STATE OF DELAWARE

DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL-SITE INVESTIGATION AND RESTORATION BRANCH

FINAL PLAN OF REMEDIAL ACTION

SCANNED
SEP 26 2006
File # 1360
B9

September 2006

Former Timmons Marina
Dagsboro, DE **DNREC Project No. DE-1360**

This Final Plan of remedial action (final plan) presents the Department of Natural Resources and Environmental Control's (DNREC's) cleanup plan for the Timmons Marina site in Dagsboro, DE. For site-related reports and more information, please see the public participation section of this document.

The purpose of this final plan is to provide 1) specific information about the soil and groundwater contamination present at the Site and 2) the Sediment Handling Plan that will be implemented at the site. In addition, as described in Section 12 of the Delaware Regulations Governing Hazardous Substance Cleanup (Regulations), DNREC will provide notice to the public, and an opportunity for the public to comment on this final plan. Included in this final plan is a summary of the Brownfield investigation (BFI) of the Site, and the Sediment Handling Plan (SHP). The SHP is an interim action that will be implemented when the Division of Water Resources issues a dredging permit to the owner. Each of these reports will be included in the administrative record file. Copies of these documents can be obtained or viewed at the DNREC offices in New Castle, Delaware.

INTRODUCTION

The Former Timmons Marina (Site) is located in the town of Dagsboro in Sussex County, Delaware (Figure 1). S.K. Pepper Creek L.L.C., the current owner of the Site, contracted Duffield Associates, Inc. (consultant) to evaluate sediment quality and provide recommendations for handling the sediments during dredging, drying, and on-site use. The owner's intent is to develop the agricultural and wooded acreage of the Site as a residential community and to rehabilitate the marina. As part of the rehabilitation, the owner proposes to dredge some of the marina sediments. The dredged sediments will then be place on selected proposed lots in the residential community.

The owner signed a Modified Brownfield Development Agreement (MBDA) with the Department of Natural Resources and Environmental Control-Site Investigation and Restoration Branch (DNREC-SIRB) on October 11, 2005. The agreement included an investigation to evaluate risks to human health and the environment, and the implementation of a Sediment Handling Plan (SHP).

The consultant performed a Brownfield Investigation (BFI) at the Site under the supervision of the DNREC-SIRB. The purpose of the BFI was to:

1. Assess the character of soil and groundwater at the Site, as well as the bottom sediments in Pepper Creek to identify issues of potential environmental concern, if any.

2. Characterize environmental conditions of the marina sediments to identify potential surface-water quality issues associated with dredging activities.

3. Identify potential issues associated with the proposed drying and use of the excavated sediments on-site

The result and recommendations of the BFI investigation was included in a report (Brownfield Investigation report) submitted to DNREC on February 13, 2006. Included in the report was the SHP. The SHP, as earlier mentioned, is an interim remedial action plan that will address the reuse of dredged sediment at the site. The plan incorporates an engineering design along with an environmental convenient that restricts the use of the dredged sediment. The SHP is further discussed below.

Following DNREC's review of the BFI report, a Proposed Plan of Remedial Action (proposed plan) was issued for public comment on July 24, 2006. The proposed plan contained a summary of the remedial investigation and the proposed remedial action. The public comment period lasted for twenty days without any public comment, after which the proposed plan was made the final plan

SITE DESCRIPTION

The Site (tax parcels 2-33-7-30 and 2-33-7-28) is bounded in the north by Piney Neck Road (southern side of County Road 336), in the south by the northern shore of Pepper Creek. Agricultural lands are adjacent to the western property boundary and residential properties are adjacent to the eastern property boundary. The majority of the property, approximately 43 acres, is currently used for agriculture. A small wooded area (approximately 2 acres) borders the agricultural area near the eastern boundary. Chicken houses, agricultural equipment, and other mechanical debris occupy the wooded area (See Figure 1).

The marina area is approximately 7 acres. The main access to the marina is via a dirt road along the western property line. The marina area extends approximately 1,040 linear feet along the northern shoreline of Pepper Creek. Uphill of the marina were several buildings that formerly supported marina operations. These included a shed and a maintenance shop along with a residence. The former maintenance shop was occupied by solid waste debris and containers of petroleum products. The buildings were demolished prior to the BFI in September 2005. The lowland portions of the marina consist of a boathouse and several piers, as well as floating docks. The majority of the structures in the marina area are deteriorated. The marina docks and piers are collapsing and the shoreline ramps and roadways are dilapidated.

