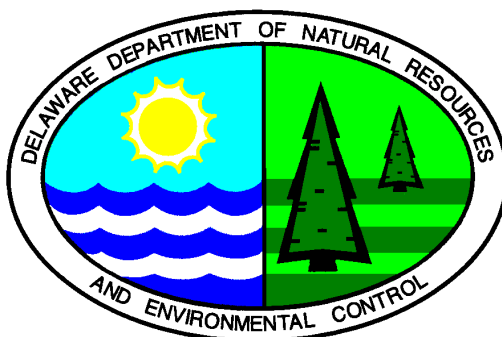


**STATE OF DELAWARE**

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

**FINAL PLAN OF REMEDIAL ACTION**



**September 2005**

**Boulevard Property  
100 South Justison Street  
Wilmington, Delaware**

**DNREC Project No. DE-1331**

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This final plan of remedial action (final plan) presents the Department of Natural Resources and Environmental Control's (DNREC's) final cleanup alternative for the Boulevard Property in Wilmington.

The purpose of the final plan is to provide specific information about the soil and groundwater contamination and the cleanup alternative DNREC has selected. As required in Section 12 of the Delaware Regulations Governing Hazardous Substance Cleanup (Regulations), DNREC provided notice to the public and an opportunity for the public to comment on the proposed plan. During the comment period, there was a request for DNREC to hold a public hearing on the contents of the proposed plan. The hearing was held in Wilmington on August 30, 2005. The Secretary of DNREC issued Secretary Order No. 2005-A-0039 on September 19, 2005 indicating that the proposed plan should be adopted as the final plan of remedial action for the site. All investigations of the site, the proposed plan, and comments received from the public, DNREC's responses to the comments, Secretary Order Number 2005-A-0039, and this final plan constitute the Remedial Decision Record.

This final plan summarizes the remedial investigation and interim remedial actions that have already taken place at the Site. Each of these reports is included in the administrative record file. The Secretary's Order and additional comments and documents submitted post-hearing are attached as Appendix I. Copies of all documents can be obtained or viewed at the DNREC Lukens Drive office in New Castle, Delaware.

## **INTRODUCTION**

The Boulevard Property (henceforth “the Site”) is approximately 2.88 acres in size and is located at 100 South Justison Street on tax parcel 26-042.00-008 in Wilmington, Delaware (Figure 1). The adjacent property, located at 101 S. West Street, is the Former Berger Brothers Property (tax parcel 26-042.00-019). The development plan for the Boulevard property calls for joint redevelopment with the adjoining Berger Brothers property. The development plan for the two properties is called Christina Crescent (formerly known as the West Street Project), and includes construction of an office building and a parking garage. A Proposed Plan of Interim Response Activities (IRA) for the West Street Project was issued by the Department of Natural Resources and Environmental Control, Site Investigation and Restoration Branch (DNREC-SIRB) in October of 2004.

In order to evaluate the environmental conditions prior to the development of the Boulevard Site, Pettinaro Construction Company (Pettinaro), the property owner, entered into the Voluntary Cleanup Program (VCP) under the provisions of the Delaware Hazardous Substance Cleanup Act (HSCA), 7 Del. C. Chapter 91 in September 2004. Through the VCP Agreement, Pettinaro agreed to perform an investigation to identify whether any risks to public health, welfare and the environment are present at the Site and to implement the remedy, if necessary. Pettinaro contracted with BrightFields, Inc. to perform the investigation.

## **SITE DESCRIPTION AND HISTORY**

The Boulevard Site is located in the Christina Riverfront section of Wilmington, Delaware and comprises an area of approximately 2.88 acres. The property is bordered by West Street to the south, the Berger Brothers Property to the east, Justison Street to the west, and Amtrak rail lines to the north (Figure 1). Surrounding properties are commercial and industrial. A warehouse formerly occupied most of the Site until it was demolished in February 2005. The proposed future Site use calls for developing the Site in concert with the adjacent Berger Brothers Property. The combined properties are referred to as Christina Crescent (formerly referred to as the West Street Project) and will encompass an area of 5.90 acres. The new Christina Crescent will include office buildings on its southern portion and a parking garage adjacent to the Amtrak viaduct on the north portion of the property, with walkways and landscaped areas in between (Figure 2).

