FINAL DOCUMENT

900 Innes Avenue Site
San Francisco, San Francisco County, California
Analysis of Brownfield Cleanup Alternatives

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U.S. Environmental Protection Agency
Region 9

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1. Introduction and Background

The U.S. Environmental Protection Agency (EPA), Region 9, in coordination with the U.S. Army Corps of Engineers (USACE), tasked Weston Solutions, Inc. (WESTON®) to conduct a Phase II Environmental Site Assessment (ESA) and an Analysis of Brownfield Cleanup Alternatives (ABCA) for the San Francisco Recreation and Parks Department (SFRPD) at the 900 Innes Avenue Site (Site). The Site is located in the Bayview – Hunters Point Neighborhood of San Francisco, in San Francisco County, California. The SFRPD would like to determine whether the Site is suitable for planned development as part of the proposed San Francisco Blue Greenway public open space. The work was performed for the EPA under the USACE Contract W91238-06-F-0083.

The purpose of this ABCA is the evaluation of site conditions and possible remedial alternatives. This evaluation will be expanded, modified if necessary, and incorporated into the final Site Cleanup Plan for review by the community, project partners, the regulatory oversight agency and the EPA.

1.1 Site Location

The Site is a cluster of eleven parcels centered at the 900 Innes Avenue property, at the intersection of Innes Avenue and Griffith Street, in the Bayview Neighborhood of San Francisco, California. The parcels are positioned adjacent to India Basin of the San Francisco Bay, directly south of India Basin Shoreline Park. The Site occupies approximately 105,550 square feet (2.4 acres) and is partially fenced. The Site is mostly unpaved, with some paved areas near the shore and an access road. The Site generally slopes towards the San Francisco Bay such that most surface runoff flows directly into India Basin. Wetlands may be present along the shoreline adjacent to the Site. Four structures exist at the Site; an abandoned single-family home, two storage buildings, and a covered pier that has partially collapsed. The project area location is presented in Figure 1, and project area layout is presented in Figure 2.

1.2 Ownership and Previous Use

The Site functioned as a boatbuilding and ship repair facility for several companies spanning over 120 years, particularly through the historic 1875 to 1930 period of marine-based cargo transportation in San Francisco. Environmental contaminants typically associated with the shipbuilding and repair industry include those generated from vessel maintenance, general facility and yard operations, marine coatings and antifoulants, and abrasive blasting. These include, but are not limited to, heavy metals such as lead, nickel, zinc, and copper; volatile organic compounds such as solvents and overspray during painting operations; biocides such as tributyltin (TBT) and cuprous (copper) compounds; waste engine fluids such as oil, hydraulic fluids, lubricants; and general solid wastes.

In 1992, the owner, Donco Industries, was prosecuted for illegal dredging, leading to their eventual bankruptcy and abandonment of the Site. In its abandoned state, the Site became a homeless encampment. Donco Industries eventually sold the abandoned property to Mikel Manuel. During its new ownership by Mikel Manuel, the Site remained in its abandoned state. In 2001, it was sold to Joe Cassidy Construction and used as construction equipment storage. Six years later, in December 2007, Joe Cassidy sold the Site to the Tenderloin Housing Clinic. Joe Cassidy retained its access agreement to the Site, allowing continued use as a construction equipment storage facility and laydown yard.

Currently, the Tenderloin Housing Clinic owns the largest portion of the Site, but does not use it; parcels owned by Wintersteen and Acosta are currently vacant. The structure at 900 Innes Avenue has been registered as a City of San Francisco Landmark by the Historic Preservation Commission, for its association with the historic marine-based cargo transportation industry of 1875 to 1930.

1.3 Site Assessment Findings

In August 2013, WESTON conducted a Phase I/II ESA and collected surface and subsurface soil samples from the Site. A total of 35 soil samples, 6 sediment samples, and 5 duplicate samples were collected at the Site. All samples were analyzed for CAM 17 metals, PAHs, and TPH-d,mo; 32 selected samples were analyzed for PCBs; 13 selected samples were analyzed for TPH-g; 9 selected samples were analyzed for organotins; 9 selected samples were analyzed for asbestos; 7 selected samples were analyzed for Maher Ordinance analytes, including VOCs.

Elevated concentrations above the established action levels of TPH-d, TPH-mo, PCBs, arsenic, chromium, cobalt, lead, mercury, copper, nickel, benz(a)anthracene, benz(b)-fluoranthene, benzo(a)pyrene, and indeno(1,2,3-cd)pyrene were found in soil samples and sediment samples throughout the Site. Elevated concentrations above the established action levels of l-dibenz(a,h)anthracene, benzo(k)fluoranthene, and chrysene were found in soil samples only. The analytical results of the soil and sediment samples results exceeding the action levels are shown in Figure 3 through Figure 6.

No elevated concentrations of asbestos, organotins, TPH-g, or VOCs above the established action levels were found in any of the soil or sediment samples.

1.4 Project Goal

The San Francisco Recreation and Parks Department plans to develop Site the as part of the proposed San Francisco Blue Greenway public open space.

The project goal is to prepare the Site by remediation of environmental impacts in accordance to regulatory guidelines and mitigate potential chemical hazards to construction workers and users of the public open space.

2. Applicable Regulations and Cleanup Standards

2.1 Cleanup Oversight Responsibility

The RWQCB and the DTSC have the authority to regulate cleanup of polluted/contaminated sites in California. In order to improve the coordination between agencies on oversight of Brownfield cleanups, a Memorandum of Agreement (MOA) was signed in March 1, 2005. The MOA describes the process and considerations used to determine the appropriate lead agency for a particular Brownfield site.

The Site has been entered into the DTSC Site Mitigation and Brownfields Reuse Program (SMBRP) database of properties that may be contaminated (EnviroStor), though listed as Donco Industries at 894 Innes Avenue. The EnviroStor database provides access to detailed information on hazardous waste permitted and corrective action facilities, as well as existing site cleanup information. EnviroStor allows you to search for information on investigation, cleanup, permitting, and/or corrective actions that are planned, being conducted or have been completed under DTSC's oversight.

2.2 Cleanup Standards for Major Contaminants

Cleanup standards for the Site are based on the San Francisco RWQCB ESLs for TPH in soil [May 2013]; California DTSC Human Health Screening Levels (CHHSLs) for lead in residential soil [January 2005]; Maher Ordinance Total Threshold Limit Concentrations (TTLCs) in soils [July 2013]; and EPA Region 9 Regional Screening Levels (RSLs) for residential soil [May 2013]. The RWQCB RSLs, CHHSLs, Maher Ordinance, and EPA RSLs are advisory numbers intended to provide remediation guidance, and have no direct regulatory effect. The combination of these cleanup standards are designed to be protective under a wide range of conditions. Alternatively, the RSLs and CHHSLs for industrial soils could be used as cleanup standards, as the planned use of the Site is not residential.

