Diamond Alkali Superfund Site OU2

ALLOCATION RECOMMENDATION REPORT

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ACRONYMS

(AP_{ABS}) - Adjusted Base Score assigned to each Allocation Party
(AP_{BS}) - Base Score assigned to each Allocation Party
(AP_{AS}) - Allocation Share assigned to each Allocation Party
(C_{MASS}) - Mass of each COC contributed by an Allocation Party to OU2 sediments
(COC) - Contaminant of Concern
(COC_{BS}) - Base Share assigned each COC discharged from a facility
(COC_{RC}) - Relative Contribution of each discharged COC to OU2 sediments
(COC_{RRN}) - COC Relative Risk Number
(COF) – The Cooperation Factor assigned to each Allocation Party
(CUF) – The Culpability Factor assigned to each Allocation Party
(DD_{DMASS}) - Mass of each COC discharged from an Allocation Party's facility via Direct Discharge
(DD_{CMASS}) - Mass of each COC contributed by an Allocation Party to OU2 sediments via Direct Discharge
($DD_{C\%}$) - Probability of each COC reaching OU2 via Direct Discharge
(D_{MASS}) - Mass of each COC discharged from an Allocation Party's facility
(EPA) - The United States Environmental Protection Agency
(GNL) - General Notice Letter
(OFT_{DMASS}) - Mass of each COC discharged from an Allocation Party's facility via Overland, Fate and Transport
(OFT_{CMASS}) - Mass of each COC contributed by an Allocation Party to OU2 sediments via Overland, Fate and Transport
($OFT_{C\%}$) - Probability of each COC reaching OU2 via Overland, Fate and Transport
(OU) - Operable Unit
(PAP) - Participating Allocation Party
($PrePVSC_{\%}$) - Percentage of operational time prior to PVSC system
($PrePVSC_{DMASS}$) - Mass of each COC discharged from an Allocation Party's facility prior to PVSC system
($PrePVSC_{CMASS}$) - Mass of each COC contributed by an Allocation Party to OU2 sediments prior to PVSC system
($PrePVSC_{C\%}$) - Probability of each COC reaching OU2 prior to PVSC system
(PRP) - Potentially Responsible Party
(PVSC) - Passaic Valley Sewer Commission
($PVSC_{\%}$) - Percentage of operational time with PVSC system
($PVSC_{DMASS}$) - Mass of each COC discharged from an Allocation Party's facility via PVSC system
($PVSC_{CMASS}$) - Mass of each COC contributed by an Allocation Party to OU2 sediments via PVSC system
($PVSC_{C\%}$) - Probability of each COC reaching OU2 via PVSC system
(T_{MASS}) - Total mass of each COC in OU2 sediments

DEFINITIONS

a. **Allocation:** The confidential process, conducted with the assistance of the Allocator, consisting of the first phase of a two-phase ADR facilitated settlement process to support settlement between EPA and the Allocation Parties.

b. **Allocation Party:** One of seventy-nine (79) entities identified by EPA as a potentially responsible party for Operable Unit 2 of the Diamond Alkali Superfund Site (the Site) and issued a General Notice Letter for one or more particular facility location, as noted in Attachment B.[1]

c. **Allocation Team:** The Allocator and professional staff of AlterEcho who are supporting conduct of the Allocation.

d. **Allocator:** David C. Batson, the individual contracted by EPA and accepted by the Participating Allocation Parties to conduct the Allocation process.

e. **Chemicals of Concern:** The following eight (8) chemicals designated as COCs by EPA in the ROD for OU2 of the Site, dated March 3, 2016

   1. Dioxin/Furans
      a. Polychlorinated dibenzo-p-dioxins (PCDD), Polychlorinated dibenzofurans (PCDF)
   2. PAH Polycyclic aromatic hydrocarbon
      a. LMW PAHs: acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, phenanthrene, and 2-methylnaphthalene
      b. HMW PAHs: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene and pyrene
   3. PCB Polychlorinated biphenyl
   4. DDx Dichlorodiphenyltrichloroethane (DDT), and its primary breakdown products; Dichlorodiphenyldichloroethane (DDD) and Dichlorodiphenyldichloroethylene (DDE)
   5. Mercury
   6. Copper
   7. Lead
   8. Dieldrin

f. **Operable Unit 2 (OU2):** An operable unit of the Passaic River Superfund Site consisting of the lower 8.3 miles of the Passaic River, in or about Essex and Hudson counties, as defined by the EPA in the ROD.

g. **Participating Allocation Party (PAP)**: An Allocation Party that has agreed to participate in the Allocation, as noted in Attachment I.

[1] Allocation Parties refers to all parties notified by EPA as PRPs for OU2 of the Diamond Alkali Site, but does not include the Passaic Valley Sewerage Commission (PVSC), the Cities of Newark, Harrison, East Newark, and Kearney, or parties that entered into an OU2 cash-out settlement with EPA

Diamond Alkali Superfund Site OU2 Allocation Recommendation Report

1. PURPOSE AND LAYOUT OF ALLOCATION RECOMMENDATION REPORT

This Allocation Recommendation Report compiles and provides an explanation of the results of an allocation conducted by David Batson, the Allocator, at the request of EPA and the concurrence of the Potentially Responsible Parties (PRPs) identified by EPA for participation in the Allocation (the Allocation Parties), to establish the relative equitable responsibility of certain parties for a portion of the costs of remediating Operable Unit 2 (OU2) of the Lower Passaic Diamond Alkali Superfund Site (the Site), as more fully detailed below (the Allocation). The body of this Allocation Recommendation Report provides an overview of the methodology that was utilized to conduct the allocation and a summary of allocated shares of responsibility as determined by the allocation.

2. PURPOSE OF THE ALLOCATION

Conduct of the Allocation is the first phase of a two (2) phase ADR facilitated settlement process to obtain future cash-out and work party settlements between EPA and the Allocation Parties. The first phase (Phase 1) is the allocation conducted by Allocator David Batson. The second phase (Phase 2) is subsequent negotiations between the Allocation Parties and EPA utilizing the Allocator's recommendation regarding the equitable allocation of responsibility among the Allocation Parties. In its September 18, 2017, letter to the Allocation Parties (Attachment A), EPA notes that the OU2 allocation is intended to result in cash-out settlement offers from EPA and identify those parties that should participate in consent decree negotiations for the performance of the remedial action for OU2.

The goal of the Allocation is to provide the EPA with a basis for such future settlements with the Allocation Parties. Therefore, it is not the purpose of this allocation process to ascertain the relative share of responsibility among all PRPs who may have contributed contaminants found in OU2 sediments over the extended history of industrial operations in the Passaic River watershed. Instead, this allocation is limited to assigning relative shares of responsibility between and among only the Allocation Parties, leaving a determination of the appropriate share of responsibility of other PRPs that discharged contaminants impacting OU2 sediments for Phase 2 settlement negotiations. The Allocator recognizes that EPA did not include the Passaic Valley Sewerage Commission ("PVSC") and four municipalities— the cities of Newark, Kearney, Harrison, and East Newark— as Allocation Parties, even though each entity received General Notice Letters from EPA and owns and/or operates a sewer system which discharges industrial effluent into the Passaic River.

Through conduct of the Allocation, the Allocator will recommend a numerical ranking of the relative shares of responsibility between and among the Allocation Parties for that portion of the costs associated with the remedial design (RD) and remedial action (RA) for Diamond Alkali OU2 determined, during Phase 2, to be attributable to the Allocation Parties as a group. The Allocator will recommend a share for each Allocation Party with respect to each facility identified with each such Allocation Party in Attachment B (but not including relative shares for those facilities for which an Allocation Party has settled with the EPA as part of the Early Settlement Option pursuant to Section 4.2), whether the party participates in the allocation process or not. The allocated shares recommended by the Allocator shall total to 100% of the aggregate responsibility of the Allocation Parties (but not including those facilities for which an early cash-out settlement has been reached pursuant to Section 4.2) to be determined during Phase 2.

While neither EPA nor the Allocation Parties are bound by the results of the Allocation, EPA has committed to use the Allocator's recommended shares of relative responsibility among the Allocation Parties as a primary factor in its future negotiations in Phase 2 with the goal of reaching agreement with the Allocation Parties on future cash-out and work party settlements.

As noted above, the Allocation is intended to serve as the first phase of a two-stage settlement process to obtain cash-out and work party agreements between the EPA and the Allocation Parties. As such, it is an intentional variation of how a typical private allocation process would be conducted. Unlike a typical allocation--the outcome of which is a recommendation on the share of responsibility of each PRP for total site related costs--this Allocation will provide a recommendation on the relative shares of responsibility between and among the Allocation Parties for that portion of the costs associated with the RD and RA for OU2, determined through future settlement negotiations to be attributable to the Allocation Parties as a group.

3. HISTORY OF FACILITY OPERATIONS IMPACTING THE SITE

The following sections contain information regarding the description of the site, site history, enforcement activities, and the selected remedy taken from the March 3, 2016, Record of Decision (ROD)[2], the Site as updated by information from the EPA Diamond Alkali Co. Superfund Site website[3]. Text taken from the ROD is denoted in italic. A listing of the seventy-nine (79) Allocation Parties and their related ninety-two (92) facilities which are subject to the final allocation is included as Attachment B. Maps denoting the location of the Allocation Party facilities are included in Attachment C. Descriptions of site Contaminants of Concern (COCs) as designated by EPA in the ROD are included as Attachment D.

Site Description

The ROD presents the selected remedy to address contaminated sediments found in the lower 8.3 miles of the Lower Passaic River, a part of the Diamond Alkali Superfund Site. The lower 8.3 miles of the Lower Passaic River comprise OU2 of the Site, also referred to in the Proposed Plan as the Focused Feasibility Study Area (FFS Study Area). The sediments of the lower 8.3 miles of the Lower Passaic River pose an unacceptable risk to human health and the environment due to the presence of a variety of contaminants, most of which stay in the environment for a long time and bioaccumulate in fish and crab. These contaminants include polychlorinated dibenzo-p-dioxins and furans (dioxins and furans), polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), Total DDx[4] and other pesticides, mercury, lead and other metals.

The lower 8.3 miles of the Lower Passaic River are located in a highly developed urban area, with approximately 1.4 million people living in Essex County (west bank) and Hudson County (east bank). At the mouth of the river (RM 0) and around Newark Bay, the near-shore land uses are commercial and industrial, in part to take advantage of the transportation infrastructure (rail, air and marine). Farther upriver, beginning near RM 4, commercial uses of near-shore properties begin to be mixed with more residential and recreational uses as well. There are narrow bands of park and open space along the river, surrounded by commercial and dense urban residential development. Near RM 7, there are marinas and boat launches along with park land surrounded by more suburban residential neighborhoods. Hard shorelines, such as bulkhead and riprap (some with overhanging vegetation) make up approximately 95 percent of the banks of the lower 8.3 miles, while aquatic vegetation predominates along about 5 percent of the banks. Approximately 100 acres of the 650-acre lower 8.3 miles consist of mudflats. Intertidal

[2] https://semspub.epa.gov/work/02/396055.pdf

[3] https://cumulis.epa.gov/supercpad/SiteProfiles/index.cfm?fuseaction=second.Cleanup&id=0200613#Status

[4] *DDT is a common name that refers to an industrially produced, chlorinated pesticide, dichlorodiphenyltrichloroethane. DDT breaks down in the environment to form 4,4'-dichlorodiphenyldichloroethane (DDD) and 4,4'-dichlorodiphenyldichloroethylene (DDE). The term Total DDx used in the ROD refers to the sum of DDT, DDD and DDE concentrations.*

mudflats and the associated shallow-water subtidal areas are important habitats for estuarine organisms, providing valuable foraging habitat for fish, blue crab and waterbirds.

