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Categorical Exclusion Determination

X1414-04 CAMP ZOE
SHANNON COUNTY, MISSOURI

November 10, 2014

Prepared for:

FARNSWORTH GROUP, INC.;
MISSOURI OA/FMDC; AND
MISSOURI DNR/DIVISION OF PARKS

SCI No. 2014-7007.20

SCI ENGINEERING, INC.
CONSULTANTS IN DEVELOPMENT, DESIGN AND CONSTRUCTION
GEOTECHNICAL
ENVIRONMENTAL
NATURAL RESOURCES
CULTURAL RESOURCES
CONSTRUCTION SERVICES

November 10, 2014

Mr. Robert Polk, PE, LEED AP
Farnsworth Group, Inc.
20 Allen Avenue, Suite 200
St. Louis, Missouri 63119

RE: NEPA Services for Categorical Exclusion Determination
X1414-04 Camp Zoe
Shannon County, Missouri
SCI No. 2014-7007.20

Dear Mr. Polk:

Enclosed is the Categorical Exclusion Determination for the new approximate 13,300-lineal-foot access road for a new 407-acre state park located in Shannon County, Missouri.

Please contact us if you have any questions or comments regarding this report.

Respectfully,

SCI ENGINEERING, INC.

Edwin P. Grimmer, P.E.
Senior Engineer

EPG/lf

Enclosures
- Appendix A – Figures
- Appendix B – Prime and Unique Farmland Correspondence
- Appendix C – Wetland and Waterbody Summary Report and 404/401 Permit Application
- Appendix D – Floodplain Model
- Appendix E – Noise Assessment Report
- Appendix F – Cultural Resource Reports
- Appendix G – Threatened and Endangered Species Correspondence and Reports
- Appendix H – Phase One Environmental Site Assessment
- Appendix I – Ozark National Scenic Riverways Project Proposal Form
- Appendix J – Scenic Easement Document on LAD property

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Form CE-2

Categorical Exclusion Determination
[As per 23CFR771.117(d)]

Route: New state park access road.

County: Shannon County

Project Termini and Length: The Project includes the upgrade and relocation of existing county roads with two entrances off State Route 19 in Shannon County, Missouri. The project length is approximately 13,300 lineal feet.

Project Description: The State of Missouri Office of Administration, Department of Facilities Management, Design and Construction (OA/FMDC) and Department of Natural Resources Division of State Parks (DNR/MSP), is redeveloping the approximate 407-acre Camp Zoe as a state park. This project involves the upgrade and relocation of approximately 13,300 feet of existing county access roads, with one primary entrance off State Route 19, a vehicular bridge over Sinking Creek, and a secondary emergency access to State Route 19. Unused existing access roads will be abandoned as part of this project. A Vicinity and Topographic Map, Figure 1, and an Aerial Photograph, Figure 2, are enclosed in Appendix A.

This project is necessary to provide a safer and more convenient access to the park facilities being constructed as part of the new state park development.

Current Average Daily Traffic (ADT): Since the current access roads are unimproved and generally not in use, there is effectively an Annual Average Daily Traffic (AADT) of 0.

Future ADT: The AADT for the access road for the design year 2035 is 870.

Right-of-Way Required (Acres):
Existing Co. Rd 19B right of way – 2.95 acres (will vacate 2.15 acres)
New Co. Rd 19B right of way – 6.05 acres
Existing Co. Rd 19-250 right of way – 2.98 acres
Permanent Roadway Easements – 0 acres
Temporary Easements – 0 acres

Displacements (Number and Type):

Residential – 0

Commercial – 0

Community Impacts: Executive Order 12898 requires each federal agency to make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects on minority and low-income populations.

Limited or no socioeconomic impacts are anticipated for this project. It is located in a rural area with a very low population density and limited services. The project will not negatively impact the surrounding rural land or infrastructure, nor will it negatively impact the nearby communities of Salem (25 miles) and Eminence (17 miles).

The project area is predominately undeveloped forested land with only a few residential properties located within five (5) miles of the project area. There are no minority or low income populations within the proposed roadway alignment. As such, the proposed project will not affect minority or low income populations in a disproportionate manner.

OA/FMDC will conduct all acquisitions in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act (referred to as the Uniform Act) of 1970, as amended. The Uniform Act and Missouri state laws require that just compensation be paid to the owner(s) of private property taken for public use. The Uniform Act is carried out without discrimination and in compliance with Title VI (the Civil Rights Act of 1964), the Executive Order on Environmental Justice, and the Americans with Disabilities Act.

An appraisal of fair market value is the basis for determining just compensation to be offered to the owner for property to be acquired. The Uniform Act defines an appraisal as a written statement independently and impartially prepared by a qualified appraiser setting forth an opinion of defined value of an adequately described property as of a specific date, supported by the presentation and analysis of relevant market information.

Farmland Impacts (Type and Area): SCI Engineering coordinated with the U.S. Department of Agriculture – Natural Resource and Conservation Service (NRCS) regarding potential impacts to prime and unique farmland associated with the project. A letter containing the General Form AD-1006 was submitted to the NRCS on August 6, 2014, to initiate consultation regarding prime and unique farmland impacts. The AD-1006 Form was returned on August 7, 2014, with parts II, III, IV and V being completed by Mr. Dave Skaer of the NRCS. Subsequent completion of Part VI and VII indicates a total site assessment point value of 100 points, 160 points below the action level of 260 points. Based on the results of the AD-1006 Form, the project area, including the proposed park development, contains 17.0 acres of prime and unique farmland; however, none of it will be converted. No further action is required for farmland impact evaluation. The correspondence regarding prime and unique farmland is enclosed as Appendix B.

Wetland and Waterbody Impacts: The National Wetlands Inventory (NWI) map and the U.S. Geological Survey (USGS) map were reviewed for information concerning the site. The USGS and NWI maps depict one dashed blue-line intermittent tributary, one solid blue-line perennial tributary, and several classes of riverine wetlands within the proposed roadway project area. More specifically, the NWI maps also indicated the classifications of the riverine wetlands to be R3USA (Riverine Upper Perennial Unconsolidated Shore Temporary Flooded) and R3UBH (Riverine Upper Perennial Unconsolidated Shore Permanently Flooded) within the boundaries of the project area. A copy of the USGS and NWI maps are included in the Wetland and Waterbody Delineation Report (Appendix C).

A site reconnaissance was conducted on February 26, 27, 2014, and July 10, 2014, to determine if wetlands or waterbodies exist within the boundaries of the proposed roadway project. One perennial tributary (Sinking Creek) and one intermittent tributary (Burnt House Hollow) were found within the boundaries of the proposed roadway project. It should be noted that the above-referenced data was extracted from a larger wetland and waterbody delineation that was conducted for the entire roadway and park development project. Findings from the entire Wetland and Waterbody Delineation survey efforts can be found within the aforementioned report.

Both Sinking Creek and Burnt House Hollow will likely be considered waters of the United States as identified under the definitions described in Section 328.3 of the Code of Federal Regulations. Based on the updated permit application, dated October 16, 2014, impacts to Sinking Creek include 0.04 acres of permanent impact and 0.075 acres for a temporary road crossing. A culverted crossing of Burnt House Hollow Creek involves 0.061 acres of impact. Based on correspondence with Farnsworth Group, required compensatory mitigation for the proposed stream impacts is yet to be determined by the United States Army Corps of Engineers (USACE). If the USACE determines that mitigation for impacts to waters of the United States are required, mitigation will need to be accomplished through the purchasing of credits from an approved stream mitigation bank, coordination with the Missouri Conservation Heritage Foundation Stream Stewardship Trust Fund or enhancement of a degraded creek and/or tributary and its associated riparian corridor. Any mitigation measures or best management practices identified in the 404 permit will be complied with during construction.

404 Permit Required (Yes/No): Yes. Development activities that result in fill being placed within a jurisdictional wetland or waterbody will require a Section 404 Permit from the USACE and Section 401 Water Quality Certification from Missouri Department of Natural Resources (MDNR). To initiate the permit process, the Section 404/401 permit application form was submitted to the USACE by Farnsworth Group (Appendix C). At this time, the Section 404/401 permit has not been issued by the regulatory agencies. It is anticipated the permit application will be processed as a Section 404 Nationwide Permit (*Nationwide Permit 14 -Linear Transportation Projects*) from the USACE and a Section 401 Water Quality Certification from MDNR.

Water Quality Impacts: No significant effect on water quality from this project is anticipated, as the necessary erosion control measures will be employed at areas of soil disturbance throughout the project. The MDNR has approved MODOT's Stormwater Pollution Prevention Plan (SWPPP) which details temporary erosion and sediment control best management practices (BMPs) which will be included in the construction contract specifications. Additionally, the SWPPP will aid in minimizing sediment loss in compliance with MODOT's State Operating Permit MO-R100007 for land disturbance and the Missouri Clean Water Law.

Floodplain Impacts: The Federal Emergency Management Agency (FEMA) has not published a Flood Insurance Rate Map (FIRM) for Sinking Creek. The State Emergency Management Agency (SEMA) was contacted, and they indicated that all existing data that they had for the park area was very old and inconclusive. Therefore, a floodplain model for the project has been prepared by Farnsworth Group and will be submitted to SEMA for review and approval as part of the overall park development. Additionally, Shannon County does not participate in the Flood Insurance Program thus a floodplain development permit will not be required for the project. A copy of the floodplain model is included as Appendix D.

Air Quality Impacts: The Clean Air Act (CAA) requires the adoption of air quality standards, quality control regions, and state implementation plans. The federal government established the National Ambient Air Quality Standards (NAAQS), to protect public health, safety, and welfare from known or anticipated effects of sulfur dioxide, particulate matter, carbon monoxide, nitrogen dioxide, ozone, and lead. The State of Missouri established additional criteria for hydrogen sulfide and sulfuric acid. Transportation can contribute to four of the six NAAQS pollutants: ozone, carbon monoxide, particulate matter, and nitrogen dioxide. Transportation conformity with the NAAQS, as required by the CAA, ensures that federally funded or approved transportation plans, programs, and projects conform to the air quality objectives established in State Implementation Plans.

The project is located in a non-classified area as defined by the Environmental Protection Agency through the Clean Air Act. Therefore, the project area is in compliance with the National Ambient Air Quality Standards and no air quality analysis is required.

Noise Impacts: The project is considered a Type I project under FHWA's noise regulations (23 CFR Part 772) because it consists of the construction of a new roadway. Therefore, a noise assessment was completed for the project. The Noise Assessment is included as Appendix E.

In summary, The projected build 2034 traffic noise levels ranged from 29.0 dB(A) to 46.3 dB(A) at the receptor locations. The projected build 2034 noise levels changed from the existing conditions from a decrease of 6.0 dB(A) to an increase of 11.1 dB(A).

Under the 2034 build scenario, no receptor locations approached or exceeded the FHWA Noise Abatement Criteria. Additionally, no receptor locations were considered impacted due to a substantial increase in traffic noise levels. Therefore, a noise abatement analysis was not warranted.

Cultural Resources: Efforts to identify historic properties and assess potential adverse effects pursuant to 36 CFR Part 800, *Protection of Historic Properties*, regulations implementing Section 106 of the National Historic Preservation Act (16 U.S.C. 470) have been implemented.

Camp Zoe was established in 1929 as a girl's summer camp but later became coed. It served in this capacity until 1986. The property was acquired by James Tebeau who operated it as a concert venue and camping facility from 1998 to 2010. In 2010, the federal government confiscated the property as part of a plea agreement related to charges that Trebeau was operating an "open-air drug market" at the concert events. The Missouri State Parks Department (MSP) then purchased Camp Zoe in an auction in 2013.

After acquiring the property, the MSP conducted a cultural resource assessment and documentation of the structures on the property—those related to the original 1929 to 1986 camp and those associated with the concert venue. Following the documentation of these structures, all but a few were razed ahead of the proposed redevelopment of the park.

Sporadically, during the first half of 2014, the Archaeological Research Center of St. Louis (ARC) conducted Phase I and II cultural resource investigations of the Camp Zoe project area (Appendix F). These investigations resulted in the identification of three new archaeological sites: 23SH1551 was related to the original Camp Zoe Youth Camp; 23SH1552 contained evidence of historic mining activities; and 23SH1553 reflected both prehistoric and historic utilization. In addition, one previously reported site, 23SH1550, was subjected to Phase II investigations by ARC. This testing consisted of machine trenching and geophysical exploration.

Site 23SH1550 contains evidence of prehistoric utilization as well as a historic cemetery, the Carpenter-Union Hill Cemetery, which began in the late 19th or early 20th century and continued to be used through the mid-1900s. MSP contracted to have a geophysical investigation conducted of the cemetery and its perimeter in order to ascertain whether or not internments existed outside the current fenced boundary of the cemetery (Appendix F). These investigations revealed the possibility of burials outside the fenced area and, therefore, a fifty-foot buffer was established around the fenced cemetery. This buffer is a no-impact zone for the current and any future development within the park. In addition, ARC conducted machine excavations in other parts of 23SH1550 in order to explore for prehistoric deposits. During this operation, ARC uncovered a series of historic wood posts which were interpreted as possibly representing the foundation of the first location of the Union Hill School. No other archaeological features were identified. It was put forth that the posts represented a significant cultural resource and recommended avoidance of the area, or if this was not possible, to mitigate any adverse effects. Thus, the cemetery and the “school” location were deemed significant but the remainder of the site was found not to be of historical/archaeological importance. The area deemed significant was identified by ARC and the new access road has been designed to avoid that area.

Site 23SH1552 was found to contain mining pits and a rock pile. Two of the pits were deemed potentially eligible and it was recommended that they be avoided during construction or, if that was not possible, to mitigate any adverse effects caused by the project. The rock pile was also determined to potentially be significant due to the fact that it may represent a prehistoric burial cairn. It too, was recommended for avoidance or mitigation as circumstances dictate. The rock pile was identified by ARC along with a fifty (50)-foot buffer which has been avoided in the new road design. The two pits were also identified and are not impacted by the new access road design.

Sites 23SH1551 and 23SH1553 were determined as not eligible for listing on the National Register of Historic Places and therefore, clearance was recommended.

The report of these investigations has been submitted by MODOT for review by the State Historic Preservation Office (SHPO). Based on the MDNR SHPO letter dated October 17, 2014, the SHPO office concurs that a thorough and adequate cultural resources survey has been conducted for the upgraded roadway and bridge development project. Furthermore, the SHPO office concurs with the recommendation that there will be **no adverse effect** on any properties that may be or have been determined to be eligible for inclusion in the National Register of Historic Places. Upon completion of Section 106 consultation, any requirements provided by SHPO will be met for the project.

Section 4(f)/6(f) Involvement (Types and Area): Section 4(f) is part of the Department of Transportation Act of 1966 designed to preserve the natural beauty of the countryside and public park and recreation lands, wildlife and waterfowl refuges, and historic sites. Section 4(f) eligible properties include those that are publicly owned except for historic sites, which could be either public or privately owned. Federally funded actions cannot impact Section 4(f) eligible sites unless there is no feasible and prudent alternative.

Section 6(f) is part of the Land and Water Conservation Fund (LWCF) Act, designed to provide restrictions for public recreation facilities funded with LWCF money. The LWCF Act provides funds for the acquisition and development of public outdoor recreation facilities that could include, at a minimum, community, county, and state parks, trails, fairgrounds, conservation areas, boat ramps, and shooting ranges. LWCF-assisted facilities must be maintained for outdoor recreational use in perpetuity, and therefore, require mitigation that includes replacement land of at least equal value and recreation utility.

A review of the NPS LWCF database indicated that no LWCF funded projects were located within 10 miles of the proposed project. This project will not encroach upon any public recreational lands. Additionally, it will provide public access to new public recreational lands. Therefore, no further action is needed.

The roadway does not involve the taking of any NPS Ozark National Scenic Riverways (ONSR) property. Approximately 54 acres of ONSR scenic easement are located within the vicinity and partially over laps the park development. The roadway will be develop within 2.3 acres of the scenic easement. Since the easement is for scenic purposes, and the portion(s) impacted are not publicly owned or open to the public, nor are they designated as a park, recreation areas, or wildlife or waterfowl refuge, there is no "use" of a 4(f) protected resource by this project.

Threatened and Endangered Species: Based on the review of the preliminary Tree Clearing Limits Exhibit, prepared by Farnsworth Group, it appears that approximately 35 acres of wooded habitat will be removed for construction of the roadway. To ensure compliance with State and Federal Endangered species regulations, the Missouri Department of Conservation (MDC) and the United States Fish and Wildlife Service (USFWS) were consulted with regard to the potential for threatened or endangered species or their preferred habitat to exist within or near the project site. Summaries of both consultation efforts can be found below. Additionally, correspondence associated with these consultations is included within Appendix G.

Missouri Department of Conservation: Based on the results of the Missouri Natural Heritage Review report, dated May 14, 2014, no wildlife preserves, designated wilderness, or critical habitats were identified within the provided Public Land Survey System (PLSS). MDC Natural Heritage records identified the plains spotted skunk (*Spilogale putorius interrupta*; state listed endangered), and the pygmy snowfly (*Allocapnia pygmaea*; state rank S3- vulnerable) within the vicinity of the project. The plains spotted skunk is most commonly found in open grasslands, brushy areas and cultivated land. Based on the dominant landscape present at Camp Zoe, the proposed project is not anticipated to have a negative impact on the species. To protect the plains spotted skunk, MDC recommended the following BMPs: limit the use of pesticide and herbicides and avoiding burning or clearing of fence rows, brush piles and downed logs/trees. The pygmy snowfly is found primarily in spring branch habitats and was last observed in 1987. While springs were observed at Camp Zoe, the proposed project is not anticipated to have a negative impact on the species.

To protect the known karst features, MDC has suggested BMPs which include: proper erosion and sediment controls during construction, use of staging areas away from the identified karst features, keeping fuel storage containers within staging areas, disposal of excess concrete and wash water from trucks/equipment away from karst areas, and if necessary ensuring temporary roadways are built with a low gradient and utilize appropriate erosion and sediment BMPs. Additionally, MDC states that a 100-foot vegetated buffer zone around identified karst features should be maintained. To control the spread of invasive/exotic species, MDC recommends routine inspection and cleaning of equipment prior to moving between project sites.

United States Fish and Wildlife Service: In addition to coordination efforts with MDC, consultation with the USFWS was initiated. Ms. Trisha Crabill, a biologist with USFWS, prepared a technical assistance letter which provided recommendations on measures to avoid and minimize effects to federally listed species. This document was received on September 8, 2014, and identified the gray bat (*Myotis grisescens*), Indiana bat (*Myotis sodalis*), and northern long-eared bat (*Myotis septentrionalis*) as species which could occur within the project area and be potentially impacted by project activities. Additionally, the Ozark Hellbender (*Cryptobranchus alleganiensis bishopi*), was found to have suitable habitat but does not exist within the project area. The Hine's emerald dragonfly (*Somatochlora hineana*) and Virginia sneezeweed (*Helenium virginicum*) are present in Shannon County; however, suitable habitat was not identified within the project area. This is consistent with what has been previously identified by the MDC consultation for the area.

At the request of USFWS, a Biological Assessment (BA) has been prepared for the proposed Camp Zoe project as part of the on-going USFWS Threatened and Endangered Species consultation process. Species outlined in the USFWS Technical Assistance Letter were evaluated to determine whether or not the proposed project actions would affect the protected resources. The following Section 7 conclusions were made for each of the species listed within the Technical Assistance Letter:

Virginia Sneezeweed and Hines Emerald Dragonfly:
As mentioned in the USFWS Technical Assistance Letter, suitable habitat for these species is not found within the proposed roadway project area. As such, the proposed project actions will cause **no effect** to these species.

Ozark Hellbender:
While Sinking Creek is suitable habitat for the Ozark hellbender, no specimens were found during an exploratory survey by USFWS biologists in October 2014. Therefore, no direct impacts to the species will occur due to project construction. However, the project lies upstream from a known suitable habitat, the Current River. Indirect effects, in the form of affecting the water quality of Sinking Creek due to the construction of vehicular bridge piers and installation of scour protection bars, are unlikely to occur. Best management practices will be in place as a conservation measure to control erosion and the resulting sediment that could make its way into Sinking Creek. Based on these conclusions, the proposed project actions **may affect, but not likely to adversely affect**, this species.

Threatened and Endangered Species Surveys: Acoustic and mist net bat surveys were conducted from May 24 through May 30, 2014. This survey effort was designed to determine the presence or probable absence of the federally listed as endangered Indiana bat (*Myotis sodalis*) as well as the proposed endangered Northern long-eared Bat (*Myotis septentrionalis*). Northern long-eared bats of both sexes were captured in the area, and the species was identified on acoustic recordings. A single male Indiana bat was captured, and acoustic recordings also confirm Indiana Bat presence. Due to the location of nearby hibernacula, it is likely that male Indiana bats are utilizing the area for summer foraging and possible roosting both in trees and cave sites. A pregnant female northern long-eared bat was captured and tracked, allowing for the location of three roost trees, two of which were maternity colonies. However, all of these trees were located outside of the Camp Zoe boundaries. Male gray bats (*Myotis grisescens*) were captured in abundance in the area, likely due to the nearby “Bat Cave Shannon” which is located at Current River State Park.

A habitat assessment site walkover was also conducted on September 11, 2014, to assess the suitability of roost habitat for the Indiana bat and Northern long-eared Bat within two sections of the proposed utility corridor upgrade area. Based on our site reconnaissance, four trees were identified as potentially suitable roost habitat. Following a site meeting on October 1, 2014, with representatives from USFWS, it was determined that only one of the four potential roost trees would be considered suitable. Additional details on the survey methodology and results for both surveys can be found within the Bat Survey Report and Bat Habitat Assessment Summary Letter, enclosed within Appendix G.

Gray Bat:

Direct impacts to gray bat known occupied habitat will not occur due to project activities, since the existing caves will not be impacted by construction of the roadways. Indirect effects may occur due to tree clearing for the roadway, particularly along the forested riparian corridors of Sinking Creek. This can fragment habitat and decrease foraging potential for the bat. Cumulative effects on the gray bat due to increased use of the areas, disturbance by human traffic and noise pollution may occur in the areas proposed for roadway construction.

Conservation measures are in place to ensure gray bats and their preferred habitats are not adversely impacted by proposed project construction. Impact avoidance will also be accomplished by working with the existing landscape to develop areas that are devoid of trees, therefore decreasing the total acreage necessary to remove. Tree clearing along Sinking Creek’s riparian corridor will also be minimal and will primarily occur at the proposed vehicular bridge crossing location. Additionally, the majority of the clearing activities will be completed between November 1st and April 1st while the bats are hibernating in caves. Based on these conclusions, the proposed project actions **may affect, but not likely to adversely affect**, this species.

Indiana Bat:

Direct effects of construction on Indiana bats could occur due to clearing trees for the roadway. Clearing of trees can expose flight corridors between foraging and roosting habitats and also decrease the foraging habitat available to the bats. Additionally, clearing of preferred or potential roost trees can eliminate roosting sites for the bats. Indirectly, bats can be disturbed and or displaced due to the increased noise and human presence during construction. The decreased habitat availability could also reduce prey availability.

Conservation measures are in place to ensure Indiana bats and their preferred habitats are not impacted by proposed project construction. In order to minimize project activity impacts to Indiana bat roosting habitat, clearing activities will avoid all roost trees identified from the previously mentioned bat and roost tree identification surveys. Removal of trees providing upper-story canopy will be minimized wherever possible in order to retain the integrity of the forested areas. Impact avoidance will also be accomplished by developing areas that are devoid of trees, therefore decreasing the total acres necessary to remove. Additionally, clearing of all potentially suitable roost habitat trees will be completed between November 1st and April 1st while the bats are hibernating in caves. While measures are in place to avoid and minimize impacts to Indiana bat potential roost habitat, there is always the possibility of inadvertent clearing of trees with such a large construction project and the difficulty of identifying all roost trees in the project area. The tree clearing limits will be clearly delineated to avoid accidental elimination of potential roost habitat. Indirect effects from the inadvertent clearing of potential roost trees are insignificant and cannot be reasonably accounted for beyond the proposed conservation measures. Based on these conclusions, the proposed project actions **may affect, but not likely to adversely affect** this species.

Northern Long-Eared Bat:

Direct effects of construction on northern long-eared bats could occur due to clearing trees for the roadway. Clearing of trees can expose flight corridors between foraging and roosting habitats and also decrease the foraging habitat available to the bats. Additionally, clearing of preferred or potential roost trees can eliminate roosting sites for the bats. Indirectly, bats can be disturbed and or displaced due to the increased noise and human presence during construction. The decreased habitat availability could also reduce prey availability.

Conservation measures are in place to ensure northern long-eared bats and their preferred habitats are not impacted by proposed project construction. In order to minimize project activity impacts to northern long-eared bat roosting habitat, clearing activities will avoid all roost trees identified from the previously mentioned bat and roost tree identification surveys. Removal of trees providing upper-story canopy will be minimized wherever possible in order to retain the integrity of the forested areas. Impact avoidance will also be accomplished by working with the existing landscape to develop areas that are devoid of trees, therefore decreasing the total acres necessary to remove. Additionally, clearing of all potentially suitable roost habitat trees will be completed between November 1st and April 1st while the bats are hibernating in caves. While measures are in place to avoid and minimize impacts to northern long-eared bat potential roost habitat, there is always the possibility of inadvertent clearing of trees with such a large construction project and the difficulty of identifying all roost trees in the project area. The tree clearing limits will be clearly delineated to avoid accidental elimination of potential roost habitat. Indirect effects from the inadvertent clearing of potential roost trees are insignificant and cannot be reasonably accounted for beyond the proposed conservation measures. Based on these conclusions, the proposed project actions **may affect, but not likely to adversely affect** this species.

Hazardous Waste Sites: A Phase One Environmental Site Assessment was performed in order to identify potential solid and hazardous waste sources within the project area. This assessment identified no evidence of recognized environmental conditions in connection with the subject site. Therefore, no potential impacts are anticipated resulting from hazardous waste sites. A detailed list of databases searched, historical records researched and the site reconnaissance are included in the Phase One Environmental Site Assessment enclosed as Appendix H.

Any previously unknown sites that are found during project construction will be handled in accordance with applicable federal and state laws and regulations. If regulated solid or hazardous wastes are found during construction activities, the construction inspector will direct the contractor to cease work at the suspect site. An appropriate environmental specialist will be contacted to discuss options for remediation. The environmental specialist and the consultant will develop a plan for sampling, remediation, and continuation of project construction. Independent consulting, analytical, and remediation services will be contracted if necessary. The Missouri DNR and U.S. Environmental Protection Agency will be contacted for coordination and approval of required activities.

Cumulative and Secondary Impacts: As discussed in the project description, the proposed roadway is being constructed to access the new state park. Construction of this park will have the following secondary impacts:

- Tree clearing associated with the proposed park development project will involve the selective and clear cutting of approximately 17.8 acres of forested land.
- No impacts to jurisdictional waters of the Unites States will occur from the proposed park development project.
- No prime and unique farmland will be converted as part of the proposed park development project.
- No direct or indirect effects are proposed to the Hine's emerald dragonfly due to project activities, and no cumulative effects can be reasonably anticipated. Based on these conclusions, the proposed park development will cause **no effect** to this species.

- No direct or indirect effects are proposed to Virginia sneezeweed due to project activities, and no cumulative effects can be reasonably anticipated. Based on these conclusions, the proposed park development will cause **no effect** to this species.

- While Sinking Creek is suitable habitat for the Ozark hellbender, no specimens were found during an exploratory survey by USFWS biologists in October 2014. However, the project lies upstream from a known suitable habitat, the Current River. No direct effects to the species will occur due to project activities, and indirect effects will be managed through the proper use of BMPs. Due to the planned avoidance measures during construction and the distance from known Ozark hellbender habitat, the proposed park development project **may affect, but not likely to adversely affect**, this species.

- The Gray bat is known to exist within caves around the project area, however no project park development actions are planned to impact the cave systems. The planned park activities near cave SHN529 are designed to keep future visitors only on the designated paths by building a boardwalk with side rails. This will also decrease impacts to the surrounding foraging area, leaving the forest understory intact from human foot traffic. The tree clearing associated with the park activities will have some indirect effects on foraging habitat, however. USFWS consultation throughout the surveys and project planning was prioritized to ensure compliance with all Endangered Species Act regulations regarding clearing in known areas of critical habitat. Based on these conclusions, the proposed park development project **may affect, but not likely to adversely affect**, this species.

- Indiana bats are found within the project area, and their preferred habitat has been documented from previous surveys. Tree clearing is a planned action as part of construction of roads, camp grounds, and wastewater disposal facilities. USFWS consultation throughout the surveys and project planning was prioritized to ensure compliance with all Endangered Species Act regulations regarding clearing in known areas of preferred habitat. In order to minimize project activity impacts to Indiana bat roosting habitat, clearing activities will avoid all identified roost trees. Impact avoidance will also be accomplished by minimizing the size of the tree clearance area as well as completing clearing activities between November 1st and April 1st. Based on these conclusions the proposed project actions **may affect, but not likely to adversely affect** this species.

- Northern long-eared bats are found within the project area, and their preferred habitat has been documented from previous surveys. Tree clearing is a planned action as part of construction of roads, camp grounds, and wastewater disposal facilities. USFWS consultation throughout the surveys and project planning was prioritized to ensure compliance with all Endangered Species Act regulations regarding clearing in known areas of preferred habitat. In order to minimize project activity impacts to Northern long-eared bat roosting habitat, clearing activities will avoid all identified roost trees. Impact avoidance will also be accomplished by minimizing the size of the tree clearance area as well as completing clearing activities between November 1st and April 1st. Based on these conclusions, the proposed park development project **may affect, but not likely to adversely affect** this species.

NPS Ozark National Scenic Riverways Easement*:* A portion of this proposed relocated primary access road (approximately 1,170 linear feet) crosses an existing National Park Service (NPS) Scenic Easement. NPS has been consulted regarding this project use of their Ozark National Scenic Riverways Proposal Form. NPS indicated that their NEPA compliance will be completed as part of Federal Highway

Administration's (FHWA) review of the entire road project. NPS can accept categorical exclusions from other Federal bureaus as long as no resource impacts are above minor. A copy of this correspondence, which discusses the impacts to the scenic easement, is enclosed as Appendix I.

The only impact within this easement would be the potential for minor impact to threatened and endangered bat species due to limited tree clearing during construction of this roadway. This impact is being addressed through the Biological Assessment discussed above.

Environmental Commitments: At this time, no significant impacts are associated with the project. However, the following activities are necessary:

- A Section 404 Nationwide permit from the USACE and a Section 401 Water Quality Certification from MDNR will be obtained for the project. Any mitigation measures or best management practices identified in the 404 permit will be complied with during construction. If the USACE determines that compensatory mitigation is required, mitigation will be accomplished through the purchasing of credits from an approved stream mitigation bank, coordination with the Missouri Conservation Heritage Foundation Stream Stewardship Trust Fund or by enhancement of a degraded creek and/or tributary and its associated riparian corridor.

- A Storm Water Pollution Prevention Plan (SWPPP) will be implemented to prevent or minimize adverse impacts to streams, water courses, lakes, ponds, or other impoundments within and adjacent to the project area. Proper erosion and sediment control best management practices (BMPs) will also be implemented throughout construction to avoid impacts to state and federal threatened and endangered species.

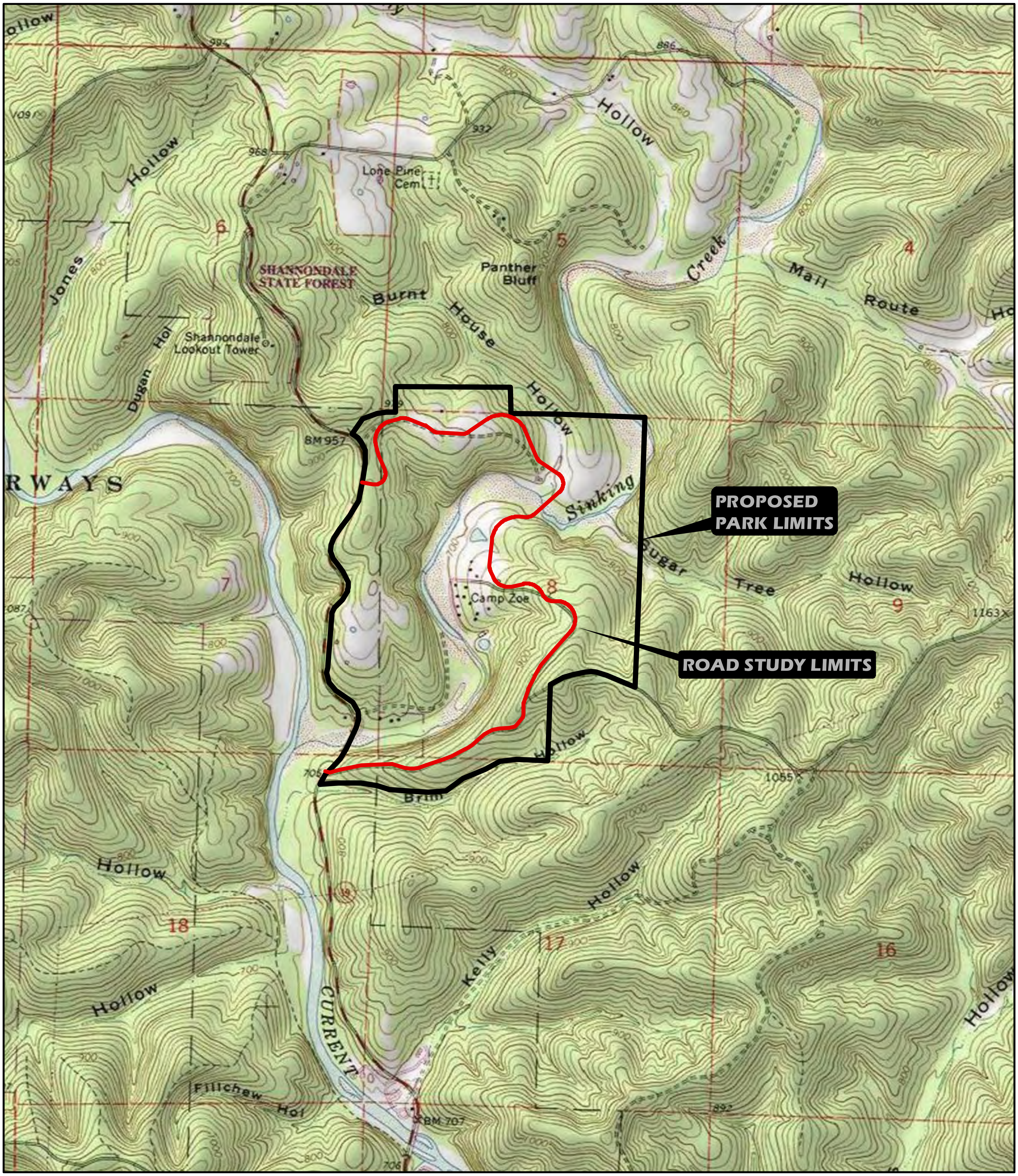
- To protect state-listed endangered or state-ranked species and known Shannon County karst areas, BMP's identified within the MDC Natural Heritage Review will be implemented.

- As part of the on-going Section 7 Consultation with the USFWS, a Biological Assessment (BA) has been prepared and submitted to the USFWS. Any avoidance or mitigation measures required as a result of this consultation will be conducted.

- Any previously unknown hazardous waste sites that are found during project construction will be handled in accordance with applicable federal and state laws and regulations. If regulated solid or hazardous wastes are found during construction activities, the construction inspector will direct the contractor to cease work at the suspect site. An appropriate environmental specialist will be contacted to discuss options for remediation. The environmental specialist and the consultant will develop a plan for sampling, remediation, and continuation of project construction. Independent consulting, analytical, and remediation services will be contracted if necessary. As appropriate, the Missouri DNR and U.S. Environmental Protection Agency will be contacted for coordination and approval of required activities.

- If changes in the project footprint or scope occur that were not evaluated in this document, MODOT shall update the NEPA document to ensure that determinations remain valid.

APPENDIX A



PROJECT NAME		
CAMP ZOE ROADWAY		
SHANNON COUNTY, MISSOURI		
VICINITY AND TOPOGRAPHIC MAP		
DRAWN BY RCV	**DATE**	**JOB NUMBER**
CHECKED BY RJG	09/2014	2014-7007.20

GENERAL NOTES/LEGEND

USGS TOPOGRAPHIC MAP
ROUND SPRING, MISSOURI QUADRANGLE
DATED 1982
PHOTO REVISED 1985
20' CONTOURS

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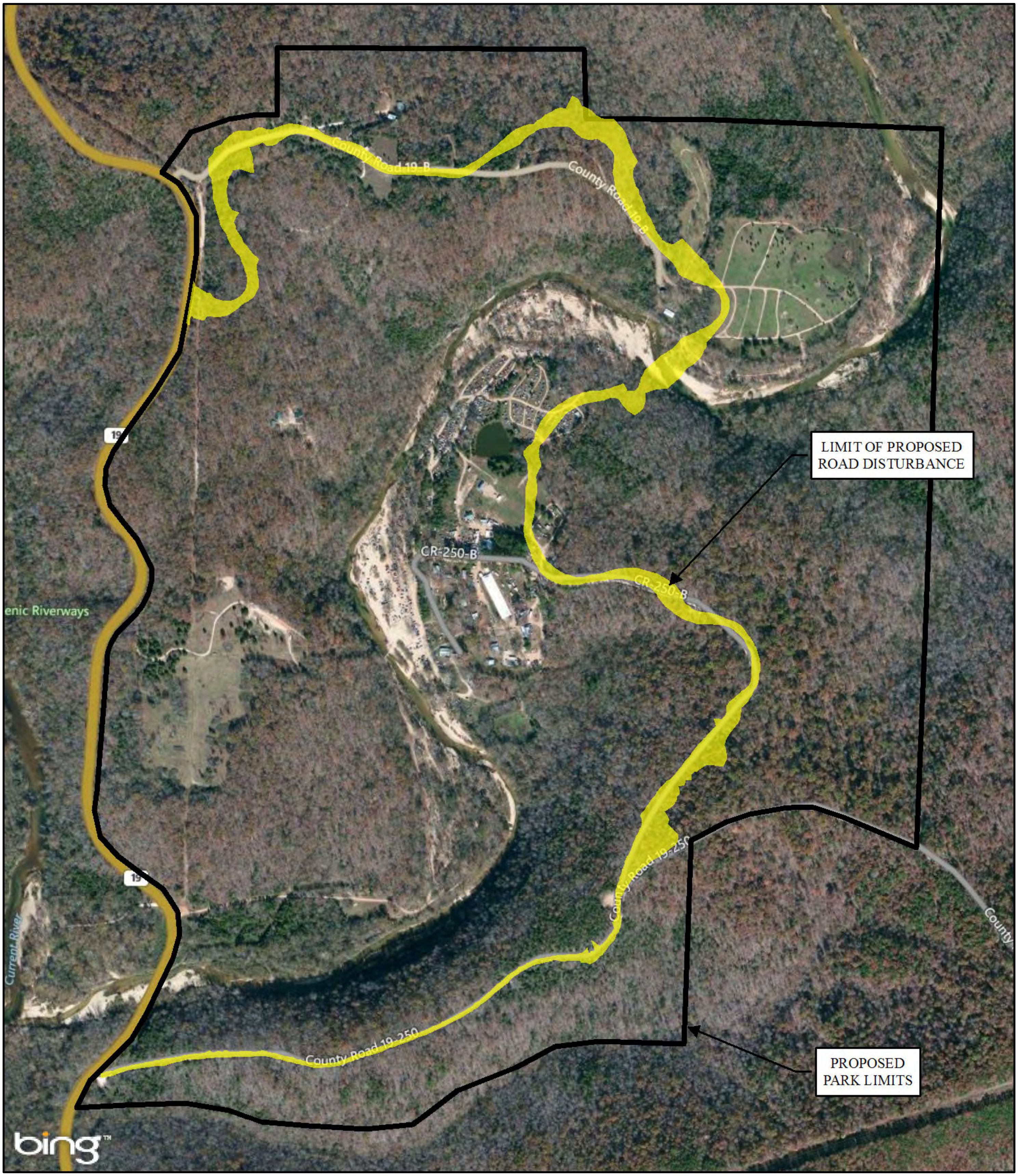
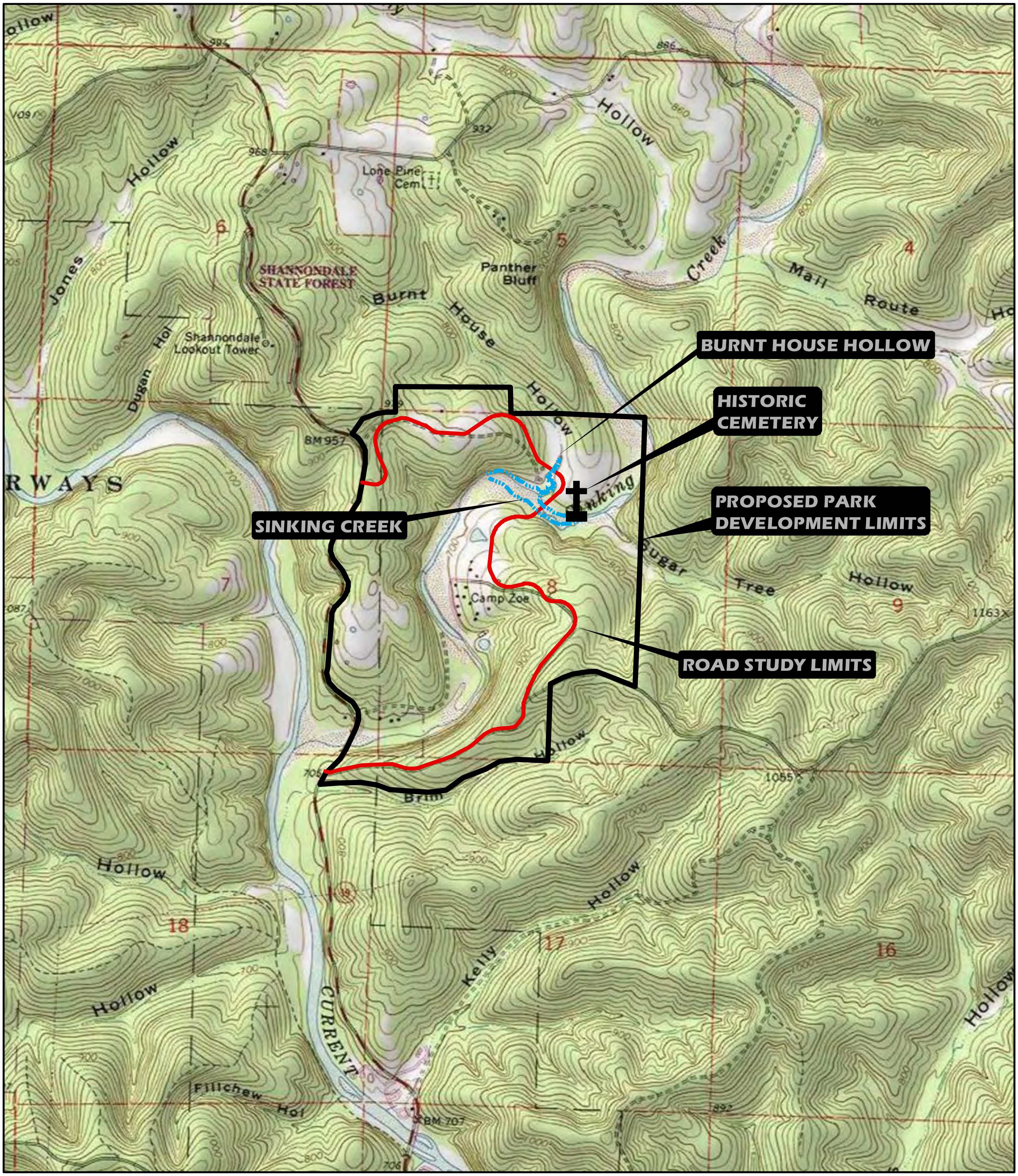
SCALE 1" = 2,000'

FIGURE 1



PROJECT NAME CAMP ZOE ROADWAY SHANNON COUNTY, MISSOURI			GENERAL NOTES/LEGEND	N W E S	
AERIAL PHOTOGRAPH				SCALE	1" = 750'
DRAWN BY RCV	DATE	JOB NUMBER			
CHECKED BY RJG	09/2014	2014-7007.20	AERIAL PHOTOGRAPH OBTAINED FROM BING MAPS VIA ARCGIS ONLINE.	FIGURE	2



PROJECT NAME
CAMP ZOE ROADWAY
SHANNON COUNTY, MISSOURI

IDENTIFIED RESOURCES WITHIN THE ROADWAY PROJECT

DRAWN BY	RCV	DATE	JOB NUMBER
CHECKED BY	RJG	11/2014	2014-7007.20

GENERAL NOTES/LEGEND
USGS TOPOGRAPHIC MAP
ROUND SPRING, MISSOURI QUADRANGLE
DATED 1982
PHOTO REVISED 1985
20' CONTOURS

N
W E
S

SCALE 1" = 2,000'

FIGURE 3

APPENDIX B

SCI ENGINEERING, INC.
CONSULTANTS IN DEVELOPMENT, DESIGN AND CONSTRUCTION
GEOTECHNICAL
ENVIRONMENTAL
NATURAL RESOURCES
CULTURAL RESOURCES
CONSTRUCTION SERVICES

August 6, 2014

Mr. Randy C. Miller
District Conservationist
USDA – Natural Resources Conservation Service
124 South Main Highway 19
P.O. Box 297
Eminence, Missouri 65466

RE: Coordination for Farmland Conversion
X1414-04 Camp Zoe
Shannon County, Missouri
SCI No. 2014-7007.30, Task 400

Dear Mr. Miller:

SCI Engineering, Inc. (SCI) is requesting written notification from the U.S. Department of Agriculture Service Center (USDA) to assist the above-referenced project in complying with the Farmland Preservation Policy Act (FPPA). As indicated on the General Form AD-1006 (enclosed), the Federal Highway Administration (FHWA) will be the funding agency for the project. We are requesting that the USDA determine the presence or absence of any prime or unique farmland within the project area.

This approximate 490-acre project area is located in Section 8 of Township 30N, Range 4W in north-central Shannon County, Missouri. The lower portion of Sinking Creek traverses the project area from northeast to southwest and forms a major attraction of the campground. Situated roughly 10.5 miles north of Eminence, Missouri, the property is currently a campground with numerous associated facilities. These facilities are in poor condition and are slated for demolition and removal. The proposed project will feature construction of a lodge, cabins, a general store, roads, utilities, septic systems and realignment of roads within the campground.

We are providing the USDA with the following:

- General Form AD-1006
- Figure 1: Vicinity and Topographic Map
- Figure 2: Aerial Photograph

Once you have completed Parts II, IV, and V, please forward Form AD-1006 to the following address:

SCI Engineering, Inc.
Attn: Mr. Rick Gundlach
130 Point West Boulevard
St. Charles, Missouri 63301

If you have any questions regarding this information please contact Mr. Rick Gundlach at (636) 757-1017 or rgundlach@scinengineering.com.

Respectfully,

SCI ENGINEERING, INC.

Rick J. Gundlach
Senior Staff Scientist

Scott D. Harding, CPSS/SC
Vice President

RJG/SEB/SDH/tlw

Enclosures
- General form AD-1006
- Figure 1: Vicinity and Topographic Map
- Figure 2: Aerial Photograph

\\SCISTCFPS01\StCharles\shared\1soils\1NEW\PROJECT FILES\Springfield\2014 Project Files\2014-7007 Camp Zoe Rehab\NR\CE\Prime and Unique Farmland Correspondence\2012-5077.30, Task 400_ Farmland Conversion Form Cover Letter.doc

U.S. Department of Agriculture

FARMLAND CONVERSION IMPACT RATING

PART I *(To be completed by Federal Agency)*	Date Of Land Evaluation Request 8/6/14
Name Of Project X1414-04 Camp Zoe	Federal Agency Involved FHA
Proposed Land Use Recreational state park	County And State Shannon, Missouri
PART II *(To be completed by NRCS)*	Date Request Received By NRCS

Does the site contain prime, unique, statewide or local important farmland? *(If no, the FPPA does not apply -- do not complete additional parts of this form).*	Yes ☑ No ☐	Acres Irrigated	Average Farm Size
Major Crop*(s)* Corn	Farmable Land In Govt. Jurisdiction Acres: 77,093 % 16		Amount Of Farmland As Defined in FPPA Acres: 113,235 % 23
Name Of Land Evaluation System Used LESA	Name Of Local Site Assessment System none		Date Land Evaluation Returned By NRCS 8/7/14

PART III *(To be completed by Federal Agency)*	Maximum Points	Alternative Site Rating Site A	Site B	Site C	Site D
A. Total Acres To Be Converted Directly		0.0			
B. Total Acres To Be Converted Indirectly		0.0			
C. Total Acres In Site		0.0	0.0	0.0	0.0
PART IV *(To be completed by NRCS)* Land Evaluation Information					
A. Total Acres Prime And Unique Farmland		17.0			
B. Total Acres Statewide And Local Important Farmland		25.0			
C. Percentage Of Farmland In County Or Local Govt. Unit To Be Converted		0.0			
D. Percentage Of Farmland In Govt. Jurisdiction With Same Or Higher Relative Value		18.3			
PART V *(To be completed by NRCS)* Land Evaluation Criterion Relative Value Of Farmland To Be Converted *(Scale of 0 to 100 Points)*		29	0	0	0
PART VI *(To be completed by Federal Agency)* Site Assessment Criteria *(These criteria are explained in 7 CFR 658.5(b)*	Maximum Points				
1. Area In Nonurban Use		15			
2. Perimeter In Nonurban Use		10			
3. Percent Of Site Being Farmed		0			
4. Protection Provided By State And Local Government		20			
5. Distance From Urban Builtup Area		15			
6. Distance To Urban Support Services		10			
7. Size Of Present Farm Unit Compared To Average		0			
8. Creation Of Nonfarmable Farmland		0			
9. Availability Of Farm Support Services		0			
10. On-Farm Investments		0			
11. Effects Of Conversion On Farm Support Services		1			
12. Compatibility With Existing Agricultural Use		0			
TOTAL SITE ASSESSMENT POINTS	160	71	0	0	0
PART VII *(To be completed by Federal Agency)*					
Relative Value Of Farmland *(From Part V)*	100	29	0	0	0
Total Site Assessment *(From Part VI above or a local site assessment)*	160	71	0	0	0
TOTAL POINTS *(Total of above 2 lines)*	260	100	0	0	0

Site Selected:	Date Of Selection	Was A Local Site Assessment Used? Yes ☐ No ☐

Reason For Selection:

(See Instructions on reverse side) **Form AD-1006 (10-83)**

This form was electronically produced by National Production Services Staff

STEPS IN THE PROCESSING THE FARMLAND AND CONVERSION IMPACT RATING FORM

Step 1 – Federal agencies involved in proposed projects that may convert farmland, as defined in the Farmland Protection Policy Act (FPPA) to nonagricultural uses, will initially complete Parts I and III of the form.

Step 2 – Originator will send copies A, B and C together with maps indicating locations of site(s), to the Natural Resources Conservation Service (NRCS) local field office and retain copy D for their files. (Note: NRCS has a field office in most counties in the U.S. The field office is usually located in the county seat. A list of field office locations are available from the NRCS State Conservationist in each state).

Step 3 – NRCS will, within 45 calendar days after receipt of form, make a determination as to whether the site(s) of the proposed project contains prime, unique, statewide or local important farmland.

. Step '4 – In cases where farmland covered by the FPPA will be converted by the proposed project, NRCS field offices will complete Parts II, IV and V of the form.

Step 5 – NRCS will return copy A and B of the form to the Federal agency involved in the project. (Copy C will be retained for NRCS records).

Step 6 – The Federal agency involved in the proposed project will complete Parts VI and VII of the form.

Step 7 – The Federal agency involved in the proposed project will make a determination as to whether the proposed conversion is consistent with the FPPA and the agency's internal policies.

INSTRUCTIONS FOR COMPLETING THE FARMLAND CONVERSION IMPACT RATING FORM

Part I: In completing the "County And State" questions list all the local governments that are responsible for local land controls where site(s) are to be evaluated.

Part III: In completing item B (Total Acres To Be Converted Indirectly), include the following:

1. Acres not being directly converted but that would no longer be capable of being farmed after the conversion, because the conversion would restrict access to them.

2. Acres planned to receive services from an infrastructure project as indicated in the project justification (e.g. highways, utilities) that will cause a direct conversion.

Part VI: Do not complete Part VI if a local site assessment is used.

Assign the maximum points for each site assessment criterion as shown in § 658.5 (b) of CFR. In cases of corridor-type projects such as transportation, powerline and flood control, criteria #5 and #6 will not apply and will, be weighed zero, however, criterion #8 will be weighed a maximum of 25 points, and criterion #11 a maximum of 25 points.

Individual Federal agencies at the national level, may assign relative weights among the 12 site assessment criteria other than those shown in the FPPA rule. In all cases where other weights are assigned relative adjustments must be made to maintain the maximum total weight points at l60.

In rating alternative sites, Federal agencies shall consider each of the criteria and assign points within the limits established in the FPPA rule. Sites most suitable for protection under these criteria will receive the highest total scores, and sites least suitable, the lowest scores.

Part VII: In computing the "Total Site Assessment Points" where a State or local site assessment is used and the total maximum number of points is other than 160, adjust the site assessment points to a base of 160. Example: if the Site Assessment maximum is 200 points, and alternative Site "A" is rated 180 points:

$$\frac{\text{Total points assigned Site A}}{\text{Maximum points possible}} = \frac{180}{200} \times 160 = 144 \text{ points for Site "A."}$$

Site Assessment Scoring for the Twelve Factors Used in FPPA

The Site Assessment criteria used in the Farmland Protection Policy Act (FPPA) rule are designed to assess important factors other than the agricultural value of the land when determining which alternative sites should receive the highest level of protection from conversion to non agricultural uses.

Twelve factors are used for Site Assessment and ten factors for corridor-type sites. Each factor is listed in an outline form, without detailed definitions or guidelines to follow in the rating process. The purpose of this document is to expand the definitions of use of each of the twelve Site Assessment factors so that all persons can have a clear understanding as to what each factor is intended to evaluate and how points are assigned for given conditions.

In each of the 12 factors a number rating system is used to determine which sites deserve the most protection from conversion to non-farm uses. The higher the number value given to a proposed site, the more protection it will receive. The maximum scores are 10, 15 and 20 points, depending upon the relative importance of each particular question. If a question significantly relates to why a parcel of land should not be converted, the question has a maximum possible protection value of 20, whereas a question which does not have such a significant impact upon whether a site would be converted, would have fewer maximum points possible, for example 10.

The following guidelines should be used in rating the twelve Site Assessment criteria:

1. How much land is in non-urban use within a radius of 1.0 mile from where the project is intended?

More than 90 percent:	15 points
90-20 percent:	14 to 1 points
Less than 20 percent:	0 points

This factor is designed to evaluate the extent to which the area within one mile of the proposed site is non-urban area. For purposes of this rule, "non-urban" should include:

- Agricultural land (crop-fruit trees, nuts, oilseed)
- Range land
- Forest land
- Golf Courses
- Non paved parks and recreational areas
- Mining sites
- Farm Storage
- Lakes, ponds and other water bodies
- Rural roads, and through roads without houses or buildings
- Open space
- Wetlands
- Fish production
- Pasture or hayland

Urban uses include:

- Houses (other than farm houses)
- Apartment buildings
- Commercial buildings
- Industrial buildings
- Paved recreational areas (i.e. tennis courts)
- Streets in areas with 30 structures per 40 acres
- Gas stations

- Equipment, supply stores
- Off-farm storage
- Processing plants
- Shopping malls
- Utilities/Services
- Medical buildings

In rating this factor, an area one-mile from the outer edge of the proposed site should be outlined on a current photo; the areas that are urban should be outlined. For rural houses and other buildings with unknown sizes, use 1 and 1/3 acres per structure. For roads with houses on only one side, use one half of road for urban and one half for non-urban.

The purpose of this rating process is to insure that the most valuable and viable farmlands are protected from development projects sponsored by the Federal Government. With this goal in mind, factor S1 suggests that the more agricultural lands surrounding the parcel boundary in question, the more protection from development this site should receive. Accordingly, a site with a large quantity of non-urban land surrounding it will receive a greater
number of points for protection from development. Thus, where more than 90 percent of the area around the proposed site (do not include the proposed site in this assessment) is non-urban, assign 15 points. Where 20 percent or less is
non-urban, assign 0 points. Where the area lies between 20 and 90 percent non-urban, assign appropriate points from 14 to 1, as noted below.

Percent Non-Urban Land within 1 mile	**Points**
90 percent or greater	15
85 to 89 percent	14
80 to 84 percent	13
75 to 79 percent	12
70 to 74 percent	11
65 to 69 percent	10
60 to 64 percent	9
55 to 59 percent	8
50 to 54 percent	7
45 to 49 percent	6
40 to 44 percent	5
35 to 39 percent	4
30 to 24 percent	3
25 to 29 percent	2
21 to 24 percent	1
20 percent or less	0

2. How much of the perimeter of the site borders on land in non-urban use?

More than 90 percent:	l0 points
90 to 20 percent:	9 to 1 point(s)
Less than 20 percent:	0 points

This factor is designed to evaluate the extent to which the land adjacent to the proposed site is non-urban use. Where factor #1 evaluates the general location of the proposed site, this factor evaluates the immediate perimeter of the site. The definition of urban and non-urban uses in factor #1 should be used for this factor.

In rating the second factor, measure the perimeter of the site that is in non-urban and urban use. Where more than 90 percent of the perimeter is in non-urban use, score this factor 10 points. Where less than 20 percent, assign 0 points. If a road is next to the perimeter, class the area according to the use on the other side of the road for that area. Use 1 and 1/3 acre per structure if not otherwise known. Where 20 to 90 percent of the perimeter is non-urban, assign points as noted below:

Percentage of Perimeter Bordering Land	Points
90 percent or greater	10
82 to 89 percent	9
74 to 81 percent	8
65 to 73 percent	7
58 to 65 percent	6
50 to 57 percent	5
42 to 49 percent	4
34 to 41 percent	3
27 to 33 percent	2
21 to 26 percent	1
20 percent or Less	0

3. How much of the site has been farmed (managed for a scheduled harvest or timber activity) more than five of the last ten years?

More than 90 percent:	20 points
90 to 20 percent:	19 to 1 point(s)
Less than 20 percent:	0 points

This factor is designed to evaluate the extent to which the proposed conversion site has been used or managed for agricultural purposes in the past 10 years.

Land is being farmed when it is used or managed for food or fiber, to include timber products, fruit, nuts, grapes, grain, forage, oil seed, fish and meat, poultry and dairy products.

Land that has been left to grow up to native vegetation without management or harvest will be considered as abandoned and therefore not farmed. The proposed conversion site should be evaluated and rated according to the percent, of the site farmed.

If more than 90 percent of the site has been farmed 5 of the last 10 years score the site as follows:

Percentage of Site Farmed	Points
90 percent or greater	20
86 to 89 percent	19
82 to 85 percent	18
78 to 81 percent	17
74 to 77 percent	16
70 to 73 percent	15
66 to 69 percent	14
62 to 65 percent	13
58 to 61 percent	12
54 to 57 percent	11
50 to 53 percent	10
46 to 49 percent	9
42 to 45 percent	8
38 to 41 percent	7
35 to 37 percent	6
32 to 34 percent	5
29 to 31 percent	4
26 to 28 percent	3

23 to 25 percent	2
20 to 22 percent percent or Less	1
Less than 20 percent	0

4. Is the site subject to state or unit of local government policies or programs to protect farmland or covered by private programs to protect farmland?

Site is protected:	20 points
Site is not protected:	0 points

This factor is designed to evaluate the extent to which state and local government and private programs have made efforts to protect this site from conversion.

State and local policies and programs to protect farmland include:

State Policies and Programs to Protect Farmland

1. Tax Relief:

A. Differential Assessment: Agricultural lands are taxed on their agricultural use value, rather than at market value. As a result, farmers pay fewer taxes on their land, which helps keep them in business, and therefore helps to insure that the farmland will not be converted to nonagricultural uses.

1. Preferential Assessment for Property Tax: Landowners with parcels of land used for agriculture are given the privilege of differential assessment.

2. Deferred Taxation for Property Tax: Landowners are deterred from converting their land to nonfarm uses, because if they do so, they must pay back taxes at market value.

3. Restrictive Agreement for Property Tax: Landowners who want to receive Differential Assessment must agree to keep their land in - eligible use.

B. Income Tax Credits

Circuit Breaker Tax Credits: Authorize an eligible owner of farmland to apply some or all of the property taxes on his or her farmland and farm structures as a tax credit against the owner's state income tax.

C. Estate and Inheritance Tax Benefits

Farm Use Valuation for Death Tax: Exemption of state tax liability to eligible farm estates.

2. "Right to farm" laws:

Prohibits local governments from enacting laws which will place restrictions upon normally accepted farming practices, for example, the generation of noise, odor or dust.

3. Agricultural Districting:

Wherein farmers voluntarily organize districts of agricultural land to be legally recognized geographic areas. These farmers receive benefits, such as protection from annexation, in exchange for keeping land within the district for a given number of years.

4. Land Use Controls: Agricultural Zoning.

Types of Agricultural Zoning Ordinances include:

A. Exclusive: In which the agricultural zone is restricted to only farm-related dwellings, with, for example, a minimum of 40 acres per dwelling unit.

B. Non-Exclusive: In which non-farm dwellings are allowed, but the density remains low, such as 20 acres per dwelling unit.

Additional Zoning techniques include:

A. Slidinq Scale: This method looks at zoning according to the total size of the parcel owned. For example, the number of dwelling units per a given number of acres may change from county to county according to the existing land acreage to dwelling unit ratio of surrounding parcels of land within the specific area.

B. Point System or Numerical Approach: Approaches land use permits on a case by case basis.

   LESA: The LESA system (Land Evaluation-Site Assessment) is used as a tool to help assess options for land use on an evaluation of productivity weighed against commitment to urban development.

C. Conditional Use: Based upon the evaluation on a case by case basis by the Board of Zoning Adjustment. Also may include the method of using special land use permits.

5. Development Rights:

   A. Purchase of Development Rights (PDR): Where development rights are purchased by Government action.

      Buffer Zoning Districts: Buffer Zoning Districts are an example of land purchased by Government action. This land is included in zoning ordinances in order to preserve and protect agricultural lands from non-farm land uses encroaching upon them.

   B. Transfer of Development Rights (TDR): Development rights are transferable for use in other locations designated as receiving areas. TDR is considered a locally based action (not state), because it requires a voluntary decision on the part of the individual landowners.

6. Governor’s Executive Order: Policy made by the Governor, stating the importance of agriculture, and the preservation of agricultural lands. The Governor orders the state agencies to avoid the unnecessary conversion of important farmland to nonagricultural uses.

7. Voluntary State Programs:

   A. California's Program of Restrictive Agreements and Differential Assessments: The California Land Conservation Act of 1965, commonly known as the Williamson Act, allows cities, counties and individual landowners to form agricultural preserves and enter into contracts for 10 or more years to insure that these parcels of land remain strictly for agricultural use. Since 1972 the Act has extended eligibility to recreational and open space lands such as scenic highway corridors, salt ponds and wildlife preserves. These contractually restricted lands may be taxed differentially for their real value. One hundred-acre districts constitute the minimum land size eligible.

      Suggestion: An improved version of the Act would state that if the land is converted after the contract expires, the landowner must pay the difference in the taxes between market value for the land and the agricultural tax value which he or she had been paying under the Act. This measure would help to insure that farmland would not be converted after the 10 year period ends.

B. Maryland Agricultural Land Preservation Program: Agricultural landowners within agricultural districts have the opportunity to sell their development rights to the Maryland Land Preservation Foundation under the agreement that these landowners will not subdivide or develop their land for an initial period of five years. After five years the landowner may terminate the agreement with one year notice.

   As is stated above under the California Williamson Act, the landowner should pay the back taxes on the property if he or she decides to convert the land after the contract expires, in order to discourage such conversions.

C. Wisconsin Income Tax Incentive Program: The Wisconsin Farmland Preservation Program of December 1977 encourages local jurisdictions in Wisconsin to adopt agricultural preservation plans or exclusive agricultural district zoning ordinances in exchange for credit against state income tax and exemption from special utility assessment. Eligible candidates include local governments and landowners with at least 35 acres of land per dwelling unit in agricultural use and gross farm profits of at least $6.000 per year, or $18,000 over three years.

8. Mandatory State Programs:

   A. The Environmental Control Act in the state of Vermont was adopted in 1970 by the Vermont State Legislature. The Act established an environmental board with 9 members (appointed by the Governor) to implement a planning process and a permit system to screen most subdivisions and development proposals according to specific criteria stated in the law. The planning process consists of an interim and a final Land Capability and Development Plan, the latter of which acts as a policy plan to control development. The policies are written in order to:

      - prevent air and water pollution;
      - protect scenic or natural beauty, historic sites and rare and irreplaceable natural areas; and
      - consider the impacts of growth and reduction of development on areas of primary agricultural soils.

   B. The California State Coastal Commission: In 1976 the Coastal Act was passed to establish a permanent Coastal Commission with permit and planning authority The purpose of the Coastal Commission was and is to protect the sensitive coastal zone environment and its resources, while accommodating the social and economic needs of the state. The Commission has the power to regulate development in the coastal zones by issuing permits on a case by case basis until local agencies can develop their own coastal plans, which must be certified by the Coastal Commission.

   C. Hawaii's Program of State Zoning: In 1961, the Hawaii State Legislature established Act 187, the Land Use Law, to protect the farmland and the welfare of the local people of Hawaii by planning to avoid "unnecessary urbanization". The Law made all state lands into four districts: agricultural, conservation, rural and urban. The Governor appointed members to a State Land Use Commission, whose duties were to uphold the Law and form the boundaries of the four districts. In addition to state zoning, the Land Use Law introduced a program of Differential Assessment, wherein agricultural landowners paid taxes on their land for its agricultural use value, rather than its market value.

   D. The Oregon Land Use Act of 1973: This act established the Land Conservation and Development Commission (LCDC) to provide statewide planning goals and guidelines.

Under this Act, Oregon cities and counties are each required to draw up a comprehensive plan, consistent with statewide planning goals. Agricultural land preservation is high on the list of state goals to be followed locally.

If the proposed site is subject to or has used one or more of the above farmland protection programs or policies, score the site 20 points. If none of the above policies or programs apply to this site, score 0 points.

5. How close is the site to an urban built-up area?

The site is 2 miles or more from an urban built-up area	15 points
The site is more than 1 mile but less than 2 miles from an urban built-up area	10 points
The site is less than 1 mile from, but is not adjacent to an urban built-up area	5 points
The site is adjacent to an urban built-up area	0 points

This factor is designed to evaluate the extent to which the proposed site is located next to an existing urban area. The urban built-up area must be 2500 population. The measurement from the built-up area should be made from the point at which the density is 30 structures per 40 acres and with no open or non-urban land existing between the major built-up areas and this point. Suburbs adjacent to cities or urban built-up areas should be considered as part of that urban area.

For greater accuracy, use the following chart to determine how much protection the site should receive according to its distance from an urban area. See chart below:

Distance From Perimeter of Site to Urban Area	Points
More than 10,560 feet	15
9,860 to 10,559 feet	14
9,160 to 9,859 feet	13
8,460 to 9,159 feet	12
7,760 to 8,459 feet	11
7,060 to 7,759 feet	10
6,360 to 7,059 feet	9
5,660 to 6,359 feet	8
4,960 to 5,659 feet	7
4,260 to 4,959 feet	6
3,560 to 4,259 feet	5
2,860 to 3,559 feet	4
2,160 to 2,859 feet	3
1,460 to 2,159 feet	2
760 to 1,459 feet	1
Less than 760 feet (adjacent)	0

6. How close is the site to water lines, sewer lines and/or other local facilities and services whose capacities and design would promote nonagricultural use?

None of the services exist nearer than 3 miles from the site	15 points
Some of the services exist more than one but less than 3 miles from the site	10 points
All of the services exist within 1/2 mile of the site	0 points

This question determines how much infrastructure (water, sewer, etc.) is in place which could facilitate nonagricultural development. The fewer facilities in place, the more difficult it is to develop an area. Thus, if a proposed site is further away from these services (more than 3 miles distance away), the site should be awarded the highest number of points (15). As the distance of the parcel of land to services decreases, the number of points awarded declines as well. So, when the site is equal to or further than 1 mile but less than 3 miles away from services, it should be given 10 points. Accordingly, if this distance is 1/2 mile to less than 1 mile, award 5 points; and if the distance from land to services is less than 1/2 mile, award 0 points.

Distance to public facilities should be measured from the perimeter of the parcel in question to the nearest site(s) where necessary facilities are located. If there is more than one distance (i.e. from site to water and from site to sewer), use the average distance (add all distances and then divide by the number of different distances to get the average).

Facilities which could promote nonagricultural use include:

- Water lines
- Sewer lines
- Power lines
- Gas lines
- Circulation (roads)
- Fire and police protection
- Schools

7. Is the farm unit(s) containing the site (before the project) as large as the average-size farming unit in the county? (Average farm sizes in each county are available from the NRCS field offices in each state. Data are from the latest available Census of Agriculture, Acreage of Farm Units in Operation with $1,000 or more in sales.)

As large or larger:	10 points
Below average: Deduct 1 point for each 5 percent below the average, down to 0 points if 50 percent or more is below average	9 to 0 points

This factor is designed to determine how much protection the site should receive, according to its size in relation to the average size of farming units within the county. The larger the parcel of land, the more agricultural use value the land possesses, and vice versa. Thus, if the farm unit is as large or larger than the county average, it receives the maximum number of points (10). The smaller the parcel of land compared to the county average, the fewer number of points given. Please see below:

Parcel Size in Relation to Average County Size	**Points**
Same size or larger than average (l00 percent)	10
95 percent of average	9
90 percent of average	8
85 percent of average	7
80 percent of average	6
75 percent of average	5
70 percent of average	4
65 percent of average	3
60 percent of average	2
55 percent of average	1
50 percent or below county average	0

State and local Natural Resources Conservation Service offices will have the average farm size information, provided by the latest available Census of Agriculture data

8. If this site is chosen for the project, how much of the remaining land on the farm will become non-farmable because of interference with land patterns?

Acreage equal to more than 25 percent of acres directly converted by the project	10 points
Acreage equal to between 25 and 5 percent of the acres directly converted by the project	9 to 1 point(s)
Acreage equal to less than 5 percent of the acres directly converted by the project	0 points

This factor tackles the question of how the proposed development will affect the rest of the land on the farm The site which deserves the most protection from conversion will receive the greatest number of points, and vice versa. For example, if the project is small, such as an extension on a house, the rest of the agricultural land would remain farmable, and thus a lower number of points is given to the site. Whereas if a large-scale highway is planned, a greater portion of the land (not including the site) will become non-farmable, since access to the farmland will be blocked; and thus, the site should receive the highest number of points (10) as protection from conversion

Conversion uses of the Site Which Would Make the Rest of the Land Non-Farmable by Interfering with Land Patterns

Conversions which make the rest of the property nonfarmable include any development which blocks accessibility to the rest of the site Examples are highways, railroads, dams or development along the front of a site restricting access to the rest of the property.

The point scoring is as follows:

Amount of Land Not Including the Site Which Will Become Non-Farmable	**Points**
25 percent or greater	10
23 - 24 percent	9
21 - 22 percent	8
19 - 20 percent	7
17 - 18 percent	6
15 - 16 percent	5
13 - 14 percent	4
11 - 12 percent	3
9 - 11 percent	2
6 - 8 percent	1
5 percent or less	0

9. Does the site have available adequate supply of farm support services and markets, i.e., farm suppliers, equipment dealers, processing and storage facilities and farmer's markets?

All required services are available	5 points
Some required services are available	4 to 1 point(s)
No required services are available	0 points

This factor is used to assess whether there are adequate support facilities, activities and industry to keep the farming business in business. The more support facilities available to the agricultural landowner, the more feasible it is for him or her to stay in production. In addition, agricultural support facilities are compatible with farmland. This fact is important, because some land uses are not compatible; for example, development next to farmland cam be dangerous to the welfare of the agricultural land, as a result of pressure from the neighbors who often do not appreciate the noise, smells and dust intrinsic to farmland. Thus, when all required agricultural support services are available, the maximum number of points (5) are awarded. When some services are available, 4 to 1 point(s) are awarded; and consequently, when no services are available, no points are given. See below:

Percent of Services Available	**Points**
100 percent	5
75 to 99 percent	4
50 to 74 percent	3
25 to 49 percent	2
1 to 24 percent	1
No services	0

10. Does the site have substantial and well-maintained on farm investments such as barns, other storage buildings, fruit trees and vines, field terraces, drainage, irrigation, waterways, or other soil and water conservation measures?

High amount of on-farm investment	20 points
Moderate amount of non-farm investment	19 to 1 point(s)
No on-farm investments	0 points

This factor assesses the quantity of agricultural facilities in place on the proposed site. If a significant agricultural infrastructure exists, the site should continue to be used for farming, and thus the parcel will receive the highest amount of points towards protection from conversion or development. If there is little on farm investment, the site will receive comparatively less protection. See-below:

Amount of On-farm Investment	**Points**
As much or more than necessary to maintain production (100 percent)	20
95 to 99 percent	19
90 to 94 percent	18
85 to 89 percent	17
80 to 84 percent	16
75 to 79 percent	15
70 to 74 percent	14
65 to 69 percent	13
60 to 64 percent	12
55 to 59 percent	11
50 to 54 percent	10
45 to 49 percent	9
40 to 44 percent	8
35 to 39 percent	7
30 to 34 percent	6
25 to 29 percent	5
20 to 24 percent	4
15 to 19 percent	3
10 to 14 percent	2
5 to 9 percent	1
0 to 4 percent	0

11. Would the project at this site, by converting farmland to nonagricultural use, reduce the support for farm support services so as to jeopardize the continued existence of these support services and thus, the viability of the farms remaining in the area?

Substantial reduction in demand for support services if the site is converted	10 points
Some reduction in demand for support services if the site is converted	9 to 1 point(s)
No significant reduction in demand for support services if the site is converted	0 points

This factor determines whether there are other agriculturally related activities, businesses or jobs dependent upon the working of the pre-converted site in order for the others to remain in production. The more people and farming activities relying upon this land, the more protection it should receive from conversion. Thus, if a substantial reduction in demand for support services were to occur as a result of conversions, the proposed site would receive a high score of 10; some reduction in demand would receive 9 to 1 point(s), and no significant reduction in demand would receive no points.

Specific points are outlined as follows:

Amount of Reduction in Support Services if Site is Converted to Nonagricultural Use	Points
Substantial reduction (100 percent)	10
90 to 99 percent	9
80 to 89 percent	8
70 to 79 percent	7
60 to 69 percent	6
50 to 59 percent	5
40 to 49 percent	4
30 to 39 percent	3
20 to 29 percent	2
10 to 19 percent	1
No significant reduction (0 to 9 percent)	0

12. Is the kind and intensity of the proposed use of the site sufficiently incompatible with agriculture that it is likely to contribute to the eventual conversion of the surrounding farmland to nonagricultural use?

Proposed project is incompatible with existing agricultural use of surrounding farmland	10 points
Proposed project is tolerable of existing agricultural use of surrounding farmland	9 to 1 point(s)
Proposed project is fully compatible with existing agricultural use of surrounding farmland	0 points

Factor 12 determines whether conversion of the proposed agricultural site will eventually cause the conversion of neighboring farmland as a result of incompatibility of use of the first with the latter. The more incompatible the proposed conversion is with agriculture, the more protection this site receives from conversion. Therefor-, if the proposed conversion is incompatible with agriculture, the site receives 10 points. If the project is tolerable with agriculture, it receives 9 to 1 points; and if the proposed conversion is compatible with agriculture, it receives 0 points.

CORRIDOR - TYPE SITE ASSESSMENT CRITERIA

The following criteria are to be used for projects that have a linear or corridor - type site configuration connecting two distant points, and crossing several different tracts of land. These include utility lines, highways, railroads, stream improvements, and flood control systems. Federal agencies are to assess the suitability of each corridor-type site or design alternative for protection as farmland along with the land evaluation information.

For Water and Waste Programs, corridor analyses are not applicable for distribution or collection networks. Analyses are applicable for transmission or trunk lines where placement of the lines are flexible.

(1) How much land is in nonurban use within a radius of 1.0 mile form where the project is intended?

(2) More than 90 percent	(3) 15 points
(4) 90 to 20 percent	(5) 14 to 1 point(s).
(6) Less than 20 percent	(7) 0 points

(2) How much of the perimeter of the site borders on land in nonurban use?

(3) More than 90 percent	(4) 10 point(s)
(5) 90 to 20 percent	(6) 9 to 1 points
(7) less than 20 percent	(8) 0 points

(3) How much of the site has been farmed (managed for a scheduled harvest or timber activity) more than five of the last 10 years?

(4) More than 90 percent	(5) 20 points
(6) 90 to 20 percent	(7) 19 to 1 point(s)
(8) Less than 20 percent	(9) 0 points

(4) Is the site subject to state or unit of local government policies or programs to protect farmland or covered by private programs to protect farmland?

Site is protected	20 points
Site is not protected	0 points

(5) Is the farm unit(s) containing the site (before the project) as large as the average - size farming unit in the County? (Average farm sizes in each county are available from the NRCS field offices in each state. Data are from the latest available Census of Agriculture, Acreage of Farm Units in Operation with $1,000 or more in sales.)

As large or larger	10 points
Below average deduct 1 point for each 5 percent below the average, down to 0 points if 50 percent or more below average	9 to 0 points

(6) If the site is chosen for the project, how much of the remaining land on the farm will become non-farmable because of interference with land patterns?

Acreage equal to more than 25 percent of acres directly converted by the project	25 points
Acreage equal to between 25 and 5 percent of the acres directly convened by the project	1 to 24 point(s)
Acreage equal to less than 5 percent of the acres directly converted by the project	0 points

(7) Does the site have available adequate supply of farm support services and markets, i.e., farm suppliers, equipment dealers, processing and storage facilities and farmer's markets?

All required services are available	5 points
Some required services are available	4 to 1 point(s)
No required services are available	0 points

(8) Does the site have substantial and well-maintained on-farm investments such as barns, other storage building, fruit trees and vines, field terraces, drainage, irrigation, waterways, or other soil and water conservation measures?

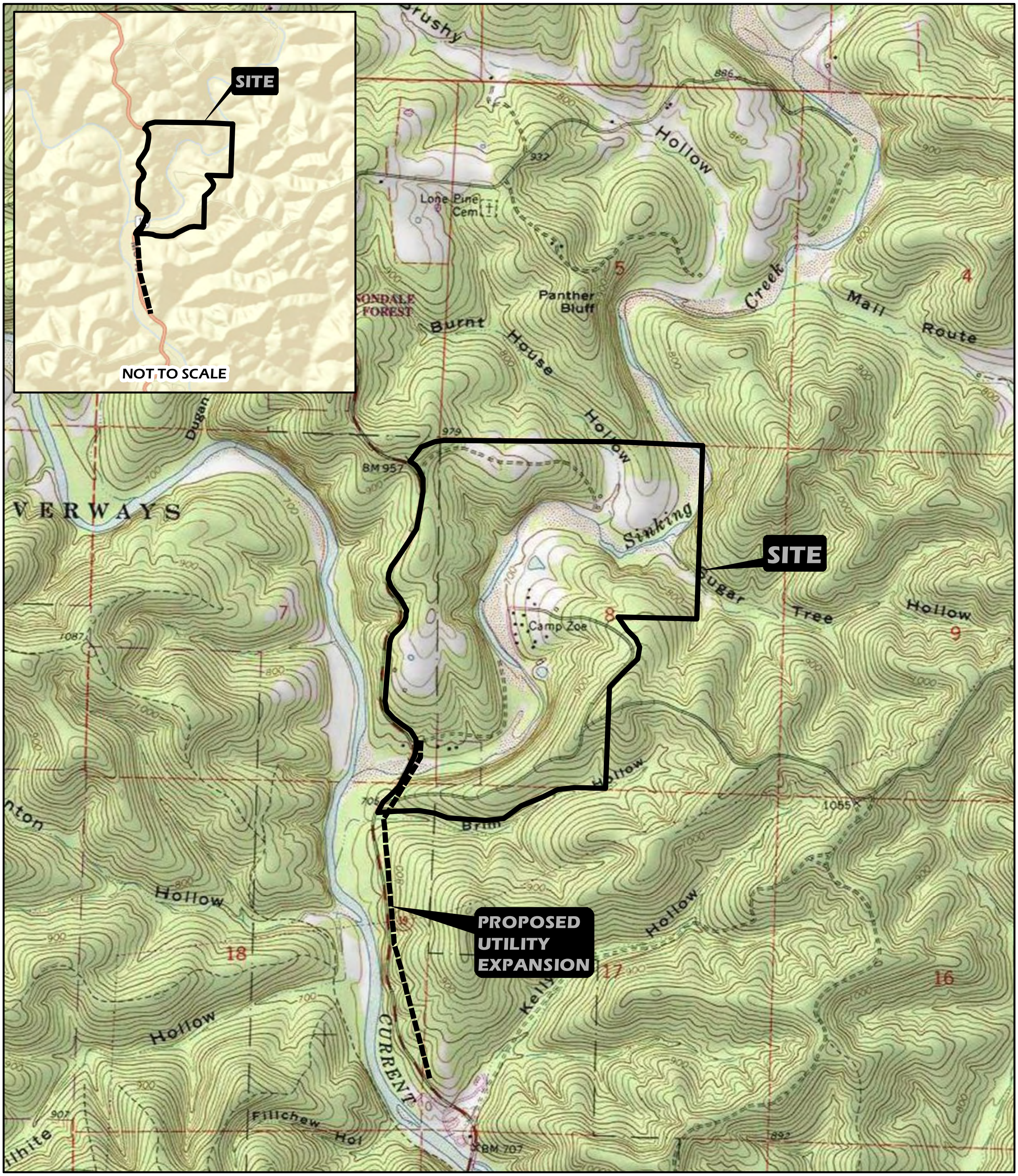
High amount of on-farm investment	20 points
Moderate amount of on-farm investment	19 to 1 point(s)
No on-farm investment	0 points

(9) Would the project at this site, by converting farmland to nonagricultural use, reduce the demand for farm support services so as to jeopardize the continued existence of these support services and thus, the viability of the farms remaining in the area?

Substantial reduction in demand for support services if the site is convened	25 points
Some reduction in demand for support services if the site is convened	1 to 24 point(s)
No significant reduction in demand for support services if the site is converted	0 points

(10) Is the kind and intensity of the proposed use of the site sufficiently incompatible with agriculture that it is likely to contribute to the eventual conversion of surrounding farmland to nonagricultural use?

Proposed project is incompatible to existing agricultural use of surrounding farmland	10 points
Proposed project is tolerable to existing agricultural use of surrounding farmland	9 to 1 point(s)
Proposed project is fully compatible with existing agricultural use of surrounding farmland	0 points



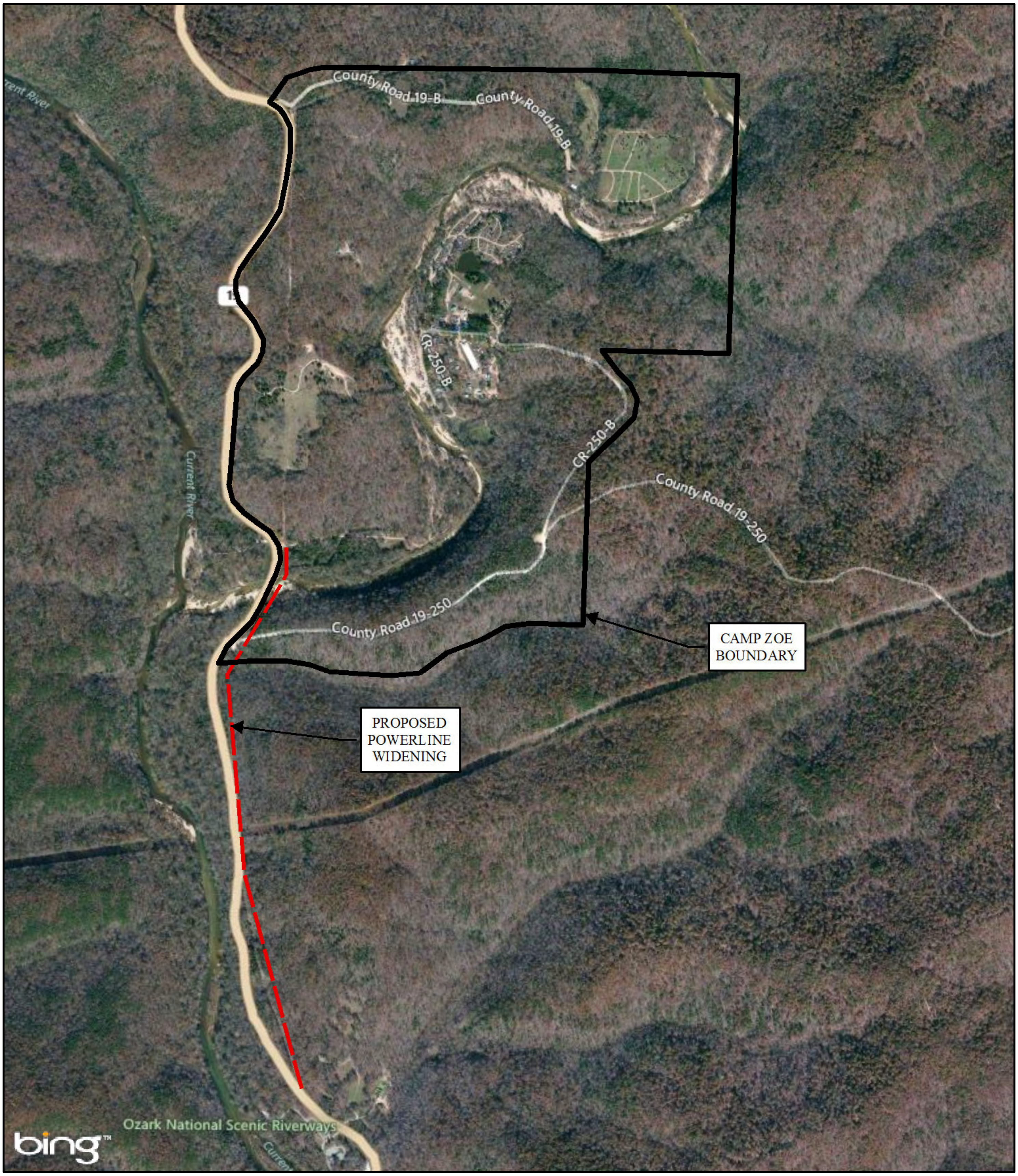
PROJECT NAME
X1414-04 CAMP ZOE
SHANNON COUNTY, MISSOURI

VICINITY AND TOPOGRAPHIC MAP

GENERAL NOTES/LEGEND
USGS TOPOGRAPHIC MAP
ROUND SPRING, MISSOURI QUADRANGLE
DATED 1982
PHOTO REVISED 1985
20' CONTOURS

DRAWN BY	RCV	DATE	JOB NUMBER
CHECKED BY	RJG	07/2014	2014-7007.20

SCALE 1" = 2,000'
FIGURE 1



PROJECT NAME	X1414-04 CAMP ZOE SHANNON COUNTY, MISSOURI	
	AERIAL PHOTOGRAPH	
DRAWN BY	RCV	DATE: 07/2014
CHECKED BY	RJG	JOB NUMBER: 2014-7007.20

GENERAL NOTES/LEGEND

AERIAL PHOTOGRAPH OBTAINED FROM BING MAPS VIA ARCGIS ONLINE.

