

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

FINAL PLAN OF REMEDIAL ACTION

SCANNED

MAR 17 2005

File# DE 0300

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February 2005

**Christina Park Site  
Wilmington, Delaware**

**DNREC Project No. DE-0300**

This final plan of remedial action (final plan) presents the Department of Natural Resources and Environmental Control's (DNREC's) preferred cleanup alternative for the remediation at the Christina Park (site) in Wilmington, Delaware. The final plan is issued under the provisions of the Delaware Hazardous Substances Cleanup Act, 7 Del. C Chapter 91 (HSCA) and the Regulations Governing Hazardous Substance Cleanup (Regulations). As described in Section 12 of the Regulations, DNREC provided notice to the public and an opportunity for the public to comment on the proposed plan of remedial action (proposed plan). During the comment period of January 10, 2005 through January 31, 2005, DNREC did not receive any comments on the proposed plan; therefore the proposed plan has been adopted as the final plan. The final plan designates the selected remedy for the site. All investigations of the site, the proposed plan and the final plan will constitute the Remedial Decision Record.

The final plan summarizes the Site Inspection (SI) report (March 2001), Remedial Investigation (RI) report (July 2003), Risk Assessment report (January 2004), the Remedial Alternatives Evaluation report (November 2004), and the administrative record file upon which this proposed remedy is based. Copies of these documents can be obtained or viewed at locations listed at the end of this document.

## INTRODUCTION

The Christina Park site is located adjacent to the Christina River in the city of Wilmington. The site is bound by the Christina River to the south and east, by Church and Front Streets to the west, and Fourth Street to the north (Figure 1). The site is approximately 6.6 acres in size (*New Castle County, Tax Parcel No. 2604400003 and 2604400004*). The City of Wilmington, the

current owner of the property entered into a Memorandum of Agreement (MOA) with DNREC under the provisions of the Delaware Hazardous Substance Cleanup Act, 7 Del. C. Chapter 91 (HSCA). Under this agreement a Remedial Investigation (RI) was performed in July 2003. Subsequently a Risk assessment was performed in January 2004 by Avatar to investigate the potential risks posed to the public health, welfare, and the environment at the site by evaluating previous investigations performed at the site. A Remedial Alternatives Evaluation Study was performed by Tetra Tech in June 2004 to evaluate remedial alternatives for the site.

## SITE DESCRIPTION AND HISTORY

Large areas of the site had been created through land-filling activities from the 19<sup>th</sup> century through the early 20<sup>th</sup> century. Fill materials were placed atop native marsh and alluvial deposits associated with the adjacent Christina River. The site's river frontage was created through the installation of bulkhead and backfilling with soils of unknown origin in the past. The fill materials were found to include shingles, glass and brick as well as garbage, coal ash and slag.

A historical maps review of the area showed that the site was the location of several industrial and commercial activities including iron works, a lumber yard, a bolt and nut factory, and coal-wood-lime yards. The Christina Park was created in the early 1900s. Currently the site consists of paved parking areas, fishing piers, a baseball field, picnicking areas, many big trees, and grass covered play areas.

## INVESTIGATION RESULTS

Based on a review of all the environmental investigations conducted at the site including the RI and SI, several contaminants were detected in soil, groundwater and sediment above Delaware's unrestricted or restricted use Uniform Risk-based Standard (URS) values. The investigation results are discussed below:

### SOIL

Analytical results indicated that several Polycyclic Aromatic Hydrocarbons (PAHs) and metals were detected in the surface and subsurface soil above their respective unrestricted or restricted use Uniform Risk-based Standard (URS) values. Contaminants that exceeded URS in the surface and subsurface soil at the site are shown in the following tables:

#### SURFACE SOIL

<u>Contaminant</u>	<u>RME Concentration*</u> <u>(mg/kg)</u>	<u>URS for Unrestricted Use</u> <u>(mg/Kg)</u>	<u>URS for Restricted Use</u> <u>(mg/Kg)</u>	<u>Default Natural Background Concentration (mg/kg)</u>
<b>PAHs</b>				
Benzo(a)anthracene	1.79	0.9	8	
Benzo(a)pyrene	1.70	0.09	0.8	
Benzo(b)fluoranthene	1.75	0.9	8.0	
Dibenz(a,h)anthracene	0.37	0.09	0.8	
Indeno(1,2,3-cd)pyrene	0.82	0.9	8.0	
<b>Metals</b>				
Arsenic	24.5	0.4	4	11
Lead	350	400	1000	30-100

