October 4, 2023

Ms. Lisa Dunning
Task Order Contracting Officer's Representative
U.S. Environmental Protection Agency, Region 7
11201 Renner Boulevard
Lenexa, Kansas 66219

Subject: Contract No. 68HERH19D0018; Task Order No. 68E0719F0190
Boys and Girls Home, 2101 Court Street, Sioux City, Woodbury County, Iowa
Analysis of Brownfields Cleanup Alternatives

Dear Ms. Dunning:

Toeroek Associates, Inc. (Toeroek) and our teaming subcontractor, Tetra Tech, Inc. (Tetra Tech), (hereafter "Toeroek Team") are pleased to present the Analysis of Brownfields Cleanup Alternatives of the Boys and Girls Home Site (the Site) at 2101 Court Street in Sioux City, Woodbury County, Iowa. This deliverable has been reviewed internally as part of Tetra Tech's quality assurance program, as well as Toeroek's quality assurance program, and is consistent with Toeroek's Quality Management Plan for the Resource Conservation and Recovery Act (RCRA) Enforcement, Permitting and Assistance (REPA) contract. Documentation of this review is retained in the Toeroek Team's project files.

If you have any questions or comments, please contact Greg Hanna at 720-898-4102 or Kaitlyn Mitchell at 816-412-1742.

Sincerely,

Greg Hanna
Toeroek Team Program Manager

Kaitlyn Mitchell
Toeroek Team Project Manager

Enclosure: Analysis of Brownfields Cleanup Alternatives

cc: Amber Krueger, EPA Region 7
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ANALYSIS OF BROWNFIELDS CLEANUP ALTERNATIVES

BOYS AND GIRLS HOME SITE
2101 COURT STREET
SIOUX CITY, WOODBURY COUNTY, IOWA

Prepared for

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION 7

Task Order	:	68E0719F0190
Subtask	:	17.03
EPA Region	:	7
Date Prepared	:	October 4, 2023
Contract No.	:	68HERH19D0018
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1.0 INTRODUCTION

The U.S. Environmental Protection Agency (EPA) tasked Toeroek Associates, Inc. (Toeroek) and its teaming subcontractor, Tetra Tech, Inc. (Tetra Tech), (hereafter "Toeroek Team") to provide technical support to the EPA Region 7 Brownfields Program under Contract 68HERH19D0018, Task Order (TO) 68E0719F0190. EPA Region 7 requested that the Toeroek Team conduct an Analysis of Brownfields Cleanup Alternatives (ABCA) of the Boys and Girls Home Site (the Site) at 2101 Court Street, Sioux City, Woodbury County, Iowa (Appendix A, Figure 1).

A non-profit social services provider currently uses the Site, which is within a mixed-use commercial and residential area, with the nearest residence approximately 115 feet to the east. The Site includes:

- One approximately 298,100-square-foot, 5- to 7-story historical hospital building;
- One approximately 3,786-square-foot former power plant building;
- One 2,676-square-foot maintenance shop building;
- One 8,940 square-foot old library building;
- One 1,990-square-foot old garage building;
- One 200-square-foot shed; and
- One 29,300-square-foot chapel building.

The Site is depicted on the Sergeant Bluff, Iowa and the Sioux City North Iowa, U.S. Geological Survey (USGS) 7.5-minute topographic series map (USGS 1993, 1994) (Appendix A, Figure 1). Coordinates at the approximate center of the Site are 42.5134993 degrees north latitude and 96.3971124 degrees west longitude. The Site encompasses approximately 14.39 acres on one parcel of land. Figure 2 in Appendix A illustrates the Site boundaries.

The Toeroek Team performed this ABCA based on results of the Targeted Brownfields Assessment (TBA), which consisted of a Phase II Environmental Site Assessment (ESA) and Hazardous Materials Survey (HMS) conducted by the Toeroek Team (Toeroek Team 2023a, b). The Phase II ESA report concluded that further investigation and/or remediation appeared warranted based on analytical results from soil and soil-gas samples. The HMS identified presence of asbestos-containing materials (ACM) in the garage, library, power plant and tunnels, chapel, and Building 25. In addition, fire doors, electrical panels, and elevator equipment throughout the buildings are assumed to be ACM. LBP were on a variety of substrates throughout the buildings—including door frames, doors, posts, steel beams, piping, door

trim, wall guards, elevator door frames, and elevator doors. Polychlorinated biphenyls (PCBs) were found in two samples from the Building 25 roof expansion joint compound caulking. The HMS concluded that ACM, LBP and PCBs should be appropriately addressed prior to building renovation or demolition.

According to the Brownfields Assessment Application (EPA 2022), Boys and Girls Home, has shown an interest in demolishing the current structures for future redevelopment of mixed density housing, contingent on findings from the Phase II ESA and HMS. Therefore, residential land use will be assumed for this ABCA.

This ABCA considers state and federal regulations regarding ACM. The federal Asbestos Hazard Emergency Response Act (AHERA) defines ACM as any material or product that contains more than 1 percent asbestos. The Iowa Department of Natural Resources (IDNR) regulations outline ACM inspection, reporting, and disposal requirements for demolition or renovation of buildings (IDNR 2023).

For LBP, this ABCA considers federal regulations regarding LBP. The federal U.S. Department of Housing and Urban Development (HUD) guidelines considers LBP as paint with lead levels above 1.0 milligram per square centimeter (mg/cm^2) (HUD 2012).

This ABCA applies the EPA action level for PCBs, which is 50 parts per million (ppm) for PCBs in materials (EPA 2016).

This ABCA also considers state and federal regulations regarding soil and soil gas. Data from soils have been compared to IDNR Statewide Standards (SWS) for Soil and to EPA Regional Screening Levels (RSLs) (IDNR 2023; EPA 2023a). Soil-gas data has been compared to EPA Vapor Intrusion Screening Levels (VISLs) (EPA 2023b). The RSLs and VISLs that were effective at the time of the Phase II ESA have been used for this ABCA (September 2023).

2.0 BACKGROUND AND DESCRIPTION

A non-profit social services provider currently uses the Site, which is within a mixed-use commercial and residential area, with the nearest residence approximately 115 feet to the east. The Site includes:

- One approximately 298,100-square-foot, 5- to 7-story historical hospital building;
- One approximately 3,786-square-foot former power plant building;
- One 2,676-square-foot maintenance shop building;
- One 8,940 square-foot old library building;
- One 1,990-square-foot old garage building;
- One 200-square-foot shed; and
- One 29,300-square-foot chapel building.

The Site lies within the city limits of Sioux City, Iowa. This discussion of the Site history derives from a Phase I ESA report prepared by HR Green, Inc. (HRG) in 2022 (HRG 2022). The HRG Phase I ESA report indicates construction of structures on the Site from as early as 1913 through 1957 (HRG 2022). HRG did not identify previous operations or occupants of the Site within the Phase I ESA report; however, St. Joseph's Mercy Hospital, as well as a nurses' home and school, are depicted on the Site in historical aerial photographs, city directories, and Sanborn maps (HRG 2022).

Currently, the Site is bounded north by 24th Street, with residential properties beyond; east by Court Street, with commercial and residential properties beyond; south by 21st Street, with commercial and residential properties beyond; and west by Virginia Street, with residential properties beyond.

3.0 PREVIOUS INVESTIGATIONS

In July 2022, HRG conducted a Phase I ESA of the Boys and Girls Home at 2101 Court Street in Sioux City, Iowa, on behalf of the City of Sioux City. The Phase I ESA identified several RECs associated with historical use of the Site, including the former power plant structure on the Site, heating oil underground storage tanks (USTs), and a mercury spill that occurred in 2009 (HRG 2022).

The Phase I ESA also identified two off-site historical RECs relating to historical uses of adjacent properties at 2118 and 2100 Court Street. 2118 Court Street is adjacent to and east of the Site. Sanborn maps depict a gasoline tank in the right-of-way (ROW) east of the subject property and west of the 2118 Court Street property in 1924 and 1949. 2100 Court Street is adjacent to and east of the Site, a Sanborn map dated 1924 depicts this parcel as hosting a garage with a gasoline tank in the Court Street ROW, while a 1949 Sanborn map depicts a gas station on the parcel with two gasoline tanks in the 21st Street ROW.

No other assessments are known to have occurred at the Site.

The Toeroek Team conducted a Phase II ESA and HMS in 2023 (Toeroek Team 2023a, b). Results of that investigation are discussed in Section 5.1.

4.0 PLANS FOR FUTURE USE

The current owner of the Site, Boys and Girls Home, has shown an interest in demolishing the current structures for future redevelopment of mixed density housing. Structures on the Site include:

- One approximately 298,100-square-foot, 5- to 7-story historical hospital building;
- One approximately 3,786-square-foot former power plant building;
- One 2,676-square-foot maintenance shop building;
- One 8,940-square-foot old library building;
- One 1,990-square-foot old garage building;
- One 200-square-foot shed; and
- One 29,300-square-foot chapel building.

Iowa's Source Water Assessment and Protection website and the City of Sioux City's drinking water consumer confidence report indicates that the City of Sioux City has 10 active wells producing from the Alluvial/Dakota Aquifer near the Missouri River. The City of Sioux City's wells closest to the Site are at the Riverfront Well Field, approximately two miles southwest of the Site. The Site is not within the groundwater source protection areas for these wells (IDNR 2023a; Sioux City, Iowa 2022).

During the HRG Phase I ESA, Environmental Data Resources, Inc. (EDR) was unable to obtain data on groundwater flow and velocity. In the absence of site-specific data or other indicators, direction of groundwater flow may be inferred from the regional topographic gradient. Therefore, groundwater flow is inferred to the south toward the Missouri River, approximately 1.7 miles south-southwest of the Site.

Three wells are within 1,000 feet of the Site: the on-site irrigation well listed in the Iowa Geological Survey (IGS) GeoSam well database, one private well tracking system well, and one permitted private well (HRG 2022).

GeoSam lists the owner of the permitted irrigation well as "Boys & Girls Home" and identifies the well as number 53482. Well number 53482 was constructed in 2000 and completed to 400 feet below ground surface (bgs) (IGS 2023). The location of well number 53482 is shown on the GeoSam website map as within one of the Site structures; however, during Phase II fieldwork activities, the irrigation well was determined to be near the basketball court on the Site (Appendix A, Figure 3). According to the Boys and Girls Home maintenance staff, this well is no longer in use.

Based on analytical results from soil and soil-gas samples, along with the HMS, further investigation and/or remediation appears warranted. If the soil is to be disturbed during redevelopment, a soil management plan may be necessary to protect construction or utility workers. Isolated areas where concentrations of contaminants exceed screening levels may require additional excavation or capping. In addition, ACM, LBP, and PCBs should be appropriately addressed prior to building renovation or demolition. No remedial activities have occurred at the Site to date.

5.0 POTENTIAL CLEANUP ALTERNATIVES

The overall goal of any brownfields cleanup action is to address environmental conditions preventing or impeding the preferred type of Site redevelopment, and to do so in a manner protective of human health and the environment. This ABCA considers ACM, LBP, PCBs and environmental media (e,g. soil). For ACM, the ABCA uses AHERA definitions, and considers the IDNR requirements for ACM inspection, reporting, and disposal for demolition or renovation of commercial buildings. HUD guidelines suggest that paint applied before 1978 may contain lead. HUD considers LBP as paint with lead levels above 1.0 mg/cm^2. The EPA action level is 50 ppm for PCBs in materials; this was the benchmark for this Survey (EPA 2016). Cleanup alternatives for soil would conform to IDNR SWS for soil or EPA RSLs if SWS are not available. Cleanup alternatives for soil gas would conform to EPA VISLs.

The Toeroek Team evaluated brownfields cleanup alternatives to address environmental impacts identified during the Phase II ESA and HMS (Toeroek Team 2023a, b). The purpose of the ABCA is to present viable cleanup alternatives based on Site-specific conditions, technical feasibility, and preliminary cost evaluations.