SITE HISTORIC USE

A Phase I Environmental Site Assessment (ESA), Pepper Creek Property was prepared by Atlantic Hydrologic, Inc., in February 2006. The 1938 aerial photograph in the ESA shows that the Site was used for agriculture. The aerial also shows a residential structure at the Site, which was demolished as of September 2005. According to the ESA, there are no public water supply wells within a one-mile radius of the Site.

The marina was constructed in 1960. During its operation, the marina was a 65-slip facility that included shop buildings, boat storage areas, and other structures. According to the ESA, herbicides were used for agricultural purposes. Numerous containers of motor oil and lubricating fluids were also observed during the ESA.

BROWNFIELD INVESTIGATION (BFI) AND RESULTS

General:

The consultant began the BFI in October 2005. As part of the BFI, a SHP report was submitted to DNREC-SIRB in November 2005. The report summarizes the consultant's assessment of sediment quality at the Site. The consultant's sampling approach during the investigation was based on potential environmental issues associated with the historic use of the Site. Since the Site has been used consistently for agricultural purposes, the assessment anticipated the potential presence of pesticides and fertilizers in the soil.

In accordance with the September 2005 approved Brownfield Investigation Work Plan (BFIWP), the consultant collected shallow and deep soils samples and installed 4 temporary groundwater monitoring wells at the Site. Sampling began in October 2005. The sampling locations are in Figure 2.

SOIL EVALUATION

Forty-eight shallow (0"-2") and 39 deep (2"- refusal/groundwater) soil samples were collected during the soil evaluation. DNREC-SIRB screened all the soil samples for volatile organic compounds (VOC), semivolatile organic compounds (SVOC), pesticides, polychlorinated biphenyls (PCBs) and inorganics (metals). The general result of DNREC-SIRB's soil screening indicated the presence of metals such as arsenic, antimony, barium, cadmium, lead, mercury, vanadium and zinc. The table below shows the metals that exceed Typical Delaware Soil Concentrations.

Table 1: Summary of Screening Detections of Inorganics

Soil Contaminant	URS for Unrestrict -ed Use mg/kg	Typical Delaware Soil Conc. Mg/kg	Average concentra-tion mg/kg	Maximum concentra-tion mg/kg	Minimum concentra-tion mg/kg
Antimony	**3**	**0.5**	**6.28**	**508**	0.06
Arsenic	**0.4**	**11**	**2.24**	**21.5**	0.01
Chromium	**12,000**	**5-30**	20.6	**76.9**	0.05
Copper	**310**	**15-40**	**48.4**	**4,121**	0.02
Lead	**400**	**30-100**	22.3	**295**	5.0
Zinc	**2,300**	**60-90**	40.1	**518**	5.7

DNREC-SIRB reported the presence of organic compounds qualitatively. These include gasoline-range organics (GRO), diesel-range organics, total petroleum hydrocarbons (TPH), and volatile organic compounds (VOC). One soil sample had GROs, two soil samples had SVOCs, and 24 soil samples had Tentatively Identified Compounds (TICs). Screening results and field observations indicate that additional sampling was needed in sampling-locations M-18 and M-19 due to high levels of TPH and GRO.

In accordance with the Work Plan, 23% of the collected samples were sent to Severn Trent Laboratories (STL) Edison for confirmatory analyses. The samples were selected based on DNREC-SIRB's screening results. The analyses included Total Analyte List (TAL) inorganics such as heavy metals and cyanide, and Total Compound List (TCL) organics such as pesticides, PCB, and semi-volatiles for two of the selected samples. Sample M-18 surface and M-19 surface were sent for diesel-range range organics (DROs) and GROs. A total of twenty-one samples were sent for TAL metals.

Inorganic contaminants were detected in the confirmatory soil samples. The average concentrations of metals such as arsenic (1.41 mg/kg), barium (22.2 mg/kg), cobalt (1.1 mg/kg), copper (15.4 mg/kg), lead (11.9 mg/kg), mercury (0.03 mg/kg), vanadium (4.55 mg/kg) and zinc (22.4mg/kg) were all included in the BFI report (see table 2). With the exception of arsenic, none of the recorded average concentrations exceeds the URS (see table2). The analytical results indicate that arsenic is present in the soil at concentrations within the naturally occurring background range. The next table (2) indicates the analytical levels (average, maximum, and minimum) of arsenic in the confirmatory samples. These concentrations are below the Typical Delaware Soil Concentration of 11 mg/kg.

