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From:
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Date:
December 22, 2010

ARCADIS Project No.:
B0066116.0000

Subject:
Technical Memorandum – Risk Assessment Approach for Operable Unit E

This memorandum outlines the technical approach for the risk assessment in the forthcoming Operable Unit E (OU-E) Remedial Investigation Report (RI) for the Former Georgia-Pacific Wood Products Facility in Fort Bragg, California (the site). Georgia-Pacific is planning the risk assessment as part of its continuing commitment to comply with the Department of Toxic Substances Control's (DTSC's) Site Investigation and Remediation Order for the Site (Docket No. HSA-RAO 06-07-150; the Order). Section 5.6 of the Order requires a Human Health Risk Assessment (HHRA) and Ecological Risk Assessment (ERA) for each operable unit (OU).

The Site-Wide Risk Assessment Work Plan (RAWP; ARCADIS BBL, 2008a) presented an overall approach for the HHRA and ERA for the site and was approved by DTSC (DTSC 2007). The RAWP recognized that not all elements of the proposed approach within the RAWP would apply to all OUs, and the specific applicability of proposed elements would be considered on an OU-specific basis as each OU was addressed. This technical memorandum addresses OU-E (Figure 1), the Ponds/Park, and includes site-specific approaches and assumptions. The scope of the OU-E risk assessment in the OU-E RI includes the areas of OU-C and OU-D associated with the future development of OU-E. The nature and extent of industrial impacts in these areas were discussed in the RI for OU-C and OU-D (ARCADIS 2010a), but the anticipated OU-E future scenario was unknown when the OU-C/OU-D RI was prepared

and was therefore not considered in the risk assessment completed for that document. Other than specific approaches based on site-specific information provided herein, the risk assessment for the OU-E RI will follow the methods described in the RAWP (ARCADIS BBL, 2008a).

Background

OU-E is comprised of several man-made open water ponds (Ponds 1 through 9 and the North Pond), seasonal wetlands, and adjacent upland areas (Figure 1). Pond 8 (partially enclosed by an earthen dam) and the low-lying area north of Pond 8, including Ponds 6, 7 and the North Pond, are part of what is currently referred to as the Mill Pond Complex[1] (MPC) (Figure 2).

In response to requirements from the Division of Safety of Dams (DSOD 2010), Georgia-Pacific and the City initiated a community planning process to identify and evaluate projects that effectively encompass the regulatory requirements for site remediation and dam safety compliance, protection of environmental resources and their beneficial uses (e.g., jurisdictional waters and environmentally sensitive habitat areas [ESHAs]), and the long-term plan the City and community of Fort Bragg have for the MPC area. Based on input from the public and the regulatory agencies, the current plan for the MPC area is that it will be altered from its current configuration (Figure 2) to reflect Alternative 6 the proposed future design for the Mill Pond Complex (Figure 3), which includes:

- Remediation of portions of Operable Unit-E (OU-E) within the MPC (expected to include sediment in Pond 8) that will be identified in the remedial investigation and feasibility study and approved by DTSC.
- Rerouting surface water flow around Pond 8 in a manner that considers the historical surface drainage and wetland features in that area.
- Removing the Pond 8 dam, spillway, cribwall, and north wall components by the close of 2015 to achieve DSOD compliance requirements.
- Regrading the former Pond 8 area and completing the ecological restoration of the restored surface drainage and wetland features. This includes filling of Pond 8 and creating upland habitat in that area.

[1] The Mill Pond Complex is synonymous with the footprint of Alternative 6 (see footnote 3) and includes Pond 8, the OU-E lowland area, which is the area within the topographic depression north of Pond 8 and encompasses Ponds 6, 7, and North Pond, the daylighted Maple Creek and the Maple Street riparian area.

Remediation and stabilization of the Pond 8 area is critical to the required removal of the dam, spillway, cribwall, and north wall, and restoration of the historical ecological features on the MPC. The MPC Restoration Project was developed through an agency and community planning process that identified a broad range of the project objectives. Key project objectives, in addition to those listed above, are:

- Restore several of the historical drainage and wetland features at the site consistent with Coastal Act policy and consolidate existing fragmented habitat features into a more ecologically functional and integrated riparian corridor and wetland complex.
- Improve the aesthetic value of the OU-E, access to Soldier Bay beach, and connect the north and south Coastal Trail segments.

As shown in Figure 3, Alternative 6 therefore also includes the daylighting of the Maple Creek and the creation of riparian floodplain wetlands in what is part of OU-C and OU-D.

Objectives

The HHRA and ERA for OU-E will assess potential risk based on proposed future conditions. As such, this memorandum provides a conceptual site model and risk assessment approach specific to the planned future use scenario for OU-E. A baseline assessment under the current land use will not be provided because there is no option for retaining the current configuration of the MPC since the DSOD requirements include the removal of the dam. Because the plan for the future use of the OU-E MPC currently is associated with stream daylighting east of OU-E, in OU-C and OU-D, the future stream channel area will be included in the risk assessment for OU-E. Ponds 5 and 9, as further discussed in the sections below, have had no known industrial use and will therefore not be included in the risk assessment.

Conceptual Site Model

The proposed OU-E-specific approach to the risk assessment described in the sections below is based on a conceptual site model (CSM) for contaminant sources, exposure pathways, and human and ecological receptors. CSM illustrating potential sources and contaminant transport pathways have been provided in previous documents and are shown on Figure 4 (upland; ARCADIS 2010b) and Figure 5 (ponds; ARCADIS BBL 2007a). CSM illustrating potential future exposure pathways and human and ecological receptors are provided in Figures 6 (terrestrial) and 7 (aquatic/wetland).

Potential Sources of Chemicals of Interest

Potential sources of chemicals of interest (COIs) in OU-E media include historical facility operations and off-site areas that drain into OU-E. These include equipment used to move, cut, and process logs and lumber; operations that involved cleaning and maintaining equipment; refueling and fuel storage activities;

power generation and distribution; wastewater treatment; and equipment and chemical storage areas, as well as limited wood treatment areas.

The OU-E upland areas north of Pond 8 contained Sawmill #1, the Powerhouse/boiler, and associated facilities, including water and wastewater facilities, a fuel oil line, and other ancillary facilities. Storage and use of chemicals, fuel and other petroleum products (lube oil, oil drums, used oil filters, filter oil, absorbent pads, transmission fluid) are potential sources of metals, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), polycyclic aromatic hydrocarbons (PAHs), and total petroleum hydrocarbons (TPH). Solvents may have been used in equipment areas. Fly ash was generated in the boiler and associated with other facilities, such as the dewatering pads and fly ash reinjection system. Dioxins/furans are potentially associated with areas with fly ash.

Previously, polychlorinated biphenyl- (PCB-) containing transformers were used within OU-E. In addition, lead-based paint (LBP) has been detected on various buildings within OU-E. Mercury switches were also used in sumps to control pumps to dewater basement areas. Plant drain lines as well as former rail line corridors are potential sources of COIs.

Additional historical industrial features in OU-E included the water cooling towers at the southwestern tip of Pond 8, which were present prior to the 1970s, the cooling towers on the north berm of Pond 8 that replaced the original cooling towers, and the pump house along the southern shore of Pond 8.

Potential sources to the ponds include:

- Direct discharge from powerhouse operations (water from debarking and dewatering processes, boiler blowdown, boiler washwater, and scrubber water/effluent) for all ponds excluding Ponds 5 and 9.

- Stormwater drainage from the City to Ponds 5 and 8

- Other inputs via soil runoff/deposition from industrial/operational areas during rain events for all ponds excluding Ponds 5 and 9. A berm around Pond 5 limits run-off from industrial areas of the site into the pond. Pond 9 is situated above grade and also does not receive surface runoff from adjacent areas.

Ponds 5 and 9 received water from Pudding Creek for fire control. Pond 5 also receives runoff from the main office area (OU-B). OU-B is a non-industrial property that received a “no further action” determination letter from DTSC. Run-off into Pond 5 is dominated by inflow from the city. Run-off into the southern ponds (Ponds 1 through 4) is dominated by surface flow from the southern part of the site, which is part of OU-D (Figure 1) and is not expected to contain elevated levels of COIs because the area had limited industrial use and COIs were not detected at elevated concentrations this area (ARCADIS, 2010a).

