FINAL PROPOSED PLAN

For

SELECTED AREAS OF CONCERN AND AREAS OF INTEREST

Former Tyson Valley Powder Farm
Eureka, Missouri, St. Louis County

FUDS Property Number: BO7MO0173

FUDS Project Number: B07MO0173-07 (TVPF Project B)

U.S. Army Corps of Engineers
Kansas City District
Kansas City, Missouri
February 2021

Contents

1.0 INTRODUCTION

The United States Army Corps of Engineers (USACE)[1] requests your comments on this **Proposed Plan**[2] (PP) for selected Areas of Concern (AOC) and Areas of Interest (AOI) at the former Tyson Valley Powder Farm (TVPF) located in Eureka, Missouri. This PP was developed by USACE with support from Missouri Department of Natural Resources (MDNR) and United States Environmental Protection Agency, Region 7 (USEPA).

The former TVPF is a **Formerly Used Defense Site (FUDS)** property that the Department of Defense (DoD) once owned, but no longer controls after conveying to Washington University and St. Louis County in the early 1960s. USACE is the lead agency for the FUDS program for DoD and is responsible for the investigation and remediation of FUDS properties. USACE has conducted environmental activities at TVPF on behalf of the Army, pursuant to the **Defense Environmental Restoration Program (DERP) - Formerly Used Defense Sites (FUDS)**.

The PP is issued to fulfill, in part, public participation responsibilities under Section 117(a) of the **Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)** of 1980, as amended, and Section 300.430(f) of the **National Contingency Plan (NCP)**. The public participation process, as required by CERCLA and the NCP, provides the public an opportunity to review project documents, attend a public meeting, and submit written or oral comments on this Proposed Plan.

This PP presents the DoD plan to address ten AOCs and six AOIs from FUDS Project Number B07MO0173-07 (TVPF Project B). Two other AOCs (AOC 3/20 and AOC 7) from Project B will be addressed in future documents. A summary of the AOCs and AOIs is presented in Section 6 of this PP. A list of these AOCs and AOIs is presented on Table 1 (see page 3).

These AOCs/AOIs were determined to pose no current or potential threat to human health or the environment based on the investigations/risk assessments, and therefore indicates that no removal or treatment of environmental media is required. Therefore, No Action by the DoD is necessary since there is no unacceptable risk to human health and the environment and no **five-year review** would be required.

The USACE Site Investigation reports, Environmental Consolidation Report (ECR), Lone Elk Park Firing Point Technical Memoranda, Lone Elk Park Supplemental Firing Point and Bullet Drop Technical Memoranda, **Remedial Investigation** (RI) reports, and other technical reports did not identify environmental contaminants in the soils, sediments, surface water or groundwater at the selected AOCs/AOIs at levels that would require DoD action. The Site Investigation and RI reports and ECR are part of the **Administrative Record File** located at the St. Louis County Eureka Hills Public Library. Primary documents used in the development of the Proposed Plan are listed in the reference section near the back of this document.

[1] A list of abbreviations can be found on Page I.
[2] All of the terms appearing in bold print are defined in the Glossary on Pages II through III.

USACE, MDNR and USEPA encourage the public to review these and additional documents to gain a comprehensive understanding of the activities conducted at this site.

Table 1. Areas of Concern and Interest

	No Action
AOC 4	**Metal Shavings Area**
AOC 5	**Railroad Spur Open Cut Dump Site**
AOC 8	**Railroad Spur Scrap Brass Burial Site**
AOC 9A	**Firing Points and Bullet Drops AOC 9A, AOC 9B and AOC 9C**
AOC 9B	
AOC 9C	
AOC 10	**Scrap Metal Open Dump Site**
AOC 11	**Three Chemical Warehouses**
AOC 32	**Two Chemical Warehouses**
AOC35	**South Castlewood State Park near Meramec River**
AOI	**Heavy Duty Garage**
AOI	**Former Oil Storage Sheds (Oil Shed #3)**
AOI	**Former Paint Shed**
AOI	**Former Mercury Bin/Truck Inspection Site**
AOI	**Railroad Pond**
AOI	**Pesticide Residues at Igloos**

2.0 COMMUNITY ROLE IN SELECTION PROCESS

The public participation process, as required by CERCLA under Section 113(k)(2), requires that the public have the opportunity to participate in developing the Administrative Record for response selection. Sections 117 and 120(f) of CERCLA also include provisions for public participation, to include state and local officials, in the remedial/removal response action planning and selection process. USACE relies on public participation to ensure that the concerns of the community are considered in selecting an effective remedy for the Site. Further details of the public meeting, comment period and submittal of comments are provided in Section 8 of this Proposed Plan.

Although this Proposed Plan recommends No Action for the AOCs and AOIs in Table 1, a final determination will not be made until the public comment period ends and all comments are reviewed and addressed in the **Responsiveness Summary** in the **Decision Document**.

3.0 SITE BACKGROUND

3.1 Site Location

The former TVPF is located in St. Louis County, approximately four miles east of Eureka, Missouri, north of I-44 (see Figure 1).

3.2 Site History

The former TVPF was originally developed by the Ordnance Department through the purchase of 2,622 acres of land in June 1941, to provide storage of powder, priming, pyrotechnics, incendiary chemicals, and small arms ammunition produced at the St. Louis Army Ammunition Plant. Prior to DoD's acquisition in 1941, the site was uninhabited except for the mining towns of Mincke, Tyson, and Morschels.

DATES TO REMEMBER	MARK YOUR CALENDARS
PUBLIC COMMENT PERIOD: March 5, 2021 through April 5, 2021	USACE will accept written comments on the Proposed Plan during the public comment period.
PUBLIC MEETING: March 16, 2021 6:00-7:00 PM	USACE will hold a virtual public meeting to explain the Proposed Plan via a Webex Conference Call: **1-844-800-2712, Access Code 199-505-3911**
For additional information, review the **Administrative Record File** at:	Eureka Hills Public Library 156 Eureka Towne Center Eureka Missouri 63025-1108 PH: 314-994-3300

The former TVPF also was used for testing (AOC 9A, AOC 9B and AOC 9C), and disposal of small arms ammunition (AOC 3, AOC 4, AOC 7 and AOC 8 (AOC 3 and AOC 7 will be addressed in separate documents)). The facility was comprised of 52 partially buried munitions storage bunkers or igloos, 10 pentaerythritol tetranitrate (PETN) vaults, five trinitrotoluene (TNT) magazines, four firing ranges (350, 1,800, 2,250, 4,800 feet [ft]), three brick chemical warehouses, two burning pans, two warehouses, and a Popping Kettle Building. A number of ancillary buildings were also part of the former TVPF which included (but are not limited to): a canning house building, paint storage shed, solvent storage building, an electric shop, three oil storage sheds, one mercury bin/truck inspection station, a heavy duty garage, plumbing shop, guard house, and fire station.

The former TVPF was declared surplus in 1945 and reported to the War Assets Administration. The area was then donated to St. Louis County in 1950 for park and recreation purposes. In 1951, the Department of the Army reoccupied most of the property, 2,371 acres, for use during the Korean War. The remainder stayed under the jurisdiction of St. Louis County. In 1961, the property was once again declared surplus and transferred to the General Services Administration which in turn transferred the property to the Department of Health, Education, and Welfare. In 1963 the Department of Health, Education, and Welfare conveyed 1,966 acres to Washington University St. Louis and the remaining 405 acres to St. Louis County for park and recreation purposes in 1964.

Investigations and studies at the former TVPF resulted in the identification of 38 AOCs and 11 AOIs. Of these 49 sites, 23 AOCs and 4 AOIs were previously closed out as No Action required by the DoD in 2014.

For this Proposed Plan, the AOCs and AOIs are proposed for No Action (see Table 1). The locations of the ten AOCs and six AOIs are shown on Figure 2.

3.2.1 Current Site Use

The former TVPF is currently divided into three major portions: Washington University's Tyson Research Center (TRC), St. Louis County's Lone Elk County Park (LECP), and West Tyson County Park (southern portion only). The sources for environmental concerns related to past DoD operations are only located in TRC and LECP. The southern portion of West Tyson County Park was located outside the security fence line of the historical main operating area; no storage or handling activities took place in this area.

The TRC is currently used as the environmental field station for Washington University as well as the Field Science Program during summer for high school students from the St. Louis area. Example uses are outdoor classrooms for students and others, cultivation of crops, and research.

Most of the remaining abandoned DoD igloos and vaults are used by Washington University for storage, libraries, or laboratories. The three chemical warehouses (AOC 11) have been extensively used as art studios and similar activities. Two former warehouses (AOC 32) were converted to new laboratory spaces with an outdoor research garden area. The recently constructed TRC Living Learning Center is a laboratory, classroom, and showcase for green architecture and other sustainable technologies. A new addition to the TRC is the CRETE House, a collaborative design using innovative forms of concrete and integration of green technologies. CRETE House is used for housing visiting researchers at the TRC.

