U.S. Coast Guard Sector Delaware Bay: Response to Rail Incidents Planning Project

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ABSTRACT: IOSC 2017-124

This paper presents solutions to a new oil spill problem in U.S. Coast Guard (USCG) Sector Delaware Bay (Sector) area of responsibility (AOR), the need for which became apparent during recent energy production growth in the region. Two projects were initiated by the Sector to ensure regional preparedness for response to unconventional crude oil spills that affect the maritime domain, in the rapidly changing North American energy renaissance:

- Identification of rail/water nexus sites and response measures, and
- Modified Consensus Ecological Risk Assessment (CERA)

The overall goals of the projects were to identify major threats from rail incidents, analyze potential transportation and spill risks associated with Bakken, bitumen, and diluted bitumen, herein known as domestic crude oil products, and document best practices and response strategies with input from stakeholders in a complex tri-state region consisting of Pennsylvania, New Jersey, and Delaware.

For these domestic crude oils, the Sector initiated an Area Contingency Plan (ACP) revision to incorporate oil spill booming strategies and pre-scripted Incident Command System (ICS) work assignments. The revision identified 38 rail/water nexus sites and incorporated a modified Consensus Ecological Risk Assessment (CERA), which defined and predicted localized spill behaviors and consequences for the unconventional crude oils in marine, brackish water, and freshwater environments of the Delaware Bay Watershed.

While domestic crude oil products are studied further at the national and international levels, the Sector focused on working alongside regional partners from the Oil and Natural Gas (ONG) industry, the Oil Spill Removal Organization (OSRO) community, National Oceanic and Atmospheric Administration (NOAA) Scientific Support Coordinator, and other relevant subject matter experts. Together, they worked to define best management practices (BMPs) for first responders and incorporate new policy and guidelines (i.e., non-floating Oils OSRO Classification and Bakken/Dilbit Oil Spill First Responder Guides) into local contingency plans, policies, and procedures (Csulak and Michel, 2015a, 2015b).

The USCG must consider and manage all potential risks to transportation safety and the marine environment from pollution. To ensure that the USCG is most prepared to respond to all potential pollution sources, as directed by the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), Sector Delaware Bay's rail incident planning process is presented as a template for updating ACPs across USCG Captain of the Port (COTP) zones.

INTRODUCTION:

Between 2012 and 2015, Sector Delaware Bay experienced the effects of the "Domestic Energy Renaissance" that was sweeping the nation. The result was a tremendous increase in domestic petrochemical production and transportation of domestic crude oil by rail, as well as by

barge and tanker, into the Sector's AOR. These domestic crude oil products included Bakken, bitumen and diluted bitumen (dilbit). This transformation dramatically altered the focus of Sector Delaware Bay's efforts in regards to responding to rail incidents involving these new types of oil within the AOR.

Historically, one million barrels of oil per day were transported to seven refining facilities along the Delaware River. Throughout the mid 2000's, this quantity was reduced and led to the temporary closure of three refining facilities along the Delaware River between 2009 and 2010 (Maritime Exchange, 2013a). Most recently, the onset of the "Domestic Energy Renaissance" brought a renewed vigor to the area's oil industry. Upwards of 580 thousand barrels per day (bpd) Bakken and 100 thousand bpd bitumen/dilbit is refined at the region's five remaining refineries; most of this product is transported along the river by three major rail companies. The dramatic increase in domestic crude oil transported by rail necessitated the need for national policy and guideline changes, as well as updates to existing contingency planning, response strategies, risk assessments, and first-responder training.

Throughout this same time period, responses to two rail incidents triggered the need to develop specific preparedness and response approaches for these domestic crude oils.

East Jefferson Street Bridge Train Derailment Paulsboro, NJ:

On November 30th, 2012, an 84 railcar train with two locomotives crossed over Mantua Creek on the East Jefferson Street Bridge in Paulsboro, New Jersey. A derailment occurred and caused seven rail cars to leave the tracks, of which four entered the waterway. Four of the seven derailed cars contained the carcinogenic chemical compound, vinyl chloride and the other three derailed cars contained lumber, plastic pellets, and 29,000 gallons of alcohol, not otherwise specified (NOS), a generic shipping label description of a flammable liquid. One of the cars

containing vinyl chloride was breached, causing the release of approximately 18,000 gallons of the volatile hazardous material into the atmosphere and surface water. Sector Delaware Bay had jurisdiction over this incident since the hazardous materials release occurred on the East Jefferson Street Bridge over an active navigable waterway, Mantua Creek. In order to reduce the health risks to the nearby community, this train derailment required interactions with first responders, especially local fire fighters that differed from those of a typical oil spill response. Although this incident did not involve the new domestic crude oil products (Bakken, bitumen, and diluted bitumen), it did prompt the Sector to further analyze the potential rail specific transportation risks, and the overall oil/hazardous material spill risks in the Sector's AOR (Maritime Exchange, 2013b).

Schuylkill Arsenal St Bridge Train Derailment Philadelphia, PA:

On January 20, 2014, seven cars of a 101-car freight train derailed on the Schuylkill Arsenal Railroad Bridge where it crosses over the Schuylkill Expressway (Interstate 76) and the Schuylkill River, in downtown Philadelphia. Six cars carried Bakken crude oil. Sector Delaware Bay dispatched a 25-foot response boat from Station Philadelphia to enforce a safety zone in the river and a Marine Environmental Response team at the incident command post to monitor the situation. Local police, firefighters, and emergency personnel also responded to the scene. Fortunately, none of the cars leaked oil (NBC Universal Media, 2014, and Moore, 2014).