Summary of Nature and Extent of COI

The soil, sediment and groundwater data collected in OU-E to date suggest the following:

- Soil samples collected in the upland area north of Pond 8 contain lead, TPH, PAHs, and, in certain areas, dioxins/furans (Attachment 7 of ARCADIS 2010e). TPH forensic analysis suggests that much of the TPH observed in the soil samples consists of natural organic material (NOM), and to a lesser extent fuel-related hydrocarbons (Attachment 10 of ARCADIS 2010e). This will be further evaluated in the RI. Fuel-impacted and metal-impacted soil was removed from select areas through an interim action in 2006 and 2008 (ARCADIS 2010b).

- A combination of historical industrial use and/or municipal stormwater management have enriched concentrations of metals (lead, zinc, and sometimes arsenic, and copper), and dioxins/furans in surface and subsurface sediment in Ponds 1, 2, 3, 6, 7, and 8 (ARCADIS 2009, ARCADIS 2010d). Petroleum hydrocarbons in the diesel range (TPHd) were detected in Pond 8 which receives stormwater runoff from the City. Ponds 4, 5, 9, and the North Pond appear relatively unimpacted (ARCADIS 2009). Pond 4 was sampled but found to contain no sediment (Pond 4 was dredged just prior to the mill closure).

- Groundwater underlying the upland areas of OU-E is largely unimpacted. Sporadic detections of petroleum hydrocarbons have been reported in groundwater collected from temporary well points and monitoring wells (Appendix A of ARCADIS 2010b; Attachment 7 of ARCADIS, 2010d) but may be due to NOM. Dissolved metals, principally arsenic and barium, have also been detected (Appendix A of ARCADIS, 2010b); but these metals are believed to be a result of site-specific geochemistry rather than industrial sources/releases (ARCADIS, 2010e).

- Surface water samples from city stormwater discharge points into Pond 8, and outfall points from Pond 6 and Pond 8 to the Pacific ocean contain dioxins/furans and dissolved metals, and TPHd and TPHg detections at estimated concentrations less than the reporting limit. PAHs have also been detected in samples from all locations, generally below the reporting limit. Several chlorinated VOCs, including tetrachloroethene (PCE) and its degradation products, have been detected in the Alder Street storm drain samples. PCBs have not been detected (ARCADIS 2010c). One round of surface water samples were collected from all ponds in 2006 and analyzed for metals, which were generally not detected or below screening levels. Additional samples have not been collected from Ponds 1 through 7, the North Pond or Pond 9 since that time because surface water is not expected to have significant concentrations of COIs.

The nature and extent of contamination in sediment, surface water, soil, and groundwater in OU-E will be presented and discussed the forthcoming RI.

Future Land Use and Influence on Exposure Media

Figures 6 (terrestrial) and 7 (aquatic/wetland) illustrate future potential exposure pathways and receptors for OU-E. Under the future use scenario (Alternative 6; Figure 3) for the MPC, habitats include daylighted streams/channel features, consisting of riparian corridors with floodplain wetlands; lowland wetland and open water features (high marsh and low marsh); and adjacent terrestrial habitats. As illustrated on Figure 3, a portion of Alternative 6 as proposed would daylight Maple Creek in what is part of OU-C and OU-D. Pond 8 will be closed and reverted to terrestrial habitat with the exception of a small area of the pond that will accommodate a portion of the stream/channel feature. Within the southern ponds, habitats are expected to remain the same or be enhanced as part of site restoration; changes to the southern ponds that would affect future exposures are not anticipated. The MPC will continue to receive stormwater runoff from the site and/or the City drainages. The final disposition of Ponds 5 and 9 has not been determined at this time. As noted previously these ponds had no industrial use and do not contain site-related COIs and so are not addressed in the OU-E risk assessment.

The daylighted stream portion of Alternative 6 that is proposed for construction in OU-C/OU-D may result in potential exposure to COI detected in OU-C/OU-D subsurface soil and groundwater. A preliminary review of data from this area of OU-C/OU-D identified the following COIs:

- metals (primarily arsenic and lead) and TPHd in soil.
- metals (primarily arsenic), PAHs, and TPHd in groundwater. PCE was also detected in samples from one monitoring well and is therefore a COI.

Receptors

Human health risks will be evaluated for the following receptors listed in the RAWP:

- Maintenance/utility/trench worker
- Construction worker
- Passive recreator (including the child and adult recreator and the frequent park user)

The maintenance/utility/trench worker is an adult receptor that would conduct short-term maintenance and emergency repair activities on underground utilities at the site and/or conduct site restoration activities associated with establishing and maintaining habitats within the future parkland/open space areas. In accordance with the approved RAWP, it is assumed that this worker would:

- be onsite up to 20 days per year for 7 years
- be involved with these types of activities on multiple utility maintenance and/or repair tasks for several years

- encounter surface sediments and surface and subsurface soils, but that exposure to deep sediments associated with the OU-E ponds or restored habitats would not be a complete exposure pathway.

In accordance with the approved RAWP, the construction worker is an adult receptor that would perform construction activities during site redevelopment and would be onsite for one year, with a frequency of 5 days per week for 50 weeks. In OU-E, this is not the construction worker involved in the remedial activities. Trained workers will apply the exposure controls identified in the site-specific health and safety plan. However, it is reasonable to assume that construction activities will be necessary in the future to place amenities (e.g., trail construction, ancillary facilities, additional restoration features).

The recreational visitor could include a range of temporary visitor types from one time visitors to daily walkers or joggers. Consistent with the approved RAWP, two possible recreational receptors will be assessed: one representative of occasional visitors (i.e., passive recreator) to the site, and the other representative of regular visitors to the site (i.e., frequent recreator). The exposure frequency and duration assumptions for these receptors will be as listed in the approved RAWP except as noted below.
For the recreator, less exposure will be assumed to sediments and surface water (12 days per year versus 50 to 200 days per year exposed to terrestrial areas). This is reasonable because the wetlands and riparian areas are ESHAs afforded protection that restricts Park/open space visitors from entering these areas (e.g., by the placement of boardwalks/trails outside of sensitive habitat areas, signage.). However, it is assumed that recreators may ignore such provisions and enter these areas within the MPC area. This is unlikely in the southern ponds where depth presents a natural physical barrier for humans to enter these areas.

Ecological receptors that will be evaluated are all ecological receptors identified in the RAWP (ARCADIS BBL, 2008a):

Upland:
- Plants
- Soil invertebrates
- California quail
- Killdeer
- American kestrel
- Ornate shrew
- Mule deer
- Red fox

Wetland/Aquatic:
- Plants
- Benthic invertebrates
- Amphibians
- Mallard
- Virginia rail
- Great blue heron
- Raccoon

Exposure Assessment

Figure 8 shows the proposed exposure units (EUs) for evaluation based on the future development. A total of four EUs will be assessed (one terrestrial and three aquatic/wetland areas).

- EU1: terrestrial area within OU-E and the Alternative 6 MPC footprint (the only industrialized terrestrial area with potential exposure; includes filled/closed Pond 8)
- EU2: aquatic/wetland area within OU-E and the Alternative 6 MPC footprint
- EU3: aquatic/wetland daylighted stream area within OU-C/OU-D and the Alternative 6 MPC footprint
- EU4: aquatic/wetland area in OU-E Ponds 1 through 4 (Southern Ponds)

As stated previously, Ponds 5 and 9 have had no known industrial use and will therefore not be included in the risk assessment. The terrestrial area around the southern ponds also will not be evaluated in the risk assessment because the area had no industrial use and, as stated previously, COIs were not detected at elevated concentrations in upgradient areas (ARCADIS, 2010a).

The Alternative 6 aquatic/wetland area was split into two EUs (EU2 and EU3) to allow separate evaluation of stream/riparian corridor area which passes through an area of which a portion was subjected to an interim action in 2008/2009 (ARCADIS, 2010g).