A portion of the TRC property is home to the Endangered Wolf Center (EWC) which conducts research for the preservation of wolves.

3.2.2 Nearby Land Use

TVPF is located between the towns of Eureka and Valley Park, Missouri along the I-44 corridor, and is located in an area that remains primarily undeveloped. The Burlington Northern – Santa Fe (BNSF) railroad tracks are located just north of TVPF and separate TVPF from Castlewood State Park.

Land uses at TRC and LECP are not expected to change significantly in the foreseeable future. TRC and LECP are part of a greenway known as the Henry Shaw Ozark Corridor, an area southwest of the city of St. Louis deemed valuable for its aesthetic and natural assets.

The World Bird Sanctuary is located next to the northeast section of LECP. Their mission is to conduct field studies, educate the public, wild bird rehabilitation, and propagation of endangered species. In addition, a portion of Castlewood State Park abuts the northern portion of the TRC and LECP, and has several biking, hiking and horseback riding trails. West Tyson County Park, TRC, LECP, Castlewood State Park, Antire Valley County Park, Route 66 State Park and site of the former town of Times Beach, and the Forest 44 Conservation Area are considered the hub of the Henry Shaw Ozark Corridor.

3.3 Environmental Investigation History

Environmental investigations and related studies of the selected AOCs and AOIs at the former TVPF are numerous. For more detailed information on the investigations and studies please refer to the Administrative Record File (See Box on Page 3).

The earliest study to include environmental sampling was conducted in 1981 by the USEPA (1981) where soil samples were collected at the Popping Kettle Area (AOC 3) and analyzed for metals. This initial field investigation was followed by an Archives Search Report by USACE (1993), Preliminary Assessment (PA) of the site by the USEPA (USEPA, 1988), an Expanded Site Inspection (ESI) by USEPA (USEPA, 2002), and Site Investigation performed by USACE (USACE, 2002a). A phased RI was performed by USACE with initial results reported in the 2005 Phase I-III RI Report (USACE, 2005a). A **Baseline Risk Assessment (BLRA)** was completed as part of the 2005 RI.

An ECR was developed in 2005 which provided a concise summary of background information and environmental data for each known AOC at the former TVPF (USACE, 2005b). In addition, AOCs that were not included in the 2005 BLRA were screened against appropriate risk-based screening values to determine risk and the need for additional investigation. As reported in the ECR, most of the 38 AOCs were determined to not be a risk to human health and the environment, and were closed with the No Action Decision Document in 2014 (USACE, 2014).

In preparation for the next phase of RI activities, a Historic Site Use Report (HSUR) was developed in 2008 (USACE, 2008a). This document identified eight new AOIs to investigate. In addition to the new AOIs, several of the remaining AOCs that were not considered closed in the 2005 ECR were investigated further. The results of these investigations and an updated **Human Health Risk Assessment (HHRA)** and **Ecological Risk Assessment (ERA)** were included in the Phase IV RI Report (USACE, 2012). An addendum to this report dated May 2014 (USACE, 2014) was also included. Based on the results of the studies, data gaps were identified and a final RI and HHRA/ERA were performed in 2015 and 2016. Results are documented in the Project B Yellow Sites RI report (USACE, 2018). This last phase of RI work covered all AOCs and AOIs listed on Table 1 except for AOC 9A, AOC 9B, AOC 9C, AOC 32, and AOC 35 since these AOCs were previously investigated.

In addition to these investigations and reports, other AOC site specific technical studies were also performed. A comprehensive list of all investigations and studies, as well as discussions related to these activities and sampling results, are presented in the Phase IV RI Report and the Project B Yellow Sites RI Report which are located in the Administrative Record File.

These investigations have enabled USACE and the regulatory agencies to have a thorough understanding of the proposed No Action by the DoD for the selected AOCs and AOIs.

4.0 AREA CHARACTERISTICS

4.1 Regional Setting

The former TVPF is located within the Ozark Plateau physiographic province of the Interior Highlands division. The Ozark Plateau is further subdivided into the Springfield Plateau, the Salem Plateau and the St. Francois Mountains. The former TVPF is located near the northeastern boundary of the Salem Plateau and north of the St. Francois Mountains where bedrock gently dips to the northeast.

The Salem Plateau includes areas of karst topography where dissolution of carbonate rocks along bedding planes, fractures, and faults has resulted in the formation of caves, tunnels, springs,

sinkholes and disappearing streams. Weathering processes also include the development of the epikarst or upper weathered bedrock zone.

4.2 Local Setting

The area surrounding the former TVPF is characterized as having relatively rugged, heavily wooded hillsides and ravines that are a result of down cutting by the intermittent streams that form the drainage basin of the Meramec River.

The area of the former TVPF is comprised of unconsolidated materials, such as residual cherty soils and alluvial deposits of the Quaternary Period, which mantle bedrock. Bedrock in the area of TVPF consists of shales, limestone, dolomite, and sandstone units. More detailed information on the site specific geology can be found in the Phases I-IV RI Reports (2005 [I-III], 2012 [IV]), and the Project B Yellow Sites RI Report (2018) in the Administrative Record File.

Drainage on the former TVPF property consists of numerous ditches, ravines, and intermittent streams that convey rainfall and runoff from snowmelt. Primary drainage on the TRC property is controlled by two intermittent streams located within Mincke and Tyson Hollows. The intermittent streams, which receive the majority of the surface water runoff, flow northward onto the floodplain of the Meramec River where they discharge to the Meramec River itself. Drainage within LECP is controlled by intermittent streams that flow towards Elk Hollow and discharge into Lone Elk Lake. A drainage below the lake dam flows northwards where it discharges to the Meramec River.

In general, **groundwater** flow within Tyson Hollow is towards Tyson Creek, and within the Meramec River floodplain deposits and shallow bedrock is towards the north-northeast. Regional groundwater flow is towards the northeast and east based on flow in the deeper bedrock units. This flow direction follows the regional dip of bedrock and is towards the junction of the Missouri and Mississippi rivers. In the area surrounding the TRC some groundwater flows towards seeps and springs.

The majority of the land surface at the former TVPF is composed of open fields or wooded areas along gradual to steep sloping hillsides. The main asphalt access roads, as well as the majority of the buildings and structures of the former TVPF are located within Tyson Hollow. These structures are serviced by gravel or worn asphalt roads. Only the former firing points and bullet drops are located on LECP property.

4.3 Nature and Extent of Contamination

Environmental samples (soil, sediment, surface water, and/or groundwater, as appropriate) were collected at the selected AOCs/AOIs and analyzed for various chemicals based on known or suspected presence and known or suspected land use. All samples were collected in accordance with approved work plans. Chemical analyses included: metals; **volatile organic compounds (VOCs)**; **semi-volatile organic compounds (SVOCs)** which includes **polycyclic aromatic hydrocarbons (PAHs)**; **polychlorinated biphenyls (PCBs)**; explosives; **perchlorate**; pesticides; and **dioxins and furans**. These potential contaminants were either not detected, detected at concentrations below or similar to naturally-occurring background concentrations, detected at concentrations levels that were below risk-based screening levels, or at concentrations that do not pose adverse human health or ecological risk as documented in the

Phases I-IV RI Reports (2005 [I-III], 2012 [IV]), and the Project B Yellow Sites RI Report (2018) which are located in the Administrative Record File. Specific sample matrices and analyses are discussed for each AOC/AOI in subsequent sections of this report.

5.0 RISK SCREENING

Human health and ecological risk evaluations were performed to evaluate the basis for no remedial action at the selected AOCs/AOIs. This process included evaluation of the analytical results for samples collected during several site investigations, and previous human health and ecological risk screening evaluations performed on these results. These investigations and risk assessments are documented in the following:

- USACE Site Investigation Report (2002),
- USEPA ESI Report (2002),
- USACE Environmental Consolidation Report (2005),
- USACE Phases I-IV RI Reports (2005 [I-III], 2012 [IV]),
- USACE Project B Yellow Sites RI Report (2018)

Numerous other technical reports and memoranda based on focused studies of the various AOCs were also used for reference (see Appendix A, 2012 Phase IV RI Report [USACE, 2012]).

6.0 SUMMARIES OF THE AOCS AND AOIS

A short summary for each of the AOCs and AOIs is provided below and includes a description of each area, the investigation history, and conclusions. The AOCs and AOIs are proposed for No Action.