METHODS:

To address the needs highlighted by these rail incidents within the AOR, the Sector initiated a revision of the ACP to first include the addition of Geographic Response Plans (GRP) designed to identify high risk areas (i.e., locations where railroads cross navigable waters) and develop response strategies for those rail/water nexus locations. The Sector enlisted the expertise

of the three major rail companies in the AOR, the local OSRO community, and Area Committee response agency representatives. The relationship the Sector built with the rail companies was a critical step in the process of understanding the locations and throughput of the crude oil movement within the AOR, as well as, understanding the risks posed to the public and environment. The second activity, funded by USCG Headquarters, was the development of a modified Consensus Ecological Risk Assessment (CERA) project. This project assessed the oil spill behaviors and consequences of spills on various organisms, including endangered species in different habitats, involving domestic crude oil products.

DISCUSSION:

Area Contingency Plan Revision:

The Sector leveraged support from its local response partners and Area Committee to discuss, plan for, and respond to the emerging threats posed by the transport of domestic crude oil products. The effort included the identification and prioritization of critical rail/water nexus areas and incorporating new oil spill response strategies into the Sector's overall GRP. Location-specific GRPs enable rapid identification of pre-approved spill response priorities for the protection of sensitive areas and resources. GRPs are utilized during the initial response and assessment phase of the incident to provide tactical guidance to responders. As the response progresses, the GRPs continue to be used to inform the revised strategies and tactics that are developed by the response organization.

USCG GRPs follow the NOAA Environmental Sensitivity Index (ESI) grids, and contain maps, area descriptions, resources, and outline pre-determined booming and equipment deployment strategies. As an example, Figure 1 shows ESI grid number 19 south of Philadelphia International Airport along the Delaware River in Pennsylvania (PA). Within the geographic

information system (GIS) database, the magenta color boxes are hyperlinked to the historical GRPs, accounting for a spill emanating from a waterside source. Updated GRPs for spills originating from rail crossings are hyperlinked to the yellow boxes and discussed in detail below.

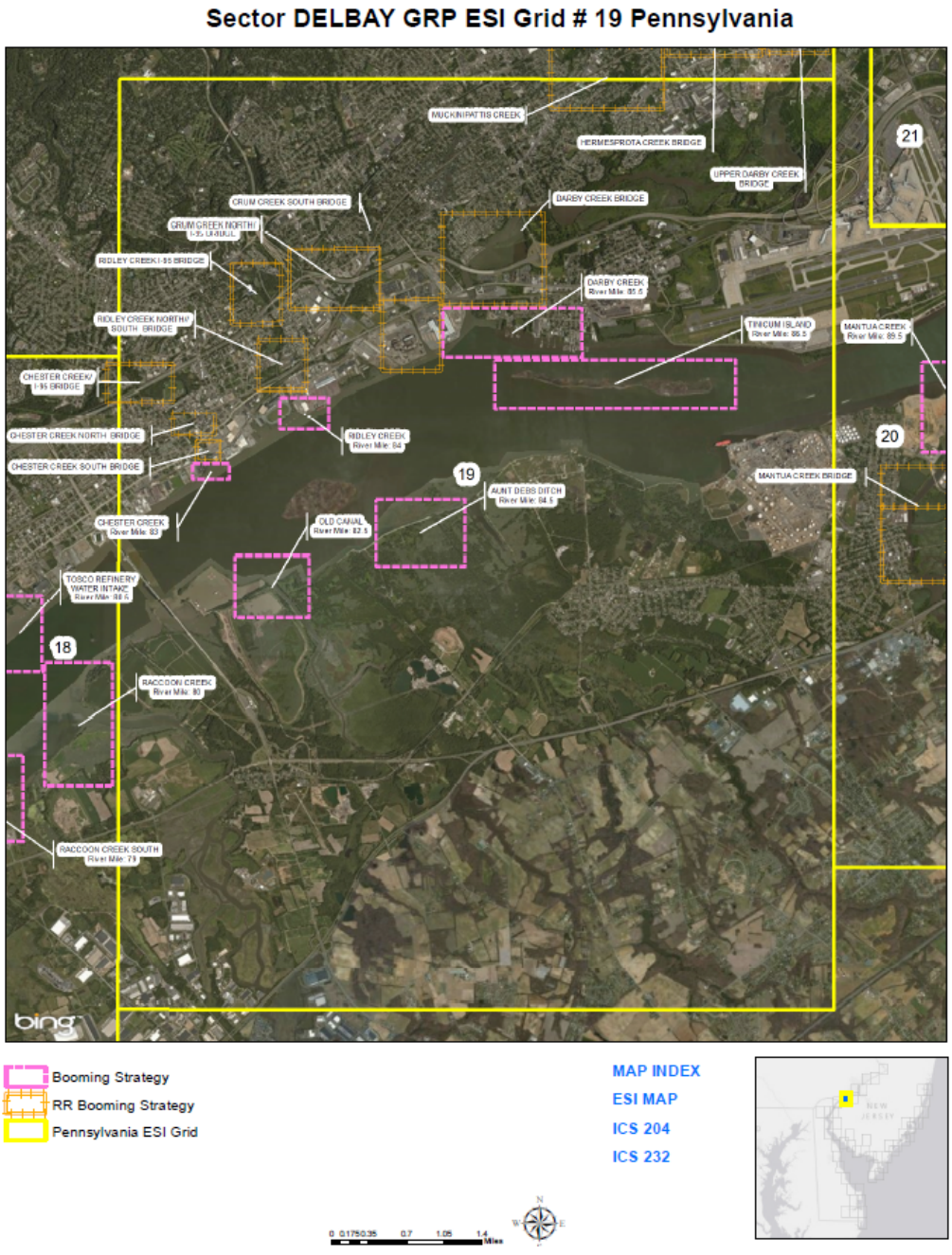

Figure 1: Sector DELBAY GRP ESI Grid #19 Pennsylvania

The Sector initiated the Oil by Rail Workgroup within the Area Committee, consisting of local, state, and federal response agencies, as well as local OSROs. The group worked with the three primary rail companies transporting oil products and identified 38 rail/water nexus sites. The workgroup then conducted site surveys and tidal analysis to develop oil spill booming strategies and pre-scripted work assignments for the 38 sites. Figure 2 shows the location of the 38 rail/water nexus sites throughout Sector Delaware Bay's AOR in Pennsylvania, New Jersey, and Delaware. A highly-clustered concentration of rail crossings occur south of the City of Philadelphia.