\*RME –Reasonable Maximum Exposure Concentration calculated as the 95% Upper Confidence Level (UCL) of the arithmetic mean of contaminants detected at the site  
 mg/kg – milligram per kilogram

**SUBSURFACE SOIL**

<u>Contaminant</u>	<u>Maximum Concentration*</u> <u>(mg/kg)</u>	<u>URS for Unrestricted Use</u> <u>(mg/Kg)</u>	<u>URS for Restricted Use</u> <u>(mg/Kg)</u>	<u>Default Natural Background Concentration (mg/kg)</u>
<b>Metals</b>				
Arsenic	52.2	0.4	4	11
Copper	868	310	8200	15-40
Iron	270800	2300	61000	3000-22000
Manganese	2160	160	4100	60-350
Lead	3170	400	1000	30-100
Vanadium	194	55	1400	15-40

\*Maximum concentration detected

**GROUNDWATER**

Groundwater at the site contains contaminants of concern which include iron and manganese that exceed groundwater URS values. These groundwater URS values are Secondary Maximum Contaminant Levels (SMCLs), which are based on the aesthetic qualities of the groundwater such as taste, odor and color. There were no VOCs, SVOCs, pesticides, or PCBs detected in any of the groundwater samples above their URS.

**GROUNDWATER**

<u>Contaminant</u>	<u>Maximum Concentration*</u> <u>(ug/L)</u>	<u>Groundwater URS (ug/L)</u>
Iron	3210	300
Manganese	7310	50

\*Maximum concentration detected in groundwater

**SEDIMENT**

Sediment sample collected from an upstream location showed the presence of Polycyclic Aromatic Hydrocarbons (PAHs) and metals above URS and were significantly higher than the sediment sample collected from a location adjacent to the site. Only benzo(a)pyrene and several metals were detected above the URS in the sample located adjacent to the site. The contaminants detected are shown in the following table:

## SEDIMENTS

<u>Contaminant</u>	<u>SED-1 (Upstream) Concentration* (mg/kg)</u>	<u>SED-2 (adjacent to site) Concentration* (mg/Kg)</u>	<u>Delaware Sediment URS Concentration (mg/kg)</u>
<b>PAHs</b>			
Napthalene	5.10	0.019	0.40
Acenaphthene	0.40	0.014	0.09
Fluorene	0.31	0.014	0.1
Phenanthrene	1.6	0.17	0.5
Anthracene	0.63	0.049	0.3
Fluoranthene	1.8	0.29	0.8
Chrysene	2.3	0.20	0.9
benzo(a)pyrene	2.6	0.14	0.10
Indeno(1,2,3-cd)pyrene	0.81	0.079	0.8
<b>Metals</b>			
Arsenic	39.8	10.1	8
Barium	353	75.4	20
Cadmium	6.7	0.49	1
Chromium	216	34.8	81
Copper	142	48.1	34
Lead	289	117	47
Mercury	0.75	0.98	0.2
Nickel	43.2	22.2	21
Zinc	2430	265	150

\*Maximum concentration detected

## SITE RISK EVALUATION

A site specific risk assessment was conducted to identify and evaluate the potential receptors and pathways of exposure to the media of concern based on the recreational use of the park which is open to the public. The primary source of risk to human health is the surface soil horizon (0-2 feet depth) present at the site. The risks associated with these soils are primarily from the potential exposure through ingestion and dermal contact of soil to arsenic and PAHs. The potential cancer risk for age adjusted recreational and worker exposures to the soil are 4.1E-05 and 4.4E-06 respectively. The cancer risk for the recreational use exceeds the acceptable risk of 1.0E-05. The non-cancer risk for recreation child visitor, adult visitor and worker exposures are hazard index (HI) of 0.468, 0.051 and 0.015 respectively. The non-cancer risk does not exceed the acceptable risk of HI 1.0.

Risks to recreational visitors or city workers from the potential exposure to subsurface soil are unlikely because these properties are effectively managed by the City of Wilmington. DNREC would require a deed restriction and notification of DNREC if any deep excavations are being planned in these areas.

