DRAFT STORMWATER SOURCE CONTROL MEASURE DESIGN & IMPLEMENTATION WORK PLAN

Former Arkema Portland Facility, Portland, Oregon

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ACRONYMS AND ABBREVIATIONS

BAT	Best Available Technology
BMP	Best Management Practice
COPC	Constituent of Potential Concern
FS	Feasibility Study
FFS	Focused Feasibility Study
IRM	Interim Remedial Measure
JSCS	Joint Source Control Strategy
LSS	Legacy Site Services LLC
NPDES	National Pollutant Discharge Elimination System
DEQ	Oregon Department of Environmental Quality
O&M	Operation and Maintenance
SCM	Source Control Measure
SWC&T	Stormwater Conveyance and Treatment
SWMM	Stormwater Management Manual
USEPA	United States Environmental Protection Agency

1 INTRODUCTION

On behalf of Legacy Site Services LLC (LSS), agent for Arkema Inc., Integral Consulting Inc has prepared this *Stormwater Source Control Measures Design and Implementation Work Plan* (Work Plan) for the former Arkema Portland Plant (the site) located at 6400 NW Front Avenue, Portland, Oregon. This Work Plan is prepared pursuant to the Order on Consent requiring Source Control Measures (SCMs) and Feasibility Study (FS) issued by the Oregon Department of Environmental Quality (DEQ), signed 31 October 2008 (DEQ No. LQVC-NWR-08-04) (Consent Order).

The goal of the Stormwater SCM is to mitigate the migration of constituents of potential concern (COPCs) in stormwater (in the aqueous phase and/or with sediment) to the Willamette River. As conceptually agreed upon between LSS and DEQ, the Stormwater SCM consists of collecting site stormwater, conveying it to a stormwater detention basin, and treatment through a sand and/or sand amended with carbon filtration system (Figure 1). Section 1.1 presents more detail on the agreed upon Stormwater SCM.

The purpose of the Work Plan is to provide the rationale and scope of work to design and implement the Stormwater SCM. This Work Plan has been prepared in general accordance with the *Stormwater Interim Remedial Measures, Focused Feasibility Study Report* (FFS; Integral 2008) and a letter dated March 18, 2009 from Todd Slater, LSS, to Matt McClincy, DEQ, regarding the Stormwater Focused Feasibility Study, Arkema Portland (LSS 2009) and associated comments received from the DEQ and the United States Environmental Protection Agency (USEPA; DEQ 2008).

This work plan includes the following scope of work elements:

- Design and implementation of temporary capping, including: permitting, pre-design evaluations, pre-design package, final design package, preparation of contractor bidding documents, contractor selection, and construction;
- Design and implementation of decommissioning of the existing stormwater collection system, including: permitting, pre-design evaluations, pre-design package, final design package, preparation of contractor bidding documents, contractor selection, and construction; and
- Design and implementation of a new stormwater conveyance and treatment (SWC&T) system, including: permitting, pre-design evaluations, pre-design package, final design package, preparation of contractor bidding documents, contractor selection, and construction.

The following subsections provide the description of the FFS process to date, the objectives of this Work Plan, and the organization for the remainder of the work plan. Details regarding site history and background are presented in the FFS (Integral 2008).

1.1 BACKGROUND

A Joint Source Control Strategy (JSCS)[1] was developed by DEQ and USEPA to identify, evaluate, and control sources of contamination (that may impact the Willamette River) in a manner that is consistent with the objective and schedule for the Portland Harbor Superfund Site Remedial Investigation/Feasibility Study. The goal of the JSCS is to achieve timely upland source control to prevent the risk of significant recontamination after the Portland Harbor cleanup is completed. The JSCS recommends that upland source control be substantially completed to the greatest extent practicable before or during any early removal actions, as well as non-time critical removal actions, in order to reduce the potential for recontamination of river sediment.

Several stormwater interim remedial measures (IRMs), including soil removal, temporary capping, and best management practices (BMPs), were implemented at the Site to address stormwater between September 2000 and November 2006 (Integral 2007). Despite success of those IRMs at reducing concentrations of COPCs in stormwater, DEQ has determined that these IRMs were not capable of meeting DEQ's interpretation of JSCS source control objectives, including numerical source control objectives which are not yet defined, in the USEPA-envisioned timeframe for the Non-Time Critical Removal Action. DEQ is requiring LSS to pursue additional measures to achieve stormwater source control despite the fact that LSS has demonstrated that the stormwater currently exiting the Site through the outfalls has a negligible impact to the overall DDx load in the Willamette River (LSS 2009; Figure 2).

LSS subsequently commenced with the preparation of an FFS to evaluate alternative stormwater interim remedial measures. The FFS was submitted to DEQ on July 3, 2008, and comments on the FFS were received from DEQ on December 18, 2008 (DEQ 2008). A response to comments was provided by LSS in a letter dated March 18, 2009 (LSS 2009). In this letter, LSS proposed the following components to the Stormwater SCM:

- LSS proposed to accommodate the 25-year, 24-hour design storm of 3.9 inches for the evaluation of flows that would be controlled and treated/mitigated.
- At DEQ's request, LSS agreed to change the infiltration basin proposed in the FFS to a non-infiltrating detention basin with adequate engineering and institutional controls to prevent it from becoming an attractive nuisance to wildlife.
- LSS agreed to DEQ's suggested approach to prevent untreated point source discharges to the river by allowing limited site-wide ponding and stormwater infiltration to occur during periods when the stormwater flow exceeds the design capacity of the detention basin and treatment system.

[1] *Portland Harbor Joint Source Control Strategy prepared by the Oregon Department of Environmental Quality and the United States Environmental Protection Agency* (December 2005) (a framework for making upland source control decisions at the Portland Harbor Superfund Site).

- LSS proposed to implement several BMPs including erosion control measures of capping areas in the drainage basins to portions of Outfalls 001 and 002, sediment control measures such as bioswales, and cleaning and repairing of asphalt capped areas of the site.
- LSS proposed to conduct treatability study sampling, including particle size distribution of suspended particles within stormwater discharges as well as determining organic carbon content and DDx concentration ranges for particles size fractions to finalize the design of the stormwater treatment system such that discharges are expected to meet yet-to-be-determined National Pollutant Discharge Elimination System (NPDES) permit criteria.
- LSS proposed to conduct treatability studies to evaluate the efficacy of a treatment system designed to meet periodic flows. Treatability studies will investigate the filtration characteristics and chemical removal efficiencies utilizing different sand gradations and sand amendments under a variety of flow conditions for the design of a sand or sand amended with carbon treatment system. LSS also proposed to evaluate coagulation/flocculation as a potential addition to the treatment train if yet-to-be determined NPDES limits could not be met by filtration alone.
- LSS proposed to conduct remedial design sampling after treatability testing to address an agency request for additional stormwater concentration data.

During subsequent meetings and discussions, DEQ and LSS provisionally agreed upon the preferred technical approach to the SCM; however, the administrative process for implementing this provisional agreement (i.e., the NPDES permit renewal) became an obstacle to implementing this preferred approach. The preferred technical approach includes BMP/best available technology (BAT) installation (including selective capping, sewer abandonment, sand filtration, and carbon adsorption), operation and monitoring of the stormwater treatment system to determine system performance, and if any treatment system modifications are necessary, providing recommendations to DEQ with the objective of improving the system's ability to treat stormwater to levels approaching yet-to-be determined numerical benchmarks. The conceptual design of the proposed treatment system is provided in Figure 1.

DEQ has not been able to assure (e.g., with a compliance schedule, use of surrogate parameter) that implementing the preferred technical approach would not put Arkema at risk to third-party actions during the time the novel system was initially installed, operated, monitored, and optimized. Therefore, a full-scale treatability analysis and implementation process and schedule have been provided in Sections 5 and 6 of this work plan. If the NPDES renewal, with respect to DDx, were able to proceed with establishing benchmarks based on TSS removal as a surrogate parameter (similar to other sites), then BAT technology, as has been thoroughly discussed and agreed upon with DEQ, will be selected and implemented as a full-scale field pilot test. Under this scenario, tasks in Sections 5.2 and 5.3 would not be needed which would result in a schedule improvement of at least 15 months.

1.2 OBJECTIVES

The objectives of this Work Plan are to:

- Describe the process for design and implementation of the Stormwater SCM;
- Describe the general process for implementation, identify tasks, and specify design deliverables and a schedule for preparation; and
- Identify additional work plans and document submittals that are required.