The Lower Passaic River has a federally authorized navigation channel which, when it was first constructed in the 1880s, extended to RM 8.1. It was expanded to its maximum length, to RM 15.4, in 1915, with depths ranging from 30 feet (from RM 0 to RM 2.6) to 10 feet at the farthest upstream reaches. After construction, the U.S. Army Corps of Engineers (USACE) dredged the channel regularly to maintain navigation and prevent infilling with sediments. The channel below RM 1.9 was regularly maintained until 1983. The channel above RM 1.9 was dredged periodically through the 1950s, with one segment maintained as late as 1976 (from RM 9.0 to RM 10.2).

As maintenance dredging declined and eventually stopped, this channel filled with sediments. At the same time, industries and municipalities disposed of wastewaters in the river. The coincidence of chemical disposal in the river and the filling-in of the navigation channel created ideal conditions for the accumulation of contaminated sediments in the Lower Passaic River (see Section 5.3 for further discussion).

The Lower Passaic River's cross-sectional area declines steadily moving upstream from RM 0 to RM 17.4, with a pronounced constriction at RM 8.3 (see Figure 2). At that location, there is also pronounced change in sediment texture. The riverbed below RM 8.3, from bank to bank, is dominated by fine-grained sediments (primarily silts) with pockets of coarser sediments (sand and gravel). Above RM 8.3, the riverbed is dominated by coarser sediments with smaller areas of fine-grained sediments, often located outside the channel. About 85 percent of the fine-grained sediment surface area of the Lower Passaic River bed is located below RM 8.3 and, by volume, about 90 percent of fine-grained sediments in the Lower Passaic River are located below RM 8.3. Due to a combination of a wider cross-section and a deeper navigation channel below RM 8.3 (16 to 30 feet) than above RM 8.3 (10 feet), thicker and wider beds of contaminated sediments accumulated below RM 8.3 than above it. The total estimated inventory of contaminated fine-grained sediments in the lower 8.3 miles (surface and deeper sediments combined) is approximately 9.7 million cubic yards (cy).

The contaminants of concern (COCs), discussed in Section 5.2, tend to bind tightly to fine grained sediment particles. Therefore, the majority of the contamination tends to be found in areas that are predominantly comprised of fine-grained sediments which, for the Lower Passaic River, are the lower 8.3 miles.

Site History and Enforcement Activities

The Passaic River was one of the major centers of the American industrial revolution starting two centuries ago. Early manufacturing, particularly textile mills, developed in the area around Great Falls in the city of Paterson, which is eight miles upriver of the Dundee Dam. The Dundee Dam, constructed along with a canal and locks in the mid-nineteenth century on top of an earlier dam, was originally conceived to provide waterpower to nearby businesses, supporting further industrialization along the banks of the river. By the end of the nineteenth century, a multitude of industrial operations, such as manufactured gas plants, paper manufacturing and recycling facilities, petroleum refineries, shipping, tanneries, creosote wood preservers, metal recyclers and

manufacturers of materials such as rubber, rope, textiles, paints and dyes, pharmaceuticals and chemicals, had located along the river's banks as cities such as Newark and Paterson grew. Industrial operations and municipalities used the river for wastewater disposal.

Along with the Dundee Dam, which physically isolates Dundee Lake and the upper river from lower river influences, another defining component of the development and urbanization of the Lower Passaic River was the construction of a navigable channel for commercial vessels. Between 1884 and 1915, dredging projects authorized by Congress and constructed by USACE created a federally authorized navigation channel from RM 0 to RM 15.4 (at Wallington, New Jersey). Further deepening of the channel was authorized by Congress in 1930. In 1932, the navigation channel was constructed to its maximum dredged depth: 30 feet from RM 0 to RM 2.6; 20 feet from RM 2.6 to RM 4.6; 16 feet from RM 4.6 to RM 8.1; and 10 feet from RM 8.1 to RM 15.4. USACE performed dredging to maintain the channel through the 1950s above RM 1.9 and until 1983 below RM 1.9.

Superfund History

The Lower Passaic River is a part of the Diamond Alkali Superfund Site. EPA's response at the Site began at a former manufacturing facility located at 80-120 Lister Avenue in Newark, New Jersey, at RM 3.4. Manufacturing of DDT and other products began at this facility in the 1940s. In the 1950s and 1960s, the facility was operated by the Diamond Alkali Company (later purchased by and merged into Occidental Chemical Corporation, or OCC). Between March 1951 and August 1969, the Diamond Alkali Company manufactured the chemical 2,4,5-trichlorophenol (2,4,5-TCP) and the herbicides 2,4-dichlorophenoxyacetic acid (2,4-D) and 2,4,5-trichlorophenoxyacetic acid (2,4,5-T), ingredients in the defoliant "Agent Orange." A by-product of the manufacturing was 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD), the most toxic form of dioxin. These substances have all been found in Lower Passaic River sediment and fish/crab tissue.

Preliminary Actions

Based on investigations by NJDEP and EPA, the Diamond Alkali Site was placed on the National Priorities List in 1984. After further investigations and several emergency response actions that addressed dioxin found on nearby properties, EPA issued a ROD in 1987 to select an interim containment remedy for the Lister Avenue facility. The remedy consisted of capping, subsurface slurry walls, and a groundwater collection and treatment system to prevent exposure to contaminated soil (that originated at the facility and that was brought back to the facility from neighboring lots) and prevent further releases to the river. Construction of the remedy at the 80-120 Lister Avenue facility was carried out by OCC and the owner of the facility, Chemical Land Holdings, Inc., now Tierra Solutions, Inc. (Tierra), under EPA oversight. Construction was completed in 2001. Maintenance of the facility is performed by Tierra on OCC's behalf, under EPA oversight. EPA performs periodic reviews of the remedy.

The Six-Mile Study

In 1994, OCC agreed to an administrative order on consent (AOC) with EPA to investigate a six mile stretch of the Lower Passaic River (RM 1 to RM 7), with the work performed by Tierra on OCC's behalf. This investigation found COCs that originated from the Diamond Alkali facility, in particular, 2,3,7,8-TCDD and pesticides, throughout the six miles, with the highest concentrations adjacent to the 80-120 Lister Avenue facility. This investigation

also found many other COCs not clearly linked to Diamond Alkali's operations, and indicated that contaminated sediments moved into and out of the six-mile stretch, leading to the conclusion that a more comprehensive study was required. In 2002, EPA expanded the scope of the investigation to include the entire 17-mile Lower Passaic River.

The 17-Mile Study

While working with OCC and Tierra on the Lister Avenue facility and the first studies of the river, EPA also identified other potentially responsible parties (PRPs) for the Lower Passaic River. A number of companies that owned or operated facilities from which hazardous substances were potentially discharged to the river formed the Cooperating Parties Group (CPG). In 2004, EPA signed a settlement agreement with CPG members in which the settling parties agreed to pay for EPA to perform the 17-mile LPRSA remedial investigation and feasibility study (RI/FS). The settlement agreement was amended in 2005 and 2007, adding more parties to reach a total of over 70 settling parties. From 2004 to 2007, EPA investigated contamination in sediments and water of the Lower Passaic River, and investigated the major tributaries, combined sewer overflows (CSOs) and stormwater outfalls (SWOs) to the river. In 2007, CPG members entered into a new AOC with EPA, in which the settling parties agreed to take over the performance of the 17-mile LPRSA RI/FS from EPA. Since 2007, the membership of the CPG has continued to change. EPA understands that some of the settling parties that signed the AOC are no longer members of the CPG and, also, that the CPG may include members that are not signatories to the AOC.

The CPG performed sampling for the RI between 2008 and 2014. The lower 8.3-mile RI/FFS prepared by EPA did incorporate data collected by EPA and the CPG for the 17-mile LPRSA RI/FS, among other datasets, and EPA has shared its lower 8.3-mile findings with the CPG to support the 17-mile RI/FS.

The Newark Bay Study

In 2004, EPA and OCC signed an AOC in which OCC agreed to conduct a separate RI/FS of the Newark Bay Study Area (Newark Bay and portions of the Hackensack River, Arthur Kill and Kill van Kull), investigating the extent of dioxin contamination and co-located contaminants, under EPA oversight. As with the 1994 agreement, Tierra is performing the work on OCC's behalf. This study of Newark Bay is ongoing.

The Tierra Removal

In June 2008, EPA, OCC and Tierra signed an AOC for a non-time-critical removal action to remove 200,000 cy of contaminated sediment from the river (from RM 3.0 to RM 3.8) adjacent to the 80-120 Lister Avenue facility. This action is referred to as the "Tierra Removal." Sediment at depth adjacent to the facility has been found to have the highest levels of 2,3,7,8-TCDD measured in the river. Dredging, dewatering and transport off site of the first 40,000 cy of sediment (known as Phase 1 of the Tierra Removal) was completed in 2012. In 2015, Tierra, on behalf of OCC, collected additional samples in the Phase 2 area. Both phases of this removal action are considered "source removal" projects.

EPA's website noted above states that the agreement contemplates the siting and use of a confined disposal facility as a receptacle for the dredged materials from Phase 2 (160,000 cubic yards). However, this has not occurred and may no longer be practicable. EPA is integrating this work with the lower 8.3-mile remedy in a coordinated and consistent manner.

The RM 10.9 Removal

In June 2012, EPA and the CPG signed an AOC for a time-critical removal action to address the risks posed by high concentrations of dioxins, PCBs and other contaminants found at the surface of a mudflat on the east bank of the river at RM 10.9 in Lyndhurst, New Jersey. This action is referred to as the "RM 10.9 Removal." The action involved placing an engineered cap over contaminated sediments, thereby reducing exposure and preventing migration of the contamination to other parts of the river. In order to ensure that the action did not exacerbate flooding, a sufficient volume of surface sediments was first dredged from the area to make space for the cap. The CPG began work in 2013 and substantially completed it in 2014, with the exception of a relatively small area of contaminated sediments located above a utility pipeline that runs under the river. This time critical removal action is not a final remedy; a final decision for the RM 10.9 Removal area will be made by EPA as part of the 17-mile LPRSA ROD.