The EPA RSL for lead in residential soil is 400 mg/kg and 800 mg/kg for industrial soil. Lead exceeded the RSL for residential soil in 10 of 41 samples and 7 of 41 samples exceeded the RSL for industrial soil. The CHHSL for lead is 150 mg/kg for residential soil and 3,500 mg/kg for industrial soil. Lead concentrations exceeded the CHHSL for residential soil in 21 of 41 sample locations and only two samples exceeded the CHHSL for industrial soil. The Maher Ordinance TTLC for lead is 1,000 mg/kg. Lead exceeded the Maher Ordinance TTLC in 6 of 41 samples.

The EPA RSL for mercury in residential soil is 1.0 mg/kg and 4.3 mg/kg for industrial soil. Mercury exceeded the RSL for residential soil in 10 of 41 samples; three samples exceeded the RSL for industrial soil. The CHHSL for mercury is 18 mg/kg for residential soil and 180 mg/kg for industrial soil. Mercury concentrations exceeded the CHHSL for residential soil in 2 of 41 samples, and no samples exceeded the CHHSL for industrial soil. The Maher Ordinance TTLC for mercury is 20 mg/kg. Mercury exceeded the Maher Ordinance TTLC in only 1 sediment sample location.

The EPA RSL for PCB Aroclor-1254 and Aroclor-1260 in residential soil is 110 µg/kg and 220 µg/kg, respectively. The EPA RSL for PCB Aroclor-1254 and Aroclor-1260 in industrial soil is 740 µg/kg. PCB Aroclor-1254 concentrations exceeded the RSL for residential soil in 7 of 32 samples; one sample exceeded the RSL for industrial soil. PCB Aroclor-1260 concentrations exceeded the RSL for residential soil in 3 of 32 samples; two samples exceeded the RSL for industrial soil. The CHHSL for PCBs is 89 µg/kg for residential soil and 300 µg/kg for industrial soil. PCB Aroclor-1254 concentrations exceeded the CHHSL for residential soil in 9 of 32 samples; three samples exceeded the CHHSL for industrial soil. PCB Aroclor-1260 concentrations exceeded the CHHSL for residential soil in 8 of 32 samples; four samples exceeded the CHHSL for industrial soil.

The RWQCB ESL for TPH as gasolines (TPH-g) and TPH as diesel (TPH-d) in soil is 100 mg/kg; the RWQCB ESL for TPH as motor oil (TPH-mo) in soil is 500 mg/kg. No elevated concentrations of TPH-g above the established action level of 100 mg/kg were found in any of the 19 soil and sediment samples. Elevated concentrations of TPH-d above the established action level of 100 mg/kg were discovered in 19 of 41 samples; elevated concentrations of TPH-mo above the established action level of 500 mg/kg were discovered in 13 of 41 samples.

The EPA RSL for benz(a)anthracene, benzo(b)fluoranthene, and indeno(1,2,3-cd)pyrene in residential soil is 150 µg/kg and 2,100 µg/kg for industrial soil. The EPA RSL for benzo(a)pyrene and dibenz(a,h)anthracene in residential soil is 15 µg/kg and 210 µg/kg for industrial soil. The EPA RSL for benzo(k)fluoranthene in residential soil is 1,500 µg/kg and 21,000 µg/kg for industrial soil. The EPA RSL for chrysene in residential soil is 15,000 µg/kg and 210,000 µg/kg for industrial soil. Benz(a)anthracene concentrations exceeded the RSL for residential soil in 8 samples and the RSL for industrial soil in 3 samples; benzo(b)fluoranthene concentrations exceeded the RSL for residential soil in 14 samples and the RSL for industrial soil in 5 samples; benzo(a)pyrene concentrations exceeded the RSL for residential soil in 12 samples and the RSL for industrial soil in 9 samples; dibenz(a,h)anthracene concentrations exceeded the RSL for residential and industrial soil in 4 samples; benzo(k)fluoranthene concentrations exceeded the RSL for residential soil in 2 samples and the RSL for industrial soil in 1 sample; chrysene concentrations exceeded the RSL for residential and industrial soil in 1 sample; indeno(1,2,3-cd)pyrene concentrations exceeded the RSL for residential soil in 6 samples and the RSL for industrial soil in 2 samples. The CHHSL for benzo(a)pyrene is 38 µg/kg for residential soil and 130 µg/kg for industrial soil. Benzo(a)pyrene concentrations exceeded the CHHSL for residential soil in 12 of 41 samples; 10 of 41 samples exceeded the CHHSL for industrial soil.

2.3 Laws and Regulations Applicable to the Cleanup

Preconstruction cleanup activities at the Site should be conducted by contractors operating in accordance to the US Department of Labor Occupation Safety & Health Administration (OSHA) Hazardous Waste Operations and Emergency Response Standard (HAZWOPER), 29 CFR 1910.120. HAZWOPER applies to clean-up operations at sites recognized by federal, state, local, or other governmental body as uncontrolled hazardous waste sites. Additionally, California OSHA developed the Lead in Construction Standard under Title 8 CCR Section 1532.1 applies to work associated with the lead impacted soil.

Laws and regulations that are applicable to this cleanup include the Federal Small Business Liability Relief and Brownfields Revitalization Act, the Federal Davis-Bacon Act, and county laws regarding procurement of contractors to conduct the cleanup.

In addition, excavation and grading permits and underground service alert notifications will be obtained prior to the work commencing.

3. Evaluation of Brownfield Cleanup Alternatives

3.1 Cleanup Action Objectives

The results of the Phase I/II ESA sampling have confirmed the presence of the following contaminants at concentrations above action levels at the Site: TPH-d, TPH-mo, PCBs (Aroclor-1254 and Aroclor-1260), PAHs, and metals (arsenic, chromium, cobalt, lead, mercury, copper, and nickel). Concentrations of lead, mercury, PAHs, TPH-d, TPH-mo, and PCBs above action levels were confirmed in subsurface samples. These exceedances are primarily localized at two sample locations and not distributed throughout the Site; additionally, the subsurface exceedances occur discretely and do not indicate a migration of contaminants from surface soils.

Groundwater testing had been requested by the City of San Francisco Department of Public Health (SFDPH) to satisfy regulatory guidance outlined in the Maher Ordinance. As indicated in Section 6.3.4 of the Sampling Analysis Plan (SAP), groundwater analysis was to be conducted on two subsurface samples, contingent upon the availability of groundwater at a maximum depth of 4-ft below ground surface (bgs). No migration pathway of contaminants to groundwater is believed to be present. However, groundwater was not encountered during subsurface sampling activities and subsequent analysis was not conducted.