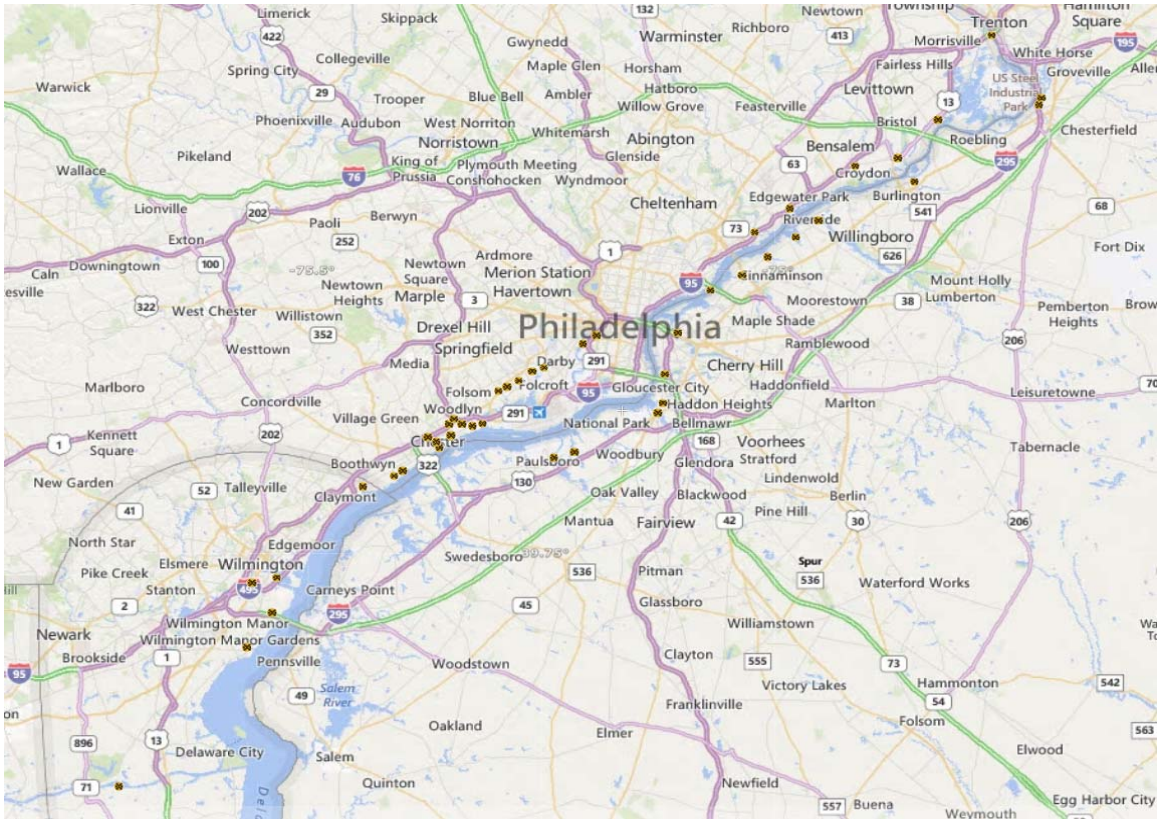

Figure 2: Sector DELBAY Rail/Water Nexus Sites

For the purposes of this paper, the Darby Creek area will be utilized as an example of the detailed GRP work due to the high concentration of rail crossings in the immediate vicinity of

the John Heinz National Wildlife Refuge. The refuge is located on Darby Creek in Southeast Pennsylvania (Figure 3) and is one of a few critical stop-over points for migrating birds in the U.S. Fish and Wildlife North Atlantic Flyway.