1.3 WORK PLAN ORGANIZATION

The remainder of this Work Plan is organized as follows:

- Section 2 provides the premise for the design and implementation of the Stormwater SCM for the Site.
- Section 3 details the scope of activities to be performed as part of the design and implementation of the temporary capping component of the Stormwater SCM;
- Section 4 details the scope of activities to be performed as part of the design and implementation of the decommissioning of the existing sewer collection system component of the Stormwater SCM;
- Section 5 details the scope of activities to be performed as part of the design and implementation of the Storm Water Conveyance and Treatment (SWC&T) system component of the Stormwater SCM;
- Section 6 presents a summary of the reporting and document submittal requirements and estimated schedule;
- Section 7 presents a summary of the project team; and
- Section 8 lists references cited in this Work Plan.

2 PREMISE OF DESIGN

The premise of this stormwater SCM design is to meet DEQ's objective to minimize the release of COPCs through stormwater pathways by implementation of three distinct stormwater Best Management Practices (BMPs)[2]:

1. Erosion control measures of capping portions of the drainage basins that discharge to Outfalls 001 and 002 which historically have had the highest surface soil concentration of COPCs.

2. Eliminating potential sources of COPCs within the existing stormwater collection system by decommissioning this system.

3. Treatment of stormwater runoff from the site by the best available technology (BAT).

Stormwater at the Site is currently discharged under a National Pollution Discharge Elimination System (NPDES) permit (#100752) which is undergoing renewal. Consistent with the DEQ 2009 guidance (Section 7.1), LSS is coordinating with the Water Quality Program to implement a Stormwater SCM consistent with NPDES permitting requirements.

One key issue that affects the permitting of stormwater discharge from the site under the NPDES program is that currently the receiving water body for the stormwater discharge (the lower Willamette River) is considered impaired for the primary COPC in the site's stormwater discharge, DDT. DEQ maintains a list of reaches of various water bodies within the state of Oregon that are considered impaired because they do not meet water quality standards for certain pollutants; this list is commonly referred to as the 303(d) list[3]. DDT was added to the 303(d) list for the lower 24.8 miles of the Willamette River in 2002. Once a water body is identified as being water quality limited, Section 303(d) requires that total maximum daily loads (TMDLs) for the water body be developed. A TMDL establishes the load capacity, which is the maximum amount of pollutant a water body can assimilate without violating a water quality standard. Further, the TMDL program will establish wasteload allocations (WLAs) that identify the amount of a given pollutant that an individual source (i.e., a Site such as Arkema) with an NPDES permit is allowed to discharge to the water body within the TMDL program. Although the stream has been designated as impaired with respect to DDT, a TMDL, and thus WLAs for individual DDT sources, has not yet been developed on the lower Willamette River.

[2] DEQ's *Guidance for Evaluating the Stormwater Pathway at Upland Sites* (2009)

[3] Section 303(d) of the Clean Water Act establishes the requirements of the states to identify and establish a priority ranking for impaired waters and submit this list to the U.S. Environmental Protection Agency.

In DEQ's May 18, 2006 TMDL Priorities and Schedule document, DEQ states that DDT (and other) water quality limited parameters will be developed after the initial TMDL development of temperature, bacteria, and mercury for the lower Willamette River. No specific time table is available for the DDT TMDL development for the lower Willamette. However, a TMDL has been established for DDT on Johnson Creek which drains into the Willamette River at river mile 18.4. While a TMDL for one water body is not directly applicable or transferrable to another water body, the methodology used to evaluate and establish the DDT TMDL along Johnson Creek is directly relevant to the methodology that will be used to establish DDT WLAs on other 303(d) stream reaches, such as the lower Willamette River. Thus, a review of the Johnson Creek TMDL assists in evaluating how a DDT TMDL may be developed for the Willamette River and would affect the WLA for the stormwater discharge from the site.

For Johnson Creek, DEQ identified that a daily load of DDT, in pounds per day of TSS, was a surrogate measure for the loading capacity of the watershed. Based upon a linear regression analysis, DEQ determined that an in-stream TSS concentration of 15 mg/L was necessary to achieve the goal of protecting the 0.001 μg/l fresh water chronic DDT criterion. The linear regression was based upon 63 samples and showed a good relationship between DDT and TSS measured at in-stream sampling locations throughout Johnson Creek. DEQ did not have a suitable dataset to run statistics for DDT loading from urban stormwater; therefore, DEQ chose not to assign a separate TSS surrogate for urban stormwater, but instead expressed the WLA as a percent reduction of DDT. The non-point source load allocation was expressed as a TSS target of 15 mg/L.

The premise for this Site stormwater SCM design is to achieve reduction in annual DDT loading to the lower Willamette River from the Site by implementation of source control BMPs (erosion control and decommissioning the existing stormwater collection system) and structural treatment BMPs. Further, another premise of this stormwater SCM design is to implement the structural BMP that represents the BAT for DDT removal. While previous studies performed by others have confirmed that limited data exists for assessing structural BMP removal efficiencies for DDT, TSS reductions have typically served as a surrogate for assessing effectiveness of DDT removal from stormwater (see above). In 2005, the Oregon Association of Clean Water Agencies (ACWA) evaluated the effectiveness of the following structural BMPs to remove pollutants from stormwater discharges: Centrifugal Separator Hydrodynamic devices; Filters (Leaf/Sand/Other); Ponds, Dry Vegetated Detention Pond; Ponds, Wet Retention Basin; Swales, Vegetated Filter Strips; Wetlands, Constructed Surface Flow; Sediment Manhole (ACWA 2005). As indicated in Table 1 which summarizes the results of the evaluation, constructed wetlands followed by filters represent the BAT for TSS removal from stormwater. Because wetlands in DEQ's opinion would represent an attractive nuisance to wildlife at the Site, DEQ has directed that filters represent the BAT for TSS removal, and thus DDT reduction, that is implementable at the Site.

DEQ's 2009 guidance states that "Selection and implementation of SCMs is often an iterative process". Another aspect of the stormwater SCM design is to implement each of these BMPs in a phased approach and continue to monitor stormwater effluent concentrations to evaluate the sufficiency and the effectiveness of each component of the SCM. This methodology will also allow for the most efficient implementation of the next phase of the stormwater SCM.

EPA's regulations at 40 CFR 130.2(i) define a TMDL as the sum of WLAs plus load allocations (LAs) plus a margin of safety (MOS) to account for uncertainty between pollutant sources and resulting water quality. Therefore, the ability for the water body to achieve water quality standards will be determined by the ability of each individual discharger of the constituent causing impairment to meet their TMDL objectives. Therefore while not directly transferrable to the discharge for the Site, a review of how other permittees address DDT stormwater discharges under the Johnson Creek TMDL will assist in evaluating the efficacy of the proposed treatment system for DDT from Site stormwater discharges.

Two municipalities, the Cities of Portland and Milwaukie, Oregon[4], have submitted stormwater NPDES MS4 Permit Renewals that address the Johnson Creek TMDL. Each of these permit renewals required the establishment of benchmarks, in the form of pollutant reduction goals, in areas where TMDLs have been established. Each permittee also used the results of modeling anticipated DDT loading with and without structural BMPs to establish the benchmark pollution reduction goals. Because data did not exist for structural BMP effectiveness for DDT removal, TSS removal efficiencies were used as a surrogate. The following summarizes the results presented in each permit:

- City of Portland:
    - Estimated a 2013 mean pollutant reduction load due to structural BMP implementation of approximately 3.6×10^{-4} lbs, or approximately 4 percent.
    - Established a benchmark pollutant reduction load of 1.8×10^{-4} to 5.1×10^{-4} lbs for 2013.
    - Estimated that the annual mean DDT load may not meet the calculated TMDL WLA by 2013.
    - Estimated that natural attenuation of DDT is by itself expected to reduce the total DDT concentration to below the water quality standard by 2024[5].

[4] The City of Portland's MS4 permit renewal submittal was reviewed at http://www.portlandonline.com/BES/index.cfm?a=246007&c=37485 the City of Milwaukie's permit renewal submittal was reviewed at http://www.cityofmilwaukie.org/news/2008/NPDES.html.
[5] Utilized the US Geological Survey (Scientific Investigation Report 2004-5061) estimate for total DDT half-life of about 10 years for natural attenuation.

- City of Milwaukie
    - Estimated a 2013 mean pollutant reduction load due to structural BMP implementation of approximately 1.2×10^{-4} lbs.
    - Established a benchmark pollutant reduction load of 5.7×10^{-4} to 1.9×10^{-3} lbs for 2013.
    - Estimated that the annual mean DDT load may not meet the calculated TMDL WLA by 2013.