## **INVESTIGATION HISTORY AND RESULTS**

BrightFields completed a Remedial Investigation Report and Focused Feasibility Study (RI/FFS) in March 2005 for the Site. This investigation involved collection of samples from surface soil, subsurface soil, and groundwater beneath the Site. Several contaminants were detected in soil and groundwater above Delaware’s unrestricted or restricted use Uniform Risk-Based Standard (URS) values. A detailed discussion of the sampling results is included in the RI/FFS report. The following is a summary of the investigation results.

## SOIL

In surface soil (0 - 2 ft below ground surface (bgs)) arsenic, lead, benzo(a)pyrene and PCBs were detected at concentrations above DNREC's restricted use (commercial/ industrial) criteria. In subsurface soil lead and benzo(a)pyrene (2.5 - 12 ft bgs) were detected at concentrations above restricted use criteria. However, when the Reasonable Maximum Exposure (RME) concentrations, calculated as the 95% of the Upper Confidence Level (UCL) of the arithmetic mean, were compared only arsenic and benzo(a) pyrene exceeded the restricted use criteria as shown in the following table.

### SOIL

<u>Contaminant</u>	<u>RME Concentration*</u> (mg/kg)	<u>URS for Restricted Use</u> (mg/kg)	<u>Default Natural Background Concentration</u> (mg/kg)
<b>INORGANICS</b>			
Arsenic	18.5	4	11
Lead	587	1000	30-100
<b>ORGANICS</b>			
Benzo (a) pyrene	1.83	0.8	
PCBs			
Arochlor-1248	0.57	3	
Arochlor-1254	0.16	3	
Arochlor-1260	0.23	3	

\* 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

A layer of stained soil with sheen and droplets of free-phase product was observed at a depth of 20-25 feet in the deeper groundwater zone. This was interpreted as non-aqueous phase liquid (NAPL) in the subsurface. Soil sample collected at this depth contained benzene, benzo(a)pyrene, and other PAHs.

## GROUNDWATER

Groundwater at the site occurs in two different zones (shallow and deep). In the shallow groundwater zone, groundwater was encountered at depths ranging from 2 to 5 feet bgs in the borings completed across the Site. The upper shallow groundwater zone consists of saturated fill (3-10 ft thick) which overlies the former surface deposits of low permeability marsh deposit and silt with some fine sand and clay. Shallow groundwater beneath the Site is estimated to flow south-southeast toward the Christina River. The shallow groundwater zone and the deep groundwater zone are separated by approximately 5-20 feet of low permeability marsh deposit and silt with some fine sand and clay.

The deep groundwater zone was encountered at depth of 20-25 feet bgs and consists of inter-layered silt, clay, and sand deposits. One (1) well was installed in this zone, to

monitor potential impacts of NAPL observed in an adjacent soil boring. The NAPL was identified as relatively unweathered tar.

Trichloroethene (TCE) and vinyl chloride are the contaminants of concern in the shallow groundwater, which were identified in the up gradient well. These contaminants are possibly from an offsite source. Benzene, toluene, ethylbenzene, and naphthalene are the contaminants of concern in the deep groundwater. Manganese and iron were also detected in the deep groundwater zone above the URS. The DNREC's URS criteria for iron and manganese are based on the Secondary Maximum Contaminant Levels (SMCLs) that are aesthetic-based (taste and odor), not health-based criteria. Therefore, iron and manganese are not considered contaminants of concern. The following tables summarize the results for groundwater and the maximum concentration of the contaminants of concern.

**SHALLOW GROUNDWATER (2-5 ft bgs)**

<u>Contaminant</u>	<u>Maximum Concentration*</u> <u>(ug/L)</u>	<u>Groundwater URS</u> <u>(ug/L)</u>
<b>ORGANICS</b>		
Trichloroethene	15	5
Vinyl Chloride	9.2	2

\* Maximum Concentration detected in groundwater.