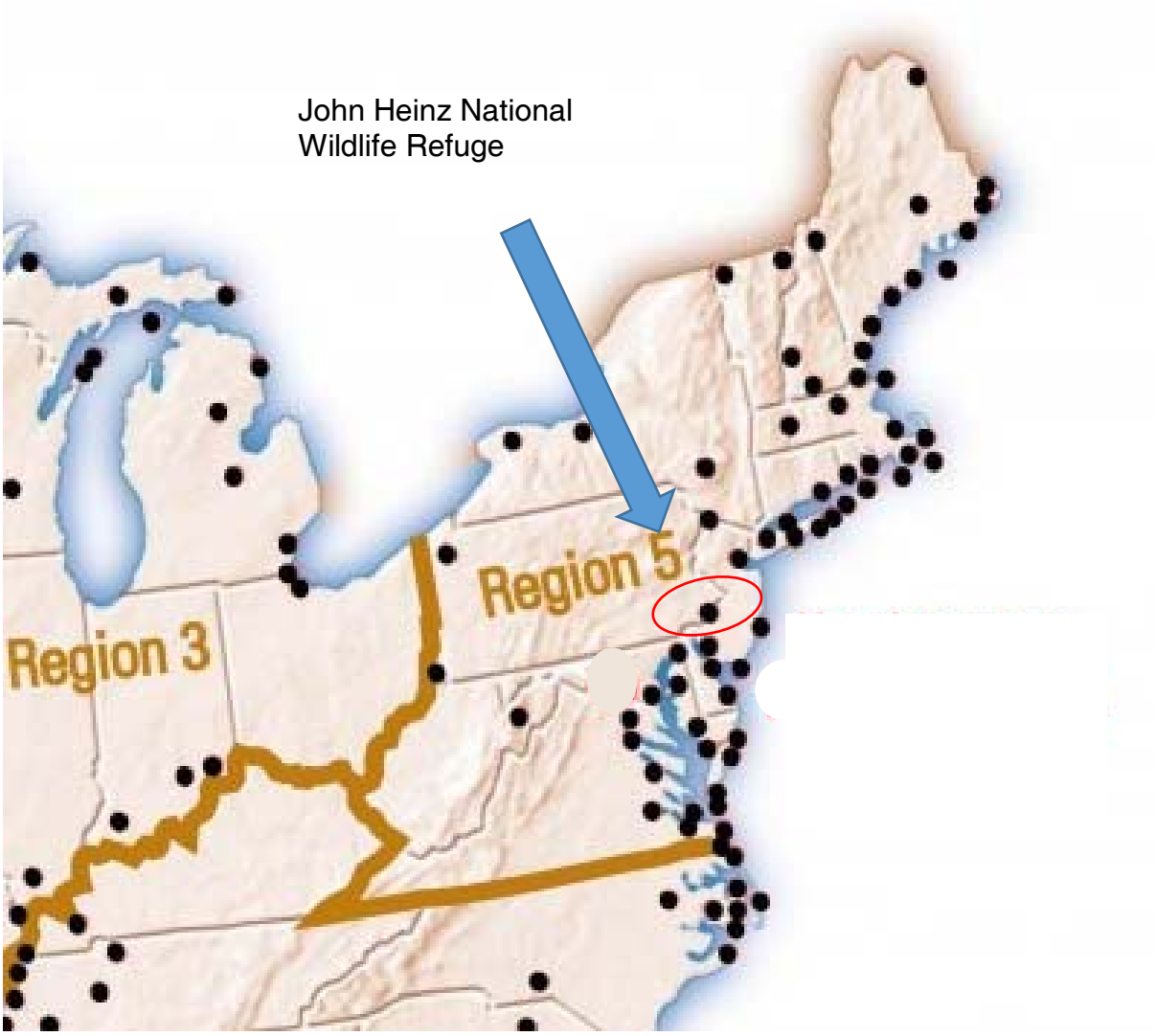

Figure 3: John Heinz National Wildlife Refuge Location
(https://pubs.usgs.gov/of//2005/1428/vandegraft/index.html)

The Area Contingency Plan was updated to include the booming strategies for the 38 critical rail/water nexus areas to include Incident Command System (ICS) Forms ICS-204A (Assignment Lists) and ICS-232 (Resources at Risk Summary). Figures 4 and 5 show a zoomed

out version of the GRP from GIS. Five rail crossings and creeks are located just to the north of the John Heinz National Wildlife Refuge (Figure 4), and one to the south (Figure 5). The refuge is depicted via the green outline and the rail crossings are portrayed via yellow and black rail crossing symbols. Red lines depict primary boom locations and yellow lines represent secondary boom locations. Equipment staging areas and skimmer/vacuum truck locations are also identified.

