTION X

SECTION X - MITIGATION REPLACEMENT AND IMPROVEMENT TO NATURAL RESOURCES

The construction of the Crisfield Maritime Industrial Park will necessarily require the filling of several acres of wetlands. The areas of the various types of wetlands are described in other sections of this application. Somerset County consists of approximately 48,000 acres of salt marsh. This represents 23% of the total area of Somerset County. This project would reduce the total inventory of wetlands in Somerset by 0.03%, except that wetlands are actually being created in the county by subsidence of fast land.

Due to the surplus of wetlands in Somerset County, it is suggested that rather than establish new wetlands, mitigation be accomplished through improvement of water quality in the Little Annemessex River Cedar Creek area.

Five mitigation alternatives are offered with this application for consideration by the Corps of Engineers and the various agencies. These alternatives are as follows:

A. The small boat harbor north of the proposed project is owned by the City of Crisfield. The basin is connected to the Little Annemessex River via a dredged channel known as Brick Kiln Channel. This channel and harbor combination is a dead end

lagoon leaving tidal action as the only means of changing the water in the basin. Approximately 65 work boats are moored there.

In addition to this activity there are several crab shedding operations around the basin perimeter. Water intakes are located in the boat basin.

It is suggested that a mitigation alternative be the construction of a conduit between the boat basin and Little Annemessex River as shown on Exhibit X-A. This conduit should provide for continuous flow through the basin. Water quality should be enhanced by this action.

Criteria for the design of this conduit will be based on input from the environmental consultant and the various agencies involved in the permitting process.

B. An existing major storm drain system, draining approximately 267 acres of the City of Crisfield, discharges directly into a tidal gut on the east side of Little Annemessex River as shown on Exhibit X-B. This discharge carries with it the run-off contaminants from the developed section of Crisfield. It is suggested that stormwater management devices be constructed as a mitigation measure to improve water quality of the first flush of stormwater. Test results are not available, but one can assume

the runoff contains oils, grease, silt, plastics and debris normally found in a developed community.

A TR-55 analysis was prepared for the drainage area to calculate peak discharges for various storm frequencies. These results are shown on Exhibit X-C.

Stormwater management for the industrial park project may be combined with management for the 267 acre City drainage area.

It will be essential to work closely with the State Department of Natural Resources and the Department of the Environment to establish design criteria and construction parameters for this alternative.

C. Several crab shedding operations have been constructed in recent years along the existing channel south of Steuart Transportation (Hop Point). Intake lines for the operation extend beyond the bulkhead into the dredged channel. When tugs deliver barges to Steuart Transportation they reportedly disturb the channel bottom creating high turbidity water which finds its way to the intake lines of the crab shedders.

It is suggested that an alternative mitigation measure be the relocation of intake lines to another section of Little

Annemessex River or to provide filters or some other means of improving water quality.

D. The existing sewage treatment plant for the City of Crisfield is a secondary plant discharging treated effluent into Little Annemessex River at the southwest corner of Steuart Transportation Bulkhead as shown on Exhibit X-D. This location is approximately 200 feet from intake lines for the crab shedders discussed in C. above. The sewage treatment plant is scheduled for upgrading in the summer of 1988 and will have the capacity of 1,000,000 mgd.

It is suggested that an alternative mitigation measure be the relocation or extension of the outfall from the sewage treatment plant to preclude short circuiting with water used for crab shedding operations.

E. It is understood that most if not all watermen perform maintenance on their boat while it is moored in the small boat harbor.

It is suggested that an alternative mitigation measure be the provision of waste oil tanks in the harbor area.

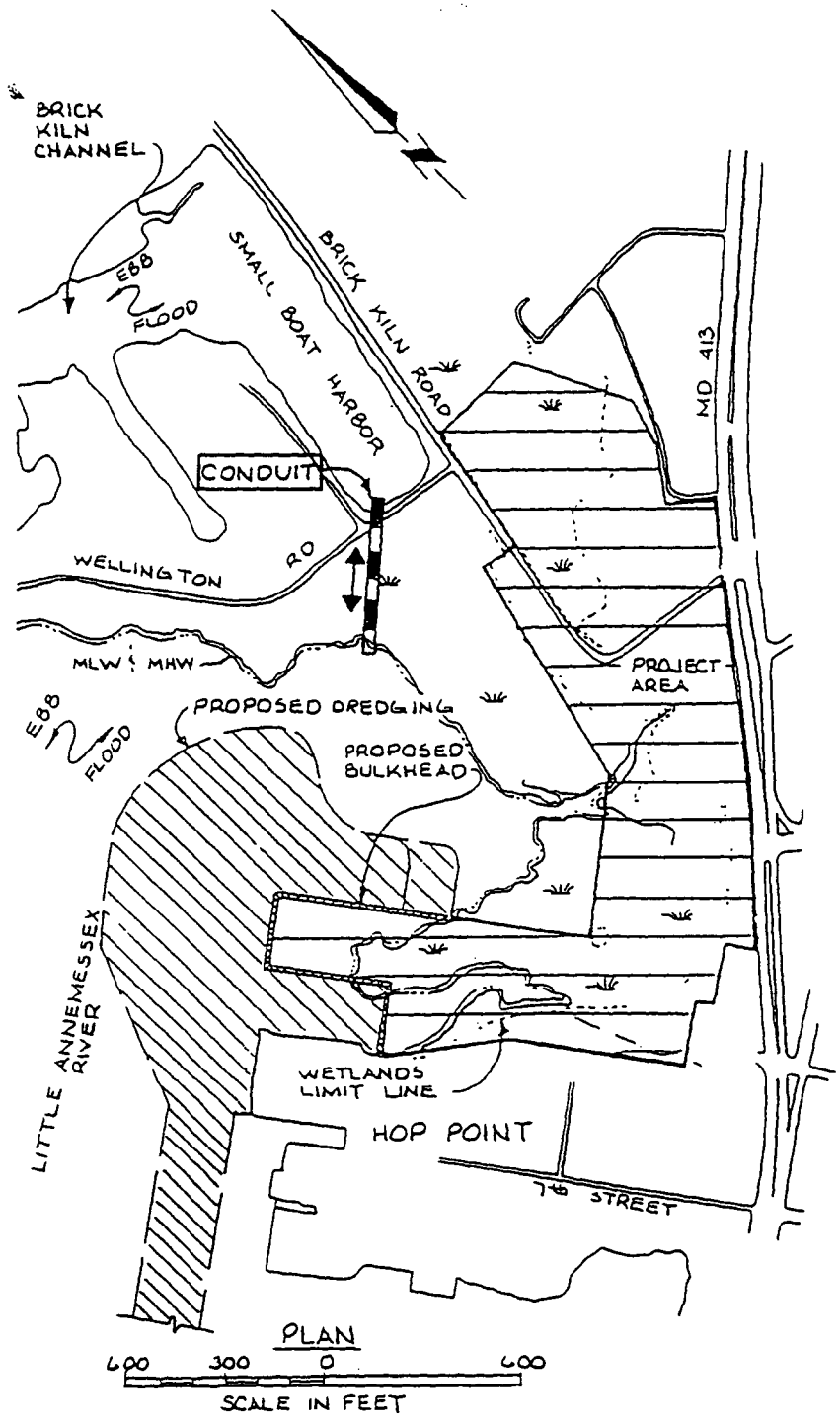
F. EXHIBITS

Exhibit X-A - Small Boat Harbor Conduit

Exhibit X-B - Watershed

Exhibit X-C - TR-55 Computation

Exhibit X-D - STP Outfall Location

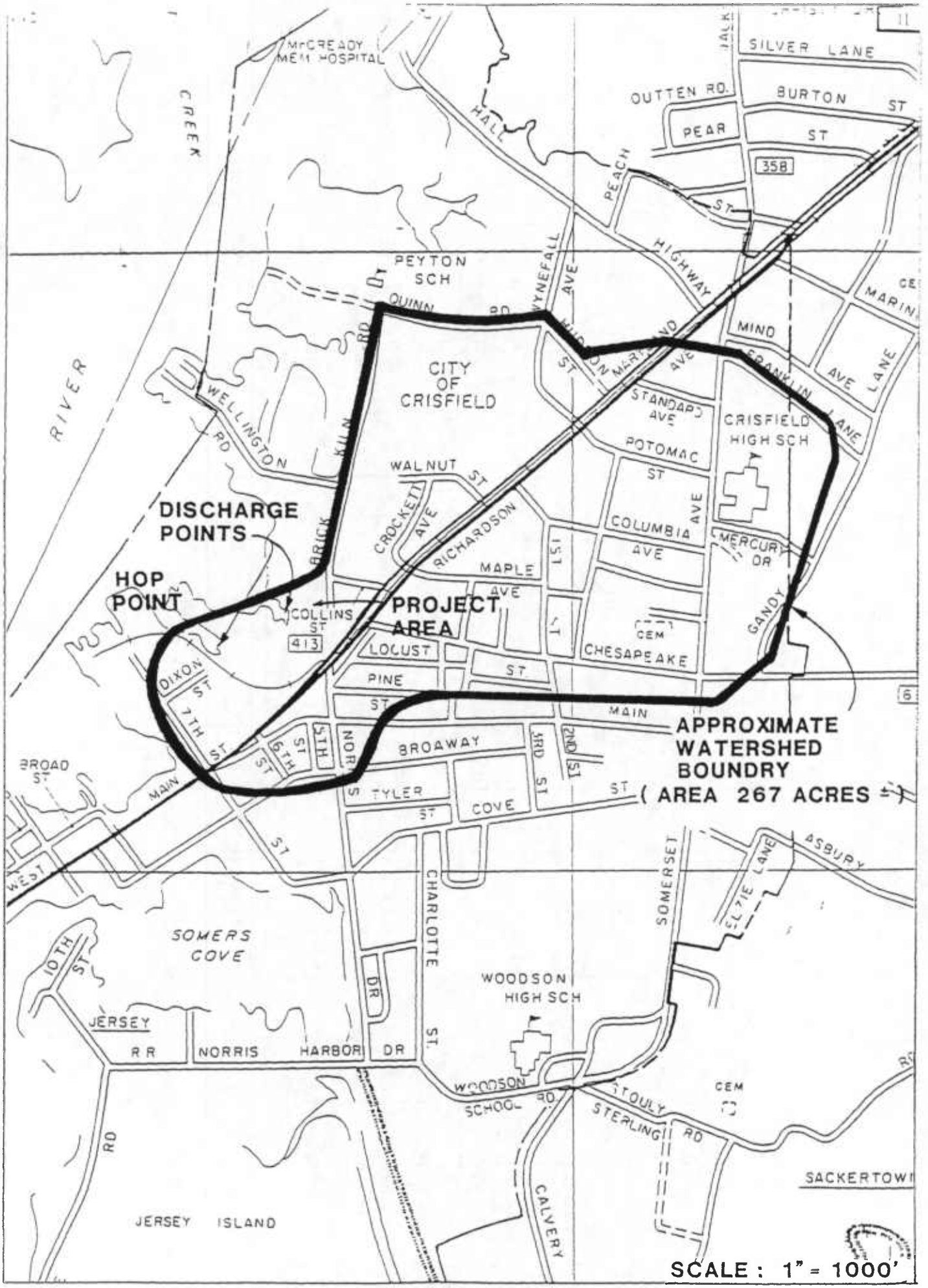


PROJECT SITE

PROPOSED CRISFIELD DOCK
AND MARITIME PARK

IN LITTLE ANNEMESSEX RIVER
AT CRISFIELD, MARYLAND
SOMERSET COUNTY STATE OF MARYLAND
APPLICATION BY: CITY OF CRISFIELD, MD

SMALL BOAT HARBOR CONDUIT **EXHIBIT X-A**



WATERSHED

EXHIBIT X-B

TR-55 CURVE NUMBER COMPUTATION — REVISION 1

Project : CRISFIELD MARITIME IND. PARK — User: RBD — Date: 05-12-88
County : SOMERSET — State: MD — Checked: ____ — Date: _____
Subtitle: PRE-DEVELOPMENT DISCHARGE AT PROJECT SITE
Subarea : A

COVER DESCRIPTION		Hydrologic Soil Group A	B	C	D
		Acres (CN)			
FULLY DEVELOPED URBAN AREAS (Veg Estab.)					
Residential districts (by average lot size)	Avg % imperv				
1/2 acre	25	-	-	-	211(85)
OTHER AGRICULTURAL LANDS					
Pasture, grassland or range	poor	-	-	-	54(89)
Total Area (by Hydrologic Soil Group)					267

SUBAREA: A — TOTAL DRAINAGE AREA: 267 Acres — WEIGHTED CURVE NUMBER: 86*

* - Generated for use by GRAPHIC method

TR-55 COMPUTATION

EXHIBIT X-C 1

TR-55 Tc and Tt Through Subarea Computation Version: 1.1

Project : CRISFIELD MARITIME IND. PARK User: RBD Date: 05-12-89
County : SOMERSET State: MD Checked: ____ Date: _____
Subtitle: PRE-DEVELOPMENT DISCHARGE AT PROJECT SITE

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	3.5	300	0.01	F					0.72
Shallow Concent'd		4820	.001	F					2.08

Time of Concentration = 2.81*

--- Sheet Flow Surface Codes ---

A Smooth Surface
B Fallow (No Res.)
C Cultivated : 20 % Res.
D Cultivated : 20 % Res
E Grass-Range, Short
F Grass, Dense
G Grass, Burmuda
H Woods, Light
I Woods, Dense

--- Shallow Concentrated Surface Codes ---

P Paved
U Unpaved

* - Generated for use by GRAPHIC method

EXHIBIT X-C 2

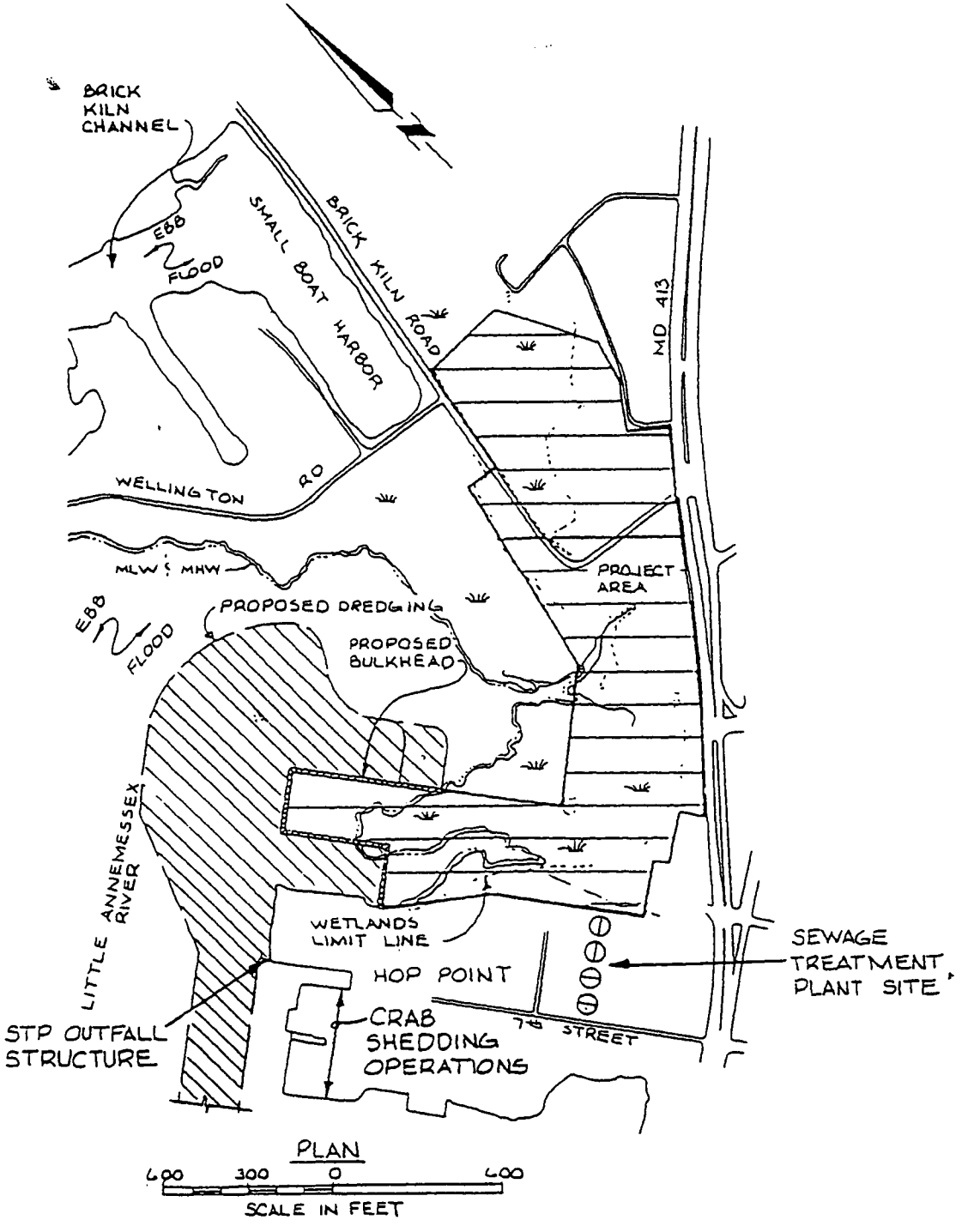
Project : CRISFIELD MARITIME IND. PARK User: RBD Date: 05- 2-8[illegible]
County : SOMERSET State: MD Checked: ____ Date: _____
Subtitle: PRE-DEVELOPMENT DISCHARGE AT PROJECT SITE

Data: Drainage Area : 267 * Acres
Runoff Curve Number : 86 *
Time of Concentration: 2.81 * Hours
Rainfall Type : DMV
Pond and Swamp Area : NONE

Storm Number	1	2	3	4	5	6	7
Frequency (yrs)	1	2	5	10	25	50	100
24-Hr Rainfall (in)	2.9	3.5	4.7	5.6	6.4	7.2	8.1
Ia/P Ratio	0.11	0.09	0.07	0.06	0.05	0.05	0.04
Used	0.11	0.10	0.10	0.10	0.10	0.10	0.10
Runoff (in)	1.58	2.10	3.19	4.03	4.79	5.56	6.47
Unit Peak Discharge (cfs/acre/in)	0.157	0.159	0.159	0.159	0.159	0.159	0.159
Pond and Swamp Factor 0.0% Ponds Used	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Peak Discharge (cfs)	66	89	135	171	207	276	277

* - Value(s) provided from TR-55 system routines

EXHIBIT X-C 3



PROJECT SITE

PROPOSED CRISFIELD DOCK AND MARITIME PARK

IN LITTLE ANNEMESSEX RIVER
AT CRISFIELD, MARYLAND
SOMERSET COUNTY STATE OF MARYLAND
APPLICATION BY: CITY OF CRISFIELD, MD

STP OUTFALL LOCATION

EXHIBIT X-D

SECTION XI

SECTION XI —ECONOMIC ANALYSIS

A. POTENTIAL FOR EMPLOYMENT

Steuart Transportation currently operates a marine repair facility on the property immediately adjacent to the west side of the planned park. Its current operations are limited due to the channel not being deep enough for larger tugs and barges. Steuart proposes to lease the west side of the loading dock, and install a marine drydock in the slip between the park and their property. This drydock will require a capital investment of $2,500,000+ by Steuart, and will give them the ability to add underwater service at their Crisfield shipyard. Steuart anticipates that this expanded service will enable them to add 71 employees in Crisfield.

The number of acres, excluding the .5 acre of dock that will be used by Steuart, totals 23.9. The estimated number of employees for this acreage is:

23.9 acres at 8 jobs per acre = 191 jobs

The total number of jobs created is therefore estimated to be the accumulation of 71 jobs at Steuart plus 191 jobs for the other acreage, giving a total of 262 jobs.

B. EXPECTED REVENUES FROM THE FACILITY

Revenues from the facility will come in the form of land sales, tax revenues from the land, tax revenues from buildings, lease of dock space, and income taxes from employees. Additional benefits to the local economy will include payroll to employees and some of the money spent on new construction.

Land sales

Industrial sites will be priced from $30,000 to $50,000 per acre, with one parcel projected to be sold per year for each of the next five years. Due to the lack of available waterfront sites on Maryland's Eastern Shore, these prices are considered to be competitive.

Year	Acres sold	Income
1990	5	$ 200,000
1991	4.1	164,000
1992	4.4	176,000
1993	4.6	184,000
1994	5.8	232,000
Total Income from sales		$ 956,000

Tax revenues from the land

Taxes for land are calculated on the assessment base for the property. This assessment base is currently 45.6% of the value of the property. The $956,000 value of the property multiplied by 45.6% gives an assessment base of $435,936. The tax revenues,

calculated one this assessment base, follow:

Tax jurisdiction	Annual taxes
County, at $1.90/$100	$ 8,283
City, at $1.50/$100	6,539
State, at $.21/$100	915
Total annual land tax revenue	$ 15,737

Tax revenues from the buildings

Taxes for buildings are also calculated on an assessment base of 45.6%. The buildings, when completed, are expected to cover 30% of the properties. For the 24.4 total acres (including the .5 acres of dock used by Steuart), this will come to 318,859 square feet of buildings. The values of the buildings are estimated as:

Type	%	Cost/SF	Value
Warehouse	55	25	$ 4,384,311
Manufacturing	35	30	3,348,020
Office	10	40	1,275,436
Total value of buildings			$ 9,007,767

The total value of the buildings multiplied by 45.6% gives an assessment base of $4,107,542. The taxes on this base would be as follows:

Tax jurisdiction	Annual taxes
County, at $1.90/$100	$ 78,043
City, at $1.50/$100	61,613
State, at $.21/$100	8,626
Total annual building tax revenue	$ 148,282

Lease income from dock space

The loading dock, including the portion used by Steuart, will be leased rather than sold. The lease income for the dock space is calculated as the estimated cost of maintaining and replacing the dock. No allowance has been made for debt service, nor has the charge for any specific tenent been determined.

Cost of loading dock	$ 2,975,500
Replacement, 50 year life	59,510
Maintenance annually	14,900
Annual cost	74,410

Piggy back income tax potential

The estimated average income tax to the state per employee is:

$12,050 average income at 0.05 rate = $602.50

Piggy back tax potential is:

Average tax at 50% for 262 employees = $78,928

Other financial benefits

The cost of construction for the buildings is estimated to be $9,007,767. An undetermined amount of this money will be spent locally.

The total payroll for the 262 employees is estimated to be $3,157,100.

C. NATURE AND VALUE OF COMMERCIAL ACTIVITY AT THE SITE

Steuart Transportation plans to install a dry dock capable of lifting barges. This will give Steuart the capability to service barges and other large vessels below the water line. Currently, Steuart is limited to repairs above the water line, such as cutting, welding, and repairing machinery.

Indications are strong that boat building companies will be attracted to the park. This activity will be beneficial to the local marina and local marine hardware merchants. Crisfield, with its maritime history, has developed an excellent system of supporting services and skills for boat building.

D. COST OF PROJECT

The construction cost estimates are:

<u>Loading dock</u>	
Concrete bulkhead	$ 2,560,000
Fill material	216,000
Paving	199,000
Total loading dock	$ 2,975,500
<u>Dredging (Maryland Port Authority)</u>	
Dredging from main channel to dock area, including	

turn around basin	$ 962,500
Dike construction	1,125,000
RIP/RAP	100,000
Total dredging and filling	$ 2,187,500

Site improvements

Roadway base material	$ 40,000
Asphalt paving	144,000
Curb and gutter	53,000
Water mains	120,000
Sewer mains	150,000
Storm drains	400,000
General lighting	80,000
Total site improvements	$ 987,000

Engineering, contingency and administration

@ 20% of construction cost	$ 1,230,000

Total project cost

$ 7,380,000

E. ADDITIONAL ANALYSIS

As indicated in the letter Exhibit XI-A, additional financial analysis may be supplied, if required, by the Department of Economic & Employment Development.

F. EXHIBITS

Exhibit XI-A - Letter from Economic Development Commission dated May 17, 1988.

Economic Development Commission
of Somerset County

AC 301 651 0500 424 N Somerset Ave Princess Anne Maryland 21853

THE EASTERN SHORE ALTERNATIVE

May 17, 1988

Mr Tony Bruce
Jones & Bruce, P A
Post Office Box 567
Princess Anne, Maryland 21853

Dear Tony:

Mr Robert Schaeplein, Director of Research for the Department of Economic & Employment Development has indicated that he would be able, if required, to help develop a market analysis of the Crisfield Maritime Industrial Park potential, based upon their input-output analysis program, showing what employment, income, investments, and tax revenues would be generated from the Maritime Industrial Park

Unfortunately, the Department is presently moving from Annapolis to Baltimore and is not able to provide the information for the next two weeks or until they are again operational.

Sincerely,

James C Threatte
Executive Director

JCT:cf

EXHIBIT XI-A

SECTION XII

APPLICATION

&

SUPPORTING DOCUMENTS

FOR PERMITS TO CONSTRUCT

CRISFIELD DOCK & MARITIME PARK

CRISFIELD, SOMERSET COUNTY

MARYLAND

MAY 1988

TABLE OF CONTENTS

TRANSMITTAL

CITY OF CRISFIELD
CITY HALL
P O BOX 270
CRISFIELD, MARYLAND 21817
(301) 968-1333

RICHARD SCOTT MAYOR
JULIAN C TYLER CITY MANAGER
TONY BRUCE CITY SOLICITOR
GAIL A RAYFIELD CLERK-TREASURER

CITY COUNCIL
ROLAND H BROWN, SR
GREGORY C STERLING, SR
C LARRY TYLER, SR

May 18, 1988

U S Army Corps of Engineers
Baltimore District
P O Box 1715
Baltimore, Maryland 21203-1715

Tidal Wetlands Division
Water Resources Administration
Tawes State Office Building D-4
Taylor Avenue
Annapolis, Maryland 21401

Re: Joint Federal/State Application For The Alteration of Any Floodplain, Waterway, Tidal or Non-Tidal Wetland in Maryland
Crisfield Dock & Maritime Park
Crisfield, Maryland

Gentlemen:

We submit herewith one original Application and (5) copies of the "Application and Supporting Documentation" to the U S Army Corps of Engineers and one original Application and (6) copies of the "Application and Supporting Documents" to the State Water Resources Administration

Upon review of this document you will see that we have reduced the proposed project to the absolute minimum currently required to prevent further loss of industry and continuing loss of jobs and livelihood for our citizens I wish to emphasize that Crisfield is Bay dependent and therefore Crisfield is in a tragic condition Up to this point Crisfield has been trapped in a paradoxical state of affairs, namely: "lack of regulation" followed by "regulation" Our seafood industries flourished until destroyed as a result of the "lack of regulation" of acid rain and industrial and agricultural pollution When we tried to create a sizeable maritime industrial facility, which would have provided growth for Crisfield, we were denied the opportunity due to "regulation".

We understand the earlier "lack of regulation" as well as the need for the current "regulation" Therefore we have reduced our goal of expansion of our industrial base to that of simply, stabilizing our current population and providing jobs for our unemployed and "to-be" unemployed as additional watermen are forced to give up their work boats

We are now asking permission to build one dock, which we desperately need, and several sites for boat builders and other water dependent industries which are willing to locate in Crisfield thereby providing jobs for our unemployed We have scaled the project back to the absolute essentials needed to keep us from proceeding to complete destruction We also propose to improve the local environment rather than allowing further deterioration

We believe that if our earlier proposal had received approval it would now be fully occupied as demonstrated by the effective marketing of the only maritime site which was available The State of Maryland delivered to the City a deed recorded on March 24, 1988 for the 8 95 acres former University of Maryland Seafood Lab This property was marketed by the Maryland Economic Development Corporation and on April 25, 1988 the City approved a draft lease and option to purchase the site with a specific tenant We anticipate announcement of the location of this tenant (who required a maritime site) to be made shortly by the Governor of Maryland and MEDCO at which time we will supplement the application with those additional supporting documents

We request that you review our proposal as quickly as possible The Mayor, Council, Project Manager and our consultants will be glad to work with you to expedite this application

We anxiously await your approval

Sincerely,

Richard D. Scott

Richard D Scott
Mayor

RDS/jwb
enc
cc: Senator Paul Sarbanes
Senator Barbara Mukulski
Representative Roy Dyson
The Honorable William Donald Schaefer

CONTRIBUTORS

CONTRIBUTORS

The undersigned wishes to acknowledge and express appreciation to those who contributed in the preparation of this document for the City of Crisfield.

Contributors of effort and content in the preparation of this "Application and Supporting Documents" are hereby recognized:

City of Crisfield:

Richard Scott	Mayor
Roland H. Brown, Sr.	Council Member
Gregory C. Sterling, Sr.	Council Member
C. Larry Tyler, Sr.	Council Member
Tony Bruce	City Solicitor & Project Manager
Julian Tyler	City Manager
Richard Tawes	Project Administrator
Glenn Lawson	Project Administrator

Somerset Economic Development Commission:

Roland Collins	Chairman
James E. Threatte	Executive Director

Maryland Department of Economic and Employment Development:

James R. Gatto	C.I.D.

Somerset County Roads Board:

Robert W. Maddox	Director

Mapping Associates:

Mark Delio and Staff	Principal

L.E. Bunting Surveyors, Inc.:

Woody Bunting and Staff	Principal

Froehling & Robertson, Inc.:

John Hynes and Staff	P.E.

Environmental Concern, Inc.:

Ed Launay and Staff	Sr. Associate

Frenco:

William Rice	Consultant

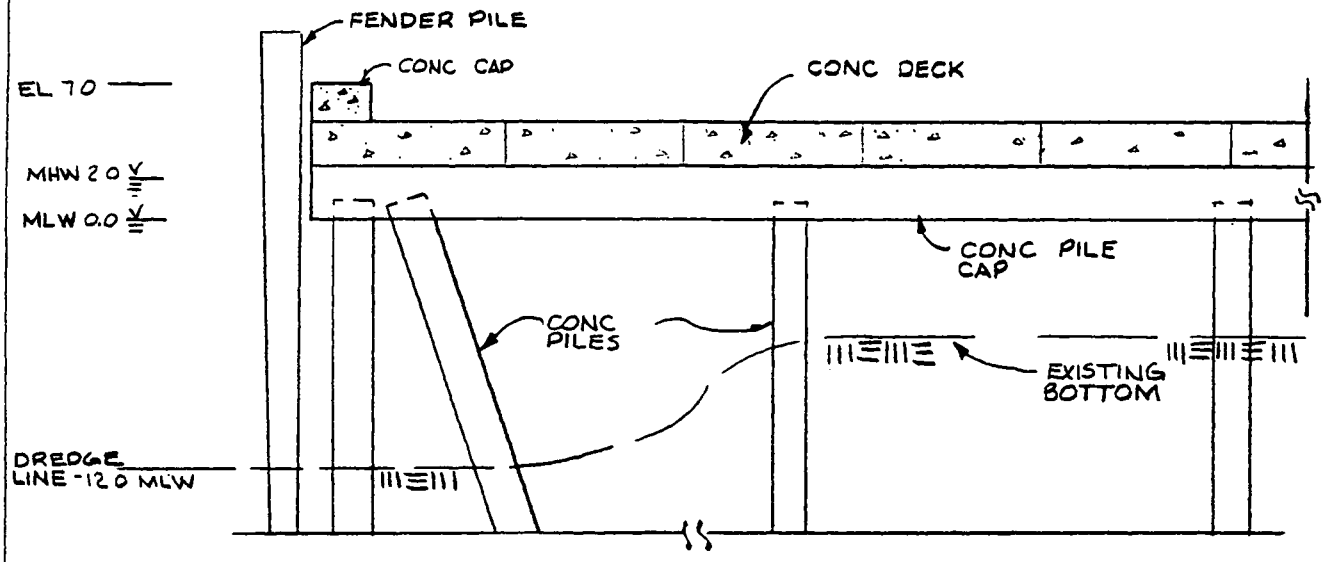
Davis, Bowen & Friedel, Inc.:

Mathew Aydelotte, Jr., P.E.	Principal
Randy B. Duplechain and Staff	

Also acknowledged are those contributing to the 1985 Application.

J.A. Davis, P.E. Principal
Davis, Bowen & Friedel, Inc.
Salisbury, Maryland

APPLICATION



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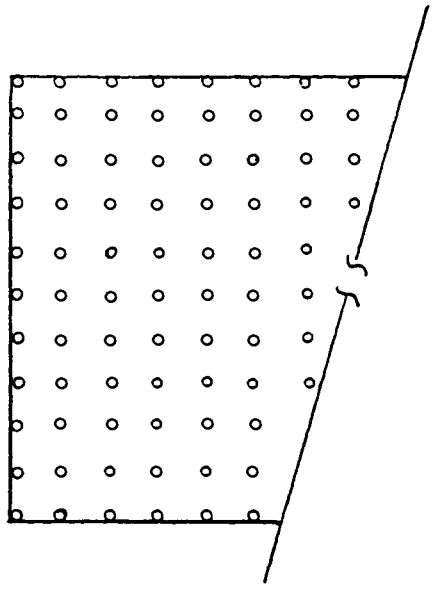

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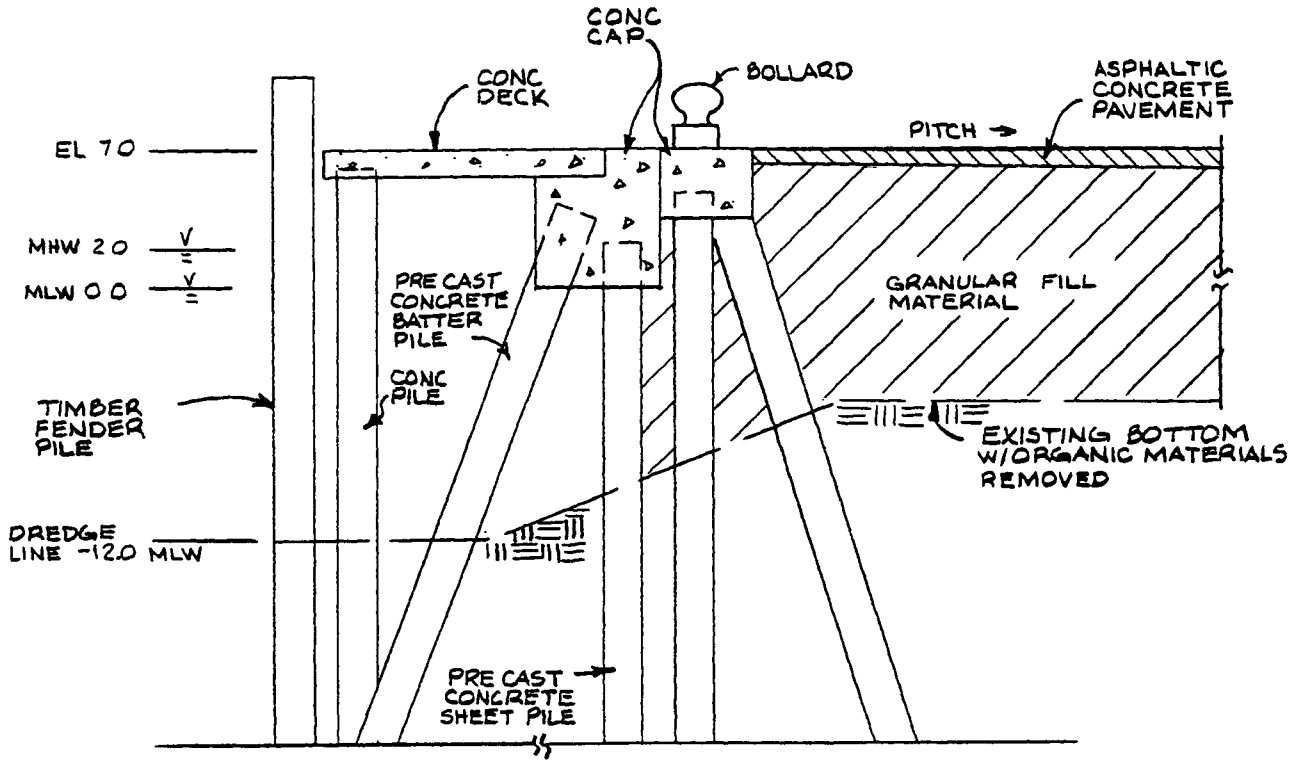
BRIDGE - DECK LOADING FACILITY

DOCK CONSTRUCTION - ALTERNATE # 2

PROPOSED CRISFIELD DOCK AND MARITIME PARK

IN LITTLE ANNEMESSEX RIVER
AT CRISFIELD, MARYLAND
SOMERSET COUNTY STATE OF MARYLAND
APPLICATION BY: CITY OF CRISFIELD, MD

SHEET 7 OF 10 DATE : MAY 20, 1988



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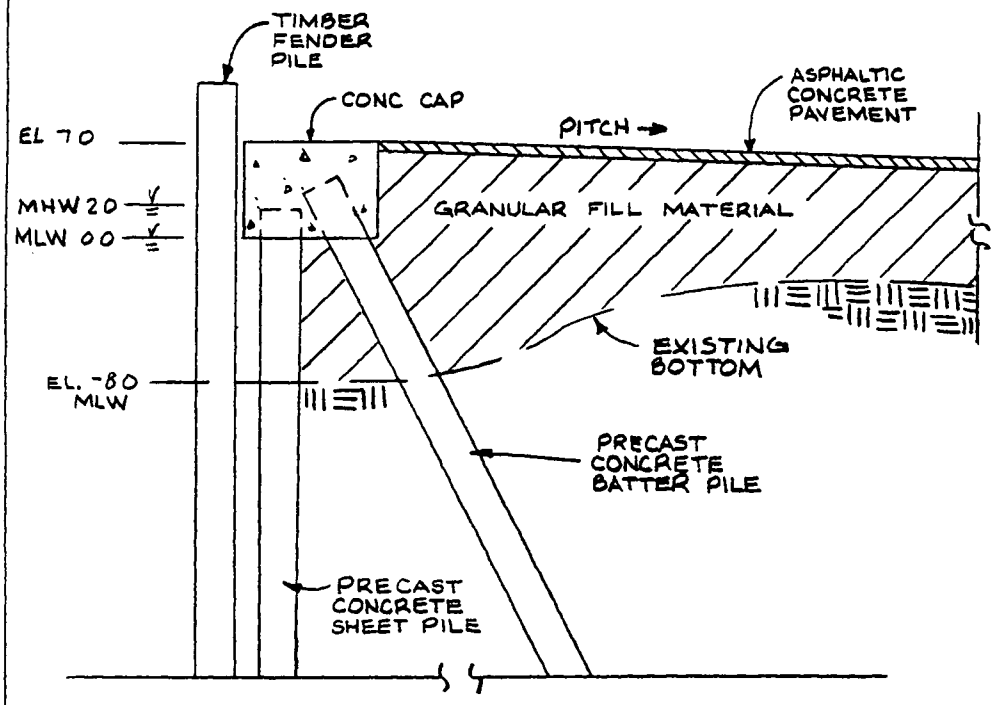
PRE CAST CONCRETE BULKHEAD

DOCK CONSTRUCTION - ALTERNATE #3

PROPOSED CRISFIELD DOCK AND MARITIME PARK

IN LITTLE ANNEMESSEX RIVER
AT CRISFIELD, MARYLAND
SOMERSET COUNTY STATE OF MARYLAND
APPLICATION BY: CITY OF CRISFIELD, MD

SHEET 8 OF 10 DATE : MAY 20, 1988



SECTION
NO SCALE

PRECAST CONCRETE BULKHEAD @ SHALLOW DREDGE DEPTH

DOCK CONSTRUCTION - ALTERNATE #4

PROPOSED CRISFIELD DOCK AND MARITIME PARK

IN LITTLE ANNEMESSEX RIVER
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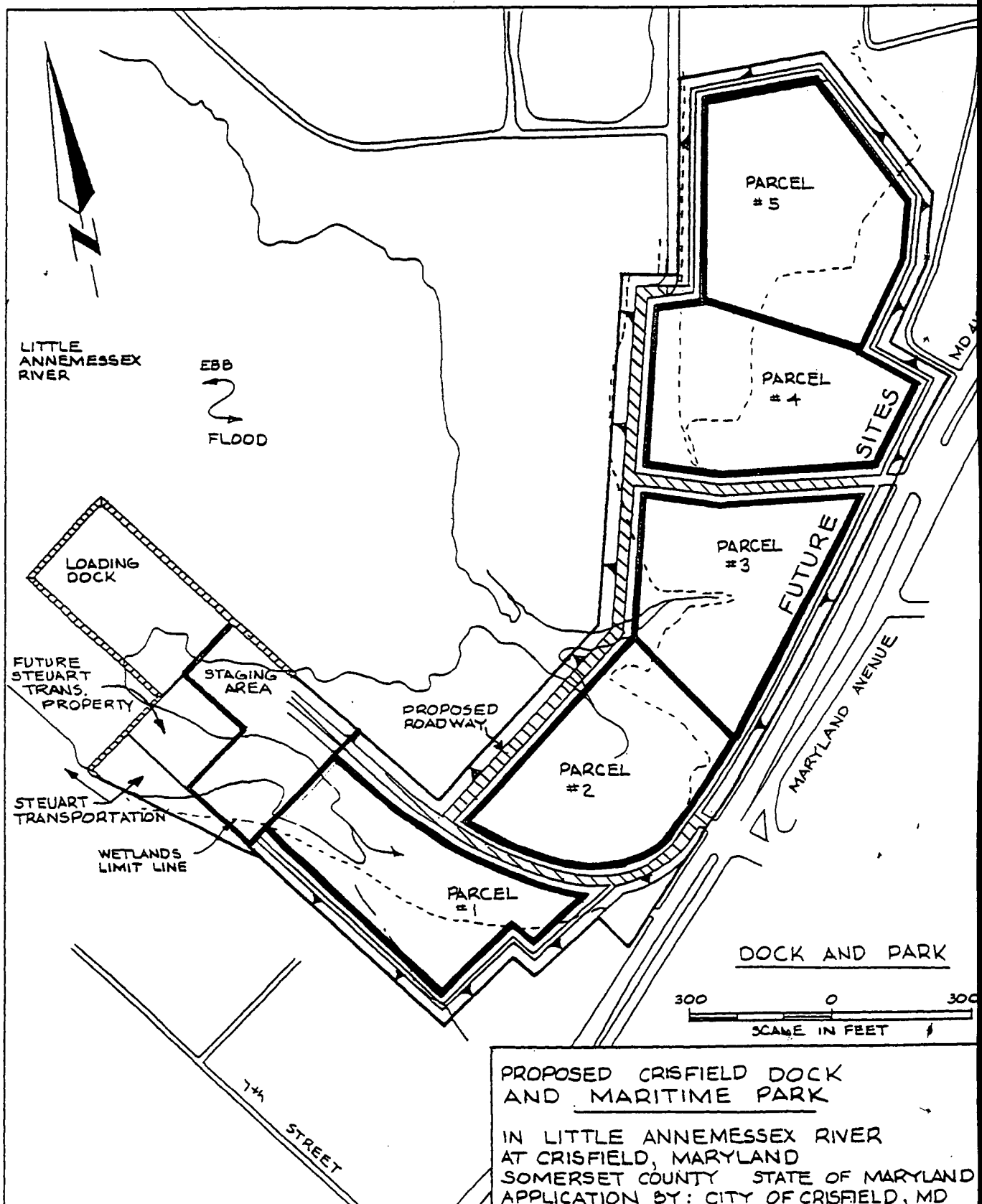
SOMERSET COUNTY STATE OF MARYLAND
APPLICATION BY: CITY OF CRISFIELD, MD

SHEET 9 OF 10 DATE : MAY 20, 1988



PROPOSED CRISFIELD DOCK AND MARITIME PARK

IN LITTLE ANNEMESSEX RIVER
AT CRISFIELD, MARYLAND
SOMERSET COUNTY STATE OF MARYLAND
APPLICATION BY: CITY OF CRISFIELD, MD

SHEET 10 OF 10 DATE: MAY 20, 1985

SECTION I

SECTION I - APPLICANT IDENTIFICATION AND STATEMENT OF PUBLIC INTEREST

A. Applicant:

1. Identification

City of Crisfield
City Hall
P.O. Box 270
Crisfield, Maryland 21817

2. Executive Body

Mayor -
Richard Scott

City Council -

C. Larry Tyler, Sr.
Roland H. Brown
Roy A. Milbourne

3. Contact

Tony Bruce, Esq., City Solicitor/Project Manager
P.O. Box 567, Princess Anne, Maryland 21853
(301) 651-2747

B. Statements of Public Interest and Need

The proposed project represents a primary element of the overall program of economic development for Somerset County. A joint project of the City of Crisfield and the Commissioners for Somerset County, it is designed with a singular purpose - - the alleviation of the severe economic distress currently plaguing the City and County.