6.1 AOC 4: Metal Shavings Area

Description

AOC 4, Metal Shavings Area is located in an open, level field off the main road in the north central portion of the TRC just east of AOC 10 (Figure 2). The AOC included the surface and near surface soils in an area devoid of vegetation. The area devoid of vegetation was a 10-foot by 20-foot dark gray patch of barren ground, surrounded by stressed vegetation, in the middle of the field. The area was used for disposal of small arms ammunition waste (SAAW), shell casings, and brass shavings. Incidental to removal work performed at AOC 7 in 2005, brass cuttings, bullets, and soil were removed from AOC 4. The material was determined to be non-hazardous and was disposed at Milam Landfill in East Saint Louis, Illinois in 2005 as documented in the 2009 Technical Memo included as Appendix A5 in the Phase IV RI Report (USACE, 2012). As of the 2018 RI, research activities are not conducted at AOC 4 and currently the area is not used in any of the educational programs conducted at the TRC (USACE, 2018).

Investigation History

Surface soil, subsurface soil, and groundwater samples were collected as part of the Phase I-III RIs (USACE, 2005a). During the Phase I RI, surface soil, subsurface soil, and groundwater samples were collected and analyzed for metals, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, and explosives. During the Phase III RI,

additional surface soil samples were collected and analyzed for metals and PAHs. Based on these investigations, waste was excavated from AOC 4 in 2005 (USACE, 2009); however, no confirmation samples were collected at the base of the excavation. The Phase IV RI (USACE, 2012) provides a technical memorandum (Appendix A5) that detailed the excavation activities at AOC 4, the nature and extent of contamination, and an evaluation of human health and ecological risks. Iron was the only constituent in groundwater that exceeded tap water RSLs and EPA maximum contaminant levels (MCLs). This metal is associated with the clayey overburden materials derived from weathered shale and is likely representative of background conditions. The reports concluded that there were no adverse human health or ecological risks, and detected metals and PAHs were consistent with background concentrations.

As part of the Project B Yellow Sites RI (USACE, 2018), confirmation surface soil samples were collected at the base of the area of excavation and analyzed for lead and mercury, VOCs, SVOCs, pesticides, and explosives. Human health and ecological risks were re-evaluated, incorporating the additional data collected in the Project B Yellow Sites RI.

Pesticides and explosives were not detected in soil samples. Antimony was the only metal that exceeded the EPA Res-soil RSL and/or background values in soils. It barely exceeded both screening values at one location in the subsurface. This metal is not associated with known DoD bullet materials or activities, and is most likely representative of minerals in the clayey soils derived from shale. Several PAHs exceeded the EPA RSLs and/or background in the Phase III surface soil samples including Benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene. However, the Project B RI Report (USACE 2018) reached the same conclusion that there were no adverse human health or ecological risks.

AOC 4 Conclusion

The human health and ecological risk evaluations as reported in the Phase I-III RI (USACE, 2005a) and the Project B Yellow Sites RI (USACE, 2018) concluded that there were no adverse human health or ecological risks. Therefore, no remedial action is necessary to ensure protection of human health and the environment at AOC 4.

6.2 AOC 5: Railroad Spur Open Cut Dump Site

Description

AOC 5 is approximately 75 ft by 100 ft in size (0.17 acres) and located on the northwest end of the TRC property (Figure 2). AOC 5 lies in a steep, wooded ravine that was used as a small waste dump. Prior to removing the debris in 1998 (USACE, 1999), AOC 5 contained various discarded materials on the surface of the ravine slope, possibly military, municipal, and industrial wastes of unknown origin. The overall surface water runoff and overburden drainage is toward the northwest along the ravine. The BNSF railroad tracks separate AOC 5 from the Meramec River, which is located approximately 1,000 ft to the north.

Investigation History

An RI was performed in 1998 (USACE 2005a). Based on this investigation a removal of debris was performed in 1998 and reported in the Final Closure Report (USACE, 1999). A Site Investigation (USACE, 2002a) and ESI (EPA, 2002) were also conducted at AOC 5. The Phase I-III RI Report (USACE, 2005a) provides information on the nature and extent of contamination in surface soil, subsurface soil, and sediment, and an evaluation of human health and ecological risks. During the Phase I-III RI, surface soil, subsurface soil, and sediment samples were analyzed for metals, VOCs, SVOCs, explosives, and radionuclides. The investigations concluded there were no adverse human health or ecological risks at AOC 5. Furthermore, detected metals and PAHs were consistent with background concentrations.

Based on a site reconnaissance performed by Washington University in 2013, further investigation was conducted during the Project B Yellow Sites RI (USACE, 2018) to characterize an unknown white substance leaching from the base of the former dump site and leaving a precipitate material as the substance had not previously been characterized. The substance was sampled and analyzed for metals, VOCs, SVOCs, PAHs, pesticides, explosives, and dioxins. Evaluation of the Project B Yellow Sites RI data revealed that the white substance consisted of high concentrations of calcium and magnesium which indicated the substance is lime and does not pose adverse human health or ecological risks. All other chemicals detected in the substance were either below their respective risk-based screening levels or consistent with background concentrations; therefore, there were no adverse human health or ecological risks at AOC 5.

AOC 5 Conclusion

The Phase I-III RI Report (USACE, 2005a) provides details of the evaluation of human health and ecological risks related to historic data collected at AOC 5. The report concluded that there were no adverse human health or ecological risks.

Based on the additional risk screening of the data collected during the Project B Yellow Sites RI (USACE, 2018), no remedial action is necessary to ensure protection of human health and the environment at AOC 5.

6.3 AOC 8: Railroad Spur Scrap Brass Burial Site

Description

AOC 8 is located near the north end of the TRC property along a former railroad right-of-way and approximately 200 yards south of the abandoned railway transfer dock (Figure 2). This AOC was originally identified as an area of stressed vegetation littered with shell casings and metal shavings. The area was used for disposal of SAAW, shell casings, and brass shavings, which were excavated and removed from the site in 2005. The area immediately west contained a pile of railroad ties, stained patches of tar/ash-like material, and disposal piles. The site is bounded by a wooded area and a gravel road to the east, a paved road and open field to the west, and a wooded area to the south.

AOC 8 is not currently used by TRC personnel, Washington University students, or any other educational programs at TRC.

Investigation History

AOC 8 was used for disposal of ammunition, SAAW, and brass cuttings with oil. Two investigations were conducted at AOC 8; the Phase I and Phase III RIs (USACE, 2005a). During the Phase I RI, surface soil, subsurface soil, and groundwater samples were collected and analyzed for metals, VOCs, SVOCs, and explosives. During the Phase III RI, a composite surface soil sample was collected and analyzed for metals to characterize the soil for removal during Phase III. Some metals and PAHs exceeded background levels in soil at AOC 8; however, not at concentrations high enough to result in a risk to human health or ecological receptors that would require a remedial action.

Incidental to removal work performed at AOC 7 in 2005, brass cuttings, bullets and soil were removed from AOC 8 to a depth of 0.5 to 1 ft. The material was determined to be non-hazardous and was disposed at Milam Landfill in East Saint Louis, Illinois in 2005 as documented in the 2009 Technical Memo included as Appendix A5 in the Phase IV RI Report (USACE, 2012). The Phase IV RI Report (USACE, 2012) summarizes the nature and extent of contamination, and an evaluation of human health and ecological risks at AOC 8.

As part of the Project B Yellow Sites RI (USACE, 2018), confirmation surface soil samples were collected at the base of the area of excavation and analyzed for metals, VOCs, SVOCs, pesticides, and explosives. Human health and ecological risks were re-evaluated, incorporating the additional data collected in the Project B Yellow Sites RI. This report also concluded that there were no adverse human health or ecological risks.

AOC 8 Conclusion

The human health and ecological risk evaluations as reported in the Phase I-III RI (USACE, 2005a) and the Project B Yellow Sites RI (USACE, 2018) concluded that there were no adverse human health or ecological risks. Therefore, no remedial action is necessary to ensure protection of human health and the environment at AOC 8.

6.4 AOC 9: Firing Points and Bullet Drops 9A, 9B and 9C

AOC 9 consists of former firing ranges and bullet drops (AOCs 9A, 9B, and 9C), where testing of small arms ammunition, including tracers, was performed in the 1940s (Figure 2). The bullet drops were areas where spent projectiles/fragments were dropped after test firing of the bullets. These areas are within the boundary of LECP, which is open year-round. The general locations of the firing sites are to the north and northeast of Lone Elk Lake, and the bullet drops are south to southwest, across Lone Elk Lake.

The park is currently a free-range wildlife park and contains diverse wildlife including bison, elk, deer, and several species of birds. The park is protected by a 10 ft high chain-link fence with a locked gate and is patrolled by Park Rangers. The park is primarily a drive-through park with picnicking facilities and a few trails.

The main structures currently used by park employees include the Visitor Center and the Maintenance Building. The World Bird Sanctuary is located near the northeastern portion of LECP. Each of the three areas (9A, 9B, and 9C) is described below.