Table 2: Summary of Analytical Detections of Inorganics

Soil Contaminant	URS for Unrestrict -ed Use mg/kg	Typical Delaware Soil Conc. mg/kg	Average concentra-tion mg/kg	Maximum concentra-tion mg/kg	Minimum concentra-tion mg/kg	Standard Deviation
Antimony	**3**	**0.5**	1.3	1.3	1.3	0.0
Arsenic	**0.4**	**11**	**1.41**	**9.6**	**0.68**	1.96
Barium	**550**	**80**	22.2	37.1	6.9	8.85
Cobalt	**22**	**13**	1.1	1.4	0.80	0.42
Copper	**310**	**40**	15.4	143	1.5	31.46
Lead	**400**	**100**	11.9	53.3	1.9	13.3
Mercury	**10**	**0.3**	0.03	0.06	0.02	0.01
Vanadium	**55**	**40**	4.6	5.5	3.66	1.3
Zinc	**2300**	**90**	22.4	132	5.8	29.8

Additional sampling (focused sampling) was performed to delineate detections above the URS for Unrestricted Use in M-14, M-17, M-18, M-19, and M-23 (Figure 2). The result of the focused sampling eliminated M-17, M-19, and M-23 as areas of potential environmental concern. The result also indicated that 93 % of the detections were below the URS for Unrestricted Use, and none of the detections exceeded 10 times the URS value. This is consistent with the "75/10" rule according to the "Remediation Standard Guidance". In line with this rule, none of the detected contaminants are of potential concern

The focused sampling showed that DRO was detected in samples M-18 surface (1,600 mg/kg) and M-19 surface (27.2 mg/kg). There is no remediation standard for DRO; however, the URS for Unrestricted and Restricted Use in a Critical Water Resource Area for petroleum hydrocarbons are 1000 mg/kg in range C_9 to C_{18} and 2,500 mg/kg in range C_{19} and C_{28}. As such, the detection of the DRO, at 1600 mg/kg exceeded this standard. Analytical results show that potential problems with DRO are isolated to the vicinity of the initial sampling location (M-18). The analytical detections of DRO poses minimal risk since the extent of the DRO detection is limited and no indication of significant petroleum migration was found.

GROUNDWATER EVALUATION

Groundwater samples were collected from five temporary wells in November 2005 and sent to GLA laboratory in Edison New jersey for analyses. The results, as shown in table 3 indicate a range of nitrate/nitrite concentrations of 4.4 mg/L to 18 mg/L in the groundwater samples. Two out of 5 of the samples exceed the EPA's National Primary Drinking Water Standards of 10 mg/L.
The results also indicate that contaminants such as semi-volatile organics, pesticides, and inorganics were present in the groundwater samples. According to table 3, chlordane was detected in only one sample (MW-2) at 2.4 ug/L, which exceeds the URS (2 ug/L).

Table3: Summary of Analytical Detections that exceed the URS

Contaminant	URS for groundwater ug/L	MW-1 ug/L	MW-2 ug/L	MW-3 ug/L	MW-4 ug/L	MW-5 ug/L
Chlordane	**2**	U	**2.4**	U	U	U
Bis(2-ethylhexyl)phthalate	**6**	U	U	U	U	2.2 J
Aluminum	**200 (SMCL)**	U	**386**	**410**	U	U
Iron	**300 (SMCL)**	**313**	**1,130**	**1,880**	**503**	U
Thallium	**2**	**4.8 U**	**4.8 U**	**4.8 U**	**4.8 U**	**4.8 U**
Nitrate/Nitrite	**10 (EPA)**	**18**	9.6	8.8	4.4	**15**

U: undetected

The following contaminants were detected but do not pose any unacceptable risk:

- Bis(2-ethylhexyl)phthalate was detected in sample MW-5 (residence well). This contaminant is not of potential concern since the reported concentration is below the standard as shown in the table above. In addition, it is a common laboratory and sampling contaminant and may not represent true site conditions.

