REMEDIAL ACTION PLAN

FORMER PORTLAND CHEMICAL FACILITY
680 NEWFIELD STREET (REAR)
MIDDLETOWN, CONNECTICUT

HRP #MID6005.RA

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LIST OF ACRONYMS

Ag	=	Silver
AOC	=	Area of Concern
As	=	Arsenic
AST	=	Above-Ground Storage Tank
ASWPC	=	Alternate Surface Water Protection Criteria
AVOCs	=	Aromatic Volatile Organic Compounds
Ba	=	Barium
Be	=	Beryllium
b.g.	=	Below Grade
BWM	=	Bureau of Water Management
c-1,2-DCE	=	cis-1,2-Dichloroethylene
C/B	=	C/B Surface Water Classification
CBYD	=	Call Before You Dig
Cd	=	Cadmium
CFR	=	Code of Federal Regulations
CGS	=	Connecticut General Statutes
COC	=	Contaminant of Concern
Con-Test	=	Con-Test Analytical Laboratories
Cr	=	Chromium
CSM	=	Conceptual Site Model
CT DEP	=	Connecticut Department of Environmental Protection
CT DOHS	=	Connecticut Department of Health Services
CTL	=	Connecticut Testing Laboratories
CT RSR	=	Connecticut Remedial Standard Regulation
Cu	=	Copper
DCE	=	Dichloroethylene
DEC	=	Direct Exposure Criteria
DI	=	Deionized (Water)
DTC	=	Diversified Technology Corporation
EIS	=	Environmental Impact Statement
ELUR	=	Environmental Land Use Restriction
EM	=	Environmental Manager

LIST OF ACRONYMS
(Continued)

EPA	=	Environmental Protection Agency
ERI	=	Environmental Research Institute
ESA	=	Environmental Site Assessment
ETPH	=	Extractable Total Petroleum Hydrocarbons
ft/sec	=	Feet per second
GA PMC	=	GA Pollutant Mobility Criteria
GB PMC	=	GB Pollutant Mobility Criteria
GWPC	=	Ground Water Protection Criteria
HASP	=	Health and Safety Plan
Hg	=	Mercury
HRP	=	HRP Associates, Inc.
HS	=	Hand Sample
HVOCs	=	Halogenated Volatile Organic Compounds
I/C DEC	=	Industrial/Commercial Direct Exposure Criteria
I/C VC	=	Industrial/Commercial Volatilization Criteria
ID	=	Inside Diameter
LNAPL	=	Light Non-Aqueous Phase Liquid
MDL	=	Minimum Detection Level
MDP	=	Municipal Development Plan
mg/l	=	Milligrams Per Liter
mg/kg	=	Milligrams Per Kilogram
MSDS	=	Material Safety Data Sheets
MSL	=	Mean Sea Level
MW	=	Monitoring Well
NAD	=	North American Datum
NAPL	=	Non-Aqueous Phase Liquid
ND	=	Non-Detectable
NGVD	=	National Geodetic Vertical Datum
Ni	=	Nickel
NOAA	=	National Oceanic and Atmospheric Association
OSHA	=	Occupational Safety and Health Administration

LIST OF ACRONYMS
(Continued)

PAH	=	Polynucleic Aromatic Hydrocarbon
Pb	=	Lead
PCB	=	Polychlorinated Biphenyls
PCE	=	Perchloroethylene (also Tetrachloroethylene)
PID	=	Photoionization Detector
PMC	=	Pollutant Mobility Criteria
ppb	=	Parts Per Billion
ppm	=	Parts Per Million
PRA	=	Potential Release Area
PVC	=	Polyvinyl Chloride
QA/QC	=	Quality Assurance/Quality Control
QAPP	=	Quality Assurance Project Plan
RA	=	Release Area
RAC	=	Remedial Areas of Concern
RAP	=	Remedial Action Plan
RAR	=	Remedial Action Report
RC	=	Remediation Contractor
RCRA	=	Resource Conservation and Recovery Act
RCSA	=	Regulations of Connecticut State Agencies
RDEC	=	Residential Direct Exposure Criteria
ROC	=	Remediation Oversight Consultant
RSR	=	Remedial Standard Regulation
RVC	=	Residential Volatilization Criteria
SC/SB	=	SC/SB Surface Water Classification
SPLP	=	Synthetic Precipitation Leaching Procedure
SOPs	=	Standard Operating Procedures
SOW	=	Scope of Work
SVOCs	=	Semi-Volatile Organic Compounds
SWPC	=	Surface Water Protection Criteria
t-1,2-DCE	=	trans-1,2-Dichloroethylene
TCE	=	Trichloroethylene

LIST OF ACRONYMS
(Continued)

TCLP	=	Toxic Characteristic Leaching Procedure
TPH	=	Total Petroleum Hydrocarbons
TtNUS	=	TetraTech NUS
US EPA	=	United States Environmental Protection Agency
Ud	=	Udorthents-Urban Land Complex
µg	=	Micrograms
USDA	=	United States Department of Agriculture
USGS	=	United States Geological Survey
UST	=	Underground Storage Tank
VC	=	Volatilization Criteria
VOCs	=	Volatile Organic Compounds
W&C	=	Woodard & Curran, Inc.
WCS	=	Waste Characterization Sampling
Zn	=	Zinc

1.0 INTRODUCTION

The purpose of this document is to address exceedances of Connecticut Remediation Standard Regulations in soil at the Portland Chemical site via soil remediation and excavation. This Remedial Action Plan (RAP) relies on previous investigations conducted at the site to date, and addresses the release areas (RAs) and potential release areas (PRAs) identified in the October 10, 2001 Phase I Environmental Site Assessment (ESA) prepared for the site by HRP Associates, Inc. (HRP). A Quality Assurance Project Plan (QAPP), dated and revised on October 10, 2004, prepared by HRP was submitted to EPA. On October 10, 2004, the EPA approved the QAPP.

1.1 Site Setting and History

The approximately 3.1 acre subject site consists of the rear lot of the former Portland Chemical Works (Portland Chemical) facility. The site had been developed and maintained by former chemical distribution operations, including Portland Chemical from 1962 to 1992. Prior to 1962, the site was a vacant, undeveloped lot. The tank farm, loading rack, storage sheds, and drum filling building associated with Portland Chemical were located on-site but have been demolished. Other smaller shed buildings were located on the east side of the site. A railroad spur, railcar loading ramp, and chain link fence are the only remaining developed features on the site. The remainder of the site currently consists of low-lying marshy areas.

The site is bounded on the north by Primary Steel, on the south by Town & Country Toyota, on the east by Jukonski Truck Sales, and on the west by Primary Steel's railroad spur. The site is accessed via Newfield Street through Jukonski Mitsubishi Truck Sales.

1.2 Summary of Previous Investigations and Current Site Status

The following previous environmental investigations have been identified for the subject site at this time.

- *Rizzo Associates, Inc. (Rizzo) letter reports dated January - November 1992*
- *Rizzo letter report dated June 23, 1992*
- *Woodard & Curran, Inc. (W&C) Phase I Environmental Site Assessment report dated June 1998*
- Woodard & Curran *Phase II and III Environmental Site Assessment Report dated August 1998*
- Environmental Condition Assessment Form (ECAF) *prepared by W&C, September 1999*
- *Phase I Environmental Site Assessment, HRP Associates, October 2001.*
- *Draft Brownfields Targeted Site Assessment, TetraTech NUS, 2002*

- *Phase III Subsurface Investigation, HRP Associates, Inc., June 2006*

HRP performed a Phase III subsurface investigation designed 1) to determine the degree and extent contamination at the known release areas based upon the findings of the October 2001 HRP Phase I ESA and September 2002 TtNUS Brownfields Targeted Site Assessment, and 2) to determine the degree and extent of a release of any substance that has occurred to the site soils and, at limited locations, site ground water. The investigations were performed in accordance with the HRP prepared QAPP, dated September 7, 2004 and revised October 13, 2004. EPA approved the QAPP on October 13, 2004. Based upon the findings of the previous environmental reports, the following table composites into one list the potential release areas (PRAs) and release areas (RAs).

PRA # or RA#	Name	Description
RA-1	Drum and Debris Burial	Buried debris and fiber drums containing various chemical wastes were identified during the excavation activities in January 2001. The drums and debris were located in an area approximately 5-feet wide by 50-feet long extending to the north-northeast of the former drum filling building.
RA-2	Former Drum Filling Building	The former drum-filling building constructed in circa 1960 was used to fill 55-gallon drums with the materials from the tank farm. Drum storage was reported to have been located in and adjacent to this building. A floor drain in this building was also indicated to have been connected to the adjacent chemical manhole.
RA- 3	Former Chemical Manhole	The chemical manhole received waste chemicals and spills from the floor drain in the drum-filling building.
RA-4	Leaching Field	The chemical manhole discharged to a nearby leaching field.
RA-5	Former Loading Rack & Piping	The former loading rack was used to unload bulk-chemicals from railroad tank-cars to the tank farm. Surficial staining identified in Hazardous Waste Notice of Violation filed in 1991.
PRA-6	Drum Storage Area	Exterior drum storage is identified from circa 1965 to circa 1980 on the northeast portion of the Site.
PRA- 7	Former Drum Storage Sheds	Drums were stored in and around the small shed formerly located at the western terminus of the railroad spur.
PRA-8	Former Tank Farm	The above ground tank farm consisted of ten (10) 10,000-gallon tanks.
PRA-9	Loading Ramp	The loading ramp was presumably used to load materials onto railroad cars.
PRA-10	Railroad Spur	The railroad spur was formerly used by tank-cars containing various bulk-chemicals. Also, railroad ties were typically treated with chlorinated-organic creosotes. Railroad right-of-ways were typically treated with herbicides.
PRA-11	Unnamed Stream and Outfall Culvert	The culvert outfall discharges run-off from Newfield Street and drainage features on the adjacent property to the east.
PRA-12	Artificial Fill Area	The northwest portion of the Site consists of fill material deposited under an Army Corps of Engineers permit. Also, six to nine fiber and steel drums containing non-hazardous substances (disodium phosphate) were removed from this area.

PRA # or RA#	Name	Description
PRA-13	2001 Emergency Response	Contaminated soil distribution and mixing occurred during the 2001 emergency response excavations. Much of the contaminated soil in direct contact with the buried waste was excavated and contained in roll-offs prior to being appropriately disposed off-site. However, the degree of excavation performed during a wet and muddy period while searching for and removing the buried waste is presumed to have resulted in the limited distribution of some contaminated soil.

In total, 116 soil samples were collected from 13 RA/PRAs identified on site and were submitted for laboratory analysis as part of the Phase III investigation. Of these samples, 28 contained exceedances of RSR criteria for various contaminants of concern, including the following breakdown:

- 13 DEC exceedances for metals,
- 3 DEC and PMC exceedances for SVOCs,
- 10 exceedances of the DEC and PMC for ETPH,
- 1 exceedance of the DEC and PMC for pesticides,
- 1 interpretive exceedance of the PMC for PCBs, and
- 8 DEC and PMC exceedances for VOCs.

The results of the Phase III investigation concluded the following:

1. The investigation results indicate that no releases requiring additional investigation or remediation have been detected in the following areas:
   - RA-5 - Former Loading Rack
   - PRA-8 - Former Tank Farm
   - RA-9 - Loading Ramp
   - PRA-10 - Railroad Spur
2. RSR criteria exceedances for hexavalent chromium, total chromium, copper, lead, ETPH, VOCs or PAHs were detected in soil or ground water samples from the eastern portion of the site. The eastern portion of the site includes of seven of the release mechanisms, all of which overlap. These seven areas and the volumetric extent of soil contamination requiring remediation are listed below.

RA#	Name	Description	Arial Extent	Volume Requiring Remediation
RA-1	Drum and Debris Burial	Buried debris and fiber drums containing various chemical wastes were identified during the excavation activities in January 2001. The drums and debris were located in an area approximately 5-feet wide by 50-feet long extending to the north-northeast of the former drum filling building.	53,600 Square feet	1,990 Cubic yards
RA-2	Former Drum Filling Building	The former drum-filling building constructed in circa 1960 was used to fill 55-gallon drums with the materials from the tank farm. Drum storage located in and adjacent to this building. A floor drain in this building was connected to the adjacent chemical manhole.		

RA- 3	Former Chemical Manhole	The chemical manhole received waste chemicals and spills from the floor drain in the drum-filling building.		
RA-4	Leaching Field	The chemical manhole discharged to a nearby leaching field.		
RA-6	Drum Storage Area	Exterior drum storage is identified from circa 1965 to circa 1980 on the northeast portion of the Site.		
RA-13	2001 Emergency Response	Excavated contaminated soil inadvertently redistributed by equipment and personnel during 2001 remediation.		
RA- 7	Former Drum Storage Sheds	Drums were stored in and around the small shed formerly located at the western terminus of the railroad spur.	Soil	
			440 square feet	35 cubic yards
			Concrete	
			440 square feet	16 cubic yards

These areas can be isolated into six Remedial Areas of Concern (RACs). Four of these areas must be remediated for PMC exceedances; the remaining two RACs are comprised of soils exceeding the Industrial/Commercial DEC. The table below summarizes the six identified RACs:

Remedial Area of Concern	Contaminants that Exceed RSR Criteria	Clean Test Pits which Define Extent	Type of Exceedance	Required Excavation Depth	Total Soil Volume
RAC-1	PAHs, VOCs, ETPH	TP-23, TP-30, TP-32, TP-26, TP-25, TP-13, TP-12, TP-11	GB PMC	Seasonal High GW Table (appprox. 4 ft below grade)	330 cubic yards
RAC-2	Pesticides, VOCs, ETPH	TP-3, TP-13, TP-15, TP-16, TP-6	GB PMC	Seasonal High GW Table (appprox. 4 ft below grade)	265 cubic yards
RAC-3	PAHs, VOCs	TP-14, TP-64, TP-18, TP-17, TP-16	GB PMC	Seasonal High GW Table (appprox. 4 ft below grade)	180 cubic yards
RAC-4	VOCs, ETPH	TP-7, TP-19, TP-66, TP-67, TP-35, TP-8	GB PMC	seasonal High GW Table (appprox. 3 ft below grade)	220 cubic yards
RAC-5	ETPH, METALS, PAHs, VOCs	TP-23, TP-29, TP-47, TP-37, TP-40, TP-75, TP-34, TP-68, TP-35, TP-8, TP-7, TP-6, TP-4, TP-13, TP-21, TP-24	I/C DEC	2 ft below grade in paved areas; 4 ft below grade in grassy areas	1020 cubic yards
RAC-6	PAHs	TP-62, full extent to be defined in field	I/C DEC	2 ft below grade in paved areas; 4 ft below grade in grassy areas	uncertain

1.3 Current Site Status and Conceptual Remedial Action Plan

Site redevelopment and reuse will require a combination of physical and institutional remedial measures described below, such that soil and ground water is rendered compliant with the RSR.

1. Isolated locations of petroleum contaminated soil which exceeds only the RDEC will comply with the RSR without physical remediation provided that an institutional Environmental Land Use Restriction (ELUR) allowing only industrial or commercial activities to occupy the site is in place with CT DEP approval.

2. Nearly all of contaminated area requiring remediation coincides with detections of chromium that exceed the RDEC and I/C DEC (RAC-5). Physical remediation of these exceedances can be limited to 2' below grade provided that the impacted area is backfilled with clean material, paved, and an ELUR preventing disturbance of the subsurface is in place with CT DEP approval.

3. An isolated exceedances of the I/C DEC for PAHs is located in the central portion of the site (RAC-6). Additional sampling will be required to determine the lateral extent of the affected soil. Physical remediation of this exceedances can be limited to 2' below grade provided that the impacted area is backfilled with clean material, paved, and an ELUR preventing disturbance of the subsurface is in place with CT DEP approval.

4. Isolated areas of VOC, PAH, and pesticide concentrations that exceed the GB PMC will require additional physical remediation beyond that excavated to comply with the I/C DEC (RACs 1-4). Of the 19,000 square feet of aerial extent requiring remediation, 11,300 square feet will require physical remediation to extend to the mean high ground water table. Based on the limited amount of ground water elevation data available to date, the mean high ground water table is no deeper than four feet beneath the impacted areas and is likely to be found at an average depth of 3.5 feet below grade.

5. Physical remediation of the areas referenced above is envisioned to consist of excavation, characterization, and off-site disposal. Confirmatory sampling of the excavation is required to verify that the extent of contamination is completely addressed.

6. Shallow ground water contamination was identified during this investigation. The hydrogeologic unit impacted from historical site use is dense clay that hinders the migration of ground water. Therefore, the contamination is expected to be contained on-site. Once the soil that exceeds the GB PMC (RACs 1-4) and the on-site remnants of the chemical manhole septic system (RAC-5) has been remediated, the effective source of the ground water contamination will be removed, and ground water is expected to attenuate naturally. On-going monitoring will be needed to verify decreasing trends in ground water contamination.