Relevant receptors and exposure pathways are shown in Figure 6 (EU1) and Figure 7 (EU2, EU3 and EU4). All receptors will be evaluated for terrestrial and wetland/aquatic EU separately initially as this will maximize estimates of exposure and risk. To address potential human exposure across the EUs, the following combined scenarios for Alternative 6 will also be assessed:

- Recreators: 80% EU1 terrestrial risk plus 10% EU2 and 10% EU3 aquatic/wetland risk
- Maintenance workers: 80% EU1 terrestrial risk plus 10% EU2 and 10% EU3 aquatic/wetland risk
- Construction workers: 80% EU1 terrestrial risk plus 10% EU2 and 10% EU3 aquatic/wetland risk

Similar to human receptors, each ecological receptor will be assumed to be exposed to a single EU using an area use factor (AUF) of 1 which provides a maximum estimate of risk. If AUFs < 1 are used, exposure to multiple EUs will be considered as well.

Human Health Exposure Pathways

Exposure pathways that will be assessed for the terrestrial areas (EU1; see Figure 6) include ingestion and dermal contact with soils, although recreators would be exposed to surface soils only (to a depth of up to 2 feet below ground surface [bgs]), and inhalation of particulates. Exposure depths for workers will be as approved in the RAWP; workers are assumed to be exposed to surface soils and soils up to 6 feet bgs (utility/trench/maintenance workers) or 10 feet bgs (construction workers). Note that in areas where groundwater is shallow, exposure depths for workers will be assumed to be no more than 2 feet below the

groundwater table. It is assumed that workers could contact groundwater and methods for estimating risks for that pathway are described in the RAWP. Based on the current data for the MPC, VOCs have not been found at significant levels (i.e., warranting an investigation of soil gas).

For the aquatic/wetland areas (EU2, EU3, and EU4; see Figure 7), exposure pathways that will be assessed are ingestion and dermal contact with surface sediment and surface water. Deeper sediments are unlikely to be encountered and that pathway is considered insignificant.

Ecological Exposure Pathways

For terrestrial habitats (EU1; see Figure 6), the following exposure pathways are considered potentially complete:

- Plant direct exposure to soil constituents. Shallow rooting plants are assumed to be exposed to the upper 2 feet of soil. Deep rooting plants are assumed to be exposed to the upper 6 feet of soil and to groundwater shallower than 6 feet bgs.
- Soil invertebrate direct exposure to soil constituents in surface soils (0-0.5 feet bgs).
- Wildlife consumption of prey items (i.e., plants, invertebrates, and wildlife). Non-burrowing wildlife are assumed to be primarily exposed to the upper 2 feet of soils and will ingest biota exposed to the top 2 feet of soil. Burrowing mammals may be exposed to soil as deep as 6 feet bgs.

For the aquatic/wetland habitats (EU2, EU3, EU4; see Figure 7), the following exposure pathways are considered potentially complete:

- Aquatic plant and benthic invertebrate direct exposure to surface sediment and surface water constituents. Some aquatic, deep-rooting plants may also be exposed to deeper sediments.
- Amphibians[2] direct exposure to surface sediment and surface water as well as ingestion of prey items.

[2] Note that a recent survey showed that although amphibians are present, the types of red-legged frogs present are not the federally listed threatened California red-legged frog (*Rana draytonii*) (Biosearch Associates 2010), but are the Northern red-legged frog (*Rana aurora*), which is a California species of special concern.

- Wildlife incidental ingestion of constituents in surface sediment and ingestion of surface water for drinking water. Some mammals (i.e., raccoon) may also be exposed to deeper sediment.

- Wildlife consumption of contaminated prey items (i.e., plants and invertebrates).

Dermal contact is considered a complete but insignificant exposure pathway for wildlife, as discussed in the RAWP.

Exposure Point Concentrations

Exposure point concentrations (EPCs) will be calculated for the following exposure depths:

- Terrestrial: 0 to 0.5 foot below ground surface (bgs), 0 to 2 feet bgs, 0 to 6 feet bgs, and 0 to 10 feet bgs, with limits associated with depth to groundwater as noted in CSM.
- Wetland/aquatic: 0 to 0.5 foot bgs and 0 to 2 feet bgs.

Consistent with the risk assessment completed for OU-C and OU-D (ARCADIS 2010a), the interval with generally higher EPCs in each EU will be selected for evaluation in the human health risk assessment.

The preferred remediation alternative for Pond 8 involves stabilization of the sediments, which is going to involve mixing of the sediments in the pond with stabilizing materials. Because the concentration of the final mixture is uncertain, a 2-tiered approach will be used to assess Pond 8 exposure under the future scenario, as combined with the entire terrestrial EU1:

- Tier 1: "soil" EPCs in EU1 will be based on an area-weighted 95-UCL calculated using the 95-UCL for the Pond 8 sediment dataset and the 95-UCL (per depth interval) for the remainder of EU1. For example, the 0 to 0.5 foot bgs interval EPC for EU1 will be calculated using the area-weighted 95-UCL for the Pond 8 sediment dataset, and the area-weighted 95-UCL for the samples within the 0 to 0.5 foot bgs interval in the remainder of EU1.

- Tier 2: "soil" EPCs in EU1 will be based on an area-weighted 95-UCL calculated using the 95-UCL for the Pond 8 sediment dataset, adjusted by the stabilization mix ratio, and the 95-UCL (per depth interval) for the remainder of EU1.

The Tier 2 scenario will only be evaluated if the Tier 1 approach shows unacceptable risk.

Exposure assumptions for human and ecological receptors will be those provided in the RAWP with the exception of aquatic/wetland media exposures to recreators, which as described previously, will include a modification to exposure duration of 12 days per year.

Effects Assessment

Toxicity values will be the same as used in those provided in the RAWP (ARCADIS BBL 2008a) and the OU-C/OU-D RI (ARCADIS 2010a, ARCADIS 2010f), updated as appropriate.

Risk Characterization and Uncertainty Analysis

Risks will be estimated by individual exposure media/units as well as a set of combined scenarios, as described previously. Uncertainties will be described as outlined in the RAWP.

Risk Assessment Dataset Development

Dataset preparation will be consistent with the approved RAWP and dataset development for previous RIs for site except where noted below. As in the previous RIs, soil in presumptive remedy areas (PRAs) will be discussed in the nature and extent section of the RI, but will be excluded from the risk datasets. PRAs will be considered if the following criteria, which are consistent with those applied to OU-A (ARCADIS BBL 2007b) are met:

- an area that likely poses an unacceptable risk or exhibits other criteria that would require remedial action regardless of the results of a risk evaluation, or

- the presence of "significant" hot spots, i.e. areas where two or more adjacent sample locations have constituents at concentrations greater than 10 times the screening level.

The risk assessment will assume that soil from these areas will be addressed in the forthcoming FS.

Soil/Sediment Dataset

Soil or sediment exposure is a complete pathway for all EU (Figure 6 for soil and Figure 7 for sediment). The OU-E risk assessment will focus on potential risks for future land use. To develop the appropriate soil/sediment dataset for the risk assessment, the future topography and data relevant to future conditions will be identified. A flow-chart illustrating the soil/sediment dataset development is provided in Figure 9.

To create features in the Alternative 6 footprint there will be "cut/fill" activity (i.e., some areas will be excavated to create features and some areas will be built up). Cross-section figures will be developed to identify the ground "surface" (soil or sediment) in the future scenario. Data for soil samples collected below the future "surface" and within the relevant depth ranges (i.e. 0 to 0.5 foot bgs, 0 – 2 feet bgs, etc) will used to calculate EPCs for EU1, EU2, and EU3. Pond 8 sediment data will be utilized as described above (see "Exposure Assessment"). As stated previously, any data included within a PRA boundary will also be

excluded from the EPC dataset (Figure 9). The completeness of these datasets for evaluating future scenario risk will be assessed following the calculation of summary statistics and EPCs.