For many years, Somerset County has been the most impoverished sub-division in the State of Maryland. The

County has the lowest assessable tax base and the lowest median income. In fact, the County trails the rest of Maryland in every economic indicator, save one -- unemployment. Somerset County consistently has the dubious distinction of leading the State with double digit monthly unemployment figures that not uncommonly exceed twenty percent.

Obviously, Somerset County is in dire need of new investment that will generate new employment opportunities. This is our mission. We are beginning to see some tangible results in the Princess Anne area. But, as of yet these developments had little impact on Crisfield, some twenty-five miles to the southwest. A seasonal tourist trade and a slowly declining seafood industry continue to be the mainstays of a very frail economy.

The attraction of new employers to an area begins with the development of suitable and desirable sites for industrial activity. Gone forever are the days when industry is relegated to tracts of land that are available only because nobody else wants them. Fully improved industrial park locations which permit industry to exist in harmony with the community are as desirable to industry as they are to local citizenry.

Industrial park development is not done in a casual manner. Every effort must be made to maximize the advantages of an area or at the least, minimize its disadvantages. In contemplating an industrial park for the Crisfield area, one overriding disadvantage stands out - - its location. Crisfield is situated at the extreme western terminus of Maryland Route 413. North-south travel on the Delmarva Peninsula and access to U.S. Route 50 for points west is possible only via U.S. route 13, over a dozen miles away. The ever-increasing importance of highway transportation and the remoteness of Crisfield has been frequently cited as a reason for the area's economic deterioration. This disadvantageous distance factor is magnified by the fact that within very close proximity to Crisfield (Pocomoke City, Salisbury, and Princess Anne) lie three other industrial parks with immediate access to U.S. 13. Thus, the competitive attractiveness of an industrial park in the classical sense within Crisfield is highly questionable.

While Crisfield's geographic location does seem to present the City with an obstacle to economic development, it also provides a unique quality. Crisfield is a waterfront community with immediate access to the major shipping lanes of the Chesapeake Bay. Exploiting this aspect of nature is the solution to overcoming the disadvantages of its relative remoteness.

A maritime oriented industrial park will provide Crisfield with the product differentiation necessary to compete for new industry. The slate of prospective tenants would not be the same as those for other nearby and otherwise more attractive industrial parks. Crisfield would be marketing the only industrial park in the region with appeal to water oriented business and, with the exception of Baltimore City, the only industrial site facility in Maryland capable of accommodating barge traffic.

The proposed project evolved from several premises. Premise one is the absolute and undeniable necessity to take action to increase employment opportunities within the community. Premise two is the fact that attraction of industry and new employers in today's economy requires attractive available sites e.g., industrial parks. Premise three is the realization that an industrial park in Crisfield is destined for failure unless it can be differentiated from parks in the surrounding area. The conclusion is that a maritime oriented industrial park will provide Crisfield with sufficient product differentiation to permit it to compete effectively for new employers and to improve its economic quality of life.

The project, upon completion, would create an industrial

park with a maritime orientation. The unique nature of the facility would enhance considerably the capability of the City of Crisfield to attract and locate new employers to the area, thereby addressing the foremost economic problem -- staggering unemployment.

SECTION II

SECTION II - PROJECT OBJECTIVES

While the project will provide numerous benefits to the citizens of Crisfield, Somerset County, and the State the following are primary project objectives:

1. Provide jobs for citizens of Crisfield.
2. Provide needed additional dock space for the City of Crisfield.
3. Provide sites for water dependent enterprises.
4. Improve the aqua-system in the area of the project.

The proposed project will accomplish all the above, thereby becoming a model for maritime-industrial-enviromental development.

SECTION III

SECTION III - PROJECT DESCRIPTION

A. DESCRIPTION OUTLINE

The proposed project is presented in the foldout Exhibit III-A and briefly described as follows:

1. Increase width and depth of channel from Federal channel to Steuart Transportation and new dock.
2. Construct new dock next to Steuart Transportation for use by Steuart, City, local and island businesses, and new water dependent enterprises.
3. Use dredge spoils for dock fill and creation of dock related highland for water dependent business sites.
4. With the construction of the dock facility and spoils highland, implement environmental benefiting mechanisms.
5. Provide roads, stormwater management facilities, water, sewer, electric and other utilities required for the dock and industrial area.

All the above are discussed in detail in the following sections.

B. EXHIBITS

Exhibit III-A - Proposed Crisfield Dock and Maritime Park

SECTION IV

SECTION IV. DEMONSTRATION OF NEED

A. CITY AND COUNTY ECONOMIC CONDITIONS

The City of Crisfield, and all of Somerset County, suffer from severe economic distress. The unemployment rate of Somerset County is consistently greater, by far, than the average for the state and anually soars to staggering proportions during certain months. For example, during February of 1987 the unemployment rate for Somerset County was 15.5%, which was far in excess of both the national (7.1%) and state (4.9%) rates for the same period. These percentages do not adequately demonstrate the lack of employment opportunity in Somerset County, for they do not take into consideration that one third of the employed persons of Somerset County must travel out of the county to their jobs.

Separate statistics are not available for the city of Crisfield. John Pyle of the Maryland Office of Employment Security indicates that in excess of 62.5% of the unemployed in Somerset County reside in Crisfield. Because of the declining seafood industry, however, the unemployment rate for Crisfield is greater than that for the county as a whole, and the Crisfield rate soars during those seasons of the year when local seafood is not being caught and processed. This shortage of jobs within Crisfield has a particularly pronounced impact upon the population, because the town is in the most remote part of the county. Therefore, any persons who commute to work from Crisfield must travel a greater distance than those from other parts of the county. The

commuting cost for many of the lower skilled workers becomes so great that they gain very little economic benefit from a job out of town, so they remain in Crisfield -- unemployed. No public transportation system exists in Somerset County.

In summary, Crisfield suffers from a severely depressed, and still slumping, economy. The only apparent remedy is the creation of local jobs.

B. HISTORY OF THE ECONOMY

Crisfield is a maritime town. The only reason for Crisfield is its closeness to the water and the marshes that encompass it.

Crisfield was founded as a port village. Before railroad transportation, the primary method of hauling freight was by sailing ship. The Chesapeake Bay, a long estuary that stretches its navigatable waters from the Virginia Capes to the harbor at Baltimore, provided a very important transportation link to the rapidly growing frontiers of western Pennsylvania and beyond. Baltimore became a key transportation center, and all the port villages along the Chesapeake were linked with this commerce center by ship transportation. A small village at Somers Cove was the main port connection between Somerset County and Baltimore. It was the only place in the county where a deep water harbor was located near to firm land. Farm products, lumber, and seafood were shipped from this small port to

Baltimore, providing income for the residents of the county. When the railroads were stretched westward from Baltimore, this rapid transportation opened many new markets, especially for pershible merchandise such as seafood. Somerset County had the most productive oyster beds known to exist on the earth at that time, so Somers Cove was soon filled with schooners loading oysters for Baltimore. John Crisfield, the president of the Eastern Shore Railroad, saw an opportunity to get into the oyster shipping business, so he ran a rail line down the long neck of dry land to Somers Cove. The appreciative citizens named the town for him.

Crisfield was incorporated in 1872, just five years after the rails reached the tiny village. By this time, it had already surpassed mighty Baltimore as the leading oyster port in the country. The rapid rail transportation also opened markets for more perishable seafood products, such as fish and crabs. When the federal government conducted a census of the important seafood industry in 1899, it discovered that this remote town on the Eastern Shore was the leading seafood port in the country, and even in the entire world. In 1900, when the results of this study were published, Crisfield was named "Seafood Capital of the World".

During its short time of existence, Crisfield had developed a very effective system of seafood catchers, boat builders, boat repairmen, net makers, sail makers, blacksmiths, marine hardware merchants, seafood brokers, seafood processors, box and barrel makers, haulers, and shippers. The entire economy of the town was based on its closeness to the productive waters and marshes of the Chesapeake Bay. Its remoteness from population centers, and even from firm land, prevented any non-maritime industry from being attracted there.

Crisfield watermen, as the seafood catchers there are called, brought to the city docks fish in the spring, crabs in the summer, fish in the fall, and oysters in the winter. They kept the town, and all its merchants and workers, busy year round.

Shortly after 1900, some species of fish began to diminish in volume. Full blame was placed on the watermen, because the most obvious reason for the decline was that the watermen had caught so many of the species that the remaining brood stock could not replenish sufficiently to compensate for the loss. When a species diminished to the point where the volume was not great enough to justify the equipment to catch it or the effort to market it, the watermen and the brokers would concentrate on some other species to make up for their loss of revenue. Then, that species would also become depleted.

The State of Maryland became alarmed at the diminishing seafood catch, and enacted regulations to reduce the efficiency of the watermen. Still, additional species became depleted, until the spring and fall fisheries closed entirely. Crisfield was left with an economy based only on oysters in the winter and crabs in the summer. During the spring and fall, unemployment for seafood processing workers rose to near 100%. The watermen, although they had no work during these seasons, were not counted among the unemployed because they were not looking for jobs. They repaired their boats and sat around their shanties while they waited for the next productive season to begin.

Watermen adjusted to the regulated inefficiencies by obtaining the most effective equipment they could use within the limits imposed. The dredging of oysters by motor powered craft was outlawed, so the watermen purchased hydraulic tongs. They also increased the size of their boats to accomodate crews so they could catch more crabs in the summer. The watermen mortgaged their homes to purchase the expensive equipment that they needed to provide them with sufficient income during the two productive seasons so they could survive the two seasons when they had no work. The better equipment allowed the watermen to work on days when the weather would not have permitted it before, and to catch a greater volume for each day of work. Watermen who did not adapt to the more efficient and expensive equipment still managed

to eake out a living, but their homes fell into disrepair and they abandoned their automobiles rather than replace them. Even these ineffective watermen were not counted among the unemployed because they remained on the water, catching enough crabs and oysters to survive.

During this past winter, however, an economic disaster struck Crisfield -- the oysters disappeared. The seafood processing workers, who were already working only half of the year, now face unemployment for three of the four seasons. The seafood brokers, who had already lost their ability to furnish seafood to their customers year round, are now faced with the fact that they no longer have the oysters that they need to maintain contact with their clients during the winter. And the watermen, who have already mortgaged their homes to purchase their expensive equipment, now must make a full year of income during the summer months alone.

We can only speculate as to what the future holds for Crisfield. The city has not yet felt the full effects of this latest crisis. The seafood brokers could well lose their summer markets to competitors from other parts of the world who can supply the vital seafood products during the winter. If this happens, the entire structure of the Crisfield seafood industry will be destroyed, and the town has no other industry to employ the

processing workers. These processing workers, who already are in such a depressed condition that many of them do not have automobiles and cannot commute to other jobs, will be thrown out of work entirely.

And the watermen, who have mortgaged their homes to finance their equipment, will not be able to find other work to pay their bills because they have skills that are not easily marketed. They will not be able to sell their boats to reduce their debts, so they will have to stay on the water. This means that they will have to catch more crabs, because that is the only seafood left in sufficient quantity to provide them with an income. But how can they catch more crabs? They can travel to Virginia to dredge for crabs during the winter, and to begin catching the migrating crabs earlier in the spring. They can also increase their catch by crabbing seven days a week during the summer, and they can begin selling the hard crabs that they had previously thrown back overboard to catch later when they became the more valuable peelers. Watermen can also work the boat two shifts a day by hiring a second crew and doubling the number of pots fished per day. And then the crab, the one species of sea life in the Crisfield vicinity that still exists in sufficient quantity to justify a commercial fishing industry, will become severly stressed by unrelenting pressures simply because the watermen need the income to pay for their boats.

The future of the seafood industry in the Crisfield area appears to be grim. Recent findings have shown that the demise of the fishing industry cannot be attributed entirely to overfishing by the watermen. This can be proven by the fact that species have not shown significant recovery after the watermen stopped working them. Loss of spawning grounds and deteriorated water quality are now recognized as factors that are contributing heavily to the decline of many of the species that once gave Crisfield its year round prosperity. So the watermen, along with the other seafood workers, are now suffering economic deprivation caused by factors which they cannot control, and they have no alternate source for employment nearby.

Aquaculture has been offered by some marine scientists as a sure cure to the current problem, but the benefits claimed for the current proposal have been challenged. Problems associated with the proposal can be summarized by the following questions that the watermen are asking:

1. What will happen to the watermen who are displaced when the Bay bottom is leased to large companies that will not need the watermen's specialized skills and equipment?
2. What reason does anyone have to believe that an oyster can be grown on leased bottom when the oysters currently being planted there do not live?

3. What reason do we have to believe that the water quality will be sufficiently improved in the next decade to reverse the decline in the oyster and fish populations?

No current proposal, aquaculture or otherwise, gives reason to believe that the downward trend of the Chesapeake Bay seafood industry will be reversed in the forseeable future.

Crisfield is a unique town. It was created and has continued to exist until now because of the waters and marshes that encompass it. But these same waters and marshes have isolated it from any economic activity except that which is maritime. These waters and marshes which once made it the seafood capital of the world are no longer productive, and so the town is in a state of severe economic depression.

Crisfield desparately needs jobs to lessen the overwhelming unemployment, and to reduce fishing pressures by providing the men with another way to make a living besides working on the water. Yet the town cannot afford any industry that will further threaten the fragile maritime ecology, for a remnant of the seafood industry remains and must be protected. For this reason, the maritime park plans include actions that are designed to more than compensate for damage that will occur to wetlands and to the shallow water habitat.

The only economic reason for the existence of the town of Crisfield continues to be maritime industry. The town is too remote from markets and firm land to offer any other attractions. Historically, maritime industry in Crisfield has meant catching and processing seafood. Now the town must look to other maritime industries, other industries that are of necessity water oriented, and the town must develop a suitable site to attract these industries.

C. CURRENT EMPLOYMENT STATISTICS

The February, 1988 edition of Civilian Labor Force, Employment, and Unemployment, published by Maryland Department of Economic and Employment Development (see Exhibit IV.C.1), indicates that the Somerset County unemployment rate was 15.2%. The Maryland Statistical Abstract 1986-87 (see Exhibit IV.C.2) indicates that the per capita personal income for Somerset County ranked next to the last among the 23 counties within the state.

Civilian Labor Force

A summary of the civilian labor force and unemployment rate for Somerset County follows:

Current labor force		10,891
Unemployment rate -	Avg, 1984	16.1%
	Feb, 1987	15.5%
	Feb, 1988	15.2%
Per capita personal income, 1983		$7957

Estimated Labor Potential

The estimated labor potential statistics include both the number of Somerset County residents currently unemployed and the number of persons commuting out of the county to work. These statistics do not include the watermen who are making a marginal living and would prefer other employment if it were available. Because of the slumping seafood industry, many of these watermen will soon become unemployed, or will be forced to commute out of the county to work.

Average unemployment, 1988	1651
Underemployment	340
High school graduates expected to enter the labor force	163
Residents commuting outside the county to work	2464
Residents planning to enter the labor force - male	145
female	270
Total Estimated Labor Potential	5033

D. LOSS OF POTENTIAL INDUSTRIES

Crisfield's advantage in attracting industry is its closeness to the water. If an industry is not water related, Crisfield is at a disadvantage because of its isolation. An industrial park in

Crisfield must be a maritime park, adjacent to the water. Maritime industrial companies have, in the past, expressed an interest in locating at Crisfield but have not been able to do so because of a lack of suitable property with access to the water. Companies have been hesitant to consider properties that include wetland, and all available properties with water access in the Crisfield area include wetland.

A survey conducted prior to the 1985 application for permit by the City of Crisfield resulted in three companies expressing their intent to locate in the park. One of these companies, Steuart Transportation, is still interested. The other two companies, listed below, no longer indicate an interest.

Industrial company	Projected Employment	Estimated Payroll
Logan's Marine Services	75	$975,000
Hosho Corporation	15	185,000

Companies contacted since 1985 who have expressed an interest in a site with water access in the Crisfield area are:

Industrial Company

Getaway Company, New Jersey, builds sports fishing boats

Ketron Company, Virginia, builds high speed boats

Jim Wallace, builds boats

Shear Water

Webb

Steel Tech

Merri Weather

King-Price Company, Gulf Coast, seafood processor

E. CRISFIELD MARITIME PARK I

Crisfield is fortunate in having a current case example of industrial response to site availability. Crisfield received the deed (Exhibit IV-E.1) on March 24, 1988 for the parcel of land designated in Exhibit IV-E.2 as Crisfield Maritime Park I. A lease on the property was executed within 31 days by a boat builder with water access requirements. (See Exhibit IV-E.3 for Governor's announcement) Boat building enterprises which require water access are finding it difficult to impossible to find available sites on water. As indicated in the above list there are other boat manufacturers interested in locating in Crisfield if there are available sites with water access. To demonstrate the specific concern of the State for Crisfield and Someret County the 1987 Annual Report of Maryland Economic Development Corporation (MEDCO) is presented as Exhibit IV-E.4. MEDCO's agreement to market the proposed sites and its ability to do so

are amply demonstrated by their success.

F. EXISTING AND PROPOSED USER REQUIREMENTS

The one industrial company that has committed to locating in the park is Steuart Transportation. Several boat builders have expressed an interest, but have not made a commitment. Maryland Economic Development Corporation (MEDCO) has committed to securing industries for the park, but they will not be a tenant. The user requirements known to date are:

For Steuart Transportation

1. Docking facilities for four additional barges and one additional tug
2. Dredged channel and turning basin
3. Additional dock facilities for overhaul
4. Additional personnel
5. Acquisition of 8-1/2 acre parcel plus leased dock space. (See Exhibit IV-F.1

For Boat Builders

1. Dredged channel
2. Access to water
3. Facilities for launching
4. Docking space

For MEDCO

See letter from Maryland Economic Development Corporation (Exhibit IV.E.2).

G. EXHIBITS

The following exhibits are included for Section IV.

Exhibit IV.C.1, Civilian Labor Force, Employment, and Unemployment

Exhibit IV.C.2, Maryland Statistical Abstract 1986-87

Exhibit IV-E.1, Deed-Maritime Park I

Exhibit IV-E.2, MEDCO-Crisfield Maritime Park I

Exhibit IV-E.3, Governor's Announcement

Exhibit IV-E.4, MEDCO Annual Report

Exhibit IV.F.1, Letter from Steuart Transportation dated May 12, 1988

Exhibit IV.F.2, Letter from Maryland Economic Development Corporation dated May 9, 1988

MARYLAND DEPARTMENT OF ECONOMIC AND EMPLOYMENT DEVELOPMENT
OFFICE OF LABOR MARKET ANALYSIS AND INFORMATION
1100 NORTH EUTAW STREET
BALTIMORE, MARYLAND 21201

STATE OF MARYLAND
CIVILIAN LABOR FORCE, EMPLOYMENT AND UNEMPLOYMENT
BY PLACE OF RESIDENCE

FEBRUARY 1988

AREA	CIVILIAN LABOR FORCE		EMPLOYMENT		UNEMPLOYMENT		UNEMPLOYMENT RATE		
	FEBRUARY	JANUARY*	FEBRUARY	JANUARY*	FEBRUARY	JANUARY*	FEBRUARY	JANUARY*	FEBRUARY '87
MARYLAND	2,396,309	2 394,049	2,273,601	2,270 527	122,708	123,522	5 1	5 2	4 9
BALTIMORE METROPOLITAN AREA	1,156,627	1,156,569	1 092,355	1 092,335	64,272	64,234	5.6	5 6	5 3
BALTIMORE CITY	340 462	340,881	312,455	312,449	28,007	28,432	8 2	8 3	7 8
ANNE ARUNDEL	205,188	204,957	197,439	197,435	7 749	7,522	3.8	3 7	3 6
BALTIMORE	374,522	373 914	356,989	356,983	17 533	16 931	4.7	4 5	4 5
CARROLL	59,168	59,345	56,018	56,017	3,150	3,328	5.3	5.6	5 7
HARFORD	77,568	77,719	72,587	72,586	4 981	5 133	6.4	6.6	5.3
HOWARD	84,947	84 951	82,962	82,960	1 985	1 991	2.3	2.3	2.3
QUEEN ANNE'S	14,772	14,800	13,905	13,905	867	895	5.9	6.0	5 9
D. C. AREA	943,033	941,231	911,628	908,391	31 405	32,840	3.3	3.5	3 2
CALVERT	21,363	21,394	20,170	20,098	1 193	1 296	5 6	6.1	5 4
CHARLES	44,268	44 155	42,720	42,568	1 548	1,587	3.5	3.6	3.0
FREDERICK	72,849	73,064	69,157	68,912	3 692	4 152	5 1	5.7	5 4
MONTGOMERY	399,551	398,564	389,206	387 824	10,345	10,740	2.6	2.7	2.5
PRINCE GEORGE'S	405,002	404,054	390,375	388,989	14,627	15,065	3.6	3 7	3 4
WESTERN MARYLAND	101,255	100,784	90 392	90,563	10 863	10 221	10.7	10 1	9 6
ALLEGANY	32,211	32,268	28,368	28,429	3,843	3 839	11 9	11 9	11 3
GARRETT	12,041	11 998	10,468	10,506	1,573	1 492	13.1	12.4	12.6
WASHINGTON	57,003	56,518	51,556	51,628	5,447	4,890	9 6	8 7	8 0
BALANCE OF STATE	195,394	195,465	179,226	179 237	16 168	16,228	8 3	8 3	8.3
CAROLINE	13,650	13,787	12,682	12,802	968	985	7 1	7 1	8.2
CECIL	34,461	34,135	30,951	30 865	3 510	3 270	10.2	9 6	8.6
DORCHESTER	17 250	17 244	15 617	15,688	1 633	1,556	9.5	9 0	12.9
KENT	8,626	8,770	7 932	8,035	694	735	8 0	8 4	9 0
ST MARY'S	35,138	35 443	33 160	33,330	1 978	2 113	5 6	6.0	4.5
SOMERSET	10,891	10,876	9,240	9 294	1 651	1 582	15 2	14.5	15.5
TALBOT	16,333	15,766	15,543	14 988	790	778	4.8	4 9	5 3
WICOMICO	40,743	41 345	38 235	38 620	2,508	2,725	6 2	6 6	6.3
WORCESTER	18,302	18,099	15,866	15 615	2,436	2,484	13.3	13.7	13 6
[1] UNITED STATES	121,678,000	121 491 000	114 196 000	113 888,000	7 482 000	7 603 000	6 1	6.3	7 1

*Estimates for the state are revised.

[1] Source: U. S Department of Labor Bureau of Labor Statistics

NOTE. Figures may not add due to rounding These are estimates relating to the week of the 12th of each month. The count is of persons not jobs. All data are not seasonally adjusted.

EXHIBIT IV-C 1

NO 113

TOTAL PERSONAL INCOME AND PER CAPITA PERSONAL INCOME BY POLITICAL SUBDIVISION: 1983 AND 1978

	TOTAL PERSONAL INCOME BY PLACE OF RESIDENCE (MILLIONS OF DOLLARS)		PERCENT CHANGE	PER CAPITA PERSONAL INCOME (DOLLARS)		PERCENT CHANGE	RANK IN STATE
	1983	1978		1983	1978		
MARYLAND	56,159	35,367	58 8	13,047	8,397	55 4	
Allegany	711	496	43 3	9,102	6,141	48 2	21
Anne Arundel	4,862	2,977	63 3	12,696	8,142	55 9	6
Baltimore City	7,806	5,388	44 9	10,057	6,605	52 3	16
Baltimore	9,319	6,085	53 1	14,099	9,348	50 8	3
Calvert	449	240	87 1	11,813	7,573	56 0	9
Caroline	210	144	45 8	8,932	6,263	42 6	22
Carroll	1,231	707	74 1	11,832	7,744	52 8	8
Cecil	641	391	63 9	10,027	6,770	48 1	17
Charles	896	496	80 6	11,318	7,254	56 0	11
Dorchester	283	199	42 2	9,433	6,354	48 5	20
Frederick	1,391	824	68 8	11,563	7,646	51 2	10
Garrett	196	130	50 8	7,287	5,037	44 7	24
Harford	1,812	1,153	57 2	12,029	8,035	49 7	7
Howard	2,037	1,134	79 6	15,622	10,039	55 6	2
Kent	168	110	52 7	10,120	6,604	53 2	14
Montgomery	11,921	7,125	67 3	19,738	12,193	61 9	1
Prince George's	8,725	5,495	58 8	12,939	8,187	58 0	5
Queen Anne's	286	172	66 3	10,585	7,065	49 8	13
St Mary's	622	352	76 7	10,120	6,199	63 3	15
Somerset	151	103	46 6	7,957	5,329	49 3	23
Talbot	362	224	61 6	13,780	8,763	57 3	4
Washington	1,106	780	41 8	9,832	6,918	42 1	18
Wicomico	631	426	48 1	9,571	6,703	42 8	19
Worcester	343	215	59 5	10,619	7,046	50 7	12

Note. County personal income data may not add to State total due to rounding

Source. U.S Department of Commerce, Bureau of Economic Analysis, Regional Economics Information System, issued April 1985

THIS DEED, made this 30th day of December, 1987, from the State of Maryland to the use of the University of Maryland, "Grantor", to the City of Crisfield, a Municipal Corporation of the State of Maryland, "Grantee"

The Grantor, for no monetary consideration and as a gift, grants conveys and assigns to the Grantee, its successors and assigns, in fee simple, the real property located in Somerset County, Maryland and more particulary described as follows:

All that lot or parcel of land situate in the City of Crisfield, Crisfield Election District, Somerset County, Maryland, lying and binding on the Southwest side of Lorie C. Quinn Drive, the Northwest side of Brick Kiln Road (also known as Collins Street), the Northeastly side of the Small Boat Harbor and the Southeasterly side of the Little Annemessex River and more particularly described as beginning at the intersection of the Northwest side of Collins Street and the Southwesterly side of Quinn Drive; thence (1) South 15° 38'0" West 445 99 feet to a point; thence (2) North 59° 44' 18" West 1200 85 feet; thence (3) North 28° 19' 25" East 54 feet; thence (4) South 80° 32' 10" East 126.50 feet; thence (5) North 30° 29' 25" East 203 72 feet to the Southwest side of Quinn Drive; thence (6) South 67° 18' 9" West 979.50 feet to the first mentioned point and place of beginning; containing 8 95 acres, more or less, including 7 60 acres of upland; and being a part only of the land depicted on a plat by W Ballard Miles dated July 15, 1950 (File D-319) and recorded among the Plat Records of Somerset County in Plat Book 3, folio 89 and subsequently surveyed by Vaughn Wimbrow and Associates in August, 1987

Being a part of that same property described in a Deed dated June 6, 1960 and recorded among the land records of Somerset County in Liber 201, Folio 259 from Stanley Cochrane Post No. 16, American Legion, Department of Maryland, Inc., a Maryland Corporation, The Bank of Crisfield and A. Wellington Tawes and Minnie Tawes to the above-named Grantor

TOGETHER with all improvements thereupon, and the rights , alleys, ways, waters, easements, privileges, appurtenances and advantages to the same belonging or in anywise appertaining thereto.

TO HAVE AND TO HOLD the property hereby conveyed to the Grantee, its sucessors and assigns, in fee simple

Subject, however, to the following conditions, each to be properly performed by the Grantee:

(1) Grantee shall, immediately upon settlement, enter into an agreement with MEDCO for the marketing and redevelopment of the property by MEDCO;

(2) Grantee shall deposit all proceeds from the subsequent sale or lease, less MEDCO's marketing costs and the Grantee's own related expenses, with the Treasurer of the State of Maryland to the State Annuity Bond Fund or any other capital fund selected by the State of Maryland Board of Public Works, and;

(3) Grantee shall, if requested by the Grantor, lease back to the Grantor the principal improvement on the property, a brick building forty feet by one hundred sixty-five feet in size, until such time as the property is conveyed or leased to a private party.

The Grantor convenants to warrant specially the property hereby conveyed, and to execute such further assurances of the property as may be requisite.

WITNESS the hand(s) and seal(s) of the parties hereto:

WITNESS:

The University of Maryland

By: John Toll, President (SEAL)

The Maryland Board of Public Works

By: William Donald Schaefer, Governor (SEAL)

James G. McGinty, Secretary

By: Lucille Maurer, Treasury (SEAL)

By: Louis L. Goldstein, Comptroller (SEAL)

The City of Crisfield

Joyce H. Morgan
Joyce H. Morgan, Clerk

Richard Scott (SEAL)
By: Richard Scott, Mayor

STATE OF MARYLAND, COUNTY OF Prince Georges, TO WIT:

ON THIS THE 3rd day of December, 1987, before me, Sue B. Lynch, the undersigned, personally appeared JOHN TOLL, who acknowledged himself to be the President of THE UNIVERSITY OF MARYLAND, and that he, as such President being authorized so to do, executed the foregoing instrument for the purposes therein contained

IN WITNESS whereof I hereunto set my hand and official seal.

Sue B. Lynch
NOTARY PUBLIC

My Commission Expires: July 1, 1990

STATE OF MARYLAND, COUNTY OF ANNE ARUNDEL, TO WIT:

I HEREBY CERTIFIY that on this 30th day of December, 1987, before me the subscriber, a Notary Public of the State and County aforesaid, personally appeared William Donald Schaefer, Governor, Louis L Goldstein, Comproller, and Lucille Maurer, Tresurer, constituting the Board of Public Works of the State of Maryland, known to me (or satisfactorily proven) to be the persons whose names are subscribed to the within Deed, who signed the same in my presence, and acknowedged that they executed the same for the purposes therein contained

AS WITNESS my hand and Notarial Seal

Marion Boschen
Notary Public

My Commission Expires: July 1, 1990.

STATE OF MARYLAND, COUNTY OF SOMERSET, TO WIT:

ON THIS THE 15th day of December, 1987, before me, the subscriber, the undersigned, personally appeared RICHARD SCOTT, who acknowledged himself to be the Mayor of THE CITY OF CRISFIELD, and that he, as such Mayor being authorized so to do, executed the foregoing instrument for the purposes therein contained.

IN WITNESS WHEREOF I hereunto set my hand and official seal.

Jacquelyn M. Horner
Notary Public

My Commission Expires: July 1, 1990

THIS IS TO CERTIFY that the within instrument was prepared by or under the supervision of the undersigned, an attorney duly admitted to practice before the Court of Appeals of Maryland.

Lisa Paschal Snyder
LISA PASCHAL SNYDER, Attorney at Law

OK
PRM

AGRICULTURAL TRANSFER TAX IN THE
AMOUNT OF Not Applicable
SIG. MSJ

RECEIVED FOR TRANSFER
State Department of
Assessments & Taxation
for Somerset County
MSJ 3-22-88
Date

THIS IS TO CERTIFY THAT,
the property conveyed herein has
been transferred on the assess-
ment books of the City of Crisfield
3/23/88
Joseph L. Mogan
CITY CLERK

DEED
REC'D ORIGNL 16.00
POST PAGE .50
CHECK/MO TL 18.50
MAR 24 1988
EXD & MAILED TO GRANTEE

FILED
Mar 24 10 13 AM '88
RECORDED
LIBER 373 FOLIO 118
CLERK OF
DEPUTY

BOOK 373 PAGE 121

AVAILABLE MARYLAND WATERFRONT SITE

Crisfield Maritime Park I

For Sale or Lease

95 Acres

Crisfield, Md , Somerset County

This property features

- 95 acres, of which 76 acres are dry
- An excellent deep-water site (6-foot controlling depth) at the entrance of the Annemessex River which leads directly to the Chesapeake Bay
- A 500-foot marine bulkhead on the inlet side within the City of Crisfield
- A single-story 6500 (165' x 40') square-foot brick building, formerly used as a marine R & D laboratory

The property is accessed via Md Route 413, which leads directly south from U S Highway 13 Crisfield can be reached by air via the Crisfield Airport, approximately 8 miles north of the site The airport includes a lighted, paved 2500-foot runway and a 3500-foot turf runway Water and sewer service is available from Somerset County and the City of Crisfield Delmarva Power & Light Company provides electrical service to the property Telephone service is provided by Bell Atlantic's C&P Telephone Company

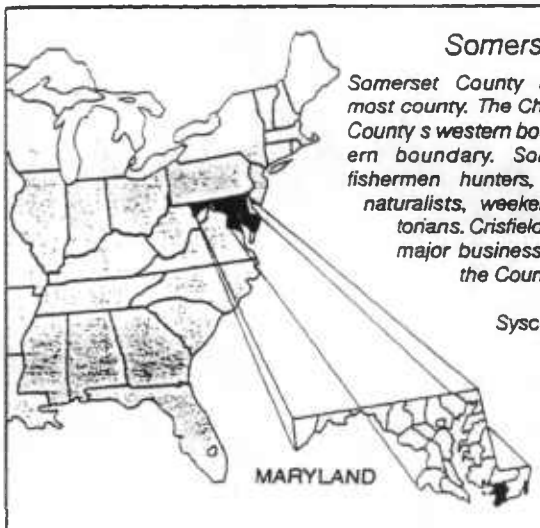
This is an especially attractive site for labor-intensive maritime industrial operations

For further information about this site and the investment potential in the State of Maryland, contact

Maryland Economic Development Corporation
36 S Charles Street, 19th floor
Baltimore, Maryland 21201
Phone: (301) 625-0051

or

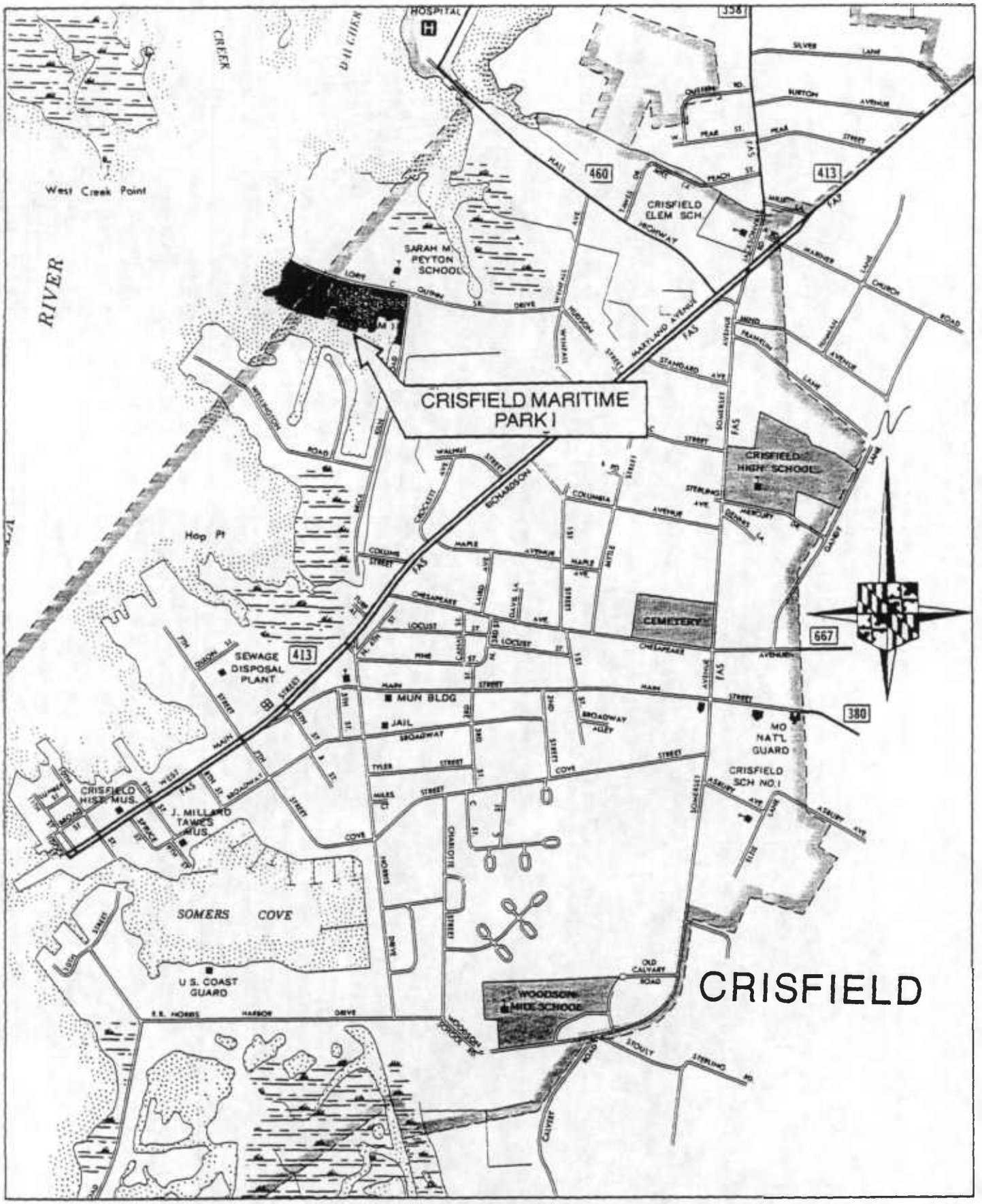
Business and Industrial Development
Maryland Department of Economic and Employment Development
45 Calvert Street
Annapolis, Maryland 21401
Phone: (301) 974-3514



Somerset County

Somerset County is Maryland s southernmost county. The Chesapeake Bay shares the County s western boundary; Virginia, its southern boundary. Somerset County attracts fishermen hunters, water sport enthusiasts, naturalists, weekend vacationers, and historians. Crisfield and Princess Anne are the major business and industrial centers of the County. Major employers in the County include Lankford/ Sysco Foods, Rubberset, Long Brothers, Abbey Homes, Mrs. Paul s Kitchens, Carvel Hall, Hosho-Somerset Celeste Industries, Handy Soft-shelled Crabs and Bird Seafood

Maryland
Department of Economic / Employment Development


CRISFIELD MARITIME PARK I
CRISFIELD
West Creek Point
RIVER
CREEK
DIGGES
HOSPITAL
CRISFIELD ELEM SCH
SARAH M. PEYTON SCHOOL
HARTLAND AVENUE
CRISFIELD HIGH SCHOOL
Hop Pt
SEWAGE DISPOSAL PLANT
CEMETERY
MUN BLDG
JAIL
MD NAT'L GUARD
CRISFIELD SCH NO. 1
CRISFIELD HIST. MUS.
J. MILLARD TAWES MUS.
SOMERS COVE
U.S. COAST GUARD
WOODSON MIDDLE SCHOOL
OLD CALVARY ROAD
WEST MAIN STREET
MAIN STREET
BROADWAY
COVE STREET
413
460
667
380
358

COMMUNITY PROFILE

Crisfield

The City of Crisfield is located in the southwest portion of Somerset County, a part of the Delmarva Peninsula, and is approximately 175 miles from Princess Anne, 20 miles from Salisbury, 45 miles from Ocean City, 120 miles from Baltimore, 115 miles from Norfolk, Virginia, and 140 miles from Philadelphia, Pennsylvania With the Chesapeake Bay on two sides, and the Annemessex River on a third side, the city and its surroundings are prime locations for water-oriented, light-manufacturing industries The manufacturing sector provides nearly 27% of the County's jobs The County's labor force is estimated at 11,450 with an unemployment rate of 106% (November 1987)

Undergraduate and graduate programs in agriculture, marine, estuarine, and environmental sciences are offered at the University of Maryland, Eastern Shore in nearby Princess Anne Salisbury State College and Wor-Wic Community College are 30 minutes away

Crisfield, with its non-metropolitan setting and dotted with picturesque farmlands and historic homes, offers a unique and gentle pace. Water enthusiasts seeking the pristine marine environment will find available to them recreational activities such as fishing, crabbing, hunting, and sailing Camping and other outdoor activities are available at nearby Janes Island State Park

OF MARYLAND
OF THE GOVERNOR

REFER TO

WILLIAM DONALD SCHAEFER
GOVERNOR

ANNAPOLIS OFFICE
STATE HOUSE
ANNAPOLIS, MARYLAND 21401
(301) 974 3901

BALTIMORE OFFICE
ROOM 1513
301 WEST PRESTON STREET
BALTIMORE, MARYLAND 21201
(301) 225 4800

WASHINGTON OFFICE
SUITE 315
444 NORTH CAPITOL STREET, N.W.
WASHINGTON, D.C. 20001
(202) 638 2215

TDD (301) 333 3098

GOVERNOR'S PRESS OFFICE

FOR IMMEDIATE RELEASE

GOVERNOR WILLIAM DONALD SCHAEFER ANNOUNCES NEW YACHT BUILDING BUSINESS IN CRISFIELD

ANNAPOLIS, MD ( ) -- Governor William Donald Schaefer today announced that Montgomery Yacht Co., Inc. of Connecticut will build a new facility on land purchased from the City of Crisfield. This site, the former University of Maryland Seafood Laboratory, was recently deeded to Crisfield by the university as part of Governor Schaefer's efforts to assist Crisfield and Somerset County in economic development efforts.