The Lower 8.3-Mile Study

Concurrent with these river studies and removal actions, EPA concluded that since the lower 8.3 miles of the river contain the bulk of the contaminated sediment which is the source of most of the risk associated with the Lower Passaic River, addressing this portion of the river first would better support the overall protection of human health and the environment than would awaiting the outcome of the 17-mile LPRSA RI/FS to make a decision for the entire Lower Passaic River. Because about 90 percent of the fine-grained (and, therefore, more heavily contaminated) sediment is below RM 8.3, EPA undertook a targeted RI and FFS of the lower 8.3 miles, which led to this ROD. The nature and extent of the contamination in the lower 8.3 miles of the Lower Passaic River and the remedial alternatives summarized in this ROD are described in greater detail in two documents: the Remedial Investigation Report for the Focused Feasibility Study of the Lower Eight Miles of the Lower Passaic River (RI Report) and the Focused Feasibility Study Report for the Lower Eight Miles of the Lower Passaic River (FFS Report).

The Lower Passaic River Restoration Project

In 2002, at the time that the 17-mile LPRSA RI/FS was being developed, EPA also formed a partnership with USACE, the State of New Jersey, the National Oceanic and Atmospheric Administration (NOAA) and U.S. Fish and Wildlife Service (USFWS) [referred to as "the Partner Agencies"], to conduct a joint study that would bring each agency's authorities to bear on the complex environmental problems of the Lower Passaic River. The goal of the Lower Passaic River Restoration Project is to remediate contaminated sediments, improve water quality, restore degraded shorelines, restore and create new habitats and enhance human use along the 17-mile Lower Passaic River and in several tributaries from Dundee Dam near Garfield, to Newark Bay. Actions by EPA to address contaminated sediments under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended, is one aspect of the Project.

Selection of the OU2 Remedy

As discussed in the Proposed Plan, EPA has determined that selecting a final remedy at this time for the sediments of the lower 8.3 miles of the Lower Passaic River is consistent with the EPA's approach of using operable units when a phased analysis is necessary or appropriate given the size or complexity of a site. EPA considered awaiting the conclusion of the 17-mile LPRSA RI/FS rather than selecting a remedy for only part of the Lower Passaic River. EPA concluded that the remedy for the lower 8.3 miles will be consistent with any remedy selected for the remainder of the Diamond Alkali Site, including the Lower Passaic River and Newark Bay Study Areas, for reasons discussed below.

EPA investigated potential COC sources to the Lower Passaic River, including atmospheric deposition, groundwater, industrial point sources, the Upper Passaic River (above Dundee Dam), Newark Bay, major tributaries, CSOs and SWOs. Data and screening-level analyses show that contaminated sediments that are already present on the river bottom in the lower 8.3 miles and that are resuspended and then resettle as a result of natural processes are, by a large margin, the biggest component of recently deposited sediment in the Lower Passaic River (see Section 5.3). In comparison, Upper Passaic River and Newark Bay contributions of COCs are small and all other sources are minor.

Sediment Conceptual Site Model

Based on analyses discussed in the RI Report for the lower 8.3 miles, direct atmospheric deposition, groundwater discharge and industrial point sources of contaminants currently are not significant contributors of COC mass (i.e., sediment particles and the COCs bound to them) to the recently deposited sediments of the Lower Passaic River. The Upper Passaic River, Newark Bay, the three main tributaries, and CSOs and SWOs were sampled between 2005 and 2011. Results of a mass balance show that the tributaries, CSOs and SWOs are minor contributors of COCs, since they are minor contributors of sediment particles compared to the Upper Passaic River and Newark Bay, and the mass of contaminants delivered by those particles is low compared to the sediments of the Lower Passaic River main stem. For COCs such as 2,3,7,8- TCDD, Total PCBs and mercury, concentrations on sediment particles from the tributaries, CSOs and SWOs are clearly lower than those on Lower Passaic River surface sediments. Current contributions to the recently deposited sediments of the Lower Passaic River are summarized in Table 3 in Appendix II. Resuspension of Lower Passaic River sediments contributes well over 90 percent of the dioxin in recently deposited sediments of the Lower Passaic River, followed by Newark Bay (approximately 5 percent) and the Upper Passaic River (3 percent or less). Resuspension of Lower Passaic River sediments contributes approximately 80 percent of PCBs and DDE in recently deposited sediments, followed by the Upper Passaic River (approximately 10 percent) and Newark Bay (less than 10 percent). Similar trends are shown for copper, mercury and lead, further supporting the conclusion that resuspension of highly contaminated surface sediments already in the lower 8.3 miles of the river is the predominant contributor to COC mass in the water column, and thus to COC concentrations in fish and crab tissue. As discussed in Section 10.1, these percentage contributions would be altered dramatically through active remediation of the lower 8.3 miles. For example, bank-to-bank replacement of the highly contaminated riverbed with effectively clean material would greatly reduce the component of the mass balance that comes from resuspension of Lower Passaic River sediments. This would reduce the overall contaminant levels in surface sediment, but it would also have the effect of increasing the

relative percentage contribution of the Upper Passaic River, Newark Bay and the Lower Passaic River above RM 8.3 to COCs depositing on top of the newly replaced lower 8.3-mile riverbed.

Under current conditions, the daily movement of contaminated surface sediments combined with the occasional uncovering and resuspension of deeper, more highly contaminated sediments in the lower 8.3 miles are the primary ongoing source of COCs to the water column and surface sediments of the Lower Passaic River.

Risk Characterization

Risk characterization involves estimating the magnitude of the potential adverse health effects associated with the COCs. It also involves making judgments about the nature of the human health threat to the defined receptor populations. The risk characterization combines the results of the dose-response (toxicity assessment) and exposure assessment to calculate cancer risks and noncancer health hazards. In accordance with EPA's guidelines, this assessment assumes that the effects of all contaminants are additive through a specific pathway within an exposure scenario.

For carcinogens, risks are generally expressed as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the carcinogen. Excess lifetime cancer risk (a unitless probability of an individual's developing cancer) is calculated by multiplying the chronic daily intake averaged over 70 years (mg/kg-day) and the slope factor (per mg/kg-day).

These risks are probabilities that usually are expressed in scientific notation (e.g., 1 x 10-6). An excess lifetime cancer risk of 1 x 10-6 indicates a probability that the RME individual has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure. This is referred to as an "excess lifetime cancer risk" because it would be in addition to the risks of cancer individuals face from other exposures. The upper-bound excess lifetime cancer risks derived in this assessment are compared to the risk range of 10-4 (one in ten thousand) to 10-6 (one in one million) established in the NCP. EPA's goal of protection for cancer risk is 10-6 and risks greater than 10-4 typically will require remedial action.

The potential for noncancer health effects is estimated by comparing the average daily dose (ADD) of a chemical for adult, adolescent and child with the RfD for the specific route of exposure (e.g., oral). The ratio of the intake to reference dose (ADD/RfD) for an individual chemical is the hazard quotient (HQ). When an RfD is available for the chemical, these ratios are calculated for each chemical that elicits a noncancer health effect. Typically, chemical-specific HQs are summed to calculate an HI value for each exposure pathway. EPA's goal of protection for noncancer health effects is an HI equal to 1. When the HI exceeds 1, there may be a concern for health effects. This approach can result in a situation where HI values exceed 1 even though no chemical-specific HQs exceed 1 (i.e., adverse systemic health effects would be expected to occur only if the receptor were exposed to several contaminants simultaneously). In this case, chemicals are segregated by similar effect on a target organ, and a separate HI value for each effect/target organ is calculated. If any of the separate HI values exceed 1, adverse, noncancer health effects are possible. It is important to note, however, that an HI exceeding 1 does not predict a specific disease.

Cancer Assessment: The HHRA shows that all of the risks associated with the RME are greater than the goal of protection established in the NCP of 10-6 (i.e., one additional cancer in 1,000,000 people). All of the risks associated with the RME are also greater than the 10-4 cancer risk that typically would require remedial action at a site or operable unit (see Tables 8 and 9 in Appendix II). In addition, cancer risks to the average exposed (CTE) individual associated with ingestion of fish and crab are above EPA's goal of protection of 10-6 (see Tables 10 and 11 in Appendix II).

For the RME adult and child combined receptor (Table 8), a cancer risk of 4 x 10^{-3} for consumption of fish or 1 x 10-3 for consumption of crab indicates that eating fish or crab from the lower 8.3 miles may cause four additional cancers in a population of 1,000 people or one additional cancer in a population of 1,000 people, respectively, under the stated exposure assumptions. For the adolescent receptor (Table 9), a cancer risk of 2 x 10-3 for consumption of fish or 6 x 10-4 for consumption of crab indicates that eating fish or crab from the lower 8.3 miles may cause two additional cancers in a population of 1,000 people or six additional cancers in a population of 10,000 people, respectively, under the stated exposure assumptions.

The primary contributors to the excess risk are dioxins/furans (70 percent for fish consumption and 82 percent for crab consumption), dioxin-like PCBs (11 percent for fish consumption and 12 percent for crab consumption) and non-dioxin-like PCBs (16 percent for fish consumption and 5 percent for crab consumption). The other COPCs contributed a combined 3 percent to the excess cancer risk.

Noncancer Health Hazards: The results for noncancer health hazards from the HHRA are summarized in Tables 12 through 14 in Appendix II for the RME scenarios and Tables 15 through 17 in Appendix II for the CTE scenarios. For the RME child who eats fish or crab from the lower 8.3 miles, the HIs are 196 and 67, respectively, which are above EPA's goal of protection of an HI equal to 1. RME results for the adult and adolescent also are above EPA's goal of protection of an HI equal to 1. In addition, noncancer HIs for the CTE individual associated with ingestion of fish and crab are above EPA's goal of protection.

Dioxin/furans and PCBs combined contribute more than approximately 98 percent of the excess hazard, while the remaining excess hazard is associated with methyl mercury for all receptors for ingestion of both fish and crab. The total noncancer HI exceeded the goal of protection and the individual HQs based on critical effect also exceeded a threshold of 1 for these contaminants.

Basis for Remedial Action

The response action selected in this ROD is necessary to protect public health or welfare and the environment from actual or threatened releases of hazardous substances into the environment. A response action is necessary for the sediments of the lower 8.3 miles of the Lower Passaic River portion of the Diamond Alkali Superfund Site at this time because:

Human Health Risk: The risk of an RME individual developing cancer or noncancer health effects as a result of COC exposure from ingestion of fish or crab in the lower 8.3 miles of the Lower Passaic River exceeds the acceptable risk range identified in the [National Contingency Plan]. Specifically, fish and crab consumption risks and [hazard indexes] for

the RME scenarios exceed CERCLA- acceptable risk levels of an excess cancer risk of 10-6 to 10-4 and a noncancer goal of protection of an HI of 1.

Ecological Risk: Risks to all ecological receptors (benthic invertebrates, fish, aquatic birds and aquatic mammals) exceed acceptable levels (HQ equal to 1).