"Cut" soil, i.e. soil above the future ground surface will not be included in the risk assessment datasets. Instead, the dataset for cut soil will be compared to site-specific risk-based screening levels for reuse, as it is assumed it will be stockpiled onsite for potential reuse. Soil excavated from within the footprint of PRAs will be designated for inclusion in the FS.

The risk assessment dataset for sediment in EU4 will consist of all available pond sediment data, within the relevant exposure depths.

Groundwater Dataset

Groundwater exposure is a complete pathway for EU1 only (Figure 6).

Data from monitoring wells considered representative for groundwater quality in EU1 will be included for the EPC calculation. As done in the risk assessment for OU-C and OU-D (ARCADIS 2010a), the groundwater dataset for EU1 will consist of monitoring well data collected in the last 8 quarters (January 2008 through December 2010). However, monitoring well data collected within this time frame, but in interim action areas prior to interim action will be excluded from the dataset since they are not representative of current conditions; data from monitoring wells installed after the remediation are more representative of current conditions and will be included.

Surface Water Dataset

Surface water exposure is a complete pathway for EU2, EU3 and EU4 (Figure 7).

Surface water in EU2 and EU3 in the future scenario will consist of groundwater, stormwater input, and run-off, with contributions related to the amount of rainfall, and therefore varying throughout the year. Initially, surface water risk for these exposure units will conservatively be assessed using EPCs based on groundwater data from monitoring wells representative for groundwater potentially discharging to the EU, and using data collected in the last 8 quarters (January 2008 through December 2010) only. As for the groundwater dataset, monitoring well data collected within this time frame, but in interim action areas prior to interim action will be excluded from the dataset since they are not representative of current conditions; data from monitoring wells installed after the remediation are more representative of current conditions and will be included. Pending the results of this evaluation, risk may be re-evaluated using a more realistic dataset for future surface water concentrations.

Surface water exposure in EU4 will be quantitatively assessed using the existing surface water data for the southern ponds.

Risk-Based Screening Level Development for Cut Soil Re-Use

Risk-based screening levels will be developed to evaluate cut soil with two potential options for future disposition:

- Soils at or below screening levels can be re-used onsite; screening levels will be identified for terrestrial soils and wetland/aquatic soils and some materials may be suitable for only one type of area/habitat.

- Soil exceeding screening levels will be either treated onsite and re-used in terrestrial areas (applies to soils with TPH only above screening levels that can be landfarmed) or hauled offsite (applies to soils with no-petroleum constituents above screening levels). Treated soils will not be placed in wetland/aquatic areas unless approved for that use by the Regional Water Quality Control Board (RWQCB).

Screening levels for cut soil will be back-calculated based on risk assessment exposure and toxicity assumptions. The back-calculations will be conducted for the full set of receptors (both ecological and human health) and the most conservative selected as the screening level. A value will be selected for upland reuses and one for wetland/aquatic reuses. The approach will be similar to that used to develop cleanup levels for Operable Unit A (ARCADIS BBL 2008b).

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CITY: Highlands Ranch DIV/GROUP: GIS DB: BG
Project # 66116 task 10
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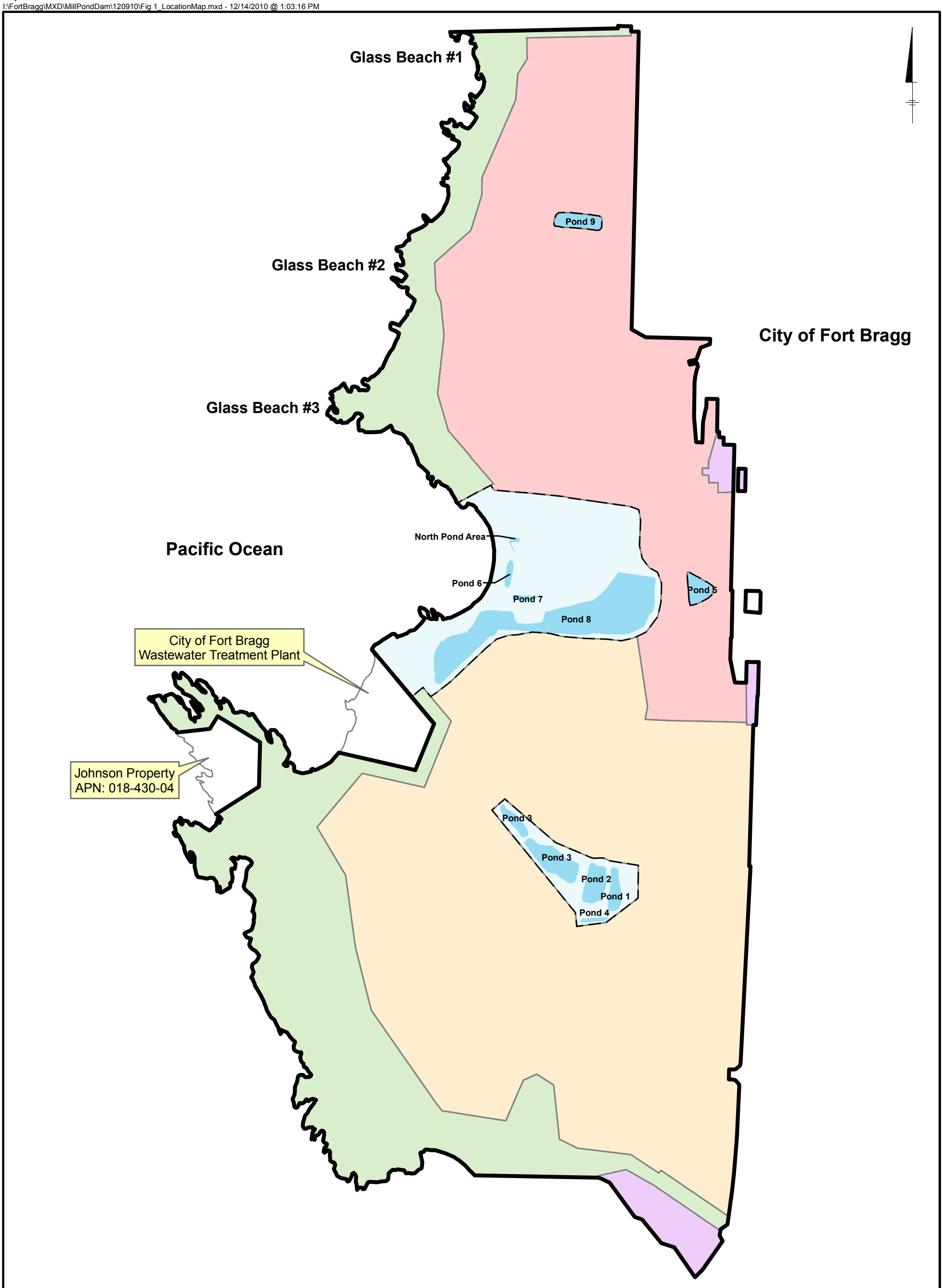

LEGEND:

POND

SITE BOUNDARY

OPERABLE UNITS

OU-A

"OFFSITE" NON-INDUSTRIAL (OU-B)

NORTHERN (OU-C)

SOUTHERN (OU-D)

PONDS/PARK (OU-E)

NOTE:

OU = OPERABLE UNIT

0 620 1,240 Feet

GRAPHIC SCALE

FORMER GEORGIA-PACIFIC WOOD PRODUCTS FACILITY
FORT BRAGG, CALIFORNIA

TECHNICAL MEMORANDUM – RISK ASSESSMENT APPROACH FOR OPERABLE UNIT E

OPERABLE UNITS

ARCADIS

FIGURE 1

Legend

- DELINEATED WETLANDS (ARCADIS 2010, WRA 2009)
- POND/DELINEATED WETLAND (WRA, 2009)
- OU-E BOUNDARY
- OU-E LOWLAND BOUNDARY

NOTE:
THE PRESENTED RESULTS OF THE 2010 WETLAND DELINEATION ARE DRAFT; BOUNDARIES MAY STILL BE MODIFIED AND THE DELINEATION HAS NOT BEEN APPROVED YET.