"We are very anxious to work with the local leadership in Crisfield and Somerset County in assisting them in their efforts to bring new jobs and business to that part of our State," Governor Schaefer said.

J. Randall Evans, Maryland Secretary of Economic and Employment Development, said that the Office of Business and Industrial Development within his department (DEED) has worked with the company since 1985 to find a suitable waterfront property on the Delmarva Peninsula. Sites in New Jersey, Delaware, Virginia, and North Carolina were also considered before Crisfield was selected as the ideal site on which to construct Montgomery Yacht's luxury 50-feet traveler yachts. Montgomery Yacht is family-owned by Arthur Montgomery and his sons, Dean and Bruce Montgomery.

-more-

Plans call for the construction of a 7,000 square foot production plant on the site, said Evans. Initially, Montgomery Yachts will hire 15 workers, gradually increasing to 100 employees within five years. Response to the concept of a true live-aboard yacht has been impressive, according to Montgomery Yacht President Arthur Montgomery. Two advertisements in yachting publications generated over 1,500 telephone and written inquiries, he said. Purchase price for the traveler yacht is in excess of $300,000.

Secretary Evans said the Crisfield location was a result of the joint efforts of DEED's office of Business and Industrial Development, Maryland Economic Development Corporation, Somerset County Economic Development Commission, and the City of Crisfield.

* * *

FOR MORE INFORMATION, CONTACT:

Jane Howard
or
Mary Lou Baker
DEED Office of Public Information
(301) 333-6925

or

Bob Douglas
or
Louise Hayman
Governor's Press Office
(301) 974-2316

MARYLAND ECONOMIC DEVELOPMENT CORPORATION (MEDCO)

1987 ANNUAL REPORT

To
The Honorable William Donald Schaefer, Governor
and
Members of the
Maryland General Assembly

The sale of the former Fairchild Industries plant was consummated in 1987 The sale was to a private party whose corporation will develop the building and land into an airpark The sale provided funds to MEDCO for other economic development projects in the State

CUMBERLAND AND ALLEGANY COUNTY

In November, 1986 Kelly-Springfield Tire Company announced that it would soon close its 67 year old tire plant in Allegany County The impact would be devastating upon the local economy 1,700 jobs would be lost as well as millions of dollars in State and local taxes Moreover, the psychological impact of closing the only Fortune 500 headquarters facility in Western Maryland would be equally devastating In response to a request by then Governor-elect William Donald Schaefer, Kelly-Springfield officials agreed to meet with a small group of local and state officials to see if Kelly would reconsider its decision

As announced in January, 1987, by Governor-elect Schaefer, Kelly agreed to keep its corporate headquarters in Allegany County, thus saving 600 jobs Other primary benefits include retention of $24 million in payroll dollars, $9 4 million in retail sales expenditures, and $3 1 million in State and local taxes

Ground was broken on March 2 1987, for a 100,000 square foot Kelly-Springfield Headquarters Building and a 33,000 square foot laboratory Occupancy took place on October 26, 1987 457 people now work at this new facility

MEDCO has taken over title to the former Kelly-Springfield manufacturing plant and is marketing the plant to potential users MEDCO has winterized the plant by contracting with former employees to de-water the pipes, put weather sensitive materials in the basement of the plant maintain the boilers, and do other things as necessary MEDCO has also contracted for security services so the plant has round-the-clock protection

MEDCO is negotiating with the State Highway Administration to locate their regional headquarters in the former headquarters building

CRISFIELD AND SOMERSET COUNTY

Due to the unavailability of industrial waterfront land in Crisfield, Governor Schaefer had the State transfer an unused nine (9) acres of land from the University of Maryland Eastern Shore, to the Town of Crisfield As a condition of the transfer, MEDCO will market the land for sale or lease That marketing effort has begun

Additionally, MEDCO is assisting the Town of Crisfield in revising their earlier application to the U S Army Corp of Engineers to dredge and fill an area which could then be used for the development of a maritime related industrial park

BALTIMORE COUNTY

MEDCO, along with Baltimore County and the Maryland Department of Economic and Employment Development (DEED), has arranged a sale-leaseback agreement with the Bethlehem Steel Corporation at Sparrows Point Under the agreement, MEDCO purchased a drydock from Bethlehem Steel for $2 8 million and in turn leased the drydock to Bethlehem Steel MEDCO borrowed $1 3 million from Baltimore County and received a grant of $1 5 million from DEED Bethlehem Steel's lease calls for fixed lease payments which will repay Baltimore County and additional payments to MEDCO based

on usage Additionally, Bethlehem Steel Corporation spent $5 million to dredge their waterways to provide access to larger ships for the drydock and make certain repairs to the drydock

It is expected that 400 jobs will be created at the shipyard as work is found for the drydock

MEDCO, on behalf of the State, has asked Baltimore County to rezone the Spring Grove State Hospital from a zoning category which allows office buildings and garden apartments to one which allows research facilities With its proximity to the campus of the University of Maryland Baltimore County, the deinstitutionalization of State hospitals, the need for university affiliated collaborative research facilities, and other needs such as business incubators, the Spring Grove property can become an important element in the State's economic development Significant buildings have been abandoned at Spring Grove because of the presence of asbestos Because of the enormous cost of asbestos removal, MEDCO intends to incrementally improve the property

It must be clearly understood, that existing uses of the Spring Grove property can be complementary to any proposed uses and that MEDCO is not attempting to close the hospital

SUMMARY

In conclusion, the past year has been a productive and exciting one for MEDCO, its accomplishments can be summarized as follows

1) The sale of the former Fairchild Industries plant providing funds for the Kelly-Springfield project and other development projects

2) The construction and occupancy by Kelly-Springfield Tire Corporation of their new international corporate headquarters and tire testing laboratory 457 people are presently working at the headquarters and other workers were retained at other facilities in the area

3) Winterization and marketing the former Kelly-Springfield tire manufacturing plant (1 8 million square feet on 85 acres)

4) Buying from and leasing to Bethlehem Steel Corporation a drydock which could help create up to 400 jobs in the next few years at the shipyard

MEDCO's administrative staff is extremely small, consisting of an Executive Director and an Administrative Assistant/Secretary MEDCO's accomplishments would not have been possible without assistance from Governor William Donald Schaefer and his staff, MEDCO's Board of Directors and their counsel, George Liebmann, the staffs from MDOT and DEED Additionally, assistance from local economic development officials in Allegany County and the City of Cumberland, Baltimore County, and Somerset County and City of Crisfield were invaluable as was assistance from various State legislators Special thanks also goes to Senators Sarbanes and Mikulski and Representative Helen Delich Bentley and their respective staffs as well as State Comptroller Louis L Goldstein and State Treasurer Lucille Maurer

And finally, MEDCO wishes to thank its' first Executive Director David Paulson for his tireless efforts on behalf of MEDCO and wishes him success in his new position

Respectfully submitted,

J Michael McWilliams
Chairman of the Board

Mayor Scott
City of Crisfield
Crisfield, MD 21817

May 12, 1988

Dear Mayor Scott:

Re: Crisfield
Maritime Industrial Park

I have been authorized by William Saul, President of Steuart Transportation Company, to inform you of the following information relating to our company's plans in the event that the Crisfield Maritime Industrial Park is developed as presently projected

Steuart currently operates a marine repair facility on its property immediately adjacent to the west side of the planned park; the scope of our current operations is restricted by the limited channel depth serving the area

Steuart proposes to acquire approximately 8½ acres within the park, adjacent to our existing facility, for the extensive expansion of our marine repair completed, the construction and operation of a substantial marine drydock

Steuart currently employs 11 persons, consisting of 8 skilled workmen, 2 clerical, 1 manager The contemplated expansion of the repair facilities would require employment of an additional 15-20 employees, 12-17 skilled, 1 clerical, and 2 supervisory The drydock operation would entail an additional 50 employees, operating in two shifts, 46 skilled, 2 clerical, 2 supervisory

It is anticipated that the expansion of the repair facility will entail a capital investment of $500,000 to $750,000 The drydock will require a capital investment of $2,500,000

Our plans necessarily must be conditioned upon satisfactory market conditions and available reasonable financing at the time of the completion of the Park However, our present intentions are as set forth above, and we will cooperate in every way assist in your development of this project

Very Sincerely Yours,

Steuart Transportation Company

By: James Mitchell Oakley
Shipyard Manager

JMO/nh
cc: Mr William R Saul, President
Steuart Transportation Company
Piney Point, Maryland 20674

EXHIBIT IV-F 1

MARYLAND ECONOMIC DEVELOPMENT CORPORATION

May 9, 1988

Honorable Richard Scott
City Hall
Crisfield, Maryland 21817

Dear Mayor Scott:

As you are aware, the Maryland Economic Development Corporation (MEDCO) has been providing technical assistance to the proposed Crisfield Maritime Industrial Park II MEDCO is eager to work with you to see that this long-awaited project becomes a reality Additionally, MEDCO is presently negotiating a contract with a luxury boat builder who will lease/purchase the Crisfield Maritime Industrial Park I

This letter will confirm MEDCO's intent to provide certain facilities and marketing assistance to Crisfield for the Crisfield Maritime Industrial Park II MEDCO is prepared to provide and operate a public over-the-clock facility to be used to provide commercial access for shippers and receivers at the Crisfield port Refrigerated warehousing may be included as part of the facility during the initial phase or will be added at a later date The facility will require truck access and other necessary public infrastructure; i e electricity, roads, sewer and water As presently envisioned, the facility would be 10,000-15,000 square feet with ground storage also being available The facility design would be flexible to allow for expansion

MEDCO will be able to assist Crisfield, Somerset County and state efforts to market the new industrial park MEDCO's public service role makes MEDCO an appropriate source for assistance to this project

Finally, let me encourage your consideration of making available land and/or a building at the Park for a boat repair business With all the expected increased pleasure and commercial boat traffic, a boat repair yard should be an economically viable project The City might wish to consider constructing a boat repair building on land at the Park to sell or lease Or the City might make the land available and market the site to a private party who would provide a boat repair service

Crisfield and Somerset County have experienced significant economic problems over the years The inability to take advantage of Crisfield's location on the water has been a deterrent to your economic resurgence Please be assured MEDCO is enthusiastically supporting your efforts to create this necessary maritime industrial park

Sincerely,

Hans F Mayer
Executive Director

HFM/ct

cc: Jim Threatte
Tony Bruce ✓

SECTION V

SECTION V - SELECTION AND SUITABILITY OF SITE

A. DISCUSSION

As discussed previously Steuart Transportation is a major marine transportation and repair facility located at Crisfield. Steuart Transportation is in need of expansion in order to meet demand for services and improve efficiency of operation. It is critical to Steuart Transportation to be able to expand their facility in their current location in Crisfield. Crisfield is strategically located half way between Baltimore, Maryland and Norfolk, Virginia on Tangier Sound. This location is critical to Steuart Transportation in order to supply tug and barge service to various locations of the Bay. The following Exhibit V-A shows the location of Crisfield on the Bay, Exhibit V-B the location on Tangier Sound, and Exhibit V-C the channels to the Steuart Transportation and the project site.

Likewise MEDCO, Maryland Economic Development Company, has the need for a facility with access to the Chesapeake Bay located between Baltimore and Norfolk. MEDCO wishes to locate a facility in Crisfield in conjunction with Steuart in order to provide assistance to the City of Crisfield and also supply needed facilities for businesses in the State which are water related. The current barge repair facility in Crisfield which is part of Steuart Transportation is only able to do above water line repair on barges. The only other facilities which do complete barge repair and renovation are located in Norfolk, and Baltimore. It

is an operational necessity for Steuart to expand its facility in Crisfield to provide more complete barge repair and service. MEDCO also wishes to assist Steuart in expanding barge repair in order to further develop this business for Maryland enterprises. Based on current needs related to the Crisfield seafood industry, MEDCO proposes a boat repair facility for pleasure and work boats. The proposed location is ideal considering its situation between the work-boat harbor and Somers Cove.

MEDCO also proposes sites for boat building and cold storage warehousing facilities. The boat building enterprises require a travel lift launching facility for boats which cannot be hauled over the road. The cold storage facility needs to be located near a dock for access of watermen from Crisfield, Smith Island, Tangier Island and other points on Tangier Sound and the central portion of the Chesapeake Bay.

Steuart Transportation has need of additional berthing areas for three to four barges, tug boat facilities, turn around basin, a deeper and wider channel. With the existing investment in the Crisfield facility, Steuart Transportation would find it impossible to justify a relocation within the Crisfield area. Therefore, it is of major concern that the new facility be located adjoining to or close to the Steuart Transportation facility in order to assist them with the required expansion. The proposed location is therefore ideal for the combined needs

of the City of Crisfield, MEDCO and Steuart Transportation.

The Steuart expansion would actually entail utilizing part of the dock facility and leased mooring facilities on at least on side. Steuart would require periodic use of additional mooring space at the new dock facility. Steuart would lease a portion of the dock facility from MEDCO. The end of the dock would also be utilized for either barge or tug boat mooring. The northeast side of the dock facility would only be utilized by Steuart on a temporary basis as required. Based on Steuart's history of operation at their existing location there is evidence related to environmental and economic factors with no detriment to the area. Based on this historical data, it is logical that the expansion in this area should not be detrimental to the environment, the local crabbers, or to the City as a whole. In fact, considerations presented in Section X demonstrate methods of improving the local aqua-system.

This proposed location is also ideal for the proposed MEDCO facilities being located on a dredged channel connected directly to the shipping channel through Tangier Sound into the Chesapeake Bay midway between Baltimore, Cape Charles and Norfolk. Other factors which effect the decision of selecting this site as "most desirable" include the location related to local utilities such as water, sewage, State highway, Delmarva Power Company services, and the local work force. This site is within walking and

biking distance of a large part of the labor force of the City of Crisfield. This area of the water front is generally considered an industrial rather than a pleasure boating area. With Somers Cove being designed and built for pleasure boats and the subject project site being designed and built for water dependent businesses and industries, we have a separation and no conflict with the various boat traffic. To the north is the small boat harbor and a site which will be used for a boat building manufacturer.

Although not a primary factor, another beneficial aspect of locating the industrial site here, with the elevated fill, is the resulting storm surge barrier created in an area where previous storms have driven high tides across the area to the State highway resulting in extensive flooding. With the filled area which will be created by the dredged spoils a protection barrier will be developed from the Steuart property to the small boat harbor. There will be drainage through the area with drain pipes from the State highway with flood gates.

Crisfield wastewater treatment plant adjoins the project site. Crisfield water mains will loop through the park. Delmarva Power Company has service passing by and will locate transformers as appropriate to the site. The volunteer fire company and ambulance service adjoins the site which is located on Maryland

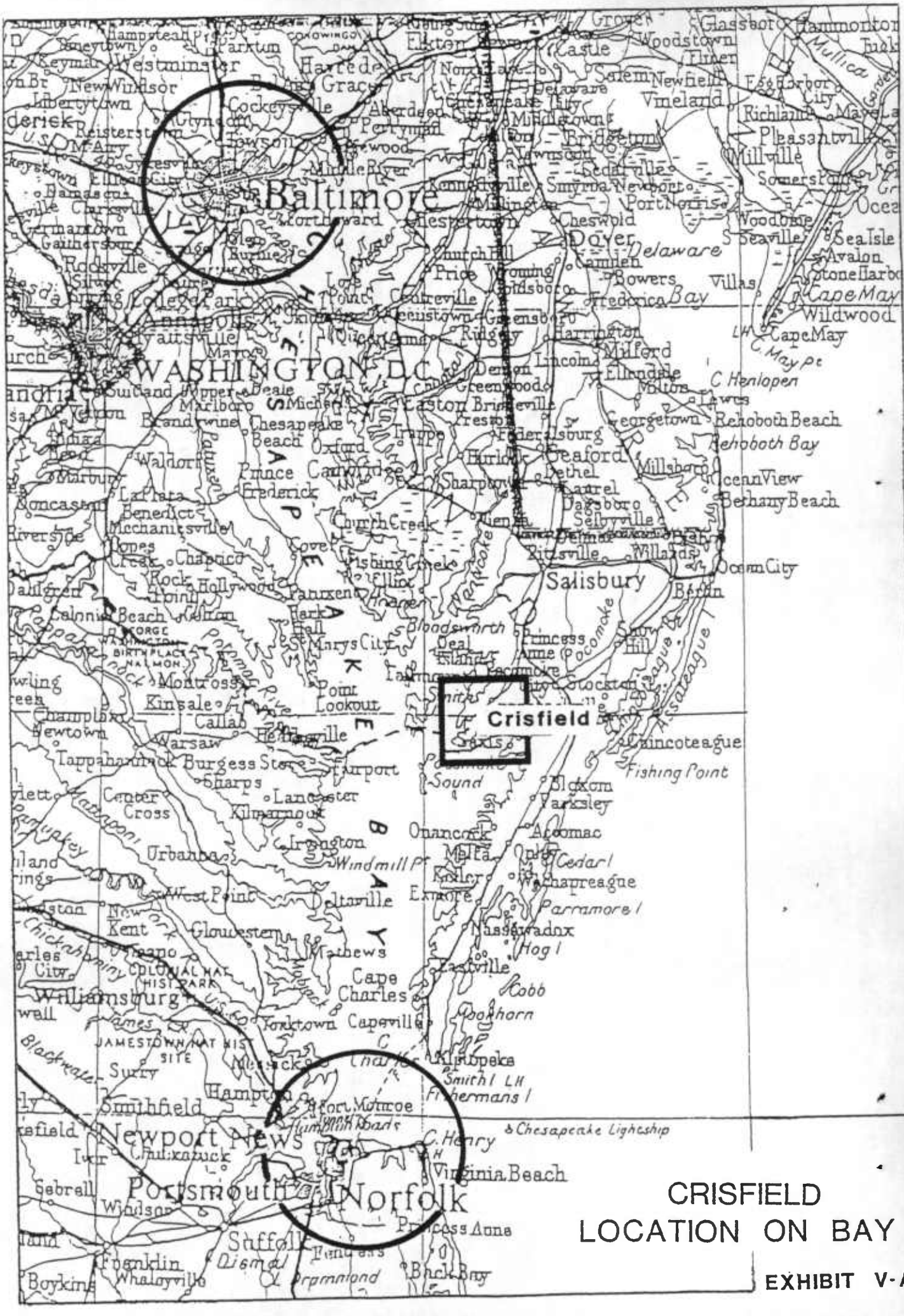
Route 413. The site location provides the industrial park and the dock facility at the end of a shipping channel coming off of Tangier Sound and provides direct access to Maryland Route 413 at the edge of Town, without interfering with the downtown tourist operations. An essential aspect of this site is the dock facility being located adjoining the Steuart property. The rest of the area which will be used for dredged spoils does contain some wetlands, however, the largest part is a portion of upland and low quality high marsh. Some of this existing wetland was developed from upland which had previously been residential. Much of this area became low quality tidal wetlands due to an effort to drain standing water for the purpose of mosquito control. Once the ditches were developed they became tidal and are therefore now classified as tidal wetlands. However this area is in need of having its elevation increased to eliminate storm surges and to be able to utilize the area once again as a worthwhile and beneficial part of the City of Crisfield. Considering all factors, it is concluded that this is the best site for the Crisfield Dock and Maritime Park and also very beneficial to the State of Maryland with the MEDCO location here.

B. EXHIBITS

Exhibit V-A - Crisfield Location on Bay

V-B - Crisfield Harbor

V-C - Channels and Project Site



CRISFIELD LOCATION ON BAY

EXHIBIT V-A

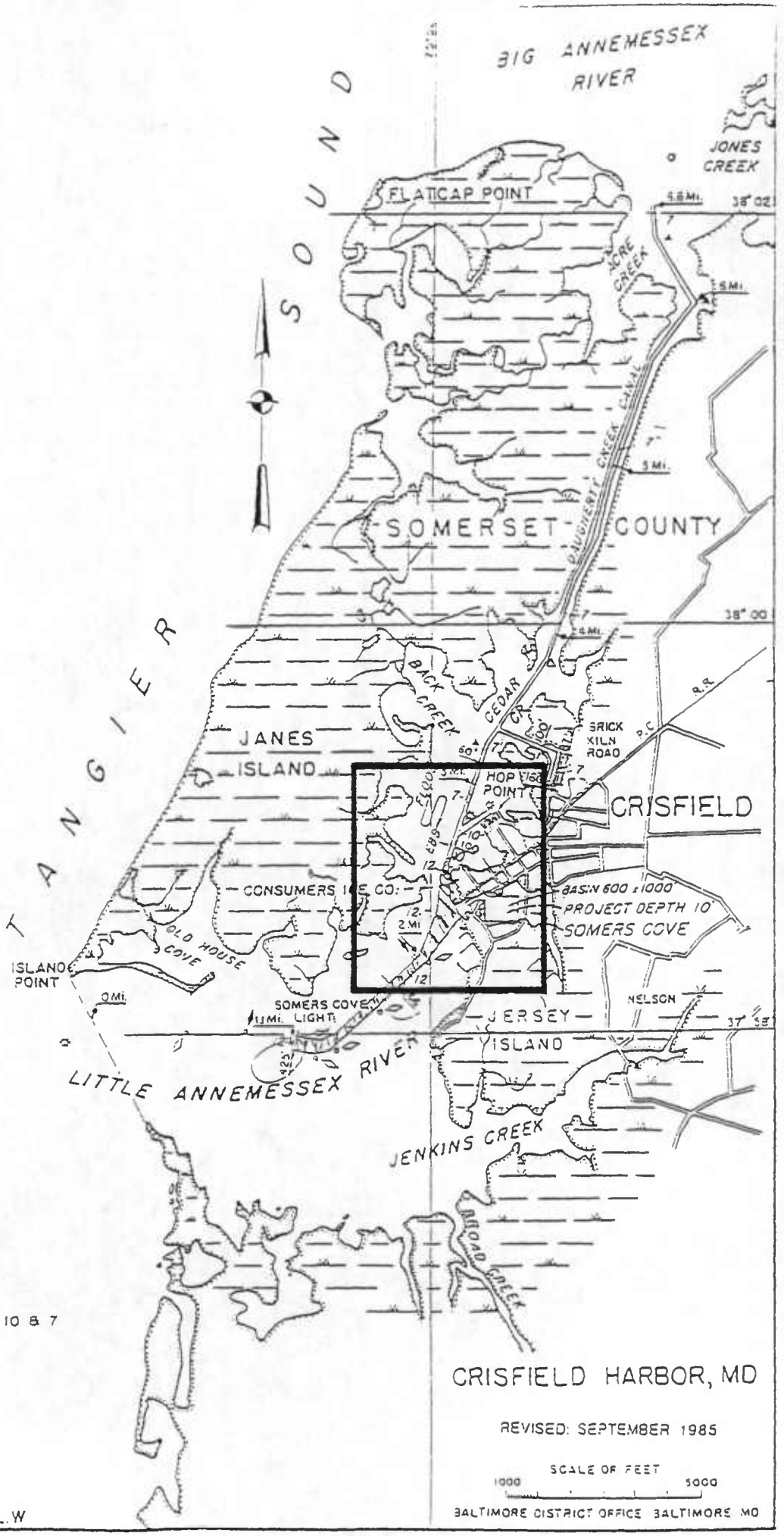
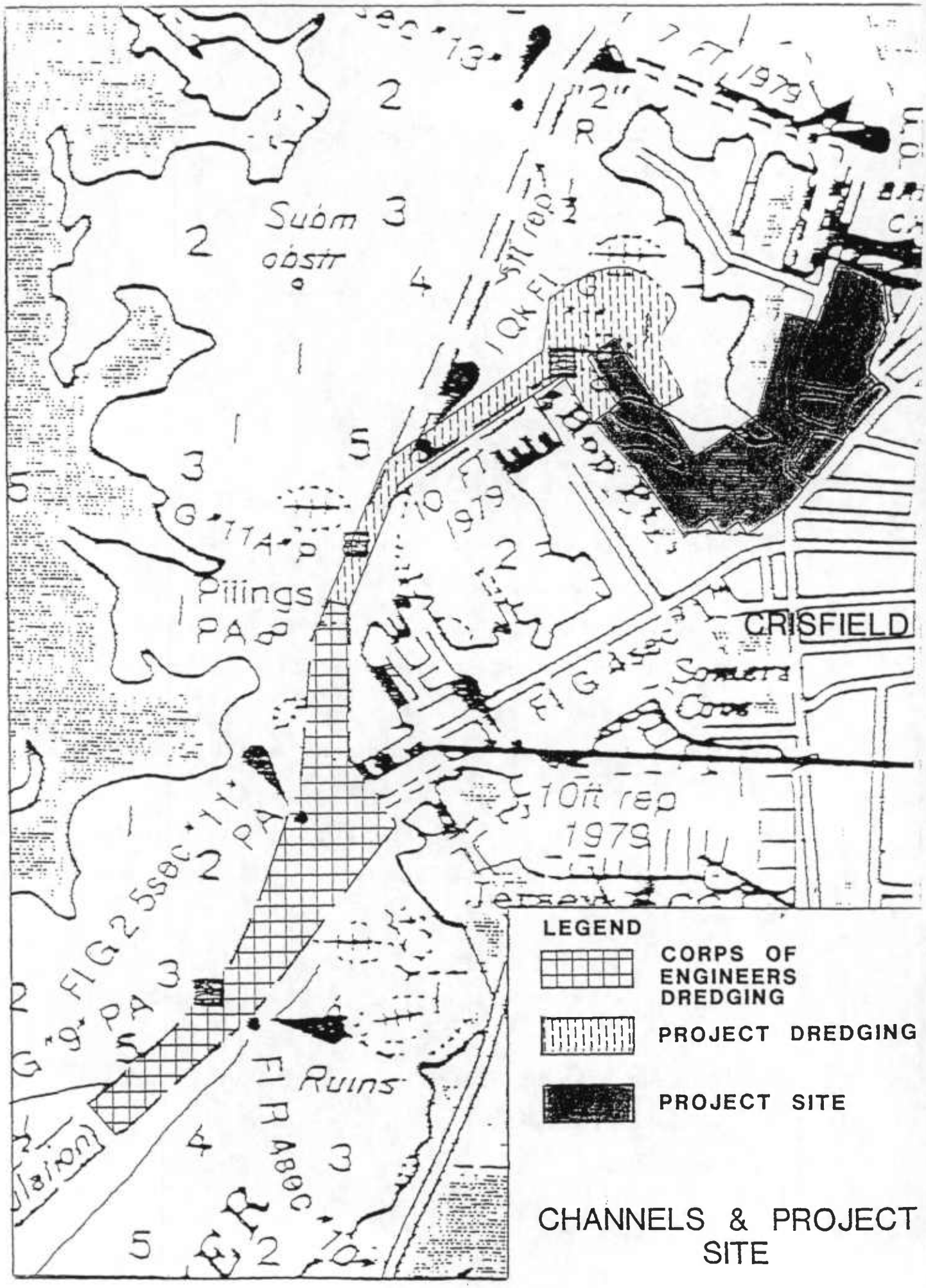

BIG ANNEMESSEX RIVER
JONES CREEK
FLATCAP POINT
38° 02'
4.6 Mi.
5 Mi.
SOUND
TANGIER
SOMERSET COUNTY
38° 00'
4 Mi.
BACK CREEK
CEDAR CR.
SRICK KILN ROAD
P.C.
P.R.
JANES ISLAND
HOP POINT
CRISFIELD
CONSUMERS ICE CO.
BASIN 600 x 1000
PROJECT DEPTH 10'
SOMERS COVE
OLD HOUSE COVE
ISLAND POINT
SOMERS COVE LIGHT
NELSON
JERSEY ISLAND
37° 55'
LITTLE ANNEMESSEX RIVER
JENKINS CREEK
BROAD CREEK
PROJECT DEPTHS 12 10 & 7
CRISFIELD HARBOR, MD
REVISED: SEPTEMBER 1985
SCALE OF FEET
1000
5000
BALTIMORE DISTRICT OFFICE BALTIMORE MD
SOUNDINGS ARE IN FEET
DATUM PLANE IS LOCAL M.L.W

EXHIBIT V-B

SECTION VI



CHANNELS & PROJECT SITE

EXHIBIT V-C

SECTION VI - ALTERNATE SITE EVALUATION

A. SITE REQUIREMENTS

Proposed project requirements for use within the immediate future include:

1. Additional dock space for Steuart Transportation, other local businesses including boat taxi, and new marine dependent industries.
2. Increased channel width and depth from the Federal Channel to the new dock facility.
3. A turning basin at the end of the channel.
4. Spoils site for the dredge material.
5. Additional site area for Steuart.
6. Common staging area adjacent to proposed dock.
7. Two or more four to five acre sites adjacent to dock for water dependent businesses.

Within a 4 year period MEDCO projects need for a maximum of an additional 3 sites within the dock area. In order to meet the project objectives several overriding factors necessitate the location of the dock and industrial sites as proposed. These factors include:

1. Location on deep water.
2. Within walking and biking distance of Crisfield's work force.
3. Located within utility service area with municipal water, sewer, electric, fire protection, medical and police assistance.

4. Acceptable location for Steuart Transportation expansion.

5. Location acceptable to MEDCO and industrial concerns willing to locate in the Crisfield area.

B. ALTERNATE SITES

Even though the proposed project site may be the obvious most-suitable site, other considerations are presented.

1. The first alternate for consideration is the site as proposed in the previous application dated 1985 (See Exhibit VI-A). This alternate met or exceeded most of the objectives and requirements. Although subject to speculation and difference of opinion it was the position of several agencies that this alternate was in excess of the demonstrated needs. Therefore this alternate is deemed unacceptable.

2. The second alternate site is that shown in Exhibit VI-B. This alternate considers the location of the dock across the cove from Steuart Transportation. Several major factors related to the consideration include.

   a. Non compatibility with Steuart's operation.

   b. Additional dredging and greater required spoils site.

   c. Greater distance from downtown area.

   d. Zoned residential and built residential

3. The third alternate site consideration as shown in Exhibit VI-C is a deviation of the proposed. This alternate was developed through consideration of minimizing wetland fill.

During this consideration it was determined that the local aqua-system could be improved by means discussed in Section X. Therefore the small area of filled wetlands were determined to be non-essential relative to the aqua stability or improvement. This alternate is considered unacceptable due to its interruption of the park and access to the dock area.

4. The fourth alternate site consideration is an expanded Crisfield Maritime Park I shown in Exhibit VI-D. Even though this site is under contract to an industrial user, its proximity to current needs warrants consideration. Factors to consider include:

   a. Park I zoned industrial.

   b. Portions of adjoining land required for sites are zoned residential.

   c. Greater distance from Federal channel would increase dredge spoils and required spoils site.

   d. Potential conflicts with work boars entering and leaving small boat harbor.

   e. Does not meet expansion requirements of Steuart Transportation.

   f. Greater distance from central Crisfield.

   Based on factors presented all the above alternates are considered unacceptable.

5. The consideration of an inland site does not meet any one of the project objectives. Without access to water no industry

will be induced to locate in this remote area with additional shipping costs with no benefits. Additionally even if such tracts of land were available the exercise would be a highly speculative one with little to no chance of success. The remoteness of Crisfield in relation to near-by communities with similar facilities would seriously undermine the competitiveness of an upland Crisfield Industrial Park. Competitive marketability can be achieved only if full advantage is taken of Crisfield's most distinguishing feature -- the water-front. Were such tracts available, it would be imperative that their marketability be closely examined. An industrial park of the classical type would have no distinguishing features from those in Pocomoke City, Salisbury, or Princess Anne other than a distance disadvantage in terms of highway access. A truly marketable facility must have site differentiation and in the case of Crisfield this means access to waterways. The paramount factor related to the inland site is the fact that the need for dock space and deep water access are not accomplished.

Other alternatives previously evaluated and rejected as being cost prohibitive, environmentally damaging, and unjustifiable are presented for the record.

Jersey Island Site

The 343 acre site contains 88.5 acres of upland area and 250 acres of wetland area, and is bounded by the Little Annemessex River on the west, Jenkins Creek on the south, and Calvery Road on the east. See Exhibit VI-E, Jersey Island Site. The site consists of three distinct areas: a river-oriented upland area, an inland-oriented wetland area, and an inland upland area. Approximately 80 percent of the wetland is exposed marshland and the remaining 20 percent is submerged marshland. The site contains two classifications of soil or surface material. The upland area is in the "made land" class or areas in which the soil material has been disturbed and changed by earth moving operations. This soil classification consists of fill material, generally oyster shells, and is so varied that site examination is mandatory to determine suitability for specific use. The soils on the remainder of the site are classified as "tidal marsh", which vary sightly in character. Some areas are salty or brackish and some of the clayey areas have high concentrations of sulfur compounds. The site is characterized by large areas subject to occasional tidal flooding (marshland) and two major and vital drainage channels. The west channel, which is east of the river-oriented upland, serves primarily as a surface drainage route for the upland area of the site. The east channel, nearest to the Calvary Road end of the site, serves both as a surface runoff collector and as a drainage way for the interior of Somers Cove, thereby preventing stagnation of water in the cove.

A large part of this proposed site is tidal marshland, and therefore characterized by occasional flooding and a seasonally high water table. The soils are saturated, and generally unsuitable for construction purposes. The wetlands associated with this site are high in biomass productivity; they provide habitat for many species of plants and animals, and act as nurseries and spawning areas for several aquatic species.

Dredging an access channel for vessels would necessitate the disposal of 3,700,000 cubic yards of spoil at the site, as noted above; this site has been used twice before for spoil disposal.

To prevent flooding due to storm surge, a bulkhead or sea wall will be required.

This site contains known archaeological resources.

Sea Island Site

This site is proposed as a man-made sea island, to be constructed of dredged fill and seven acres in area. The sea island would be located approximately one mile due west of Island Point on Janes Island and approximately 0.7 miles north of the Janes Island Horn. This location would allow the island to be constructed in five feet of water while having over 42 feet of water depth available only 300 feet away. The long axis of the sea island would be oriented in a NE-SW direction. The facilities on the

sea island would be capable of handling up to 40,000 DWT vessels requiring 42 feet of water. Deep draft berths for handling break bulk, fertilizer and fishmeal would be provided. Shallow drift berths would be provided for "shuttle barges" transferring cargo to a shore location at the Jersey Island or Crisfield City sites, such that deep draft vessels would berth at the sea island and would not need to enter Crisfield Harbor. There would be no dredging in Crisfield Harbor if the sea island concept was used. A 9 foot deep channel, extending east from the sea island to the existing Crisfield Harbor entrance channel would be dredged for barge traffic to and from the island.

Berths would be provided for deep draft vessels along a 1100 foot structure, capable of berthing four vessels at any one time:

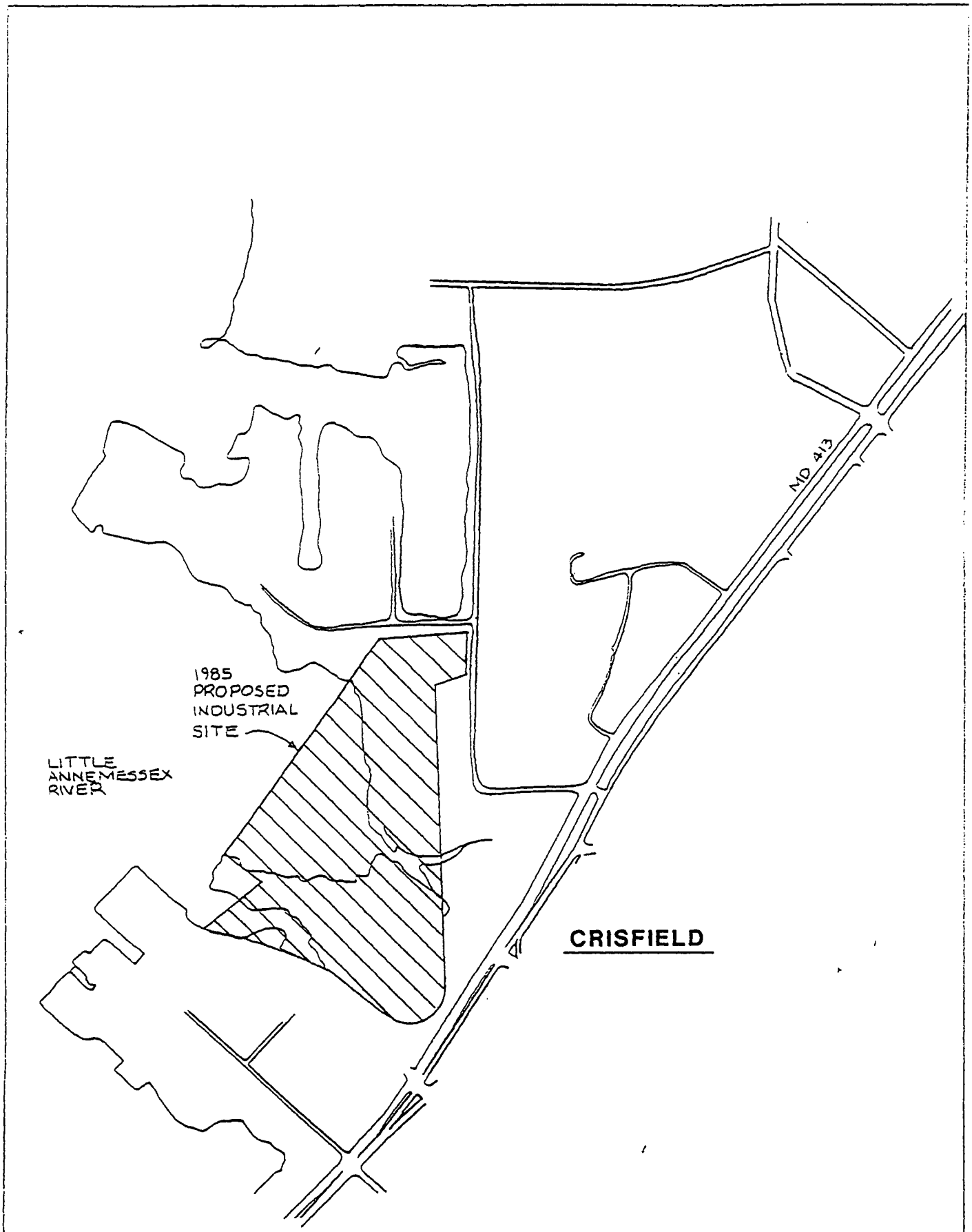
Two 550 foot break bulk berths with a 50 foot apron for landing pelletized cargo

A 550 foot dry bulk berth for handling fertilizer

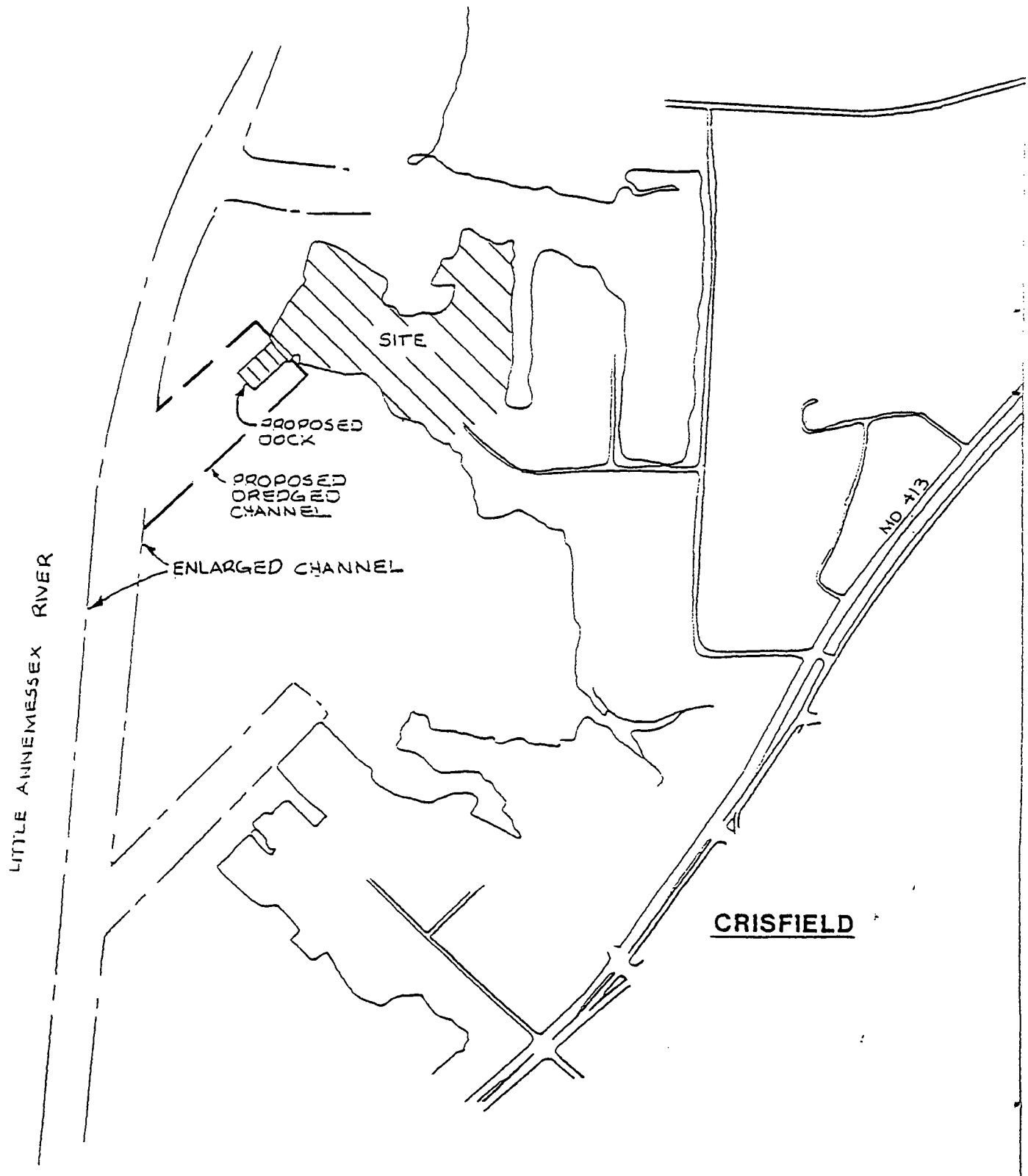
A 550 foot berth for handling bulk fishmeal

1100 feet of barge berths are also provided

50,000 square foot transit shed for cold storage or processed food and meats and for storage of fertilizer