The following sections describe brownfields cleanup alternatives for addressing presence of ACM, LBP, PCBs and contamination in soil and soil gas, including a "No Action" alternative. Following the description, each alternative is evaluated in terms of its effectiveness, implementability, and cost. The purpose of evaluating each alternative is to determine its advantages and disadvantages relative to the other alternatives in order to identify key tradeoffs that would affect selection of the preferred alternative.

Effectiveness of an alternative refers to its ability to meet objectives of the brownfields cleanup. Criteria applied to assess effectiveness of an alternative include all of the following:

- Overall protection of human health and the environment;
- Long-term effectiveness;
- Reduction of toxicity, mobility, or volume through treatment/removal; and
- Short-term effectiveness.

Criteria applied to assess implementability of an alternative are all of the following:

- Technical feasibility;
- Administrative feasibility;

- Availability of services and materials required during implementation of the alternative;
- State acceptance; and
- Community acceptance.

Each alternative is evaluated to determine its estimated cost. The evaluations compare the alternatives' respective direct capital costs, which include equipment, services, and contingency allowances, as well as longer-term institutional controls (ICs), engineering controls (ECs), and operations and maintenance (O&M) costs. Again, the purpose of evaluating each alternative is to determine its advantages and disadvantages relative to the other alternatives in order to identify key tradeoffs that would affect selection of the preferred alternative.

5.1 EVALUATED CONTAMINATION

This ABCA evaluates ACM, LBP, PCBs, soil, and soil gas at the Site. The sections below discuss contaminants and materials identified during the Phase II ESA and HMS at the Site. Additional details about sampling methodology and detected constituents are in the Phase II ESA and HMS reports (Toeroek Team 2023a, b).

5.1.1 Asbestos-Containing Materials

During the ACM survey portion of the HMS, the Toeroek Team collected bulk samples of suspect ACM from all interior areas of the on-site buildings. Collection of samples of building materials accorded with National Emissions Standards for Hazardous Air Pollutants (NESHAP) as adopted by EPA, and with AHERA protocols. Suspect ACM samples were analyzed via polarized light microscopy (PLM). AHERA defines ACM as any material or product that contains more than 1% asbestos.

This Survey identified ACM in the following materials:

Garage

- Black roof flashing (approximately 1,012 square feet [SF]) on the Garage roof.

Library

- Light green with gray streaks vinyl floor tile (12-inch [12"] by 12") (approximately 50 SF) on the 1st and 2nd floors of the Library.

Power Plant and Tunnels

- Pipe insulation (approximately 400 linear feet [LF]) throughout the Power Plant and tunnels;
- Transite board (approximately 100 SF) in the Power Plant (between large boilers);
- Tank insulation (approximately 200 SF) in the upper room of the Power Plant and below the Library;
- Aircell pipe insulation (approximately 600 LF) throughout Power Plant and below the Library; and
- Black flashing (approximately 500 LF) on the perimeter of the Power Plant roof.

Chapel

- Red vinyl floor tile (9" by 9″) (approximately 500 SF) in the mezzanine of the Chapel;
- Aircell pipe insulation (approximately 1,000 LF) throughout the Chapel;
- White window glaze (128 windows) on the exterior Chapel windows;
- Black roof flashing (approximately 400 LF) under the Chapel roof flashing;
- Thick black roof flashing (approximately 400 LF) over the Chapel roof flashing;
- Black window caulk (two windows) on the Chapel penthouse windows;
- White window caulk (two windows) on the Chapel penthouse windows;
- Expansion joint caulk (two windows) under Chapel penthouse windows;
- White window caulk (128 windows) on the north side Chapel windows;
- Black sealant (approximately 500 SF) on the north side of the Chapel foundation; and
- Tan door caulk (five doors) on the Chapel exterior.

Building 25

- Pebble sheet flooring (approximately 2,350 SF) throughout 3rd floor hallways of Building 25;
- Vinyl floor tile, grey with brown streaks (12″ by 12″) (approximately 15,000 SF) throughout the 4th and 3rd floors of Building 25;
- 12″ pipe insulation (approximately 500 LF) in the access near old elevator/stairs in Building 25;
- Mudded joint fittings (approximately 200 LF) throughout Building 25;

- Aircell pipe insulation (approximately 800 LF) throughout Building 25;
- White expansion joint compound (approximately 200 LF) on the roof of Building 25;
- White window caulk (8 windows) on the Building 25 roof and penthouse windows;
- Sheet flooring with square pebbles (approximately 4,000 SF) on the 2nd floor – A wing of Building 25;
- Beige vinyl floor tile (12″ by 12″) (approximately 250 SF) on the ground floor – southeast room of Building 25;
- White door caulk (approximately 16 LF) on the west door of Building 25; and
- White expansion joint (approximately 10 LF) on the Building 25 hall that connects to the Chapel.

Main Building

- Black sink undercoating (15 sinks) throughout the Main Building;
- Tan with gray streaks vinyl floor tile (9″ by 9″) (approximately 3,400 SF) in the Main Building basement - C and D wings;
- Green with white and gray specs vinyl floor tile (12″ by 12″) (approximately 1,500 SF) in the Main Building basement - A wing;
- Vinyl floor tile, off-white with gray streaks (12″ by 12″) (approximately 900 SF) on the ground, 3rd, and 5th floors of the Main Building;
- Vinyl floor tile, cream with brown streaks (12″ by 12″) (approximately 180 SF) on the ground, 3rd, and 5th floors of the Main Building;
- Vinyl floor tile, gray with gray streaks (12″ by 12″) (approximately 2,740 SF) in the Main Building basement – A and C wings;
- Wood panel mastic (approximately 9,505 SF) in the Main Building basement – C wing;
- Spray-on fire proofing (approximately 580 SF) on the 4th and 5th floors of the Main Building;
- White window caulk (158 windows) on the exterior windows of the Main Building;
- Black door caulk (10 doors) on the exterior doors of the Main Building;
- White flashing caulk (approximately 90 LF) on the east side (above sidewalk) on the Main Building; and
- White expansion joint (approximately 90 LF) located between Building 25 and Main Building (Northwest Corner).

In addition, fire doors, electrical panels, and elevator equipment throughout the buildings are assumed to be ACM. These locations were not sampled because of concerns with structural damage and safety.

5.1.2 Lead-Based Paint

During the LBP survey portion of the HMS, the Toeroek Team screened all areas of the buildings using a handheld x-ray fluorescence (XRF) spectrometer. The HMS report describes LBP screening locations (Toeroek Team 2023b).

Approximately 23,525 SF of various colors of LBP were on a variety of substrates throughout the buildings—including door frames, doors, posts, steel beams, piping, door trim, wall guards, elevator door frames, and elevator doors. Widespread occurrence of LBP precluded the documentation of specific locations.

5.1.3 Polychlorinated Biphenyls

During the HMS, the Toeroek Team collected 17 samples of suspected PCB-containing caulk materials. Collection of the samples accorded with EPA guidance (EPA 2023c). Upon completion of sampling activities, the bulk samples were sent for analysis for PCBs. EPA has set an action level of 50 ppm for PCBs in materials, and that was the benchmark used for the HMS. Laboratory results indicate that two sample locations had exceedances of PCBs: Samples B25-EJC1-01, and B25-EJC2-01 had concentrations of 1,400 ppm and 150 ppm, respectively. Those sample locations are representative of the Building 25 roof expansion joint compound caulking.

5.1.4 Surface and Subsurface Soil

As part of the Phase II ESA in 2023, at each of 12 locations across the Site (SB-1 through SB-12), the Toeroek Team collected a surface soil sample and a subsurface soil sample (Appendix A, Figure 3). Soil borings were advanced to maximum depth of 35 feet bgs, to groundwater, or to refusal, whichever occurred first. Surface soil samples were collected within 0-3 feet bgs. Subsurface soil samples were collected within select intervals based on visual staining, detected odor, or elevated photoionization detector (PID) readings. If no obvious contamination was noted within the subsurface interval, the sample was collected from the bottom 2-foot interval of the soil core.

Surface and subsurface soil samples were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), total extractable hydrocarbons (TEH), and Target Analyte List (TAL)

metals, including mercury. Soil sample results from the Phase II ESA were compared to IDNR SWSs for soil (IDNR 2023) and to EPA RSLs, assuming residential land use and a total hazard quotient (THQ) of 0.1 (EPA 2023a). Metals results from soil samples also were compared to Woodbury County average concentrations plus one standard deviation to determine if detected metals concentrations were consistent with naturally occurring concentrations (USGS 2023).

Comparisons of analytical data to IDNR SWSs and to EPA RSLs resulted in the following noteworthy findings:

- VOCs were detected in all soil samples except SB-12 (32-35). No detected concentration of a VOC in any soil sample exceeded a regulatory benchmark.
- SVOCs were detected in 16 of 24 soil samples. Concentrations of benzo(a)pyrene exceeded the EPA RSL for residential soil in surface soil samples SB-6 (0-3), SB-7 (0-3), SB-8 (0-10), and SB-10 (0-3). No other SVOC was present at concentration exceeding any regulatory benchmark.
- TEH were detected in 13 of 24 soil samples. No concentration of TEH exceeded the IDNR SWS.
- Metals were detected in all soil samples. Detections of arsenic occurred at concentrations exceeding the EPA RSL for industrial soil in all samples, but none exceeded the average background concentration for Woodbury County, Iowa (mean plus one standard deviation). No detection in any soil sample of any analyte other than arsenic occurred at a concentration exceeding an EPA RSL for residential or industrial soil or an IDNR SWS. Detections of arsenic were all within one standard deviation of the average background concentration, indicating presence of arsenic at the Site likely is naturally occurring.

5.1.5 Soil Gas

As part of the Phase II ESA in 2023, to investigate possible presence of contaminants in soil gas from historical activities at the Site, the Toeroek Team collected eight soil-gas samples (SG-1 through SG-8) (Appendix A, Figure 3. Soil-gas samples were analyzed for VOCs. Analytical data were compared to EPA VISLs (EPA 2023b) to provide an initial screen for potential residential exposure risk from vapor intrusion. Because risk from the detected constituents is primarily or entirely driven by cancer risk, a total hazard quotient of 1.0 was assumed.

VOCs were detected in all soil-gas samples. Three VOCs were detected at concentrations exceeding the EPA residential VISL—benzene in SG-9; 1,3-butadiene in SG-7; and chloroform in SG-7, SG-9, SG-10, SG-11, and SG-12. No VOC exceeded an EPA commercial VISL.

5.2 EVALUATION OF CLEANUP ALTERNATIVES FOR ACM

Evaluations of cleanup alternatives are based on potential future use scenarios at the Site—to be conservative, residential development is assumed. The Toeroek Team has developed three cleanup alternatives for ACM. Although demolition of the Site buildings is presumed, cleanup alternatives for ACM are developed to indicate alternatives for limited abatement of damaged ACM, as well as demolition or removal of all hazardous materials.

Regarding ACM, three options were evaluated: (1) no action, (2) abatement of all ACM wastes, and (3) Enclosure of ACM with O&M and ICs. Alternatives 2 and 3 are expected to achieve clearance criteria under IDNR requirements.

5.2.1 Alternative 1: No Action (Baseline)

The no action alternative is included as a baseline for comparison to the other proposed alternatives. Alternative 1 (No Action) would leave ACM in place at the Site.

Effectiveness

This alternative would not be effective if the Site buildings are demolished. Redevelopment of areas containing ACM would have to be restricted to ensure that those materials remain undisturbed. Additionally, in accordance with NESHAP regulations, demolition of the Site building cannot proceed before proper abatement; therefore, demolition could not occur if this alternative would be selected. This alternative would also be ineffective in achieving the goal of reducing health risks.

Implementation

Implementation of this alternative is straightforward—ACM left in place. Future redevelopment would have to consider the location and condition of the ACM and ensure that those materials remain undisturbed. Demolition could not occur prior to abatement.

Cost

This alternative would not involve any direct costs.