Remedial Action Objectives

Remedial action objectives (RAOs) describe what a remedial action is expected to accomplish. The following RAOs have been established for the lower 8.3 miles of the Lower Passaic River:

- *Reduce cancer risks and noncancer health hazards for people eating fish and crab by reducing the concentrations of COCs in the sediments of the lower 8.3 miles.*

- *Reduce the risks to ecological receptors by reducing the concentrations of COCs in the sediments of the lower 8.3 miles.*

- *Reduce the migration of COC-contaminated sediments from the lower 8.3 miles to upstream portions of the Lower Passaic River and to Newark Bay and the New York-New Jersey Harbor Estuary.*

These RAOs address human exposure through fish and/or crab consumption, and ecological exposures. The unacceptable exposures identified in the risk assessments are primarily derived from elevated COC concentrations in surface sediments that result in bioaccumulation of COCs in fish and crab. Addressing these sediments will reduce COC concentrations in biota, including fish and crab tissue, thereby significantly reducing potential human health risks and hazards, and
ecological risks. By addressing exposure to and mobility of the surface sediments, the remedial action is expected to achieve the RAOs.

Preliminary Remediation Goals

There are no chemical-specific federal or State of New Jersey standards for the COCs in sediment. Therefore, EPA developed Site-specific, risk-based preliminary remediation goals (PRGs) for the lower 8.3-mile sediments. Below is a discussion of how the PRGs were developed in the RI/FFS, and what led EPA to select the final remediation goals.

Risk-based sediment concentrations to protect human health were developed based on fish or crab tissue concentrations of COCs (dioxins, PCBs and mercury) that would allow adult anglers to eat self-caught fish or crab from the lower 8.3 miles of the Lower Passaic River at a 10-6 cancer risk level or a noncancer HI of 1 as the goal of protection. (see Table 24 in Appendix II) Protective concentrations in tissue were also developed for risk levels of 10-5 and 10-4 (the last of which is typically the level that triggers the need for remedial action at a site). Protective concentrations in fish and crab tissue were calculated based on the site-specific adult consumption rates of 35 g/day for fish or 21 g/day for crab used in the HHRA. These consumption rates are equivalent to 56 eight-ounce fish meals per year or 34 eight-ounce crab meals per year. Additional tissue concentrations were developed for 12 eight-ounce fish or crab meals per year (or one meal per month), for use as interim remediation milestones (Table 24, columns 8-10). Interim remediation milestones are fish and crab tissue concentrations to be used during monitoring after

remedy implementation to evaluate if contaminant concentrations in fish and crab tissue are decreasing as expected. EPA will share monitoring data and consult with NJDEP about whether the prohibitions on fish and crab consumption can be lifted or adjusted to allow for increased consumption as contaminant levels decline.

Sediment concentrations needed to meet protective fish and crab tissue concentrations were estimated using site-specific biota-sediment accumulation relationships developed from the COC concentrations in sediments and co-located fish or crab tissue concentrations. These relationships between sediment and tissue concentrations take into account the possibility that some of the fish or crab may have been exposed to contamination outside of the lower 8.3 miles of the Lower Passaic River, and are consistent with research showing that tissue concentrations may not decline at the same rate as sediment concentrations after sediments are remediated. These risk-based sediment PRGs for human health are presented in Table 25 in Appendix II, columns 3-8 and 12-13, along with the interim remediation milestones (columns 9-11 and 14).

While all of the COCs discussed in Section 7.2 cause unacceptable risks (HQ greater than 1) to some or all of the receptors evaluated, risk-based PRGs were developed for dioxins, PCBs, mercury and Total DDx, because they are representative COCs (based on the magnitude of HQs and number of receptors affected) and because there were multiple lines of evidence developed to evaluate how the alternatives would achieve PRGs for these four COCs after remediation. In addition, most active alternatives (i.e., alternatives other than No Action) designed to address these COCs would also address the other COCs.

Sediment PRGs that would be protective of benthic invertebrates were developed based on the sediment benchmarks used to evaluate risks in the BERA. The benchmarks are published literature values shown through independent research to be good predictors of toxicity.

Selected Remediation Goals

PRGs become final remediation goals when EPA selects a remedy after taking into consideration all public comments. The NCP identifies a 10-6 cancer risk level or a noncancer hazard of 1 as the goal of protection for determining remediation goals for alternatives when applicable or relevant and appropriate requirements (ARARs) are not available or are not sufficiently protective. EPA has concluded that a 10-6 cancer risk for the fish and crab consumption exposure pathway cannot be attained through remediation, given the Site's urban setting and the ubiquity of Site COCs in the environment. However, a remedy that includes active remediation and natural recovery provides the conditions for eventually achieving protective levels within EPA's risk range of 10-4 and 10-6 and an HI of 1 for the lower 8.3 miles of the Lower Passaic River (see Section 10.1 for further discussion). For the COCs with human health PRGs, remediation goals within the risk range and at an HI equal to 1 were selected, so they are protective of human health. For mercury and Total DDx, remediation goals at an HQ equal to 1 were selected, so they are protective of the environment.

Nearly all surface sediment samples in the lower 8.3 miles have COC concentrations that exceed one or more of the PRGs, which has led to the development of remedial alternatives that address the lower 8.3 miles bank to bank (Alternatives 2 and 3, described in Section 9.2). EPA's analysis indicates that a combination of active remediation in the lower 8.3 miles and natural recovery would result in surface sediment concentrations of

dioxins/furans at or near the remediation goals based on human health PRGs in the lower 8.3-miles under these two alternatives. For the other COCs, a combination of active remediation in the lower 8.3 miles and natural recovery will be needed to achieve surface sediment concentrations in the lower 8.3 miles approaching the remediation goals based on human health PRGs, with additional actions in the Lower Passaic River above RM 8.3, in Newark Bay, and above Dundee Dam needed to reduce recontamination from incoming COCs and maintain the lower surface sediment concentrations achieved by the lower 8.3-mile remediation. For dioxins and PCBs, it is unlikely that the ecological PRGs could be met under any of the alternatives, even with natural recovery processes.

EPA Selected Remedy

The following information was copied directly from EPA's website for the Diamond Alkali Superfund Site noted above.

> The RI/FFS and a Proposed Plan describing EPA's preferred alternative for remediating the sediment of the lower 8.3 miles were released for public comment in April 2014. During a four-month public comment period, hundreds of comments were received. EPA carefully considered the comments and took them into account in developing the Record of Decision that was issued on March 4, 2016.
>
> The selected remedy for the sediment of the lower 8.3 miles includes an engineered cap that will be installed in the lower 8.3 miles, bank to bank. Before installation of the cap, approximately 3.5 million cubic yards of contaminated sediment will be dredged from the lower 8.3 miles, so that the cap does not make flooding worse and to accommodate continued commercial navigation in the 1.7 miles of the river closest to Newark Bay. The dredged materials will be barged to a sediment processing facility on the banks of the Passaic River or Newark Bay, dewatered and transported off-site to permitted facilities for disposal. The estimated cost of the remedy is $1.38 billion. In September 2016, EPA and OCC signed a legal agreement for OCC to perform the design of the lower 8.3-mile remedy, under EPA oversight. The design is underway.
>
> The website states that EPA approved the CPG's Baseline Human Health Risk Assessment and Baseline Ecological Risk Assessment (BERA) for the LPRSA, including a BERA for the discrete upper 9-mile reach, in July 2017 and June 2019, respectively. The final RI Report was submitted by the CPG in July 2019 and has been conditionally approved by EPA pending approval of the bioaccumulation model. The bioaccumulation model is an appendix to the RI that is still under development; the model is expected to be finalized and peer reviewed by approximately fall 2021.
>
> The website notes that in July 2017, the CPG proposed moving away from the original schedule for a final ROD for the LPRSA, or upper 9 miles, and instead evaluating an interim remedy for source control. This would take advantage of cost efficiencies available if work can be undertaken in the upper 9 miles while the infrastructure constructed for the lower 8.3 remedy is in place, as well as reduce the disruption in the river and to the many communities along the river. Such an interim remedy would further incorporate an adaptive management approach into the site cleanup and would be integrated with the remedial action currently being designed for the lower 8.3 miles. EPA expects that an interim remedy that includes the cleanup of areas with elevated concentrations of contaminants (e.g. dioxins and PCBs) could result in expedited recovery of the river. An interim remedy for the upper nine miles, if selected, would

not alter the previously selected cleanup for the lower 8.3 miles of the river. EPA projects that an interim remedy for source control that is initiated in late 2021 will be followed by some years of post-remedy monitoring, development of risk-based remedial goals and conclude in a final ROD. In August 2019, the CPG submitted a draft FS for a possible interim remedy which is currently under EPA review.

4. CONDUCT OF THE ALLOCATION

The Allocation was conducted in furtherance of the Revised Work Plan for the Allocation (denoted as Task Order #096 under Contract EP-W-14-020) (Attachment E) and in compliance with governing documents developed by the Allocator in coordination with and adopted by the Participating Allocation Parties (PAPs) and EPA, including the OU2 Allocation Confidentiality Agreement between and among the PAPs, Allocation Team and EPA (Attachment F), the Diamond Alkali Superfund Site OU2 Allocation Guide (Allocation Guide) (Attachment G), and the Diamond Alkali Superfund Site OU2 Allocation Protocol (Allocation Protocol) (Attachment H), as modified in part by the Allocator based on an evaluation of the unique Site circumstances and available information during conduct of the allocation as explained herein. The process, standards, and procedures used for conduct of the allocation were established consistent with judicial precedent and customary allocation practice, including analysis of site-specific circumstances and application of appropriate equitable factors, including the nexus between the waste contribution of each Allocation Party's and the scope of remedial requirements, the relative degree of toxicity of contributed wastes, and the equitable distribution of orphan shares. However, the Allocator assumes the knowledge of the reader regarding such legal precedents and, therefore, does not include citations to them herein. The Allocation was sponsored by EPA, as set forth in, among other things; EPA's letters to the Allocation Parties dated September 18, 2017, November 28, 2017, January 5, 2018, February 16, 2018, February 23, 2018, and May 1, 2018 (Attachment A).

Of the eighty-four (84) Allocation Parties originally designated by EPA for participation in the allocation, seventy-four (74) parties decided to participate in the allocation pursuant to the provisions of the governing documents noted above, herein referred to as the Participating Allocation Parties (PAPs). Subsequently, five (5) of the PAPs were removed from consideration by the allocation through settlements reached with EPA that resolved their liability regarding the Site. A listing of the PAPs is included as Attachment I. The allocation assigns an allocated equitable share of responsibility for all Allocation Parties (including non-participating parties), with the exception of the five (5) parties that have settled with EPA.