Descriptions

AOC 9A, 600 and 1,800-Foot Firing Ranges and Bullet Drops

AOC 9A is the northernmost range and consists of two ranges. One is a 1,800 ft firing range and bullet drop (firing point 1 and bullet drop 1). The second range at AOC 9A is a 600 ft firing range and bullet drop (firing point 2 and bullet drop 2). The ranges are oriented northeast to southwest parallel to Valley Drive. Bullet drop 1 is located approximately 2,400 ft from the entrance to LECP, off Valley Drive atop a gravel parking area in the northwestern portion of the property. The bullet drop 1 area is approximately 20 ft by 60 ft in size, and is bound on the north by an open field, on the south by the gravel parking area and drainage ditch, on the east by a portion of the gravel fill parking area that slopes toward an open field, and on the west by berm built into a wooded hillside. Bullet drop 2 is located near the northwestern edge of Lone Elk Lake off Valley Drive. The bullet drop 2 area is approximately the same size as bullet drop 1, and is bound by the hillside to the north, south and west, and by an open area leading to the road on the east.

AOC 9B, 4,800-Foot Firing Range and Bullet Drop

AOC 9B, 4,800-Foot Firing Range and Bullet Drop, lies in the central portion of the valley within LECP. The bullet drop is located within the Bison Compound approximately 5,000 ft south from the entrance to LECP. The bullet drop is located on a hillside berm, which serves as a dam. The bullet drop is bounded on the north and west by Valley Drive; on the north and southwest by a man-made pond; on the southeast and east by a steeply sloped hillside; and the northeast by an open field. This area is approximately 100 ft by 150 ft.

AOC 9C, 2,250-Foot Firing Range and Bullet Drop

AOC 9C, 2,250-Foot Firing Range and Bullet Drop, lies in the eastern portion of the former TVPF and within the current boundary of LECP. The associated bullet drop is located in the south-central portion of the park approximately 2,900 ft from the entrance to LECP. The bullet drop is located on a hillside berm which is bounded on the north by Center Road, on the south by a wooded hillside, on the east by a berm built into a wooded hillside, and on the west by an open field. This area is approximately 100 ft by 100 ft.

All bullet drop areas were suspected of soil contamination with lead and other inorganic contaminants associated with projectile fragments.

Investigation History

Surface soil, subsurface soil, surface water, and groundwater samples were collected for several environmental investigations of AOC 9A, 9B and 9C, including the USEPA ESI (USEPA, 2002), USACE Site Investigation (USACE, 2002a) and Phase I-III RI (USACE, 2005a), and the Phase IV RI (USACE, 2012). Several technical memoranda were also issued for evaluations related to the firing ranges including the Technical Memorandum on White, Yellow, Red or Elemental Phosphorus Issue at Former Tyson Valley Powder Farm (USACE, 2002b), the Firing Point Investigation (USACE, 2005c), and the Supplemental Firing Point/Bullet Drop/Squib Shed Technical Memorandum (USACE, 2008b). These memoranda are included in Appendix A of the Phase IV RI Report (USACE, 2012). Collectively, surface and subsurface soil were sampled and analyzed for metals, VOCs, SVOCs, PAHs, explosives, pesticides, and perchlorate. Groundwater was sampled and analyzed for explosives, perchlorate, and metals. Surface water

was sampled and analyzed for explosives and perchlorate. These reports concluded that there were no adverse human health or ecological risks. Some metals and PAHs in soil exceeded background levels in soil at AOC 9; however, not at concentrations high enough to result in a risk to human health or ecological receptors that would require a remedial action.

In addition, an investigation for munitions and explosives of concern (MEC) at AOC 9 was completed and documented in the Final Military Munitions Response Program (MMRP) Site Inspection (Shaw, 2010). No MEC were found.

AOC 9 Conclusion

The MMRP Site Inspection (Shaw, 2010), and the human health and ecological risk evaluations as summarized in the Phase IV RI Report (USACE, 2012) concluded that there were no adverse human health or ecological risks. Therefore, no remedial action is necessary to ensure protection of human health and the environment at AOC 9.

6.5 AOC 10: Scrap Metal Open Dump Site

Description

AOC 10 is located in a downward-sloping wooded area along and within the floodplain of Tyson Creek, to the northwest of AOC 4 (Figure 2). The area is approximately 60 ft by 45 ft in size (0.06 acres). The historical use of AOC 10 has not been established; however, based on field reconnaissance and investigations, the area appears to have been used as a debris dump site. AOC 10 contains approximately six empty and deteriorated 55 gallon steel drums along with construction debris, clay tile, rusted metal cables, rebar, fence material, bottles, dishes, and other similar refuse.

AOC 10 is not currently used by TRC personnel, Washington University students, or other educational programs.

Investigation History

Surface and subsurface soil samples were collected as part of the ESI conducted by USEPA in 2001 (USEPA, 2002). Surface soil, subsurface soil, and groundwater samples were collected during the Phase I-III RI (USACE, 2005a) and Phase IV RI (USACE, 2012). Collectively, surface and subsurface soil were sampled and analyzed for metals, VOCs, SVOCs, PAHs, explosives, pesticides, and PCBs. Groundwater was sampled and analyzed VOCs. These reports concluded that there were no adverse human health or ecological risks. Some metals and PAHs in soil exceeded background levels in soil at AOC 10; however, not at concentrations high enough to result in a risk to human health or ecological receptors that would require a remedial action.

In 2004, AOC 10 was included in a United States Geological Survey (USGS) geophysical study to locate buried ferrous metals materials at AOC 7 and AOC 10. Several anomalies were recorded, and verified via excavation in 2005. No buried waste disposal pits were identified (USGS, 2004).

During the Project B Yellow Sites RI field work, AOC 10 was investigated further in an attempt to identify the source for chemicals detected in soil and groundwater during previous

investigations, primarily trichloroethene, collect soil samples beneath the metal debris, and to collect sufficient data to re-assess human health and ecological risks (USACE, 2018). The RI concluded that there were no adverse human health risks for the most reasonably anticipated future land use scenarios at AOC 10 (e.g., maintenance workers and recreational users). Non-carcinogenic hazards slightly exceeded one for the hypothetical residential and indoor worker scenarios, due primarily to exposure to volatiles in groundwater via the ingestion and vapor intrusion pathways. These exceedances are based on the assumptions that a building would be constructed at AOC 10 and that a well would be installed in the clayey overburden to provide building occupants (i.e., residents or indoor workers) with a source of drinking water. Neither of these exposure scenarios are likely given that AOC 10 is within the floodplain of Tyson Creek and the shallow **aquifer** is unlikely to provide sufficient yield to support potable use.

Risks did not exceed one for potential ecological receptors exposed to AOC 10 soils for all detected chemicals in surface soil, except for mercury, which only slightly exceeded one (hazard quotient of approximately two) but mercury concentrations were consistent with background. Population or community-level risks due to exposure to mercury in soil are not expected.

AOC 10 Conclusion

Based on the results of the RI (USACE, 2018), no remedial action is necessary to ensure protection of human health and the environment at AOC 10.

6.6 AOC 11: Three Chemical Warehouses

Description

AOC 11 includes three buildings formerly used as chemical warehouses (Buildings 301-1, 301-2, and 301-3). These buildings are located northwest of Tyson Hollow and just east of AOC 7 within a wooded area with sparse ground vegetation as shown on Figure 2. Each building has a loading dock and parking area in front of or to the side of the dock.

Investigation History

Surface and subsurface soil samples were collected at AOC 11 by USEPA during the ESI in 2001 (USEPA, 2002). The report concluded chemicals detected in soil were below background levels; therefore, no adverse human health or ecological risks are expected.

Additional surface soil, subsurface soil, and groundwater samples were collected during the Project B Yellow Sites RI (USACE, 2018) and analyzed for metals, VOCs, SVOCs, PAHs, and pesticides.

The RI concluded that there were no adverse ecological risks. Furthermore, the RI also concluded that there were no adverse human health risks for the most reasonably anticipated future land use scenarios at AOC 11 (e.g., maintenance workers and recreational users).

As noted in the RI, a layer of degraded asphalt paving is located at the surface in various areas in front of all three chemical warehouses. In general, asphalt contains significant concentrations of PAHs. Although efforts were made to collect samples in areas where the asphalt paving was not visually present, it is likely that the PAHs observed in the surface soil samples collected at AOC 11 are due to leaching from the adjacent asphalt pavement. A cancer risk of $6x10^{-4}$ was

calculated for the hypothetical residential scenario due primarily to exposure to the PAH benzo(a)pyrene in surface soil, which was detected at a much higher concentration than background in one surface soil sample. This elevated risk is based on the assumption that a full-time residence would be constructed at AOC 11. Residential construction is not currently planned for this area nor anticipated in the future.

AOC 11 Conclusion

Based on the results of the RI (USACE, 2018), no remedial action is necessary to ensure protection of human health and the environment at AOC 11.