5.2.2 Alternative 2: Abatement of all Asbestos-Containing Material

Alternative 2 would involve, prior to demolition or renovations, proper abatement of all ACM identified in the Site buildings. Abatement by a licensed State of Iowa asbestos abatement contractor would accord with applicable local, state, and federal regulations, and a pre-approved Remedial Action Plan (RAP). Regulatory clearance sampling would occur according to a pre-approved quality assurance project plan (QAPP), and IDNR may conduct pre/post-abatement inspections (if required).

Effectiveness

Removal of all identified ACM under Alternative 2 would meet the applicable or relevant and appropriate requirements (ARARs) established by the NESHAP regulation and would address the risk to human health posed by ACM. In addition, full abatement would allow redevelopment of the Site without restrictions pertaining to disturbance of ACM.

Implementation

Abatement of ACM by a licensed State of Iowa asbestos abatement contractor would accord with applicable local, state, and federal regulations. EPA, state, and OSHA requirements must be met during removal of ACM and during demolition. A RAP and Health and Safety Plan would address these regulations.

Cost

Table 1 provides a breakdown of abatement costs for this alternative, and Table 2 provides total costs. Estimated total cost of Alternative 2 is $340,000. Estimated abatement costs were gathered from local vendors. Listed cost per SF/LF includes removal and disposal costs. Estimated cost for abatement of the ACM associated with the Site buildings is $324,500. This estimate does not include restoration costs. Additional costs to be considered include those for three technical reports (RAP, QAPP, and Final Abatement Report) and for collection of clearance samples. Estimated cost of technical plans/reports is $3,500 per plan/report (cost of plans includes consideration of all environmental issues to be addressed by cleanup activities). Additional costs for oversight and clearance sampling are considered variable based on requirements and duration of abatement. Estimated cost associated with oversight and clearance is $5,000.

TABLE 1

ACM ALTERNATIVE 2 - ABATEMENT COSTS FOR ALL MATERIALS

Material Description	Material Locations	Estimated Quantity	Cost/Unit ($/SF or $/LF)	Total Cost
Garage				
Black Roof Flashing	Garage Roof	1,012 SF	$4	$4,048
Library				
Light Green with Gray Streaks Vinyl Floor Tile 12" x 12"	1st and 2nd Floors	50 SF	$4	$200
Power Plant and Tunnels				
Pipe Insulation	Throughout	400 LF	$15	$6,000
Transite Board	Between Large Boilers	100 SF	$8	$800
Tank Insulation	Upper Room of Power Plant and Below Library	200 SF	$15	$3,000
Aircell Pipe Insulation	Throughout	600 LF	$15	$9,000
Black Flashing	Perimeter of Power Plant Roof	500 LF	$4	$2,000
Chapel				
Red Vinyl Floor Tile 9" x 9″	Mezzanine	500 SF	$4	$2,000
Aircell Pipe Insulation	Throughout	1,000 LF	$15	$15,000
White Window Glaze	Exterior Chapel Windows	128 Windows (6 LF/Window)	$8	$6,144
Black Roof Flashing	Under Chapel Roof Flashing	400 LF	$4	$1,600
Thick Black Roof Flashing	Over Chapel Roof Flashing	400 LF	$4	$1,600
Black Window Caulk	Chapel Penthouse Windows	2 Windows	$8	$96
White Window Caulk	Chapel Penthouse Windows	2 Windows	$8	$96
Expansion Joint Caulk	Under Chapel Penthouse Windows	2 Windows	$8	$96
White Window Caulk	North Side Chapel Windows	128 Windows	$8	$6,114
Black Sealant	North Side of Chapel Foundation	500 SF	$8	$4,000
Tan Door Caulk	Chapel Exterior Doors	5 Doors (16 LF/Door)	$8	$640
Building 25				
Pebble Sheet Flooring	Throughout 3rd Floor Hallways	2,350 SF	$4	$9,400
Vinyl Floor Tile, Grey with Brown Streaks 12″ x 12″	Throughout 4th and 3rd Floors	15,000 SF	$4	$60,000
12″ Pipe Insulation	Access near Old Elevator/Stairs	500 LF	$15	$7,500
Mudded Joint Fittings	Throughout	200 LF	$15	$3,000
Aircell Pipe Insulation	Throughout	800 LF	$15	$12,000
White Expansion Joint Compound	Roof	200 LF	$8	$1,600
White Window Caulk	Roof and Penthouse Windows	8 Windows	$8	$384
Sheet Flooring with Square Pebbles	2nd Floor – A Wing	4,000 SF	$4	$16,000
Beige Vinyl Floor Tile 12″ x 12″	Ground Floor – Southeast Room	250 SF	$4	$1,000
White Door Caulk	West Door	16 LF	$8	$128
White Expansion Joint	Hall that connects to Chapel	10 LF	$8	$80

TABLE 1

ACM ALTERNATIVE 2 – ABATEMENT COSTS FOR ALL MATERIALS

Material Description	Material Locations	Estimated Quantity	Cost/Unit ($/SF or $/LF)	Total Cost
Main Building				
Black Sink Undercoating	Throughout	15 Sinks	$50	$750
Tan With Gray Streaks Vinyl Floor Tile 9″ x 9″	Basement – C and D Wings	3,400 SF	$4	$13,600
Green With White and Gray Specs Vinyl Floor Tile 12″ x 12″	Basement – A Wing	1,500 SF	$4	$6,000
Vinyl Floor Tile, Off-White with Gray Streaks 12″ x 12″	Ground, 3rd, and 5th Floors	900 SF	$4	$3,600
Vinyl Floor Tile, Cream with Brown Streaks 12″ x 12″	Ground, 3rd, and 5th Floors	180 SF	$4	$720
Vinyl Floor Tile, Gray with Gray Streaks 12″ x 12″	Basement – A and C Wings	2,740 SF	$4	$10,960
Wood Panel Mastic	Basement – C Wing	9,505 SF	$8	$76,040
Spray-on Fire Proofing	4th and 5th Floors	580 SF	$50	$29,000
White Window Caulk	Exterior Windows	158 Windows	$8	$7,584
Black Door Caulk	Exterior Doors	10 Doors	$8	$1,280
White Flashing Caulk	East Side (above Sidewalk)	90 LF	$8	$720
White Expansion Joint	Between Building 25 and Main Building (Northwest Corner)	90 LF	$8	$720
Total ACM Abatement Cost				**$324,500**

TABLE 2

ACM ALTERNATIVE 2 – TOTAL COSTS

Line Item	Cost
Abatement of asbestos-containing material (ACM)	$324,500
Development of Remedial Action Plan (RAP)	$3,500
Development of Quality Assurance Project Plan (QAPP)	$3,500
Final Abatement Report	$3,500
Oversight and clearance sampling	$5,000
Total Alternative 2 Cost	**$340,000**

5.2.3 Alternative 3: O&M Plan

If demolition of one or more Site buildings is not to occur, Alternative 3 would involve preparing ICs and an O&M plan for the Site to address any ACM present. The damaged ACM would require proper abatement by a licensed State of Iowa asbestos abatement contractor in accord with applicable local, state, and federal regulations, and a pre-approved Remedial Action Plan (RAP). Regulatory clearance sampling would occur according to a pre-approved Quality Assurance Project Plan (QAPP), and Iowa DNR

possibly would conduct pre/post-abatement inspections (if required). For the purpose of this ABCA, it is assumed that approximately 80% of the regulated ACM identified in Section 5.1.4 is damaged and would require proper abatement. However, prior to implementation of this alternative, all ACM would need to be reassessed for damage. The building may not be demolished unless the ACM is abated, so selection of this alternative would preclude demolition.

Effectiveness

This alternative would be effective regarding rehabilitation of the subject property building containing ACM. This alternative would also be effective in achieving the goal of reducing health risks and would allow for redevelopment of the subject property as proposed. As such, regular monitoring of ACM remaining in place would be necessary to ensure it is not damaged, and future redevelopment plans would have to consider locations and condition of the remaining ACM, and ensure those materials would not be disturbed.

Implementation

Implementation of this alternative would include leaving some ACM in place and properly abating damaged ACM. An O&M Plan would be developed to document presence and locations of ACM, and future maintenance procedures regarding the ACM. Additionally, filing the O&M Plan on the property's chain-of-title as an IC would be required.

Cost

Estimated cost of completing an O&M Plan described above would be $4,500. Estimated abatement costs for damaged ACM were gathered from local vendors. Estimated cost for abatement of damaged ACM associated with the subject property building is $259,600. This estimate does not include restoration costs. Table 2 below summarizes costs for abatement of damaged ACM. Additional costs to be considered, particularly if the subject property would be enrolled in the Iowa VCP, include those for three technical reports (RAP, QAPP, and Final Abatement Report) and for collection of clearance samples. Estimated cost of technical plans/reports is $3,500 per plan/report (cost of plans includes consideration of all environmental issues to be addressed by cleanup activities). Additional costs for oversight and clearance sampling are considered variable based on requirements and duration of abatement. Estimated cost associated with oversight and clearance is $5,000. Estimated total cost of Alternative 2 is $275,100. This cost does not include re-inspections of ACM.

5.3 EVALUATION OF CLEANUP ALTERNATIVES FOR LBP

Evaluations of cleanup alternatives are based on potential future use scenarios at the Site—to be conservative, residential development is assumed. The Toeroek Team has developed three cleanup alternatives for LBP. Although demolition of the Site buildings is presumed, cleanup alternatives for LBP are developed to indicate alternatives for limited abatement of damaged LBP, as well as demolition or removal of all hazardous materials.

Regarding LBP, three options were evaluated: (1) no action, (2) abatement of all LBP wastes, and (3) Encapsulation of LBP with O&M and ICs. Alternatives 2 and 3 are expected to achieve clearance criteria under IDNR requirements.

5.3.1 Alternative 1: No Action (Baseline)

The no action alternative is included as a baseline for comparison to the other proposed alternatives. Alternative 1 (No Action) would leave LBP in place at the Site.

Effectiveness

This alternative would not be effective if the Site buildings are renovated. Redevelopment of areas containing LBP would have to be restricted to ensure that those materials remain undisturbed. This alternative would also be ineffective in achieving the goal of reducing health risks. If the buildings will be demolished a toxicity characteristic leaching procedure (TCLP) sample for RCRA metals could be collected of the demolition debris prior to disposal to determine if the debris is hazardous prior to disposal.

Implementation

Implementation of this alternative is straightforward—LBP left in place. Future redevelopment would have to consider the location and condition of the LBP and ensure that those materials remain undisturbed. Demolition could occur without abatement; however, TCLP sampling would be required prior to disposal of demolition debris.

Cost

This alternative would not involve any direct costs.

5.3.2 Alternative 2: Abatement of all LBP

Alternative 2 would involve, prior to demolition or renovations, proper abatement of all LBP identified in the Site buildings. All surfaces and components that contain LBP determined to be in good condition would be removed for proper disposal. LBP removal by a licensed LBP removal professional would comply with applicable local, state, and federal regulations. Regulatory clearance sampling would occur according to a pre-approved quality assurance project plan (QAPP), and IDNR may conduct pre/post-abatement inspections (if required).

Effectiveness

Removal of all identified LBP under Alternative 2 would meet the applicable or relevant and appropriate requirements (ARARs) established by the NESHAP regulation and would address the risk to human health posed by LBP. In addition, full abatement would allow redevelopment of the Site without restrictions pertaining to disturbance of LBP.

Implementation

Abatement of LBP by a licensed LBP removal professional would accord with applicable local, state, and federal regulations. EPA, state, and OSHA requirements must be met during removal of LBP and during demolition. A RAP and Health and Safety Plan would address these regulations.

Cost

Estimated total cost of Alternative 2 is $501,000. Table 3 lists total costs associated with this alternative. Listed cost per LF includes removal and disposal costs. Estimated cost for abatement of the LBP associated with the Site buildings is $470,500. This estimate does not include restoration costs. Additional costs to be considered include those for three technical reports (RAP, QAPP, and Final Abatement Report) and for collection of clearance samples. Estimated cost of technical plans/reports is $3,500 per plan/report (cost of plans includes consideration of all environmental issues to be addressed by cleanup activities). Additional costs for oversight and clearance sampling are considered variable based on requirements and duration of abatement. Estimated cost associated with oversight and clearance is $20,000.

