ASSESSMENT OF DREDGING PRODUCTION RATES AND CONSTRUCTION DURATION ASSUMPTIONS ON EPA'S FS COST ESTIMATES

This memorandum discusses likely cost impacts associated with applying more realistic, longer sediment remediation construction durations to EPA's alternatives in Feasibility Study (FS) Sections 3 and 4. During recent senior manager discussions, Jim Woolford of EPA Headquarters requested that the LWG estimate the cost impacts associated with longer alternative construction durations. This request came about due to the LWG's expressed concerns about overly optimistic construction duration assumptions in EPA's FS.

Section 1 provides brief background on EPA and LWG construction duration estimates. Section 2 discusses the analysis of duration impacts on alternative costs as requested by Jim Woolford. Section 3 discusses the other LWG issues related to overly optimistic construction duration assumptions, given that the LWG's duration concerns are not limited to just the impact on FS costs. Finally, because construction durations are not the LWG's only concern regarding the high costs of EPA's alternatives, Section 4 compares construction duration impacts on cost to other EPA assumptions that appear to unnecessarily drive up the costs of the FS alternatives.

1 BACKGROUND ON CONSTRUCTION DURATION ESTIMATES

The LWG has consistently expressed concerns about and commented on EPA's construction duration assumptions. Attached is the LWG's January 15, 2014 memorandum to EPA providing the initial comments and concerns. These concerns include:

- **Dredging Days per Week**. EPA assumed 122 days per season during the construction window between July 1st and October 31st. That works out to 7 days per week. A more realistic assumption based on local project experience is 104 days per season, which excludes federal holidays and Sundays. Sundays are typically used for maintenance or schedule "make up" days.
- **Dredging Hours per Day**. EPA assumed 24 hours per day of dredging citing projects such as the Buffalo River, Indiana Harbor and Hudson River. The LWG common consultants and the Port of Portland have consistently indicated based on extensive local project experience with environmental and navigational dredging projects that the public will be resistant to 24/7 dredging and that 12 hours per day is a more realistic assumed work period for the FS.
- **Daily Production Rate**. EPA calculated daily production rates based on a theoretical analysis assuming certain cycle times, bucket size, percent bucket full, efficiencies, work hours per day, and assuming that three dredges work simultaneously. EPA also evaluated production rates for clamshell buckets and articulated arm dredges. EPA then supported their calculations by citing large environmental projects from around the country (see previous bullet). The 2012 draft FS presented a theoretical calculation for clamshell bucket dredges and compared the results to Portland region environmental dredging projects (which all used clamshell bucket dredges) that had similar types of disposal. LWG and EPA appear to agree that three dredges working simultaneously is a reasonable

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assumption for the FS. Expressed on a per dredge plant daily basis, EPA's analysis results in 1,300 cubic yards/12 hour day (or 2,700 cy/24 hr day) for clamshell bucket dredges and 575 cy/12 hr day (1,150 cy/24 hr day) for articulated arm dredges. EPA then assumed 55% of dredging would be conducted using cable arm dredges and 45% using articulated arm dredges, resulting in an average of 1,000 cy/12 hr day (2,000 cy/24 hr day). The 2012 draft FS analysis resulted in an overall production rate of 700 cy/12 hr day (1,400 cy/24 hr day). Because the 2012 draft FS estimates were validated using data from similar local dredging projects, the LWG believes the slower rates applied over a 12 hour day are more realistic assumptions for the FS.

- **Bottleneck at the Offloading Facility**. The total seasonal dredge rate needs to consider all elements of the dredging process including dredging, handling, offloading, processing, sediment treatment (if needed), dewater collection and treatment, transport and disposal. One of the major bottlenecks for Portland Harbor will be the offloading facility. Based on a review of existing or potentially available shoreline properties, the Port of Portland determined that very large waterfront facilities (greater than 40 to 50 acres) centrally located within Portland Harbor are not available. The 2012 draft FS included a conceptual design for an offloading facility that could process 230,000 cy/season, consistent with the above draft FS production rates. The assumed facility would need to have enough room for offloading equipment, materials handling, stockpiling, and rail. The 2012 draft FS conceptually laid out a facility approximately 20 acres in size for the assumed quantity of material (230,000 cy/season). EPA assumed an offloading facility 140 acres in size to handle the approximately 720,000 cy/season resulting from the above EPA dredge production rate estimates. EPA indicated that such a facility would avoid process bottlenecks and therefore would have no impact on construction durations. Given the size of available properties for offloading facilities, EPA's assumption of no bottlenecks appears unrealistic.