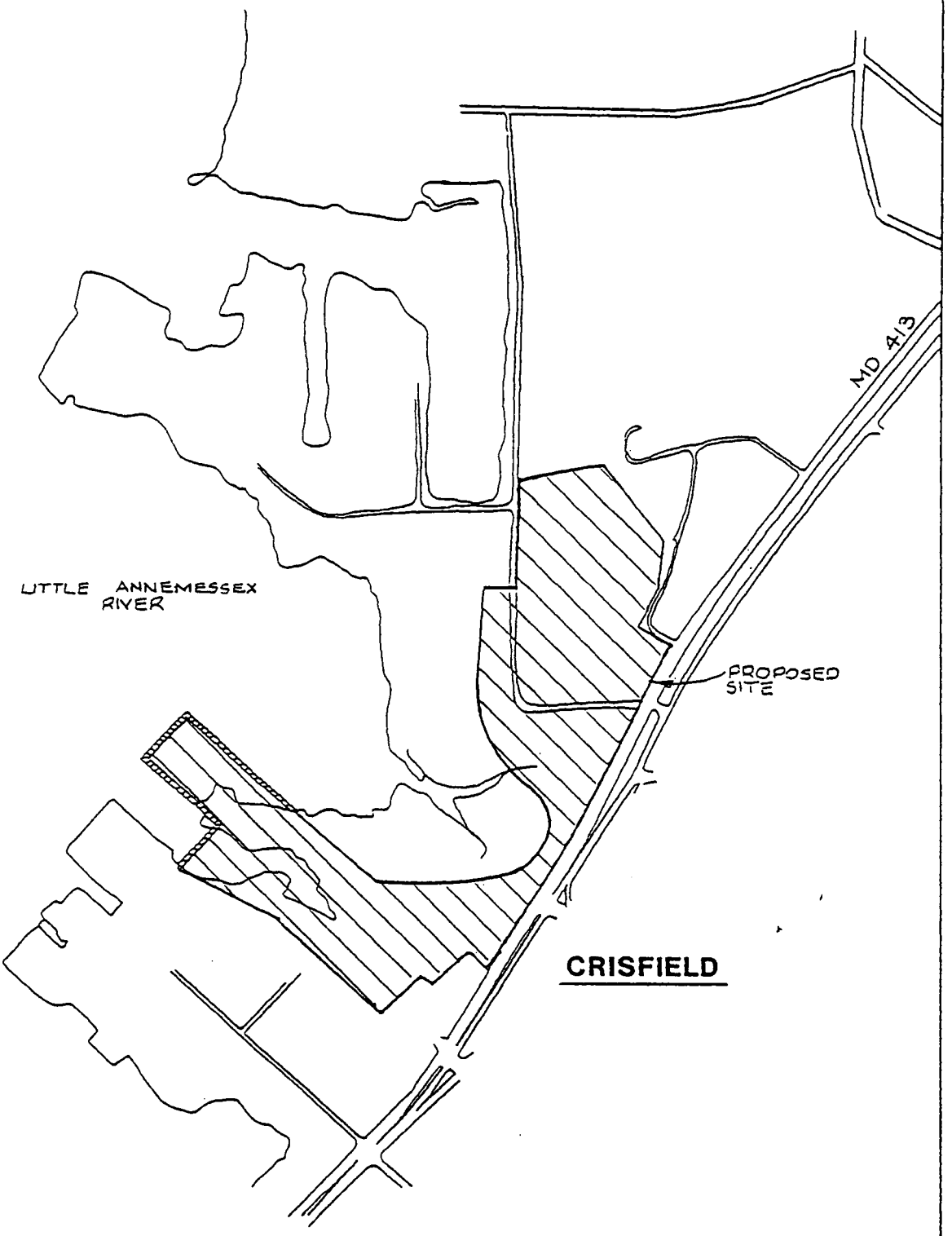


ALTERNATE SITE - 1 **EXHIBIT VI-A**



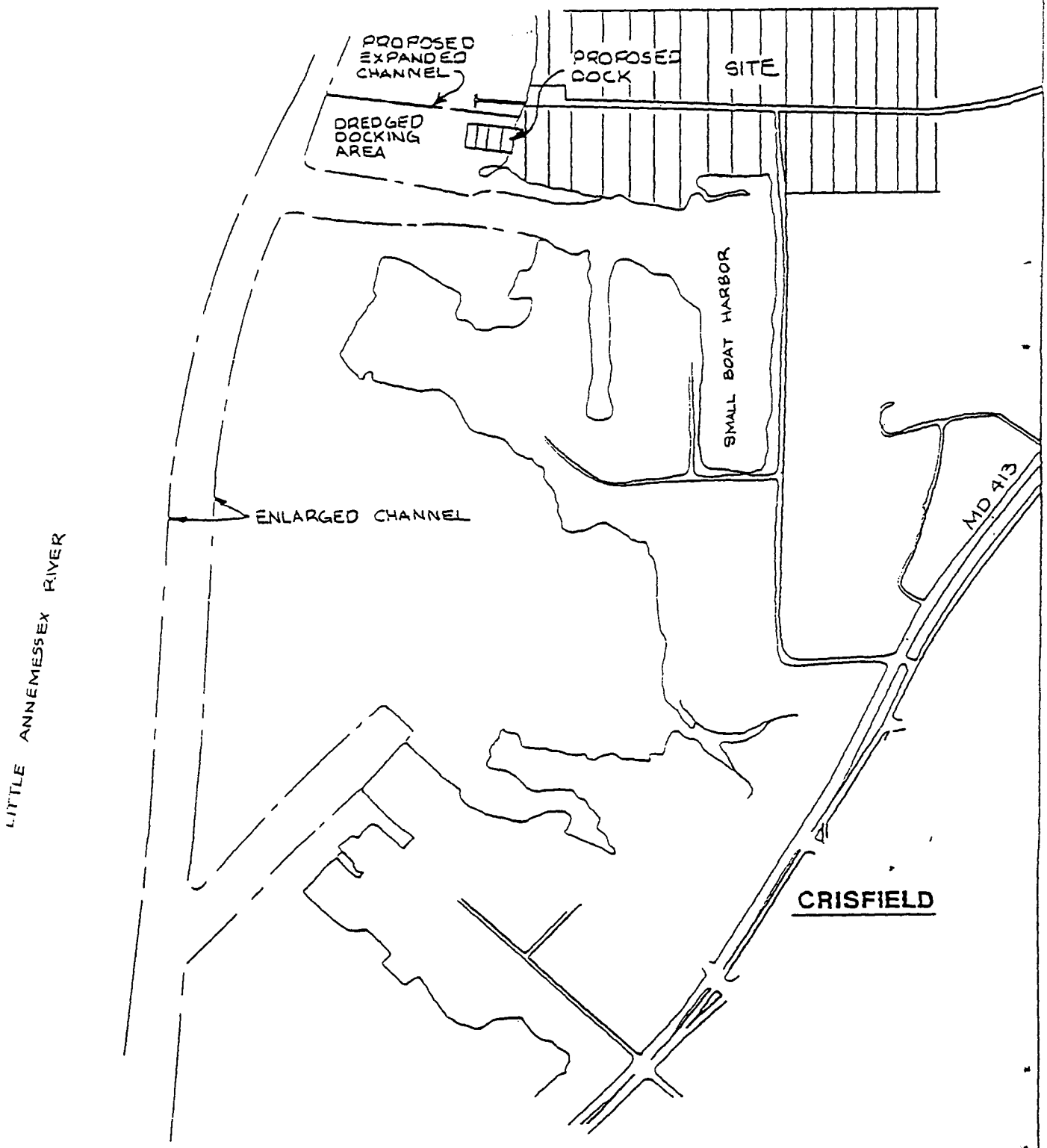
ALTERNATE SITE - 2

EXHIBIT VI-B



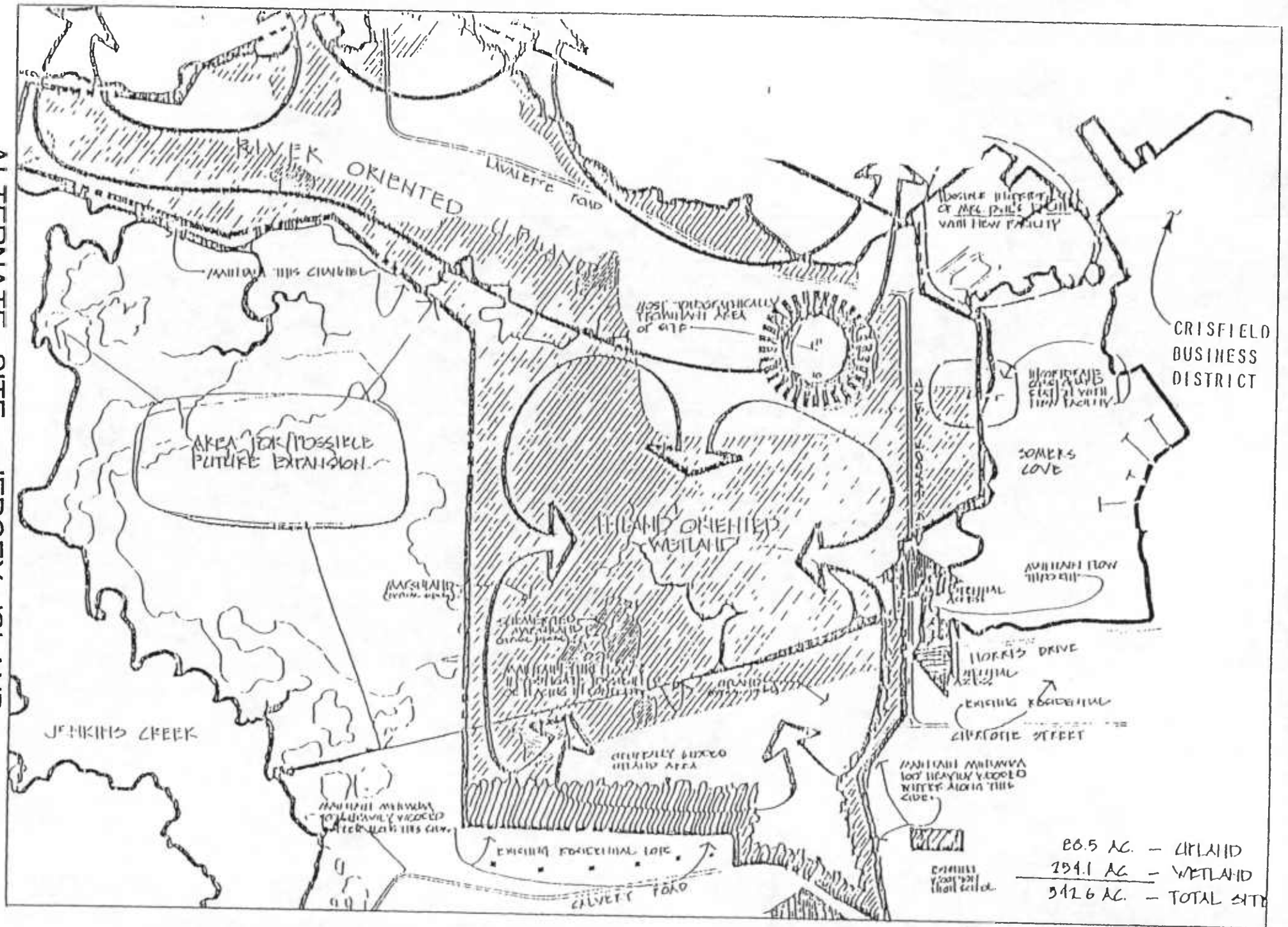
ALTERNATE SITE - 3

EXHIBIT VI-C



ALTERNATE SITE - 4

EXHIBIT VI-D



ALTERNATE SITE – JERSEY ISLAND EXHIBIT VI-E

RE 1985 APPLICATION

SECTION VII

SECTION VII - SITE CHANGES AND PROPOSED CONSTRUCTION

Changes to the proposed site will include construction of approximately 7100 linear feet of 10 foot high earth dikes to contain dredged spoils; excavation of an estimated 275,000 cubic yards of dredge spoils; establishment of 1600 linear feet of precast concrete bulkheading for a dock loading facility and improvments to the dredge fill site to render it useful as a maritime industrial park.

A. Dredging

A series of ten foot high containment dikes will divide the project site into three separate spoils containment cells. (See Exhibits VII-A and VII-B). Each cell will be filled uniformly with the dredged material from the channel improvement to the Little Annemessex River. The earth dikes will be constructed by first removing the upper layer of organic material along the dike lines and replacing it with select borrow material from an approved upland source. The select material will be placed in 8" maximum loose lifts and compacted by mechanical means to the proper density and permeability. A representative of the geotechnical engineering firm will be on site during compaction operations to insure all testing requirements are met. Once dike construction is complete the contractor will be required to topsoil, seed and straw mulch all exposed surfaces before dredging operations begin. A rip-rap revetment will be designed

and built along all dikes exposed to wave or tidal action. Exhibit VII-C shows the locations of available borrow sites in Somerset County.

The three containment cells will each have a weir box structure constructed in accordance with requirements of the State of Maryland Water Resource Administration. The weir structure is used to control water levels in the cell and provide an outlet for spoils water once turbidity requirements are met. The dredging contractor will be responsible for monitoring water turbidity levels and submitting water test samples as required to the Water Resource Administration. Exhibit VII-A shows the proposed plan for the weir structure system.

The total available spoils area will allow for deposition of approximately 146,000 cubic yards of compacted dredge spoils. Greater fill depth may be used after further study. As shown on Exhibit VII-A each spoils cell is designated by a number. Cell number 1 has an estimated spoils capacity of 32,000 cubic yards. Cells 2 and 3 have an estimated spoils capacity of 54,000 and 60,000 cubic yards, respectively based on a 2:1 expansion factor. Spoil sites to contain the remaining 129,000 cubic yards of dredge material have not been selected. When the selection process is complete the plans will be presented to the appropriate agencies for review.

Project dredging will be from the limit of the Corps of Engineers channel maintenance dredging project to a point 500' north of the proposed dock facility. Approximately 3,700 linear feet of channel will be dredged to a depth of 12 feet below mean low water. Width of dredging will be 200 feet along the entrance channel and a maximum radius of 500 feet at the proposed turning basin. (See Exhibit VII-D)

According to the Geotechnical Engineering report prepared by Froehling and Robertson, Inc., and presented at the end of this section, the majority of the dredge material will be sand or silty sand. Test results show the silt contents in the sands ranged from 5 to 25 percent. (See Exhibit VII-K)

All local and county sediment and erosion control requirements will be followed during construction of the project. Mr. Larry Fykes of the Somerset Soil Conservation District has reviewed the proposed project and agrees to the preliminary sediment and erosion control concepts presented. His approval of the final design will be required before the necessary local and state construction permits can be obtained.

B. Dock Loading Facility

Sixteen hundred linear feet of bulkheading will be needed to construct a 92,000 square foot dock facility. The rectangular

shaped dock will be located at the west end of the project site just north of Steuart Transportation.

Several types of bulkhead systems are being considered for the dock facility. Factors such as ease of construction, durability, and cost will be evaluated in the selection process during design. Following is a list of the bulkhead systems being considered and a brief description of each.

1. Precast Concrete Cylinder Pile Bulkhead

   The cylinder pile bulkhead system consists of driving a series of 54 inch diameter precast prestressed concrete piles approximately 6 inches apart. Organic material inside the piles will be removed and replaced with clean well graded sand or gravel. Precast concrete spacers are driven between each pile and filter cloth is placed against the landward face of the bulkhead. (See Exhibit VII-E)

   The advantage of the cylinder pile system is that no tiebacks are required. Fill can be placed behind the bulkhead with conventional equipment without the risk of damage to the structural integrity of the bulkhead or anchors. Since all exposed surfaces are of high density concrete the life expectancy of the bulkhead is much longer than that for steel or wooden systems.

2. Precast Concrete Bridge Deck

The precast concrete bridge deck design is similar to a typical concrete pier. Construction consists of driving a group of precast concrete piles to an appropriate depth and using them as the foundation for construction of a over the water concrete deck. The deck is then used as the surface of the dock facility. This type structure is easy to construct and eliminates the problems associated with backfilling the dock area. (See Exhibit VII-F)

3. Precast Concrete Sheet Piles with Outboard Batter Piles

The outboard batter pile design consists of driving precast concrete batter piles and attaching them to the front face of a concrete sheet pile system. Additional vertical piles are driven on the outboard side of the sheet piling and a short precast concrete deck is extended past the exposed portion of the batter piles. Filling of the dock area can be accomplished by conventional means. (See Exhibit VII-G)

4. Precast Concrete Sheet Pile with Inboard Batter Piles

This type bulkhead is similar in design to the previously discussed bulkhead except the batter piles are placed on the inward side of the sheet piles. Inboard batter piles allow

for the elimination of the small concrete deck but can only be used where shallow dredge depths are encountered. Care must be taken when filling near the bulkhead to prevent damage to the batter piles. (See Exhibit VII-H)

A mooring dolphin or fender pile system will be designed to absorb the energy produced by vessel docking activity and prevent structural damage to the dock. Typical fender systems consist of a series or group of timber piles driven along the front face or water side of the dock. The pile or group of piles are usually connected by timber wales which form the energy absorbing system.

At the north east end of the dock a special travel lift facility may be constructed. The travel lift will be used by boat builders to move small to medium size boats in and out of the water. In the area of the travel lift facility the bottom of the river will be dredged to an elevation of-8 feet.

The dock surface will be designed for loading of users including Steuart Transportation, boat builders, waterman, commercial, and daily business traffic.

C. Site Improvements

To provide easy and safe access to all parts of the industrial park a network of 24 foot wide bituminous paved roads will be constructed. (See Exhibit VII-I) All roads will be built on previously compacted select borrow material used during dredging operations as spoil containment dikes. Construction of roads on the dike system allows for immediate placement of the pavement section without concern of substantial settlements.

The only established entrance to the site is located along Collins Street. Collins Street will be closed during construction so the street can be raised, to an elevation of +6 feet. After dredging, Collins Street will be extended to the proposed ring road. The ring road will run from Brick Kiln Road south to Fifth Street and continue northwest to the dock facility. An additional road will be constructed at the intersection of Fourth Street and Route 413 and loop south and west to the ring road and Fifth Street intersection. Approximately 2650 feet of new road will be constructed for the proposed project.

A common staging area will be located between parcel no. 1 and the dock facility (See Exhibit VII-I) The staging area, used to store products between transportation activities, will be paved with crusher run.

Water, sewer and electrical services are readily available to the project site. The City of Crisfield will supply the sewer and water services while Delmarva Power Company, will supply electrical services.

The City of Crisfield has installed a 12 inch ductile iron water main along Maryland Route 413, directly east of the proposed site. Construction of approximately 3000 linear feet of 8" water mains will be required to supply water to the park. The 8" main will form a loop through the industrial park by connecting into the 12 inch line at the proposed entrances along Route 413.

The City of Crisfield is supplied by five wells and one stand-by well. The combined pumping capability of the five wells is 1910 GPM. An additional 800 GPM well is under contract for construction in the summer of 1988.

Storage consists of two elevated towers. The Broadway Street tower holds 250,000 gallons while the tower at the Rubberset Plant holds 75,000 gallons. Both towers appear to be in excellent condition. Water system pressure varies from 53 to 40 psi.

The Crisfield municipal wastewater treatment plant is located on 7th Street adjacent to the southern edge of the proposed

industrial park site. Present capacity of the treatment plant is 1,000,000 GPD. The current permitted flow capacity is 900,000 GPD while the average daily flow is 800,000 to 825,000 GPD. The plant is currently scheduled for upgrading with construction to begin this summer. Once upgrading is completed the plant will be able to process the rating capacity of 1,000,000 GPD while meeting discharge limitations.. The City has entered into a design contract to expand the plant to 2 MGPD. Expansion construction is estimated to be 3 years away.

Both primary and secondary power three phase and single phase are available to the site. On the South edge of the site, a substation is located within the confines of the wastewater treatment facility. An oil powered booster generating station is located within 1/2 mile of the proposed site. The Delmarva Power Company supplies all electrical services to this area. Available secondary voltages are 240, 480, and 600 volts.

Stormwater management in a tidal area may be waived in accordance with the City of Crisfield stormwater management ordinance, but the issue of water quality must be addressed. Water quality enhancement is normally accomplished by storing, in an infiltration system, the volume equivalent to the first half inch of rainwater falling on the site (first flush). A stormwater management plan must be approved by the City before a grading or building permit can be issued.

To handle stormwater discharge during construction activity an existing storm drain, will be extended beyond the west containment dike into the Little Annemessex River. A swale will be constructed outside of the proposed south dike to divert stormwater associated with the area south of the project. (See Exhibit VII-J)

D. EXHIBITS

Exhibit VII-A - Spoil Sites

Exhibit VII-B - Adjacent Property Owners

Exhibit VII-C - Borrow Pit Sites

Exhibit VII-D - Channel Dredging Plan

Exhibit VII-E - Dock Construction-Alternate #1

Exhibit VII-F - Dock Construction-Alternate #2

Exhibit VII-G - Dock Construction-Alternate #3

Exhibit VII-H - Dock Construction-Alternate #4

Exhibit VII-I - Dock and Park

Exhibit VII-J - Temporary Stormwater Management Plan

Exhibit VII-K - Geotechnical Evaluation

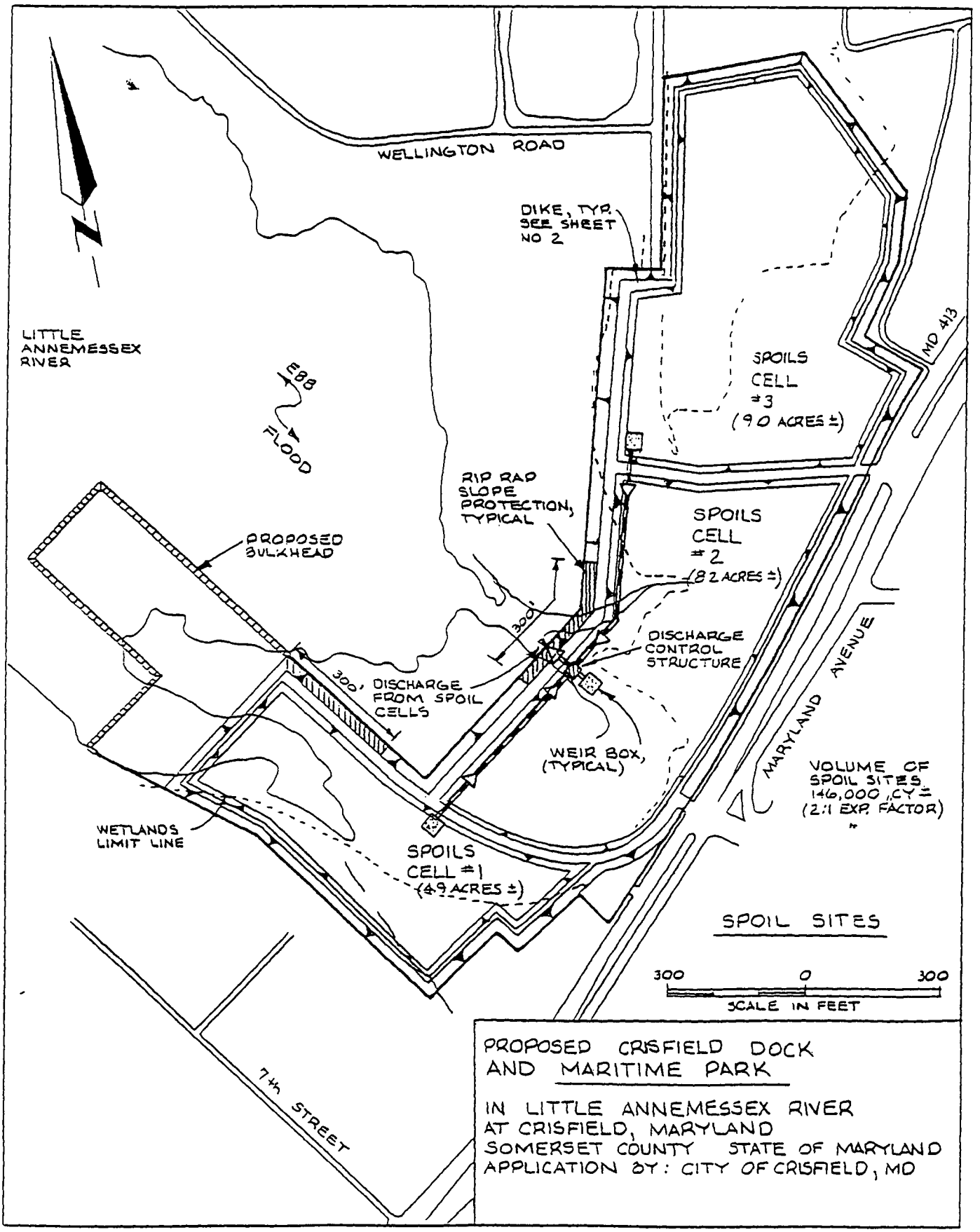
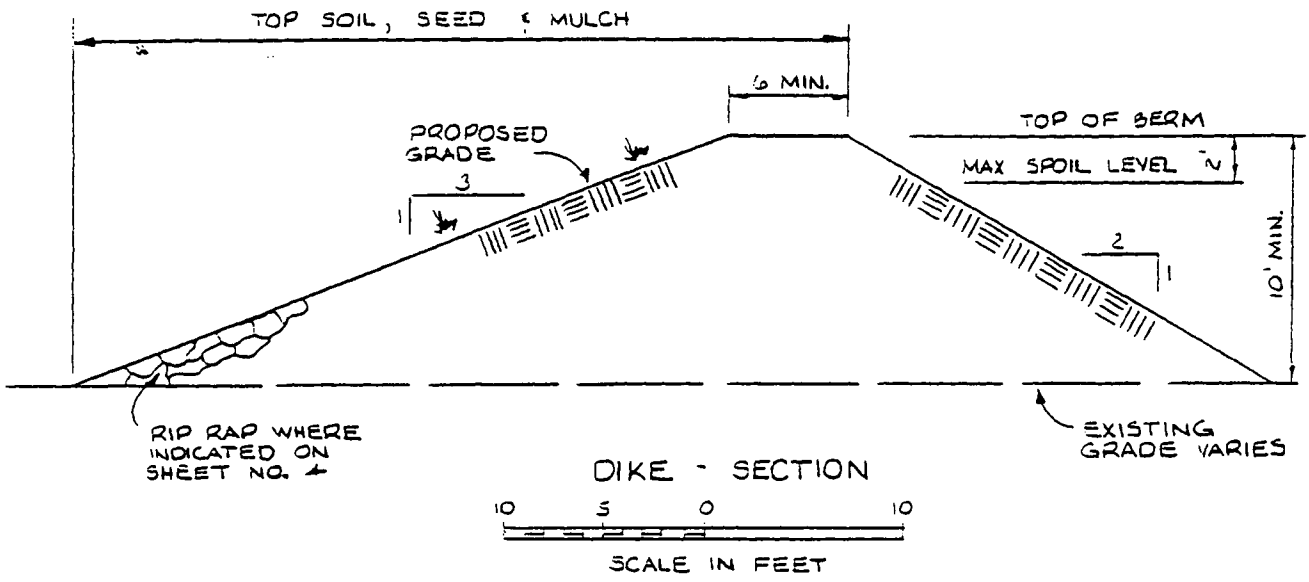


EXHIBIT VII-A



DIKE - SECTION

10 5 0 10

SCALE IN FEET

ADJACENT PROPERTY OWNERS

1 STEUART TRANSPORTATION
2 DELMARVA POWER & LIGHT
3 EASTERN SHORE MARKET INC
4 CANES RENTALS INC
5 MC KENZIE BROWN
6 SARAH WISE
7 ELIZABETH BROWN
8 ELIZABETH GLASER
9 GRACIE TAYLOR
10 JESSE BYRD
11 MT CARMEL HOLINESS CHURCH
12 EMMA JEWETT
13 WESLEY BALLARD
14 FRANK TAYLOR
15 CHARLES WICKS
16 VINCENT BONOMHA
17 LILLIAN & ROGER FORBUSH
18 JOHN REVELLE
19 JOHN STERLING

NOTES

1 DIKE TO BE CONSTRUCTED WITH MATERIAL FROM AN UPLAND BORROW PIT

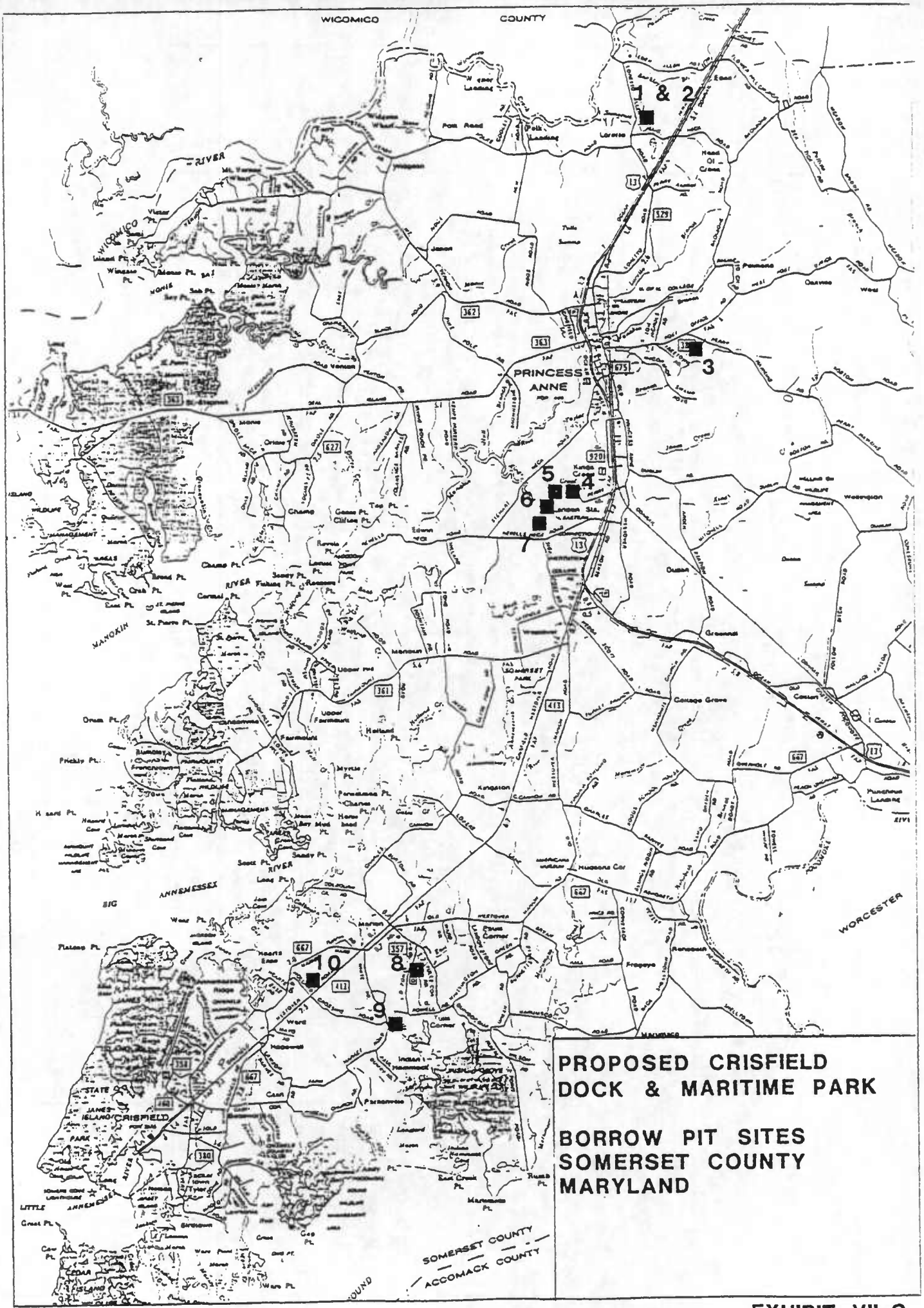
2 EXISTING ORGANIC MATERIAL BELOW PROPOSED DIKE LOCATION TO BE REMOVED

ADJACENT PROPERTY OWNERS

PROPOSED CRISFIELD DOCK AND MARITIME PARK

IN LITTLE ANNEMESSEX RIVER
AT CRISFIELD, MARYLAND
SOMERSET COUNTY STATE OF MARYLAND
APPLICATION BY: CITY OF CRISFIELD, MD

EXHIBIT VII-B



PROPOSED CRISFIELD DOCK & MARITIME PARK

BORROW PIT SITES SOMERSET COUNTY MARYLAND

EXHIBIT VII-C

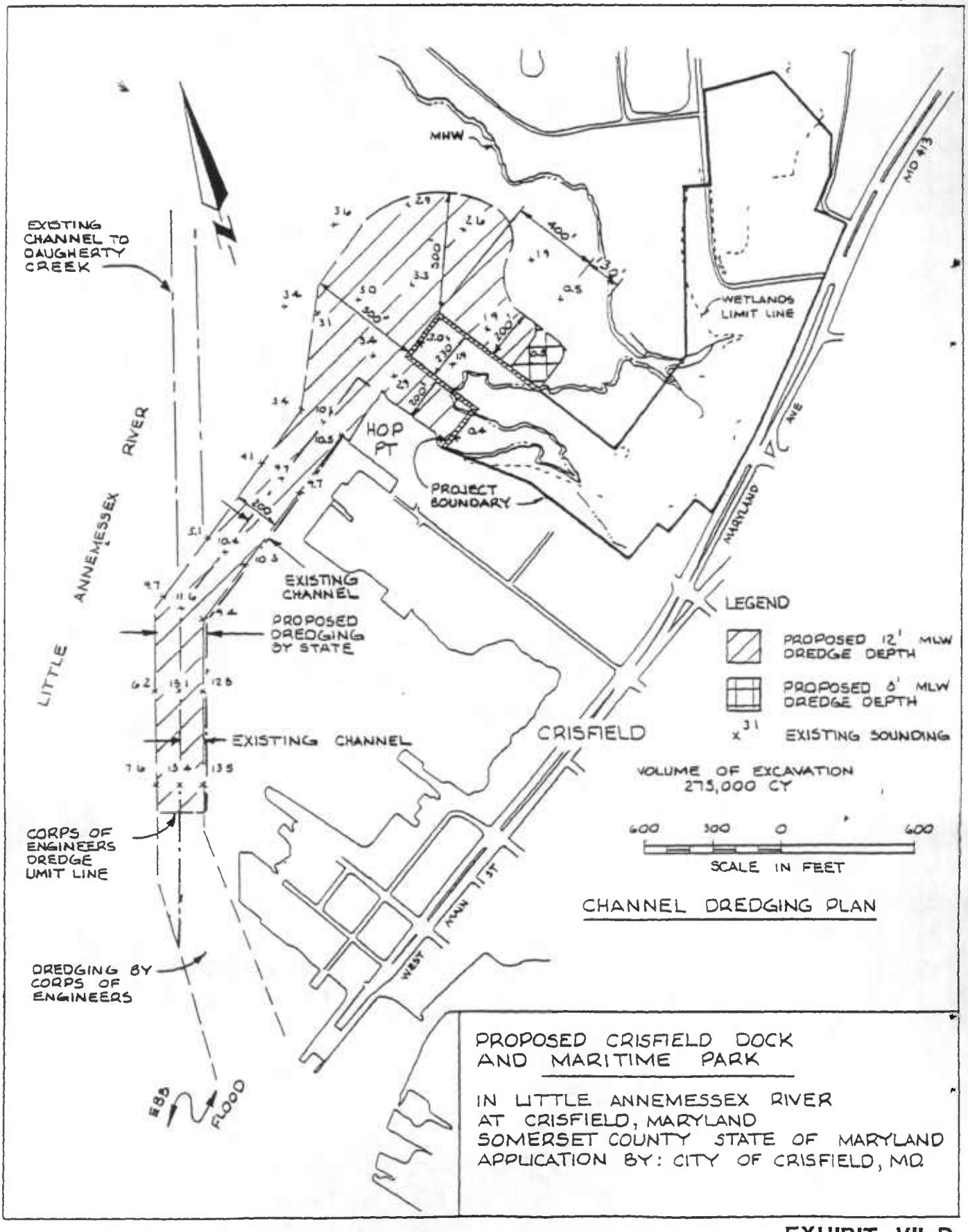
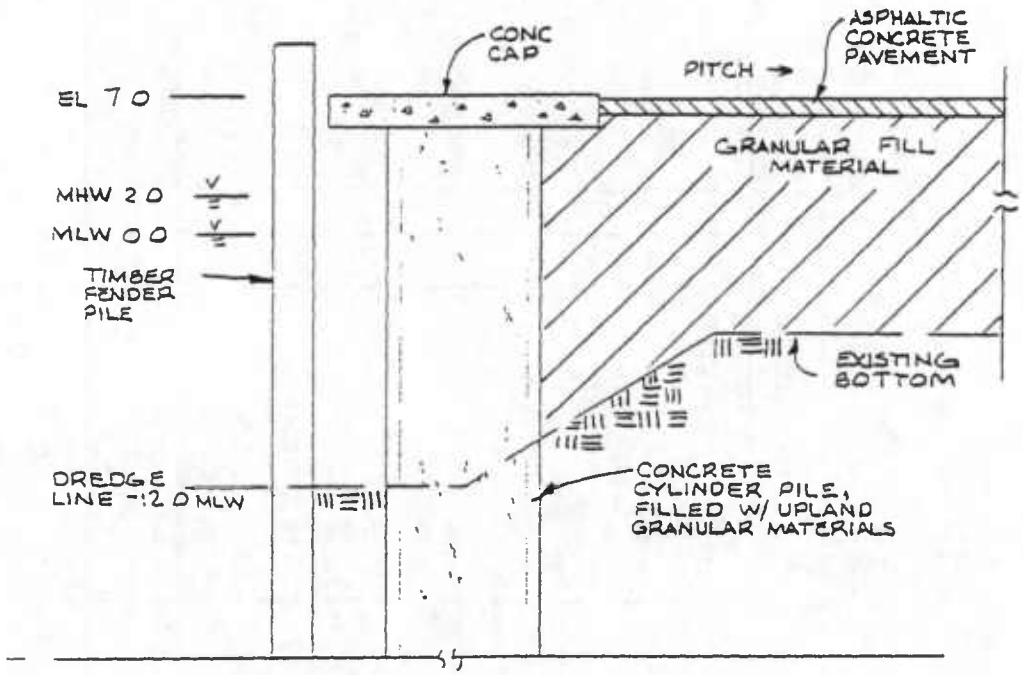


EXHIBIT VII-D



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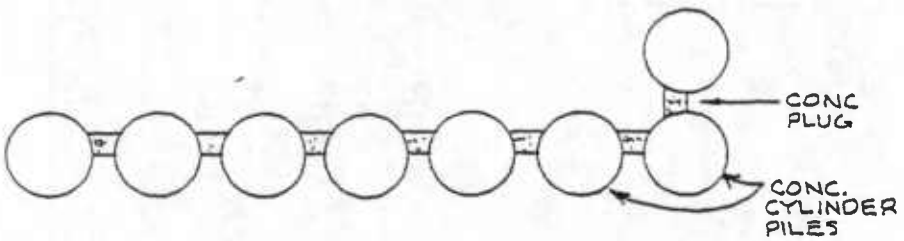


PLAN
NO SCALE

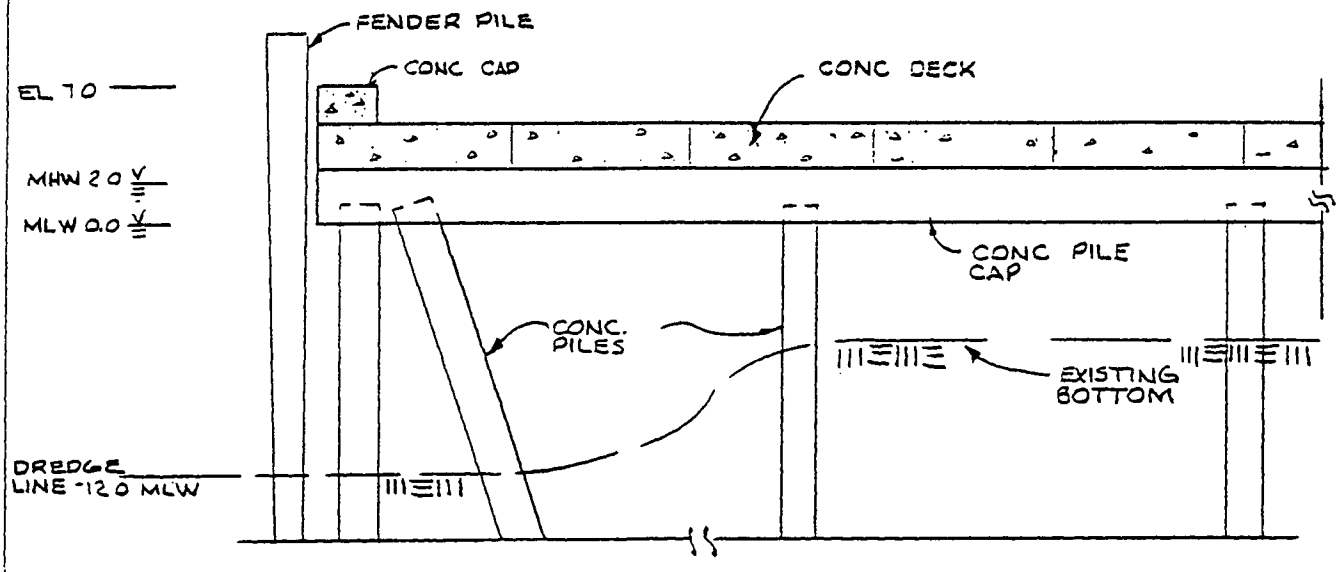
PRE CAST CONCRETE CYLINDER BULKHEAD

DOCK CONSTRUCTION - ALTERNATE #1

PROPOSED CRISFIELD DOCK AND MARITIME PARK

IN LITTLE ANNEMESSEX RIVER
AT CRISFIELD, MARYLAND
SOMERSET COUNTY STATE OF MARYLAND
APPLICATION BY: CITY OF CRISFIELD, MD

EXHIBIT VII-E



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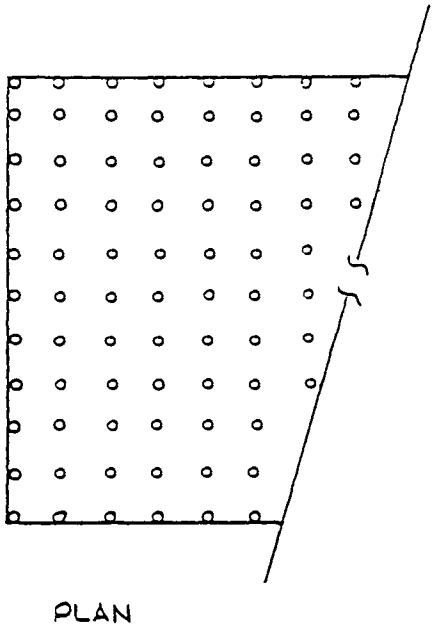