TABLE 3

LBP ALTERNATIVE 2 – TOTAL COSTS

Line Item	Cost
Abatement of LBP (23,525 linear feet at $20/linear foot)	$470,500
Development of Remedial Action Plan (RAP)	$3,500
Development of Quality Assurance Project Plan (QAPP)	$3,500
Final Abatement Report	$3,500
Oversight and clearance sampling	$20,000
Total Alternative 2 Cost	**$501,000**

5.3.3 Alternative 3: LBP Encapsulation and O&M

If demolition of the Site building is not to occur, Alternative 3 would involve encapsulating LBP in site buildings and preparing ICs and an O&M plan for the Site to address any LBP present. LBP-containing surfaces would be inspected, and removal of loose LBP would be required. Removed LBP residue would be segregated for proper disposal. LBP encapsulant would be a durable, air- and dust-tight surface coating. Application of the encapsulant would ensure that remaining LBP could not leach to the painted surface and pose a threat to future occupants. This will prevent access and disturbance of LBP identified during the Phase II ESA. The O&M plan would include the following: maps and drawings showing locations of remaining LBP, description of accessibility, protocols and schedules for regular inspections, and contingency plans for dealing with any damaged or necessarily disturbed LBP. In addition, filing the O&M Plan on the property's chain-of-title as an IC would be required. If renovation of the structure is to occur, the remaining LBP are not to be disturbed and may remain in place. The building may not be demolished unless the LBP is abated, so selection of this alternative would preclude demolition.

Effectiveness

LBP encapsulation and O&M for the Site under Alternative 3 would meet the ARARs established by the NESHAP regulation and would address the risk to human health posed by LBP. As such, LBP left to remain in place would have to be regularly monitored to ensure it is not damaged, and future redevelopment plans would have to consider locations and condition of the remaining LBP, and ensure those materials would not be disturbed.

Implementation

Regular inspections of LBP by a licensed State of Iowa lead inspector would accord with applicable local, state, and federal regulations. A Health and Safety Plan would address these regulations.

Cost

Estimated cost of LBP Encapsulation and O&M plan is $352,875. Additional costs for oversight and regular inspections are considered variable based on requirements and duration of inspections. Estimated total cost of Alternative 3 is $357,875.

5.4 EVALUATION OF CLEANUP ALTERNATIVES FOR PCBs

Evaluations of cleanup alternatives are based on potential future use scenarios at the Site—to be conservative, residential development is assumed. The Toeroek Team has developed three cleanup alternatives for PCBs. Although demolition of the Site buildings is presumed, cleanup alternatives for PCBs are developed to indicate alternatives for limited abatement of damaged PCBs, as well as demolition or removal of all hazardous materials.

Regarding PCBs, three options were evaluated: (1) no action, (2) abatement of all PCBs wastes, and (3) Enclosure of PCBs with O&M and ICs. Alternatives 2 and 3 are expected to achieve clearance criteria under IDNR requirements.

5.4.1 Alternative 1: No Action (Baseline)

The no action alternative is included as a baseline for comparison to the other proposed alternatives. Alternative 1 (No Action) would leave PCBs in place at the Site.

Effectiveness

This alternative would not be effective if the Site buildings are demolished. Redevelopment of areas containing PCBs would have to be restricted to ensure that those materials remain undisturbed. Additionally, in accordance with NESHAP regulations, demolition of the Site building cannot proceed before proper abatement; therefore, demolition could not occur if this alternative would be selected. This alternative would also be ineffective in achieving the goal of reducing health risks.

Implementation

Implementation of this alternative is straightforward— PCBs left in place. Future redevelopment would have to consider the location and condition of the PCBs and ensure that those materials remain undisturbed. Demolition could not occur prior to abatement.

Cost

This alternative would not involve any direct costs.

5.4.2 Alternative 2: Abatement of all PCBs

Alternative 2 would involve, prior to demolition or renovations, proper abatement of all PCBs identified in the Site buildings. Abatement by a licensed abatement contractor would accord with applicable local, state, and federal regulations, and a pre-approved RAP. Regulatory clearance sampling would occur according to a pre-approved QAPP, and IDNR may conduct pre/post-abatement inspections (if required).

Effectiveness

Removal of all identified PCBs under Alternative 2 would meet the applicable or relevant and appropriate requirements (ARARs) established by the NESHAP regulation and would address the risk to human health posed by PCBs. In addition, full abatement would allow redevelopment of the Site without restrictions pertaining to disturbance of PCBs.

Implementation

Abatement of PCBs by a licensed abatement contractor would accord with applicable local, state, and federal regulations. EPA, state, and OSHA requirements must be met during removal of PCBs and during demolition. A RAP and Health and Safety Plan would address these regulations.

Cost

Estimated total cost of Alternative 2 is $21,800. Table 4 lists total costs associated with this alternative. Listed cost per LF includes removal and disposal costs. Estimated cost for abatement of the PCBs associated with the Site buildings is $6,300. This estimate does not include restoration costs. Additional costs to be considered include those for three technical reports (RAP, QAPP, and Final Abatement Report) and for collection of clearance samples. Estimated cost of technical plans/reports is $3,500 per plan/report (cost of plans includes consideration of all environmental issues to be addressed by cleanup activities). Additional costs for oversight and clearance sampling are considered variable based on requirements and duration of abatement. Estimated cost associated with oversight and clearance is $5,000.

TABLE 4

PCB ALTERNATIVE 2 – TOTAL COSTS

Line Item	Cost
Abatement of PCBs (210 linear feet at $30/linear foot)	$6,300
Development of Remedial Action Plan (RAP)	$3,500
Development of Quality Assurance Project Plan (QAPP)	$3,500
Final Abatement Report	$3,500
Oversight and clearance sampling	$5,000
Total Alternative 2 Cost	**$21,800**

5.4.3 Alternative 3: PCBs Enclosure and O&M

If demolition of the Site building is not to occur, Alternative 3 would involve enclosing PCBs in site buildings and preparing ICs and an O&M plan for the Site to address any PCBs present. This alternative would involve creating an air-tight barrier over or around PCBs in damaged or poor condition. This will prevent access and disturbance of PCBs identified during the Phase II ESA. The O&M plan would include the following: maps and drawings showing locations of remaining PCBs, description of accessibility, protocols and schedules for regular inspections, and contingency plans for dealing with any damaged or necessarily disturbed PCBs. In addition, filing the O&M Plan on the property's chain-of-title as an IC would be required. If renovation of the structure is to occur, the remaining PCBs are not to be disturbed and may remain in place. The building may not be demolished unless the PCBs is abated, so selection of this alternative would preclude demolition.

Effectiveness

PCBs Enclosure and O&M for the Site under Alternative 3 would meet the ARARs established by the NESHAP regulation and would address the risk to human health posed by PCBs. As such, PCBs left to remain in place would have to be regularly monitored to ensure it is not damaged, and future redevelopment plans would have to consider locations and condition of the remaining PCBs, and ensure those materials would not be disturbed.

Implementation

Regular inspections of PCBs by a licensed inspector would accord with applicable local, state, and federal regulations. A Health and Safety Plan would address these regulations.

Cost

Estimated cost of PCBs Enclosure and O&M is $6,300. Additional costs for oversight and regular inspections are considered variable based on requirements and duration of inspections. Estimated total cost of Alternative 3 is $11,300.

5.5 EVALUATION OF CLEANUP ALTERNATIVES FOR SOIL

The Toeroek Team has also developed three cleanup alternatives for soil. Three options were evaluated for residential reuse: (1) no action; (2) Soil Excavation with Off-Site Disposal; and (3) On-Site Consolidation and Capping with ICs.

5.5.1 Alternative 1: No Action (Baseline)

The no action alternative is included as a baseline for comparison to the other proposed alternatives. This alternative would involve no containment, treatment, removal, or monitoring of contaminants. All contaminated soil would be left in place, and no restrictions on future land use would be imposed.

Effectiveness

Because the no action alternative would not be protective of human health and the environment, it is not considered effective.

Implementation

Implementation of this alternative would require no effort because no containment, treatment, removal, or monitoring of contaminants would occur. Future redevelopment would have to consider the potential threat to human health and the environment.

Cost

This alternative would not involve any direct costs.

5.5.2 Alternative 2: Soil Excavation with Off-Site Disposal

The alternative would involve excavation of contaminated soil in place in areas where SVOCs exceeding RSLs. Following excavation, five-point composite confirmation soil samples would be collected from the

walls and the floor of each excavation area to ensure contaminant concentrations in remaining soils are below residential cleanup levels.

Soil would be stockpiled on the Site for waste profile characterization before off-site disposal. Following characterization for disposal, excavated soils would be hauled to and disposed of at an off-site permitted disposal facility. Depending on hazardous and leaching characteristics, waste disposal may occur at a Class I, II, or III permitted facility.

Excavated areas would then be backfilled and compacted with clean fill material, graded, and seeded as appropriate.

- Soil Excavation: The volume of soil to be excavated to cleanup levels is approximately 841 cubic yards (cy) total, assuming a total area of 2,200 SF and depth of 4 to 11 feet bgs. The approximate area for excavation is depicted on Figure 4 in Appendix A. The excavation area was estimated based on the limited soil sample results from the Phase II ESA compared to IDNR Statewide Standards (SWS) for Soil and to EPA Regional Screening Levels (RSLs) (IDNR 2023; EPA 2023a). The organization undertaking cleanup actions at the Site will need to work with the oversight agency to establish appropriate cleanup levels specific to the Site.

- Confirmation Sampling: Confirmation soil sampling will require collection of five five-point composite samples from each excavated area—four from the walls and one from the floor—to ensure contaminant concentrations in remaining soils are below cleanup levels.

- Backfill: Excavated areas will be backfilled with clean material from off site, graded and seeded as needed for redevelopment.

- Waste Disposal: Presumably, all excavated soil will be accepted at a landfill facility as non-hazardous waste.

Alternative 2 would allow redevelopment of the Site as planned.

Effectiveness

Alternative 2 would be effective in removing contaminated soil from the Site, and would allow residential redevelopment of the Site.

Implementation

Alternative 2 rates easy for implementation as soil excavation and off-site disposal are common remediation practices and the materials, services, and equipment necessary for implementation are readily available. Soil excavation by qualified equipment operators would accord with applicable state and federal regulations. All waste soil excavated during this process would be transported for disposal off site

as either non-hazardous or hazardous waste, depending on results of toxicity characteristic leaching procedure (TCLP) analysis. For cost estimating purposes, assumptions are that none of the excavated soil would be used as backfill and all excavated soil would be handled as non-hazardous waste. In addition, planning this process would require careful consideration of precautions concerning worker health and safety.

Cost

Estimated total cost of Alternative 2 in 2023 dollars is $242,000. Table 5 lists total costs associated with this alternative: $186,086 for capital costs, and $55,826 for contingency. Costs were estimated by applications of selected functions of Remedial Action Cost Engineering and Requirements System (RACER) Version 11.2.16.0 and professional judgment. Details of costs are in Appendix B.

TABLE 5

SOIL ALTERNATIVE 2 – TOTAL COSTS

Line Item	Cost
Construction Subtotal	$139,914
Construction Management	$13,991
Remedial Design	$20,987
Project Management	$11,193
Contingency	$55,826
Total Alternative 2 Cost (Rounded)	**$242,000**

5.5.3 Alternative 3: On-Site Consolidation and Capping with ICs

Alternative 3 would involve excavation of contaminates soil in the areas where concentrations exceeding cleanup levels. Excavated soil would then be consolidated onsite and capped. The alternative would leave contaminated soil in place in areas where concentrations exceeding RSLs. Potential site receptors currently are not protected from exposure to contaminated soil via dermal contact and incidental ingestion. However, a soil management plan SMP would be necessary to guide proper handling of soil at the Site if the soil is disturbed (for example, during new structure construction). The SMP would present a tiered approach to soil management, regulatory approval, documentation, and record keeping to minimize administrative requirements.