Additionally, sampling depths were selected based upon considerations regarding planned future use of the Site – San Francisco Blue Greenway public open space; groundwater is unlikely to be encountered by those visiting the Site for recreational purposes. Of greater likelihood is the possibility that recreational activities will expose visitors to contaminated soils and sediments.

Therefore, the potential short-term exposure scenario for construction workers to these compounds would be by dermal contact and incidental uptake of impacted surface and shallow subsurface soil. Currently, the potential short-term exposure of Site visitors (recreational use) to the contaminants would be dermal contact and incidental uptake of impacted surface soil. Prolonged contact with contaminated soils is less likely for Site visitors than construction workers because recreational use would be intermittent and of short duration. The Site contaminants need to be remediated to protect both future visitors and current construction workers, though construction workers represent the primary concern driving immediate remediation efforts.

3.2 Identification and Evaluation of Cleanup Alternatives

Three potentially feasible cleanup alternatives were identified based on WESTON’s experience with similar sites. These alternatives include:

1. No Action.
2. Construction of a physical barrier.
3. Excavation and disposal.

Evaluation criteria include effectiveness, implementability, and cost. The evaluation for effectiveness considers the appropriateness of the alternative with respect to long- and short-term satisfaction of cleanup goals and comprehensiveness in terms of protection to human and environmental health/safety. Implementability addresses the technical and administrative feasibility of the remedial alternative. Cost evaluates the short- and long-term costs associated with remedy implementation.

Alternative 1 – No Action

Under the No Action Alternative, impacted media would remain in place without treatment.

Effectiveness: This alternative would not lower concentrations of contaminants known to pose a potential risk to future visitors and construction workers at the Site. For this reason, the No Action Alternative would not be effective with respect to the protection of human health.

Implementability: This alternative is easily implemented.

Cost: No costs would be incurred during the implementation of this alternative.

Alternative 2 - Construction of a Physical Barrier

This alternative incorporates institutional controls including a deed restriction or protective covenant and the construction of a 2 to 3 feet thick soil physical barrier in unpaved areas. Physical barriers are commonly utilized at Brownfield redevelopment sites where contaminant removal is impossible or prohibitively expensive. These constructed barriers prevent construction workers and future occupants from contacting contaminated soils at the Site. The barriers do nothing to reduce or remove the concentration of contaminants in subsurface soils.

Effectiveness: This alternative offers limited protection of the human health and safety of construction workers and site visitors. It is not protective to construction workers excavating trenches for utilities or deep foundations; any subsurface work at contaminated areas during site construction would have to be closely monitored, and protective measures would likely be required. The barrier should not be considered protective for future redevelopment. Any redevelopment at the property would likely be accompanied by contaminant source removal, effectively requiring another, second investment in protective measures. The presence of the un-remediated contaminant would be noticed by way of a deed restriction or protective covenant.

Implementability: The barrier is readily implemented using commonly available technology.

Cost: The volumes considered when determining cost projections were estimated based upon the limited sampling of the September 2013 Phase I/II Targeted Brownfields Assessment (TBA). Additional characterization of the Site would better delineate the horizontal and vertical extent of soil and sediment contamination, and likely provide significant reductions in projected volumes of clean fill necessary for construction of a physical barrier. Provided this understanding, there are two feasible cost alternatives; the first associated with construction of a physical barrier for the entire site, the second associated with construction of a physical barrier covering only unpaved areas.

Based on experience with similar projects, the first scenario would cost approximately $360,000. The cost would include importing approximately 11,250 tons of clean fill and grading with 90% compaction. Alternatively, the second scenario would cost approximately $96,000. The cost would include importing approximately 3,000 tons of clean fill and grading with 90% compaction. Costs for subsequent removal are not included (refer to following alternatives for an approximation of this ultimate additional expense). Additional design and engineering would be needed to modify the existing construction plans that would accommodate the raised grade and include the construction of low retaining walls to hold the soil barrier in place. The additional design, engineering and retaining wall construction costs are not included in this estimate.

Alternative 3 – Excavation and Disposal

This alternative would involve the physical removal of contaminated soil. The upper two feet of impacted soil would be excavated from the majority of the Site. Impacted soils would be stockpiled onsite at the existing concrete pad, pending laboratory analysis for waste classification. Verification sampling would be conducted to ensure contaminant concentrations are below Site action levels. If contaminant levels are discovered above Site action levels, an additional two feet of soil would be excavated. Again, the impacted soil would be stockpiled onsite at the existing concrete pad, pending laboratory analysis for waste classification. Following the disposal of the impacted soil stockpile, the concrete pad would be demolished and verification sampling would be conducted to ensure the remaining contaminants are below Site action levels.

The excavated soil would be transported off-site for disposal at an appropriately licensed treatment/disposal facility. Based on a preliminary waste characterization, the TPH-d, TPH-mo, PCBs, PAHs, lead, and mercury impacted soils are considered California hazardous waste under CCR Title 22. Soil containing TPH-g, asbestos, organotins, VOCs, arsenic, and chromium found during Phase II investigation would not be considered a hazardous waste as concentrations are either below action levels or are characteristic of naturally occurring concentrations for the region. The excavation would be backfilled and compacted with clean material suited for the construction project to follow.

Effectiveness: Excavation will completely remove contaminated soil from the shallow subsurface, eliminating the threat from dermal contact (primarily to construction workers) and future Site occupants.

Implementability: The historic site structures will remain intact at the Site; all remaining structures, including the two storage buildings and the covered pier, will be removed in preparation for redevelopment. The existing trees are to remain at the Site. Because the majority of the Site soil will require removal, the excavation will need to be conducted in two events due to limited space for soil stockpiling. Access to streets and freeways is easy with minimal disruption to nearby residents. This alternative is easily implemented.

Cost: The volumes considered when determining cost projections were estimated based upon the limited sampling of the September 2013 Phase I/II TBA. Additional characterization of the Site would better delineate the horizontal and vertical extent of soil and sediment contamination, and likely provide significant reductions in projected volumes of soil targeted for excavation and disposal. Provided this understanding, there are two feasible cost alternatives; the first associated with excavation/disposal for the entire site, the second associated with excavation/disposal for unpaved areas only.

Based on experience with similar projects, it is estimated that costs for planning, permitting, waste profiling, and reporting will total $20,000. The first scenario, including the complete excavation and disposal of soils to 2 ft bgs (9,000 tons), would total $1,215,000; excavation and disposal of soils to 4 ft bgs (18,000 tons) would total $2,430,000. Backfilling, grading ,and compaction of 11,250 tons of clean fill to 90% across the entire site is estimated to total $360,000. The total estimated cost of the first scenario ranges from $1,595,000 to $2,810,000, depending on depth of excavation. Partial excavation and disposal of unpaved areas to 2 ft bgs (2,812 tons) would cost $380,000; partial excavation and disposal of unpaved areas to 4 ft bgs (5,625 tons) would cost $760,000. Backfilling, grading, and compaction of 3,000 tons of clean fill to 90% is estimated to total $96,000. The total approximated cost of the second scenario ranges from $496,000 to $876,000. In the event that contaminated soils are not determined to be a hazardous waste, based on the analytical results of stockpiled excavated soil and verification sampling, significant cost savings would be realized for disposal at a Class II landfill.