2.1 SUMMARY

Although DEQ has yet to develop a TMDL and WLAs for the stream, the premise for this Site stormwater SCM is consistent with the approaches approved by DEQ in other stream segments, which is to achieve substantial measurable reduction of DDT concentrations through the implementation of BMPs using the BAT. **However, given the low mass contribution of DDT from the Site, it should be noted that even if substantial DDT removal were obtainable from the Site stormwater discharge (which is as yet unproven using BAT) the Lower Willamette River would still be a DDT limited receiving body because of upstream sources which are not being controlled at this time (Figure 2).**

3 TEMPORARY CAPPING DESIGN AND IMPLEMENTATION

This section details the tasks and deliverables that will be required for the design and implementation of the temporary capping component of the Stormwater SCM.

3.1 PERMITTING

Since the project is being conducted under a Consent Order with DEQ, the project can be implemented through the exempt process. Under this process, City of Portland development permit approvals are not required; however, the substantive requirements of the permits must be met. The only applicable City of Portland permits include:

- Grading permit, including an approved Erosion, Sediment, and Pollution Control Plan.

Additional permit requirements may need to be achieved following a land use review and negotiation with the City of Portland Development Review Services regarding the Greenway Overlay zoning (i.e. River Industrial) and potential impacts due to design and construction.

Specific State of Oregon permits that may be required for the construction of the temporary capping include:

- A Construction Stormwater General Permit (1200C)

Based on discussions between DEQ and Federal agencies, no Federal permits will be required for this project. The final design package will be provided to other Federal agencies as determined necessary by DEQ.

3.2 PRE-DESIGN EVALUATION

A pre-design evaluation will be performed with the primary purpose of completing final delineation of the area to be capped. Tasks include:

- A review of current site surficial soil data.
- Coordination of temporary capping with hot spot identification conducted as part of the final Feasibility Study to minimize re-working of site soils (i.e. temporary capping, then, removing cap and excavating as part of hot spot removal in the final remedy).
- Coordination of temporary capping with respect to construction of the groundwater barrier wall component of the groundwater source control

measure (e.g., slurry wall construction will require a large are of mixing of slurry).

The data obtained from the preliminary design evaluation will be presented in a technical memorandum submitted to DEQ and USEPA and used to support the Pre-Final Design.

3.3 PRE-FINAL DESIGN

The objective of the pre-final design is to locate, size and provide detail of the technical features of the Temporary Capping component of the Stormwater SCM. The pre-final design scope will include the preparation of:

- Design drawings;
- Technical specifications;
- Related design package submittals (e.g., Pre-Design Evaluation results, design bases and criteria, supporting design analysis and calculations); and
- Preparation of additional planning documents for construction of the Temporary Capping, including:
    - Construction Quality Assurance Plan;
    - Draft Maintenance Plan;
    - Health and Safety Plan;
    - Contaminated Material Management Plan;
    - Emergency Response and Spill Contingency Plan;
    - Air Monitoring Plan;
    - Dust Control Plan;
    - Site Management Plan; and
    - Erosion, Sediment and Pollution Control Plan.

The pre-design package will be submitted to DEQ and USEPA for review, comment, and approval. Responses to DEQ and USEPA comments will be accomplished by appropriate changes included in the final design documents.

3.4 FINAL DESIGN

The Final Design scope will include:

- Revising the pre-final design package to incorporate DEQ and USEPA comments/revisions; and
- Incorporating potential design consideration based on contractor input.

Copies of the final design package will be submitted to DEQ and USEPA.

3.5 CONTRACTOR BIDDING

The objective of the contract bidding phase is to engage contractor(s) capable of successfully and safely implementing the Temporary Capping component of the Stormwater SCM. The Bidding Phase includes:

- Preparing bid documents;
- Contractor bidding, evaluation, and clarification of bids;
- Contractor selection; and
- Contract execution.

Contractors will be selected and engaged through LSS' established procurement procedures, which includes verification of reference projects, review and evaluation of health and safety performance, and other criteria.

3.6 CONSTRUCTION

The tasks to be completed during the Construction Phase include:

- Mobilization and site preparation;
- Clearing and grading areas for temporary capping;
- Preparation of areas for asphalt repair;
- Installation of temporary cap;
- Repair of asphalt; and

- Site restoration and de-mobilization.

3.7 MAINTENANCE

The objective of the maintenance phase is to provide data to assess performance of the temporary cap and to maintain the temporary capping until the final site remedy can be installed. The performance monitoring of the temporary cap will be conducted until the decommissioning of the existing stormwater collection system phase is implemented (Section 4). Routine maintenance will commence after the construction phase, and consist of the following tasks:

- Routine surface integrity checks and maintenance;
- Documenting system performance monitoring parameters; and
- Repairs, if necessary.

4 DECOMMISSIONING OF EXISTING STORMWATER COLLECTION SYSTEM

This section details the task and deliverables that will be required for the design and implementation of the decommissioning of the existing collection system component of the Stormwater SCM.

4.1 PERMITTING

As discussed in Section 2.1, the project can be implemented through the City of Portland's exempt process because it is being conducted under a Consent Order with DEQ. Under this process, City of Portland development permit approvals are not required; however, the substantive requirements of the permits must be met. The only applicable City of Portland permits include:

- Grading permit, including an approved Erosion, Sediment, and Pollution Control Plan.

Additional permit requirements may need to be achieved following a land use review and negotiation with the City of Portland Development Review Services regarding the Greenway Overlay zoning (i.e. River Industrial) and potential impacts due to design and construction.

Specific State of Oregon permits that may be required for the construction of the temporary capping include:

- A Construction Stormwater General Permit (1200C)

Based on discussions between DEQ and Federal agencies, no Federal permits will be required for this project. The final design package will be provided to other Federal agencies as determined necessary by DEQ.

4.2 PRELIMINARY DESIGN (30%) HYDROLOGIC STUDIES

The objective of the preliminary design hydrologic studies is to resolve the data required to complete the design and implementation of the decommissioning of the existing stormwater collection system as well as the SWC&T system. The preliminary design hydrological studies include:

- Evaluate stormwater flows under a variety of storm return periods for use in the design of the treatability studies (Section 5.3);

- Evaluate stormwater flows and ponding areas (i.e. areas of enhanced infiltration) due to limited site-wide ponding and stormwater infiltration occurring during periods when the stormwater flow exceeds the design capacity of the stormwater conveyance and treatment system;
- Determine the feasibility of abandoning the existing collection system prior to implementation of the new stormwater conveyance and treatment system[6]; and
- Finalization of preliminary hydrologic studies completed as part of the Stormwater SCM FFS for final design of the SWC&T.

The data obtained from the preliminary design hydrological studies will be presented in a technical memorandum submitted to DEQ and USEPA and used to support the Pre-Final Design.

4.3 INFILTRATION TESTING EVALUATION

The objective of the infiltration testing evaluation will be to assess the impact of limited site-wide ponding proposed to occur during periods when the stormwater flows exceed the design capacity of the stormwater conveyance and treatment systems. Infiltration testing will follow the City of Portland's Stormwater Management Manual (SWMM; Portland 2008), and will completed by conducting open pit falling head tests as outline in Appendix F of the SWMM.[7] These tests will be conducted in the areas where site-wide ponding may enhance infiltration.

The data obtained from the infiltration testing will be presented in a technical memorandum submitted to DEQ and USEPA and used to support the Pre-Final Design.

4.4 PRE-FINAL DESIGN

The objective of this pre-final design task is to locate, size, and provide detail of the technical features of the decommissioning of the current collection system component of the Stormwater SCM. Hydrologic studies (Section 4.2) and infiltration testing (Section 4.3) will be conducted to determine if it is feasible to abandoned the current collection system prior to implementation the final stormwater conveyance and treatment system. Staging the components of the SCM in this manner has several advantages:

[6] As part of an adaptive management approach, it may be feasible to abandoned the existing collection system, and, with minimal routing (i.e. grading), provide for discharge through Outfall 004. This adaptive management approach would allow for the determination of the efficacy of temporary capping and removing the existing collection system on reducing DDx concentrations in stormwater discharges.

[7] These tests are not being conducted as part of the design of a stormwater management facility. Therefore, pits will be excavated to an approximate depth of two feet to allow a 2-inch layer of coarse sand or fine gravel at the bottom of the pit and filling of the pit a minimum of 1 foot above the soil to be tested.

- Decommissioning of the existing collection system prior to installation of the final treatment system allows for adequate time for design of the treatment system that will be more compatible with the final site remedy while still removing the collection system prior to installation of the groundwater barrier wall as part of the groundwater source control measure.
- Once the existing collection system is abandoned, performance monitoring will be conducted to determine the anticipated final stormwater quality requiring treatment. This will allow for an efficient design of the final stormwater conveyance and treatment system.