**DEEP GROUNDWATER (20-25 ft bgs)**

<u>Contaminant</u>	<u>Maximum Concentration*</u> <u>(ug/L)</u>	<u>Groundwater URS</u> <u>(ug/L)</u>
<b>ORGANICS</b>		
Benzene	49,000	5
Toluene	3,000	1,000
Ethylbenzene	4,700	700
Naphthalene	6,400	20

\* Maximum Concentration detected in groundwater.

**SITE RISK EVALUATION**

A risk assessment was performed to evaluate the possible effects on human health and environment by the contaminants of concern at the Site.

**Soil**

The carcinogenic cumulative risk posed by Site soil to a commercial worker would be  $1.87 \times 10^{-5}$  (1.87 in 100,000), which exceeds DNREC's acceptable risk level of  $1 \times 10^{-5}$ . The individual compounds that most significantly contribute to the carcinogenic risk are benzo(a)pyrene (25.0% of the total risk) and arsenic (51.8% of the total risk). The non-carcinogenic cumulative risk calculation resulted in a Hazard Index (HI) of 0.37, which is below DNREC's acceptable risk level of HI of 1.0. The mean lead concentration across the Site is 587 mg/kg, which is below the restricted use criteria of 1,000 mg/kg.

Under a construction worker risk scenario, the non-carcinogenic and carcinogenic risks were calculated for incidental ingestion, dermal contact, inhalation of soil particles, and total (cumulative) risk. Neither the individual nor the cumulative carcinogenic risks exceeded the acceptable risk level of  $1 \times 10^{-5}$ . The cumulative non-carcinogenic risk to construction workers from exposure to contaminated soil at the Site resulted in a total Hazard Index of 1.66.

The soil with NAPL detected at a depth of 25 feet does not pose a risk to construction and utility workers for direct contact because of its depth below construction activities. The risk of groundwater contamination and indoor intrusion of vapor associated with the NAPL are discussed in their respective sections of this document.

### **Groundwater**

The risk assessment performed for Site groundwater shows that consumption of groundwater from the Site would pose unacceptable carcinogenic and non-carcinogenic risks. However, two safeguards to prevent human exposure will be in place. First, a restrictive covenant consistent with Delaware's Uniform Environmental Covenants Act (UECA) will be established. Second, the Site area lies within DNREC's existing City of Wilmington Groundwater Management Zone (GMZ) and is also regulated by City of Wilmington municipal law, all of which prevent installation of water wells and the consumption of groundwater within the City limits.

**Groundwater to Surface-water Impact:** Mass loading screening calculations indicated that shallow groundwater discharge to Christina River surface water does not pose a potential risk to surface water receptors. The screening mass loading calculations for the deep groundwater discharge to Christina River surface water indicated that benzene and xylene pose a potential risk to surface water receptors. However, groundwater modeling performed to further evaluate the deep groundwater discharge indicated that no such risk to surface water receptors exists.

### **Vapor Intrusion**

The potential risk of vapor intrusion into indoor air due to the elevated levels of VOCs in the NAPL layer and groundwater at the Site was calculated as  $6 \times 10^{-5}$  and  $8 \times 10^{-5}$ . The conservative risk assessment exceeds DNREC's cleanup criteria of  $1 \times 10^{-5}$ . The proposed office buildings and parking garage will be built across the Site and the adjacent Berger Brothers Site (Figure 2). Similar to the Berger Brothers Site, a vapor barrier underneath all structures for the Boulevard Site will be required to meet the cleanup goals.

## **INTERIM RESPONSE REMOVAL ACTIVITIES**

The following response activities will occur as part of redevelopment of the Christina Crescent Project, as stated in the DNREC-approved Proposed Plan of Interim Remedial Activities (IRA) for the West Street Project. IRAs were performed at the site prior to the issuance of the proposed plan and will continue until construction completion. Any

actions which involve the removal of contaminated soil and/or groundwater will be managed in accordance with the DNREC-approved Contaminated Materials Management Plan (CMMP). The CMMP will be amended as required by changing Site conditions. Any addendums to the CMMP will be approved by DNREC prior to implementation.