3.3 Comparison of Alternatives

The No Action Alternative (**Alternative 1**) would meet none of the protective criteria for this project and is therefore dismissed without additional evaluation. Of the two remaining alternatives (**Alternative 2** and **Alternative 3**), each offers short-term protection. **Alternative 3** offers both short-term and long-term protection.

Alternative 2 would raise the existing grade of the Site by 2 to 3 feet. The Site is bounded by India Basin on one side and additional design, engineering and construction of retaining walls would be required to keep the soil barrier in place. Alternative 2 is not protective for the extended term, and additional remediation would likely be required at some point in the future to ensure the complete health and safety protection of recreational visitors. Given long-term development considerations as public open space, which may provide recreational opportunities for many visitors, this remedial alternative may not get approval from DTSC/RWQCB.

Alternative 3 offers long-term protection and removes the possibility of continued environmental monitoring and future remediation efforts. The majority of contaminant mass is located in the shallow subsurface – removed by excavation without difficulty. Given the physical circumstances and the analysis of the conceptual cost breakdown, remediation by physical removal (excavation and disposal) is the most advantageous and conservative alternative with respect to public health and safety, though this alternative is clearly the most expensive option.

Table 1
Cost Estimate Comparison for Cleanup Alternatives

	Cleanup Alternative 1	**Cleanup Alternative 2**		**Cleanup Alternative 3**	
		Scenario 1	***Scenario 2***	***Scenario 1***	***Scenario 2***
Description	No Action Alternative - no remediation conducted	Construction of Physical Barrier (entire site)	Construction of Physical Barrier (unpaved areas)	Full Excavation and Disposal (entire Site)	Partial Excavation and Disposal (unpaved areas)
Cost Estimate	No Associated Costs	$360,000	$96,000	$1,595,000 (2 ft bgs depth)	$496,000 (2 ft bgs depth)
				$2,810,000 (4 ft bgs depth)	$876,000 (4 ft bgs depth)

Again, cost estimates have been generated based upon results from the Phase I/II TBA conducted in September 2013, which provided a limited understanding of the horizontal and vertical extents of contamination at the Site. Additional characterization of the Site would better delineate the horizontal and vertical extent of soil and sediment contamination, and likely provide significant reductions in projected volumes of soil targeted for excavation and disposal.

3.4 Consideration of Climate Change Impacts

Scientific evidence demonstrates that the climate is changing at an increasingly rapid rate, outside the range to which society has adapted in the past. These changes can pose significant challenges to the EPA's ability to fulfill its mission. The EPA must adapt to climate change if it is to continue fulfilling its statutory, regulatory and programmatic requirements. The Agency is therefore anticipating and planning for future changes in climate to ensure it continues to fulfill its mission of protecting human health and the environment even as the climate changes.

In February 2013, the EPA released its draft Climate Change Adaptation Plan to the public for review and comment. The plan relies on peer-reviewed scientific information and expert judgment to identify vulnerabilities to EPA's mission and goals from climate change. The Region 9 Plan identifies vulnerabilities in Region 9, including lack of rainfall and the prospect of future droughts, reduction in groundwater supply, sea level rise, projected temperature increase and its impact on urban areas, wildfire prevalence, agricultural and ocean productivity, and habitat loss and ecosystem shift. Priority is being placed on mainstreaming climate adaptation within EPA and to encourage adaptation planning across the entire federal government.[1]

The nine-county San Francisco Bay Area has recognized the potential of climate change to impact the economy, environment, and quality of life in the Bay Area. According to a shoreline vulnerability assessment released by the San Francisco Bay Conservation and Development Commission (BCDC) in October 2011, a 16-inch rise in sea level (relative to sea level observed in 2000) would potentially expose 281 square miles of Bay shoreline to flooding, and a 55-inch rise in sea level would potentially expose 333 square miles of Bay shoreline to flooding.[2]

Located along the shoreline of India Basin within the Central San Francisco Bay Area, the Site is subject to inundation associated with climate change-related sea level rise. Figure 7 illustrates three potential inundation scenarios at the Site; 46-cm (18-inch) sea level rise, 100-cm (39-inch) sea level rise, and 139-cm (55-inch) sea level rise. Approximately 4,367 sq. ft. (0.10 acres) of the Site may be subject to inundation according to the 18-inch sea level rise scenario; 6,787 sq. ft. (0.16 acres) of the Site may be subject to inundation according to the 39-inch sea level rise scenario; and 11,346 sq. ft. (0.26 acres) of the Site may be subject to inundation according to the 55-inch sea level rise scenario. Figure 8 shows sensitive habitat at the Site, as designations categorized by the San Francisco Estuary Institute (SFEI) and BCDC. Sensitive habitat susceptible to flooding at the Site, as designated by BCDC, includes Developed Bay Fill and Shallow Bay/Channel; nearby habitat includes Developed Bay Fill, Lagoons, Shallow Bay/Channel, Tidal Flat, Tidal Marsh, and Undeveloped Fill. Sensitive habitat susceptible to flooding at the Site, as designated by SFEI, includes Shallow Bay and

[1] United States EPA. September 2013. EPA Region 9 Climate Change Adaptation Implementation Plan. http://epa.gov/climatechange/Downloads/impacts-adaptation/region-9-plan.pdf.

[2] San Francisco BCDC. October 2011. Living with a Rising Bay: Vulnerability and Adaptation in San Francisco Bay and on its Shoreline. http://www.bcdc.ca.gov/BPA/LivingWithRisingBay.pdf.

Undefined; nearby habitat includes Filled Bayland, Fully Tidal Bayland, Muted Tidal Bayland, and Shallow Bay.

Apparent from these analyses is the vulnerability of the Site to threats imposed by sea level rise, with additional significant vulnerability observed at nearby India Basin Shoreline Park northwest of the Site and Hunters Point Shipyard southeast of the Site. It is clear that essential development on the Bay shoreline, including the San Francisco Blue Greenway, will require protection to prevent flooding and permanent inundation from sea level rise, yet protecting all developed areas may prove to be financially infeasible or ecologically destructive. Cleanup alternatives should be selected that anticipate shoreline threats resulting from climate change, both at the Site and at nearby locations subject to similar potential inundation. Flood damage to fills and shoreline areas can result from a combination of sea level rise, storm surge, rainfall, high tides, and winds blowing onshore. Adequate measures should be provided to prevent damage from sea level rise and storm activity that may occur on fill or near the shoreline over the expected life of a project.[3]

Alternative 2, which utilizes construction of a physical barrier to limit exposure to impacted media, would be subject to the erosive and destructive forces of eventual sea level rise. In accordance with the goals of the EPA’s Climate Change Adaptation Plan, **Alternative 3** presents itself as the more advantageous cleanup alternative; Site contamination at vulnerable elevations below the base high water level metric would be completely excavated for appropriate disposal, removing the potential for reintroduction of environmental contaminants via flood damage.