0 170 340 Feet

FORMER GEORGIA-PACIFIC WOOD PRODUCTS FACILITY
FORT BRAGG, CALIFORNIA
TECHNICAL MEMORANDUM – RISK ASSESSMENT APPROACH FOR OPERABLE UNIT E

CURRENT CONFIGURATION MILL POND COMPLEX

ARCADIS

FIGURE 2

CITY: Highlands Ranch DIV/GROUP: GIS DB: BG
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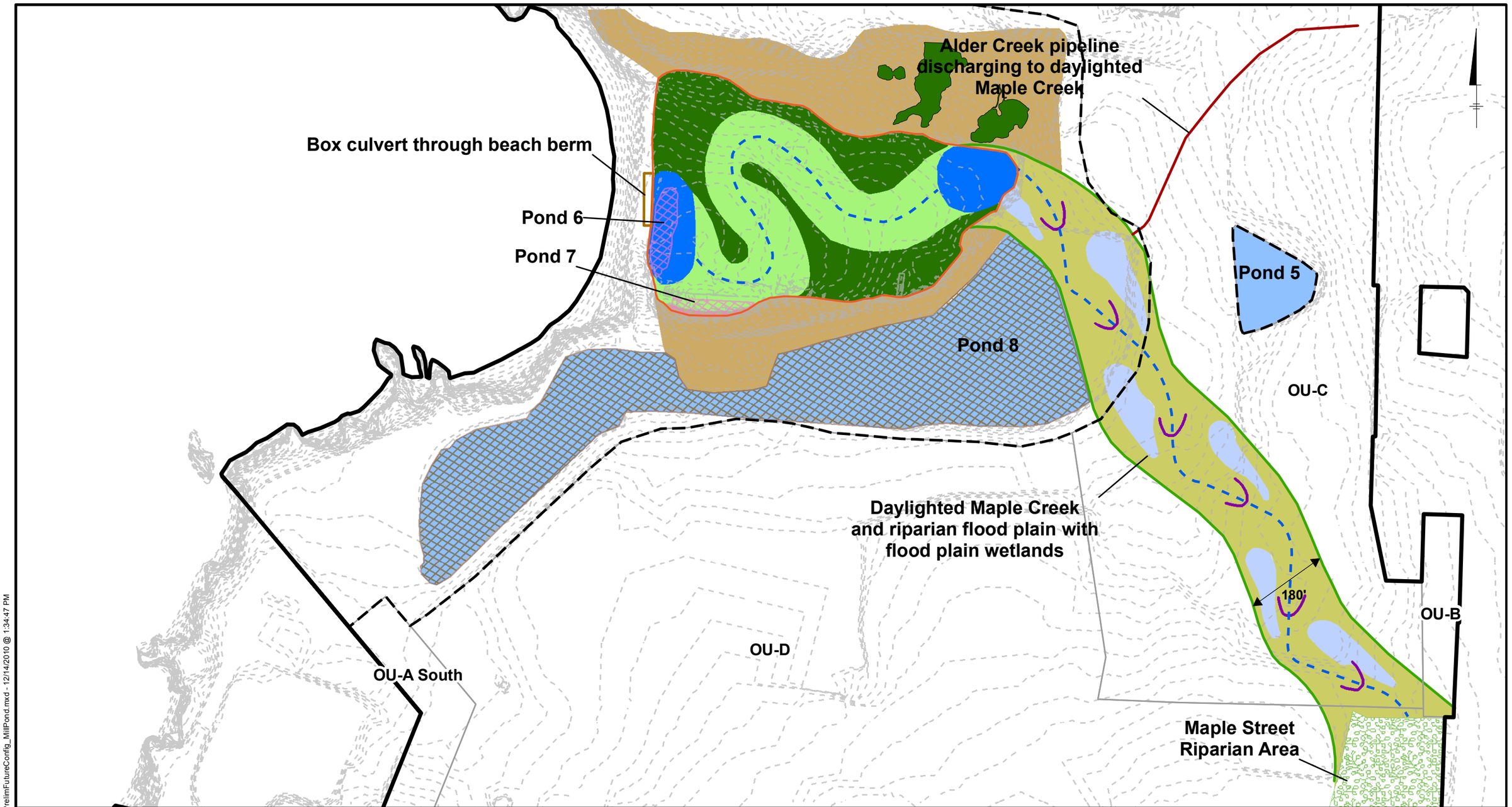

Legend

- STABILIZED/FILLED POND
- REMEDIATED POND
- CONTOURED SLOPE/ COASTAL BLUFF SHRUB HABITAT
- LOW MARSH
- HIGH MARSH
- PONDED AREAS
- RIPARIAN HABITAT
- EXISTING MAPLE STREET RIPARIAN AREA
- FLOODPLAIN WETLAND
- EXISTING POND
- OU-E LOWLAND BOUNDARY
- ALDER CREEK PIPELINE
- BOX CULVERT
- MAPLE CREEK AND RIPARIAN FLOOD PLAIN
- GEOMORPHIC GRADE CONTROL FEATURE
- TOPOGRAPHIC CONTOUR
- SITE BOUNDARY
- OU-E BOUNDARY
- OU BOUNDARY

ACRONYMS:
OU - OPERABLE UNIT

DRAFT

0 100 200 300 Feet

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TECHNICAL MEMORANDUM – RISK ASSESSMENT APPROACH FOR OPERABLE UNIT E

PRELIMINARY FUTURE CONFIGURATION
MILL POND COMPLEX: ALTERNATIVE 6

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FIGURE 3

CITY: HR DIV/GROUP: GIS DB: BG
Project # 66116 task 10
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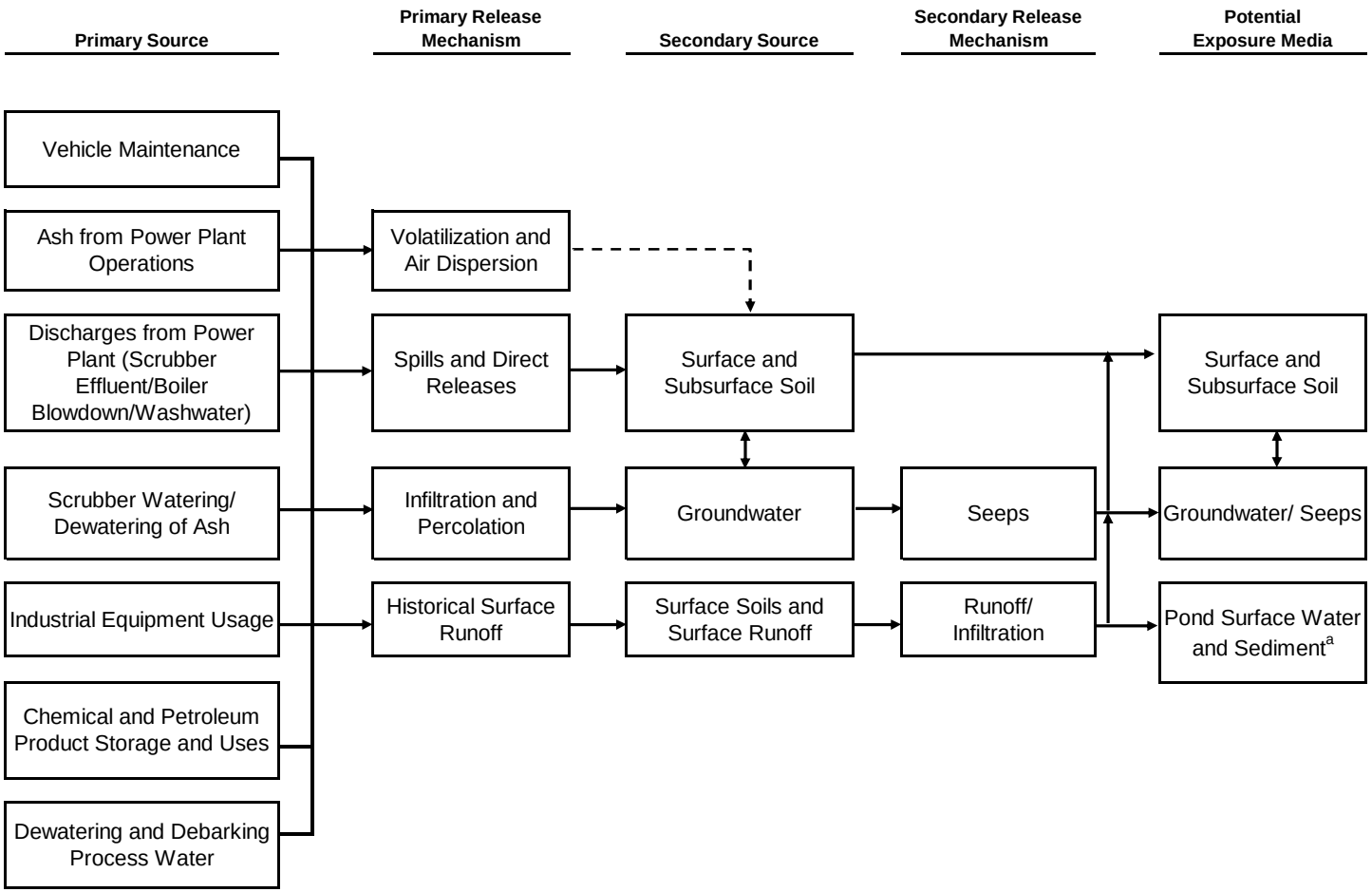