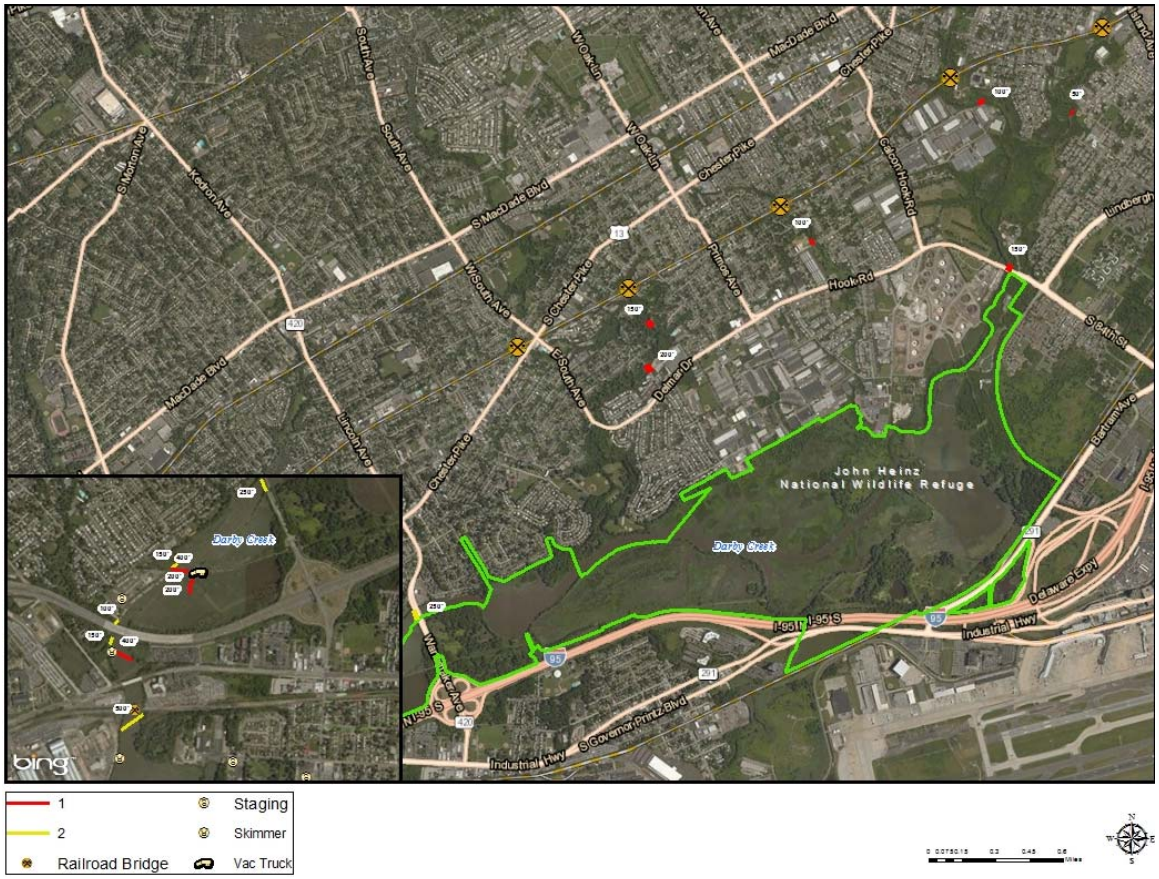

Figure 4: Rail Crossings near John Heinz National Wildlife Refuge

Figure 5: Sector DELBAY GRP Darby Creek Bridge

The ICS-204 work assignment below for Darby Creek provides a description of the area, an overview of the resources at risk, the required oil spill response resources, and the latitude and

longitude locations of all oil spill response booming tie-off locations (Figure 6). This information would be used by the work crews as they enact the response plan.

1. Incident Name	2. Operational Period (Date/Time) From: To:	ASSIGNMENT LIST ATTACHMENT ICS 204a-CG
3. Branch	4. Division/Group	
5. Strike Team/Task Force/Resource (Identifier)	6. Leader	7. Assignment Location (ESI 19) Darby Creek / Muckinipattis

8. Work Assignment Special Instructions, Special Equipment/Supplies Needed for Assignment, Special Environmental Considerations, Special Site Specific Safety Considerations

Description: This booming strategy is for the Darby Creek and Muckinipattis Creek Railroad Bridges. There are two boat launches, one north and the other south of the bride. Unfortunately the geographical area makes it difficult to get to launch from closer locations. Much of the land around the river is gated off, except for around RR Bridge.
The mouth of Darby Creek opens into a wide cove. Upstream of the mouth are two railroad bridges, the Rt. 291 Bridge and the I-95 Bridge. Upstream marshes on Darby Creek are very sensitive and are considered of great value. The John Heinz National Wildlife Refuge is located on Darby Creek. A series of collection booms can be run between the railroad bridges and the Rt. 291 Bridge. A removal effort will need to be mounted here. The boom is stored at EXCELON Eddystone.

Resources at Risk:
Present in area are "Endangered Raptor 2", which are endangered in the State of New Jersey and threatened in the State of Pennsylvania. Also present in area is "Endangered Plant" which is endangered in the State of NJ. Present in the Delaware River is the Hickory Shad, which is endangered in the State of Pennsylvania. Shortnose Sturgeon, which is Federally endangered, and is endangered in both Pennsylvania and New Jersey. Atlantic Sturgeon, which is Federally endangered and is endangered in both New Jersey and Pennsylvania. Present in the John Heinz NWR is the Peregrine Falcon, which is endangered in the State of Pennsylvania. Also present in John Heinz NWR is the Field Dodder (plant), which is threatened in Pennsylvania, the Forked Rush, and Walter's Barnyard Grass, both plants that are considered by Pennsylvania to be endangered.
See ESI Map #19 for additional information.

Deployable Resources:
Primary boom to go across the creek by the bridge will cover 260 feet
North side boom anchored at 39.865603 -075.313861 / 39.865486, -075.312639,
South boom: 39.864648 -75.313935 / 39.864835, -075.312704
Secondary boom:
North: 39.867966 -75.31488 / 39.868254 -075.31379,
South boom: 39.863064 -75.31434 / 39.862895 -75.313090
Tertiary boom 39.872531 -75.310255 / 39.87196, -75.309461
Muckinipattis Boom: 39.892324 -75.285349 / 39.892595 -75.285575
39.895088 -75.285388 / 39.895358 -75.285109

Protective Boom for Refuge:
39.86944 -75.314265 / 39.87012 -75.31371
39.86923 -75.31369 / 39.87022 -75.31361
39.87032 -75.31347 / 39.87052 -75.31149 39.87086 -75.312677 / 39.87108 -75.309931
39.87146 -75.31153 / 39.87190 -75.30939 39.871933 -75.30950 / 39.871976 -75.31129
39.87311 -75.30744 / 39.872918 -75.30982

9. Other Attachments (as needed)
☒ Map/Chart ☐ Weather Forecast/Tides/Currents ☐ _____
☐ _____ ☐ _____ ☐ _____

10. Prepared by Date/Time	11. Reviewed by (PSC) Date/Time	12. Reviewed by (OSC) Date/Time

ASSIGNMENT LIST ATTACHMENT ICS 204a-CG (Rev 04/04)

Figure 6: Darby Creek ICS-204

The ICS-232 form, which outlines the resources at risk, is presented in Figure 7 for the Darby Creek area. The form describes the shoreline, the biological and threatened/endangered species in the area, and the archeological and cultural resources to be protected.