PLAN
NO SCALE

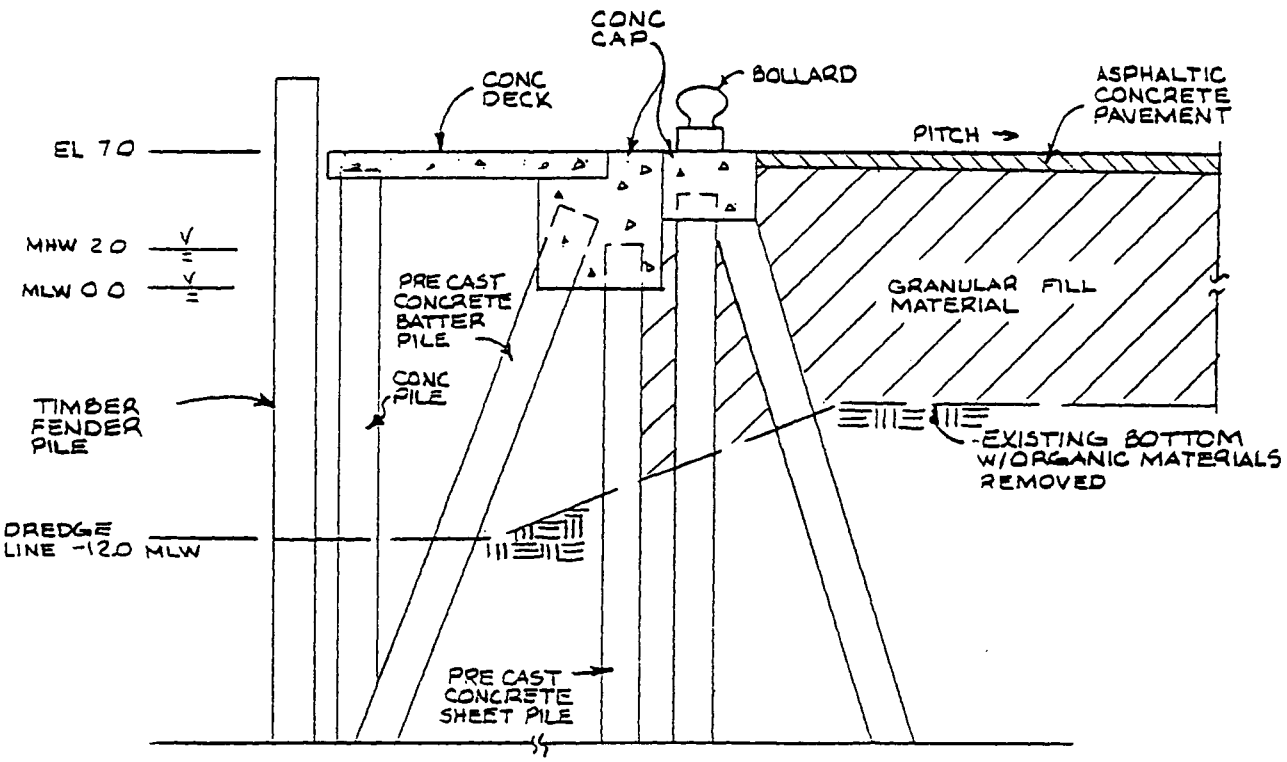
BRIDGE - DECK LOADING FACILITY

DOCK CONSTRUCTION - ALTERNATE #2

PROPOSED CRISFIELD DOCK AND MARITIME PARK

IN LITTLE ANNEMESSEX RIVER
AT CRISFIELD, MARYLAND
SOMERSET COUNTY STATE OF MARYLAND
APPLICATION BY: CITY OF CRISFIELD, MD

EXHIBIT VII-F



SECTION

NO SCALE

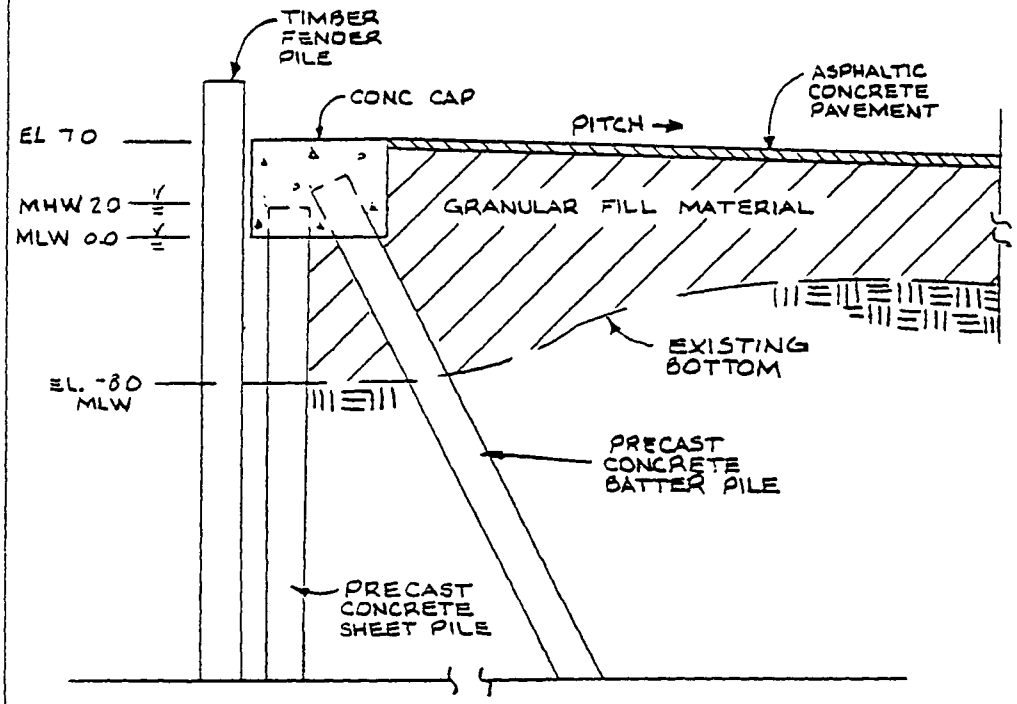
PRE CAST CONCRETE BULKHEAD

DOCK CONSTRUCTION - ALTERNATE #3

PROPOSED CRISFIELD DOCK AND MARITIME PARK

IN LITTLE ANNEMESSEX RIVER
AT CRISFIELD, MARYLAND
SOMERSET COUNTY STATE OF MARYLAND
APPLICATION BY: CITY OF CRISFIELD, MD

EXHIBIT VII-G



SECTION
NO SCALE

PRECAST CONCRETE BULKHEAD @ SHALLOW DREDGE DEPTH

DOCK CONSTRUCTION - ALTERNATE #4

PROPOSED CRISFIELD DOCK AND MARITIME PARK

IN LITTLE ANNEMESSEX RIVER
AT CRISFIELD, MARYLAND
SOMERSET COUNTY STATE OF MARYLAND
APPLICATION BY: CITY OF CRISFIELD, MD

EXHIBIT VII-H

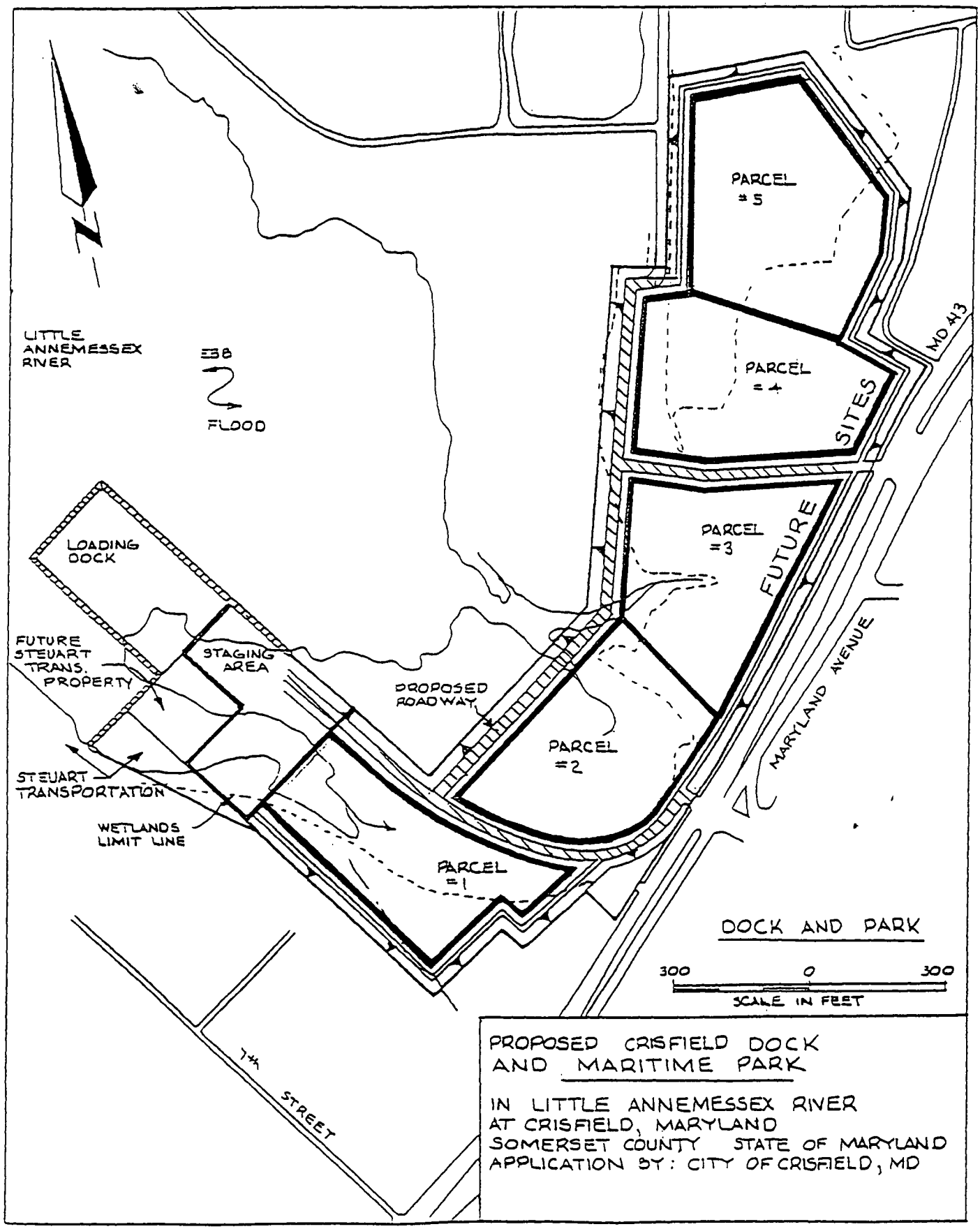


EXHIBIT VII-I

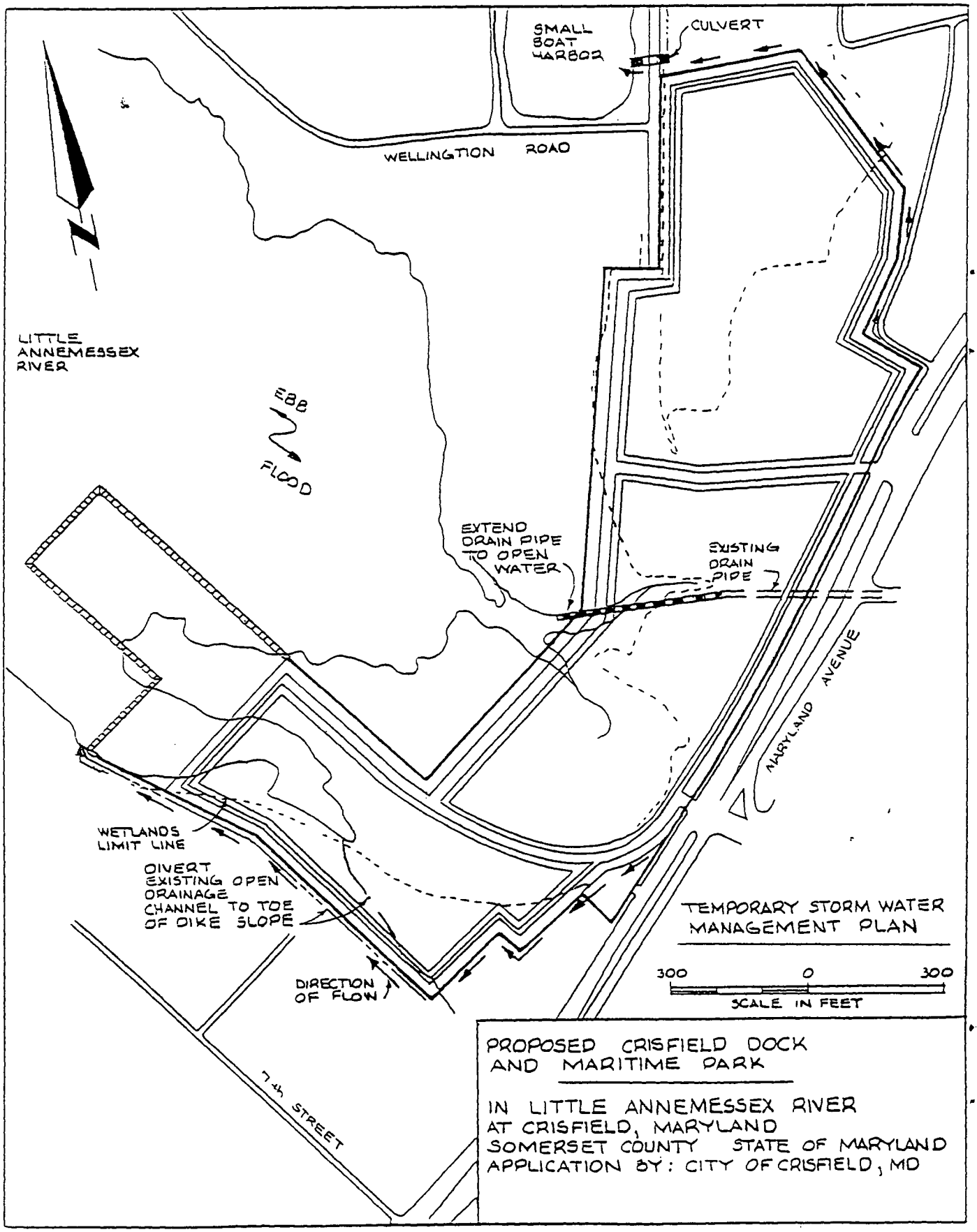


EXHIBIT VII-J

SINCE
1881

FROEHLING & ROBERTSON, INC.
FULL SERVICE LABORATORIES • ENGINEERS & CHEMISTS
"OVER ONE HUNDRED YEARS OF SERVICE"

1411-A S Salisbury Blvd.
Salisbury, MD 21801
(301) 749-3322
March 24, 1988

Davis, Bowen & Friedel, Inc
One Plaza East, Suite 200
Salisbury, Maryland 21801
ATTN: John A Davis, P E

RE: Subsurface Exploration and Geotechnical
Engineering Evaluation
Crisfield Maritime Industrial Park
Crisfield, Maryland
F & R Project No 0-73-250

Gentlemen:

Froehling & Robertson, Inc has completed the authorized exploration study and geotechnical engineering evaluation for the referenced project This report discusses subsurface conditions, field and laboratory testing and provides design and construction recommendations pertaining to earth-related development The testing and engineering services were provided in general accordance with our February 12, 1988 proposal

Included hereinafter are evaluations and recommendations regarding expected settlements at the dredge spoils site, estimated drainage times and permeabilities of dredge materials and estimated soil strength parameters for bulkhead design Our field and laboratory test data will be forwarded in a supplement to this report

We have appreciated this opportunity to be of service. If you have any questions regarding the contents of this report or if we may be of further assistance, please contact our office

Respectfully,

FROEHLING & ROBERTSON, INC

Michael T. Forwood

Michael T Forwood
Engineering Staff

John D Hynes, P E.
Manager

Linda Flood for
Daniel S Rom, P E
Senior Engineer

REPORT OF
SUBSURFACE EXPLORATION
AND
GEOTECHNICAL ENGINEERING EVALUATION

CRISFIELD MARITIME INDUSTRIAL PARK
CRISFIELD, MARYLAND

PREPARED FOR
DAVIS, BOWEN & FRIEDEL, INC.

MARCH 24, 1988
F & R PROJECT NO. 0-73-250

TABLE OF CONTENTS

PURPOSE AND SCOPE

The purpose of this study was to explore the referenced land parcel and proposed offshore dredge site basin to establish engineering recommendations regarding:

1. Bulkhead design and construction.
2. Settlement at the dredge disposal site.
3 Acceptability of dredge materials for fill and the estimated time rate of consolidation of dredge materials.
4. Underground utility construction.
5. Groundwater and drainage.
6 Other aspects of the design and construction for the proposed development indicated by the exploration.

The field and laboratory test data used in our evaluation are also described and will be presented in a supplement to this report Additional evaluations and recommendations can be provided upon request.

FIELD EXPLORATION AND STUDY

In order to determine the nature of the subsurface conditions at the site, twenty-four (24) test borings were drilled at locations identified on the boring location plan. The test boring locations and depths were specified by D B.F. following discussions with F&R regarding the project requirements. The boring program included ten (10), fifteen (15) foot water borings at the proposed dredge site (B-1, 2, 3, 4, 5, 6, 9, 10, 11 and 14), five (5) deep (40 and 50 foot) water borings at the proposed bulkhead line (B-7, 8, 12, 13 and 15) and nine (9) land borings to alternating 25 and 40 foot depths at the proposed dredge disposal site.

The land borings were located in the field by pacing from existing landmarks. The Project Surveyor is to locate the actual boring locations in the field and indicate the test boring locations and elevations on a topographical plan.

The Surveyor established a series of lines on land to be used by F&R to locate the water borings F&R used the linear control and measured distances to locate the water borings. Due to the technique used and the rough water conditions at the time of our exploration, the water boring locations should be considered approximate. A realistic degree of accuracy would be plus or minus ten (10) to fifteen (15) feet.

The land borings were drilled during the period of February 22 to March 10, 1988, and the water borings were drilled during the period of February 25 to March 7, 1988. Trailer- and truck-mounted CME-45 drilling equipment was used to drill the land borings. Crane mats and an excavator assisted our equipment in mobilizing to boring B-17, 19 and 22. A skid CME-45 drill rig was mounted on a portable drilling barge/platform and was towed by boat to the water boring locations.

The test drilling and sampling operations were conducted in accordance with ASTM Specification D-1586. A brief description of our field procedures is included in the Appendix. The results of all boring and sampling operations are shown on the boring logs

Samples of the subsurface soils were examined by the Geotechnical Engineer, and were visually classified in accordance with the Unified Soil Classification System Unified Soil Classification Symbols appear on the boring logs, and a key to the system nomenclature is provided in the Appendix of this report. Also included are reference sheets which define the terms and symbols used on the boring logs and explain Standard Penetration Test procedures

Laboratory testing included gradation analysis, Atterberg Limits testing (liquid and plastic), consolidation testing, remolded permeability tests and natural moisture content testing The results of these tests will be presented in a supplement to this report

GENERAL SUBSURFACE CONDITIONS: LAND BORINGS

At the time our field exploration was conducted, the land parcel was clear of trees and development. Generally, the site was covered by a mat of grasses of differing types including "swamp grass" Some areas had sparse brush coverage and stands of "elephant grass", such as B-17 and B-20.

At all boring locations except B-18, an Organic SILT and Peat layer was identified to depths ranging from 1 0 foot at boring B-24 to 6 0 feet at boring B-22. A thin fill layer was identified at borings B-16, 18 and 21, which varied in thickness from 4 inches at boring B-16 to 2 5 feet at boring B-18. The noted organic soil layer was characterized by Standard Penetration Resistance values (N-values) of 1 to 11 blows per foot. This range of penetration resistance indicates in-place consistencies of very soft to stiff.

Below the organic soil and fill layers, interbedded clays, silts and sands were encountered to termination depths. These materials, which were classified as Sandy CLAY, Silty CLAY, Clay SILT, SILT,

Sandy SILT, Silty SAND and SAND, were characterized by N-values of Weight of Hammer (W.O.H.) to 77 blows per foot. This range of penetration resistance indicates in-place consistencies of very soft to hard or relative densities of very loose to very dense

Water level readings were taken upon completion of each test boring. The water level depths ranged from 2 5 feet at B-17 to 6.0 feet at B-18. However, during and following precipitation, we expect water levels near the ground surface (approximately minus 6 inches) at the lowest areas, such as B-17.

GENERAL SUBSURFACE CONDITIONS: WATER BORINGS

The water levels indicated on the boring logs indicate depths at approximately high tide. As indicated on the boring logs, water level depths ranged from 2 5 feet at B-12 to 6.0 feet at B-2. Soundings should be taken to accurately determine the water level depths. Note that borings B-1 through B-15 are considered "water borings" These borings were drilled from a portable barge.

At the "dredge borings" (B-1, 2, 3, 4, 5, 6, 9, 10, 11 and 14), materials consisting predominantly of silts and sands were identified. These materials were classified as Sandy SILT, Silty SAND and SAND However, at some locations (B-1, 2, 9 and 10), material classified as Silty CLAY and Clayey SILT were encountered at 13 0 to 15 5 feet. Also, some organic sediments were noted as being mixed with the shallow silts and sands at borings B-6, 8, 13 and 14 The materials at the dredge borings were characterized by N-values of W.O H. to 19 blows per foot. This range of penetration resistance indicates in-place consistencies of very soft to very stiff or relative densities of very loose to medium dense

Water borings B-7, 8, 12, 13 and 15 were drilled along the proposed bulkhead line. A review of the boring profiles indicates that interbedded non-plastic and plastic soil layers were encountered at each of these test borings. These materials, which were classified as SAND, Silty Sand, Sandy SILT, Clayey SILT, Silty CLAY and CLAY, were characterized by N-values of W O.H to 106 blows per foot. This range of penetration resistance indicates in-place consistencies of very soft to hard or relative densities of very loose to very dense. Note that organic silts were identified in samples 1 and 2 of boring B-8, and in samples 1 and 5 of boring B-13.

LOCAL GEOLOGY

The "Crisfield Maritime Industrial Park" site lies within the Atlantic Coastal Plains deposits of southwestern Somerset County,

Maryland. The Atlantic Coastal Plains physiographic province is characterized by deep alluvial deposits of layered and mixed sediments.

Based upon the visual characteristics of the soil samples obtained during the exploration phase and available geological information for the Crisfield area, materials of the Tidal Marsh Deposits were identified shallow This formation is of the Holocene Era of the Quaternary Age. The Tidal Marsh Deposits at the site were characterized by Organic Silt and Peat materials, and were found to depths of 1.0 to 6.0 feet. Below these organic materials and at the river bottom, materials believed to be of the Yorktown or Cohansey Formation were identified. These materials are thought to be of the Miocene Era of the Tertiary Age. Commonly, this Formation contains interbedded silt-clays and sands. Fossils are also common in this formation. However, none were identified in the test boring samples.

PROJECT CHARACTERISTICS

Basically, the development program is to include the dredging of a shallow basin (location indicated on site plan) to approximately minus 12 elevation (from sea level), and the placement of the spoils on the "fast land" adjacent to the basin (south and southeast) The spoils area will be dedicated to and utilized for industrial sites of the "Crisfield Maritime Industrial Park" In addition, the development is to include provisions for public utilities (roads, sewer, water and gas) to service the industrial park.

EVALUATION

An evaluation of the subsurface conditions and dredge materials, with respect to settlement at the made land areas, consolidation of the spoil materials and expected soil strength parameters along the bulkhead, are provided herein. Our evaluation and recommendations are based on our understanding of the proposed development, the data obtained from the soil borings and laboratory testing and our experience with similar subsurface conditions and projects. If there are any significant changes to the project characteristics such as revised elevations, changed bulkhead alignment, revised dredging depths, etc., we request that this office be notified so the recommendations of this report can be re-evaluated.

A. Made Land: Settlement Evaluation

We have estimated settlement at the dredge spoil site considering added overburden (fill) increments of 3 0, 6 0 and 9 0 feet, the soil boring data and the consolida-

tion test results. The estimated ranges of settlements and their corresponding settlement periods are as follows:

3.0 foot overburden: 0 5 to 0.7 inches
1-1.5 month settlement period

6.0 foot overburden: 1.5 to 2.0 inches
2-3.5 month settlement period

9 0 foot overburden: 4 to 6 inches
5-8 month settlement period

We recommend the use of settlement monitoring devices (settlement plates and posts). The settlement elevation readings can be used to compare the predicted versus the actual settlement In addition, the settlement curve can be plotted so that the owner can anticipate the earliest possible development dates at the site. Since the dredge spoil materials are primarily SANDS and SILTY SANDS, the consolidation of the natural organic layer will be the controlling factor regarding time rate of settlement

B. Consolidation of Dredge Materials

The test borings indicate that the materials to be dredged are predominately silty SANDS and SANDS These materials will be acceptable for use as structural fill. Note,however, that organic sediments were identified in Borings B-6, 8 and 13, and that silty CLAYS and clayey SILTS were identified at depths of 13 0 to 15 5 feet in Borings B-1, 2, 9 and 10 These plastic soils are located near the dredge limit. Organic soils and some clay materials will be unacceptable for structural fill These soils should be identified in the exploration phase on the individual site development projects and during the proofrolling stage of construction.

Falling Head Permeability Tests were performed on three (3) samples taken from the dredge site borings The test samples and results are as follows:

Sample 1: Boring B-2: $K_{20} = 7\ 44 \times 10^{-2}$ CM/S

Sample 2: Boring B-14: $K_{20} = 8\ 43 \times 10^{-2}$ CM/S

Sample 3: Composite from B-3, 6 and 9: $K_{20} = 4\ 11 \times 10^{-2}$ CM/S

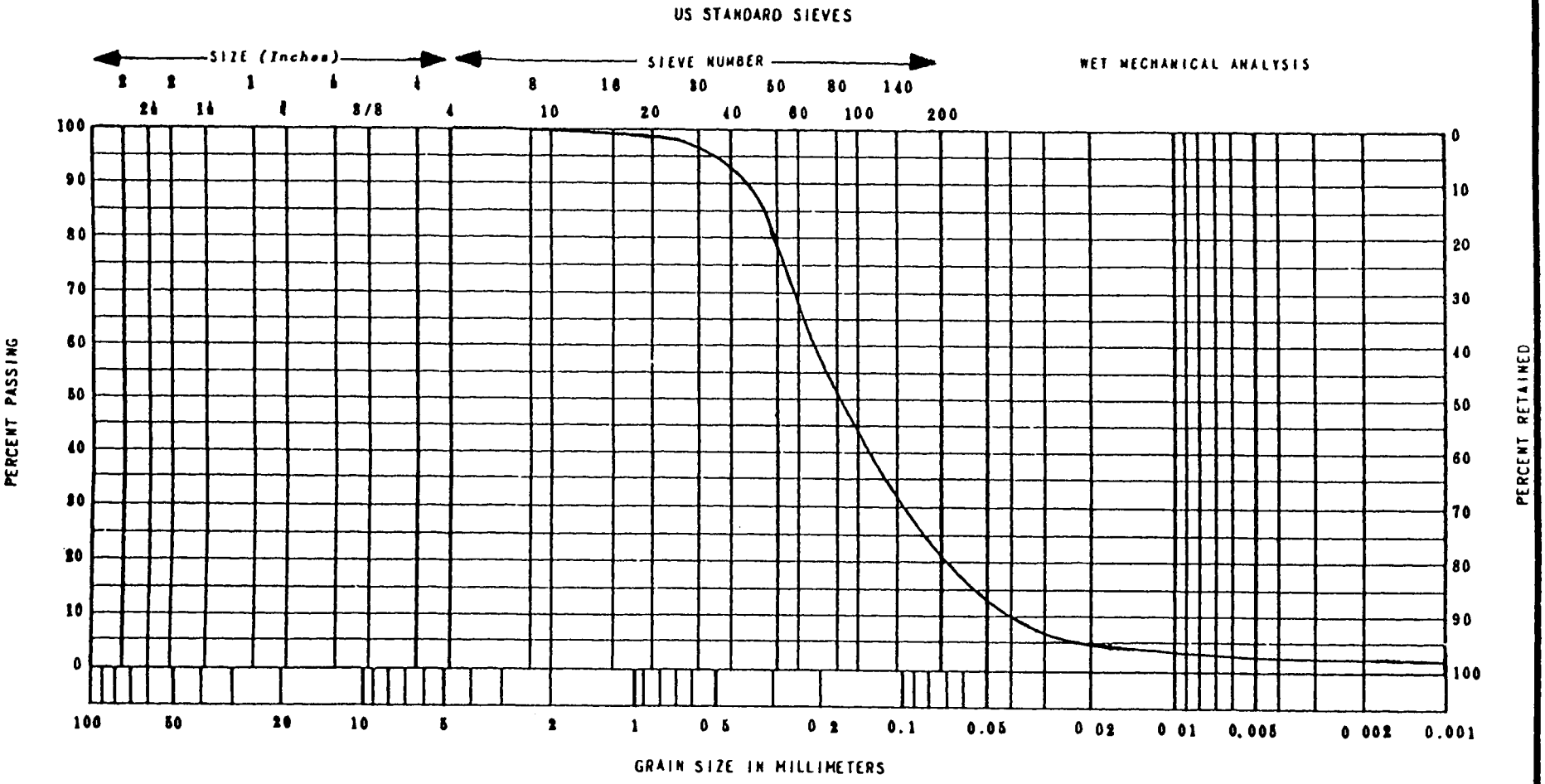
The test results are extremely high permeability rates The test rates are high because the SANDS were uniformly

FROEHLING & ROBERTSON, INC.
FULL SERVICE LABORATORIES • ENGINEERS & CHEMISTS

GRAIN SIZE DISTRIBUTION GRAPH - AGGREGATE GRADING CHART

DATE: April 26, 1988

PROJECT: Crisfield Maritime Industrial Park



EXCAVATION NUMBER	SAMPLE NUMBER	NATURAL % MOISTURE	w_L	w_P	I_P	CLASSIFICATION	REMARKS
B-15	S-2	--	--	--	--	SM	Light brown, silty, fine to medium
							Sand w/trace clay

TECHNICIAN (Signature): D T

PLOTTED BY (Signature): M.T F

CHECKED BY (Signature): Michael Foxwood

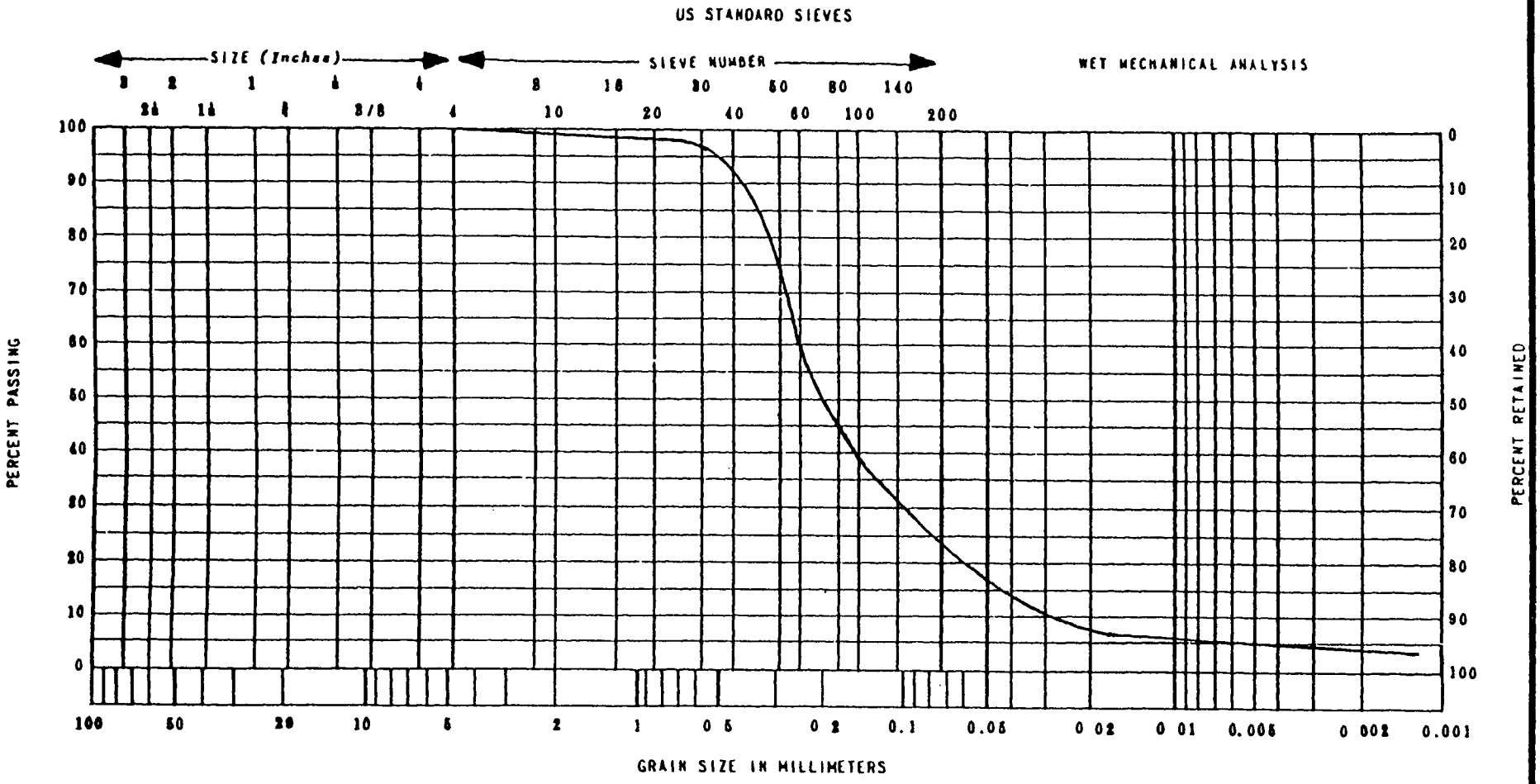
F&R

EROEHLING & ROBERTSON, INC.
FULL SERVICE LABORATORIES ● ENGINEERS & CHEMISTS

GRAIN SIZE DISTRIBUTION GRAPH - AGGREGATE GRADING CHART

DATE: April 26, 1988

PROJECT: Crisfield Maritime Industrial Park



EXCAVATION NUMBER	SAMPLE NUMBER	NATURAL % MOISTURE	w_L	w_P	I_P	CLASSIFICATION	REMARKS
B-10	S-1	--	--	--	--	SM	Gray, silty, fine to med. SAND w/trace clay

TECHNICIAN (Signature): D.T

PLOTTED BY (Signature): M.T.F.

CHECKED BY (Signature): Wilbur Norwood

Form No 110

graded (medium SANDS), and because some of the fines were lost in the sampling process. We anticipate actual permeability values of approximately 1.00 x 10^{-2} CM/S

Because of the high permeability of the dredge spoil materials, the fill will drain very rapidly (almost immediately) Therefore, the controlling time for development will be the consolidation of the natural PEAT/ORGANIC SILT layer (as described above).

Following the runoff of the free water from the dredging process, we estimate consolidation of the dredge material to be on the order of ten (10) percent of the fill height. The dredging contractor should be careful to fill the spoil site evenly Overloading spot locations could create a "mud wave" in the organic soil layer

At the time of development of the spoil site, shallow improvement of the soil material will likely be necessary All structural and pavement areas should be proofrolled to determine the stability of the fill layer and to locate any isolated areas requiring improvement. Pockets of silts or organics soils may form in the dredging process Note that removal and "controlled" replacement of two (2) to three (3) feet of material may be necessary at developed areas (e.g , pavement subgrades) in order for the fill to perform well under the imposed loading conditions Most of the "removed" materials would be acceptable for re-use.

C. **Bulkhead** Construction

Refer to the Appendix for the estimated ranges of soil strength parameters and "moist" unit weights based upon the Standard Penetration Test values, laboratory test results visual soil classifications and our experience with similar soil conditions.

D. **Underground Utilities**

If at all possible, underground utility lines should be installed in the granular material above the organic soil layers. However, frost protection must be considered. Consolidation of the organic soil layer and consolidation and drainage of the dredge spoils should be allowed prior to utility construction. Structures relating to utility construction (manholes, pump stations, etc.) may require deep foundations or overexcavation and subgrade improvement. Depending upon when development at the industrial park occurs and the type of development and loading

conditions, flexible utility connections may be necessary to minimize the effects of differential settlement at service connections.

E. **Groundwater and Drainage**

If the utility lines are installed in the fill layer following settlement and drainage as recommended above, no serious groundwater related problems are anticipated. Some water infiltration could occur as a result of surface runoff or perched water, but this should be controlled easily by means of sump pit and pump or gravity ditching procedures.

Groundwater will likely be encountered in any excavations into the natural soils. Suitable dewatering measures should be implemented to facilitate construction at those excavations (such as the use of a well point system)

REMARKS

This report has been prepared to aid in the evaluation of this site for the proposed Site Development for the "Crisfield Maritime Industrial Park."

These analyses and recommendations are, of necessity, based on the concepts made available to us at the time of the writing of this report and on-site conditions, surface and subsurface that existed at the time the exploratory borings were drilled. Further assumption has been made that the limited exploratory borings, relation both to the areal extent of the site and to depth, are representative of conditions across the site. If conditions are encountered during construction which differ significantly from those reported herein, we request that we be notified immediately so our analyses and recommendations can be reviewed and revised as necessary It is also recommended that we be given the opportunity to review the plans and specifications in order to comment on the interaction of soil conditions as described herein and the design requirements

Our professional services have been performed, our findings obtained and our recommendations prepared in accordance with generally accepted engineering principles and practices. This warranty is in lieu of all other warranties, either implied or expressed. The Geotechnical Engineer assumes no responsibility for interpretations made by others based upon the work or recommendations made herein.

APPENDIX

1. Investigative Procedures
2. Project Location Map
3 Test Boring Location Sketch
4 Boring Logs
5 Soil Strength Parameters and Unit Weights
6. Unified Soil Classification Sheet
7 Field Classification Sheet

INVESTIGATIVE PROCEDURES

SOIL TEST BORINGS

Soil drilling and sampling operations were conducted in accordance with ASTM Specifications D-1586. The borings were advanced by mechanically turning continuous hollow-stem auger flights into the ground. At regular intervals, samples were obtained with a standard 1.4-inch I.D , 2.0-inch O.D splitspoon sampler The sample was the first seated 6 inches to penetrate any loose cuttings and then driven an additional foot with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the final foot is the "Standard Penetration Resistance". The penetration resistance, when properly evaluated, is an index to the soil's strength, density and behavior under applied loads. The soil descriptions and penetration resistances for each boring are presented on the Test Boring Records in the Appendix.

SOIL CLASSIFICATION

Soil classifications provide a general guide to the engineering properties of various soil types and enable the engineer to apply his past experience to current conditions. In our investigation, jar samples obtained during drilling operations are examined in our laboratory and visually classified by the geotechnical engineer in accordance with ASTM Specification D-2488. The soils are classified according to the AASHTO or Unified Soil Classification System (ASTM D-2487) Each of these classification systems and the in-place physical soil properties provides an index for estimating the soil's behavior

ATTERBERG LIMITS

Portions from representative soil samples obtained during drilling operations were selected for Atterberg Limits Tests. The Atterberg Limits are indicative of the soil's plasticity characteristics. The soil's plasticity index (PI) is representative of this characteristic and is the difference between the liquid and plastic limits. The liquid limit is the moisture content at which the soil will flow as a heavy viscous fluid and is determined in accordance with ASTM Specification D-4318. The plastic limit is the moisture content at which the soil begins to loose its plasticity and is determined in accordance with ASTM Specification D-4318

COMPACTION TEST

Representative samples of the proposed subgrade soils were obtained for laboratory compaction testing Standard Proctor compaction tests (ASTM D-698) were performed on these soils to determine its compaction characteristics, including its maximum dry density and optimum moisture content.

PERMEABILITY TEST: FALLING HEAD

The coefficient of permeability (K_20) was determined for samples collected and recompacted in a standard proctor mold at a given percent compaction (90 or 95%). Adjustments were made for readings made at temperatures other than 20° C using the recommended viscosity table for NT/N20 Results are expressed in centimeters/second

GRAIN SIZE TEST

Grain Size Tests were performed to determine the particle size and distribution of the samples tested. The grain size distribution of soils coarser than a No. 200 sieve was determined by passing the samples through a standard set of nested sieves. The material retained on the No. 100 and No 200 sieves were washed to better determine the percent passing those sieves This is done in order to better distinguish borderline fine/granular soils Materials passing the No. 200 sieve were suspended in water and the grain size distribution was determined by the rate of settlement (D-421 and D-422).

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DATE: 7-24-88
SCALE: 1" = 1.4 miles
DRWN:

Project Site Map
Crisfield Maritime Industrial Park
Crisfield, Maryland

DWG NO
0-73-250-1

FORM NO 103

FREDERICK & ROBERTSON, INC.

SCALE: NTS	F&R PROJECT:	DRAWN BY
DATE: 3-24-88	0-73-250	REVISED

Boring Location Sketch

Crisfield Maritime Industrial Park
Crisfield, Maryland

DRAWING NUMBER
0-73-250-2

Form No. 504

Form No 500

BORING LOG

SINCE 1881

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"OVER ONE HUNDRED YEARS OF SERVICE"

Report No 0-73-250 DATE March 23, 1988

Client: Davis, Bowen and Friedel, Inc.

Project: Crisfield Maritime Industrial Park

Boring No: B-1 | Total Depth: 16 ft | Elevation: * 0.0 ft. | Location: See Boring Location Plan

Type of Boring: Mud Rotary | Started: 3-3-88 | Completed: 3-3-88 | Driller: J. Burch

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	Sample Blows	Sample Depth (Feet)	% Core Recovery	REMARKS
0.0	0.0	WATER				GROUNDWATER DATA Water at top of boring WOH - Weight of Hammer
-5 0	5 0	Light brown to gray, wet, very loose, silty, fine to med SAND (SM)	WOH	6 5		Test boring located in field by F&R using plans provided by the client
-8 5	8 5	Light brown, wet, loose, fine to med SAND w/little silt (SM)	4 3-3	11 0		*Top of bulk head at Steward Shipyard used as datum (2 5 ft) Water level at approximately mean tide (0 0 ft) elevation should be considered as approximate
-15 5	15 5		5			
-16 0	16 0	**	3-3	16 0		**Dark gray, wet, med stiff, silty CLAY w/littl fine sand (CL)
		Boring termination @ 16 0 feet				

No of blows req d for a 140 lb hammer dropping 30 in to drive 2 in O D 1 375 in I D sampler a total of 18 inches in three 6 in increments The sum of the last two increments of penetration is termed the standard penetration resistance N

Scale 1 =5 unless otherwise noted

Form No 500

BORING LOG

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Report No 0-73-250 DATE March 23, 1988

Client: Davis, Bowen and Friedel, Inc.