4. Limitations and Additional Assessment Needs

The Combined Phase I/II TBA provides a valuable characterization of current and historical conditions at the 900 Innes Avenue Site, including a summary of historical site use, previous investigations and regulatory involvement, detailed records review for the Site and surrounding properties, site reconnaissance and photo documentation, and an evaluation of environmental concerns. Analytical results, from surface and subsurface sampling of soils and sediments, were compared against action levels established in the Sampling and Analysis Plan (SAP) to determine the risk to human health and the environment, and to determine mitigation requirements (if any exist).

Phase II sampling efforts primarily function as a screening survey, identifying and roughly delineating Analytes of Concern (AOCs) at a Site. Soil and sediment samples were collected from a triangular grid with 50-ft spacing between sample locations; the sampling grid was the most appropriate sampling approach to assess potential

[3] San Francisco BCDC. October 2011. Living with a Rising Bay: Vulnerability and Adaptation in San Francisco Bay and on its Shoreline. http://www.bcdc.ca.gov/BPA/LivingWithRisingBay.pdf.

contamination at sites with no readily identifiable sources of contamination. The triangular grid sampling design captured generalized contamination associated with current construction equipment storage and laydown yard activities, aboveground storage tanks, onsite structures, and previous boatbuilding and ship repair activities. Subsurface sampling extended to 4 feet below ground surface (bgs), to allow vertical characterization of contaminants in soils and groundwater characterization if encountered. Given the limited quantity and horizontal/vertical distribution of samples, there may be additional releases that were not detected during this assessment. To allow this higher resolution determination of contaminant extent, additional surface and subsurface sampling throughout the Site for petroleum hydrocarbons, PCBs, PAHs, and metals (lead, copper, nickel, and mercury) is recommended.

The limited sampling scope of a TBA is generally not sufficient to determine the exact extent of hazardous waste volume or hazardous waste classification for a Site; hazardous waste characterization is often best determined during the stockpiling and removal of excavated soil. For the planned reuse of the Site as recreational open space, it is recommended that further characterization should be completed prior to excavation and removal – further characterization of soil and sediment contamination at the Site would refine the suggested cleanup alternatives, allowing greater accuracy when estimating costs, and ensuring greater confidence when discussing which alternative is most effective at protecting human health and safety. The City and County of San Francisco may also have additional sampling requirements under the Maher Ordinance, such as groundwater characterization, that may be necessary before finalizing cleanup alternatives and costs. The Phase I/II TBA, and associated ABCA, can provide mitigation guidance but is not a removal characterization; information therein represents only the site-specific recognized environmental conditions and opinions of the Environmental Professional.