ICs would be necessary to ensure that potential site receptors are protected from exposure to contaminated soils. Alternative 3 would involve capping the consolidated soils with a concrete

foundation layer topped with compacted soil and vegetative cover. The cap would consist of a 12-inch concrete foundation layer, 2 feet of low-permeability compacted clay, 6 inches of topsoil, and a vegetative cover.

ICs would be necessary to ensure that an SMP is in place to manage contaminated soils. ICs would be implemented in the form of a deed restriction/environmental covenant disallowing excavation of Site soil where iron and vanadium have been detected at concentrations exceeding cleanup level at SB-8.

Alternative 3 would allow redevelopment of the Site as planned; however, ICs would be required in perpetuity.

Effectiveness

Alternative 3 would be effective in limiting exposure of affected soils to Site occupants and would allow residential redevelopment of the Site. However, this alternative would leave affected soil in place and would require long-term stewardship to ensure continuation of all restrictive measures over the life of the ICs.

Implementation

On-site consolidation and capping would be easy to implement, as this is a common remediation practices and the materials, services, and equipment necessary for implementation are readily available. Implementation of ICs would include a restrictive covenant filed with the Register of Deeds to prohibit disturbance of contamination left in place under any future use scenario. This alternative would mandate annual inspections to ensure that Site occupants comply with restrictive covenants.

Cost

Estimated total cost of Alternative 3 in 2023 dollars is $615,000. Table 6 lists total costs associated with this alternative. Costs were estimated by applying selected functions of RACER Version 11.2.16.0. Details of costs are in Appendix B. Estimated costs for this alternative could be reduced if additional sampling occurs to further delineate lateral and vertical extents of contamination, thereby possibly reducing excavation volume.

TABLE 6

SOIL ALTERNATIVE 3 – TOTAL COSTS

Line Item	Cost
Capital Costs	
Construction Subtotal	$291,315
Construction Management	$29,132
Remedial Design	$43,697
Project Management	$23,305
Contingency	$116,235
Institutional Controls	
Land Use Controls Plan	$27,317
Meetings	$4,362
Restrictive Covenant	$1,579
Contingency	$9,977
Operations and Maintenance (30 years) Rounded	**$68,000**
Total Alternative 2 Cost Rounded	**$615,000**

5.6 EVALUATION OF CLEANUP ALTERNATIVES FOR SOIL GAS

The Toeroek Team evaluated three cleanup alternatives for soil gas: (1) no action; (2) institutional controls; and (3) active vapor intrusion mitigation of any future structure on the Site, O&M, and ICs. Detected VOC concentrations exceeding EPA benchmarks in soil-gas samples from across the Site suggest that vapor intrusion is a concern at the Site, and that soil or groundwater under the building may be contaminated with VOCs.

5.6.1 Alternative 1: No Action (Baseline)

Alternative 1 (No Action) is presented for baseline comparison. This alternative would provide no containment, treatment, removal, or monitoring of contaminants.

Effectiveness

Because the no action alternative would not be protective of human health and the environment, it is not considered effective.

Implementation

Implementation of this alternative would require no effort because no containment, treatment, removal, or monitoring of contaminants would occur. Future redevelopment would have to consider the potential threat to human health and the environment.

Cost

This alternative would not involve any direct costs.

5.6.2 Alternative 2: Institutional Controls

The alternative would restrict land use to commercial. Concentrations of VOCs in soil gas at SG-7, SG-9, SG-10, SG-11 and SG-12 exceeded the residential VISLs, but not the commercial VISLs. As a result, potential residential site receptors might be exposed to acceptably high levels of VOCs in indoor air in structures on the property. However, potential commercial site receptors would not be. ICs would be necessary to restrict future land use to commercial use only. ICs would be implemented in the form of a deed restriction/environmental covenant.

Alternative 2 would allow redevelopment of the Site as commercial; however, ICs would be required in perpetuity.

Effectiveness

Alternative 2 would allow commercial redevelopment of the Site. However, this alternative would not mitigate soil gas vapors and would require long-term stewardship to ensure continuation of all restrictive measures over the life of the ICs. This would restrict building over these areas to commercial only. A restrictive covenant would also require vapor mitigation for any future residential structure to be built or further investigation.

Implementation

ICs would be easy to implement, as no physical remediation would be required. Implementation of ICs would include a restrictive covenant filed with the Register of Deeds to prevent future residential use of the property.

Cost

Estimated total cost of Alternative 2 in 2023 dollars is $43,000. Table 7 lists total costs associated with this alternative. Costs were estimated by applications of selected functions of RACER Version 11.2.16.0 and professional judgment. Details of costs are in Appendix B.

TABLE 7

SOIL-GAS ALTERNATIVE 2 – TOTAL COSTS

Line Item	Cost
Institutional Controls	**$33,258**
Land Use Controls Plan	$27,317
Meetings	$4,362
Restrictive Covenant	$1,579
Contingency	$9,977
Total Alternative 2 Cost Rounded	**$43,000**

5.6.3 Alternative 3: Vapor Intrusion Mitigation for New Structures, Operation and Maintenance, and Institutional Controls

Alternative 3, presuming removal of the current buildings on the Site, would involve construction of a vapor intrusion mitigation system for any new residential structure to be built on the Site. Each vapor intrusion mitigation system would create a small negative pressure and diffusion underneath the slab of the structure, providing a preferential flow pathway for the vapor and thus inducing movement of it through the perforated piping and outside rather than into the occupied structure. Each vapor mitigation system would include a gravel layer with perforated piping and a vapor barrier consisting of metalized film sheet, nitrile-modified asphalt, and protection fabric layers. Vent risers would extend through the roof of the structure. The soil-gas vapor collected would be vented outside to the atmosphere through these risers.

Regular inspections and possibly repairs or maintenance of each vapor mitigation system would be necessary as long as its associated structure is occupied on the Site and contamination remains above cleanup levels. ICs would be necessary to ensure (1) inclusion of a vapor intrusion mitigation system in design of any new structure to be built on the Site, and (2) continued integrity of that vapor intrusion mitigation system.

Whether and at what size a structure will be built on the Site is unknown. Therefore, for cost estimating purposes, one structure with a slab foundation encompassing 20,000 SF of first-floor space were assumed.

Effectiveness

This alternative would limit exposure of vapors from soil to receptors on the Site, and thus would allow redevelopment of the Site as proposed. However, the source of soil-gas contamination, either soil or

groundwater, would remain in place, and maintenance of the vapor intrusion mitigation system would be required. ICs also would be necessary to ensure inclusion of a vapor intrusion mitigation system in the design of any new structure to be built on the Site, as well as continued integrity of that vapor intrusion mitigation system.

Implementation

Vapor intrusion mitigation is a common remediation practice, and the materials, services, and equipment necessary for implementation are readily available; however, the vapor intrusion mitigation system would require routine inspections and possibly repairs or maintenance until sub-slab and indoor air concentrations are below cleanup levels. In addition, air monitoring may be required to verify performance of the vapor mitigation system as intended. For the purpose of this ABCA, costs for air monitoring have been included as part of O&M. Any structure to be built on the Site would be designed with a vapor mitigation system, including a vapor barrier, gravel layer, perforated piping, and blowers. Implementation of ICs would include a restrictive covenant that would be filed with the Register of Deeds to ensure inclusion of a vapor mitigation system in the design of any new structure to be built on the Site.

Cost

Estimated total cost of Alternative 3 in 2023 dollars is $340,000. Table 8 lists total costs associated with this alternative: $209,000 for capital costs, $43,000 for ICs, and $88,000 for O&M over a 30-year period. Costs were estimated by applying selected functions of RACER Version 11.2.16.0, contractor quotes, and professional judgment. Details of costs are in Appendix B.

TABLE 8

SOIL-GAS ALTERNATIVE 3 – TOTAL COSTS

Line Item	Cost
Capital Costs	**$160,590**
Vapor Mitigation System, 20,000-square-foot building ($5.93 per square foot)	$120,744
Management and Design	$39,864
Contingency	$48,177
Institutional Controls	**$33,258**
Land Use Controls Plan	$27,317
Meetings	$4,362
Restrictive Covenant	$1,579
Contingency	$9,977
Operations and Maintenance (30 years)	**$33,258**
Total Alternative 3 Cost Rounded	**$340,000**

5.7 RECOMMENDED CLEANUP ALTERNATIVES

This section recommends cleanup alternatives for contaminated soil, vapor intrusion, and ACM at the Site.

5.7.1 Asbestos-Containing Material

Alternative 2 (Abatement of ACM) is the recommended cleanup alternative for ACM. Future plans at the Site include either substantial rehabilitation/renovation or demolition; therefore, removal of the identified ACM would be required prior to initiation of those activities.

5.7.2 Lead-Based Paints

Alternative 2 (Abatement of LBP) is the recommended cleanup alternative for LBP Future plans at the Site include either substantial rehabilitation/renovation therefore, removal of the identified LBP would be required prior to initiation of those activities. If the buildings onsite will be demolished, Alternative 1 (No Action), would be recommended; however, TCLP sampling of demolition debris would be required prior to disposal to determine if the debris is hazardous.

5.7.3 Poly-chlorinated Biphenyls

Alternative 2 (Abatement of PCBs) is the recommended cleanup alternative for PCBs. Future plans at the Site include either substantial rehabilitation/renovation or demolition; therefore, removal of the identified PCBs would be required prior to initiation of those activities.

5.7.4 Affected Soils

Alternative 2 (Soil Excavation with Off-Site Disposal) is the recommended cleanup alternative for soils. This alternative would be a direct approach and would allow unrestricted use of the Site. It would achieve regulatory compliance and would allow residential and/or commercial redevelopment of the Site. This alternative would be the more cost-effective option (excluding the no action alternative) to address contaminated soil at the Site.

5.7.5 Soil Gas

Alternative 3 (Vapor Intrusion Mitigation for New Structures, O&M, and ICs) is the recommended cleanup alternative for vapor intrusion, as demolition of the existing structure is anticipated with construction of new buildings. This alternative would limit exposure of vapors from soil to receptors at the Site and would allow redevelopment of the Site. It would achieve regulatory compliance and would allow residential and/or commercial redevelopment of the Site. A restrictive covenant would be filed with the Register of Deeds to ensure installation of a vapor mitigation system for any building on the Site.

5.7.6 Total Cleanup Cost

Table 9 summarizes total cleanup costs for the recommended alternatives assuming future residential land use. If the future use of the site will be commercial, there are no soil gas commercial VISL exceedances to address, but institutional controls would be required to prevent residential use. Based on the recommended cleanup alternatives, estimated total cleanup cost is $1,885,800. As stated above, costs for demolition of the buildings, Site restoration, and any associated disposal costs for addressing construction and demolition waste materials have not been included in this ABCA. If the buildings onsite will be demolished, LBP abatement would not be required; however, TCLP sampling of demolition debris would be required prior to disposal to determine if the debris is hazardous.

TABLE 9

SUMMARY OF COSTS FOR RECOMMENDED ALTERNATIVES

Contaminant / Material	Recommended Alternative	Action - Cost	Total Cost
Asbestos-containing Material (ACM)	Alternative 2 – Abatement of all ACM	Abatement – $324,500 Oversight and Clearance Sampling – $5,000 Technical Reporting – $10,500	$340,000
Lead-based Paints (LBPs)	Alternative 2 – Abatement of all LBP	Abatement of LBP – $470,500 Oversight and clearance sampling – $5,000 Technical Reporting – $10,500	$501,000
Polychlorinated Biphenyls (PBCs)	Alternative 2 – Abatement of all PCB	Abatement – $6,300 Oversight and Clearance Sampling – $5,000 Technical Reporting – $10,500	$21,800
Affected Soils	Alternative 2 – Soil Excavation with Off-Site Disposal	Construction Subtotal – $395,229 Construction Management – $39,530 Remedial Design – $59,295 Project Management – $31,624 Contingency – $157,724	$683,000
Soil Gas	Alternative 3 – Vapor Intrusion Mitigation for New Structures, Operation and Maintenance, and Institutional Controls	Capital Costs – $160,590 Institutional Controls – $33,258 Operations and Maintenance (30 years) – $33,258	$340,000
Total Cost			**$1,885,800**

6.0 REFERENCES

ASTM International (ASTM). 2021. Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process. E1527-21.