1.4 Conceptual Site Model

The CSM was developed based on with the finding of the previous environmental reports. Twelve known release areas (RAs) and potential release areas (PRAs) were identified. In accordance with the CT DEP Draft June 12, 2000 Site Characterization Guidance Document ("Site Characterization Guidance Document") and the standards of best industry practice, the RAs/PRAs defined in the Phase I ESA have been actively investigated using the CSM process. The specific details of the CSM are presented in Table 1 including a presentation of: RA/PRA location, RA/PRA specific constituents of concern (COCs), release mechanisms, potential migration pathways, investigation methods, sample types and locations, detected releases, and affected media.

Most of the site consists of low-lying areas with either standing water or saturated soils covered in thick vegetation. Previous investigations focused on the portions of the site that were formerly developed – the higher ground on the western and southern portions of the site and the raised area in the center of the site where the tank farm used to be. Shallow groundwater flows toward the east. Potential ground water receptors east of the historically developed portions of the site include small, on-site watercourses and, off-site 1500' to the east, the Mattabasset River. The on-site watercourses converge and ultimately discharge to the Mattabasset River. The surface water classification of the Mattabasset River is "C/B", defined by CT DEP as surface water that does not meet Class "B" criteria due to point or non-point sources of pollution. The on-site watercourses are not classified on published CT DEP mapping, and as such, is presumed to be of Class "A" quality. The only developed land use between the subject site and the Mattabasset River currently consists of a storage yard for large crane equipment.

2.0 PROJECT REMEDIATION CRITERIA

2.1 Overview and Applicability

The objective of the following proposed remedial actions is to bring the soils on the site into compliance with both the Pollutant Mobility Criteria (PMC) and the Direct Exposure Criteria (DEC) specified in the Remedial Standard Regulation – "RSR" (RCSA 22a-133k) by rendering soils inaccessible and/or excavation and off-site disposal. This work will be performed to remediate that portion of site soils which require off-site disposal. Following the PMC remediation, the residential Direct Exposure Criteria (DEC) soil contamination exceedances will be rendered inaccessible via appropriate excavation, grading and filling of the site.

Analytical results for soils and ground water have been compared to the RSRs (January 30, 1996, and subsequent addenda) developed by the CT DEP. The RSRs are codified in Sections 22a-133k-1 through Section 22a-133k-3 of the Regulations of Connecticut State Agencies (RCSA). The cleanup standards are summarized herein, but the actual referenced document should be consulted for complete details.

2.2 Soil Cleanup Criteria

The RSRs soil remediation goals applicable to this site integrate two soil cleanup criteria: (1) Pollutant Mobility Criteria (PMC) to protect ground water quality from pollutants that migrate from the soil to ground water; and (2) Direct Exposure Criteria (DEC) to protect human health and the environment from risks associated with direct exposure to pollutants in contaminated soil. Soils to which both criteria apply must be remediated to the more stringent criteria.

PMC. The PMC that apply to remediation of a site depend on the ground water classification of the site. The purpose of these criteria is to prevent contamination to ground water in GA classified areas, and to prevent unacceptable further degradation to ground water in GB classified areas. The PMC generally apply to all soil in the unsaturated zone, from the ground surface to the seasonal low water table in GA classification areas. For sites within GB ground water classified areas, the PMC are applicable to all soils from the ground surface to the seasonal high water table and do not apply to soils below the seasonal high water table. The PMC or an appropriate alternative criteria may also be applied to soils below the water table if such soils constitute an ongoing source of ground water pollution and if remediation of such soils is technically practicable. The criteria do not apply to environmentally isolated soils that are polluted with substances other than VOCs provided that an ELUR is recorded for the site which ensures that such soils will not be exposed as a result of demolition of the building or other activities. Environmentally isolated soils are defined as contaminated soils beneath an existing building (or other permanent structure, as approved by the Commissioner) which are not a source of ongoing pollution. "Urban fill" material (coal or wood ash, or asphalt fragments) may also be exempt from the PMC.

According to the RSRs, a substance, other than an inorganic substance or PCB, in soil shall be remediated to at least that concentration at which the results of a mass analysis of soil for such substance does not exceed the PMC applicable to the ground water classification of the area in which the soil is located. An inorganic substance or PCB in soil shall be remediated to at least that concentration in which

the results of a Toxicity Characteristic Leaching Procedure (TCLP) or SPLP analysis of such soil for such substance does not exceed the PMC applicable to the ground water classification of the area in which the soil is located.

DEC. Specific numeric exposure criteria for a broad range of pollutants in soil have been established by CT DEP, based on exposure assumptions relative to incidental ingestion of pollutants in soils and dermal contact with soils. The DEC apply to soil to a depth of 15 feet. The DEC for substances other than PCBs do not apply to inaccessible soil at a release area provided that an ELUR is in effect with respect to the subject parcel. Refer to the cleanup regulations for specific requirements regarding PCB-contaminated soil. Inaccessible soil generally means polluted soil which is: (1) more than 4 feet below the ground surface; (2) more than 2 feet below a paved surface comprised of a minimum of 3 inches of bituminous concrete or concrete; (3) beneath an existing building; or (4) beneath another permanent structure approved by the Commissioner. The disturbance of inaccessible soil for which an ELUR has been previously recorded requires that the Commissioner of the DEP grant a release from the ELUR. Inaccessible soil cannot be exposed by excavation, demolition, or construction activities without written approval from the Commissioner.

CT DEP has established two sets of DEC using exposure assumptions appropriate for residential land use (RDEC) or for industrial and certain commercial land use (I/C DEC). In general, all sites are required to be cleaned up to the residential criteria. An industrial/commercial site may meet the industrial land-use criteria in lieu of meeting the residential standards if an ELUR that prohibits residential use is in effect with respect to such parcel.

2.3 Summary of Proposed Site Remediation Criteria

Based on the requirements of the RSRs, site-specific conditions, and discussions with CT DEP, data was compared to the following criteria to evaluate the need for remediation:

<u>Soil</u>

- I/C DEC (ELUR restricting residential uses and disturbance of soil. The direct exposure criteria does not apply to inaccessible soil)
- GB PMC

3.0 REMEDIAL APPROACH

3.1 Remediation for Compliance With the PMC

Excavation and proper off-site disposal has been chosen as the preferable remedial alternative to achieve compliance with the GB PMC. The recommended method for delineation and removal of PMC soils is referred to as the Spot Remediation Protocol (SRP). Confirmatory soil sampling will be used to demonstrate compliance with the GB PMC following excavation work and as a means of defining the degree and extent of the contamination identified in the respective RACs. Documentation of appropriate sampling procedures and satisfactory results will be presented in the RAR. The recommended SRP procedures are presented in Section 5.2.

3.2 Remediation for Compliance With the DEC

The RSRs stipulate that the DEC do not apply to soil that has been rendered inaccessible and an Environmental Land Use Restriction (ELUR) is in effect for the concerned site. The RSRs define inaccessible soils as polluted soil that is:

1. More than 4 feet b.g. The distance measured b.g. must be perpendicular to the grade;

2. More than 2 feet below a paved surface comprised of a minimum of 3 inches of bituminous concrete or concrete, which 2 feet may include the depth of any material used as sub-base for the pavement; or

3. Beneath an existing building or another existing permanent structure provided written notice that such structure will be used to prevent human contact with such soil has been provided to the commissioner.

In support of an ELUR, and to limit remedial costs, the most feasible DEC remedial option will be to cover DEC impacted soil with 2 feet of fill and a minimum of 3 inches of pavement. Any areas that may be used for plantings, ornamental shrubs, or lawn will need to be covered by 4 feet of fill. The ELUR will then be used to prevent the disturbance of the inaccessible soil that exceeds the direct exposure criteria. As final development plans are issued, modifications to grading and/or cover requirements will be made in accordance with RSR criteria.

4.0 PROJECT IMPLEMENTATION

4.1 Project Team

This section identifies the members of the Project Team and summarizes their responsibilities.

- Project Owner: The City of Middletown (Middletown) is responsible for remediation and site preparation. Contractors approved and selected by Middletown will perform soil remediation, site filling, and grading. Any manifests or material shipping records required for off-site disposal or treatment of contaminated soil will be signed by Middletown or their designated authorized representatives.

- Remediation Oversight Consultant (ROC): Environmental Partners, LLC will be the Remediation Oversight Consultant. Environmental Partners will supervise the implementation of the remedial actions, conduct sampling and screening of soil, and ensure coordination between the RAP and bid specifications. The ROC will also prepare the final Remedial Action Report (RAR) that documents the implementation and performance of this RAP.

- Remediation Contractor (RC): The remediation contractor will be responsible for implementation of the project in accordance with the RAP and the contract documents. The selection of the remediation contractor will be by competitive bid.

The ROC will have authority to communicate directly with the RC regarding the day-to-day activities during implementation of the RAP. These communications will include notification of any adverse screening data or other observations that indicate a release or threat of release of contaminants to the environment or a potential health and safety issue, evidence of materials encountered that require further evaluation or other actions (i.e., "hot spots"), or other conditions that could warrant immediate cessation of work activities.

The ROC will also have the responsibility of examining any waste piles, containment systems, silt and erosion controls, and general work area conditions on a daily basis or as needed during implementation of the RAP. Any conditions that are observed by the ROC during the course of those inspections that require attention or immediate action will be reported directly to the RC. Criteria for action will be based on conditions that could potentially have an immediate or other effect on human health or the environment or potentially lead to a release of hazardous substances to the environment if left unchecked. A checklist will be maintained by the ROC to document daily inspections of any stockpiles and other routine work area inspection items (Appendix B). This will include but not be limited to the condition of any stockpile areas (damage or loose covering, water infiltration, leachate, or runoff, etc.), evidence of excessive dust production or erosion, and any other conditions that are judged to be of concern based on general "good practice" considerations.

5.0 SOIL REMEDIATION PLAN

5.1 Overview of Proposed Scope of Work

The overall scope of investigation and remediation is two-fold. The first step is to excavate the four identified RACs and properly dispose all soils that exceed the PMC based on existing data, or are highly suspect to exceed the PMC or constitute significant sources of contamination based on field conditions. Confirmatory soil samples will be collected from the RACs, and remedial excavations will be continued in each RAC until all obviously contaminated material is removed and all confirmatory soil samples pass the PMC. Any "hot spots" identified during site preparation or during RAC excavation will be treated in a manner similar to the RACs and will be excavated until laboratory results indicate compliance with the RSR.

The second step of the RAP entails covering the site with the appropriate combination of fill to render DEC soil inaccessible as defined by the RSRs. Filling activities will include the placement of a geotextile warning layer as detailed in Section 7.2. Based upon the final proposed grades for the site, additional excavation of site soils beyond the identified RACs may become necessary. Excess DEC soils will be segregated and relocated in accordance with the provisions set forth in Section 7. 1 of this text.

5.2 RACs – PMC Remediation

RACs will be remediated by excavation and proper off-site disposal of the soils known or highly suspected to exceed the PMC. The locations of each RAC are shown on Figure 3 and preliminary excavation quantities are presented in Section 1.2. The extent of the initial RAC excavations have been determined based upon (1) the soil sampling data generated during the previous investigations, and (2) knowledge of the operational history of the individual AOCs extant in each RAC. Modifications to the initial RAC excavation limits may be made based on field conditions observed during excavation activities. Field screening will also be performed to determine appropriate excavation limits. Soil samples will be screened for the presence of Volatile Organic Compounds (VOCs) using a PID. The results of these field testing methods will be used to guide the limits of contaminant excavations and the collection of soil samples for laboratory analysis. The soil sampling and analysis plan is presented in Section 6.0. Confirmation of the extent of contamination and completeness of soil remediation will be based solely on the results of certified laboratory analysis, not field screening results.

Once an initial RAC soil excavation has been completed, the ROC will collect confirmatory soil samples from the sidewalls and bottom of the resultant excavation. The excavator bucket may be used to collect the confirmatory soil samples from deep or unsafe excavations. Confirmatory soil samples will not be collected from the base of remedial excavations that extend down to either the bedrock surface or the water table. Once the confirmatory soil samples have been collected, the excavation will be secured and the equipment will be moved onto the next excavation location. Sample locations will be staked and surveyed in.

The soil samples will be analyzed at the laboratory on a priority basis, typically 5-day turn-around time. The results will be reviewed upon receipt to determine if soils exceeding the PMC remain at the boundaries of the initial RAC excavation. Additional excavation will be performed wherever soil contamination exceeds the

PMC in the confirmatory soil sampling results. Additional confirmatory soil samples will be collected wherever sequential soil excavations are performed to remove soils exceeding the PMC. Soil excavation and confirmatory soil sampling will continue as an iterative process until all confirmatory soil samples pass the PMC.

RACs will be backfilled to an elevation two feet less than the final grade with DEC soils according to the specifications outlined in Section 22a-133k-2(h) of the RSRs. The DEC soils utilized as backfill material will be selected based on DEC soils that have been impacted by similar contaminant release mechanisms as the individual RAC soils.

5.3 DEC Soil Remediation

Remediation of site-wide DEC soil will be accomplished by placing sufficient cover material to render the DEC soil inaccessible in accordance with the CT DEP RSRs. To accommodate the final site development grading plans (Figure 4), some areas of DEC soils will be excavated, relocated, and regraded on-site in accordance with Section 7.0 Site Restoration. The final surface of the regraded DEC soils will be established to maintain certain minimum depths below the proposed development final grades.

Implementation of the "render inaccessible" remedial option to achieve compliance with the DEC consists of an analysis of four sets of data:

1. Identification of delineated areas of GB PMC, RDEC and I/C DEC (Figure 3),
2. Existing topographic contours,
3. The proposed final grade elevations (Figure 4) and site development information.

Using this data, a proposed remediation surface has been designed to provide the necessary fill thickness and surface treatments to render the contaminated soil exceeding DEC criteria inaccessible, based on the proposed final grading plan and details. The proposed remediation grades and proposed cross-sections are shown on Figure 4.

Relocation of DEC soils on-site will be in accordance with the requirements specified in Section 7.1 of this RAP. The relocated soil will not be placed below the water table and will not be placed in an area subject to erosion.

Excavated DEC soils may be stockpiled on-site pending final relocation in accordance with Section 8.7.1. Relocated DEC soils will be placed in maximum lifts of 8 inches and compacted to a minimum density of 95%. After the DEC soils have been regraded, the entire surface will be surveyed and a map of these elevations prepared for the site RAR to document the depth of the DEC soils surface.

The entire site will then be covered with a high-visibility geotextile to serve as a warning "barrier" on top of the DEC soil. The geotextile will serve as a warning layer in the event that future excavation is necessary. As previously stated, two

feet of backfill material meeting the CT Solid Waste Regulations definition (RCSA Section 22a-209-1) of "natural soil" will be placed and compacted above the geo-textile warning layer. Three inches of bituminous concrete or concrete paving will be placed over the site.

5.3.1 Environmental Land Use Restriction

An Environmental Land Use Restriction (ELUR) for the site will be recorded by the City of Middletown to bring the DEC Remediation Plan into full compliance with the RSR criteria. The ELUR will specify that the site be used only for commercial and/or industrial purposes and restrict residential uses. Additionally, the ELUR will stipulate that inaccessible soil shall not be disturbed as a result of excavation, demolition, or other activities.

Once the ELUR is in place, a release of the ELUR must be obtained from the Commissioner prior to excavation into the subsurface DEC soils. The process to obtain a release is described in Section 22a-133o(d) of the RSRs. It involves submittal of a plan for the Commissioner's review and approval that demonstrates that the requirements of the RSRs (22a-133k) will be met.

The schedule for submittal and recording of the ELUR will be specified in the RAR.

5.3.2 Preliminary Post Remediation Conceptual Site Model

Upon completion of soil remediation and recording of the ELUR for the site, the potential human health and environmental impacts described in the CSM will be mitigated. Rendering the soils with DEC exceedances inaccessible will eliminate direct exposure pathways. The primary potential soil contaminant migration pathway, the leaching of contaminants from soil to groundwater, will be eliminated by excavation and disposal of soils with contaminant concentrations exceeding the GB PMC.

The proposed remedial action should result in a condition of no significant risk to future site receptors, provided that the soil cover rendering DEC soil inaccessible is properly maintained. Future site development that could potentially alter the topography of the site will need to be conducted under the stipulations of the ELUR. If future development affects the soil cover designed to render DEC soils inaccessible, restoration or repair will be required to maintain the conditions of the ELUR.

A final post remediation CSM will be presented in the RAR.

5.4 "Hot Spots"

Visual observations and field screening with a PID and RM will be used during the excavation activities to inspect for areas of gross contamination. If any additional areas of gross contamination are identified, they will be treated as unidentified releases and will either be excavated and relocated on the site or removed for off-site disposal or treatment, as appropriate. If previously unidentified buried drums are identified during excavation, an Emergency Response protocol will take effect and the CT DEP Oil and Chemical Spills Division will be immediately contacted.

Areas of "gross" contamination (i.e., "hot spots") will initially be defined by field observations. These will include any areas showing evidence of possible contaminants or conditions that appear to be significantly different than those previously identified, or evidence of levels of potential contaminants significantly higher than those previously detected. This evaluation will be based on significantly elevated PID screening readings, evidence of visible NAPL on soil or measurable NAPL on standing water, very unusual color or discoloration, strong oil or chemical odors, or other physical or chemical evidence that appears anomalous and inconsistent with previous data and observations at the site.