SITE LOCATION MAP

900 Innes Avenue Site

Analysis of Brownfield Cleanup Alternatives

San Francisco, California

0 0.25 0.5 Mile

FIGURE 1

SITE LAYOUT MAP

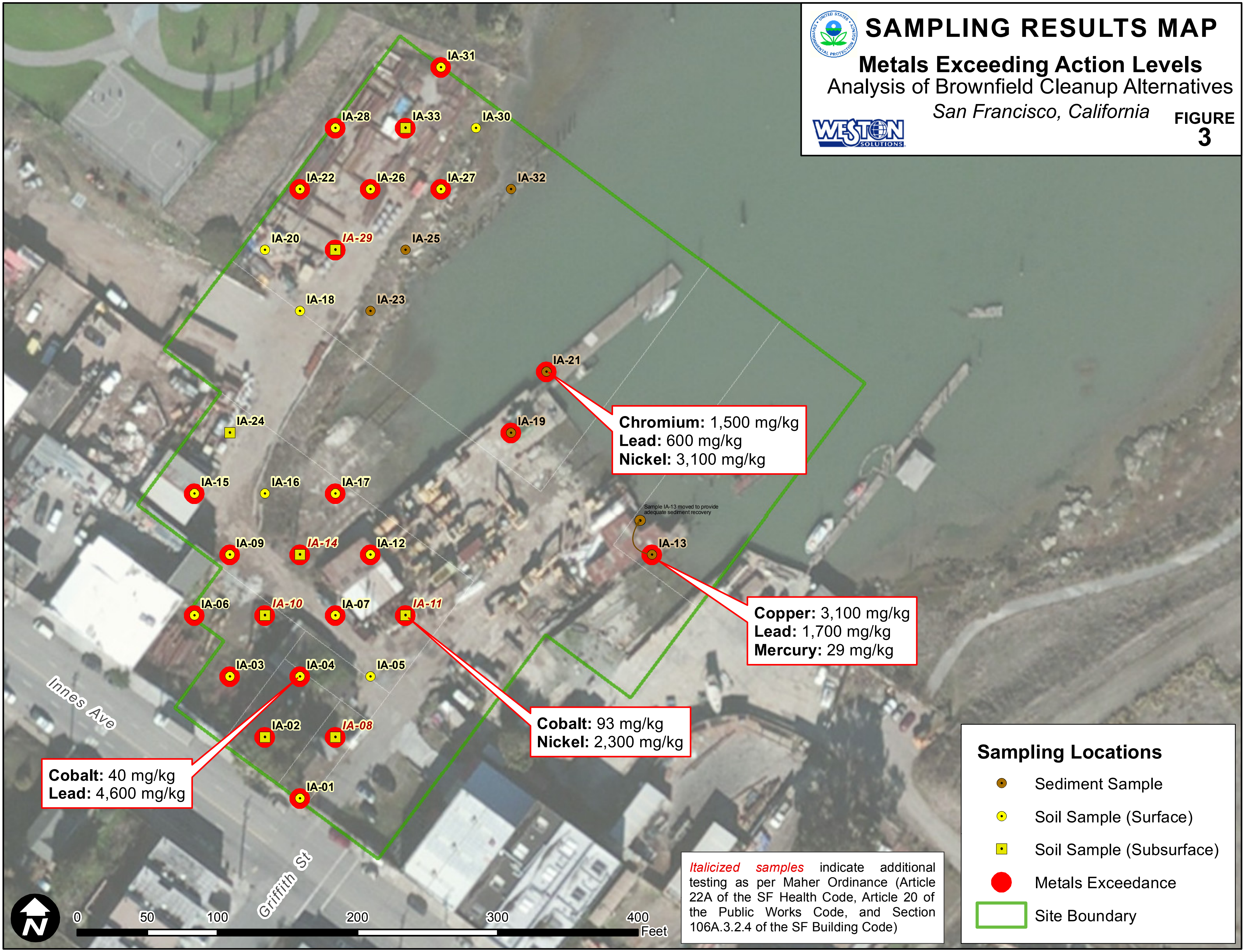
900 Innes Ave Site

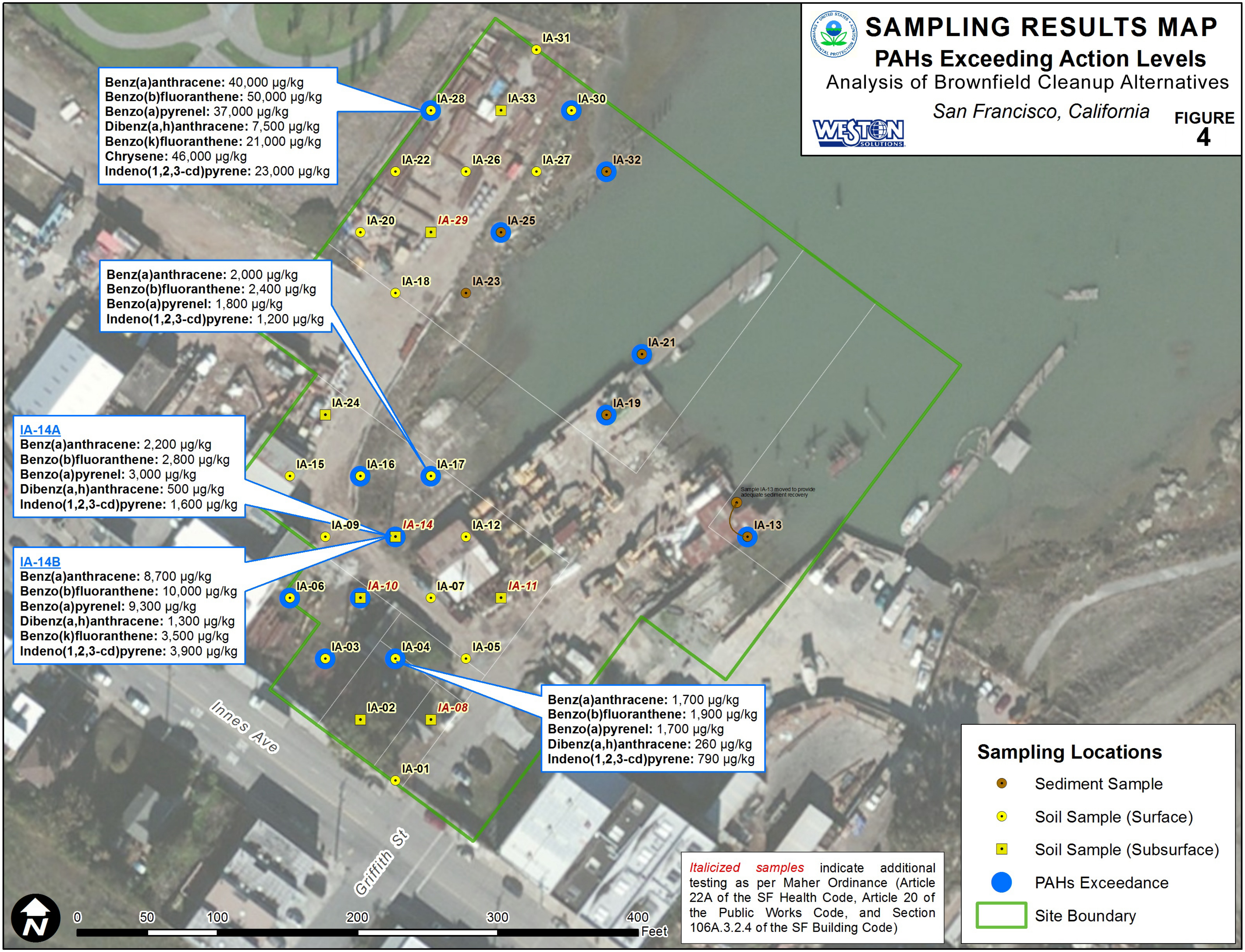
Analysis of Brownfield Cleanup Alternatives