6.7 AOC 32: Two Chemical Warehouses

Description

AOC 32, Two Chemical Warehouses (Building 360-1 and 360–2), are located northwest of TVPF Headquarters Building (Figure 2). The Chemical Warehouses were a concern due to the numerous uses of the buildings. During the Korean War (1950-53), these large corrugated warehouses were constructed and used for the disassembly and crating of trucks for shipment to the war zone. Between the end of the Korean War and September 1960 this area was used for munitions storage. Indianapolis Grain Warehouse Corporation entered into a lease with the United States commencing 1 October 1960, for general commercial warehousing purposes. The lease involved 5 acres of land, two single story warehouses, railroad sidings and docks. This lease and amended leases were in place until TVPF was conveyed to Washington University on October 2, 1963.

Washington University has since converted the two warehouses into research laboratories, along with outdoor experimental research garden space and a large capacity rainwater capture system.

Investigation History

Soil samples were collected at AOC 32 as part of the ESI (USEPA, 2002) and analyzed for metals. The data from the ESI was evaluated in the ECR (USACE, 2005b) and detected concentrations of metals were consistent with background.

Prior to the conversion of the warehouses into laboratories and installation of the outside experimental gardens, Washington University collected additional surface soil and groundwater samples (ESC, 2013). Soil samples were metals, VOCs, SVOCs, explosives, and pesticides and groundwater samples were analyzed for VOCs, SVOCs, and pesticides. No VOCs, SVOCs, or pesticides were detected in groundwater. Some metals and one PAH exceeded background levels in soil at AOC 32; however, not at concentrations high enough to result in a risk to human health or ecological receptors that would require a remedial action.

AOC 32 Conclusion

Based on the risk screening and ecological risk evaluation as presented in the 2005 ECR and the 2013 Washington University study, no remedial action is necessary to ensure protection of human health and the environment at AOC 32.

6.8 AOC 35: South Castlewood State Park near Meramec River

Description

AOC 35 is located on the southern portion of Castlewood State Park (Figure 2). An intermittent stream flows eastward along the base of the Burlington Northern right-of-way near Castlewood Loop Trail to just north of LECP where it discharges into the Meramec River. The railroad tracks are just above the discharge location where the samples were collected. There are no known former DoD activities related specifically to this AOC. The USEPA designated this AOC due to concerns about run-off from AOC 9A, AOC 9B and AOC 9C.

AOC 35 is within the 100-year floodplain of the Meramec River and is frequently flooded during times of elevated river flow. During flooding events soils and sediments in drainages are flushed into the Meramec River upstream and carried by the river current downstream. The sediments eventually settle out as the floodwater recedes. These sediments can be remobilized during a subsequent flood event with strong river currents and transported further downstream where they are then redeposited.

Seventy-six historic river crests of 14.74 feet above base flow or greater have been recorded upstream in Eureka, MO since 1941 when TVPF was acquired by the DoD. Since 2008 there have been four historic river crests at this gauging station above 40.06 feet, with the most recent record flood stage of 46.11 recorded on May 3, 2017 (NOAA, 2018). These recent flood events are classified as major flood stage events where water reaches and sometimes washes over the BNSF railroad tracks. Frequent flooding events such as these have long since washed away any contaminated sediments that may have been deposited at this AOC.

Investigation History

Sediment samples were collected from AOC 35 as part of the ESI conducted by USEPA (USEPA, 2002) and analyzed for metals, VOCs, SVOCs, PCBs, radionuclides, dioxins/furans, and explosives. Some metals and one PAH exceeded background levels established for soil; however, not at concentrations high enough to result in a risk to human health or ecological receptors that would require a remedial action. The report concluded that there were no adverse human health or ecological impacts.

AOC 35 Conclusion

Based on the evaluation of the sediment samples collected by USEPA, and in consideration of the frequent flooding, erosion, and sediment deposition by the Meramec River since DoD activity ceased operations at the TVPF, no remedial action is necessary to ensure protection of human health and the environment.

6.9 AOI Heavy Duty Garage and AOI Oil Sheds

Description

The former Heavy Duty Garage was located approximately 150 ft southwest of the TRC Headquarters Building (Figure 2). The building is no longer in existence and the AOI is approximately 0.4 acres in size. This area was used by the EWC for office trailers and staff parking. The area is currently covered with gravel and is next to the solar panel array which provides electricity for the TRC. Former oil storage shed Building 335-3 (Oil Shed #3) was

located approximately 50 ft east of the former Heavy Duty Garage. The garage and shed were removed from the site, but demolition/removal documentation were not located during the records search.

The former Heavy Duty Garage was apparently used for the repair of vehicles by DoD until approximately 1963. No specific use or description of Oil Shed #3 was identified in archived data; therefore, the use is assumed to be related to the title of the building (oil storage) provided on historical plot plans.

The Tyson vegetable garden that is maintained and used by TRC faculty and staff is located next to the Oil Shed #3 area. This area is due south of the TRC Headquarters Building (Figure 2). It is bounded by a fence and surrounded by a grass lawn, and is approximately 0.06 acres in size. The TRC set up and began using this area as a vegetable garden several years after the Phase IV RI field investigation work had been completed. Prior to this time the area had been used for parking.

Investigation History

These two AOIs were first identified and discussed in the HSUR (USACE, 2008a). It is not known if there were historic releases of waste constituents at these buildings. No obvious soil staining or signs of stressed vegetation were observed during field reconnaissance.

A Site Investigation of Oil Shed buildings 335-1, 335-2 and 335-3 was performed as part of the Phase IV RI and documented in Appendix A1 of the report (USACE, 2012). Surface soil samples were collected and analyzed for PAHs. The report concluded that there were no adverse human health risks; however, potential ecological impacts were not evaluated in this report. Some PAHs exceeded background levels in soil at this AOI near building 335-3 (Oil Shed #3); however, not at concentrations high enough to result in a risk to human health or ecological receptors that would require a remedial action.

During the Project B Yellow Sites RI field effort (USACE, 2018), these two AOIs were investigated together due to their proximity to each other. Additional soil samples were collected from Oil Shed #3 area to verify the results from the Site Investigation. Surface soil, subsurface soil, and groundwater samples were collected and analyzed for metals, VOCs, SVOCs, PAHs, diesel range organics (DRO), gasoline range organics (GRO), and oil range organics (ORO) to further characterize the nature and extent of potential contamination and any potential human health and/or ecological risks. During the investigation it appeared that soil was imported from an unknown source to this location because the soil was observed to have a high gravel content compared to the surrounding soil. It was likely used in this area to provide a level surface for placement of the auxiliary building to the EWC office buildings.

The RI concluded that there were no adverse human health risks for the most reasonably anticipated future land use scenarios at these two AOIs (e.g., maintenance workers and recreational users). Carcinogenic risks ($2x10^{-4}$) were calculated for the hypothetical future residential scenario due primarily to exposure to arsenic in groundwater via the ingestion pathway. Non-carcinogenic hazards (hazard index = 7) exceeded one for the hypothetical residential exposure scenario due primarily to exposure to arsenic, cobalt, and iron in

groundwater via the ingestion pathway. Incidental ingestion of metals in surface soil at or near background concentrations also contributed to the hazard index. Concentrations of metals detected in groundwater are likely the result of turbidity during sampling and are not indicative of dissolved concentrations. It was concluded that their concentrations in groundwater appear to reflect natural conditions (section 13.6.5). Furthermore, it was assumed that a shallow well would be installed in the clayey overburden to provide residents with a source of drinking water. This exposure scenario is unlikely given that the overburden material is unlikely to provide sufficient yield to support potable use (USACE, 2018) even if the land were to be used for residential purposes. In addition, the TRC water supply line is located nearby and any buildings or homes would likely be added to this system. See sections 13.4.4.6 and 13.4.6 in the RI for lead discussions and 13.6.5 for conclusions.

Ecological risks for terrestrial plants and soil invertebrates with limited mobility exposed to surface soils are above one, based on exposure to four metals in surface soil that slightly exceeded background concentrations. These risks are applicable to individual organisms, and population- or community-level risks are not anticipated due to the mostly unsuitable habitat and small size of these AOIs.

As previously indicated no previous investigation of the Tyson vegetable garden had been conducted prior to the Project B Yellow Sites RI. Due to the proximity of the garden to the former Heavy Duty Garage and former Oil Shed #3, surface soil samples were collected and analyzed for metals, VOCs, SVOCs, PAHs, explosives, and pesticides. Some metals and one PAH exceeded background levels in soil at the vegetable garden; however, not at concentrations high enough to result in a risk to human health or ecological receptors that would require a FUDS remedial action. Based on the screening results and ecological evaluation presented in the 2018 Project B Yellow Sites RI Report, no remedial action is necessary to ensure the protection of human health and the environment.

AOI Heavy Duty Garage and AOI Oil Sheds Conclusion

Based on results of the RI (USACE, 2018), no remedial action is necessary to ensure protection of human health and the environment.