If gross contamination is identified, soil samples may be collected to characterize the contaminants prior to determining whether further excavation and off-site disposal is required. Such sampling will include all COCs on the site, as well as other parameters that may be needed for full waste characterization and possible off-site disposal. Alternatively, the soil in the suspected "hot spot" will be removed and stockpiled. The ROC will make a determination in the field regarding whether soil suspected of being grossly contaminated should be immediately removed and stockpiled or left in place for waste characterization sampling. This determination will be made on the basis of field observations and screening data. This decision will also consider the location of the soil, the practicality of leaving it in place temporarily and moving the excavation operation to another area, and potential risks associated with excavation of soil with unknown characteristics or with visible NAPL or other substances that may require special procedures. Representative soil samples will be collected by hand methods from any stockpiled soil for waste characterization.

The ROC will attempt to remediate any previously unidentified releases encountered during remedial excavation to the extent possible. This may require excavation beyond the RAC limits depicted in Figure 3. Soils determined by field observations, screening data, and laboratory analysis to contain contaminants that require remediation will be removed to the extent possible to mitigate such releases. In those areas, the ROC will direct the RC to excavate soil and place it in a stockpile constructed according to the design specified in this RAP. Excavation will continue until the ROC determines, based on field evidence, that the conditions characterizing the "hot spot" no longer exist. The "hot spot" will be remediated to the requirements of the RSRs. Sidewall and bottom confirmatory samples will be collected at the suspected limits of these areas to confirm adequate removal of affected material.

The goal of any "hot spot" remediation will be to remediate the conditions that resulted in classification of the area as a "hot spot". These criteria would include exceedances of the GB PMC or conditions that, if left unchecked, could represent an imminent hazard. The goals, therefore, may or may not be the RSR criteria depending on the characteristics of the contaminants. However, the RSR criteria will be used as the minimum standards.

In summary, the treatment of "hot spots" will be as follows:

1. Identification by the ROC based on field observations and screening data (PID/RM).

2. Decision made regarding immediate removal and stockpiling or sampling in-place to further characterize the material.

3. In cases where excavation is selected, material will be removed until "hot spot" conditions appear to diminish sufficiently or terminate. These excavations will extend beyond the targeted excavation areas as necessary (i.e., RAC).

4. Sampling of sidewalls and bottom at excavation limits.

5. In cases where immediate sampling is selected rather than removal, excavation operations will be moved to an area thought to be beyond the "hot spot" pending receipt of lab results that will be used to characterize the "hot spot" material. Excavation and confirmatory sampling would then occur, presuming all conditions allowed safe excavation, as outlined in Steps #3 and #4.

6. Stockpiled soil from "hot spots" will be sampled for waste characterization for determination of proper disposal methods as necessary.

7. In the event that buried drums are identified, work will cease and DEP will be notified immediately via telephone.

Following characterization and/or remediation of "hot spots", a determination will be made as to the potential source(s) for the release(s). If a very significant release or other condition (large UST, unidentified buried wastes or structure contributing to contamination, etc.) is identified, additional assessment may be performed prior to completing further remedial excavation in those areas. This would typically consist of installation of exploratory test pits or borings.

Field observations and screening and post-excavation surveying will be used to confirm compliance with the remediation goals. The final excavation limits (vertical and horizontal) will be located by survey and will be shown on figures in the Remedial Action Report (RAR).

6.0 SOIL SAMPLING AND ANALYSIS PLAN

Confirmatory soil sampling will be conducted following removal of soil exceeding the PMC and any "hot spots" of gross contamination. Sampling of fill materials prior to their placement on the site will be conducted to verify their environmental suitability.

6.1 Confirmatory and Investigation Soil Sampling

Confirmatory and investigation soil samples will be collected from all RAC excavations and any "hot spot" excavations to obtain data for use in evaluating excavation endpoints and for site characterization. A complete COC analyte summary for each RAC is presented in the table in Section 1.3. Samples from RACs will be collected from material that remains on-site after excavation activities are complete and will be analyzed only for the COCs determined for the specific RAC or "hot spot." If the sampling results indicate that contamination exceeding the PMC persists, additional material will be removed and the area will be resampled until the PMC exceedance or hot spot has been adequately remediated. As previously stated, the goal of remediation of any identified "hot spots" will be to mitigate those conditions that result in the area's classification as a "hot spot", and removal of all soils exceeding the PMC.

6.1.1 Confirmatory Sampling Locations

If the sidewall of a RAC, hot spot, or newly identified soil staining excavation is greater than six feet, confirmatory samples will be collected from two different vertical intervals at each sampling location. One sample will be collected at an interval corresponding to the mid-point of the vadose (unsaturated) zone, or the location in the vadose zone most likely to be contaminated. The other sample will be collected at the bottom of the vadose zone. If the sidewall is less than six feet, samples will be collected from only one depth interval, which will correspond to the interval most likely to be contaminated. This interval will typically be at the bottom of the vadose zone, unless observations indicate that other intervals contain greater contamination. Only bottom samples will be collected from dish-shaped soil "scrapes" less than 2 feet deep.

Confirmation samples will be collected at the depth intervals described above at a frequency of one sample per 25 linear feet of excavation sidewall and a minimum of one sample per sidewall, regardless of length. Each sampling location will be located by survey prior to backfilling of the excavation.

If RACs or hot spots are excavated to an elevation at or below the seasonal high water table or to the bedrock surface, confirmation samples will not be collected from the excavation bottoms. If the bottoms of the excavations do not extend to the water table, bottom samples will be collected at a frequency of approximately one every 25 by 25 foot area (one sample for every 400 square feet). All confirmatory soil sample locations will be targeted at worst-case conditions, typically beneath or beyond the original contaminant source location (stained area, spill, vessel, etc.).

6.2 Sampling of Soils in Hot Spots

If any areas of "gross" contamination are identified during excavation, representative samples will be collected and analyzed for characterization. Any grossly contaminated soils will be removed and stockpiled pending waste characterization and determination regarding disposition. Representative soil samples will be collected by hand methods from any stockpiled soil. Sampling frequency will depend on the volume of soil removed and stockpiled. At a minimum, one sample per 100 cy will be collected.

Laboratory analysis for characterization of soil in suspected "hot spots" and for stockpiled soil will include the following parameters, since it is assumed that the contaminants in these areas are unknown:

- EPA Method 8260B – Volatile Organic Compounds (using Preservation Method EPA 5035)
- CT-DEP ETPH
- 8 RCRA Toxic Metals (TCLP)
- 8 RCRA Toxic Metals and 7 Additional Metals (antimony, beryllium, thallium, vanadium, copper, nickel, and zinc) (Total and SPLP)
- SVOCs by EPA 8270C and SPLP
- pH
- Reactive sulfur and cyanide
- PCBs
- Flash Point

6.3 Fill Sampling

Prior to importation and placement of any fill material to the site, it will be necessary to collect and analyze representative samples. The specific source(s) of the fill material for the site has not yet been identified and the necessary quantity is not known at this time. Off-site fill sources will be native material from a sand and gravel pit. The material may require screening and/or crushing to limit the size to 3-inch minus prior to transport to the site.

Composite samples will be collected from the fill material proposed for use at the site. The composite samples will consist of soil collected from a maximum of five (5) locations per sample. Composite samples will be collected, with a frequency of one sample per 5,000 cy of fill material anticipated for use on the site. Representative samples will be collected by hand methods from prospective gravel pits prior to it being brought to the site and placed in the excavation. The ROC will be responsible for collection and analysis of fill samples and inspection of fill from the proposed source(s). Use of on-site material for fill is additionally described in Sections 7.1 and 8.2.

6.3.1 Laboratory Analysis

Analysis of fill samples will include a comprehensive list of COCs from the site, including VOCs, PAHs, ETPH, 15 DEP Metals, and PCBs. Samples for

analysis of volatile organic compounds (VOC) will not be composited or mixed. VOC soil samples will be collected in accordance with CT DEP VOC sampling protocol. Detection limits will be consistent with RSR criteria and the CT DEP RCP guidelines.

6.3.2 Evaluation Criteria

The criteria that will be used to evaluate the suitability of the fill used for backfill will be the Residential Direct Exposure Criteria (RDEC) and the GA Pollutant Mobility Criteria (GA PMC). The material will also meet the definition of natural soil presented in Section 22a-209-1 of the Regulations of Connecticut State Agencies.

6.4 Sampling Procedures

Samples collected for confirmation purposes will be obtained from the excavation sidewalls using manual sampling methods if the excavation complies with OSHA requirements for slope and dimension. If entry is not possible, samples will be collected using the backhoe bucket. The typical equipment requirements and collection procedures used to sample soil are described below.

Equipment

- Stainless Steel (SS) Trowels, Spoons, or Scoops
- SS Spade or Hand Auger
- Sample Containers (provided by the laboratory)

Sample Collection Procedures

Soil samples will be collected according to the following procedure. Changes to these procedures must be justified and recorded in the field logbook.

1) Decontaminate sampling equipment

2) Sketch and record the sampling locations on the site map and in the field notebook.

3) Photograph the sampling location and conditions.

4) Collect the sample from the excavation sidewall at the prescribed depth intervals using the SS equipment noted above. Alternatively, collect the sample from the middle of the backhoe bucket after scraping the prescribed interval (care should be taken not to include materials that may have fallen into the bucket from other intervals). Fill the appropriate sample container for the analyte(s) required.

5) Immediately label and refrigerate the sample.

6) Stake the sample location and label and record in the logbook as indicated below.

7) Submit the sample to the laboratory under chain-of-custody protocol.

Documentation

The following information is typical of that documented and reported in the field logbook when collecting soil samples:

- Description of the sample that is being submitted to the laboratory including the physical characteristics of the sample (e.g., color, odor, and texture), and unusual characteristics.
- Approximate depth of the sample.
- Type of sample (Grab or Composite).
- Sample designation and location.

6.5 Project Quality Assurance/Quality Control

The laboratory utilized for project analyses will be required to perform all of the internal quality control procedures that are specified in the specific methods. Connecticut Reasonable Confidence Protocols will be followed. Methodologies include the following as specified in SW-486*:

- EPA Method 8260B – Volatile Organic Compounds (using Preservation Method EPA 5035)
- CT-DEP ETPH
- RCRA Toxic Metals (Total and SPLP)
- 7 Additional Metals (antimony, beryllium, thallium, vanadium, copper, nickel, and zinc) (Total and SPLP)
- EPA Method 8082 Pesticides
- SVOCs by EPA 8270C

**not including CT-DEP ETPH Method.*

QA/QC procedures will include but are not limited to:

- Blanks - The laboratory will analyze method blanks prepared and analyzed with each set of samples. These are a check of the accuracy of the system and indicate if there are positive biases.
- Calibration Checks - These are standards generally from a different source from the calibration standards that are analyzed along with the samples. The purpose of the calibration checks is to determine if the analytical equipment is functioning accurately.
- Matrix Spike - A matrix spike is an actual sample that is spiked with a known amount of one or more target compounds. The matrix spike recovery is calculated from the results of the analysis. This information is useful for estimating the effect of the sample matrix on the analytical procedure. At least one matrix spike sample will be analyzed for each batch of twenty samples analyzed.

Upon receipt of the laboratory data, the ROC will perform a review of the data to evaluate its usability. This will include checking of such items as:

- Holding times,
- Field and laboratory blanks;
- Field and laboratory duplicates;
- Surrogate recoveries, if applicable;
- Calibration checks;
- Spike recoveries, if applicable; and
- Temperature.

Minimum detection limits consistent with the RSR (i.e., as low as minimum applicable criteria) will be used for all analyses. Items such as GC/MS tuning, initial calibrations, calculations, and raw data will be checked by the lab.

7.0 SITE RESTORATION

Site restoration will include relocating excavated DEC soils, the filling required to render the site soils inaccessible, and the final grading and installation of erosion control measures.

7.1 DEC Soil Relocation

In accordance with the soil remediation plan (Section 5.0), soils that exceed the DEC may be excavated and relocated on-site provided they are placed in conformance with the requirements of Section 8.2 Identification of On-Site fill Materials. In addition, placement of DEC soils will conform to provisions stipulated in Section 22a-133k-2(h) of the RSRs. These include: (1) prior to reuse, a map showing the location and depth of proposed placement of such soil is submitted to the Commissioner, (2) the soil cannot be placed below the water table, (3) it cannot be placed in an area that is subject to erosion, (4) any soil in which the concentration of any substance exceeds the pollutant mobility criteria applied to a GA area is not placed over soil and ground water which have not been affected by a release at the parcel and which placement is proposed; and (5) for soil polluted with PCBs, the commissioner has issued a written approval in accordance with Section 22a-467 of the Connecticut General Statutes. The relocated materials are defined as "controlled materials" on maps and cross-sections.

A map constructed from actual survey information depicting the soil relocation areas including cross-sections will be included in the RAR. The ROC will document to the extent possible the areas in which soil from specific locations in the site are placed.

7.2 Geotextile Installation

Following DEC excavation and relocation, and any PMC remediation and backfilling, a geotextile material will be installed over the entire site. This material will act as a marker horizon or warning layer to distinguish the clean fill from the material that exceeds the DEC.

7.3 Site Backfilling

Following the geotextile installation, the entire site will be covered with a minimum of 2 feet of clean fill, as defined in the CT DEP Solid Waste Regulations. Backfill will consist of 3-inch minus material meeting geotechnical specifications determined by the civil engineer. The material will be placed in maximum 12-inch lifts and compacted. Compaction will be tested in-situ to verify compliance with 95% optimum density (based on Modified Proctor or equivalent ASTM test). Soil density testing (Modified Proctor, ASTM 1557) will be performed by a testing laboratory.

7.4 Surface Restoration

Following the placement of two (2) feet of fill materials, a cover material consisting of four inches of bituminous asphalt pavement will be required to be placed to render the soils "inaccessible" in accordance with CT DEP's Remediation Standard Regulations. Figure 6 is a typical pavement section detail. The Bituminous Concrete Pavement shall conform to CT DOT Form 816 Section 4.06. These specifications provide a description of materials, construction methods, method of measurement, and basis of payment for bituminous pavement placement.

Additionally, any required Water Pollution Control shall conform to specifications CT DOT Form 816 Section 2.10. These specifications provide a description of materials, construction methods, method of measurement, and basis of payment for water pollution control. Applicable CT DOT Forms are included as Appendix A.

The City of Middletown will be responsible for maintaining the fill surface once the RC's work has been accepted as complete.

8.0 GENERAL REMEDIATION IMPLEMENTATION PROCEDURES

8.1 Pre-Remedial Site Preparation

Tree cutting, clearing, and incidental removal of miscellaneous debris will be performed by others prior to the start of site Remediation work. Following removal of these materials in the project area, the ROC will inspect the newly exposed areas to determine if additional AOCs are present. If new AOCs are identified, they will be characterized by hand samples, borings and/or test pit installation. Any concrete will be visually inspected for staining and stained sections will be segregated for disposal as a Connecticut Regulated Waste, while, clean concrete will be disposed of as demolition debris.

8.2 Identification of On-Site Fill Materials

Several types of on-site materials will be evaluated for use as fill in PMC excavations or other areas below the geotextile barrier (refer to Section 7.2) and natural soil fill, but above the seasonal high water table. These materials include existing site soils, demolition materials (concrete, brick, asphalt, and rock), and boulders/cobbles excavated with site soils. To be found acceptable for use as fill, such materials must meet the requirements of Section 22a-133k-2(h)(3) of the RSRs and the definition of "clean fill" presented in Section 22a-209-1 of the RCSA. The following sections describe the process of evaluating and documenting the use of these materials as fill.

8.2.1 Site Soils

Soils affected by a specific release area will not be relocated into areas that have not been affected by similar substances, but may be used in the vicinity it was excavated from.

8.2.2 Boulders/Cobbles

Boulders and cobbles are present in the subsurface and will be excavated with site soils. Similar to demolition material, these materials will be inspected for evidence of staining. If staining is present, the boulders/cobbles will be disposed of at a permitted off-site facility. If no staining is present, the boulders/cobbles will be crushed to 3-inch minus size and used as fill below the geotextile, but above the seasonal high water table. Documentation of the material condition and the general area it was used as fill will be provided in the RAR.

8.3 Permits and Approvals

To perform the remediation work, several permits and approvals will be required. Certain regulatory approvals also may be necessary for off-site disposal of soils and/or other project wastes. The specific approval required will depend on the actual disposal facility selected. Any such approval for disposal of project waste off-site will be obtained after the actual facility has been selected, and prior to the actual disposal.

A copy of each permit and/or authorization for the remediation work will be included in every remediation contract and the contractor will be informed of the permit/authorization requirements and their responsibility for compliance with these requirements.

8.3.1 Wetlands Permit

Soil excavation, regrading and filling at the subject site will require conformance with the Army Corps of Engineers (ACOE) Programmatic Permit (Permit). The Permit is a "general" permit that covers all wetland activities throughout the State that meet the requirements set forth in its conditions. The Permit is designed to streamline the permitting process to meet both the Federal and State definitions of wetlands.