The Allocation was conducted as an alternative dispute resolution (ADR) process pursuant to the provisions of the ADR Act of 1996, 5 USC 571, et seq., and relevant state authorities. Information used for conduct of the allocation was contained in documents provided by EPA and the PAPs. Each received document was assigned a reference code which includes a numerical sequence preceded by "PAS", if received from EPA, and "PAP" if received from a PAP. All received documents, submissions from the PAPs, and information produced by the Allocator were held in an ADR confidential, limited-access document repository during conduct of the allocation. Information obtained from available documents and information received from the PAPs were organized into facility-specific Allocation Party Facility Data Reports prepared by the Allocator and reviewed by the PAPs, included in Attachment J. The determination of allocated shares was computed utilizing a custom software program created by the Allocation Team specifically for the allocation. A spreadsheet summarizing the outputs and operations of the allocation computations is included as Attachment K. The determination of an allocation share for each Allocation Party was made through an analysis of an Allocation Party's contribution of each COC to OU2 sediments, as weighted by the

relative risk each COC poses to human health and the environment, and other relevant equitable factors. The EPA identified COCs included dioxin/furans, PCBs, copper, mercury, lead, DDT, dieldrin and PAHs (Attachment D).

The intent of the allocation process is to produce a numerical ranking of the relative responsibility of the Allocation Parties with a sufficient numerical significance to provide a basis for informed settlement decisions among and between the Allocation Parties and EPA. The following is an outline and explanation of the methodology that was followed by the Allocation Team in conducting the cost allocation regarding OU2.

The unique circumstances and facts presented by the Site, in light of judicial precedents regarding similar sites, make it difficult to determine the appropriate approach for determining allocation shares in this situation. In particular, the extreme differential in risk created by the release of one of the COCs, dioxin/furans, almost exclusively by one of the Allocation Parties, OCC, in relation to that of the other COCs and Allocation Parties could be considered to raise an equitable issue not fully considered by prior legal determinations or allocation practice. When the Allocator believes that this unique situation affects determinations regarding conduct of the Allocation as noted below, he provides suggestions for addressing potential concerns for the consideration of EPA and the Allocation Parties during their Phase 2 settlement deliberations.

Description of Allocation Methodology

The following steps were undertaken in order to conduct the allocation:

Step 1: Establish Allocation Party Facility COC Total Pathway CMass

For each AP facility, the total mass of each COC that was historically discharged by and reached OU2 sediments (Facility COC Total Pathway CMass), was determined following the procedures below.

Substep 1.a. – The mass of each COC that reached OU2 sediments was determined through the analysis of four discharge pathways from facilities to OU2, as described below.

The total mass of each COC contributed by an Allocation Party to OU2 sediments was determined by evaluating the flow of COCs from the facility to OU2 sediments via each of four pathways:

- Discharge via connection to a sewer system prior to the establishment of the Passaic Valley Sewer Commission (PVSC) (PrePVSC);
- Discharge via connection to the PVSC sewer system (PVSC);
- Direct discharge via a pipe or other discrete conveyance to a water body with a hydraulic connection to OU2 (DD); or
- Overland fate and transport from the facility to a surface water body with a hydraulic connection to OU2 (OFT).

For each of the four pathways, the mass of each COC that flowed/flows to OU2 sediments from an Allocation Party's facility via that pathway (Pathway CMass) was determined as the product of the mass of the COC discharged from the facility via that pathway (Pathway D_{Mass}) and the percentage of the Pathway DMass that was determined to have reached the OU2 sediments (Pathway C%) via each pathway, as shown below.

$$PrePVSC_{CMass} = PrePVSC_{DMass} \text{ x } PrePVSC_{C\%}$$

$$PVSC_{CMass} = PVSC_{DMass} \text{ x } PVSC_{C\%}$$

$$DD_{CMass} = DD_{DMass} \text{ x } DD_{C\%}$$

$$OFT_{CMass} = OFT_{DMass} \text{ x } OFT_{C\%}$$

Substep 1.b. – Pursuant to the methodology and considerations established in the Allocation Protocol, DMass was determined for the mass of COC discharged by a facility via each of the four pathways $PrePVSC_{DMass}$, $PVSC_{DMass}$, DD_{DMass} and OFT_{DMass} using the following procedures.

1. For the **PrePVSC, PVSC, and DD** pathways, as noted above, the pathway specific DMass ($PrePVSC_{DMass}$, $PVSC_{DMass}$ and DD_{DMass}) were determined as the product of the volume of effluent discharged from a facility via a pathway over the operational life of the facility and the concentration of each COC in the discharged effluent.

   Pathway DMass = (Years of facility operations x Annual volume of facility discharge via pathway) x Concentration of COC in facility effluent

   The required operational life of the facility, annual volume of effluent discharged from a facility via each pathway, and concentration of each COC in the discharged effluent were identified based on the following available information or data assumptions made pursuant to the Allocation Protocol:

   i. The facility's length of operation based on the year operations started and the year operations ceased, except for the COC PCBs for which only the years of operation after 1930 were utilized.
   ii. The hours of operation per day (based on number of shifts), the number of days per week the facility operated, and number of days per year the facility operated.
   iii. The number and types of pathways of discharge from the facility and the years that each conveyance operated.
   iv. The flow rates of wastewater (process, sanitary or other) via each discharge pathway
   v. Calculations for the gallons per year of flow via each pathway
   vi. Where multiple flowrates via a pathway were found in data documents, an average of those flowrates were utilized
   vii. The concentration of COCs in wastewater (process, sanitary or other) discharged via each pathway; where multiple concentrations of a COC in wastewater were found in the data documents, an average of those concentrations was calculated

   In many cases, data provided by the Allocation Party(ies) did not provide information on Polycyclic Aromatic Hydrocarbons (PAHs) in the discharge waste streams. However, information and data were generally available for effluent parameters such as Total Organic Carbon (TOC) and/or Oil & Grease. In order to estimate High Molecular Weight and Low Molecular Weight PAHs (HPAH and LPAH) the following assumptions were made for the purposes of the allocation when a general PAH, TOC or Oil & Grease concentration data were provided.

- General PAH concentration contains 60% HPAH and 40% LPAH
- Oil & Grease concentration contains 10% PAHs
- Oil & Grease comprises 2.5% of TOC concentration

Information regarding the determination of DMass for the PrePVSC, PVSC, and DD pathways for specific Allocation Party facilities are included in the individual Facility Data Computation Spreadsheets in Attachment L.

2. For the **OFT pathway**, as noted above, the pathway specific DMass (OFT DMass) was determined for each facility COC as the product of the volume of contaminated media discharged from a facility via overland flow over the operational life of the facility and the concentration of each COC in the discharged contaminated media.

OFT DMass = (Years of facility operations x Estimated annual volume of contaminated media discharged via overland flow) x Concentration of COC in discharged contaminated media

The operational life of the facility, annual volume of contaminated media discharged from a facility via overland flow, and concentration of each COC in the discharged contaminated media were identified based on the following available information or data assumptions made pursuant to the Allocation Protocol:

i. Estimation of the amount of bare soil based on historic aerial photographs, site maps or text describing the percentage of buildings, structures, and pavement, in a site-specific report.
ii. Determination of the facility length of operation/ownership based on the year operations/ ownership started and the year operations/ownership ceased. For PCBs, the period was adjusted to begin in 1930 if site operations/ownership occurred before 1930.
iii. Estimation of soil density was made based on site-specific soil descriptions.
iv. 0.1 millimeter per year of soil erosion from onsite disturbances was assumed.
    Note: Several PAPs recommended that an annual soil erosion of 0.03 mm/yr be considered. However, though 0.03 mm/yr is on the low end of what could be justified as an acceptable range of soil erosion rates, the Allocation Team determined that the rate of 0.1 mm/yr is appropriate for purposes of the allocation based on analysis of USDA data for lands with a combination of unvegetated and vegetated soils.
v. Determination of the appropriate concentration of each COC was made using data in available documents on concentrations in surface soil, shallow soil, or deeper soil as deemed appropriate if shallow data was unavailable as follows:
    1. For HPAHs, the benzo(a)pyrene equivalent concentration using the seven carcinogenic PAHs was calculated
    2. For LPAHs, detected concentrations were totaled
    3. For PCBs, total PCB concentrations were used
    4. For DDx, total DDx concentrations were used

        Note: The appropriate concentration for calculation of the mass of a COC was determined on a facility-specific basis dependent on the level of sampling data available. Several PAPs suggested that this be calculated based on an averaging of sampling data, however, the wide variation in sampling data available for each of the facility sites

made this approach inequitable. Instead, the Allocation Team selected a single data point for each facility site that was determined to most appropriately represent the level of COC contamination.

vi. For sites located completely on historic fill as determined by the allocation team, soil concentrations were utilized if the selected concentration (mg/kg) of copper, lead, or mercury exceeded the concentrations 1,200 mg/kg, 10,000 mg/kg, or 3.7 mg/kg, respectively, determined from NJDEP-approved historic fill numbers from local sites not included in this allocation, for purposes of the allocation. If a site was partially located or not located on historic fill, the highest, shallowest soil concentration was used, regardless of where it was collected. Maps denoting the location of historic fill on the Allocation Party facility sites, based on mapping conducted and published by NJDEP, is included in Attachment C.

NOTE: NJDEP policy determinations establish that parties are not liable for uneroded or undisturbed contamination existing in historic fill on their property. The maximum concentrations used for purposes of the allocation noted above were selected to establish equitable treatment between those facility properties containing historic fill and those without historic fill.

vii. OFT DMass was not calculated for thirty-five (35) Allocation Party facility sites where available information indicated an extremely low probability that any discharge would reach OU2 sediments due to, among other reasons, location in another watershed or above the Dundee Dam.

viii. For facility sites that caused contamination of an adjacent AP facility property, separate OFTMass calculations were performed to determine the impact on the adjacent property which were then associated with the source facility

ix. Unique calculations were done for other pathways (e.g., large volume releases of products or wastes, lagoons that overflowed, areas where holes were eroded by firehose discharge or by other means, and explosions and resulting airborne dispersion).

x. For owners of sites that had multiple owners, where there was no data for the earlier period of occupancy, data collected for later site owners/operators were used to estimate OFTMass.

xi. Where information was not available from provided documentation, assumptions and estimates were made based on an examination of historic aerial photos and site maps, analytical data collected from the site under a later owner/operator, and limited internet research.

Information regarding the determination of OFT DMass, or the lack of an OFT pathway, for specific Allocation Party facilities is included in the Facility Data Computation Sheets in Attachment L.

Substep 1.c. – Pursuant to the methodology and considerations established in the Allocation Protocol for each pathway, the percentage of discharged mass of each COC that reached OU2 sediments (Pathway COC C%) was determined following the procedures below.

1. **PrePVSC C% and DD C%** - For purposes of the allocation, it is assumed that 100% of COCs discharged via the PrePVSC and DD pathways reached OU2 sediments. As noted above, discharge via connection to a pre-PVSC sewer system would result in the discharge of contaminants to the Passaic River without treatment or loss of mass.

Likewise, direct discharge via a pipe or other discrete conveyance would result in the discharge of contaminants without treatment or loss of mass. Therefore, the $PrePVSC_{C\%}$ and $DD_{C\%}$ both equal 100%.

2. **OFT C% -** For purposes of the allocation, it is assumed that there was sufficient heavy rainfall during periodic tropical storms or hurricanes to transport eroded and disturbed contaminated soil deposited in a ditch, stream, or tributary near a facility from the sediment surface to the Passaic River and OU2 (i.e., multiple tropical storms and hurricanes occurred each decade). Recontamination from flood waters was not considered, although floods likely resulted in deposition of contaminated sediment. Therefore, the $OFT_{C\%}$ equals 100%.