N
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S

SCALE 1" = 1250'

FIGURE 2

APPENDIX C

SCI ENGINEERING, INC.
1114 North Bishop
Rolla, Missouri 65401
573-426-4901 Fax 573-426-4853
www.sciengineering.com

Wetland and Waterbody Delineation

X1414-04 CAMP ZOE
SHANNON COUNTY, MISSOURI

September 2014

Prepared for:

FARNSWORTH GROUP, INC.;
MISSOURI OA/FMDC; AND
MISSOURI DNR/DIVISION OF PARKS

SCI No. 2014-7007.30, .32

SCI ENGINEERING, INC.
CONSULTANTS IN DEVELOPMENT,
DESIGN AND CONSTRUCTION
GEOTECHNICAL
ENVIRONMENTAL
NATURAL RESOURCES
CULTURAL RESOURCES
CONSTRUCTION SERVICES

September 18, 2014

Mr. Robert Polk, PE, LEED AP
Farnsworth Group, Inc.
20 Allen Avenue, Suite 200
St. Louis, Missouri 63119

RE: Wetland and Waterbody Delineation
X1414-04 Camp Zoe
Shannon County, Missouri
SCI No. 2014-7007.30, .32

Dear Mr. Polk:

SCI is pleased to submit the attached updated report, dated August 2014. Our services consisted of a review of resource maps, reconnaissance survey for the presence of wetlands and waterbodies, and a delineation of the observed wetlands. SCI conducted a wetland and waterbody delineation of the site on February 26, 27, 2014 and July 10, 2014. The site was found to contain one perennial tributary (Sinking Creek), three intermittent tributaries (Brim Hollow, Burnt House Hollow and Sugar Tree Hollow), four ponds, two wetlands, three springs, and one dry sewage lagoon. All of the waterbodies with the exception of the lagoon and the smallest ponds may be considered waters of the United States as identified under the definitions described in Section 328.3 of the Code of Federal Regulations. Additionally, SCI identified various terrestrial habitats such as known caves, dolomite glades, gravel washes/sand bars and various woodland types throughout the site.

As you move forward with project planning, please keep in mind that any impact to a waters of the United States, including filling, crossing, piping, relocating, or discharging into, will require a Section 404 Permit from the U.S. Army Corps of Engineers (USACE) and a Section 401 Water Quality Certification from the Missouri Department of Natural Resources (MDNR). Additionally, the USACE has the sole authority to determine if any of the identified features are under their jurisdiction.

The attached report should be read in its entirety. We appreciate the opportunity to provide you with our natural resource services.

1114 North Bishop, Rolla, Missouri 65401 • phone 573-426-4901 • fax 573-426-4853 • www.sciengineering.com

You may reach me at (636) 757-1017 or rgundlach@sciengineering.com if you have any questions or concerns.

Respectfully,

SCI ENGINEERING, INC.

Rick J. Gundlach
Senior Staff Scientist

Scott D. Harding, CPSS/SC
Vice President

RJG/SDH/tlw

Enclosure

\\SCISTCFPS01\StCharles\shared\1soils\1NEW\PROJECT FILES\Springfield\2014 Project Files\2014-7007 Camp Zoe Rehab\NR\30\Camp Zoe Rehab_Wetland Delineation Report_03_21_2014.docx

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Wetland and Waterbody Delineation

X1414-04 CAMP ZOE
SHANNON COUNTY, MISSOURI

1.0 INTRODUCTION

SCI Engineering, Inc. (SCI) was retained by Farnsworth Group Inc., to conduct a wetland and waterbody delineation at the above-referenced site. The scope of our services included performing a site reconnaissance to characterize the soils, vegetation, and hydrology for the delineation of wetlands and waterbodies. Our services were provided in general accordance with our proposals dated February 6, 2014 and April 30, 2014.

The area delineated is approximately 490 acres and the proposed location of a State Park, which will include construction of a lodge, cabins, general store, roads, utilities, septic systems and the realignment of roads within the existing campground. The site was found to contain one perennial tributary (Sinking Creek), three intermittent tributaries (Brim Hollow, Burnt House Hollow and Sugar Tree Hollow), four ponds, two wetlands, three springs, and one sewage treatment lagoon. Creeks and tributaries, as well as most wetlands, are considered waters of the United States as identified under the definitions described in Section 328.3 of the Code of Federal Regulations (33 CFR). Any impact to a water of the United States, including filling, crossing, piping, relocating, or discharging into, will require a Section 404 Permit from the USACE and a Section 401 Water Quality Certification from the MDNR. Proposed impacts to the on-site ponds, tributaries, or wetlands may require both Section 404 and Section 401 permits.

2.0 SITE LOCATION

The site is located at the northeast corner of State Route 19 and County Road 19-250, approximately 10 miles north of Eminence, Missouri (Township 30 North, Range 4 West, Sections 7 and 8). The *Vicinity and Topographic Map* is enclosed as Figure 1.

3.0 SOIL SURVEY AND TOPOGRAPHIC RESEARCH

According to the Natural Resources Conservation Service (NRCS) Web Soil Survey (http://websoilsurvey.nrcs.usda.gov), the site contains the soil units listed in Table 3.1 below. No mapped soil units were identified as hydric on the *NRCS National Hydric Soils List: Hydric Soils of the United States*.

Table 3.1 – NRCS Mapped Soil Units

Map Unit Symbol	Map Unit Name	Acres in AOI
73042	Niangua-Bardley complex, 15 to 50 percent slopes, extremely stony	48.9
73055	Alred-Rueter complex, 15 to 35 percent slopes, very stony	73.5
73139	Poynor-Clarksville-Scholten complex, 8 to 15 percent slopes, stony	0.6
73140	Clarksville-Scholten complex, 15 to 45 percent slopes, very stony	51.5
73143	Courtois silt loam, 3 to 8 percent slopes	16.6
73155	Gasconade-Rock outcrop complex, 3 to 35 percent slopes	17.6
73269	Brussels-Gasconade-Rock outcrop complex, 35 to 90 percent slopes, very bouldery	59.6
73336	Rueter-Gepp complex, bench, 8 to 15 percent slopes	24.4
73339	Arkana-Gepp complex, 8 to 15 percent slopes, rocky, stony	10.1
73340	Rueter-Gepp complex, 8 to 15 percent slopes, stony	50.2
73341	Gepp-Arkana complex, 15 to 55 percent slopes, rocky	8.7
73342	Alred-Arkana complex, 8 to 15 percent slopes, rocky	37.3
75408	Secesh silt loam, 0 to 2 percent slopes, rarely flooded	3.4
75409	Relfe sandy loam, 0 to 3 percent slopes, occasionally flooded	5.5
75417	Relfe-Sandbur complex, 0 to 2 percent slopes, frequently flooded	56.8
75430	Wideman fine sandy loam, 0 to 3 percent slopes, occasionally flooded	7.8
75462	Huzzah sandy loam, 0 to 3 percent slopes, occasionally flooded	0.2
76036	Midco very gravelly loam, 1 to 3 percent slopes, occasionally flooded	2.4
76040	Relfe sandy loam, 1 to 3 percent slopes, occasionally flooded	7.5
Totals for Area of Interest		**482.6**

The United States Geological Survey (USGS) topographic map and National Wetlands Inventory (NWI) map were reviewed for information concerning the site. The USGS and NWI maps depict three dashed blue-line intermittent tributaries, one solid blue-line perennial tributary, three ponds and several classes of riverine wetlands. The NWI maps defined some of the ponds as a PUBGh (Palustrine Unconsolidated Bottom Intermittently Exposed, Diked/Impounded) and PUBFh (Palustrine Unconsolidated Bottom Semi permanently Flooded, Diked/Impounded). The NWI maps also indicated the classifications of the riverine wetlands to be R3USA (Riverine Upper Perennial Unconsolidated Shore Temporary Flooded), R3UBH (Riverine Upper Perennial Unconsolidated Shore Permanently Flooded) and R3USC (Riverine Upper Perennial Unconsolidated Shore Seasonally Flooded) within the boundaries of the subject site. The subject site appeared, upon review of the USGS, NWI, and aerial imagery, to contain forested rolling hills and steep cliffs combined with lowland and riverine areas. Copies of the USGS topographic and NWI maps are enclosed as Figures 1 and 2, respectively.

4.0 SITE RECONNAISSANCE

On February 26 and 27, and July 10, 2014, SCI Natural Resource scientists performed a field exploration of the subject site to delineate the extent of wetlands and waterbodies and to provide an inventory of wetland areas that exist within the site. Additionally, SCI documented other known natural resource communities, including: caves, dolomite glades and cliffs, rock outcroppings, gravel washes, sand bars and various forest types. The site primarily exists as dry and mesic forest with rolling topography and steep cliffs, combined with the lower portion of Sinking Creek and its tributaries (see Figure 4 – *Aerial Photograph*). The site existed historically as a campground with numerous associated facilities. These facilities were in poor condition, and many have been demolished and removed from the site prior to our visit. Remnant building pads and gravel roads were also noted throughout the site. Additionally, the western portion of the site contained two parcels which currently contain occupied residences.

5.0 CONDITION SUMMARY

A photographic summary of the representative site conditions is included as Appendix A. The *Routine Wetland Determination Data Forms* are enclosed as Appendix B. The conditions summarized below are mapped on the *Wetland Delineation* figure and are enclosed as Figures 3A & 3B. Additionally, the identified features are summarized in Table 5.1 below.

5.1 Wetlands and Waterbodies

5.1.1 *Streams*

Sinking Creek, a perennial tributary, was identified traversing the site from the northeast to the southwest and is the primary aquatic resource present on-site (Photos 1 through 6). Sinking Creek exists on site for approximately 9,925 linear feet (LF), and is a tributary to the Current River, connecting off site to the west. This waterway was observed to contain clear water, gravel and cobble dominated substrates, extensive gravel bars, and abundant pool and riffle complexes throughout its length. Sinking Creek was observed to possess an average Ordinary High Water Mark (OHWM) of approximately 130 feet. The tributary possessed a riparian corridor that ranged from 50 feet near the previously existing campground facilities to 1,500 feet where uninterrupted woodlands are present. Dominant vegetation within the riparian corridor was observed to include Eastern cottonwood (*Populus deltoides*), sycamore (*Platanus occidentalis*), hackberry (*Celtis occidentalis*), silver maple (*Acer saccharinum*), American elm (*Ulmus americana*), chinkapin oak (*Quercus muehlenbergii*), buttonbush (*Cephalanthus occidentalis*), sandbar willow (*Salix exigua*), stinging nettle (*Urtica dioica*), Virginia wild rye (*Elymus virginicus*), giant sunflower (*Helianthus giganteus*), and ironweed (*Vernonia altissima*).

Burnt House Hollow, an intermittent tributary to Sinking Creek, was identified within the north-central portion of the site (Photos 7 and 8). The tributary exists on site for approximately 1,600 LF before its confluence with Sinking Creek. This waterway was primarily dry, however isolated pooling was observed throughout. The substrate consisted primarily of gravel and cobble which formed distinct riffle structures throughout its length. Burnt House Hollow was observed to possess an OHWM that ranged from approximately 5 to 10 feet in width. The tributary possessed a riparian corridor that ranged from approximately 15 feet near its confluence with Sinking Creek to approximately 100 feet where uninterrupted woodlands are present. Dominant vegetation within the riparian corridor was observed to include sycamore (*Platanus occidentalis*), red maple (Acer *rubrum*), American elm (*Ulmus americana*), Eastern red cedar (*Juniperus virginiana*), Virginia wild rye (*Elymus virginicus*), giant sunflower (*Helianthus giganteus*) and multiflora rose (*Rosa multiflora*).

Sugar Tree Hollow, an intermittent tributary to Sinking Creek, was identified within the northeastern portion of the site (Photos 9 to 11). The tributary exists on site for approximately 800LF before its confluence with Sinking Creek. This waterway was primarily dry, however isolated flows and pooling were observed. The substrate consisted primarily of gravel and cobble which formed distinct riffle structures throughout its length. Additionally, this tributary was observed to contain a series of smaller braided channels that formed approximately 230LF upstream of its confluence with Sinking Creek. Sugar Tree Hollow was observed to possess an OHWM that ranged from approximately 3 to 12 feet in width. The tributary possessed a riparian corridor that ranged from approximately 50 to 100 feet in width. Dominant vegetation within the riparian corridor was observed to include sycamore (*Platanus occidentalis*), hackberry (*Celtis occidentalis*), American elm (*Ulmus americana*), chinkapin oak (*Quercus muehlenbergii*) and multiflora rose (*Rosa multiflora*).

Brim Hollow is an intermittent tributary to the Current River and is located in the very southeast corner of the property (Photos 12 and 13). The tributary exists on site for 350LF, and flows southwest to its confluence with the Current River offsite. Brim Hollow was observed to possess an OHWM of approximately 6 feet in width. The substrate consisted of dolomite boulder, cobble, and clay. The riparian corridor ranged from approximately 50 to 100 feet in width, and dominant vegetation along the banks consisted of Eastern red cedar (*Juniperus virginia*), beech saplings (*Fagus grandifolia*), scarlet and black oaks (*Quercus coccinea* and *Quercus velutina*), and sugar maple (*Acer saccharum*).

5.1.2 Wetlands

Two wetlands were identified during our site investigation. These features were primarily located within areas classified as riverfront forests and contained characteristic ridge-and-swale topography likely caused by historical flooding and sediment deposition. Although the areas delineated were found within generally low-lying terrain, complex microtopographies existed throughout the wetlands. As defined in the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual*, these areas can be classified as wetland/non-wetland mosaic landscapes. Our delineated boundaries encompass some of these small rises or ridges, which were interspersed throughout the wetland.

Wetland A is located in the northeast corner of the site, abutting the western bank of Sinking Creek (Photos 14 and 15). The forested wetland exists on site for approximately 2.87 acres and extends north along Sinking Creek past the site boundary. The primary hydrologic source for this wetland is likely derived from Sinking Creek. Wetland A contains typical swale topography, which likely resulted in the areas of pooling surface water which were observed. Dominant vegetation within Wetland A included sycamore (*Platanus occidentalis*), American elm (*Ulmus americana*), green ash (*Fraxinus pennsylvanica*), awlfruit sedge (*Carex stipata*), soft rush (*Juncus effusus*), giant sunflower (*Helianthus giganteus*), Eastern woodland sedge (*Carex blanda*), and Virginia wild rye (*Elymus virginicus*).

Wetland B is an approximately 2.62 acre forested wetland located in the eastern section of Camp Zoe, west of Sugar Tree Hollow (Photo 16). Similar to Wetland A, Wetland B abuts Sinking Creek on the eastern bank. Accordingly, the hydrology to the wetland is likely derived via Sinking Creek. There was no surface water present at the time of the delineation; however there was an area of open water on the western side of the wetland that appeared to frequently receive backwater flow from Sinking Creek. Dominant vegetation within Wetland B included sycamore (*Platanus occidentalis*), American elm (*Ulmus americana*), hackberry (*Celtis occidentalis*), Eastern cottonwood (*Populus deltoides*), box elder (*Acer negundo*), buttonbush (*Cephalanthus occidentalis*), and Eastern woodland sedge (*Carex blanda*).

5.1.3 Ponds

Pond A is a man-made pond approximately 0.84 acres in size and mapped as a PUBGh feature on the NWI (Photo 17). The pond appeared to be an impoundment which likely originated from a drainageway between the hills to the east. It is located in the north portion of the site, east of Sinking Creek, and near the previous camp facilities. Dominant bank vegetation includes Eastern red cedar (*Juniperus virginia*), black willow (*Salix nigra*), sycamore (*Platanus occidentalis*), and little bluestem (*Schizachyrium scoparium).*

Pond B is a man-made pond approximately 0.02 acres in size (Photo 18). The pond is located near the western site boundary of Camp Zoe, adjacent to the mowed field of the existing residence. The source of hydrology is likely derived from overland flows and direct precipitation. Dominant bank vegetation is Eastern red cedar (*Juniperus virginiana*) and little bluestem (*Schizachyrium scoparium).*

Pond C is a man-made pond approximately 0.04 acres in size (Photo 19). The pond is located southwest of Pond B and is mapped as a PUBFh feature on the NWI. The source of hydrology is likely derived from overland flows and direct precipitation. Dominant bank vegetation includes Eastern red cedar (*Juniperus virginiana*), black locust (*Robinia pseudoacacia*), multiflora rose (*Rosa multiflora*), and *Persicaria* species.

Pond D is approximately 0.10 acres and is adjacent to Sinking Creek on the southern end of the site (Photo 20). The pond's source of hydrology is likely overflow discharge from Sinking Creek. Pond D appears to be made by excavating (possibly gravel) near the western bank of Sinking Creek. Dominant bank vegetation includes coastal plains willow (*Salix caroliniana),* sycamore *(Platanus occidentalis),* scarlet and black oaks *(Quercus coccinea* and *Quercus velutina),* and silver maple *(Acer saccharinum*).

Lagoon A is a dry, remnant sewage lagoon approximately 0.44 acres in size and an NWI PUBGh mapped feature (Photo 21). It is located on the east side of Sinking Creek and south of the previous camp facilities in the center of the site. SCI understands the lagoon was the former site of a sewage treatment facility, and appears to have been drained. The source of hydrology is unknown, and the lagoon was not observed to be holding water at the time of inspection. Weedy vegetation has established within the lagoon, and the dominant vegetation observed was: Eastern red cedar (*Juniperus virginiana*), aster species, and little bluestem (*Schizachyrium scoparium*).

Additionally, a small, approximately 0.04 acre suspect waterbody was identified on the provided topographic map within the northwest portion of this site. While this area is shown as a small depression on the map, it was not able to be verified during the field investigation.

5.1.4 Springs

Spring A is located on the eastern side of Sinking Creek and south of the previous camp facilities in the center of the site (Photo 22). Water from the spring has channelized and drains into Sinking Creek. The surface of the spring was observed to be dominated by lesser duckweed (*Lemna minor*).

Spring B is located on the western side of Sinking Creek and north of caves SHN546 and SHN547 (Photo 23). The spring appears to flow from underneath dolomite rock outcrop, and subsequently channelizes and drains into Sinking Creek.

Spring C is located to the west of Burnt House Hollow, adjacent to a dolomite glade area (Photo 38). Adjacent vegetation consisted of Eastern red cedar (*Juniperus virginia*), Queen Anne's lace (*Daucus carota*), and Aster species (*Symphyotrichum spp*.).

Table 5.1 – Wetland and Waterbody Summary

Water Feature	Classification	OHWM width	LF/Acreage
Tributaries			
• Sinking Creek	Perennial	130 feet (average)	9,925 LF
• Burnt House Hollow	Intermittent	5-10 feet	1,600 LF
• Sugar Tree Hollow	Intermittent	3-12 feet	800 LF
• Brim Hollow	Intermittent	6 feet (average)	350 LF
Wetlands			
• Wetland A	Forested	N/A	2.87 AC
• Wetland B	Forested	N/A	2.62 AC

Table 5.1 – Wetland and Waterbody Summary (continued)

Water Feature	Classification	OHWM width	LF/Acreage
Ponds			
• Pond A	PUBGh	N/A	0.84 AC
• Pond B	N/A	N/A	0.02 AC
• Pond C	PUBFh	N/A	0.04 AC
• Pond D	N/A	N/A	0.10 AC
• Lagoon A (dry)	PUBGh	N/A	0.44 AC
Springs			
• Spring A	N/A	N/A	290 LF
• Spring B	N/A	N/A	200 LF
• Spring C	N/A	N/A	< 0.01 AC

5.2 Potentially Isolated/Non-Regulated Features

Based on SCI's understanding of Section 328.3 of the Code of Federal Regulations (33 CFR), several of the identified features on site have the potential to not meet the definition of a jurisdictional waters of the United States. Ponds A, B and C, Lagoon A, and the approximate 0.04 acre suspect waterbody located in the northern boundary of site all appeared to lack a direct hydrologic connection to any waters of the United States, and as such, these features may not be regulated by the USACE. Similarly, a man-made closed depression identified in the northwest corner of the site contains hydrophytic vegetation. The depression is located adjacent to County Road 19-B, and appears to be the result of repeated activity in the power line right-of-way, creating a depression suitable for such vegetation to grow but lacks other jurisdictional wetland characteristics (photo 38). There is also a ravine in the north central area of the site, leading down to Sinking Creek that exhibits bed and bank at the gentler slope at the top of the hill, however the feature is predominantly an erosional gully that lacks jurisdictional characteristics such as a consistent bed and bank and OWHM indicators.

5.3 Terrestrial Habitats

In addition to boasting high-quality aquatic resources, Camp Zoe is also rich in other natural resource communities. The topography of rolling hills and steep cliffs combined with lowland and riverine areas create a highly varied landscape that includes dolomite glades, limestone and dolomite cliffs, gravel washes and sand bars, and various forest types such as dry to mesic dolomite woodland, dry-mesic chert woodland, dry-mesic and mesic bottomland, and riverfront forests. Further details and in-depth descriptions can be found in the Camp Zoe Natural Resource Assessment created by the Missouri Department of Natural Resources[1].

The limestone and dolomite cliffs are found throughout the property, and are inhabited primarily by Eastern red cedar (*Juniperus virginiana*), chinkapin oak (*Quercus muehlenbergii*), and briar species (*Smilax* spp) (Photo 24). The taller cliffs that line Sinking Creek also contain caves that serve as winter bat hibernacula. Five caves were identified on our site visit: SHN527, SHN528, SHN529, SHN546, and SHN547 (Photos 25 through 28). An additional cave, SHN090, was reported to exist, however it was not located during our site visit. SCI has been contracted to perform acoustics and mist net surveys for the presence of any Threatened and Endangered bat species such as the Indiana Bat.

Due to the meandering nature of Sinking Creek, gravel and sand bar areas frequently line the banks of the channel. Sugar Tree Hollow also has mid-channel gravel bars in the southeast corner of the site. These areas are dominated by rocky gravel and sand substrates, but some vegetation is also present, including sycamore (*Platanus occidentalis*), sandbar willow (*Salix exugua*), buttonbush (*Cephalanthus occidentalis*), swamp dogwood (*Cornus amomum ssp. oblique*), and eastern witch hazel (*Hamamelis virginiana*) (Photo 29).

The lowland areas along Sinking Creek also contain riverfront forests (Photo 30). Since they are frequently inundated with water, the species in these areas tend to be hydrophytic, and associated with identified wetland areas. The dominant species in the riverfront forests are woodland sedge (*Carex blanda*), hackberry (Celtis occidentalis), box elder (*Acer negundo*), American elm (*Ulmus americana*), Eastern cottonwood (*Populus deltoides*), sycamore (*Platanus occidentalis*), and buttonbush (*Cephalanthus occidentalis*).

The majority of the site on either side of Sinking Creek is dominated by various types of highly sloping upland forest areas, which include the dry to dry-mesic dolomite woodland, dry-mesic chert woodland and dry-mesic and mesic bottomland (Photos 31 through 34). Rocky outcroppings of dolomite and limestone can be seen protruding from hill slopes throughout the site (Photo 35). These areas are dominated by Eastern red cedar (*Juniperus virginiana*), chinkapin oak (*Quercus muehlenbergii*), black oak (*Quercus velutina*), hackberry (*Celtis occidentalis*), white ash (*Fraxinus americana*), black gum

[1] McCarty, Ken, Chris Crabtree, Allison Vaughn, Dennis Meinert, and Tim Turpin. "Camp Zoe Natural Resource Assessment, Phase I: Initial Inventory and Data Review." Missouri Department of Natural Resources, December 6, 2013.

(*Nyssa sylvatica*), sugar maple (*Acer saccharum*), gray dogwood (*Cornus racemosa*), sycamore (*Platanus occidentalis*), Carolina buckthorn (*Rhamnus caroliniana*), multiflora rose (*Rosa multiflora*), and briar species (*Smilax* spp).

Another terrestrial environment unique to the Ozark area is the dolomite glade (Photos 36 and 37). These areas were identified in the northern section of the site on south-facing slopes that capture abundant sunlight and are free of canopy cover. The dominant vegetation included little bluestem (*Schizachyrium scoparium*), big bluestem (*Andropogon gerardii*), orchard grass (*Dactylis glomerata*), Indian grass (*Sorghastrum nutans*), switch grass (*Panicum virgatum*), sideoats grama (*Bouteloua curtipendula*), and glade coneflower (*Echinacea simulata*).

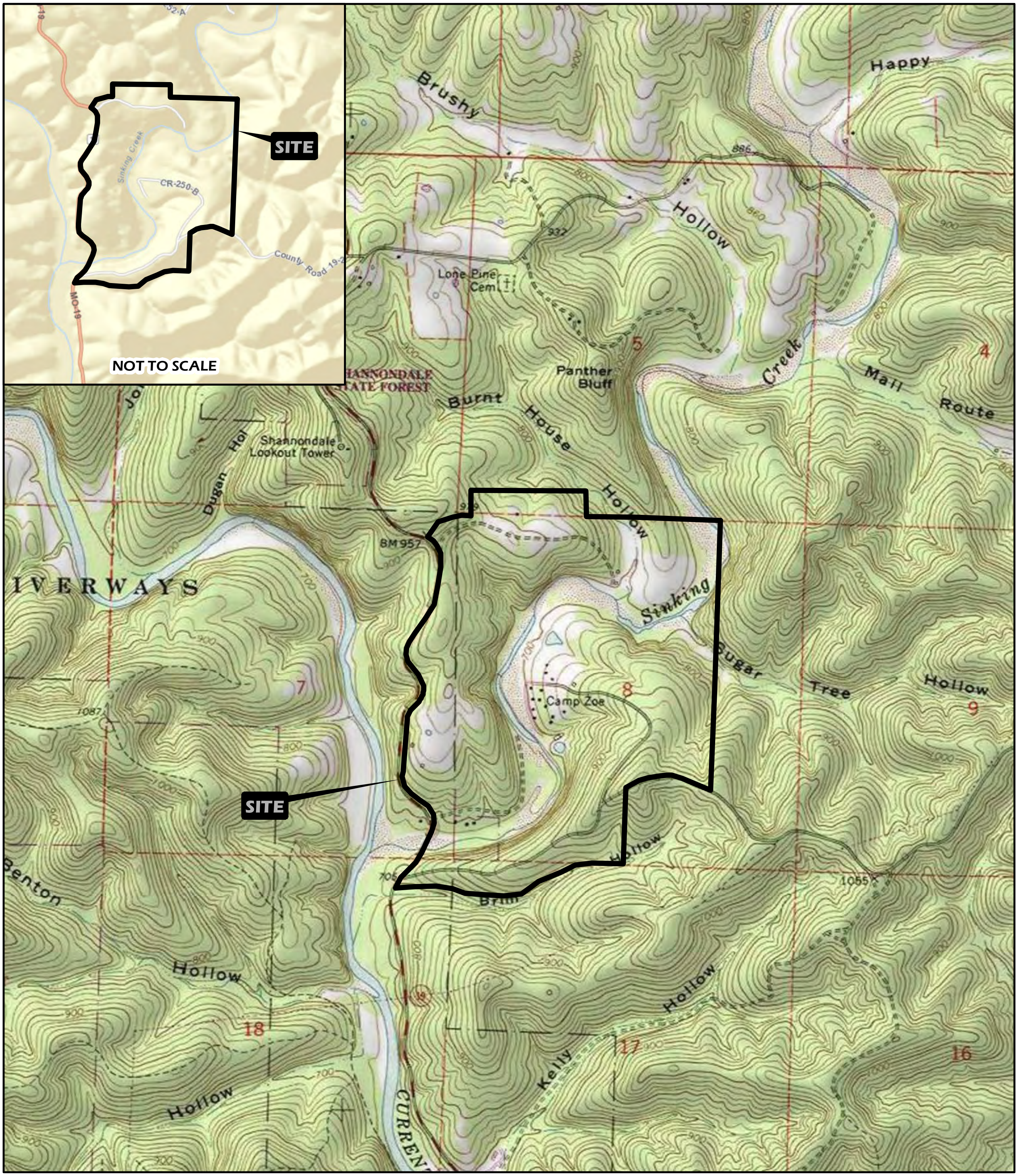
6.0 CONCLUSION

During our February 26 and 27, and July 10, 2014 field explorations, the project site was found to contain one perennial tributary (Sinking Creek), three intermittent tributaries (Brim Hollow, Burnt House Hollow, and Sugar Tree Hollow), four ponds, two wetlands, three springs, and one dry sewage lagoon. The tributaries and largest pond may be considered waters of the United States as identified under the definitions described in Section 328.3 of the Code of Federal Regulations. Any proposed development activities that result in a disturbance to a jurisdictional wetland or waterbody would require a Section 404 Permit from the USACE and a Section 401 Water Quality Certification from MDNR. Alternately, the USACE does not require a Section 404 Permit for the development of a site that does not impact jurisdictional wetlands or waterbodies. Likewise, a Section 401 Water Quality Certification from MDNR is not typically required for a project that does not require a Section 404 Permit. Upon receipt of a preliminary development plan for the site, SCI will conduct a wetland and waterbody impact assessment and, if necessary, submit a Section 404 and 401 application to the USACE and MDNR to initiate the permitting process. If it appears that no wetland and/or waterbody impacts will occur, we are available to submit a request for a "no permit required" letter to the USACE.

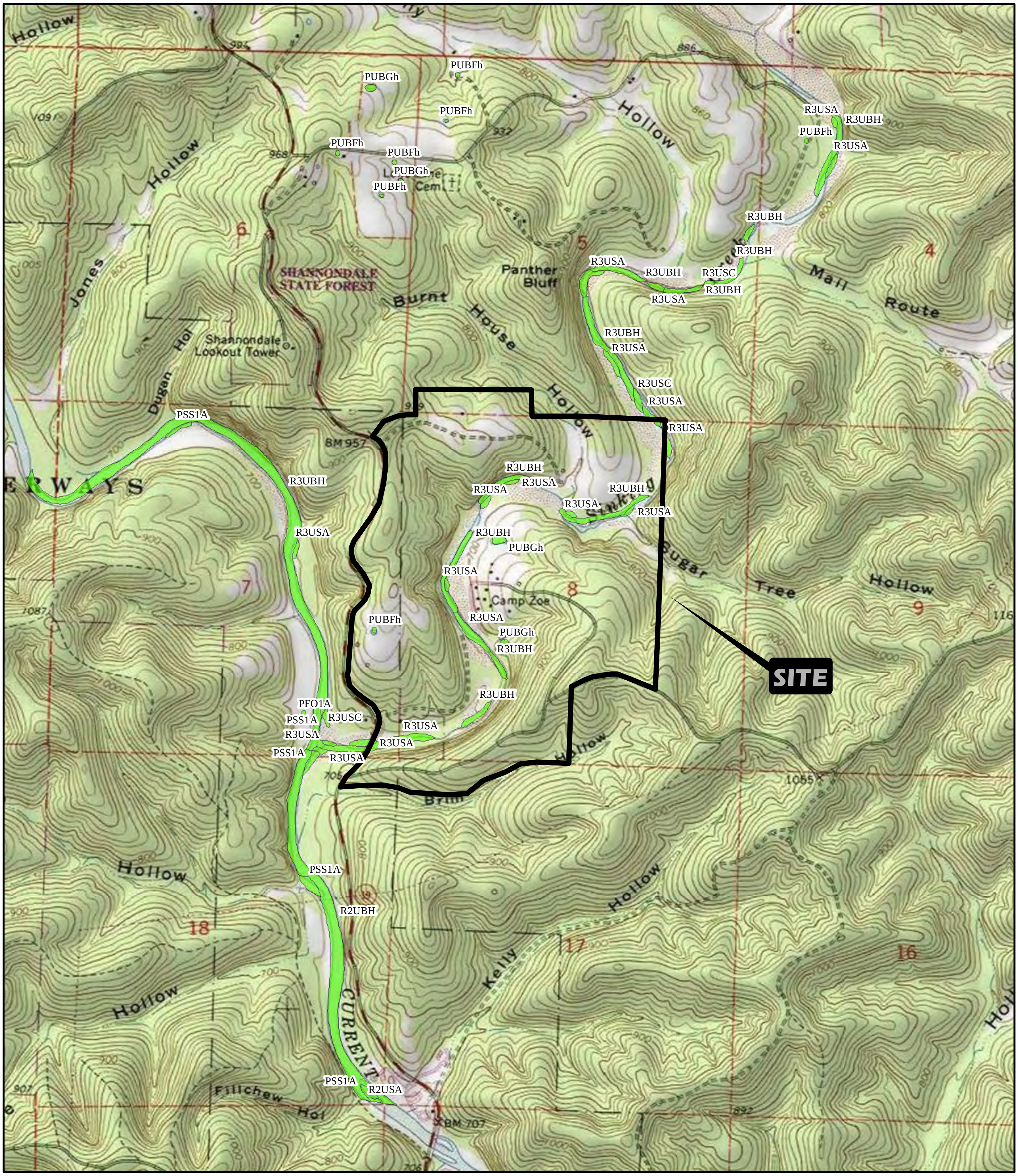
7.0 LIMITATIONS

This report has been prepared for the exclusive use of Farnsworth Group, the State of Missouri, the USACE, and MDNR. SCI is not responsible for independent conclusions or recommendations made by others. Furthermore, written consent must be provided by SCI should anyone other than our client or the aforementioned agencies wish to excerpt, or rely on the contents of this report. The findings of this report are valid as of the present date of the delineation. SCI is not responsible for surveys, calculations, or plans that were prepared by others.

Changes in surface and subsurface conditions of a property can occur with the passage of time, whether due to natural processes or the works of man on this or adjacent properties. In addition, changes in applicable or appropriate standards may occur, whether they result from legislation, the broadening of knowledge, or other reasons. Accordingly, the findings of this report may be invalidated in whole or in part by changes outside our control.



	PROJECT NAME X1414-04 CAMP ZOE SHANNON COUNTY, MISSOURI			**GENERAL NOTES/LEGEND** USGS TOPOGRAPHIC MAP ROUND SPRING, MISSOURI QUADRANGLE DATED 1982 PHOTO REVISED 1985 20' CONTOURS
	VICINITY AND TOPOGRAPHIC MAP			**SCALE** 1" = 2000'
	DRAWN BY RCV	**DATE**	**JOB NUMBER**	**FIGURE** 1
	CHECKED BY RJG	09/2014	2014-7007.30, .32	



PROJECT NAME

X1414-04 CAMP ZOE
SHANNON COUNTY, MISSOURI

NATIONAL WETLAND INVENTORY MAP

DRAWN BY	RCV	DATE	JOB NUMBER
CHECKED BY	RJG	09/2014	2014-7007.30, .32

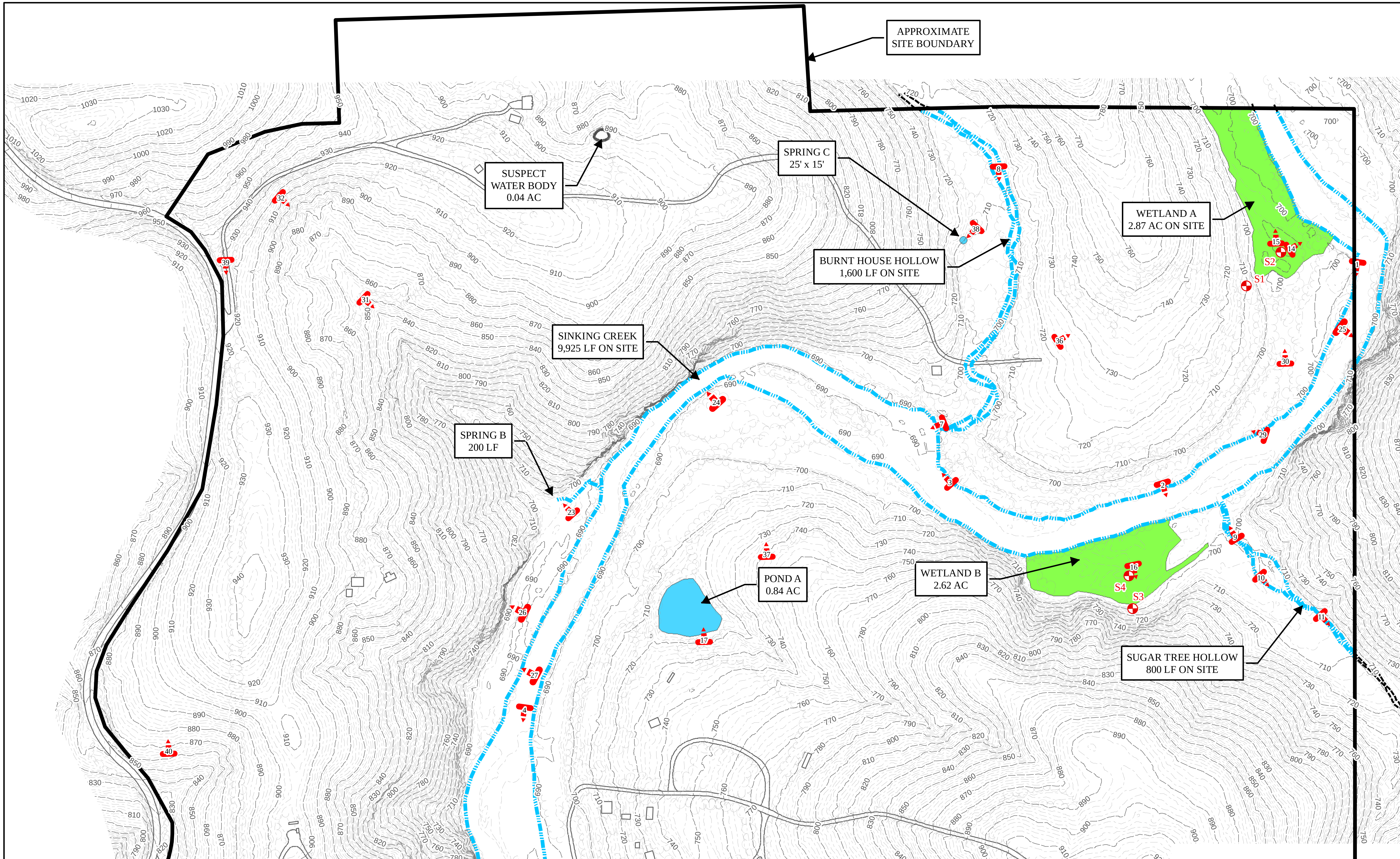
GENERAL NOTES/LEGEND

NATIONAL WETLAND INVENTORY DATA OBTAINED FROM www.fws.gov.

USGS TOPOGRAPHIC MAP
ROUND SPRING, MISSOURI QUADRANGLE
DATED 1982
PHOTO REVISED 1985
20' CONTOURS

SCALE 1" = 2000'

FIGURE 2



GENERAL NOTES/LEGEND

APPROXIMATE SOIL BORING LOCATION.

APPROXIMATE PHOTO ORIENTATION & LOCATION.

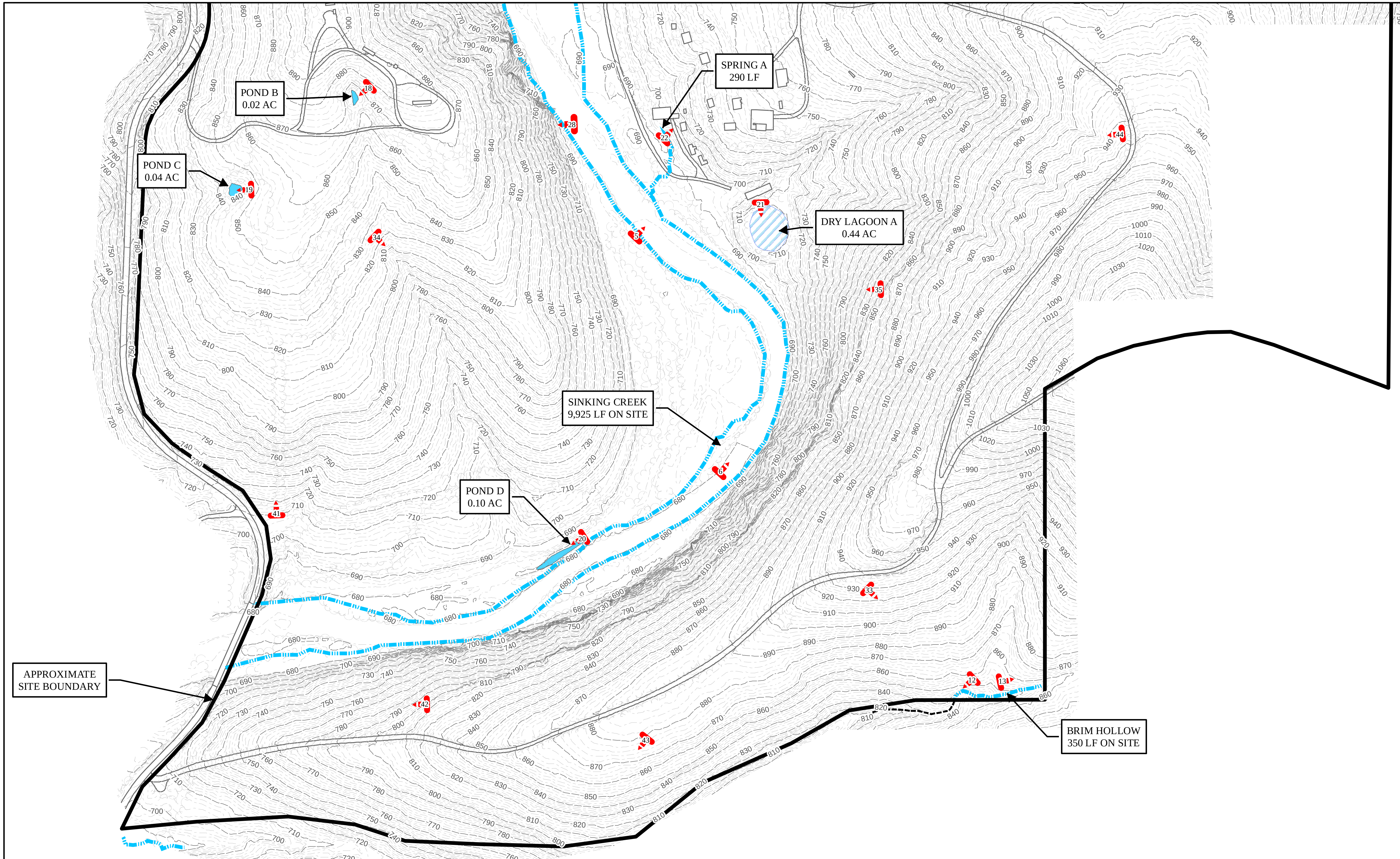
AERIAL PHOTOGRAPH OBTAINED FROM ARCGIS ONLINE, WORLD IMAGERY. DIMENSIONS AND LOCATIONS ARE APPROXIMATE; ACTUAL MAY VARY. DRAWING SHALL NOT BE USED OUTSIDE THE CONTEXT OF THE REPORT FOR WHICH IT WAS GENERATED.

PROJECT NAME

X1414-04 CAMP ZOE
SHANNON COUNTY, MISSOURI

WETLAND DELINEATION AND PRELIMINARY SITE PLAN

SCALE	1" = 350'
JOB NUMBER	2014-7007.30, .32
DATE	09/2014
DRAWN BY	RCV
CHECKED BY	RJG
FIGURE	3A



GENERAL NOTES/LEGEND

- APPROXIMATE SOIL BORING LOCATION.
- APPROXIMATE PHOTO ORIENTATION & LOCATION.

AERIAL PHOTOGRAPH OBTAINED FROM ARCGIS ONLINE, WORLD IMAGERY. DIMENSIONS AND LOCATIONS ARE APPROXIMATE; ACTUAL MAY VARY. DRAWING SHALL NOT BE USED OUTSIDE THE CONTEXT OF THE REPORT FOR WHICH IT WAS GENERATED.

PROJECT NAME
X1414-04 CAMP ZOE
SHANNON COUNTY, MISSOURI

WETLAND DELINEATION AND PRELIMINARY SITE PLAN

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SCALE	1" = 350'
JOB NUMBER	2014-7007.30, .32
DATE	09/2014
DRAWN BY	RCV
CHECKED BY	RJG
FIGURE	3B

GENERAL NOTES/LEGEND

AERIAL PHOTOGRAPH OBTAINED FROM ARCGIS ONLINE, WORLD IMAGERY.

PROJECT NAME
CAMP ZOE REHAB
SHANNON COUNTY, MISSOURI

AERIAL PHOTOGRAPH

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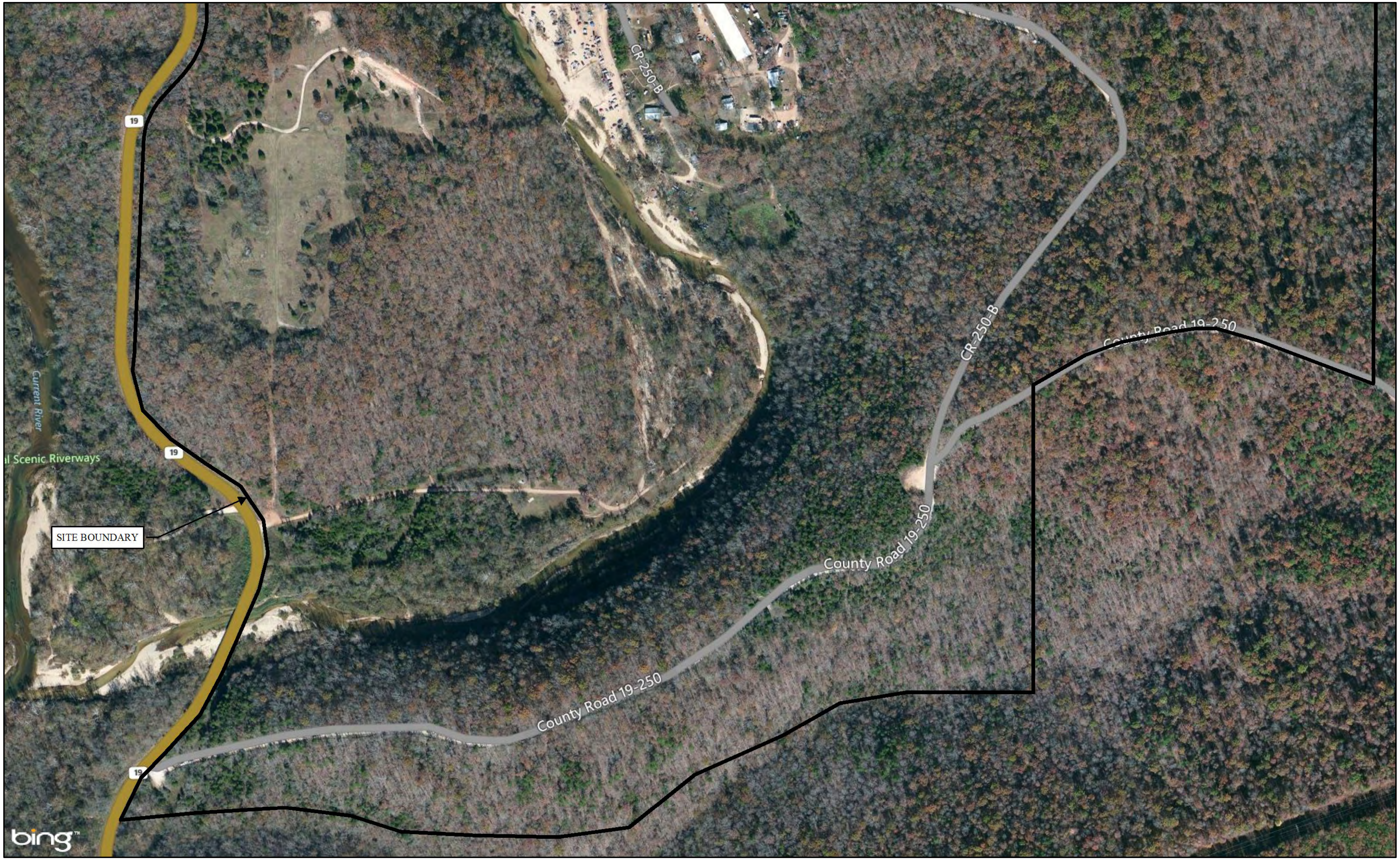
SCALE	1" = 350'
JOB NUMBER	2014-7007.30, .32
DATE	09/2014
DRAWN BY	RCV
CHECKED BY	RJG
FIGURE	4A



GENERAL NOTES/LEGEND

AERIAL PHOTOGRAPH OBTAINED FROM ARCGIS ONLINE, WORLD IMAGERY.

PROJECT NAME

CAMP ZOE REHAB
SHANNON COUNTY, MISSOURI

AERIAL PHOTOGRAPH

SCALE	1" = 350'
JOB NUMBER	2014-7007.30, .32
DATE	09/2014
DRAWN BY	RCV
CHECKED BY	RJG
FIGURE	4B

Appendix A

Photo 1. Sinking Creek looking downstream in the northeast section of the site, facing south

Photo 2. Sinking Creek at potential Crossing 1, facing southeast

Photo 3. Sinking Creek at potential Crossing 2, facing northwest

Photo 4. Sinking Creek in the center of Camp Zoe, facing south

Photo 5. Sinking Creek at potential Crossing 3, facing northeast

Photo 6. Sinking Creek looking upstream where it exits the site in the southwest, facing northeast

Photo 7. Burnt House Hollow at its confluence with Sinking Creek, facing southwest

Photo 8. Burnt House Hollow northern upstream section, facing south

Photo 9. Sugar Tree Hollow, downstream of braided channel near Sinking Creek, facing northwest

Photo 10. Sugar Tree Hollow, middle braided section, facing southwest

Photo 11. Sugar Tree Hollow, upstream of braided area, facing southeast

Photo 12. Brim Hollow downstream, facing southwest

Photo 13. Brim Hollow upstream, facing northeast

Photo 14. Wetland A, facing east

Photo 15. Wetland A, facing north

Photo 16. Wetland B, facing south

Photo 17. Pond A, facing north

Photo 18. Pond B, facing southwest

Photo 19. Pond C, facing west

Photo 20. Pond D, facing southwest

Photo 21. Dry Lagoon A, facing south

Photo 22. Spring A, facing northeast

Photo 23. Spring B, facing northwest

Photo 38. Spring C, facing southwest

Photo 24. Typical dolomite cliff, facing northwest

Photo 25. Caves SHN527 and SHN528, facing east

Photo 26. Cave SHN546, facing west

Photo 27. Cave SHN547, facing west

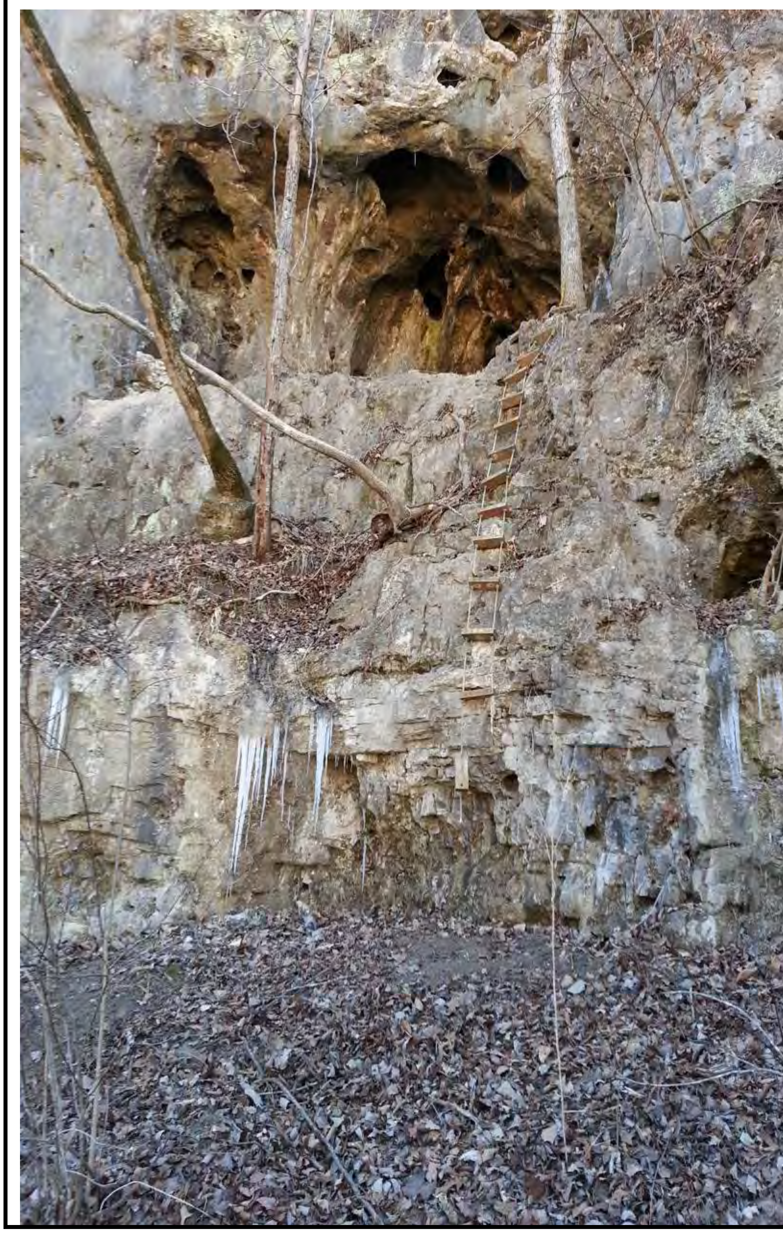


Photo 28. Cave SHN529, facing west

Photo 29. Typical gravel bar with sycamore, sand bar willow, and buttonbush, facing northwest

Photo 30. Typical riverfront forest, facing north

Photo 31. Upland forest in northwest corner of Camp Zoe, with ravine in center, facing southeast

Photo 32. Drainageway in the northwest corner of the site, facing southeast

Photo 33. Upland forest in southeast corner of Camp Zoe, facing southeast

Photo 34. Wooded area in the southwest area of the site, south of existing residence, facing southeast

Photo 35. Typical rocky outcropping in southeast corner of Camp Zoe, facing west

Photo 36. Typical dolomite glade in northeastern section of Camp Zoe, facing northeast

Photo 37. Dolomite glade in former parking area, facing north

Photo 39. Man-made closed depression, facing south

Photo 40. Existing overhead power line right-of-way in NPS property, facing north

Photo 41. Existing overhead power line right-of-way north of Sinking Creek, facing north

Photo 42. Upland woods the southwest corner of the site, facing west

Photo 43. Upland woods along the southern boundary of the site, facing southwest

Photo 44. Upland woods along the eastern limits of the site, facing west

Appendix B

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Camp Zoe City/County: Shannon CO. Sampling Date: 26 Feb, 2014

Applicant/Owner: State of Missouri State: MP Sampling Point: Wet A_WDP

Investigator(s): SCI Engineering Section, Township, Range: S7&8, T40N, R4W

Landform (hillslope, terrace, etc.): Terrace Local relief (concave, convex, none): Concave Slope (%): 0

Subregion (LRR or MLRA): LRR N Lat: 37.315637 Long: -91.398322° Datum: NAD83

Soil Map Unit Name: Relfe-Sandbar complex, 0-2% slopes, frequently flooded NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓ No ___	**Is the Sampled Area within a Wetland?** **Yes ✓ No ___**
Hydric Soil Present?	Yes ✓ No ___	
Wetland Hydrology Present?	Yes ✓ No ___	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ✓ Sediment Deposits (B2)
- ✓ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ✓ Drainage Patterns (B10)
- ✓ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ✓ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ✓ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___ No ✓	Depth (inches): N/A	
Water Table Present?	Yes ___ No ✓	Depth (inches): 10+	
Saturation Present? (includes capillary fringe)	Yes ___ No ✓	Depth (inches): 10+	**Wetland Hydrology Present? Yes ✓ No ___**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: Wet A_WDP

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. Platanus occidentalis	60	Y	FACW
2. Ulmus americana	25	Y	FACW
3. Fraxinus pennsylvanica	15	N	FACW
4.			
5.			
6.			
7.			
8.			
	100% = Total Cover		

Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	0% = Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. Carex stipata	30	Y	OBL
2. Juncus effusus	20	Y	FACW
3. Helianthus giganteus	20	Y	FACW
4. Carex blanda	10	N	FAC
5. Elymus virginicus	5	N	FACW
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	85% = Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	0% = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	30	x 1 =	30
FACW species	145	x 2 =	290
FAC species	10	x 3 =	30
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	185 (A)		350 (B)

Prevalence Index = B/A = 1.9

Hydrophytic Vegetation Indicators:

✓ 1 - Rapid Test for Hydrophytic Vegetation

✓ 2 - Dominance Test is >50%

✓ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ✓ **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: Wet A_WDP

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-10	10YR 3/1	90	10YR 4/4	10	C	M	SCL	
10+	Probe Refusal							

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ✓ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Rock/Gravel

Depth (inches): 10

Hydric Soil Present? Yes ✓ No ______

Remarks:

Refusal due to natural rock and gravel present within the soil profile.

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Camp Zoe City/County: Shannon CO. Sampling Date: 26 Feb, 2014

Applicant/Owner: State of Missouri State: MO Sampling Point: WET A_UDP

Investigator(s): SCI Engineering Section, Township, Range: S7&8, T40N, R4W

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Convex Slope (%): 2

Subregion (LRR or MLRA): LRR N Lat: 37.315459 Long: -91.398785 Datum: NAD83

Soil Map Unit Name: Niangua-Bardley complex, 15 to 50 % slopes, extremely stony NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes ___ No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?		✓
Hydric Soil Present?		✓
Wetland Hydrology Present?		✓

Is the Sampled Area within a Wetland? **Yes** ___ **No** ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

	Yes	No	Depth (inches)
Surface Water Present?		✓	N/A
Water Table Present?		✓	12+
Saturation Present? (includes capillary fringe)		✓	12+

Wetland Hydrology Present? **Yes** ___ **No** ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: WET A_UDP

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. Juniperus virginiana	40	Y	FACU
2. Acer rubrum	20	Y	FAC
3. Juglans nigra	15	N	FACU
4. Robinia pseudoacacia	10	N	FACU
5.			
6.			
7.			
8.			
	85% = Total Cover		

Sapling/Shrub Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. Rosa multiflora	10	Y	FACU
2. Rhus typhina	5	N	FACU
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	15% = Total Cover		

Herb Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. Carex pensylvanica	30	Y	UPL
2. Pastinaca sativa	30	Y	UPL
3. Solidago altissima	20	Y	FACU
4. Setaria italica	20	Y	FACU
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	100% = Total Cover		

Woody Vine Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	0% = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	1	(A)
Total Number of Dominant Species Across All Strata:	7	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	14.29%	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	20	x 3 =	60
FACU species	120	x 4 =	480
UPL species	60	x 5 =	300
Column Totals:	200 (A)		840 (B)

Prevalence Index = B/A = 4.2

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
___ 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ___ **No** ✓

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: WET A_UDP

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-12	10YR 3/3	100					SIL	
12+	Probe refusal							

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Rock/Clay

Depth (inches): 12+

Hydric Soil Present? Yes ______ **No** ✓

Remarks:
Refusal due to presence of natural rock and clay layer

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Camp Zoe City/County: Shannon CO. Sampling Date: 27 Feb, 2014

Applicant/Owner: State of Missouri State: MO Sampling Point: WET B_WDP

Investigator(s): SCI Engineering Section, Township, Range: S7&8,T40N, R4W

Landform (hillslope, terrace, etc.): Floodplain terrace Local relief (concave, convex, none): Concave Slope (%): 0

Subregion (LRR or MLRA): LRR N Lat: 37.312091° Long: -91.400279° Datum: NAD83

Soil Map Unit Name: Relfe-Sandbur complex, 0 to 2 % slopes, frequently flooded NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓ No ___	**Is the Sampled Area within a Wetland?**	**Yes ✓ No ___**
Hydric Soil Present?	Yes ✓ No ___		
Wetland Hydrology Present?	Yes ✓ No ___		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ✓ Sediment Deposits (B2)
- ✓ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ✓ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ✓ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___ No ✓	Depth (inches): N/A	
Water Table Present?	Yes ___ No ✓	Depth (inches): 14+	
Saturation Present? (includes capillary fringe)	Yes ✓ No ___	Depth (inches): 14	**Wetland Hydrology Present? Yes ✓ No ___**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: WET B_WDP

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1. Ulmus americana	40	Y	FACW
2. Platanus occidentalis	25	Y	FACW
3. Celtis occidentalis	20	Y	FACU
4. Populus deltoides	10	N	FAC
5. Acer negundo	5	N	FAC
6.			
7.			
8.			
	100%	= Total Cover	

Sapling/Shrub Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1. Cephalanthus occidentalis	10	Y	OBL
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	10%	= Total Cover	

Herb Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1. Carex blanda	5	Y	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	5%	= Total Cover	

Woody Vine Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	0%	= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 80% (A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	10	x 1 =	10	
FACW species	65	x 2 =	130	
FAC species	20	x 3 =	60	
FACU species	20	x 4 =	80	
UPL species	0	x 5 =	0	
Column Totals:	115	(A)	280	(B)

Prevalence Index = B/A = 2.4

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- ✓ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ✓ **No** ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: WET B_WDP

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 3/2	98	10YR 4/3	2	C	MS	SCL	
6-14	10YR 4/2	90	10YR 5/6	10	C	MS	SL	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ 2 cm Muck (A10) **(LRR N)**
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7)
___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
___ Thin Dark Surface (S9) **(MLRA 147, 148)**
___ Loamy Gleyed Matrix (F2)
✓ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
___ Umbric Surface (F13) **(MLRA 136, 122)**
___ Piedmont Floodplain Soils (F19) **(MLRA 148)**

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10) **(MLRA 147)**
___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
___ Red Parent Material (TF2)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ✓ **No** ______

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Camp Zoe City/County: Shannon CO. Sampling Date: 28 Feb, 2014

Applicant/Owner: State of Missouri State: MO Sampling Point: WET B_UDP

Investigator(s): SCI Engineering Section, Township, Range: S7&8,T40N, R4W

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Convex Slope (%): 10

Subregion (LRR or MLRA): LRR N Lat: 37.311533 Long: -91.399584 Datum: NAD83

Soil Map Unit Name: Brussels-Gasconade-Rock outcrop complex, 35 to 90 % slopes, very bouldery NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____ No ✓	**Is the Sampled Area within a Wetland?** **Yes** ____ **No** ✓
Hydric Soil Present?	Yes ____ No ✓	
Wetland Hydrology Present?	Yes ____ No ✓	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ____ No ✓	Depth (inches): N/A	
Water Table Present?	Yes ____ No ✓	Depth (inches): 8+	
Saturation Present? (includes capillary fringe)	Yes ____ No ✓	Depth (inches): 8+	**Wetland Hydrology Present? Yes** ____ **No** ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: WET B_UDP

Tree Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1. Quercus muehlenbergii	60	Y	UPL
2. Celtis occidentalis	20	Y	FACU
3. Quercus nigra	5	N	FAC
4.			
5.			
6.			
7.			
8.			
	85% = Total Cover		

Sapling/Shrub Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1. Cornus racemosa	5	Y	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	5% = Total Cover		

Herb Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1. Thalictrum dioicum	5	Y	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	5% = Total Cover		

Woody Vine Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	0% = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50% (A/B)

Prevalence Index worksheet:

	Total % Cover of:	Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	15	x 3 =	45
FACU species	20	x 4 =	80
UPL species	60	x 5 =	300
Column Totals:	95 (A)		425 (B)

Prevalence Index = B/A = 4.5

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ______ **No** ✓

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: WET B_UDP

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-8	10YR 2/1	100					SICl	
8+	Probe refusal							

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Clay/frozen ground

Depth (inches): 8+

Hydric Soil Present? **Yes** ___ **No** ✓

Remarks:
Probe refusal due to frozen ground and clay soils

U.S. ARMY CORPS OF ENGINEERS **APPLICATION FOR DEPARTMENT OF THE ARMY PERMIT** 33 CFR 325. The proponent agency is CECW-CO-R.	*Form Approved -* *OMB No. 0710-0003* *Expires: 31-AUGUST-2013*

Public reporting for this collection of information is estimated to average 11 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of the collection of information, including suggestions for reducing this burden, to Department of Defense, Washington Headquarters, Executive Services and Communications Directorate, Information Management Division and to the Office of Management and Budget, Paperwork Reduction Project (0710-0003). Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. Please DO NOT RETURN your form to either of those addresses. Completed applications must be submitted to the District Engineer having jurisdiction over the location of the proposed activity.

PRIVACY ACT STATEMENT

Authorities: Rivers and Harbors Act, Section 10, 33 USC 403; Clean Water Act, Section 404, 33 USC 1344; Marine Protection, Research, and Sanctuaries Act, Section 103, 33 USC 1413; Regulatory Programs of the Corps of Engineers; Final Rule 33 CFR 320-332. Principal Purpose: Information provided on this form will be used in evaluating the application for a permit. Routine Uses: This information may be shared with the Department of Justice and other federal, state, and local government agencies, and the public and may be made available as part of a public notice as required by Federal law. Submission of requested information is voluntary, however, if information is not provided the permit application cannot be evaluated nor can a permit be issued. One set of original drawings or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings and/or instructions) and be submitted to the District Engineer having jurisdiction over the location of the proposed activity. An application that is not completed in full will be returned.

(ITEMS 1 THRU 4 TO BE FILLED BY THE CORPS)

1. APPLICATION NO.	2. FIELD OFFICE CODE	3. DATE RECEIVED	4. DATE APPLICATION COMPLETE

(ITEMS BELOW TO BE FILLED BY APPLICANT)

5. APPLICANT'S NAME	8. AUTHORIZED AGENT'S NAME AND TITLE (agent is not required)
First - Michael Middle - Last - Qutami	First - Micki Middle - Last - Hansel
Company - State of Missouri Office of Adminstration	Company - Farnsworth Group
E-mail Address - Michael.Qutami@oa.mo.gov	E-mail Address - mhansel@f-w.com
6. APPLICANT'S ADDRESS:	9. AGENT'S ADDRESS:
Address- P.O. Box 809	Address- 20 Allen Ave. Suite 200
City - Jefferson City State - MO Zip - 65102 Country - USA	City - St. Louis State - MO Zip - 63119 Country - USA
7. APPLICANT'S PHONE NOs. w/AREA CODE	10. AGENTS PHONE NOs. w/AREA CODE
a. Residence b. Business (573)751-3182 c. Fax (573)751-7277	a. Residence b. Business 314-962-7900 c. Fax 314-962-1253

STATEMENT OF AUTHORIZATION

11. I hereby authorize, Micki Hansel, Farnsworth Group to act in my behalf as my agent in the processing of this application and to furnish, upon request, supplemental information in support of this permit application.

[signature] 7/15/14
SIGNATURE OF APPLICANT DATE

NAME, LOCATION, AND DESCRIPTION OF PROJECT OR ACTIVITY

12. PROJECT NAME OR TITLE (see instructions)
Camp Zoe

13. NAME OF WATERBODY, IF KNOWN (if applicable) Sinking Creek	14. PROJECT STREET ADDRESS (if applicable) Address HCR 62 Box 389
15. LOCATION OF PROJECT Latitude: °N 37.311267 Longitude: °W -91.406556	City - Salem State- MO Zip- 65560

16. OTHER LOCATION DESCRIPTIONS, IF KNOWN (see instructions)
State Tax Parcel ID Municipality Shannon County
Section - 8 Township - 30N Range - 4W

17. DIRECTIONS TO THE SITE

FROM LITTLE ROCK, AR : 230 miles - 4 hours drive

67 north for 60 miles to 167 north (exit #55) for 70 miles. Then a right on US 62/US 412 for 10 miles to a left on 63 north for 20 miles. Then turn right on Hwy 19 north and go about 70 miles to a right into the campground entrance before (gate #1) or after (gate #2) the Sinking Creek bridge.

18. Nature of Activity (Description of project, include all features)

Construction of two bridges, one vehicular and one pedestrian, to span Sinking Creek. Utiltiy crossings via horizontal directional drill (HDD), access points to the creek and associated grading.

Updated 9/30/2014

Construction of 2 Bridges. One vehicular bridge and one pedestrian bridge to span Sinking Creek. Bridge construction will also include the installation of Floodplain Scour Prevention Bars. Utilities that crossing Sinking Creek will be installed by Horizontal Directional Drill (HDD) or by attachment to the new bridges.

Updated 10/16/2014

Construction of a precast three sided bridge over Burnt House Hollow, improvements of the waterway down stream of an existing stream and a temporary crossing over Sinking Creek to be used durring construction.

19. Project Purpose (Describe the reason or purpose of the project, see instructions)

All work is proposed in conjunction with a new State Park. The park will include cabins, a lodge, camping facilities and day use facilities. The bridges will be used to transport vehicles and pedestrians across the creek. The access points will allow the State Park visitors access to the creek for canoeing and recreation.

USE BLOCKS 20-23 IF DREDGED AND/OR FILL MATERIAL IS TO BE DISCHARGED

20. Reason(s) for Discharge

Some discharge may occur as a result of the construction of bridge abutments. Preventative measures will be in place to minimize this discharge. A SWPPP and erosion control plans will be developed as a part of the construction documents.

Updated 9/30/2014

Rock will be installed within the Ordinary High Water Mark (OHWM) to construct the Floodplain Scout Prevention Bars. An additional rock and concrete will be installed to construction Bent No.4 (STA 52+77.48) of the vehicular bridge

Updated 10/16/2014

Installation of scour protection in Burnt House Hollow.

21. Type(s) of Material Being Discharged and the Amount of Each Type in Cubic Yards:

Type Amount in Cubic Yards	Type Amount in Cubic Yards	Type Amount in Cubic Yards
Rock for FSPB: 500 cu.yds.	Rock/concrete for Bent 4: 230 cu.yds.	

22. Surface Area in Acres of Wetlands or Other Waters Filled (see instructions)

Acres: Rock for FSPB: 0.06AC, Rock/Concrete for Bent No. 4: 0.04AC

or

Linear Feet: Burnt House Hollow: disturbing approximate 2,660 sf (or 100 ft), Spring inprovment result in approximately 140 LF of improvements to the water body downstream of the spring, temporary crossing 130'x25'

23. Description of Avoidance, Minimization, and Compensation (see instructions)

A wetlands delination has been completed for the property. All new construction will avoid existing wetlands. All new building construction will be located outside the floodplain of Sinking Creek. Utility crossings will be install by HDD to minimize the disturbance to Sinking Creek. Updated: 9/30/201 - The pedestrian bridge was designed to eliminate piers in the OHWM. The vehicular bridge was design to minimize piers in the OHWM

24. Is Any Portion of the Work Already Complete? ☐ Yes ☒ No IF YES, DESCRIBE THE COMPLETED WORK

25. Addresses of Adjoining Property Owners, Lessees, Etc., Whose Property Adjoins the Waterbody (if more than can be entered here, please attach a supplemental list).

a. Address- National Parks Service, 404 Watercress Drive, PO Box 490

City - Van Buren State - MO Zip - 63965

b. Address- L-A-D Foundation, 319 North 4th Street

City - St. Louis State - MO Zip - 63102

c. Address- Pioneer Forest LLC, P.O. Box 497

City - Salem State - MO Zip - 65560

d. Address-

City - State - Zip -

e. Address-

City - State - Zip -

26. List of Other Certificates or Approvals/Denials received from other Federal, State, or Local Agencies for Work Described in This Application.

AGENCY	TYPE APPROVAL*	IDENTIFICATION NUMBER	DATE APPLIED	DATE APPROVED	DATE DENIED

* Would include but is not restricted to zoning, building, and flood plain permits

27. Application is hereby made for permit or permits to authorize the work described in this application. I certify that this information in this application is complete and accurate. I further certify that I possess the authority to undertake the work described herein or am acting as the duly authorized agent of the applicant.

[signature] 7/15/14 [signature] 7/15/14

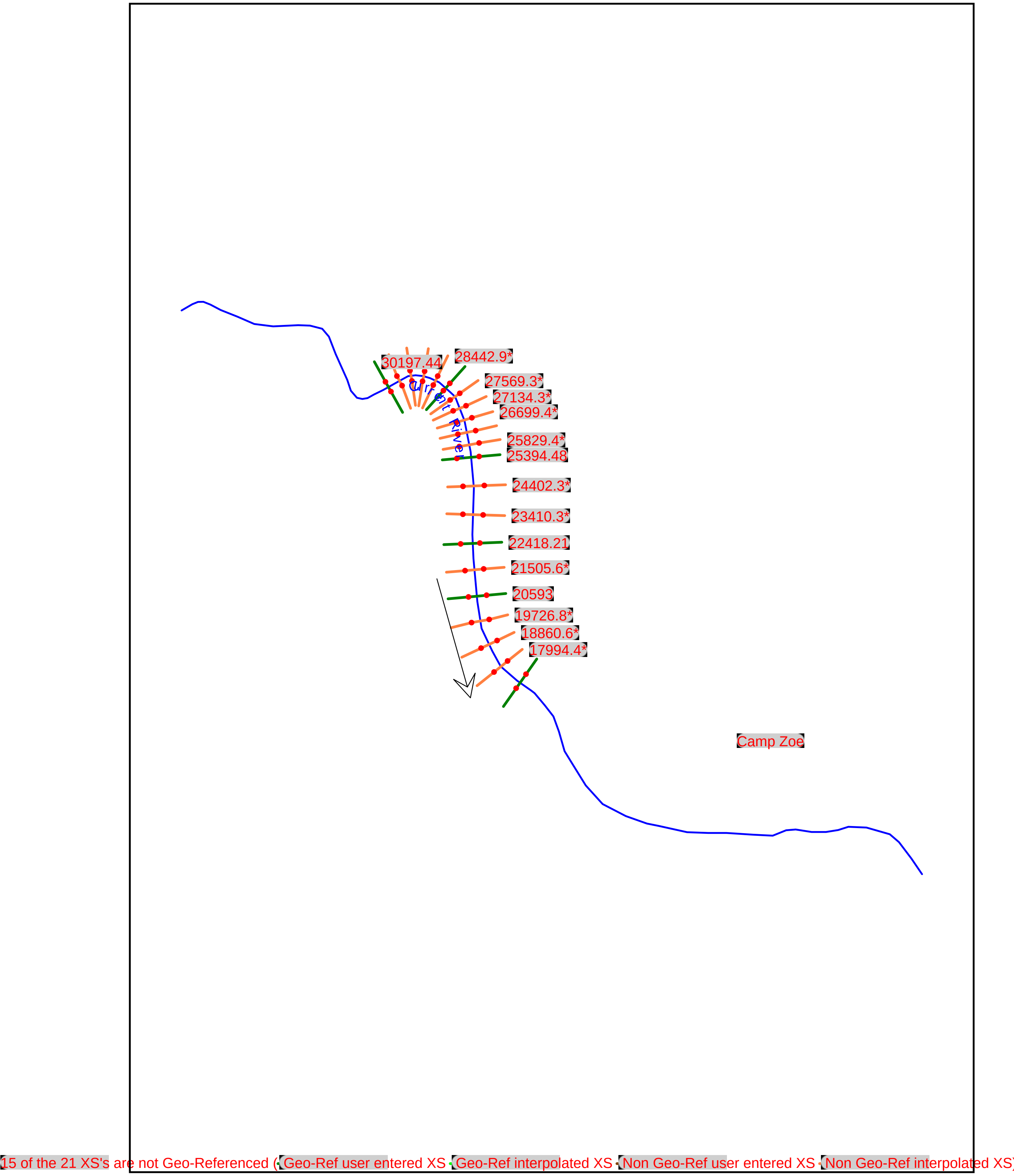
SIGNATURE OF APPLICANT DATE SIGNATURE OF AGENT DATE

The Application must be signed by the person who desires to undertake the proposed activity (applicant) or it may be signed by a duly authorized agent if the statement in block 11 has been filled out and signed.

18 U.S.C. Section 1001 provides that: Whoever, in any manner within the jurisdiction of any department or agency of the United States knowingly and willfully falsifies, conceals, or covers up any trick, scheme, or disguises a material fact or makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statements or entry, shall be fined not more than $10,000 or imprisoned not more than five years or both.