- Excavation associated with demolition of the former building foundation and subsequent filling of excavation;
- Site grading;
- Erosion and Sediment Controls;
- Excavation of trenches for utility installation, and/or relocation, grade beams, an elevator shaft, post holes for perimeter fence installation and light pole bases;
- Excavation dewatering, sludge/silt removal, free product removal;
- Installation/construction of storm water management infrastructure;
- Augering pilot holes for foundation piles and installation of the piles;
- Construction of the office buildings and parking garage, and new street-scaping;
- Backfilling of trenches; stockpiling of any extra soil; (Utility trenches will be backfilled with DNREC-approved clean fill);
- Restoration of paved areas; and
- Removal and proper management of petroleum-contaminated materials or underground storage tanks (USTs) that are encountered during construction activities at the Site per applicable DNREC Tank Management Branch (TMB) and HSCA regulations and guidance.

At the completion of the proposed response actions, the property owner or his representative will provide DNREC with a Construction Completion Report with appropriate documentation of all the remedial actions conducted at the Site. This will be included in the Remedial Decision Record.

## **REMEDIAL ACTION OBJECTIVES**

According to Section 8.4(1) of the HSCA Regulations, site-specific remedial action objectives (RAOs) must be established for all plans of remedial action. The Regulations provide that DNREC will set objectives for land use, resource use, and cleanup levels that are protective of human health and the environment. The following qualitative remedial action objectives are appropriate for the Boulevard Site:

- Prevent human exposure to contaminated soil and groundwater under future restricted land use for as long as the contaminated soil remains at concentrations exceeding acceptable concentrations;
- Prevent the use of groundwater for all purposes at the site for as long as the groundwater is contaminated with hazardous substances at unacceptable concentrations;
- Restrict environmental degradation due to contaminated soil and groundwater;
- Minimize potential exposure to contaminated soil and groundwater for workers during Site development;
- Control potential contaminated soil erosion and subsequent overland transport of contaminated soil and surface water to the Christina River during Site development;
- Properly reuse or dispose of all excavated soil and groundwater generated during construction, in accordance with local, state and federal regulations.

These objectives are consistent with the planned development of the Site and the surrounding land and development plans for the City of Wilmington, zoning policies, state regulations governing water supply, and worker health and safety.

Based on the above qualitative remedial action objectives, the following quantitative remedial action objectives (RAOs) based on a restricted site use are proposed:

- Prevent human exposure to soil contaminated with PAHs and metals that would result in a cumulative carcinogenic risk factor greater than  $1 \times 10^{-5}$  and a non-carcinogenic risk greater than Hazard Index of 1.0 for as long as concentrations of hazardous substances exceed acceptable concentrations.
- Prevent human exposure to groundwater contaminated with VOCs that would result in a cumulative carcinogenic risk factor greater than  $1 \times 10^{-5}$  and a non-carcinogenic risk greater than Hazard Index of 1.0 for as long as concentrations of hazardous substances exceed acceptable concentrations.
- Prevent human exposure from indoor intrusion of vapor from subsurface soil and groundwater contamination (vapor intrusion) in future buildings having a cumulative carcinogenic risk factor greater than  $1 \times 10^{-5}$  and a Hazard Index of 1.0 for as long as concentrations of hazardous substances exceed acceptable concentrations.

## **EVALUATION OF POTENTIAL REMEDIAL ALTERNATIVES**

To accomplish the above remedial action objectives, three potential remedial alternatives were evaluated.

Alternative 1: No Action

Alternative 2: Contaminated Soil Removal and Capping: Removal of all contaminated soil across the entire site and the implementation of institutional

controls to control potential exposure to utility workers and unauthorized digging.

Alternative 3: Selective Soil Removal, Capping and Long-term Stewardship. Exhumation and safe disposal of contaminated soil encountered during site grubbing and grading, building construction, excavation for foundations, footings and parking garages, as well as utility corridors using adequate safe worker safety training and protections. All utility corridors will be constructed with clean fill and a marker layer indicating the presence of contaminated soil beneath the layer. This soil excavation and disposal operation will be integrated into the project construction timetable to ensure expedited excavation and disposal and avoidance of interruption with the overall project timetable. In addition, the entire site surface, will be capped with at least two (2) feet of clean fill and a vapor barrier will be constructed under appropriate portions of the developed site. Finally, DNREC and the site developer will be undertaking a long-term stewardship program including a restrictive covenant consistent with Delaware's UECA.