3. **PVSC C% -** As noted in Attachment M and illustrative maps included in Attachment C, the PVSC sewer collection system included a series of CSO valves and Bypass valves to allow for the release of untreated sewerage from the system as needed to prevent overloading of the system and POTW during rain events. This resulted in a percentage of all sewerage passing through the sewer system during rain events to be discharged to the Passaic River. For purposes of the allocation, unless otherwise indicated, it is assumed that any Allocation Party facility served by the PVSC sewer collection area disposed of wastes via connection to the sewer system beginning in 1924.

   A facility specific PVSC C% was calculated for each Allocation Party facility. The facility specific PVSC C% was determined as the sum of the individual CSO C% and bypass valve C% through which a facility's waste passed on its way to the PVSC POTW for treatment and ultimate discharge.

   Facility PVSC C% = facility relevant CSO C% + facility relevant Bypass C%

   Information regarding the determination of the PVSC C% for specific Allocation Party facilities is included in the Facility Data Computation Sheets in Attachment L.

   a. Calculation of CSO C%.

   C% for each CSO was determined as the product of the percentage of total time of CSO overflow and percentage of volume in sewer line lost during CSO overflow

   $$CSO\ C\% = \frac{Total\ period\ of\ CSO\ overflow}{Total\ period\ of\ system\ observation} \times CSO\ Overflow\ \%$$

   All data for CSO C% calculations were taken from the Killiam Report (Report Upon Overflow Analysis to Passaic Valley Sewerage Commissioners, Passaic River Overflows, Newark Area, PAP-00091710), except as noted below.

   - Worthington CSO - No metering was performed at this location for the Killiam Report. CSO C% was calculated by the median of the sum of all CSOs in the Harrison municipality
   - Delavan CSO - No metering was performed at this location for the Killiam Report. CSO C% was calculated as the median of the sum of all CSOs in the Newark municipality

Information regarding the determination of CSO C% for each CSO valve is included in Attachment N.

b. Calculation of Bypass C%

C% for each Bypass valve was determined as the product of the percentage of total time of Bypass operation and percentage of volume in sewer line lost during Bypass valve operation (100%).

$$\textit{Bypass C\%} = \frac{\textit{Total period of Bypass operation}}{\textit{Total period of system observation}} \; X \; 100\,\%$$

All data for Bypass C% calculations were taken from Exhibit 2-4 Documented PVSC Bypasses in the May 2020 Koch Report (Koch Report) (PAP-00488395) included as Attachment O.

- The Koch Report included data drawn from observations of system operations for the periods October 1950 - December 1962 and October 1974 - September 1975.
- For purposes of the allocation, CSO C% and Bypass C% calculated using this data was applied to all time periods of Allocation Party facility operations.
- Gail Koch reports that 100% of the flow volume in a sewer line on which a Bypass valve is located is discharged during operation of the Bypass valve.
- An evaluation of data in the Koch Report resulted in identification of the following discrepancies in the Report which were corrected for purposes of the allocation, as noted below for certain Bypass locations.

  Union

  - 1952-1962 several entries were added; either missed or entered in wrong outlet.

  Verona

  - 1950-1962 – Changes made to elapsed time included: Start Bypass to River date 5/12/1952 in Koch Report changed to 5/11/1952 (PAP-00456138); 11/24/1959 to 11/25/1959 (PAP-00456201) entry moved to Union tab.

  4th Street

  - 1950-1962 – Changes made to elapsed time include: Entry for 2/11/1951 to 2/15/1951 was missed (PAP-00456088) and entry for 5/7/1952 to 5/8/1952 (PAP-00456140) was missed in Koch Report.

  Polk

  - 1950-1962 - Changes made to elapsed time include: Entry 4/23/1952 to 4/24/1952 (PAP-00456142) was missed in Koch Report.
  - 1974-1975 - Changes made to elapsed time include: Start bypass to river time was changed from 14:00 to 16:00 (PAP-00456740) incorrectly enter in Koch Report.

  Yantacaw

  - 1950-1962 - Changes made to elapsed time include: Entry 2/7/1951 start bypass time incorrectly enter in Gail Koch report. Entry for 10/1/1958 was

moved to Union tab; and entry for 10/15/1959 end bypass incorrectly enter in Koch Report.

Information regarding the determination of Bypass C% for each Bypass valve is included in Attachment P.

Substep 1.d. – For each pathway, the mass of each COC that reached OU2 sediments via the pathway (Pathway COC CMass) was determined by multiplying the Pathway COC DMass by the Pathway COC C%

A pathway specific CMass for each COC was determined for each pathway as the product of the pathway specific DMass and pathway specific C%

PrePVSC CMass

$$PrePVSC_{\%} = \frac{Years\ prior\ to\ PVSC}{Total\ operational\ years}$$

$$PrePVSC_{DMASS} = POTW_{MASS} \times PrePVSC_{\%}$$

$$PrePVSC_{CMASS} = PrePVSC_{DMASS} \times PrePVSC_{C\%}$$

PVSC CMass

$$PVSC_{\%} = \frac{PVSC\ years}{Total\ operational\ years}$$

$$PVSC_{DMASS} = POTW_{MASS} \times PVSC_{\%}$$

$$PVSC_{C\%} = \sum_{0}^{n} (n_{Time\%} \times n_{Flow\%})$$

$$PVSC_{CMASS} = PVSC_{DMASS} \times PVSC_{C\%}$$

DD CMass

$$DD_{CMASS} = (DD_{DMASS} \times DD_{C\%})$$

OFT CMass

$$OFT_{CMASS} = (OFT_{DMASS} \times OFT_{C\%})$$

Note: The computation of $COC\ C_{Mass}$ has been expanded from what is noted in the Allocation Protocol. As originally proposed in the Allocation Protocol, COC C% was a single value, without reference to the different pathways of COC transport to OU2 sediments. However, during conduct of the allocation, the Allocator determined that the probability of a COCs fate and transport differs depending on the pathway via which it reached OU2 sediments. To account for

this reality, we established a C% for each of the four potential specific pathways (Pathway COC C%) to provide an accurate computation of COC CMass.

Substep 1.e. – For each facility, the total mass of each COC that was discharged by and reached OU2 sediments via all pathways (Facility COC Total Pathway CMass) were determined by summing the 4 Pathway COC CMass values determined for that facility

$$COC\ Total\ PC_{Mass} = PrePVSC_{CMass} + PVSC_{CMASS} + DD_{CMASS} + OFT_{CMASS}$$

The Allocator also considered the following issues in determining an appropriate Facility COC Total PCMass for the COCs discharged from each of the Allocation Party facilities.

Statutory Defenses - A number of PAPs propose that their share of responsibility for any contribution of contamination of OU2 should be lessened or eliminated due to alleged legal defenses associated with their operation of an allocation facility. In particular, parties allege that exercise of the federally permitted releases exception and petroleum exclusion pursuant to CERCLA should limit their responsibility. For purposes of the allocation, the Allocator determines that neither of these provisions exclude or limit the assigned responsivities of Allocation Parties for certain contamination of OU2.

Federally Permitted Releases – CERCLA §107(j), 42 U.S.C. §9601(10(A) provides that "recovery by any person … for response costs or damages resulting from a federally permitted release shall be pursuant to existing law in lieu of this section." In other words, "damages caused by a 'federally permitted release' must be recovered under other statutes, not CERCLA." Idaho v. Hanna Mining Co., 699 F. Supp. 827, 831 (D. Idaho 1987). The term "federally permitted release" includes "discharges in compliance with a permit under section 402 of the Federal Water Pollution Control Act and the introduction of any pollutant into a publicly owned treatment works when such pollutant is specified in and in compliance with applicable pretreatment standards of section 1317(b) or (c) of Title 33 and enforceable requirements in a pretreatment program submitted by a State or municipality for Federal approval under section 1342 of Title 33. 42 U.S.C. § 9601(10)(A).

By the nature of the releases to the Passaic River from the PVSC sewer system, it is the opinion of the Allocator that this statutory provision has a limited application to the determination of an Allocation Party's equitable responsibility for contamination of OU2. Specifically, for purposes of the allocation, the statutory exclusion will only apply to the extent that a COC, for which a permit limit is specified in a CWA §402 or applicable pretreatment permit, was discharged in full compliance with such permit following treatment at the PVSC POTW as anticipated by the permitting authority. Therefore, the discharge of COCs from the PVSC collection system, prior to final treatment at the PVSC POTW, via CSO and Bypass valves, and discharges of COCs for which discharge limitations were not established by applicable permits, will be accounted for in the calculation of an Allocation Party's facility CMass.

Petroleum Exclusion – The term "hazardous substances" is defined in CERCLA §101(14) to exclude "petroleum, including crude oil or any fraction thereof", unless specifically listed or designated under CERCLA. Caselaw has clarified

that substances that are naturally a component of petroleum or added during the refining of petroleum products are also excluded from CERCLA authority. How to apply the petroleum exclusion to the liability of PRPs for remediation of contaminated property has been a source of much confusion and debate--even more so in the field of hazardous waste allocation where the goal is to ensure that entities that contributed to a risk to human health and the environment equitably share the responsibility for its remediation. It is the opinion of the Allocator for purposes of the allocation that the petroleum exclusion should not be considered to limit the responsibility of Allocation Parties for the release of PAHs that contribute to the contamination of OU2. Though Allocation Parties may have utilized or stored petroleum subject to the exclusion in facility operations, insufficient evidence was provided during the allocation to establish that the contaminants spilled or released to facility soils was unadulterated petroleum product or that such product did not become contaminated by hazardous substances in facility soils and surfaces prior to their release from the facility property.

Third-Party Actions - A number of PAPs propose that their share of responsibility should be lessened or eliminated due to the alleged intervention of third parties in the creation of contamination on an allocation facility. Examples of third-party actions ranged from contamination by prior property owner/operators and illegal trespassers to movement of contamination from adjacent properties. As explained in the Facility Data Computation Sheets in Attachment L, each of these allegations was evaluated and appropriate adjustments made to the assigned responsibility of the Allocation Party.

Legal Defenses - A number of PAPs propose that their share of responsibility should be lessened or eliminated due to alleged legal defenses associated with their ownership of an allocation facility or an alleged release from liability associated with a facility. As specified in the Allocation Protocol, Step 2.d.9., the Allocator reviewed such allegations, upon the request of an Allocation Party, to determine whether the DMass of COCs discharged or released by the Allocation Party should be reduced due to the probability that the Allocation Party would prevail in the assertion of a legal defense to its liability for such discharges or releases of COCs from its facility. Where such requests were made, the determination of the Allocator is included with the Facility Data Computation Sheets (Attachment L) for the requesting facility.