APPENDIX D

1. HEC RAS Model Output
    a. "Current River" Model
        i. Plan View
        ii. Cross Sections
        iii. Profile
        iv. Standard Table
        v. Report of Inputs and Warnings/Errors
    b. "Sinking Creek" Model
        i. Plan View, Proposed Geometry, 100 year
        ii. Cross Sections, Proposed vs. Existing Geometry, 100 year
        iii. Profile, Compare Geometries, 100 year
        iv. Standard Table, Compare Geometries, 100 year
        v. Bridge Tables, Proposed Geometry, 100 year
        vi. Weir Tables, Proposed Geometry, 100 year
        vii. Reports
            1. Input and Warnings/Errors, Natural Geometry
            2. Input and Warnings/Errors, Existing Geometry
            3. Input and Warnings/Errors, Proposed Geometry
2. Hydraulic Calculations
    a. Flow Data
    b. Stream Slope
    c. Manning's Roughness
    d. Known Water Surface Boundary Condition
    e. Reach Lengths
    f. Ineffective Area
    g. Bankfull Flow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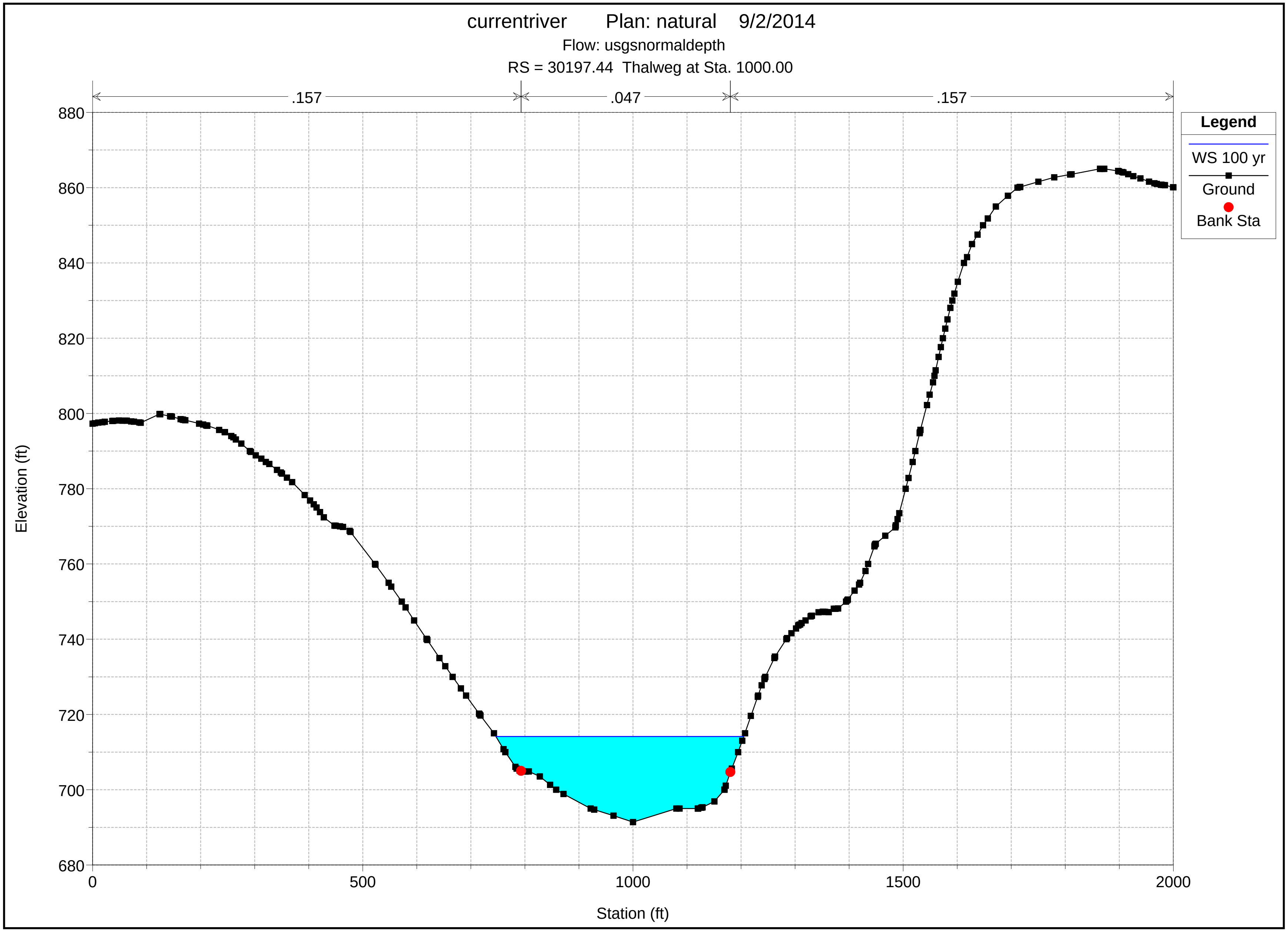
27134.3*
26699.4*
25829.4*
25394.48
24402.3*
23410.3*
22418.21
21505.6*
20593
19726.8*
18860.6*
17994.4*
Camp Zoe
15 of the 21 XS's are not Geo-Referenced (Geo-Ref user entered XS Geo-Ref interpolated XS Non Geo-Ref user entered XS Non Geo-Ref interpolated XS)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.157
.047
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Legend
WS 100 yr
Ground
Bank Sta
880
860
840
820
800
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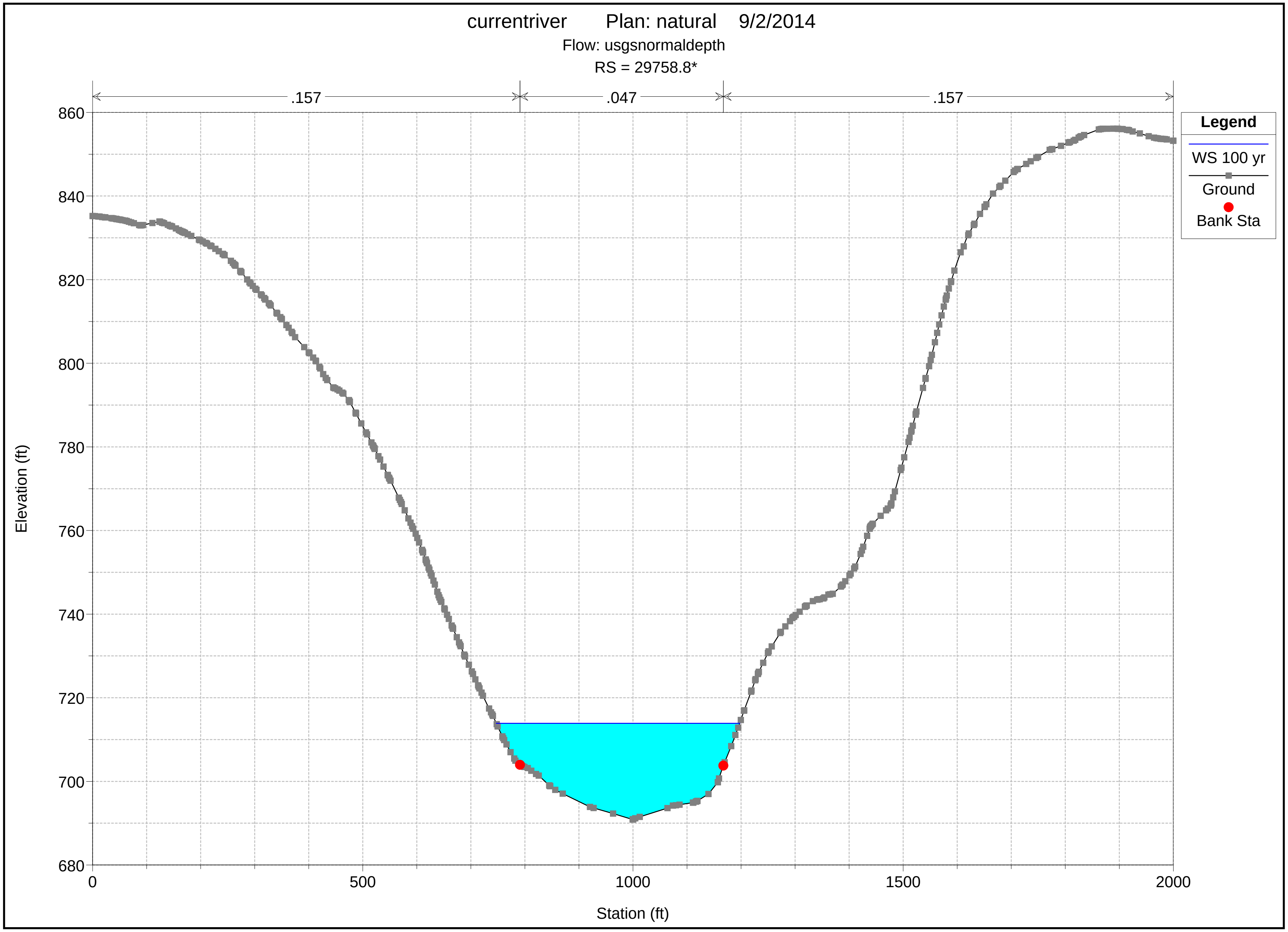
760
740
720
700
680
Elevation (ft)
0
500
1000
1500
2000
Station (ft)



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Ground
Bank Sta
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760
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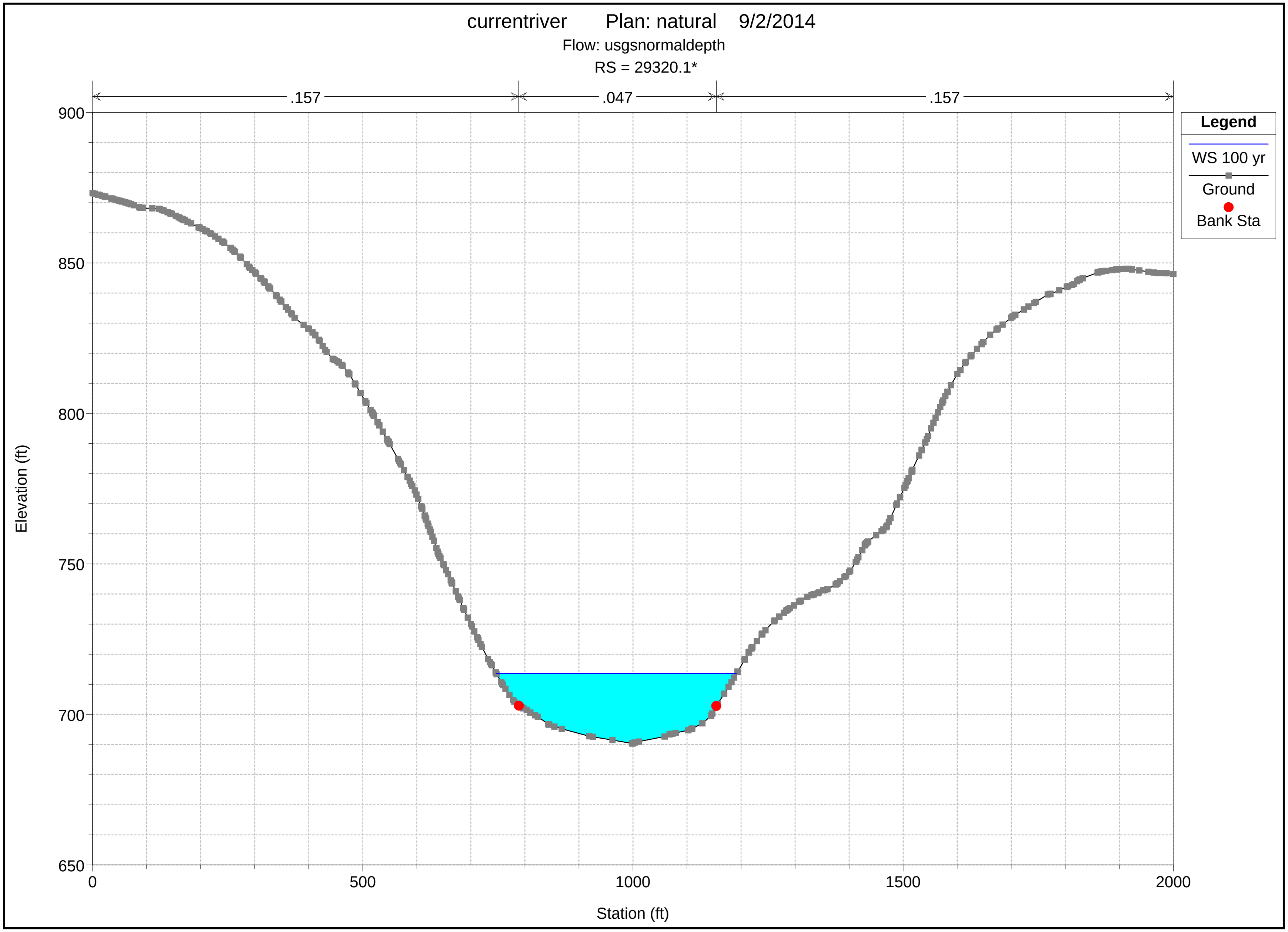
Station (ft)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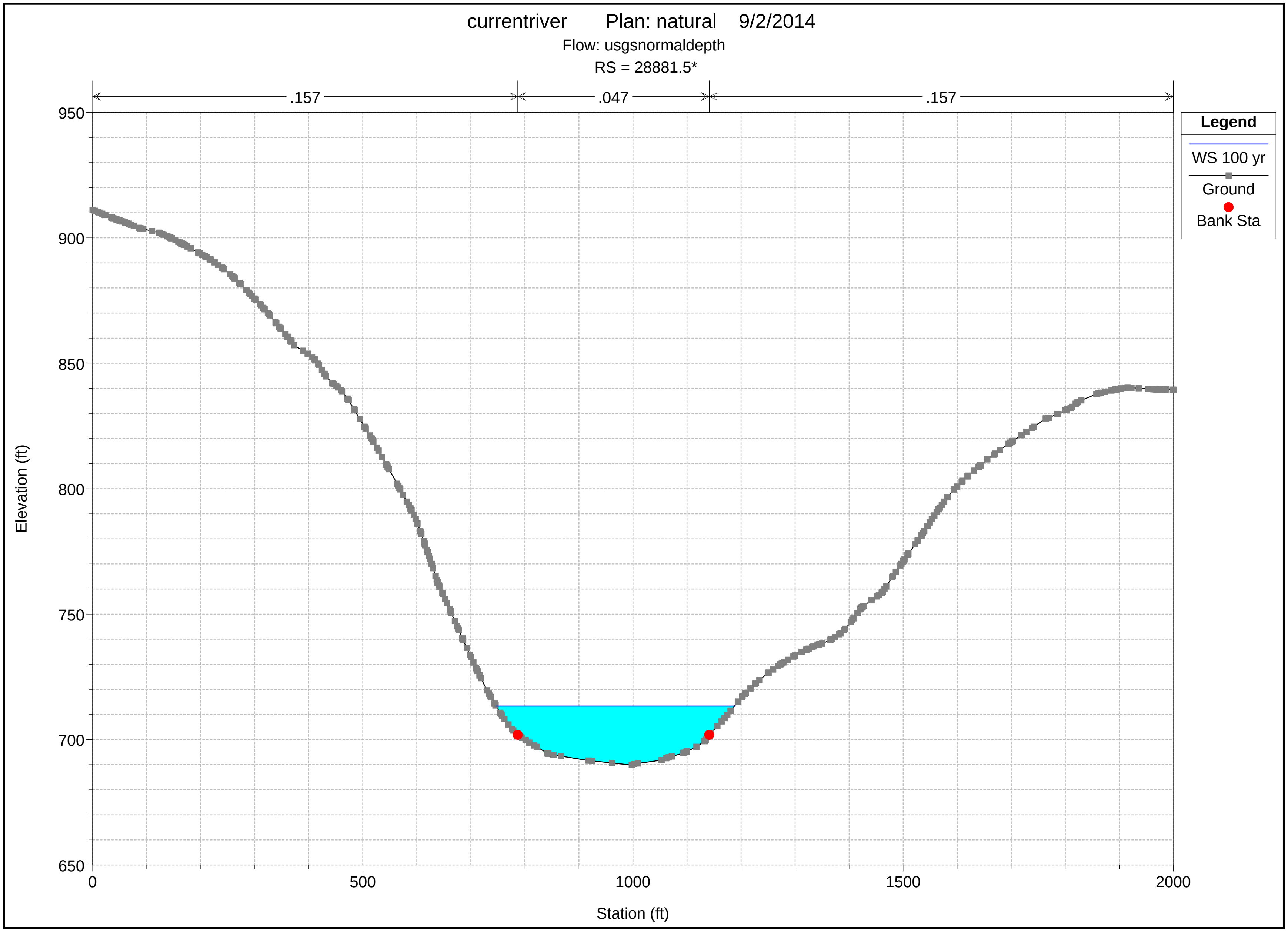
2000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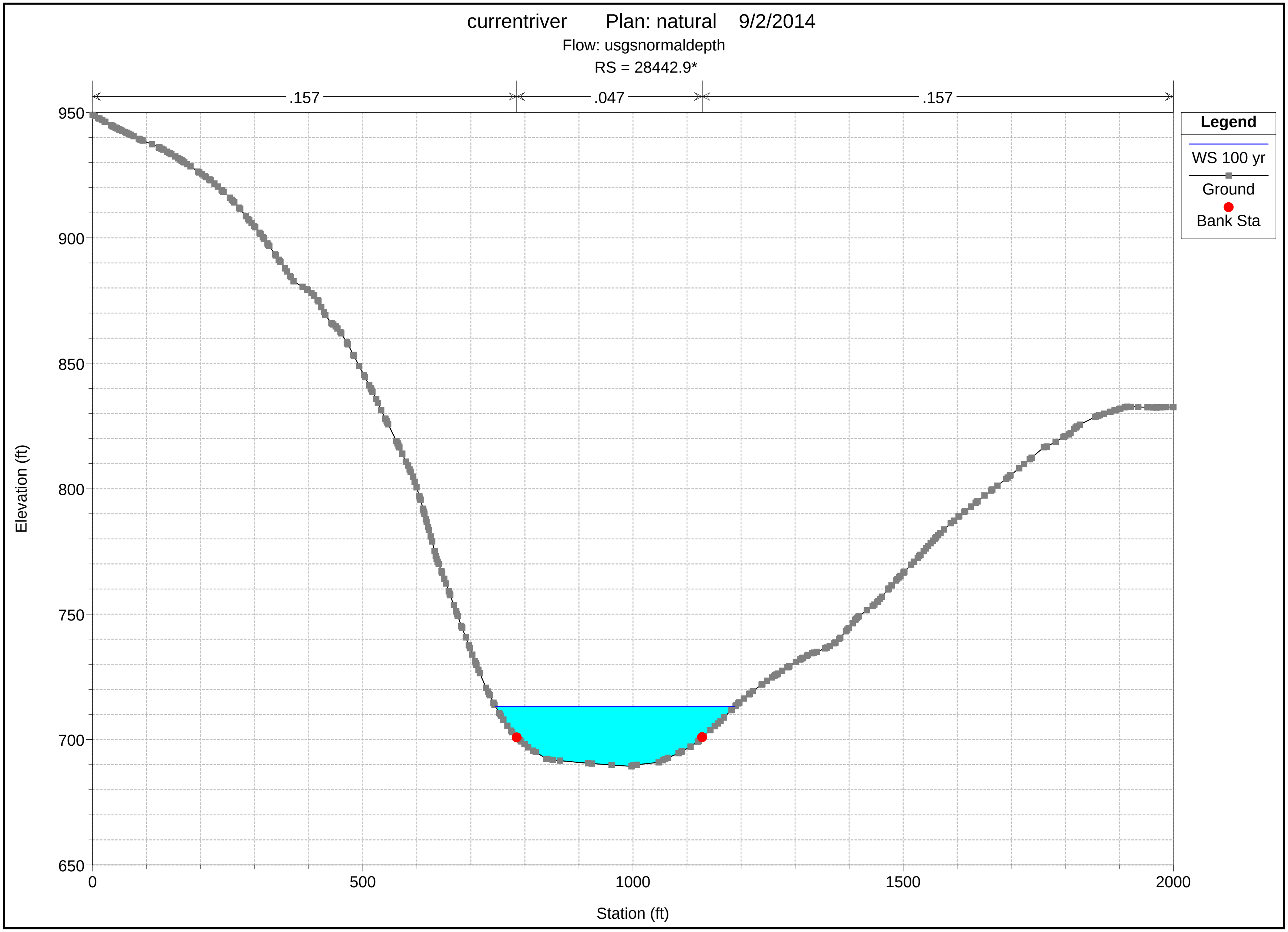
Station (ft)
Elevation (ft)
Legend
WS 100 yr
Ground
Bank Sta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Legend
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Ground
Bank Sta
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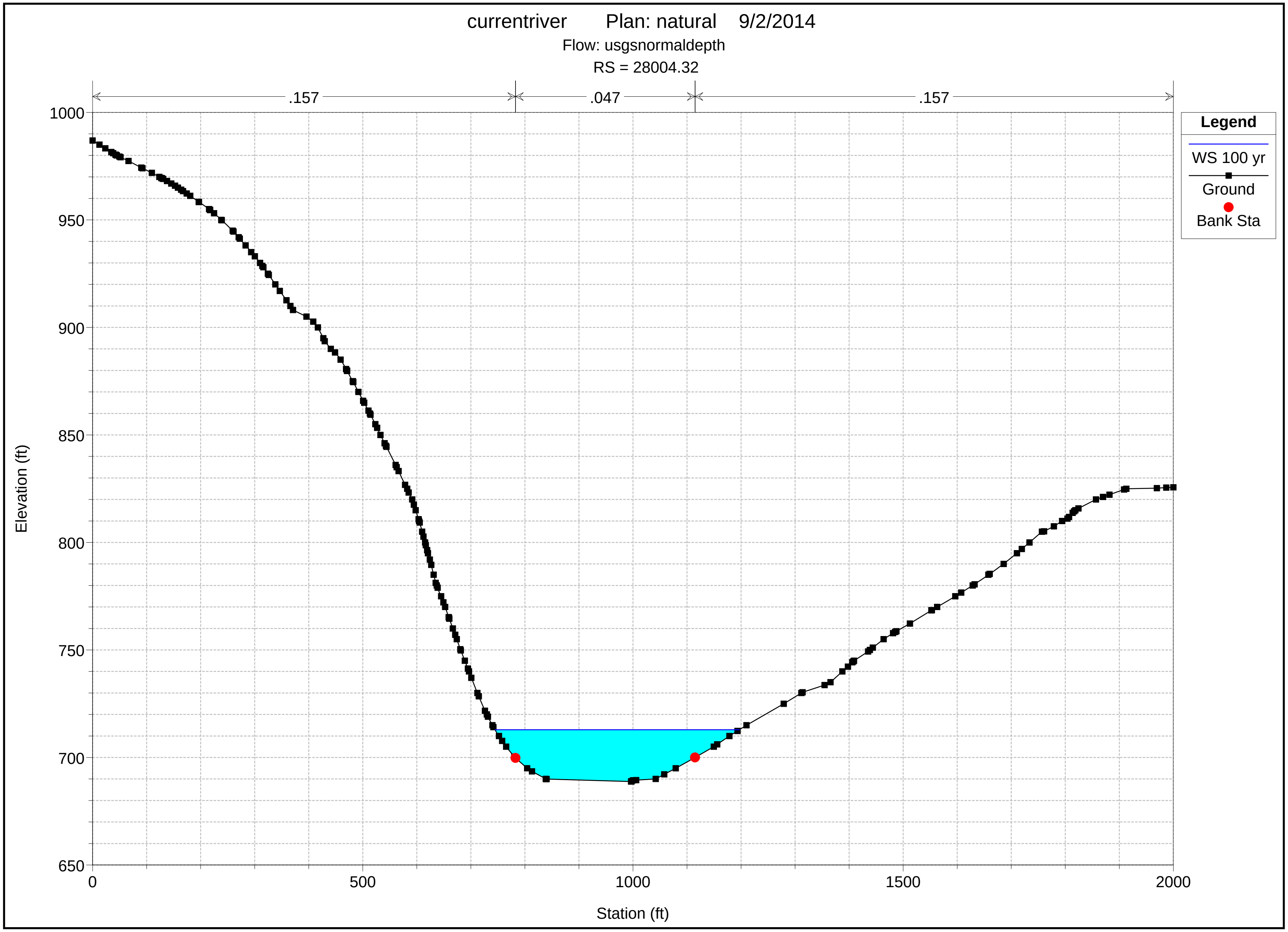
Station (ft)



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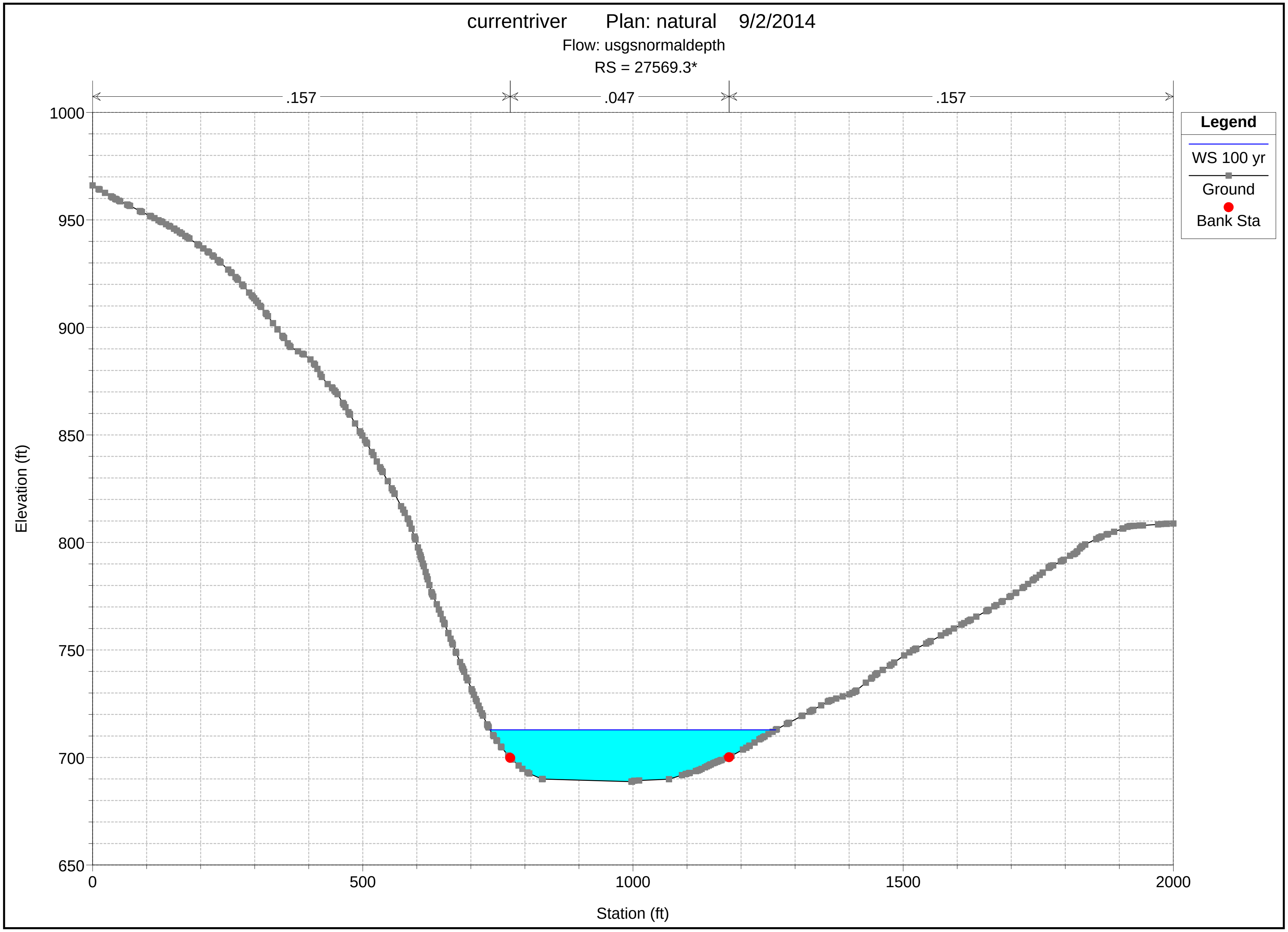
500
1000
1500
2000
Station (ft)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.047
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Legend
WS 100 yr
Ground
Bank Sta
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850
800
750
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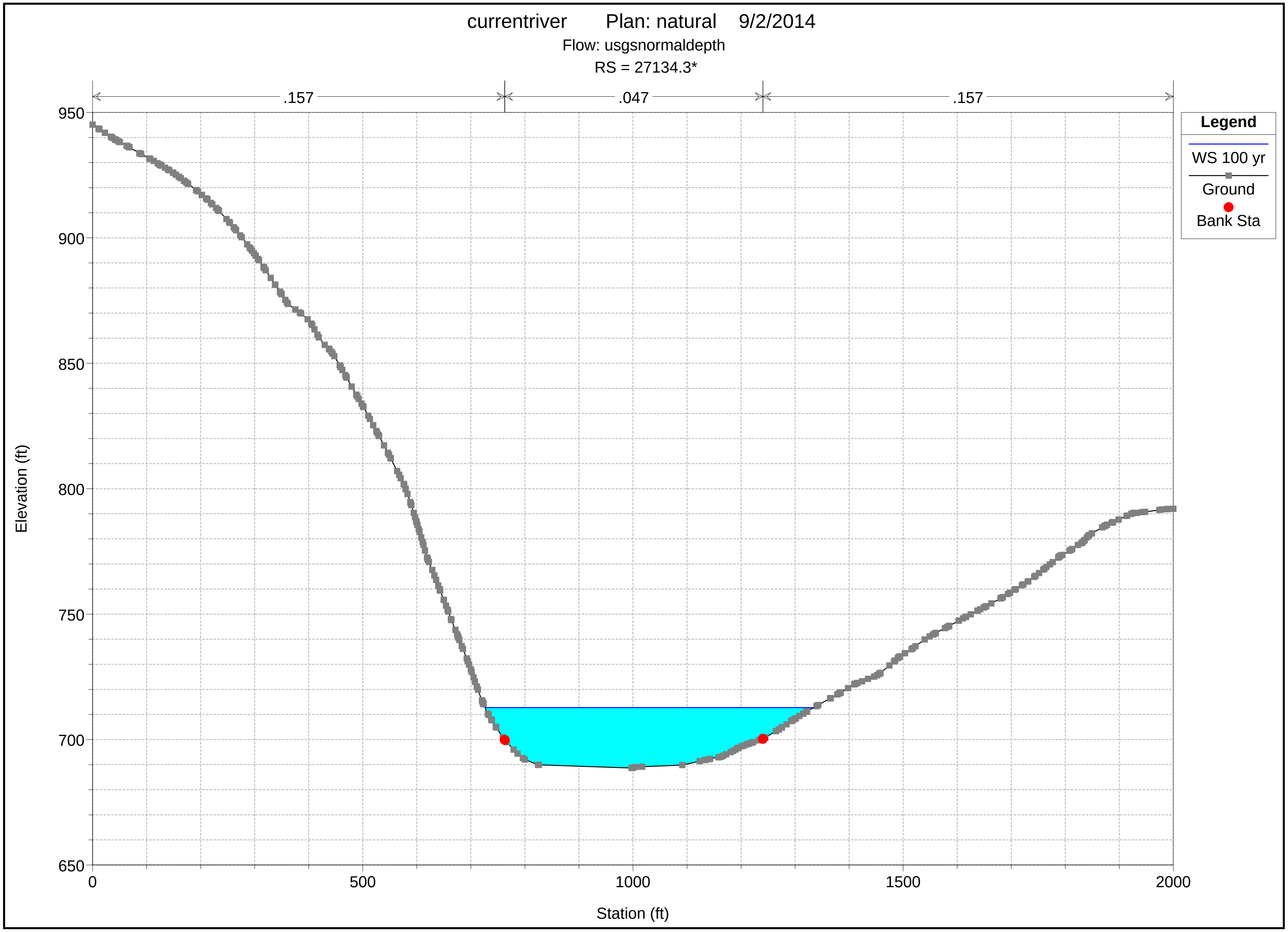
0
500
1000
1500
2000
Station (ft)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.047
.157
Legend
WS 100 yr
Ground
Bank Sta
Elevation (ft)
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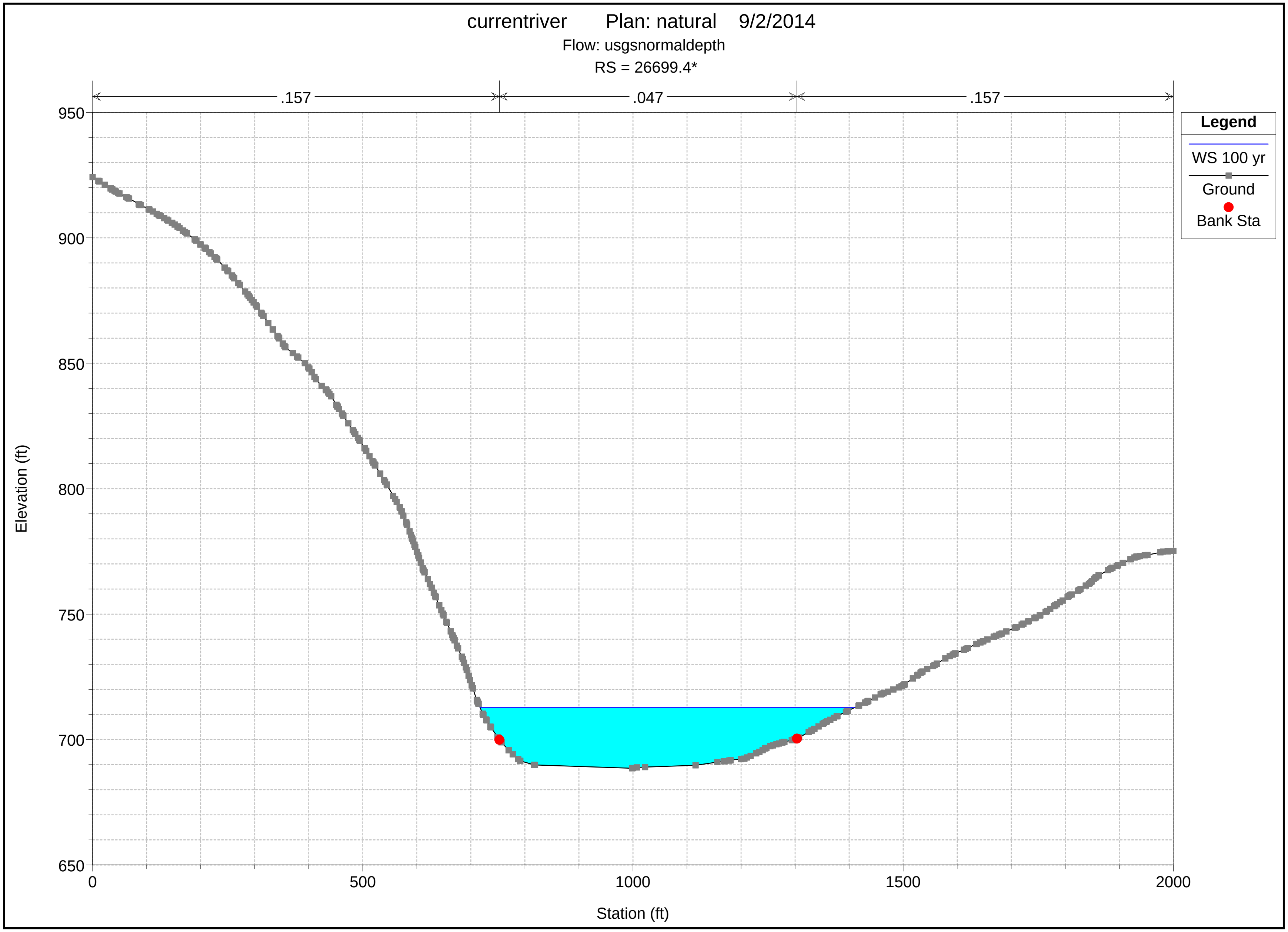
900
850
800
750
700
650
0
500
1000
1500
2000
Station (ft)



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Flow: usgsnormaldepth
RS = 26699.4*
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.047
.157
Legend
WS 100 yr
Ground
Bank Sta
Elevation (ft)
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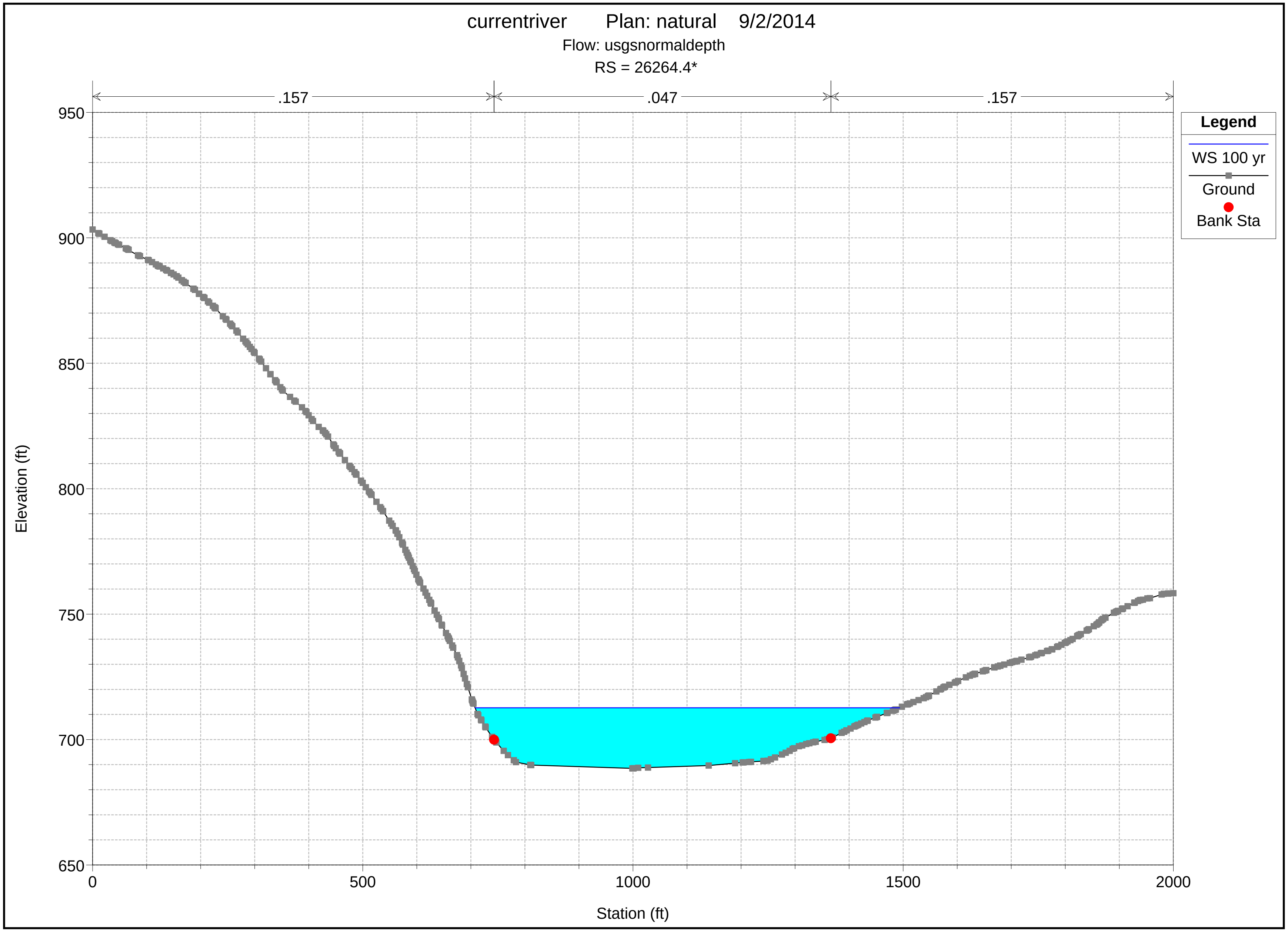
850
800
750
700
650
0
500
1000
1500
2000
Station (ft)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Flow: usgsnormaldepth
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.047
.157
Legend
WS 100 yr
Ground
Bank Sta
Elevation (ft)
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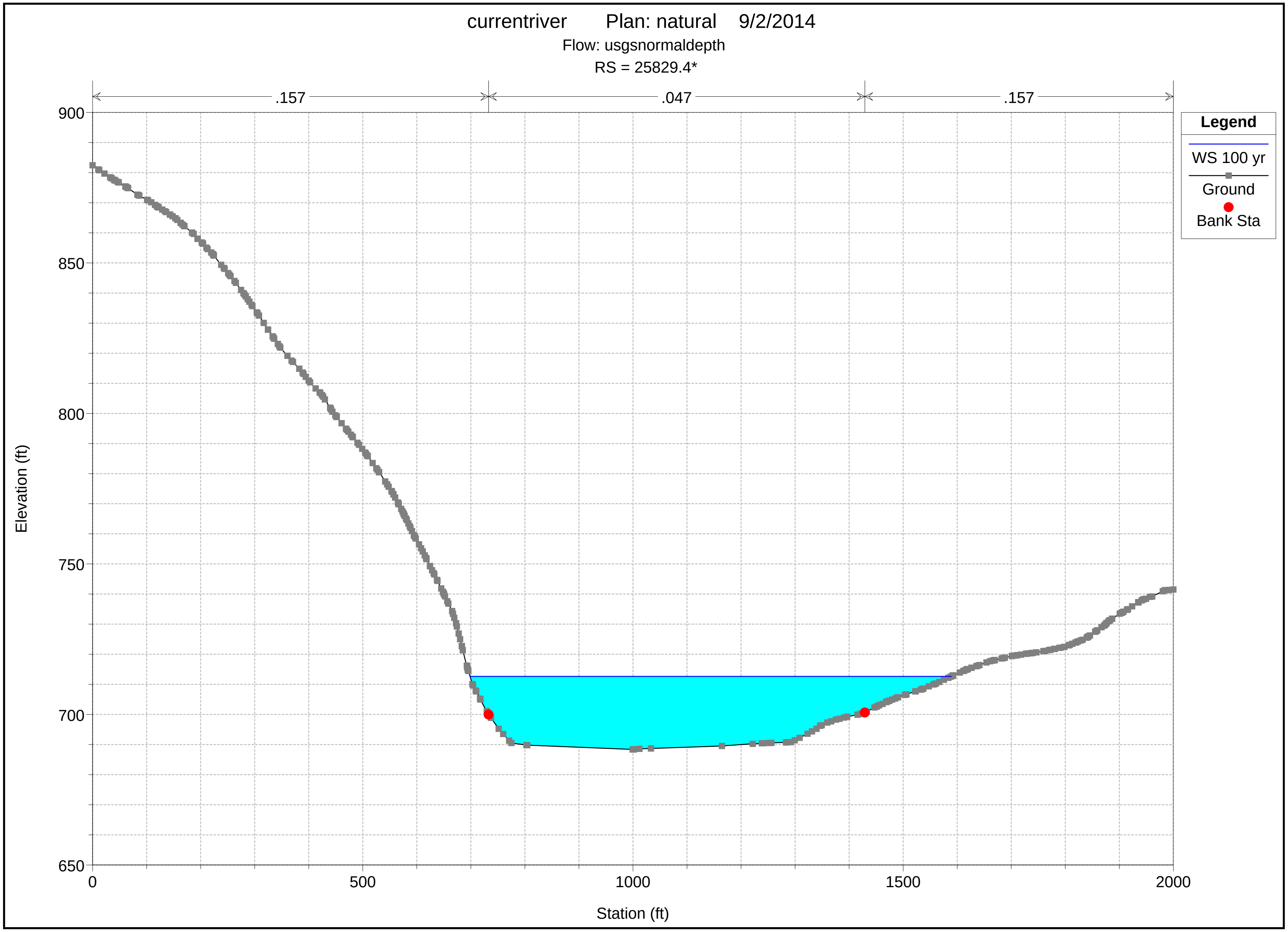
850
800
750
700
650
0
500
1000
1500
2000
Station (ft)



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Flow: usgsnormaldepth
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.047
.157
Legend
WS 100 yr
Ground
Bank Sta
Elevation (ft)
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850
800
750
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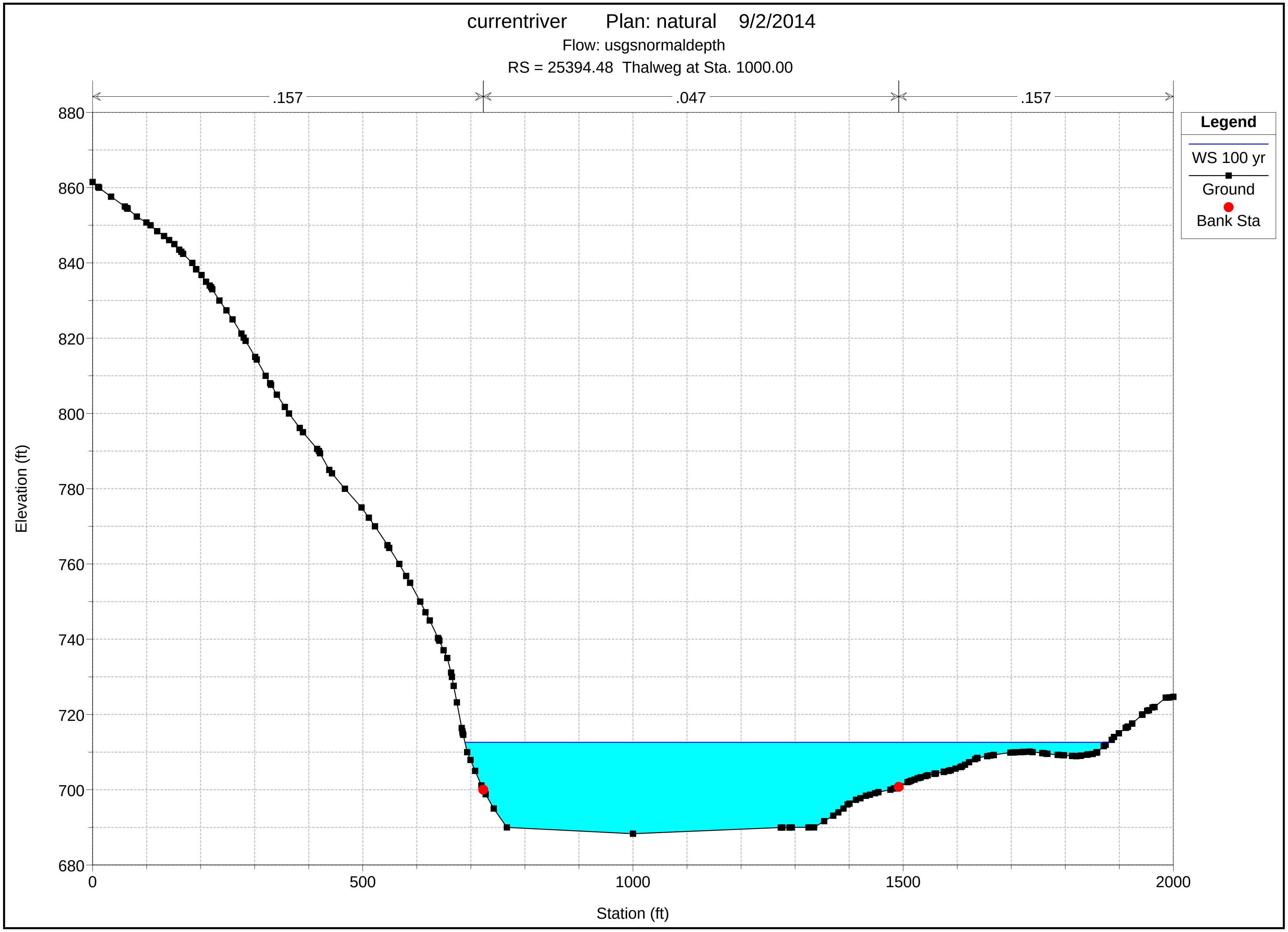
1000
1500
2000
Station (ft)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Flow: usgsnormaldepth
RS = 25394.48 Thalweg at Sta. 1000.00
.157
.047
.157
Legend
WS 100 yr
Ground
Bank Sta
Elevation (ft)
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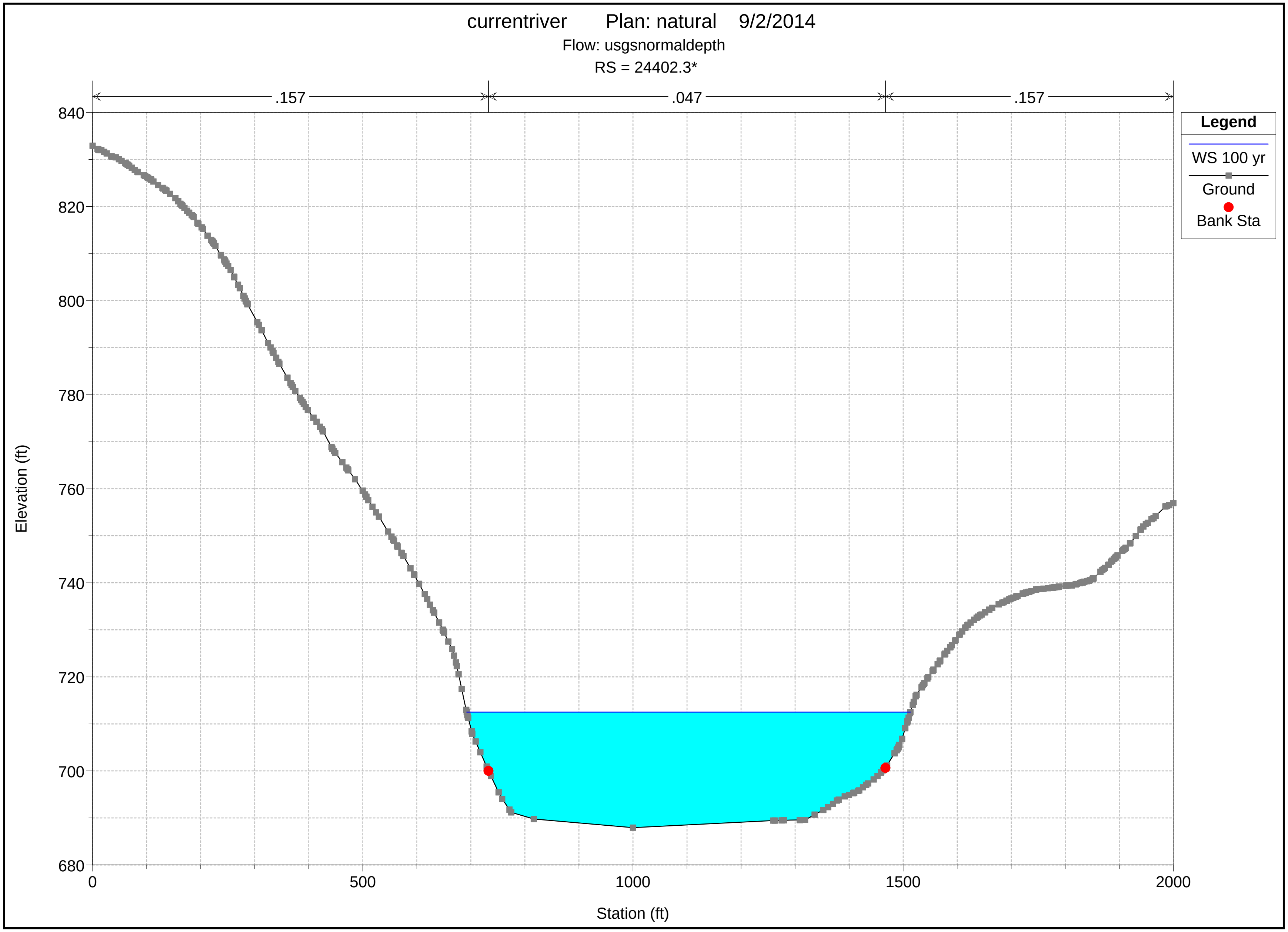
840
820
800
780
760
740
720
700
680
0
500
1000
1500
2000
Station (ft)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Flow: usgsnormaldepth
RS = 24402.3*
.157
.047
.157
Legend
WS 100 yr
Ground
Bank Sta
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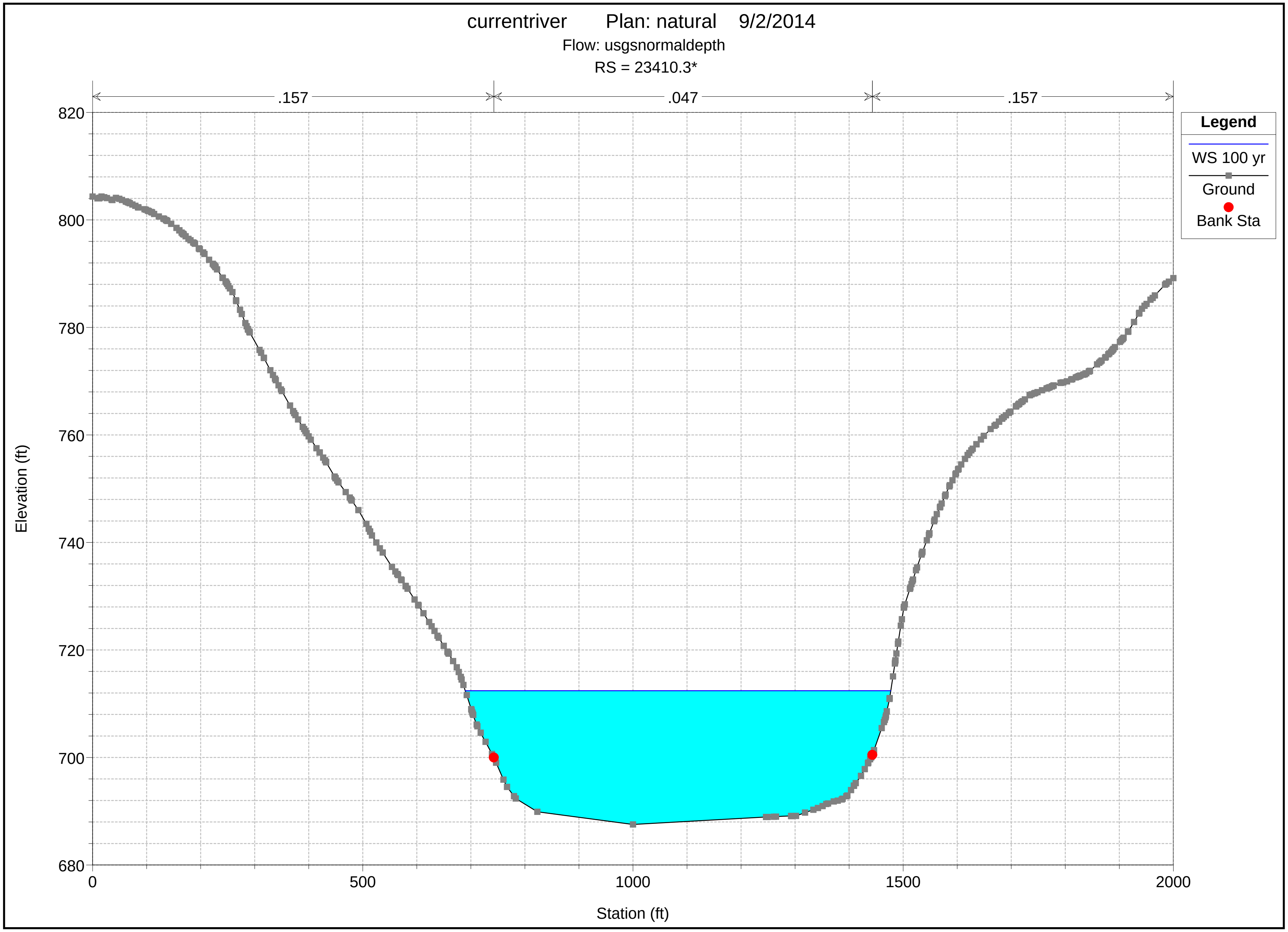
800
780
760
740
720
700
680
Elevation (ft)
0
500
1000
1500
2000
Station (ft)



currentriver Plan: natural 9/2/2014
Flow: usgsnormaldepth
RS = 23410.3*
.157
.047
.157
Legend
WS 100 yr
Ground
Bank Sta
Elevation (ft)
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800
780
760
740
720
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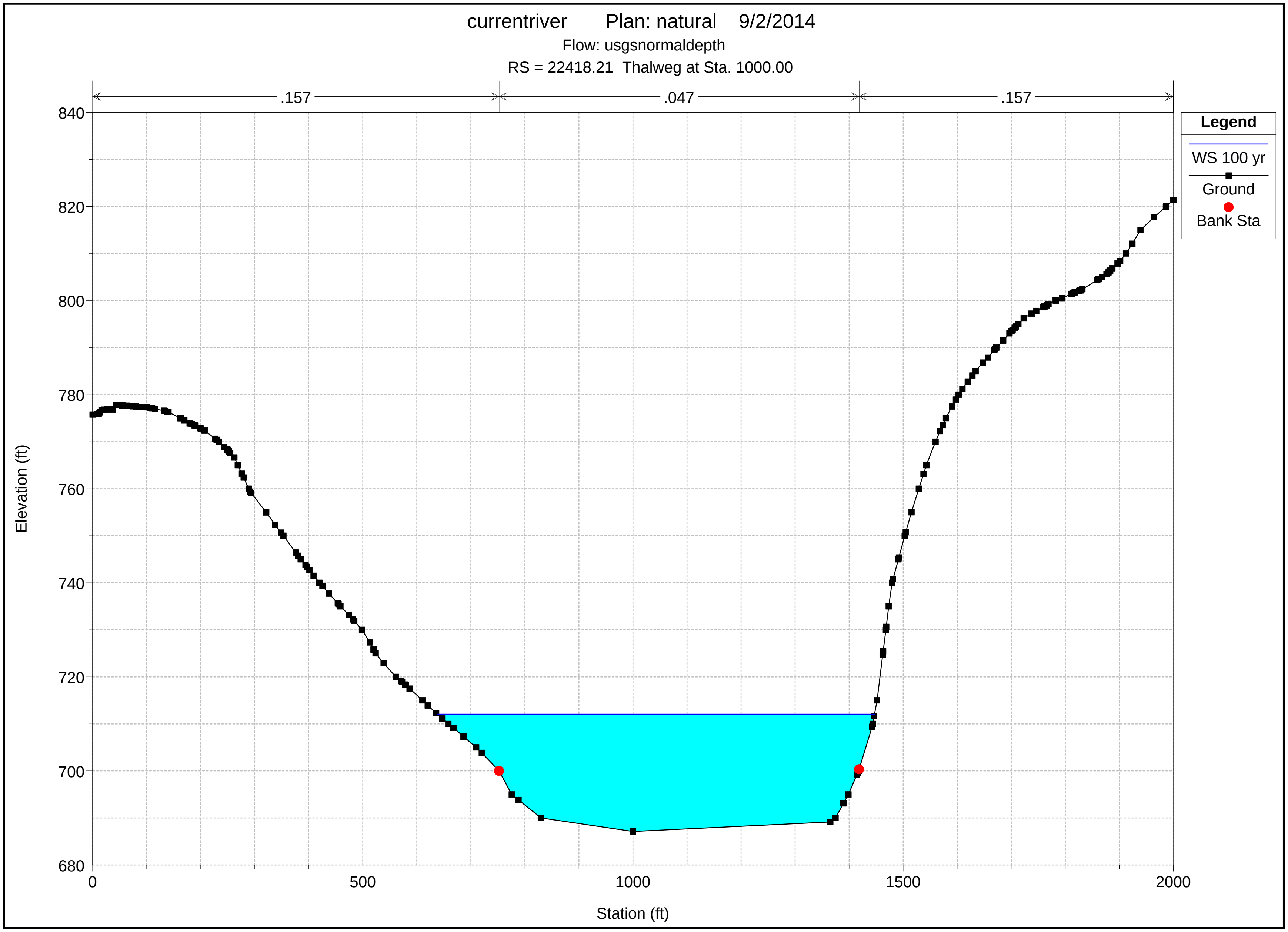
680
0
500
1000
1500
2000
Station (ft)



currentriver Plan: natural 9/2/2014
Flow: usgsnormaldepth
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.157
.047
.157
Legend
WS 100 yr
Ground
Bank Sta
Elevation (ft)
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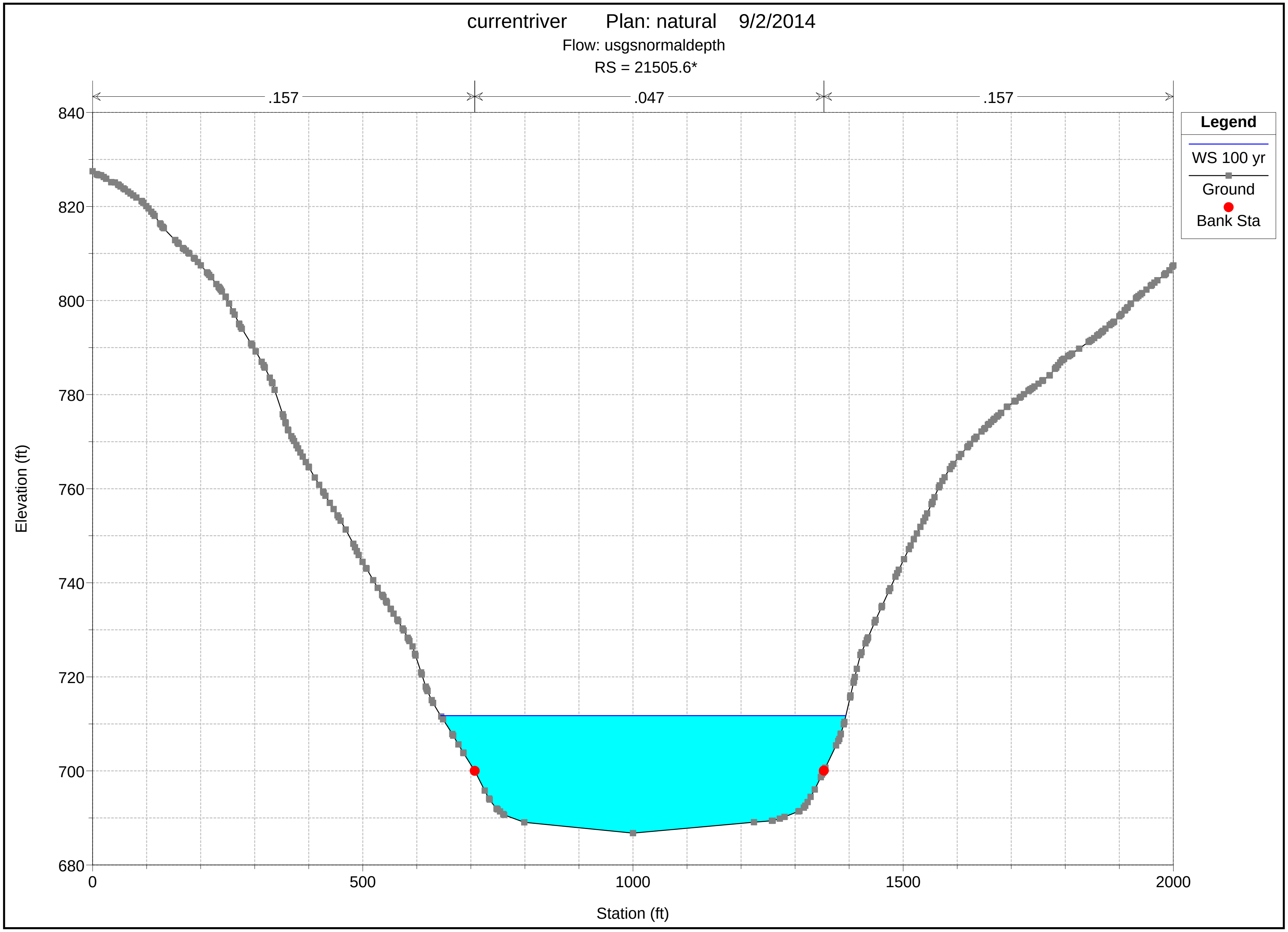
820
800
780
760
740
720
700
680
0
500
1000
1500
2000
Station (ft)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Flow: usgsnormaldepth
RS = 21505.6*
.157
.047
.157
Legend
WS 100 yr
Ground
Bank Sta
Elevation (ft)
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780
760
740
720
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0
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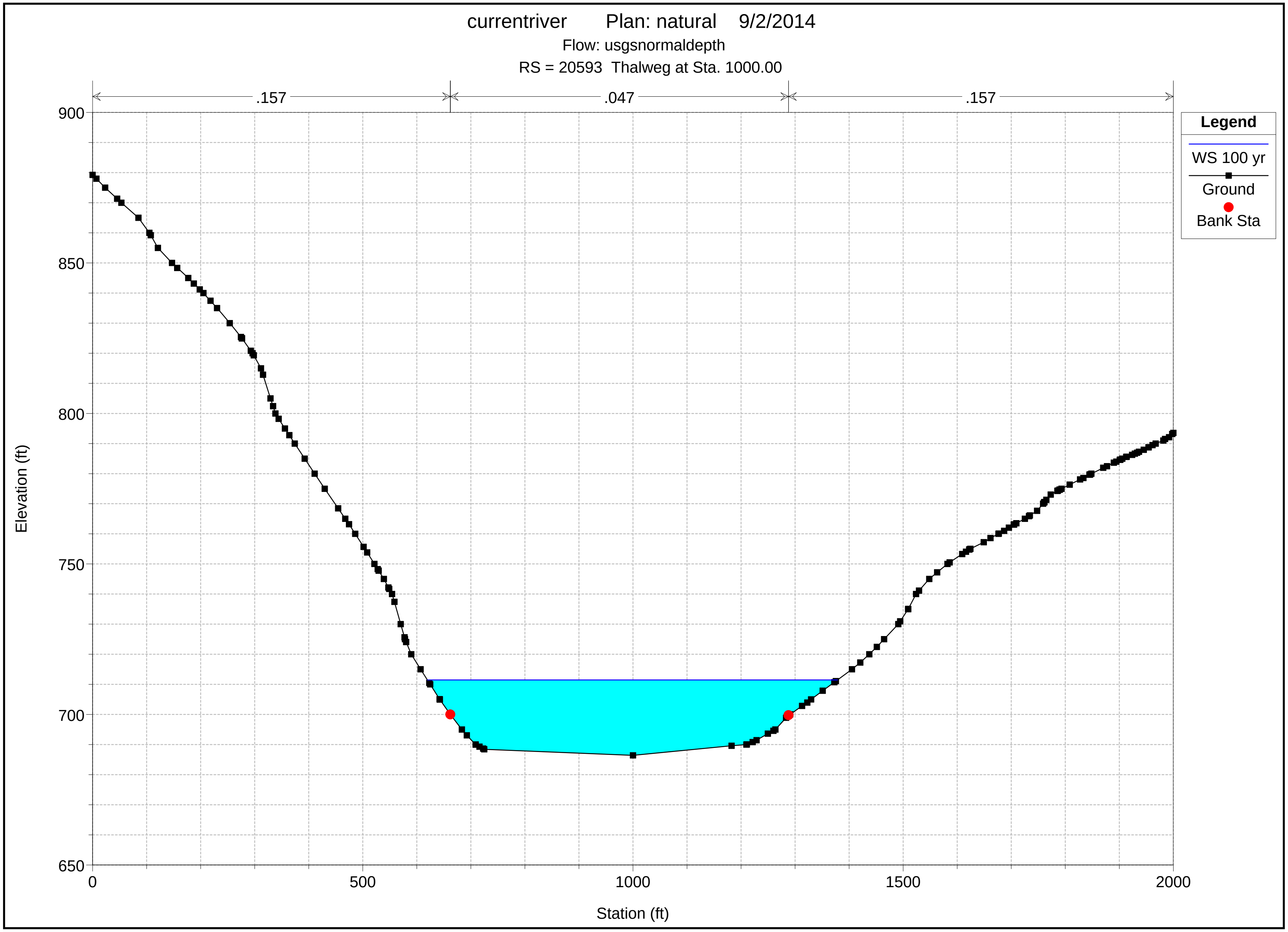
2000
Station (ft)



currentriver Plan: natural 9/2/2014
Flow: usgsnormaldepth
RS = 20593 Thalweg at Sta. 1000.00
.157
.047
.157
Legend
WS 100 yr
Ground
Bank Sta
Elevation (ft)
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800
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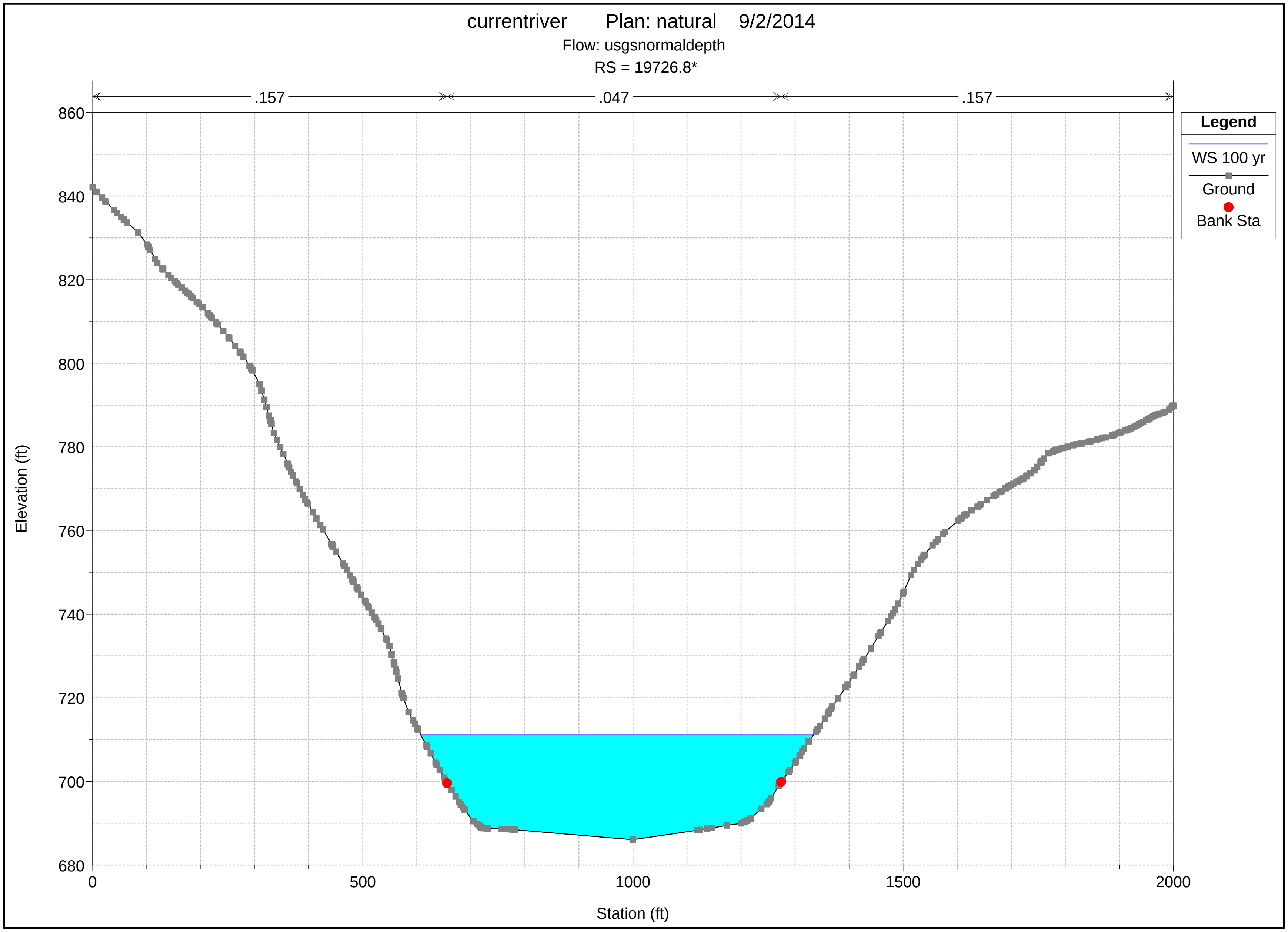
650
0
500
1000
1500
2000
Station (ft)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Flow: usgsnormaldepth
RS = 19726.8*
.157
.047
.157
Legend
WS 100 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
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840
820
800
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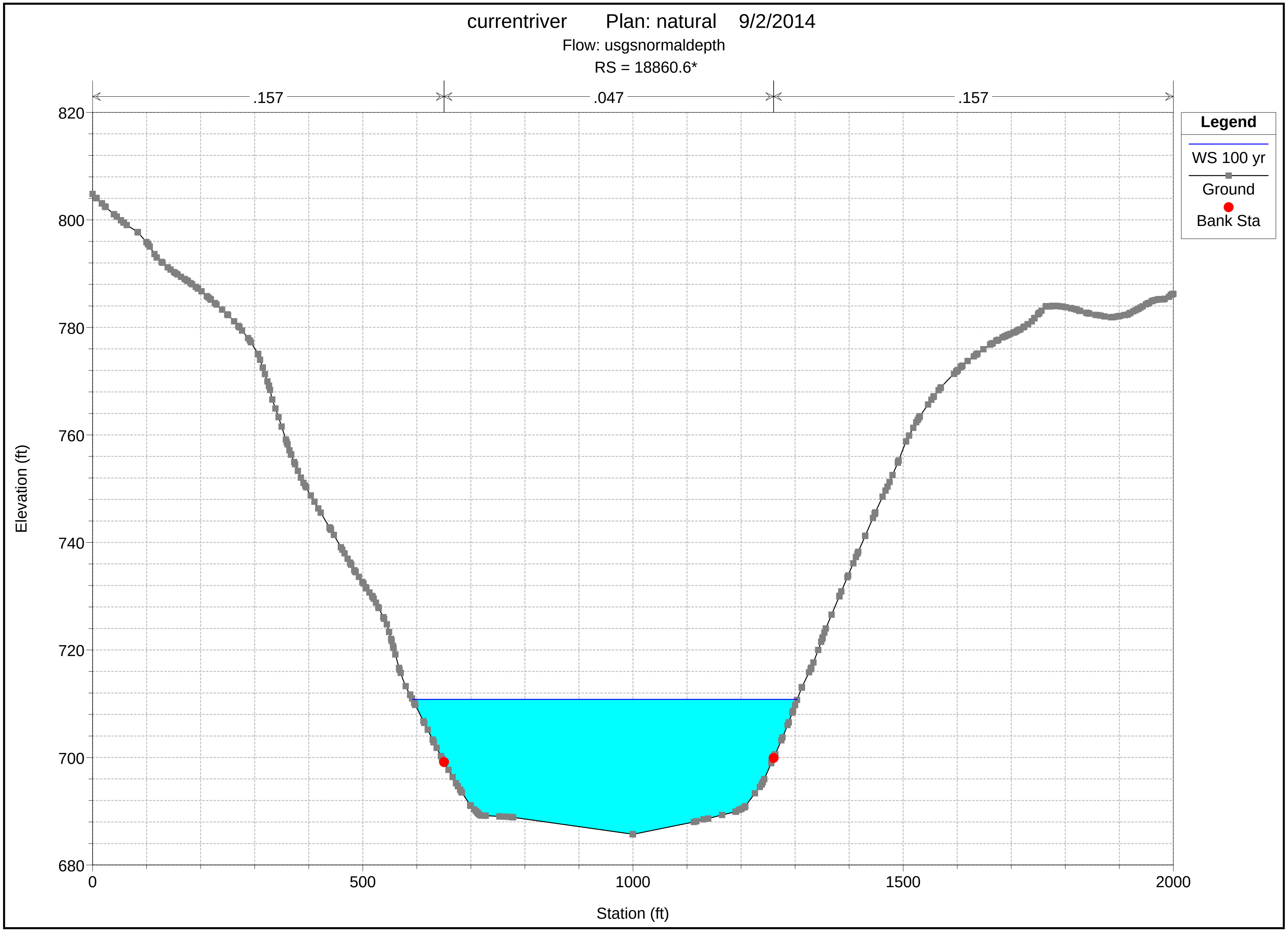
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Flow: usgsnormaldepth
RS = 18860.6*
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.047
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Legend
WS 100 yr
Ground
Bank Sta
Elevation (ft)
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780
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680
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1500
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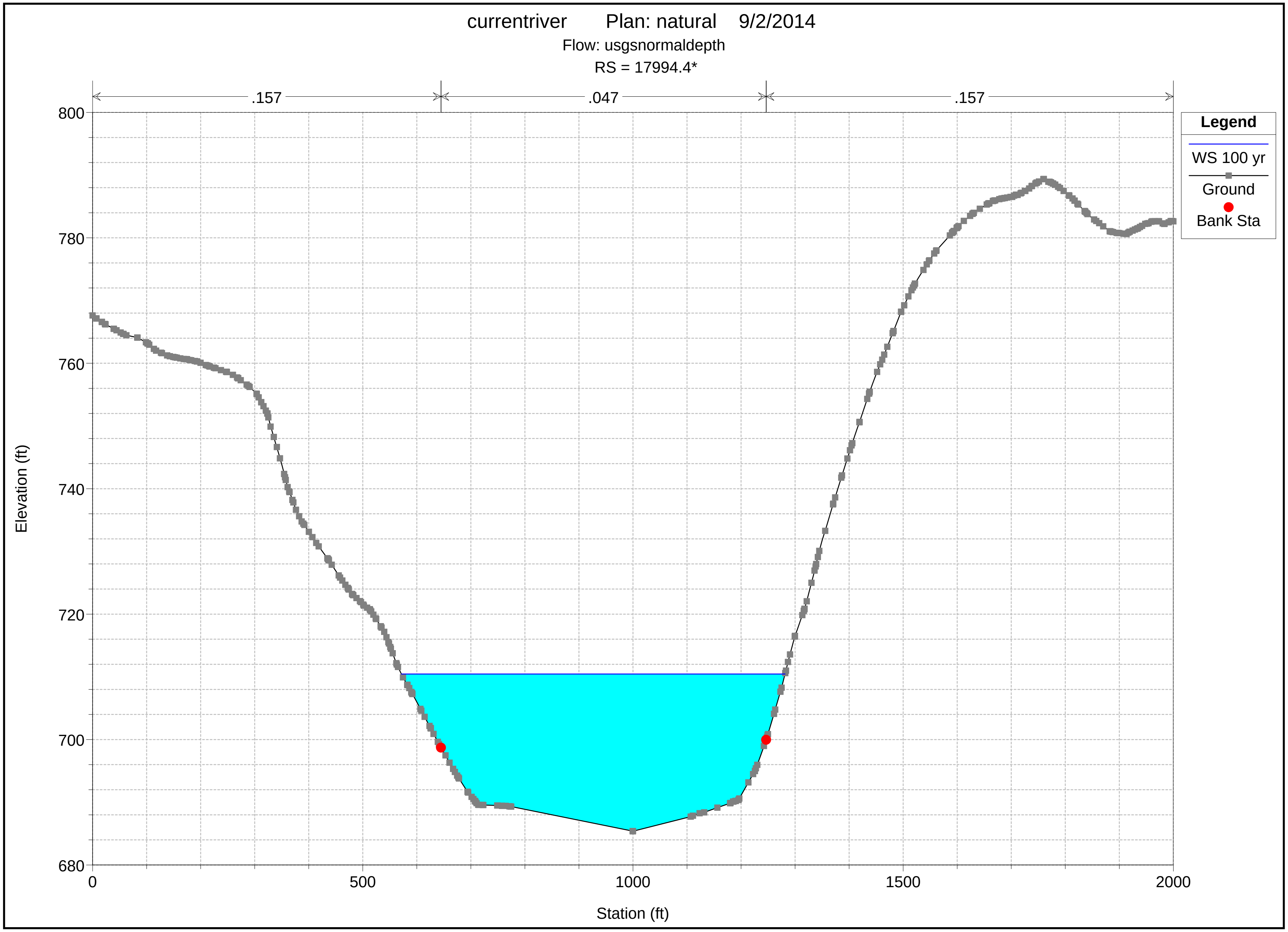
Station (ft)



currentriver Plan: natural 9/2/2014
Flow: usgsnormaldepth
RS = 17994.4*
.157
.047
.157
Legend
WS 100 yr
Ground
Bank Sta
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760
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500
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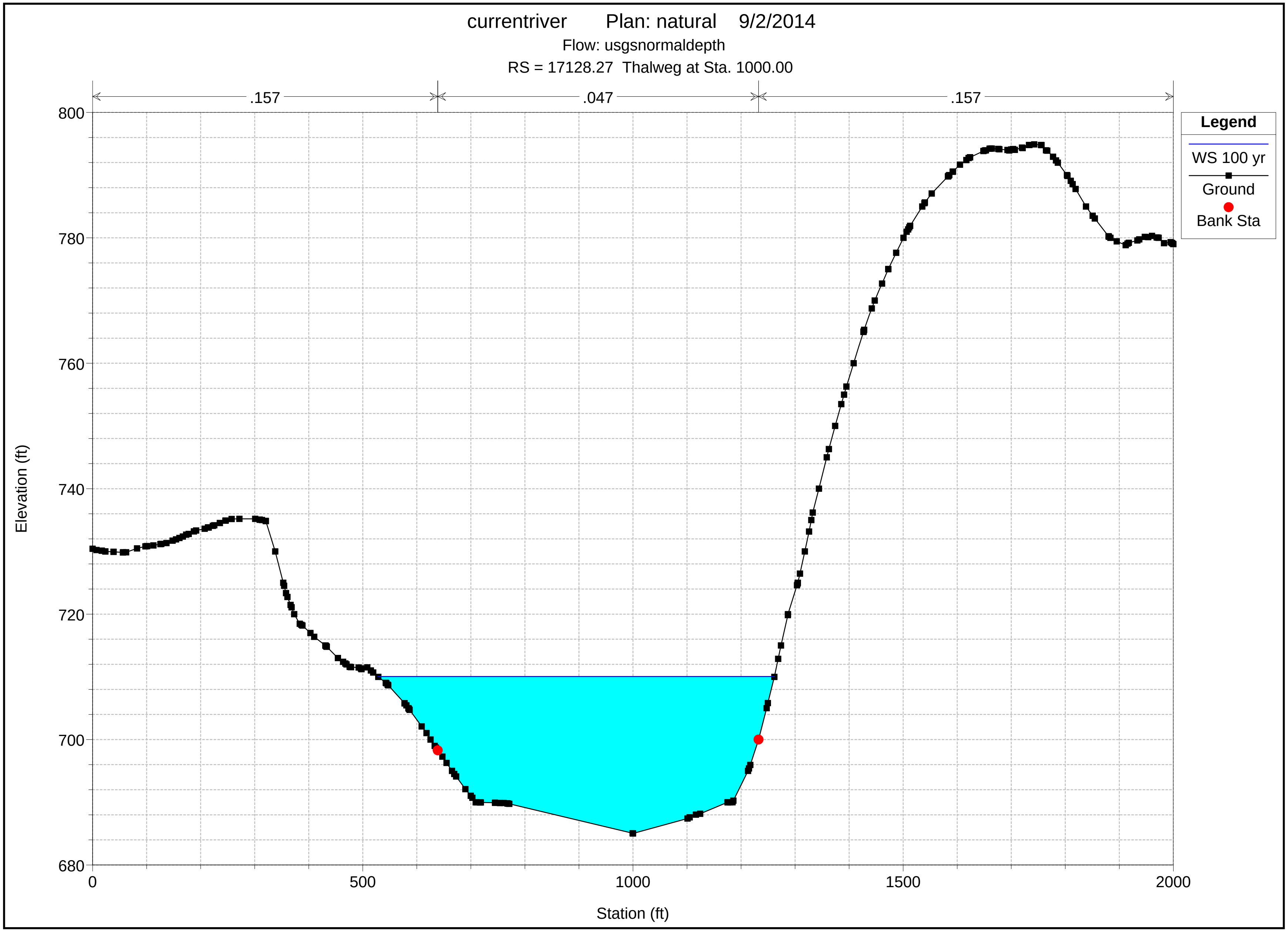
1500
2000
Elevation (ft)
Station (ft)



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.047
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Legend
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Ground
Bank Sta
Elevation (ft)
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680
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500
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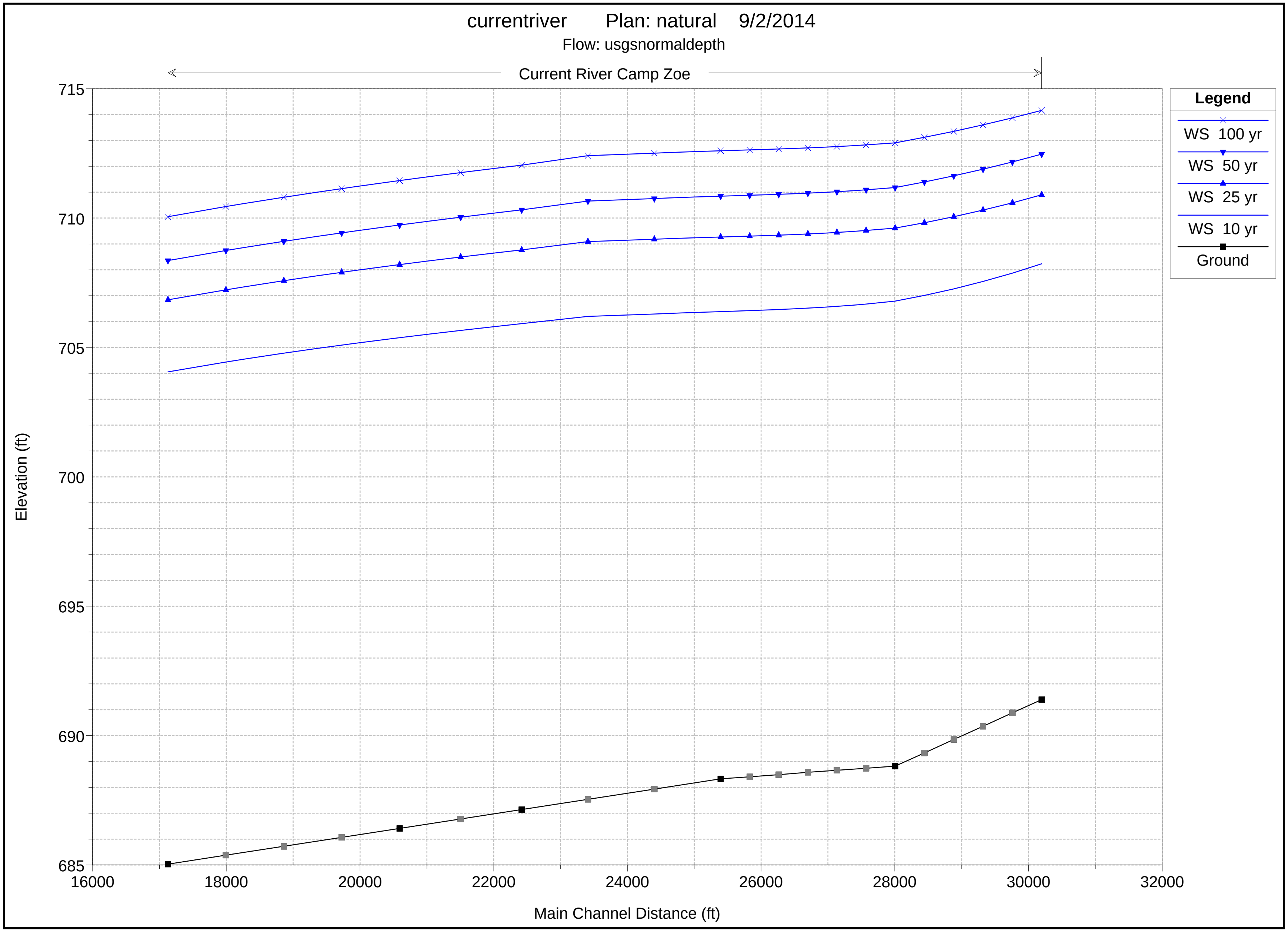
1500
2000
Station (ft)


currentriver Plan: natural 9/2/2014
Flow: usgsnormaldepth
Current River Camp Zoe
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
Ground
Elevation (ft)
715
710
705
700
695
690
685
16000
18000
20000
22000
24000
26000
28000
30000
32000
Main Channel Distance (ft)

HEC-RAS Plan: natural River: Current River Reach: Camp Zoe

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Camp Zoe	30197.44	10 yr	22097.00	691.39	708.24		708.60	0.000887	4.85	4608.39	417.70	0.25
Camp Zoe	30197.44	25 yr	28690.00	691.39	710.90		711.31	0.000753	5.12	5747.54	436.84	0.24
Camp Zoe	30197.44	50 yr	33643.00	691.39	712.47		712.92	0.000731	5.41	6442.92	447.44	0.24
Camp Zoe	30197.44	100 yr	38748.00	691.39	714.16		714.65	0.000691	5.62	7208.94	458.96	0.24
Camp Zoe	29758.8*	10 yr	22097.00	690.88	707.87		708.23	0.000803	4.76	4705.60	409.98	0.24
Camp Zoe	29758.8*	25 yr	28690.00	690.88	710.59		710.99	0.000693	5.06	5845.42	428.96	0.23
Camp Zoe	29758.8*	50 yr	33643.00	690.88	712.17		712.61	0.000681	5.36	6530.99	439.55	0.23
Camp Zoe	29758.8*	100 yr	38748.00	690.88	713.87		714.35	0.000650	5.58	7289.80	450.50	0.23
Camp Zoe	29320.1*	10 yr	22097.00	690.36	707.55		707.89	0.000720	4.66	4823.02	403.48	0.23
Camp Zoe	29320.1*	25 yr	28690.00	690.36	710.31		710.69	0.000634	4.98	5962.44	423.01	0.22
Camp Zoe	29320.1*	50 yr	33643.00	690.36	711.89		712.32	0.000631	5.30	6639.41	433.40	0.22
Camp Zoe	29320.1*	100 yr	38748.00	690.36	713.60		714.08	0.000608	5.54	7392.18	444.31	0.22
Camp Zoe	28881.5*	10 yr	22097.00	689.85	707.26		707.59	0.000640	4.56	4962.02	398.72	0.22
Camp Zoe	28881.5*	25 yr	28690.00	689.85	710.05		710.42	0.000577	4.90	6102.33	419.07	0.21
Camp Zoe	28881.5*	50 yr	33643.00	689.85	711.63		712.05	0.000582	5.23	6772.37	429.57	0.22
Camp Zoe	28881.5*	100 yr	38748.00	689.85	713.35		713.82	0.000567	5.48	7522.31	441.38	0.22
Camp Zoe	28442.9*	10 yr	22097.00	689.33	707.01		707.32	0.000564	4.44	5126.33	397.05	0.21
Camp Zoe	28442.9*	25 yr	28690.00	689.33	709.82		710.18	0.000522	4.81	6271.52	418.38	0.20
Camp Zoe	28442.9*	50 yr	33643.00	689.33	711.40		711.80	0.000534	5.16	6939.32	429.99	0.21
Camp Zoe	28442.9*	100 yr	38748.00	689.33	713.12		713.57	0.000526	5.43	7692.35	442.56	0.21
Camp Zoe	28004.32	10 yr	22097.00	688.82	706.79		707.08	0.000495	4.32	5324.09	399.43	0.19
Camp Zoe	28004.32	25 yr	28690.00	688.82	709.61		709.96	0.000471	4.72	6484.57	423.29	0.20
Camp Zoe	28004.32	50 yr	33643.00	688.82	711.18		711.58	0.000488	5.08	7158.58	437.06	0.20
Camp Zoe	28004.32	100 yr	38748.00	688.82	712.91		713.35	0.000486	5.36	7926.78	452.35	0.20
Camp Zoe	27569.3*	10 yr	22097.00	688.74	706.68		706.88	0.000345	3.59	6366.90	472.11	0.16
Camp Zoe	27569.3*	25 yr	28690.00	688.74	709.52		709.75	0.000325	3.91	7745.16	498.01	0.16
Camp Zoe	27569.3*	50 yr	33643.00	688.74	711.09		711.36	0.000337	4.20	8540.23	512.79	0.17
Camp Zoe	27569.3*	100 yr	38748.00	688.74	712.83		713.13	0.000335	4.43	9445.16	528.48	0.17
Camp Zoe	27134.3*	10 yr	22097.00	688.66	706.59		706.73	0.000251	3.05	7440.86	545.71	0.14
Camp Zoe	27134.3*	25 yr	28690.00	688.66	709.45		709.62	0.000236	3.32	9040.31	574.55	0.14
Camp Zoe	27134.3*	50 yr	33643.00	688.66	711.02		711.22	0.000244	3.57	9958.20	590.17	0.14
Camp Zoe	27134.3*	100 yr	38748.00	688.66	712.77		712.98	0.000242	3.77	11003.47	608.28	0.14
Camp Zoe	26699.4*	10 yr	22097.00	688.58	706.52		706.63	0.000188	2.65	8545.80	620.73	0.12
Camp Zoe	26699.4*	25 yr	28690.00	688.58	709.39		709.51	0.000177	2.88	10372.99	653.53	0.12
Camp Zoe	26699.4*	50 yr	33643.00	688.58	710.96		711.11	0.000183	3.10	11418.94	672.62	0.12
Camp Zoe	26699.4*	100 yr	38748.00	688.58	712.71		712.88	0.000182	3.27	12612.78	692.83	0.12
Camp Zoe	26264.4*	10 yr	22097.00	688.49	706.46		706.55	0.000145	2.33	9690.22	700.05	0.11
Camp Zoe	26264.4*	25 yr	28690.00	688.49	709.34		709.44	0.000136	2.54	11759.26	740.39	0.11
Camp Zoe	26264.4*	50 yr	33643.00	688.49	710.92		711.03	0.000141	2.73	12945.64	763.07	0.11
Camp Zoe	26264.4*	100 yr	38748.00	688.49	712.67		712.80	0.000140	2.88	14302.90	785.60	0.11
Camp Zoe	25829.4*	10 yr	22097.00	688.41	706.42		706.49	0.000114	2.08	10881.30	788.77	0.09
Camp Zoe	25829.4*	25 yr	28690.00	688.41	709.30		709.38	0.000108	2.26	13231.51	841.75	0.09
Camp Zoe	25829.4*	50 yr	33643.00	688.41	710.88		710.97	0.000111	2.43	14580.04	866.24	0.10
Camp Zoe	25829.4*	100 yr	38748.00	688.41	712.63		712.73	0.000111	2.57	16120.96	890.66	0.10
Camp Zoe	25394.48	10 yr	22097.00	688.33	706.39		706.44	0.000091	1.86	12185.38	907.28	0.08
Camp Zoe	25394.48	25 yr	28690.00	688.33	709.27		709.33	0.000086	2.03	14884.66	1027.53	0.08
Camp Zoe	25394.48	50 yr	33643.00	688.33	710.85		710.92	0.000089	2.19	16665.68	1173.73	0.09
Camp Zoe	25394.48	100 yr	38748.00	688.33	712.60		712.69	0.000088	2.30	18742.43	1191.29	0.09
Camp Zoe	24402.3*	10 yr	22097.00	687.93	706.29		706.35	0.000091	1.90	11791.69	787.30	0.08
Camp Zoe	24402.3*	25 yr	28690.00	687.93	709.18		709.25	0.000087	2.08	14091.59	804.44	0.08
Camp Zoe	24402.3*	50 yr	33643.00	687.93	710.75		710.83	0.000092	2.25	15363.34	812.34	0.09
Camp Zoe	24402.3*	100 yr	38748.00	687.93	712.51		712.60	0.000092	2.38	16796.45	820.96	0.09
Camp Zoe	23410.3*	10 yr	22097.00	687.54	706.20		706.26	0.000091	1.94	11558.29	752.49	0.08
Camp Zoe	23410.3*	25 yr	28690.00	687.54	709.09		709.16	0.000089	2.13	13759.71	770.35	0.09
Camp Zoe	23410.3*	50 yr	33643.00	687.54	710.66		710.74	0.000094	2.31	14974.01	778.87	0.09
Camp Zoe	23410.3*	100 yr	38748.00	687.54	712.41		712.50	0.000095	2.45	16347.05	787.34	0.09
Camp Zoe	22418.21	10 yr	36061.00	687.14	705.92		706.09	0.000255	3.27	11201.67	732.81	0.14
Camp Zoe	22418.21	25 yr	47982.00	687.14	708.77		708.98	0.000265	3.70	13341.54	769.19	0.15
Camp Zoe	22418.21	50 yr	55074.00	687.14	710.32		710.56	0.000269	3.93	14547.12	789.55	0.15
Camp Zoe	22418.21	100 yr	63489.00	687.14	712.05		712.32	0.000274	4.18	15928.78	808.80	0.15