The activities in this RAP were previously authorized under a Permit that expired on May 15, 2006 and only allows for continuation of previously authorized activities if construction has commenced. A new application will be required to be submitted under the new Programmatic Permit which became effective on May 31, 2006 and expires on May 31, 2011, prior to initialization of remediation.

8.4 Waste Management

Materials to be removed from the site may be classified into one of the following waste streams:

1. Connecticut regulated waste (CRW);
2. Bulky waste;
3. Municipal solid waste (MSW);
4. Liquid waste (including decontamination wastewater); and

Prior to being transported off-site, all wastes will be properly characterized and profiled for disposal. Waste disposal will be approved as required (CT Special Waste Disposal Authorization, MA LSP approval, etc.), and the intended disposal facility will confirm their acceptance of the waste prior to transport.

Soil to be excavated that has been completely characterized and approved for disposal may be loaded directly into transport vehicles for shipping to the off-site disposal facility. Other soil to be disposed of off-site will be staged on-site until characterization and approval/acceptance is complete. A typical soil staging detail is shown on Figure 5.

The CRW and any identified hazardous waste will be disposed of at facility permitted to accept such wastes. Bulky waste (primarily demolition debris) will be disposed of at a disposal or recycling facility permitted to handle such waste.

Solid materials generated during the remediation will be segregated. If solid materials (such as plastic sheeting, hay bales, personal protective equipment, etc.) come into contact with contaminated materials, the solid materials will be disposed of along with the contaminated materials. If the solid materials do not come into contact with contaminated materials, they will be disposed of as municipal waste.

Liquid wastes that will be generated include decontamination wastes. Liquid wastes will be disposed of at a permitted, off-site facility.

Waste removal from the site will be documented by manifest or bill of lading. It will be the responsibility of the waste disposal subcontractor to prepare the manifests or bills of lading and the responsibility of the ROC to review waste disposal documentation. A representative of Middletown will sign waste profile forms and manifests. The disposal documentation will be included in the RAR.

8.4.1 Waste Characterization Sampling

Laboratory analysis for characterization of material targeted for disposal will include all parameters required by the disposal/ treatment/ relocation facilities. Typically, the following parameters will include:

- EPA Method 8260B – Volatile Organic Compounds (using Preservation Method EPA 5035)
- CT-DEP ETPH, or TPH by 418.1 or equivalent
- 8 RCRA Toxic Metals (TCLP) and total (mass analysis)
- SVOCs by EPA 8270C
- pH
- Reactive sulfur and cyanide
- PCBs
- Flash Point
- Conductivity

Sampling procedures will be generally similar to those described in Section 6.4, with the exception that representative samples will be collected from stockpiled materials. Sampling frequency will be consistent with the disposal/treatment facility's requirements.

8.5 Monitoring Wells

Due to the extensive site remediation/restoration impacts, many of the existing monitoring wells on-site may have to be abandoned and selectively replaced for the ground water monitoring program. Each well to be abandoned will be abandoned in accordance with the Connecticut Well Drilling regulations. The wells will be tremie-grouted from the bottom up with a Portland cement/bentonite grout. After the grout sets, any well screen and riser will be excavated as necessary along with the soil in the area to a depth as required for the soil remediation.

A network of new monitoring wells will be installed to replace those abandoned during the soil remediation work. Post soil remediation ground water monitoring will be performed to evaluate the effectiveness of soil remediation measures in minimizing future ground water impacts. Well installation locations and numbers will be directed by the ROC.

8.6 Sediment and Erosion Control

Prior to the excavation of contaminated soils, an erosion and sedimentation control (ESC) system (hay bales and/or silt fence) will be installed around the site perimeter and other locations on-site where appropriate.

8.6.1 Stockpiling

Excavated soil to be staged prior to off-site disposal will be stockpiled on-site and properly labeled to indicate its origin. Stockpiles will be constructed in a manner to contain and secure the material and prevent contact of the stockpiled material with the ground beneath it or release of any stockpiled material to the surrounding area. Soils will be stockpiled on and covered by plastic sheeting, which will be anchored with sandbags or other materials to contain the soils and minimize potential exposure. Hay bales will be placed around areas used for stockpiling to prevent the migration of contaminated soil from the stockpile. Soil will be stockpiled as shown in Figure 5.

Any incidental spillage of soil that occurs during material transfer to/from the stockpiles will be collected and returned to the stockpile. To ensure that all spilled soil is cleaned up, the existing surficial soils beneath the spilled soil will also be removed and handled in the same manner as the spilled soil.

Excavation below the seasonal high water table is not anticipated. As such, materials containing free draining liquids and requiring stabilization are not anticipated in significant quantities.

8.7 Dust Control

Due to the potential for the COCs at the site to be released in particulate form during site operations, dust control measures will be implemented. The dust control measures may include the use of water to pre-wet soil that will be excavated. Water will also be sprayed onto active work areas, dirt roads, and other areas of the site that may be subject to the release of dust. Calcium chloride or dust control material may also be used in high-traffic areas to minimize dust emissions caused by vehicular traffic. Air monitoring procedures will be implemented to monitor the total dust and contaminant emissions from the site during remediation.

8.8 Decontamination

Heavy equipment used to excavate and relocate DEC soil will be decontaminated upon completion of these activities and prior to the placement of the geotextile warning layer. Decontamination will be performed at the perimeter of the work area so that the soils removed from the equipment may be included with the relocated DEC soils, covered with the geotextile warning layer, and rendered inaccessible beneath natural soil cover material.

A clean gravel anti-tracking pad will be installed at all vehicular entrances to the site to prevent over-the-road vehicles from tracking contaminated soil in tire treads off-site. If necessary, contaminated material that is present on the exterior of the trucks will be brushed off at the tracking bed. Wet decontamination of vehicles leaving the site is not planned, unless gross contamination is observed. Contaminated anti-tracking pads will be removed and disposed off-site after handling of contaminated materials is complete. New anti-tracking pads will be installed as necessary for continued traffic to/from the site.

A determination will be made in the field regarding the need for additional decontamination methods, such as steam cleaning. If required, a decontamination area will be erected consisting of 10-mil polyethylene with appropriately bermed sides to

retain liquids for collection and off-site disposal. Any such liquids will be drummed and properly disposed off-site. Waste characterization sampling will be performed on the drummed liquids as required. All drums will be labeled as to the contents, and stored in protected areas.

8.9 Site Security

Fencing will be installed as necessary to secure the site during remediation and site restoration.

Signs that indicate that remediation is taking place on the site and that the area is restricted will be posted on the fences. These signs will include information about emergency contacts.

8.10 Demobilization

Upon completion of the remediation, equipment, excess materials, and waste will be removed form the site.

9.0 POST-REMEDIAL GROUND WATER MONITORING

According to section 22a-133k-3(g)(2) of the RSRs, a ground water monitoring plan shall be prepared with respect to remediation of a release area or a ground water plume in a GB area. Ground water monitoring under such a plan shall be designed to determine:

1. The effectiveness of soil remediation in preventing further pollution of ground water by substances from the release area;

2. The effectiveness of any remediation in eliminating or minimizing identified health or safety risks associated with such release;

3. Whether applicable GWPC, SWPC and VC have been met; and

4. Whether the ground water plume interferes with any existing use of the ground water for a drinking water supply, or with any other existing use of the ground water, including but not limited to industrial, agricultural or commercial purposes.

Based on the existing data, the location of post-remediation ground water monitoring wells will be selected to optimize ground water analysis down gradient of known contaminant release areas and remediation areas proposed in this report. However, the well locations will be re-evaluated based on additional information obtained during remediation at the discretion of the ROC. Final post remediation monitoring well locations will be presented in the RAR.

10.0 DOCUMENTATION AND REPORTING

The ROC will oversee the implementation of remediation, and will prepare and maintain a complete record of remediation activities performed. The remediation oversight consultant will be responsible for ensuring that the project is completed in accordance with the specifications of this RAP, the HASP (to be provided as a separate document), and generally accepted industry/engineering standards.

10.1 Field Documentation/Notification

The following specific documentation and reporting requirements will be the responsibility of the ROC:

Verifying achievement of remediation goals;

- Ensuring compliance with provisions of the HASP and air monitoring program;
- Ensuring proper management of remediation wastes, including stockpiling, loading for transport, etc.;
- Maintaining an accurate accounting of materials entering and leaving the site, including contaminated soils and other materials, contractor forces, and placement of contaminated fill on the site;
- Photographic documentation of completed excavations, completed remediation areas, and other pertinent observations;
- Documenting, and reporting of any spills, leaks, or other discharges occurring at the site;
- Documenting and reporting of any disruption/damage to utilities;
- Completion of a daily report summarizing the progress, events, contractor activities and other pertinent details; and,
- Ensuring that erosion control and site security measures are adequately maintained throughout the project.
- Documentation of relocation of soils and demolition debris. Daily sketches of soil/debris relocation areas and progress will be made and included in the RAR.
- Verbal notification to DEP via telephone within 24 hours of identification of any "hot spots".
- Verbal notification to DEP via telephone within 48 hours of any problems noted during inspections of fill cover (i.e., site restoration).

10.2 Post-Remediation Reporting

A Remedial Action Report (RAR) will be prepared for the site and submitted to CTDEP. The report will describe the completed work at the site, and will contain, but will not be limited to, the following specific items:

- Description of all remediation activities;

- Site plan showing site features, sample locations, and the vertical and horizontal limits of excavation;
- Tables containing results of any sampling;
- Figures showing the location and depth of all confirmatory samples;
- Complete laboratory reports;
- Discussion of validity of data and acceptable Quality Assurance/Quality Control;
- Documentation of waste disposal (if any), including manifests, bills-of-lading, certificates of relocation, etc., along with a summary of the reuse of soils with identified contamination above the DEC;
- Photographs of remediation activities;
- Copies of standardized field notes;
- Maps and cross-sections illustrating the depths of soils used to render soil that exceeds the DEC inaccessible, and soil reuse areas. In addition, maps will be provided illustrating the elevation and extent of the geotextile warning fabric;
- Detailed post-remediation ground water monitoring plan;
- Summary of findings of the investigations that are proposed in this RAP document.

11.0 SCHEDULE

This RAP will be implemented according to the following schedule.

Task	Dates
Issue RAP to City of Middletown	March 26, 2007
City Review and Concurrence with RAP	To Be Determined
Remediation Bid and Contract Period	To Be Determined
Remediation	To Be Determined
Submission of Draft Remedial Action Report (RAR)	To Be Determined
Submission of ELUR Documents to DEP	To Be Determined
DEP Review and Approval of ELUR	To Be Determined
Review and Approval of RAR	To Be Determined

Note: The relocation of DEC soils and the placement of clean fill to render the DEC soils inaccessible are dependent on site access.

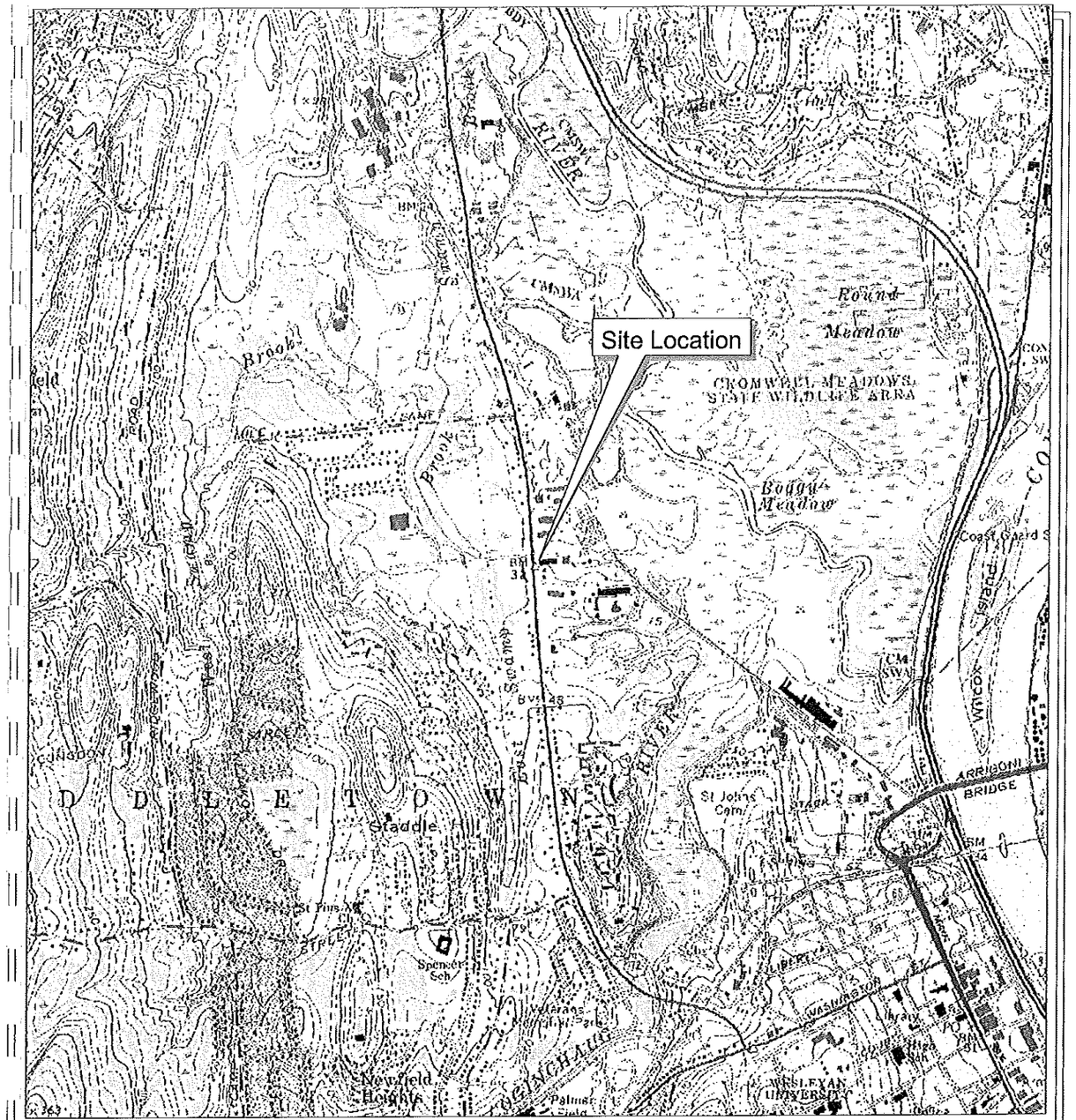
TABLES

TABLE 1
CONSEPTUAL SITE MODEL
The Former Portland Chemical Works
680 Newfield Street (rear) Middletown, cT
(HRP# MID6003.P3)