Agency for Toxic Substance and Disease Registry (ATSDR). 2008. "Asbestos: Health Effects." Accessed December 13, 2012. http://www.atsdr.cdc.gov/asbestos/asbestos/health_effects

HR Green, Inc. (HRG). 2022. Phase I Environmental Site Assessment. Boys and Girls Home. 2102 Court Street, Woodbury County, Sioux City, Iowa. July 29.

Iowa Department of Natural Resources (IDNR). 2023. Cumulative Risk Calculator. Statewide Standards. Accessed September 2023. https://programs.iowadnr.gov/riskcalc/Home/statewidestandards

Toeroek Associates, Inc. and Tetra Tech Inc. (Toeroek Team). 2023a. Targeted Brownfields Assessment, Phase II Environmental Site Assessment, Boys and Girls Home, 2101 Court Street, Sioux City, Iowa. September 14.

Toeroek Associates, Inc. and Tetra Tech Inc. (Toeroek Team). 2023b. Targeted Brownfields Assessment, Hazardous Materials Survey Boys and Girls Home, 2101 Court Street, Sioux City, Iowa. August 30.

U.S. Department of Housing and Urban Development (HUD). 2012. *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing*. Second Edition. July.

U.S. Environmental Protection Agency (EPA). 2022. Brownfields Assessment Application: Boys and Girls Home, 2102 Court Street, Sioux City, Iowa. August 9.

U.S. Environmental Protection Agency (EPA). 2023a. Regional Screening Levels (RSLs) – Generic Tables. Accessed September 2023. https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables

U.S. Environmental Protection Agency (EPA). 2023b. Vapor Intrusion Screening Level Calculator. Accessed September 2023. https://www.epa.gov/vaporintrusion/vapor-intrusion-screening-level-calculator

U.S. Environmental Protection Agency (EPA). 2023c. How to Test for PCBs and Characterize Suspect Materials. December. https://www.epa.gov/pcbs/how-test-pcbs-and-characterize-suspect-materials

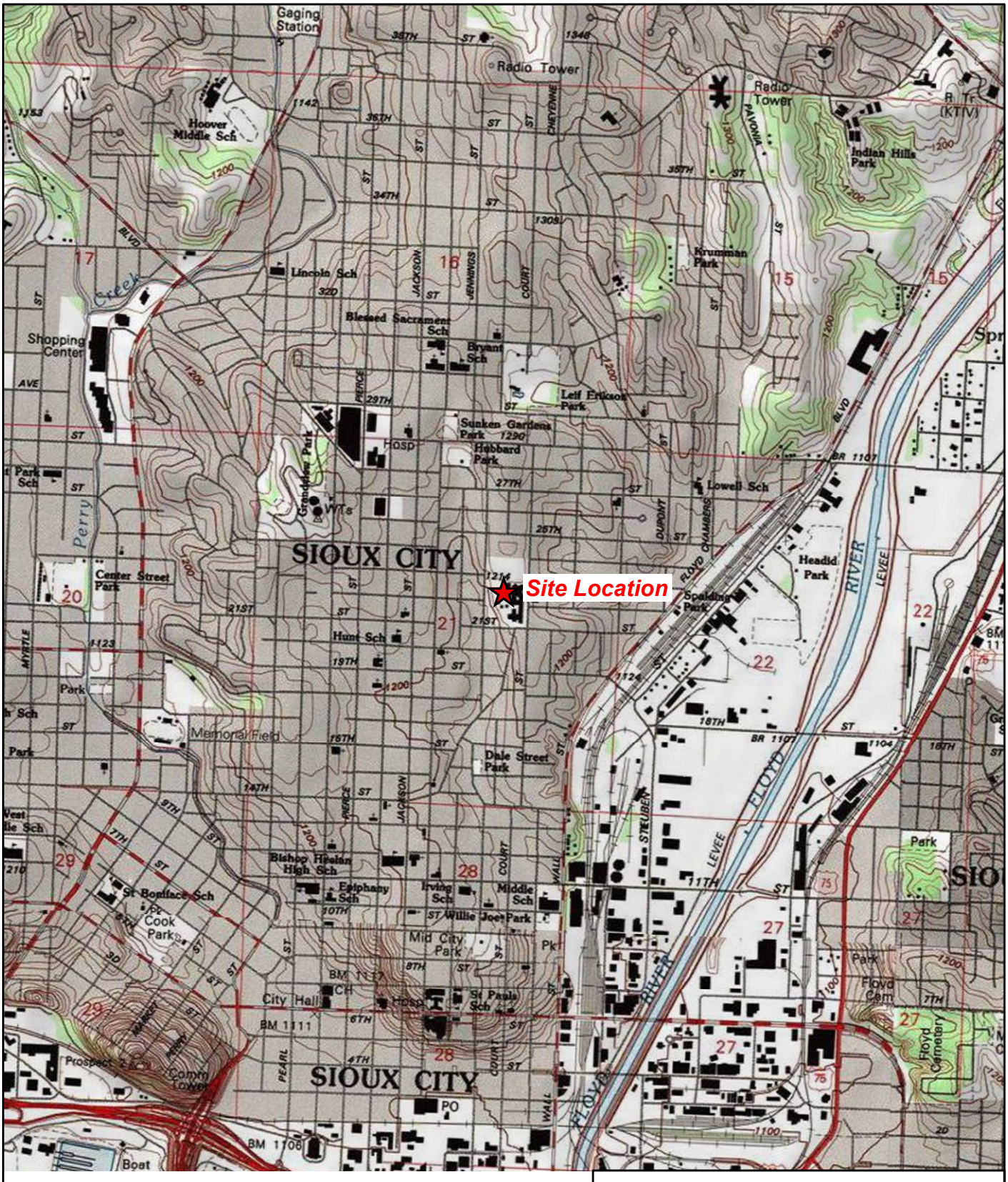
U.S. Geological Survey (USGS). 1993. Sergeant Bluff, Iowa Quadrangle. USGS 7.5-Minute Topographic Series.

U.S. Geological Survey (USGS). 1994. Sioux City North, Iowa Quadrangle. USGS 7.5-Minute Topographic Series.

U.S. Geological Survey (USGS). 2023. Average concentrations of elements in Woodbury County, Iowa. Accessed September 2023. https://mrdata.usgs.gov/geochem/county.php?place=f19193&el=As&rf=central

APPENDIX A

FIGURES



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USGS Sioux City North, IA 7.5 Minute Topo Quad,1993; USGS Sioux City North, IA 7.5 Minute Topo Quad,1994

Boys and Girls Home
Sioux City, IA

Figure 1
Site Location Map

TETRA TECH

TOEROEK ASSOCIATES, INC.

Date: 8/22/2023 Drawn By: Susmita Shrestha Project No: 103G65210190.17.03

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Legend

Approximate site boundary

N

0 100 200

Feet

Source: Esri, ArcGIS Online, World Imagery (Clarity)

Boys and Girls Home
Sioux City, IA

Figure 2
Site Layout Map

TETRA TECH

TOEROEK ASSOCIATES, INC.

Date: 8/22/2023 Drawn By: Susmita Shrestha Project No: 103Z65210190.18.03

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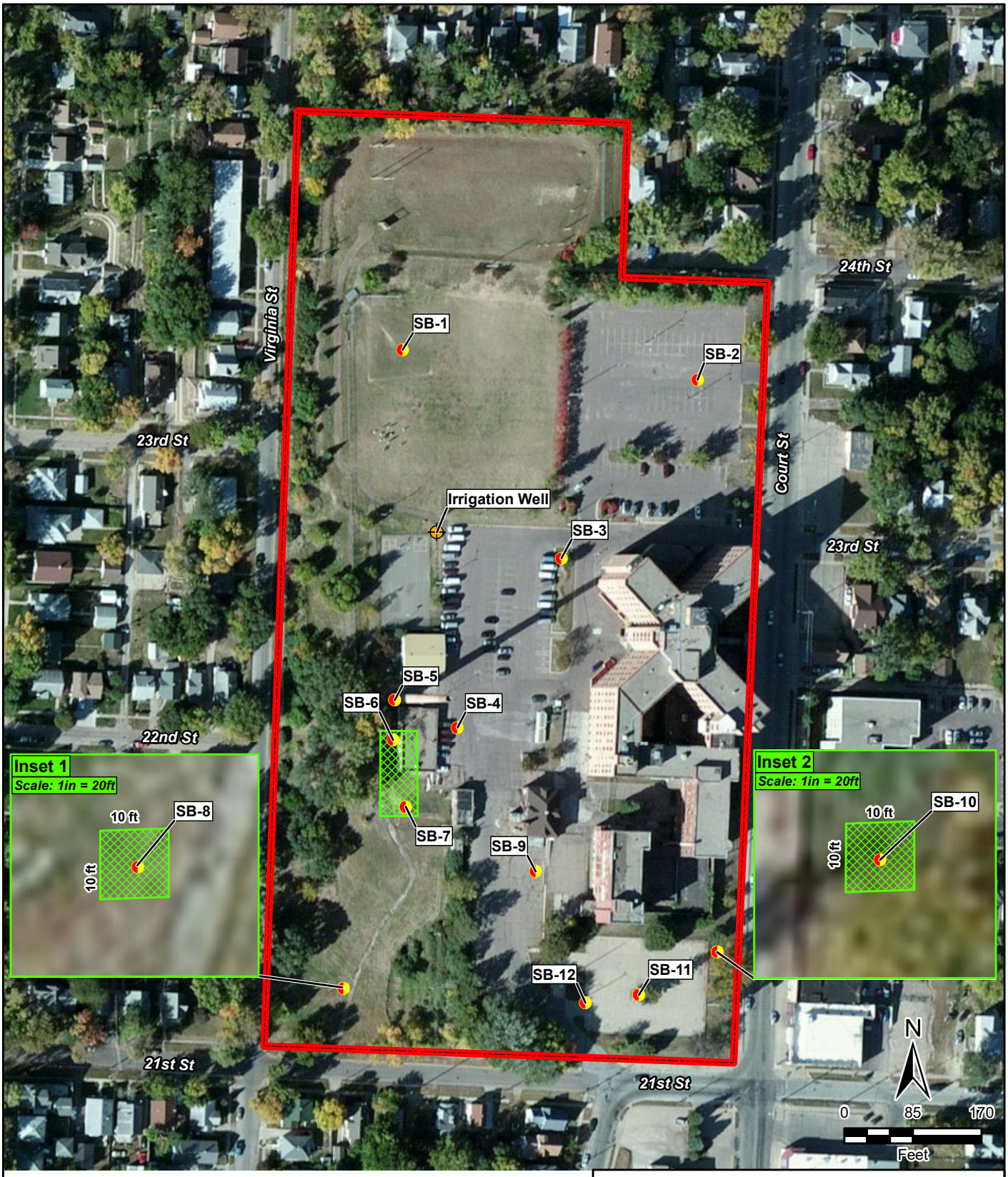

Legend

- DPT soil/soil-gas sample location
- Irrigation well sample location
- Approximate excavation area
- Approximate site boundary

DPT Direct-push technology

SB Soil boring

Source: Esri, ArcGIS Online, World Imagery (Clarity)

Boys and Girls Home
Sioux City, IA

Figure 3

Alternative 2, Excavation Areas Map

TETRA TECH

TOEROEK ASSOCIATES, INC.