San Francisco, California

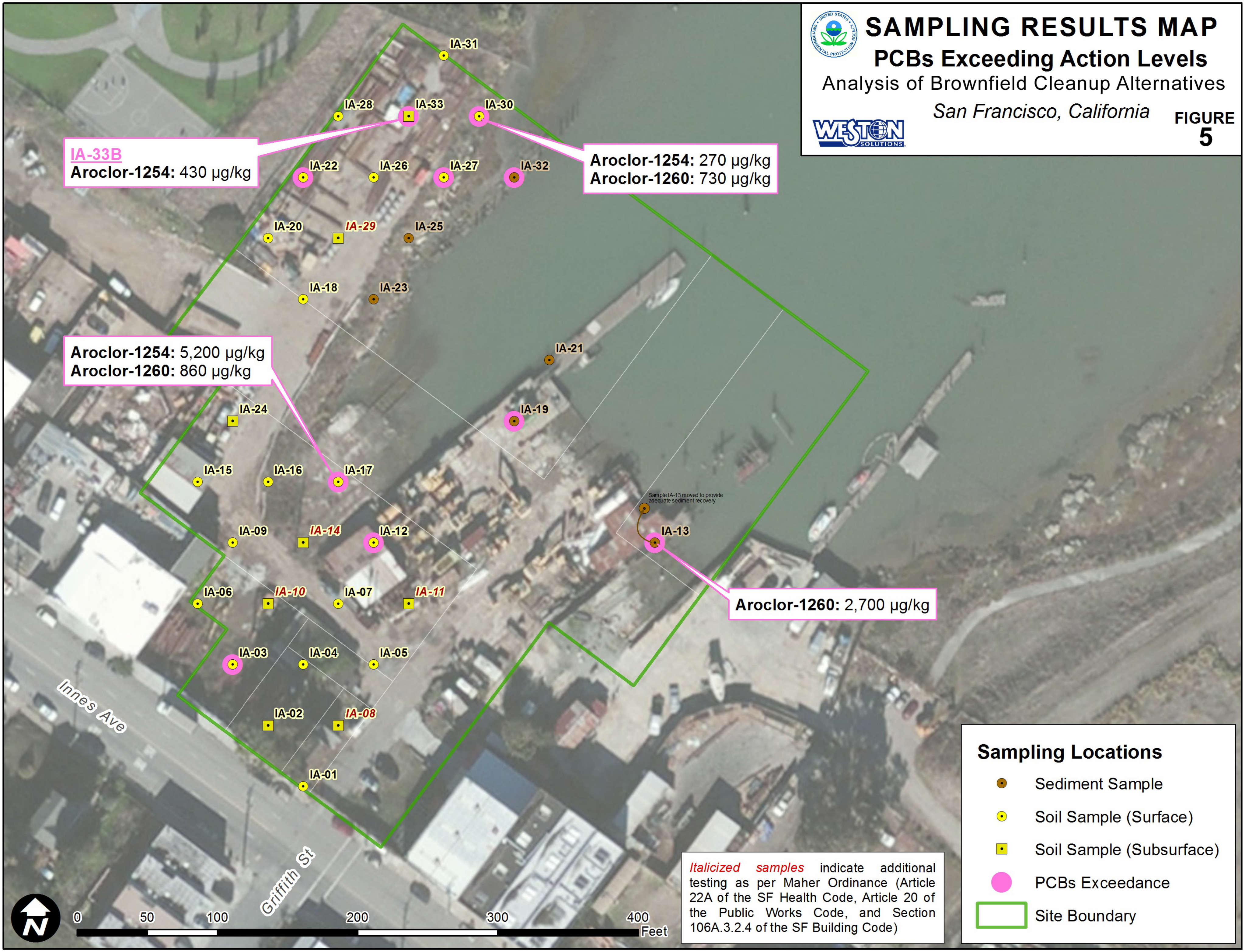
WESTON SOLUTIONS

FIGURE 2

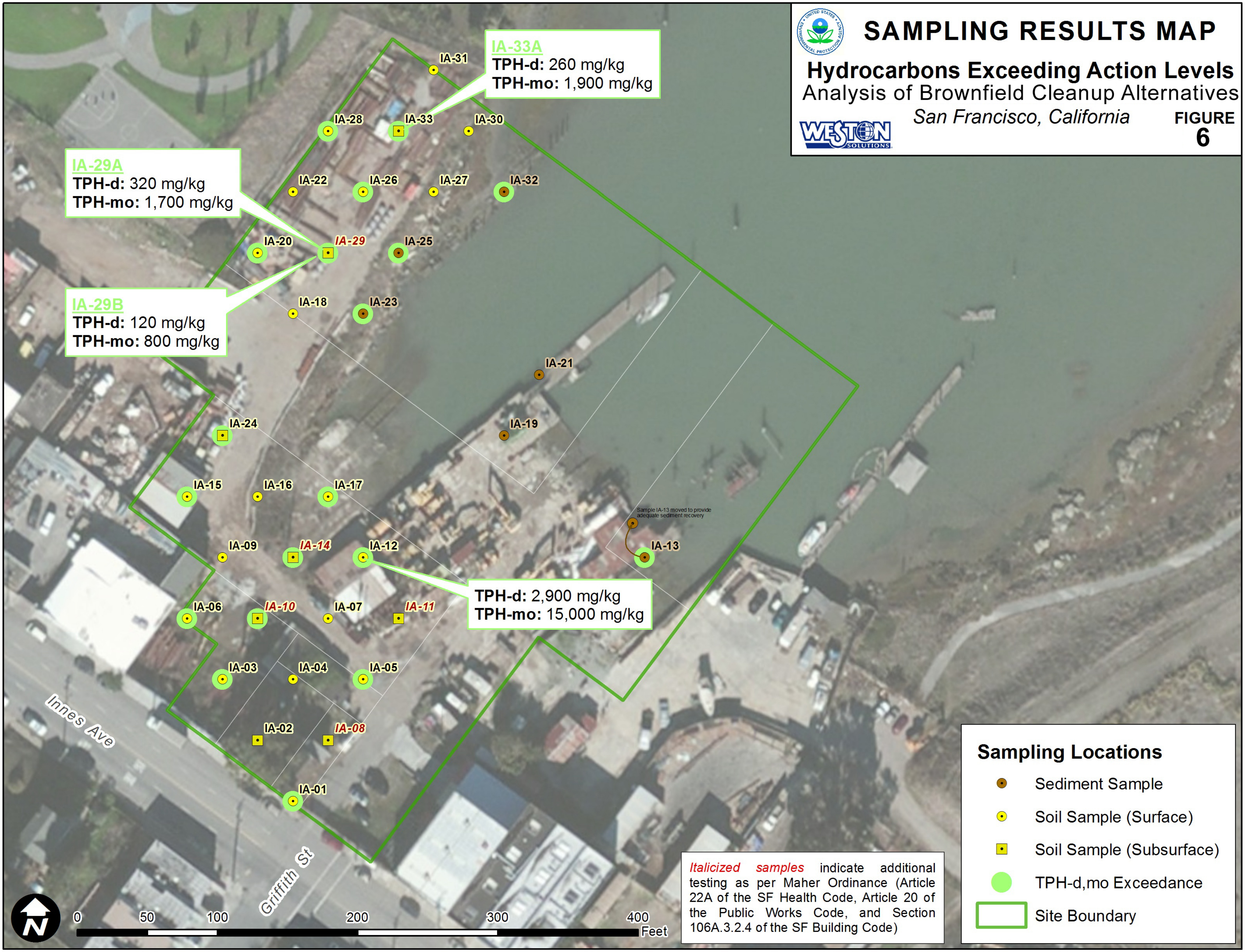

SAMPLING RESULTS MAP
Metals Exceeding Action Levels
Analysis of Brownfield Cleanup Alternatives
San Francisco, California
FIGURE 3
WESTON SOLUTIONS
IA-31
IA-28
IA-33
IA-30
IA-22
IA-26
IA-27
IA-32
IA-20
IA-29
IA-25
IA-18
IA-23
IA-21
Chromium: 1,500 mg/kg
Lead: 600 mg/kg
Nickel: 3,100 mg/kg
IA-24
IA-19
IA-15
IA-16
IA-17
Sample IA-13 moved to provide adequate sediment recovery
IA-09
IA-14
IA-12
IA-13
IA-06
IA-10
IA-07
IA-11
Copper: 3,100 mg/kg
Lead: 1,700 mg/kg
Mercury: 29 mg/kg
IA-03
IA-04
IA-05
Innes Ave
IA-02
IA-08
Cobalt: 93 mg/kg
Nickel: 2,300 mg/kg
Cobalt: 40 mg/kg
Lead: 4,600 mg/kg
IA-01
Griffith St
0 50 100 200 300 400 Feet
Italicized samples indicate additional testing as per Maher Ordinance (Article 22A of the SF Health Code, Article 20 of the Public Works Code, and Section 106A.3.2.4 of the SF Building Code)
Sampling Locations
Sediment Sample
Soil Sample (Surface)
Soil Sample (Subsurface)
Metals Exceedance
Site Boundary