HEC-RAS Plan: natural River: Current River Reach: Camp Zoe (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Camp Zoe	21505.6*	10 yr	36061.00	686.78	705.66		705.84	0.000284	3.42	10683.10	700.01	0.15
Camp Zoe	21505.6*	25 yr	47982.00	686.78	708.49		708.73	0.000294	3.87	12704.01	724.26	0.16
Camp Zoe	21505.6*	50 yr	55074.00	686.78	710.03		710.30	0.000298	4.11	13828.95	736.77	0.16
Camp Zoe	21505.6*	100 yr	63489.00	686.78	711.76		712.05	0.000303	4.36	15108.31	749.59	0.16
Camp Zoe	20593	10 yr	36061.00	686.41	705.38		705.57	0.000304	3.53	10371.50	691.36	0.15
Camp Zoe	20593	25 yr	47982.00	686.41	708.20		708.45	0.000315	4.00	12366.96	722.33	0.16
Camp Zoe	20593	50 yr	55074.00	686.41	709.73		710.01	0.000320	4.24	13487.82	739.49	0.16
Camp Zoe	20593	100 yr	63489.00	686.41	711.45		711.76	0.000324	4.51	14772.52	758.69	0.17
Camp Zoe	19726.8*	10 yr	36061.00	686.07	705.09		705.30	0.000329	3.64	10045.64	671.01	0.16
Camp Zoe	19726.8*	25 yr	47982.00	686.07	707.90		708.16	0.000339	4.11	11968.26	696.34	0.17
Camp Zoe	19726.8*	50 yr	55074.00	686.07	709.43		709.72	0.000343	4.36	13042.62	710.22	0.17
Camp Zoe	19726.8*	100 yr	63489.00	686.07	711.14		711.47	0.000348	4.63	14270.62	727.02	0.17
Camp Zoe	18860.6*	10 yr	36061.00	685.72	704.78		705.00	0.000359	3.75	9730.30	659.08	0.17
Camp Zoe	18860.6*	25 yr	47982.00	685.72	707.58		707.86	0.000366	4.23	11611.94	684.15	0.17
Camp Zoe	18860.6*	50 yr	55074.00	685.72	709.10		709.41	0.000370	4.48	12663.52	697.25	0.18
Camp Zoe	18860.6*	100 yr	63489.00	685.72	710.81		711.16	0.000374	4.76	13863.86	711.81	0.18
Camp Zoe	17994.4*	10 yr	36061.00	685.38	704.44		704.67	0.000395	3.88	9408.02	652.56	0.17
Camp Zoe	17994.4*	25 yr	47982.00	685.38	707.23		707.52	0.000400	4.37	11267.79	679.38	0.18
Camp Zoe	17994.4*	50 yr	55074.00	685.38	708.75		709.08	0.000403	4.62	12310.25	694.05	0.18
Camp Zoe	17994.4*	100 yr	63489.00	685.38	710.45		710.82	0.000405	4.90	13503.84	710.01	0.19
Camp Zoe	17128.27	10 yr	36061.00	685.03	704.05	693.34	704.31	0.000441	4.04	9076.90	652.09	0.18
Camp Zoe	17128.27	25 yr	47982.00	685.03	706.84	694.51	707.16	0.000441	4.52	10940.75	686.41	0.19
Camp Zoe	17128.27	50 yr	55074.00	685.03	708.36	695.16	708.71	0.000441	4.77	11996.50	706.74	0.19
Camp Zoe	17128.27	100 yr	63489.00	685.03	710.05	695.86	710.45	0.000441	5.05	13217.75	733.94	0.19

HEC-RAS Version 4.1.0 Jan 2010
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X     X  XXXXXX   XXXX        XXXX     XX     XXXX
X     X  X       X    X       X   X   X  X   X
X     X  X       X            X   X  X    X  X
XXXXXXX  XXXX    X      XXX   XXXX   XXXXXX   XXXX
X     X  X       X            X X    X    X       X
X     X  X       X    X       X  X   X    X       X
X     X  XXXXXX   XXXX        X   X  X    X  XXXXX
```

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PROJECT DATA
Project Title: currentriver
Project File : currentriver.prj
Run Date and Time: 9/2/2014 9:14:37 AM

Project in English units

Project Description:
Current River Model.
Geometry Data from USGS.
Flow data from USGS Regression
Equations (by MSH 06/16/14).
Modeled by JCZ 06/18/14.
Checked by RBL
07/02/14.
JCZ Added 2 yr, 200 yr, and 500 yr Flow 07/24/14.

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PLAN DATA

Plan Title: natural
Plan File : p:\Missouri OA-FMDC\0131554 - Camp Zoe\0131554.02 - Site Design\Drainage\HEC-RAS\currentriver.p02

Geometry Title: natural
Geometry File : p:\Missouri OA-FMDC\0131554 - Camp Zoe\0131554.02 - Site Design\Drainage\HEC-RAS\currentriver.g02

Flow Title   : usgsnormaldepth
Flow File   : p:\Missouri OA-FMDC\0131554 - Camp Zoe\0131554.02 - Site Design\Drainage\HEC-RAS\currentriver.f03

Plan Description:
Natural conditions (no existing or proposed bridges).
USGS Regression Flow
Data.
Normal Depth DS Boundary Condition.

Plan Summary Information:

Number of:	Cross Sections	= 21	Multiple Openings	=	0
	Culverts	= 0	Inline Structures	=	0
	Bridges	= 0	Lateral Structures	=	0

```
Computational Information
    Water surface calculation tolerance  =  0.01
    Critical depth calculation tolerance =  0.01
    Maximum number of iterations         =  20
    Maximum difference tolerance         =  0.3
    Flow tolerance factor                =  0.001

Computation Options
    Critical depth computed only where necessary
    Conveyance Calculation Method: At breaks in n values only
    Friction Slope Method:         Average Conveyance
    Computational Flow Regime:     Subcritical Flow


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FLOW DATA

Flow Title: usgsnormaldepth
Flow File : p:\Missouri OA-FMDC\0131554 - Camp Zoe\0131554.02 - Site
Design\Drainage\HEC-RAS\currentriver.f03

Flow Data (cfs)
******************************************************************************
*******************************
* River           Reach           RS       *           10 yr           25 yr
       50 yr          100 yr *
* Current River   Camp Zoe        30197.44*            22097           28690
       33643           38748 *
* Current River   Camp Zoe        22418.21*            36061           47982
       55074           63489 *
******************************************************************************
*******************************

Boundary Conditions
******************************************************************************
**************************
* River           Reach           Profile           *            Upstream
          Downstream    *
******************************************************************************
**************************
* Current River   Camp Zoe        10 yr             *
   Normal S = 0.0004409 *
* Current River   Camp Zoe        25 yr             *
   Normal S = 0.0004409 *
* Current River   Camp Zoe        50 yr             *
   Normal S = 0.0004409 *
* Current River   Camp Zoe        100 yr            *
   Normal S = 0.0004409 *
******************************************************************************
**************************

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SUMMARY OF MANNING'S N VALUES