- The inorganic (iron and aluminum) contaminants detected in the groundwater samples exceed the Secondary Maximum Contaminant level (SMCL) standard, which only applies to characteristics of water that affects the taste, odor, color, or appearance of water. Therefore, the inorganics are not of potential concern.

SEDIMENT EVALUATION

Twenty-two split sediment samples were collected from the marina area (Figure 2). In accordance with the work plan, 22 split samples were sent to DNREC-SIRB for screening and STL in Edison New Jersey for analyses. STL analyzed three of the 22 samples for SVOCs, VOCs, pesticides, PCBs, and metals. The remaining samples were sent for polynuclear aromatic hydrocarbons (PAH), BTEX (benzene, toluene, ethylbenzene, and xylene), TPH, Acid Volatile

Sulfide (AVS), and sulfur Extracted Metals (SEM). The assessment of the sediment quality at the Site shows that most metal concentrations in the sediment are consistent throughout the boathouse area. The analytical result indicated average concentrations of metals such as arsenic (11mg/kg), barium (above 39.9 mg/kg), copper (75 mg/kg), lead (35.1 mg/kg), nickel (22.5 mg/kg) and zinc (200 mg/kg) as being contaminants of potential concern because their average concentrations exceed the URS for Unrestricted use. It appears from the analytical result that in the propose-dredge area, the surface sediments contain higher concentrations of metals than the subsurface sediments.

Based on the geochemical and physical properties characterizing Pepper Creek, significant dissolution of the metals in the water column is not anticipated. However, just as a precautionary measure, the consultant recommends hydraulic dredging. This allows for the removal of sediments by suction and pumping, thereby minimizing the re-suspension of sediments in the water column.

Risk Evaluation of Sediments

The consultant performed a risk calculation in accordance with the "Site-Specific Standard with Calculation for Multiple Analytes" procedure described in the Remediation Standard Guidance.

The cumulative cancer risk for the sediment was calculated to be $3x10^{-5}$ and the calculated Hazard Index was 0.7. The calculated cancer risk exceeds the State of Delaware's regulatory risk level of $1x10^{-5}$ according to the Regulations Governing Hazardous Substance Cleanup (State of Delaware, 1996). The main contributor to the high cancer risk level is the arsenic contaminant in the sediment. The calculated non-carcinogenic Hazard Index is lower than DNREC's regulatory level of one (1). The result of this risk calculation clearly shows that the sediments are not suitable for use where daily direct contact of the sediments might occur; therefore, human exposure to sediments must be minimized.

For Non-residential Scenario, the cumulative cancer risk for the sediments was calculated to be $7x10^{-6}$, and the calculated Hazard Index was 0.3. These risks are lower than the State of Delaware's Regulation of $1x10^{-5}$ and 1 for cancer risk and non-carcinogenic risk respectively. As such, the sediments meet non-residential requirements. Since the sediments will be placed on parcels at the Site that will be non-residential, this requirement will be met. The probability of exposure will be further reduced by providing a clean cover over the sediment.

In addition, consultant performed calculations to estimate the concentration of arsenic expected in the leachate from the sediment drying and use areas per EPA's July 1996, document titled "Soil Screening Guidance: Users Guide". Based on the calculations, the estimated concentration of arsenic that could produce a leachate exceeding drinking water standards is 29.1 mg/kg. Whereas, the calculated 95% Upper Confidence Limit (UCL) is 12 mg/kg, which is well below the critical concentration. This provides the confidence that the leachate from the dredge sediments will not contain arsenic levels that exceed drinking water standards.

Sediment Handling and Storage

As part of the Sediment Handling Plan (SHP), the handling of the dredged sediments will be a two-staged process. The material will be placed on a temporary drying area (Figure2) as slurry. The dredged sediments are then transferred to a drying basin. After drying, the dredged sediments will be excavated and moved to parcels onsite dedicated for non-residential use. The approximate size and proposed location of the sediment-drying basin is shown on Figure 3. The owner proposes a post excavation sampling to confirm that the arsenic concentration at the temporary drying location and the drying basin does not exceed the target level of 5 mg/kg. If the concentration is exceeded, the soils at the locations will be excavated until the target level is met. The drying basin will be designed to accommodate approximately 20,000 cubic yards or 1.5 times the sediment volume (approximately 10,200 cubic yards), plus freeboard.