Determination of Lessor Liability – One of the Allocation Parties, Foundry Street Complex, is noted by EPA as an Allocation Party solely due to their status as an owner of property that was leased to other Allocation Parties, Sequa Corporation, Sun Chemical, and Automatic Electro Plating, which operated various facilities on its property that contributed to the contamination of OU2. Several other Allocation Parties had a dual status as owner/operator that leased to other entities that operated facilities on their property, however, inadequate information was made available to determine whether such operator entities' operations contributed to the OU2 contamination. It is the opinion of the Allocator that an owner/lessor and operator/ lessee should share the equitable responsibility for contamination caused by the lessees' operations and activities conducted on the lessor's property pursuant to the lease. Therefore, for purposes of the allocation, the equitable responsibility for ownership and releases due to the lessee's operations have been allocated at the ratio of 25% and 75%, respectively.

Step 2: Establish Allocation Party Facility COC CMass

For each AP facility, the total mass of each COC in OU2 sediments that is assigned as the responsibility of the facility's Allocation Party (Facility COC CMass) was determined following the procedures below.

Note: As indicated in the Allocation Protocol, the intent of the determination of a Facility COC CMass and the subsequent determination of the relative contribution of a COC discharged by a facility to the mass of the COC remaining in OU2 sediments (Facility COC RC) is to incorporate into the allocation process a method of appropriately accounting for both a facility's responsibility for its direct contribution to contamination of OU2 sediment and its responsibility, pursuant to CERCLA's joint and several liability, to equitably share responsibility for the contamination of OU2 sediments by PRPs other than the Allocation Parties (Orphan Parties).

In accord with judicial precedent and traditional allocation practice as applied to typical hazardous waste sites, the Allocation Protocol provided for the calculation of each facility COC RC as the quotient of the facility's COC CMass, defined as the percentage of each COC discharged from a facility that remains in the OU2 sediments, and the corresponding COC TMass determined by EPA. This traditional computation results in a pro rata redistribution among the Allocation Parties of the responsibility for risks created by the contributions of Orphan Parties to the contamination of OU2 sediments (the orphan share). The methodology for computation of a facility's COC CMass using the traditional orphan share redistribution method is indicated by Substeps 2.a and 2.b below.

Following conduct of the allocation, however, the Allocator notes that it could be argued that this traditional methodology for redistribution of the orphan share, though accurate, may be too simplistic to account for the complexities of facts and circumstances inherent in the current matter, thereby, potentially creating an inequitable outcome and hampering future settlement efforts. This traditional method, in redistributing responsibility on a pro rata basis, assigns responsibility to each Allocation Party in accord with their overall share of contribution to the risks being addressed in OU2 from all the COCs. This results in Allocation Parties with the largest overall share of relative responsibility for the creation of risks by the Allocation Parties being assigned the same share of the risks attributable to the contributions of any Orphan Parties. As applied to the unique circumstances of the current matter, however, this traditional approach results in the potentially inequitable result of one Allocation Party which has a high relative responsibility for the creation of risks by the Allocation Parties, due almost exclusively to the fact that it contributed close to 100% of the COC dioxin/furans, being assigned responsibility for the same share of the risks attributable to the contributions of any Orphan Parties even though no dioxin/furans were contributed by the Orphan Parties.

Based on these considerations, should EPA and the Allocation Parties wish to explore an alternative method for redistribution of the risks attributable to the contributions of any Orphan Parties, the addition of Substeps 2.c and 2.d, in italic below, should be considered. The addition of these steps into the computation of COC CMass shifts the reassignment of the orphan share to each Allocation Party

in accord with their share of contribution of each COC and their related risks individually, a methodology that has its own potential for inequity. This approach results in those Allocation Parties that contributed a particular COC being assigned responsibility for the totality of the risks attributable to the contributions of that COC by any Orphan Parties. As applied to the unique circumstances of the current matter, this alternative approach results in the potentially inequitable result of a higher overall share of responsibility, for a remedy primarily driven by risks associated with the presence of dioxin/furans, being assigned to Allocation Parties that constitute a relatively small number of parties that contributed a lower risk COC.

An accounting of Allocation Shares calculated utilizing both the traditional approach for redistribution of any orphan share as specified in the Allocation Protocol and the potential alternative approach is included in Attachment Q. The impact on the relative shares of Allocation Parties and potential inequities of the use of the different approaches is evident in the provided information.

Substep 2.a. - Determine the percentage of attenuation of all COCs that remained in OU2 sediments following the actions of natural processes and human activities that diminished their mass from when they may have originally reached OU2 sediments (A%).

Due to the variety of COCs, mix of natural forces and human activities affecting the movement of sediments, and varying periods over which COCs were placed in OU2 sediments, the determination of an appropriate A% for a matter such as this is typically problematic. Such forces and activities include the daily tidal flow in the Lower Passaic River, the effects of storms, flooding, and other hydraulic events on the movement of sediments, and the dredging and removal of sediments for navigation of commercial vessels and other reasons.

Fortunately, EPA has provided the parameters to allow a justifiable estimate to be determined. EPA established in the 2014 Remedial Investigation Report and 2016 Record of Decision that resuspension of historically contaminated OU2 sediments is the predominant contributor to COC concentrations driving the need for the required remedial actions, and that other sources are not significant contributors of contamination for most risk drivers to the OU2 sediments. The EPA analysis also established that all of the COCs tend to bind tightly to fine-grained sediment particles in the Lower Passaic River and are transported in the sediment load in a similar way. The Allocator's analysis of allocation documents determined that OCC contributed the vast majority (99.997%) of the total mass of dioxin/furans contributed by all AP facilities (D/F COC TCMass). Knowing both that close to 100% of dioxin/furans in OU2 sediments was historically contributed by OCC and that there are no other significant sources of dioxin/furans but OU2 sediments, allows the percentage of each COC that reached and remains in OU2 sediments (A%) to be accurately estimated as the quotient of the total mass of the COC determined by EPA to remain in OU2 sediments (D/F COC TMass) and the total mass of dioxin/furan determined to be historically contributed to OU2 sediments (D/F COC TCMass).

$$A\% = \frac{\frac{D}{F}\ COC\ T_{MASS}}{\frac{D}{F}\ COC\ TC_{MASS}} = \frac{38_{kg}}{3764.0051_{kg}} = 0.0100956$$

The total mass of each COC present in OU2 sediments (COC Tmass) was determined by EPA through an analysis based on 1990-2012 data sets and statistical methods presented in Data Evaluation Report No.5 (DER No 5) of the 2014 Remedial Investigation and Focused Feasibility Study Reports (USEPA, 2014), as described in "*Additional Contaminant Inventory Analysis for Lower Eight Miles of the Lower Passaic River*", April 2019 (Attachment R).

> **Note:** A few PAPs propose that the calculation of the mass of the COC copper contributed by their facility should be reduced further because the copper that they discharged to the Lower Passaic River via connection to the local sewer collection systems was discharged to the sewer system in a soluble form and, therefore, would have never been deposited to OU2 sediments. However true this may have been at the point at which the COCs were discharged to the local sewer system, the nature of the solubility of metals indicates that many conditions present in the sewer system and environment once the COCs are discharged to the Passaic River can cause metals to precipitate out of solution and become deposited into OU2 sediments. Given the likelihood of precipitation, for purposes of the allocation, the solubility of metals COCs will not be considered in determining COC CMass.

Substep 2.b. - For each COC contributed by a facility, determine the Facility COC CMass as the product of the facility's COC Total Pathway CMass and A%.

$$Facility\ COC\ CMass\ =\ COC\ Total\ Pathway\ CMass\ x\ A\%$$

Note: If utilizing the alternative approach for redistribution of any orphan share, Substep 2.b. would be restated as follows:

Substep 2.b. - *For each COC contributed by a facility, determine the Facility COC Historic CMass by multiplying the facility's COC Total Pathway CMass by the A%.*

$$Facility\ COC\ Historic\ CMass\ =\ COC\ Total\ Pathway\ CMass\ x\ A\%$$

Substep 2.c. - *For each COC CMass contributed by a facility, determine the level of responsibility of the facility for the historic contribution of the COC to OU2 sediments by PRPs other than the Allocation Parties (COC Orphan Share (OS) CMass) as the product of the Total OS Mass and the percentage of a COC contributed by the facility to OU2 sediments (Facility COC %), as explained below.*

(i) Determine the total attenuated mass of each COC historically contributed by PRPs other than the Allocation Parties that remains in OU2 sediments (Total COC OS Mass) as the difference between the mass of the COC determined by EPA to be in OU2 sediments (COC TMass) and the sum of the AP facilities' attenuated COC CMass (Total COC Historic CMass).

$$Total\ COC\ OS\ CMass\ =\ COC\ TMass - Total\ COC\ Historic\ CMass$$

(ii) For each COC CMass contributed by a facility, determine the Facility COC C% as the quotient of Facility COC CMass and the sum of the COC CMass contributed by all AP facilities

$$COC\ C\% = \frac{Facility\ COC\ Historic\ C_{MASS}}{Total\ COC\ Historic\ C_{MASS}}$$

(iii) Determine the Facility COC OS CMass as the product of the Total COC OS CMass and the Facility COC C%

$$Facility\ COC\ OS\ CMass\ =\ Total\ OS\ COC\ CMass\ x\ Facility\ COC\ C\%$$

Substep 2.d. *- For each COC CMass contributed by a facility, determine the Facility COC CMass as the sum of the Facility COC Historic CMass and the Facility COC OS CMass*

$$Facility\ COC\ CMass\ =\ COC\ Historic\ CMass + COC\ OS\ CMass$$

The Allocator determined that the following five (5) Allocation Parties have no discharge of COCs that reached OU2 sediments or, otherwise, have no nexus to COCs in OU2 sediments and, therefore, have been assigned an Allocation Share of 0%.

Automatic Electro Plating Corp. (Foundry Street Complex)
Drum Service of Newark Inc.
Everett Smith Group
Pabst Brewing Company
Sequa Corporation (Foundry Street Complex)

Step 3: Establish Allocation Party Facility COC Relative Responsibility

The Relative Responsibility of an Allocation Party Facility for each COC that reached and remained in OU2 sediments (COC RR) was determined as the quotient of the Facility Total COC CMass and the COC TMass.

$$COC_{RR} = \frac{Facility\ COC\ C_{MASS}}{COC\ T_{MASS}}$$

Note: The COC RR of a facility was titled the "COC Relative Contribution" (COC RC) in the Allocation Protocol. However, the term was changed to allow its use for both the traditional computation method and the alternative method for which it denotes the combination of the relative contribution of a COC by the facility and, if applicable, the facility's relative equitable responsibility for the orphan share of the COC contributed by PRPs other than the Allocation Parties.

Step 4: Establish Allocation Party Facility Base Scores

A Base Score was assigned to each Allocation Party facility (Facility BS) determined as the sum of the products of the COC Relative Risk Number (COC_{RRN}) and COC Relative Responsibility (COC_{RR}) for each COC discharged from the Allocation Party's facility.