  Other likely bottlenecks besides the offloading facility that are associated with a higher production rate include multiple project coordination, vessel traffic coordination, material barge coordination, and rail/truck coordination. For example, on the Terminal 117 Duwamish waterway dredging project occasional delays were experienced due to the offloading facility unloading material from Boeing Plant 2 remediation work. This will be a common occurrence for Portland Harbor cleanup with multiple dredges working independently and using a common offloading facility. Coordinating materials barges for residual covers, backfill, and cap construction occurring at the same time as dredging will also be difficult. Both the availability of haul barges and materials will likely impact production rates. Finally, any little delay in rail or truck transport (accident, rail outage, etc.) will have a domino effect on all of the project schedules.

Taken together, EPA's FS construction duration assumptions result in highly optimistic construction durations that are approximately two to three times as fast as the construction durations for similarly sized alternatives in the 2012 draft FS.

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2 IMPACT OF DURATION ON COST

A complete determination of the impact of durations on EPA's cost estimates would require a detailed reconstruction of EPA's alternatives over a longer more realistic period. However, as with the technical aspects of EPA's FS, the document lacks the information necessary to evaluate EPA's estimation methods, much less check the accuracy of their cost estimates. Therefore, for this analysis the LWG focused on the following elements of EPA's FS cost estimate:

- **Mobilization/demobilization**. EPA's cost estimate assumed mobilization and demobilization was 1.6 percent of direct costs without contingency.
- **Project Management**. EPA's cost estimate assumed project management was 2 percent of the total direct cost and contingency.
- **Construction Management**. EPA's cost estimate assumed construction management was 3 percent of the total direct cost and contingency.
- **Offloading Facility Costs**. There are fixed costs for development of the offloading facility, but there are also yearly costs including rail gondola mobilization, property lease, labor for inspections and monitoring, and yearly monitoring reports.

This focused analysis did not attempt to adjust any of the direct capital costs outside of the offloading facility. Instead the analysis addressed the added time and costs for mobilization/ demobilization, project management and construction management associated with the longer construction durations. To quantify these added costs, the LWG evaluated the increased time caused by the difference in seasonal dredging production rates estimated, which was 230,000 cy/season for LWG and approximately 730,000 cy/season for EPA[1]. However, it appears that EPA used a smaller production rate than 730,000 cy/season, based on a comparison of the total dredge volume to the assumed dredge time presented in EPA's FS for each alternative. For instance, EPA's Alternative F appears to assume between approximately 490,000 and 650,000 cy/season of dredging, given that EPA states in Section 3.6.7 that between 4,382,540 to 5,843,380 cy will be dredged in 9 years.

The approximate ratio of 2 to 3 times the EPA durations based on the above production per season estimates was applied to the mobilization, project management, and construction management costs elements to estimate increased construction costs relative to these three cost elements. This increased cost was then added to the increased cost associated with the longer duration of operation of the offloading facility to obtain an overall added cost estimate. **This overall added cost was found to range from approximately 10 to 20 percent higher across all of EPA's alternatives as compared to EPA's estimated total capital costs.**

It is important to note that the above percent overall added costs are presented on a non-discounted cost basis (i.e., without the net present value calculation included). In a cost sensitivity analysis in Appendix G, EPA keeps all of the capital costs the same and then divides

[1] Note this seasonal production rate is not stated anywhere in EPA's FS or associated memoranda, but this is the calculated result based EPA's assumption of 2,000 cy/24 hour day/dredge plant, three dredge plants and 122 days dredging per season.

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those same costs evenly over a 50% longer or 50% shorter construction durations, which results in virtually no net change in capital costs. EPA then applies the discount value in the net present value calculation for these same expenditures over the increased and decreased periods to conclude that longer construction durations are less expensive on a net present value basis. Thus, the only changes in EPA's costs are caused by the net present value discounting assumptions, which is not a meaningful analysis of impacts of construction duration on costs. By this logic, all sediment remedies should be extended as long as possible in order to "reduce" the costs of the construction. Assessing the effect of duration on costs is better understood by evaluating non-discounted costs and evaluating how the capital costs will change over these durations as presented in the LWG's analysis above.