River:Current River
*****************************************************************
*     Reach       *   River Sta.   *   n1    *   n2    *   n3    *
*****************************************************************
*Camp Zoe         *    30197.44    *     .157*     .047*     .157*
*Camp Zoe         *    29758.8*    *     .157*     .047*     .157*
*Camp Zoe         *    29320.1*    *     .157*     .047*     .157*
```

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*Camp Zoe         *    28881.5*    *      .157*      .047*      .157*
*Camp Zoe         *    28442.9*    *      .157*      .047*      .157*
*Camp Zoe         *    28004.32    *      .157*      .047*      .157*
*Camp Zoe         *    27569.3*    *      .157*      .047*      .157*
*Camp Zoe         *    27134.3*    *      .157*      .047*      .157*
*Camp Zoe         *    26699.4*    *      .157*      .047*      .157*
*Camp Zoe         *    26264.4*    *      .157*      .047*      .157*
*Camp Zoe         *    25829.4*    *      .157*      .047*      .157*
*Camp Zoe         *    25394.48    *      .157*      .047*      .157*
*Camp Zoe         *    24402.3*    *      .157*      .047*      .157*
*Camp Zoe         *    23410.3*    *      .157*      .047*      .157*
*Camp Zoe         *    22418.21    *      .157*      .047*      .157*
*Camp Zoe         *    21505.6*    *      .157*      .047*      .157*
*Camp Zoe         *    20593       *      .157*      .047*      .157*
*Camp Zoe         *    19726.8*    *      .157*      .047*      .157*
*Camp Zoe         *    18860.6*    *      .157*      .047*      .157*
*Camp Zoe         *    17994.4*    *      .157*      .047*      .157*
*Camp Zoe         *    17128.27    *      .157*      .047*      .157*
*****************************************************************

******************************************************************************
**

SUMMARY OF REACH LENGTHS

River: Current River
*****************************************************************
*     Reach       *   River Sta.   *  Left    * Channel *  Right   *
*****************************************************************
*Camp Zoe         *    30197.44    *     493.6*    438.62*    399.42*
*Camp Zoe         *    29758.8*    *     493.6*    438.62*    399.42*
*Camp Zoe         *    29320.1*    *     493.6*    438.62*    399.42*
*Camp Zoe         *    28881.5*    *     493.6*    438.62*    399.42*
*Camp Zoe         *    28442.9*    *     493.6*    438.62*    399.42*
*Camp Zoe         *    28004.32    *    458.12*    434.98*    434.98*
*Camp Zoe         *    27569.3*    *    458.12*    434.98*    416.86*
*Camp Zoe         *    27134.3*    *    458.12*    434.98*    416.86*
*Camp Zoe         *    26699.4*    *    458.12*    434.98*    416.86*
*Camp Zoe         *    26264.4*    *    458.12*    434.98*    416.86*
*Camp Zoe         *    25829.4*    *    458.12*    434.98*    416.86*
*Camp Zoe         *    25394.48    *   1000.94*    992.09*    990.26*
*Camp Zoe         *    24402.3*    *   1000.94*    992.09*    990.26*
*Camp Zoe         *    23410.3*    *   1000.94*    992.09*    990.26*
*Camp Zoe         *    22418.21    *     912.6*     912.6*     912.6*
*Camp Zoe         *    21505.6*    *     912.6*     912.6*     912.6*
*Camp Zoe         *    20593       *    803.32*    866.18*     939.8*
*Camp Zoe         *    19726.8*    *    803.32*    866.18*     939.8*
*Camp Zoe         *    18860.6*    *    803.32*    866.18*     939.8*
*Camp Zoe         *    17994.4*    *    803.32*    866.18*     939.8*
*Camp Zoe         *    17128.27    *          *          *          *
*****************************************************************

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SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Current River

*******************************************************
*     Reach       *   River Sta.   * Contr.  * Expan.  *
*******************************************************
*Camp Zoe         *    30197.44*       .1*        .3*
*Camp Zoe         *    29758.8**       .1*        .3*
*Camp Zoe         *    29320.1**       .1*        .3*
*Camp Zoe         *    28881.5**       .1*        .3*
*Camp Zoe         *    28442.9**       .1*        .3*
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*Camp Zoe        *    28004.32*       .1*       .3*
*Camp Zoe        *    27569.3**       .1*       .3*
*Camp Zoe        *    27134.3**       .1*       .3*
*Camp Zoe        *    26699.4**       .1*       .3*
*Camp Zoe        *    26264.4**       .1*       .3*
*Camp Zoe        *    25829.4**       .1*       .3*
*Camp Zoe        *    25394.48*       .1*       .3*
*Camp Zoe        *    24402.3**       .1*       .3*
*Camp Zoe        *    23410.3**       .1*       .3*
*Camp Zoe        *    22418.21*       .1*       .3*
*Camp Zoe        *    21505.6**       .1*       .3*
*Camp Zoe        *    20593   *       .1*       .3*
*Camp Zoe        *    19726.8**       .1*       .3*
*Camp Zoe        *    18860.6**       .1*       .3*
*Camp Zoe        *    17994.4**       .1*       .3*
*Camp Zoe        *    17128.27*       .1*       .3*
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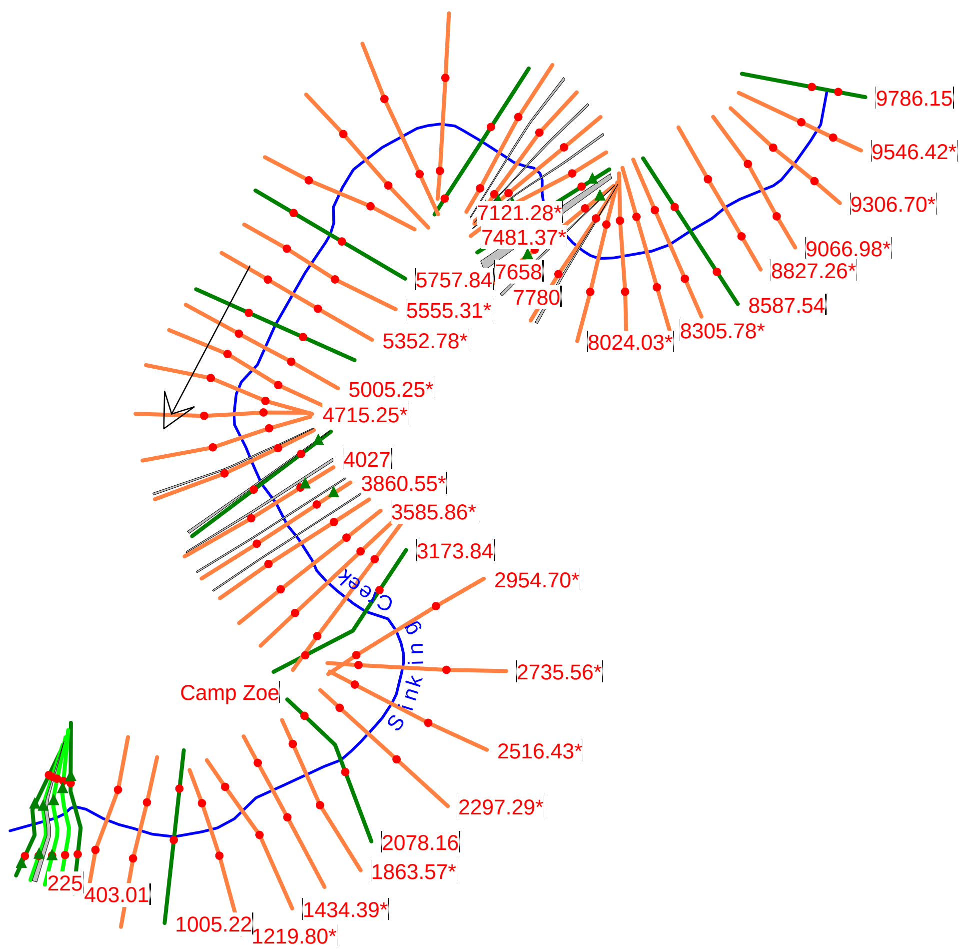
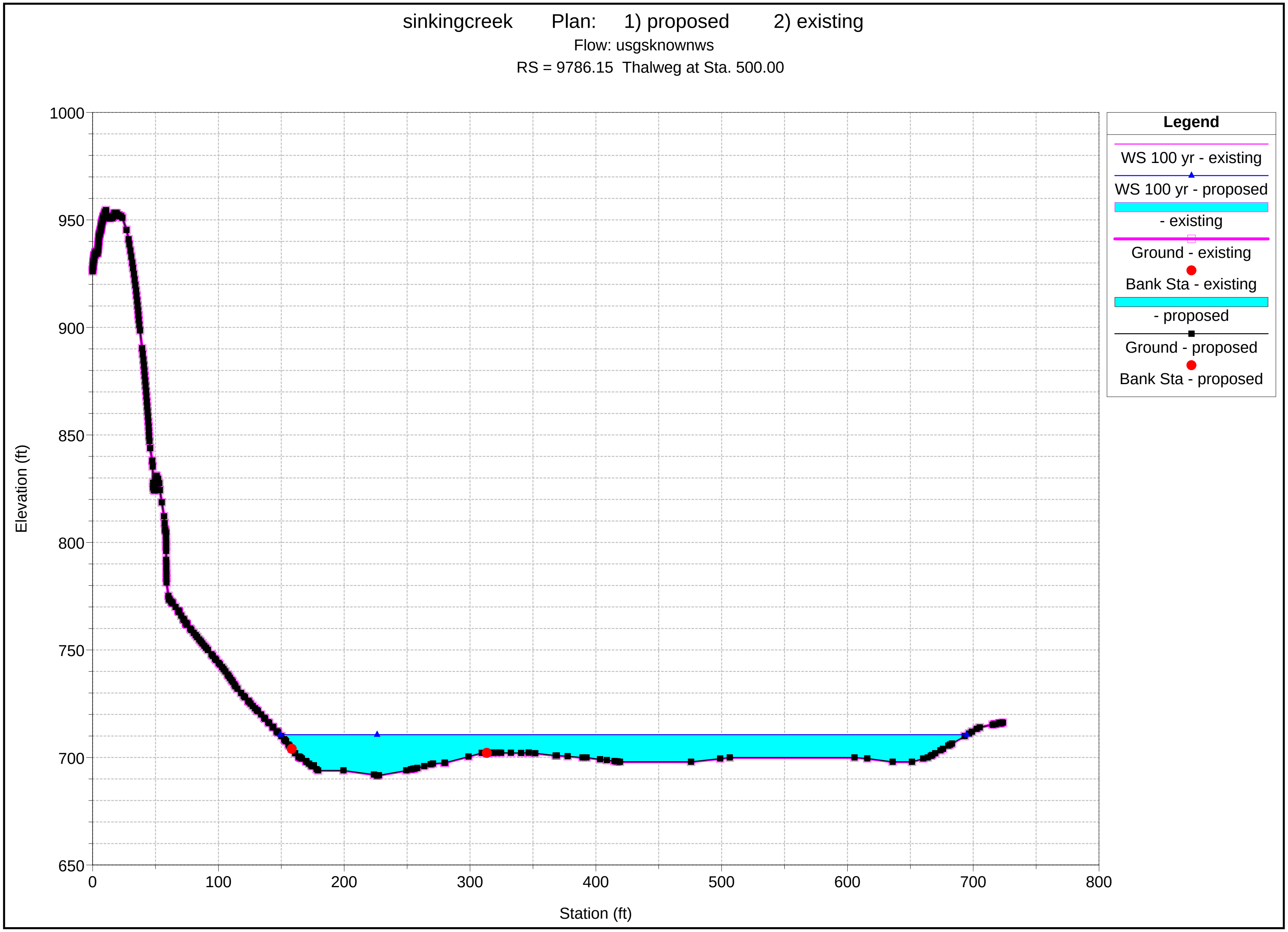
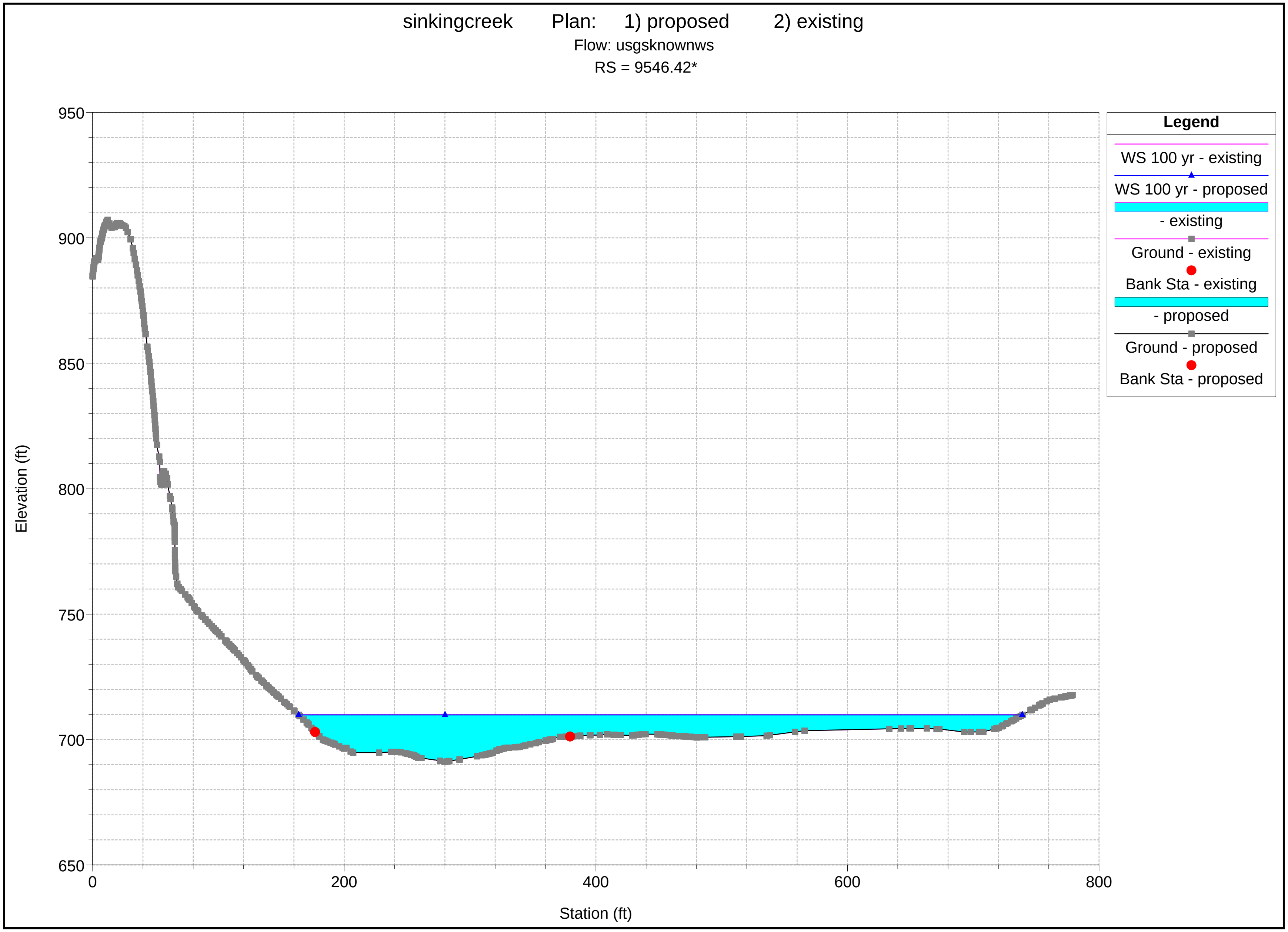
ERRORS WARNINGS AND NOTES
Errors Warnings and Notes for Plan : natural

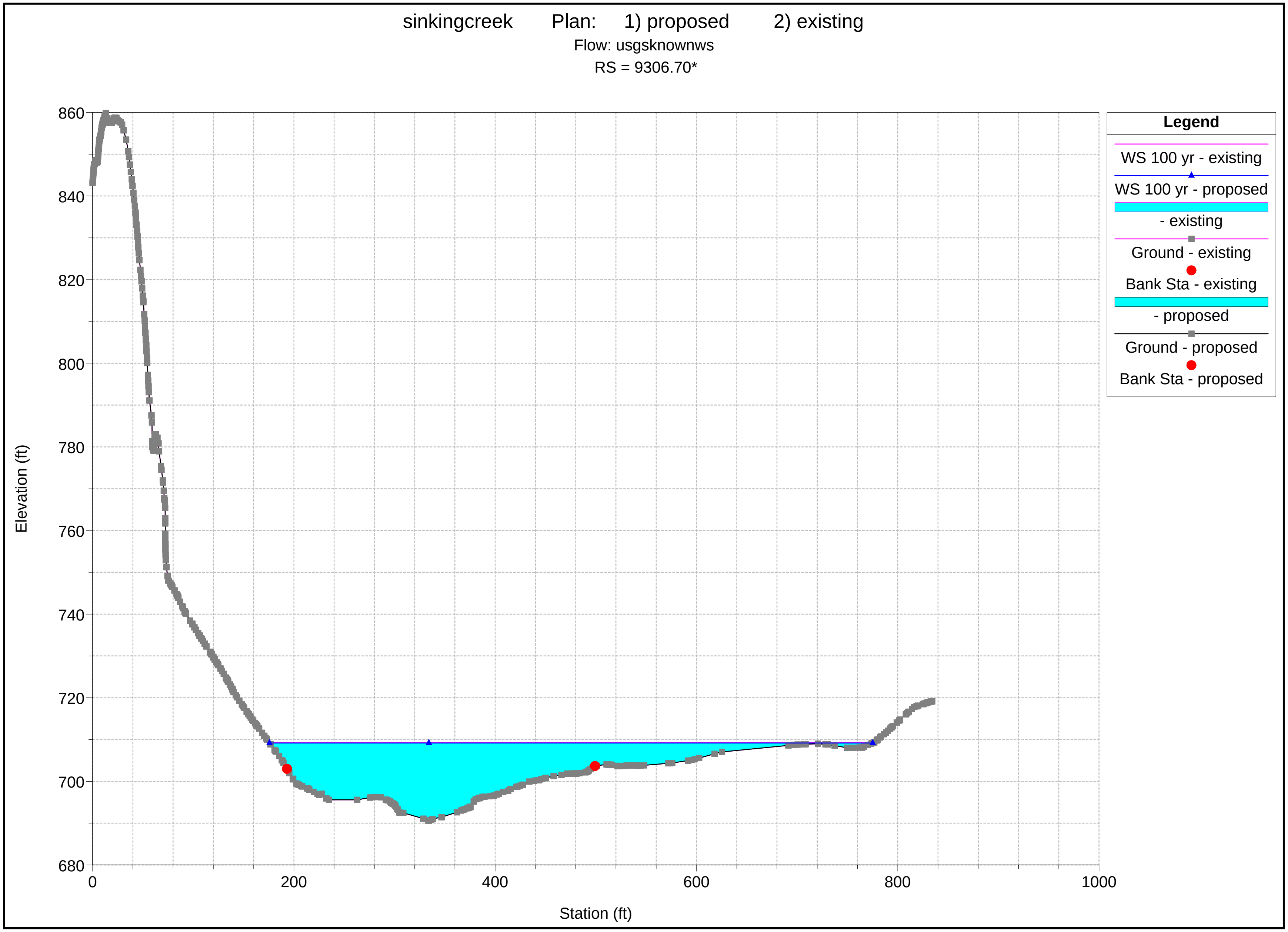
No Errors, Warnings or Notes in Computations

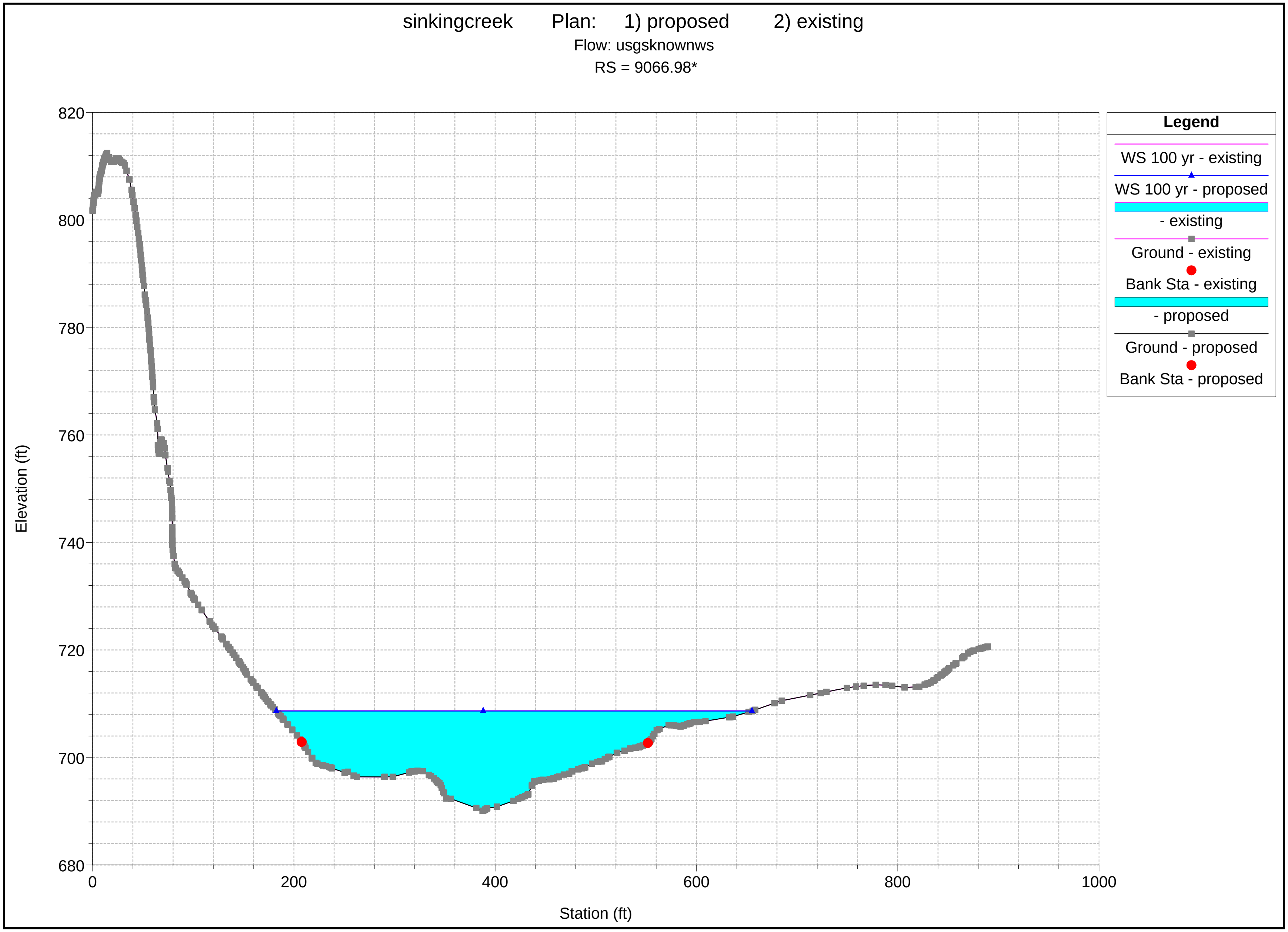


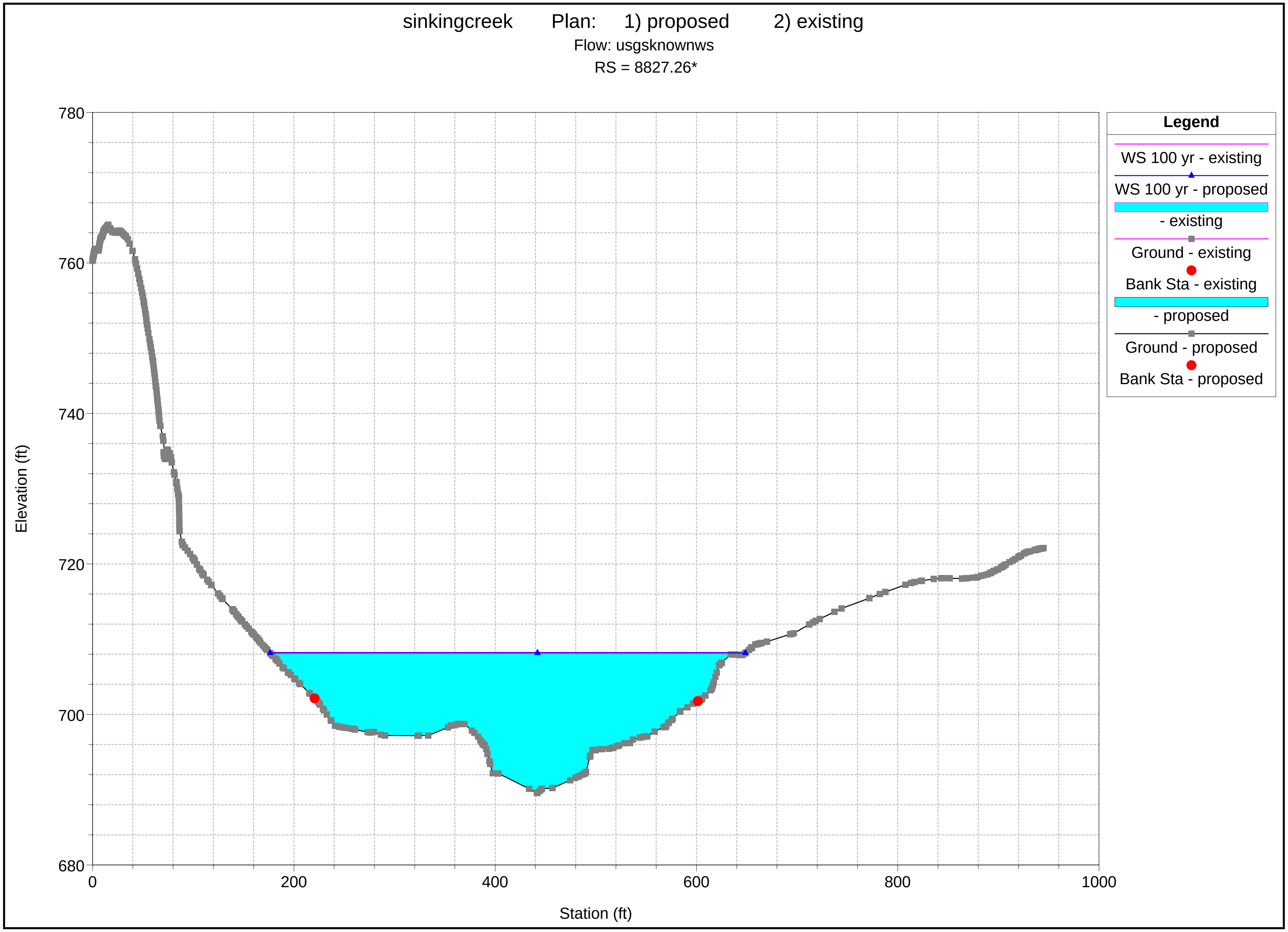
Some schematic data outside default extents (see View/Set Schematic Plot Extents...)
42 of the 57 XS's are not Geo-Referenced (Geo-Ref user entered XS Geo-Ref interpolated XS Non Geo-Ref user entered XS Non Geo-Ref interpolated XS)


sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 9786.15 Thalweg at Sta. 500.00
Elevation (ft)
Station (ft)
1000
950
900
850
800
750
700
650
0
100
200
300
400
500
600
700
800
Legend
WS 100 yr - existing
WS 100 yr - proposed
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Bank Sta - proposed

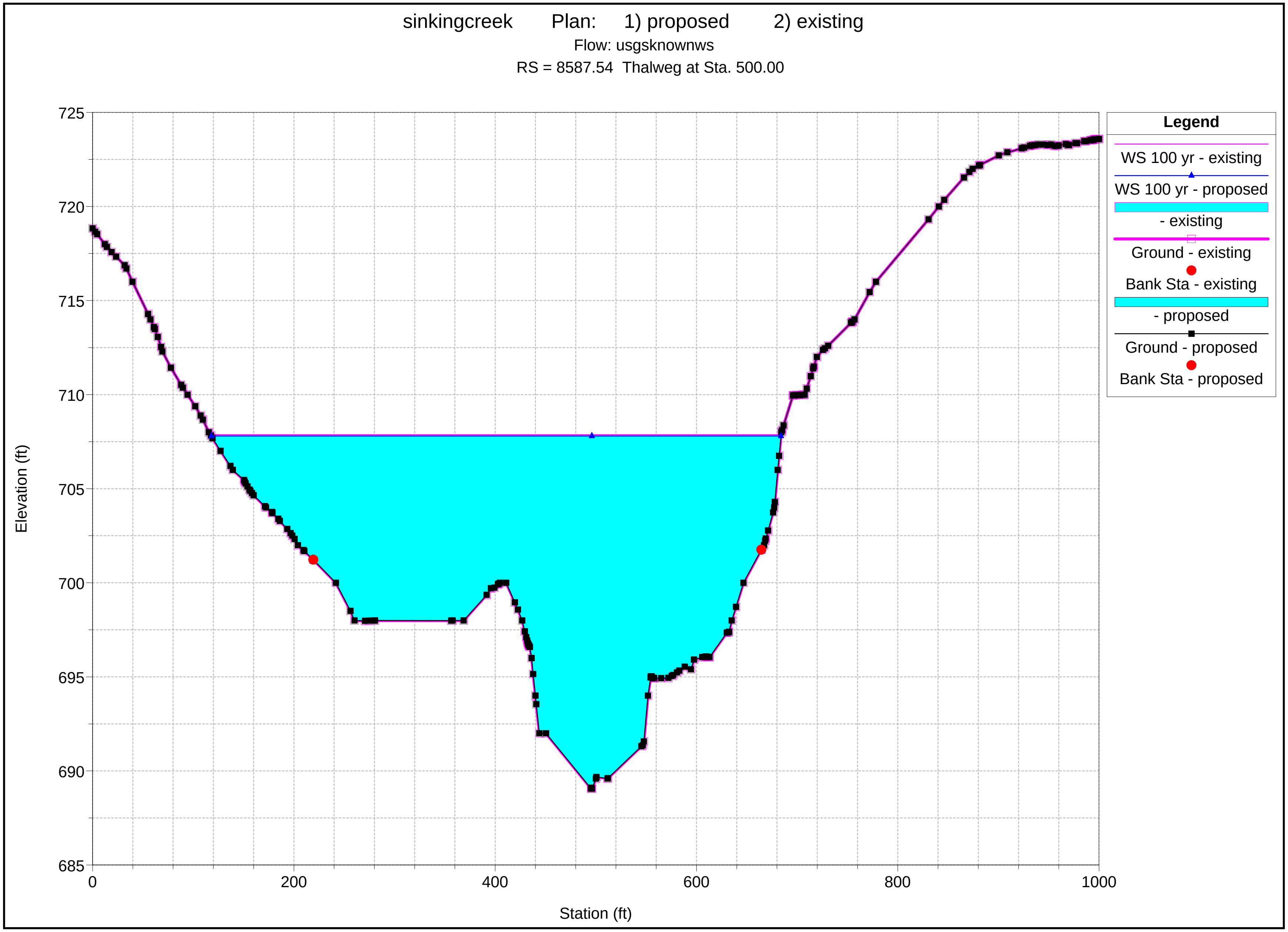

sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 9546.42*
Elevation (ft)
Station (ft)
950
900
850
800
750
700
650
0
200
400
600
800
Legend
WS 100 yr - existing
WS 100 yr - proposed
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Bank Sta - proposed

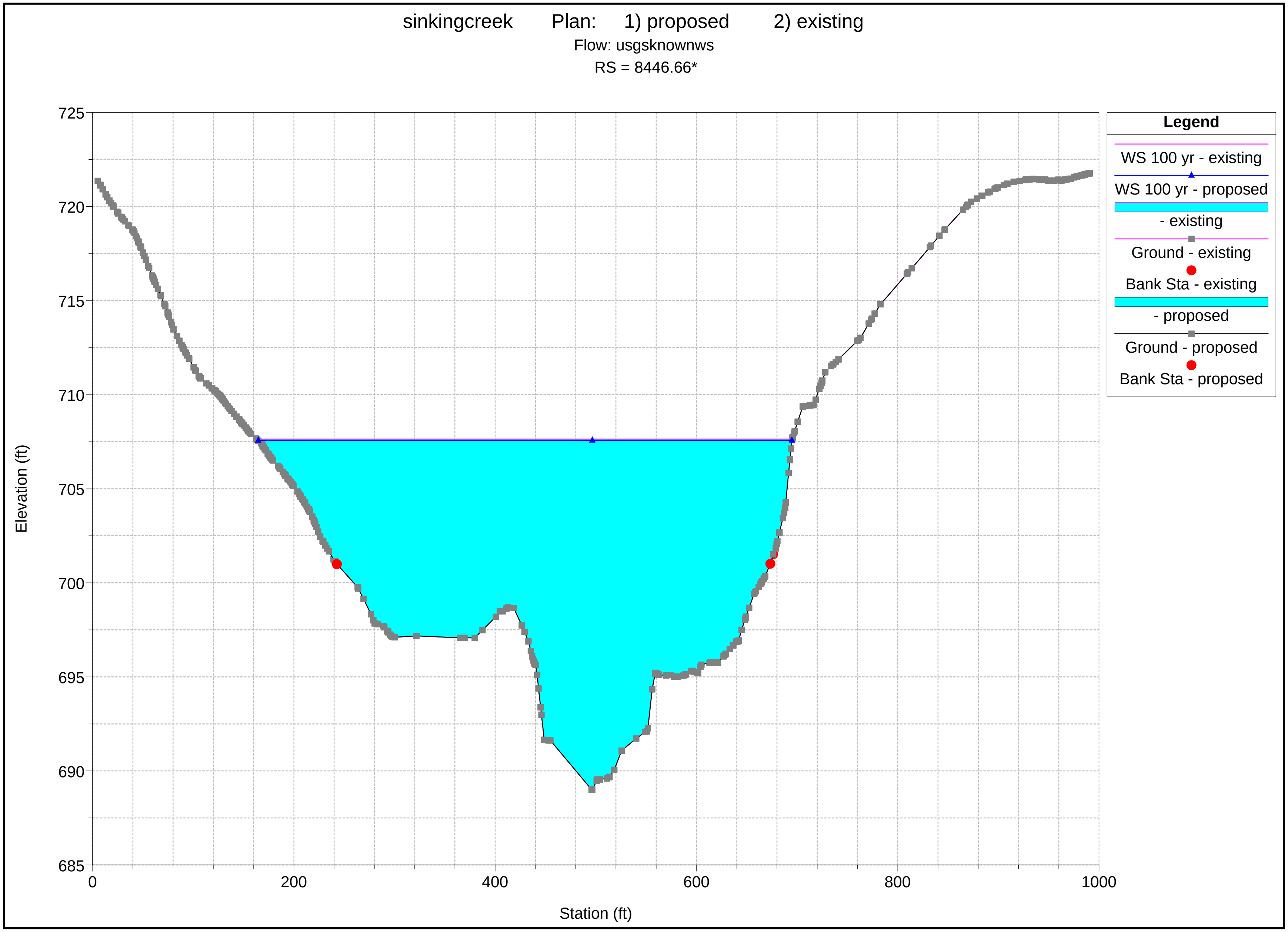

sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 9306.70*
Legend
WS 100 yr - existing
WS 100 yr - proposed
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Bank Sta - proposed
Elevation (ft)
Station (ft)
860
840
820
800
780
760
740
720
700
680
0
200
400
600
800
1000

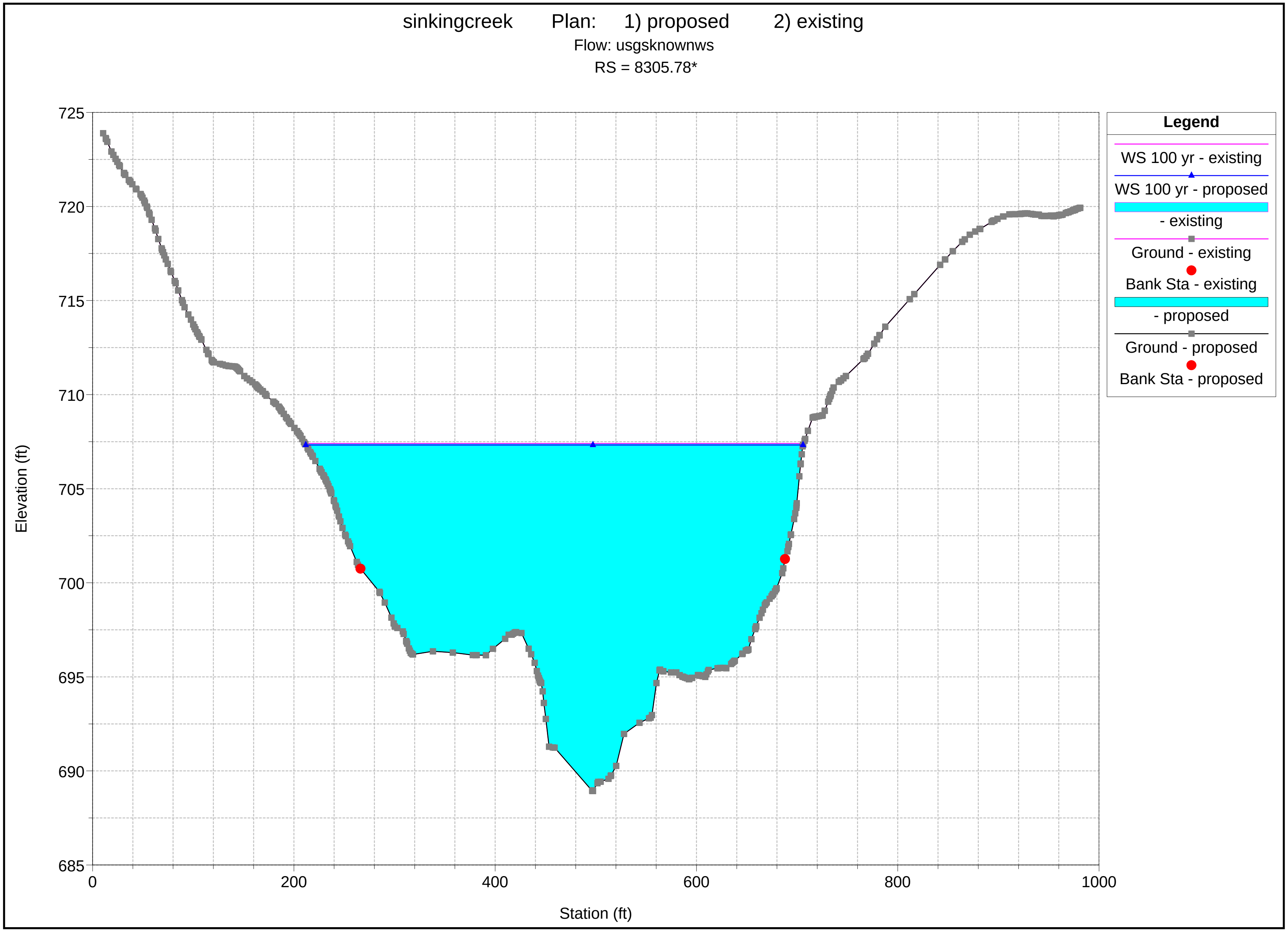

sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 9066.98*
Legend
WS 100 yr - existing
WS 100 yr - proposed
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Bank Sta - proposed
Elevation (ft)
Station (ft)
820
800
780
760
740
720
700
680
0
200
400
600
800
1000

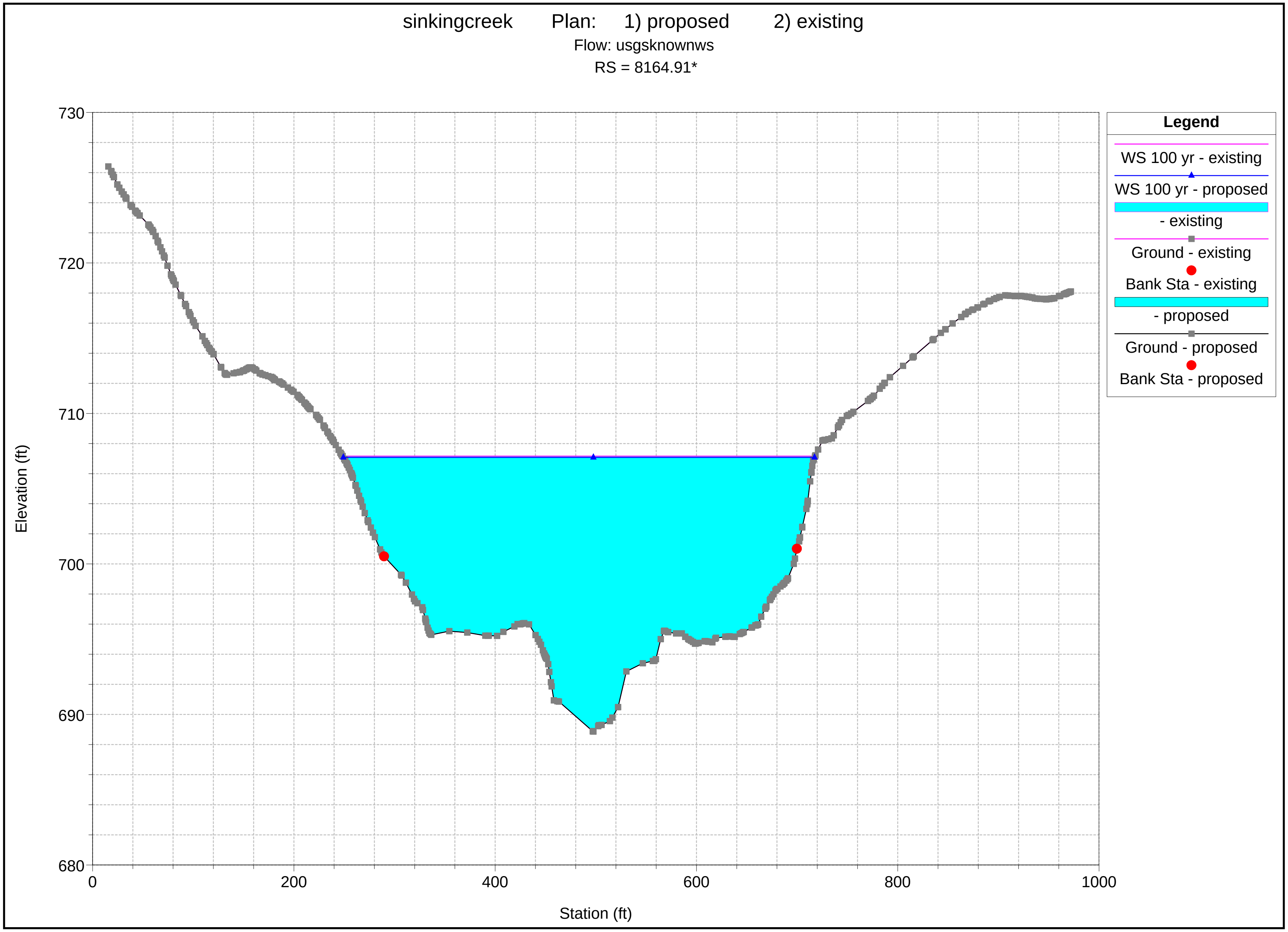


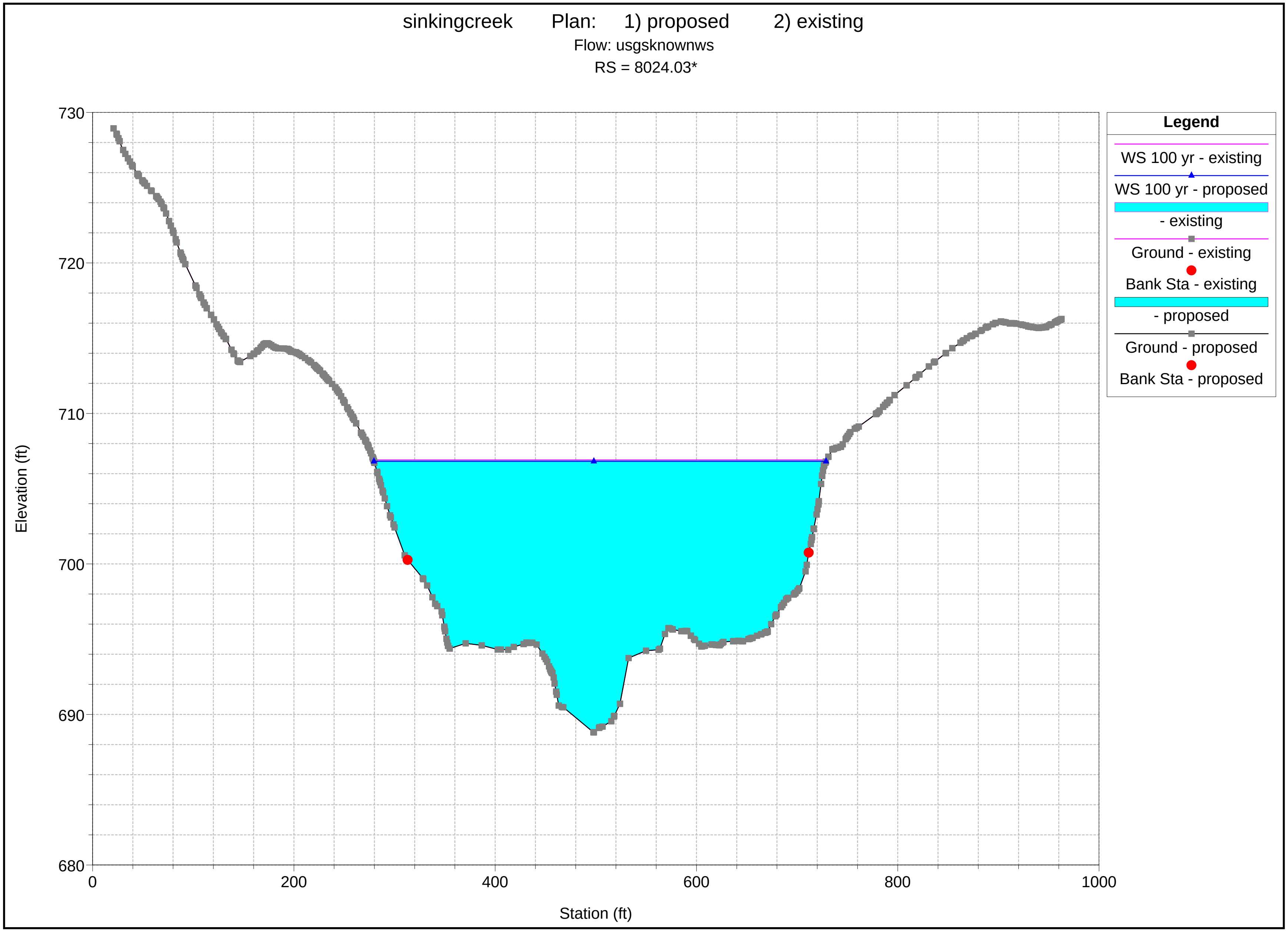
sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 8827.26*
Elevation (ft)
780
760
740
720
700
680
0
200
400
600
800
1000
Station (ft)
Legend
WS 100 yr - existing
WS 100 yr - proposed
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Bank Sta - proposed


sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 8587.54 Thalweg at Sta. 500.00
Legend
WS 100 yr - existing
WS 100 yr - proposed
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Bank Sta - proposed
Elevation (ft)
725
720
715
710
705
700
695
690
685
0
200
400
600
800
1000
Station (ft)

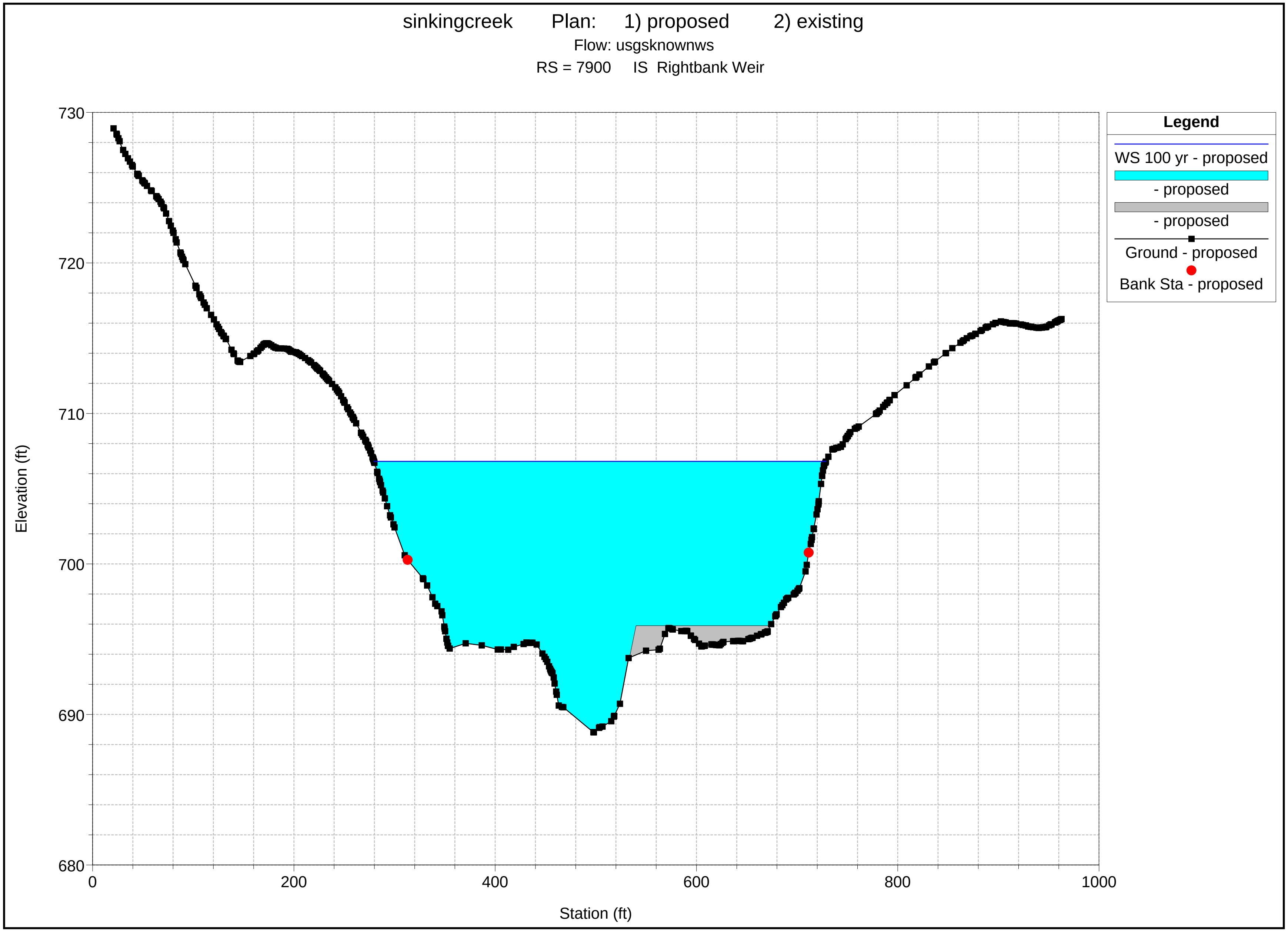

sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 8446.66*
Legend
WS 100 yr - existing
WS 100 yr - proposed
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Bank Sta - proposed
Elevation (ft)
Station (ft)
725
720
715
710
705
700
695
690
685
0
200
400
600
800
1000


sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 8305.78*
Legend
WS 100 yr - existing
WS 100 yr - proposed
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Bank Sta - proposed
Elevation (ft)
725
720
715
710
705
700
695
690
685
0
200
400
600
800
1000
Station (ft)

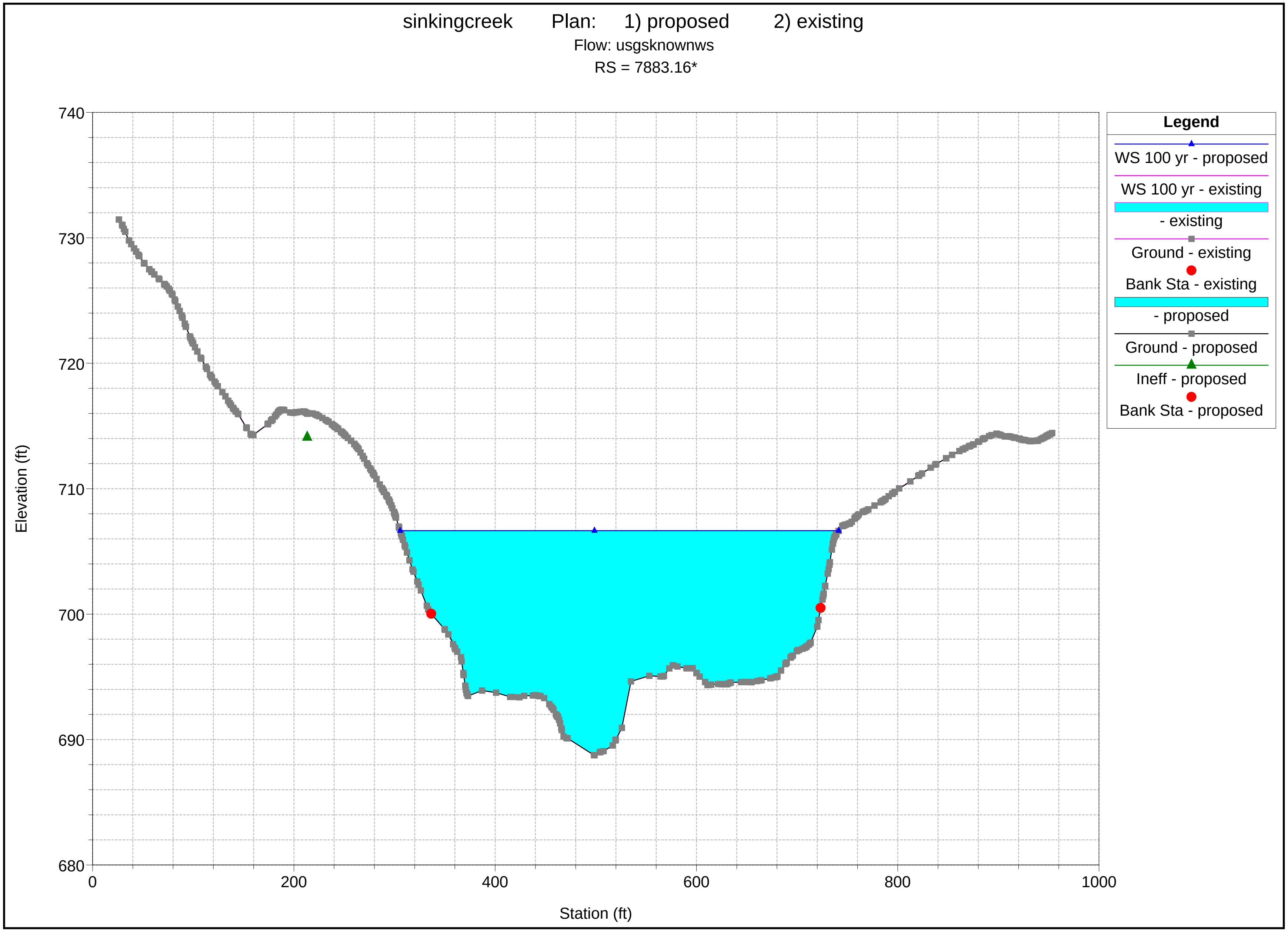

sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 8164.91*
Elevation (ft)
Station (ft)
730
720
710
700
690
680
0
200
400
600
800
1000
Legend
WS 100 yr - existing
WS 100 yr - proposed
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Bank Sta - proposed

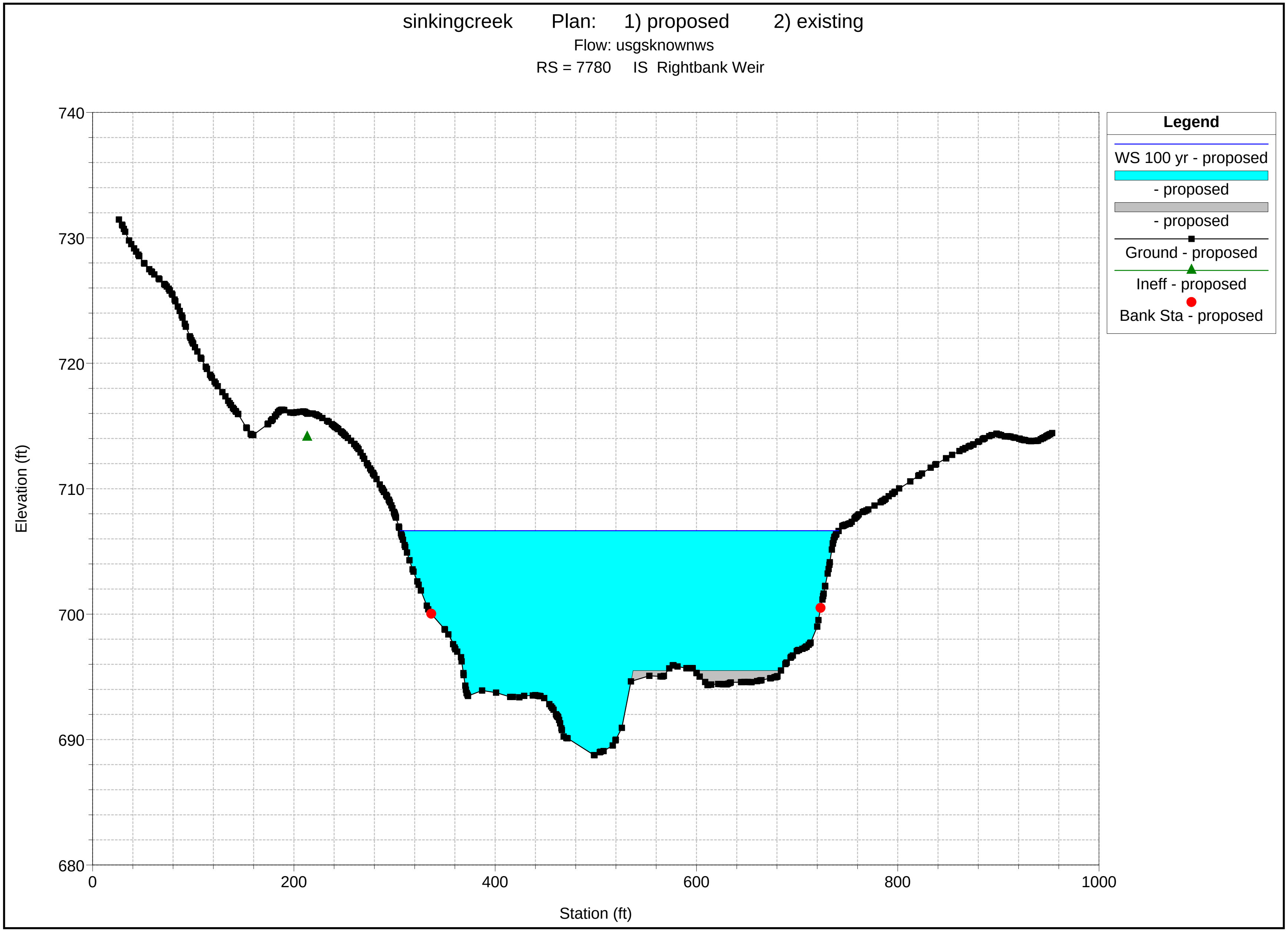


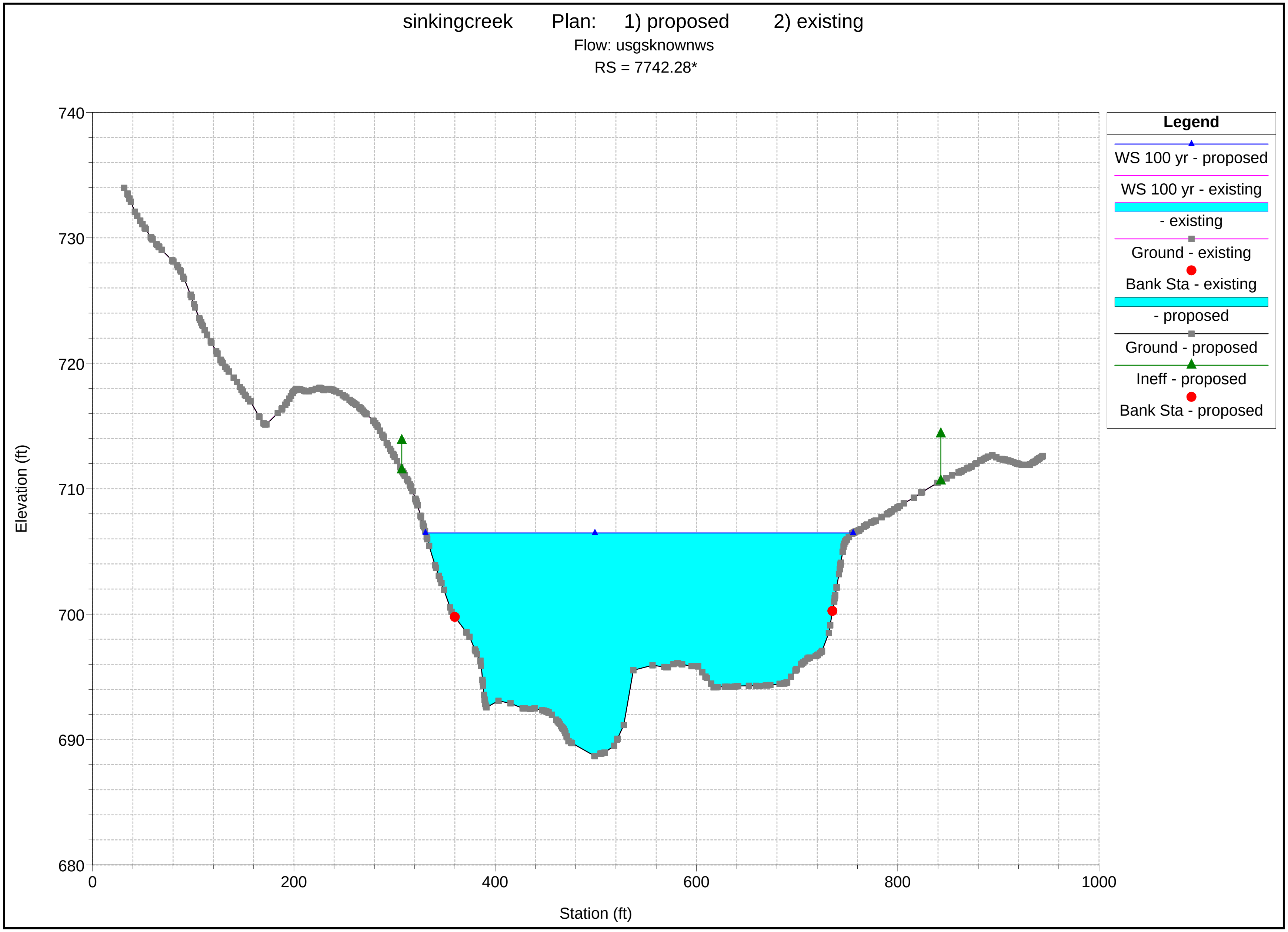
sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 8024.03*
Legend
WS 100 yr - existing
WS 100 yr - proposed
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Bank Sta - proposed
Elevation (ft)
730
720
710
700
690
680
Station (ft)
0
200
400
600
800
1000



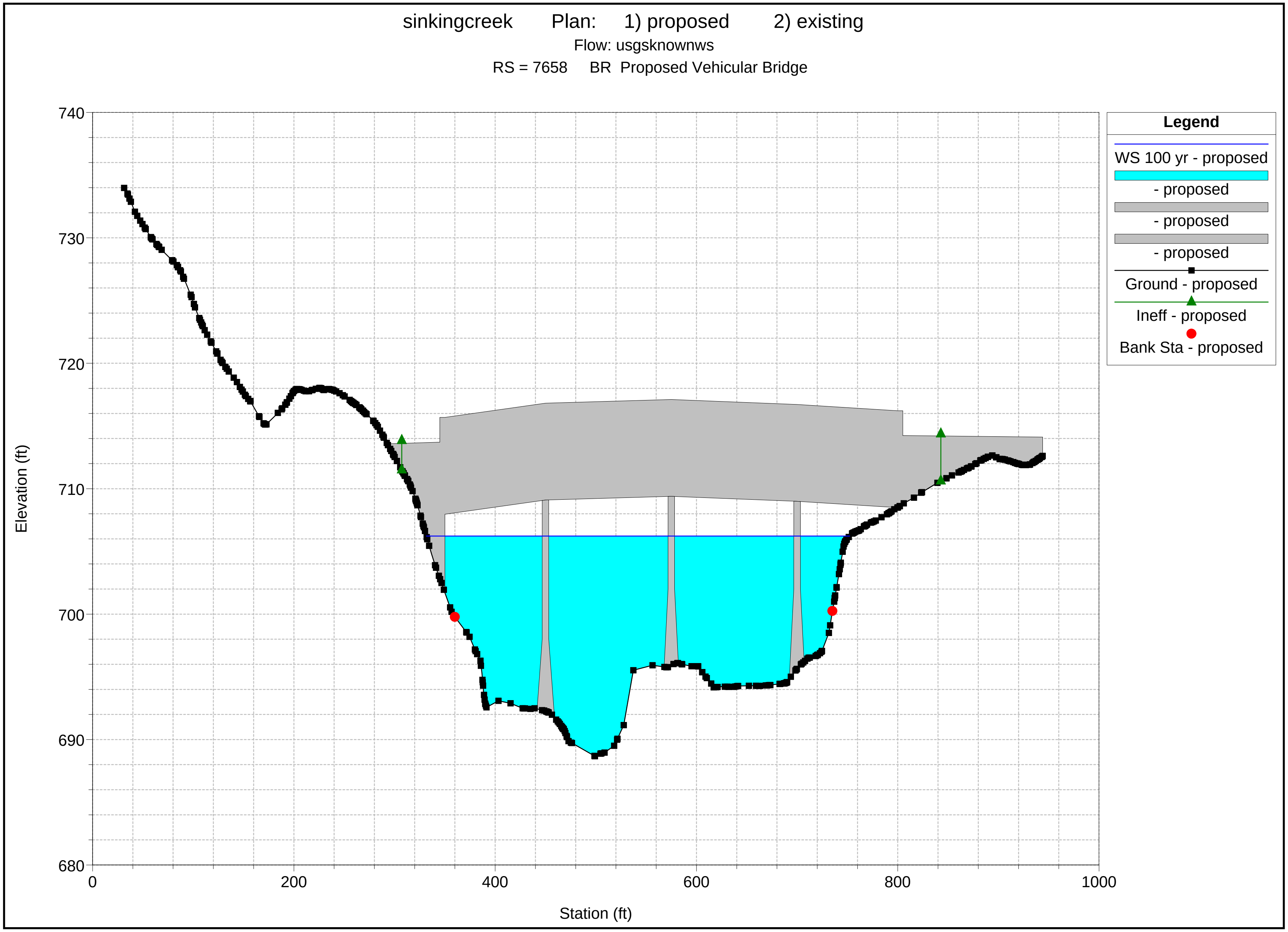
sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 7900 IS Rightbank Weir
Legend
WS 100 yr - proposed
- proposed
- proposed
Ground - proposed
Bank Sta - proposed
Elevation (ft)
Station (ft)
730
720
710
700
690
680
0
200
400
600
800
1000


sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 7883.16*
Legend
WS 100 yr - proposed
WS 100 yr - existing
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Ineff - proposed
Bank Sta - proposed
Elevation (ft)
Station (ft)
740
730
720
710
700
690
680
0
200
400
600
800
1000

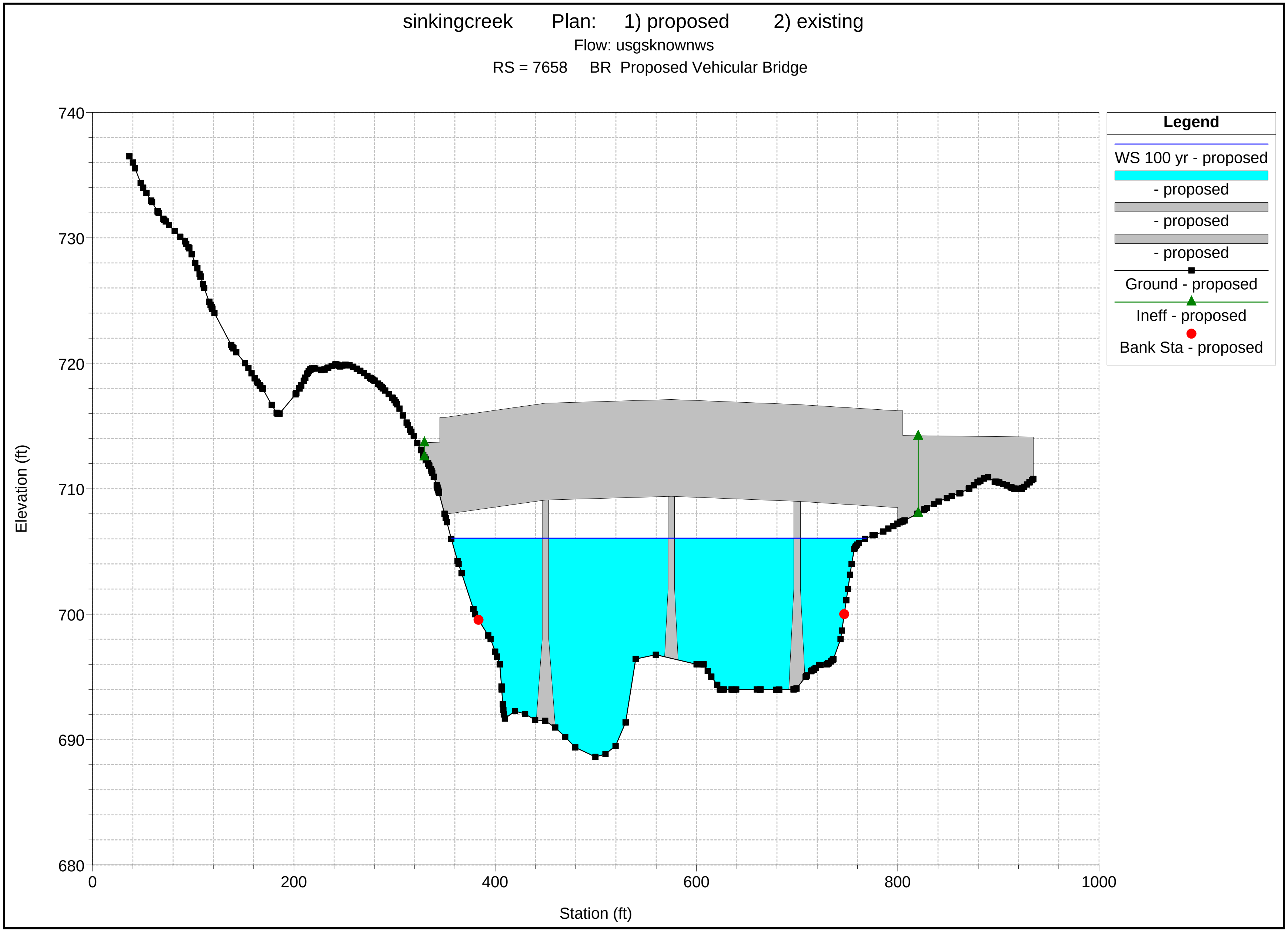

sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 7780 IS Rightbank Weir
Elevation (ft)
740
730
720
710
700
690
680
0
200
400
600
800
1000
Station (ft)
Legend
WS 100 yr - proposed
- proposed
- proposed
Ground - proposed
Ineff - proposed
Bank Sta - proposed



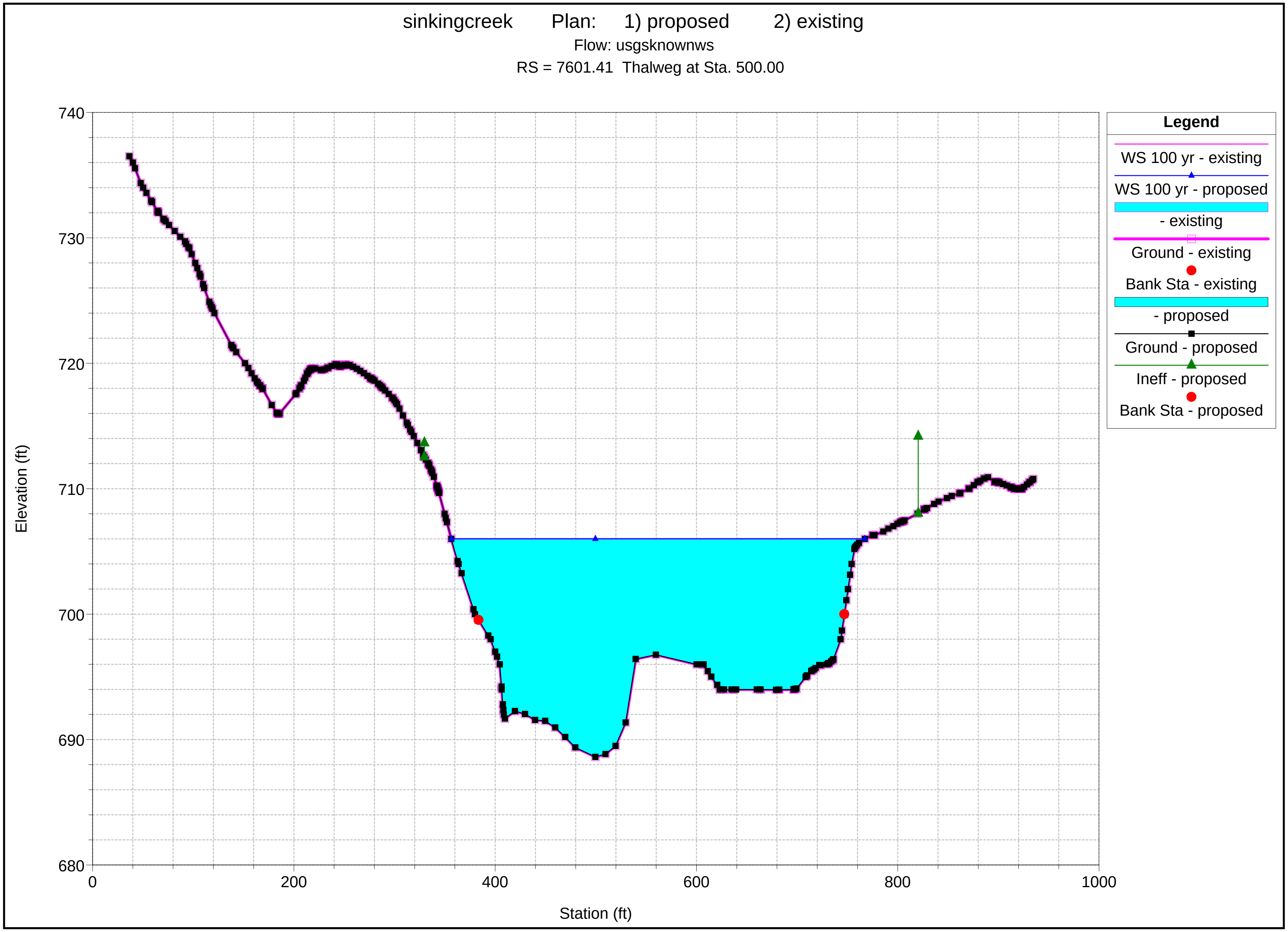
sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 7742.28*
Legend
WS 100 yr - proposed
WS 100 yr - existing
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Ineff - proposed
Bank Sta - proposed
Elevation (ft)
Station (ft)
740
730
720
710
700
690
680
0
200
400
600
800
1000



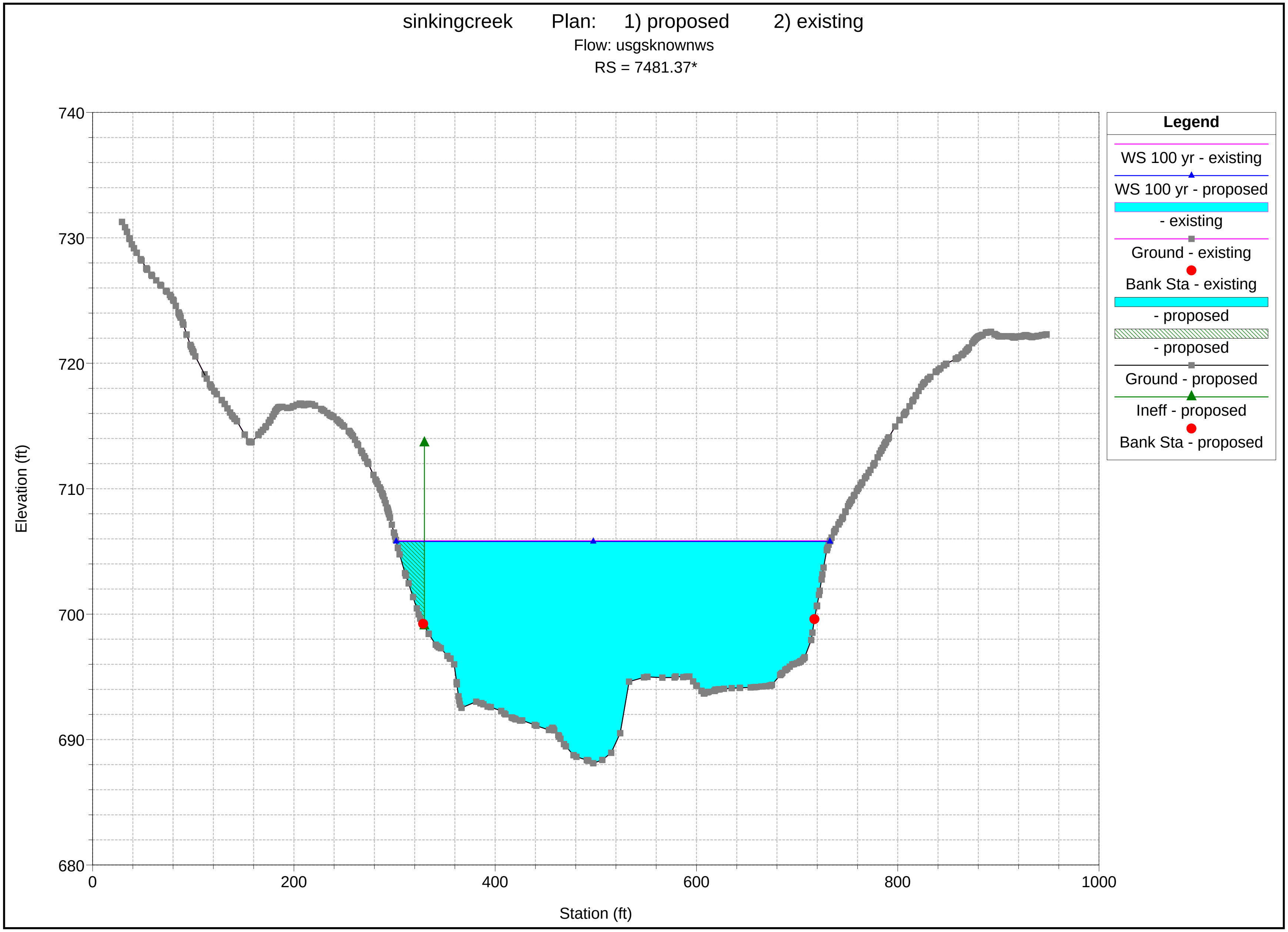
sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 7658 BR Proposed Vehicular Bridge
Legend
WS 100 yr - proposed
- proposed
- proposed
- proposed
Ground - proposed
Ineff - proposed
Bank Sta - proposed
Elevation (ft)
740
730
720
710
700
690
680
0
200
400
600
800
1000
Station (ft)

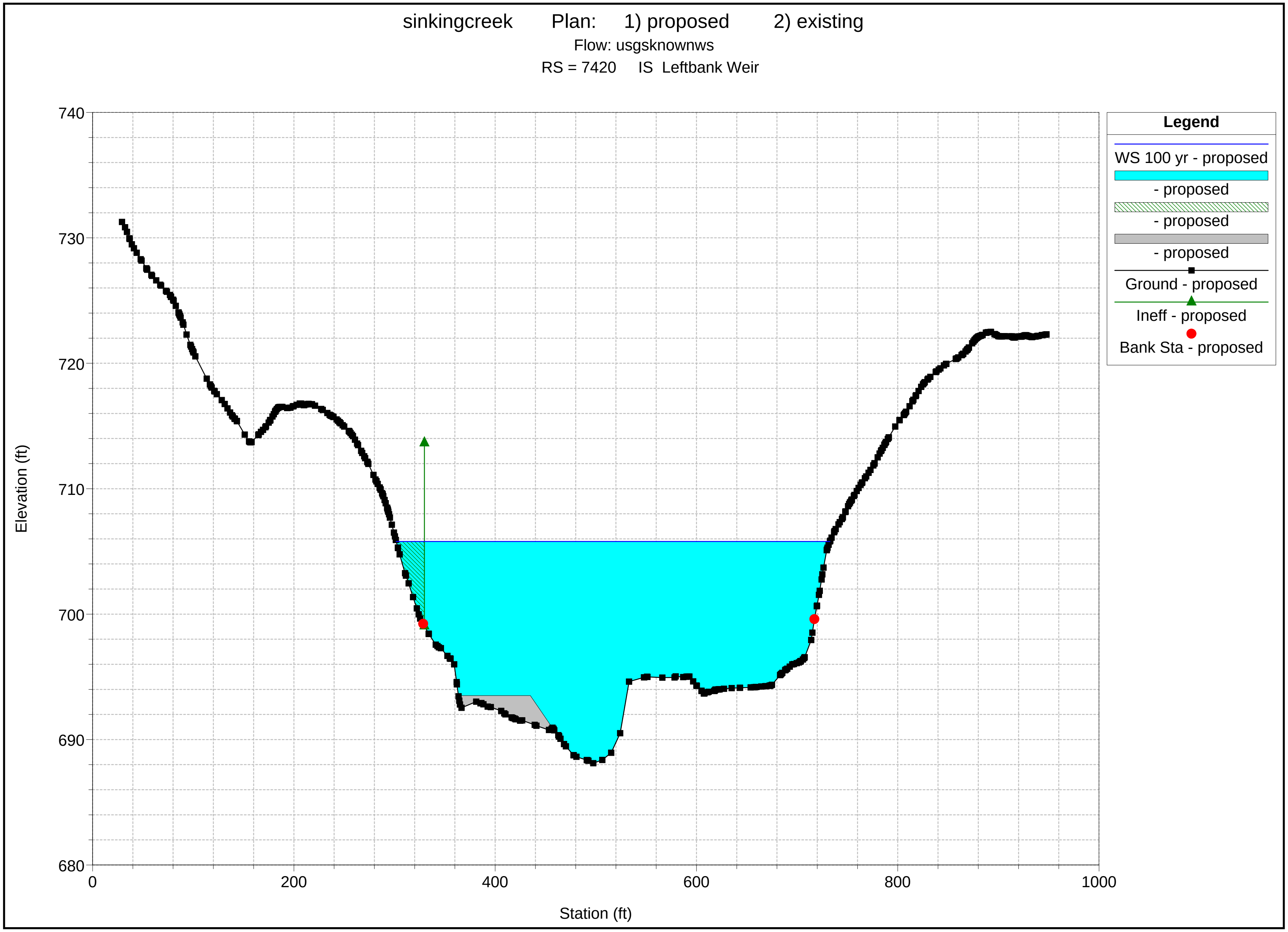


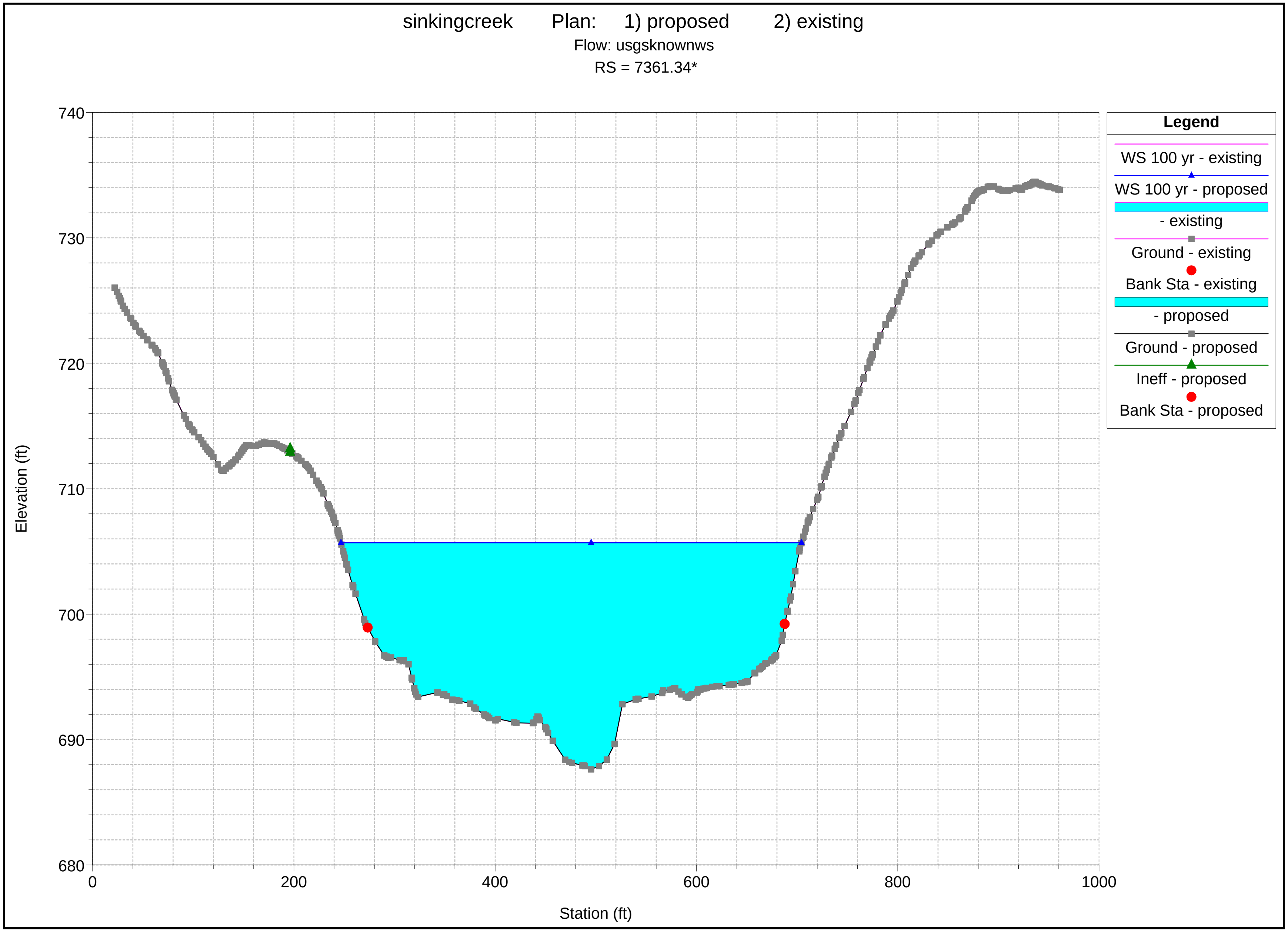
sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 7658 BR Proposed Vehicular Bridge
Legend
WS 100 yr - proposed
- proposed
- proposed
- proposed
Ground - proposed
Ineff - proposed
Bank Sta - proposed
Elevation (ft)
740
730
720
710
700
690
680
0
200
400
600
800
1000
Station (ft)



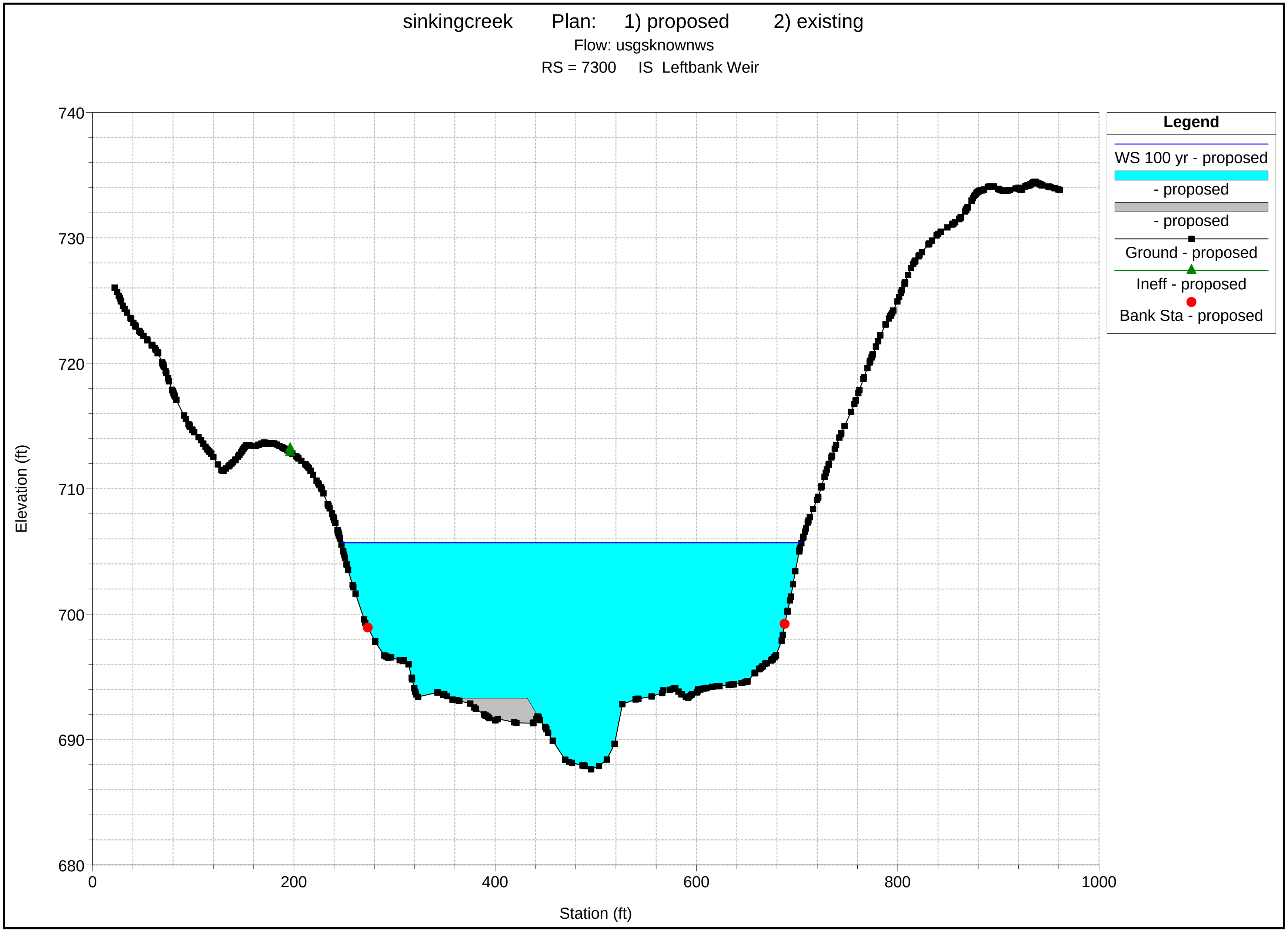
sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 7601.41 Thalweg at Sta. 500.00
Legend
WS 100 yr - existing
WS 100 yr - proposed
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Ineff - proposed
Bank Sta - proposed
Elevation (ft)
Station (ft)
740
730
720
710
700
690
680
0
200
400
600
800
1000

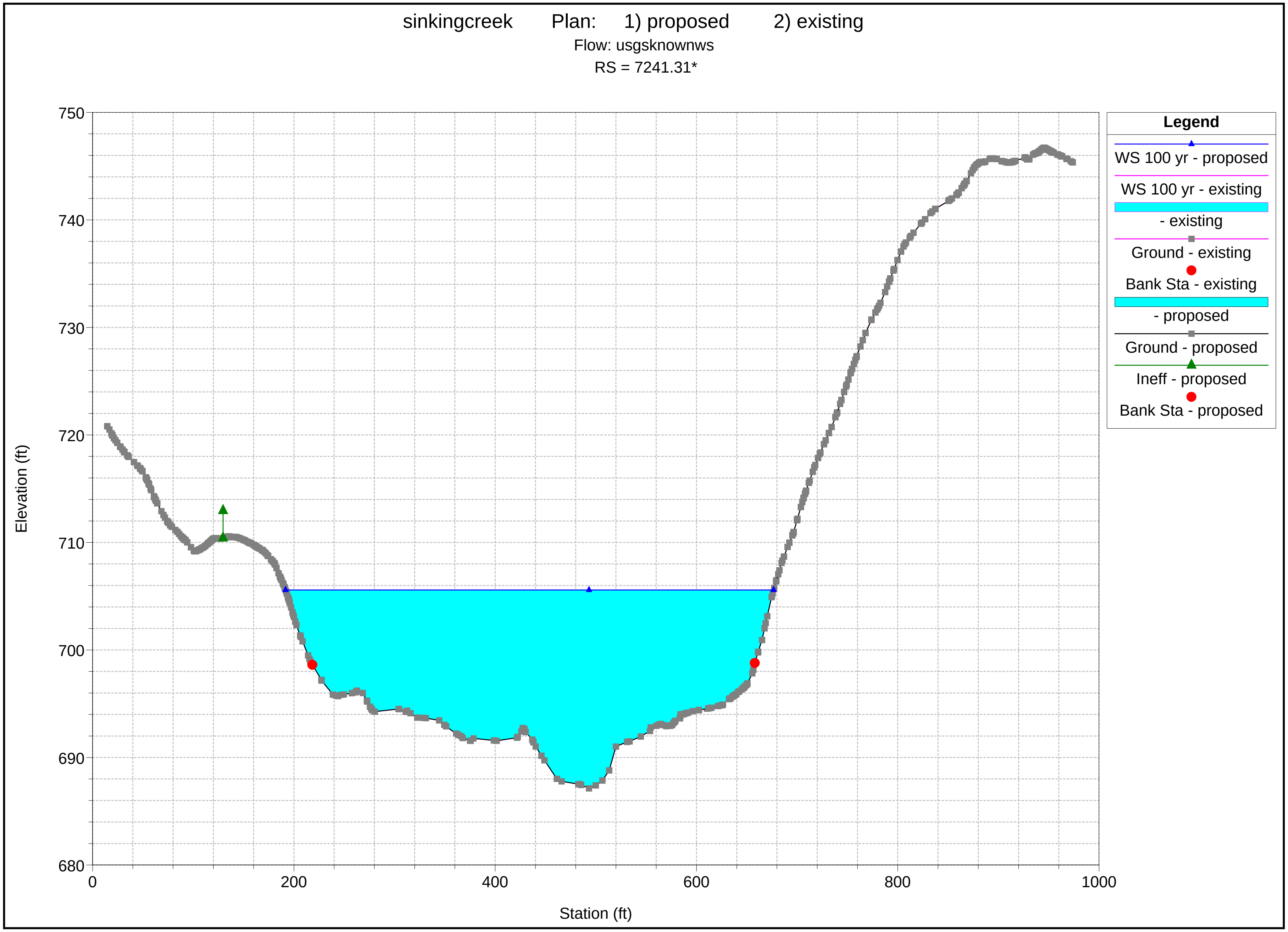

sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 7481.37*
Legend
WS 100 yr - existing
WS 100 yr - proposed
- existing
Ground - existing
Bank Sta - existing
- proposed
- proposed
Ground - proposed
Ineff - proposed
Bank Sta - proposed
Elevation (ft)
Station (ft)
740
730
720
710
700
690
680
0
200
400
600
800
1000


sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 7420 IS Leftbank Weir
Legend
WS 100 yr - proposed
- proposed
- proposed
- proposed
Ground - proposed
Ineff - proposed
Bank Sta - proposed
Elevation (ft)
Station (ft)
740
730
720
710
700
690
680
0
200
400
600
800
1000

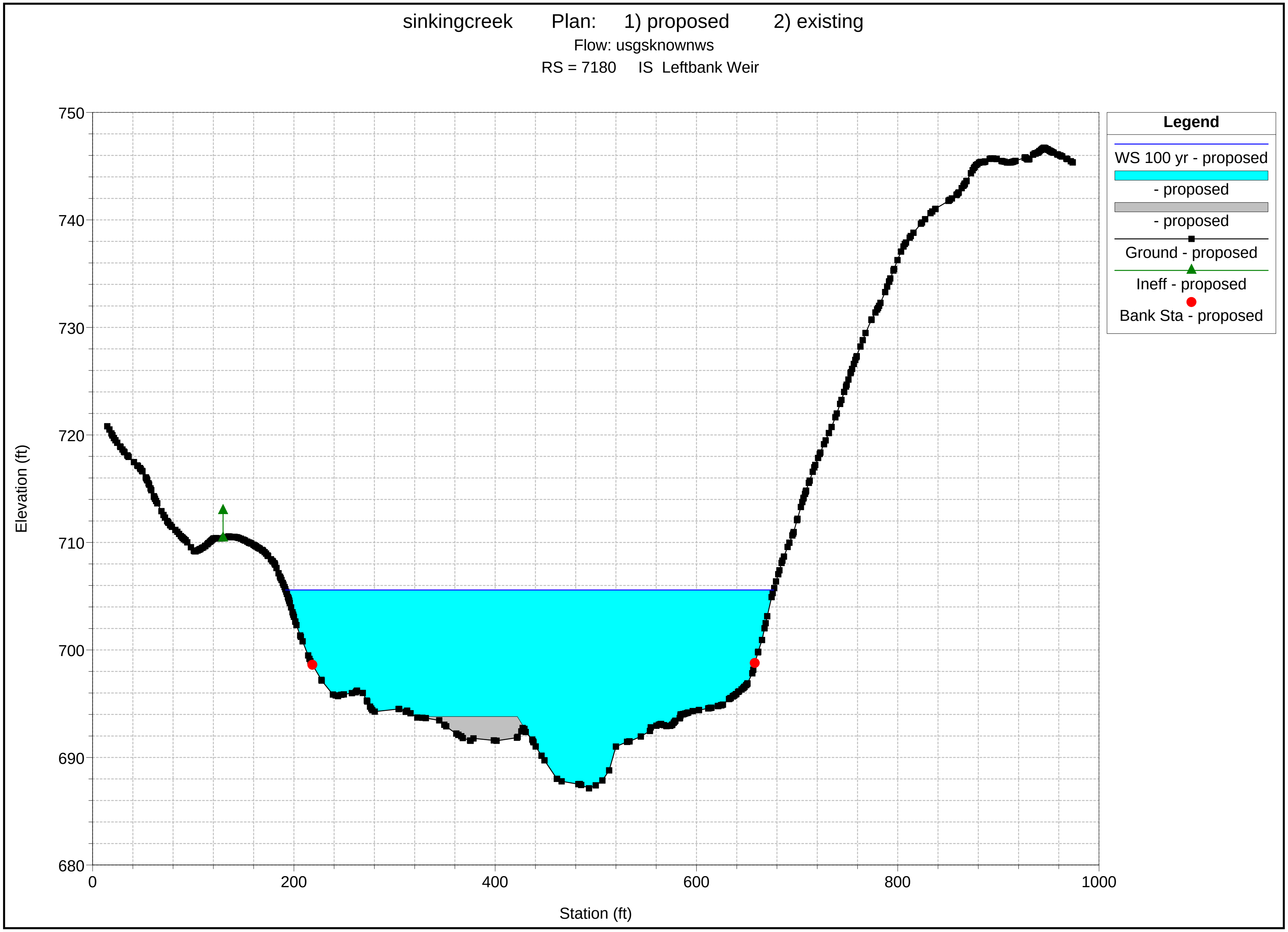


sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 7361.34*
Legend
WS 100 yr - existing
WS 100 yr - proposed
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Ineff - proposed
Bank Sta - proposed
Elevation (ft)
Station (ft)
740
730
720
710
700
690
680
0
200
400
600
800
1000

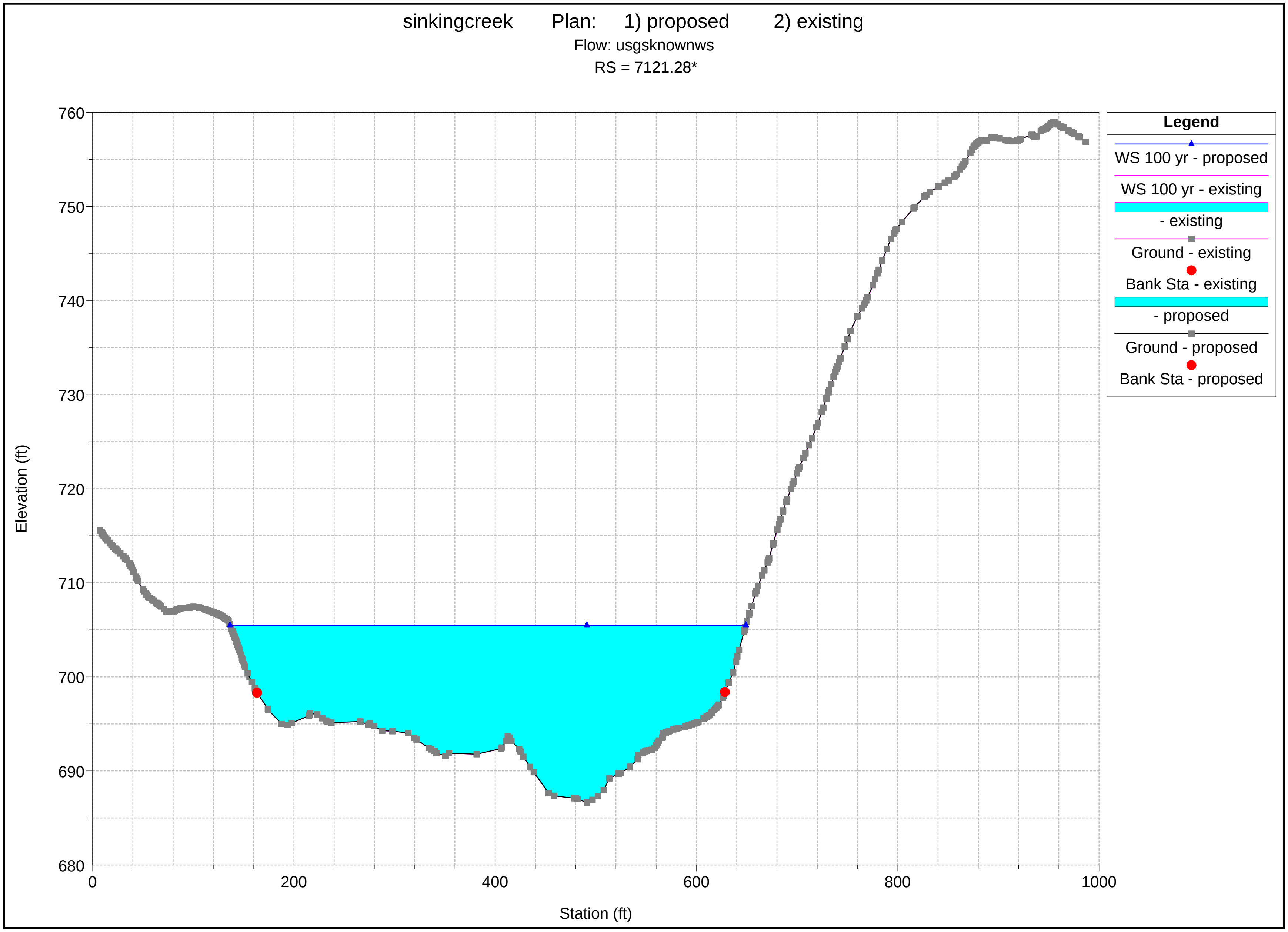

sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 7300 IS Leftbank Weir
Elevation (ft)
740
730
720
710
700
690
680
Station (ft)
0
200
400
600
800
1000
Legend
WS 100 yr - proposed
- proposed
- proposed
Ground - proposed
Ineff - proposed
Bank Sta - proposed

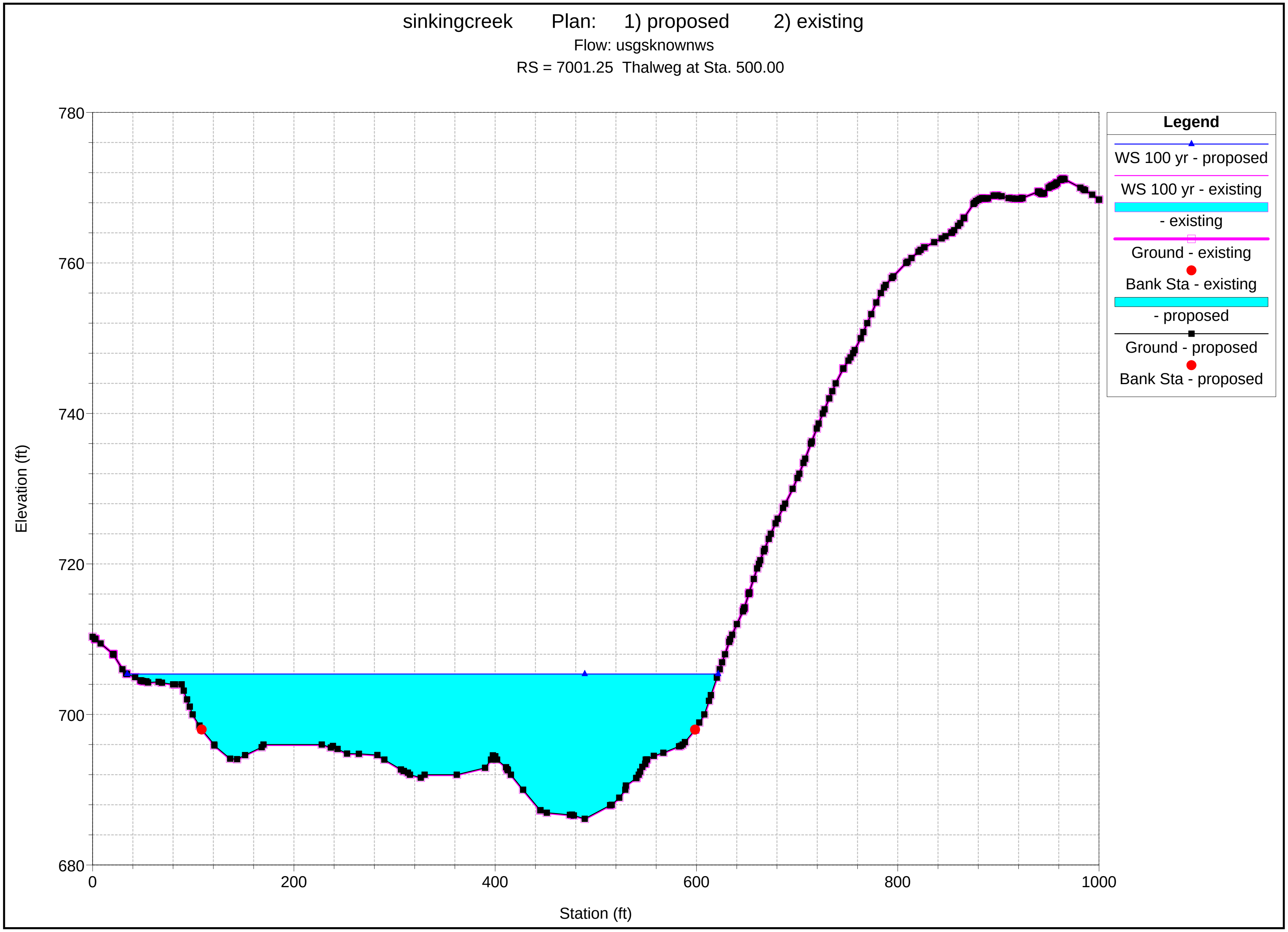


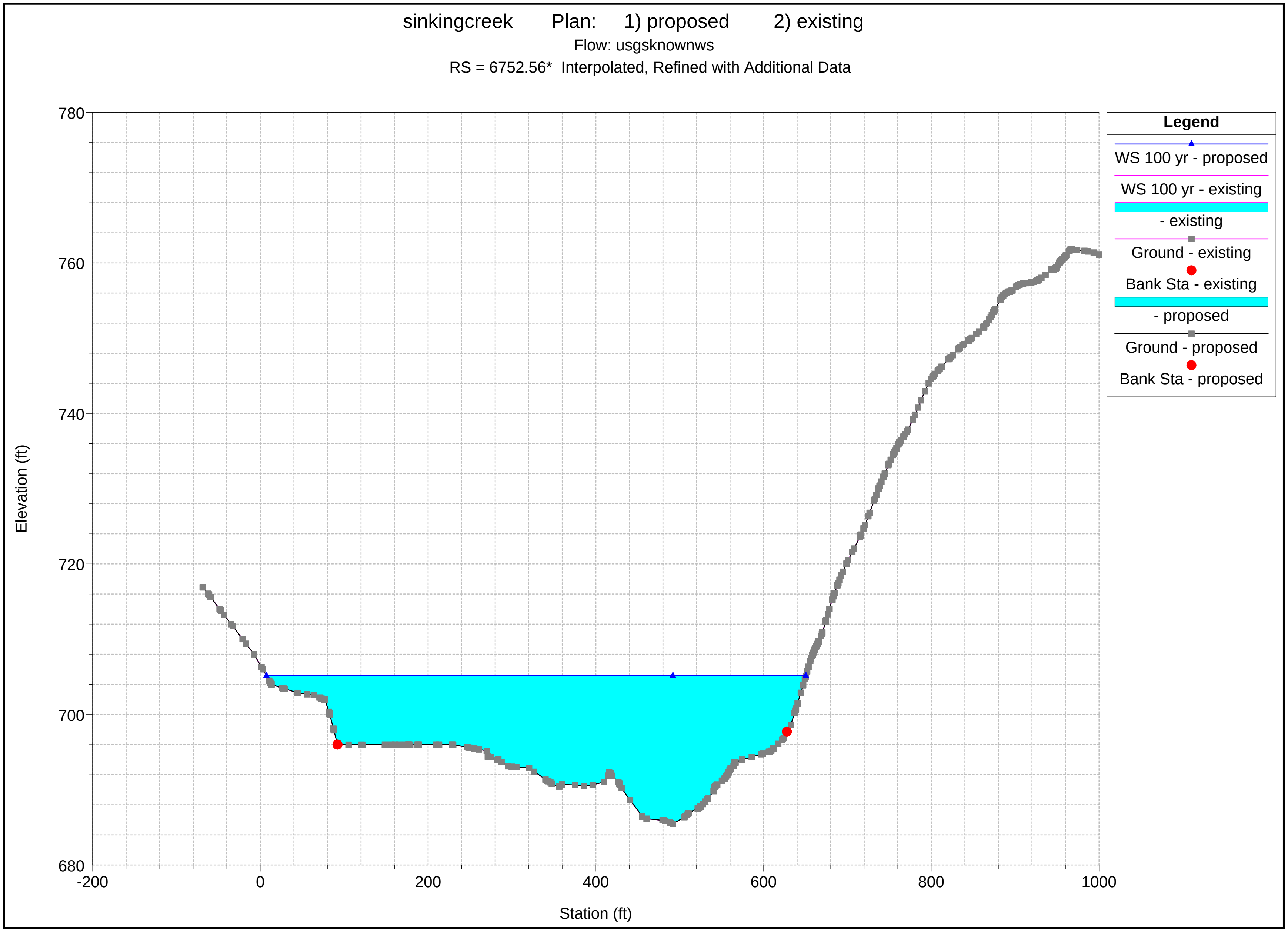
sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 7241.31*
750
740
730
720
710
700
690
680
Elevation (ft)
0
200
400
600
800
1000
Station (ft)
Legend
WS 100 yr - proposed
WS 100 yr - existing
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Ineff - proposed
Bank Sta - proposed

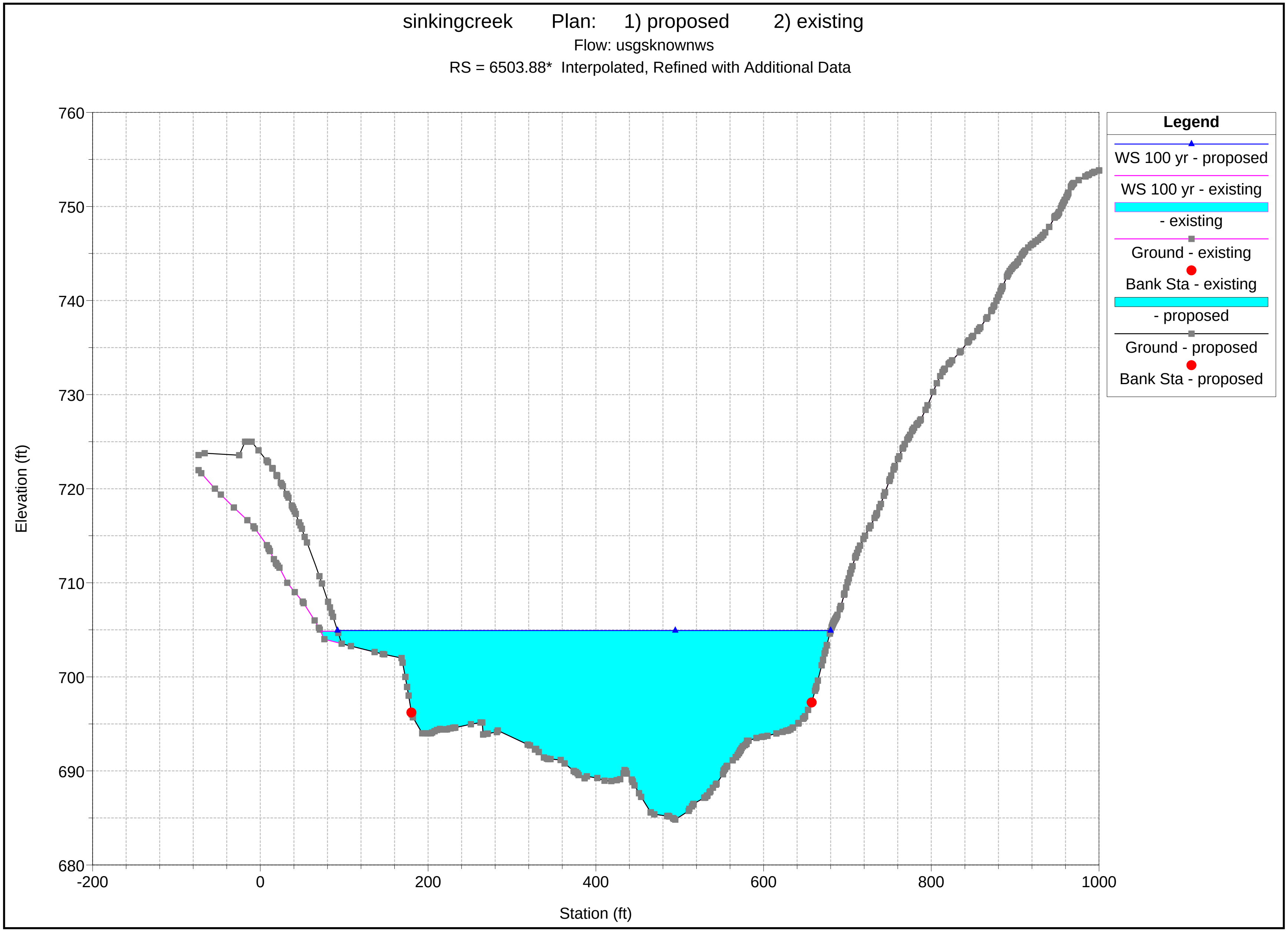


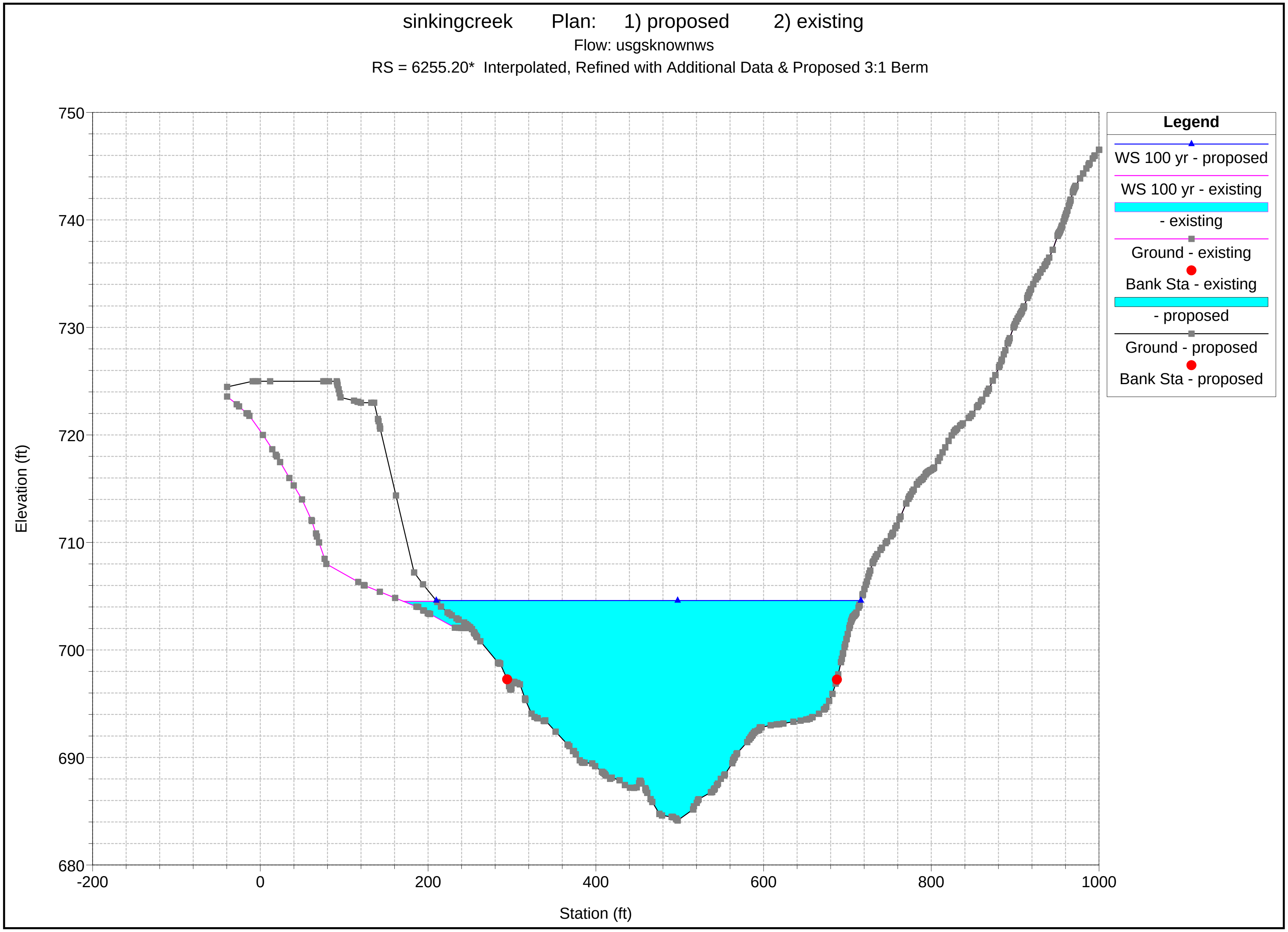
sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 7180 IS Leftbank Weir
Legend
WS 100 yr - proposed
- proposed
- proposed
Ground - proposed
Ineff - proposed
Bank Sta - proposed
Elevation (ft)
Station (ft)
750
740
730
720
710
700
690
680
0
200
400
600
800
1000

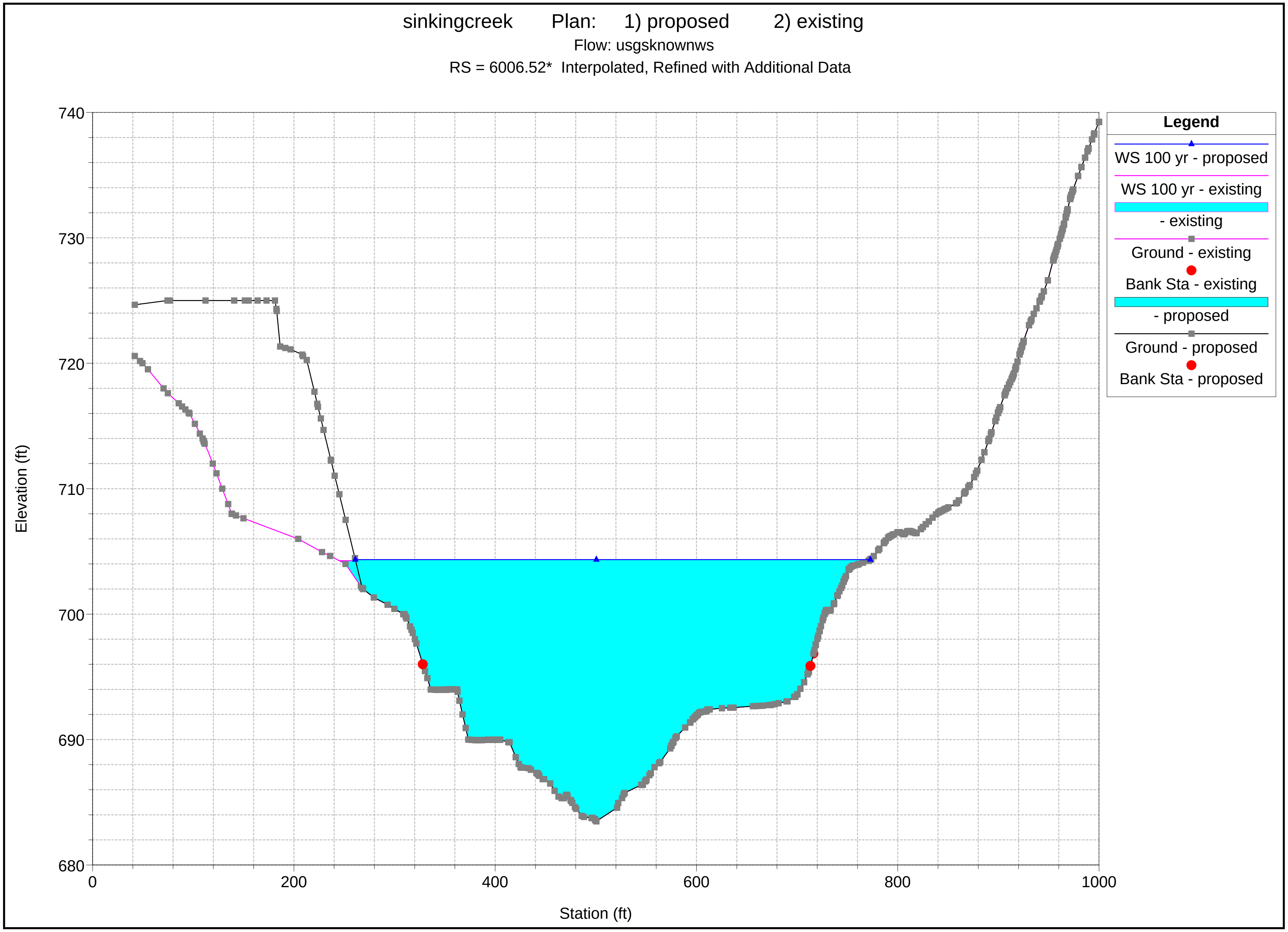

sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 7121.28*
Elevation (ft)
Station (ft)
760
750
740
730
720
710
700
690
680
0
200
400
600
800
1000
Legend
WS 100 yr - proposed
WS 100 yr - existing
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Bank Sta - proposed

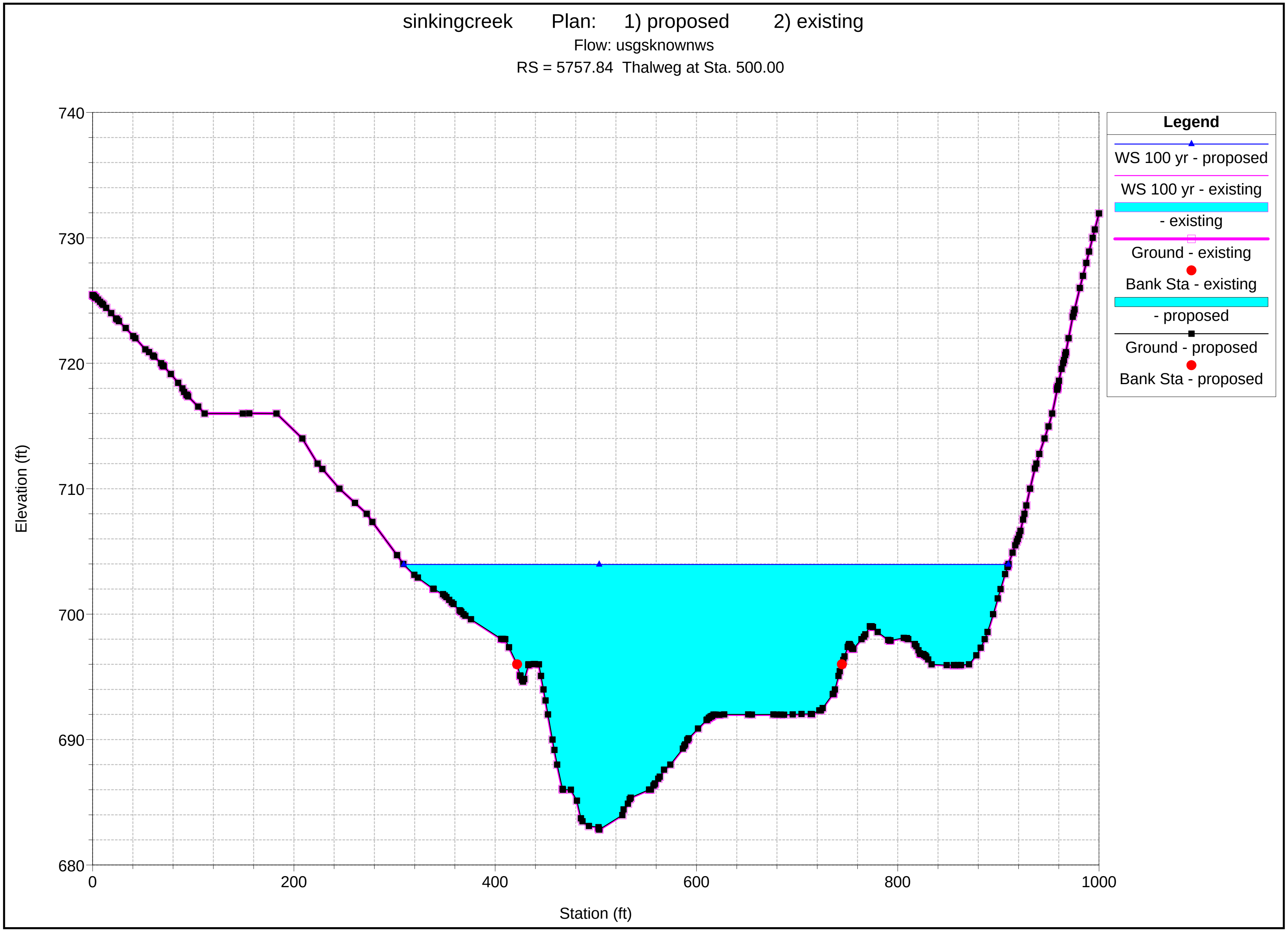

sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 7001.25 Thalweg at Sta. 500.00
Elevation (ft)
Station (ft)
780
760
740
720
700
680
0
200
400
600
800
1000
Legend
WS 100 yr - proposed
WS 100 yr - existing
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Bank Sta - proposed


sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 6752.56* Interpolated, Refined with Additional Data
Legend
WS 100 yr - proposed
WS 100 yr - existing
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Bank Sta - proposed
Elevation (ft)
Station (ft)
780
760
740
720
700
680
-200
0
200
400
600
800
1000

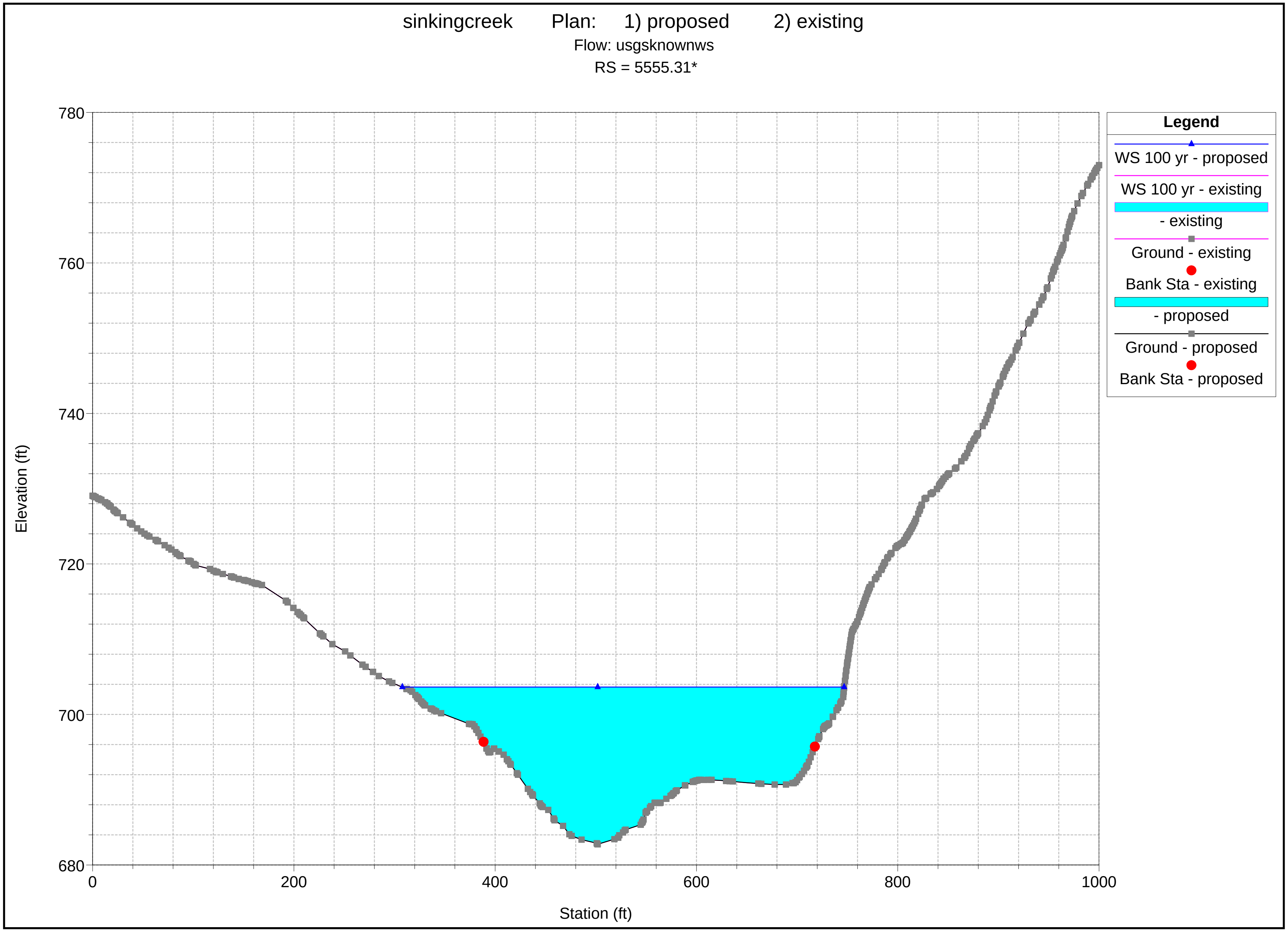

sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 6503.88* Interpolated, Refined with Additional Data
Elevation (ft)
Station (ft)
760
750
740
730
720
710
700
690
680
-200
0
200
400
600
800
1000
Legend
WS 100 yr - proposed
WS 100 yr - existing
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Bank Sta - proposed

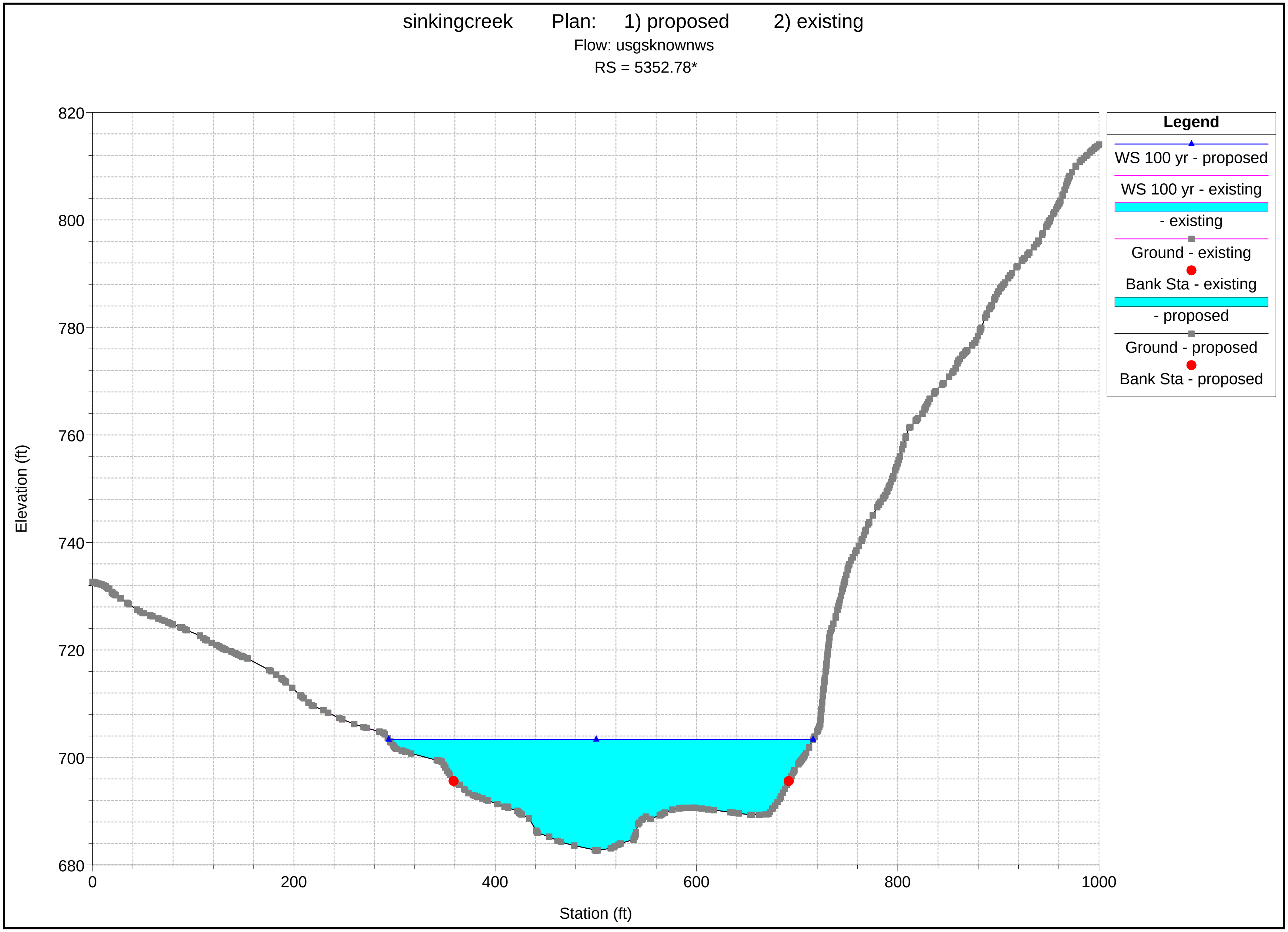

sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 6255.20* Interpolated, Refined with Additional Data & Proposed 3:1 Berm
Legend
WS 100 yr - proposed
WS 100 yr - existing
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Bank Sta - proposed
Elevation (ft)
Station (ft)
750
740
730
720
710
700
690
680
-200
0
200
400
600
800
1000

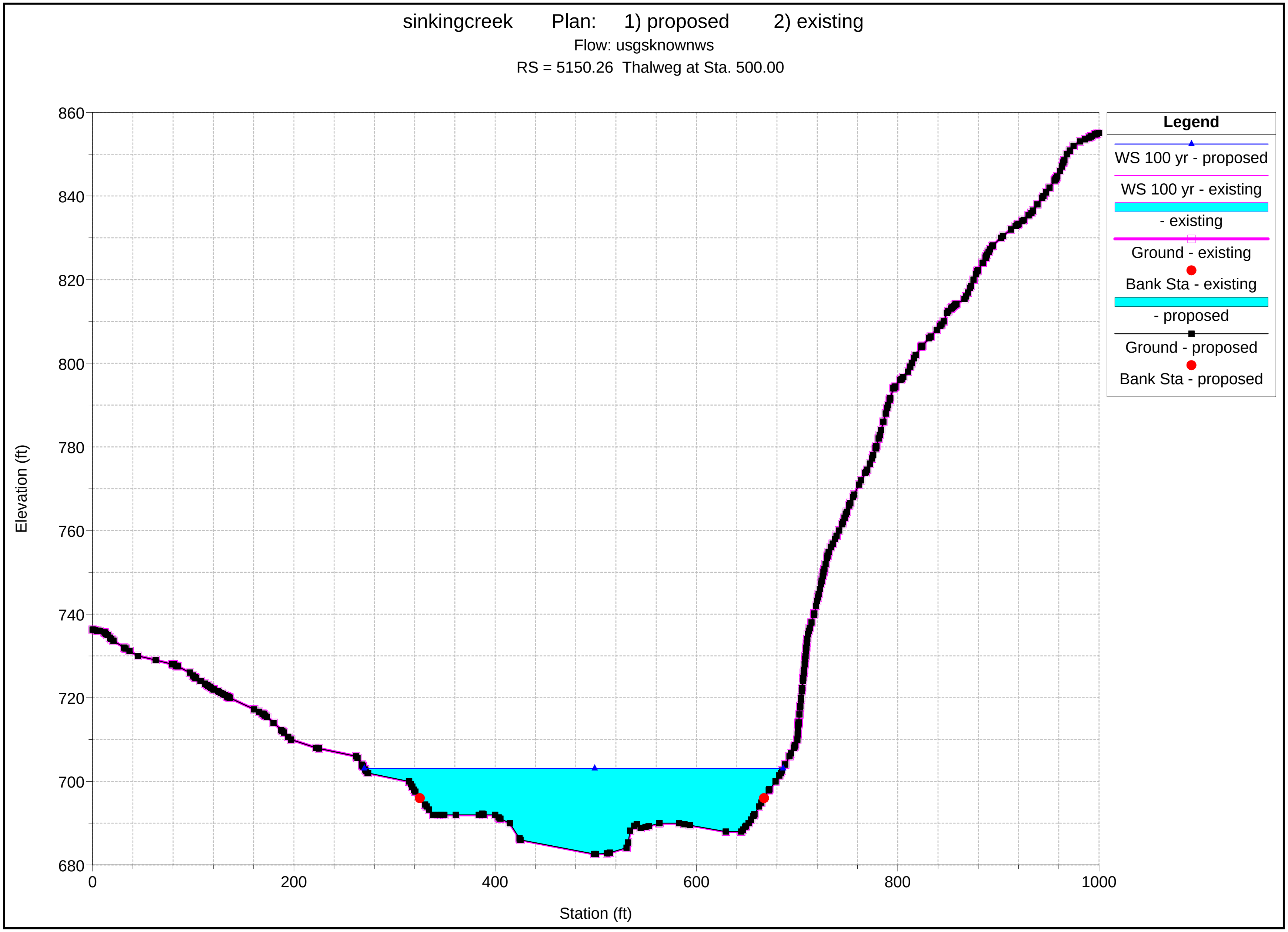

sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 6006.52* Interpolated, Refined with Additional Data
Legend
WS 100 yr - proposed
WS 100 yr - existing
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Bank Sta - proposed
Elevation (ft)
Station (ft)
740
730
720
710
700
690
680
0
200
400
600
800
1000

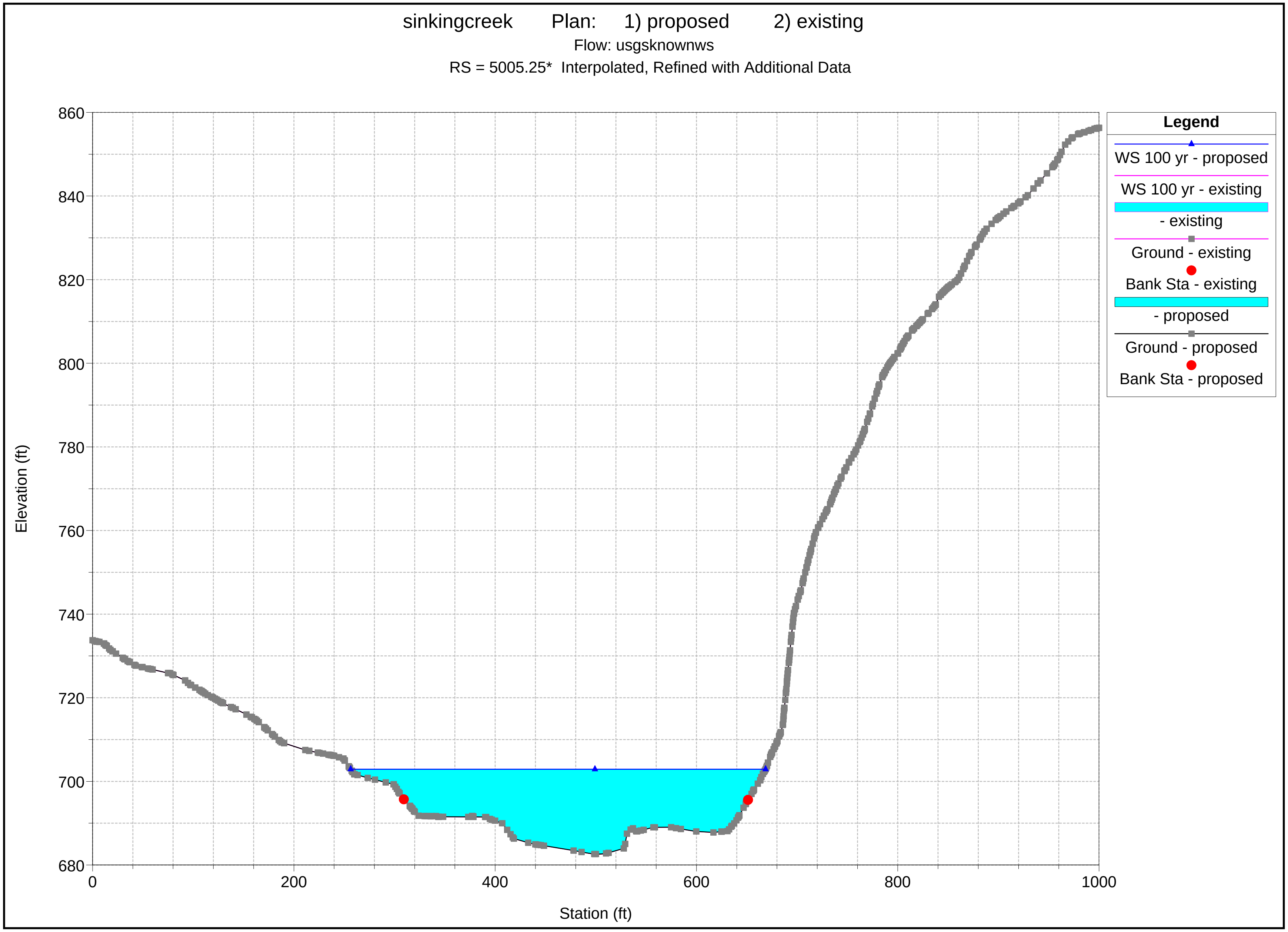


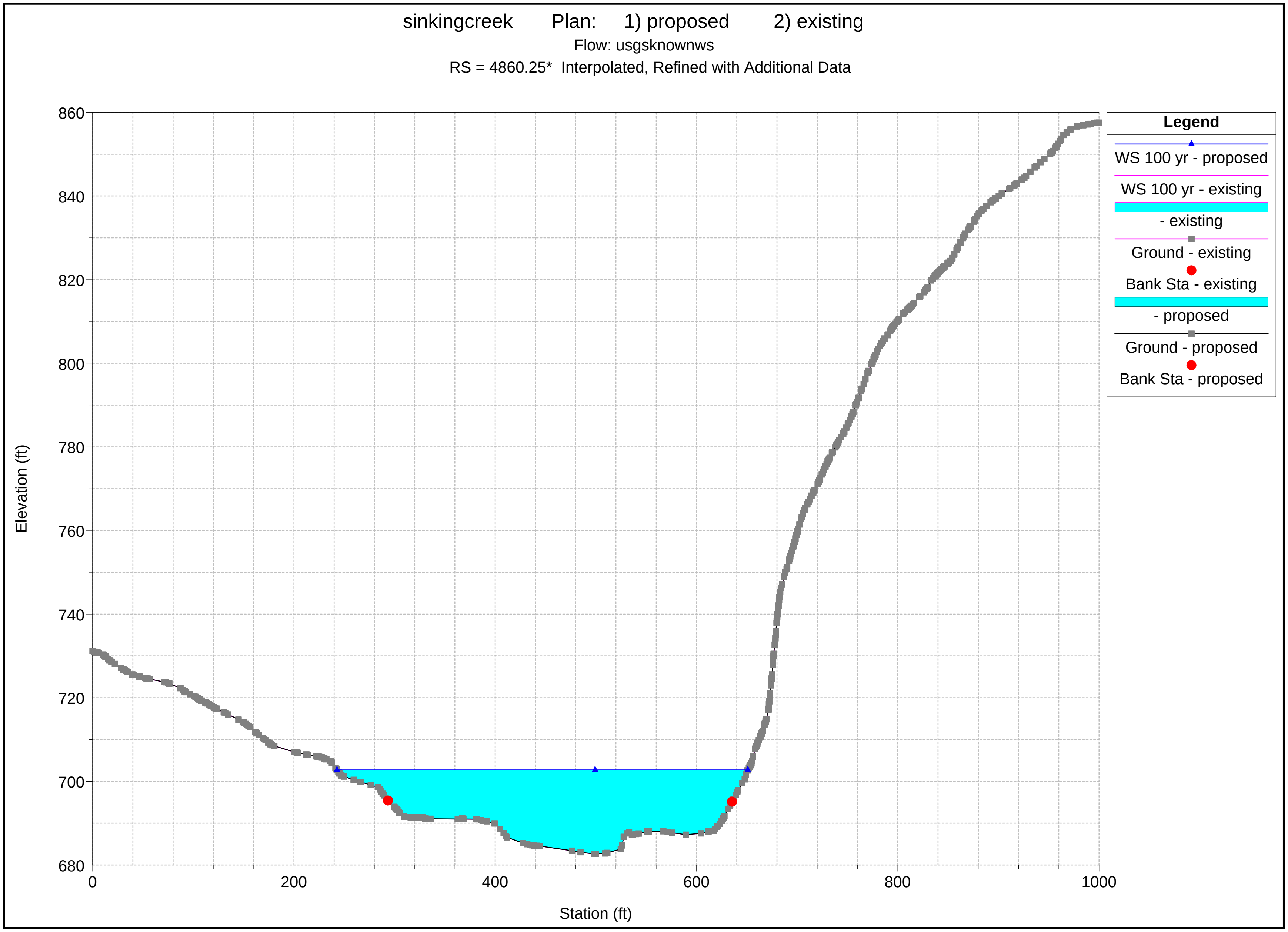
sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 5757.84 Thalweg at Sta. 500.00
Legend
WS 100 yr - proposed
WS 100 yr - existing
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Bank Sta - proposed
Elevation (ft)
Station (ft)
740
730
720
710
700
690
680
0
200
400
600
800
1000

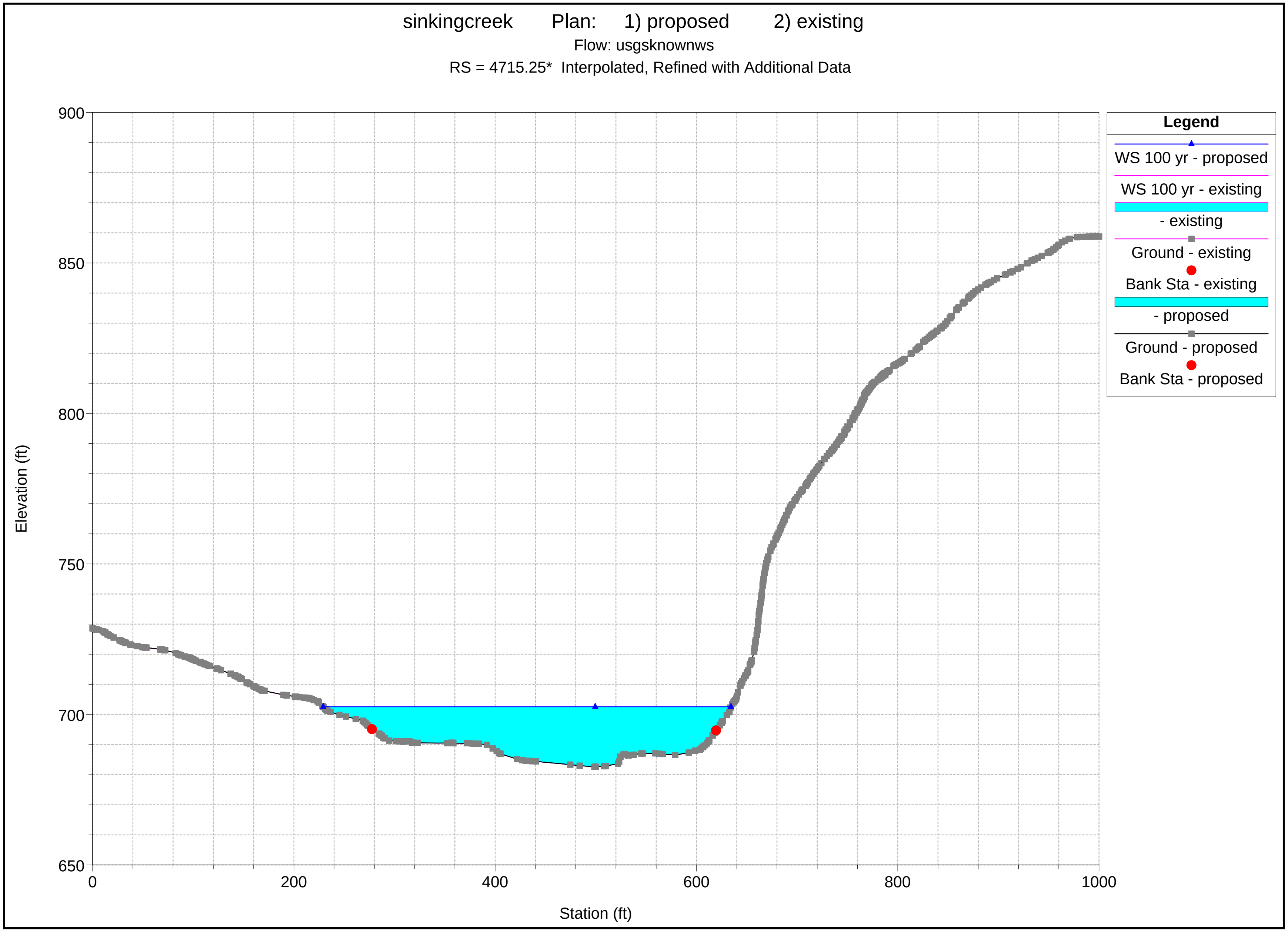

sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 5555.31*
Elevation (ft)
Station (ft)
780
760
740
720
700
680
0
200
400
600
800
1000
Legend
WS 100 yr - proposed
WS 100 yr - existing
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Bank Sta - proposed

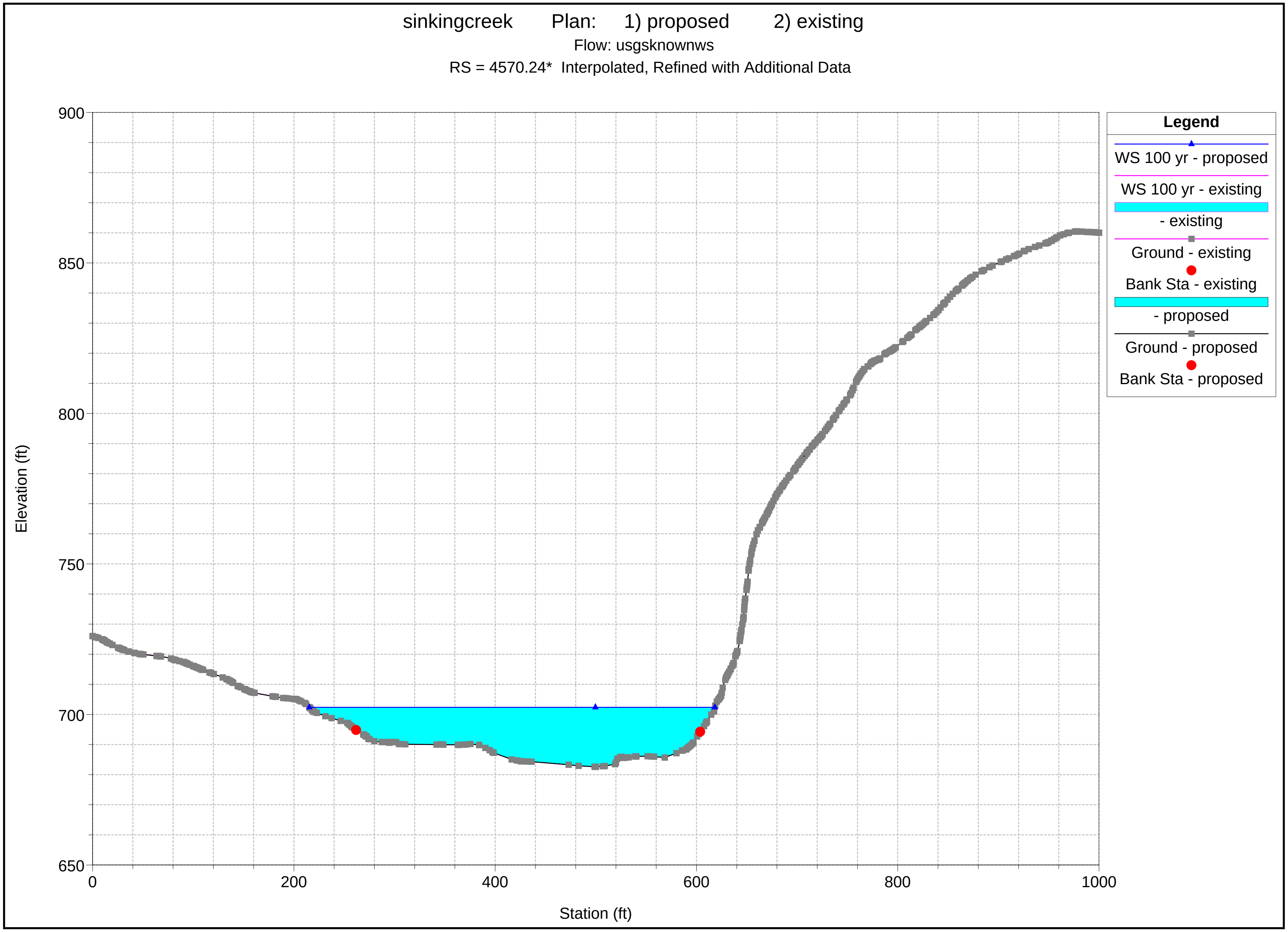

sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 5352.78*
Legend
WS 100 yr - proposed
WS 100 yr - existing
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Bank Sta - proposed
Elevation (ft)
820
800
780
760
740
720
700
680
0
200
400
600
800
1000
Station (ft)

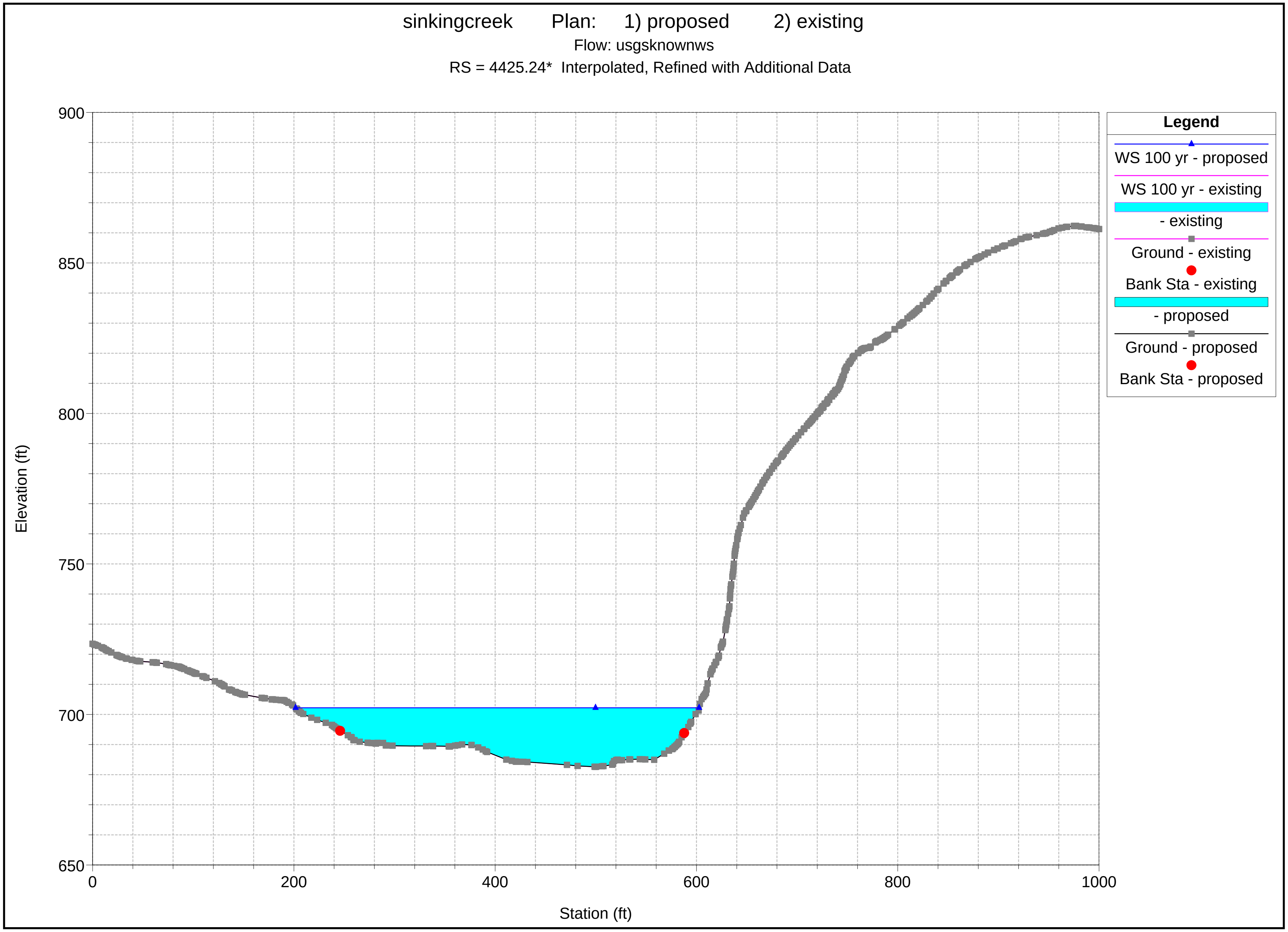

sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 5150.26 Thalweg at Sta. 500.00
Legend
WS 100 yr - proposed
WS 100 yr - existing
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Bank Sta - proposed
Elevation (ft)
Station (ft)
860
840
820
800
780
760
740
720
700
680
0
200
400
600
800
1000

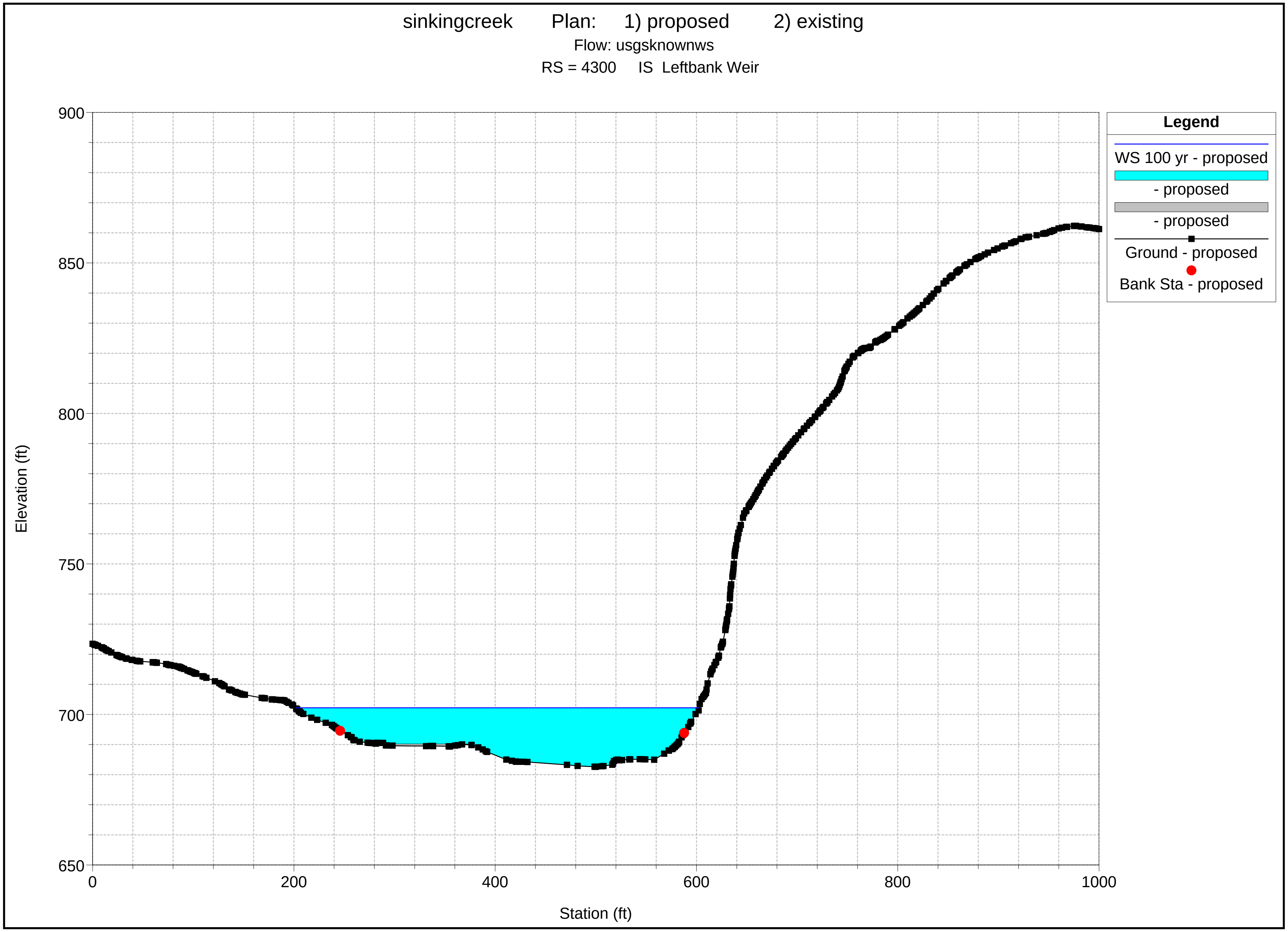

sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 5005.25* Interpolated, Refined with Additional Data
Legend
WS 100 yr - proposed
WS 100 yr - existing
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Bank Sta - proposed
Elevation (ft)
Station (ft)
860
840
820
800
780
760
740
720
700
680
0
200
400
600
800
1000

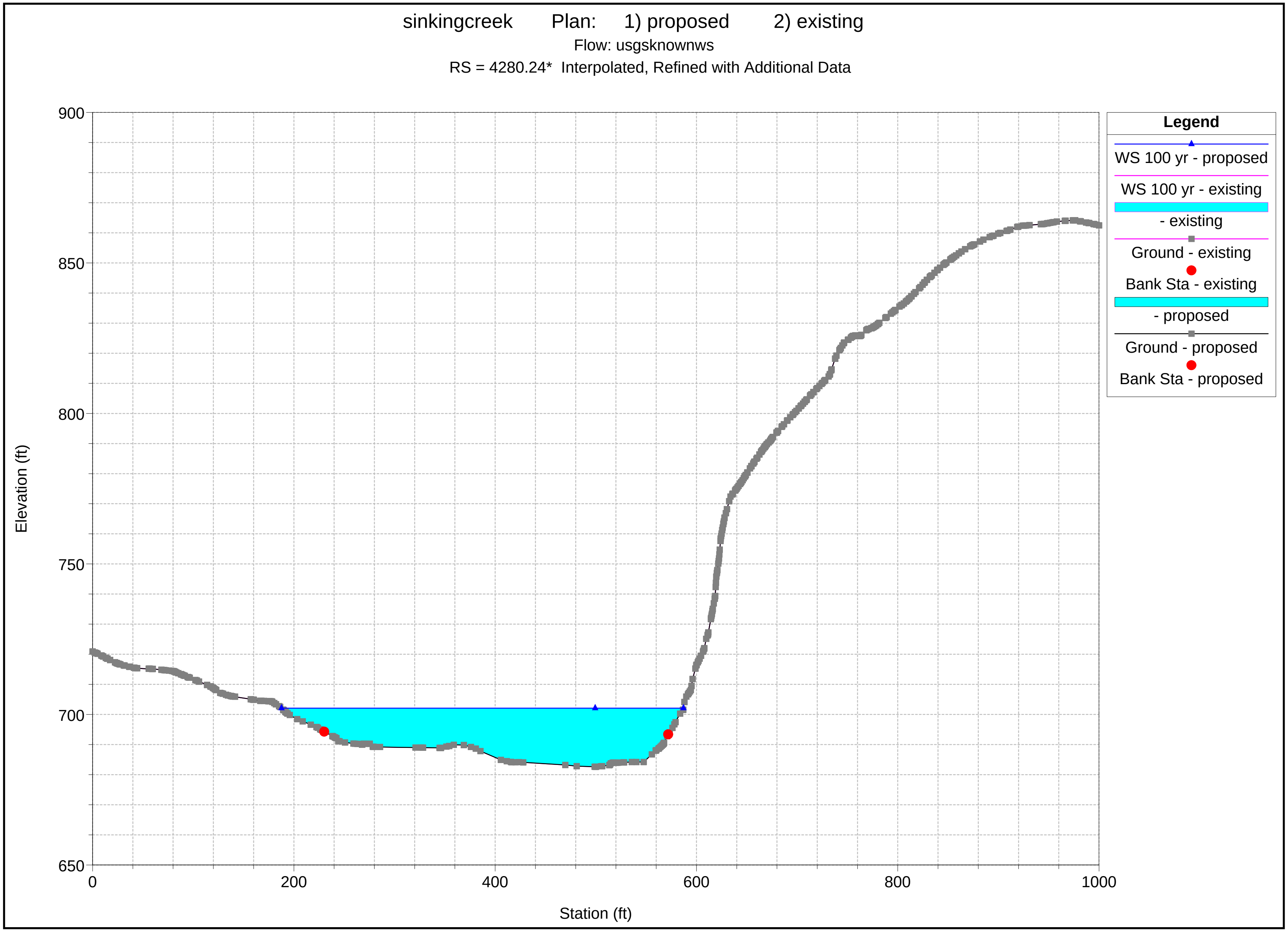

sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 4860.25* Interpolated, Refined with Additional Data
Legend
WS 100 yr - proposed
WS 100 yr - existing
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Bank Sta - proposed
Elevation (ft)
Station (ft)
860
840
820
800
780
760
740
720
700
680
0
200
400
600
800
1000

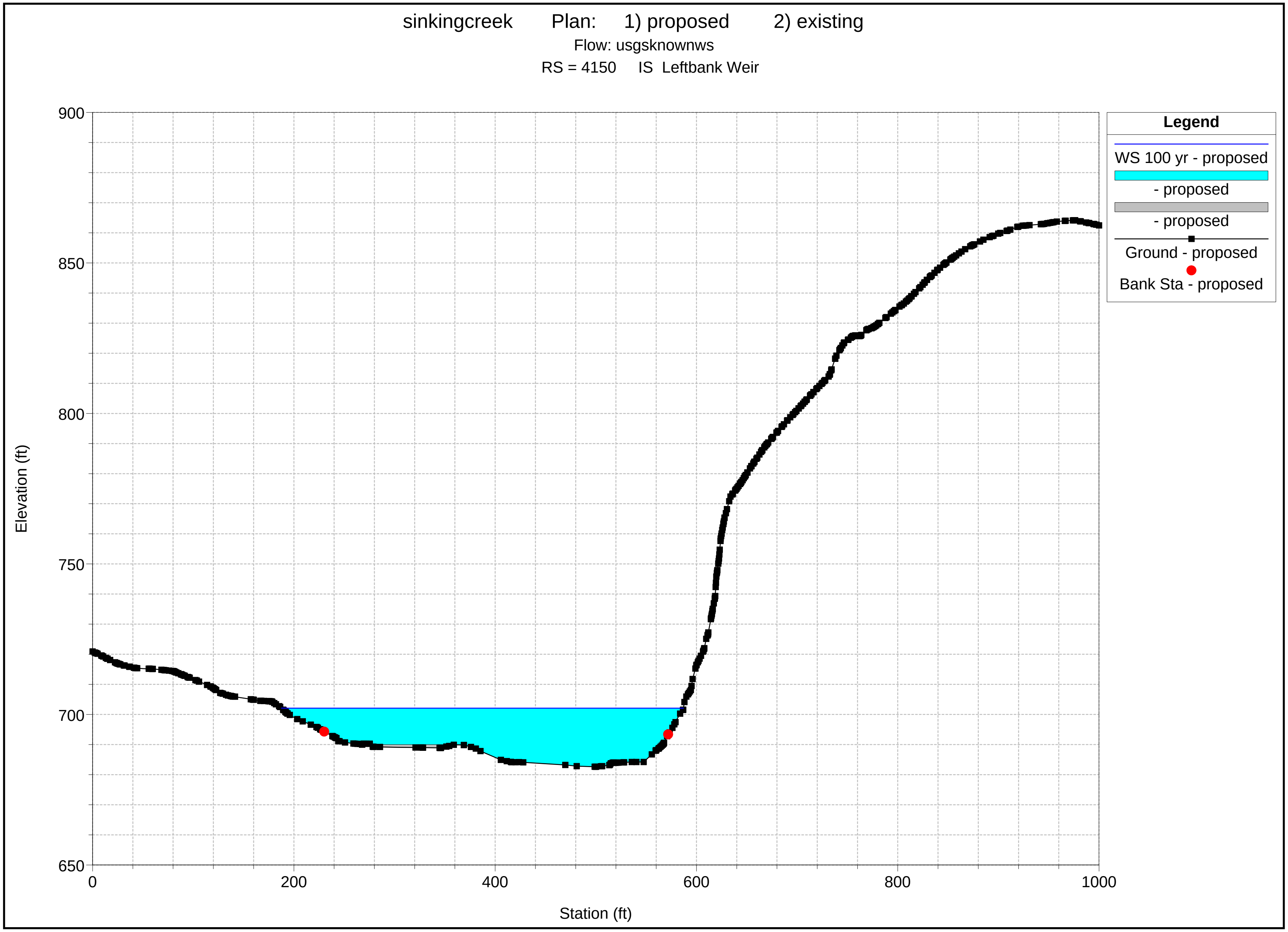

sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 4715.25* Interpolated, Refined with Additional Data
Elevation (ft)
Station (ft)
900
850
800
750
700
650
0
200
400
600
800
1000
Legend
WS 100 yr - proposed
WS 100 yr - existing
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Bank Sta - proposed


sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 4570.24* Interpolated, Refined with Additional Data
Elevation (ft)
900
850
800
750
700
650
0
200
400
600
800
1000
Station (ft)
Legend
WS 100 yr - proposed
WS 100 yr - existing
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Bank Sta - proposed

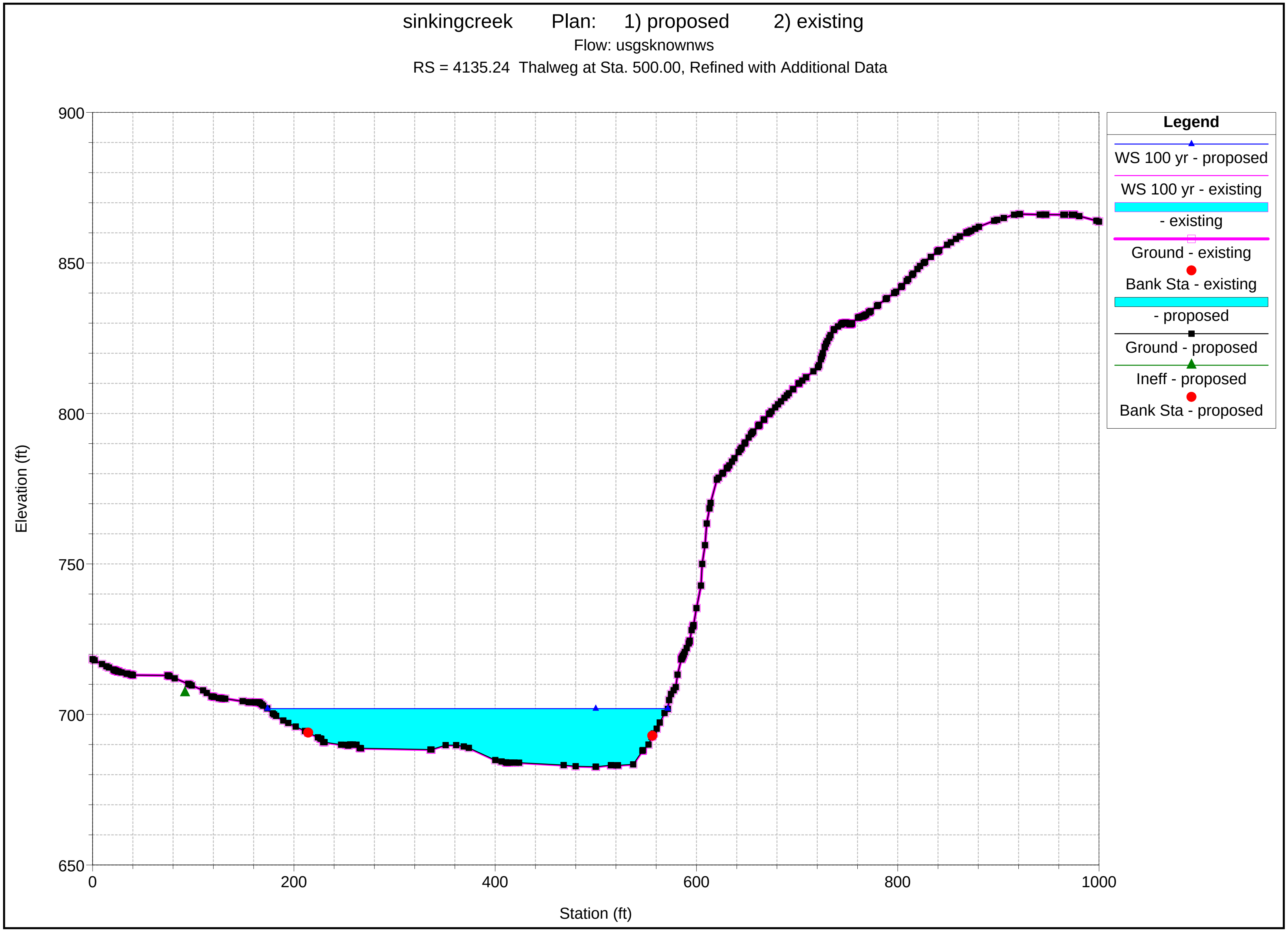

sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 4425.24* Interpolated, Refined with Additional Data
Legend
WS 100 yr - proposed
WS 100 yr - existing
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Bank Sta - proposed
Elevation (ft)
Station (ft)
900
850
800
750
700
650
0
200
400
600
800
1000

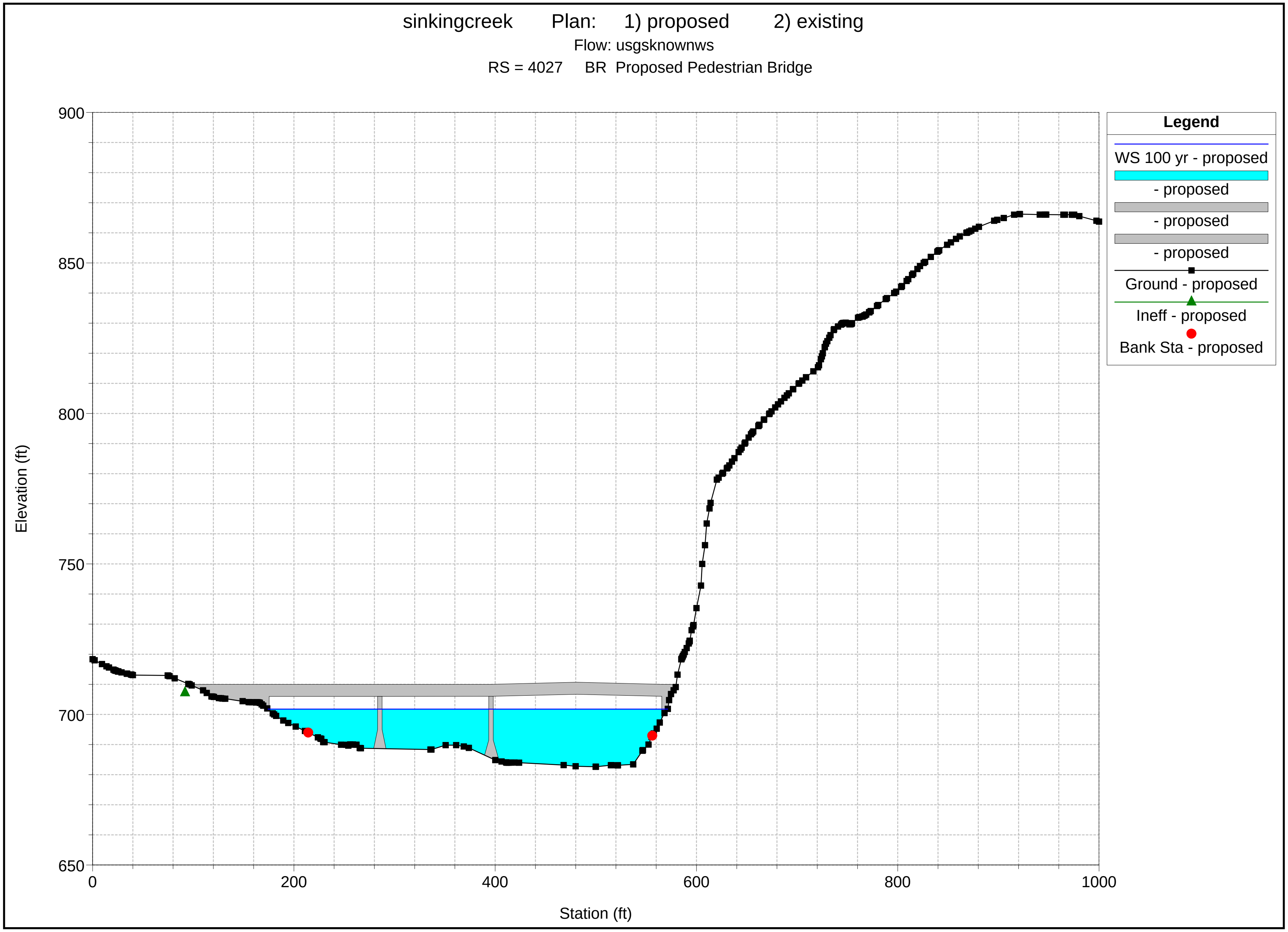

sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 4300 IS Leftbank Weir
Legend
WS 100 yr - proposed
- proposed
- proposed
Ground - proposed
Bank Sta - proposed
Elevation (ft)
900
850
800
750
700
650
0
200
400
600
800
1000
Station (ft)

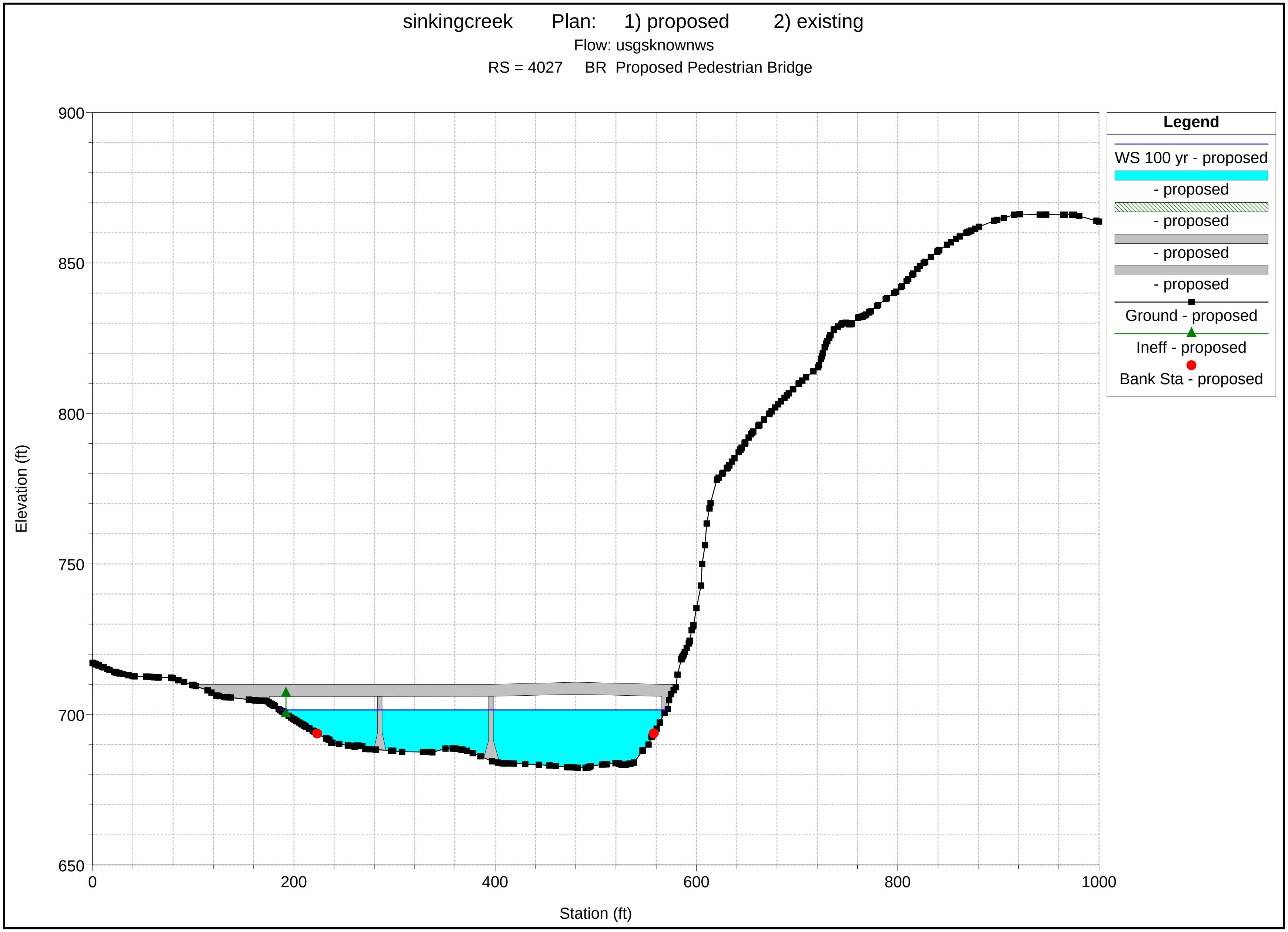

sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 4280.24* Interpolated, Refined with Additional Data
Elevation (ft)
Station (ft)
900
850
800
750
700
650
0
200
400
600
800
1000
Legend
WS 100 yr - proposed
WS 100 yr - existing
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Bank Sta - proposed



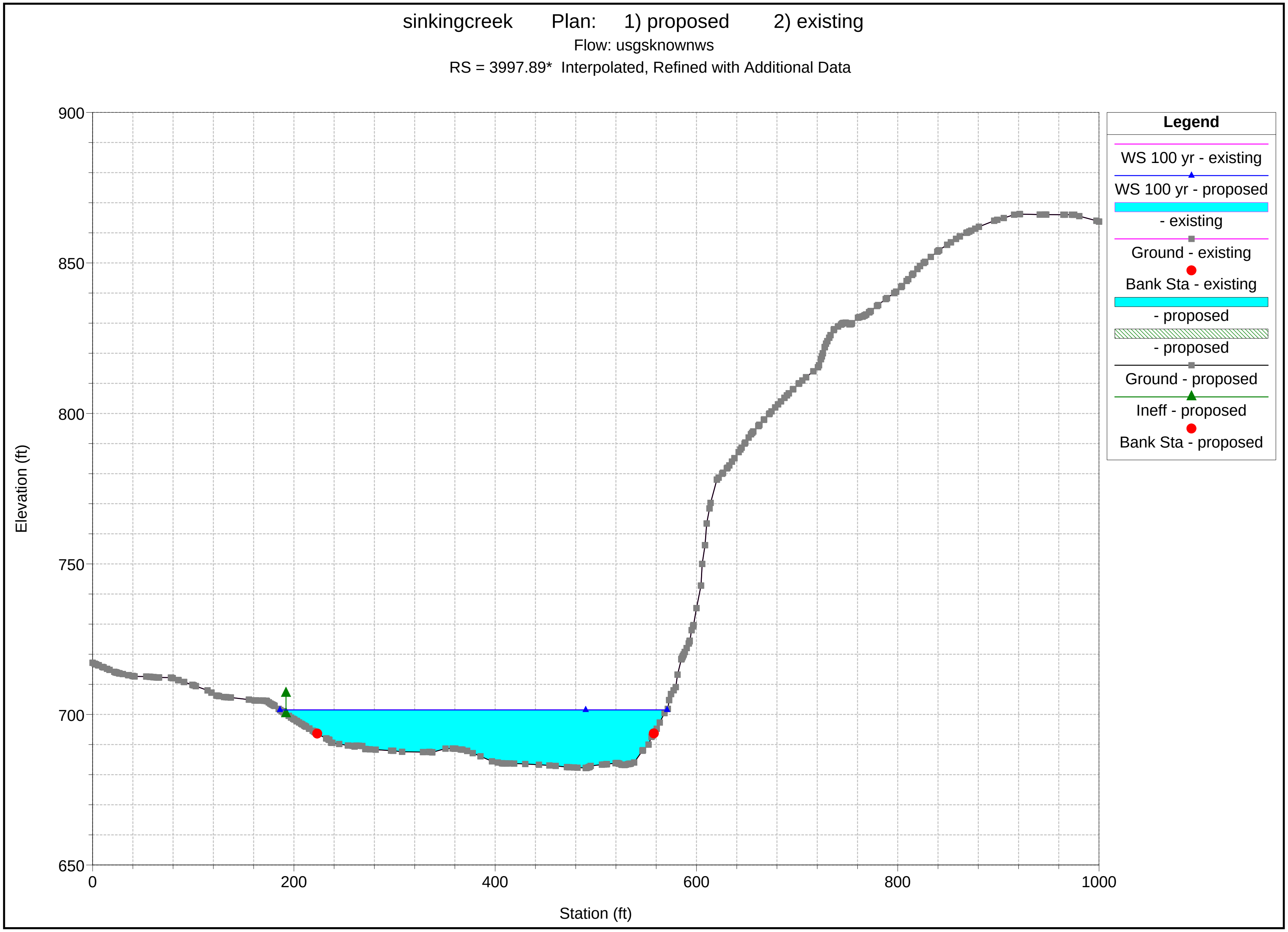
sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 4150 IS Leftbank Weir
Legend
WS 100 yr - proposed
- proposed
- proposed
Ground - proposed
Bank Sta - proposed
Elevation (ft)
Station (ft)
900
850
800
750
700
650
0
200
400
600
800
1000

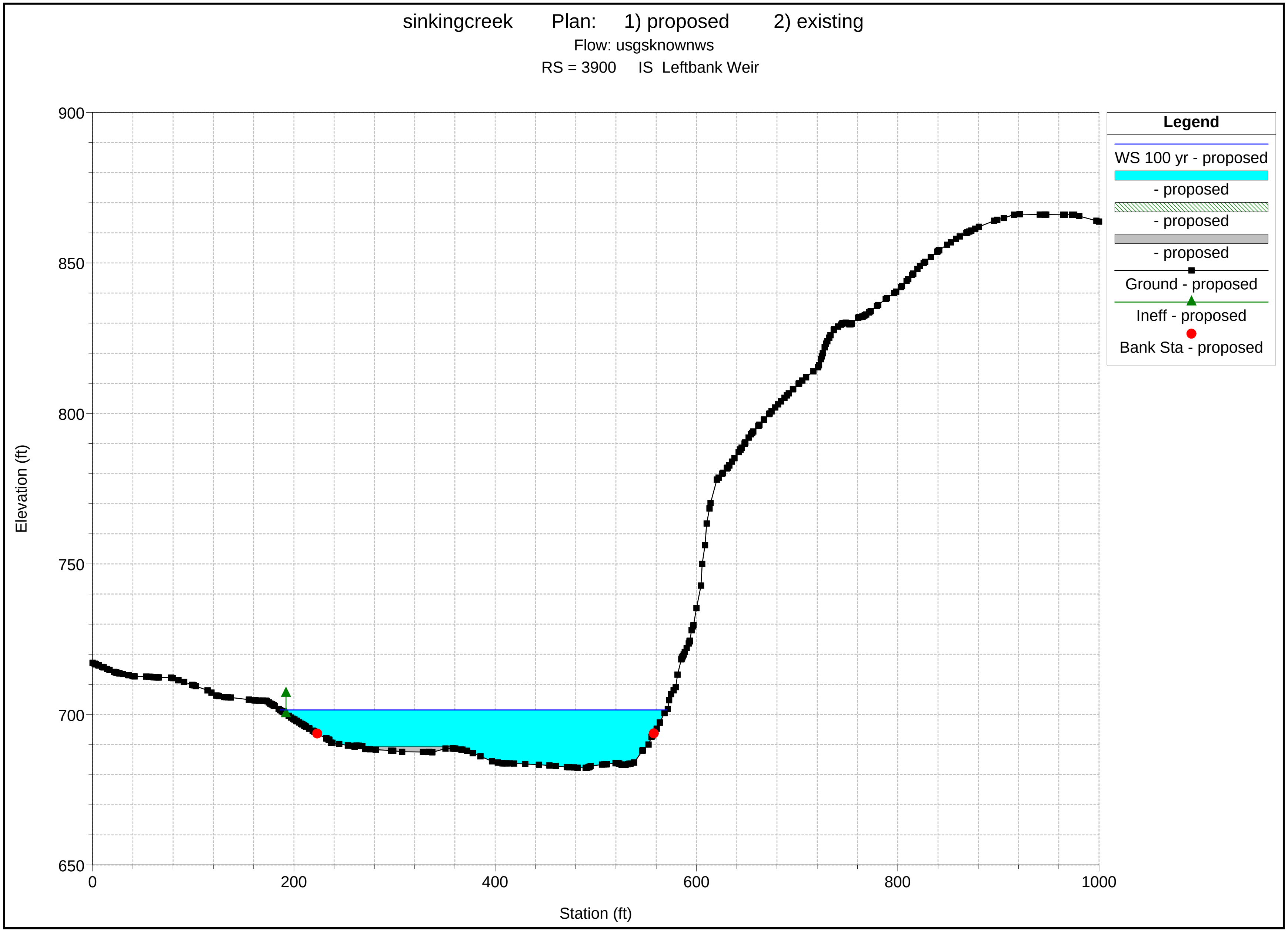

sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 4135.24 Thalweg at Sta. 500.00, Refined with Additional Data
Elevation (ft)
Station (ft)
900
850
800
750
700
650
0
200
400
600
800
1000
Legend
WS 100 yr - proposed
WS 100 yr - existing
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Ineff - proposed
Bank Sta - proposed


sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 4027 BR Proposed Pedestrian Bridge
Legend
WS 100 yr - proposed
- proposed
- proposed
- proposed
Ground - proposed
Ineff - proposed
Bank Sta - proposed
Elevation (ft)
Station (ft)
900
850
800
750
700
650
0
200
400
600
800
1000

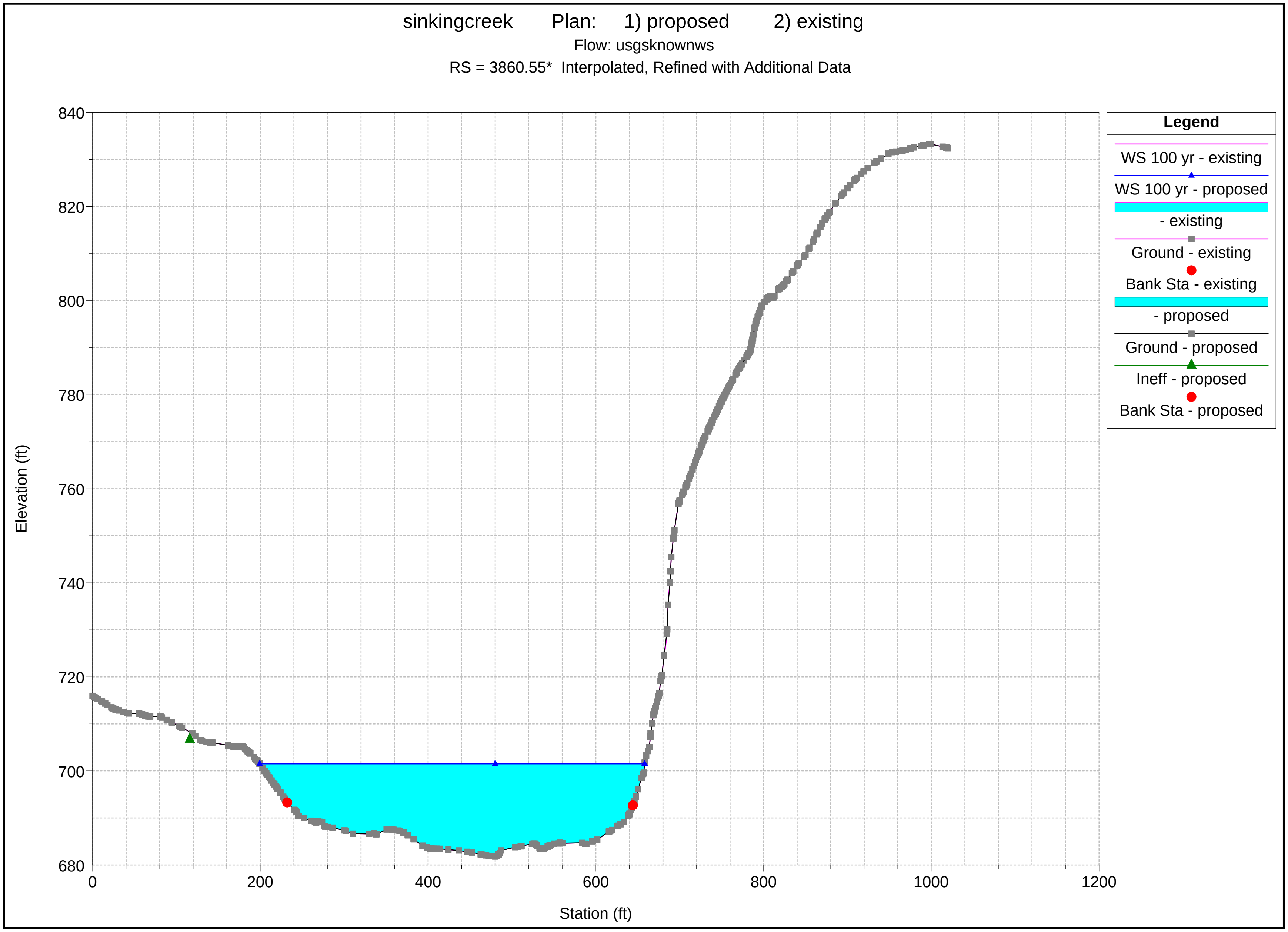


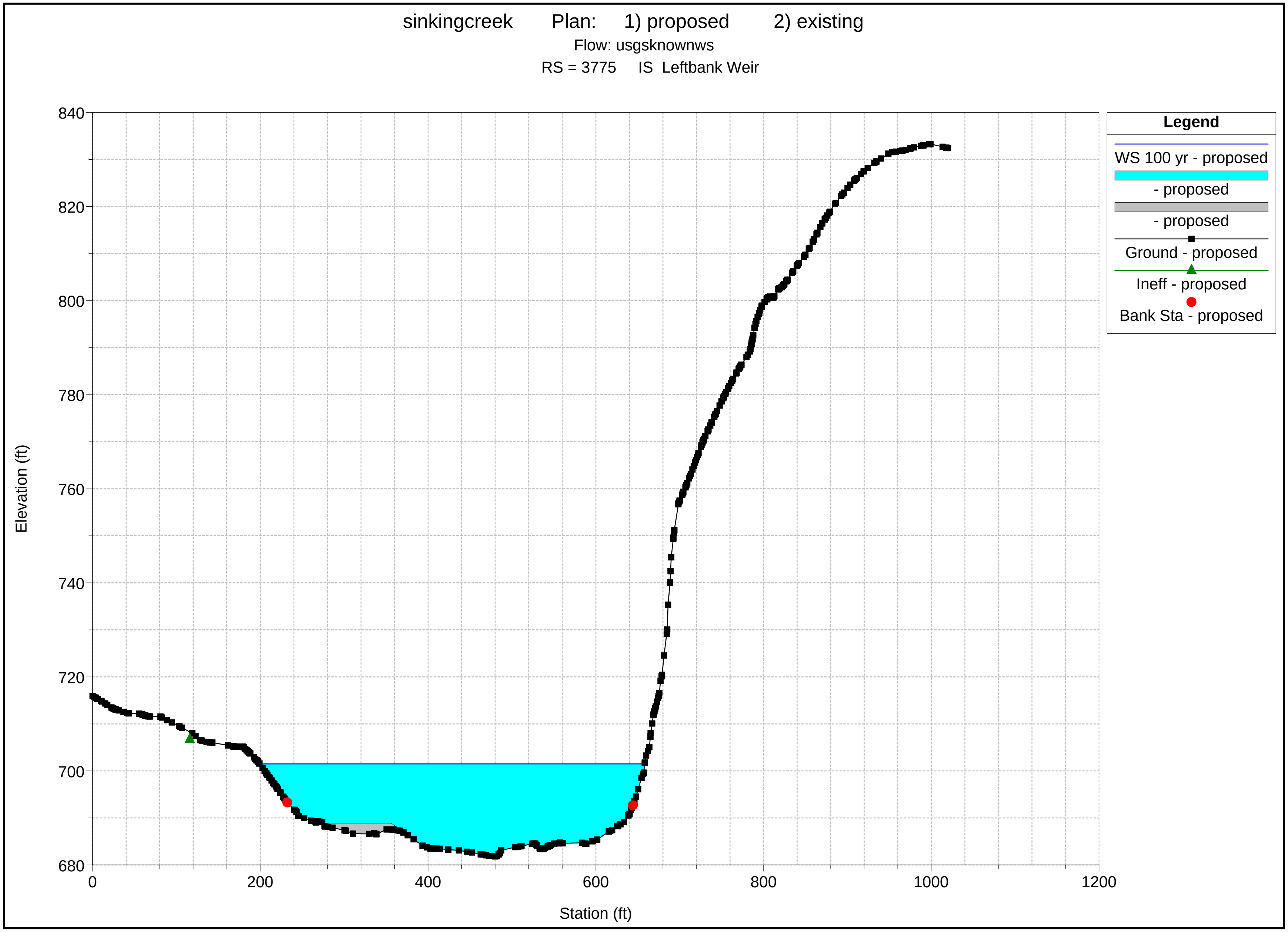
sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 4027 BR Proposed Pedestrian Bridge
Elevation (ft)
Station (ft)
900
850
800
750
700
650
0
200
400
600
800
1000
Legend
WS 100 yr - proposed
- proposed
- proposed
- proposed
- proposed
Ground - proposed
Ineff - proposed
Bank Sta - proposed


sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 3997.89* Interpolated, Refined with Additional Data
Elevation (ft)
900
850
800
750
700
650
0
200
400
600
800
1000
Station (ft)
Legend
WS 100 yr - existing
WS 100 yr - proposed
- existing
Ground - existing
Bank Sta - existing
- proposed
- proposed
Ground - proposed
Ineff - proposed
Bank Sta - proposed

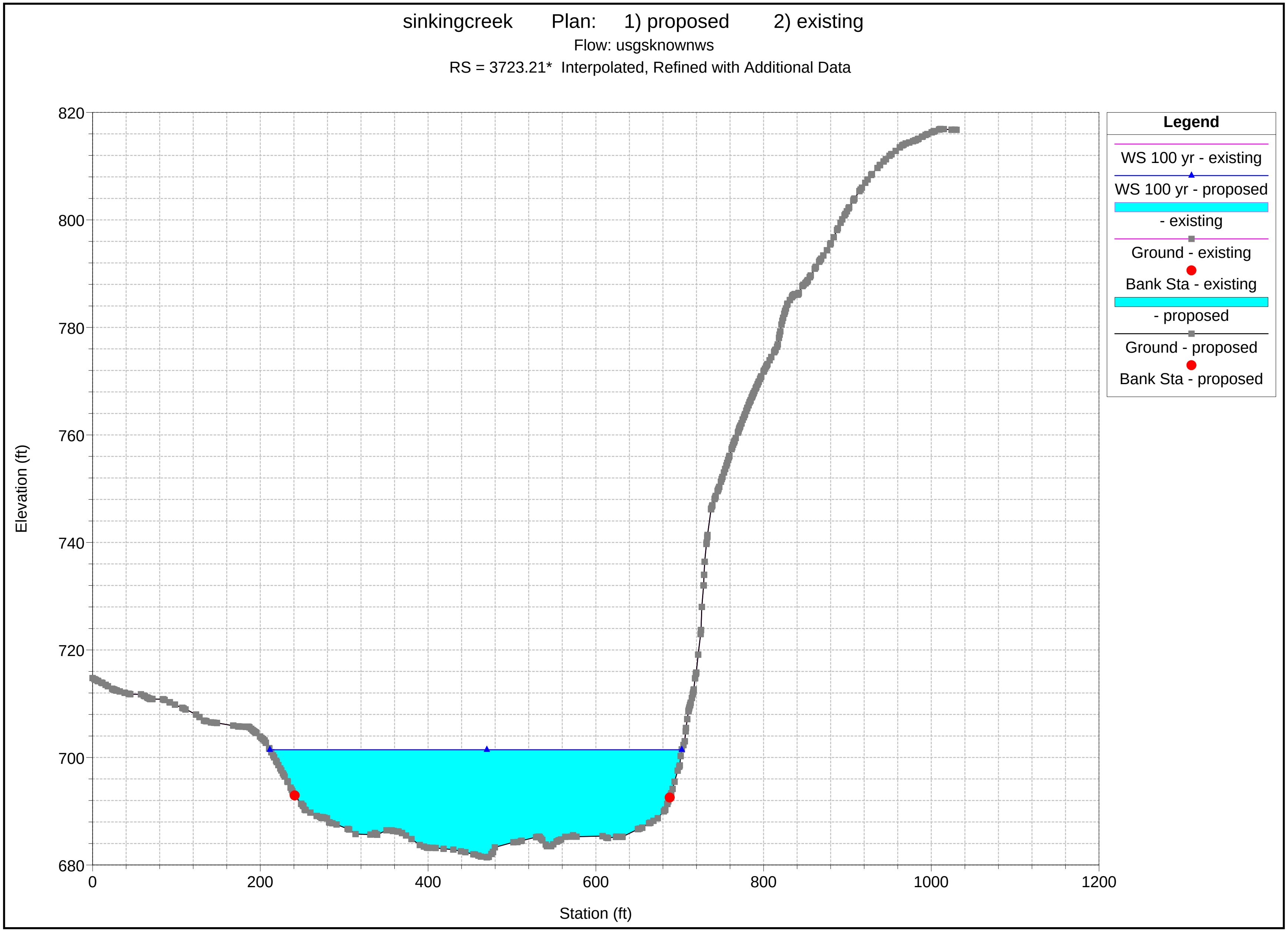


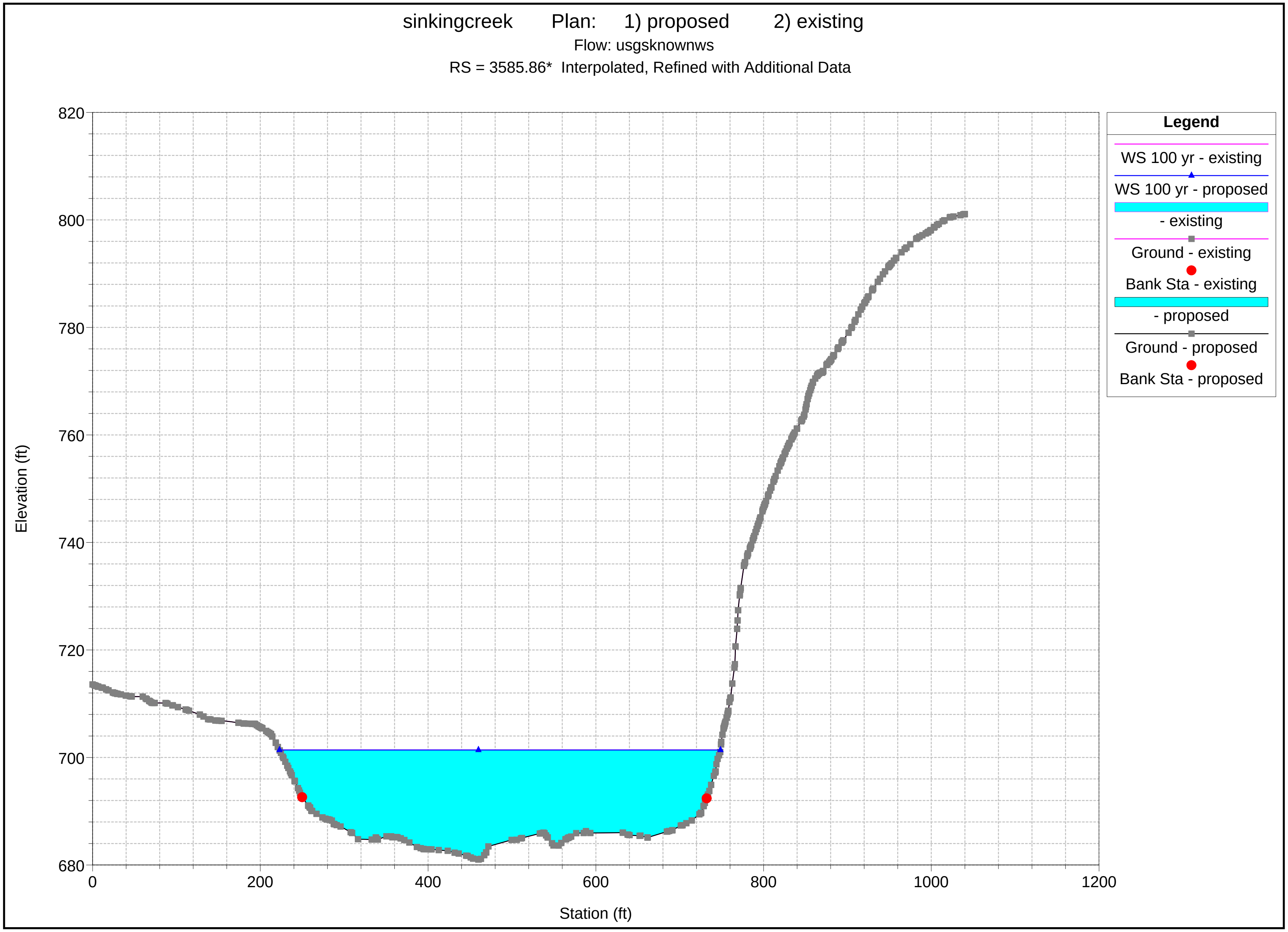
sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 3900 IS Leftbank Weir
Legend
WS 100 yr - proposed
- proposed
- proposed
- proposed
Ground - proposed
Ineff - proposed
Bank Sta - proposed
Elevation (ft)
Station (ft)
900
850
800
750
700
650
0
200
400
600
800
1000

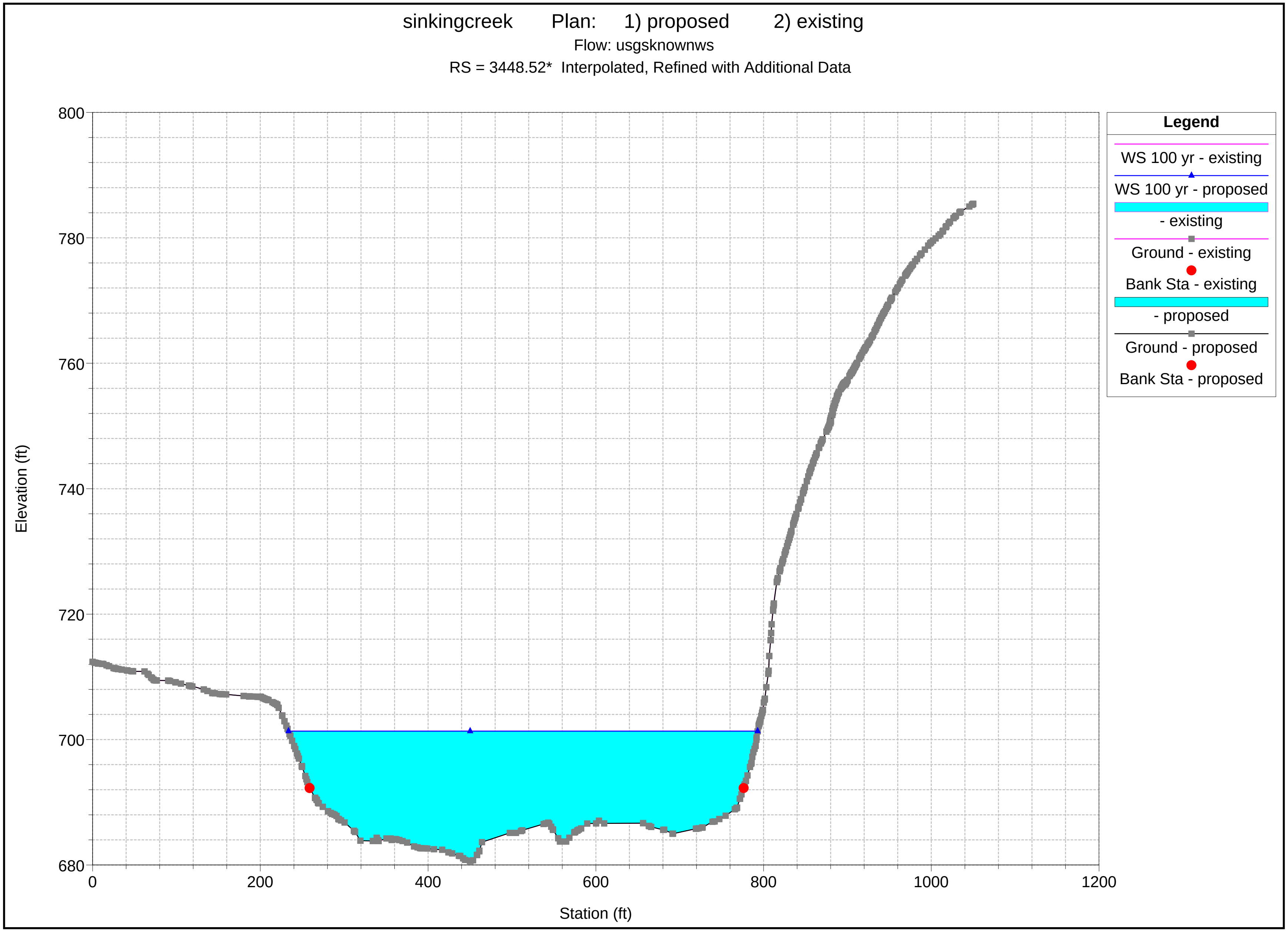

sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 3860.55* Interpolated, Refined with Additional Data
Elevation (ft)
840
820
800
780
760
740
720
700
680
0
200
400
600
800
1000
1200
Station (ft)
Legend
WS 100 yr - existing
WS 100 yr - proposed
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Ineff - proposed
Bank Sta - proposed

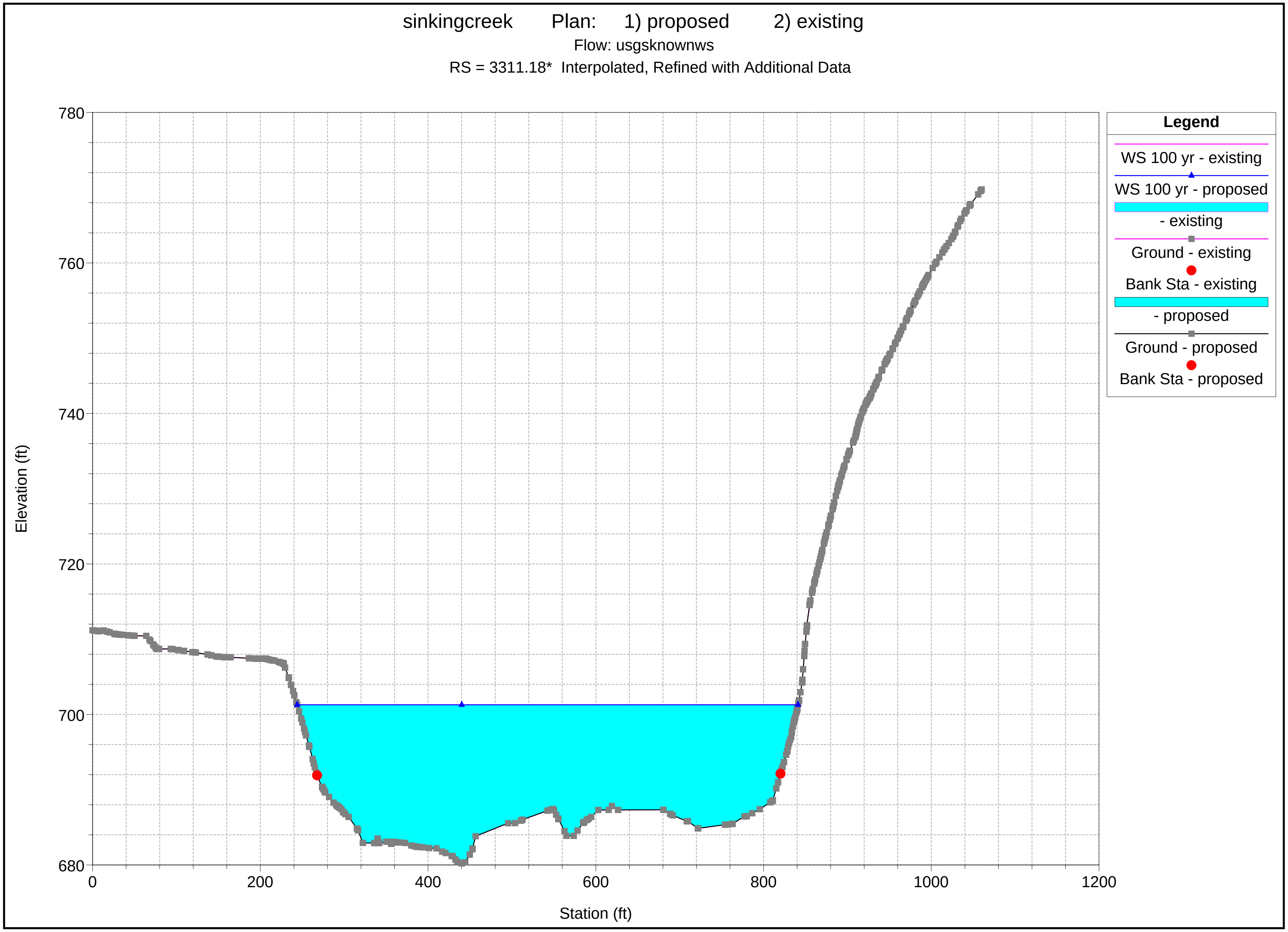


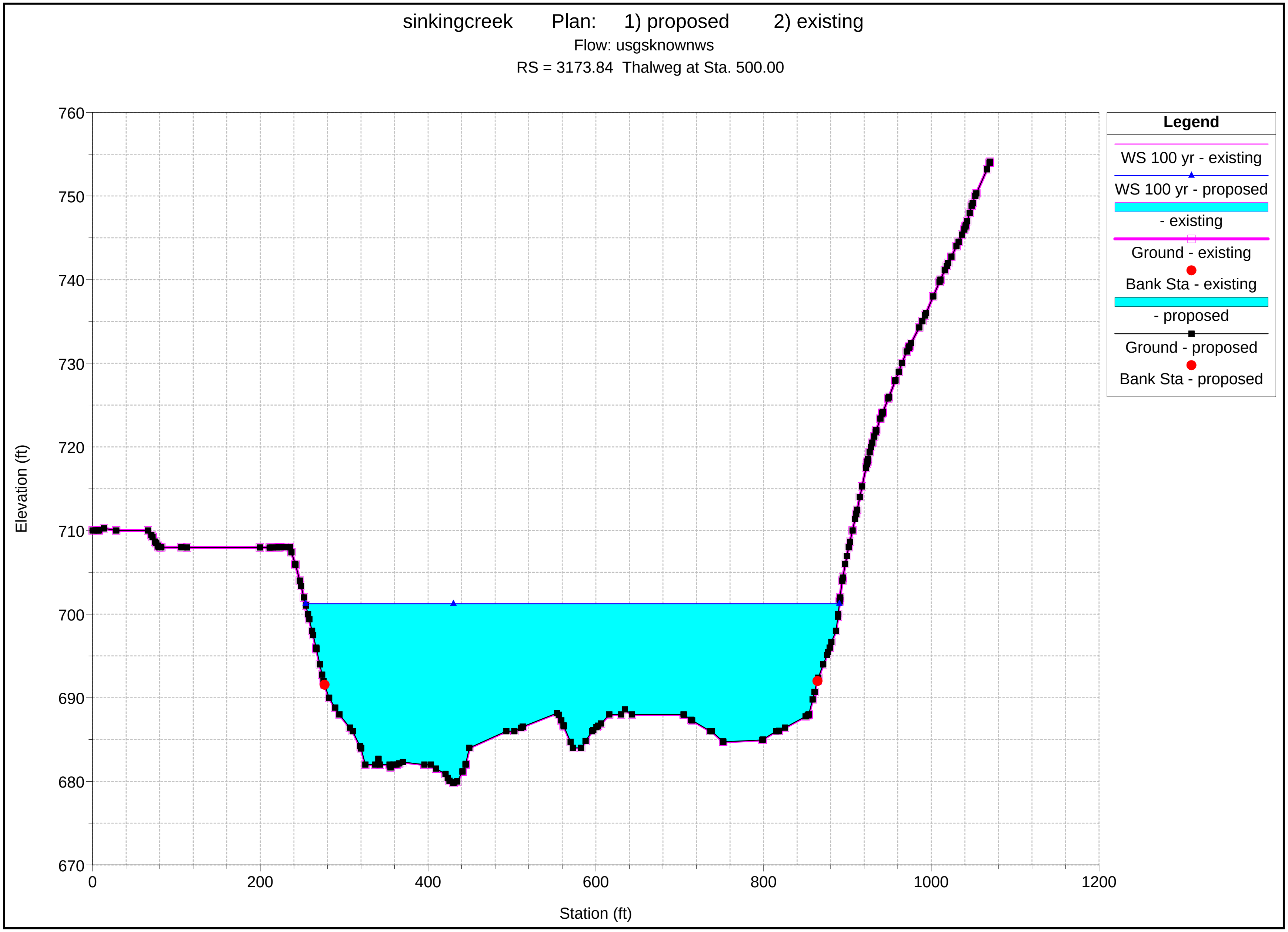
sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 3775 IS Leftbank Weir
Elevation (ft)
Station (ft)
840
820
800
780
760
740
720
700
680
0
200
400
600
800
1000
1200
Legend
WS 100 yr - proposed
- proposed
- proposed
Ground - proposed
Ineff - proposed
Bank Sta - proposed

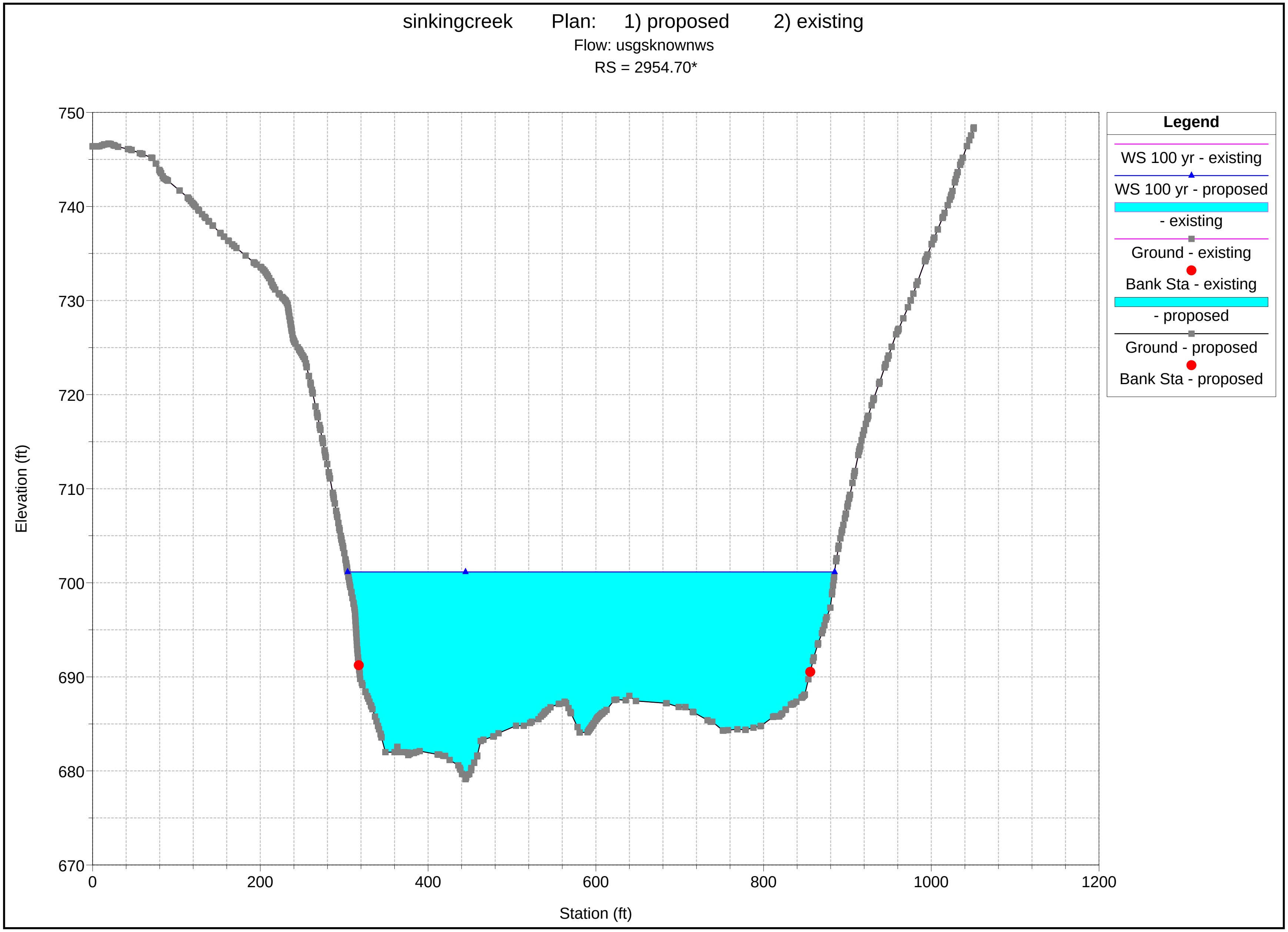

sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 3723.21* Interpolated, Refined with Additional Data
Legend
WS 100 yr - existing
WS 100 yr - proposed
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Bank Sta - proposed
Elevation (ft)
Station (ft)
820
800
780
760
740
720
700
680
0
200
400
600
800
1000
1200

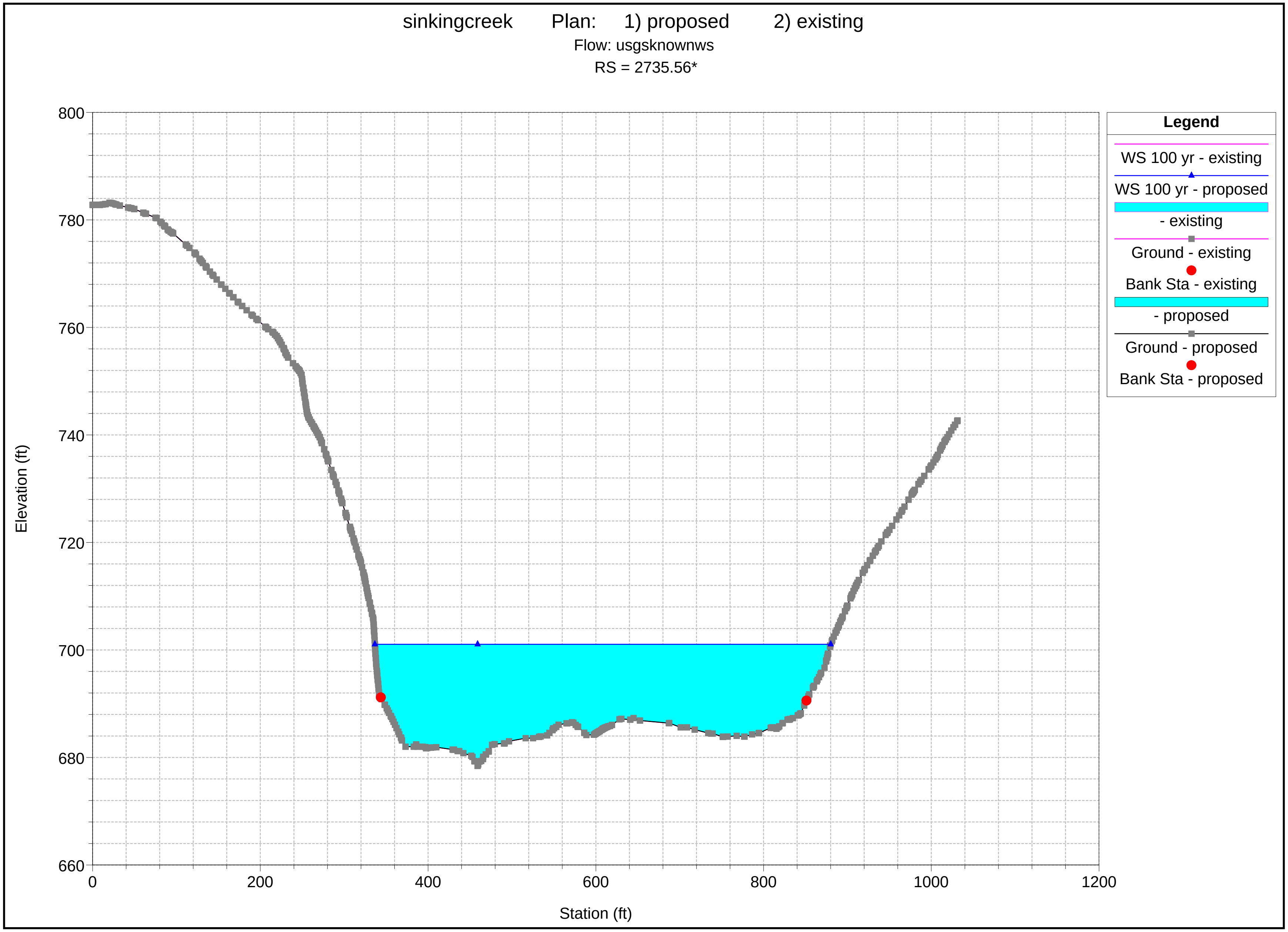

sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 3585.86* Interpolated, Refined with Additional Data
Legend
WS 100 yr - existing
WS 100 yr - proposed
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Bank Sta - proposed
Elevation (ft)
Station (ft)
820
800
780
760
740
720
700
680
0
200
400
600
800
1000
1200

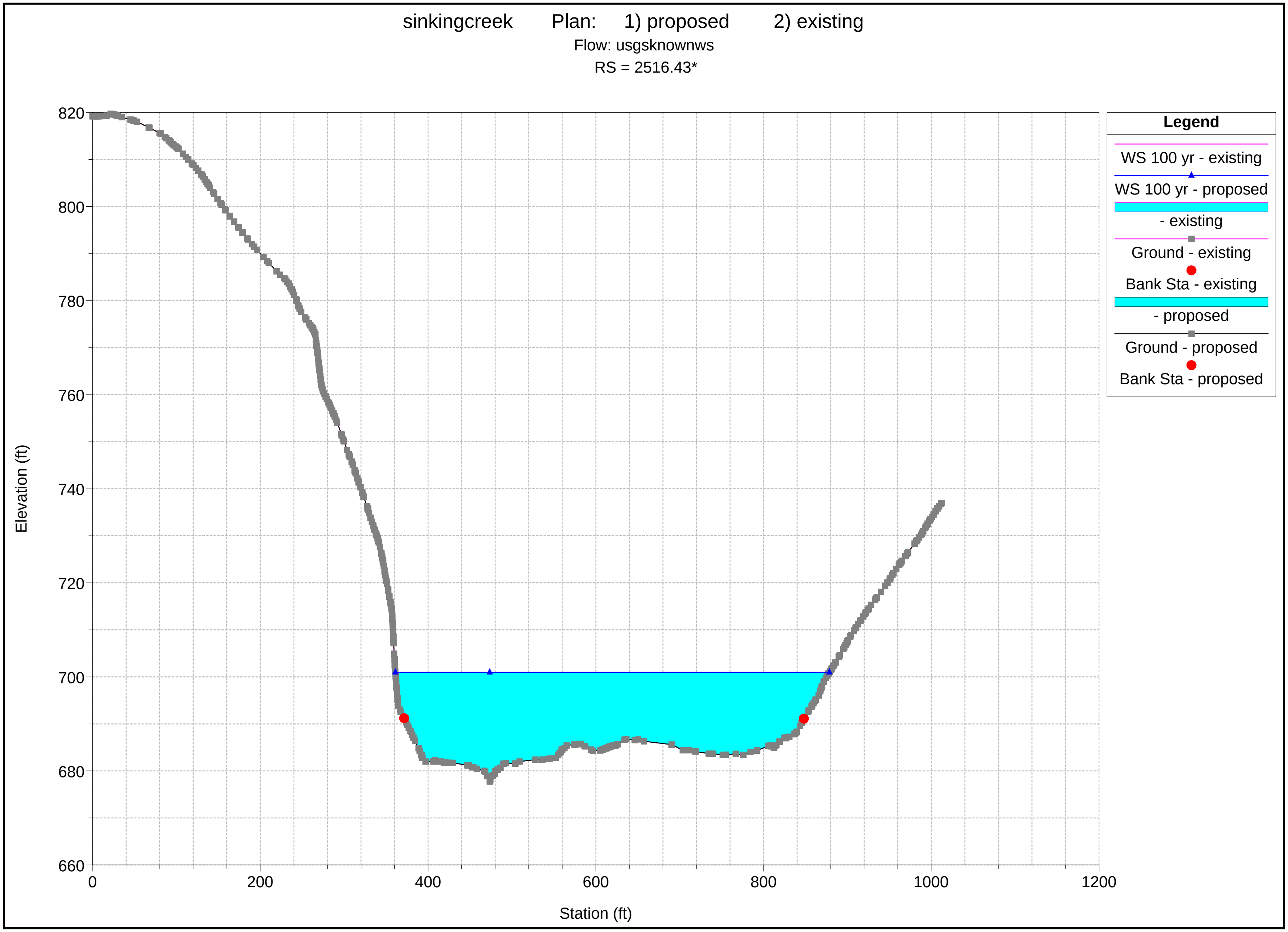

sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 3448.52* Interpolated, Refined with Additional Data
Elevation (ft)
800
780
760
740
720
700
680
0
200
400
600
800
1000
1200
Station (ft)
Legend
WS 100 yr - existing
WS 100 yr - proposed
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Bank Sta - proposed

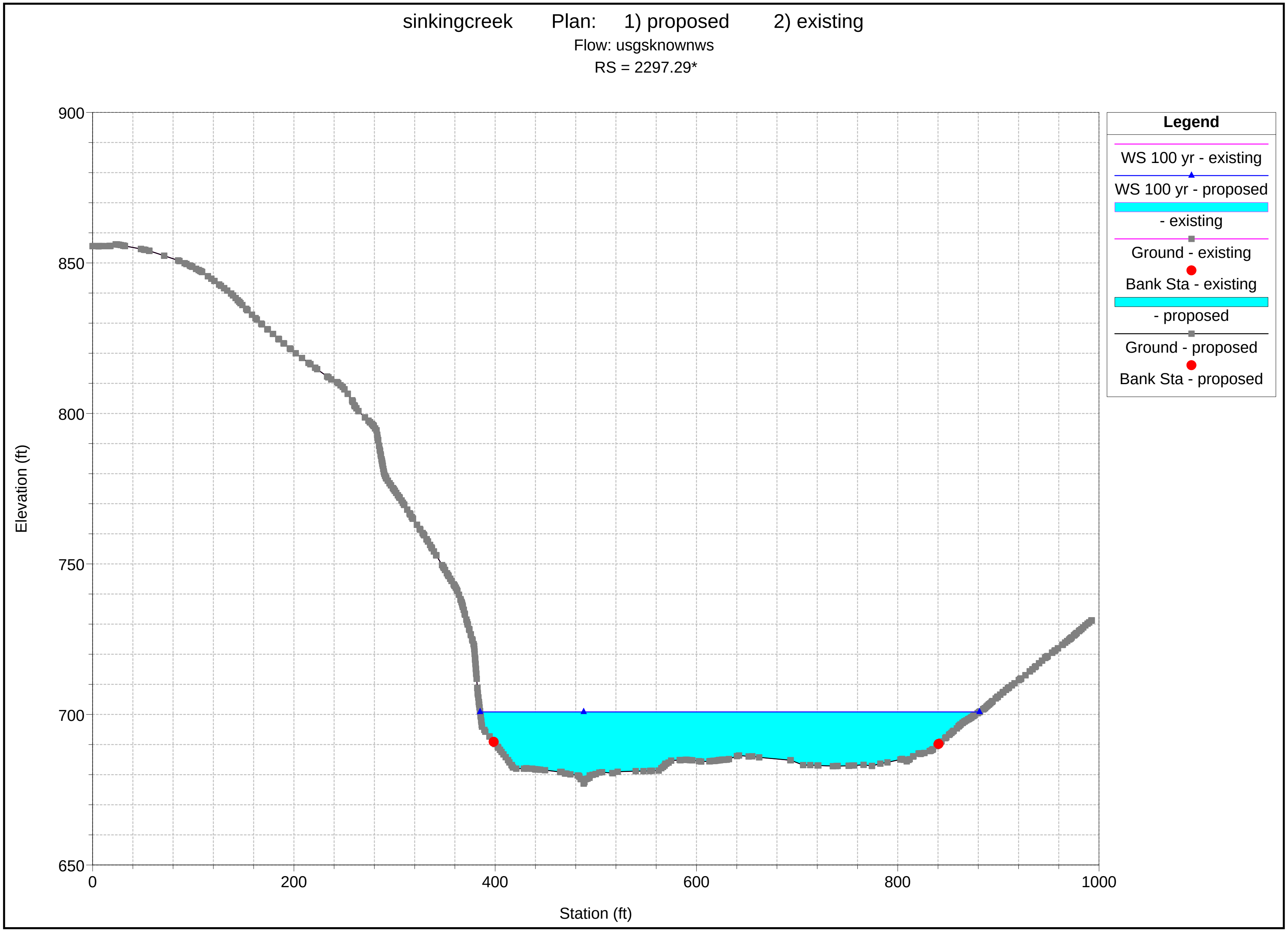

sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 3311.18* Interpolated, Refined with Additional Data
Elevation (ft)
Station (ft)
780
760
740
720
700
680
0
200
400
600
800
1000
1200
Legend
WS 100 yr - existing
WS 100 yr - proposed
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Bank Sta - proposed

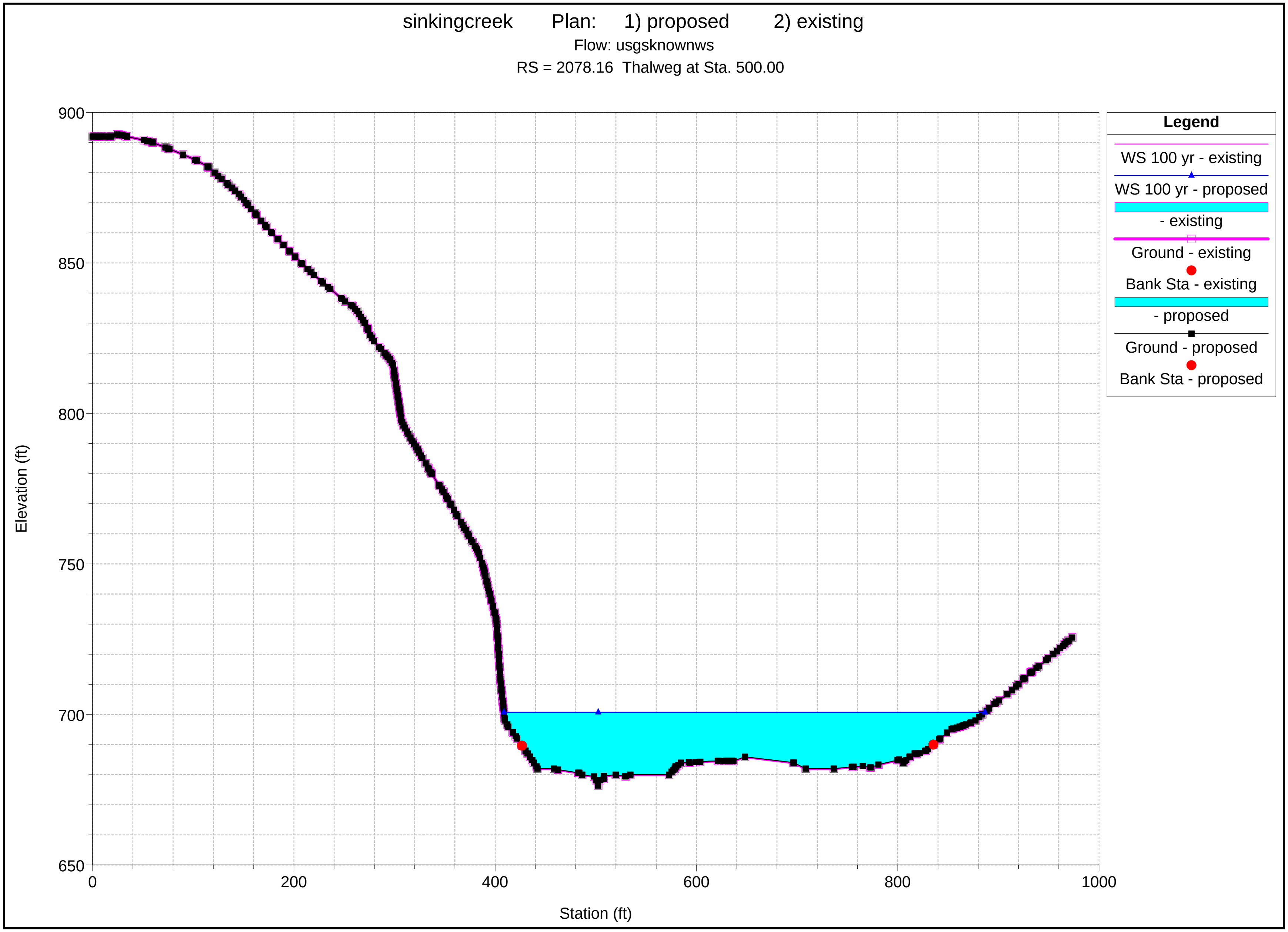

sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 3173.84 Thalweg at Sta. 500.00
Elevation (ft)
760
750
740
730
720
710
700
690
680
670
0
200
400
600
800
1000
1200
Station (ft)
Legend
WS 100 yr - existing
WS 100 yr - proposed
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Bank Sta - proposed

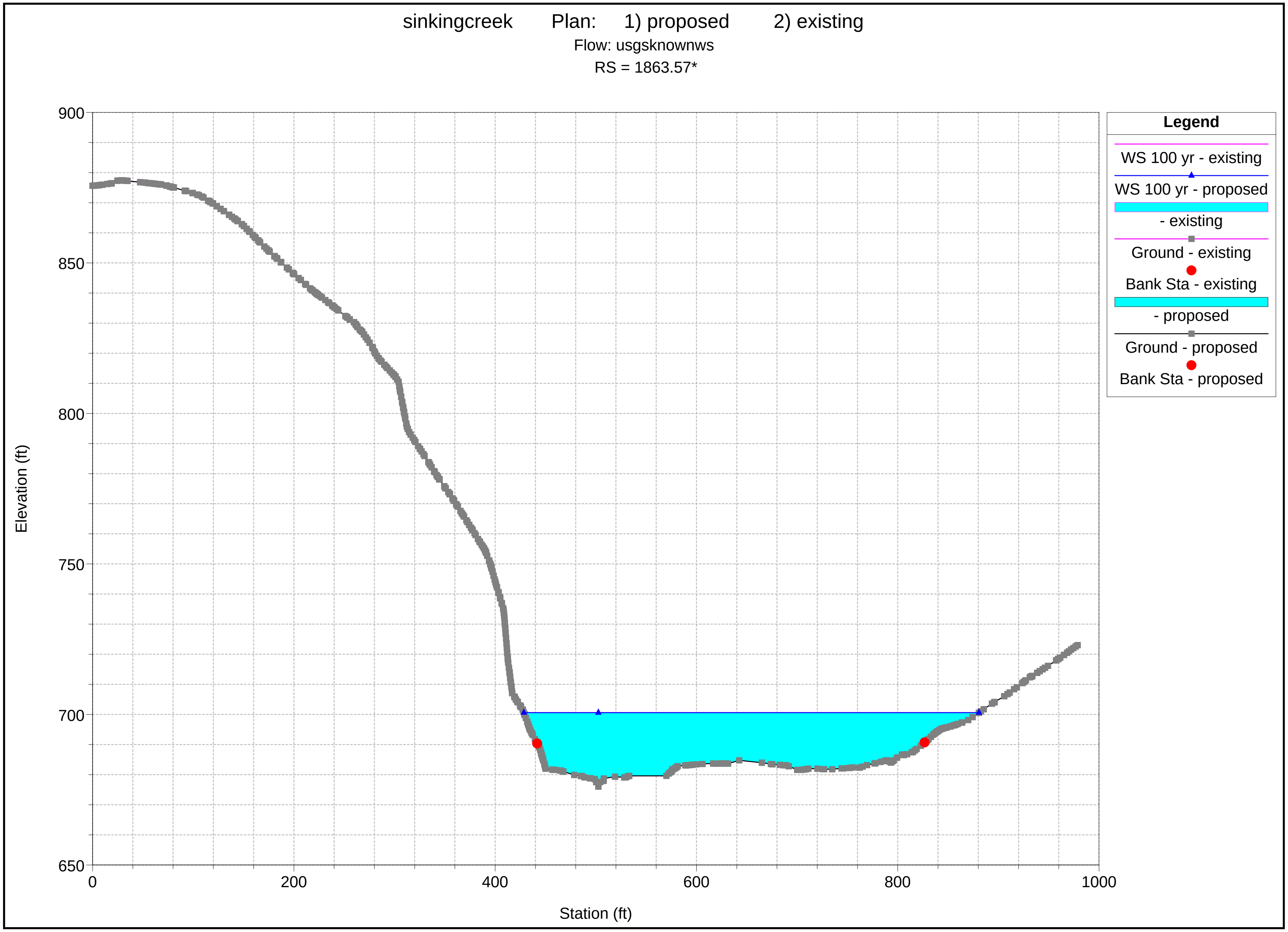

sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 2954.70*
Legend
WS 100 yr - existing
WS 100 yr - proposed
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Bank Sta - proposed
Elevation (ft)
Station (ft)
750
740
730
720
710
700
690
680
670
0
200
400
600
800
1000
1200

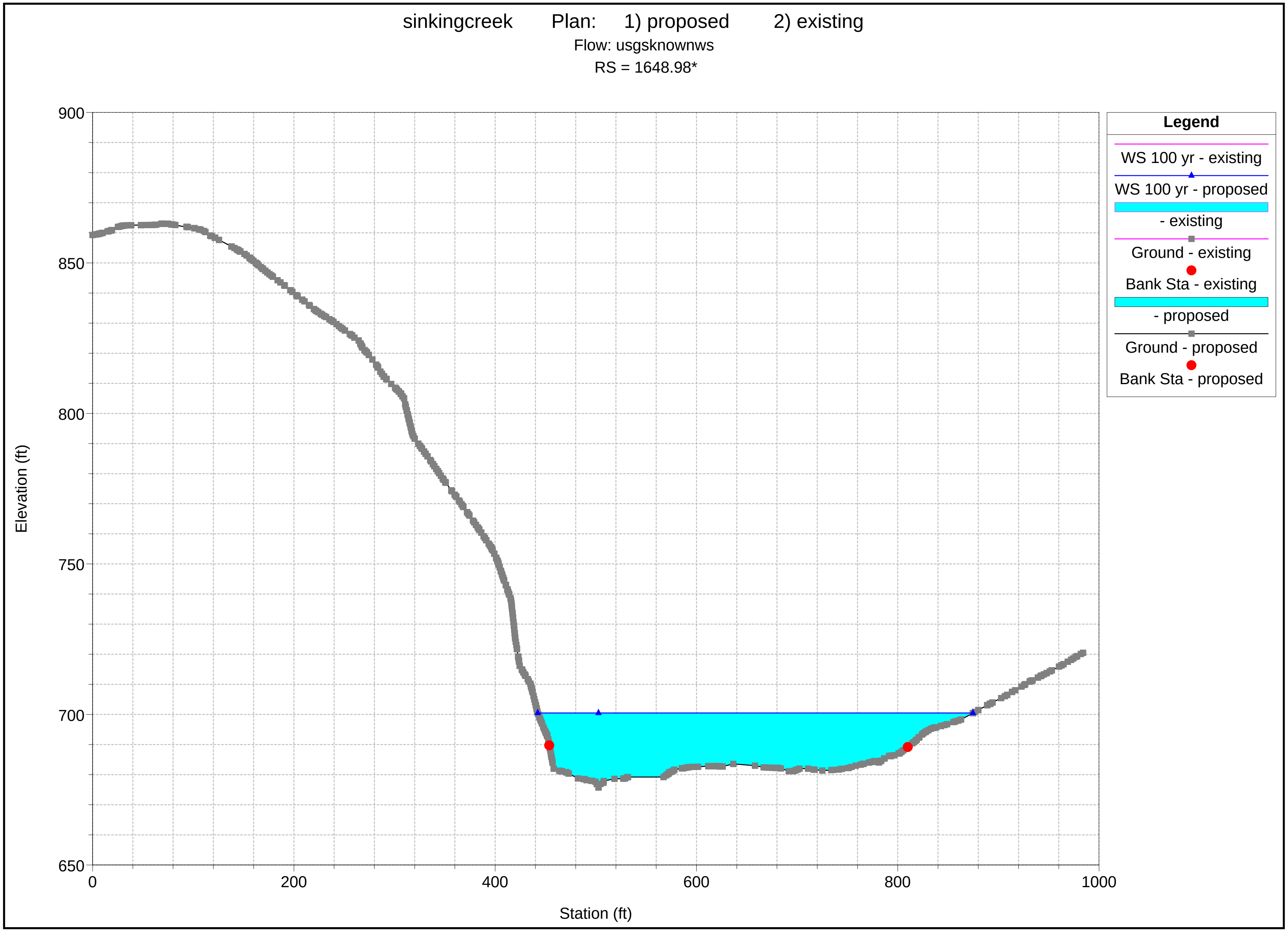

sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 2735.56*
Legend
WS 100 yr - existing
WS 100 yr - proposed
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Bank Sta - proposed
Elevation (ft)
Station (ft)
800
780
760
740
720
700
680
660
0
200
400
600
800
1000
1200


sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 2516.43*
Legend
WS 100 yr - existing
WS 100 yr - proposed
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Bank Sta - proposed
Elevation (ft)
Station (ft)
820
800
780
760
740
720
700
680
660
0
200
400
600
800
1000
1200

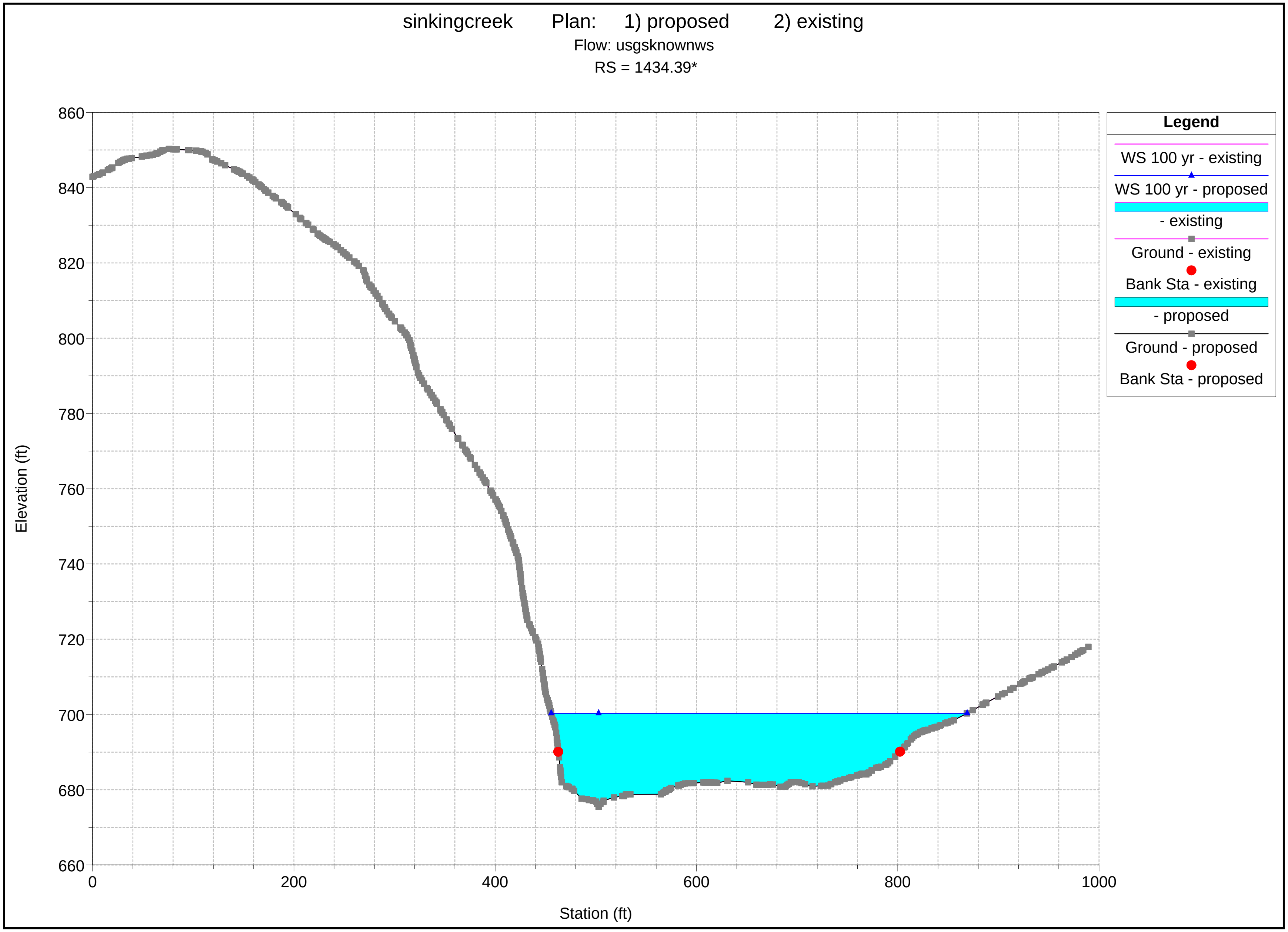

sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 2297.29*
Legend
WS 100 yr - existing
WS 100 yr - proposed
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Bank Sta - proposed
Elevation (ft)
Station (ft)
900
850
800
750
700
650
0
200
400
600
800
1000


sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 2078.16 Thalweg at Sta. 500.00
Legend
WS 100 yr - existing
WS 100 yr - proposed
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Bank Sta - proposed
Elevation (ft)
Station (ft)
900
850
800
750
700
650
0
200
400
600
800
1000

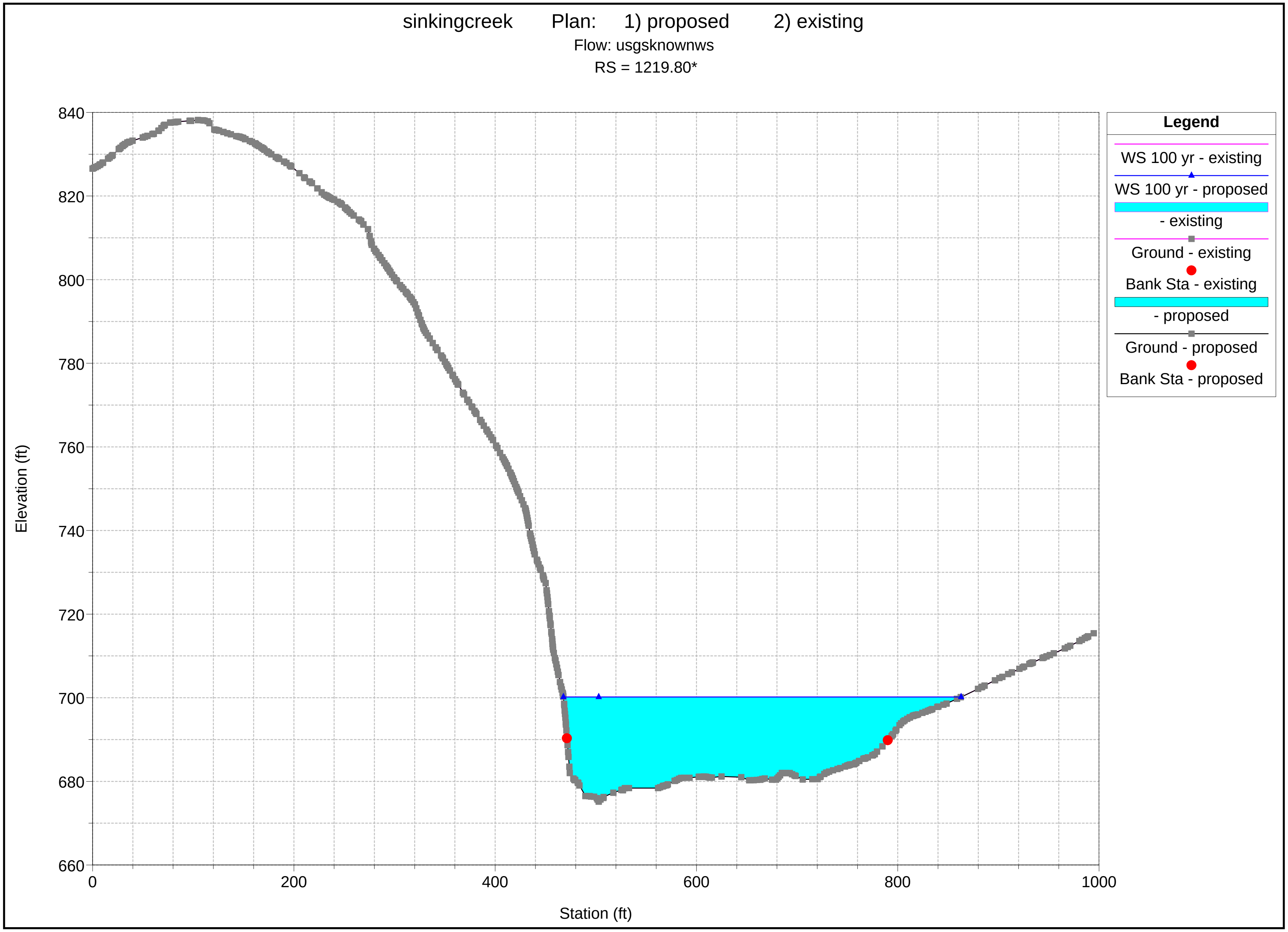

sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 1863.57*
Legend
WS 100 yr - existing
WS 100 yr - proposed
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Bank Sta - proposed
Elevation (ft)
900
850
800
750
700
650
0
200
400
600
800
1000
Station (ft)

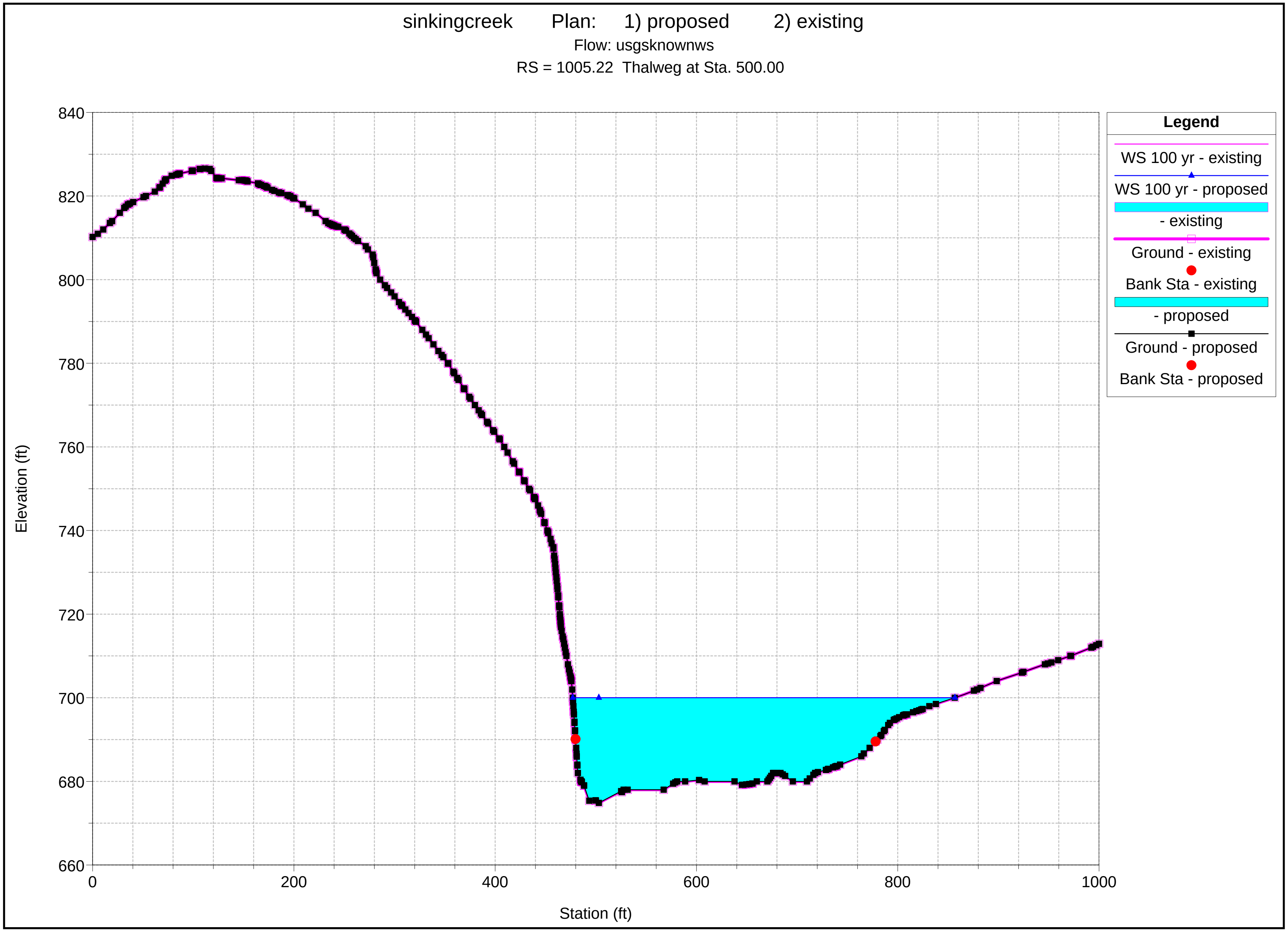


sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 1648.98*
Legend
WS 100 yr - existing
WS 100 yr - proposed
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Bank Sta - proposed
Elevation (ft)
900
850
800
750
700
650
0
200
400
600
800
1000
Station (ft)

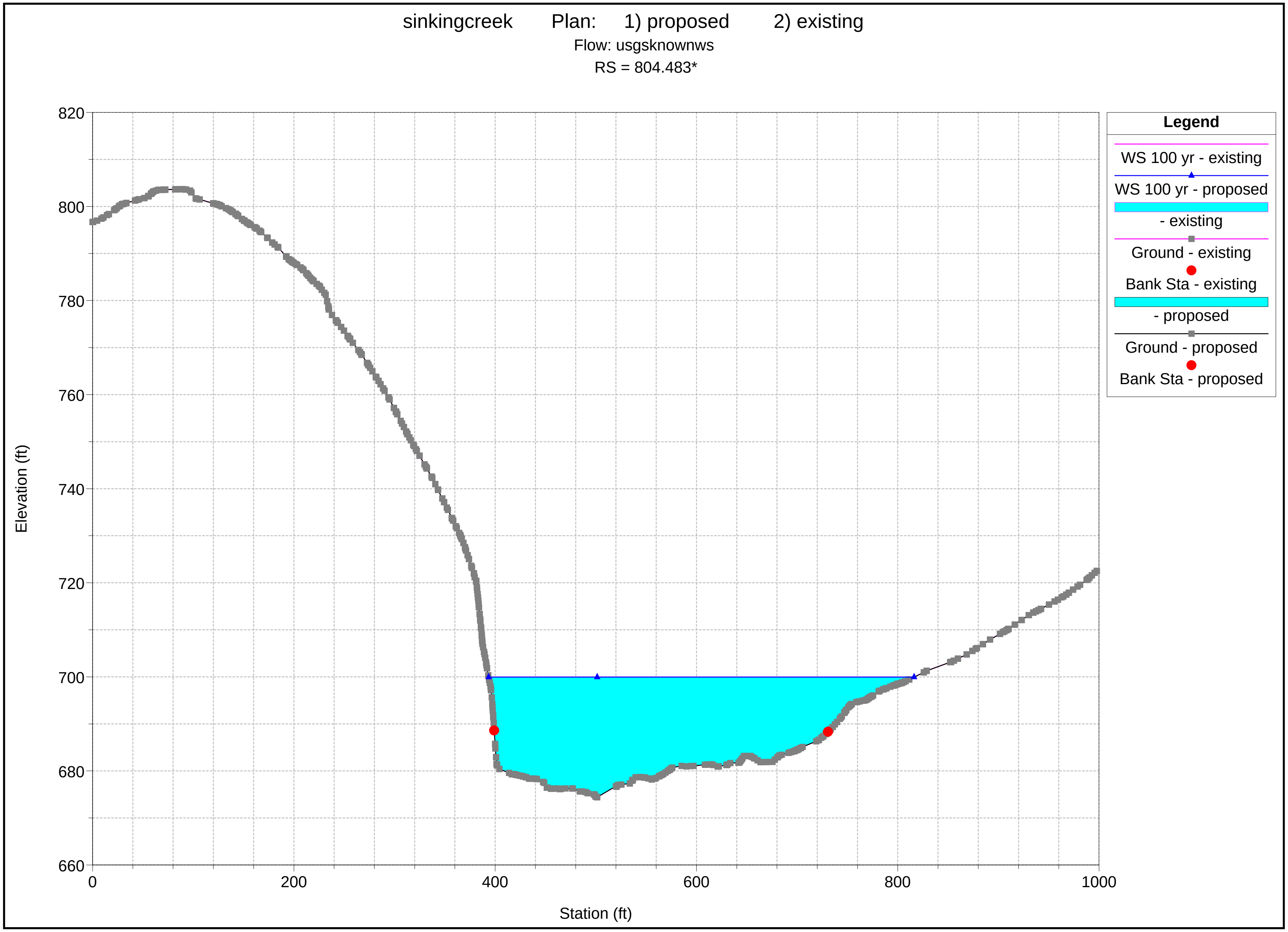


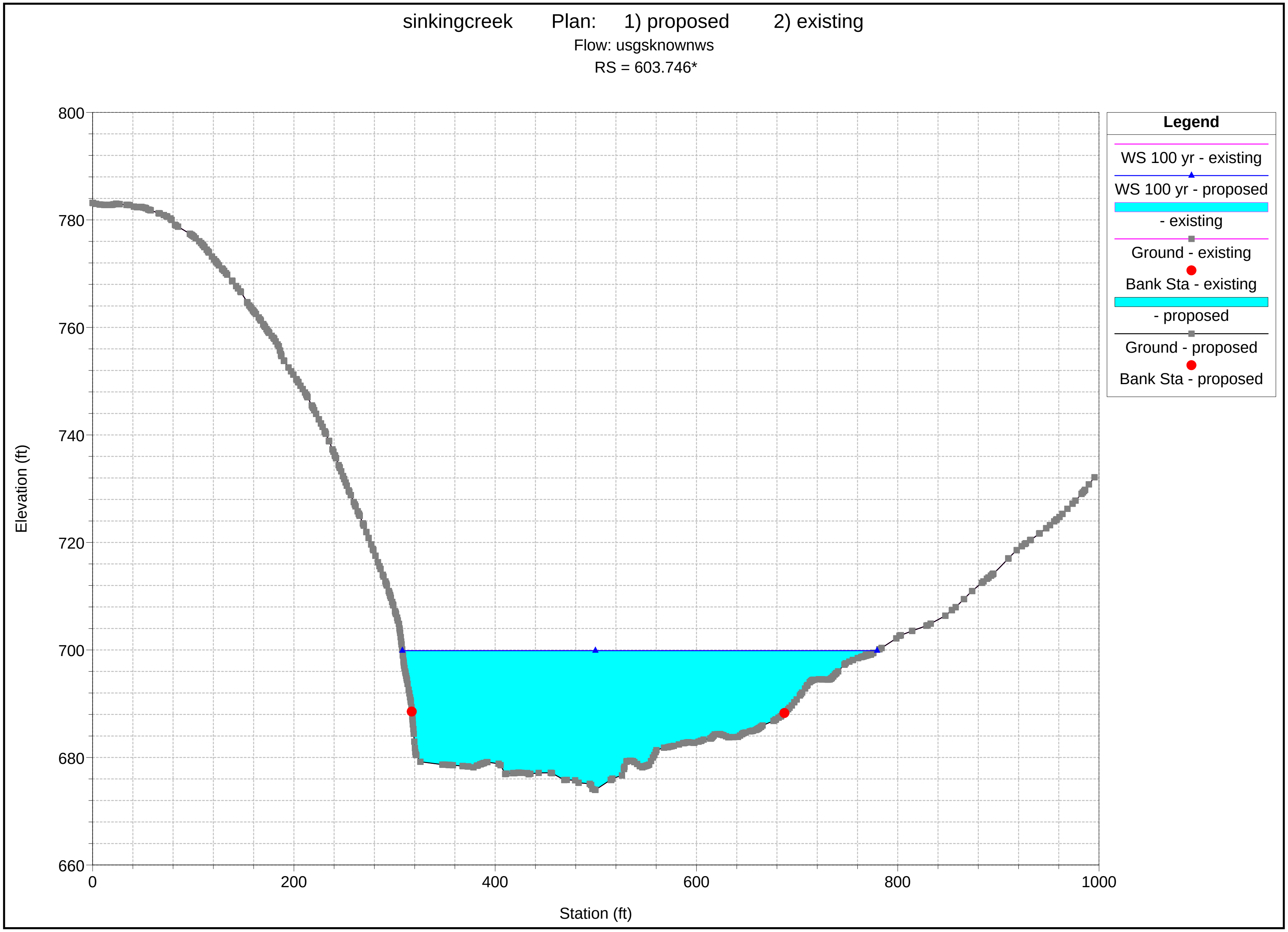
sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 1434.39*
Legend
WS 100 yr - existing
WS 100 yr - proposed
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Bank Sta - proposed
Elevation (ft)
860
840
820
800
780
760
740
720
700
680
660
Station (ft)
0
200
400
600
800
1000


sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 1219.80*
Legend
WS 100 yr - existing
WS 100 yr - proposed
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Bank Sta - proposed
Elevation (ft)
Station (ft)
840
820
800
780
760
740
720
700
680
660
0
200
400
600
800
1000

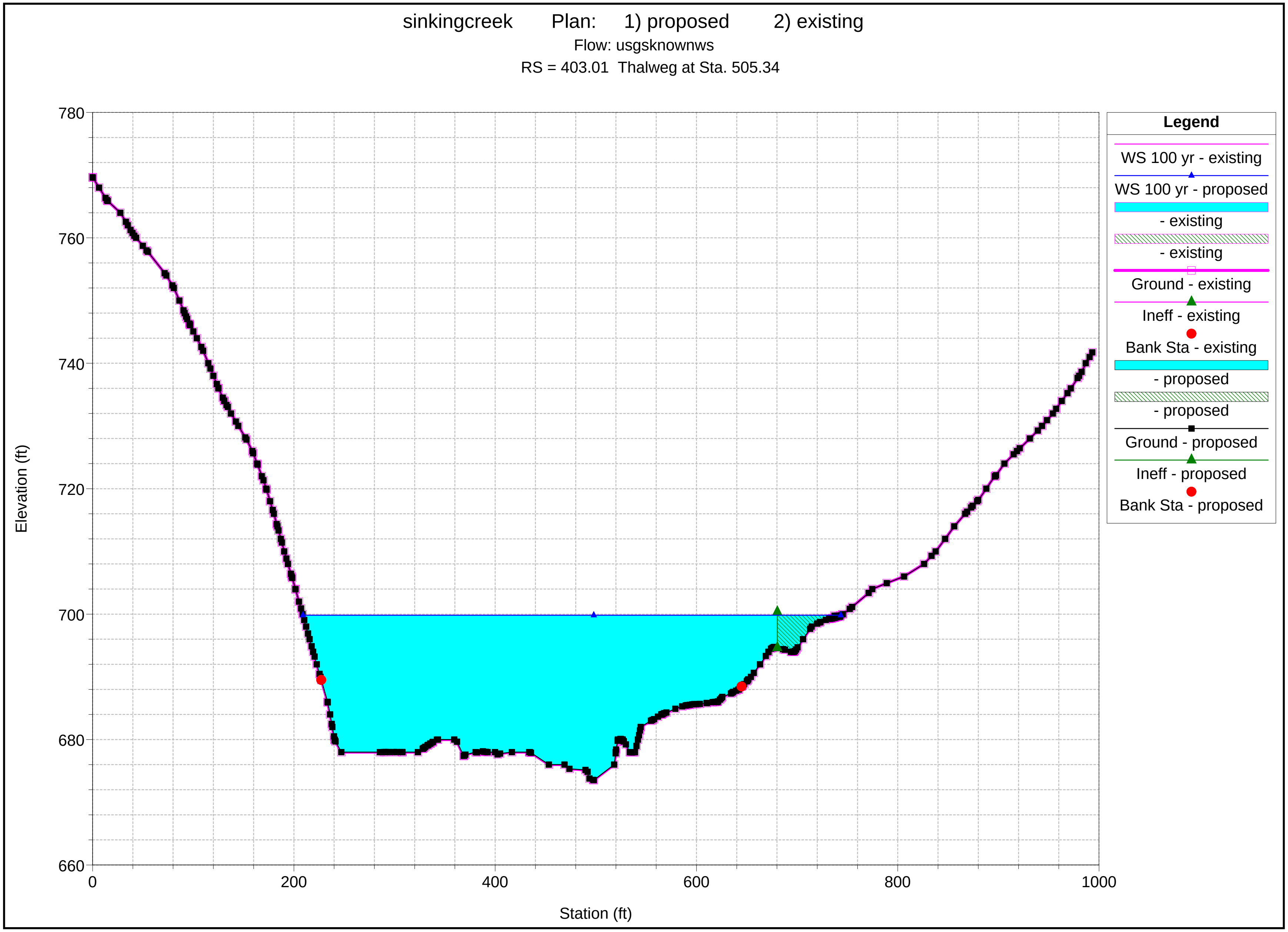


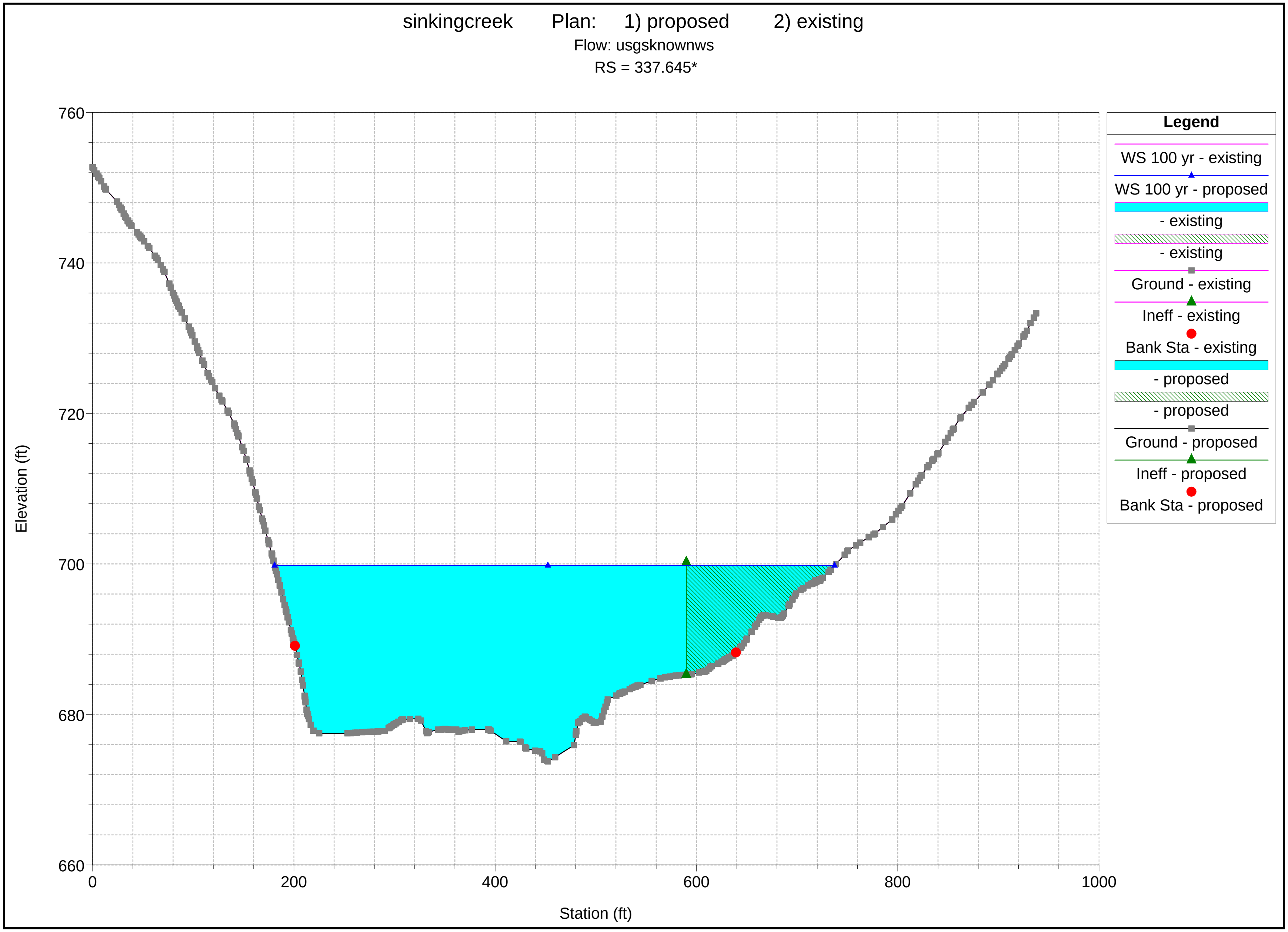
sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 1005.22 Thalweg at Sta. 500.00
Elevation (ft)
Station (ft)
840
820
800
780
760
740
720
700
680
660
0
200
400
600
800
1000
Legend
WS 100 yr - existing
WS 100 yr - proposed
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Bank Sta - proposed

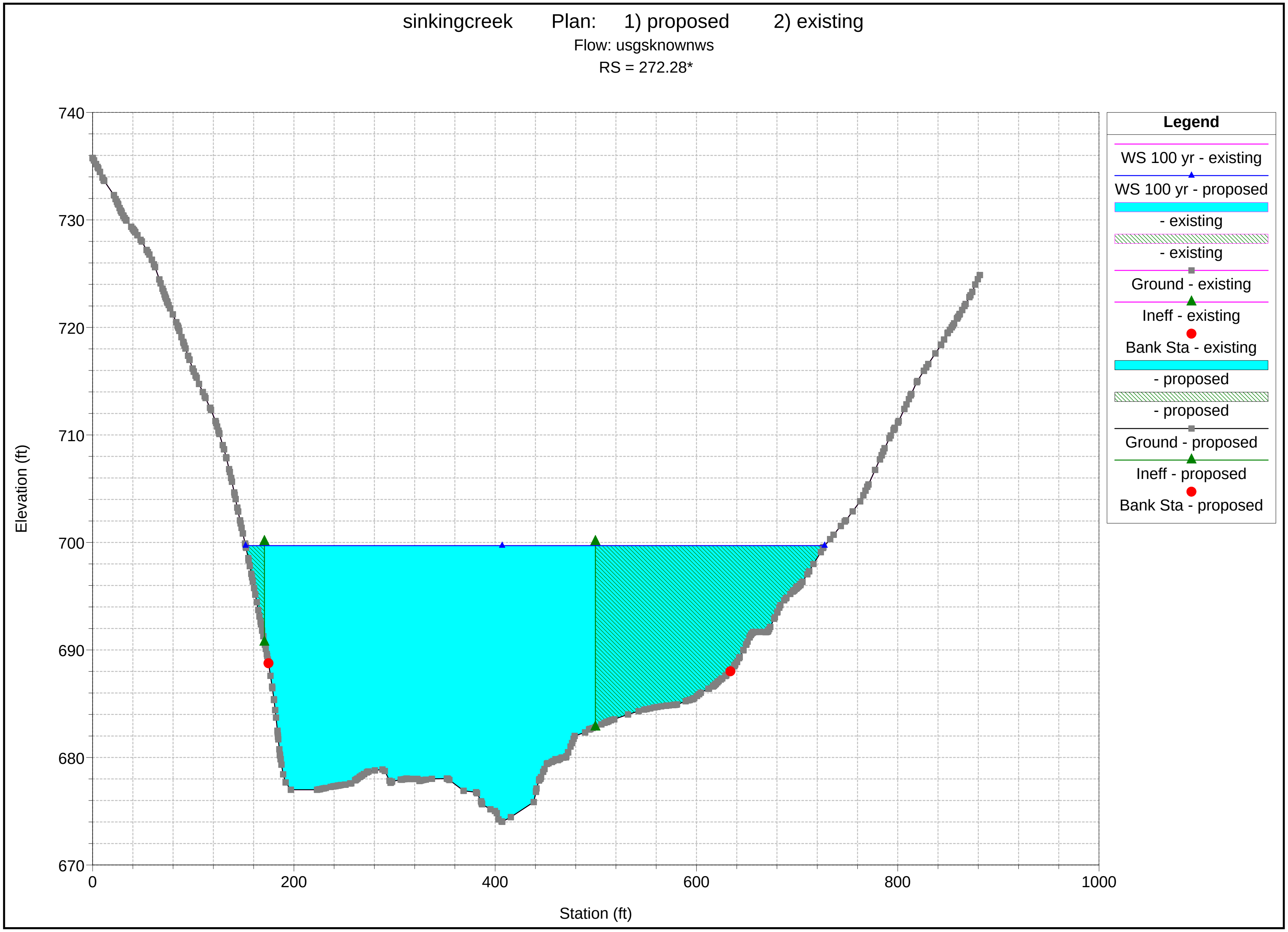

sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 804.483*
Legend
WS 100 yr - existing
WS 100 yr - proposed
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Bank Sta - proposed
Elevation (ft)
Station (ft)
820
800
780
760
740
720
700
680
660
0
200
400
600
800
1000



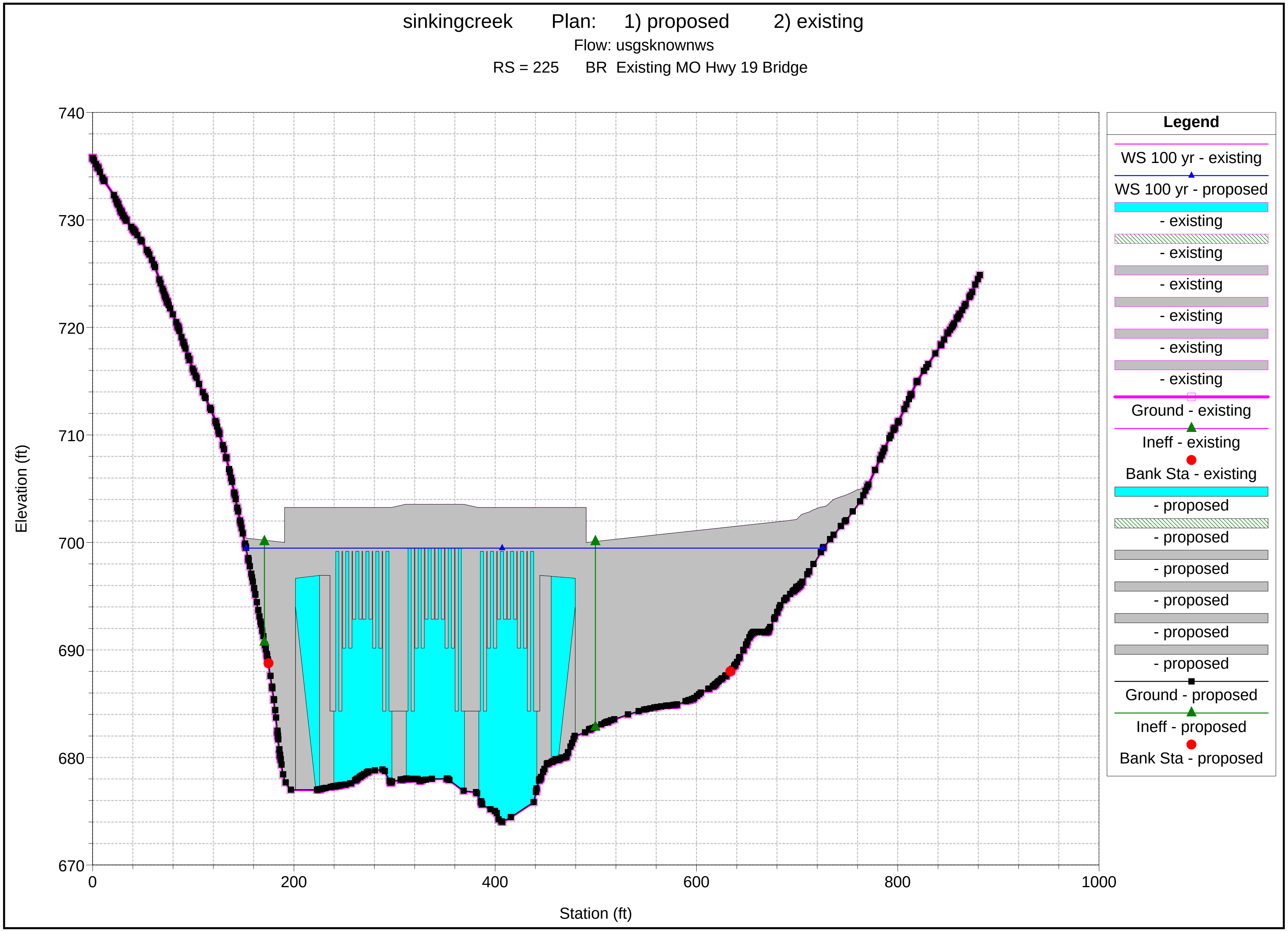
sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 603.746*
Legend
WS 100 yr - existing
WS 100 yr - proposed
- existing
Ground - existing
Bank Sta - existing
- proposed
Ground - proposed
Bank Sta - proposed
Elevation (ft)
Station (ft)
800
780
760
740
720
700
680
660
0
200
400
600
800
1000


sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 403.01 Thalweg at Sta. 505.34
Legend
WS 100 yr - existing
WS 100 yr - proposed
- existing
- existing
Ground - existing
Ineff - existing
Bank Sta - existing
- proposed
- proposed
Ground - proposed
Ineff - proposed
Bank Sta - proposed
Elevation (ft)
Station (ft)
780
760
740
720
700
680
660
0
200
400
600
800
1000

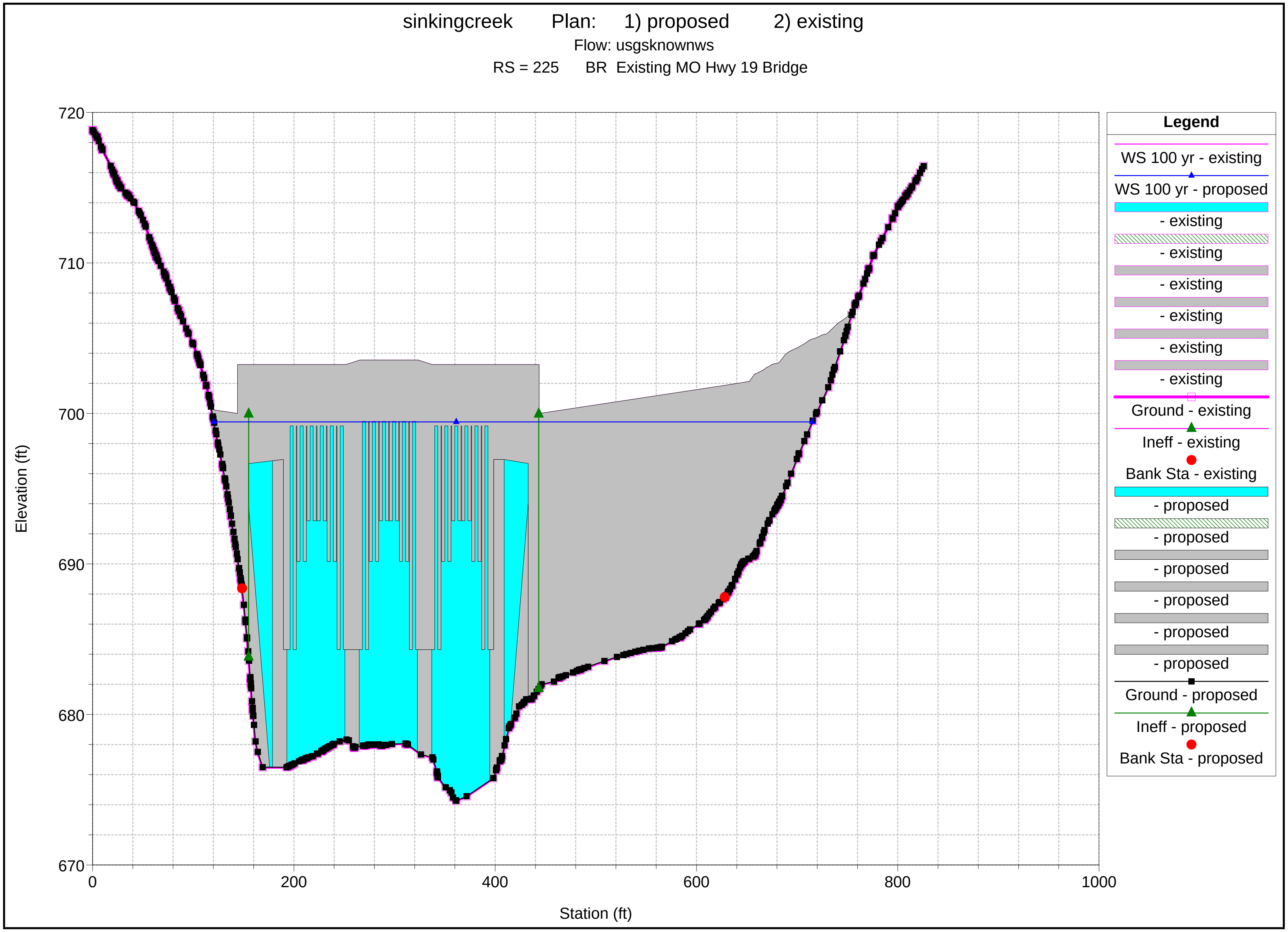

sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 337.645*
Legend
WS 100 yr - existing
WS 100 yr - proposed
- existing
- existing
Ground - existing
Ineff - existing
Bank Sta - existing
- proposed
- proposed
Ground - proposed
Ineff - proposed
Bank Sta - proposed
Elevation (ft)
Station (ft)
760
740
720
700
680
660
0
200
400
600
800
1000

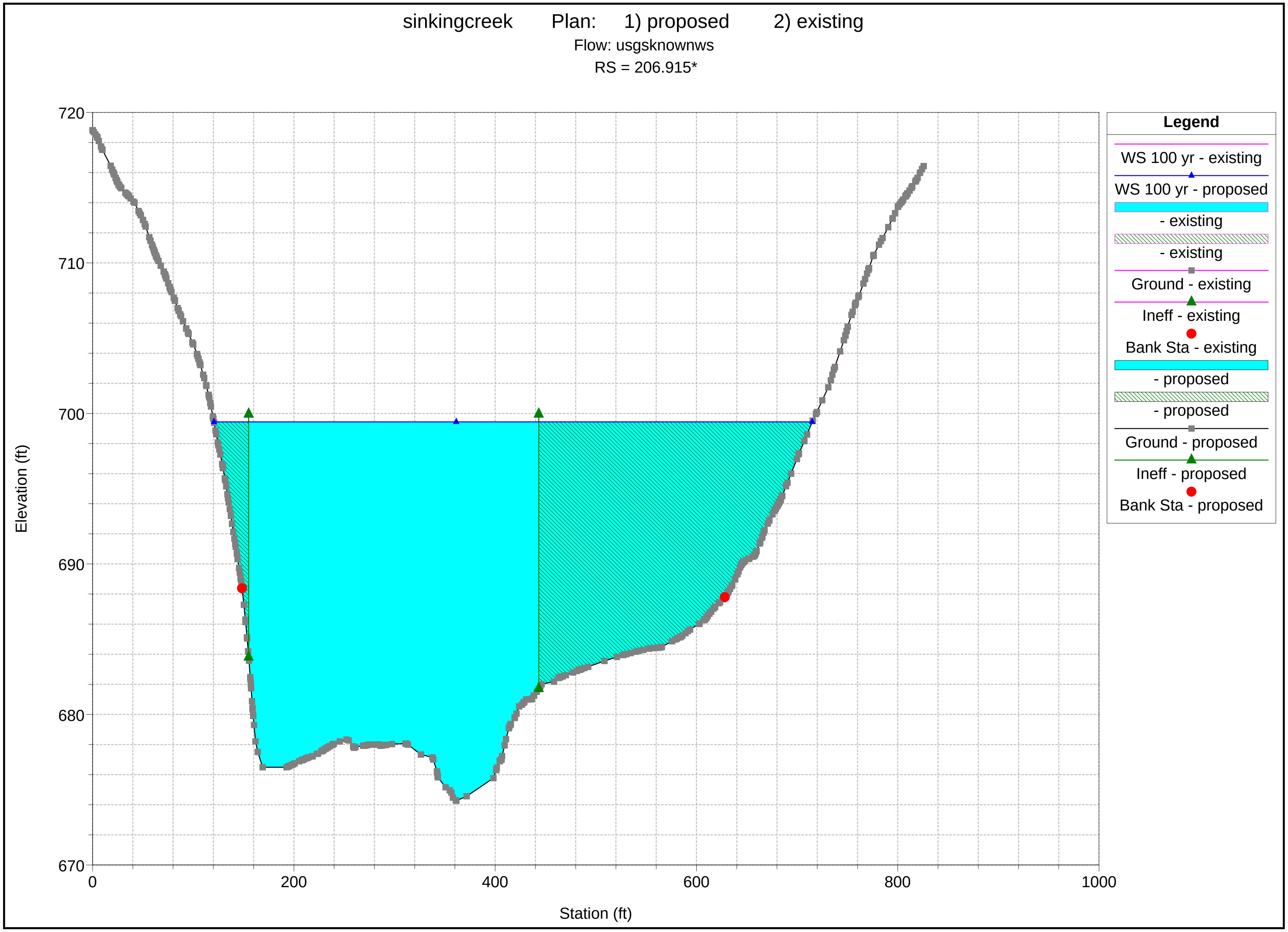


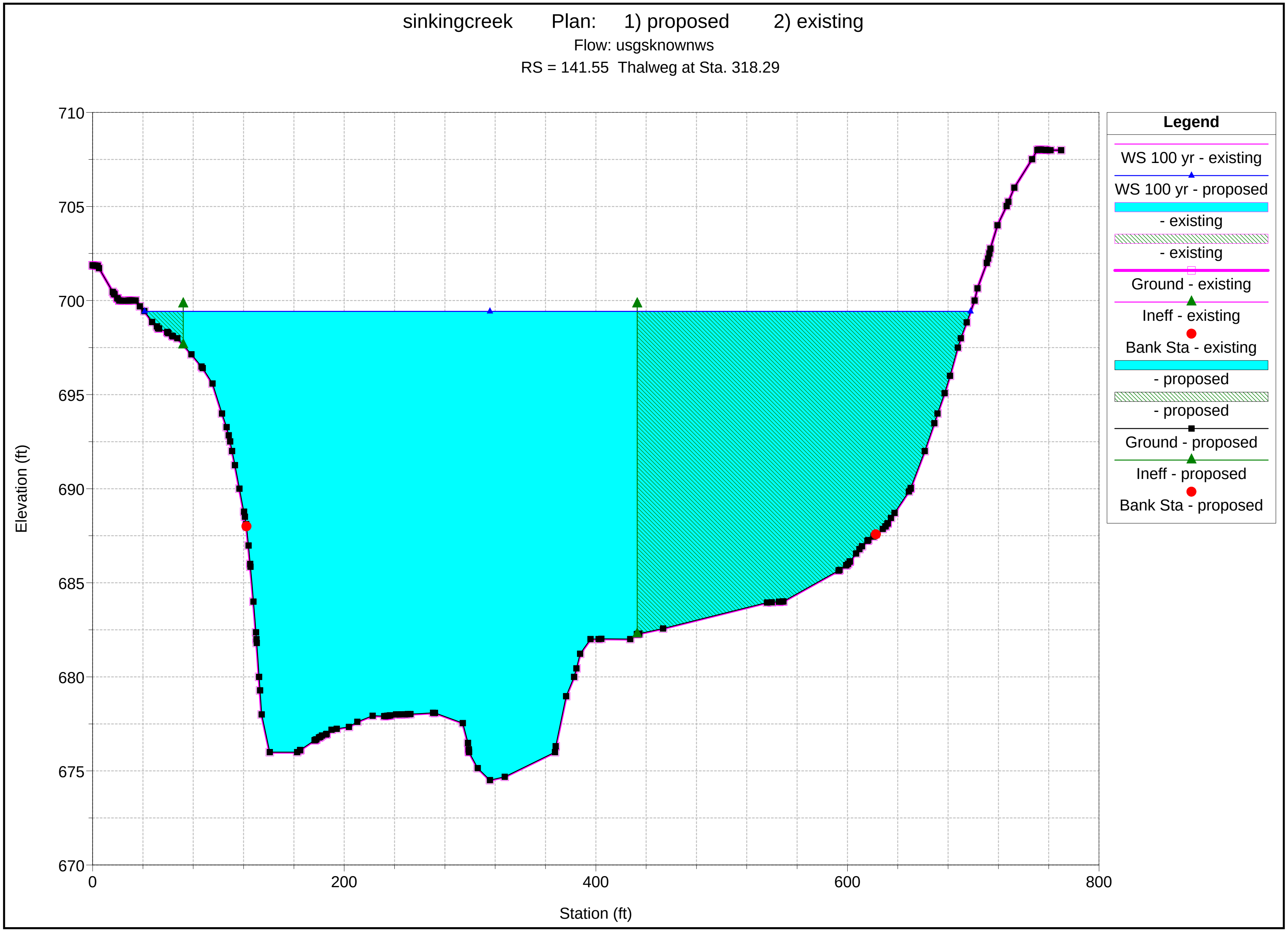
sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 272.28*
Legend
WS 100 yr - existing
WS 100 yr - proposed
- existing
- existing
Ground - existing
Ineff - existing
Bank Sta - existing
- proposed
- proposed
Ground - proposed
Ineff - proposed
Bank Sta - proposed
Elevation (ft)
740
730
720
710
700
690
680
670
Station (ft)
0
200
400
600
800
1000

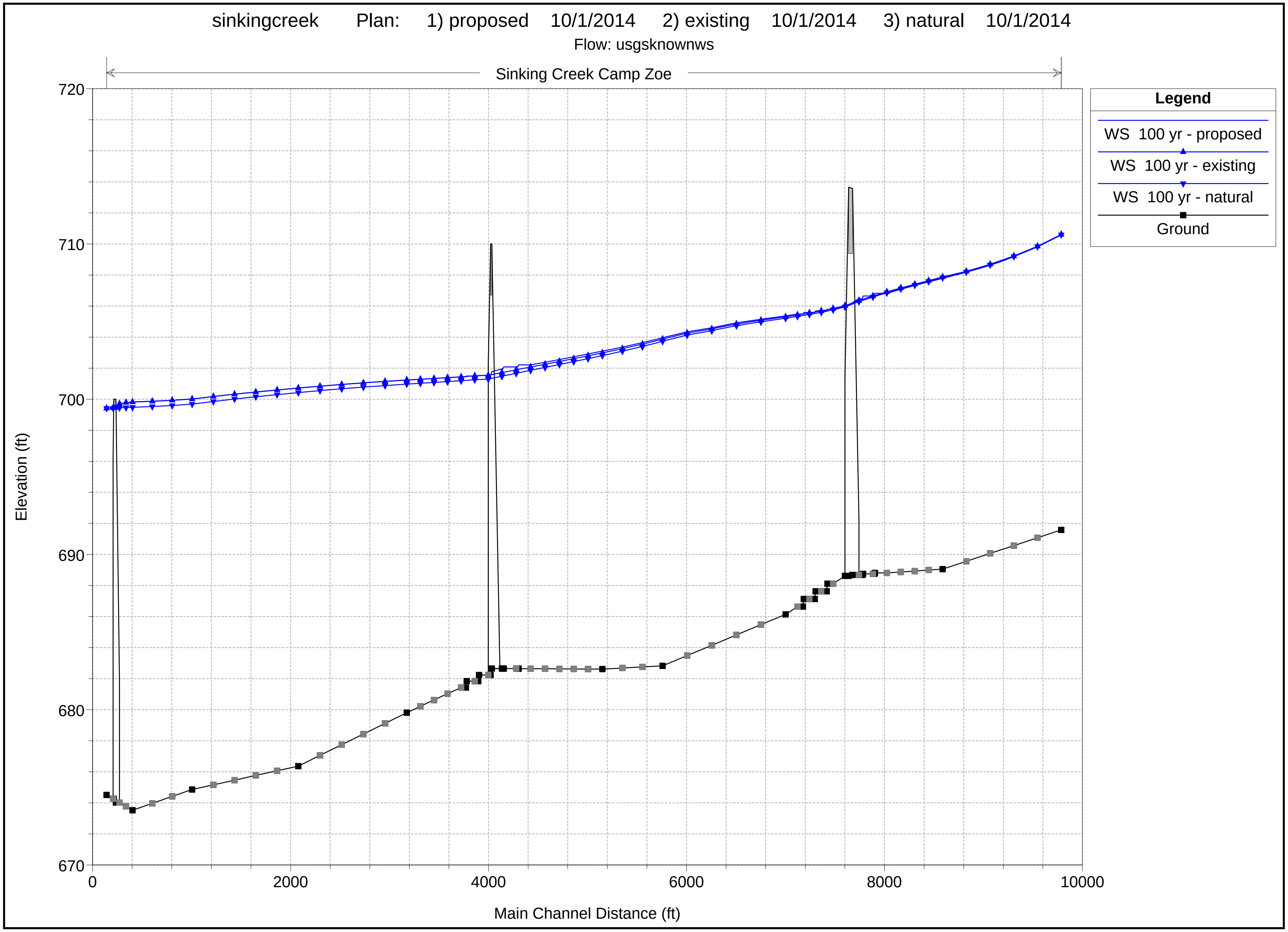


sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 225 BR Existing MO Hwy 19 Bridge
740
730
720
710
700
690
680
670
Elevation (ft)
0
200
400
600
800
1000
Station (ft)
Legend
WS 100 yr - existing
WS 100 yr - proposed
- existing
- existing
- existing
- existing
- existing
- existing
- existing
Ground - existing
Ineff - existing
Bank Sta - existing
- proposed
- proposed
- proposed
- proposed
- proposed
- proposed
- proposed
Ground - proposed
Ineff - proposed
Bank Sta - proposed


sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 225 BR Existing MO Hwy 19 Bridge
Elevation (ft)
720
710
700
690
680
670
0
200
400
600
800
1000
Station (ft)
Legend
WS 100 yr - existing
WS 100 yr - proposed
- existing
- existing
- existing
- existing
- existing
- existing
- existing
Ground - existing
Ineff - existing
Bank Sta - existing
- proposed
- proposed
- proposed
- proposed
- proposed
- proposed
- proposed
Ground - proposed
Ineff - proposed
Bank Sta - proposed


sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 206.915*
Legend
WS 100 yr - existing
WS 100 yr - proposed
- existing
- existing
Ground - existing
Ineff - existing
Bank Sta - existing
- proposed
- proposed
Ground - proposed
Ineff - proposed
Bank Sta - proposed
Elevation (ft)
720
710
700
690
680
670
Station (ft)
0
200
400
600
800
1000


sinkingcreek Plan: 1) proposed 2) existing
Flow: usgsknownws
RS = 141.55 Thalweg at Sta. 318.29
Legend
WS 100 yr - existing
WS 100 yr - proposed
- existing
- existing
Ground - existing
Ineff - existing
Bank Sta - existing
- proposed
- proposed
Ground - proposed
Ineff - proposed
Bank Sta - proposed
Elevation (ft)
Station (ft)
710
705
700
695
690
685
680
675
670
0
200
400
600
800



sinkingcreek Plan: 1) proposed 10/1/2014 2) existing 10/1/2014 3) natural 10/1/2014
Flow: usgsknownws
Sinking Creek Camp Zoe
Legend
WS 100 yr - proposed
WS 100 yr - existing
WS 100 yr - natural
Ground
Elevation (ft)
Main Channel Distance (ft)
720
710
700
690
680
670
0
2000
4000
6000
8000
10000

HEC-RAS River: Sinking Creek Reach: Camp Zoe Profile: 100 yr

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Camp Zoe	9786.15	100 yr	proposed	23918.00	691.58	710.58		711.02	0.002573	6.52	6286.64	545.75	0.30
Camp Zoe	9786.15	100 yr	existing	23918.00	691.58	710.61		711.05	0.002553	6.50	6302.96	545.89	0.30
Camp Zoe	9786.15	100 yr	natural	23918.00	691.58	710.59		711.03	0.002566	6.51	6292.67	545.80	0.30
Camp Zoe	9546.42*	100 yr	proposed	23918.00	691.08	709.81		710.40	0.002865	6.77	5372.90	575.14	0.32
Camp Zoe	9546.42*	100 yr	existing	23918.00	691.08	709.85		710.43	0.002835	6.75	5394.73	575.35	0.32
Camp Zoe	9546.42*	100 yr	natural	23918.00	691.08	709.83		710.41	0.002854	6.76	5380.97	575.21	0.32
Camp Zoe	9306.70*	100 yr	proposed	23918.00	690.57	709.18		709.74	0.002711	6.08	4584.03	599.28	0.30
Camp Zoe	9306.70*	100 yr	existing	23918.00	690.57	709.23		709.78	0.002674	6.06	4611.92	599.96	0.30
Camp Zoe	9306.70*	100 yr	natural	23918.00	690.57	709.20		709.76	0.002697	6.07	4594.35	599.53	0.30
Camp Zoe	9066.98*	100 yr	proposed	23918.00	690.07	708.63		709.12	0.002338	5.60	4515.64	472.55	0.28
Camp Zoe	9066.98*	100 yr	existing	23918.00	690.07	708.69		709.17	0.002303	5.58	4541.67	473.74	0.28
Camp Zoe	9066.98*	100 yr	natural	23918.00	690.07	708.66		709.14	0.002325	5.59	4525.28	473.04	0.28
Camp Zoe	8827.26*	100 yr	proposed	23918.00	689.56	708.17		708.58	0.002001	5.14	4868.68	472.28	0.26
Camp Zoe	8827.26*	100 yr	existing	23918.00	689.56	708.24		708.64	0.001966	5.11	4898.66	473.27	0.26
Camp Zoe	8827.26*	100 yr	natural	23918.00	689.56	708.20		708.60	0.001988	5.12	4879.78	472.64	0.26
Camp Zoe	8587.54	100 yr	proposed	23918.00	689.06	707.80		708.12	0.001649	4.54	5616.53	566.08	0.23
Camp Zoe	8587.54	100 yr	existing	23918.00	689.06	707.87		708.18	0.001615	4.51	5657.06	567.05	0.23
Camp Zoe	8587.54	100 yr	natural	23918.00	689.06	707.83		708.14	0.001636	4.53	5631.57	566.42	0.23