Notes:

Potentially significant transport pathway (primarily historical)

Complete but likely insignificant transport pathway relative to current conditions (due to temporal nature and/or significance of source)

OU = Operable Unit

[a] See figure 6 for a conceptual site model addressing potential sources to ponds only.

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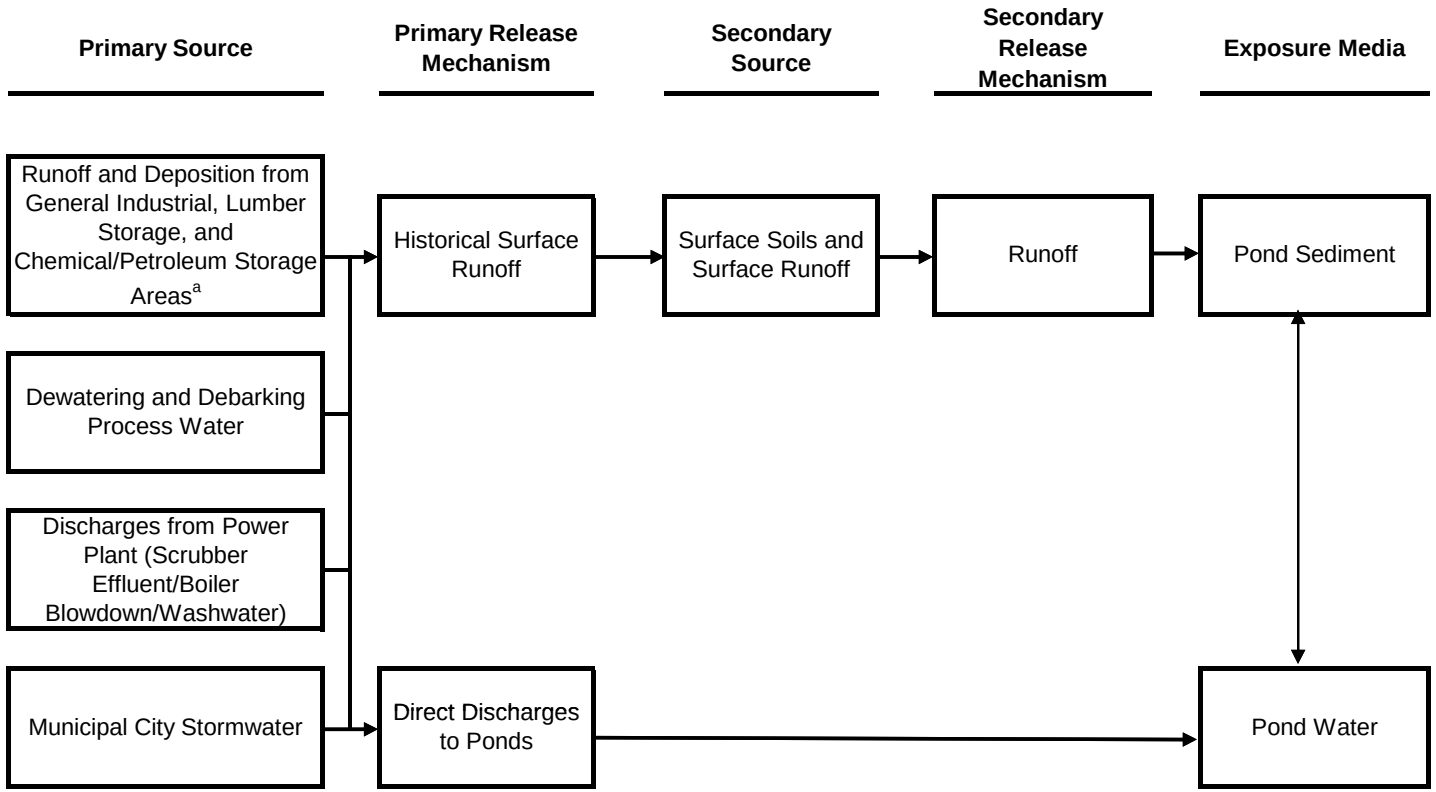
Technical Memorandum - Risk Assessment Approach for OU-E

GENERAL CONCEPTUAL SITE MODEL - Upland

ARCADIS

FIGURE

4



Notes:

Potentially significant transport pathway (primarily historical).

[a] Industrial site run-off is not a source for Pond 9, which is situated above grade; run-off into Pond 5 from industrial areas of the site is limited by a berm and therefore expected to be minimal.

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GENERAL CONCEPTUAL SITE MODEL - Ponds

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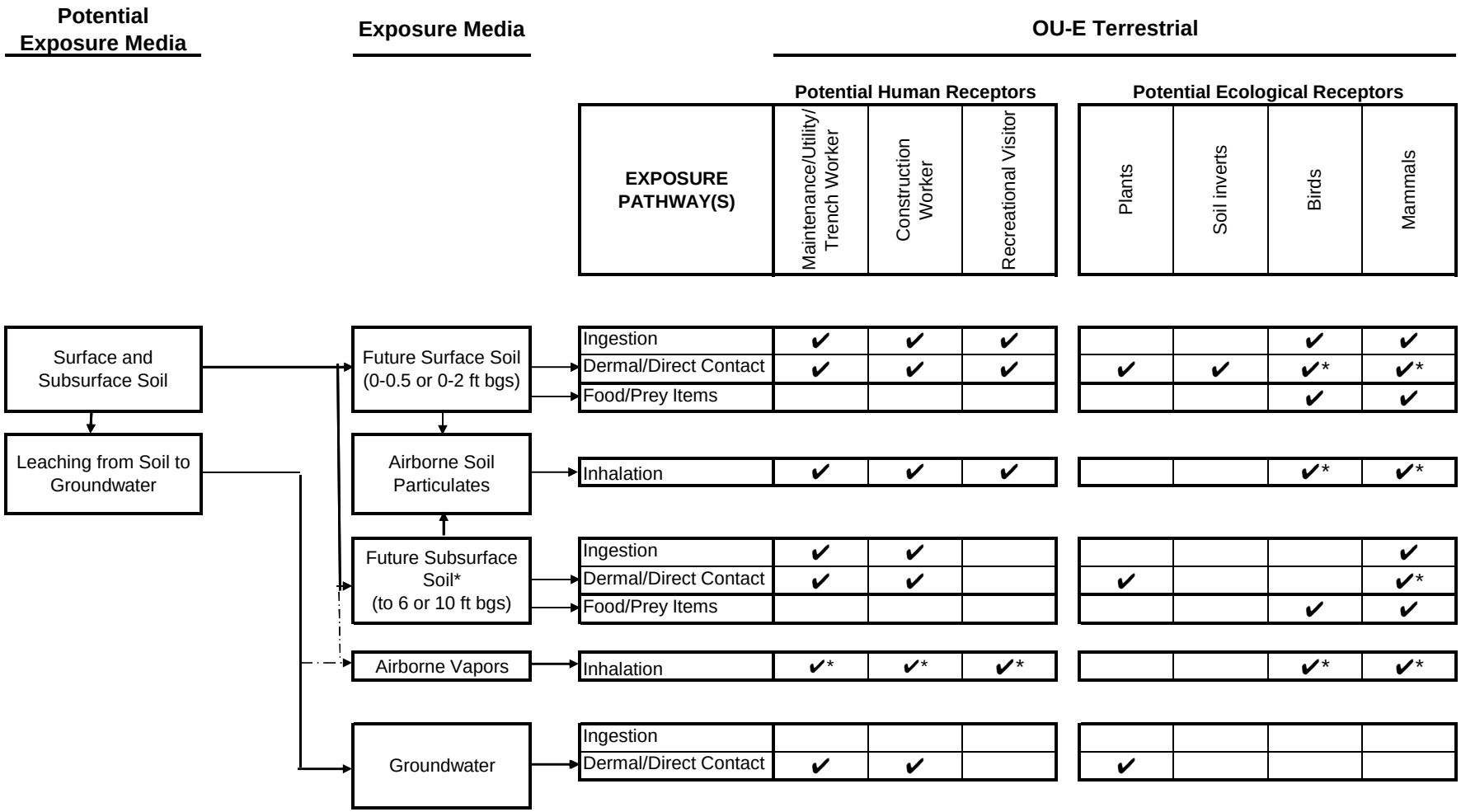
FIGURE
5