The pre-final design scope will include the preparation of:

- Design drawings;
- Technical specifications;
- Related design package submittals (e.g., Pre-Design Evaluation results, design bases and criteria, supporting design analysis and calculations); and
- Preparation of additional planning documents for construction, including:
    - Construction Quality Assurance Plan;
    - Draft Operation and Maintenance Plan;
    - Health and Safety Plan;
    - Contaminated Material Management Plan;
    - Emergency Response and Spill Contingency Plan;
    - Air Monitoring Plan;
    - Dust Control Plan;
    - Site Management Plan; and
    - Erosion, Sediment and Pollution Control Plan.

The pre-design package will be submitted to DEQ and USEPA for review, comment, and approval. Responses to DEQ and USEPA comments will be accomplished by appropriate changes included in the final design documents.

4.5 FINAL DESIGN

The Final Design scope will include:

- Revising the pre-final design package to incorporate DEQ and USEPA comments/revisions; and
- Incorporating potential design consideration based on contractor input.

Copies of the final design package will be submitted to DEQ and USEPA.

4.6 CONTRACTOR BIDDING

The objective of the contract bidding phase is to engage contractor(s) capable of successfully and safely implementing the decommissioning of the existing stormwater collection system. The Bidding Phase includes:

- Preparing bid documents;
- Contractor bidding, evaluation, and clarification of bids;
- Contractor selection; and
- Contract execution.

Contractors will be selected and engaged through LSS' established procurement procedures, which includes verification of reference projects, review and evaluation of health and safety performance, and other criteria.

4.7 CONSTRUCTION

The tasks to be completed during the Construction Phase include:

- Mobilization and site preparation;
- Site regarding and channel construction;
- Abandon existing sewer system; and,
- Site restoration and de-mobilization.

4.8 OPERATION AND MAINTENANCE

The objectives of the O&M phase are to provide sufficient data for compliance monitoring and reporting. Routine O&M will commence after the startup phase, and consists of the following tasks:

- Routine system integrity checks;
- Performance (effluent) monitoring; and,
- Repairs, if necessary.

The design documents, O&M plan, and other deliverables will provide details regarding the tasks outlined above.

5 STORMWATER CONVEYANCE AND TREATMENT DESIGN AND IMPLEMENTATION

This section details the task and deliverables that will be required for the design and implementation of the SWC&T component of the Stormwater SCM. The full-scale treatability analysis and implementation process provided in this Section is based on discussions with DEQ. To date, DEQ has not been able to assure (e.g., with a compliance schedule, use of surrogate parameter) that implementing the preferred technical approach (as previously discussed in Section 1) would not put Arkema at risk to third-party actions during the system installation, initial operation, monitoring, and optimization time period. The administrative process for implementing this provisional agreement (i.e., the NPDES permit renewal) has become an obstacle to implementing the approach preferred by DEQ and LSS. The administrative process has largely been held up by benchmarks that have been discussed between DEQ and LSS. The benchmarks discussed are based on human-health long-term exposure criteria and are not verifiably achievable using existing stormwater treatment BAT. If the NPDES renewal, with respect to DDx, were able to proceed with establishing benchmarks based on TSS removal as a surrogate parameter (similar to what has been used at other sites), then BAT , as has been thoroughly discussed and agreed upon with DEQ, will be selected and implemented as a full-scale field pilot test. Under this scenario, tasks outlined in Sections 5.2 and 5.3 below would not be required and would result in a schedule improvement of at least 15 months.

5.1 PERMITTING

This section discusses the permit requirements for the SWC&T. As discussed in Sections 3.1 and 4.1, the project can be implemented through the City of Portland's exempt process because the project is being conducted under a Consent Order with DEQ. Under this process, City of Portland development permit approvals are not required; however, the substantive requirements of the permits must be met. The only applicable City of Portland permits include:

- Grading permit, including an approved Erosion, Sediment, and Pollution Control Plan.

Additional permit requirements may need to be achieved following a land use review by the City of Portland Bureau of Development Services.

Specific State of Oregon permits that are expected to be required for the construction of the SWC&T include:

- Renewal of the NPDES Industrial Stormwater Permit for discharging treated stormwater to the Willamette River (currently under discussion with DEQ); and

- A Construction Stormwater General Permit (1200C)

Based on discussions between DEQ and Federal agencies, no Federal permits will be required for this project. The final design package will be provided to other Federal agencies as determined necessary by DEQ.

5.2 PRE-DESIGN AND TREATABILITY EVALUATION

The objectives of the pre-design and treatability evaluation include:

- Further characterize stormwater discharges for the design of treatability studies;
- Collect sufficient stormwater samples for use in the treatability studies; and,
- Address previously stated agency requests for data during the early fall rainstorm periods (DEQ 2008).

Pre-design & treatability evaluation sampling and analysis are anticipated to include the following elements:

- Analysis of particle size distribution of suspended particles within stormwater discharges;
- Analysis of organic carbon content for different ranges of particle size fractions;
- Analysis of DDx concentration ranges for different ranges of particle size fractions as well as dissolved concentrations; and
- Analysis of other constituent concentrations that will be monitored as part of the NPDES permit for different ranges of particle size fractions as well as dissolved concentrations.

The extent of the sampling, analysis, and data interpretation requirements of the pre-design and treatability testing will be dependent upon NPDES permit effluent requirements currently under discussion with DEQ. As the NPDES permitting process moves forward and draft effluent limits are developed, a Sampling and Analysis Plan (along with supporting documents) for the Pre-Design and Treatability Evaluation will be prepared and submitted to DEQ and USEPA for review and approval prior to conducting field work.

The data obtained from the pre-design and treatability evaluation will be presented as part of the SWC&T system pre-design evaluation and used to support the Pre-Final Design.

5.3 TREATABILITY TESTING

The objective of treatability testing will be to assess the efficacy of a treatment system designed to meet the periodic flows that are associated with stormwater to meet the yet-to-be determined NPDES concentration effluent limits. The extent of the treatability testing requirements of the pre-design and treatability testing will be dependent upon NPDES permit effluent requirements currently under discussion with DEQ. As the NPDES permitting process moves forward and draft effluent limits are developed, a Sampling and Analysis Plan (along with supporting documents) for the Pre-Design and Treatability Evaluation will be prepared and submitted to DEQ and USEPA for review and approval prior to conducting field work.

The data obtained from the pre-design and treatability evaluation will be presented as part of the SWC&T system pre-design evaluation and used to support the Pre-Final Design.

5.4 PRE-FINAL DESIGN

The objective of this pre-final design task is to locate, size, and provide detail of the technical features of the SWC&T system component of the Stormwater SCM. The pre-final design scope will include the preparation of:

- Design drawings;
- Technical specifications;
- Related design package submittals (e.g., Pre-Design Evaluation results, design bases and criteria, supporting design analysis and calculations); and
- Preparation of additional planning documents for construction, including:
    - Construction Quality Assurance Plan;
    - Draft Operation and Maintenance Plan;
    - Health and Safety Plan;
    - Contaminated Material Management Plan;
    - Emergency Response and Spill Contingency Plan;
    - Air Monitoring Plan;
    - Dust Control Plan;
    - Site Management Plan; and

- Erosion, Sediment and Pollution Control Plan.

The pre-design package will be submitted to DEQ and USEPA for review, comment, and approval. Responses to DEQ and USEPA comments will be accomplished by appropriate changes included in the final design documents.

5.5 FINAL DESIGN

The Final Design scope will include:

- Revising the pre-final design package to incorporate DEQ and USEPA comments/revisions; and
- Incorporating potential design consideration based on contractor input.

Copies of the final design package will be submitted to DEQ and USEPA.

5.6 CONTRACTOR BIDDING

The objective of the contract bidding phase is to engage contractor(s) capable of successfully and safely implementing the SWC&T component of the Stormwater SCM. The Bidding Phase includes:

- Preparing bid documents;
- Contractor bidding, evaluation, and clarification of bids;
- Contractor selection; and
- Contract execution.

Contractors will be selected and engaged through LSS' established procurement procedures, which includes verification of reference projects, review and evaluation of health and safety performance, and other criteria.

5.7 CONSTRUCTION

The tasks to be completed during the Construction Phase include:

- Mobilization and site preparation;
- Installation of the Stormwater Treatment System;

- Installation of the Stormwater Conveyance System; and,
- Site restoration and de-mobilization.

5.8 OPERATION AND MAINTENANCE

The objectives of the O&M phase are to provide sufficient data for compliance monitoring, permit reporting, and system optimization of the SWC&T system. Routine O&M will commence after the startup phase, and consists of the following tasks:

- Routine system checks and maintenance;
- Documenting system operating parameters and information required for permits, performance monitoring (influent and effluent monitoring), and optimization;
- Troubleshooting; and,
- Repairs, if necessary.