Shaded cells identify samples that investigate more than one RA/PRA

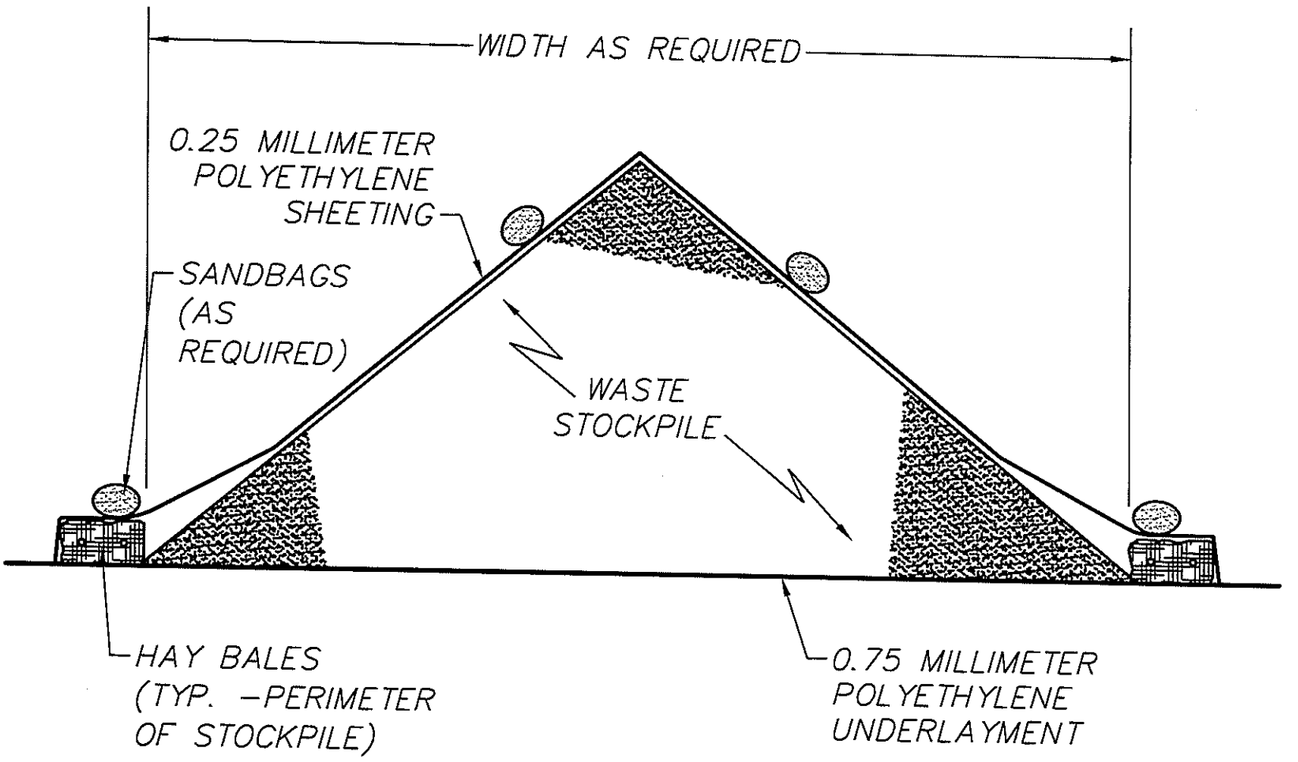
RAs/PRAs Included & Location		Potential Release Mechanism	Comments	Contaminants of Concern	Investigation Techniques	Sample ID	Sampling Media	Sample Depth	Release Detected Above RSR Criteria						Detected Contaminants								Soil Remedial Area of Concern (RAC)
RA/PRA Number	Description								DEC	PMC	SWPC	GPC	RVC	ICVC	VOCs	PAHs	Metals*	ETPH	PCBs	Pesticides	Herbicides	pH	
RA-1	Drum and Debris Burial	Spills or container failure of buried fiber drums and debris, historical drum storage, leach field associated with on-site chemical man-hole (PRA-3), and GPR subsurface anomaly affecting shallow, intermediate, and deep soils and groundwater.	Buried debris and fiber drums containing various chemical wastes were identified during the excavation activities in January 2001.	VOCs, PAHs, PCBs, ETPH, Metals, Pesticides, PCBs	47 test pits and 3 soil borings w/ soil sampling, 3 groundwater grab samples from testpits, groundwater monitoring from 5 borings finished as temporary groundwater sampling points and 3 existing monitoring wells	TP-1	SOIL	7.0'	X									X						RAC-1, RAC-4, RAC-5
						TP-2	SOIL	2.5'																
						TP-9	SOIL	2.0'																
						TP-10A	SOIL	2.0'																
						TP-11B	SOIL	6.0'																
						TP-12A	SOIL	3.7'																
						TP-12B	SOIL	2.0'																
						TP-13B	SOIL	6.0'																
						TP-15B	SOIL	5.0'																
						TP-16A	SOIL	2.0'																
						TP-16B	SOIL	2.5'																
						TP-17A	SOIL	1.0'																
						TP-17B	SOIL	2.5'																
						TP-18B	SOIL	4.5'																
						TP-19B	SOIL	4.0'																
						TP-20B	SOIL	7.0'	X	X					X									
						TP-22	SOIL	3.0'																
						TP-23A	SOIL	3.0'																
						TP-23B	SOIL	4.0'																
						TP-24A	SOIL	2.0'	X	X						X								
						TP-24B	SOIL	4.0'																
						TP-25A	SOIL	1.5'	X								X							
						TP-26A	SOIL	2.0'																
						TP-29	SOIL	2.0'																
						TP-30	SOIL	8.0'																
						TP-31A	SOIL	5.5'	X	X								X						
						TP-32	SOIL	3.5'																
						TP-34	SOIL	1.0'																
						TP-35A	SOIL	1.5'																
						TP-35B	SOIL	6.0'																
						TP-36	SOIL	1.8'	X								X							
						TP-37	SOIL	1.9'																
						TP-38	SOIL	3.0'	X								X							
						TP-38a	SOIL	3.0'	X								X							
						TP-38b	SOIL	4.0'	X								X							
						TB-38c	SOIL	2.0'	X								X							
						TP-38d	SOIL	4.0'																
						TP-38e	SOIL	8.0'	X								X							
						TP-38f	SOIL	4.0'																
						TP-38g	SOIL	4.0'																
						TP-38h	SOIL	4.0'																
						TP-38i	SOIL	8.0'																
						TP-39	SOIL	3.0'	X								X							
						TP-40	SOIL	2.5'																
						TP-41A	SOIL	1.6'																
						TP-47	SOIL	2.0'																
						TP-48A	SOIL	1.8'																
						TP-48B	SOIL	2.5'																
						TP-49A	SOIL	2.0'																
						TP-49B	SOIL	3.0'																
						TP-50A	SOIL	8.0'																
						TP-50B	SOIL	1.0'																
						TP-52A	SOIL	3.0'																
						TP-52B	SOIL	5.0'																
						TP-54B	SOIL	6.0'																
						TP-55B	SOIL	7.0'																
						TP-56A	SOIL	3.0'																
						TP-56B	SOIL	6.0'																
						TP-57A	SOIL	3.0'																
						TP-57B	SOIL	6.0'																
						TP-58A	SOIL	2.0'																
						TP-59A	SOIL	1.0'																
						TP-59B	SOIL	7.5'																
						TP-60A	SOIL	2.0'																
						TP-60B	SOIL	3.0'																
						TP-61A	SOIL	6.0'																
						TP-62A	SOIL	2.0'	X							X			X					
						TP-62B	SOIL	8.5'																
						TP-71A	SOIL	1.0'																
						TP-71B	SOIL	2.7'																
						TP-73	SOIL	6.0'																
						TB-4	SOIL	0-3'																
						TB-8A	SOIL	6-7.5																
						TB-8B	SOIL	8-10.0'																
						TB-10	SOIL	6-10'																
						TP-16W	GW	-			X		X	X	X		X							
						TP-28W	GW	-			X					X	X							
						TP-59W	GW	-																
						TB-1W	GW	-			X					X	X							
						TB-2W	GW	-			X		X		X		X							
						TB-3W	GW	-			X						X							
						TB-07W	GW	-																
						TB-8W	GW	-					X		X									
						MW-1	GW	-																
						MW-3	GW	-																
						MW-5	GW	-																

FIGURES



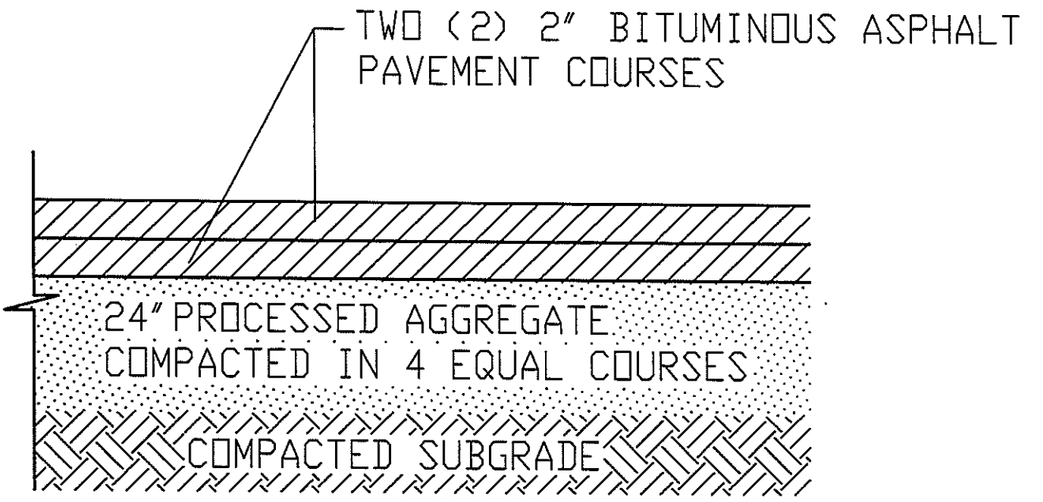
MIDDLETOWN, CONN
41072-E6-TF-024
1965
PHOTOREVISED 1992
DMA 6467 II SW-SERIES V816

Figure 1. Site location.
Former Portland Chemical
680 Newfield St Rear
Middletown, CT 06457
HRP# MID6003.RA



WASTE STOCKPILE AREA
NOT TO SCALE

FIGURE 5
TYPICAL WASTE STOCKPILE DETAIL
FORMER PROTLAND CHEMICAL FACILITY
680 NEWFIELD STREET (REAR)
MIDDLETOWN, CONNECTICUT
HRP # MID6008.CE
NOT TO SCALE



PAVEMENT DETAIL

NO SCALE

FIGURE 6
TYPICAL PAVEMENT SECTION DETAIL
FORMER PROTLAND CHEMICAL FACILITY
680 NEWFIELD STREET (REAR)
MIDDLETOWN, CONNECTICUT
HRP # MID6008.CE
NOT TO SCALE

APPENDIX A

DOT Form 814A Section 2.10

APPENDIX B

Site Inspection Criteria Checklist

TABLE 1
CONSEPTUAL SITE MODEL
The Former Portland Chemical Works
680 Newfield Street (rear) Middletown, CT
(HRP# MID6003.P3)

Shaded cells identify samples that investigate more than one RA/PRA

RAs/PRAs Included & Location		Potential Release Mechanism	Comments	Contaminants of Concern	Investigation Techniques	Sample ID	Sampling Media	Sample Depth	Release Detected Above RSR Criteria						Detected Contaminants								Soil Remedial Area of Concern (RAC)
RA/PRA Number	Description								DEC	PMC	SWPC	GPC	RVC	ICVC	VOCs	PAHs	Metals*	ETPH	PCBs	Pesticides	Herbicides	pH	
PRA-11	Unnamed Stream and Outfall Culvert	Discharge associated with spills or container failure from former tank farm and run-off from adjacent industrial properties affecting shallow, intermeditate and deep soils and groundwater	Unnamed Stream receiving run-off from Newfield Street, adjacent industrial properties, on-site tributaries, and drainage from the former tank farm (PRA-8)	VOCs,PAHs, ETPH, Metals, Pesticides, PCBs	4 surface water samples and 4 sediment samples	SW-1	SW	-					X		X								Not Applicable
						SW-2	SW	-															
						SW-3	SW	-															
						SW-4	SW	-															
						SED-1	SED	-		X							X						
						SED-2	SED	-		X							X						
						SED-3	SED	-	X	X							X			X			
						SED-4	SED	-	X	X							X						
PRA-12	Artifical Fill Area	Spills or container failure from buried drums and presence of contaminated fill affecting shallow and deep soils	The northwest portion of the Site consists of fill material deposited under a Army Corps of Engineers permit. Also, six to nine fiber and steel drums containing non-hazardous substances (disodium phosphate) were removed from this area.	VOCs,PAHs, ETPH, Metals, Pesticides, PCBs, Herbicides	1 test pit w/ soil sampling	TP-62A	SOIL	2.0'	X							X		X					RAC-6
						TP-62B	SOIL	8.5'															
PRA-13	Emergency Response 2001	Spills or container failure from buried drums affecting shallow, intermediate, and deep soils	Crushed fiber drums unearthed during remediation effort 4 feet below grade. Contaminated soils and groundwater were removed from site and the excavation trenchs back-filled. However, limited redistribution of contaminated soil over the work area surface is expected.	VOCs, PAHs, PCBs, ETPH, Metals, Pesticides, PCBs	Review of previous investigations, documents from CT DEP OCSRD, and infield investigation than installation of 6 test pits within response work area	TP-18A	SOIL	1.0'	X									X					RAC-5
						TP-25A	SOIL	1.5'															
						TP-26A	SOIL	2.0'															
						TP-32	SOIL	3.5'															
						TP-33A	SOIL	4.0'															
						TP-33B	SOIL	6.0'															
						TP-64A	SOIL	1.5'	X								X						
						TP-64B	SOIL	3.5'	X								X						

TABLE 1
CONSEPTUAL SITE MODEL
The Former Portland Chemical Works
680 Newfield Street (rear) Middletown, cT
(HRP# MID6003.P3)

Shaded cells identify samples that investigate more than one RA/PRA

RAs/PRAs Included & Location		Potential Release Mechanism	Comments	Contaminants of Concern	Investigation Techniques	Sample ID	Sampling Media	Sample Depth	Release Detected Above RSR Criteria						Detected Contaminants								Soil Remedial Area of Concern (RAC)
RA/PRA Number	Description								DEC	PMC	SWPC	GPC	RVC	ICVC	VOCs	PAHs	Metals*	ETPH	PCBs	Pesticides	Herbicides	pH	
RA-2	Former Drum Filling Building	Spill or container failure and floor drain impacting shallow soils	The former drum-filling building constructed in circa 1960 was used to fill 55-gallon drums with the materials from the tank farm. Drum storage was reported to have been located in and adjacent to this building. A floor drain in this building was also indicated to have been connected to the adjacent chemical manhole.	VOCs,PAHs, PCBs, ETPH, Metals, Pesticides, PCBs	3 test pits w/ soil sampling and groundwater monitoring at 2 existing, cross- to down-gradient monitoring wells	TP-66	SOIL	2.0'																RAC-4
						TP-67	SOIL	2.5'																
						TP-68	SOIL	1.0'		X					X									
						RIZ-4	GW	-																
						MW-3	GW	-																
RA- 3	Former Chemical Manhole	Discharge from floor drain in drum filling building affecting shallow and intermediate soils	The chemical manhole received waste chemicals and spills from the floor drain in the drum-filling building.	VOCs,PAHs, PCBs, ETPH, Metals, Pesticides, PCBs	2 test pits w/ soil sampling	TP-64A	SOIL	1.5'	X								X							RAC-5
						TP-64B	SOIL	3.5'	X								X							
						TP-66	SOIL	2.0'																
RA-4	Leaching Field	Spills or container failure from buried wastes, historical drum storage, GPR subsurface anomaly, and leaching field associated with chemical man-hole (PRA-3) affecting shallow and intermediate soils	Chemical manhole discharged to leaching field, leaching field is located entirely within PRA-6	VOCs,PAHs, PCBs, ETPH, Metals, Pesticides, PCBs	15 test pits w/ soil sampling, groundwater grab sampling from 1 test pit, groundwater monitoring at 1 existing monitoring well	TP-3	SOIL	3.5'																RAC-1, RAC-2, RAC-3, RAC-5
						TP-4	SOIL	3.0'	X	X								X	X	X			
						TP-5	SOIL	2.7'	X	X					X			X					
						TP-6	SOIL	2.0'																
						TP-13A	SOIL	2.0'																
						TP-13B	SOIL	6.0'																
						TP-14A	SOIL	2.0'																
						TP-15A	SOIL	2.0'																
						TP-15B	SOIL	5.0'																
						TP-16A	SOIL	2.0'																
						TP-16B	SOIL	2.5'																
						TP-17B	SOIL	2.5'																
						TP-21	SOIL	5.0'	X	X					X									
						TP-25B	SOIL	2.5'																
						TP-26B	SOIL	5.0'	X									X						
						TP-27	SOIL	4.0'																
						TP-28	SOIL	1.5'	X	X					X	X	X	X						
						TP-64A	SOIL	1.5'	X								X							
						TP-64B	SOIL	3.5'	X								X							
						TP-16W	GW	-			X		X	X	X		X							
						MW-1	GW	-																
RA-5	Former Loading Rack	Spills from loading rack transferring bulk-chemicals from rail cars to AST tank farm affecting surface media and shallow soils	The former loading rack was used to unload bulk-chemicals from railroad tank-cars to the tank farm. Surficial staining identified in Hazardous Waste Notice of Violation filed in 1991.	VOCs,PAHs, PCBs, ETPH, Metals, Pesticides, PCBs	2 borings w/ soil sampling and groundwater monitoring from 1 temporary sampling boring and 1 existing monitoring well	TB-7	SOIL	0-3'																Not Applicable
						TB-9	SOIL	0-2'																
						TB-7W	GW	-																
						MW-203	GW	-																
PRA-6	Drum Storage Area	Spills or container failure from buried wastes, historical drum storage, and GPR subsurface anomaly, affecting surface media, shallow, and intermediate soils	Exterior drum storage is identified from circa 1965 to circa 1980 on the northeast portion of the Site.	VOCs,PAHs, PCBs, ETPH, Metals, Pesticides, PCBs	13 test pits w/ soil sampling	TP-7	SOIL	1.5'																RAC-1, RAC-4,RAC-5
						TP-8	SOIL	1.5'																
						TP-11A	SOIL	1.0'																
						TP-12B	SOIL	2.0'																
						TP-14B	SOIL	0.6'	X								X							
						TP-18A	SOIL	1.0'	X								X							
						TP-19A	SOIL	1.5'																
						TP-20A	SOIL	1.5'	X	X					X			X						
						TP-24A	SOIL	2.0'	X	X						X								
						TP-25A	SOIL	1.5'	X								X							
						TP-26A	SOIL	2.0'																
						TP-31B	SOIL	3.0'																
						TP-33A	SOIL	4.0'																
						TP-33B	SOIL	6.0'																
PRA- 7	Former Drum Storage Sheds	Spills or container failure of historically stored drums affecting surface media and shallow soils	Drums were stored in and around the small shed formerly located at the western terminus of the railroad spur.	VOCs,PAHs, PCBs, ETPH, Metals, Pesticides, PCBs	2 test pits w/ soil sampling and groundwater grab sampling from 1 test pit	TP-69	SOIL	2.0'	X															ELUR restricting residential use
						TP-70	SOIL	1.0'																
						TP-70W	GW	-																
PRA-8	Former Tank Farm	Spills or container failure from AST tanks affecting surface media, shallow and deep soils	The above-ground tank farm consisted of ten (10) 10,000-gallon tanks.	VOCs,PAHs, PCBs, ETPH, Metals, Pesticides, PCBs	7 test pits, 6 of 7 w/ soil sampling	TP-43	SOIL	No Sample																Not Applicable
						TP-54A	SOIL	3.0'																
						TP-54B	SOIL	6.0'																
						TP-55A	SOIL	4.0'																
						TP-55B	SOIL	7.0'																
						TP-73	SOIL	6.0'																
						TP-74	SOIL	3.0'																
						TP-75	SOIL	3.0'																
PRA-9	Loading Ramp	Spills or container failure from transfering bulk-chemicals from rail cars affecting surface media and shallow soils	The loading ramp was presumably used to load materials onto railroad cars.	VOCs,PAHs, PCBs, ETPH, Metals, Pesticides, PCBs, Herbicides	4 borings, 3 of 4 borings w/soil sampling, groundwater monitoring from 1 boring finished as temporary sampling point	TB-3	SOIL	No Sample																Not Applicable
						TB-4	SOIL	0-3'																
						TB-5	SOIL	0-3'																
						TB-6	SOIL	0-2'																
						TB-3W	GW	-			X							X						
PRA-10	Railroad Spur	Spills or container failure from tank-cars transporting bulk-chemicals affecting surface media, shallow and intermediate soils	The railroad spur was formerly used by tank-cars containing various bulk-chemicals. Also, railroad ties were typically treated with chlorinated-organic creosotes. Railroad right-of-ways were typically treated with herbicides.	VOCs, PAHs, PCBs, ETPH, Metals, Herbicides	4 borings, 3 of 4 borings w/ soil samping, groundwater monitoring from 2 borings finished as temporary sampling point	TB-3	SOIL	No Sample																Not Applicable
						TB-7	SOIL	0-3'																
						TB-10	SOIL	4-6'																
						TB-11	SOIL	0-2'																
						TB-3W	GW	-			X							X						
						TB-7W	GW	-																