Figure 6
Terrestrial Area Conceptual Site Model
Technical Memorandum - Risk Assessment Approach for OU-E

Former Georgia-Pacific Wood Products Facility
Fort Bragg, California



Notes:

Potentially complete pathway if VOCs are identified as COPCs.

✔ Potentially complete exposure pathway

✔* Potentially complete but likely insignficant pathway

COPC = Chemical of potential concern
ft bgs = feet below ground surface
OU = operable unit
VOC = Volatile organic compounds

* Note that where depth of groundwater is shallow, exposure depths will be lmited to 2 feet below the groundwater table.

Figure 7
Wetland/Aquatic Area Conceptual Site Model
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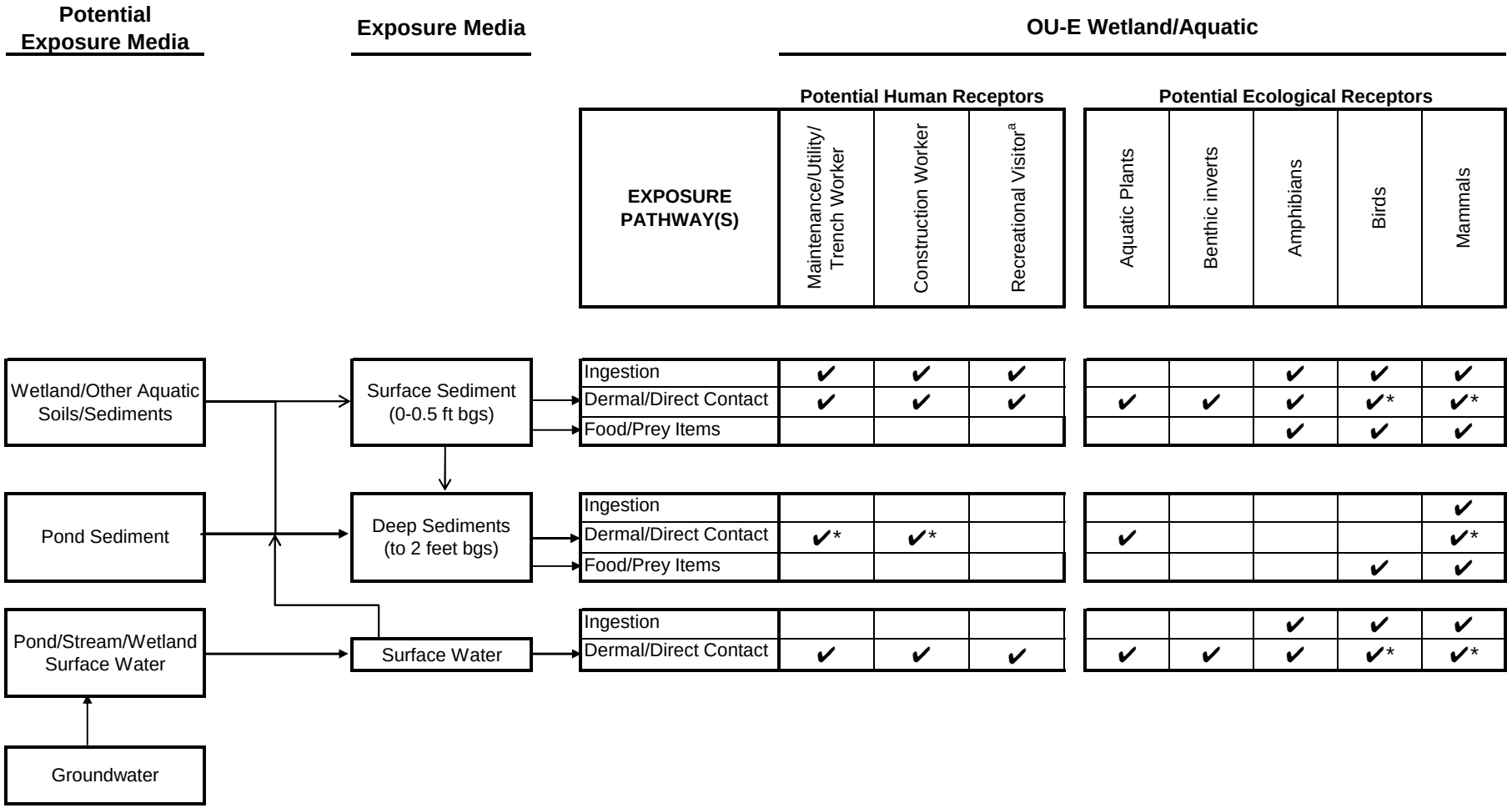
Former Georgia-Pacific Wood Products Facility
Fort Bragg, California