Substep 4.a. – For each of the eight COCs, an individual COC Relative Risk Number (COC RRN) was assigned pursuant to the *Methodology for Determination of the Relative Risk of OU2 Contaminants of Concern for the Purpose of the Allocation*, Attachment A to the Allocation Protocol (Attachment H).

$$COC_{RRN} = \left(\frac{RRN}{\sum RRN}\right) \times 100$$

As explained in Attachment A to the Allocation Protocol, a Relative Risk Number for each COC was determined as noted above, taking into consideration the human health cancer, human health noncancer, and ecological risk/harm associated with each COC, based on risk data presented in the RI/FFS and ROD, and consistent with the conclusions presented in the RI, FFS, and ROD. The COC Relative Risk Number for each COC is listed in Attachment A to the Allocation Protocol (Attachment H).

Substep 4.b. – For each COC contributed to OU2 sediments, determine a COC specific base score (COC Base Score) by multiplying the Facility COC Relative Responsibility (COC_{RR}) by the COC Relative Risk Number (COC_{RRN})

$$COC_{BS} = COC_{RRN} \times COC_{RR}$$

Substep 4.c. – Determine the Facility Base Score (Facility BS) by summing the COC Base Scores for all COCs contributed to OU2 sediments by the facility

$$Facility_{BS} = \sum COC_{BS}$$

Step 5: Establish Adjusted Allocation Party Facility Base Scores

An Adjusted Base Score to each Allocation Party (AP ABS) was determined as the sum of the Allocation Party's Base Score and factors for culpability and cooperation established for the Allocation Party.

$$AP_{ABS} = AP_{BS} + CUF + COF$$

Substep 5.a. – As required by the Allocation Protocol, a factor representing the level of culpability evidenced by the facility was established regarding the contribution of COCs to OU2 sediments (CUF)

Establish for each Allocation Party Facility a Culpability Factor (CUF) that addresses the level to which the Allocation Party's contribution of COCs to OU2 sediments were the result of culpable conduct.

$$CUF = CUF_{\%} \times AP_{BS}$$

For purposes of the allocation, culpable conduct is described in the Allocation Protocol as referring to the release or discharge of COCs in contravention of prevailing industrial standards and practices, either (1) knowingly and with intent to skirt environmental regulatory obligations, and/or (2) with conscious awareness that the release or discharge of COCs were illegal or posed substantial risk to human health or the environment. Each Allocation Party was assigned a numerical Culpability Factor equivalent to 0% to 100% of its Base Score, escalating with the level of culpability, depending on the nature, extent and/or

impact of an Allocation Party's culpable conduct. The following scale and definition of relative culpable behavior was utilized to assign Culpability Factors to individual Allocation Party facilities.

0% Operation of facility met industrial standards of environmental conduct for era in which occurred based on available information, or there was insufficient information in available documents upon which to make a determination

5% Occasional or minor releases of COCs during facility operations or other industrial practices potentially impacting operations utilizing COCs

10% Episodic releases of COCs during facility operations or other industrial practices that indicate the potential for mishandling or release of COCs with culpable intent and/or knowledge

100% Significant sustained releases of COCs in contravention of standard industrial practices indicating knowledge of the risk and illegality of the actions and an intentional disregard of the impact on human health or the environment

> Note: A number of the PAPs propose that the differential between 100% culpability and other levels of culpability be increased to account for the extreme difference between the culpable behavior of OCC and that of any other Allocation Party. The Allocator selected the scale and definition of relative culpable behavior above in recognition of this fact, while accounting also for the wide divergence of available information regarding Allocation Party behaviors.

Information regarding the rationale for determination of Culpability Factors is included in Attachment S. Information regarding the determination of the Culpability Factor for specific Allocation Party facilities is included in the Facility Data Computation Sheets in Attachment L.

Substep 5.b. – Establish a factor representing the level of cooperation evidenced by the facility regarding remediation of OU2 contamination (COF)

Establish for each Allocation Party Facility a Cooperation Factor (COF) that indicates the level to which the Allocation Party cooperated or failed to cooperate with federal and state authorities in addressing the contamination of OU2.

$$COF = COF_{\%} \times AP_{BS}$$

For purposes of the allocation, each Allocation Party will be assigned a numerical Cooperation Factor equivalent to -20% to +20% of its Base Score, escalating with the level of cooperation. The following scale and definition of relative cooperative behavior was utilized to assign Cooperation Factors to individual Allocation Party facilities.

+20% Failure to cooperate with government efforts to remediate OU2 contamination when requested; Refusal to participate in available group action to cooperate with governmental/regulatory entities to address environmental or public harm created by own activities; Failure to participate in conduct of the allocation

+10% Failure to fully cooperate with conduct of the allocation or requests for related information

0% Compliance with actions required by governmental/regulatory entities (UAO) to address environmental or public harm created by own activities; Full participation in conduct of allocation and requests for related information

-10% Actions taken, or funding provided, in cooperation with governmental/regulatory entities (AOC/CD) to address environmental or public harm created by own activities; Participation in PRP Group action to cooperate with governmental/ regulatory entities to address environmental or public harm created by own activities

-20% Continuous provision of funding and participation in PRP Group(s) actions to cooperate with governmental/regulatory entities to address environmental or public harm created by own activities

Information regarding the rationale for determination of Cooperation Factors is included in Attachment S. Information regarding the determination of the Cooperation Factor for specific Allocation Party facilities is included in the Facility Data Computation Sheets in Attachment L.

Substep 5.c. – Determine the Facility Adjusted Base Score by increasing or decreasing the determined Facility Base Score by the sum of the Facility CUF and Facility COF

Step 6: Establish an Allocation Party Adjusted Base Score (AP ABS) for each Allocation Party

Substep 6.a. – The AP ABS was determined by summing the Facility ABSs associated with facilities for which the Allocation Party has responsibility (as applicable)

AP ABS = AP Facility #1 ABS + AP Facility #2 ABS

Step 7: Establish the Allocation Share of each Allocation Party

The Allocation Share (AS) of each Allocation Party was determined as the product of 100 and a value equal to the quotient of the Allocation Party's Adjusted Base Score and the sum of all Allocation Party Adjusted Base Scores.

$$AP_{AS} = \left(\frac{AP_{ABS}}{\sum AP_{ABS}}\right) \times 100$$

Substep 7.a. - The Adjusted Base Scores were summed for all Allocation Parties (Sum of ABSs).

Substep 7.b. - For each Allocation Party, the Allocation Party's Adjusted Base Score was divided by the Sum of ABSs and then multiplied by 100 to determine the Allocation Party's Allocation Share.

Step 8: Establish Allocation Tiers

An Allocation Tier was assigned to each Allocation Party based on a consideration of the relative relationship and natural grouping of the Allocation Parties' Allocation Shares.

Assignment of Allocation Party Shares and Tier Designations

Based on information made available to the Allocator and reasonable inferences of fact made pursuant to the Allocation Protocol, the Allocator established Allocation Share Relative Ranking assignments and Allocation Tier designations for each Allocation Party, as noted in Attachment Q.

Upon initiating the allocation process, the Allocator hoped that sufficiently consistent data would be made available regarding operations across all Allocation Party facilities to establish an accurate relative numerical relationship between the Allocation Parties in the assignment of allocation shares. Upon review and application of all available data, however, it is evident that it is impossible for the allocation process to produce a numerical ranking of the Allocation Parties that can identify with any acceptable level of certainty the relative responsibility of similarly situated parties. This is due to the lack of and variability of available data on facility operations and site conditions which required a significant level of allocation data to be inferred through reference to other data sources as detailed in the Allocation Protocol.

These data limitations have created a sufficient uncertainty in the determination of allocation shares and substantially affect the credibility of relative numerical share calculations among and between similarly ranked individual Allocation Parties, with this uncertainty increasing with the diminution in the size of equitable share determinations. In order to account for this inherent limitation on the ability to specify the relative relationship between equitable allocation shares assigned to the Allocation Parties and to ensure the credibility of the allocation, the ultimate results of the allocation, as noted in Attachment Q, presents the results of both the traditional and alternative allocation methodology in a bifurcated form. This presentation provides the numerical relationship between the share of OCC and that of the remaining PRPs and the numerical relationship among the remaining PRPs, in order to provide a clearer relative numerical ranking of the Allocation Parties.

In addition, as specified in the Allocation Protocol, the relative listing of Allocation Parties has been grouped into five numerically significant tiers which signify Allocation Parties of similar responsibility within an acceptable level of certainty. The level of uncertainty in the numerical relationship between assigned allocation shares should be considered to increase by a factor of 10 as numerical values decrease, so that the uncertainty as to the exact ranking of an Allocation Party within Tier 3 equals .1, Tier 4 equals .01, and Tier 5 equals .001. Therefore, the specific location of an Allocation Party within each tiered grouping should be considered insignificant for purposes of the allocation.

As specified in Step 2.2(c) of the Allocation Protocol and as noted in Section 4, Step 2 above, the Allocator determined that the following five (5) Allocation Parties should be assigned an Allocation Share of 0%. Therefore, they have been removed from the list of Allocation Parties in Attachment Q.

Automatic Electro Plating Corp. (Foundry Street Complex)	
Drum Service of Newark Inc.	Everett Smith Group
Pabst Brewing Company	Sequa Corporation (Foundry Street Complex)

A spreadsheet summarizing the outputs and operations of the allocation computations is included as Attachment K. Information regarding the determination of an Allocation Share Relative Ranking for specific Allocation Parties is included in the Facility Data Computation Sheets in Attachment L.

ATTACHMENTS

A. EPA'S LETTERS TO THE ALLOCATION PARTIES DATED SEPTEMBER 18, 2017, NOVEMBER 28, 2017, JANUARY 5, 2018, FEBRUARY 16, 2018, FEBRUARY 23, 2018, AND MAY 1, 2018

B. LIST OF ALLOCATION PARTIES & RELATED FACILITIES

C. FACILITY LOCATION AND PVSC SEWER SYSTEM MAPS

D. CONTAMINANTS OF CONCERN FROM THE ROD

E. REVISED WORK PLAN FOR THE ALLOCATION

F. OU2 ALLOCATION CONFIDENTIALITY AGREEMENT

G. DIAMOND ALKALI SUPERFUND SITE OU2 ALLOCATION GUIDE

H. DIAMOND ALKALI SUPERFUND SITE OU2 ALLOCATION PROTOCOL

I. LIST OF PARTICIPATING ALLOCATION PARTIES

J. ALLOCATION PARTY FACILITY DATA REPORTS

K. ALLOCATION OPERATIONS SPREADSHEET

L. FACILITY DATA COMPUTATION SHEETS

M. HISTORY OF SEWER COLLECTION AND TREATMENT IN THE PASSAIC VALLEY

N. CSO VALVE WORKSHEETS

O. MAY 2020 KOCH REPORT

P. BYPASS VALVE WORKSHEETS

Q. ALLOCATION SHARE RELATIVE RANKING AND ALLOCATION TIER DESIGNATIONS

R. ADDITIONAL CONTAMINANT INVENTORY ANALYSIS FOR LOWER EIGHT MILES OF THE LOWER PASSAIC RIVER, APRIL 2019

S. CULPABILITY & COOPERATION FACTORS WORKSHEET