The Site owner intends to use the dried material (sediment) as part of the Site features. The dried material will be divided into two parts. One part will be used to create a landscaping berm on a nonresidential parcel within the property. As an extra precaution, the dried material will be contained within a geo-textile material serving as a barrier, and covered with clean soil along with the necessary erosion control features. The remaining part will be placed beneath a parking lot to be constructed onsite. In addition, an environmental covenant that limits the future use of the selected lots to non-residential use will be recorded. Figure 3 shows the proposed dredged material storage areas.

CONCLUSION OF BFI

The analytical results of the soil reflect no environmental issues present at the Site with respect to VOCs, pesticides, PCBs, DRO, inorganics, and PAHs that pose a risk to human health or the environment. Therefore, no further action is necessary to address soil related conditions at the Site.

Groundwater results indicate the presence of nitrate/nitrite and certain inorganics in the submitted samples. The presence of nitrate/nitrite in the groundwater samples is due to the historic use of the Site. The presence of inorganics, such as iron and aluminum, represent natural background conditions. However, further evaluation is required if groundwater is to be used for human consumption.

According to the SHP, most of the metal concentrations in the sediment are consistent throughout the investigated area of the Pepper Creek. The calculated non-cancer risk associated with these contaminants is acceptable. The calculated cancer and non-cancer risk for a construction worker exposure is acceptable. The results of the soil leaching calculations indicate that concentrations of arsenic in the sediments will not impact groundwater.

REMEDIAL ACTION OBJECTIVES

According to Section 5.1 of the Delaware Regulations Governing Hazardous Substance Cleanup, site-specific remedial action objectives (RAOs) must be established for all plans of remedial action. The Regulations provide that DNREC set objectives for land use, resource use, and cleanup levels that are protective of human health and the environment.

Qualitative RAOs describe, in general terms, what the ultimate result of the remedial action, if necessary, should be. The following qualitative RAO is determined to be appropriate for the Site:

- Prevent human exposure to contaminated dredge sediments at the Site.

The objective is consistent with the Sussex County zoning policies; State regulations governing water supply; worker health and safety; and the proposed use of the Site as a residential development.

Based on the above qualitative RAO, the following quantitative RAO was developed:

- Prevent human exposure to contaminated dredged sediments having an arsenic level greater than the Typical Delaware Soil Concentration of 11 mg/kg.

FINAL PLAN OF REMEDIAL ACTION

Based on DNREC-SIRB's evaluation of the Site information and the above remedial action objectives, the DNREC proposes the following remedial action be taken at the site:

- Implement the provisions of the SHP as highlighted above under Sediment Handling and Storage, and according to the Sediment Handling Plan, Former Timmons Marina dated November 2005, which was submitted to DNREC-SIRB on December 20, 2005.

- An environmental covenant, consistent with Delaware's Uniform Environmental Covenants Act, UECA (Title 7, Del. C. Chapter 79, Subtitle II), will be required at the Site, within 90-days following DNREC's adoption of the Final Plan of Remedial Action. The covenant will prohibit future soil excavation at both dredge sediment locations (parcels) at the Site, and limit the use of these parcels to nonresidential.

PUBLIC PARTICIPATION

DNREC did not receive any comments on the Proposed Plan of remedial action between the period of July 24, 2006 and August 14, 2006.