The design documents, O&M plan, and other deliverables will provide details regarding the tasks outlined above.

6 REPORTING AND SCHEDULE

During each phase of the evaluation, design, and implementation of the Stormwater SCM, LSS will submit deliverables to the DEQ and USEPA for review and approval. The major submittals, agency reviews, project milestones, and estimated schedule are summarized in Figure 3. Because of the close proximity of the schedules for implementing the temporary capping and decommissioning of the existing stormwater collection system, these two phases could be combined into a single phase.

Any unexpected conditions, alternative activities, personnel, or other variations from DEQ approved work plans will, to the greatest extent practicable, be identified and communicated to DEQ before the respective scope of work is conducted. These conditions and variations will be communicated in the Quarterly Progress Reports to DEQ, as required by the Consent Order. Work plans will be revised, as necessary, to reflect new information and will be submitted to DEQ for approval. If variations from the approved work plans are encountered during the scope of work, all variations will be documented in the final report submitted to DEQ, and LSS will notify DEQ's project manager verbally of the variations as soon as possible, but no later than 24 hours after the variation is identified.

If an event occurs that is beyond LSS' reasonable control and that causes or might cause a delay or deviation in performance of the requirements of the Consent Order, LSS will promptly notify DEQ's project manager verbally of the cause of the delay or deviation, its anticipated duration, the measures that have been or will be taken to prevent or minimize the delay or deviation, and the timetable by which LSS proposes to carry out such measures. LSS will confirm this information in writing within five working days of the verbal notification.

7 PROJECT PERSONNEL

A brief description of personnel currently anticipated to be involved with the scope of work is included below. This team is consistent with the personnel used by LSS to date in performance of work under the Voluntary Agreement. Therefore, in accordance with Section 8 A. (1) of the Consent Order, this team is considered approved by DEQ. Proposed changes to this team will be submitted in writing to DEQ as described in Section 8 A. (2) of the Consent Order. Subcontractors have not yet been identified at this stage of the project work.

- Todd Slater, LSS (todd.slater@total.com; 610-594-4430). Primary point of contact for LSS, agent for Arkema.
- David Livermore, RG, Integral Consulting Inc. (dlivermore@integral-corp.com; 503-284-5545). Primary point of contact and overall Project Principal for Integral, consultant managing performance of the work on behalf of LSS.
- Michael Martin, PE, Integral Consulting Inc. (mmartin@integral-corp.com; 303-404-2944). Primary engineer and project manager for the implementation of the Stormwater SCM.
- Kevin Deeny, PE, KC Environmental (kdeeny@comcast.net; 215.949.0524). Senior technical advisor for groundwater and stormwater treatment and permitting.
- Eron Dodak, PG, Integral Consulting Inc. (edodak@integral-corp.com; 503-284-5545). Lead for hydrogeologic evaluation for the Stormwater SCM.
- Erik Ipsen, PE, ERM (erik.ipsen@erm.com; 503-488-5282). Overall project manager for ERM, consultant managing performance of the overall SOW on behalf of LSS.
- Karen Traeger, LSS (Karen.traeger@total.com; 303-741-0426). In-house Counsel for LSS.
- Stephen Parkinson, Groff Murphy (sparkinson@GroffMurphy.com; 206-832-1484). Legal Counsel for LSS.

8 REFERENCES

DEQ 2008. Letter from Matt McClincy, Oregon Department of Environmental Quality, to Todd Slater, Legacy Site Services LLC, dated December 18, 2008. Subject: Draft Stormwater Interim Remedial Measures Focused Feasibility Study Report, Arkema Portland Plant, ECSI No. 398.

DEQ 2009. Guidance for Evaluating the Stormwater Pathway at Upland Sites. Oregon Department of Environmental Quality, Environmental Cleanup Program. Portland, Oregon. January 2009.

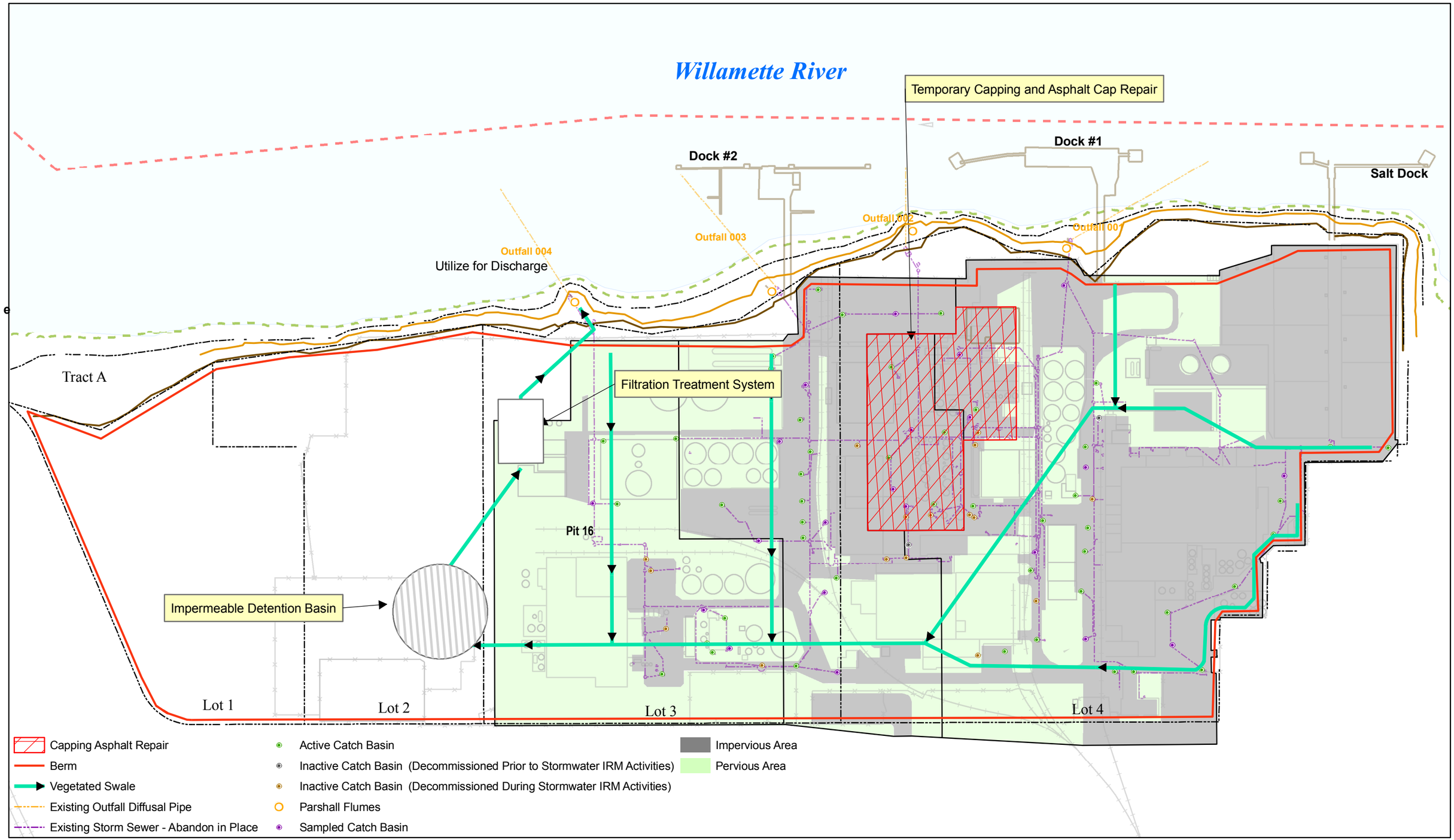
EPA 2008. TMDLs to Stormwater Permits Handbook. United States Environmental Protection Agency.

Integral 2007. Stormwater Interim Remedial Measures Field Sampling and Data Report, Arkema Portland Facility. Prepared for Legacy Site Services LLC, Exton, PA. Prepared by Integral Consulting Inc. Portland, Oregon. November 2, 2007.

Integral 2008. Stormwater Interim Remedial Measures Focused Feasibility Study Report, Arkema Portland Facility. Prepared for Legacy Site Services LLC, Exton, PA. Prepared by Integral Consulting Inc. Portland, Oregon. July 3, 2008.

LSS 2009. Letter from Todd Slater, Legacy Site Services LLC, to Matt McClincy, Oregon Department of Environmental Quality, dated March 18, 2009. Subject: Stormwater Focused Feasibility Study, Arkema Portland.