Camp Zoe	8446.66*	100 yr	proposed	23918.00	689.00	707.56		707.88	0.001637	4.60	5463.54	530.16	0.23
Camp Zoe	8446.66*	100 yr	existing	23918.00	689.00	707.64		707.96	0.001600	4.56	5505.10	531.94	0.23
Camp Zoe	8446.66*	100 yr	natural	23918.00	689.00	707.59		707.91	0.001622	4.58	5479.50	530.80	0.23
Camp Zoe	8305.78*	100 yr	proposed	23918.00	688.93	707.32		707.65	0.001637	4.65	5339.29	494.07	0.24
Camp Zoe	8305.78*	100 yr	existing	23918.00	688.93	707.40		707.73	0.001600	4.61	5379.71	495.53	0.23
Camp Zoe	8305.78*	100 yr	natural	23918.00	688.93	707.35		707.68	0.001623	4.63	5354.47	494.67	0.23
Camp Zoe	8164.91*	100 yr	proposed	23918.00	688.87	707.07		707.42	0.001664	4.72	5222.59	468.16	0.24
Camp Zoe	8164.91*	100 yr	existing	23918.00	688.87	707.16		707.50	0.001625	4.69	5263.80	469.66	0.24
Camp Zoe	8164.91*	100 yr	natural	23918.00	688.87	707.11		707.45	0.001649	4.71	5238.04	468.72	0.24
Camp Zoe	8024.03*	100 yr	proposed	23918.00	688.81	706.82	699.16	707.18	0.001725	4.83	5092.82	449.22	0.24
Camp Zoe	8024.03*	100 yr	existing	23918.00	688.81	706.91		707.27	0.001681	4.79	5135.40	450.37	0.24
Camp Zoe	8024.03*	100 yr	natural	23918.00	688.81	706.85		707.21	0.001708	4.82	5108.81	449.65	0.24
Camp Zoe	7900			Inl Struct									
Camp Zoe	7883.16*	100 yr	proposed	23918.00	688.75	706.65	699.01	707.03	0.001777	4.93	4982.85	435.77	0.25
Camp Zoe	7883.16*	100 yr	existing	23918.00	688.75	706.65		707.02	0.001779	4.93	4981.31	435.74	0.25
Camp Zoe	7883.16*	100 yr	natural	23918.00	688.75	706.58		706.96	0.001810	4.96	4953.71	434.91	0.25
Camp Zoe	7780			Inl Struct									
Camp Zoe	7742.28*	100 yr	proposed	23918.00	688.68	706.47	698.92	706.87	0.001872	5.07	4846.17	424.91	0.25
Camp Zoe	7742.28*	100 yr	existing	23918.00	688.68	706.35		706.76	0.001934	5.12	4795.62	422.54	0.26
Camp Zoe	7742.28*	100 yr	natural	23918.00	688.68	706.28		706.69	0.001970	5.14	4766.49	421.48	0.26
Camp Zoe	7658			Bridge									
Camp Zoe	7601.41	100 yr	proposed	23918.00	688.62	705.99	698.89	706.44	0.002189	5.37	4561.45	410.86	0.27
Camp Zoe	7601.41	100 yr	existing	23918.00	688.62	706.02		706.47	0.002173	5.36	4572.51	411.62	0.27
Camp Zoe	7601.41	100 yr	natural	23918.00	688.62	705.95		706.40	0.002219	5.39	4541.21	409.79	0.27
Camp Zoe	7481.37*	100 yr	proposed	23918.00	688.12	705.79	698.15	706.17	0.001771	4.93	4889.05	430.90	0.25
Camp Zoe	7481.37*	100 yr	existing	23918.00	688.12	705.84		706.21	0.001734	4.88	5013.08	431.27	0.24
Camp Zoe	7481.37*	100 yr	natural	23918.00	688.12	705.76		706.14	0.001772	4.92	4978.40	430.63	0.25
Camp Zoe	7420			Inl Struct									
Camp Zoe	7361.34*	100 yr	proposed	23918.00	687.63	705.69	697.61	706.00	0.001457	4.52	5411.68	457.57	0.22
Camp Zoe	7361.34*	100 yr	existing	23918.00	687.63	705.69		706.01	0.001457	4.52	5412.21	457.56	0.22
Camp Zoe	7361.34*	100 yr	natural	23918.00	687.63	705.60		705.93	0.001490	4.55	5373.64	457.00	0.23
Camp Zoe	7300			Inl Struct									
Camp Zoe	7241.31*	100 yr	proposed	23918.00	687.13	705.58	697.25	705.86	0.001267	4.24	5780.91	484.93	0.21
Camp Zoe	7241.31*	100 yr	existing	23918.00	687.13	705.55		705.83	0.001277	4.25	5766.16	484.71	0.21
Camp Zoe	7241.31*	100 yr	natural	23918.00	687.13	705.46		705.75	0.001307	4.28	5723.74	484.09	0.21
Camp Zoe	7180			Inl Struct									
Camp Zoe	7121.28*	100 yr	proposed	23918.00	686.64	705.49		705.74	0.001141	4.02	6105.28	512.56	0.20
Camp Zoe	7121.28*	100 yr	existing	23918.00	686.64	705.43		705.68	0.001160	4.03	6073.91	512.18	0.20
Camp Zoe	7121.28*	100 yr	natural	23918.00	686.64	705.33		705.59	0.001188	4.06	6027.18	511.62	0.20
Camp Zoe	7001.25	100 yr	proposed	23918.00	686.14	705.37		705.60	0.001070	3.85	6410.16	587.15	0.19
Camp Zoe	7001.25	100 yr	existing	23918.00	686.14	705.30		705.54	0.001089	3.87	6372.97	585.72	0.19
Camp Zoe	7001.25	100 yr	natural	23918.00	686.14	705.21		705.44	0.001117	3.90	6317.63	583.60	0.20
Camp Zoe	6752.56*	100 yr	proposed	23918.00	685.48	705.15		705.34	0.000891	3.52	7065.47	643.10	0.17

HEC-RAS River: Sinking Creek Reach: Camp Zoe Profile: 100 yr (Continued)

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Camp Zoe	6752.56*	100 yr	existing	23918.00	685.48	705.08		705.28	0.000908	3.54	7022.00	642.57	0.18
Camp Zoe	6752.56*	100 yr	natural	23918.00	685.48	704.98		705.18	0.000933	3.57	6957.10	641.76	0.18
Camp Zoe	6503.88*	100 yr	proposed	23918.00	684.82	704.92		705.12	0.000866	3.66	6810.04	588.03	0.17
Camp Zoe	6503.88*	100 yr	existing	23918.00	684.82	704.85		705.05	0.000882	3.68	6788.99	607.94	0.18
Camp Zoe	6503.88*	100 yr	natural	23918.00	684.82	704.74		704.95	0.000906	3.71	6723.62	607.01	0.18
Camp Zoe	6255.20*	100 yr	proposed	23918.00	684.15	704.60		704.88	0.001092	4.23	5953.75	506.37	0.20
Camp Zoe	6255.20*	100 yr	existing	23918.00	684.15	704.53		704.80	0.001111	4.25	5977.54	545.15	0.20
Camp Zoe	6255.20*	100 yr	natural	23918.00	684.15	704.41		704.69	0.001143	4.29	5914.52	541.06	0.20
Camp Zoe	6006.52*	100 yr	proposed	23918.00	683.49	704.34		704.61	0.001038	4.19	6058.66	511.67	0.19
Camp Zoe	6006.52*	100 yr	existing	23918.00	683.49	704.26		704.53	0.001057	4.21	6031.65	526.13	0.19
Camp Zoe	6006.52*	100 yr	natural	23918.00	683.49	704.14		704.41	0.001088	4.24	5966.97	518.40	0.20
Camp Zoe	5757.84	100 yr	proposed	23918.00	682.83	703.96		704.30	0.001445	4.85	6042.38	600.71	0.23
Camp Zoe	5757.84	100 yr	existing	23918.00	682.83	703.87		704.22	0.001479	4.88	5988.12	599.17	0.23
Camp Zoe	5757.84	100 yr	natural	23918.00	682.83	703.73		704.09	0.001532	4.94	5905.74	596.75	0.23
Camp Zoe	5555.31*	100 yr	proposed	23918.00	682.76	703.64		704.01	0.001444	4.92	5187.32	438.91	0.23
Camp Zoe	5555.31*	100 yr	existing	23918.00	682.76	703.54		703.92	0.001478	4.96	5144.70	437.08	0.23
Camp Zoe	5555.31*	100 yr	natural	23918.00	682.76	703.39		703.78	0.001531	5.01	5079.97	434.32	0.23
Camp Zoe	5352.78*	100 yr	proposed	23918.00	682.69	703.36		703.72	0.001361	4.82	5219.46	421.71	0.22
Camp Zoe	5352.78*	100 yr	existing	23918.00	682.69	703.26		703.62	0.001394	4.86	5175.59	421.00	0.22
Camp Zoe	5352.78*	100 yr	natural	23918.00	682.69	703.10		703.47	0.001448	4.91	5108.53	419.92	0.23
Camp Zoe	5150.26	100 yr	proposed	23918.00	682.62	703.10		703.44	0.001334	4.74	5232.34	416.16	0.22
Camp Zoe	5150.26	100 yr	existing	23918.00	682.62	702.99		703.34	0.001369	4.77	5186.10	415.60	0.22
Camp Zoe	5150.26	100 yr	natural	23918.00	682.62	702.81		703.18	0.001425	4.83	5115.19	414.74	0.22
Camp Zoe	5005.25*	100 yr	proposed	23918.00	682.62	702.91		703.25	0.001288	4.69	5284.62	412.28	0.21
Camp Zoe	5005.25*	100 yr	existing	23918.00	682.62	702.80		703.14	0.001323	4.73	5236.72	411.67	0.22
Camp Zoe	5005.25*	100 yr	natural	23918.00	682.62	702.62		702.97	0.001380	4.79	5163.08	410.73	0.22
Camp Zoe	4860.25*	100 yr	proposed	23918.00	682.63	702.73		703.07	0.001252	4.65	5328.94	408.25	0.21
Camp Zoe	4860.25*	100 yr	existing	23918.00	682.63	702.61		702.95	0.001288	4.69	5279.39	407.61	0.21
Camp Zoe	4860.25*	100 yr	natural	23918.00	682.63	702.42		702.77	0.001345	4.75	5203.05	406.74	0.22
Camp Zoe	4715.25*	100 yr	proposed	23918.00	682.63	702.56		702.88	0.001224	4.62	5365.95	405.15	0.21
Camp Zoe	4715.25*	100 yr	existing	23918.00	682.63	702.43		702.76	0.001260	4.66	5314.70	404.58	0.21
Camp Zoe	4715.25*	100 yr	natural	23918.00	682.63	702.23		702.58	0.001318	4.73	5235.46	403.76	0.22
Camp Zoe	4570.24*	100 yr	proposed	23918.00	682.64	702.38		702.71	0.001205	4.60	5392.70	402.85	0.21
Camp Zoe	4570.24*	100 yr	existing	23918.00	682.64	702.25		702.58	0.001242	4.64	5339.59	402.39	0.21
Camp Zoe	4570.24*	100 yr	natural	23918.00	682.64	702.04		702.39	0.001301	4.71	5257.30	401.63	0.22
Camp Zoe	4425.24*	100 yr	proposed	23918.00	682.64	702.21	692.29	702.53	0.001195	4.59	5408.95	400.96	0.21
Camp Zoe	4425.24*	100 yr	existing	23918.00	682.64	702.07		702.40	0.001232	4.63	5353.90	400.47	0.21
Camp Zoe	4425.24*	100 yr	natural	23918.00	682.64	701.86		702.20	0.001294	4.70	5268.36	399.70	0.22
Camp Zoe	4300			Inl Struct									
Camp Zoe	4280.24*	100 yr	proposed	23918.00	682.65	702.08	692.11	702.40	0.001181	4.57	5431.62	399.32	0.21
Camp Zoe	4280.24*	100 yr	existing	23918.00	682.65	701.89		702.22	0.001232	4.63	5356.45	398.64	0.21
Camp Zoe	4280.24*	100 yr	natural	23918.00	682.65	701.67		702.01	0.001297	4.71	5267.53	397.83	0.22
Camp Zoe	4150			Inl Struct									
Camp Zoe	4135.24	100 yr	proposed	23918.00	682.65	701.95	691.99	702.27	0.001177	4.57	5442.33	397.82	0.21
Camp Zoe	4135.24	100 yr	existing	23918.00	682.65	701.71		702.05	0.001243	4.64	5347.03	396.68	0.21
Camp Zoe	4135.24	100 yr	natural	23918.00	682.65	701.48		701.82	0.001311	4.72	5254.57	395.36	0.22
Camp Zoe	4027			Bridge									
Camp Zoe	3997.89*	100 yr	proposed	23918.00	682.24	701.52	691.55	701.86	0.001221	4.66	5291.61	384.60	0.21
Camp Zoe	3997.89*	100 yr	existing	23918.00	682.24	701.54		701.88	0.001216	4.66	5302.90	384.72	0.21
Camp Zoe	3997.89*	100 yr	natural	23918.00	682.24	701.30		701.64	0.001284	4.73	5209.59	383.08	0.22
Camp Zoe	3900			Inl Struct									
Camp Zoe	3860.55*	100 yr	proposed	23918.00	681.84	701.50	690.30	701.70	0.000716	3.66	6697.60	458.93	0.16
Camp Zoe	3860.55*	100 yr	existing	23918.00	681.84	701.50		701.71	0.000715	3.66	6701.22	458.96	0.16
Camp Zoe	3860.55*	100 yr	natural	23918.00	681.84	701.26		701.47	0.000754	3.72	6588.04	457.84	0.17
Camp Zoe	3775			Inl Struct									
Camp Zoe	3723.21*	100 yr	proposed	23918.00	681.43	701.44		701.61	0.000585	3.34	7326.89	491.07	0.15
Camp Zoe	3723.21*	100 yr	existing	23918.00	681.43	701.44		701.61	0.000585	3.34	7326.89	491.07	0.15
Camp Zoe	3723.21*	100 yr	natural	23918.00	681.43	701.19		701.37	0.000617	3.39	7203.79	489.91	0.15
Camp Zoe	3585.86*	100 yr	proposed	23918.00	681.03	701.38		701.53	0.000497	3.09	7913.83	525.78	0.14
Camp Zoe	3585.86*	100 yr	existing	23918.00	681.03	701.38		701.53	0.000497	3.09	7913.83	525.78	0.14
Camp Zoe	3585.86*	100 yr	natural	23918.00	681.03	701.13		701.28	0.000525	3.14	7780.14	524.79	0.14

HEC-RAS River: Sinking Creek Reach: Camp Zoe Profile: 100 yr (Continued)

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Camp Zoe	3448.52*	100 yr	proposed	23918.00	680.62	701.33		701.46	0.000436	2.88	8460.97	559.44	0.13
Camp Zoe	3448.52*	100 yr	existing	23918.00	680.62	701.33		701.46	0.000436	2.88	8460.97	559.44	0.13
Camp Zoe	3448.52*	100 yr	natural	23918.00	680.62	701.08		701.21	0.000460	2.93	8316.95	558.36	0.13
Camp Zoe	3311.18*	100 yr	proposed	23918.00	680.22	701.29		701.40	0.000392	2.72	8971.53	597.22	0.12
Camp Zoe	3311.18*	100 yr	existing	23918.00	680.22	701.29		701.40	0.000392	2.72	8971.53	597.22	0.12
Camp Zoe	3311.18*	100 yr	natural	23918.00	680.22	701.03		701.14	0.000414	2.76	8816.06	596.11	0.12
Camp Zoe	3173.84	100 yr	proposed	23918.00	679.81	701.24		701.35	0.000359	2.58	9463.66	636.54	0.11
Camp Zoe	3173.84	100 yr	existing	23918.00	679.81	701.24		701.35	0.000359	2.58	9463.66	636.54	0.11
Camp Zoe	3173.84	100 yr	natural	23918.00	679.81	700.98		701.09	0.000380	2.63	9296.18	635.57	0.12
Camp Zoe	2954.70*	100 yr	proposed	23918.00	679.12	701.15		701.26	0.000387	2.73	8931.65	580.78	0.12
Camp Zoe	2954.70*	100 yr	existing	23918.00	679.12	701.15		701.26	0.000387	2.73	8931.65	580.78	0.12
Camp Zoe	2954.70*	100 yr	natural	23918.00	679.12	700.88		701.00	0.000409	2.78	8775.84	579.84	0.12
Camp Zoe	2735.56*	100 yr	proposed	23918.00	678.43	701.05		701.18	0.000404	2.84	8605.40	543.48	0.12
Camp Zoe	2735.56*	100 yr	existing	23918.00	678.43	701.05		701.18	0.000404	2.84	8605.40	543.48	0.12
Camp Zoe	2735.56*	100 yr	natural	23918.00	678.43	700.78		700.91	0.000427	2.89	8456.66	542.76	0.13
Camp Zoe	2516.43*	100 yr	proposed	23918.00	677.75	700.95		701.08	0.000426	2.95	8285.07	517.40	0.13
Camp Zoe	2516.43*	100 yr	existing	23918.00	677.75	700.95		701.08	0.000426	2.95	8285.07	517.40	0.13
Camp Zoe	2516.43*	100 yr	natural	23918.00	677.75	700.67		700.81	0.000451	3.00	8140.63	516.24	0.13
Camp Zoe	2297.29*	100 yr	proposed	23918.00	677.06	700.84		700.99	0.000455	3.10	7958.29	496.19	0.13
Camp Zoe	2297.29*	100 yr	existing	23918.00	677.06	700.84		700.99	0.000455	3.10	7958.29	496.19	0.13
Camp Zoe	2297.29*	100 yr	natural	23918.00	677.06	700.55		700.71	0.000481	3.15	7816.81	494.79	0.13
Camp Zoe	2078.16	100 yr	proposed	23918.00	676.37	700.72		700.88	0.000491	3.26	7644.67	477.94	0.14
Camp Zoe	2078.16	100 yr	existing	23918.00	676.37	700.72		700.88	0.000491	3.26	7644.67	477.94	0.14
Camp Zoe	2078.16	100 yr	natural	23918.00	676.37	700.43		700.60	0.000519	3.32	7505.21	476.83	0.14
Camp Zoe	1863.57*	100 yr	proposed	23918.00	676.07	700.59		700.77	0.000519	3.40	7307.41	452.17	0.14
Camp Zoe	1863.57*	100 yr	existing	23918.00	676.07	700.59		700.77	0.000519	3.40	7307.41	452.17	0.14
Camp Zoe	1863.57*	100 yr	natural	23918.00	676.07	700.30		700.48	0.000549	3.45	7172.51	450.54	0.14
Camp Zoe	1648.98*	100 yr	proposed	23918.00	675.77	700.46		700.66	0.000548	3.56	7028.56	432.45	0.14
Camp Zoe	1648.98*	100 yr	existing	23918.00	675.77	700.46		700.66	0.000548	3.56	7028.56	432.45	0.14
Camp Zoe	1648.98*	100 yr	natural	23918.00	675.77	700.16		700.36	0.000580	3.62	6896.42	430.41	0.15
Camp Zoe	1434.39*	100 yr	proposed	23918.00	675.46	700.33		700.53	0.000577	3.68	6756.04	413.25	0.15
Camp Zoe	1434.39*	100 yr	existing	23918.00	675.46	700.33		700.53	0.000577	3.68	6756.04	413.25	0.15
Camp Zoe	1434.39*	100 yr	natural	23918.00	675.46	700.01		700.23	0.000611	3.74	6626.72	410.73	0.15
Camp Zoe	1219.80*	100 yr	proposed	23918.00	675.16	700.18		700.40	0.000618	3.85	6475.48	395.18	0.15
Camp Zoe	1219.80*	100 yr	existing	23918.00	675.16	700.18		700.40	0.000618	3.85	6475.48	395.18	0.15
Camp Zoe	1219.80*	100 yr	natural	23918.00	675.16	699.85		700.09	0.000655	3.91	6348.65	392.04	0.16
Camp Zoe	1005.22	100 yr	proposed	23918.00	674.86	700.01		700.26	0.000674	4.05	6176.69	379.68	0.16
Camp Zoe	1005.22	100 yr	existing	23918.00	674.86	700.01		700.26	0.000674	4.05	6176.69	379.68	0.16
Camp Zoe	1005.22	100 yr	natural	23918.00	674.86	699.68		699.94	0.000714	4.12	6051.53	375.47	0.16
Camp Zoe	804.483*	100 yr	proposed	23918.00	674.42	699.93		700.13	0.000516	3.59	7002.21	422.72	0.14
Camp Zoe	804.483*	100 yr	existing	23918.00	674.42	699.93		700.13	0.000516	3.59	7002.21	422.72	0.14
Camp Zoe	804.483*	100 yr	natural	23918.00	674.42	699.59		699.80	0.000547	3.66	6860.23	419.17	0.15
Camp Zoe	603.746*	100 yr	proposed	23918.00	673.97	699.87		700.03	0.000403	3.19	7897.87	471.71	0.13
Camp Zoe	603.746*	100 yr	existing	23918.00	673.97	699.87		700.03	0.000403	3.19	7897.87	471.71	0.13
Camp Zoe	603.746*	100 yr	natural	23918.00	673.97	699.53		699.69	0.000428	3.25	7737.24	468.35	0.13
Camp Zoe	403.01	100 yr	proposed	23918.00	673.53	699.82	683.47	699.94	0.000313	2.82	8769.97	534.37	0.11
Camp Zoe	403.01	100 yr	existing	23918.00	673.53	699.82	683.47	699.94	0.000313	2.82	8769.97	534.37	0.11
Camp Zoe	403.01	100 yr	natural	23918.00	673.53	699.48		699.60	0.000331	2.87	8770.42	527.80	0.11
Camp Zoe	337.645*	100 yr	proposed	23918.00	673.78	699.78	683.47	699.92	0.000330	2.96	8161.30	556.28	0.11
Camp Zoe	337.645*	100 yr	existing	23918.00	673.78	699.78	683.45	699.92	0.000330	2.96	8161.30	556.29	0.11
Camp Zoe	337.645*	100 yr	natural	23918.00	673.78	699.46		699.58	0.000308	2.76	9167.30	553.45	0.11
Camp Zoe	272.28*	100 yr	proposed	23918.00	674.02	699.71	683.42	699.88	0.000406	3.39	7086.26	575.31	0.13
Camp Zoe	272.28*	100 yr	existing	23918.00	674.02	699.71	683.42	699.88	0.000406	3.39	7086.26	575.31	0.13
Camp Zoe	272.28*	100 yr	natural	23918.00	674.02	699.45		699.55	0.000286	2.65	9560.18	572.84	0.11
Camp Zoe	225			Bridge									
Camp Zoe	206.915*	100 yr	proposed	23918.00	674.27	699.44	683.37	699.66	0.000487	3.76	6354.02	594.44	0.14
Camp Zoe	206.915*	100 yr	existing	23918.00	674.27	699.44	683.37	699.66	0.000487	3.76	6354.03	594.44	0.14
Camp Zoe	206.915*	100 yr	natural	23918.00	674.27	699.43		699.53	0.000266	2.55	9949.50	594.40	0.10
Camp Zoe	141.55	100 yr	proposed	23918.00	674.51	699.42	683.46	699.61	0.000449	3.55	6954.25	656.54	0.13
Camp Zoe	141.55	100 yr	existing	23918.00	674.51	699.42	683.46	699.61	0.000449	3.55	6954.25	656.54	0.13
Camp Zoe	141.55	100 yr	natural	23918.00	674.51	699.42	683.76	699.51	0.000248	2.45	10416.81	656.54	0.10

Plan: proposed   Sinking Creek   Camp Zoe RS: 7658   Profile: 100 yr

E.G. US. (ft)	706.87	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	706.47	E.G. Elev (ft)	706.70	706.57
Q Total (cfs)	23918.00	W.S. Elev (ft)	706.23	706.06
Q Bridge (cfs)	23918.00	Crit W.S. (ft)	699.24	699.31
Q Weir (cfs)		Max Chl Dpth (ft)	17.55	17.44
Weir Sta Lft (ft)		Vel Total (ft/s)	5.45	5.62
Weir Sta Rgt (ft)		Flow Area (sq ft)	4391.01	4254.89
Weir Submerg		Froude # Chl	0.28	0.29
Weir Max Depth (ft)		Specif Force (cu ft)	31724.82	30762.34
Min El Weir Flow (ft)	713.73	Hydr Depth (ft)	11.47	10.82
Min El Prs (ft)	709.39	W.P. Total (ft)	439.89	452.31
Delta EG (ft)	0.43	Conv. Total (cfs)	450661.1	428286.8
Delta WS (ft)	0.48	Top Width (ft)	382.70	393.13
BR Open Area (sq ft)	5478.13	Frctn Loss (ft)	0.12	0.09
BR Open Vel (ft/s)	5.62	C & E Loss (ft)	0.01	0.03
Coef of Q		Shear Total (lb/sq ft)	1.76	1.83
Br Sel Method	Energy only	Power Total (lb/ft s)	31.33	36.55

Plan: proposed   Sinking Creek   Camp Zoe RS: 4027   Profile: 100 yr

E.G. US. (ft)	702.27	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	701.95	E.G. Elev (ft)	702.13	701.88
Q Total (cfs)	23918.00	W.S. Elev (ft)	701.77	701.52
Q Bridge (cfs)	23918.00	Crit W.S. (ft)	692.23	691.84
Q Weir (cfs)		Max Chl Dpth (ft)	19.12	19.28
Weir Sta Lft (ft)		Vel Total (ft/s)	4.62	4.70
Weir Sta Rgt (ft)		Flow Area (sq ft)	5174.93	5088.13
Weir Submerg		Froude # Chl	0.19	0.19
Weir Max Depth (ft)		Specif Force (cu ft)	42615.50	42518.39
Min El Weir Flow (ft)	710.01	Hydr Depth (ft)	13.58	13.96
Min El Prs (ft)	706.70	W.P. Total (ft)	433.70	417.57
Delta EG (ft)	0.42	Conv. Total (cfs)	600226.0	597448.6
Delta WS (ft)	0.43	Top Width (ft)	381.10	370.33
BR Open Area (sq ft)	6781.85	Frctn Loss (ft)		
BR Open Vel (ft/s)	4.70	C & E Loss (ft)		
Coef of Q		Shear Total (lb/sq ft)	1.18	1.22
Br Sel Method	Momentum	Power Total (lb/ft s)	0.00	0.00

Plan: proposed   Sinking Creek   Camp Zoe RS: 225   Profile: 100 yr

E.G. US. (ft)	699.88	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	699.71	E.G. Elev (ft)	699.88	699.66
Q Total (cfs)	23918.00	W.S. Elev (ft)	699.47	699.44
Q Bridge (cfs)	23918.00	Crit W.S. (ft)	684.72	684.48
Q Weir (cfs)		Max Chl Dpth (ft)	25.45	25.17
Weir Sta Lft (ft)		Vel Total (ft/s)	7.12	7.05
Weir Sta Rgt (ft)		Flow Area (sq ft)	3357.33	3393.95
Weir Submerg		Froude # Chl	0.25	0.25
Weir Max Depth (ft)		Specif Force (cu ft)	48654.77	49306.67
Min El Weir Flow (ft)	700.01	Hydr Depth (ft)	303065.90	158.01
Min El Prs (ft)	699.47	W.P. Total (ft)	1180.36	1157.69
Delta EG (ft)	0.23	Conv. Total (cfs)	147276.2	151915.1
Delta WS (ft)	0.27	Top Width (ft)	0.01	21.48
BR Open Area (sq ft)	3357.33	Frctn Loss (ft)		
BR Open Vel (ft/s)	7.12	C & E Loss (ft)		

Plan: proposed   Sinking Creek   Camp Zoe RS: 225   Profile: 100 yr (Continued)

Coef of Q		Shear Total (lb/sq ft)	4.68	4.54
Br Sel Method	Press Only	Power Total (lb/ft s)	0.00	0.00

Plan: proposed   Sinking Creek   Camp Zoe RS: 7900   Inl Struct: Profile: 100 yr

E.G. Elev (ft)	707.18	Q Gates (cfs)	
W.S. Elev (ft)	706.82	Q Gate Group (cfs)	
Q Total (cfs)	23918.00	Gate Open Ht (ft)	
Q Weir (cfs)	23918.00	Gate #Open	
Weir Flow Area (sq ft)	5118.14	Gate Area (sq ft)	
Weir Sta Lft (ft)	277.71	Gate Submerg	
Weir Sta Rgt (ft)	731.50	Gate Invert (ft)	
Weir Max Depth (ft)	18.37	Gate Weir Coef	
Weir Avg Depth (ft)	11.28		
Weir Coef (ft^1/2)	2.600	Q Breach (cfs)	
Weir Submerg	0.98	Breach Avg Velocity (ft/s)	
Min El Weir Flow (ft)	688.82	Breach Flow Area (sq ft)	
Wr Top Wdth (ft)	453.79		

Plan: proposed   Sinking Creek   Camp Zoe RS: 7780   Inl Struct: Profile: 100 yr

E.G. Elev (ft)	707.03	Q Gates (cfs)	
W.S. Elev (ft)	706.65	Q Gate Group (cfs)	
Q Total (cfs)	23918.00	Gate Open Ht (ft)	
Q Weir (cfs)	23918.00	Gate #Open	
Weir Flow Area (sq ft)	5058.66	Gate Area (sq ft)	
Weir Sta Lft (ft)	304.08	Gate Submerg	
Weir Sta Rgt (ft)	745.11	Gate Invert (ft)	
Weir Max Depth (ft)	18.28	Gate Weir Coef	
Weir Avg Depth (ft)	11.47		
Weir Coef (ft^1/2)	2.600	Q Breach (cfs)	
Weir Submerg	0.98	Breach Avg Velocity (ft/s)	
Min El Weir Flow (ft)	688.76	Breach Flow Area (sq ft)	
Wr Top Wdth (ft)	441.03		

Errors Warnings and Notes

Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid,
	energy was used.

Plan: proposed   Sinking Creek   Camp Zoe RS: 7420   Inl Struct: Profile: 100 yr

E.G. Elev (ft)	706.17	Q Gates (cfs)	
W.S. Elev (ft)	705.79	Q Gate Group (cfs)	
Q Total (cfs)	23918.00	Gate Open Ht (ft)	
Q Weir (cfs)	23918.00	Gate #Open	
Weir Flow Area (sq ft)	4928.40	Gate Area (sq ft)	
Weir Sta Lft (ft)	329.67	Gate Submerg	
Weir Sta Rgt (ft)	734.67	Gate Invert (ft)	
Weir Max Depth (ft)	18.05	Gate Weir Coef	
Weir Avg Depth (ft)	12.17		
Weir Coef (ft^1/2)	2.600	Q Breach (cfs)	
Weir Submerg	0.98	Breach Avg Velocity (ft/s)	
Min El Weir Flow (ft)	688.13	Breach Flow Area (sq ft)	
Wr Top Wdth (ft)	405.00		

Errors Warnings and Notes

Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid,
	energy was used.

Plan: proposed   Sinking Creek   Camp Zoe RS: 7300   Inl Struct: Profile: 100 yr

E.G. Elev (ft)	706.00	Q Gates (cfs)	
W.S. Elev (ft)	705.69	Q Gate Group (cfs)	
Q Total (cfs)	23918.00	Gate Open Ht (ft)	
Q Weir (cfs)	23918.00	Gate #Open	
Weir Flow Area (sq ft)	5450.82	Gate Area (sq ft)	
Weir Sta Lft (ft)	245.82	Gate Submerg	
Weir Sta Rgt (ft)	705.55	Gate Invert (ft)	
Weir Max Depth (ft)	18.37	Gate Weir Coef	
Weir Avg Depth (ft)	11.86		
Weir Coef (ft^1/2)	2.600	Q Breach (cfs)	
Weir Submerg	0.98	Breach Avg Velocity (ft/s)	
Min El Weir Flow (ft)	687.64	Breach Flow Area (sq ft)	
Wr Top Wdth (ft)	459.72		

Plan: proposed   Sinking Creek   Camp Zoe RS: 7180   Inl Struct: Profile: 100 yr

E.G. Elev (ft)	705.86	Q Gates (cfs)	
W.S. Elev (ft)	705.58	Q Gate Group (cfs)	
Q Total (cfs)	23918.00	Gate Open Ht (ft)	
Q Weir (cfs)	23918.00	Gate #Open	
Weir Flow Area (sq ft)	5761.82	Gate Area (sq ft)	
Weir Sta Lft (ft)	190.65	Gate Submerg	
Weir Sta Rgt (ft)	677.50	Gate Invert (ft)	
Weir Max Depth (ft)	18.73	Gate Weir Coef	
Weir Avg Depth (ft)	11.83		
Weir Coef (ft^1/2)	2.600	Q Breach (cfs)	
Weir Submerg	0.99	Breach Avg Velocity (ft/s)	
Min El Weir Flow (ft)	687.14	Breach Flow Area (sq ft)	
Wr Top Wdth (ft)	486.85		

Errors Warnings and Notes

Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid,
	energy was used.

Plan: proposed   Sinking Creek   Camp Zoe RS: 4300   Inl Struct: Profile: 100 yr

E.G. Elev (ft)	702.53	Q Gates (cfs)	
W.S. Elev (ft)	702.21	Q Gate Group (cfs)	
Q Total (cfs)	23918.00	Gate Open Ht (ft)	
Q Weir (cfs)	23918.00	Gate #Open	
Weir Flow Area (sq ft)	5490.55	Gate Area (sq ft)	
Weir Sta Lft (ft)	200.65	Gate Submerg	
Weir Sta Rgt (ft)	602.79	Gate Invert (ft)	
Weir Max Depth (ft)	19.89	Gate Weir Coef	
Weir Avg Depth (ft)	13.65		
Weir Coef (ft^1/2)	2.600	Q Breach (cfs)	
Weir Submerg	0.99	Breach Avg Velocity (ft/s)	
Min El Weir Flow (ft)	682.65	Breach Flow Area (sq ft)	
Wr Top Wdth (ft)	402.14		

Plan: proposed   Sinking Creek   Camp Zoe RS: 4150   Inl Struct: Profile: 100 yr

E.G. Elev (ft)	702.40	Q Gates (cfs)	
W.S. Elev (ft)	702.08	Q Gate Group (cfs)	
Q Total (cfs)	23918.00	Gate Open Ht (ft)	
Q Weir (cfs)	23918.00	Gate #Open	

Plan: proposed Sinking Creek Camp Zoe RS: 4150 Inl Struct: Profile: 100 yr (Continued)

Weir Flow Area (sq ft)	5487.10	Gate Area (sq ft)	
Weir Sta Lft (ft)	186.72	Gate Submerg	
Weir Sta Rgt (ft)	587.22	Gate Invert (ft)	
Weir Max Depth (ft)	19.75	Gate Weir Coef	
Weir Avg Depth (ft)	13.70		
Weir Coef (ft^1/2)	2.600	Q Breach (cfs)	
Weir Submerg	0.99	Breach Avg Velocity (ft/s)	
Min El Weir Flow (ft)	682.66	Breach Flow Area (sq ft)	
Wr Top Wdth (ft)	400.49		

Plan: proposed Sinking Creek Camp Zoe RS: 3900 Inl Struct: Profile: 100 yr

E.G. Elev (ft)	701.86	Q Gates (cfs)	
W.S. Elev (ft)	701.52	Q Gate Group (cfs)	
Q Total (cfs)	23918.00	Gate Open Ht (ft)	
Q Weir (cfs)	23918.00	Gate #Open	
Weir Flow Area (sq ft)	5297.05	Gate Area (sq ft)	
Weir Sta Lft (ft)	192.11	Gate Submerg	
Weir Sta Rgt (ft)	571.53	Gate Invert (ft)	
Weir Max Depth (ft)	19.62	Gate Weir Coef	
Weir Avg Depth (ft)	13.96		
Weir Coef (ft^1/2)	2.600	Q Breach (cfs)	
Weir Submerg	0.99	Breach Avg Velocity (ft/s)	
Min El Weir Flow (ft)	682.25	Breach Flow Area (sq ft)	
Wr Top Wdth (ft)	379.42		

Plan: proposed Sinking Creek Camp Zoe RS: 3775 Inl Struct: Profile: 100 yr

E.G. Elev (ft)	701.70	Q Gates (cfs)	
W.S. Elev (ft)	701.50	Q Gate Group (cfs)	
Q Total (cfs)	23918.00	Gate Open Ht (ft)	
Q Weir (cfs)	23918.00	Gate #Open	
Weir Flow Area (sq ft)	6646.39	Gate Area (sq ft)	
Weir Sta Lft (ft)	198.39	Gate Submerg	
Weir Sta Rgt (ft)	658.25	Gate Invert (ft)	
Weir Max Depth (ft)	19.86	Gate Weir Coef	
Weir Avg Depth (ft)	14.45		
Weir Coef (ft^1/2)	2.600	Q Breach (cfs)	
Weir Submerg	0.99	Breach Avg Velocity (ft/s)	
Min El Weir Flow (ft)	681.85	Breach Flow Area (sq ft)	
Wr Top Wdth (ft)	459.86		

Errors Warnings and Notes

Note:	Multiple critical depths were found at this location. The critical depth with the lowest, valid,
	energy was used.

HEC-RAS Version 4.1.0 Jan 2010
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

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            X     X  XXXXXX   XXXX        XXXX      XX      XXXX
            X     X  X       X    X       X   X    X  X    X
            X     X  X       X            X   X   X    X   X
            XXXXXXX  XXXX    X       XXX  XXXX    XXXXXX    XXXX
            X     X  X       X            X X     X    X        X
            X     X  X       X    X       X  X    X    X        X
            X     X  XXXXXX   XXXX        X   X   X    X   XXXXX
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PROJECT DATA
Project Title: sinkingcreek
Project File : sinkingcreek.prj
Run Date and Time: 10/1/2014 5:42:14 AM

Project in English units

Project Description:
Sinking Creek Model.
Geometry Data merged from Aerial Topo and Ground Shots at
Cross Sections.
Flow Data from USGS Regression Equation (by MSH
06/16/14).
Modeled by JCZ 06/18/14.
Checked by RBL 07/02/14.
Revised by JCZ
07/03/14 with RBL comments.
Revised by JCZ 07/15/14 with MSH
comments.
Revised by JCZ 07/24/14 with proposed bridges, weirs, and scour
analysis.
Revised by JCZ 08/27/14 with RBL + WK comments.
Revised by JCZ
09/09/14 with add'l data + proposed berms near RS 6255.20
Revised by JCZ
09/12/14 with add'l weirs per SCI comments.
Revised by JCZ 09/19/14 with
refined cross sections at pedestrian bridge
Revised by JCZ 09/26/14 with
stacked boulders at base of proposed piers.

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PLAN DATA

Plan Title: natural
Plan File : p:\Missouri OA-FMDC\0131554 - Camp Zoe\0131554.02 - Site
Design\Drainage\HEC-RAS\sinkingcreek.p01

Geometry Title: natural
Geometry File : p:\Missouri OA-FMDC\0131554 - Camp Zoe\0131554.02 -
Site Design\Drainage\HEC-RAS\sinkingcreek.g01

Flow Title   : usgsknownws

Flow File : p:\Missouri OA-FMDC\0131554 - Camp Zoe\0131554.02 - Site Design\Drainage\HEC-RAS\sinkingcreek.f04

Plan Description:
Natural conditions (no existing or proposed bridges).
USGS Regression Flow
Data.
Known WS DS Boundary Condition from Current River Model.

Plan Summary Information:

Number of:	Cross Sections =	57	Multiple Openings =	0
	Culverts =	0	Inline Structures =	0
	Bridges =	0	Lateral Structures =	0

Computational Information

Water surface calculation tolerance =	0.01
Critical depth calculation tolerance =	0.01
Maximum number of iterations =	20
Maximum difference tolerance =	0.3
Flow tolerance factor =	0.001

Computation Options
Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

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FLOW DATA

Flow Title: usgsknownws
Flow File : p:\Missouri OA-FMDC\0131554 - Camp Zoe\0131554.02 - Site Design\Drainage\HEC-RAS\sinkingcreek.f04

Flow Data (cfs)

River	Reach	RS	10 yr	25 yr	50 yr	100 yr
Sinking Creek	Camp Zoe	9786.15	13581	18752	20758	23918

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Sinking Creek	Camp Zoe	10 yr		Known WS = 693.29
Sinking Creek	Camp Zoe	25 yr		Known WS = 696.14
Sinking Creek	Camp Zoe	50 yr		Known WS = 697.69
Sinking Creek	Camp Zoe	100 yr		Known WS = 699.42

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SUMMARY OF MANNING'S N VALUES

River:Sinking Creek

Reach	River Sta.	n1	n2	n3
Camp Zoe	9786.15	.157*	.068*	.157*
Camp Zoe	9546.42*	.157*	.068*	.157*
Camp Zoe	9306.70*	.157*	.068*	.157*
Camp Zoe	9066.98*	.157*	.068*	.157*
Camp Zoe	8827.26*	.157*	.068*	.157*
Camp Zoe	8587.54	.157*	.068*	.157*
Camp Zoe	8446.66*	.157*	.068*	.157*
Camp Zoe	8305.78*	.157*	.068*	.157*
Camp Zoe	8164.91*	.157*	.068*	.157*
Camp Zoe	8024.03*	.157*	.068*	.157*
Camp Zoe	7883.16*	.157*	.068*	.157*
Camp Zoe	7742.28*	.157*	.068*	.157*
Camp Zoe	7601.41	.157*	.068*	.157*
Camp Zoe	7481.37*	.157*	.068*	.157*
Camp Zoe	7361.34*	.157*	.068*	.157*
Camp Zoe	7241.31*	.157*	.068*	.157*
Camp Zoe	7121.28*	.157*	.068*	.157*
Camp Zoe	7001.25	.157*	.068*	.157*
Camp Zoe	6752.56*	.157*	.068*	.157*
Camp Zoe	6503.88*	.157*	.068*	.157*
Camp Zoe	6255.20*	.157*	.068*	.157*
Camp Zoe	6006.52*	.157*	.068*	.157*
Camp Zoe	5757.84	.157*	.068*	.157*
Camp Zoe	5555.31*	.157*	.068*	.157*
Camp Zoe	5352.78*	.157*	.068*	.157*
Camp Zoe	5150.26	.157*	.068*	.157*
Camp Zoe	5005.25*	.157*	.068*	.157*
Camp Zoe	4860.25*	.157*	.068*	.157*
Camp Zoe	4715.25*	.157*	.068*	.157*
Camp Zoe	4570.24*	.157*	.068*	.157*
Camp Zoe	4425.24*	.157*	.068*	.157*
Camp Zoe	4280.24*	.157*	.068*	.157*
Camp Zoe	4135.24	.157*	.068*	.157*
Camp Zoe	3997.89*	.157*	.068*	.157*
Camp Zoe	3860.55*	.157*	.068*	.157*
Camp Zoe	3723.21*	.157*	.068*	.157*
Camp Zoe	3585.86*	.157*	.068*	.157*
Camp Zoe	3448.52*	.157*	.068*	.157*
Camp Zoe	3311.18*	.157*	.068*	.157*
Camp Zoe	3173.84	.157*	.068*	.157*
Camp Zoe	2954.70*	.157*	.068*	.157*
Camp Zoe	2735.56*	.157*	.068*	.157*
Camp Zoe	2516.43*	.157*	.068*	.157*
Camp Zoe	2297.29*	.157*	.068*	.157*
Camp Zoe	2078.16	.157*	.068*	.157*
Camp Zoe	1863.57*	.157*	.068*	.157*
Camp Zoe	1648.98*	.157*	.068*	.157*
Camp Zoe	1434.39*	.157*	.068*	.157*
Camp Zoe	1219.80*	.157*	.068*	.157*
Camp Zoe	1005.22	.157*	.068*	.157*
Camp Zoe	804.483*	.157*	.068*	.157*
Camp Zoe	603.746*	.157*	.068*	.157*
Camp Zoe	403.01	.157*	.068*	.157*
Camp Zoe	337.645*	.157*	.068*	.157*
Camp Zoe	272.28*	.157*	.068*	.157*
Camp Zoe	206.915*	.157*	.068*	.157*
Camp Zoe	141.55	.157*	.068*	.157*

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SUMMARY OF REACH LENGTHS

River: Sinking Creek

Reach	River Sta.	Left	Channel	Right
Camp Zoe	9786.15	251.62	239.72	181.03
Camp Zoe	9546.42*	251.62	239.72	181.03
Camp Zoe	9306.70*	251.62	239.72	181.03
Camp Zoe	9066.98*	251.62	239.72	181.03
Camp Zoe	8827.26*	251.62	239.72	181.03
Camp Zoe	8587.54	166.12	140.88	85.01
Camp Zoe	8446.66*	166.12	140.88	85.01
Camp Zoe	8305.78*	166.12	140.88	85.01
Camp Zoe	8164.91*	166.12	140.88	85.01
Camp Zoe	8024.03*	166.12	140.88	85.01
Camp Zoe	7883.16*	166.12	140.88	85.01
Camp Zoe	7742.28*	166.12	140.88	85.01
Camp Zoe	7601.41	89.37	120.03	124.77
Camp Zoe	7481.37*	89.37	120.03	124.77
Camp Zoe	7361.34*	89.37	120.03	124.77
Camp Zoe	7241.31*	89.37	120.03	124.77
Camp Zoe	7121.28*	89.37	120.03	124.77
Camp Zoe	7001.25	130.65	248.68	264.77
Camp Zoe	6752.56*	130.65	248.68	264.77
Camp Zoe	6503.88*	130.65	248.68	264.77
Camp Zoe	6255.20*	130.65	248.68	264.77
Camp Zoe	6006.52*	130.65	248.68	264.77
Camp Zoe	5757.84	202.53	202.53	202.53
Camp Zoe	5555.31*	202.53	202.53	202.53
Camp Zoe	5352.78*	202.53	202.53	202.53
Camp Zoe	5150.26	97.94	145	150.07
Camp Zoe	5005.25*	97.94	145	150.07
Camp Zoe	4860.25*	97.94	145	150.07
Camp Zoe	4715.25*	97.94	145	150.07
Camp Zoe	4570.24*	97.94	145	150.07
Camp Zoe	4425.24*	97.94	145	150.07
Camp Zoe	4280.24*	97.94	145	150.07
Camp Zoe	4135.24	132.47	137.34	143.02
Camp Zoe	3997.89*	132.47	137.34	143.02
Camp Zoe	3860.55*	132.47	137.34	143.02
Camp Zoe	3723.21*	132.47	137.34	143.02
Camp Zoe	3585.86*	132.47	137.34	143.02
Camp Zoe	3448.52*	132.47	137.34	143.02
Camp Zoe	3311.18*	132.47	137.34	143.02
Camp Zoe	3173.84	245.7	219.14	69.67
Camp Zoe	2954.70*	245.7	219.14	69.67
Camp Zoe	2735.56*	245.7	219.14	69.67
Camp Zoe	2516.43*	245.7	219.14	69.67
Camp Zoe	2297.29*	245.7	219.14	69.67
Camp Zoe	2078.16	216.52	214.59	179.34
Camp Zoe	1863.57*	216.52	214.59	179.34
Camp Zoe	1648.98*	216.52	214.59	179.34
Camp Zoe	1434.39*	216.52	214.59	179.34
Camp Zoe	1219.80*	216.52	214.59	179.34
Camp Zoe	1005.22	184.15	200.74	222.35
Camp Zoe	804.483*	184.15	200.74	222.35
Camp Zoe	603.746*	184.15	200.74	222.35
Camp Zoe	403.01	77.96	65.36	28.71
Camp Zoe	337.645*	77.96	65.36	28.71
Camp Zoe	272.28*	77.96	65.36	28.71