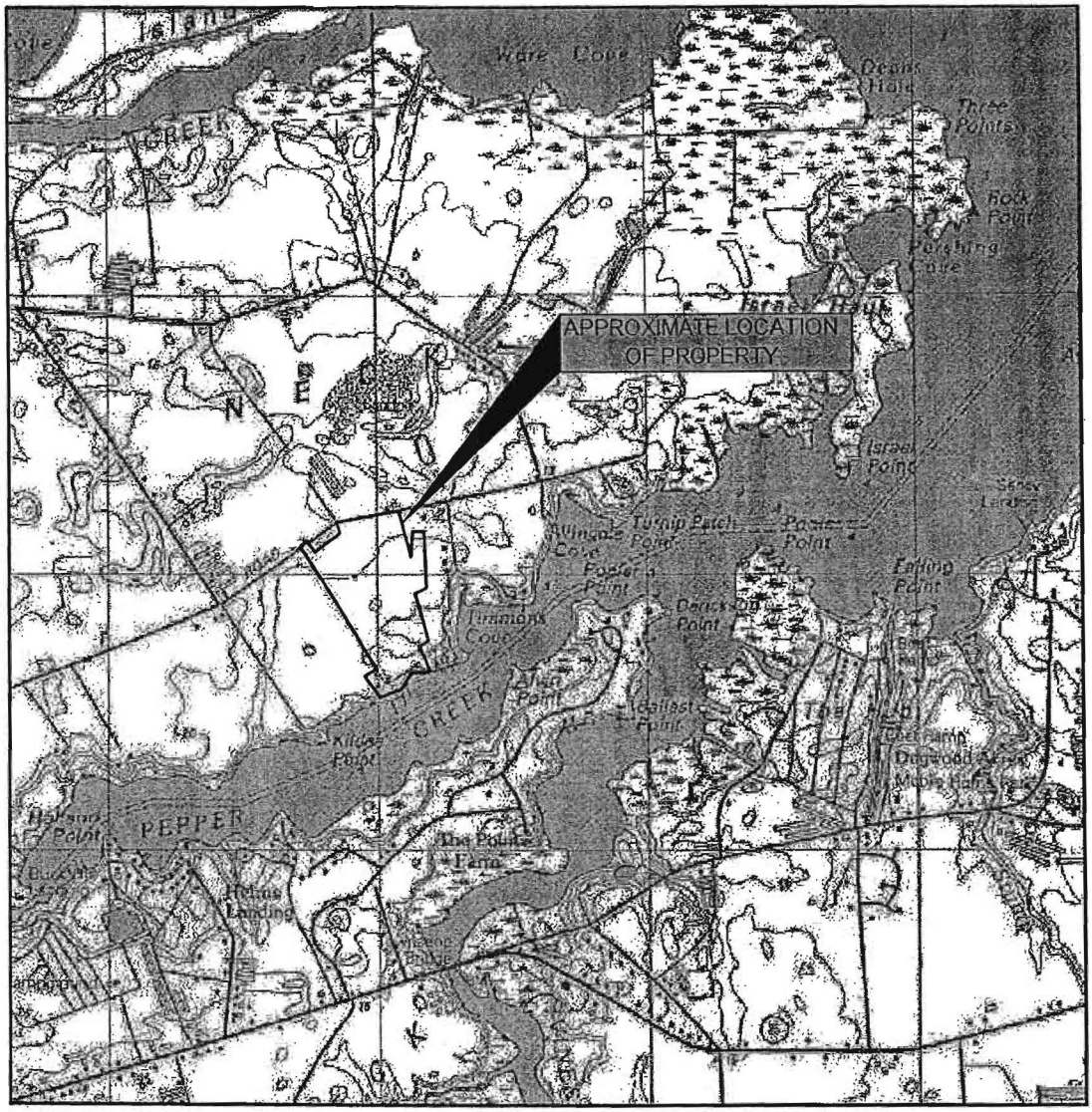
If you have any questions or concerns regarding the site, or if you would like to view reports or other information regarding this site, please contact the project manager, Babatunde Asere, 391 Lukens Drive, New Castle, Delaware 19720 or at 302.395.2600.