Figures



integral consulting

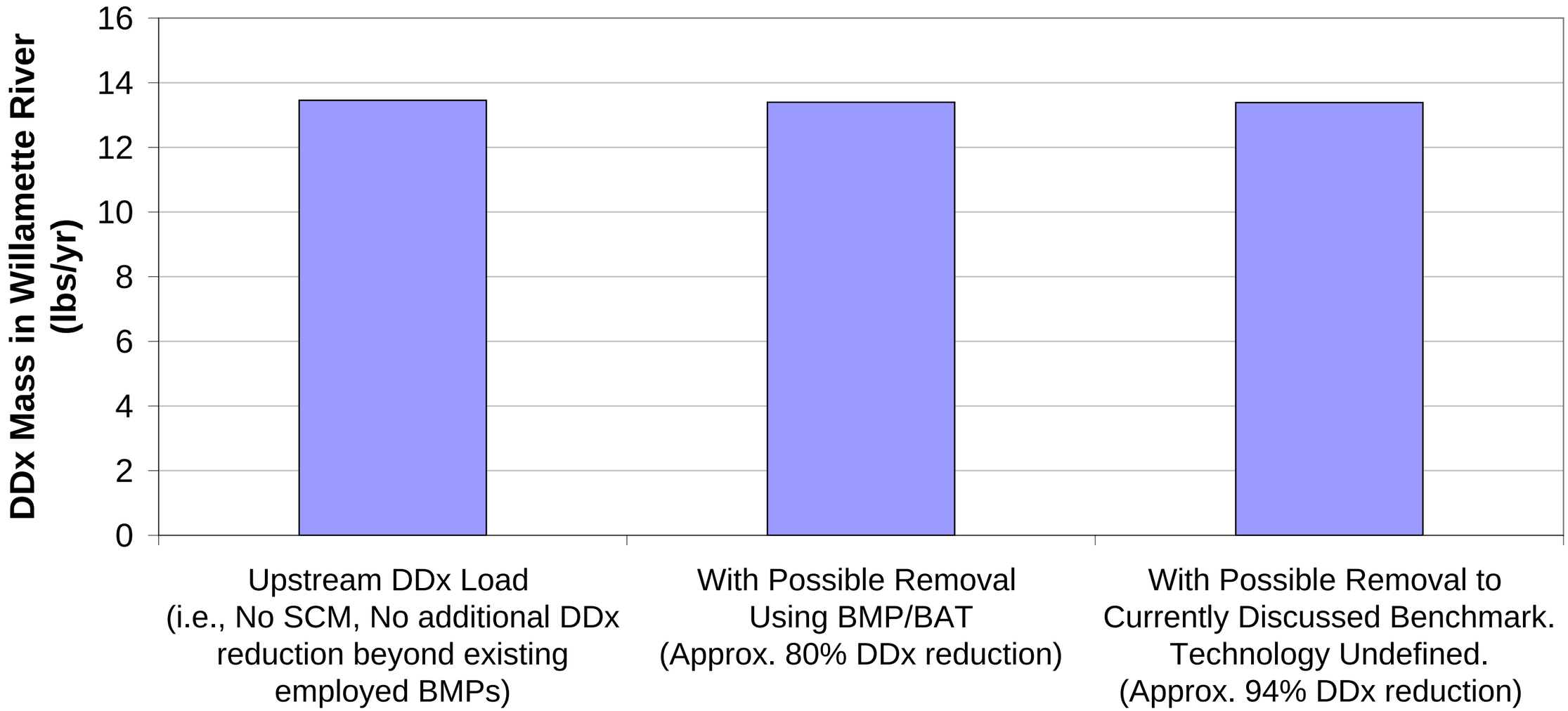
0 100 200
Feet

12 ft Contour
Navigation Channel
River
Existing Drainage Area
Property and Lot Boundaries
Ordinary High Water
Top of Bank

DRAFT
DO NOT QUOTE OR CITE

Figure 1
Conceptual Stormwater Conveyance and Treatment System Design, Stormwater Interim Remedial Measures, Former Arkema Facility, Portland, OR.

Figure 2. DDx Mass in the Willamette River For Three Stormwater Source Control Measure (SCM) Options



As a result of upstream contributions, residual DDx concentrations in the Willamette River remain essentially unchanged under the three treatment scenarios considered.

Figure 3. Project Schedule. Stormwater Interim Remedial Measures Implementation Work Plan. Former Arkema Facility, Portland, OR

ID	Task Name	Duration	Start	Finish
1	**Stormwater Interim Remedial Measure Work Plan**	**88 days**	**10/7/09**	**1/2/10**
2	Submit SW IRM Work Plan	1 day	10/7/09	10/7/09
3	Agency Review of SW IRM Work Plan	30 days	10/8/09	11/6/09
4	Response to Comments on SW IRM Work Plan	20 days	11/7/09	11/26/09
5	Discussions to SW IRM Work Plan	30 days	11/27/09	12/26/09
6	Agency Approval of SW IRM Work Plan	7 days	12/27/09	1/2/10
7	**Stormwater Interim Remedial Measure Design & Implementation**	**326 days**	**11/7/09**	**9/28/10**
8	**Temporary Capping**	**326 days**	**11/7/09**	**9/28/10**
9	**Temporary Capping Pre-Design Evaluation & Pre-Final Design**	**162 days**	**11/7/09**	**4/17/10**
10	Existing Data Review	20 days	11/7/09	11/26/09
11	Preparation and Submittal of Pre-Design Technical Memorandum & Pre-Final Design	45 days	11/27/09	1/10/10
12	Agency Review of Technical Memorandum & Pre-Final Design	30 days	1/11/10	2/9/10
13	Repond to ODEQ Comments	30 days	2/10/10	3/11/10
14	Discussions to Finalize Pre-Final Design	30 days	3/12/10	4/10/10
15	Agency Approval of Pre-Final Design	7 days	4/11/10	4/17/10
16	**Temporary Capping Final Design**	**67 days**	**4/18/10**	**6/23/10**
17	Final Design Preparation and Submittal	30 days	4/18/10	5/17/10
18	Agency Review of Final Design	30 days	5/18/10	6/16/10
19	Agency Approval of Final Design	7 days	6/17/10	6/23/10
20	**Temporary Capping Permitting**	120 days	1/11/10	5/10/10
21	**Temporary Capping Contractor Bidding**	**63 days**	**6/17/10**	**8/18/10**
22	Preparation of Bid Documents	20 days	6/17/10	7/6/10
23	Contractor Bid Submission	20 days	7/7/10	7/26/10
24	Evaluation of Bids	7 days	7/27/10	8/2/10
25	Contractor Selection	1 day	8/3/10	8/3/10
26	Contract Execution	15 days	8/4/10	8/18/10
27	**Temporary Capping Construction**	**41 days**	**8/19/10**	**9/28/10**
28	Mobilization and Site Preparation	5 days	8/19/10	8/23/10
29	Asphalt Cap Repair	10 days	8/24/10	9/2/10
30	Temporary Cap Installation	20 days	9/3/10	9/22/10
31	Demob & Site Restoration	5 days	9/23/10	9/27/10
32	Commence Long Term O&M	1 day	9/28/10	9/28/10
33	**Decommissioning of Existing Stormwater Collection System**	**741 days**	**11/7/09**	**11/17/11**
34	**Hydrologic & Infiltration Evaluation & Pre-Final Design**	**172 days**	**11/7/09**	**4/27/10**
35	Hydrologic Studies	45 days	11/7/09	12/21/09
36	Infiltration Studies	45 days	11/7/09	12/21/09