SAMPLING RESULTS MAP
PAHs Exceeding Action Levels
Analysis of Brownfield Cleanup Alternatives
San Francisco, California
FIGURE 4
WESTON SOLUTIONS
Benz(a)anthracene: 40,000 µg/kg
Benzo(b)fluoranthene: 50,000 µg/kg
Benzo(a)pyrenel: 37,000 µg/kg
Dibenz(a,h)anthracene: 7,500 µg/kg
Benzo(k)fluoranthene: 21,000 µg/kg
Chrysene: 46,000 µg/kg
Indeno(1,2,3-cd)pyrene: 23,000 µg/kg
Benz(a)anthracene: 2,000 µg/kg
Benzo(b)fluoranthene: 2,400 µg/kg
Benzo(a)pyrenel: 1,800 µg/kg
Indeno(1,2,3-cd)pyrene: 1,200 µg/kg
IA-14A
Benz(a)anthracene: 2,200 µg/kg
Benzo(b)fluoranthene: 2,800 µg/kg
Benzo(a)pyrenel: 3,000 µg/kg
Dibenz(a,h)anthracene: 500 µg/kg
Indeno(1,2,3-cd)pyrene: 1,600 µg/kg
IA-14B
Benz(a)anthracene: 8,700 µg/kg
Benzo(b)fluoranthene: 10,000 µg/kg
Benzo(a)pyrenel: 9,300 µg/kg
Dibenz(a,h)anthracene: 1,300 µg/kg
Benzo(k)fluoranthene: 3,500 µg/kg
Indeno(1,2,3-cd)pyrene: 3,900 µg/kg
Benz(a)anthracene: 1,700 µg/kg
Benzo(b)fluoranthene: 1,900 µg/kg
Benzo(a)pyrenel: 1,700 µg/kg
Dibenz(a,h)anthracene: 260 µg/kg
Indeno(1,2,3-cd)pyrene: 790 µg/kg
IA-31
IA-28
IA-33
IA-30
IA-22
IA-26
IA-27
IA-32
IA-20
IA-29
IA-25
IA-18
IA-23
IA-21
IA-24
IA-19
IA-15
IA-16
IA-17
Sample IA-13 moved to provide adequate sediment recovery
IA-09
IA-14
IA-12
IA-13
IA-06
IA-10
IA-07
IA-11
IA-03
IA-04
IA-05
IA-02
IA-08
IA-01
Innes Ave
Griffith St
0 50 100 200 300 400 Feet
Italicized samples indicate additional testing as per Maher Ordinance (Article 22A of the SF Health Code, Article 20 of the Public Works Code, and Section 106A.3.2.4 of the SF Building Code)
Sampling Locations
Sediment Sample
Soil Sample (Surface)
Soil Sample (Subsurface)
PAHs Exceedance
Site Boundary



SAMPLING RESULTS MAP
PCBs Exceeding Action Levels
Analysis of Brownfield Cleanup Alternatives
San Francisco, California
FIGURE 5
WESTON SOLUTIONS
IA-33B
Aroclor-1254: 430 µg/kg
Aroclor-1254: 270 µg/kg
Aroclor-1260: 730 µg/kg
Aroclor-1254: 5,200 µg/kg
Aroclor-1260: 860 µg/kg
Aroclor-1260: 2,700 µg/kg
Sample IA-13 moved to provide adequate sediment recovery
IA-31
IA-28
IA-33
IA-30
IA-22
IA-26
IA-27
IA-32
IA-20
IA-29
IA-25
IA-18
IA-23
IA-21
IA-24
IA-19
IA-15
IA-16
IA-17
IA-09
IA-14
IA-12
IA-13
IA-06
IA-10
IA-07
IA-11
IA-03
IA-04
IA-05
IA-02
IA-08
IA-01
Innes Ave
Griffith St
N
0 50 100 200 300 400 Feet
Italicized samples indicate additional testing as per Maher Ordinance (Article 22A of the SF Health Code, Article 20 of the Public Works Code, and Section 106A.3.2.4 of the SF Building Code)
Sampling Locations
Sediment Sample
Soil Sample (Surface)
Soil Sample (Subsurface)
PCBs Exceedance
Site Boundary


SAMPLING RESULTS MAP
Hydrocarbons Exceeding Action Levels
Analysis of Brownfield Cleanup Alternatives
San Francisco, California
FIGURE 6
WESTON SOLUTIONS
IA-33A
TPH-d: 260 mg/kg
TPH-mo: 1,900 mg/kg
IA-29A
TPH-d: 320 mg/kg
TPH-mo: 1,700 mg/kg
IA-29B
TPH-d: 120 mg/kg
TPH-mo: 800 mg/kg
TPH-d: 2,900 mg/kg
TPH-mo: 15,000 mg/kg
IA-31
IA-28
IA-33
IA-30
IA-22
IA-26
IA-27
IA-32
IA-20
IA-29
IA-25
IA-18
IA-23
IA-21
IA-24
IA-19
IA-15
IA-16
IA-17
Sample IA-13 moved to provide adequate sediment recovery
IA-09
IA-14
IA-12
IA-13
IA-06
IA-10
IA-07
IA-11
IA-03
IA-04
IA-05
IA-02
IA-08
IA-01
Innes Ave
Griffith St
N
0
50
100
200
300
400
Feet
Italicized samples indicate additional testing as per Maher Ordinance (Article 22A of the SF Health Code, Article 20 of the Public Works Code, and Section 106A.3.2.4 of the SF Building Code)
Sampling Locations
Sediment Sample
Soil Sample (Surface)
Soil Sample (Subsurface)
TPH-d,mo Exceedance
Site Boundary

POTENTIAL INUNDATION MAP

900 Innes Avenue Site

Analysis of Brownfield Cleanup Alternatives

San Francisco, California

FIGURE 7


SENSITIVE HABITAT MAP
900 Innes Avenue Site
Analysis of Brownfield Cleanup Alternatives
San Francisco, California
FIGURE
8
WESTON SOLUTIONS
0
0.25
0.5
0.75
Mile
San Francisco Bay
India Basin
900 Innes Avenue Site
Hunters Point
Sensitive Habitat (SFEI)
Aeolian Land
Alluvial Plain
Deep Bay
Diked
Filled Bayland
Fully Tidal
Fully Tidal Bayland
Hillslope
Muted Tidal Bayland
Shallow Bay
Undefined
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
Sensitive Habitat (BCDC)
Agricultural Bayland
Beach
Deep Bay/Channel
Developed Bay Fill
Diked Wetland
Lagoons
Riparian Forest/Willow Grove
Salt Pond
Shallow Bay/Channel
Other
Storage or Treatment Basin
Tidal Flat
Tidal Marsh
Undeveloped Fill
Upland
San Francisco Bay
India Basin
900 Innes Avenue Site
Hunters Point
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community