Alternative 4: Capping and Institutional Controls: Covering the existing surface of the site with two feet of clean fill and capping the site with buildings, pavement, hardscaping and landscaping. All utility corridors would be constructed with clean fill and a marker layer indicating the presence of contaminated soil beneath the layer. Institutional controls to control potential exposure to utility workers and unauthorized digging.

Alternative 1 (no action) is not a viable alternative because it is not protective of human health or the environment and does not comply with the current laws. Alternatives 2 and 4 are considered to be equally protective and effective in the short term. Alternative 2 which involves extensive soil excavation is more difficult to implement due to the extent of dewatering that would be required, as well as more expensive to implement. Alternative 3 (Selective Soil Removal, Capping and Long-term Stewardship) does not provide as much protective conservatism as Alternative 2 because it only removes contaminated soil encountered during site preparation and construction activities. It provides more protection than Alternative 4 because it explicitly incorporates contaminated soil removal as part of the project and ensures that long-term stewardship action will be taken as part of the project. Alternative 4 will be less costly because of the disposal of a lesser quantity of soil but is equally protective in the short term, but may not be as effective in the long run.

DNREC has selected Alternative 3 (Selective Soil Removal, Capping and Long-term Stewardship) as the preferred remedial action for the Site based on its cost effectiveness, sustainability, and appropriateness with regards to meeting remedy selection criteria found in HSCA regulations.



## **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 requires that the following remedial actions be taken at the Site:

1. The surface of the Site will be covered with buildings, pavement, or a minimum of two feet of clean fill material including the landscaped areas. The entire surface of the Site will be altered from its current condition.
2. All construction and redevelopment work will be done in accordance with the DNREC-approved Proposed Plan of Interim Remedial Activities, Site-specific Contaminated Material Management Plan (CMMP) and a Site-specific Health and Safety Plan (HASP), which results in removal and proper disposal of excavated contaminated soil
3. All utility corridors will be constructed with clean fill and there will be a marker layer placed over the contaminated soil indicating the presence of contaminated soil beneath the layer.
4. The office building and parking garage will be designed to include an effective vapor barrier beneath their foundations.
5. A DNREC-approved Operation and Maintenance (O&M) Plan will be established and implemented within ninety (90) days following construction completion. The O&M plan will detail 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 and vapor barrier.
6. A Ground Management Zone (GMZ) is already in place for the City of Wilmington (August 2001). The Site is within the City of Wilmington boundary limits. The GMZ will prohibit the installation of any water wells on, or groundwater usage at the site without prior written approval of DNREC. In addition, the City prohibits drinking water wells to be installed within the City limits.
7. The Site use will be restricted to commercial use by the owner by the placement of a restrictive covenant consistent with Delaware's UECA. Any future development of the parcels will be limited to commercial development.
8. A restrictive covenant consistent with Delaware's UECA will be placed on the Site following the completion of the construction activities prohibiting any land-disturbing activities including excavation, digging at the Site without prior written approval of DNREC except in the clean utility corridors and clean landscaping areas. The location of these clean areas will be noted in the Construction

Completion report and the O&M Plan, which will be maintained in DNREC's Site file. The Site will be incorporated into DNREC's Long-Term Site Stewardship program as it develops.

## **PUBLIC PARTICIPATION**

The Department held a 20-day comment period on the proposed plan of remedial action between July 20, 2005, and August 8, 2005. During the comment period, a request was made for DNREC to hold a public hearing on the proposed plan. The public hearing was held in Wilmington at the Carvel Building on Tuesday, August 30, 2005. Upon review of the hearing record, the Secretary of DNREC, by way of Secretary's Order No. 2005-A-0039, adopted the proposed plan as the final plan of remedial action for the Site on September 19, 2005.