1. Incident Name GRP # PA19	2. Operational Period (Date/Time) From: To:	RESOURCES AT RISK SUMMARY ICS 232-CG

3. Environmentally-Sensitive Areas and Wildlife Issues

Site #	Priority	Site Name and/or Physical Location	Site Issues

Narrative

Shoreline: This area is primarily Exposed Solid Man-Made Structures (1B), Mixed Sand & Gravel Beaches (5), Exposed Riprap (6) Sheltered Scarps in Clay and Mud (8A), and Fresh-Water Marshes (10B). This area also includes: Exposed Wave-Cut Platforms (2A), Sheltered Solid Man-Made Structures (8B), Salt and Brackish Water Marshes (10), and Scrub-Shrub Wetlands (10D).

Biological Resources: This area contains Diving Birds, Gulls & Terns, Passerine Birds, Shorebirds, Wading Birds, Raptors and Waterfowl. The Delaware River has numerous species of fish, bivalves, and crabs. The fresh water marshes in this area contain amphibians and turtles.

Threatened Endangered or Species of Concern

Birds: 2 types of endangered raptors, 1 type of threatened raptor, American Bittern, Bald Eagle, Black Tern, Black-Crowned Night Heron, Blackpoll Warbler, Common Tern, Great Egret, King Rail, Least Bittern, Loggerhead Strike, Northern Harrier, Osprey, Peregrine Falcon, Piping Plover, Sedge Wren, Short-Eared Owl, Upland Sandpiper, Yellow-Bellied Flycatcher, and Yellow-Crowned Night Heron.

Fish: Hickory Shad (E), Atlantic Sturgeon (E), Short-Nosed Sturgeon (E).

Habitat: 1 type of endangered plant, Field Dodder, Forked Rush, Walter's Barnyard Grass, Swamp-Pink.

Reptiles: Eastern Redbelly Turtle, Southern Leopard Frog,

Human-Use Resources: This area includes several boat ramps and numerous archeological and historical sites.

4. Archaeo-cultural and Socio-economic Issues

HUN#	Priority	Site Name and/or Physical Location	Site Issues
123		Ridley Township Marina	
168		Boeing Helicopters Center South	
181		Crozer-Chester	
316		Logan Pond Wildlife Mgmt Area	NJ Div of Fish & Wildlife
339		Nehonsey Brook Preserve	NJ Dept of Natural Lands Trust
395		Bridgeport Boat Yard	856/467-0943
442		Island Marina	
492		Richard's Buttonwood Marina	James Richards: 215/397-7583
691		John Heinz National Wildlife Refuge	USFWS

Narrative

Cultural & Historic Resources: TBD

Socio Economic: TBD

5. Prepared by: (Environmental Unit Leader) **Date/Time**

RESOURCES AT RISK SUMMARY ICS 232-CG (Rev.07/04)

Figure 7: Darby Creek ICS-232

The 38 site updates were approved by the Area Committee Executive Steering Committee for inclusion into the ACP. Also, both the Oil & HAZMAT Annexes to the plan were updated to include rail incident-specific information. The Sector's local Quick Response Cards (QRCs) were updated to include critical rail incident emergency contact information and notification procedures.

Consensus Ecological Risk Assessment:

The Sector drafted a project scope to conduct a modified Consensus Ecological Risk Assessment (CERA) that was approved for funding by Coast Guard Headquarters, Office of Marine Environmental Response (MER) in January 2015. The project was guided by a project committee comprised of representatives from the USCG, NOAA, Environmental Protection Agency (EPA), Pennsylvania Department of Environmental Protection (PADEP), Delaware Department of Natural Resources and Environmental Control (DNREC), New Jersey Department of Environmental Protection (NJDEP), U.S. Fish & Wildlife Service (USFWS), Delaware Bay & River Cooperative (DBRC), Philadelphia Office of Emergency Management, and SEA Consulting Group.

The CERA concept has been applied in many other sectors for other oil spill response projects. Planning efforts led to the development of a modified CERA titled "Consensus Ecological Risk Assessment of Potential Transportation-related Bakken and Dilbit Crude Oil Spills," which developed consensus-based recommendations aimed at improving spill preparedness and response for these unconventional crudes oils (Walker, Scholz and McPeek, 2016, and Walker, Stern, Scholz et al., 2016). The end product was designed to ultimately inform the Sector and local responder's preparedness and response decisions regarding potential incidents involving Bakken and dilbit crude oils transported through the tri-state area.

The CERA used literature review, local knowledge, and experience of academic and industry experts to develop consensus-based recommendations that took into account the impacts of spilled oil and response actions on habitats and organisms, including endangered species. It also accounted for the impacts to human health and safety during an incident. Participants defined levels of concern associated with the oils relative to response actions on freshwater, brackish, and saltwater habitats and resources at risk.

The consensus agreements were reached in multi-day workshops. The Sector evaluated potential rail, barge, and tanker transportation incidents involving unconventional crude oils that could threaten the Delaware River and Bay, and its tributaries. Through the process, the workgroup developed risk mitigation strategies and solutions to help prepare for future spills throughout the AOR.

The aim of the Sector Commander, who is the designated Federal On-scene Coordinator (FOSC), and the Area Committee was to explore potential risks of these oils with the local response partners in a collaborative fashion, to update the ACP, and to ultimately improve preparedness to oil spills in the Sector's AOR. Improvements were achieved by identifying timely and effective response actions for resource protection and impact mitigation, keeping in mind varying recovery rates of different resources at risk, in the event of future spills from Bakken and dilbit oils. A related project objective was to consider threatened and endangered (T/E) species in accordance with USCG guidance on Section 7 consultations (Gelzer, 2013) pursuant to the Endangered Species Act (ESA) and Essential Fish Habitat (EFH) under the Magnuson-Stevens Fisheries Conservation and Management Act (MSA).