```
*Camp Zoe        *    206.915*    *    77.96*    65.36*    28.71*
*Camp Zoe        *    141.55      *         *         *         *
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SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Sinking Creek

```
*******************************************************
*     Reach      *   River Sta.   * Contr.  * Expan.  *
*******************************************************
*Camp Zoe        *    9786.15 *       .1*       .3*
*Camp Zoe        *    9546.42**       .1*       .3*
*Camp Zoe        *    9306.70**       .1*       .3*
*Camp Zoe        *    9066.98**       .1*       .3*
*Camp Zoe        *    8827.26**       .1*       .3*
*Camp Zoe        *    8587.54 *       .1*       .3*
*Camp Zoe        *    8446.66**       .1*       .3*
*Camp Zoe        *    8305.78**       .1*       .3*
*Camp Zoe        *    8164.91**       .1*       .3*
*Camp Zoe        *    8024.03**       .1*       .3*
*Camp Zoe        *    7883.16**       .1*       .3*
*Camp Zoe        *    7742.28**       .1*       .3*
*Camp Zoe        *    7601.41 *       .1*       .3*
*Camp Zoe        *    7481.37**       .1*       .3*
*Camp Zoe        *    7361.34**       .1*       .3*
*Camp Zoe        *    7241.31**       .1*       .3*
*Camp Zoe        *    7121.28**       .1*       .3*
*Camp Zoe        *    7001.25 *       .1*       .3*
*Camp Zoe        *    6752.56**       .1*       .3*
*Camp Zoe        *    6503.88**       .1*       .3*
*Camp Zoe        *    6255.20**       .1*       .3*
*Camp Zoe        *    6006.52**       .1*       .3*
*Camp Zoe        *    5757.84 *       .1*       .3*
*Camp Zoe        *    5555.31**       .1*       .3*
*Camp Zoe        *    5352.78**       .1*       .3*
*Camp Zoe        *    5150.26 *       .1*       .3*
*Camp Zoe        *    5005.25**       .1*       .3*
*Camp Zoe        *    4860.25**       .1*       .3*
*Camp Zoe        *    4715.25**       .1*       .3*
*Camp Zoe        *    4570.24**       .1*       .3*
*Camp Zoe        *    4425.24**       .1*       .3*
*Camp Zoe        *    4280.24**       .1*       .3*
*Camp Zoe        *    4135.24 *       .1*       .3*
*Camp Zoe        *    3997.89**       .1*       .3*
*Camp Zoe        *    3860.55**       .1*       .3*
*Camp Zoe        *    3723.21**       .1*       .3*
*Camp Zoe        *    3585.86**       .1*       .3*
*Camp Zoe        *    3448.52**       .1*       .3*
*Camp Zoe        *    3311.18**       .1*       .3*
*Camp Zoe        *    3173.84 *       .1*       .3*
*Camp Zoe        *    2954.70**       .1*       .3*
*Camp Zoe        *    2735.56**       .1*       .3*
*Camp Zoe        *    2516.43**       .1*       .3*
*Camp Zoe        *    2297.29**       .1*       .3*
*Camp Zoe        *    2078.16 *       .1*       .3*
*Camp Zoe        *    1863.57**       .1*       .3*
*Camp Zoe        *    1648.98**       .1*       .3*
*Camp Zoe        *    1434.39**       .1*       .3*
*Camp Zoe        *    1219.80**       .1*       .3*
*Camp Zoe        *    1005.22 *       .1*       .3*
*Camp Zoe        *    804.483**       .1*       .3*
*Camp Zoe        *    603.746**       .1*       .3*
*Camp Zoe        *    403.01  *       .3*       .5*
```

```
*Camp Zoe        *    337.645**       .3*       .5*
*Camp Zoe        *    272.28* *       .3*       .5*
*Camp Zoe        *    206.915**       .3*       .5*
*Camp Zoe        *    141.55  *       .3*       .5*
*******************************************************

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ERRORS WARNINGS AND NOTES
Errors Warnings and Notes for Plan : natural

River: Sinking Creek Reach: Camp Zoe   RS: 403.01   Profile: 100 yr
     Warning:Divided flow computed for this cross-section.

HEC-RAS Version 4.1.0 Jan 2010
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X     X  XXXXXX    XXXX        XXXX       XX      XXXX
X     X  X        X    X       X   X     X  X    X
X     X  X        X            X   X    X    X   X
XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
X     X  X        X            X  X     X    X        X
X     X  X        X    X       X   X    X    X        X
X     X  XXXXXX    XXXX        X    X   X    X   XXXXX
```