✔ Potentially complete exposure pathway

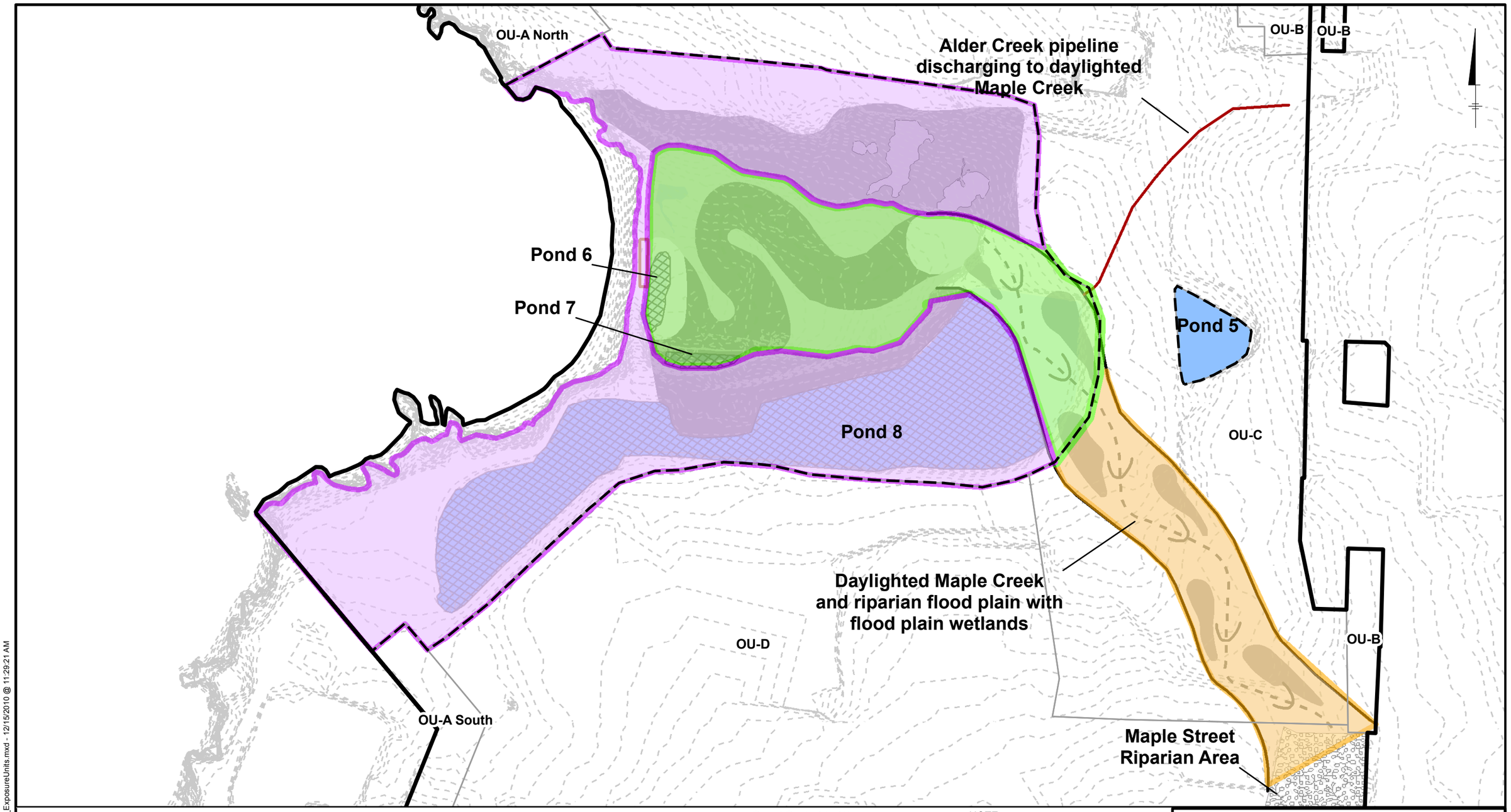
✔* Potentially complete but likely insignficant pathway

COPC = Chemical of potential concern

ft bgs = feet below ground surface

OU = operable unit

[a] Recreators are unlikely to be frequently exposed to surface water and sediment but this pathway will be quantitatively evaluated to be protective.



Legend

- STABILIZED/FILLED POND
- REMEDIATED POND
- CONTOURED SLOPE/ COASTAL BLUFF SHRUB HABITAT
- LOW MARSH
- HIGH MARSH
- PONDED AREAS
- RIPARIAN HABITAT
- EXISTING MAPLE STREET RIPARIAN AREA
- FLOODPLAIN WETLAND
- EXISTING POND
- EXPOSURE UNIT 1 - MPC TERRESTRIAL
- EXPOSURE UNIT 2 - MPC WETLAND/AQUATIC
- EXPOSURE UNIT 3 - OUC CHANNEL
- OU BOUNDARY
- ALDER CREEK PIPELINE
- BOX CULVERT
- MAPLE CREEK AND RIPARIAN FLOOD PLAIN
- GEOMORPHIC GRADE CONTROL FEATURE
- TOPOGRAPHIC CONTOUR
- SITE BOUNDARY

NOTE:
REFER TO FIGURE 3 FOR SPECIFIC DETAILS ON ALTERNATIVE 6

ACRONYMS:
OU - OPERABLE UNIT

0 220 440 Feet

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FORT BRAGG, CALIFORNIA

TECHNICAL MEMORANDUM – RISK ASSESSMENT APPROACH FOR OPERABLE UNIT E

ALTERNATIVE 6 WITH EXPOSURE UNITS 1, 2, AND 3

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FIGURE 8

CITY: HR_DIV/GROUP: GIS DB: BG
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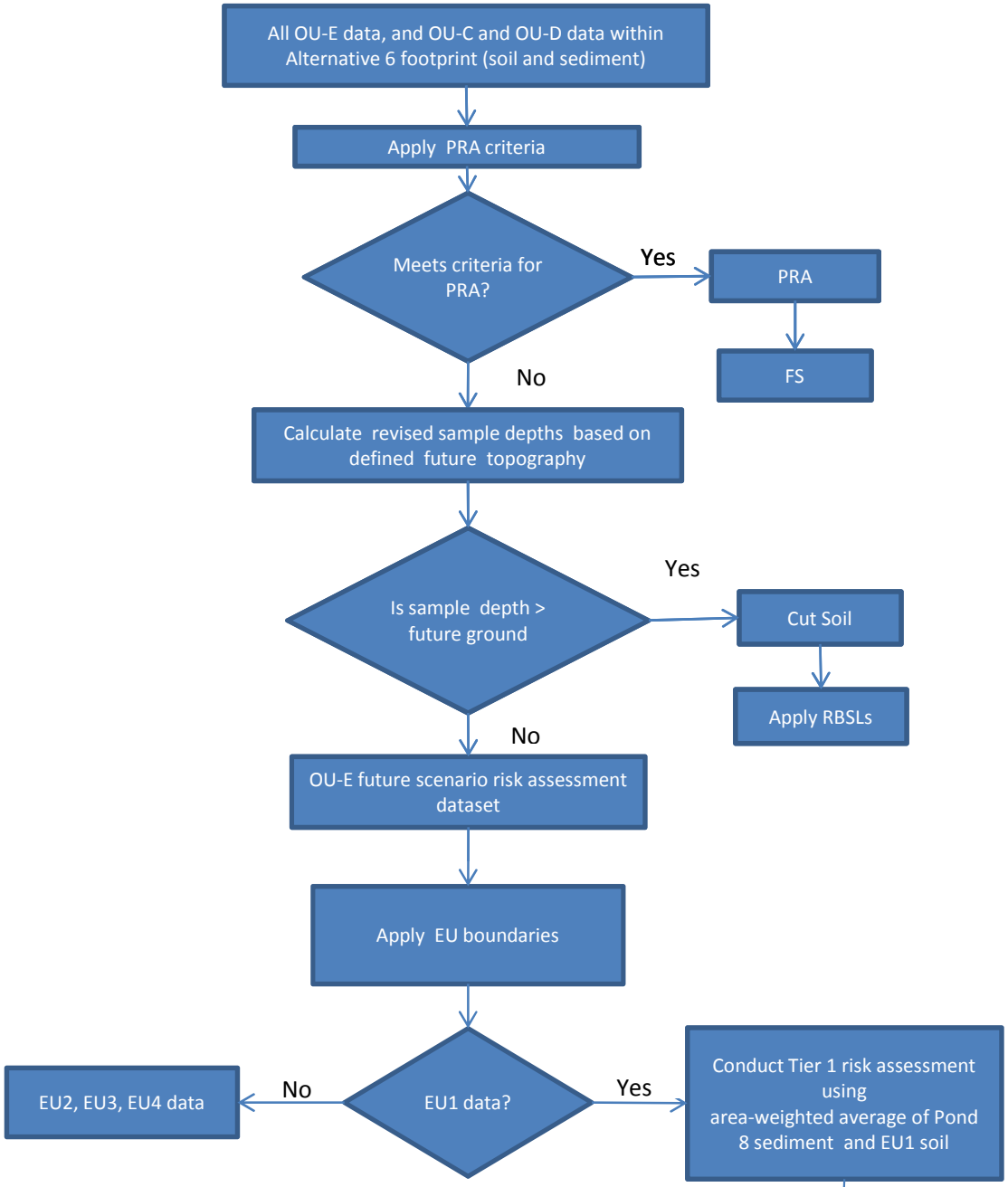

Notes

EU = Exposure unit
FS = Feasibility study
OU = Operable unit
PRA = Presumptive remedy area
RBSL = Risk based screening level

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Flow-chart for Risk Assessment Dataset Preparation

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FIGURE
9