3 WIDER CONTEXT OF CONSTRUCTION DURATION ASSUMPTIONS

Cost is just one of many impacts on the overall FS evaluation associated with assuming optimistic shorter alternative construction durations. As discussed in the LWG's Significant Issue comments these other impacts include:

- **Short-term Impacts and Risks**. Overly optimistic shorter construction durations result in EPA understating the short term impacts and risks associated with all of EPA's alternatives. The optimistic and shorter construction durations decrease the amount of assumed short term impacts associated with:
  - Unavoidable dredge releases and associated water quality impacts and risks
  - Quality of life impacts associated with trucks, trains, and construction equipment moving through and around the surrounding neighborhoods and communities 24 hours per day
  - Quality of life impacts associated with nearshore and on-water construction activities including noise, lights, odors, and other impacts 24 hours per day
  - Worker injuries and potential deaths that are directly related to the number of hours worked as presented in the 2012 draft FS
- **Time to Achieve Remedial Action Objectives (RAOs).** EPA's FS describes the ability to estimate natural recovery and long-term outcomes of the alternatives, such as the time to achieve RAOs, as highly uncertain. Yet EPA asserts that the smaller alternatives (i.e., Alternatives B and D) will not achieve the RAOs as quickly as the larger alternatives (i.e., E, F, and G). In LWG's view, this is unsupported because EPA underestimates the duration of construction of all the alternatives. Using more realistic and longer construction durations clarifies that it is highly unlikely that the larger alternatives would be able to achieve RAOs sooner than the smaller alternatives. The LWG's Significant Issue comment 14d contains a simple analysis of the alternative construction durations that illustrates that EPA's qualitative conclusions regarding time to achieve RAOs is highly dependent on the optimistically short construction durations assumed by EPA.

As a result, EPA's overall qualitative evaluation of the alternatives overstates the overall protectiveness and effectiveness of the larger alternatives as compared to the smaller alternatives.

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EPA uses the overly optimistic construction durations to conclude that the larger alternatives will achieve RAOs more quickly and that fewer short term impacts will occur than is reasonable.

4 OTHER IMPORTANT COST FACTORS

The cost question posed by Jim Woolford links the issue of more realistic construction durations to the issue of the potentially increased costs associated with EPA's already high cost FS alternatives. Although realistic longer construction durations are estimated to range from a 10 to 20 percent increase in the cost of EPA's alternatives, construction duration is not the most important aspect of the LWG's concerns associated with EPA's FS alternative costs. Other factors that are equally or likely more important in driving up the assumed costs of EPA's alternatives include:

- Biased technology assignments, which favor generally more expensive dredging over often less expensive capping. The biases in EPA's technology assignment approach are discussed in the LWG's Significant Issue comment 1.
- The use of thermal desorption for 100% of removed Principal Threat Waste source material
- The use of Subtitle C disposal of 100% of removed Principal Threat Waste source material (even after treatment)
- Increased treatment and disposal requirements for EPA-determined PAH and DDx "highly toxic" Principal Threat Waste.
- EPA's inappropriate use and application of TPAH, DDx, and dioxin/furan Remedial Action Levels (RALs). The concerns regarding EPA's RALs are discussed in the LWG's Significant Issue comment 3.
- EPA's assumed use of sheetpile containment around the full extents of Principal Threat Waste source material, even in very deep water extending into the navigation channel
- Complete replacement of dredge volumes with clean backfill in many circumstances
- Widespread application of 5 percent activated carbon to caps and residual covers in all EPA designated Principle Threat Waste or "groundwater plume" areas
- Inclusion of riverbank soils volumes and remediation requirements in the sediments FS
- Potential additional treatment and disposal requirements related to inappropriate Resource Conservation Recovery Act (RCRA) and other hazardous waste determinations. The LWG's concerns regarding these waste determination issues are discussed in Significant Issue comment 18.

Also, as detailed in the LWG's Significant Issue comment 16, the actual costs for many of these factors are likely even higher than EPA's Appendix G cost estimates due to numerous omissions and inappropriate technical procedures in EPA's costing process. Consequently, the impact of durations on costs is likely not the LWG's primary concern regarding the underestimated high costs associated with EPA's FS alternatives.

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Attachment:

January 15, 2014 LWG Memorandum to Chip Humphrey and Kristine Koch, EPA Regarding Proposed Process for Incorporation of EPA's Dredge Production and Dredge Residual

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