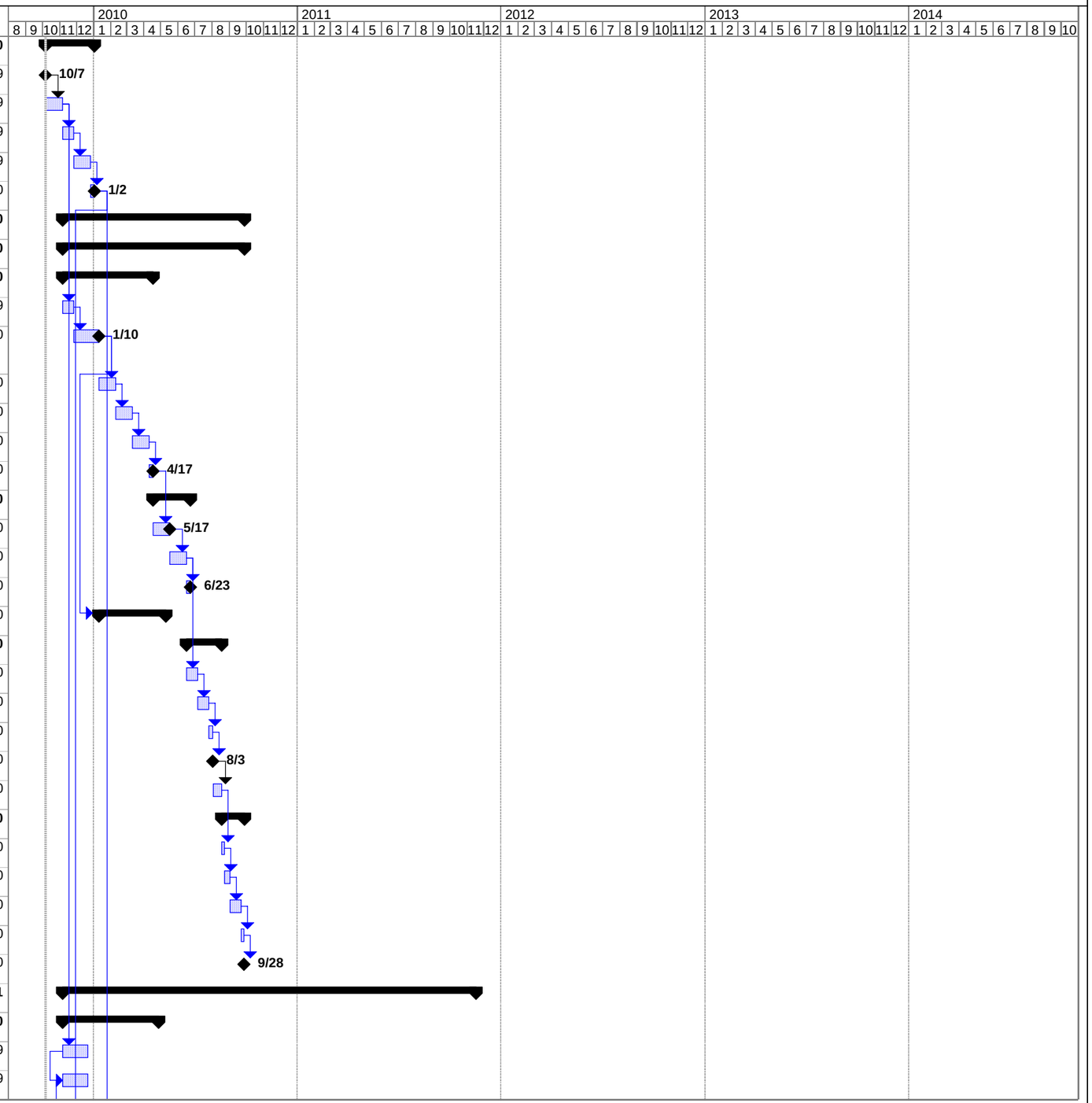


Figure 3. Project Schedule. Stormwater Interim Remedial Measures Implementation Work Plan. Former Arkema Facility, Portland, OR

ID	Task Name	Duration	Start	Finish
37	Preparation and Submittal of Pre-Design Evaluation Technical Memorandum & Pre-Final Design	60 days	11/22/09	1/20/10
38	Agency Review of Technical Memorandum and Pre-Final Design	30 days	1/21/10	2/19/10
39	Response to ODEQ Comments	30 days	2/20/10	3/21/10
40	Discussions to Finalize Pre-Final Design	30 days	3/22/10	4/20/10
41	Agency Approval of Pre-Final Design	7 days	4/21/10	4/27/10
42	**Final Design**	**67 days**	**4/28/10**	**7/3/10**
43	Final Design Preparation and Submittal	30 days	4/28/10	5/27/10
44	Agency Review of Final Design	30 days	5/28/10	6/26/10
45	Agency Approval of Final Design	7 days	6/27/10	7/3/10
46	**Decommisioning of Existing System Permitting**	120 days	1/21/10	5/20/10
47	**Contractor Bidding**	**63 days**	**6/27/10**	**8/28/10**
48	Preparation of Bid Documents	20 days	6/27/10	7/16/10
49	Contractor Bid Submission	20 days	7/17/10	8/5/10
50	Evaluation of Bids	7 days	8/6/10	8/12/10
51	Contractor Selection	1 day	8/13/10	8/13/10
52	Contract Execution	15 days	8/14/10	8/28/10
53	**Construction**	**446 days**	**8/29/10**	**11/17/11**
54	Mobilization and Site Preparation	10 days	8/29/10	9/7/10
55	Site Regrading & Channel Construction	30 days	9/8/10	10/7/10
56	Decommission Existing Sewer	30 days	10/8/10	11/6/10
57	Demob & Site Restoration	10 days	11/7/10	11/16/10
58	Commence Long Term O & M	1 day	11/17/10	11/17/10
59	Performance Monitoring	365 days	11/18/10	11/17/11
60	**Stormwater Conveyance and Treatment System**	**1353 days**	**1/3/10**	**11/21/13**
61	**Pre-Design & Treatability Evaluation**	**454 days**	**1/3/10**	**4/1/11**
62	**Sampling and Analysis Plan (SAP) and Supporting Documents**	**117 days**	**1/3/10**	**4/29/10**
63	Preparation and Submittal of SAP	30 days	1/3/10	2/1/10
64	Agency Review of SAP	30 days	2/2/10	3/3/10
65	Response to Comments from ODEQ	20 days	3/4/10	3/23/10
66	Discussions to Finalize SAP	30 days	3/24/10	4/22/10
67	Agency Approval of SAP	7 days	4/23/10	4/29/10
68	**Stormwater Sampling and Analysis**	**210 days**	**4/30/10**	**11/25/10**
69	Stormwater Sampling	90 days	4/30/10	7/28/10
70	Laboratory Analysis	90 days	5/30/10	8/27/10
71	Data Validation	90 days	6/29/10	9/26/10
72	Treatability Testing	120 days	7/29/10	11/25/10