To address response options specifically for the previously identified types of oil, this project adapted the CERA process, as described in Developing Consensus Ecological Risk

Assessments: Environmental Protection in Oil Spill Response Planning, A Guidebook (Aurand et al., 2000). Previous CERAs assessed the risks associated with a single oil type in one or two scenarios, the variables being different spill volumes or, in some previous CERAs, spill location. This CERA assessed two types of crude oil with different properties and behavior, in five spill scenarios involving rail, barge, and tanker modes of transportation, in two seasons (winter and spring), and in three different settings (i.e., creek [freshwater], river [brackish/salt water depending upon the volume of fresh water flowing into the river], and bay [saltwater]). Special consideration was given to T/E species throughout the process. The properties of these oils (Bakken-highly flammable and dilbit-weathering and sinking) necessitated developing a new set of response actions, and evaluating the risks of the spilled oil and response actions in two phases:

- initial emergency phase (initial 4-6 hours) and
- longer-term (6 hours onward, especially 4-7 days).

A new set of 10 response actions and conceptual models were developed and the risk ranking matrix was revised. Due to the serious fires in recent incidents involving Bakken oil, the project assessed human health and safety risks in addition to ecological risks.

Figure 8 below shows the location and details of the five scenarios that were used during the CERA process. More detailed analysis and results of the CERA can be found at https://www.uscg.mil/d5/sectDelawareBay/Planning/Planning.1.asp and http://www.mdpi.com/2077-1312/4/1/23/htm.

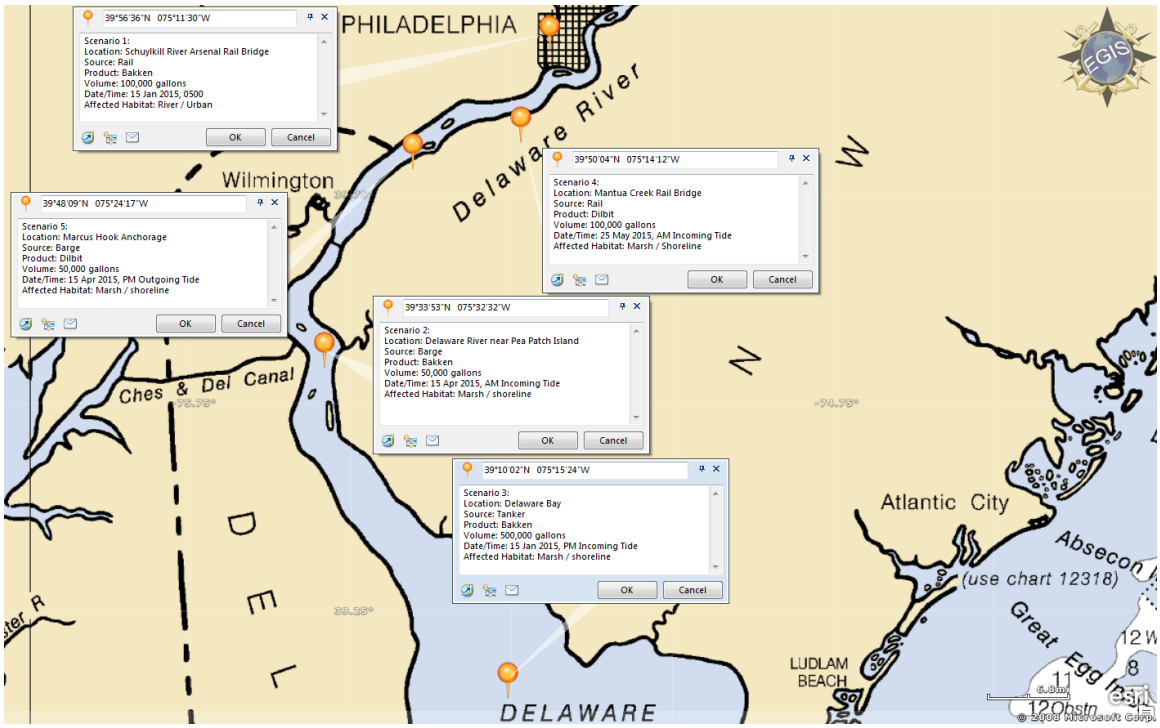

Figure 8: CERA's Location and Scenario Details

RESULTS:

As discussed in the Area Contingency Plan Revision section, through the established working relationships with port partners, the Area Maritime Security Committee, and the Area Committee, Sector Delaware Bay adapted response planning to incorporate emerging local domestic oil industry trends. The Oil by Rail Workgroup augmented the Area Contingency Plan with the identified 38 rail/water nexus areas within USCG Sector Delaware Bay Coastal Zone, conducted site surveys, developed digital booming strategies in GIS as GRPs, and created an ICS-204a and ICS-232 for each nexus area. Sector staff integrated the ACP revision and CERA projects with information policy gathering by involving the Area Committee, Local Emergency Planning Committees (LEPC), industry, and local response partners and city officials. The Sector also participated in multiple rail-specific exercise and trainings provided by the rail companies.

In summary, the broad spill response findings of the CERA include:

1) For Bakken oil: the primary initial strategy is to mitigate flammable vapor safety risks for both first responders and the public. Air monitoring is critical. Protective booming strategies should also be implemented during the initial stages of the response.
2) For dilbit oil: the primary initial strategy is to contain and recover the oil. There are greater long-term ecological risks associated with a dilbit spill than a Bakken crude oil spill due to the persistence of the oil in the environment.
3) There are moderate ecological risks associated with the use of fire fighting foam in fresh, brackish, and salt water environments, which applies to both Bakken and dilbit spills.