DATE:_____ REPORT No._____

DAILY FIELD LOG - ENVIRONMENTAL

See attached site plan for daily excavation, backfill, geotextile, and survey areas. **Other documentation attached YES / NO**	**PROJECT** DESCRIPTION: Remediation and Site Improvements LOCATION: Former Portland Chemical Facility 680 Newfield Street Middletown, Connecticut	HRP INSPECTOR _____ WEATHER _____

Excavation Activities (identify area/depth of excavation on attached figure)

Were excavation activities scheduled for today? _____ Did they occur as planned? _____

If no, what appeared to be the cause for change? _____

Brief Narrative of Excavation Activities: _____

Backfill Activities (attach figure showing backfilled area if applicable)

Did any backfill take place today? _____

Number of Loads? _____

Source of Material: _____

Estimated volume of gravel backfill brought in to date?

Was geotextile fabric and/or stone installed today? _____

Approximate area covered (ft^2): _____

Brief Narrative of Backfilling Activities: _____

Survey Activities (identify survey areas on attached figure if possible)

Were there any survey activities conducted on-site? _____

Name contractor who conducted survey activities? _____

What areas were surveyed? _____

Brief Narrative of Survey Activities: _____

Documents Received (if any): _____

Erosion Control Measures

Are erosion control measures in place? YES / NO

Was Erosion Control Checklist Completed YES / NO

List any problems or action items:

Control of Airborne Emissions

Method of controlling airborne emissions:

Is this method minimizing the dispersion of dust, odors, vapors and other airborne emissions? YES / NO

If not, what alternative method will be utilized?

Are air emissions being monitored by the contractor? YES / NO

Has total particulate exceeded 2 mg/m^3? YES / NO If yes, what actions were taken?

Was Air Monitoring Form Completed: YES / NO

Comments (if any):

Decontamination Activities

Was on-site equipment properly decontaminated prior to leaving work zone? YES / NO

Method of decontamination of equipment:

Comments (if any):

INCLUDE THIS SHEET ONLY IF PREVIOUSLY UNKNOWN CONTAMINATION DISCOVERED

Describe previously unidentified material(s):

PID Readings: Is NAPL Present? YES / NO / POSSIBLY / UNCERTAIN

Staining / discoloration: NONE / Chemical / petroleum odors: NONE /

Other evidence: NONE /

Source and Extent:

DOES AREA APPEAR TO QUALITY AS "HOT SPOT" AS PER RAP. YES / NO

Did excavation of "hot spot" occur? YES / NO

How were excavation limits determined?

Did confirmation sampling take place?

Were samples submitted to the lab? (If yes, attach a copy of the chain of custody) When are the results expected?

Were the excavation depths, limits and sampling locations surveyed?

Was all of material removed? YES / NO If no, explain:

Was the excavation backfilled?

Comments (if any):

Activity Log / Picture Log

Date

Field Inspector (Print)

Field Inspector (Signature)

EROSION CONTROL INSPECTION CHECKLIST
Former Portland Chemical Facility
680 Newfield Street, Middletown, CT

Date:					
Inspector:					
Identify Erosion control measures in place (circle if present)	Tacking pad Silt fence Hay bales Other:	Tacking pad Silt fence Hay bales Other	Tacking pad Silt fence Hay bales Other	Tacking pad Silt fence Hay bales Other	Tacking pad Silt fence Hay bales Other
Condition of Tracking Pad (circle condition)	Good Needs Maintenance Sediment in roadway	Good Needs Maintenance Sediment in roadway	Good Needs Maintenance Sediment in roadway	Good Needs Maintenance Sediment in roadway	Good Needs Maintenance Sediment in roadway
Condition of silt fence/hay bales (circle condition)	Good Needs Maintenance (indicate location): Sediment in breach (indicate location):	Good Needs Maintenance (indicate location): Sediment in breach (indicate location):	Good Needs Maintenance (indicate location): Sediment in breach (indicate location):	Good Needs Maintenance (indicate location): Sediment in breach (indicate location):	Good Needs Maintenance (indicate location): Sediment in breach (indicate location):
Condition of catch basins (circle condition) :	Good Needs Maintenance (indicate location): Sediment breach (indicate location):	Good Needs Maintenance (indicate location): Sediment breach (indicate location):	Good Needs Maintenance (indicate location): Sediment breach (indicate location):	Good Needs Maintenance (indicate location): Sediment breach (indicate location):	Good Needs Maintenance (indicate location): Sediment breach (indicate location):
General Condition of Clean Cover (circle condition)	Good Evidence of erosion (indicate location):	Good Evidence of erosion (indicate location):	Good Evidence of erosion (indicate location):	Good Evidence of erosion (indicate location):	Good Evidence of erosion (indicate location):
Comments / Response Actions Taken					

Condition of Cover should be monitored for evidence of inadequate stabilization.
Evidence of erosion should include large gullies as well as any number of small rills.
Inspection of catch basins and silt fencing should ensure a sufficient level of erosion protection is provided.
All items of concern must note the response action taken.

SOIL STOCKPILE INSPECTION CHECKLIST
Former Portland Chemical Facility
680 Newfield Street, Middletown, CT

Date:					
Inspector:					
List Stockpile Numbers: Record stockpile identification numbers, locations, and approximate volume (cubic yards) on **Daily Field Log**					
Condition of Plastic Sheeting (circle condition)	Good Needs Maintenance (indicate stockpile #): Sediment breach (indicate stockpile #):	Good Needs Maintenance (indicate stockpile): Sediment breach (indicate stockpile):	Good Needs Maintenance (indicate stockpile): Sediment breach (indicate stockpile):	Good Needs Maintenance (indicate stockpile): Sediment breach (indicate stockpile):	Good Needs Maintenance (indicate stockpile): Sediment breach (indicate stockpile):
Evidence of Seepage (circle condition)	None Seepage identified (indicate stockpile #):	None Seepage identified (indicate stockpile #):	None Seepage identified (indicate stockpile #):	None Seepage identified (indicate stockpile #):	None Seepage identified (indicate stockpile #):
Comments / Response Actions Taken					

Condition of plastic sheeting should be monitored for rips, tears, loose covering, cover integrity and inadequate stabilization.
Evidence of seepage and leaching conditions includes any evidence of liquid release from the stockpile including evidence of erosion including gullies of rills.
All items of concern must note the response action taken.

of the pavement, drop inlets or catch basins that might be affected shall be sufficiently barricaded so as to prevent silt or runoff from plugging the drainage system.

If a rejuvenator is used, an approved metering device shall be used to ensure the accuracy of the amount of rejuvenator used.

Compaction shall be achieved by the use of a vibratory roller having the capability of producing high amplitude and low frequency vibrations. The compaction shall be a minimum of 95% of the proctor wet density (AASHTO T-180D).

4.03.04—Method of Measurement: The cold reclaimed asphalt pavement work will be measured for payment in square yards (square meters). The thickness will be as indicated on the plans, or as ordered by the Engineer and within +2 inches (+50 millimeters) and -1 inch (-25 millimeters).

Measurement to determine the thickness will be made by the Engineer at intervals of 500 feet (150 meters) or less. If deficient thicknesses are found, the Engineer will make such additional measurements as he considers necessary to determine the limits of the deficiency. Areas not within allowable tolerance shall be corrected, as ordered by the Engineer, without additional compensation to the Contractor.

Additional aggregates, as required, shall be measured for payment by the number of tons (metric tons) of aggregate delivered and incorporated into the pavement structure.

4.03.05—Basis of Payment: This work will be paid for at the contract unit price per square yard (square meter) for "Cold Reclaimed Asphalt Pavement," which price shall include all materials (except additional aggregate), equipment, tools, and labor incidental thereto.

Additional aggregate shall be paid at the contract unit price per ton (metric ton) delivered to the project site.

Pay Item	Pay Unit
Cold Reclaimed Asphalt Pavement	s.y. (s. m)
Additional Aggregate	ton (t)

SECTION 4.06
BITUMINOUS CONCRETE

4.06.01—Description: Work under this section shall consist of the production and placement of a smooth and dense bituminous concrete mixture with a uniform texture for (1) a completed base course, (2) the surface of an existing pavement or (3) the surface of an existing pavement which has been brought to proper grade and cross section. Work under this section shall also include sawing and sealing of joints and cracks.

4.06.02—Materials: The materials for the bituminous concrete mixture, sources of supply, formula for mix, tack coat, joint seal, mix tolerances, approval of mix formula, and the control of the mixture shall conform to the requirements of Section M.04.

Recycle Option: The Contractor has the option of recycling reclaimed asphalt pavement (RAP). RAP may be recycled in Class 1, Class 2, Class 3, and Class 4.

Crushed Glass Option: The Contractor has the option of adding clean, environmentally acceptable crushed, recycled container glass (CRCG) to Class 1 (Not to be used in the surface course), Class 3 and Class 4.

4.06.03—Construction Methods: The methods employed in performing the work and all equipment, tools, machinery and plant used in handling material and executing any part of the work must be approved by the Engineer prior to their use. If at any time these are unsatisfactory to the Engineer, the Contractor shall change them, as the Engineer requires.

1. Material Documentation: All vendors producing bituminous concrete must have their truck-weighing scales, storage scales, and mixing plant automated to provide a detailed ticket. Delivery tickets must include the following information:

b. Name of producer, identification of plant, and specific storage bin (silo) if used.
c. Date and time of day.
d. Type of material (Class 3 mixture for machine-placed curbing must state "curb mix only")
e. Net weight (mass) of material.
f. Gross weight (mass) or tare weight (mass) of truck.
g. Project number, purchase order number, name of contractor (if contractor other than producer)
h. Truck number for specific identification of truck.

Notes:

Items a. through f. must be printed on the ticket automatically by the batch control system.

The time of day may be printed by a separate time clock.

Items g. and h. must be printed or handwritten legibly.

The Contractor must notify the Engineer immediately if, during the production day, there is a malfunction of the recording system in the automated plant or truck-weighing scales. Manually written tickets containing all required information will be allowed for one hour, but for no longer, provided that each load is weighed on State-approved scales. One hour after any malfunction of the recording system, trucks will not be approved to leave the plant unless a State inspector is present to monitor weighing. If such a malfunction is not fixed within forty-eight hours, material will not be approved to leave the plant until the system is fixed to the Engineer's satisfaction.

2. Transportation of Mixture:

Trucks with loads of bituminous materials being delivered to State projects must not exceed the State legal weight limits. The State reserves the right to check the gross and tare weight (mass) of any delivery truck. During any check, a variation of the documented weight (mass) from that shown on a producer's ticket of two percent or less shall be considered evidence that the weight (mass) shown on the producer's ticket is correct. If the gross or tare weight (mass) varies from that shown on the delivery ticket by more than two percent, the Engineer will recalculate the net weight (mass).

If a truck delivers material to the project and the ticket

unloaded. An adjustment for weight (mass) will be taken in accordance with Subarticle 4.06.04.

The State reserves the right to have an inspector present to monitor batching and /or weighing operations.

The mixture shall be transported from the mixing plant in trucks that have previously been cleaned of all foreign material and that have no gaps through which material might inadvertently escape. The use of kerosene, gasoline, fuel oil, or similar products for the coating of the inside of truck bodies is prohibited. Truck body coating and cleansing agents must not have a deleterious effect on the transported materials. If such agents are applied, truck bodies shall be raised immediately prior to loading to remove any excess agent.

Loaded trucks shall be tightly covered with waterproof covers acceptable to the Engineer. Mesh covers are prohibited. The front and rear of the cover must be fastened to minimize air infiltration.

3. Paving Equipment:

The Contractor shall have the paving and compaction equipment at the Project site in a sufficient amount of time before operations so that it can be inspected and approved by the Engineer. The Contractor shall repair or replace any equipment found worn or defective, either before or during paving, to the satisfaction of the Engineer.

A. Pavers: Each paver shall have a receiving hopper with sufficient capacity to provide for a uniform spreading operation and a distribution system that places the mix uniformly, without segregation. The paver shall be equipped with a vibratory screed system with heaters or burners. The screed system shall be capable of producing a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture. Pavers with extendible screed units as part of the system shall have auger extensions and tunnel extenders as necessary. The screed unit shall have automatic screed controls for grade and slope unless otherwise approved by the Engineer. The controls shall automatically adjust the screed to compensate for irregularities in the preceding course or existing base. The controls shall maintain the proper transverse slope and be readily ad-

B. Rollers: All rollers shall be self-propelled and designed for compaction of bituminous concrete.

Non-vibratory (static) rollers shall be steel wheel types. These rollers may also be of the type that can be used as vibratory rollers.

Pneumatic tire rollers shall be self-propelled and equipped with wide-tread compaction tires capable of exerting an average contact pressure from 60 to 90 pounds per square inch (420 to 620 kiloPascals) uniformly over the surface, adjusting ballast and tire inflation pressure as required. The Contractor shall furnish evidence regarding tire size; pressure and loading to confirm that the proper contact pressure is being developed and that the loading and contact pressure are uniform for all wheels.

Vibratory rollers shall be equipped with indicators that provide the operator with amplitude, frequency and speed settings/readouts to measure the impacts per foot during the compaction process.

C. Lighting: For paving operations, which will be performed during hours of darkness, the paving equipment shall be equipped with lighting fixtures as described below, or with approved lighting fixtures of equivalent light output characteristics. A sufficient number of spare lamps shall be available on site as replacements in the event of failures. The Contractor shall provide brackets and hardware for mounting light fixtures and generators to suit the configuration of the rollers and pavers. Mounting brackets and hardware shall provide for secure connection of the fixtures, minimize vibration, and allow for adjustable positioning and aiming of the light fixtures. Lighting shall be aimed to maximize the illumination on each task and minimize glare to passing traffic. The Contractor shall provide generators on rollers and pavers of the type, size, and wattage, to adequately furnish 120 V AC electric power to operate the specified lighting equipment. A sufficient amount of fuel shall be available on site. There shall be switches to control the lights. Wiring shall be weatherproof and installed to all applicable codes. The minimum lighting requirements are:

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Paver lighting

Fixture	Quantity	Remarks
Type A	3	Mount over screed area
Type B (narrow) or Type C (spot)	2	Aim to auger and guideline
Type B (wide) or Type C (flood)	2	Aim 25' (8 m) behind paving machine

Roller Lighting

Fixture	Quantity
Type B (wide)	2
Type B (narrow)	2

OR

Type C (flood)	2
Type C (spot)	2

Note: All fixtures shall be mounted above the roller. Aim floodlights and wide beam lights 50 feet (15 meters) in front of and behind roller; aim spotlights and narrow beam lights 100 feet (30 meters) in front of and behind roller.

Type A: Fluorescent fixture shall be heavy-duty industrial type. It shall be enclosed and gasketed to seal out dirt and dampness. It shall be UL listed as suitable for wet locations. The fixture shall contain two 4-foot (1.2-meter) long lamps - Type "F48T12CWHO." The integral ballast shall be a high power factor, cold weather ballast, and 120 volts for 800 MA HO lamps. The housing shall be aluminum, and the lens shall be acrylic with the lens frame secured to the housing by hinging latches. The fixture shall be horizontal surface mounting, and be made for continuous row installation.