6.10 AOI Former Paint Shed

Description

The site of the former Paint Shed AOI, Building 320, is a wooded area approximately 315 feet south-southeast of the current TRC Headquarters Building (Figure 2). The former Paint Shed was demolished, but historical drawings show the building footprint as less than 250 square feet. The AOI includes the area surrounding the33 former building and is approximately 70 ft by 70 ft (0.11 acres). An unnamed stream is located approximately 325 ft east-northeast of the AOI. The stream flows northwest and joins Tyson Creek. This AOI is not currently used by TRC personnel, Washington University students, or any other educational programs at TRC.

Investigation History

Surface soil, subsurface soil, and groundwater samples were collected during the Phase IV RI (USACE, 2012). Additional soil samples were collected during the Project B Yellow Sites RI (USACE, 2018) to further characterize the nature and extent of contamination (see Sections 15.2

and 15.4 for more detail). Collectively, surface and subsurface soil were sampled and analyzed for metals, VOCs, SVOCs, PAHs, explosives, and pesticides. Groundwater was sampled and analyzed for VOCs. These reports concluded that there were no adverse human health for the most reasonably anticipated future land use scenarios at this AOI (e.g., maintenance workers and recreational users). These reports also concluded that there were no adverse ecological risks. Some metals and PAHs exceeded background levels in soil at this AOI; however, not at concentrations high enough to result in a risk to human health or ecological receptors that would require a remedial action, with the exception of thallium. A non-carcinogenic hazard of four was calculated for the hypothetical residential scenario due primarily to exposure to thallium in surface soil, exceeding a hazard of one. This exceedance is based on the assumption that a full-time residence would be constructed at this AOI. Residential construction is not currently planned for this area. Furthermore, the relatively uniform distribution of thallium concentrations in surface soil indicates thallium is likely naturally occurring since there is no known use of this metal by the DoD. The hypothetical residential exposure scenario was evaluated using standard, default USEPA exposure factors (e.g., exposure frequency of 350 days/year, exposure duration of 26 years including the 0-6 year old).

Ecological risks for terrestrial plants and soil invertebrates with limited mobility exposed to surface soils are above one based on exposure to naphthalene and four metals in surface soil that slightly exceeded background concentrations. These risks are applicable to individual organisms, and population- or community-level risks are not anticipated due to the small size of this AOI and the presence of high quality habitat beyond AOI boundaries (USACE, 2018).

AOI Former Paint Shed Conclusion

Based on results of the RIs (USACE, 2012, 2018), no remedial action is necessary to ensure protection of human health and the environment.

6.11 AOI Former Mercury Bin/Truck Stop Inspection

Description

During the review of historical plot plans for TVPF, one building was identified as the Mercury Bin Building (Building 327). Other documentation also labeled this building as the Truck Inspection Station. The specific use or description of the building was not found. The building was situated approximately 1,000 ft from the main entrance to the TRC on the north side of the paved road (Figure 2). The building no longer exists, and the area is covered with woody vegetation and leafy groundcover. The AOI is approximately 1,500 square ft in size (0.03 acres). Remnants of the building were not located during field reconnaissance, and no obvious soil staining or signs of stressed vegetation were observed.

Investigation History

Surface and subsurface soil samples were collected during the Phase IV RI (USACE, 2012) and the Project B Yellow Sites RI (USACE, 2018) and analyzed for mercury and methyl mercury. Both reports concluded that there were no adverse human health or ecological risks since detected concentrations of mercury and methyl mercury were below human health and ecological screening values.

AOI Former Mercury Bin/Truck Stop Inspection Conclusion
Based on the results of the risk assessments and ecological evaluation presented in the 2018 Project B Yellow Sites RI Report (USACE, 2018), no remedial action is necessary to ensure the protection of human health and the environment.

6.12 AOI Railroad Pond

Description
The Railroad Pond is located just to the northeast of AOC 4 (Figure 2). The pond is approximately 0.2 acres in size and located within a triangular piece of property bounded by Tyson Valley Road to the east, Bobcat Road to the west, and the Perimeter Road to the north. Railroad tracks and a railroad siding were located within this area when the former TVPF was operated by the DoD.

This pond and nine other ponds were constructed by Washington University after obtaining the property in 1963. The pond is located at the bottom of a steeply sloping hillside in a flat area surrounded by heavy vegetation. Water is supplied to the pond via a drainage channel and base seepage from the hill.

Investigation History
No previous investigation of the Railroad Pond has been conducted prior to the Project B Yellow Sites RI. The Railroad Pond and adjacent wetland receive groundwater seepage and the objective of sampling was to assess overall Tyson Hollow environmental quality since the pond is located at the mouth of the valley.

Sediment samples collected and analyzed for metals, VOCs, SVOCs, PAHs, explosives, and pesticides. A single surface water sample was collected and analyzed for VOCs, SVOCs, PAHs, explosives, and pesticides. All detected chemicals were either below their respective human health and ecological screening levels, or consistent with background; therefore, the RI concluded that there were no adverse human health or ecological risks (USACE, 2018).

AOI Railroad Pond Conclusion
Based on the screening results and ecological evaluation presented in the 2018 Project B RI Yellow Sites Report, no remedial action is necessary to ensure the protection of human health and the environment.

6.13 AOI Pesticide Residues at Igloos

Description
Based on information provided in the HSUR (USACE, 2005), pesticides were applied to oak pallets used in the igloos to prevent infestations of powder post beetles. The pesticides were applied by dipping 8 feet (ft.) x 10 ft. oak pallets into a portable tank filled with a pesticide solution that was transported around the former TVPF to each igloo. The pallets were then "drip dried" outside the igloo. The application of the pesticides is considered to be consistent with normal use given the size of the pallets.

Following completion of the Phase IV RI, concerns were raised by MDNR and TRC that pesticide usage near igloos located near Tyson Creek could have impacted the water quality of this drainage. The headwaters of Tyson Creek begin adjacent to the main access road to the former TVPF, approximately 1 mile from the Gate House (Figure 2). Tyson Creek flows northward through the central portion of the former TVPF, and eventually empties into the Meramec River.

Tyson Creek generally conveys water during periods of elevated precipitation and surface water runoff. Portions of the creek are dry except during and immediately after rainfall events. Tyson Creek is thought to be mostly a losing stream where stream water seeps into the side banks and underlying sediments, although there may be some gaining sections along its reach where groundwater discharges into the stream.

Investigation History

Based on the information provided in the HUSR, an investigation of pesticide residues at igloos at the TRC was performed as part of the Phase IV RI and documented in Appendix A1 of the report (USACE, 2012). A field reconnaissance survey was conducted to identify any igloos where visible areas of stained soil or stressed vegetation existed near the structures. Aside from the soil plots at the Wild Canid Igloo, Igloo 303-6, where there was a notable absence of vegetation, no signs of potential releases near other igloos were observed. Due to concerns on the lack of vegetation and reports of not being able to grow plants or flowers near Igloo 303-6, surface soil samples were collected and analyzed for pesticides and pentachlorophenol (PCP) at Igloo 303-6.

PCP was not detected in the soil samples collected from Igloo 303-6. Dieldrin and heptachlor epoxide were detected below the USEPA Residential-Soil Regional Screening Levels (RSL) and the USEPA soil criteria developed for groundwater quality protection soil to groundwater RSLs in the surface soil samples. Beta chlordane was also detected but RSLs are not available for this pesticide. Dieldrin, heptachlor epoxide, and beta chlordane hazard quotients are below the threshold for unacceptable risk for ecological receptors.

No previous investigation of Tyson Creek had been conducted prior to the Project B Yellow Sites RI. The objective of the sampling along Tyson Creek was to evaluate potential impacts to surface soil related to pesticide usage associated with 52 storage igloos and surface water runoff to Tyson Creek at the former TVPF.

Surface water samples were collected and analyzed for pesticides and metals as part of the RI and the results were compared to appropriate, risk-based human health screening levels. Based on this evaluation, the RI concluded that there were no adverse human health risks (USACE, 2018).

AOI Pesticide Residues at Igloos Conclusion

Based on the screening results presented in the Phase IV RI and in the 2018 Project B Yellow Sites RI, no remedial action is necessary to ensure the protection of human health and the environment.

7.0 SUMMARY OF THE PROPOSED PLAN

Based on conclusions presented in various environmental investigations, no adverse human health or ecological risks exist at the selected AOCs and AOIs. Therefore, No Action for the ten AOCs and six AOIs by the DoD is necessary to ensure protection of human health and the environment.

8.0 COMMUNITY PARTICIPATION

The public is encouraged to participate in the process by providing comments on this Proposed Plan and/or attending the virtual public meeting. Due to Covid19 and non-entry into the Eureka Hills Public Library, a copy of the Former Tyson Valley Powder Farm No Action Proposed Plan is available for viewing at: https://www.nwk.usace.army.mil/Media/Public-Notices/

8.1 Public Comment Period

The public comment period begins on March 5, 2021 and ends on April 5, 2021. The purpose of the public comment period is to offer members of the public and other stakeholders an opportunity to provide comments on this Proposed Plan. A final decision will be made after review of the comments received during the comment period.