Kathleen Hetter Banning for
James D. Werner
Director of Air & Waste Management

9/25/06
Date

BTA:alm
BTA06028.doc
DE 1360 II B 9

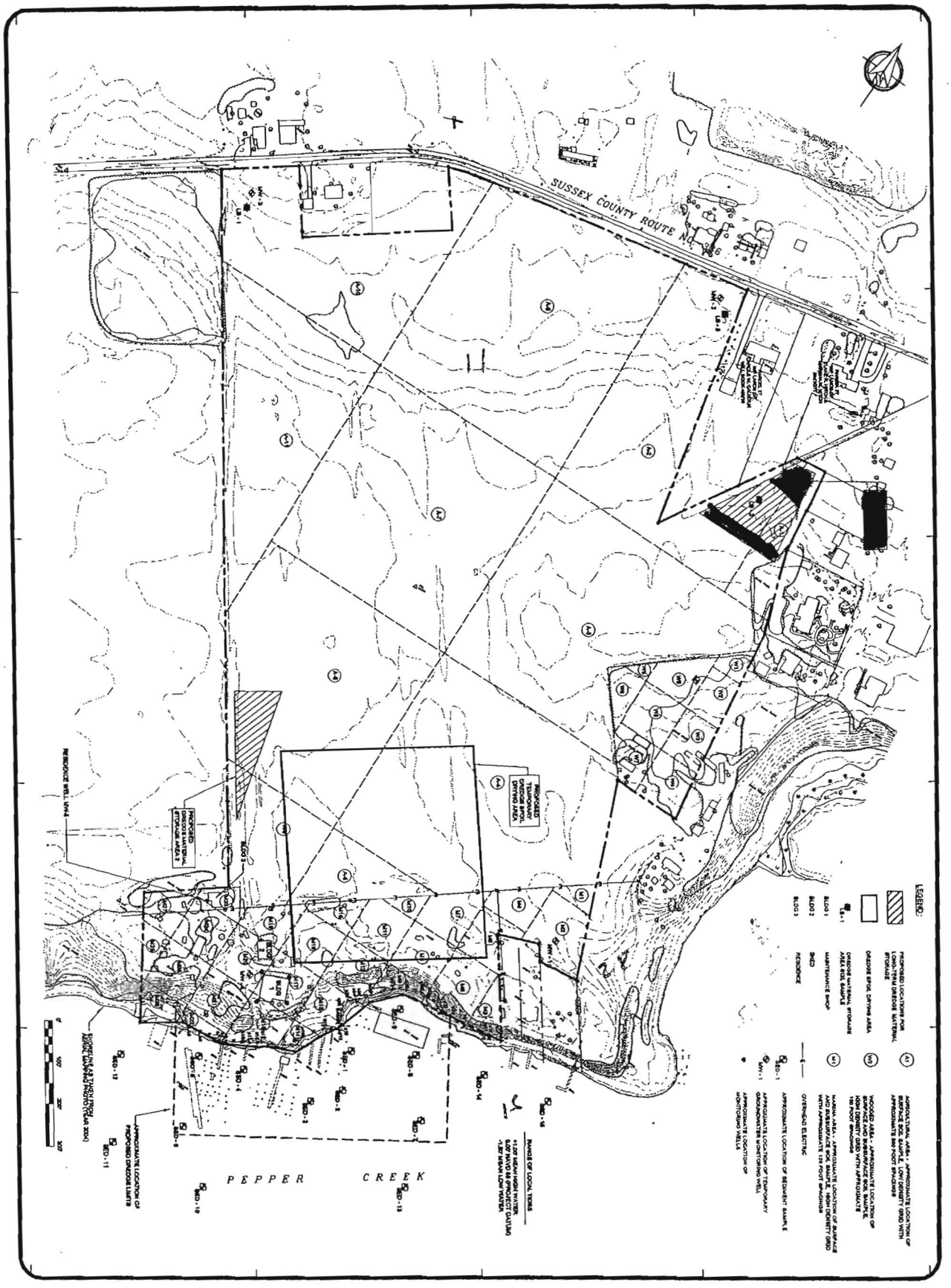
FIGURE 1



NOTE:
THIS LOCATION SKETCH IS ADAPTED FROM THE U.S.G.S. TOPOGRAPHIC MAP, 7.5 MINUTE SERIES, FOR FRANKFORD, DELAWARE 1993.

DATE: 8 AUGUST 2005	LOCATION SKETCH	DESIGNED BY: JLG	DUFFIELD ASSOCIATES
SCALE: 1"=2000'	FORMER TIMMONS MARINA DE-1360	DRAWN BY: EMW	
PROJECT NO. 6143.EA		CHECKED BY:	
SHEET: FIGURE 1	DAGSBORO ~ SUSSEX COUNTY ~ DELAWARE	FILE: A-6143EA-01	