Project: Crisfield Maritime Industrial Park

Boring No: B-2 | Total Depth: 16 ft. | Elevation: * 0.0 ft. | Location: See Boring Location Plan

Type of Boring: Mud Rotary | Started: 3-1-88 | Completed: 3-1-88 | Driller: J. Burch

Elevation 0.0	Depth 0.0	DESCRIPTION OF MATERIALS (Classification)	Sample Blows	Sample Depth (Feet)	% Core Recovery	REMARKS
		WATER				GROUNDWATER DATA Water at top of boring WOH - Weight of Hammer
-6 0	6 0	Dark gray, wet, very loose, sandy organic SILT (OL)	WOH	7 5		Test boring located in field by F&R using plans provided by the client
-8 5	8 5	Dark gray, wet, med dense, silty, fine to med , organic SAND (SM)	4 5-6	11 0		*Top of bulk head at Steward Shipyard used as datum (2 5 ft) Water level at approximately mean tide (0 0 ft) elevation should be considered as approximate
-14 5	14 5	Gray, wet, very soft, clayey SILT (ML)	1 1-1	16 0		
-16 5	16 0	Boring termination @ 16 0 feet				

No of blows req d for a 140 lb hammer dropping 30 in to drive 2 in O D 1 375 in I D sampler a total of 18 inches in three 6 in increments The sum of the last two increments of penetration is termed the standard penetration resistance N

Scale 1 =5 unless otherwise noted

BORING LOG

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Report No 0-73-250 DATE March 23, 1988

Client: Davis, Bowen and Friedel, Inc.

Project: Crisfield Maritime Industrial Park

Boring No: B-3 | Total Depth: 16 ft. | Elevation: * 0.0 ft. | Location: See Boring Location Plan

Type of Boring: Mud Rotary | Started: 3-2-88 | Completed: 3-2-88 | Driller: J. Burch

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	Sample Blows	Sample Depth (Feet)	% Core Recovery	REMARKS
0.0	0.0	WATER				GROUNOWATER DATA Water at top of boring WOH - Weight of Hammer
-5 0	5 0	Dark gray, wet, very loose, sandy SILT (ML)	WOH	6 5		Test boring located in field by F&R using plans provided by the client
-9 0	9 0	Light brown to light gray, wet, very loose, silty, fine to coarse SAND (SM)	2 2-1	11 0		*Top of bulk head at Steward Shipyard used as datum (2 5 ft) Water level at approximately mean tide (0 0 ft) elevation should be considered as approximate
-13 0	13 0	Dark gray, wet, med stiff, sandy ORGANIC SILT (OL)	4 5-4	16 0		
-16 0	16 0	Boring termination @ 16 0 feet				

No of blows req d for a 140 lb hammer dropping 30 in to drive 2 in O D 1 375 in I D sampler a total of 18 inches in three 6 in increments The sum of the last two increments of penetration is termed the standard penetration resistance N

Scale 1 =5 unless otherwise noted

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Report No 0-73-250 DATE March 23, 1988

Client: Davis, Bowen and Friedel, Inc.

Project: Crisfield Maritime Industrial Park

Boring No: B-4 | Total Depth: 16 ft. | Elevation: * 0.0 ft. | Location: See Boring Location Plan

Type of Boring: Mud Rotary | Started: 3-2-88 | Completed: 3-2-88 | Driller: J. Burch

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	Sample Blows	Sample Depth (Feet)	% Core Recovery	REMARKS
0.0	0.0	WATER				GROUNOWATER OATA Water at top of boring WOH - Weight of Hammer
-5 0	5 0	Light brown to gray, wet, very loose, silty, fine to med SAND w/little clay & a trace organic material (SM)	WOH	6 5		
-7 5	7 5	Light brown to gray, wet, very loose, fine to coarse SAND w/little silt (SM)	2 2-1	11 0		Test boring located in field by F&R using plans provided by the client *Top of bulk head at Steward Shipyard used as datum (2 5 ft) Water level at approximately mean tide (0 0 ft) elevation should be considered as approximate
-13 0	13 0	Dark gray to brown, wet, loose, silty, fine to med SAND w/little clay (SM)	3 2-4	16 0		
-16 0	16 0	Boring termination @ 16 0 feet				

No of blows req d for a 140 lb hammer dropping 30 in to drive 2 in O D 1 375 in I D sampler a total of 18 inches in three 6 in increments The sum of the last two increments of penetration is termed the standard penetration resistance N

Scale 1"=5 unless otherwise noted

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Report No 0-73-250 DATE March 23, 1988

Client: Davis, Bowen and Friedel, Inc.

Project: Crisfield Maritime Industrial Park

Boring No: B-5 | Total Depth: 16 ft. | Elevation: * 0 0 ft. | Location: See Boring Location Plan

Type of Boring: Mud Rotary | Started: 3-3-88 | Completed: 3-3-88 | Driller: J. Burch

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	Sample Blows	Sample Depth (Feet)	% Core Recovery	REMARKS
0.0	0.0	WATER				GROUNOWATER DATA Water at top of boring WOH - Weight of Hammer
-5 0	5 0	Light gray, wet, very loose, silty, fine to med, SAND w/trace organic material (SM)	WOH	6 5		Test boring located in field by F&R using plans provided by the client
-8 5	8 5	Light gray to light brown, wet, loose, fine to med SAND w/little silt (SM)	4 5-4	11 0		*Top of bulk head at Steward Shipyard used as datum (2 5 ft) Water level at approximately mean tide (0 0 ft) elevation should be considered as approximate
-15 0	15 0		4			
-16 0	16 0	Brown to light gray, wet, very **	1-2	16 0		**loose, med to coarse SAND w/trace silt (SP-SM)
		Boring termination @ 16 0 feet				

No of blows req d for a 140 lb hammer dropping 30 in to drive 2 in O D 1 375 in I D sampler a total of 18 inches in three 6 in increments The sum of the last two increments of penetration is termed the standard penetration resistance N

Scale 1 =5 unless otherwise noted

Form No 500

BORING LOG

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Report No 0-73-250 DATE March 23, 1988

Client: Davis, Bowen and Friedel, Inc.

Project: Crisfield Maritime Industrial Park

Boring No: B-6 | Total Depth: 16 ft. | Elevation: * 0.0 ft. | Location: See Boring Location Plan

Type of Boring: Mud Rotary | Started: 3-2-88 | Completed: 3-2-88 | Driller: J. Burch

Elevation 0.0	Depth 0.0	DESCRIPTION OF MATERIALS (Classification)	Sample Blows	Sample Depth (Feet)	% Core Recovery	REMARKS
		WATER				GROUNDWATER DATA Water at top of boring WOH - Weight of Hammer
-5 0	5 0	Dark gray, wet, very loose, silty, fine to med., organic SAND (SM)	WOH	6 5		
-7 0	7 0	Light brown, wet, very loose, silty, fine to coarse SAND (SM)	2 2-2	11 0		Test boring located in field by F&R using plans provided by the client *Top of bulk head at Steward Shipyard used as datum (2 5 ft) Water level at approximately mean tide (0 0 ft) elevation should be considered as approximate
-14 0	14 0	Dark gray, wet, very loose, clayey, fine to coarse SAND w/little silt (SC)	4 2-3	16 0		
16 0	16 0	Boring termination @ 16 0 feet				

No of blows req d for a 140 lb hammer dropping 30 in to drive 2 in O D 1 375 in I D sampler a total of 18 inches in three 6 in increments The sum of the last two increments of penetration is termed the standard penetration resistance N

Scale 1 =5 unless otherwise noted

Form No 500

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Report No 0-73-250 DATE March 23, 1988

Client: Davis, Bowen and Friedel, Inc.

Project: Crisfield Maritime Industrial Park

Boring No: B-7 | Total Depth: 16 ft | Elevation: * 0.0 ft. | Location: See Boring Location Plan

Type of Boring: Mud Rotary | Started: 3-3-88 | Completed: 3-3-88 | Driller: J. Burch

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	Sample Blows	Sample Depth (Feet)	% Core Recovery	REMARKS
0.0	0.0	WATER				GROUNDWATER DATA Water at top of boring WOH - Weight of Hammer
-4 5	4 5	Gray, wet, very loose, silty, fine to coarse SAND w/trace clay and occasional shell fragments (SM)	WOH	6 0		Test boring located in field by F&R using plans provided by the client
-8 5	8 5	Light brown to light gray, wet, very loose, silty, fine to med SAND with a trace clay (SM)	4 3-2	11 0		*Top of bulk head at Steward Shipyard used as datum (2 5 ft) Water level at approximately mean tide (0 0 ft) elevation should be considered as approximate
-12 0	12 0	Light gray, wet, loose, fine to med SAND w/little silt and a trace organic material and a trace clay (SM)	6 5-2	16 0		
-19 5	19 5	Dark gray, wet, very soft, silty CLAY w/little fine sand (CL)	1 1-1	21 0		
-22 0	22 0	Dark gray, wet, med dense, fine SAND w/little silt, little organic material and occasional clay lenses (SM)	4 8-10	26 0		
-28 0	28 0	Dark gray, wet, stiff, sandy SILT w/little clay and a trace organic material (ML)	4 5-7	31 0		
-34 5	34 5	Brown to light brown to light gray, wet, med dense to very dense, fine to coarse SAND w/little silt and a trace organic material (SM)	4 12-14	36 0		

No of blows req d for a 140 lb hammer dropping 30 in to drive 2 in O D 1 375 in I D sampler a total of 18 inches in three 6 in increments The sum of the last two increments of penetration is termed the standard penetration resistance N

Scale 1 =5 unless otherwise noted

Form No 500

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'OVER ONE HUNDRED YEARS OF SERVICE'

Report No 0-73-250

DATE March 23, 1988

Client: Davis, Bowen and Friedel, Inc.

Project: Crisfield Maritime Industrial Park

Boring No: B-7(Cont) | Total Depth: 16 ft. | Elevation: * 0.0 ft. | Location: See Boring Location Plan

Type of Boring: Mud Rotary | Started: 3-3-88 | Completed: 3-3-88 | Driller: J. Burch

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	Sample Blows	Sample Depth (Feet)	% Core Recovery	REMARKS
-40.0	40.0		*	41 0		GROUNDWATER DATA
-43 0	43 0	Brown to light brown to light gray, wet, med dense to very dense, fine to coarse SAND w/little silt**				*17,22,31
		Dark gray, wet, very dense, fine to coarse SAND w/trace silt and a trace organic material (SP-SM)	45 56-60	46 0		** and a trace organic material (SM)
-48 0	48 0					
-51 0	51 0	DARK GRAY, wet, very dense, silty, fine to med SAND w/trace organic material (SM)	25 30-33	51 0		
		Boring terminated at 51 0 ft				

No of blows req d for a 140 lb hammer dropping 30 in to drive 2 in O D 1 375 in I D sampler a total of 18 inches in three 6 in increments The sum of the last two increments of penetration is termed the standard penetration resistance N

Scale 1 =5 unless otherwise noted

Form No 500

BORING LOG

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"OVER ONE HUNDRED YEARS OF SERVICE"

Report No 0-73-250 DATE March 23, 1988

Client: Davis, Bowen & Friedel, Inc.

Project: Crisfield Maritime Industrial Park

Boring No: B-8 | Total Depth: 51.0 ft. | Elevation: * 0.0 ft. | Location: See boring location plan

Type of Boring: Mud Rotary | Started: 3-7-88 | Completed: 3-7-88 | Driller: J. Burch

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	Sample Blows	Sample Depth (Feet)	% Core Recovery	REMARKS
0 0	0.0	WATER				GROUNDWATER DATA Water at top of boring.
						WOH - Weight of hammer
-5 0	5 0	Dark gray, wet, very soft, sandy ORGANIC SILT (OL)	WOH	6 5		Test boring located in the field by F & R using plans provided by the client
			WOH	11 0		*Top of bulkhead at Steward Shipyard used as datum (2 5ft). Water level at approximately mean tide (0 0 ft) Elevations should be considered as approximate.
-12 0	12.0	Gray, wet, loose, silty, fine SAND (SM)	4 4-2	16 0		
-18 0	18 0	Gray, wet, very soft, clayey SILT with a little fine SAND (ML)	1 1-1	21 0		
-22 0	22.0	Gray, wet, medium dense, silty, fine to medium SAND with a trace organics (SM)	5 11-12	26.0		
-29 5	29.5	Gray, wet, stiff, CLAY with a little silt (CL)	4 5-6	31 0		
-32 0	32.0	Gray, wet, medium dense, fine to coarse SAND with a little silt, a trace fine gravel and a trace **				**organic material (SM)
-35 0	35 0	Gray to brown, wet, medium dense to very dense, silty, fine to coarse SAND with a trace organic material (SM)	8 12-14	36.0		

No of blows req d for a 140 lb hammer dropping 30 in to drive 2 in O D 1 375 in I D sampler a total of 18 inches in three 6 in increments The sum of the last two increments of penetration is termed the standard penetration resistance N

Scale 1 =5 unless otherwise noted

Form No 500

BORING LOG

SINCE 1881

FROEHLING & ROBERTSON, INC

FULL SERVICE LABORATORIES • ENGINEERS & CHEMI

'OVER ONE HUNDRED YEARS OF SERVICE'

Report No 0-73-250 DATE March 23, 1988

Client: Davis, Bowen & Friedel, Inc.

Project: Crisfield Maritime Industrial Park

Boring No: cont B-8 | Total Depth: 51.0 | Elevation: *0.0 | Location: See boring location plan

Type of Boring: Mud Rotary | Started: 3-7-88 | Completed: 3-7-88 | Driller: J. Burch

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	Sample Blows	Sample Depth (Feet)	% Core Recovery	REMARKS
-40.0	40.0					
		Gray to brown, wet, medium dense to very dense, silty, fine to coarse SAND with a trace organic material*	*	41.0		GROUNDWATER DATA
-43.0	43.0					* 25, 30 34 (SM)
		Brown, wet, very dense, fine to coarse SAND with a little silt, a trace gravel and a trace organic material (SP-SM)	22 28-48	46 0		
-51 0	51 0					
		Boring terminated at 51 0 ft				

No of blows req d for a 140 lb hammer dropping 30 in to drive 2 in O D 1 375 in I D sampler a total of 18 inches in three 6 in increments Tha sum of the last two increments of penetration is termed the standard penetration resistance N

Scale 1 =5 unless otherwise noted

Form No 500

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Report No 0-73-250 DATE March 23, 1988

Client: Davis, Bowen & Friedel, Inc.

Project: Crisfield Maritime Industrial Park

Boring No: B-9 | Total Depth: 16.0 ft. | Elevation: * 0 0 ft. | Location: See boring location plan

Type of Boring: Mud Rotary | Started: 3-2-88 | Completed: 3-2-88 | Driller: J. Burch

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	Sample Blows	Sample Depth (Feet)	% Core Recovery	REMARKS
0.0	0.0	WATER				GROUNDWATER DATA Water at top of boring
-5 0	5 0	Dark gray, wet, very loose, silty, fine to medium, organic SAND (SM)	WOH	6.5		WOH - Weight of hammer.
-7 0	7 0	Light gray to light brown, wet, very loose, silty, fine to medium SAND with a little clay (SM)	2 1-1	11.0		Test boring located in field by F & R using plans provided by the client. *Top of bulkhead at Steward Shipyard used as datum (2 5 ft) Water level at approximately mean tide (0 0 ft) Elevation should be considered as approximate.
-13 0	13.0	Dark gray, wet, very loose, silty, fine to coarse SAND with a little clay (SM)	5 1-1			
-16 0	16 0	Boring terminated at 16 0 ft.		16 0		

No of blows req d for a 140 lb hammer dropping 30 in to drive 2 in O D 1 375 in I D sampler a total of 18 inches in three 6 in increments The sum of the last two increments of penetration is termed the standard penetration resistance N

Scale 1 =5 unless otherwise noted

Form No 500

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"OVER ONE HUNDRED YEARS OF SERVICE"

Report No 0-73-250 DATE March 23, 1988

Client: Davis, Bowen & Friedel, Inc.

Project: Crisfield Maritime Industrial Park

Boring No: B-10 | Total Depth: 16.0 ft. | Elevation: * 0.0 ft. | Location: See boring location plan

Type of Boring: Mud Rotary | Started: 3-2-88 | Completed: 3-2-88 | Driller: J. Burch

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	Sample Blows	Sample Depth (Feet)	% Core Recovery	REMARKS
0 0	0.0	WATER				GROUNDWATER DATA Water at top of boring.
-4 0	4.0	Gray, wet, very loose, silty, fine to medium SAND with a trace clay (SM)	WOH	5 5		WOH - Weight of hammer
-7 0	7 0	Dark gray, wet, very loose, fine to medium SAND with a little silt (SM)	1 1-1	11 0		Test boring located in field by F & R using plans provided by the client *Top of bulkhead at Stewart Shipyard used as datum (2 5 ft) Water level at approximately mean tide (0 0 ft) Elevation should be considered approximate.
-13 0	13.0	Dark gray, wet, loose, silty, fine to coarse SAND with a little fine gravel and a trace clay (SM)	5 4-6	16 0		
-16 0	16 0	Boring terminated at 16 0 ft.				

No of blows req d for a 140 lb hammer dropping 30 in to drive 2 in O D 1 375 in I D sampler a total of 18 inches in three 6 in increments The sum of the last two increments of penetration is termed the standard penetration resistance N

Scale 1 =5 unless otherwise noted

Form No 500

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Report No 0-73-250 DATE March 23, 1988

Client: Davis, Bowen & Friedel, Inc.

Project: Crisfield Maritime Industrial Park

Boring No: B-11 | Total Depth: 16.0 ft. | Elevation: ± 0.0 ft. | Location: See boring location plan

Type of Boring: Mud Rotary | Started: 3-2-88 | Completed: 3-2-88 | Driller: J. Burch

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	Sample Blows	Sample Depth (Feet)	% Core Recovery	REMARKS
0.0	0.0	WATER				GROUNDWATER DATA Water at top of boring
-4 0	4.0	Dark gray, wet, very loose, fine to medium SAND with a trace silt and a trace organic material (SP)	WOH	5 5		WOH - Weight of hammer Test boring located in field by F & R using plans provided by the client
-8 0	8.0	Gray, wet, medium dense, fine to medium SAND with a little silt (SP-SM)	9 10-9	11 0		*Top of bulkhead at Steward Shipyard used as datum (2 5 ft) Water level at approximately mean tide (0 0 ft) elevation should be considered as approximate
-14 0	14.0	Gray, wet, very loose, fine to coarse SAND with a trace silt (SP-SM)	9 4-1	16 0		
-16 0	16 0	Boring terminated at 16 0 ft				

No of blows req'd for a 140 lb hammer dropping 30 in to drive 2 in O D 1 375 in I D sampler a total of 18 inches in three 6 in increments The sum of the last two increments of penetration is termed the standard penetration resistance N

Scale 1 =5 unless otherwise noted

Form No. 500

BORING LOG

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Report No 0-73-250 DATE March 23, 1988

Client: Davis, Bowen & Friedel, Inc.

Project: Crisfield Maritime Industrial Park

Boring No: B-12 | Total Depth: 50.0 ft | Elevation: * 0.0 ft. | Location: See boring location plan

Type of Boring: Mud Rotary | Started: 2-25-88 | Completed: 2-25-88 | Driller: J. Burch

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	Sample Blows	Sample Depth (Feet)	% Core Recovery	REMARKS
0.0	0.0	WATER				GROUNDWATER DATA
-2.5	2.5	Light gray to light brown to dark brown, wet, very loose, sandy SILT with a trace clay (ML)	WOH	4.0		Water at top of boring. WOH - Weight of Hammer 2/18 - 2 blows for 18 inches Test boring located in the field by F & R using plans provided by the client. *Top of bulkhead at Steward Shipyard used as datum (2.5 ft) Water level at approximately high tide (0.0 ft) Elevations should be considered as approximate
			2/18	11.0		
-13.0	13.0	Light gray to brown, wet, very loose, silty, fine SAND (SM)	1 1-1	15.0		
-16.0	16.0	Dark gray, wet, medium stiff to stiff, silty CLAY with a little to some, fine to medium SAND (CL)	1 1-2	16.5		
			5 4-6	21.0		
			4 5-6	26.0		
			3 5-6	31.0		
-34.0	34.0	Brown, wet, dense to very dense, fine to medium SAND with a trace silt (SP-SM)	16 14-19	36.0		

No. of blows req'd for a 140 lb. hammer dropping 30 in. to drive 2 in. O.D. 1.375 in. I.D. sampler a total of 18 inches in three 6 in. increments. The sum of the last two increments of penetration is termed the standard penetration resistance, N.

Scale 1" = 5' unless otherwise noted

Form No 500

BORING LOG

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FROEHLING & ROBERTSON, INC

FULL SERVICE LABORATORIES • ENGINEERS & CHEMISTS

"OVER ONE HUNDRED YEARS OF SERVICE"

Report No 0-73-250 DATE March 23, 1988

Client: Davis, Bowen & Friedel, Inc.

Project: Crisfield Maritime Industrial Park

Boring No: B-12 con't | Total Depth: 50.0 ft. | Elevation: * 0.0 ft. | Location: See boring location plan.

Type of Boring: Mud Rotary | Started: 2-25-88 | Completed: 2-27-88 | Driller: J. Burch

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	Sample Blows	Sample Depth (Feet)	% Core Recovery	REMARKS
-40 0	40 0	Brown, wet, dense to very dense, fine to medium SAND with a trace silt (SP-SM)	*	41 0		GROUNDWATER DATA
						* 21,37,35
-44 0	44 0					
		Gray, wet, dense, fine to coarse SAND with a trace silt (SP)	2 15-23	47 0		
-50 0	50 0					
		Boring terminated at 50 0 ft		50 0		

No of blows req'd for a 140 lb hammer dropping 30 in to drive 2 in O D 1 375 in I D sampler a total of 18 inches in three 6 in increments The sum of the last two increments of penetretion is termed the standard penetration resistance N

Scale 1 =5 unless otherwise noted

Form No 500

BORING LOG

SINCE 1881

FROEHLING & ROBERTSON, INC
FULL SERVICE LABORATORIES • ENGINEERS & CHEMISTS
"OVER ONE HUNDRED YEARS OF SERVICE"

Report No 0-73-250 DATE March 23, 1988

Client: Davis, Bowen & Friedel, Inc.

Project: Crisfield Maritime Industrial Park

Boring No: B-13 | Total Depth: 38.0 ft. | Elevation: * -0.0 ft. | Location: See boring location plan

Type of Boring: Mud Rotary | Started: 3-1-88 | Completed: 3-1-88 | Driller: J. Burch

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	Sample Blows	Sample Depth (Feet)	% Core Recovery	REMARKS
0.0	0.0	WATER				GROUNDWATER DATA Water at top of boring
-4 0	4.0	Dark gray to black, wet, very loose, silty, organic SAND (SM)	**	5.5		WOH - Weight of Hammer Test boring located in field by F & R using plans provided by the client
-8 0	8.0	Brown to light gray, wet, soft, sandy SILT with a little clay (ML)	2 2-2	11.0		*Top of bulkhead at Steward Shipyard used a datum (2.5 ft). Water level at approximately high tide (0.0 ft) Elevation should be considered as approximate
-14.0	14 0	Gray, wet, medium, dense, fine to medium SAND with a little silt (SM)	8 10-9	16 0		**WOH for 12 inches, 1 blow for 6 inches
-19 0	19 0	Dark gray, wet, very soft, silty CLAY with a little fine sand (CL)	1 1-1	21 0		
-23 0	23 0	Dark gray to black, wet, very stiff, sandy ORGANIC SILT (OL)	9 10-12	26.0		
-26 5	26.5	Gray, wet, very stiff, silty CLAY with a little fine sand (CL)	22 10-13	31.0		
-32.0	32.0	Dark gray, wet, very stiff, sandy SILT with a little caly (ML)	8 9-14	36.0		
-38.0	38.0	Boring terminated at 38 0 ft				

No of blows req d for a 140 lb hammer dropping 30 in to drive 2 in O D 1 375 in I D sampler a total of 18 inches in three 6 in increments The sum of the last two increments of penetration is termed the standard penetration resistance N

Scale 1 =5 unless otherwise noted

Form No 500

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FROEHLING & ROBERTSON, INC

FULL SERVICE LABORATORIES • ENGINEERS & CHEMIS

"OVER ONE HUNDRED YEARS OF SERVICE"

Report No 0-73-250 DATE March 23, 1988

Client: Davis, Bowen & Friedel, Inc.

Project: Crisfield Industrial Park

Boring No: B-14 | Total Depth: 16.0 ft. | Elevation: * 0.0 ft. | Location: See Boring Location Plan

Type of Boring: Mud Rotary | Started: 3-1-88 | Completed: 3-1-88 | Driller: J. Burch

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	Sample Blows	Sample Depth (Feet)	% Core Recovery	REMARKS
0.0	0.0	WATER				GROUNDWATER DATA Water at top of boring.
-4 0	4 0	Brown to dark gray to black, wet, very loose, silty, fine organic SAND (SM)	WOH	5 5		WOH - Weight of Hammer Test boring located in the field by F & R using plans provided by the client *
-9 5	9 5	Light gray, wet, very loose, sandy SILT (ML)	1 1-1	11.0		*Top of bulkhead at Stewart Shipyard used as datum (2.5 ft) Water level at approximately mean tide (0 0 ft) elevation should be considered as approximate.
-14.5	14 5	Gray, wet, very loose, silty, fine to coarse SAND w/trace gravel (SM)	7 3-1	16.0		
-16 0	16 0	Boring terminated at 16.0 ft				

No of blows req d for a 140 lb hammer dropping 30 in to drive 2 in O D 1 375 in I D sampler a total of 18 inches in three 6 in increments The sum of the last two increments of penetration is termed the standard penetration resistance N

Scale 1 =5 unless otherwise noted

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FROEHLING & ROBERTSON, INC
FULL SERVICE LABORATORIES • ENGINEERS & CHEM
"OVER ONE HUNDRED YEARS OF SERVICE

Report No 0-73-250 DATE March 23, 1988

Client: Davis, Bowen and Friedel, Inc.

Project: Crisfield Maritime Industrial Park

Boring No: B-15 | Total Depth: 50.0 | Elevation: * 0.0 ft. | Location: See Boring Location Plan

Type of Boring: Mud Rotary | Started: 2-28-88 | Completed: 2-28-88 | Driller: J. Burch

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	Sample Blows	Sample Depth (Feet)	% Core Recovery	REMARKS
0.0	0.0	WATER				GROUNDWATER DATA Water at top of boring
-3 0	3 0	Gray, wet, very soft, clayey SILT w/ little fine sand (ML)	WOH	4 5		WOH - Weight of Hammer
-6 0	6 0	Light brown to light gray, wet, very loose, sandy SILT w/little clay (ML)	2 2-2	10 0		Test boring located in field by F&R using plans provided by the client
-10 0	10 5	Gray, wet, loose, fine to med SAND w/trace silt (SP)	6 2-5	16 0		*Top of bulk head at Steward Shipyard used as datum (2.5 ft) Water level at approximately mean tide (0 0 ft) elevation should be considered as approximate
-19 0	19 0	Gray, wet, med stiff to stiff to very stiff, sandy SILT w/little clay and sand lenses at 35 0 ft (ML)	2 3-5	21 0		
			5 8-6	26 0		
			7 8-7	31 0		
			5 10-14	36 0		
-37 5	37 5	Brown to gray, wet, very dense, fine to coarse SAND w/trace to little silt (SP-SM)				

No of blows req d for a 140 lb hammer dropping 30 in to drive 2 in O D 1 375 in I D sampler a total of 18 inches in three 6 in increments The sum of the last two increments of penetration is termed the standard penetration resistance N

Scale 1 =5 unless otherwise note

Form No 500

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FULL SERVICE LABORATORIES • ENGINEERS & CHEMIS
"OVER ONE HUNDRED YEARS OF SERVICE

Report No 0-73-250 DATE March 23, 1988

Client: Davis, Bowen and Friedel, Inc.

Project: Crisfield Maritime Industrial Park

Boring No: B-15 (cont) Total Depth: 50 0 ft Elevation: * 0.0 ft Location: See Boring Location Plan

Type of Boring: Mud Rotary Started: 2-28-88 Completed: 2-28-88 Driller: J. Burch

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	Sample Blows	Sample Depth (Feet)	% Core Recovery	REMARKS
-40.0	40.0	Brown to gray, wet, very dense, fine to coarse SAND w/trace to little silt (SP-SM)	*			GROUNDWATER DATA *30, 34,33
-50.0	50.0	Boring terminated at 50 0 ft.				

No of blows req d for a 140 lb hammer dropping 30 in to drive 2 in O D 1 375 in I D sampler a total of 18 inches in three 6 in increments The sum of the last two increments of penetration is termed the standard penetration resistance N

Scale 1 =5 unless otherwise noted

Form No 500

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FULL SERVICE LABORATORIES • ENGINEERS & CHEMI

'OVER ONE HUNDRED YEARS OF SERVICE

Report No 0-73-250 DATE March 23, 1988

Client: Davis, Bowen and Friedel, Inc.

Project: Crisfield Maritime Industrial Park

Boring No: B-16 | Total Depth: 40 5 ft | Elevation: 2.5 ft. | Location: See Boring Location Plan

Type of Boring: Hollow Stem | Started: 2-23-88 | Completed: 2-23-88 | Driller: J. Walther

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	Sample Blows	Sample Depth (Feet)	% Core Recovery	REMARKS
2.5	0.0					
1 5	1 0	Brown, moist, very loose PEAT (PT)	2			GROUNDWATER DATA
1 0	1 5	*	2-2	1 5		
		Dark brown to black, wet, very soft ORGANIC SILT and PEAT (OL) (PT)	2 2-1	3 0		Groundwater level at 4 0 feet upon completion of test boring
-1 0	3 5	Light gray, wet, very soft, sandy SILT w/little clay and a trace organic material (ML)	WOH	4 5		Approximately 4 inches of organic bearing material at surface
-5.5	8 0	Light gray to light brown, wet, very loose, fine to med SILTY SAND (SM)	2 1-1	10 5		Test boring located in field by F&R using plans provided by the client
-10.5	13 0	Dark gray, wet, very loose, silty, fine to coarse SAND (SM)	WOH 1-1	15 5		WOH - Weight of Hammer
						*Light brown, moist, very loose, sand SILT (ML)
-14.5	17 0	Gray, wet, med dense, fine to coarse SAND w/trace silt and a trace fine gravel (SP-SM)	8 10-13	20 5		
-20 5	23 0	Gray to brown, wet, med stiff, sandy CLAY w/little silt (CL)	4 4-5	25 5		
-24.5	27 0	Light gray to brown to reddish brown, wet, med stiff, sandy SILT w/little clay and a trace organic material (ML)	3 3-3	30 5		
-29.5	32 0	Gray, wet, stiff, silty CLAY w/little fine sand and a trace organic material (CL)	4 5-6	35 5		
-35 0	37 5	Gray to brown, wet, med dense, silty, fine to coarse SAND (SM)	6 7-8			Boring terminated at 40.5 ft.
-37.5	40.0					

No of blows req d for a 140 lb hammer dropping 30 in to drive 2 in O D 1 375 in I D sampler a total of 18 inches in three 6 in increments The sum of the last two increments of penetration is termed the standard penetration resistance N

Scale 1 =5 unless otherwise noted

Form No 500

BORING LOG

FROEHLING & ROBERTSON, INC
FULL SERVICE LABORATORIES • ENGINEERS & CHEMIST
"OVER ONE HUNDRED YEARS OF SERVICE
1881

Report No 0-73-250 DATE March 23, 1988

Client: Davis, Bowen & Friedel, Inc.

Project: Crisfield Maritime Industrial Park

Boring No: B-17 | Total Depth: 41.0 ft. | Elevation: 2.5 ft. | Location: See boring location plan

Type of Boring: Hollow Stem | Started: 2-24-88 | Completed: 2-24-88 | Driller: J. Burch

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	Sample Blows	Sample Depth (Feet)	% Core Recovery	REMARKS
2.5	0.0	Brown to black, wet, very soft ORGANIC SILT and PEAT (OL/OH) (PT)	*	1.5		GROUNDWATER DATA
			*	3.0		Groundwater at 2 5 ft upon completion of test boring
			UD			
-3 0	5.5	Light gray to light brown, wet, very loose, sandy SILT with a trace organic material. (ML)	1 1-1	7 5		
-7 5	10.0	Black, wet, very soft, sandy ORGANIC SILT (OL/OH)	1 1-1	11 0		Test boring located in field by F & R using plans provided by the client.
-10.0	12.5	Light gray to light brown, wet, loose sandy SILT (ML)	5 4-4	16.0		UD - undisturbed sample taken. * 1 blow for 12 inches 1 blow for 6 inches
-17 5	20 0	Brown, wet, dense, fine to coarse SAND w/a trace silt and a trace **	5 15-30	21 0		**fine gravel (SP)
-19 5	22 0	Gray, wet, medium stiff, silty CLAY with a little fine sand (CL)	2 3-4	26.0		
			2 3-4	31.0		
-30 5	33.0	Brown to gray, wet, loose to medium dense, SILT and fine to medium SAND (SM)	5 6-7	36.0		

No of blows req d for a 140 lb hammer dropping 30 in to drive 2 in O D 1 375 in I D sampler a total of 18 inches in three 6 in increments The sum of the last two increments of penetration is termed the standard penetration resistance N

Scale 1 =5 unless otherwise noted

Form No 500

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FROEHLING & ROBERTSON, INC

FULL SERVICE LABORATORIES • ENGINEERS & CHEMIST
"OVER ONE HUNDRED YEARS OF SERVICE

Report No 0-73-250 DATE March 23, 1988

Client: Davis, Bowen & Friedel, Inc.

Project: Crisfield Industrial Maritime Park

Boring No: B-17(cont) | Total Depth: 41.0 ft. | Elevation: 2.5 ft. | Location: See boring location plan

Type of Boring: Hollow stem | Started: 2-24-88 | Completed: 2-24-88 | Driller: J. Burch

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	Sample Blows	Sample Depth (Feet)	% Core Recovery	REMARKS
-37.5	40.0					
-38.5	41 0	Brown to gray, wet, loose to *	**			GROUNDWATER DATA
		Boring terminated at 41 0 ft.				*medium dense, silty, fine to medium dense, silty, fine to medium SAND (SM) **3, 4, 5

No of blows req d for a 140 lb hammer dropping 30 in to drive 2 in O D 1 375 in I D sampler a total of 18 inches in three 6 in increments The sum of the last two increments of penetration is termed the standard penetration resistance N

Scale 1 =5 unless otherwise noted

Form No 500

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FULL SERVICE LABORATORIES • ENGINEERS & CHEMIST
OVER ONE HUNDRED YEARS OF SERVICE

Report No 0-73-250 DATE March 23, 1988

ient: Davis, Bowen & Friedel, Inc.

Project: Crisfield Maritime Industrial Park

Boring No: B-18 | Total Depth: 24.5 ft. | Elevation: 2.5 ft. | Location: See boring location plan

Type of Boring: Hollow stem | Started: 2-22-88 | Completed: 2-22-88 | Driller: J. Burch

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	Sample Blows	Sample Depth (Feet)	% Core Recovery	REMARKS
2.5	0 0	Fill material: dark brown to black, moist, medium dense, silty, fine **	9 10-10	1.5		GROUNDWATER DATA
-0 5	2 0	Dark gray, moist, stiff, sandy CLAY with a little silt and a little***	7 8-5	3 0		Groundwater at 6 0 ft. upon completion of test boring.
-1 5	4 0	Gray, moist to wet, very loose, sandy SILT (ML)	1 1-1	6.0		Approximately 3 inches of organic bearing material at surface
-5 5	8 0		1 1-1	7 5		
		Light brown, wet, sandy SILT with a trace clay (ML)				Test boring located in field by F & R using plans provided by the client
-8 5	11 0		2 4-3	11.0		
		Dark gray, wet, very loose, silty, fine to coarse SAND (SM)				*WOH for 6 inches, 2 blows for 12 inches
			*	16 0		Flowing sands at 21 0 ft.
-15 5	18.0	Dark gray, wet, desne, fine to coarse SAND with a trace to little sand (SP-SM)	15 18-24	21.0		** to coarse SAND with a trace fine gravel (SM)
						***organic material (CL)
-22 0	24.5	Boring terminated at 24 5 ft.				

No of blows req d for a 140 lb hammer dropping 30 in to drive 2 in O D 1 375 in I D sampler a total of 18 inches in three 6 in increments The sum of the last two increments of penetration is termed the standard penetration resistance N

Scale 1 =5 unless otherwise noted

BORING LOG

FROEHLING & ROBERTSON, INC
FULL SERVICE LABORATORIES • ENGINEERS & CHEMIS
OVER ONE HUNDRED YEARS OF SERVICE"

Report No 0-73-250 DATE March 23, 1988

Client: Davis, Bowen and Friedel, Inc.

Project: Crisfield Maritime Industrial Park

Boring No: B-19 | Total Depth: 25.5 ft | Elevation: 2.0 ft. | Location: See Boring Location Plan

Type of Boring: Hollow Stem | Started: 2-24-88 | Completed: 2-24-88 | Driller: J Walther

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	Sample Blows	Sample Depth (Feet)	% Core Recovery	REMARKS
2.0	0.0	Dark brown to black to gray, wet, very soft ORGANIC SILT and PEAT (OL/OH) (PT)	1 0-1	1 5		GROUNOWATER OATA
			1 1-1	3 0		Groundwater level at 5 0 ft upon completion of test boring
-1 0	3 0	Gray, wet, very loose, sandy SILT w/trace clay and a trace organic material (ML)	2 1-3	4 5		
			*	10 5		Test boring located in field by F&R using plans provided by the client
-11 0	13 0	Dark gray, wet, med dense, silty fine to coarse SAND w/trace fine gravel (SM)	4 8-9	15 5		*WOH for 12 inches, 1 blow for 6 inches
-15 0	17 0	Gray, wet, very loose, fine to coarse SAND w/trace silt (SP-SM)	5 1-1	20 5		
-21 0	23 0	Dark gray, wet, soft, silty CLAY (CL)	1 1-2	25 5		
-23 5	25 5	Boring termination at 25 5 feet				

No of blows req d for a 140 lb hammer dropping 30 in to drive 2 in O D 1 375 in I D sampler a total of 18 inches in three 6 in increments The sum of the last two increments of penetration is termed the standard penetration resistance N

Scale 1"=5 unless otherwise noted

Form No 500

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"OVER ONE HUNDRED YEARS OF SERVICE"

Report No 0-73-250 DATE March 23, 1988

Client: Davis, Bowen and Friedel, Inc.

Project: Crisfield Maritime Industrial Park

Boring No: B-20 | Total Depth: 40.5 ft. | Elevation: 2.5 ft. | Location: See Boring Location Plan

Type of Boring: Hollow Stem | Started: 2-24-88 | Completed: 2-24-88 | Driller: J. Walther

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	Sample Blows	Sample Depth (Feet)	% Core Recovery	REMARKS
2 5						GROUNOWATER DATA
	1 5	Dark brown to brown, moist, very soft ORGANIC SILT and PEAT (OL/OH)(PT)	1 2-1	1 5		
		Gray, wet, very soft, silty CLAY w/ little fine sand and a little organic material	2 1-1 WOH 2-1	3 0 4 5		Groundwater level at 4 0 upon completion of test boring Test boring located in field by F&R using plans provided by the client
-5 5	8 0					
		Light gray to light brown, wet, very loose to med dense, silty fine to coarse SAND w/trace clay (SM)	2 2-1	10 5		
			3 2-10	15 5		
-14 5	17 0					
		Dark gray, wet, very soft, sandy SILT w/little clay (ML)	1 1-2	20 5		
-19 5	22 0					
		Dark gray, wet, loose, silty fine SAND (SM)	2 3-4	25 5		
-25 5	28 0					
		Dark gray, wet, med dense, med to coarse SAND w/trace silt and a trace fine gravel (SP)	8 10-13	30 5		
-30 5	33 0					
		Dark gray, wet, loose to med dense, fine to coarse SAND w/little silt (SP-SM)	4 4-5	35 5		
-37 5	40 0		10 11-14	40.5		Boring terminated at 40.5 ft

No of blows req'd for a 140 lb hammer dropping 30 in to drive 2 in O D 1 375 in I D sampler a total of 18 inches in three 6 in increments The sum of the last two increments of penetration is termed the standard penetration resistance N

Scale 1 =5 unless otherwise noted

Form No 500

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FROEHLING & ROBERTSON, INC
FULL SERVICE LABORATORIES • ENGINEERS & CHEMIS
"OVER ONE HUNDRED YEARS OF SERVICE"
1881

Report No 0-73-250 DATE March 23, 1988

Client: Davis, Bowen and Friedel, Inc.

Project: Crisfield Maritime Industrial Park

Boring No: B-21 | Total Depth: 31.0 ft. | Elevation: 3.5 ft. | Location: See Boring Location Plan

Type of Boring: Hollow stem | Started: 2-23-88 | Completed: 2-23-88 | Driller: J. Burch

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	Sample Blows	Sample Depth (Feet)	% Core Recovery	REMARKS
3.5	0.0	Dark gray to dark brown to black, sandy ORGANIC SILT and PEAT (OL/OH) (PT)	3 6-5	1.5		GROUNDWATER DATA
			4 5-4	3 0		Groundwater at 3 0 ft upon completion of test boring.
-1.0	4.5	Gray, wet, soft, sandy SILT with a little clay (ML)	1 2-3	6 0		Approximately 3 inches of organic bearing material at surface.
			3 3-2	7 5		
-4 5	8 0	Gray, wet, very soft, silty CLAY with a little fine sand (CL)	1 1-1	11 0		Test boring located in field by F & R using plans provided by the client
-9 5	13.0	Dark gray, wet, medium dense to very loose, silty, fine to coarse SAND (SM)	2 2-14	16 0		* 3 blows for 6 inches 1 blow for 12 inches
			*	21 0		**1 blow for 12 inches 8 blows for 6 inches
-19 5	23.0	Dark gray, wet, very loose, sandy SILT (ML)	1 1-2	26.0		
-24.5	28.0	Dark gray, wet, loose, fine to coarse SAND with a trace silt and a trace fine gravel (SP-SM)	**	31 0		
-27 5	31 0	Boring terminated at 31 0 ft				

No of blows req d for a 140 lb hammer dropping 30 in to drive 2 in O D 1 375 in I D sampler a total of 18 inches in three 6 in increments The sum of the last two increments of penetration is termed the standard penetration resistance N

Scale 1 =5 unless otherwise noted

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"OVER ONE HUNDRED YEARS OF SERVICE
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Report No 0-73-250 DATE March 23, 1988

Client: Davis, Bowen and Friedel, Inc.