Date: 9/27/2023 Drawn By: Nick Wiederholt Project No: 103Z65210190.17.03

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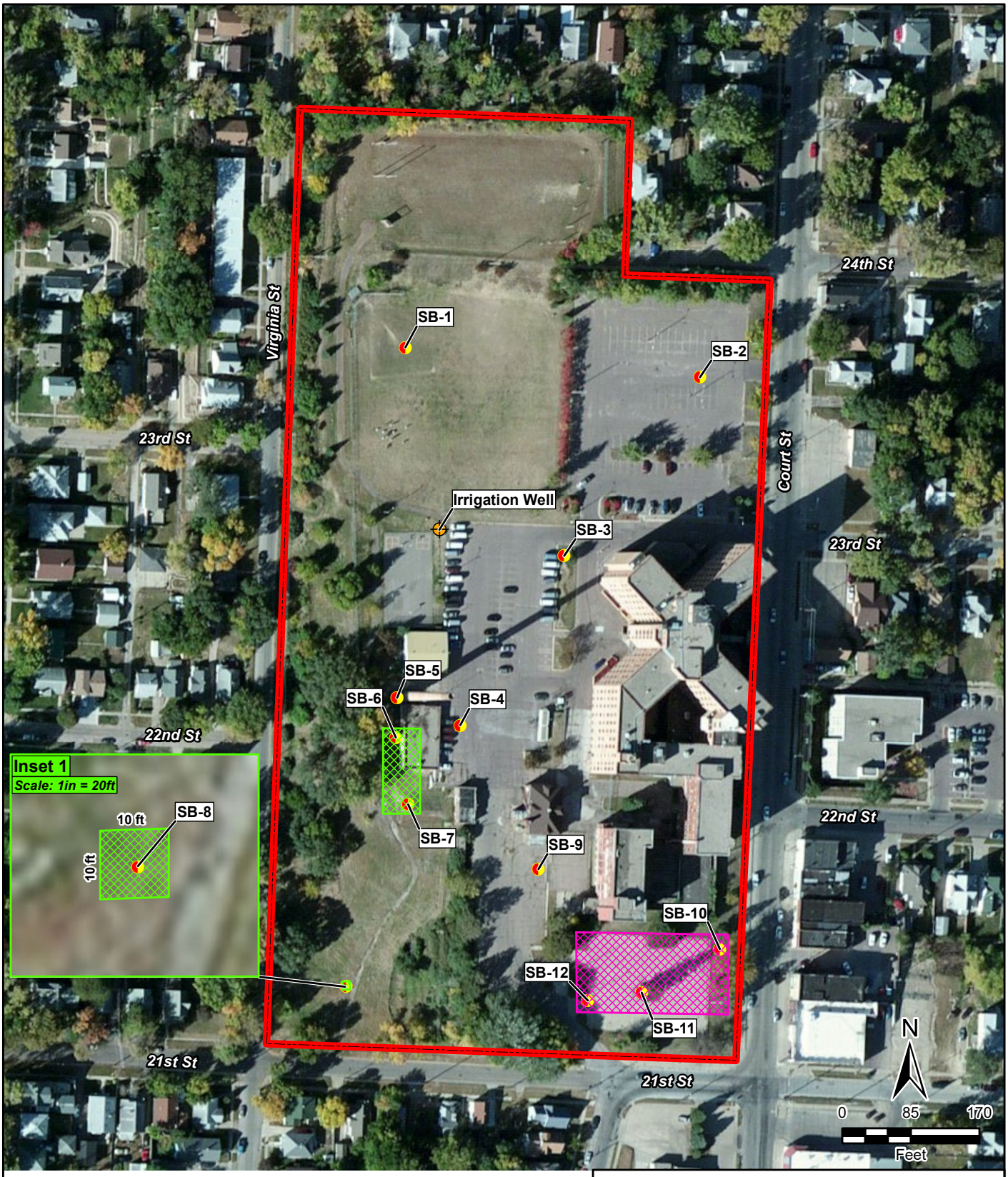

Legend

- DPT soil/soil-gas sample location
- Irrigation well sample location
- Approximate capped area
- Approximate excavation area
- Approximate site boundary
- DPT Direct-push technology
- SB Soil boring

Source: Esri, ArcGIS Online, World Imagery (Clarity)

Boys and Girls Home
Sioux City, IA

Figure 4
Alternative 3,
Excavation and Capped Areas Map

TETRA TECH
TOEROEK ASSOCIATES, INC.

Date: 9/27/2023 Drawn By: Nick Wiederholt Project No: 103Z65210190.17.03

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APPENDIX B

COST ESTIMATES

Appendix B
Remedial Alternatives Cost Estimates for Soil
Site 17 - Boys and Girls Home Site
Sioux City, Iowa

TABLE B-1					
COST SUMMARY					
Alternative	**Description**	**Capital Cost**	**Institutional Controls**	**Operation & Maintenance**	**Total**
1	No Action	$0	$0	$0	$0
2	Soil Excavation with Off-Site Disposal	$ 242,000	$ -	$ -	$ 242,000
3	On-Site Consolidation and Capping with ICs	$ 504,000	$ 43,000	$ 68,000	$ 615,000

Appendix B
Remedial Alternatives Cost Estimates for Soil
Site 17 - Boys and Girls Home Site
Sioux City, Iowa

ALTERNATIVE 2
SOIL EXCAVATION WITH OFF-SITE DISPOSAL

Table B-2
Cost Summary
Alternative 2 - Soil Excavation with Off-Site Disposal

Source	Description	Subtotal	Contingency	Total (Rounded)
Table B-3	Capital Cost	$ 186,086	$ 55,826	$ 242,000
NA	Institutional Controls	$ -	$ -	$ -
NA	Operation and Maintenance	$ -	$ -	$ -

Contingency	30%		$ 55,825.69
Total			**$ 242,000**

Overhead and Profit (O&P)

Means	15%	
RACER	35%	Assumed markup for costing purposes
Contractor quote	15%	Assumed prime contractor markup for costing purposes
Professional judgment	0%	

Inflation	3.22%	Avg. annual inflation from 2015 to 2023

Appendix B
Remedial Alternatives Cost Estimates for Soil
Site 17 - Boys and Girls Home Site
Sioux City, Iowa

Table B-3								
Capital Cost								
Alternative 2 - Soil Excavation with Off-Site Disposal								
Item	**Description**	**Quantity**	**Unit**	**Source**	**Year**	**Unit Price**	**Unit Price (Incl. O&P and Inflation)**	**Total Cost**
	Construction Subtotal							**$ 139,914**
	Excavation at SB-6 and SB-7 to 4 feet bgs (~718 cy)							**$ 64,956**
1	12-cy dump truck haul/hour	45	hrs	RACER	2015	$ 108.96	$ 189.50	$ 8,528
2	Excavate and load, bank measure, medium material, 2-cy bucket, hydraulic excavator	718	bcy	RACER	2015	$ 1.67	$ 2.90	$ 2,085
3	Unclassified fill, 6-inch lifts, off-site (includes delivery, spreading, and compaction)	932.89	cy	RACER	2015	$ 27.91	$ 48.54	$ 45,284
4	Seeding, vegetative cover	0.13	ac	RACER	2015	$ 3,994.78	$ 6,947.74	$ 903
5	Disposable material per sample	5	ea	RACER	2015	$ 10.34	$ 17.98	$ 90
6	Testing, semivolatile organics (625, 8270)	5	ea	RACER	2015	$ 720.63	$ 1,253.32	$ 6,267
7	Project Manager	5	hrs	RACER	2015	$ 91.12	$ 158.48	$ 792
8	Project Scientist	5	hrs	RACER	2015	$ 75.99	$ 132.16	$ 661
9	QA/QC Officer	1	hrs	RACER	2015	$ 75.99	$ 132.16	$ 132
10	Field Technician	1	hrs	RACER	2015	$ 38.20	$ 66.44	$ 66
11	Word Processing/Clerical	1	hrs	RACER	2015	$ 41.02	$ 71.34	$ 71
12	Draftsman/CADD	1	hrs	RACER	2015	$ 43.99	$ 76.51	$ 77
	Excavation at SB-8 to 11 feet bgs (~108 cy)							**$ 17,351**
13	12-cy dump truck haul/hour	7	hrs	RACER	2015	$ 108.96	$ 189.50	$ 1,327
14	Excavate and load, bank measure, medium material, 3/4-cy bucket, hydraulic excavator	108	bcy	RACER	2015	$ 4.28	$ 7.44	$ 804
15	Unclassified fill, 6-inch lifts, off-site (includes delivery, spreading, and compaction)	140.35	cy	RACER	2015	$ 27.91	$ 48.54	$ 6,813
16	Seeding, vegetative cover	93.63	sy	RACER	2015	$ 1.54	$ 2.68	$ 251
17	Disposable material per sample	5	ea	RACER	2015	$ 10.34	$ 17.98	$ 90
18	Testing, semivolatile organics (625, 8270)	5	ea	RACER	2015	$ 720.63	$ 1,253.32	$ 6,267
19	Project Manager	5	hrs	RACER	2015	$ 91.12	$ 158.48	$ 792
20	Project Scientist	5	hrs	RACER	2015	$ 75.99	$ 132.16	$ 661
21	QA/QC Officer	1	hrs	RACER	2015	$ 75.99	$ 132.16	$ 132
22	Field Technician	1	hrs	RACER	2015	$ 38.20	$ 66.44	$ 66
23	Word Processing/Clerical	1	hrs	RACER	2015	$ 41.02	$ 71.34	$ 71
24	Draftsman/CADD	1	hrs	RACER	2015	$ 43.99	$ 76.51	$ 77
	Excavation at SB-10 to 4 feet bgs (~15 cy)							**$ 9,618**
25	12-cy dump truck haul/hour	2	hrs	RACER	2015	$ 108.96	$ 189.50	$ 379
26	Excavate and load, bank measure, medium material, 3/4-cy bucket, hydraulic excavator	15	bcy	RACER	2015	$ 4.28	$ 7.44	$ 112
27	Unclassified fill, 6-inch lifts, off-site (includes delivery, spreading, and compaction)	19.26	cy	RACER	2015	$ 27.91	$ 48.54	$ 935
28	Seeding, vegetative cover	13.33	sy	RACER	2015	$ 1.54	$ 2.68	$ 36
29	Disposable material per sample	5	ea	RACER	2015	$ 10.34	$ 17.98	$ 90
30	Testing, semivolatile organics (625, 8270)	5	ea	RACER	2015	$ 720.63	$ 1,253.32	$ 6,267
31	Project Manager	5	hrs	RACER	2015	$ 91.12	$ 158.48	$ 792
32	Project Scientist	5	hrs	RACER	2015	$ 75.99	$ 132.16	$ 661
33	QA/QC Officer	1	hrs	RACER	2015	$ 75.99	$ 132.16	$ 132
34	Field Technician	1	hrs	RACER	2015	$ 38.20	$ 66.44	$ 66
35	Word Processing/Clerical	1	hrs	RACER	2015	$ 41.02	$ 71.34	$ 71
36	Draftsman/CADD	1	hrs	RACER	2015	$ 43.99	$ 76.51	$ 77
	Transportation and Off-Site Disposal (Nonhazardous)							**$ 47,989**
37	Bulk solid waste loading into disposal vehicle or bulk disposal container	841	bcy	RACER	2015	$ 2.57	$ 4.47	$ 3,759
38	Transport bulk solid hazardous waste, maximum 20-cy (per mile)	215	mile	RACER	2015	$ 2.57	$ 4.47	$ 961
39	Waste stream evaluation fee, not including 50% rebate on 1st shipment	1	ea	RACER	2015	$ 49.50	$ 86.09	$ 86
40	32-ft dump truck, 6-mil liner, disposable	43	ea	RACER	2015	$ 25.48	$ 44.31	$ 1,906
41	Landfill non-hazardous solid bulk waste by cy	841	cy	RACER	2015	$ 28.22	$ 49.08	$ 41,277

Construction subtotal		$ 139,914
Construction management[1]	10%	$ 13,991
Remedial design[1,2]	15%	$ 20,987
Project management[1]	8%	$ 11,193
Capital Cost Subtotal		**$ 186,086**

Appendix B
Remedial Alternatives Cost Estimates for Soil
Site 17 - Boys and Girls Home Site
Sioux City, Iowa

Notes:

1	Based on "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study" (EPA 2000).
2	Remedial design includes developing plans and specifications, such as a remedial action work plan, design analysis, and construction cost estimating.

ac	Acre
bcy	Bulk cubic yard
CADD	Computer-aided Drafting and Design
cy	Cubic yard
ea	Each
EPA	U.S. Environmental Protection Agency
hrs	Hours
O&P	Overhead and profit
QA/QC	Quality assurance/quality control
RACER	Remedial Action Cost Engineering and Requirements System
sy	Square yard

Reference:

EPA. 2000. "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study." EPA 540-R-00-002, Office of Solid Waste and Emergency Response 9355.0-75. July.