FIGURE 2



EXISTING CONDITIONS
AND SAMPLING PLAN

FORMER TIMMONS MARINA
DE 1360

DAGSBORO ~ SUSSEX COUNTY ~ DELAWARE

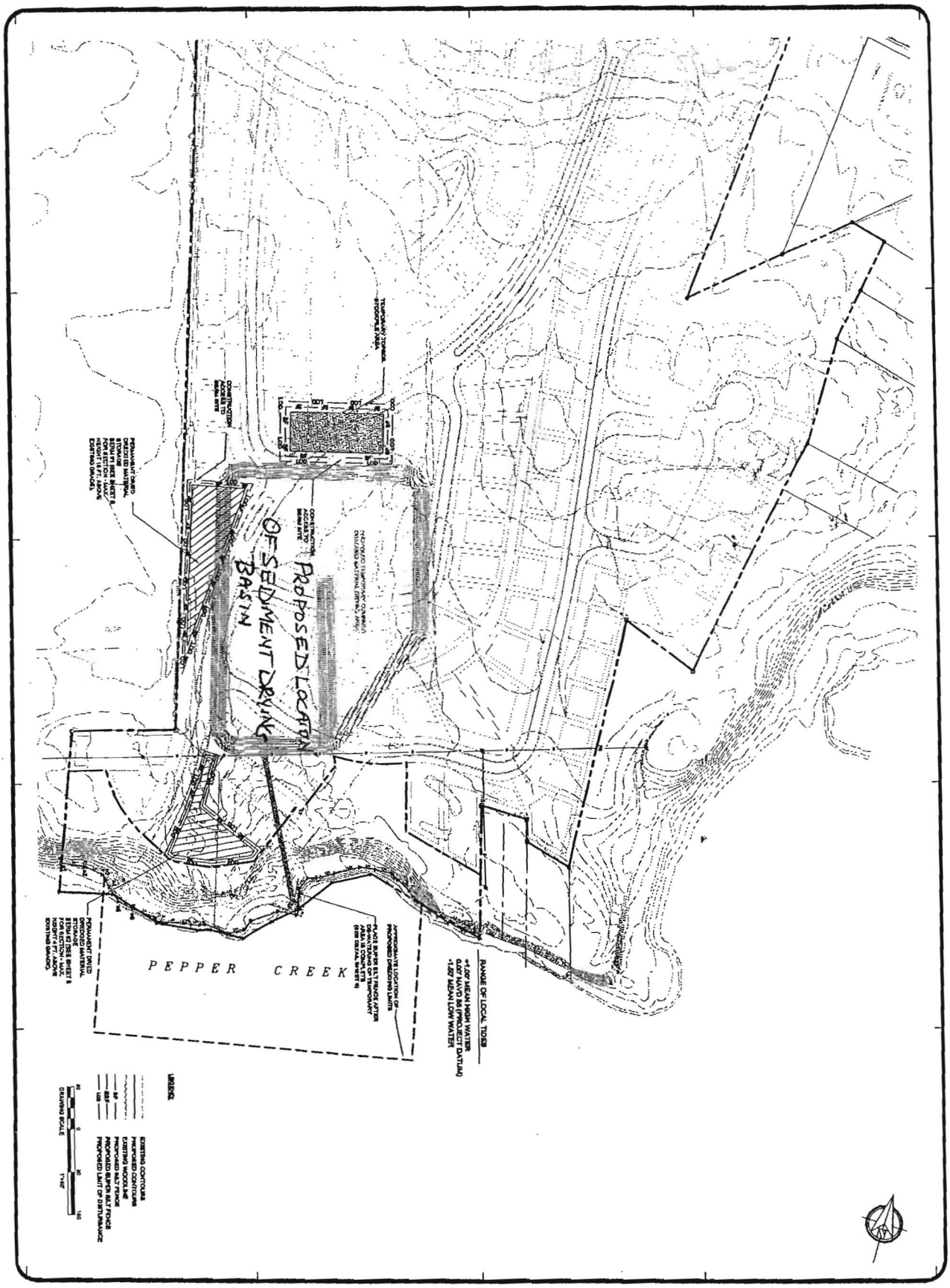
OWNER:

No.	REVISION	DATE

DESIGNED BY: JLO
CHECKED BY:
DRAWN BY: EMW
FILE NAME: D4160EA-Lo.R3

DELTA FIELD ASSOCIATES

FIGURE 3



PERMANENT STORAGE EROSION
AND SEDIMENT CONTROL PLAN
AND SITE GRADING PLAN

THE LANDINGS AT PEPPER CREEK
TEMPORARY DREDGED MATERIAL
CONFINED DRYING AREA

DAGSBORO HUNDRED–SUSSEX COUNTY–DELAWARE

OWNER:
SK PEPPER CREEK, LLC
21 NATURE'S WAY
BETHANY BEACH, DELAWARE 19930

No.	REVISION	CHK'D BY
1	PER COMMENTS SCCD	

DESIGNED BY: FOK
CHECKED BY: JFC
DRAWN BY: FOK
FILE NAME: D-6343CD-01
PETER G. KEARNEY
DELAWARE

DUFFIELD ASSOCIATES