All written comments or questions about the Proposed Plan should be sent to USACE, as noted in Section 8.4 of this document, and must be postmarked, no later than April 5, 2021.

Based on public comments and/or new information, USACE may decide to modify the No Action recommendation or select another remedial action. Therefore, it is important to comment on the Proposed Plan. USACE will respond to substantive comments received in the Responsiveness Summary section of the Decision Document, which will be placed in the Administrative Record.

8.2 Public Meeting

As part of the public comment period, due to Covid19 USACE will host a virtual public meeting to provide information and discuss this Proposed Plan. The Webex meeting can be accessed by calling the following number:

DATE: **March 16, 2021**

LOCATION: **Webex Conference Call-in Number**
1-844-800-2712
Access Code 199-505-3911

TIME: **6:00 pm to 7:00 pm**

A court reporter will be present to record the meeting. The meeting will be held on March 16, 2021 starting at 6:00 pm to 7:00 pm. During the meeting, the public will be allowed to present spoken comments on the Proposed Plan. In addition to the Webex Conference Call-in number, a link to the Webex meeting can be found in the Former Tyson Valley Powder Farm No Action Public Meeting Notice posted on the Kansas City Army Corps of Engineers web site: https://www.nwk.usace.army.mil/Media/Public-Notices/

8.3 Administrative Record File

The Administrative Record File contains the reports and other materials used in preparation of this Proposed Plan. A copy of the Administrative Record File is located at the Eureka Hills Public Library. The library is located at 156 Eureka Towne Center Drive, Eureka, MO 63025, and due to Covid19 the library is currently open for curb-side pickup only during the following hours:

Monday-Thursday 1:00 pm. - 6:00 p.m., and Friday 1:00 p.m. - 5:00 p.m.

8.4 Contacts

If you have any questions about this Proposed Plan, or wish to submit comments, please contact the following USACE personnel:

United States Army Corps of Engineers
ATTN: Adrian Goettemoeller
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601 East 12th Street
Kansas City, MO 64106-2896
Adrian.E.Goettemoeller@usace.army.mil

9.0 LIST OF ABBREVIATIONS AND ACRONYMS

AOC	areas of concern
AOI	areas of interest
BLRA	Baseline Risk Assessment
BNSF	Burlington Northern Santa Fe
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
DERP-FUDS	Defense Environmental Restoration Program for Formerly Used Defense Sites
DoD	Department of Defense
DRO	Diesel range organics
ECR	Environmental Consolidation Report
ERA	Ecological Risk Assessment
ESI	Expanded Site Inspection
EWC	Endangered Wolf Center
FUDS	Formerly Used Defense Sites
GRO	Gasoline range organics
HHRA	Human Health Risk Assessment
HSUR	Historical Site Use Report
LECP	St. Louis County's Lone Elk County Park
MDNR	Missouri Department of Natural Resources
MEC	munitions and explosives of concern
MMRP	Military Munitions Response Program
NCP	National Contingency Plan
ORO	Oil Range Organics
PA	Preliminary Assessment
PAH	polycyclic aromatic hydrocarbons
PCB	polychlorinated biphenyls
PETN	pentaerythritol tetranitrate
PP	Proposed Plan
RI	Remedial Investigation
RSL	Regional Screening Level
SAAW	small arms ammunition waste
SVOC	semi-volatile organic compounds
TBD	to be determined
TNT	trinitrotoluene
TRC	Washington University's Tyson Research Center
TVPF	Tyson Valley Powder Farm
USACE	United States Army Corps of Engineers
USEPA	US Environmental Protection Agency
USGS	United States Geological Survey
VOC	volatile organic compounds

10.0 GLOSSARY OF TERMS USED IN THIS PROPOSED PLAN

This glossary defines technical terms used in this Proposed Plan. The terms and abbreviations contained in this glossary are often defined in the context of hazardous waste management and apply specifically to work performed under the CERCLA program. These terms may have other meanings when used in a different context.

Administrative Record File: The body of documents that forms the basis for the selection of a particular response at a site. At the time the Administrative Record File if finalized (upon completion of the Decision Document), the Administrative Record File becomes the Administrative Record.

Aquifer: A geologic formation that is water bearing. It can be a layer of soil, sand, gravel, or rock that will yield economically significant quantities of water to a well or spring.

Baseline Risk Assessment (BLRA): A study of the actual or potential danger to human health and welfare from hazardous substances at a specific site. The BLRA estimates human health risks at a site, as it exists with no response action taken.

Cancer Risk: Incremental probability of an individual developing cancer over a lifetime as a result of site– related exposure to potential carcinogens. The NCP defines acceptable exposure cancer risk range for site-related exposures is 10^{-4} to 10^{-6}.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA): The CERCLA as amended by the Superfund Amendments and Reauthorization Act (SARA), and other amendments, 42 U.S.C. 9601 et seq., also referred to as "Superfund."

Defense Environmental Restoration Program (DERP): Established in 1984, DERP promotes and coordinates efforts for the evaluation and cleanup of contamination at Department of Defense installations (10 U.S.C. 2701).

Dioxins and Furans: Dioxins and furans are not manufactured or produced intentionally but are created when other chemicals or products are made. These chemicals may be created during burning of forests or household trash; chlorine bleaching of pulp and paper; or manufacturing or processing of certain types of chemicals, such as pesticides.

Ecological Risk Assessment (ERA): A study of the actual or potential danger to the environment from hazardous substances at a specific site. The ERA estimates nonhuman health risks at a site, as it exists with no response action taken.

Five Year Review: Five-year reviews generally are required under CERCLA §121(c) or program policy when hazardous substances remain on site above levels that permit unrestricted use and unlimited exposure. Five-year reviews provide an opportunity to evaluate the implementation and performance of a remedy to determine whether it remains protective of human health and the environment. Five year reviews are repeated every succeeding five years so long as future uses remain restricted.

Formerly Used Defense Sites (FUDS): FUDS are properties that were real property that was under the jurisdiction of the Secretary (Secretary of Defense and the Secretaries of each of the Military Departments, as well as the Secretaries of any predecessor departments or agencies of DoD) and owned by, leased by, or otherwise possessed by the United States (including governmental entities that are the legal predecessors of Department of Defense [DoD] or the Components) and those real properties where

accountability rested with DoD but where the activities at the property were conducted by contractors (i.e., government-owned, contractor-operated [GOCO] properties) that were transferred from DoD control prior to 17 October 1986. The FUDS program was established by Section 211 of the Superfund Amendments and Reauthorization Act (SARA) of 1986 by establishing the Defense Environmental Restoration Program (DERP). USACE is the lead agency on all FUD sites.

Groundwater: Underground water that fills pores in soils, sands, or openings in rocks to the point of saturation. Groundwater is often used as a source of drinking water via municipal or domestic wells.

Hazard Index: A measure of the adverse health effects associated with exposure to chemicals that are not known to cause cancer. A Hazard Index of 1.0 or less is considered highly unlikely to cause non-cancer adverse effects even if exposure continues for a lifetime.

National Contingency Plan (NCP): Federal regulations specifying the methods and criteria for cleaning up sites under CERCLA, codified at 40 Code of Federal Regulations Part 300.

Overburden: The unconsolidated geologic material that lies above bedrock.

Perchlorate: Perchlorate is a naturally occurring and manufactured chemical anion, and is commonly used as an oxidizer in rocket propellants, munitions, fireworks, airbag initiators for vehicles, matches, and signal flares. It is naturally occurring in some fertilizers.

Polychlorinated biphenyls (PCBs): PCBs belong to a broad family of man-made organic chemicals known as chlorinated hydrocarbons that were manufactured from 1929 until manufacturing was banned in 1979. Due to their non-flammability, chemical stability, high boiling point and electrical insulating properties, PCBs were used in hundreds of industrial and commercial applications.

Polycyclic Aromatic Hydrocarbons (PAHs): An organic compound that occurs in oil, coal, and tar deposits and is produced as byproducts of burning fuel.

Proposed Plan: The preferred plan for a site as selected by the lead agency (USACE) is presented to the public for review and comment in the Proposed Plan. The Proposed Plan summarizes all relevant project information documenting the decision making process.

Remedial Investigation: The first part of a two-part study that determines how much and what kind of contamination exists at a site. A Remedial Investigation generally involves collecting and analyzing samples of groundwater, surface water, soil, sediment, and air. The second part of the study is a Feasibility Study.

Semi-volatile Organic Compounds: A group of organic compounds that have a tendency to change from liquids to gases as relatively low temperatures, higher than ambient temperature.

Trichloroethene: A stable, colorless liquid with a low boiling point. Trichloroethene has many industrial applications, including use as a solvent and as a metal degreasing agent. Trichloroethene may be toxic to humans when inhaled, ingested or through skin contact and can damage vital organs, especially the liver [see also Volatile organic compounds].