Type B: The floodlight fixture shall be heavy-duty cast aluminum housing, full swivel and tilt mounting, tempered-glass lens, gasketed door, reflector to provide a wide distribution or narrow distribution as required, mogul lamp socket for 250 watt Metal Halide lamp, 120 volt integral ballast, suitable for wet locations.

Type C: The power beam holder shall have a ribbed die cast aluminum housing, and a clear tempered-glass lens to enclose the fixture. There shall be an arm fully adjustable for aiming, with a male-threaded mount with serrated teeth and lock nuts. There shall be a 120-volt heatproof socket with extended fixture wiring for an "Extended Mogul End Prong" lamp base. The fixture shall have gaskets, and shall be UL listed as suitable for wet locations. The lamps shall be 1000-watt quartz PAR64, both Q1000PAR64MFL (flood) and Q1000PARNSP (spot) will be required.

4. Placing of Mixture: Prior to the placement of the bituminous concrete, the underlying base course shall be brought to the plan grade and cross section within the allowable tolerance. Immediately before placing the mixture, the area to be surfaced shall be cleaned by brooming or by other means acceptable to the Engineer.

Weather and Seasonal Limitations: The bituminous concrete mixture shall not be placed whenever the surface is wet or frozen or when the temperature is outside the limitations stated in Table 1 unless the contractor has a Cold Weather Paving procedure approved by the Engineer. The Contractor shall be responsible for submitting the procedure at least one week in advance of any paving operations that may result in placement of the bituminous concrete pavement outside of the temperature limitations stated in Table 1 and 1a.

TABLE 1- English

TEMPERATURE LIMITATIONS FOR PLACEMENT OF BITUMINOUS CONCRETE PAVEMENT

Lift thickness	**Minimum Air and Surface Temperatures - Degree F	
(Inches)	**Final Course**	**All Other Courses**
Less than 1-1/2	50	50
1-1/2 to 2-1/2 in	40	40
Over 2-1/2 in.	40	32

TABLE 1a- Metric

TEMPERATURE LIMITATIONS FOR PLACEMENT OF BITUMINOUS CONCRETE PAVEMENT

Lift thickness	**Minimum Air and Surface Temperatures - Degree C	
(mm)	**Final Course**	**All Other Courses**
Less than 40 mm	10	10
40 to 60 mm	4	4
Over 60 mm	4	0

Table 1 & 1a- ** Air and surface temperatures are taken in the shade. The surface is defined as the surface on which the new bituminous concrete pavement layer is to be placed.

Placing and Compacting Mixture: The mixtures shall be placed and compacted to provide a smooth and dense surface with a uniform texture. When overtaken by sudden storms, the Engineer may permit placement of the bituminous concrete to continue up to the quantity of material that is in transit from the plant.

The mixture shall be placed at a temperature that is within 25°F (15°C) of the approved job mix formula.

Before rolling is started, the mat shall be checked for defects in material or placement. Such defects shall be corrected to the satisfaction of the Engineer. Where it is impracticable due to physical limitations to operate the paving equipment, the Engineer may permit the use of other methods or equipment. Where hand spreading is permitted, the mixture shall be placed by means of suitable shovels and other tools, and in a uniformly loose layer at a depth that will result in a completed pavement having the designed depth. Any deviation from standard crown or section shall be immediately remedied by placing additional material or removing surplus as directed by the Engineer. The Engineer may direct that other means of spreading be used to ensure a better control of the depths of material and the finished surface.

sufficient time to break (set). All surfaces that have been in place longer than five calendar days shall have an application of tack coat. A tack coat shall be applied to all contact surfaces such as gutters, manholes and concrete barriers. The tack coat shall be applied by a non-gravity pressurized spray system that results in uniform overlapping coverage at an application rate of 0.05 to 0.15 gallons per square yard (140 to 450 milliliters per square meter). Gravity-fed systems are not acceptable for tack coat application. The Engineer must approve the equipment and the method of measurement prior to use. The material for tack coat shall not be heated in excess of 160°F (70°C) and shall not be further diluted.

Refueling of equipment is prohibited in any location on the paving project where fuel might come in contact with bituminous concrete mixtures already placed or to be placed. Solvents for use in cleaning mechanical equipment or hand tools shall be stored clear of areas paved or to be paved. Before any such equipment and tools are cleaned, they shall be moved off the paved or to-be-paved area; and they shall not be returned for use until after they have been allowed to dry.

Immediately before placing bituminous concrete on a waterproofing membrane, the membrane shall be swept clean. If the membrane is damaged it shall be repaired by patching as directed by the Engineer.

Temporary and permanent transverse joints shall be formed by saw-cutting a sufficient distance back from the previous run, existing bituminous concrete pavement, or bituminous concrete driveways to expose the full depth of the course. On any cold joint, immediately prior to additional bituminous concrete materials being placed, a brush of tack coat shall be used on all contact surfaces.

The longitudinal joint shall be offset at least six inches (150 millimeters) from the joint in the course immediately below. The joint in the final surface shall be at the centerline or at lane lines.

5. Compaction: In general, rolling shall consist of initial or breakdown rolling, intermediate rolling and final or finish rolling. The contractor shall furnish a sufficient number and type(s) of rollers for each paving machine to properly compact the mat. When operating the roller in the vibratory (dynamic) mode, the operator shall maintain a

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per meter). All vibratory rollers shall be shut off from the vibrating mode when reversing directions and be equipped with automatic reversing eccentrics (weights). The use of a vibratory roller in the dynamic or vibratory mode is prohibited on concrete structures such as bridges and catch basins.

If the Engineer determines that the use of vibratory compaction equipment may damage highway components, utilities or adjacent property, the Contractor shall provide alternate compaction equipment to meet specification requirements unless otherwise approved by the Engineer. The completed pavement course on roadways and bridges will have the mat and longitudinal joints tested for compaction in accordance with the "Density Testing Procedure" established by the Department's Director of Research and Materials. Each course placed at a depth of one and one-half inches (40 mm) or greater shall have the mat and longitudinal joints compacted to a minimum of 92.0 percent and no more than 97.0 percent density as determined by AASHTO T209 (modified). Class 4 bituminous concrete is excluded from the joint density requirements.

6. Surface Tolerance: The Contractor shall perform random spot-checks with a contractor-supplied ten-foot straightedge placed parallel to the centerline of the road to verify surface tolerances. The final surface course will not vary more than 1/4 inch (6.4 millimeters) from a ten-foot (3 meter) straightedge and 3/8 inch (9.5 millimeters) for all other courses. Such tolerance will apply to all paved areas including bridge approaches, headers, and existing pavement. Any irregularity of the surface exceeding these limits shall be corrected.

7. Protection of the Work: All sections of the newly finished pavement shall be protected by the Contractor from damage by the Contractor's equipment and traffic.

8. Corrective Work Procedures: Any portion of the completed pavement determined by the Engineer to be defective in surface texture, density or composition, or that does not comply with the requirements of the specifications shall be corrected at the expense of the Contractor. Any corrective courses placed as the final wearing surface shall not be less than one and one-half inches (40mm) in depth after compaction.

If pavement placed by the Contractor does not meet the specifications, and the Engineer requires its replacement or correction, the Contractor shall:

A. Propose a corrective procedure to the Engineer for review and approval prior to any corrective work commencing. The proposal shall include:

1. Limits of pavement to be replaced or corrected, indicating stationing or other landmarks that are readily distinguishable.
2. Schedule.
3. Construction method and sequence of operations.
4. Methods of maintenance and protection of traffic.
5. Material sources.
6. Names and telephone numbers of supervising personnel.

B. Perform all corrective work in accordance with the Contract and the approved corrective procedure.

9. Joints and Cracks in Bituminous Concrete Pavement: Work under this section shall consist of constructing new joints and repairing existing joints and cracks.

A. Equipment: All equipment shall be approved by the Engineer prior to its use.

1. Kettle: The unit shall be a combination melter and pressurized applicator of a double-boiler type with space between the inner and outer shells filled with oil or other material not having a flash point of less than 600°F (320°C). The kettle shall include a temperature control indicator and mechanical agitator. The kettle shall be capable of maintaining the material at a temperature within 15°F (9°C) of the manufacturer's specified temperature.
2. Compressor: The compressor shall have a sufficient capacity and length of hose to enable a continuous sealing operation.

3. Saw: The saw shall be capable of providing a straight cut of uniform depth and width.

B. Control of Joint Seal Material: Material that is heated or cooled beyond the manufacturer's specified temperature range shall be discarded.

C. Sawing and Sealing Joints in Bituminous Concrete Pavement: Work under this item shall consist of making a straight-line saw cut transversely across the final course of bituminous concrete pavement directly over the new and existing Portland Cement concrete (PCC) transverse joints. The sawing and sealing of joints shall be completed for bituminous concrete pavements with a total depth of three inches (75 millimeters) or greater. The saw cut shall be immediately sealed with a joint seal material. The sawing and sealing shall commence within one week of the completion of any final course of pavement and be a continuous operation until all joints have been completed. If the final course of pavement will not be completed prior to winter shutdown, each exposed course shall have a ¼ inch (6 millimeters) by ¼ inch (6 millimeters) kerf cut above the new and existing transverse joints. The kerf shall be cut with a saw or abrasive wheel approved by the Engineer. The kerf cut shall not be sealed. The kerf cuts at the joints will be paid under the contract item "Kerf Cut in Bituminous Concrete Pavement".

Prior to the paving operation, the Contractor shall establish sufficient controls to locate each transverse joint. This work shall include setting markers at each joint to reference its location and alignment, and having each of these markers tied and referenced. A written procedure for this work shall be submitted to the Engineer for review prior to commencement of such work.

The saw cut will be made by using diamond saw blades with a gang blade arrangement in order to achieve the joint detail as shown on the plans. The saw cut will be in a straight line across the pavement directly over the joint. Transverse joints

the underlying PCC pavement. The sawed joints shall be cleaned with compressed air to the satisfaction of the Engineer.

Immediately following the cleaning, the joint seal material shall be installed. When cooled, the top of the sealant material shall be recessed a minimum of 1/16 inch (1.6 millimeters) but not greater than 1/8 inch (3.2 millimeters) below the adjacent pavement surface. The roadway shall not be opened to traffic until the material has become tack free. Any depression in the sealer greater than 1/8 inch (3.2 millimeters) shall be brought up to the specified limit by further addition of joint seal material. Care shall be taken during the sealing operation to ensure that overfilling and spilling of material is avoided.

Any reflective cracking attributable to improper joint referencing or construction shall be repaired at the expense of the Contractor, in a manner approved by the Engineer for a period of one year from the date of completion of any sawed and sealed portion of final pavement.

D. Cleaning and Sealing Joints and Cracks in Pavement: Work under this item shall consist of cleaning existing joints and cracks of all dirt, dust, loose joint material, and all deleterious matter with compressed air to the satisfaction of the Engineer. After a sufficient number of joints and cracks have been cleaned so as to ensure a continuous operation, all joints and cracks shall be sealed with joint seal material. Sealing of the joints shall be done as described in Subarticle 4.06.03-9C.

E. Cutting and Sealing Joints in the Bituminous Concrete Shoulder: When PCC pavement is the final wearing surface a longitudinal saw cut at the interface of the bituminous concrete shoulder and PCC pavement shall be made. The saw cut shall be made in the bituminous concrete shoulder to expose the abutting edge of the PCC pavement. The size of the saw cut shall be 1/2 inch (13 millimeters) wide by 1-1/2 (38 millimeters) inches deep. Cleaning and sealing of the joints shall be

10. Cut Bituminous Concrete Pavement: Work under this item shall consist of making a straight-line cut in the bituminous concrete pavement to the lines delineated on the plans or as directed by the Engineer. The cut shall provide a straight, clean, vertical face with no cracking, tearing or breakage along the cut edge.

4.06.04—Method of Measurement:

1. Bituminous Concrete Class ( ): The quantity of bituminous concrete mixture measured for payment will be determined by the documented net weight (mass), in tons, in accordance with Subarticle 4.06.03-1 and shall be subject to the following:

A. Theoretical Yield: A theoretical yield is the amount of material (tons or mtons) required for placement over a given area at a planned thickness and will be calculated by the Engineer and recorded in the project records. The formula to determine theoretical yield is:

English: (L x W) / 9 x PT x 0.0575 Tons/SY/inch = Theoretical Yield (TY)

Where: **L**= Length in Feet **W**= Width in Feet **PT**= Planned thickness in inches

Metric: L x W x (PT x 1m/1000mm) x 2.55 Mg/m^3 = TY (Mg)

Where: **L**= Length in meters **W**= Width in meters **PT**= Planned thickness in millimeters

B. Measured Weight (Mass) Adjustments: The material in all courses of bituminous concrete except leveling courses, wedge courses and one-course applications will be subject to adjustments to thickness and area.

1. Thickness Adjustment: The average measured thickness (MT) of each lift will be determined by measurements taken by the Engineer. The total thickness of the class of material will be the sum of the average thickness of each lift. In the event the total thickness of any course of material varies from those specified on the plans beyond the tolerances shown in Table 2, the longitudinal limits of such variation will be determined by the Engineer. The locations and intervals of the measurements and all information relative

thereto will be recorded in the project records by the Engineer.

Where the total thickness of the class of material exceeds that shown on the plans beyond the tolerances shown in Table 2, an adjustment will be applied. The quantity of bituminous concrete representing the adjustment will be determined using the theoretical yield formula in Subarticle 4.06.04-1A substituting MT in lieu of PT to determine the Actual Yield (AY), and will be deducted from the tons measured for payment.

Where the thickness of the class of material is less than that shown on the plans beyond the tolerances shown in Table 2, the Contractor, with the approval of the Engineer, shall take corrective action in accordance with Subarticle 4.06.03-8. The areas where a corrective course of bituminous concrete is placed or reconstruction of pavement is performed, will be measured as though originally constructed. No compensation will be made to the Contractor for the material removed or removal of materials and disposal thereof, or for restoration of affected supporting base or adjacent construction.

TABLE 2 - Thickness Tolerances

Type of Material	Tolerance per Class of material
Class 4	+/- 3/4 inch (19 millimeters)
Classes 1, 2, and 12	+/- 1/2 inch (12.5 millimeters)

2. Area Adjustment: The horizontal limits for each course of material will be determined by measurements taken by the Engineer. The locations and intervals of the measurements and all information relative thereto will be recorded in the project records by the Engineer.

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Where the horizontal limit of the course of material exceeds that shown on the plans by more than the planned depth of each course, an adjustment will be applied. The longitudinal limits representing the adjustment will be determined by the Engineer. The quantity of tons (mtons) representing the excess area will be calculated using the theoretical yield in Subarticle 4.06.04-1A and deducted from the tons measured for payment.

3. Over weight (mass) Adjustments - An adjustment to the net weight (mass) will be made when a truck delivers material to the Project and the delivery ticket shows that the truck exceeds the allowable gross weight for the vehicle type. The deduction will be taken even if the excess is not discovered until after its incorporation into the project. The quantity of tons (metric tons) representing the over weight (mass) will be deducted from the tons (metric tons) measured for payment.

C. Material Deficiency Adjustment (MDA): Ten percent of the total quantity of material determined by the Engineer that exceeds one or more of the tolerances shown in Table 3 will be used for purposes of determining the Material Deficiency Adjustment. The tons (mtons) will be calculated as follows:

MDA Tons (mtons) = DM x .10

Where: **DM** = Total tons (mtons) of material exceeding tolerance.

TABLE 3- JOB MIX FORMULA TOLERANCES FOR CONSECUTIVE TESTS

Classes	Criteria	% Tolerances (+/-)
-	Bitumen	0.4
1,2,4	#200 (75 µm)	2.0
1,2,4	#50 (300 µm)	4.0
1,2	#30 (600µm)	5.0
1,2,4	#8 (2.36mm)	6.0
1,2,4	#4 (4.75mm)	7.0
1,2,4	3/8", 1/2" & 3/4" (9.5,12.5,19.0mm)	8.0

D. Density Adjustment:

1. Sampling and Testing: All density testing will be done in accordance with the "Materials Testing Manual" published by the Department's Division of Materials Testing. The density for the lot will be the average of the percent densities from the sub-lots. The density for the lot will be used to determine whether any adjustments for density apply.

   a. Bridge Lot: For bridge deck pavement, a bridge lot is defined as that amount of bituminous concrete in tons (metric tons) placed in a continuous paving operation and will be the number of linear feet (meters) of structure paved. For testing purposes, a single paver pass is a sub-lot and the length of the structure will determine the number of tests per sub-lot as shown in Table 4. A test is defined as the average of two (2) density measurements. All tests from the sub-lots will be averaged to determine the density for the bridge lot.

TABLE 4 - Testing Requirement for Bridge Lot

Length of Structure Feet (meter)	MAT No. of Tests per Sub-lot	JOINT No. of Tests per Joint
Less than 1000 (300)	2	2
1000-1500 (300-450)	4	4
Greater than 1500 (450)	4 plus 2 addt'l tests for every 500' (150 m) over 1500 (450)	4 plus 2 addt'l tests for every 500' (150 m) over 1500 (450)

   b. Non-Bridge Lot: A non-bridge lot is defined as that amount of bituminous concrete placed for each lift of material in a continuous paving operation as determined by the Engineer. A lot shall be divided into equal sub-lots as indicated in Table 5. Each sub-lot will have at least one test taken. A test is defined as the average of two (2) density measurements. All tests from the sub-lots will be averaged to determine the density for the non-bridge lot.