Iron and manganese detected in groundwater exceeded the Secondary Maximum Contaminant Levels (SMCLs), which are based on the aesthetic qualities of the groundwater such as taste, odor and color and does not present a human health risk. Moreover, groundwater at the site is not

being used and there is no receptor adjacent to the site. The site is within the city wide Groundwater Management Zone (GMZ) which prohibits installation of any water wells on, or groundwater usage at the site without prior written approval of DNREC.

Sediments samples collected indicated that upstream sources of contamination (existing and historic) may be responsible for contamination observed adjacent to the site. Sediment samples collected upstream of the site were more contaminated than sediments adjacent to the site. Ecological assessment concluded that there is no record of state-rare or federally listed species of plants, animal or natural communities at the site.

## REMEDIAL ACTION OBJECTIVES

Qualitative objectives describe, in general terms, what the ultimate result of the cleanup action, if necessary, should be. The following qualitative objectives have been determined to be appropriate for the site:

- Prevent recreational visitors exposure to impacted soils and groundwater;
- Minimize potential exposure to site contaminants of concern for workers at the site;
- Restrict environmental degradation due to impacted soil and groundwater; and
- Prevent the use of groundwater for all purposes at the site.

These objectives are consistent with present and future use of the site as a park and the City of Wilmington zoning policies, State Regulations governing water supply, worker health and safety, and HSCA.

Quantitative objectives define specific levels of remedial action to achieve protection of human health and the environment. Based on the qualitative objectives, the quantitative objectives will be used to ensure that future site users such as visitors and workers do not come in contact with soils that contain elevated levels of arsenic, and PAHs. The quantitative objectives are:

- Prevent human exposure to soil contaminated with arsenic to the health based concentration of 23 ppm for arsenic
- Prevent human exposure to soil contaminated with PAHs that would result in a cancer risk above  $1.0E-05$  and a non-cancer risk above HI of 1.0

## FINAL PLAN OF REMEDIAL ACTION

Based on DNREC's evaluation of the site information, which includes current and past environmental investigations, historical information, the above remedial action objectives, and the remedial alternatives evaluated in the feasibility study, DNREC determined that the following remedial actions be taken at the site:

1. Installation of one-foot clean soil protective barrier on top of a geo-textile demarcation fabric across the entire site. A remedial design providing details of the cap and the resulting storm water erosion control management plan shall be submitted for DNREC's review and approval prior to installation. The cover should be implemented in compliance with known applicable laws and regulations including the storm water/erosion control regulations.

2. A deed restriction shall be placed within ninety (90) days following DNREC's adoption of the final plan on the site prohibiting any land-disturbing activities including excavation, digging at the site without prior written approval of DNREC.
3. An Operation and Maintenance (O&M) Plan shall be established and implemented, detailing the procedures and practices including regular inspections to minimize the potential for disturbing the cap and to promote the long-term integrity of the cap. The O&M Plan shall be established within sixty (60) days following the installation of the remedy.
4. A Groundwater Management Zone (GMZ) is already in place for the City of Wilmington. The Christina Park site is within the City of Wilmington limits. The GMZ will prohibit the installation of any water wells on, or groundwater usage, at the site without prior written approval of DNREC. The existence of the GMZ and its requirements will be noted on the deed for the property.

The final plan includes remedial actions for groundwater based on the Department's best understanding of the current and anticipated future use of groundwater at or near the site. Groundwater is considered a valuable resource in the State of Delaware. Therefore, if the actual or potential future use of the groundwater resource at or near the site changes or if it becomes known that groundwater conditions result in an unacceptable risk to public health and/or the environment additional remedial actions shall be required.

## PUBLIC PARTICIPATION

The Department actively solicited written public comments and suggestions on the proposed plan of remedial action. The comment period began January 10, 2005, and ended on January 31, 2005. No comments were received. If you have any questions or concerns regarding the Christina Park site, or if you would like to view reports or other information regarding this site, please contact the project manager, Qazi Salahuddin, at 391 Lukens Drive, New Castle, Delaware 19720, or at 302.395.2600.

## DECLARATION

The final plan of remedial action for the Christina Park site is protective of human health, welfare and the environment, and is consistent with the requirements of the Delaware Hazardous Substance Cleanup Act.