## **DECLARATION**

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

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James D. Werner, Director  
Division of Air and Waste Management

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Date of Review of Final Plan

RMG/plw

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**FIGURE 1 - Site Location Map**

*USGS Topo Map 1 Jul 1998 (downloaded from TerraServer 1/3/05)*

Boulevard Property Remedial Investigation  
100 Justison Street  
Wilmington, Delaware

File No. 0433.28.21

0 2,000  
SCALE (feet)



Figure 1 Site Location Map

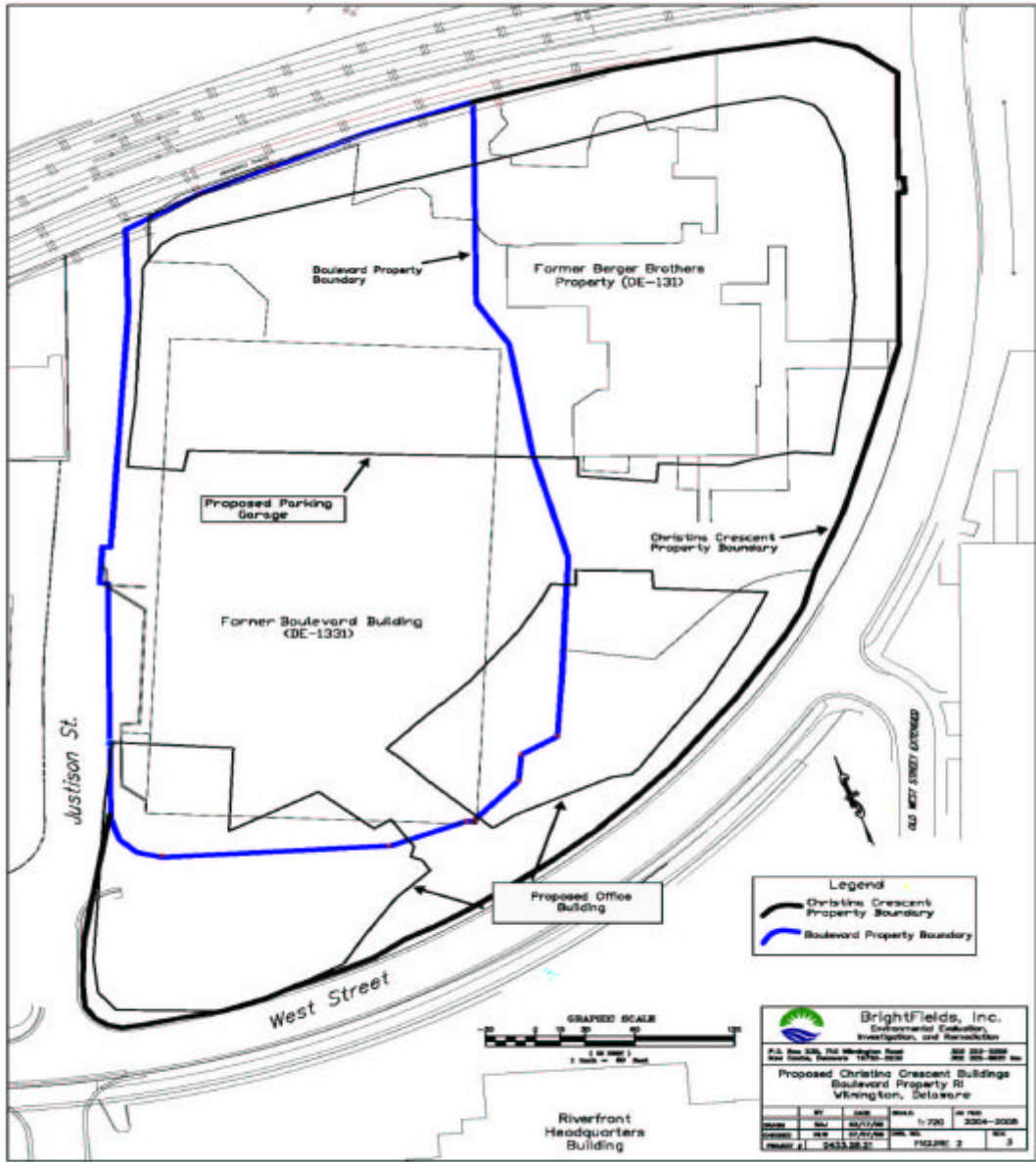


Figure 2 Site Map Showing Future Development Plan

APPENDIX I: Department's Post-Hearing Responses to  
Comments and Secretary's Order No. 2005-A-0039