Project: Crisfield Maritime Industrial Park

Boring No: B-22 | Total Depth: 41.0 ft. | Elevation: 2.0 ft. | Location: See Boring Location Plan

Type of Boring: Hollow stem | Started: 3-10-88 | Completed: 3-10-88 | Driller: J. Burch

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	Sample Blows	Sample Depth (Feet)	% Core Recovery	REMARKS
2.0	0.0	Light gray to light brown to black, wet, very soft ORGANIC SILT and PEAT (OL/OH) (PT)	*	1.5		GROUNDWATER DATA
			2			Groundwater at 5.5 ft upon completion of test boring
			1-1	3.0		
-2.0	4.0	Light brown to light gray, wet, very loose, sandy SILT (ML)	WOH	4.5		Test boring located in field by F & R using plans provided by the client
			1			
			1-1	7.5		
-7.0	9.0	Gray, wet, very loose, sandy SILT (ML)	WOH			WOH - Weight of hammer
			1-1	11.0		* 1 blow for 12 inches 1 blow for 6 inches
-11.0	13.0	Gray, wet, loose, silty, fine SAND (SM)				
			3			
			3-4	16.0		
-15.0	17.0	Gray, wet, very soft, silty CLAY with a little fine sand (CL)				
			*	21.0		
-20.0	22.0	Dark gray, wet, medium dense, sandy SILT (ML)				
			5			
			4-9	26.0		
-27.0	29.0	Gray to brown, wet, very dense, fine to coarse SAND with a trace silt and a trace fine gravel (SP)	23			
			35-42	31.0		
-32.0	34.0	Gray to brown, wet, medium dense, silty, fine to coarse SAND with a trace clay to occasional clayey silt lenses (SM)	5			
			9-9	36.0		

No of blows req'd for a 140 lb hammer dropping 30 in to drive 2 in O D 1 375 in I D sampler a total of 18 inches in three 6 in increments The sum of the last two increments of penetration is termed the standard penetration resistance N

Scale 1 =5 unless otherwise noted

Form No 500

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FROEHLING & ROBERTSON, INC
FULL SERVICE LABORATORIES • ENGINEERS & CHEMIS
"OVER ONE HUNDRED YEARS OF SERVICE

Report No 0-73-250 DATE March 23, 1988

Client: Davis, Bowen & Friedel, Inc.

Project: Crisfield Maritime Industrial Park

Boring No: cont. B-22 | Total Depth: 41.0 ft | Elevation: 2.0 ft. | Location: See boring location plan

Type of Boring: Hollow stem | Started: 3-10-88 | Completed: 3-10-88 | Driller: J. Burch

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	Sample Blows	Sample Depth (Feet)	% Core Recovery	REMARKS
-38.0	40.0					
-39.0	41.0	Gray to brown, wet, medium dense*	**			GROUNDWATER DATA
		Boring terminated at 41.0 ft				*silty, fine to coarse SAND with a trace clay to occasional clayey silt lenses (SM)
						** 7 / 8-10

No of blows req d for a 140 lb hammer dropping 30 in to drive 2 in O D 1 375 in I D sampler a total of 18 inches in three 6 in increments The sum of the last two increments of penetration is termed the standard penetration resistance N

Scale 1 =5 unless otherwise noted

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FULL SERVICE LABORATORIES • ENGINEERS & CHEMIST
"OVER ONE HUNDRED YEARS OF SERVICE

Report No 0-73-250 DATE March 23, 1988

Client: Davis, Bowen & Friedel, Inc.

Project: Crisfield Maritime Industrial Park

Boring No: B-23 | Total Depth: 25.5 ft. | Elevation: 3.5 ft. | Location: See boring location plan

Type of Boring: Hollow stem | Started: 2-23-88 | Completed: 2-23-88 | Driller: J. Walther

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	Sample Blows	Sample Depth (Feet)	% Core Recovery	REMARKS
3.5	0.0	Brown to light brown, moist, soft ORGANIC SILT and PEAT (OL/OH) (PT)	2 2-3 5 3-2	1 5 3 0		GROUNDWATER DATA Groundwater level at 4 0 ft upon completion of test boring Test boring located in field by F & R using plans provided by the client
0 5	3 0	Gray to light brown, wet, very soft to soft, sandy SILT with a little clay (ML)	2 2-3	4.5		
			2 1-2	10 5		
-11 5	15 0	Gray, wet, very loose, silty, fine to coarse SAND with a trace clay (SM)	2 1-1	15.5		
-14 5	18 0	Dark gray, wet, soft, silty CLAY with a little fine sand and a little organic material (CL)	2 2-3	20.5		
-18 5	22.0	Gray, wet, medium dense, silty, fine SAND (SM)	8 9-10	25 5		
-22 0	25 5	Boring terminated at 25.5 ft.				

No of blows req d for s 140 lb hammer dropping 30 in to drive 2 in O D 1 375 in I D sampler a total of 18 inches in three 6 in increments The sum of the last two increments of penetrstion is termed the standard penetrstion resistance N

Scale 1 =5 unless otherwise noted

Form No 500

BORING LOG

SINCE 1881

FROEHLING & ROBERTSON, INC

FULL SERVICE LABORATORIES • ENGINEERS & CHEMIST
"OVER ONE HUNDRED YEARS OF SERVICE

Report No 0-73-250 DATE March 23, 1988

Client: Davis, Bowen & Friedel, Inc.

Project: Crisfield Maritime Industrial Park

Boring No: B-24 | Total Depth: 26.0 ft. | Elevation: 2.5 ft. | Location: See boring location plan

Type of Boring: Hollow stem | Started: 3-8-88 | Completed: 3-8-88 | Driller: J. Burch

Elevation	Depth	DESCRIPTION OF MATERIALS (Classification)	Sample Blows	Sample Depth (Feet)	% Core Recovery	REMARKS
2.5	0.0					
		Brown, wet, soft, sandy ORGANIC SILT (OL/OH)	2 1-3	1 5		GROUNDWATER DATA
1.0	1.5	Light gray to light brown, wet, soft, silty CLAY with a little fine sand (CL)	2 2-2	3 0		Groundwater at 5 0 ft upon completion of test boring.
-1.5	4 0	Light gray to light brown, wet, soft, sandy SILT with a little clay (ML)	1 2-3	6 0		Test boring located in field by F & R using plans provided by the client
			3 2-2	7 5		
-6.0	8.5	Gray, wet, very loose, silty, fine SAND (SM)	*	11 0		*1 blow for 12 inches 1 blow for 6 inches
-10 5	13 0	Dark gray, wet, medium dense, silty, fine to medium SAND with a trace clay (SM)	6 7-10	16 0		
-16 5	19 0	Dark gray, wet, loose, coarse SAND with a little silt and a little fine gravel (SP-SM)	1 4-6	21 0		
-20 5	23 0	Gray, wet, loose, clayey, fine to coarse SAND with a little silt (SC)	4 4-4	26 0		
-23 5	26.0	Boring terminated at 26 0 ft.				

No of blows req d for a 140 lb hammer dropping 30 in to drive 2 in O D 1 375 in I D sampler a total of 18 inches in three 6 in increments The sum of the last two increments of penetration is termed the standard penetration resistance N

Scale 1 =5 unless otherwise noted

SINCE
F&R
1881

SOIL STRENGTH PARAMETERS AND UNIT WEIGHTS

SOIL LAYER	C - VALUE PSF	O - VALUE DEGREES	UNIT WEIGHT* PCF
Sandy SILTS, silty SANDS and SAND with N-values less than 10.	0	32	95-115
Silty SANDS and SANDS with N-values from 10 to 19.	0	34	110-130
Silty SANDS and SANDS with N-values greater than 19.	0	38	115-135
CLAY and silty CLAY with N-values less than 5.	500	0	95-115
CLAY and silty CLAY with N-values from 5 to 12.	800-1500	0	100-130
CLAY and silty CLAY 12 N-values greater than 12.	1800	0	120-140

*NOTE: This is the moist unit weight. This value should be adjusted for submerged conditions where applicable.

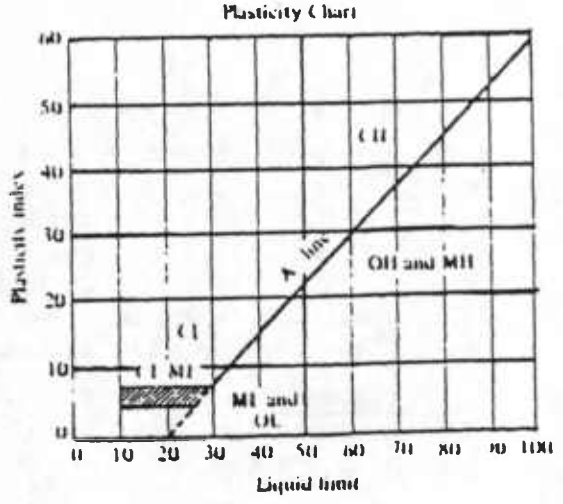
Equivalent Fluid Pressure values can be provided as necessary. However, we can provide better estimates when the type of bulkhead system and elevations have been selected.

SINCE F&R 1881

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D-2487)

Major Divisions			Group Symbols		Typical Names	Laboratory Classification Criteria	
Coarse-grained soils (More than half of material is larger than No. 200 sieve size)	Gravels (More than half of coarse fraction is larger than No. 4 sieve size)	Clean gravels (Little or no fines)	GW		Well-graded gravels gravel-sand mixtures little or no fines	$C_U = \frac{D_{60}}{D_{10}}$ greater than 4; $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	
			GP[c]		Poorly graded gravels gravel-sand mixtures little or no fines	Not meeting all gradation requirements for GW	
		Gravels with fines (Appreciable amount of fines)	GM[d,e,f]		Silty gravels gravel-sand-silt mixtures	Atterberg limits below A line or P I less than 4	Above A line with P I between 4 and 7 are *borderline* cases requiring use of dual symbols
			GC		Clayey gravels gravel-sand-clay mixtures	Atterberg limits below A line with P I greater than 7	
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (Little or no fines)	SW		Well-graded sands gravelly sands little or no fines	$C_U = \frac{D_{60}}{D_{10}}$ greater than 6; $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	
			SP		Poorly graded sands gravelly sands little or no fines	Not meeting all gradation requirements for SW	
		Sands with fines (Appreciable amount of fines)	SM[d,e,f]		Silty sands sand-silt mixtures	Atterberg limits above A line or P I less than 4	Limits plotting in hatched zone with P I between 4 and 7 are *borderline* cases requiring use of dual symbols
			SC		Clayey sands sand-clay mixtures	Atterberg limits above A line with P I greater than 7	
Fine-grained soils (More than half material is smaller than No. 200 sieve)	Silts and clays (Liquid limit less than 50)		ML		Inorganic silts and very fine sands rock flour silty or clayey fine sands or clayey silts with slight plasticity	Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size) coarse-grained soils are classified as follows: Less than 5 per cent: GW, GP, SW, SP. More than 12 per cent: GM, GC, SM, SC. *Borderline* cases requiring dual symbols[b]	
			CL		Inorganic clays of low to medium plasticity gravelly clays sandy clays silty clays lean clays		
			OL		Organic silts and organic silty clays of low plasticity		
	Silts and clays (Liquid limit greater than 50)		MH		Inorganic silts micaceous or diatomaceous fine sandy or silty soils elastic silts		
			CH		Inorganic clays of high plasticity fat clays		
			OH		Organic clays of medium to high plasticity organic silts		
Highly organic soils			Pt		Peat and other highly organic soils		

Plasticity Chart



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FIELD CLASSIFICATION SYSTEM FOR SOIL EXPLORATION

NON COHESIVE SOILS
(Silt, Sand, Gravel and Combinations)

Density

Very Loose	- 5 blows/ft. or less
Loose	- 6 to 10 blows/ft.
Medium Dense	- 11 to 30 blows/ft.
Dense	- 31 to 50 blows/ft.
Very Dense	- 51 blows/ft. or more

Relative Proportions

Descriptive Term	Percent
Trace	1-10
Little	11-20
Some	21-35
And	36-50

Particle Size Identification

Boulders	- 8 inch diameter or more
Cobbles	- 3 to 8 inch diameter
Gravel	- Coarse -1 to 3 inch
	- Medium -¼ to 1 inch
	- Fine -¼ to ½ inch
Sand	- Coarse -0.6mm to ¼ inch (dia. of pencil lead)
	- Medium -0.2mm to 0 6mm (dia. of broom straw)
	- Fine -0.05mm to 0.2mm (dia. of human hair)
Silt	-0.6mm to 0 002mm (cannot see particles)

Cohesive Soils
(Clay, Silt and Combinations)

Consistency

Very Soft	- 3 blows/ft. or less
Soft	- 4 to 5 blows/ft
Medium Stiff	- 6 to 10 blows/ft.
Stiff	- 11 to 15 blows/ft.
Very Stiff	- 16 to 30 blows/ft
Hard	- 31 blows/ft. or more

Plasticity

Degree of Plasticity	Plasticity Index
None to Slight	0-4
Slight	5-7
Medium	8-22
High to Very High	over 22

Classification on logs are made by visual inspection of samples.

Standard Penetration Test- Driving a 2.0" O.D., 1-3/8" I.D , sampler a distance of 1.0 foot into undisturbed soil with a 140 pound hammer free falling a distance of 30.0 inches. It is customary for F&R to drive the spoon 6 inches to seat into undisturbed soil. then perform the test. The number of hammer blows for seating the spoon and making the test are recorded for each 6 inches of penetration on the drill log (Example - 6/8/9). The standard penetration test can be obtained by adding the last two figures (i.e. 8+9=17 blows/ft.) (ASTM D-1586-67)

Strata Changes- In the column "Soil Descriptions", on the drill log, the horizontal lines represent strata changes. A solid line ( ) represents an actually observed change, a dashed line (_ _) represents an estimated change.

Ground Water - Observations were made at the times indicated. Porosity of soil strata, weather conditions, site topography, etc., may cause changes in the water levels indicated on the logs.

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FROEHLING & ROBERTSON, INC.
FULL SERVICE LABORATORIES • ENGINEERS & CHEMISTS
"OVER ONE HUNDRED YEARS OF SERVICE"

1411-A S. Salisbury Blvd.
Salisbury, MD 21801
(301) 749-3322

April 28, 1988

Davis, Bowen & Friedel, Inc.
One Plaza East, Suite 200
Salisbury, Maryland 21801

Attn: John A. Davis, P.E.

Re: Supplement to the March 24, 1988 Geotechnical Report
Crisfield Maritime Industrial Park
Crisfield, Maryland
F & R Project No 0-73-250

Gentlemen:

Froehling & Robertson, Inc. has completed the laboratory testing for the referenced project. This laboratory testing report supplements our March 24, 1988 geotechnical report.

In addition, we have reviewed the original report and found an error in the reporting of the permeability test results. The correct Falling Head Permeability test results are as follows:

Sample 1: Boring B-2: $K_{20} = 7.44 \times 10^{-2}$ cm/min. or
$K_{20} = 1.24 \times 10^{-3}$ cm/sec.

Sample 2: Boring B-14: $K_{20} = 8.43 \times 10^{-2}$ cm/min. or
$K_{20} = 1.40 \times 10^{-3}$ cm/sec.

Sample 3: Composite from B-3, 6 and 9:
$K_{20} = 4.11 \times 10^{-2}$ cm/min. or
$K_{20} = 6.89 \times 10^{-4}$ cm/sec.

Because of the difficulty in retrieving the samples, some of the fine grain soil particles were lost during the sampling process. Therefore, the actual permeability values should be less than those reported.

However, because of the high permeability of the dredge spoil materials, the fill will drain very rapidly (almost immediately). Therefore, the controlling time for development will be the consolidation of the natural PEAT/ORGANIC SILT layer.

If you have any questions regarding this report, please contact our office.

Respectfully,

FROEHLING & ROBERTSON, INC.

John D. Hynes, P.E.
Manager

REPORT OF
SUBSURFACE EXPLORATION
AND
GEOTECHNICAL ENGINEERING EVALUATION

LABORATORY TESTING SUPPLEMENT

CRISFIELD MARITIME INDUSTRIAL PARK
CRISFIELD, MARYLAND

PREPARED FOR
DAVIS, BOWEN & FRIEDEL, INC.

April 28, 1988
F & R Project No. 0-73-250

INVESTIGATIVE PROCEDURES

SOIL TEST BORINGS

Soil drilling and sampling operations were conducted in accordance with ASTM Specifications D-1586. The borings were advanced by mechanically turning continuous hollow-stem auger flights into the ground. At regular intervals, samples were obtained with a standard 1.4-inch I.D., 2.0-inch O.D. splitspoon sampler The sampler was first seated 6 inches to penetrate any loose cuttings and then driven an additional foot with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the final foot is the "Standard Penetration Resistance" The penetration resistance, when properly evaluated, is an index to the soil's strength, density and behavior under applied loads. The soil descriptions and penetration resistances for each boring are presented on the Test Boring Records in the Appendix

SOIL CLASSIFICATION

Soil classifications provide a general guide to the engineering properties of various soil types and enable the engineer to apply his past experience to current conditions. In our investigation, jar samples obtained during drilling operations are examined in our laboratory and visually classified by the geotechnical engineer in accordance with ASTM Specification D-2488. The soils are classified according to the AASHTO or Unified Soil Classification System (ASTM D-2487). Each of these classification systems and the in-place physical soil properties provides an index for estimating the soil's behavior.

ATTERBERG LIMITS

Portions from a representative soil samples obtained during drilling operations were selected for Atterberg Limits Tests. The Atterberg Limits are indicative of the soil's plasticity characteristics. The soil's plasticity index (PI) is representative of this characteristic and is the difference between the liquid and plastic limits. The liquid limit is the moisture content at which the soil will flow as a heavy viscous fluid and is determined in accordance with ASTM Specification D-4318. The plastic limit is the moisture content at which the soil begins to loose its plasticity and is determined in accordance with ASTM Specification D-4318.

COMPACTION TEST

Representative samples of the proposed subgrade soils were obtained for laboratory compaction testing. Standard Proctor compaction tests (ASTM D-698) were performed on these soils to determine its compaction characteristics, including its maximum dry density and optimum moisture content.

PERMEABILITY TEST: FALLING HEAD

The coefficient of permeability (K_{20}) was determined for samples collected and recompacted in a Standard Proctor mold at a given percent compaction (90 or 95%). Adjustments were made for readings made at temperatures other than 20° C using the recommended viscosity table for NT/N20. Results are expressed in centimeters/second.

GRAIN SIZE TEST

Grain size tests were performed to determine the particle size and distribution of the samples tested. The grain size distribution of soils coarser than a No. 200 sieve was determined by passing the samples through a standard set of nested sieves. The material retained on the No. 100 and No. 200 sieves were washed to better determine the percent passing those sieves. This is done in order to better distinguish borderline fine/granular soils. Materials passing the No. 200 sieve were suspended in water and the grain size distribution was determined by the rate of settlement (D-421 and D-422).

CONSOLIDATION TEST

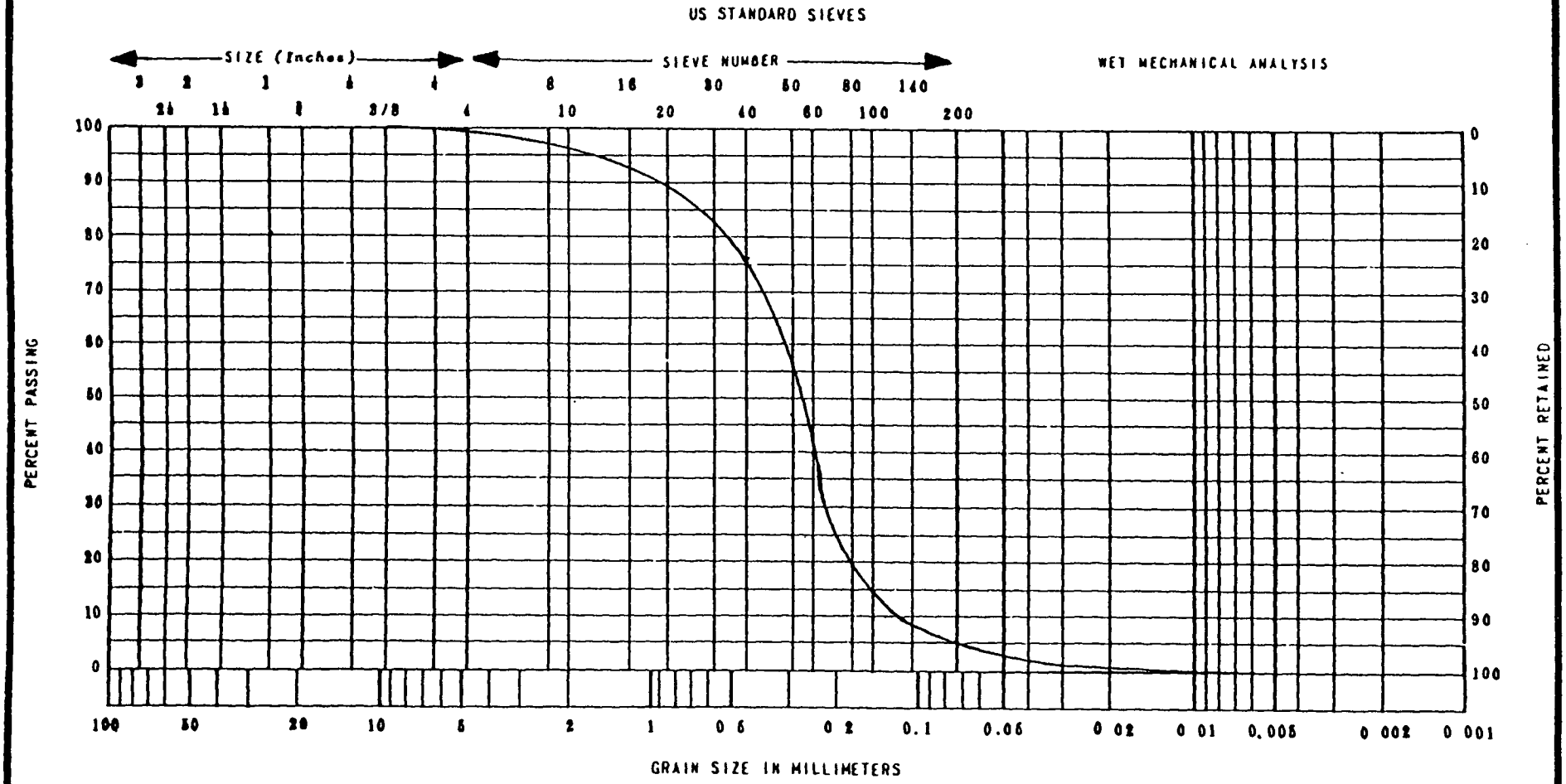
A single section of selected, undisturbed samples was extruded from its sampling tube for consolidation testing. The section was trimmed into a disc 2.4 inches in diameter and 1 inch thick. The disc was confined in a stainless steel ring and sandwiched between porous plates. After being saturated, it was then subjected to incrementally increasing vertical loads and the resulting deformations measured with a micrometer dial gauge. The test results are presented in the form of a pressure vs. strain curve on the accompanying Consolidation Test sheet.

FROEHLING & ROBERTSON, INC.
FULL SERVICE LABORATORIES • ENGINEERS & CHEMISTS

GRAIN SIZE DISTRIBUTION GRAPH - AGGREGATE GRADING CHART

DATE: April 26, 1988

PROJECT: Crisfield Maritime Industrial Park



EXCAVATION NUMBER	SAMPLE NUMBER	NATURAL % MOISTURE	w_L	w_P	I_P	CLASSIFICATION	REMARKS
B-7	S-8	--	--	--	--	SP-SM	Light brown to light gray, fine to coarse SAND w/trace silt & a trace gravel

TECHNICIAN (Signature): D T

PLOTTED BY (Signature): M.T F

CHECKED BY (Signature): Michael Norwood

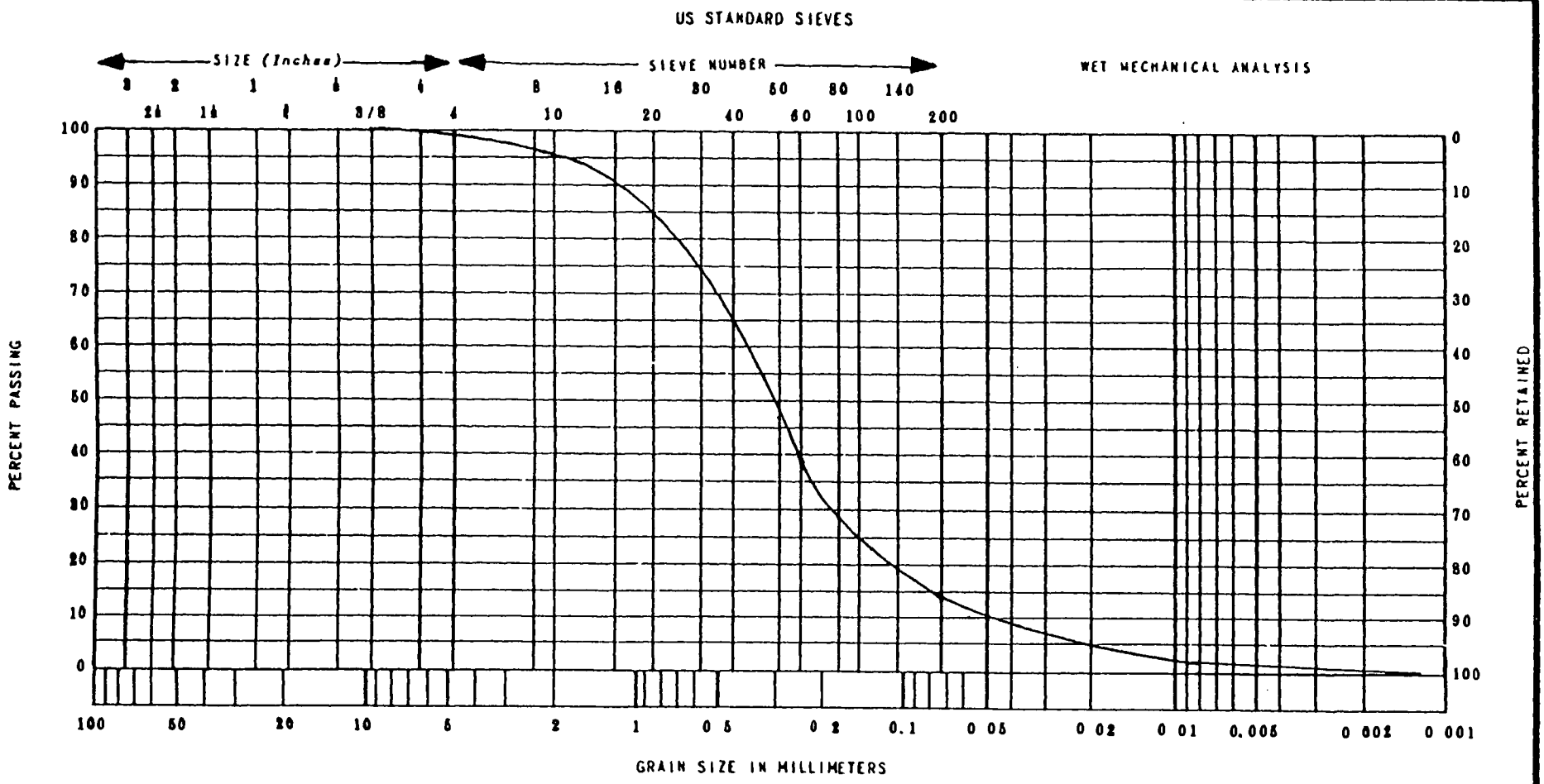
Form No. 110

FROEHLING & ROBERTSON, INC.
FULL SERVICE LABORATORIES ● ENGINEERS & CHEMISTS

GRAIN SIZE DISTRIBUTION GRAPH - AGGREGATE GRADING CHART

DATE: April 26, 1988

PROJECT: Crisfield Maritime Industrial Park



EXCAVATION NUMBER	SAMPLE NUMBER	NATURAL % MOISTURE	w_L	w_P	I_P	CLASSIFICATION	REMARKS
B-15	S-7	--	--	--	--	SM	Gray, fine to coarse SAND w/little silt

TECHNICIAN (Signature): D T

PLOTTED BY (Signature): M.T F

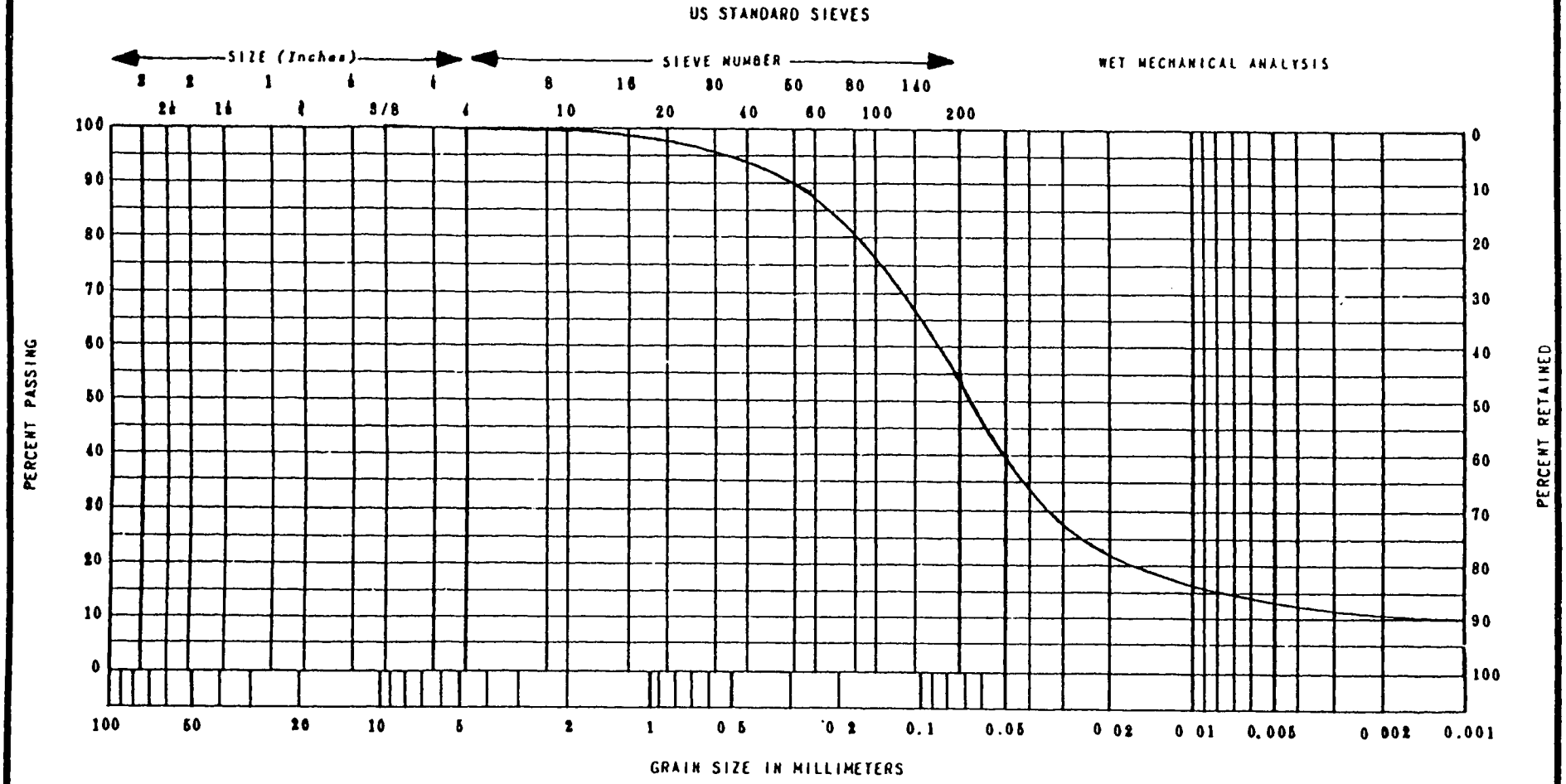
CHECKED BY (Signature): Michael P. Orwood

FROEHLING & ROBERTSON, INC.
FULL SERVICE LABORATORIES ● ENGINEERS & CHEMISTS

GRAIN SIZE DISTRIBUTION GRAPH - AGGREGATE GRADING CHART

DATE: April 26, 1988

PROJECT: Crisfield Maritime Industrial Park



EXCAVATION NUMBER	SAMPLE NUMBER	NATURAL % MOISTURE	w_L	w_P	I_P	CLASSIFICATION	REMARKS
B-23	S-3	--	--	--	--	ML	Gray, sandy SILT w/little clay

TECHNICIAN (Signature): D T

PLOTTED BY (Signature): M.T.F

CHECKED BY (Signature): Michael Forwood

LABORATORY TEST DATA

Test Results

Sample[1] Number	Liquid Limit	Plasticity Index	Natural Moisture (%)
B6/S6	N/A[2]	N/A	21.6
B7/S4	35	14	45.8
B8/S4	38	13	37 2
B13/S6	34	15	40.5
B15/S6	29	13	32.2
B20/S2	N/A	N/A	28.8
B23/S4	NP[3]	NP[3]	17.1
B24/S5	N/A	N/A	31 2

1. Sample Number B6/S6 means Boring 6, Sample 6.
2. N/A means not applicable; tests not taken.
3. N.P. means non-plastic. No test results could be provided.

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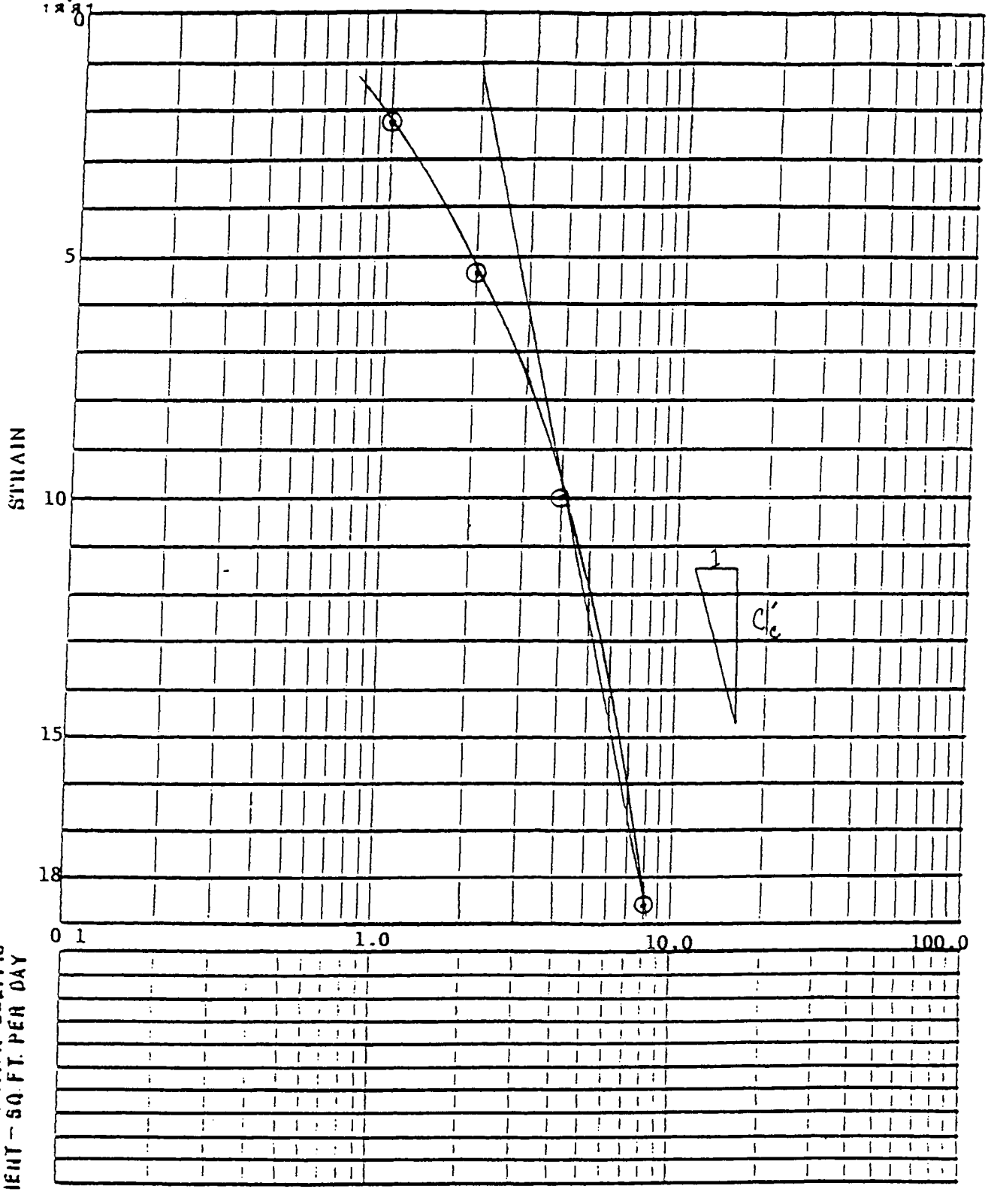
$C_c' = 0.293$



CONSOLIDATION TEST

SAMPLE DESIGNATION B-13: 21 to 23 feet

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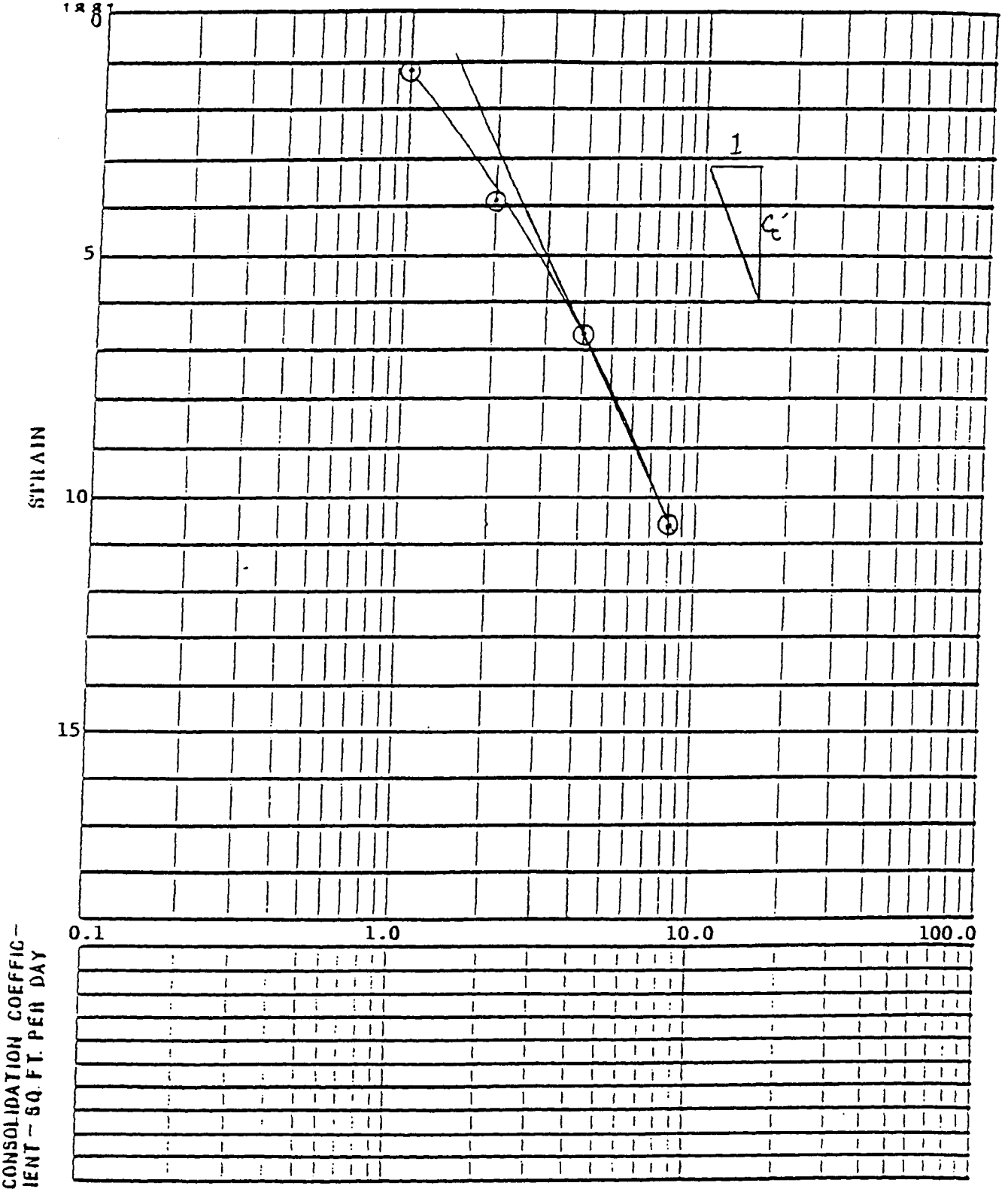
C_c' = 0 1335