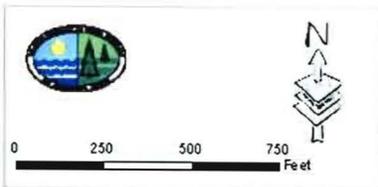
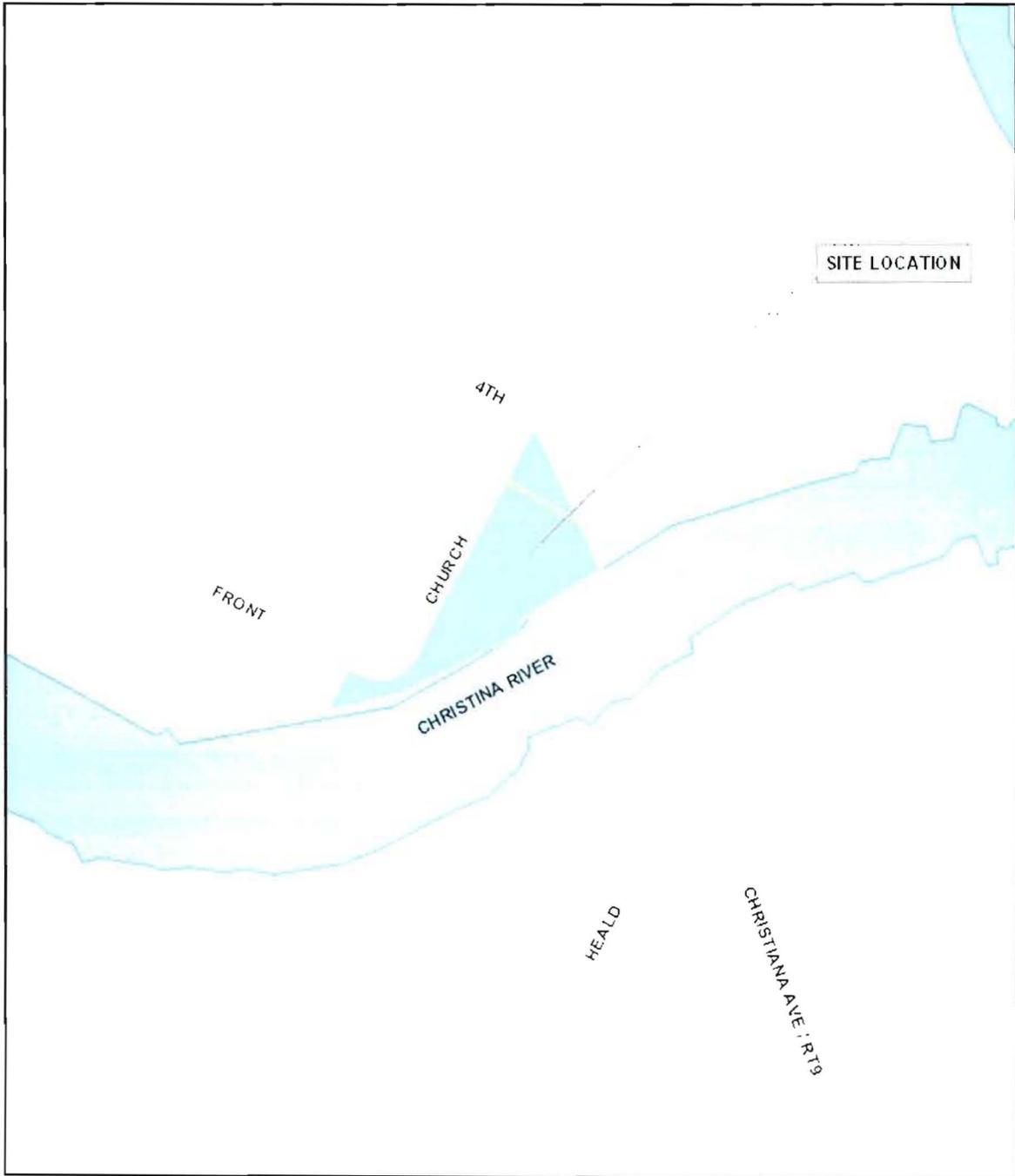
*Marjorie A. Crofts*

Marjorie A. Crofts, Acting Director  
Division of Air and Waste

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Date

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**FIGURE 1:  
 CHRISTINA PARK  
 WILMINGTON, DELAWARE**