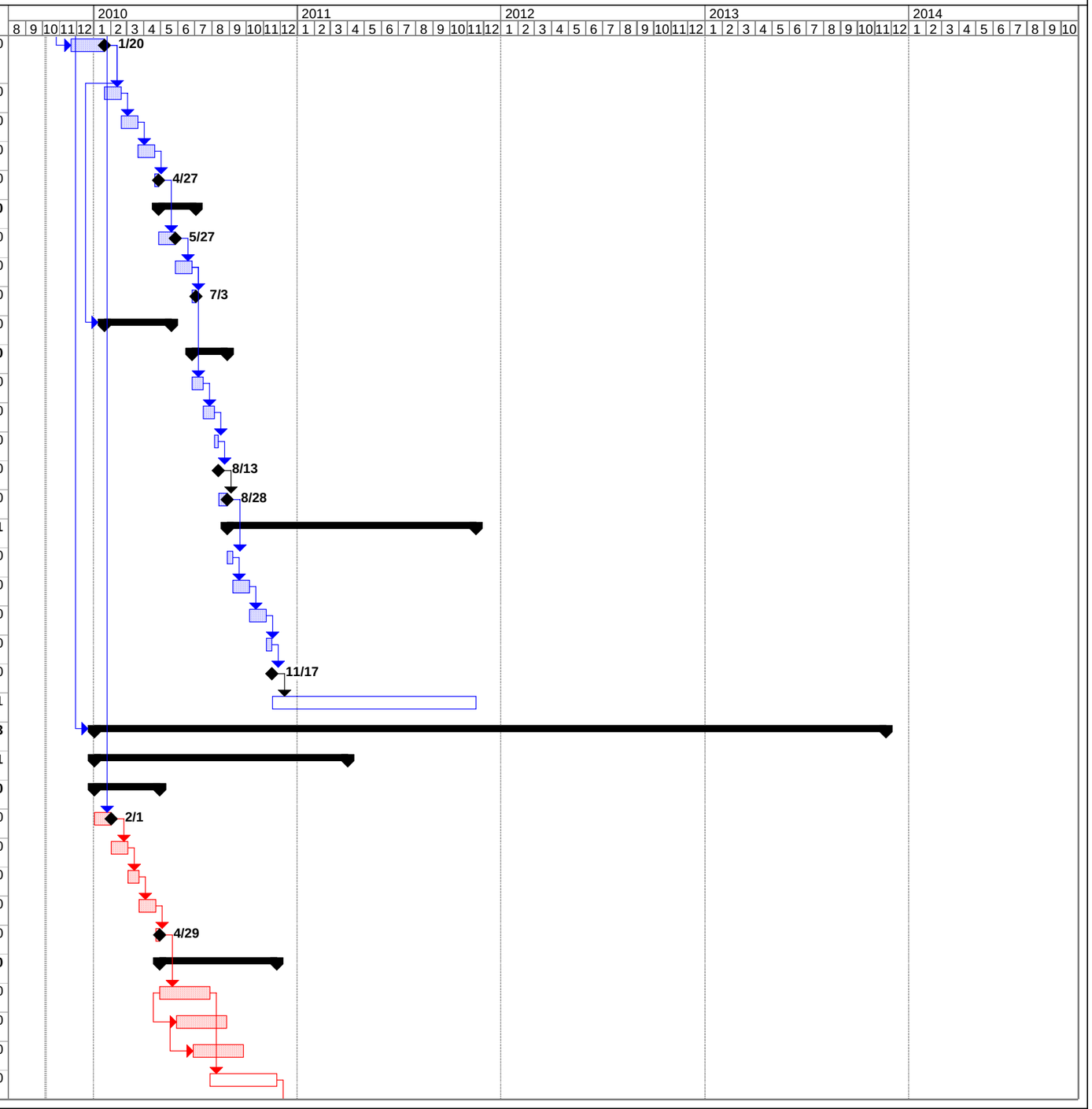
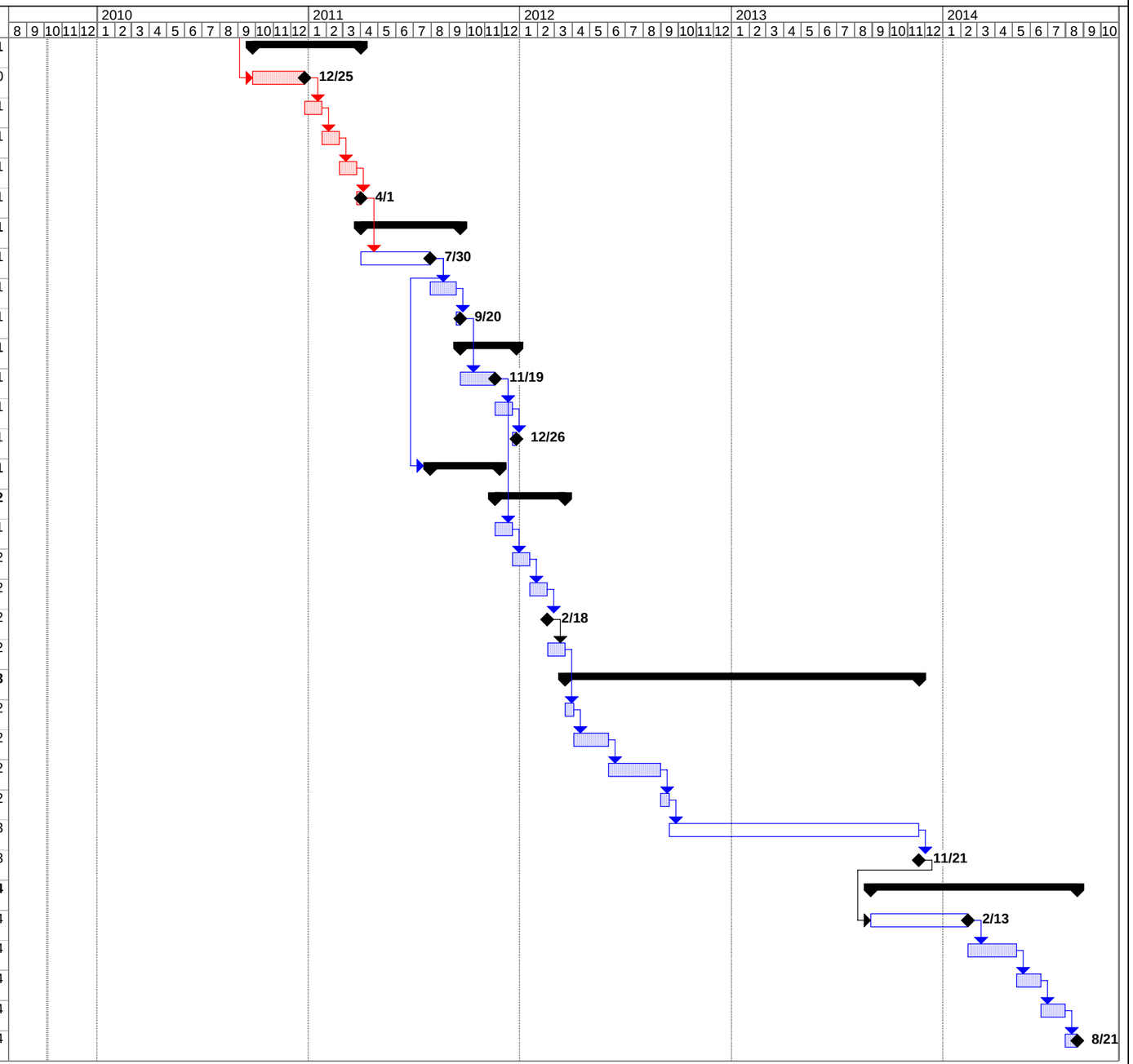


Figure 3. Project Schedule. Stormwater Interim Remedial Measures Implementation Work Plan. Former Arkema Facility, Portland, OR

ID	Task Name	Duration	Start	Finish
73	**Pre-Design & Treatability Evaluation Data Report**	**187 days**	**9/27/10**	**4/1/11**
74	Data Report Preparation and Submittal	90 days	9/27/10	12/25/10
75	Agency Review of Data Report	30 days	12/26/10	1/24/11
76	Response to ODEQ Comments	30 days	1/25/11	2/23/11
77	Discussions to Finalize Data Report	30 days	2/24/11	3/25/11
78	Agency Approval of Data Report	7 days	3/26/11	4/1/11
79	**Pre-Final Design**	**172 days**	**4/2/11**	**9/20/11**
80	Pre-Final Design and Submittal	120 days	4/2/11	7/30/11
81	Agency Review of Pre-Final Design	45 days	7/31/11	9/13/11
82	Agency Approval of Pre-Final Design	7 days	9/14/11	9/20/11
83	**Final Design**	**97 days**	**9/21/11**	**12/26/11**
84	Final Design and Submittal	60 days	9/21/11	11/19/11
85	Agency Review of Final Design	30 days	11/20/11	12/19/11
86	Agency Approval of Final Design	7 days	12/20/11	12/26/11
87	**SWC&T Permitting**	**120 days**	**7/31/11**	**11/27/11**
88	**Contractor Bidding**	**121 days**	**11/20/11**	**3/19/12**
89	Preparation of Bid Documents	30 days	11/20/11	12/19/11
90	Contractor Bid Submission	30 days	12/20/11	1/18/12
91	Evaluation of Bids	30 days	1/19/12	2/17/12
92	Contractor Selection	1 day	2/18/12	2/18/12
93	Contract Execution	30 days	2/19/12	3/19/12
94	**Construction**	**546 days**	**3/20/12**	**11/21/13**
95	Mobilization and Site Preparation	15 days	3/20/12	4/3/12
96	Construction of Conveyance System	60 days	4/4/12	6/2/12
97	Construction of Treatment System	90 days	6/3/12	8/31/12
98	Demob & Site Restoration	15 days	9/1/12	9/15/12
99	System Optimization	365 days	9/16/12	11/20/13
100	Commence Long Term O & M	1 day	11/21/13	11/21/13
101	**Stormwater IRM Implementation Report**	**255 days**	**8/30/13**	**8/21/14**
102	Implementation Report Preparation and Submittal	120 days	8/30/13	2/13/14
103	Agency Review of Implementation Report	60 days	2/14/14	5/8/14
104	Response to ODEQ Comments	30 days	5/9/14	6/19/14
105	Discussions to Finalize of Implementation Report	30 days	6/20/14	7/31/14
106	Agency Approval of Implementation Report	15 days	8/1/14	8/21/14



Tables

Table 1. BMP Effectiveness Summary (Median Effluent Concentrations)

BMP Type	TSS mg/L	TP mg/L	E. Coli count/100 ml	Diss. Copper µg/L	Total Copper µg/L	Diss. Lead µg/L	Total Lead µg/L	Diss. Zinc µg/L	Total Zinc µg/L	Flow Reduction %
Centrifugal Separator Hydrodynamic devices	57	0.13	--	6.9	12	11	5.7	25	70	0
Filters (Leaf/Sand/Other	13	0.12	98	6.6	9.3	0.13	3	27	44	0
Ponds, Dry Vegetated Detention Pond	33	0.29	--	12	20	1.5	18	44	83	23
Ponds - West Rentention Basin	16	0.14	--	2.9	7.1	0.1	1.88	17.6	31.7	5
Swales - Vegetated Filter Strips	23	0.24	--	5.1	11.9	0.42	7.43	19	47	29
Wetlands - Constructed Surface Flow	7	0.08	--	--	3	0.72	1	11	17	0
Sediment Manhole	50	--	--	--	--	--	--	--		--

Source: Table 3 of Storm Water BMP Effectiveness Work Group Report (5/9/2005).