In order to ensure a comprehensive preparedness for response, one of the next steps that the Sector and Area Committee needs to complete is to conduct computer based trajectory modeling for all 38 water/rail nexus sites. One option is PISCES II software, a commercial modeling tool that is used for both exercise and planning purposes. Model inputs include oil product and amount, time of release, wind and tide data, boom type and amount, and skimmer and vacuum truck locations and capabilities. On behalf of the Area Committee, Precision Planning and Simulations Inc. and Delaware Bay and River Cooperative conducted modeling using PICES II for both flood and ebb tides at Darby Creek, PA. Figure 9 below depicts the discharge of 27,000 gallons (the approximate carrying capacity of a rail car) of a light diesel during a flood tide. The modeling shows that for an incoming tide, when product is discharged from the southern bridge, collection capabilities should be added along the southern edge of

Darby Creek (along I-95) because there is a natural collection point at that location. This natural collection point was confirmed via further site visits.

Scenario Details: boom type: protected water boom (18-24”), product: southern diesel (from NOAA’s ADIOS Program), amount: 27,000 gal., flood tide from 0500-1200, snapshot is at 1145 local time.

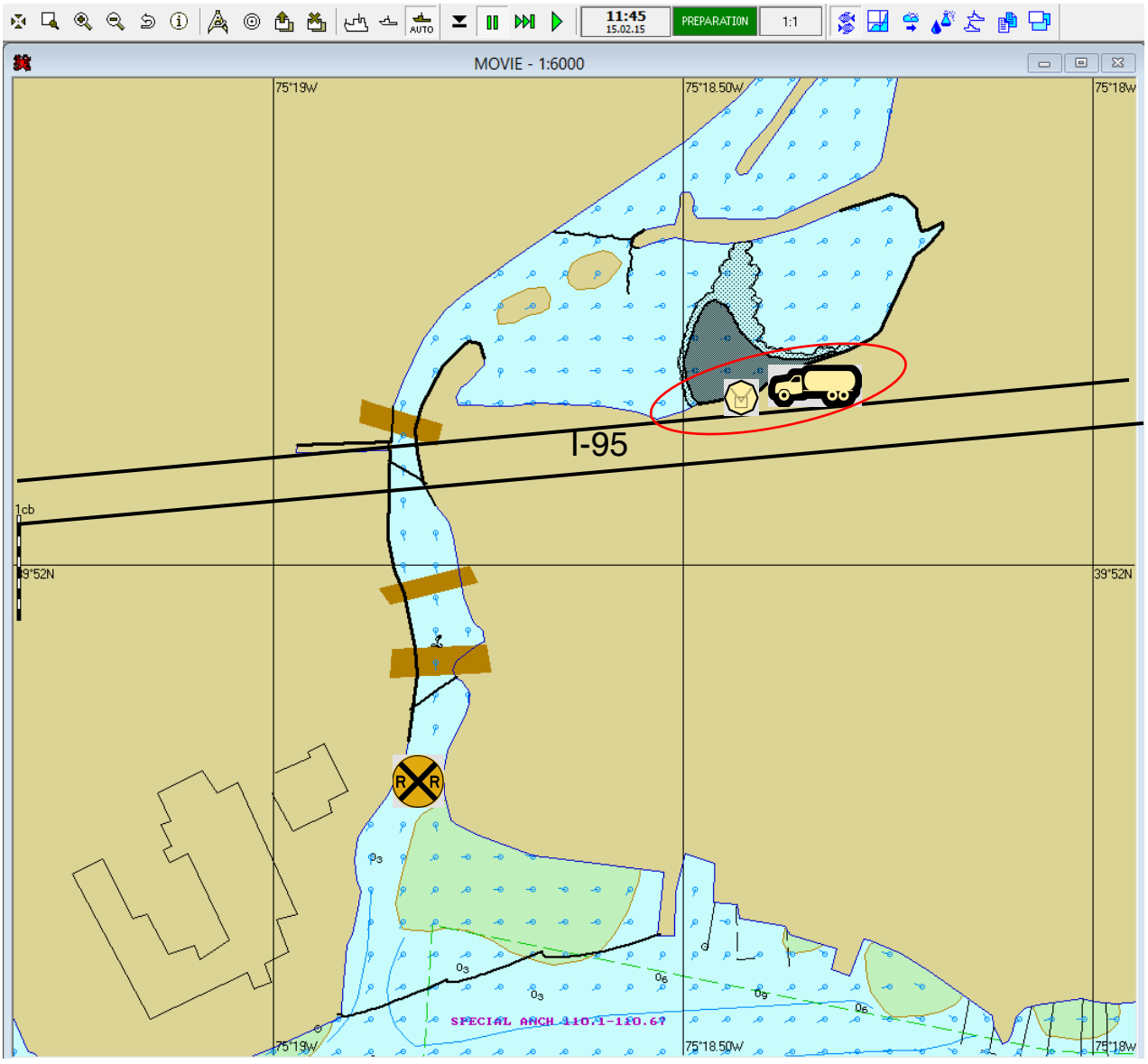

Figure 9: PISCES II Modeling of a Darby Creek Spill

The Sector and Area Committee continue to educate USCG staff and local response agencies in understanding Bakken and dilbit crude oils, and exercising the established responder guidance/BMPs (Csulak and Michel 2015a, 2015b). In order to ensure that the USCG and the response community is prepared to respond to all potential pollution incidents, including unconventional crude oils, Sector Delaware Bay's rail incident planning process could be used as a template for updating local ACPs across USCG Captain of the Port zones.

The views expressed herein are those of the authors and are not to be construed as official or reflecting the views of the U.S. Government or of the respective agencies.

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