Volatile Organic Compound (VOC): A group of organic compounds that tend to change from liquids to gas easily.

11.0 REFERENCES

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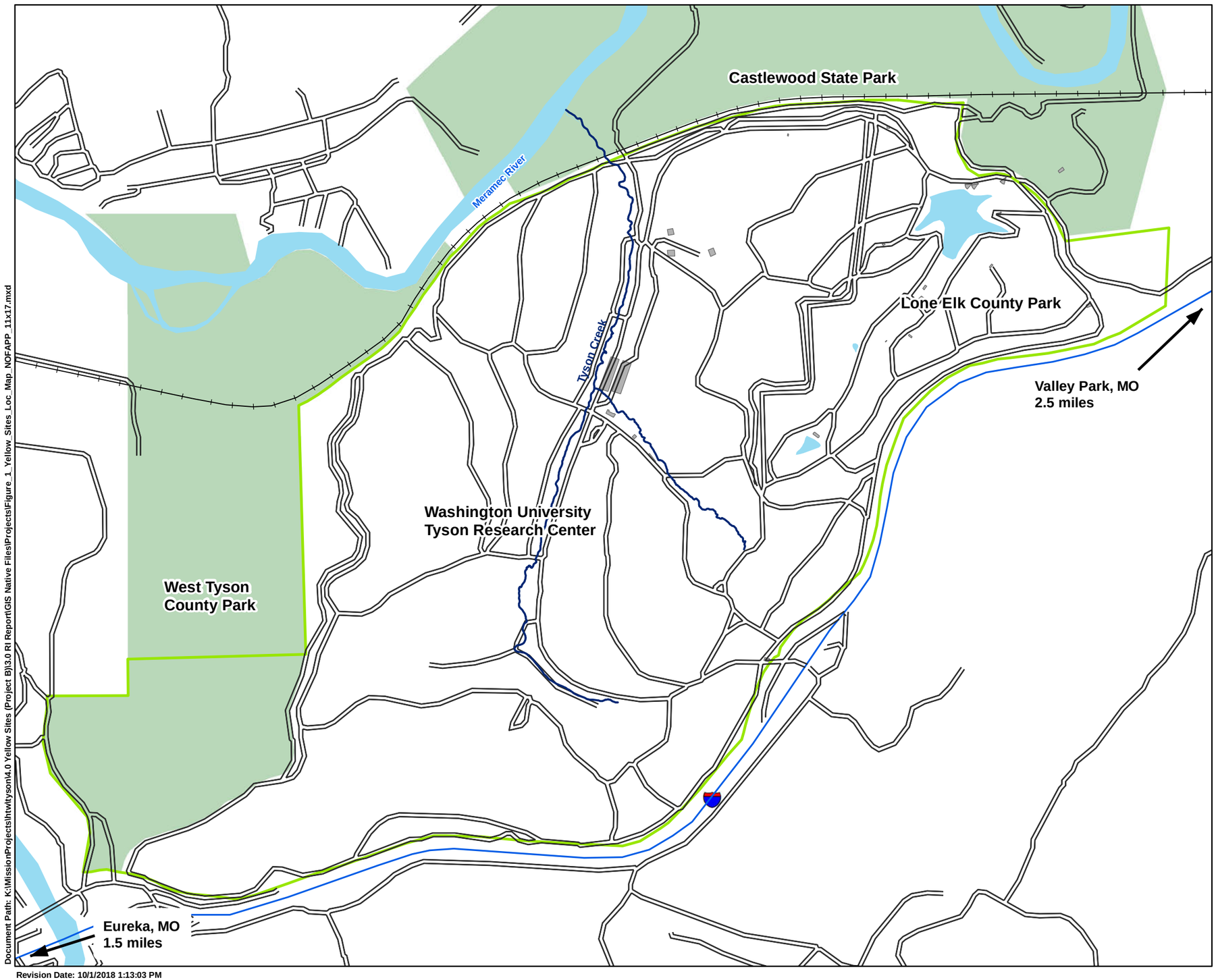
FIGURES



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Proposed Plan
Former Tyson Valley Powder Farm

Figure 1
Former Tyson Valley Powder Farm
Location Map

Legend

- Tyson Creek
- Burlington Northern Railroad
- Road
- Interstate 44
- Building
- Public Park
- Water Body
- Former TVPF Boundary

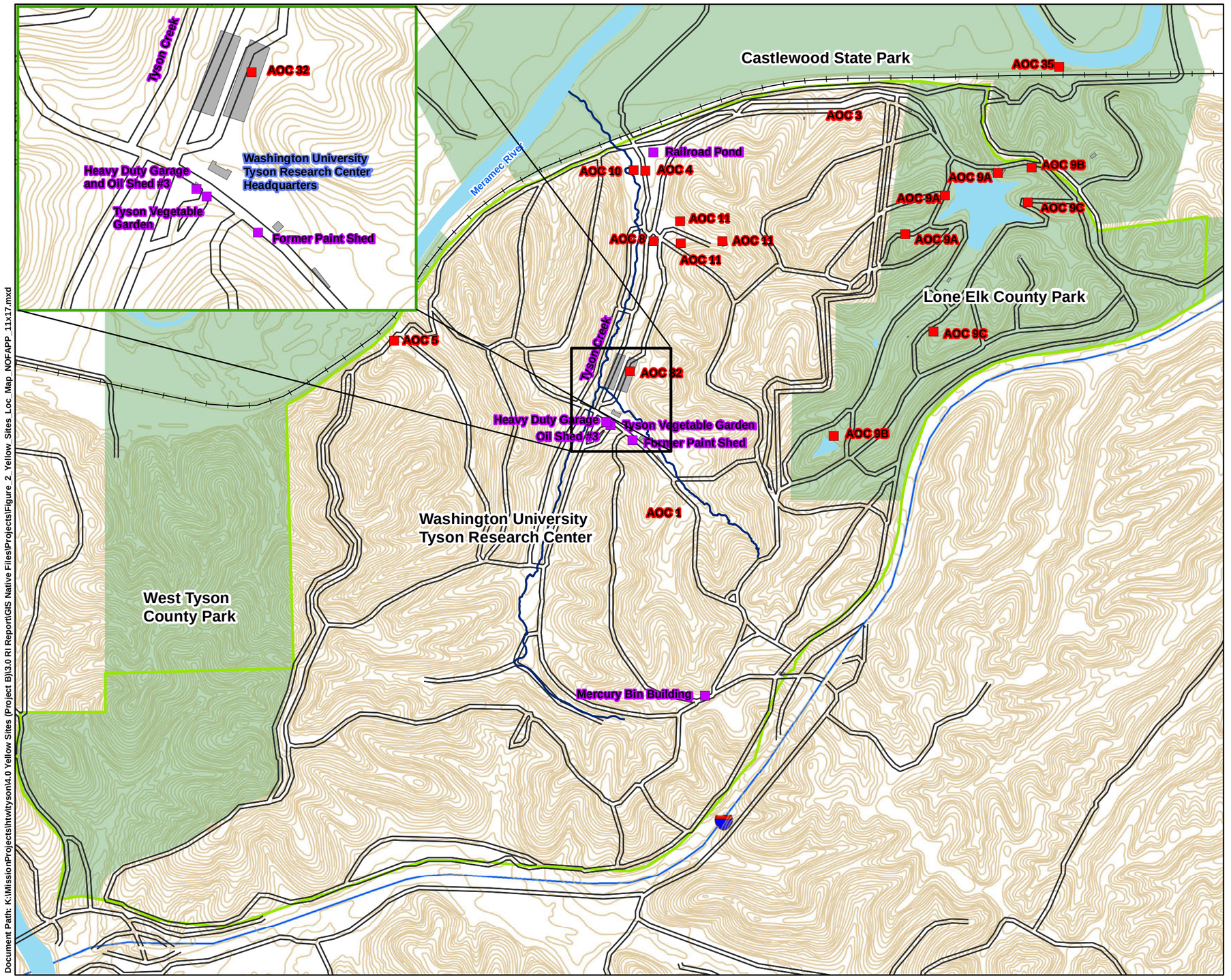
N

0 750 1,500 3,000 Feet

1 inch = 1,500 feet

Projection: UTM Zone 15N
North American Datum (NAD), 1983

US Army Corps of Engineers



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Proposed Plan
Former Tyson Valley Powder Farm

Figure 2
Selected Areas of Concern and Interest

Legend

- Area of Concern
- Area of Interest / Feature
- 10-Foot Contour
- Tyson Creek
- Burlington Northern Railroad
- Road
- Interstate 44
- Building
- Public Park
- Water Body
- Former TVPF Boundary

N

0 700 1,400 2,800 Feet

1 inch = 1,500 feet

Projection: UTM Zone 15N
North American Datum (NAD), 1983

US Army Corps of Engineers