CONSOLIDATION TEST

SAMPLE DESIGNATION B-17: 3 to 5 feet

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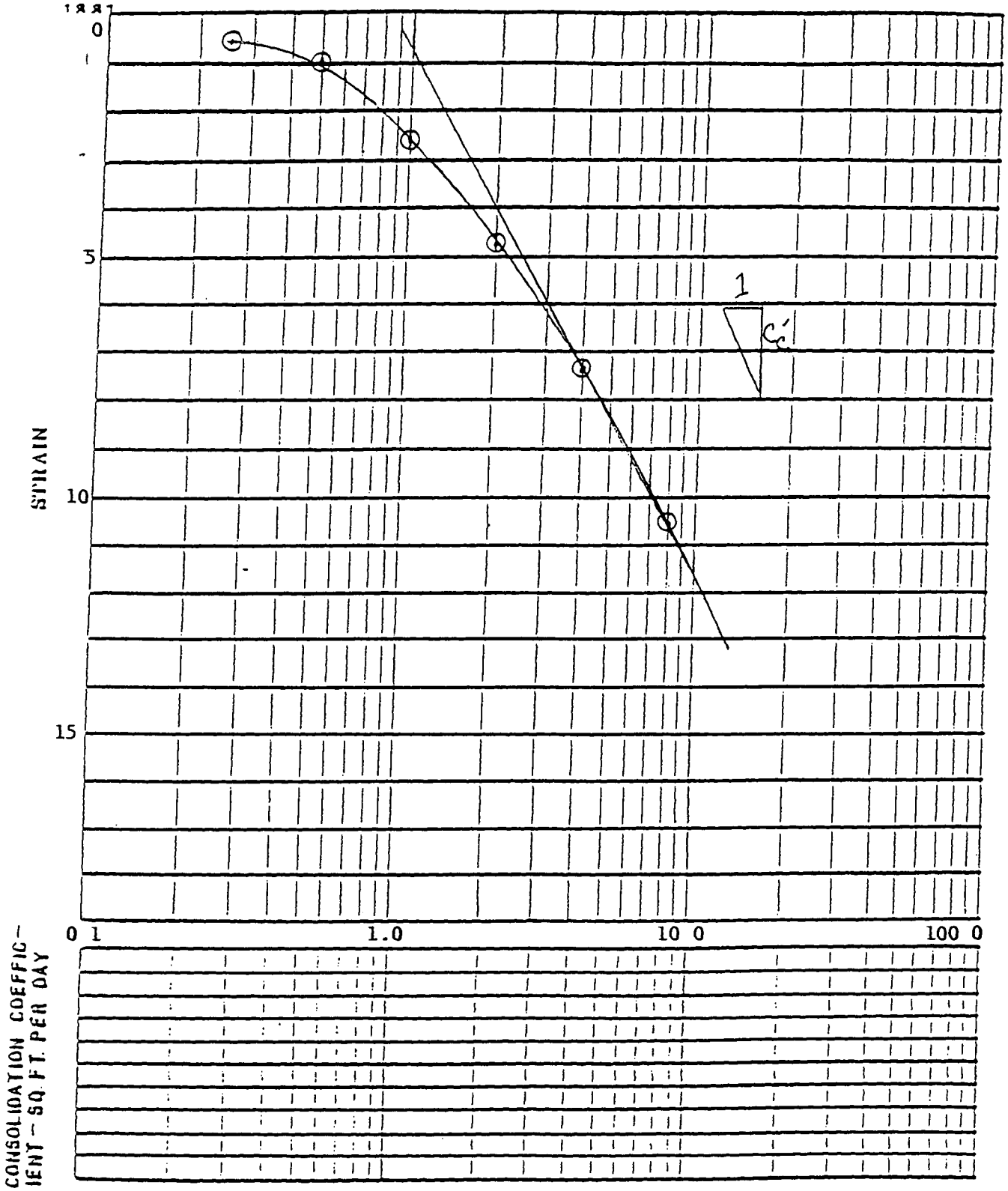
"OVER ONE HUNDRED YEARS OF SERVICE"

$C_c' = 0.102$



CONSOLIDATION TEST

SAMPLE DESIGNATION B-22: 2 to 4 feet

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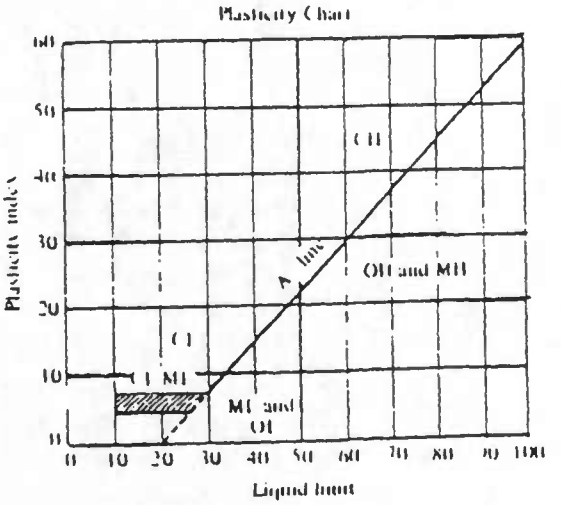
UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D-2487)

Major Divisions			Group Symbols	Typical Names	Laboratory Classification Criteria	
Coarse-grained soils (More than half of material is larger than No. 200 sieve size)	Gravels (More than half of coarse fraction is larger than No. 4 sieve size)	Clean gravels (Little or no fines)	GW	Well-graded gravels, gravel sand mixtures, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	
			GP	Poorly graded gravels or gravel sand mixtures, little or no fines	Not meeting all gradation requirements for GW	
		Gravels with fines (Appreciable amount of fines)	GM[a,d]	Silty gravels, gravel sand silt mixtures	Atterberg limits below A line or P.I. less than 4	Above A line with P.I. between 4 and 7 are *borderline* cases requiring use of dual symbols
			GC	Clayey gravels, gravel sand clay mixtures	Atterberg limits below A line with P.I. greater than 7	
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (Little or no fines)	SW	Well graded sands, gravelly sands, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	
			SP	Poorly graded sands, gravelly sands, little or no fines	Not meeting all gradation requirements for SW	
		Sands with fines (Appreciable amount of fines)	SM[a,c]	Silty sands, sand silt mixtures	Atterberg limits above A line or P.I. less than 4	Limits plotting in hatched zone with P.I. between 4 and 7 are *borderline* cases requiring use of dual symbols
			SC	Clayey sands, sand clay mixtures	Atterberg limits above A line with P.I. greater than 7	
Fine-grained soils (More than half material is smaller than No. 200 sieve)	Silts and clays (Liquid limit less than 50)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity		
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays		
			OL	Organic silts and organic silty clays of low plasticity		
	Silts and clays (Liquid limit greater than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts		
			CH	Inorganic clays of high plasticity, fat clays		
			OH	Organic clays of medium to high plasticity, organic silts		
	Highly organic soils		Pt	Peat and other highly organic soils		

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size) coarse-grained soils are classified as follows:
Less than 5 per cent — GW, GP, SW, SP
More than 12 per cent — GM, GC, SM, SC
5 to 12 per cent — *Borderline* cases requiring dual symbols[b]



FIELD CLASSIFICATION SYSTEM FOR SOIL EXPLORATION

NON COHESIVE SOILS
(Silt, Sand, Gravel and Combinations)

Density

Very Loose	- 5 blows/ft or less
Loose	- 6 to 10 blows/ft.
Medium Dense	- 11 to 30 blows/ft.
Dense	- 31 to 50 blows/ft
Very Dense	- 51 blows/ft or more

Relative Proportions

Descriptive Term	Percent
Trace	1-10
Little	11-20
Some	21-35
And	36-50

Particle Size Identification

Boulders	- 8 inch diameter or more
Cobbles	- 3 to 8 inch diameter
Gravel	- Coarse -1 to 3 inch
	- Medium -¼ to 1 inch
	- Fine -¼ to ½ inch
Sand	- Coarse -0 6mm to ¼ inch (dia of pencil lead)
	- Medium -0 2mm to 0 6mm (dia. of broom straw)
	- Fine -0 05mm to 0 2mm (dia of human hair)
Silt	-0 6mm to 0 002mm (cannot see particles)

Cohesive Soils
(Clay, Silt and Combinations)

Consistency

Very Soft	- 3 blows/ft. or less
Soft	- 4 to 5 blows/ft.
Medium Stiff	- 6 to 10 blows/ft
Stiff	- 11 to 15 blows/ft.
Very Stiff	- 16 to 30 blows/ft
Hard	- 31 blows/ft or more

Plasticity

Degree of Plasticity	Plasticity Index
None to Slight	0-4
Slight	5-7
Medium	8-22
High to Very High	over 22

Classification on logs are made by visual inspection of samples.

Standard Penetration Test- Driving a 2.0" O.D., 1-3/8" I.D , sampler a distance of 1 0 foot into undisturbed soil with a 140 pound hammer free falling a distance of 30.0 inches. It is customary for F&R to drive the spoon 6 inches to seat into undisturbed soil. then perform the test. The number of hammer blows for seating the spoon and making the test are recorded for each 6 inches of penetration on the drill log (Example - 6/8/9) The standard penetration test can be obtained by adding the last two figures (i.e. 8+9=17 blows/ft). (ASTM D-1586-67)

Strata Changes- In the column "Soil Descriptions", on the drill log, the horizontal lines represent strata changes. A solid line (__) represents an actually observed change, a dashed line (_ _) represents an estimated change

Ground Water - Observations were made at the times indicated. Porosity of soil strata, weather conditions, site topography, etc., may cause changes in the water levels indicated on the logs

SECTION VIII

SECTION VIII - ENVIRONMENTAL INVENTORY ELEMENTS

A. GEOLOGY & SOILS

Crisfield is located on the shoreline of the lower south western portion of the Delmarva Peninsula. The Delmarva Peninsula is located within the Coastal Plain which is underlain by beds of sand, gravel and clay, ranging in age from Cretaceous to recent. The major subsurface formations of the Coastal Plain have the general form of broad flat sheets which slope gently to the southeast. These sheets extend out under the ocean and presumably crop out on the ocean's bottom at the edge of the continental shelf. The parent material of the soils in Somerset county consisted of sediments transported mainly by water, although part of it may have been transported by wind, and part by ice floes carried by glacial meltwater.

In general the entire county is level or gently sloping with most slopes being less than 2 percent. Slopes of 10 percent are rarely exceeded. Only 10 percent of the county exceeds elevations in excess of 20 feet and almost all of the county is below 40 feet above sea level.

The parent soil material forming the marshes and lowlying areas of the project site were deposited in shallow salt water. These sediments were recently elevated to sea level by the slow uplift of the land or by fluctuations in the level of the sea and of the

Chesapeake Bay. The texture of the soil is directly related to the texture of its parent material.

Two soil associations, the Tidal Marsh Association and the Othello-Portsmouth Association are characteristic of the project site and its surrounding region. In fact, these two associations make up respectively 25 and 50 percent of Somerset County. The Othello-Portsmouth Association is composed of individual soils which are poorly drained to very poorly drained silt loams with nearly level topography. The Tidal Marsh Association is composed of highly organic soils occurring adjacent to tidal water bodies which are regularly inundated by tidal events. As illustrated by the soil map of Somerset County, Exhibit VIII-A, the project site is composed of three soil types, Tidal marsh, Man-made land and Othello silt loam with 0 to 2 percent slopes.

Approximately 30 percent of the existing land being utilized by this project is composed of Othello silt loam. This soil is characterized by dark grey to dark grey brown silt loam surface layer between 1 to 6 inches in undisturbed areas, or up to 10 inches in plowed areas. The surface layer is underlain by a thin grey silty layer which exhibits fine yellow brown mottles. The subsoil extends to a depth of 26 to 30 inches. It is composed of a sticky light grey to grey silty clay loam which exhibits pronounced yellow brown mottles. In some instances grayish sand underlines the subsoil below depths of 26 inches.

Generally Othello Soils lies soils are poorly drained and strongly acidic. They have a seasonal high water table located within 1 foot of the soil surface.

Man-made lands also represent approximately 30 percent of the existing land area utilized by this project. In most instances these are areas of former tidal marsh. The composition of the fill material varies from debris and oyster shell to select gravel fill.

The remaining 40 percent of existing land area utilized by this project consists of tidal marsh. Composition varies from soft highly organic sediments to firmer silty clay sediments.

In general the depth of marsh sediments are shallow and are underlain by sand. This can be observed along the channelward edge of tidal marsh area bordering the Little Annemessex River. Underlying sands are washed out from underneath marsh sediments by wave action along the shoreline edge. This results in significant ongoing erosion of the shoreline as surface sediments collapse into the adjacent waters.

B. HYDROLOGY

Somerset County is drained by rivers, streams and their tributaries which flow into Tangier Sound to the west and Pocomoke Sound to the south. The five rivers within the county

include the Wicomico, Manokin, Big Annemessex, Little Annemessex and Pocomoke. Marumsco Creek and East Creek are main water bodies which also drain a significant amount of acreage in the southern part of the county.

The project site is located on the easterly shore of the Little Annemessex River in an area known as Hop Point. It is located 2.5 miles upstream of the confluence of the river and Tangier Sound. Water depths at the mouth of the Little Annemessex River range from 3 to 13 feet. Water depth in Tangier Sound in the vicinity of the river range from 7 to 70 feet.

The natural headwater area of the Little Annemessex River is located 1 mile north-northeast of Hop Point. At this point the river is connected with the waters of the Big Annemessex River by a 1 1/2 mile long, 6 1/2 foot deep man-made canal known as Daugherty Creek Canal.

In the vicinity of the project site water depth ranges from 1 to 4 feet at mean low water. Water depth of the maintained navigational channel in the vicinity of the project is listed as 6 1/2 feet at mean low water. The width of the river in the vicinity of the project varies between 1/5 to 4/5 miles.

The surrounding landforms north of Hop Point and south of the

project form a small embayment to the west of the project site. Water depths in this embayment are variable, however, less than three feet at mean low water in most instances.

The predicted normal range of tide at the project site is 2 feet above mean low water. The average level of spring tides is predicted to be 2.4 feet above mean low water.

The proposed project site is composed of 3.65 acres that are presently composed of shallow water. This include a small portion of the existing embayment and the lower half of a ± 15 foot wide unnamed creek located in the central portion of the project site. All other water areas within the project area are man made ditches of variable width constructed for drainage or mosquito control purposes.

Depth to seasonal high water table within the land areas of the project site can be expected to be within 0 to 3 feet of the existing surfaces. Elevations within the project site do not exceed elevation 4.0. mean sea level.

Due to the relatively low elevation of this project site and it's vicinity, this area was the entry point of flood waters in the March 1984 flood of Crisfield. A portion of the navigational chart encompassing the project vicinity has been provided as Exhibit VIII-B of this report.

C. VEGETATION

Somerset County occupies 212,480 acres of land on the Delmarva Peninsula. Although no recent data exists it can be estimated that about 64,000 acres of the county is open land and about 70,000 acres is forested. Due to the large extent of poorly drained soil types found in the county trees are mostly water loving or water tolerant species. Oaks and Virginia pine are predominant in drier areas. Loblolly pine, pond pine, silver maple, red maple, sweet gum, blackgum, beech, dogwoods and american holly are found in damper soils.

Somerset County is composed of over 66,000 acres of coastal marshes. The most common marsh type, as identifies by the Maryland Department of Natural Resources, are high brackish marshes dominated be Juncus romerianus (black needle rush). This wetland type occupies 22,543 acres within the county.

The next most common wetland type is brackish high marsh dominated by Spartina patens (salt hay) and Distichlis spicata (salt grass). This wetland type occupies 13,236 acres within the county. This acreage is the highest of any Maryland county.

The third most commonly occurring wetland type is identified as low brackish marsh dominated by Spartina alterniflora (saltmarsh cordgrass). 6,901 acres of this wetland type is found within the

county. This figure is not exceeded by any other Maryland county with the exception of neighboring Dorchester county which has 12,280 acres of the marsh type.

Crisfield is an essentially urbanized and suburban town center. The most significant vegetation type is tidal wetlands which comprise 13 percent of the city. Most of this area is part of the approximately 400 acres of tidal wetlands located at Jersey Island. James Island State Park which is composed of 3000 acres of tidal wetlands is located along the western shore of the Little Annemessex River, opposite the proposed project site.

A detailed investigation of submerged aquatic and terrestrial vegetation types found on the project site was completed in May 1988. A detailed site cover map and boundary survey of wetlands under the jurisdiction of the Corps of Engineers was prepared. This work was accomplished utilizing the three parameter approach outlined in the Corps Wetland Delineation Manual, Technical Report Y-87-1, published January 1987. The result of the survey is illustrated on the 1"=100 foot photogrammetric map entitled Wetland Vegetation Map provided with the text of this report.

This detailed survey confirms the 1"=200 foot scale State of Maryland Wetlands Map (sheets 142,152,153 Somerset County). The main difference is that in the case of almost all of the 2.48

acres listed as "other" (indicating degraded areas) on our detailed survey, none of this land is shown to be under state jurisdiction.

The wetland limits and classification of the National Wetland Inventory Map prepared by the U.S. Department of the Interior which is included as Exhibit VIII-C of this report were also confirmed by our survey.

In regards to the occurrence submerged aquatic vegetation in the vicinity of the project, results of the 1978 and 1986 submerged aquatic vegetation maps provided by the Maryland Department of Natural Resources were reviewed in addition to the 1"=200 scale state wetlands maps. A intensive on site survey was also conducted by Environmental Concern Inc. in the immediate project vicinity on May 6, 1988.

The 1986 submerged aquatic vegetation map is provided as Exhibit VIII-D of this report. The 1976 map shows vegetation occurring in the same general locations, however, to a lesser extent. The 1986 map indicates the occurrence of Ruppia maritima (Widgeon grass) along the immediate shoreline of James Island State Park which forms the western bank of the Little Annemessex River. Areas of Ruppia maritima are shown to occur from Long Point upstream to Daugherty Creek Canal. Areas of vegetation are shown

to be largest in protected coves and mouths of small tributaries to the Little Annemessex River as exampled by West Creek, Back Creek and Island Gut. The closest portion of the proposed project is at or about 500 yards away from the mapped areas of Ruppia maritima.

A boat survey during low tide conditions was undertaken in the project vicinity on the morning of May 6, 1988. Visual observation as well as selected bottom sampling was conducted. The entire embayment in front of the project site including the area surrounding the Steuart Transportation facility was inspected. No submerged aquatic plant species were found to occur within or adjacent to the project site or anywhere east of the existing main navigational channel. This confirms the results of all past mappings.

West of the main navigational channel Ruppia maritima was found in coves and near shoreline edges of the Little Annemessex River. Dense patches of vegetation more frequently occurred in protected coves. Along land area immediately fronting the main river channel vegetation extended out not more than 200 to 250 feet. The results of past mappings are, therefore, also confirmed.

No Zannichella palustris (horned pondweed) was found anywhere in the vicinity of the project. This particular cosmopolitan

species is found in spring and late fall and is sometimes not present in summer months. Water salinity was sampled at 19 ppt on the day of the survey and previously noted at 14 ppt in past water quality reports. This salinity range is considered too high for the occurrence of this species.

In summary, dense scattered patches of the submerged aquatic plant Ruppia maritima (Widegon grass) is found in the segment of the Little Annemessex River along which the project is located. The occurrence of Ruppia maritima is, however, isolated to the western shoreline of the river. The closest occurrence being at a distance of approximately 500 yards from the most channelward portion of the proposed project.

A detailed wetland vegetation map, Exhibit VIII-E (foldout map) was developed in March 1988. No significant vegetation occurs on upland portions of the project (13.60 acres). These areas consist of existing impervious surfaces, open areas vegetated by lawn grasses or Phragmites australis (common reed).

Wetland areas of the project site for the purpose of discussion have been divided into 4 types, low marsh (1.45 acres), intermediate marsh (4.50 acres) high marsh (6.35 acres) and other (2.48 acres). Areas categorized as "other" are for the most part, not mapped as wetlands by the State of Maryland. However,

although degraded, they technically meet the standard for classification as area under Corps of Engineers regulatory authority.

The low marsh zone as delineated on the wetland vegetation map, consists mainly of Spartina alterniflora, generally between 6 to 18 inches in height. These areas occupy the lowest elevations on the wetland landscape. The intermediate marsh zone is composed of mainly of mixed Spartina alterniflora less than six inches high and Spartina patens. Distichilis spicata is also common to the mix. Juncus romerianus and Iva frutescens (high tide bush) are occasional.

The high marsh zone is characterized by mixed Spartina patens and Distichilis spicata. Iva frutescens and the common reed, Phragmites australis are common, especially in areas bordering uplands.

4.95 acres of high marsh impacted by this project is located to the east of Collins Avenue it is separated from direct connection to existing marsh/estaurine system by roads and surrounding development. The entire impounded wetland area totals approximately 25 acres in size. Tidal inundation into this area is limited. One 18" pipe, over 250 feet long, and 24" pipe connecting with the small boat

harbor provide only limited tidal flushing throughout the site. The limited tidal influence occurring in this area is confirmed by incursion and expansion of less salt tolerant species within this area in recent years. Review of past aerial photographs of the site shows a more monotypic area of salt grasses present. Species such as Myrica pensylvanica (bayberry), Baccharis halimifolia (groundsel tree), Juniperus virginiana (red cedar) and Toxicodendron radicans (poison ivy) have overtaken a large percentage of wetland northeast of the project site.

Slightly over one acre of land with the "other" wetland classification is part of the 4.95 acre area under discussion. This area is characterized by pure stands of Iva frutescens or Phragmites australis. Many old fill piles and debris also commonly occur. Until recently buildings were located within this area.

In March of 1988 maintenance and excavation of new mosquito ditches in this area was completed. Due to the limited tidal flushing of the site and surface ponding which still frequently occurs in this 25 acre area, it will remain a significant mosquito source despite the ditching. The wetlands area east of Collins Avenue has also been ditched in accordance with "open marsh" water management techniques. In this case, however, the ditching can be expected to have more positive effects because

the marsh is open to tidal action and is at a relatively lower elevation.

A partial list of other brackish marsh plant species potently occurring on a limited basis within the project site include:

Rhizoclonium kernei	red mat algae
Pluchea camphorata	salt marsh flea bane
Atriplex hastata	orach
Cyperus sp.	nut grass
Salicornia sp.	glassworts
Aster tenuifolius	salt marsh aster

Correspondence indicating that no state or federally listed plant or animal species occur at this site provided by the Maryland Department of Natural Resources is provided as Exhibit VIII-F.

D. FISH, SHELLFISH & WILDLIFE

Fish, shellfish and wildlife populations native to the Delmarva Peninsula are generally abundant in Somerset County due to the non-urbanized nature of the region. The occurrence of 66,000 acres of coastal wetlands and 85,000 acres of shallow water areas less than 12 feet in depth within Somerset County provide the necessary resources and habitat for diverse and productive fish and shellfish populations. Most open upland areas, including agricultural lands, are at a minimum fairly suited for open-land wildlife types typical of rabbits, some deer, red fox, meadow

vole, quail, and other upland birds. These areas represent approximately 30 percent of the county.

Although very few areas of virgin timber exist in Somerset County approximately 1/3 of the land is mature woods or land undergoing active sivicultural management. Most of these areas are well suited for woodland wildlife types such as white tailed deer, opossum, squirrels, pine vole and grouse.

Brackish water and salt water wetland areas comprise the remaining 26 percent of Somerset County. Quality habitat for wetland wildlife populations typical of muskrat, raccoon, rails, egrets, herons, ducks and geese is provided regionally as well as within the county.

The most significant wildlife habitats located within the limits of Crisfield are tidal saltwater wetlands which comprise 13 percent of the city. Most of this area is a part of approximately 400 acres of tidal wetlands located at Jersey Island, 1 mile south of the project site. Janes Island State Park which is composed of 3,000 acres of tidal wetlands is located along western shore of the Little Annemessex River opposite the proposed project site. Janes Island provides a large contiguous tract of high quality tidal wetland habitat which is relatively well isolated from most human activities.

The proposed project development limit and limit of proposed dredging is within 500 yards, and is to some degree, composed of tidal wetlands and shallow water areas used as waterfowl and fin fish breeding, nursery and habitat area.

Of the 31.80 acres to be developed, 13.60 acres are uplands and 3.42 acres are existing shallow water areas.

3.17 acres of this shallow water is part of shallow water embayment and narrow tidal creek which are suitable for finfish nursery habitat. The remaining 0.25 acres is composed of man made tidal ditches which are physically isolated from the surrounding system. These ditches are not significant with regard to fish, shellfish or waterfowl nursery habitat.

Existing shallow water habitat (one foot above to 4 below mean low water) which will be impacted by dredging for this project is estimated to be 15 acres. This area is located in proximity to the existing Steuart Transportation facility and existing navigational channel which presently services Steuart.

Data previously provided to the applicant in 1985 by the Fisheries Division, Maryland Department of Natural Resources is the most recent available information collected in the project vicinity. Data collected in the immediate vicinity of the

proposed project in May 1984 found seven species of fish occurring.

These include:

	Average Total Lengths (mm)
Leiostomus xanthurus (Spot)	39.2
Anchoa mitchilli (Bay anchovy)	48.0
Brevoortia tyrannus (Menhaden)	40.0
Trinectes maculates (Mummichog)	----
Fundulus majalis (Striped killifish)	----
Menidia beryllina (Silversides minnow)	40.0
Trinectes maculates (Hogchoker)	

As usual for collections made in saltmarsh habitat, the majority of the specimens collected were small, indicating that the utilization of the area is primarily as a nursery grounds. Other data collected by the Division in the Little Annemessex River, south of Crisfield, indicates high numerical density of individuals within the population combined with low total weight density. This condition also indicates that the project region is a fish habitat and nursery area.

The average number of individuals per acre collected in the Little Annemessex River, south of Crisfield by trawl samples from 1980 to 1983 was as follows:

SPECIES	ADV. NO. PER ACRE
Blue Crab (Callinectes sapidus)	15.4
Bay Anchovy (Anchoa mitchilli)	422.1
Spot (Leiostomus xanthurus)	289.4
Atlantic Menhaden (Brevoortia tyrannus)	13.3
Harvestfish (Peprilus alepidotus)	1.1
Atlantic Silverside (Menidia menidia)	0.3
Striped Anchovy (Anchoa hepsetus)	0.9
Toadfish (Opsanus tau)	0.1
Blueback Herring (Alosa aestivalis)	0.1
Hogchoker (Trinectes maculatus)	0.3
Summer Flounder (Paralichthys dentatus)	0.8
Northern Pipefish (Syngnathus fuscus	0.2
Weak fish (Cynoscion regalis)	0.5
Lizardfish (Synodus foetans)	0.1
Pigfish (Orthopristis chrysoptera)	0.1
total	764.6

Analysis of the data provided by the Division indicates the waters proximate to the project site are most frequently utilized as a nursery area for Leiostomus xanthurus (spot) and Anchoa mitchilli (bay anchovy).

In an early contribution to the knowledge of the benthic

intertebrate fuana of this region, Pfitisenmeyer found forty-one invertebrate species limited to bottoms in water between 3 and 9 feet deep. The common synapta, Leptosynapta inhaerens, the ornate worm, Amphitrite ornata, and the stout razor clam, Tagelus plebius, were the most abundant and widely distributed species (Pfitsenmeyer, 1960).

A partial list of invertebrate species potentially occurring at or near the project site is provided as Exhibit VIII-G of this report. In their 1984 sampling of the cove at the Steuart facility the Division collected three aquatic invertebrate species. These were:

Blue Crab	Callinectes sapidus *
Grass shrimp	Palaemonetes pugio
Soft clam	Mya arenaria

* average total length of sample was 70 mm.

Five natural oyster bars, totaling 3,285 acres are located in Tangier Sound in the vicinity of the mouth of the Little Annemessex River. The largest bar (N.O.B. 36-5) is 2176 acres and is closest to the River. It is located 3 4/5 river miles downstream of the project site. No natural oyster bars occur within 500 yards of the project site.

Of the 31.80 acres to be developed, 14.78 acres are regulated

tidal wetlands. The wildlife values of the 14.78 acres vary from high and low extremes. As detailed in the discussion on vegetation, regulated wetlands within the project site have been divided into four types.

Low Marsh (1.45 acres) - mostly Spartina alterniflora, flooded twice daily.

Intermediate Marsh (4.50 acres) marsh - mostly mixed S. alternilora and Spartina patens, regularly flooded.

High Marsh (6.35 acres) - Mixed S. patens, Phragmites australis and Iva frutescens, irregularly flooded.

Other (2.48 acres) - Highly degraded and/or disturbed areas mostly Phragmites australis, irregularly flooded.

The importance to the estaurine food chain of low lying, regularly inundated, salt marshes characterized by the low and intermediate types identified on this project site is well understood. Aside from the yearly production of 2.5 to 3.6 tons/acre of primary biomass in the form of organic detritus,

PREDICTED PRODUCTIVITY OF MARSH ZONES AT CRISFIELD

MARITIME INDUSTRIAL PARK

ZONE	STANDING CROP TONS/ACRE (TOPS)
Low marsh mostly S. alterniflora	2.5-3.6
Intermediate marsh mixed S.alterniflora and S. patens	1.0-1.8
High marsh mixed S. patens Distichlis spicata	1.5

Source :Estimated from standing crop data, Coastal Wetlands of Maryland, Maryland Department of Natural Resources.

this saltmarsh type provides highly productive habitat for a variety microorganisms and macroinvertebrates. Dense vegetation coverage and moist organic sediments characteristic of this wetlands type provide food, cover and living space for these organisms. Most of these small organisms are an important dietary component of larger vertebrate secondary consumers. The high value of these lowlying saltmarsh types to their adjacent estuaries is in many ways directly related to their frequency and degree of flooding. This is also true for many other recognized functions of tidal wetlands such as water purification. Flushing provided by tidal inundation is the mechanism which drives the water, plant and animal interactions inherent to saltmarshes. These interactions coupled with primary productively are the

basis for the recognition that saltmarsh wetlands, especially lowlying types, are valuable resources. 5.95 acres of the proposed project site are composed of these lowlying wetland types.

6.35 Acres of area characterized as high marsh exists within the proposed project site. The character of this habitat type is variable throughout the site. 1.4 acres high marsh is bordered by other wetlands types adjacent to the existing shallow water embayment west of the project site. A significant percentage of this area is dominated by the common reed, Phragmites australis, rather than more productive Spartina patens and/or Distichlis spicata wetland types. These areas are relatively less important in comparison with low and intermediate marsh types. Their detrital export to the estuarine system is lower and it is less frequently flushed into adjacent water bodies. The abundance of macroinvertebrates important to many secondary consumers of the marsh estuaries is much less. They do, however, provide buffering from human activities, as well as cover for larger forms of wildlife.

The value of the remaining 4.95 acres of high marsh located west of Collins Street is impacted by a unique set of existing circumstances. This area is impounded by the existing roadway network or surrounding upland development. With the exception of one 18 inch diameter pipe over 250 feet in length and one 24 inch

diameter pipe, this area is completely shut off from tidal influence. Wetlands areas, not part of the project site, which are also part of the impounded area total approximately 20 acres. Little if any flushing, therefore, can occur over this 25 acre wetland area under present circumstances.

With the exception of a highly disturbed and debris filled area which was a former building site, (part of the project site, categorized under "other" classification), all of the 25 acres is predominantly vegetated by mixed Distichlis spicata and Spartina patens grasses. Phragmites australis and Iva frutecens also occur frequently. Species such as :

Myrica pensylvanica	(bayberry)
Baccharis halimifolia	(grounsel berry)
Juniperus virginiana	(red cedar)
Toxicodendron radicans	(poison ivy)

also commonly occur on the northeast portion of the area, away from the project site.

Although this area has value as wildlife habitat in a general sense, the present circumstances greatly reduce the functional significance generally associated with wetlands of this type. Due to the limited interaction of this area with adjacent estuarine waters, export of detritus, decomposing plant material, nutrients, microorganisms and macroinvertebrates is not possible.

The relative contribution of this area to the adjacent marsh/ estaurine system is low in comparison to other wetland the areas previously described.

The area in its present condition would still provide space for salt meadow inhabiting organisms not so dependent on tidal flooding. Rodent populations and some assemblages of insect populations are good examples. Some middle and upper level carnivores would still find adequate food and cover. Ditches within the site provide habitat for killifish and are utilized as forage areas for birds such as egrets and herons. The limited tidal inundation of this site is also confirmed by the occurrence of plants and animal associated with lower salinity habitats such as the snapping turtle (observed at site). A partial list of vertebrate species potentially to occurring in or near wetlands in the vicinity of the proposed project is provided as Exhibit VIII-H of this report.

Despite recent mosquito control efforts in it's present condition, especially in disturbed parts of the area, this portion of the project site is still capable of producing a significant number of salt marsh breeding mosquitos, such as Ades sollicitans. Due to the proximate location of this site to the center of Crisfield this area very likely contributes significantly to any local mosquito problem.

The upland areas of the proposed project have no significance as wildlife habitat. Almost all of this area is cleared of any woody vegetation. Vegetative coverage is either Phragmites austrailis or upland lawn grasses. Impervious developed surfaces or bare gravel surfaces also compose this acreage.

The main focal point of observable wildlife activity on site is at the shallow water/shoreline/low marsh ecotone along the embayment formed by the waters of the Little Annemessex River. This would be expected since wildlife biologists have long recognized that high wildlife values occur where vegetation/ water interspersion occurs to a high degree.

Conversely, observable wildlife activity within the wetland area impounded by Collins Street which includes the 4.95 acres of high marsh to be filled is less frequent and diverse. Likewise, this would be expected for a number of reasons. No significant vegetation/water interspersion exists. Free access into and out of this site by many organisms is limited by existing physical barriers. The site along it's perimeter is abutted by existing residential development, roads or other human activities.

In summary, tidal wetland and shallow water habitat are a portion of, and exist within, 500 yards of the project site. The functional values of the areas impacted by the project are highly

variable. Impact of filling shallow water and impact to low marsh will have the greatest effect to the fish and wildlife resources.

The most important impact aspect of this project will be in the loss of primary productivity, invertebrate production and finfish nursery habitat. The project site and it's vicinity is less important to a significant degree with regards to waterfowl and other mammal populations. This is mainly due to it's location, surrounding uses, and ongoing adjacent human activities. In the case of the area east of Collins Avenue, isolation and lack of vegetation/water interspersion are key limiting factors.

In regards to the presence of any state or federally listed plant or animal species occurring on the project site we have enclosed as Exhibit VIII-F updated findings by the Maryland Department of Natural Resources. None occur on the project site. A colony of least terns does occur near the Coast Guard Station. This area is sufficiently distant form the project site so that no impact due to this project will occur.

E. WATER QUALITY

The Tangier Sound area encompasses the Little Annemessex River,

Deal Island, and the water area between Smith, South Marsh and Bloodsworth Islands and the mainland of Somerset County. Besides the mixing and exchanging that occurs with the Chesapeake Bay, the Tangier Sound segment has the Nanticoke, Wicomico, Big Annemessex Rivers and Little Annemessex emptying into it.

Almost all waters within this segment are Class II and open to shellfish harvesting except Jenkins Creek, Little Annemessex River and Daugherty Creek Canal.

In July 1976, an intensive study of the Little Annemessex River and it's tributaries was conducted the purpose of input information for modeling. All standards for Class II and Class I waters were met. From this limited amount of information, water quality appear to be good in this area. One biological station was also sampled at Crisfield. The species diversity index was 2.90 (3.0 is a minimum for clean water designation) indicating good water quality (Corps, 1984). One trend station located in Crisfield was sampled six times between April and October, 1976, and all parameters for Class II waters (except one bacterial sample) were met. Aside from high fecal coliform levels, it is still reasonable to expect that water in the Little Annemessex River likely remains good since no major changes in the area have occurred over recent years.

Since May 1942 all of the Little Annemessex River upstream of

Long Point and Hammock Point (±7/8 mile below Crisfield) has been closed for shellfish harvesting. Fecal coliform levels exceeding the state standard of 14 M.P.N./100 mls are regularly exceeded in the vicinity of project. Recent data provided by the Department of the Environment for the Hop Point area has been provided as Exhibit VIII-I of this report. The area closed for shellfish harvesting in the Little Annemessex/ Daugherty Creek Canal segment is 957 acres. Since the proposed project site is located in the immediate vicinity of the outfall pipe discharging from Crisfield Sewerage Treatment Facility, it can be expected that the project site will remain within the "safety zone" for shellfish harvesting activities even if water quality conditions improve in future years.

The major center of pollution on the Little Annemessex River is Crisfield. Crisfield's secondary sewage treatment plant adjacent to the project site is the most significant single point source. Additional pollutant contributions can be attributed to boating activities, shoreline erosion, failing rural septic systems, stormwater and agricultural runoff.

Information collected in the July 1976 study indicated the following conditions in the Hops Point vicinity of the Little Annemessex River:

Salinity	13.97 ppt
ph	7-8
Dissolved Oxygen	6.7 mgl.

Water salinity of 19 ppt. was recorded at the project site on May 6, 1988. Other than fecal coliform data available from the Maryland Department of Environment, Exhibit VIII-I,no other recent water quality data has been located as of this date.

F. OUTDOOR RECREATION

Tourism and all water related outdoor recreational activities are presently and will continue to be an important segment of the economy of Crisfield and Somerset County. Locally, in the vicinity of the proposed project Somers Cove Marina and the surrounding downtown areas along Md. Rt. 413 are a focal point for tourist activities. Cruises are provided to nearby Smith Islands and charter fishing is available. Hunting excursions also depart from this area. Excellent boat launching and marina facilities at Somers Cove along with restaurants, motels and a museum are also present.

Rural lands and wetlands outside of Crisfield provide large tracts of acreage for waterfowl, deer and upland game hunting activities. Tangier Sound provides excellent sport fishing.

The proposed project site is not important to these activities. Due to surrounding residential development hunting is not an appropriate activity.

Direct water access to the Little Annemessex River from the project site is limited. Water fronting the project site east of the navigational channel are not important recreation or commercial fishing or boating areas.

Surrounding land uses are not tourism related. Existing use is mixed commercial/industrial with some secondary residential use. The Crisfield sewage treatment facility is also located adjacent to the project site. This segment of the Little Annemessex River fronting the project site is presently closed to shellfish harvesting.

G. LOCATION OF ADJACENT WATER QUALITY DEPENDENT INDUSTRIES

Crab shedding operations are common throughout the waterfront areas of Crisfield. Most are small independent operations.

Within 500 yards of the project site crab shedding operations occur in two specific areas. First, approximately 30 independently owned and operated float boxes are dispersed throughout the small boat harbor. The harbor is located to the immediate north and east of the project site. It is a man-made

lagoon which has channel access to the Little Annemessex River upstream of the project site. In terms of river miles is approximately 1,100 yards away from the project site.

The second area where crab shedding operations occur is along the waterfront of a cove formed by a bulkheaded fast land portion of Crisfield immediately downstream of the Steuart Transportation facility.

Floats exist at the commercial facilities of the Byrd, Handy, Dryden and Bluepoint Companies. The Handy Company operation is by far the largest and most important. Channel dredging operations are proposed within 75 yards of the Handy and Byrd shoreline frontage. Fastland development for the proposed project is located approximately 360 yards from the waterfront areas of these facilities.

H. EXHIBITS

Exhibit VIII-A - County Soil Map

Exhibit VIII-B - Nautical Chart

Exhibit VIII-C - National Wetlands Inventory

Exhibit VIII-D - Submerged Aquatic Vegetation

Exhibit VIII-E - Wetland Vegetation Map (Foldout)

Exhibit VIII-G - Names of Invertebrates

Exhibit VIII-H - Names of Invertebrates

Exhibit VIII-I - Fecol Coliform Levels

COUNTY SOIL MAP

Oh A - Othello Silt Loam Tm - Tidal Marsh Ma - Made Land

EXHIBIT VIII-A

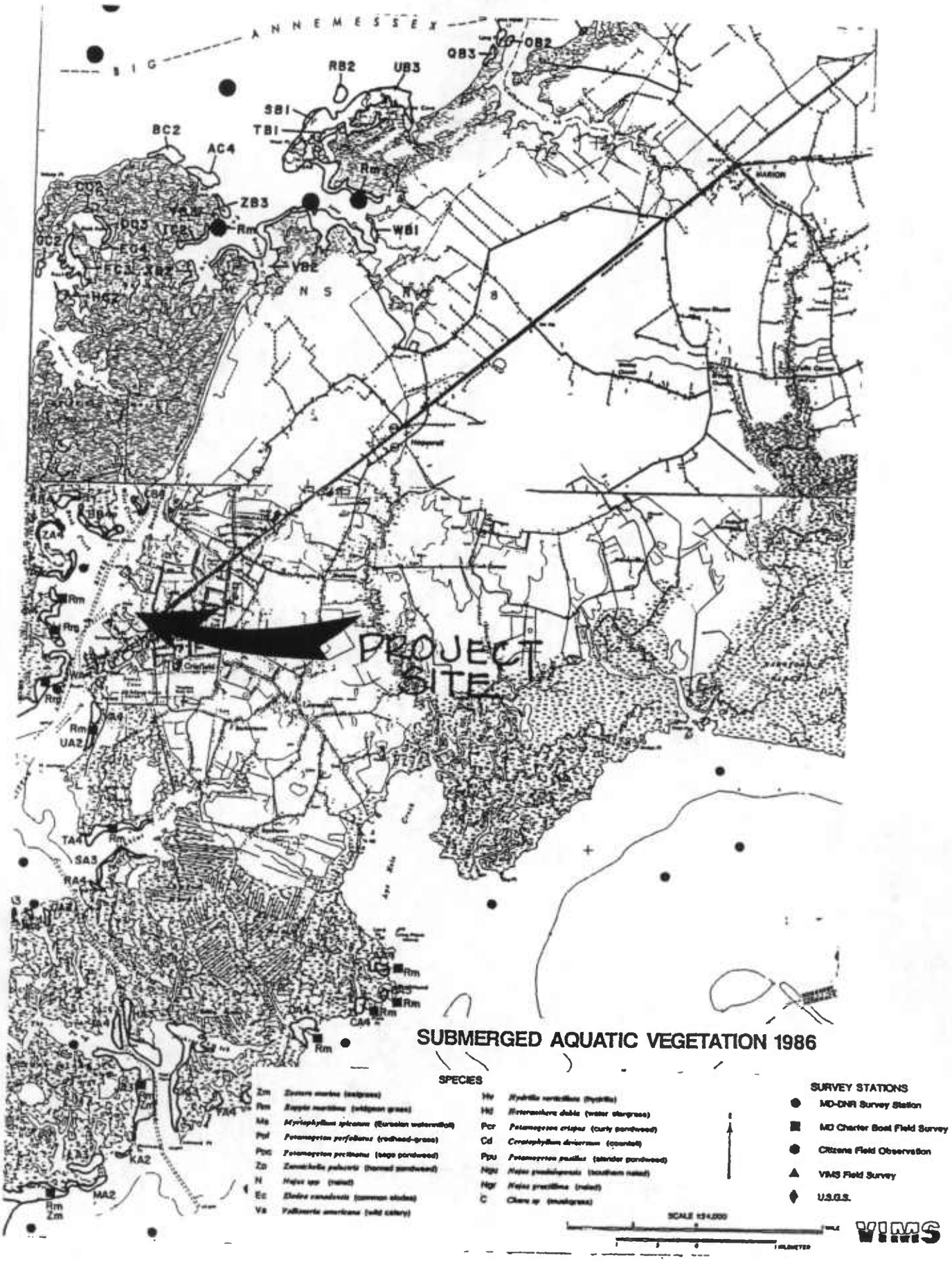


EXHIBIT VIII-D