Appendix B
Remedial Alternatives Cost Estimates for Soil
Site 17 - Boys and Girls Home Site
Sioux City, Iowa

ALTERNATIVE 3
ON-SITE CONSOLIDATION AND CAPPING WITH ICs

Table B-4
Cost Summary
Alternative 3 - On-Site Consolidation and Capping with ICs

Source	Description	Subtotal	Contingency	Total (Rounded)
Table B-5	Capital Cost	$ 387,449	$ 116,235	$ 504,000
Table B-6	Institutional Controls	$ 33,258	$ 9,977	$ 43,000
Table B-7, B-8	Operation and Maintenance	$ 51,933	$ 15,580	$ 68,000

Contingency	30%		$ 141,792.05
Total			**$ 615,000**

Overhead and Profit (O&P)		
Means	15%	
RACER	35%	Assumed markup for costing purposes
Contractor quote	15%	Assumed prime contractor markup for costing purposes
Professional judgment	0%	
Inflation	3.22%	Avg. annual inflation from 2015 to 2023

Appendix B
Remedial Alternatives Cost Estimates for Soil
Site 17 - Boys and Girls Home Site
Sioux City, Iowa

Table B-5
Capital Cost
Alternative 3 - On-Site Consolidation and Capping with ICs

Item	Description	Quantity	Unit	Source	Year	Unit Price	Unit Price (Incl. O&P and Inflation)	Total Cost
	Construction Subtotal							**$ 291,315**
	Excavation at SB-6 and SB-7 to 4 feet bgs (~718 cy)							**$ 64,956**
1	12-cy dump truck haul/hour	45	hrs	RACER	2015	$ 108.96	$ 189.50	$ 8,528
2	Excavate and load, bank measure, medium material, 3/4-cy bucket, hydraulic excavator	718	bcy	RACER	2015	$ 1.67	$ 2.90	$ 2,085
3	Unclassified fill, 6-inch lifts, off-site (includes delivery, spreading, and compaction)	932.89	cy	RACER	2015	$ 27.91	$ 48.54	$ 45,284
4	Seeding, vegetative cover	0.13	ac	RACER	2015	$ 3,994.78	$ 6,947.74	$ 903
5	Disposable material per sample	5	ea	RACER	2015	$ 10.34	$ 17.98	$ 90
6	Testing, semivolatile organics (625, 8270)	5	ea	RACER	2015	$ 720.63	$ 1,253.32	$ 6,267
7	Project Manager	5	hrs	RACER	2015	$ 91.12	$ 158.48	$ 792
8	Project Scientist	5	hrs	RACER	2015	$ 75.99	$ 132.16	$ 661
9	QA/QC Officer	1	hrs	RACER	2015	$ 75.99	$ 132.16	$ 132
10	Field Technician	1	hrs	RACER	2015	$ 38.20	$ 66.44	$ 66
11	Word Processing/Clerical	1	hrs	RACER	2015	$ 41.02	$ 71.34	$ 71
12	Draftsman/CADD	1	hrs	RACER	2015	$ 43.99	$ 76.51	$ 77
	Excavation at SB-8 to 11 feet bgs (~108 cy)							**$ 17,351**
13	12-cy dump truck haul/hour	7	hrs	RACER	2015	$ 108.96	$ 189.50	$ 1,327
14	Excavate and load, bank measure, medium material, 3/4-cy bucket, hydraulic excavator	108	bcy	RACER	2015	$ 4.28	$ 7.44	$ 804
15	Unclassified fill, 6-inch lifts, off-site (includes delivery, spreading, and compaction)	140.35	cy	RACER	2015	$ 27.91	$ 48.54	$ 6,813
16	Seeding, vegetative cover	93.63	sy	RACER	2015	$ 1.54	$ 2.68	$ 251
17	Disposable material per sample	5	ea	RACER	2015	$ 10.34	$ 17.98	$ 90
18	Testing, semivolatile organics (625, 8270)	5	ea	RACER	2015	$ 720.63	$ 1,253.32	$ 6,267
19	Project Manager	5	hrs	RACER	2015	$ 91.12	$ 158.48	$ 792
20	Project Scientist	5	hrs	RACER	2015	$ 75.99	$ 132.16	$ 661
21	QA/QC Officer	1	hrs	RACER	2015	$ 75.99	$ 132.16	$ 132
22	Field Technician	1	hrs	RACER	2015	$ 38.20	$ 66.44	$ 66
23	Word Processing/Clerical	1	hrs	RACER	2015	$ 41.02	$ 71.34	$ 71
24	Draftsman/CADD	1	hrs	RACER	2015	$ 43.99	$ 76.51	$ 77
	Engineering Controls (Capping)							**$ 209,008**
25	Unclassified fill, 6-inch lifts, off-site (includes delivery, spreading, and compaction)	446	cy	RACER	2015	$ 27.91	$ 48.54	$ 21,626
26	Asphalt Pavement, 6-inch base course layer, 3-inch topping	2,138	sy	RACER	2015	$ 37.28	$ 64.84	$ 138,653
27	Clay, low permeability, 6-inch lifts, off-site	498.97	cy	RACER	2015	$ 30.27	$ 52.65	$ 26,269
28	40 Mil polymeric liner, high-density polyethylene	21,171	sf	RACER	2015	$ 0.61	$ 1.06	$ 22,460

Construction subtotal		$ 291,315
Construction management[1]	10%	$ 29,132
Remedial design[1,2]	15%	$ 43,697
Project management[1]	8%	$ 23,305
Capital Cost Subtotal		**$ 387,449**

Appendix B
Remedial Alternatives Cost Estimates for Soil
Site 17 - Boys and Girls Home Site
Sioux City, Iowa

Table B-6								
Institutional Controls								
Alternative 3 - On-Site Consolidation and Capping with ICs								
Item	**Description**	**Quantity**	**Unit**	**Source**	**Year**	**Unit Price**	**Unit Price (Incl. O&P and Inflation)**	**Periodic Cost**
	Institutional Controls Subtotal							**$ 33,258**
	Prepare LUC Implementation Plan							**$ 27,317**
29	Project manager	22	hrs	RACER	2015	$ 74.72	$ 129.95	$ 2,859
30	Project engineer	30	hrs	RACER	2015	$ 54.69	$ 95.12	$ 2,854
31	Staff engineer	45	hrs	RACER	2015	$ 66.28	$ 115.27	$ 5,187
32	QA/QC officer	11	hrs	RACER	2015	$ 62.31	$ 108.37	$ 1,192
33	Word processing/clerical	60	hrs	RACER	2015	$ 33.64	$ 58.51	$ 3,510
34	Draftsman/CADD	30	hrs	RACER	2015	$ 36.07	$ 62.73	$ 1,882
35	Attorney, partner, real estate	22	hrs	RACER	2015	$ 239.59	$ 416.70	$ 9,167
36	Other direct costs	1	ls	RACER	2015	$ 383.09	$ 666.27	$ 666
	Meetings with Agencies							**$ 4,362**
37	Per diem (per person)	1	day	RACER	2015	$ 129.00	$ 224.36	$ 224
38	Project manager	20	hrs	RACER	2015	$ 74.72	$ 129.95	$ 2,599
39	Word processing/clerical	16	hrs	RACER	2015	$ 33.64	$ 58.51	$ 936
40	Draftsman/CADD	8	hrs	RACER	2015	$ 36.07	$ 62.73	$ 502
41	Other direct costs	1	ls	RACER	2015	$ 58.03	$ 100.93	$ 101
	Restrictive Covenant							**$ 1,579**
42	Overnight deliver, 8 oz letter	3	ea	RACER	2015	$ 18.85	$ 32.78	$ 98
43	Project manager	1	hrs	RACER	2015	$ 74.72	$ 129.95	$ 130
44	Word processing/clerical	3	hrs	RACER	2015	$ 33.64	$ 58.51	$ 176
45	Attorney, associate, real estate	3	hrs	RACER	2015	$ 169.05	$ 294.01	$ 882
46	Paralegal, real estate	3	hrs	RACER	2015	$ 49.18	$ 85.53	$ 257
47	Other direct costs	1	ls	RACER	2015	$ 20.76	$ 36.11	$ 36

Appendix B
Remedial Alternatives Cost Estimates for Soil
Site 17 - Boys and Girls Home Site
Sioux City, Iowa

Table B-7								
Operation and Maintenance								
Alternative 3 - On-Site Consolidation and Capping with ICs								
Item	**Description**	**Quantity**	**Unit**	**Source**	**Year**	**Unit Price**	**Unit Price (Incl. O&P and Inflation)**	**Periodic Cost**
	O&M (cost per year)							**$ 3,873**
48	Routine inspection	1	ls	Professional judgment	2023	$ 500.00	$ 500.00	$ 500
49	Asphalt Pavement, 6-inch base course layer, 3-inch topping	52.03	sy	RACER	2015	$ 37.28	$ 64.84	$ 3,373

Notes:

1	Based on "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study" (EPA 2000).
2	Remedial design includes , Labor rates will be required to conform to the Davis-Bacon Act.
bcy	Bulk cubic yard
CADD	Computer-aided Drafting and Design
cy	Cubic yard
ea	Each
EPA	U.S. Environmental Protection Agency
ft	Feet
hrs	Hours
mil	0.001 inch
O&P	Overhead and profit
QA/QC	Quality assurance / quality control
RACER	Remedial Action Cost Engineering and Requirements System
sf	Square foot
sy	Square yard

Reference:

EPA. 2000. "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study." EPA 540-R-00-002, Office of Solid Waste and Emergency Response 9355.0-75. July.

Appendix B
Remedial Alternatives Cost Estimates for Soil
Site 17 - Boys and Girls Home Site
Sioux City, Iowa

Annual Discount Rate:

30-Yr 7.0%

Table B-8
Present Value Analysis

Year	Annual Discount Factor [1, 2]	Alternative 3 - On-Site Consolidation and Capping with ICs		
		O&M Costs		
	30-Yr	O&M Future Cost[3]		Present Value (2023)
0	1.000	$3,873		$3,873
1	0.935	$3,873		$3,620
2	0.873	$3,873		$3,383
3	0.816	$3,873		$3,162
4	0.763	$3,873		$2,955
5	0.713	$3,873		$2,761
6	0.666	$3,873		$2,581
7	0.623	$3,873		$2,412
8	0.582	$3,873		$2,254
9	0.544	$3,873		$2,107
10	0.508	$3,873		$1,969
11	0.475	$3,873		$1,840
12	0.444	$3,873		$1,720
13	0.415	$3,873		$1,607
14	0.388	$3,873		$1,502
15	0.362	$3,873		$1,404
16	0.339	$3,873		$1,312
17	0.317	$3,873		$1,226
18	0.296	$3,873		$1,146
19	0.277	$3,873		$1,071
20	0.258	$3,873		$1,001
21	0.242	$3,873		$935
22	0.226	$3,873		$874
23	0.211	$3,873		$817
24	0.197	$3,873		$764
25	0.184	$3,873		$714
26	0.172	$3,873		$667
27	0.161	$3,873		$623
28	0.150	$3,873		$583
29	0.141	$3,873		$544
30	0.131	$3,873		$509
Total Present Value of Periodic Cost				**$51,933**

Notes:

1	Based on "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study" (U.S. Environmental Protection Agency [EPA] 2000).
2	Annual discount factor = $1/(1+i)^t$, where i = discount rate (includes inflation and interest) and t = year
3	Current dollar cost of future event
EC	Engineering Control
IC	Institutional control
O&M	Operation and maintenance
Yr	Year

Reference:

EPA. 2000. "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study." EPA 540-R-00-002, Office of Solid Waste and Emergency Response 9355.0-75. July.