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TABLE 5 - Sub-Lots for Density Testing

Daily Production- tons (mtons)	MAT No. of Sub-lots	JOINT No. Sub-lots per joint
Less than 500 (450)	1 per 100 (90)	1 per 100 (90)
500-1500 (450-1350)	10	5
Greater than 1500 (1350)	20	10

2. Adjustment Schedule: The adjustment will be applied where the compacted depth of pavement is 1-1/2 inches (38 millimeters) or greater. Separate density adjustments will be made for non-bridge lots and bridge lots and will not be combined to establish one density adjustment.

   The Contractor may request additional testing if; 1) the tests result in a negative adjustment and 2) it contends the test results are not representative of the entire continuous paving operation. If the Engineer agrees, he will establish the limits of a second lot which will only represent the material not previously tested. Additional testing will be in accordance with Subarticle 4.06.04-D-1. Any adjustment for density will be based on the average of the test results for both lots.

   For purposes of making density adjustments, the following apply:

   The average of the theoretical maximum specific gravity (Gmm) calculations for the material placed during a continuous paving operation will

for any adjustment in accordance with Table 6. If none is available, the average of the Gmm calculation for the last ten days of production will be used. If more than one source of supply is used, then a weighted average will be computed using the Gmm calculation from each source of supply.

TABLE 6 - Mat and Longitudinal Joint Adjustments

Average % Density	% Adjustment (PA)
100 - 97.1	-2.5
97.0-94.0	+2.5
93.9-92.0	0.0
91.9-91.0	-2.5
90.9-89.1	-5.0
89.0-87.0	-30
86.9 or less	-50 or rejection

The amount of tons (mtons) representing the density adjustment (DA) for each lot will be calculated as follows:

DA tons (metric tons) = { [PA_M x .40] + [PA_J x .60] } X Tons (metric tons)

Where: PA_M = Mat density percent adjustment from Table 6

PA_J = Joint density percent adjustment from Table 6

2. Cut Bituminous Concrete Pavement: The quantity of bituminous concrete pavement cut will be measured in accordance with Article 2.02.04.

3. Sawing and Sealing Joints: The quantity of sawed and sealed joints measured for payment will be the actual number of linear feet (meters) of joints sawed and sealed in

the bituminous concrete pavement surface accepted by the Engineer.

4. Kerf Cut in Bituminous Concrete Pavement: The quantity of kerf cuts measured for payment will be the actual number of linear feet (meters) of kerf cuts in the bituminous concrete pavement surface accepted by the Engineer.

5. Cleaning and Sealing Joints and Cracks: The quantity of cleaned and sealed joints and cracks measured for payment will be the actual number of pounds (kilograms) of joint seal material accepted by the Engineer. Weights as marked on the shipping containers shall be used; or if directed by the Engineer, scales shall be furnished by and at the expense of the Contractor, and the joint seal material weighed in a manner satisfactory to the Engineer.

6. Cutting and Sealing Joint in the Bituminous Concrete Shoulder: The quantity of cut and sealed joints measured for payment will be the actual number of linear feet (meters) of joints cut and sealed in the bituminous concrete shoulder and accepted by the Engineer.

7. Material for Tack Coat: The quantity of tack coat will be measured for payment by the number of gallons (liters) furnished and applied on the Project and accepted by the Engineer. There are two methods of measurement allowed: 1) Material furnished in a container will be measured to the nearest one-half gallon (liter). The volume will be determined by either measuring the volume in the original container by a method approved by the Engineer or using a separate graduated container capable of measuring the volume to the nearest one-half gallon. The container in which the material is furnished must include the description of material, including lot number or batch number and manufacturer or product source. 2) The Engineer will establish a weight per gallon (mass/liter) of the bituminous material based on the specific gravity at 60°F (15°C) for the material furnished. The number of gallons (liters) furnished will be determined by weighing the material on scales furnished by and at the expense of the Contractor.

4.06.05—Basis of Payment:

1. Bituminous Concrete, Class ( ): The furnishing

Concrete, Class ( )." The cost for providing lighting for the purpose of illuminating the work area and equipment shall be considered part of the Contractor's equipment and tools, and will not be measured for payment, but will be included in the general cost of the work.

No payment will be made for any work related to the replacement or correction of defective pavement. Related work includes items such as the removal and replacement of bituminous concrete, maintenance and protection of traffic, density testing, pavement repairs, replacement of bridge joints, pavement markings and any other work that is deemed necessary by the Engineer to provide an acceptable pavement.

2. Adjustments: Contract items will be incorporated by construction order for material deficiency and density adjustments as measured in Subarticle 4.06.04-1C and 1D.

1. Material Deficiency Adjustment (MDA): The quantity of MDA tons (metric tons) measured in Subarticle 4.06.04-1C will be used to determine the adjustment value and will be calculated as follows:

MDA tons (metric tons) X Net Price per ton (metric ton)* = MDA Adjustment

***Net Price per ton (metric ton)** is the F.O.B. price at the material vendor's plant furnishing the material as shown in the most recent Annual Bid Contract Award entitled "1304- Bituminous Concrete Materials and Bituminous Materials with Fibers." In the event a vendor has not bid on the above contract award, the price per ton (metric ton) will be computed by averaging the bid price of three vendors closest to the non-bidding vendor's plant.

2. Density Adjustment (DA): The quantity of DA tons (metric tons) measured in Subarticle 4.06.04-1D will be used to determine the adjustment value and will be calculated as follows:

DA Tons (metric tons) X Contract Unit Price = DA Adjustment

3. The cutting of bituminous concrete pavement will be paid in accordance with Article 2.02.05.

4. The sawing and sealing of joints will be paid for at the Contract unit price per linear foot (meter) for "Sawing and Sealing Joints."

5. Kerf cuts will be paid for at the Contract unit price per linear foot (meter) for "Kerf Cut in Bituminous Concrete Pavement."

6. The cleaning and sealing of joints and cracks will be paid for at the Contract unit price per pound (kilogram) for "Cleaning and Sealing Joints and Cracks."

7. The cutting and sealing of joints in the bituminous concrete shoulders will be paid for at the Contract unit price per linear foot (meter) for "Cutting and Sealing Joint in the Bituminous Concrete Shoulder."

8. Material for tack coat will be paid for at the Contract unit price per gallon (liter) for "Material for Tack Coat."

Payment will be for the items completed and accepted by the Engineer, the price of which shall include all labor, materials and equipment incidental thereto.

Pay Item	Pay Unit
Bituminous Concrete, Class ( )	ton (mtons)
Sawing and Sealing Joints	l.f. (m)
Kerf Cut in Bituminous Concrete Pavement	l.f.. (m)
Cleaning and Sealing Joints and Cracks	lb. (kg)
Material for Tack Coat	gal. (L)
Cutting and Sealing Joint in the Bituminous Concrete Shoulder	l.f. (m)

SECTION 4.14
BITUMINOUS SURFACE TREATMENT

4.14.01—Description: This work shall consist of furnishing and applying a bituminous surface treatment with one or more covers of sand, where called for on the plans or directed by the Engineer. It shall also include sweeping, spotting, dragging, honing or manipulation of the surface after the application of the sand, distributing, mixing and smoothing the combination of bituminous material and sand in such manner as the Engineer shall direct.

Unless specifically authorized by the Engineer, this work shall be performed only when the surface to be treated is

in such condition as to permit proper drainage. It shall be checked and approved by the Engineer prior to placing any pavement structure and shoulders thereon.

2.09.04—Method of Measurement: Payment lines for formation of subgrade shall be coincident with the outside edges of the pavement or where paved shoulders are constructed, with the outside edges of the shoulder. Where precast concrete barrier curb is permanently installed, payment shall include the area under the precast concrete barrier curb. Payment for formation of subgrade will be allowed when such work is done in providing connections to public roads. Payment for formation of subgrade will not be allowed for work at private drives, in areas where traffic bound gravel is constructed or in areas where existing pavement is used as a base for resurfacing with bituminous concrete.

The area computed for payment shall not include the area of any bridge floor where the type of construction is such as to eliminate any necessity for the work described herein.

2.09.05—Basis of Payment: Formation and protection of subgrade, including all work provided for hereinbefore, will be paid for at the contract unit price per square yard (square meter) for "Formation of Subgrade," which price shall include all materials, equipment, tools and labor necessary thereto.

There shall be no specific payment for the work of scarifying existing stone or gravel roads as described in Article 2.02.03, but the cost of such work shall be considered included in the payment for the item providing for the formation of subgrade.

When no item for "Formation of Subgrade" appears in the proposal, the cost of this work shall be included in the contract unit price for the pavement item or items involved.

Pay Item	Pay Unit
Formation of Subgrade	s.y. (s.m)

SECTION 2.10
WATER POLLUTION CONTROL (SOIL EROSION)

2.10.01—Description: This work shall consist of measures to control water pollution and soil erosion through the use of berms, dikes, dams, sediment basins, erosion

ditches, channels, riprap, grading to control surface runoff and other erosion control devices or methods.

If the Contractor proposes changes in construction or his scheduling which would affect the designed pollution controls, he shall submit plans before starting construction for revised pollution controls for the approval of the engineer.

The Contractor shall submit a plan showing erosion and sedimentation controls above and beyond those called for in the plans and/or specifications, necessitated by the proposed sequence of operations and/or construction activities. The construction shall not proceed until the erosion and sedimentation control plans have been approved by the Engineer. The Engineer may order additional control measures if the measures mentioned above prove insufficient.

2.10.02—Materials: The materials shall consist of items conforming to the pertinent articles of the Standard Specifications and approved by the Engineer, or other items approved by the Engineer, such as:

(a) Soil tackifiers, erosion control matting, burlap, and plastic sheets. All materials shall be clean and free from noxious weeds, contaminants, and debris deleterious to plant growth. Erosion control matting shall conform to Sections 9.50 and M.13.

(b) Slope drains or ditches may be constructed of pipe, rubble, riprap, sod, burlap, plastic sheets, portland cement concrete, bituminous concrete, or other material approved by the Engineer.

(c) Seeding shall conform to Sections 9.50 and M.13.

2.10.03—Construction Method: The Engineer has the authority to control the surface area of earth material exposed by construction operations and to direct the Contractor to immediately provide permanent or temporary pollution control measured to prevent contamination of adjacent streams, watercourses, lakes, ponds or other areas of water impoundment. Every effort shall be made by the Contractor to prevent erosion on the site and abutting property.

All slopes shall be stabilized by mulching, seeding or otherwise protected as the work progresses to comply with the intent of this specification

All seeding shall include mulch or other protective covering approved by the Engineer.

When hay is used as a mulch with seeding, it shall be a minimum of 2 inches (50 millimeters) deep and held down with a tackifier.

When wood fiber mulch is used, it shall be applied in a water slurry at a rate of 2000 pounds per acre (900 kilograms/4000 square meters) with or immediately after the application of seed, fertilizer and limestone.

All damaged slopes shall be repaired as soon as possible. The Engineer shall limit the surface area of earth material exposed if the Contractor fails to sufficiently protect the slopes to prevent pollution.

The Contractor shall at all times have on hand the necessary materials and equipment to provide for early slope stabilization and corrective measures to damaged slopes.

Temporary channels, ditches and outfalls shall be protected prior to directing water into them to prevent erosion.

The erosion control features installed by the Contractor shall be maintained by the Contractor, and he shall remove such installations if ordered by the Engineer. Maintenance of erosion control measures by the Contractor shall include the clean out of accumulated sediment.

The Contractor shall operate all equipment and perform all construction operations so as to minimize pollution. The Contractor shall cease any of his operations which will increase pollution during rain storms.

The Contractor shall give the Engineer sufficient notice of impending shutdowns to enable the Engineer and Contractor to examine the project and to implement erosion and pollution control work.

2.10.04—Method of Measurement: Measurement for payment of work and materials involved with the construction, application and installation of water pollution controls will be as provided for under the applicable contract items.

Temporary slope protection will be measured for payment by the number of square yards (square meters) of slope protected in accordance with this specification and as directed by the Engineer. When no applicable contract item

shown on the plans, the additional work and materials required for those measures shall be measured for payment as provided for under Article 1.09.04 - Extra and Cost-Plus Work. All extra work performed on an agreed-price basis shall be incorporated through construction orders and paid for on an item-by-item basis.

The sum of money shown on the estimate and in the itemized proposal as "Estimated Cost" for this work will be considered the price bid even though payment will be made only for actual work performed. The estimated cost figure is not to be altered in any manner by the bidder. Should the bidder alter the amount shown, the altered figures will be disregarded and the original price will be used to determine the total amount bid for the contract.

2.10.05—Basis of Payment: Work will be paid for under the applicable contract items or as provided for under Article 1.09.04 - Extra and Cost-Plus Work. No payment will be made for the clean out of accumulated sediment for either permanent or temporary erosion control measures.

Temporary control measures that are made necessary by the Contractor's negligence, carelessness, failure to install permanent controls as a part of the work as scheduled and are ordered by the Engineer, or are made necessary by the Contractor's failure to perform the sequence and scheduling of work as part of his schedule as given in the Preconstruction Conference or as later amended and approved, shall be ordered by the Engineer to be accomplished and performed by the Contractor at his own expense.

On areas off the right-of-way that are selected by the Contractor and which include but are not necessarily limited to borrow pits (other than commercially operated sources), Contractor's haul roads, disposal areas, storage, maintenance, batching areas, etc., temporary control work shall be the responsibility of the Contractor and shall be performed by him at his expense in a manner approved by the Engineer. No direct payment will be made for this work; the cost is to be included in other items of the Contract. Temporary control work on the aforesaid areas which are specifically designated for contractual operations by the State shall be paid for under the provisions of this specification.

Temporary slope protection will be paid for at the contract

Slope Protection," which price shall include the installation and removal, where necessary, of the protective material and all equipment, materials, tools and labor incidental thereto.

Pay Item	Pay Unit
Water Pollution Control	est. (est.)
Temporary Slope Protection	s.y. (s.m)

SECTION 2.12
SUBBASE

2.12.01—Description: The subbase shall consist of a clean soil-aggregate mixture of bank or crushed gravel, crusher run stone, reclaimed miscellaneous aggregate containing no more than 2% by weight (mass) of asphalt cement or any combinations thereof, placed where shown on the plans or where directed by the Engineer and constructed in accordance with these specifications.

2.12.02—Materials: All materials for this work shall conform to the requirements of Articles M.02.02 and M.02.06. Grading "B" shall be used.

2.12.03—Construction Methods: The prepared foundation for the subbase shall be carefully shaped to the required cross-section and compacted as specified in Article 2.02.03. Where underdrains and outlets are specified on the plans or ordered by the Engineer, they shall be in place and functioning before any subbase material is placed.

The subbase material shall be spread uniformly upon the required grade, in courses not to exceed 6 inches (150 millimeters) in thickness after final compaction. However, if the required thickness of subbase does not exceed 8 inches (200 millimeters), it may be placed in one course.

After each course has been placed as specified above, its entire area shall be compacted with equipment specifically manufactured for that purpose. The sole use of hauling and spreading equipment shall not be considered as a substitute for compacting equipment. Compaction shall be continued until the entire course is uniformly compacted to the required minimum density. The dry density after compaction shall not be less than 95% of the dry density for that subbase material when tested in accordance with AASHTO T-180, Method D. If a subbase course is formed

bituminous concrete, the wet density after compaction on this course shall not be less than 95% of the wet density for that subbase when tested in accordance with AASHTO T180, Method D.

Each layer of subbase shall be compacted at optimum moisture content. No subsequent layer shall be placed until the specified compaction is obtained for the previous layer.

Exception to the use of compacting equipment will be allowed where subbase is made of gravel and used in conjunction with a traffic bound gravel surface in which case the work shall be in accordance with Article 4.13.03.

Should the foundation material beneath the subbase become churned up and mixed with subbase material at any time, the Contractor shall, without additional compensation, remove the mixture and replace it with new subbase material to the required thickness shown on the plans or as previously required by the Engineer. Such replaced subbase material shall be compacted to the required minimum density.

2.12.04—Method of Measurement: Subbase will be measured horizontally in place after final grading and compaction. The thickness will be as indicated on the plans, or as ordered by the Engineer, and within the following tolerances:

Less than 24 inches (600 millimeters): minus 1 inch (25 millimeters) to plus 3/4 inch (19 millimeters)

24 inches (600 millimeters) and greater: minus 2 inches (50 millimeters) to plus 1 inch (25 millimeters)

Measurements to determine the thickness will be made by the Engineer at intervals of 500 feet (150 meters), or less, along lanes and shall be considered as representative of the lane. For purposes of these measurements, a shoulder will be considered a lane.

If deficient thicknesses are found, the Engineer will make such additional measurements as he considers necessary to determine the longitudinal limits of the deficiency. Areas not within allowable tolerances shall be corrected, as ordered by the Engineer, without additional compensation to the Contractor.

2.12.05—Basis of Payment: This work will be paid at the contract unit price per cubic yard (cubic meter) for