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PROJECT DATA
Project Title: sinkingcreek
Project File : sinkingcreek.prj
Run Date and Time: 10/1/2014 5:42:02 AM

Project in English units

Project Description:
Sinking Creek Model.
Geometry Data merged from Aerial Topo and Ground Shots at
Cross Sections.
Flow Data from USGS Regression Equation (by MSH
06/16/14).
Modeled by JCZ 06/18/14.
Checked by RBL 07/02/14.
Revised by JCZ
07/03/14 with RBL comments.
Revised by JCZ 07/15/14 with MSH
comments.
Revised by JCZ 07/24/14 with proposed bridges, weirs, and scour
analysis.
Revised by JCZ 08/27/14 with RBL + WK comments.
Revised by JCZ
09/09/14 with add'l data + proposed berms near RS 6255.20
Revised by JCZ
09/12/14 with add'l weirs per SCI comments.
Revised by JCZ 09/19/14 with
refined cross sections at pedestrian bridge
Revised by JCZ 09/26/14 with
stacked boulders at base of proposed piers.

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PLAN DATA

Plan Title: existing
Plan File : p:\Missouri OA-FMDC\0131554 - Camp Zoe\0131554.02 - Site
Design\Drainage\HEC-RAS\sinkingcreek.p02

Geometry Title: existing
Geometry File : p:\Missouri OA-FMDC\0131554 - Camp Zoe\0131554.02 -
Site Design\Drainage\HEC-RAS\sinkingcreek.g02

Flow Title   : usgsknownws

Flow File : p:\Missouri OA-FMDC\0131554 - Camp Zoe\0131554.02 - Site Design\Drainage\HEC-RAS\sinkingcreek.f04

Plan Description:
Existing conditions (no proposed bridges).
USGS Regression Flow Data.
Known
WS DS Boundary Condition from Current River Model.

Plan Summary Information:

```
Number of:  Cross Sections =   57    Multiple Openings  =    0
            Culverts       =    0    Inline Structures  =    0
            Bridges        =    1    Lateral Structures =    0
```

Computational Information

```
    Water surface calculation tolerance  =  0.01
    Critical depth calculation tolerance =  0.01
    Maximum number of iterations         =  20
    Maximum difference tolerance         =  0.3
    Flow tolerance factor                =  0.001
```

Computation Options

```
    Critical depth computed only where necessary
    Conveyance Calculation Method: At breaks in n values only
    Friction Slope Method:         Average Conveyance
    Computational Flow Regime:     Subcritical Flow
```

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FLOW DATA

Flow Title: usgsknownws
Flow File : p:\Missouri OA-FMDC\0131554 - Camp Zoe\0131554.02 - Site Design\Drainage\HEC-RAS\sinkingcreek.f04

Flow Data (cfs)

River	Reach	RS	10 yr	25 yr	50 yr	100 yr
Sinking Creek	Camp Zoe	9786.15	13581	18752	20758	23918

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Sinking Creek	Camp Zoe	10 yr		Known WS = 693.29
Sinking Creek	Camp Zoe	25 yr		Known WS = 696.14
Sinking Creek	Camp Zoe	50 yr		Known WS = 697.69
Sinking Creek	Camp Zoe	100 yr		Known WS = 699.42

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SUMMARY OF MANNING'S N VALUES

River:Sinking Creek

Reach	River Sta.	n1	n2	n3
Camp Zoe	9786.15	.157	.068	.157
Camp Zoe	9546.42*	.157	.068	.157
Camp Zoe	9306.70*	.157	.068	.157
Camp Zoe	9066.98*	.157	.068	.157
Camp Zoe	8827.26*	.157	.068	.157
Camp Zoe	8587.54	.157	.068	.157
Camp Zoe	8446.66*	.157	.068	.157
Camp Zoe	8305.78*	.157	.068	.157
Camp Zoe	8164.91*	.157	.068	.157
Camp Zoe	8024.03*	.157	.068	.157
Camp Zoe	7883.16*	.157	.068	.157
Camp Zoe	7742.28*	.157	.068	.157
Camp Zoe	7601.41	.157	.068	.157
Camp Zoe	7481.37*	.157	.068	.157
Camp Zoe	7361.34*	.157	.068	.157
Camp Zoe	7241.31*	.157	.068	.157
Camp Zoe	7121.28*	.157	.068	.157
Camp Zoe	7001.25	.157	.068	.157
Camp Zoe	6752.56*	.157	.068	.157
Camp Zoe	6503.88*	.157	.068	.157
Camp Zoe	6255.20*	.157	.068	.157
Camp Zoe	6006.52*	.157	.068	.157
Camp Zoe	5757.84	.157	.068	.157
Camp Zoe	5555.31*	.157	.068	.157
Camp Zoe	5352.78*	.157	.068	.157
Camp Zoe	5150.26	.157	.068	.157
Camp Zoe	5005.25*	.157	.068	.157
Camp Zoe	4860.25*	.157	.068	.157
Camp Zoe	4715.25*	.157	.068	.157
Camp Zoe	4570.24*	.157	.068	.157
Camp Zoe	4425.24*	.157	.068	.157
Camp Zoe	4280.24*	.157	.068	.157
Camp Zoe	4135.24	.157	.068	.157
Camp Zoe	3997.89*	.157	.068	.157
Camp Zoe	3860.55*	.157	.068	.157
Camp Zoe	3723.21*	.157	.068	.157
Camp Zoe	3585.86*	.157	.068	.157
Camp Zoe	3448.52*	.157	.068	.157
Camp Zoe	3311.18*	.157	.068	.157
Camp Zoe	3173.84	.157	.068	.157
Camp Zoe	2954.70*	.157	.068	.157
Camp Zoe	2735.56*	.157	.068	.157
Camp Zoe	2516.43*	.157	.068	.157
Camp Zoe	2297.29*	.157	.068	.157
Camp Zoe	2078.16	.157	.068	.157
Camp Zoe	1863.57*	.157	.068	.157
Camp Zoe	1648.98*	.157	.068	.157
Camp Zoe	1434.39*	.157	.068	.157
Camp Zoe	1219.80*	.157	.068	.157
Camp Zoe	1005.22	.157	.068	.157
Camp Zoe	804.483*	.157	.068	.157
Camp Zoe	603.746*	.157	.068	.157
Camp Zoe	403.01	.157	.068	.157
Camp Zoe	337.645*	.157	.068	.157
Camp Zoe	272.28*	.157	.068	.157
Camp Zoe	225	Bridge		
Camp Zoe	206.915*	.157	.068	.157

Camp Zoe	141.55		.157	.068	.157

SUMMARY OF REACH LENGTHS

River: Sinking Creek

Reach	River Sta.	Left	Channel	Right
Camp Zoe	9786.15	251.62	239.72	181.03
Camp Zoe	9546.42*	251.62	239.72	181.03
Camp Zoe	9306.70*	251.62	239.72	181.03
Camp Zoe	9066.98*	251.62	239.72	181.03
Camp Zoe	8827.26*	251.62	239.72	181.03
Camp Zoe	8587.54	166.12	140.88	85.01
Camp Zoe	8446.66*	166.12	140.88	85.01
Camp Zoe	8305.78*	166.12	140.88	85.01
Camp Zoe	8164.91*	166.12	140.88	85.01
Camp Zoe	8024.03*	166.12	140.88	85.01
Camp Zoe	7883.16*	166.12	140.88	85.01
Camp Zoe	7742.28*	166.12	140.88	85.01
Camp Zoe	7601.41	89.37	120.03	124.77
Camp Zoe	7481.37*	89.37	120.03	124.77
Camp Zoe	7361.34*	89.37	120.03	124.77
Camp Zoe	7241.31*	89.37	120.03	124.77
Camp Zoe	7121.28*	89.37	120.03	124.77
Camp Zoe	7001.25	130.65	248.68	264.77
Camp Zoe	6752.56*	130.65	248.68	264.77
Camp Zoe	6503.88*	130.65	248.68	264.77
Camp Zoe	6255.20*	130.65	248.68	264.77
Camp Zoe	6006.52*	130.65	248.68	264.77
Camp Zoe	5757.84	202.53	202.53	202.53
Camp Zoe	5555.31*	202.53	202.53	202.53
Camp Zoe	5352.78*	202.53	202.53	202.53
Camp Zoe	5150.26	97.94	145	150.07
Camp Zoe	5005.25*	97.94	145	150.07
Camp Zoe	4860.25*	97.94	145	150.07
Camp Zoe	4715.25*	97.94	145	150.07
Camp Zoe	4570.24*	97.94	145	150.07
Camp Zoe	4425.24*	97.94	145	150.07
Camp Zoe	4280.24*	97.94	145	150.07
Camp Zoe	4135.24	132.47	137.34	143.02
Camp Zoe	3997.89*	132.47	137.34	143.02
Camp Zoe	3860.55*	132.47	137.34	143.02
Camp Zoe	3723.21*	132.47	137.34	143.02
Camp Zoe	3585.86*	132.47	137.34	143.02
Camp Zoe	3448.52*	132.47	137.34	143.02
Camp Zoe	3311.18*	132.47	137.34	143.02
Camp Zoe	3173.84	245.7	219.14	69.67
Camp Zoe	2954.70*	245.7	219.14	69.67
Camp Zoe	2735.56*	245.7	219.14	69.67
Camp Zoe	2516.43*	245.7	219.14	69.67
Camp Zoe	2297.29*	245.7	219.14	69.67
Camp Zoe	2078.16	216.52	214.59	179.34
Camp Zoe	1863.57*	216.52	214.59	179.34
Camp Zoe	1648.98*	216.52	214.59	179.34
Camp Zoe	1434.39*	216.52	214.59	179.34
Camp Zoe	1219.80*	216.52	214.59	179.34
Camp Zoe	1005.22	184.15	200.74	222.35
Camp Zoe	804.483*	184.15	200.74	222.35
Camp Zoe	603.746*	184.15	200.74	222.35
Camp Zoe	403.01	77.96	65.36	28.71
Camp Zoe	337.645*	77.96	65.36	28.71

```
*Camp Zoe        *    272.28*     *    77.96*    65.36*    28.71*
*Camp Zoe        *    225         *Bridge   *         *         *
*Camp Zoe        *    206.915*    *    77.96*    65.36*    28.71*
*Camp Zoe        *    141.55      *         *         *         *
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```

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Sinking Creek

```
*******************************************************
*     Reach      *   River Sta.   * Contr.  * Expan.  *
*******************************************************
*Camp Zoe        *    9786.15 *       .1*       .3*
*Camp Zoe        *    9546.42**       .1*       .3*
*Camp Zoe        *    9306.70**       .1*       .3*
*Camp Zoe        *    9066.98**       .1*       .3*
*Camp Zoe        *    8827.26**       .1*       .3*
*Camp Zoe        *    8587.54 *       .1*       .3*
*Camp Zoe        *    8446.66**       .1*       .3*
*Camp Zoe        *    8305.78**       .1*       .3*
*Camp Zoe        *    8164.91**       .1*       .3*
*Camp Zoe        *    8024.03**       .1*       .3*
*Camp Zoe        *    7883.16**       .1*       .3*
*Camp Zoe        *    7742.28**       .1*       .3*
*Camp Zoe        *    7601.41 *       .1*       .3*
*Camp Zoe        *    7481.37**       .1*       .3*
*Camp Zoe        *    7361.34**       .1*       .3*
*Camp Zoe        *    7241.31**       .1*       .3*
*Camp Zoe        *    7121.28**       .1*       .3*
*Camp Zoe        *    7001.25 *       .1*       .3*
*Camp Zoe        *    6752.56**       .1*       .3*
*Camp Zoe        *    6503.88**       .1*       .3*
*Camp Zoe        *    6255.20**       .1*       .3*
*Camp Zoe        *    6006.52**       .1*       .3*
*Camp Zoe        *    5757.84 *       .1*       .3*
*Camp Zoe        *    5555.31**       .1*       .3*
*Camp Zoe        *    5352.78**       .1*       .3*
*Camp Zoe        *    5150.26 *       .1*       .3*
*Camp Zoe        *    5005.25**       .1*       .3*
*Camp Zoe        *    4860.25**       .1*       .3*
*Camp Zoe        *    4715.25**       .1*       .3*
*Camp Zoe        *    4570.24**       .1*       .3*
*Camp Zoe        *    4425.24**       .1*       .3*
*Camp Zoe        *    4280.24**       .1*       .3*
*Camp Zoe        *    4135.24 *       .1*       .3*
*Camp Zoe        *    3997.89**       .1*       .3*
*Camp Zoe        *    3860.55**       .1*       .3*
*Camp Zoe        *    3723.21**       .1*       .3*
*Camp Zoe        *    3585.86**       .1*       .3*
*Camp Zoe        *    3448.52**       .1*       .3*
*Camp Zoe        *    3311.18**       .1*       .3*
*Camp Zoe        *    3173.84 *       .1*       .3*
*Camp Zoe        *    2954.70**       .1*       .3*
*Camp Zoe        *    2735.56**       .1*       .3*
*Camp Zoe        *    2516.43**       .1*       .3*
*Camp Zoe        *    2297.29**       .1*       .3*
*Camp Zoe        *    2078.16 *       .1*       .3*
*Camp Zoe        *    1863.57**       .1*       .3*
*Camp Zoe        *    1648.98**       .1*       .3*
*Camp Zoe        *    1434.39**       .1*       .3*
*Camp Zoe        *    1219.80**       .1*       .3*
*Camp Zoe        *    1005.22 *       .1*       .3*
*Camp Zoe        *    804.483**       .1*       .3*
```

```
*Camp Zoe        *    603.746**       .1*       .3*
*Camp Zoe        *    403.01  *       .3*       .5*
*Camp Zoe        *    337.645**       .3*       .5*
*Camp Zoe        *    272.28* *       .3*       .5*
*Camp Zoe        *    225     *Bridge   *         *
*Camp Zoe        *    206.915**       .3*       .5*
*Camp Zoe        *    141.55  *       .3*       .5*
*******************************************************

******************************************************************************
**
```

ERRORS WARNINGS AND NOTES
Errors Warnings and Notes for Plan : existing

```
River: Sinking Creek  Reach: Camp Zoe     RS: 403.01     Profile: 100 yr
     Note:   Multiple critical depths were found at this location.  The
critical depth with the lowest, valid, energy was used.
River: Sinking Creek  Reach: Camp Zoe     RS: 337.645*     Profile: 100 yr
     Note:   Multiple critical depths were found at this location.  The
critical depth with the lowest, valid, energy was used.
River: Sinking Creek  Reach: Camp Zoe     RS: 272.28*     Profile: 100 yr
     Note:   Multiple critical depths were found at this location.  The
critical depth with the lowest, valid, water surface was
             used.
River: Sinking Creek  Reach: Camp Zoe     RS: 225     Profile: 100 yr
     Note:   Momentum answer is not valid if the water surface is above the
low chord or if there is weir flow.  The momentum
             answer has been disregarded.
     Note:   The downstream water surface is below the minimum elevation for
pressure flow.  The sluice gate equations were used
             for pressure flow.
River: Sinking Creek  Reach: Camp Zoe     RS: 225     Profile: 100 yr Upstream
     Note:   Multiple critical depths were found at this location.  The
critical depth with the lowest, valid, water surface was
             used.
River: Sinking Creek  Reach: Camp Zoe     RS: 225     Profile: 100 yr
Downstream
     Note:   Multiple critical depths were found at this location.  The
critical depth with the lowest, valid, water surface was
             used.
River: Sinking Creek  Reach: Camp Zoe     RS: 206.915*     Profile: 100 yr
     Note:   Multiple critical depths were found at this location.  The
critical depth with the lowest, valid, water surface was
             used.
River: Sinking Creek  Reach: Camp Zoe     RS: 141.55     Profile: 100 yr
     Note:   Multiple critical depths were found at this location.  The
critical depth with the lowest, valid, energy was used.
```

HEC-RAS Version 4.1.0 Jan 2010
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X     X  XXXXXX    XXXX        XXXX      XX      XXXX
X     X  X        X    X       X   X    X  X    X
X     X  X        X            X   X   X    X   X
XXXXXXX  XXXX     X       XXX  XXXX    XXXXXX    XXXX
X     X  X        X            X  X    X    X        X
X     X  X        X    X       X   X   X    X        X
X     X  XXXXXX    XXXX        X    X  X    X   XXXXX
```

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PROJECT DATA
Project Title: sinkingcreek
Project File : sinkingcreek.prj
Run Date and Time: 10/1/2014 5:41:50 AM

Project in English units

Project Description:
Sinking Creek Model.
Geometry Data merged from Aerial Topo and Ground Shots at
Cross Sections.
Flow Data from USGS Regression Equation (by MSH
06/16/14).
Modeled by JCZ 06/18/14.
Checked by RBL 07/02/14.
Revised by JCZ
07/03/14 with RBL comments.
Revised by JCZ 07/15/14 with MSH
comments.
Revised by JCZ 07/24/14 with proposed bridges, weirs, and scour
analysis.
Revised by JCZ 08/27/14 with RBL + WK comments.
Revised by JCZ
09/09/14 with add'l data + proposed berms near RS 6255.20
Revised by JCZ
09/12/14 with add'l weirs per SCI comments.
Revised by JCZ 09/19/14 with
refined cross sections at pedestrian bridge
Revised by JCZ 09/26/14 with
stacked boulders at base of proposed piers.

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PLAN DATA

Plan Title: proposed
Plan File : p:\Missouri OA-FMDC\0131554 - Camp Zoe\0131554.02 - Site
Design\Drainage\HEC-RAS\sinkingcreek.p03

Geometry Title: proposed
Geometry File : p:\Missouri OA-FMDC\0131554 - Camp Zoe\0131554.02 -
Site Design\Drainage\HEC-RAS\sinkingcreek.g03

Flow Title   : usgsknownws

Flow File : p:\Missouri OA-FMDC\0131554 - Camp Zoe\0131554.02 - Site Design\Drainage\HEC-RAS\sinkingcreek.f04

Plan Description:
Proposed conditions.
USGS Regression Flow Data.
Known WS DS Boundary
Condition from Current River Model.

Plan Summary Information:

Number of:	Cross Sections	= 57	Multiple Openings	=	0
	Culverts	= 0	Inline Structures	=	9
	Bridges	= 3	Lateral Structures	=	0

Computational Information
Water surface calculation tolerance = 0.01
Critical depth calculation tolerance = 0.01
Maximum number of iterations = 20
Maximum difference tolerance = 0.3
Flow tolerance factor = 0.001

Computation Options
Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

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FLOW DATA

Flow Title: usgsknownws
Flow File : p:\Missouri OA-FMDC\0131554 - Camp Zoe\0131554.02 - Site Design\Drainage\HEC-RAS\sinkingcreek.f04

Flow Data (cfs)

River	Reach	RS	10 yr	25 yr	50 yr	100 yr
Sinking Creek	Camp Zoe	9786.15	13581	18752	20758	23918

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Sinking Creek	Camp Zoe	10 yr		Known WS = 693.29
Sinking Creek	Camp Zoe	25 yr		Known WS = 696.14
Sinking Creek	Camp Zoe	50 yr		Known WS = 697.69
Sinking Creek	Camp Zoe	100 yr		Known WS = 699.42

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SUMMARY OF MANNING'S N VALUES

River:Sinking Creek

Reach	River Sta.	n1	n2	n3
Camp Zoe	9786.15	.157	.068	.157
Camp Zoe	9546.42*	.157	.068	.157
Camp Zoe	9306.70*	.157	.068	.157
Camp Zoe	9066.98*	.157	.068	.157
Camp Zoe	8827.26*	.157	.068	.157
Camp Zoe	8587.54	.157	.068	.157
Camp Zoe	8446.66*	.157	.068	.157
Camp Zoe	8305.78*	.157	.068	.157
Camp Zoe	8164.91*	.157	.068	.157
Camp Zoe	8024.03*	.157	.068	.157
Camp Zoe	7900	Inl Struct		
Camp Zoe	7883.16*	.157	.068	.157
Camp Zoe	7780	Inl Struct		
Camp Zoe	7742.28*	.157	.068	.157
Camp Zoe	7658	Bridge		
Camp Zoe	7601.41	.157	.068	.157
Camp Zoe	7481.37*	.157	.068	.157
Camp Zoe	7420	Inl Struct		
Camp Zoe	7361.34*	.157	.068	.157
Camp Zoe	7300	Inl Struct		
Camp Zoe	7241.31*	.157	.068	.157
Camp Zoe	7180	Inl Struct		
Camp Zoe	7121.28*	.157	.068	.157
Camp Zoe	7001.25	.157	.068	.157
Camp Zoe	6752.56*	.157	.068	.157
Camp Zoe	6503.88*	.157	.068	.157
Camp Zoe	6255.20*	.157	.068	.157
Camp Zoe	6006.52*	.157	.068	.157
Camp Zoe	5757.84	.157	.068	.157
Camp Zoe	5555.31*	.157	.068	.157
Camp Zoe	5352.78*	.157	.068	.157
Camp Zoe	5150.26	.157	.068	.157
Camp Zoe	5005.25*	.157	.068	.157
Camp Zoe	4860.25*	.157	.068	.157
Camp Zoe	4715.25*	.157	.068	.157
Camp Zoe	4570.24*	.157	.068	.157
Camp Zoe	4425.24*	.157	.068	.157
Camp Zoe	4300	Inl Struct		
Camp Zoe	4280.24*	.157	.068	.157
Camp Zoe	4150	Inl Struct		
Camp Zoe	4135.24	.157	.068	.157
Camp Zoe	4027	Bridge		
Camp Zoe	3997.89*	.157	.068	.157
Camp Zoe	3900	Inl Struct		
Camp Zoe	3860.55*	.157	.068	.157
Camp Zoe	3775	Inl Struct		
Camp Zoe	3723.21*	.157	.068	.157
Camp Zoe	3585.86*	.157	.068	.157
Camp Zoe	3448.52*	.157	.068	.157
Camp Zoe	3311.18*	.157	.068	.157
Camp Zoe	3173.84	.157	.068	.157
Camp Zoe	2954.70*	.157	.068	.157
Camp Zoe	2735.56*	.157	.068	.157
Camp Zoe	2516.43*	.157	.068	.157
Camp Zoe	2297.29*	.157	.068	.157
Camp Zoe	2078.16	.157	.068	.157
Camp Zoe	1863.57*	.157	.068	.157

*Camp Zoe	*	1648.98*	* .157*	.068*	.157*
*Camp Zoe	*	1434.39*	* .157*	.068*	.157*
*Camp Zoe	*	1219.80*	* .157*	.068*	.157*
*Camp Zoe	*	1005.22	* .157*	.068*	.157*
*Camp Zoe	*	804.483*	* .157*	.068*	.157*
*Camp Zoe	*	603.746*	* .157*	.068*	.157*
*Camp Zoe	*	403.01	* .157*	.068*	.157*
*Camp Zoe	*	337.645*	* .157*	.068*	.157*
*Camp Zoe	*	272.28*	* .157*	.068*	.157*
*Camp Zoe	*	225	*Bridge *	*	*
*Camp Zoe	*	206.915*	* .157*	.068*	.157*
*Camp Zoe	*	141.55	* .157*	.068*	.157*

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SUMMARY OF REACH LENGTHS

River: Sinking Creek

* Reach	* River Sta.	* Left *	Channel *	Right *
*Camp Zoe	* 9786.15	* 251.62*	239.72*	181.03*
*Camp Zoe	* 9546.42*	* 251.62*	239.72*	181.03*
*Camp Zoe	* 9306.70*	* 251.62*	239.72*	181.03*
*Camp Zoe	* 9066.98*	* 251.62*	239.72*	181.03*
*Camp Zoe	* 8827.26*	* 251.62*	239.72*	181.03*
*Camp Zoe	* 8587.54	* 166.12*	140.88*	85.01*
*Camp Zoe	* 8446.66*	* 166.12*	140.88*	85.01*
*Camp Zoe	* 8305.78*	* 166.12*	140.88*	85.01*
*Camp Zoe	* 8164.91*	* 166.12*	140.88*	85.01*
*Camp Zoe	* 8024.03*	* 166.12*	140.88*	85.01*
*Camp Zoe	* 7900	*Inl Struct*	*	*
*Camp Zoe	* 7883.16*	* 166.12*	140.88*	85.01*
*Camp Zoe	* 7780	*Inl Struct*	*	*
*Camp Zoe	* 7742.28*	* 166.12*	140.88*	85.01*
*Camp Zoe	* 7658	*Bridge *	*	*
*Camp Zoe	* 7601.41	* 89.37*	120.03*	124.77*
*Camp Zoe	* 7481.37*	* 89.37*	120.03*	124.77*
*Camp Zoe	* 7420	*Inl Struct*	*	*
*Camp Zoe	* 7361.34*	* 89.37*	120.03*	124.77*
*Camp Zoe	* 7300	*Inl Struct*	*	*
*Camp Zoe	* 7241.31*	* 89.37*	120.03*	124.77*
*Camp Zoe	* 7180	*Inl Struct*	*	*
*Camp Zoe	* 7121.28*	* 89.37*	120.03*	124.77*
*Camp Zoe	* 7001.25	* 130.65*	248.68*	264.77*
*Camp Zoe	* 6752.56*	* 130.65*	248.68*	264.77*
*Camp Zoe	* 6503.88*	* 130.65*	248.68*	264.77*
*Camp Zoe	* 6255.20*	* 130.65*	248.68*	264.77*
*Camp Zoe	* 6006.52*	* 130.65*	248.68*	264.77*
*Camp Zoe	* 5757.84	* 202.53*	202.53*	202.53*
*Camp Zoe	* 5555.31*	* 202.53*	202.53*	202.53*
*Camp Zoe	* 5352.78*	* 202.53*	202.53*	202.53*
*Camp Zoe	* 5150.26	* 97.94*	145*	150.07*
*Camp Zoe	* 5005.25*	* 97.94*	145*	150.07*
*Camp Zoe	* 4860.25*	* 97.94*	145*	150.07*
*Camp Zoe	* 4715.25*	* 97.94*	145*	150.07*
*Camp Zoe	* 4570.24*	* 97.94*	145*	150.07*
*Camp Zoe	* 4425.24*	* 97.94*	145*	150.07*
*Camp Zoe	* 4300	*Inl Struct*	*	*
*Camp Zoe	* 4280.24*	* 97.94*	145*	150.07*
*Camp Zoe	* 4150	*Inl Struct*	*	*
*Camp Zoe	* 4135.24	* 132.47*	137.34*	143.02*
*Camp Zoe	* 4027	*Bridge *	*	*
*Camp Zoe	* 3997.89*	* 132.47*	137.34*	143.02*

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*Camp Zoe        *     3900        *Inl Struct*          *         *
*Camp Zoe        *     3860.55*    *   132.47*   137.34*   143.02*
*Camp Zoe        *     3775        *Inl Struct*          *         *
*Camp Zoe        *     3723.21*    *   132.47*   137.34*   143.02*
*Camp Zoe        *     3585.86*    *   132.47*   137.34*   143.02*
*Camp Zoe        *     3448.52*    *   132.47*   137.34*   143.02*
*Camp Zoe        *     3311.18*    *   132.47*   137.34*   143.02*
*Camp Zoe        *     3173.84     *    245.7*   219.14*    69.67*
*Camp Zoe        *     2954.70*    *    245.7*   219.14*    69.67*
*Camp Zoe        *     2735.56*    *    245.7*   219.14*    69.67*
*Camp Zoe        *     2516.43*    *    245.7*   219.14*    69.67*
*Camp Zoe        *     2297.29*    *    245.7*   219.14*    69.67*
*Camp Zoe        *     2078.16     *   216.52*   214.59*   179.34*
*Camp Zoe        *     1863.57*    *   216.52*   214.59*   179.34*
*Camp Zoe        *     1648.98*    *   216.52*   214.59*   179.34*
*Camp Zoe        *     1434.39*    *   216.52*   214.59*   179.34*
*Camp Zoe        *     1219.80*    *   216.52*   214.59*   179.34*
*Camp Zoe        *     1005.22     *   184.15*   200.74*   222.35*
*Camp Zoe        *     804.483*    *   184.15*   200.74*   222.35*
*Camp Zoe        *     603.746*    *   184.15*   200.74*   222.35*
*Camp Zoe        *     403.01      *    77.96*    65.36*    28.71*
*Camp Zoe        *     337.645*    *    77.96*    65.36*    28.71*
*Camp Zoe        *     272.28*     *    77.96*    65.36*    28.71*
*Camp Zoe        *     225         *Bridge   *          *         *
*Camp Zoe        *     206.915*    *    77.96*    65.36*    28.71*
*Camp Zoe        *     141.55      *         *          *         *
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SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Sinking Creek

*******************************************************
*     Reach      *   River Sta.   * Contr.  * Expan.  *
*******************************************************
*Camp Zoe        *     9786.15 *        .1*        .3*
*Camp Zoe        *     9546.42**        .1*        .3*
*Camp Zoe        *     9306.70**        .1*        .3*
*Camp Zoe        *     9066.98**        .1*        .3*
*Camp Zoe        *     8827.26**        .1*        .3*
*Camp Zoe        *     8587.54 *        .1*        .3*
*Camp Zoe        *     8446.66**        .1*        .3*
*Camp Zoe        *     8305.78**        .1*        .3*
*Camp Zoe        *     8164.91**        .1*        .3*
*Camp Zoe        *     8024.03**        .1*        .3*
*Camp Zoe        *     7900    *Inl Struct*          *
*Camp Zoe        *     7883.16**        .3*        .5*
*Camp Zoe        *     7780    *Inl Struct*          *
*Camp Zoe        *     7742.28**        .3*        .5*
*Camp Zoe        *     7658    *Bridge   *          *
*Camp Zoe        *     7601.41 *        .3*        .5*
*Camp Zoe        *     7481.37**        .3*        .5*
*Camp Zoe        *     7420    *Inl Struct*          *
*Camp Zoe        *     7361.34**        .3*        .5*
*Camp Zoe        *     7300    *Inl Struct*          *
*Camp Zoe        *     7241.31**        .3*        .5*
*Camp Zoe        *     7180    *Inl Struct*          *
*Camp Zoe        *     7121.28**        .1*        .3*
*Camp Zoe        *     7001.25 *        .1*        .3*
*Camp Zoe        *     6752.56**        .1*        .3*
*Camp Zoe        *     6503.88**        .1*        .3*
*Camp Zoe        *     6255.20**        .1*        .3*
*Camp Zoe        *     6006.52**        .1*        .3*
*Camp Zoe        *     5757.84 *        .1*        .3*
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*Camp Zoe        *    5555.31**       .1*       .3*
*Camp Zoe        *    5352.78**       .1*       .3*
*Camp Zoe        *    5150.26 *       .1*       .3*
*Camp Zoe        *    5005.25**       .1*       .3*
*Camp Zoe        *    4860.25**       .1*       .3*
*Camp Zoe        *    4715.25**       .1*       .3*
*Camp Zoe        *    4570.24**       .1*       .3*
*Camp Zoe        *    4425.24**       .1*       .3*
*Camp Zoe        *    4300    *Inl Struct*        *
*Camp Zoe        *    4280.24**       .1*       .3*
*Camp Zoe        *    4150    *Inl Struct*        *
*Camp Zoe        *    4135.24 *       .3*       .5*
*Camp Zoe        *    4027    *Bridge   *         *
*Camp Zoe        *    3997.89**       .3*       .5*
*Camp Zoe        *    3900    *Inl Struct*        *
*Camp Zoe        *    3860.55**       .3*       .5*
*Camp Zoe        *    3775    *Inl Struct*        *
*Camp Zoe        *    3723.21**       .1*       .3*
*Camp Zoe        *    3585.86**       .1*       .3*
*Camp Zoe        *    3448.52**       .1*       .3*
*Camp Zoe        *    3311.18**       .1*       .3*
*Camp Zoe        *    3173.84 *       .1*       .3*
*Camp Zoe        *    2954.70**       .1*       .3*
*Camp Zoe        *    2735.56**       .1*       .3*
*Camp Zoe        *    2516.43**       .1*       .3*
*Camp Zoe        *    2297.29**       .1*       .3*
*Camp Zoe        *    2078.16 *       .1*       .3*
*Camp Zoe        *    1863.57**       .1*       .3*
*Camp Zoe        *    1648.98**       .1*       .3*
*Camp Zoe        *    1434.39**       .1*       .3*
*Camp Zoe        *    1219.80**       .1*       .3*
*Camp Zoe        *    1005.22 *       .1*       .3*
*Camp Zoe        *    804.483**       .1*       .3*
*Camp Zoe        *    603.746**       .1*       .3*
*Camp Zoe        *    403.01  *       .3*       .5*
*Camp Zoe        *    337.645**       .3*       .5*
*Camp Zoe        *    272.28* *       .3*       .5*
*Camp Zoe        *    225     *Bridge   *         *
*Camp Zoe        *    206.915**       .3*       .5*
*Camp Zoe        *    141.55  *       .3*       .5*
*******************************************************

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ERRORS WARNINGS AND NOTES
Errors Warnings and Notes for Plan : proposed

```
River: Sinking Creek  Reach: Camp Zoe     RS: 7883.16*     Profile: 100 yr
     Note:   Multiple critical depths were found at this location.  The
critical depth with the lowest, valid, energy was used.
River: Sinking Creek  Reach: Camp Zoe     RS: 7780     Profile: 100 yr
     Note:   Multiple critical depths were found at this location.  The
critical depth with the lowest, valid, energy was used.
River: Sinking Creek  Reach: Camp Zoe     RS: 7742.28*     Profile: 100 yr
     Note:   Multiple critical depths were found at this location.  The
critical depth with the lowest, valid, water surface was
             used.
River: Sinking Creek  Reach: Camp Zoe     RS: 7658     Profile: 100 yr
Upstream
     Note:   Multiple critical depths were found at this location.  The
critical depth with the lowest, valid, water surface was
             used.
River: Sinking Creek  Reach: Camp Zoe     RS: 7658     Profile: 100 yr
Downstream
     Note:   Multiple critical depths were found at this location.  The
```

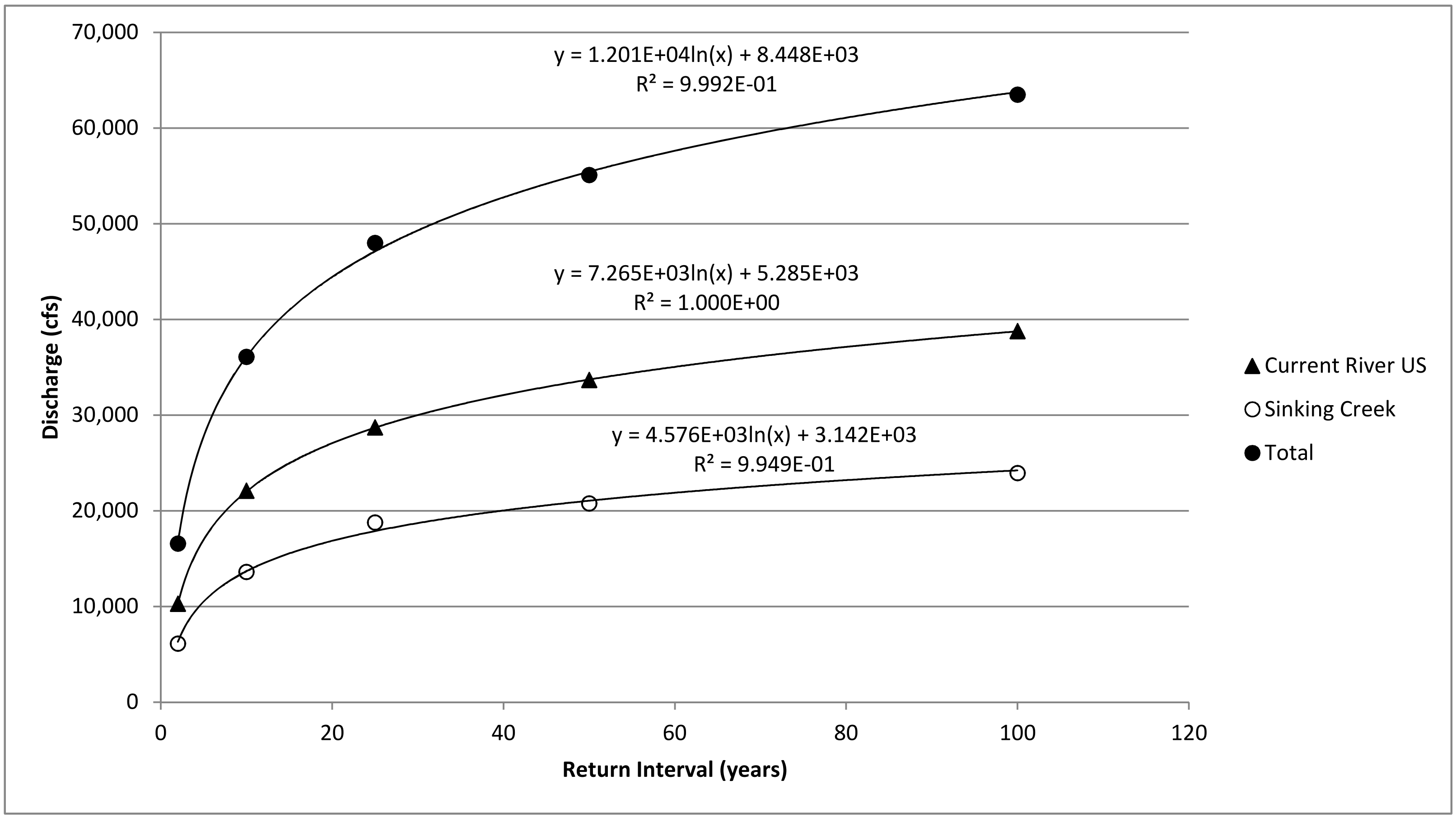
critical depth with the lowest, valid, water surface was
used.
River: Sinking Creek Reach: Camp Zoe RS: 7601.41 Profile: 100 yr
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was
used.
River: Sinking Creek Reach: Camp Zoe RS: 7481.37* Profile: 100 yr
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
River: Sinking Creek Reach: Camp Zoe RS: 7420 Profile: 100 yr
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
River: Sinking Creek Reach: Camp Zoe RS: 7241.31* Profile: 100 yr
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
River: Sinking Creek Reach: Camp Zoe RS: 7180 Profile: 100 yr
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
River: Sinking Creek Reach: Camp Zoe RS: 4135.24 Profile: 100 yr
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was
used.
River: Sinking Creek Reach: Camp Zoe RS: 4027 Profile: 100 yr
Upstream
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was
used.
River: Sinking Creek Reach: Camp Zoe RS: 4027 Profile: 100 yr
Downstream
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was
used.
River: Sinking Creek Reach: Camp Zoe RS: 3860.55* Profile: 100 yr
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
River: Sinking Creek Reach: Camp Zoe RS: 3775 Profile: 100 yr
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
River: Sinking Creek Reach: Camp Zoe RS: 403.01 Profile: 100 yr
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
River: Sinking Creek Reach: Camp Zoe RS: 337.645* Profile: 100 yr
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.
River: Sinking Creek Reach: Camp Zoe RS: 272.28* Profile: 100 yr
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was
used.
River: Sinking Creek Reach: Camp Zoe RS: 225 Profile: 100 yr
Note: Momentum answer is not valid if the water surface is above the low chord or if there is weir flow. The momentum
answer has been disregarded.
Note: The downstream water surface is below the minimum elevation for pressure flow. The sluice gate equations were used
for pressure flow.
River: Sinking Creek Reach: Camp Zoe RS: 225 Profile: 100 yr Upstream
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was
used.
River: Sinking Creek Reach: Camp Zoe RS: 225 Profile: 100 yr
Downstream
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was
used.
River: Sinking Creek Reach: Camp Zoe RS: 206.915* Profile: 100 yr
Note: Multiple critical depths were found at this location. The

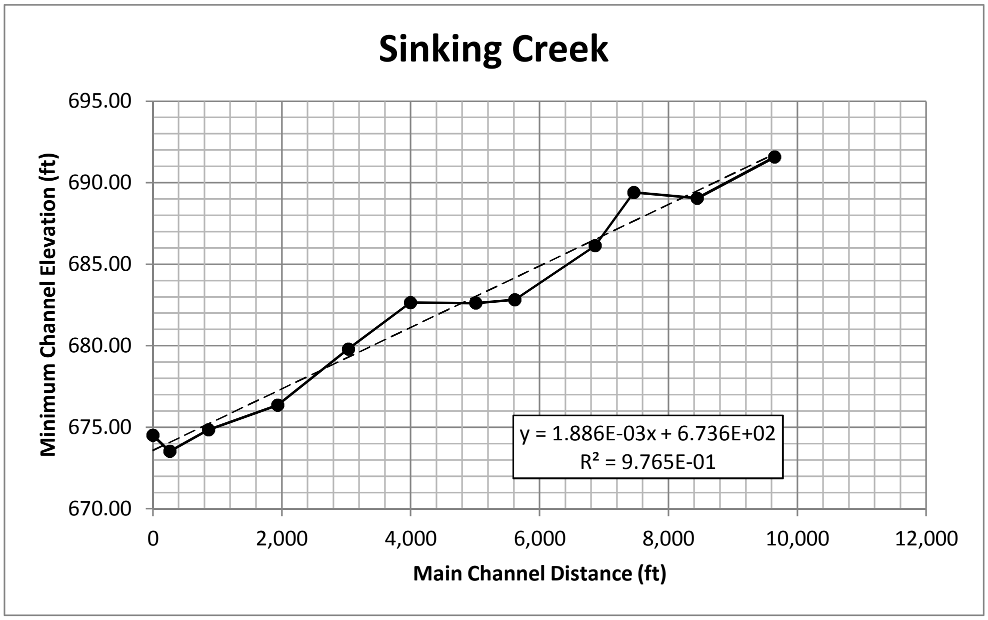
critical depth with the lowest, valid, water surface was
used.
River: Sinking Creek Reach: Camp Zoe   RS: 141.55   Profile: 100 yr
Note: Multiple critical depths were found at this location. The
critical depth with the lowest, valid, energy was used.

Flow Data

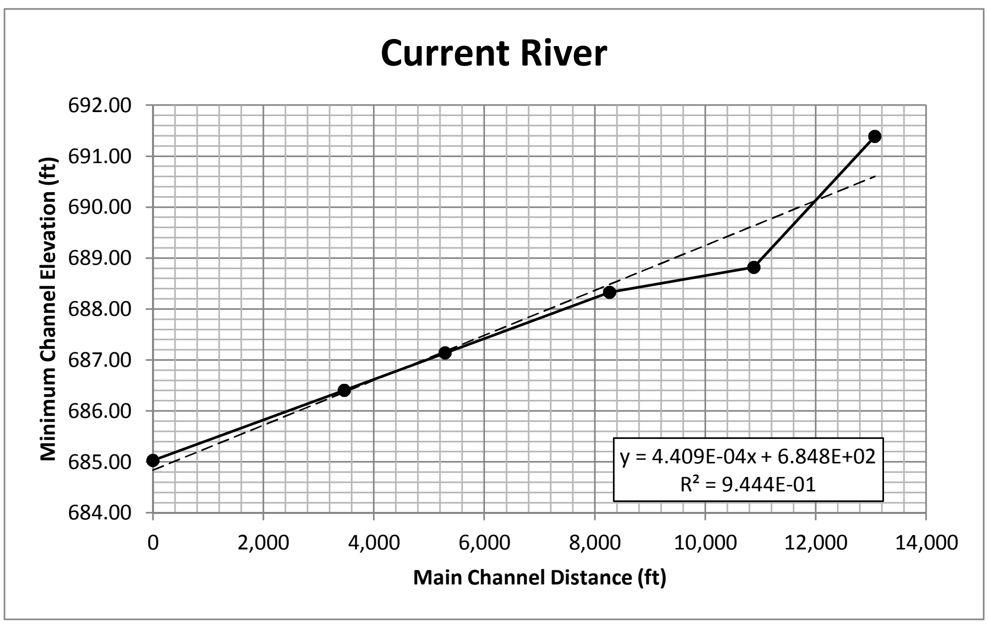
USGS Regression Results (from MSH)						
Flood Interval	2	10	25	50	100	
Current River US	10,276	22,097	28,690	33,643	38,748	US end of Current
Sinking Creek	6,108	13,581	18,752	20,758	23,918	US end of Sinking
Current River DS	161	383	540	673	823	
Total	16,545	36,061	47,982	55,074	63,489	convergence, Current

Extrapolated		
Flood Interval	200	500
Current River US	43,777	50,434
Sinking Creek	27,387	31,580
Current River DS	916	1,071
Total	72,081	83,085





SINKING CREEK	
Main Channel Distance	Minimum Channel Elevation
(ft)	(ft)
0.00	674.51
261.46	673.53
863.67	674.86
1936.61	676.37
3032.29	679.81
3993.69	682.65
5008.71	682.62
5616.29	682.83
6859.70	686.14
7459.86	689.41
8445.99	689.06
9644.60	691.58



CURRENT RIVER	
Main Channel Distance	Minimum Channel Elevation
(ft)	(ft)
0.00	685.03
3464.73	686.41
5289.94	687.14
8266.21	688.33
10876.05	688.82
13069.17	691.39

SINKING CREEK

Channel Roughness

nb	0.028		"Coarse Sand" to "Gravel"
n1	0.006		Moderate Irregularity due to bed roughness
n2	0.010		Occasionally alternating sections, main flow shifts
n3	0.005		Minor obstructions in the channel
n4	0.010		Medium amount of vegetation in the channel

Lm	9786.2	ft	Meandering length of reach
Ls	6346.5	ft	Straight length of reach
Lm/Ls	1.5		Meandering ratio
m	1.15		Meandering factor

n	0.068	Channel Roughness Coefficient

Floodplain Roughness

nb	0.035	"Gravel" to "Cobble"
n1	0.012	Severe irregularity
n2	0.000	N/A
n3	0.010	Minor obstructions
n4	0.100	Very large amount of vegetation in the floodplain

m	1.000	N/A

n	0.157	Floodplain Roughness Coefficient

CURRENT RIVER

Channel Roughness

nb	0.028		"Coarse Sand" to "Gravel"
n1	0.004		Minor Irregularity due to bed roughness
n2	0.002		Occasionally alternating sections
n3	0.003		Negligible obstructions in the channel
n4	0.010		Medium amount of vegetation in the channel

Lm	13069.2	ft	Meandering length of reach
Ls	11126.7	ft	Straight length of reach
Lm/Ls	1.2		Meandering ratio
m	1		Meandering factor

n	0.047	Channel Roughness Coefficient

Floodplain Roughness

nb	0.035	"Gravel" to "Cobble"
n1	0.012	Severe irregularity
n2	0.000	N/A
n3	0.010	Minor obstructions
n4	0.100	Very large amount of vegetation in the floodplain

m	1.000	N/A

n	0.157	Floodplain Roughness Coefficient

Known WS from Current River Model
Use depth of high water in Sinking Creek Model

CURRENT RIVER					**SINKING CREEK**			
River Station	Flood (year)	Min. Grd Elev.	WS Elev	Depth to Thalweg	River Station	Flood (year)	Min. Grd Elev.	WS Elev
22418.21	2	687.14	700.11	12.97	141.55	2	674.51	687.48
22418.21	10	687.14	705.92	18.78	141.55	10	674.51	693.29
22418.21	25	687.14	708.77	21.63	141.55	25	674.51	696.14
22418.21	50	687.14	710.32	23.18	141.55	50	674.51	697.69
22418.21	100	687.14	712.05	24.91	141.55	100	674.51	699.42
22418.21	200	687.14	713.72	26.58	141.55	200	674.51	701.09
22418.21	500	687.14	715.72	28.58	141.55	500	674.51	703.09

By inspection, Known DS WS boundary condition controls over Normal Depth for Sinking Creek

SINKING CREEK

Total Reach Length				Divided Reach Length			
River Station	DS L Bank Distance	DS Thlwg Distance	DS R Bank Distance	Number Interp. XS	DS L Bank Distance	DS Thlwg Distance	DS R Bank Distance
9786.15	1258.12	1198.61	905.13	4	251.62	239.72	181.03
8587.54	1162.84	986.13	595.07	6	166.12	140.88	85.01
7601.41	446.85	600.16	623.84	4	89.37	120.03	124.77
7001.25	653.24	1243.41	1323.83	4	130.65	248.68	264.77
5757.84	607.58	607.58	607.58	2	202.53	202.53	202.53
5150.26	685.59	1015.02	1050.5	6	97.94	145.00	150.07
4135.24	927.32	961.4	1001.13	6	132.47	137.34	143.02
3173.84	1228.52	1095.68	348.36	4	245.70	219.14	69.67
2078.16	1082.62	1072.94	896.68	4	216.52	214.59	179.34
1005.22	552.45	602.21	667.06	2	184.15	200.74	222.35
403.01	311.84	261.46	114.85	3	77.96	65.37	28.71
141.55							

CURRENT RIVER

Total Reach Length				Divided Reach Length			
River Station	DS L Bank Distance	DS Thlwg Distance	DS R Bank Distance	Number Interp. XS	DS L Bank Distance	DS Thlwg Distance	DS R Bank Distance
30197.44	2467.98	2193.12	1997.08	4	493.60	438.62	399.42
28004.32	2748.73	2609.84	2501.13	5	458.12	434.97	416.86
25394.48	3002.83	2976.27	2970.77	2	1000.94	992.09	990.26
22418.21	1825.21	1825.21	1825.21	1	912.61	912.61	912.61
20593.00	3213.28	3464.73	3759.2	3	803.32	866.18	939.80
17128.27							

SINKING CREEK

1.5	Contraction Ratio
1.8	Expansion Ratio
0.001886	Average Thalweg Slope

Existing Conditions, Hwy 19 over Sinking Creek

River Station	Thalweg Station	Struct Ctr Station	Eff. Flow Width	LT Ineff. Station	LT Weir Elevation	RT Ineff. Station	RT Weir Elevation	
1005.22	500.00	423.36	1306.09	-229.69	701.45	1076.41	701.45	
804.48	501.78	425.14	1038.44	-94.08	701.07	944.36	701.07	
603.75	503.56	426.92	770.79	41.52	700.69	812.32	700.69	
403.01	505.34	428.70	503.15	177.13	700.32	680.27	700.32	
337.65	458.58	381.94	415.99	173.94	700.19	589.94	700.19	
272.28	411.82	335.18	328.84	170.76	700.07	499.60	700.07	
235.50	411.82	335.18	279.80	195.28	700.00	475.08	700.00	Bridge US
214.50	365.06	299.24	279.80	159.34	700.00	439.14	700.00	Bridge DS
206.92	365.06	299.24	288.23	155.12	699.95	443.35	699.95	
141.55	318.29	252.47	360.86	72.04	699.82	432.90	699.82	DS Limit

= no ineffective areas in the cross section

SINKING CREEK (cont.)

Proposed Conditions, Vehicular Bridge over Sinking Creek

River Station	Thalweg Station	Struct Ctr Station	Eff. Flow Width	LT Ineff. Station	LT Weir Elevation	RT Ineff. Station	RT Weir Elevation	
8024.03	500.00	575.00	911.37	119.31	714.36	1030.69	714.89	
7883.16	500.00	575.00	723.55	213.23	714.10	936.77	714.63	
7742.28	500.00	575.00	535.71	307.15	713.83	842.85	714.36	
7678.00	500.00	575.00	450.00	350.00	713.71	800.00	714.24	Bridge US
7638.00	500.00	575.00	450.00	350.00	713.71	800.00	714.24	Bridge DS
7601.41	500.00	575.00	490.66	329.67	713.64	820.33	714.17	
7481.37	500.00	575.00	624.03	262.98	713.41	887.02	713.94	
7361.34	500.00	575.00	757.40	196.30	713.19	953.70	713.72	
7241.31	500.00	575.00	890.77	129.62	712.96	1020.38	713.49	
7121.28	500.00	575.00	1024.13	62.93	712.74	1087.07	713.27	

= no ineffective areas in the cross section

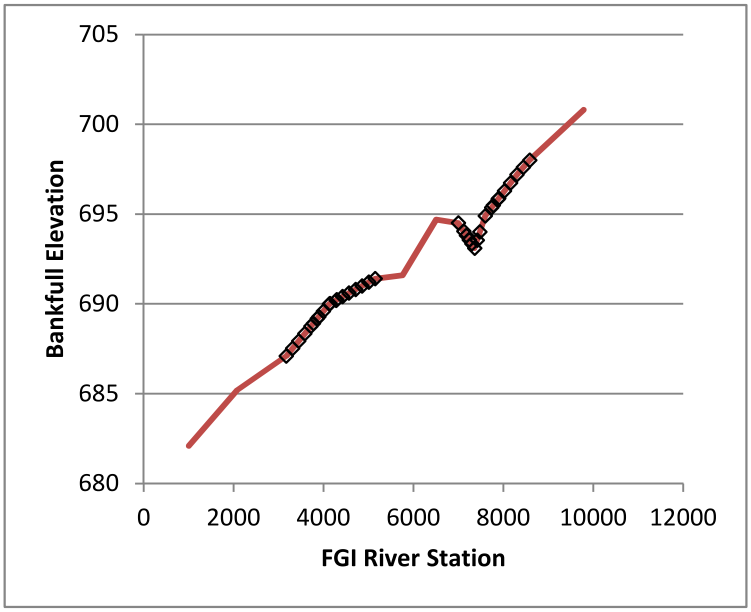
Proposed Conditions, Pedestrian Bridge over Sinking Creek

River Station	Thalweg Station	Struct Ctr Station	Eff. Flow Width	LT Ineff. Station	LT Weir Elevation	RT Ineff. Station	RT Weir Elevation	
4280.24	500.00	355.00	719.75	-4.88	707.47	714.88	710.47	
4135.24	500.00	355.00	526.42	91.79	707.19	618.21	710.19	
4033.00	500.00	370.50	390.10	175.45	707.00	565.55	710.00	Bridge US
4021.00	500.00	370.50	390.10	175.45	707.00	565.55	710.00	Bridge DS
3997.89	500.00	400.00	415.78	192.11	706.96	607.89	709.96	
3860.55	500.00	400.00	568.38	115.81	706.70	684.19	709.70	
3723.21	500.00	400.00	720.98	39.51	706.44	760.49	709.44	

= no ineffective areas in the cross section

Bankfull Flow

SCI XS	FGI RS	BF Elev
15	9786.15	700.8
14	8587.54	698
13	8305.78	697.2
12	7601.41	694.9
11	7361.34	693.1
10	7001.25	694.5
9	6503.88	694.7
8	5757.84	691.6
7	5150.26	691.4
6	4135.24	690
5	3173.84	687.1
4	2078.16	685.2
3	1005.22	682.1
2	403.01	
1	141.55	



Vehicular Bridge Weirs

RS	BF Elev	Bank
8587.54	698.00	
8446.66	697.60	
8305.78	697.20	
8164.91	696.74	
8024.03	696.28	
7900	**695.87**	**RT**
7883.16	695.82	
7780	**695.48**	**RT**
7742.28	695.36	
7601.41	694.90	
7481.37	694.00	
7420	**693.54**	**LT**
7361.34	693.10	
7300	**693.34**	**LT**
7241.31	693.57	
7180	**693.81**	**LT**
7121.28	694.03	
7001.25	694.50	

Pedestrian Bridge Weirs

RS	BF Elev	Bank
5150.26	691.40	
5005.25	691.20	
4860.25	691.00	
4715.25	690.80	
4570.24	690.60	
4425.24	690.40	
4300	**690.23**	**LT**
4280.24	690.20	
4150	**690.02**	**LT**
4135.24	690.00	
3997.89	689.59	
3900	**689.29**	**LT**
3860.55	689.17	
3775	**688.91**	**LT**
3723.21	688.76	
3585.86	688.34	
3448.52	687.93	
3311.18	687.51	
3173.84	687.10	

APPENDIX E

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Rolla, Missouri 65401
573-426-4901 Fax 573-426-4853
www.sciengineering.com

Noise Analysis Technical Report

X1414-04 CAMP ZOE
SHANNON COUNTY, MISSOURI

October 27, 2014

Prepared for:

FARNSWORTH GROUP, INC.;
MISSOURI OA/FMDC; AND
MISSOURI DNR/DIVISION OF PARKS

SCI No. 2014-7007.23

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Noise Analysis Technical Report

X1414-04 CAMP ZOE
SHANNON COUNTY, MISSOURI

1.0 INTRODUCTION

This traffic noise study has been conducted to evaluate traffic noise for an access road to a new 407-acre state park. The project includes upgrade and relocation of approximately 13,300 feet of existing county access roads, with one primary entrance off State Route 19, a vehicular bridge over Sinking Creek, and a secondary emergency access to State Route 19 in Shannon County, Missouri. The noise study area is illustrated in the Vicinity and Topographic Map, Figure 1, and an Aerial Photograph, Figure 2.

The study will evaluate existing and future traffic noise conditions and, if appropriate, potential noise abatement measures. The existing land use adjacent to the road is primarily park property.

Section 2 summarizes the federal and state noise regulations. This report contains a discussion of noise sensitive receptors (Section 3), a description of the noise analysis methodology (Section 4), the analysis of the existing and future noise levels (Section 5), construction noise (Section 6), and the noise analysis conclusion (Section 7).

2.0 NOISE BACKGROUND AND REGULATIONS

2.1 Noise Background

Sound is caused by the vibration of air molecules, and is measured on a logarithmic scale using units of decibels (dB). Sound is composed of a wide range of frequencies; however, the human ear is not uniformly sensitive to all frequencies. Therefore, the "A" weighted scale was devised to correspond with the ear's sensitivity. The A-weighting generally weights more heavily noise levels in the humanly audible range and screens out noise levels that cannot be heard but are still generated, such as a high frequency dog whistle. The A-weighted unit is used because:

1. It is easily measured,
2. It approximates the human ear's sensitivity to sounds of different frequencies,
3. It matches attitudinal surveys of noise annoyance better than other noise measurements, and
4. Has been adopted as the basic unit of environmental noise by many agencies around the world in dealing with community noise issues.

The equivalent sound level is the steady-state, A-weighted sound level, which contains the same amount of acoustic energy as the actual time-varying, A-weighted sound level over a specified period of time. If the time period is 1 hour, the descriptor is the hourly equivalent sound level or L_{eq}(h), which is widely used by state highway agencies as a descriptor of traffic noise. It is generally the equivalent level of sound [in decibels or dB(A)] which represents the level of sound, held constant over a specified period of time, which reflects the same amount of energy as the actual fluctuating noise over that time period. L_{eq} is based on the energy average, not a noise level average.

2.2 Federal Regulations

Traffic noise analyses are required for all projects considered a Type I project. The Federal Highway Administration (FHWA) regulations (23 CFR Part 772) define Type I projects as follows:

- The construction of a highway on new location; or,
- The physical alteration of an existing highway where there is either:
  a. *Substantial Horizontal Alteration*. A project that halves the distance between the traffic noise source and the closest receptor between the existing condition to the future build condition; or,
  b. *Substantial Vertical Alteration*. A project that removes shielding therefore, exposing the line-of-sight between the receptor and the traffic noise source. This is done by either altering the vertical alignment of the highway or by altering the topography between the highway traffic noise source and the receptor; or,
- The addition of a through-traffic lane(s). This includes the addition of a through-traffic lane that functions as an high-occupancy vehicle (HOV) lane, high-occupancy toll (HOT) lane, bus lane, or truck climbing lane; or,
- The addition of an auxiliary lane, except for when the auxiliary lane is a turn lane; or,
- The addition or relocation of interchange lanes or ramps added to a quadrant to complete an existing partial interchange; or,
- Restriping existing pavement for the purpose of adding a through-traffic lane or an auxiliary lane; or,
- The addition of a new or substantial alteration of a weigh station, rest stop, ride-share lot or toll plaza.

The proposed improvements are characterized as a Type I noise project, as it includes the upgrade and relocation of existing county roads.

The FHWA established noise abatement criteria to determine where noise abatement should be evaluated. Five separate noise abatement criteria (NAC) based upon land use are used by the FHWA to assess potential noise impacts. A traffic noise impact occurs when noise levels approach or exceed the NAC listed in Table 1.[1] In determining the applicable noise activity category for the study area, existing land use was reviewed. The applicable NAC for park property noise receptors evaluated is 67 dB(A).

Table 1 - Noise Abatement Criteria - Hourly Weighted Sound Level

Activity Category	L_{eq}(h)	Evaluation Location	Activity Description
A	57	Exterior	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67	Exterior	Residential.
C	67	Exterior	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails and trail crossings.
D	52	Interior	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios.
E	72	Exterior	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A-D or F.
F	---	---	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing.
G	---	---	Undeveloped lands that are not permitted.

2.3 Missouri Department of Transportation (MoDOT) Policy

Based on the FHWA regulations, State Highway Authorities are allowed to establish the noise level determined to approach the NAC and the increase in noise levels determined to be a substantial increase. The MoDOT defines noise impacts as follows:

- Design-year traffic noise levels approach, meet or exceed the NAC, with approach defined as 66 dB(A) for Category B and C NAC of 67 dB(A) and 71 dB(A) for Category D NAC of 72 dB(A).
- Design-year traffic noise levels are a substantial increase over existing traffic generated noise levels, defined as an increase greater than 15 dB(A).

[1] Based on 23 Code of Federal Regulations Part 772, Procedures for Abatement of Highway Traffic Noise and Construction Noise. (adopted 2010).

3.0 NOISE RECEPTOR SELECTION

The land use within the area is park land (Activity Category C). Only areas with exterior use are considered receptors. Based on the land use along the project corridor, receptor locations were selected to represent the land use with established NAC. For this project, this includes 10 receptor locations.

The enclosed Table 2 lists the receptor locations, activity category, the nearest roadway, and the approximate distance to the nearest roadway's existing centerline of the receptor locations. Ten receptor locations were chosen for analysis. Figure 3, Noise Receptor Location Map, depicts an aerial photograph of the study area with these receptor locations. Receptor locations are between 25 feet and 350 feet from the nearest roadway existing centerline.

4.0 NOISE ANALYSIS METHODOLOGY

Modeling of the traffic noise levels at the 10 receptor locations within the project limits was conducted utilizing the FHWA approved Traffic Noise Model (TNM). Prediction of noise levels is one step in assessing potential noise impacts and abatement strategies. Traffic noise levels for the receptor sites were predicted using future year (2034) traffic volumes.

Inputs into TNM include traffic volume, traffic mix (cars, heavy trucks, and medium trucks), receptor distance, elevation, and average speeds during free flowing conditions. Information sources used in the analysis are briefly described in the following subsections. TNM inputs are enclosed as Appendix A.

4.1 Traffic Volumes

A traffic figure prepared by Farnsworth Group, Inc. was used to develop the traffic volume input. This document included peak hour traffic volumes for the years 2012 and 2034 for all roadways within the project limits. The traffic data is enclosed as Appendix B.

4.2 Traffic Composition

Two types of vehicles: cars and medium trucks (to represent recreational vehicles) were input into TNM. The traffic mix percentage was estimated as 95 percent cars and 5 percent trucks. For the purpose of the model, no heavy trucks and no motorcycles were considered.

4.3 Receptor Distance/Elevation

The enclosed Table 2 includes the distances of the receptors from the closest roadway's existing centerline. The height of each receptor above the ground surface is included in Table 3 (enclosed).

The representative receptors include primarily park land. The distance and elevation of each receptor directly affects the predicted traffic noise level. These distances vary from 130 feet at Cabins 1 to 640 feet at Cabins 4. The elevation was 4.92 feet above ground surface at all locations.

4.4 Speed Conditions

The average speed during free flow conditions for the individual roadways was used for the noise analysis and has been input into the model as the posted speed limit. The existing posted speed limits in the project area range from 15 mph on access roads to 55 mph on State Route 19. The proposed posted speed limits are anticipated to remain the same for 2034.

5.0 TNM RESULTS

5.1 Existing and Build Receptor Noise Evaluation

Build (2034) traffic noise levels were predicted for the 10 receptor locations utilizing TNM. The enclosed Table 3 presents the projected (2034) noise levels for the 10 receptor points. Figure 3 depicts an aerial photograph of the study area with these points. TNM outputs are enclosed as Appendix C.

Since no operating roadway was present in the project area, it was not possible to model the existing traffic noise. Therefore, a value of 35 dB(A) was used as an estimate for existing noise. This noise level is consistent with a level associated with “Quiet Suburban Nighttime” by National Highway Institute.

The projected build 2034 traffic noise levels range from 29.0 dB(A) at the Cabins 4 receptor location to 46.3 dB(A) at the Cabins 2 receptor location. The projected build 2034 noise levels changed from the existing conditions from a decrease of 6.0 dB(A) to an increase of 11.1 dB(A).

Under the 2034 build scenario, no receptor locations approach or exceed the FHWA NAC. Additionally, no receptor locations are considered impacted due to a substantial increase in traffic noise levels. Therefore, a noise abatement analysis is not warranted.

6.0 CONSTRUCTION NOISE

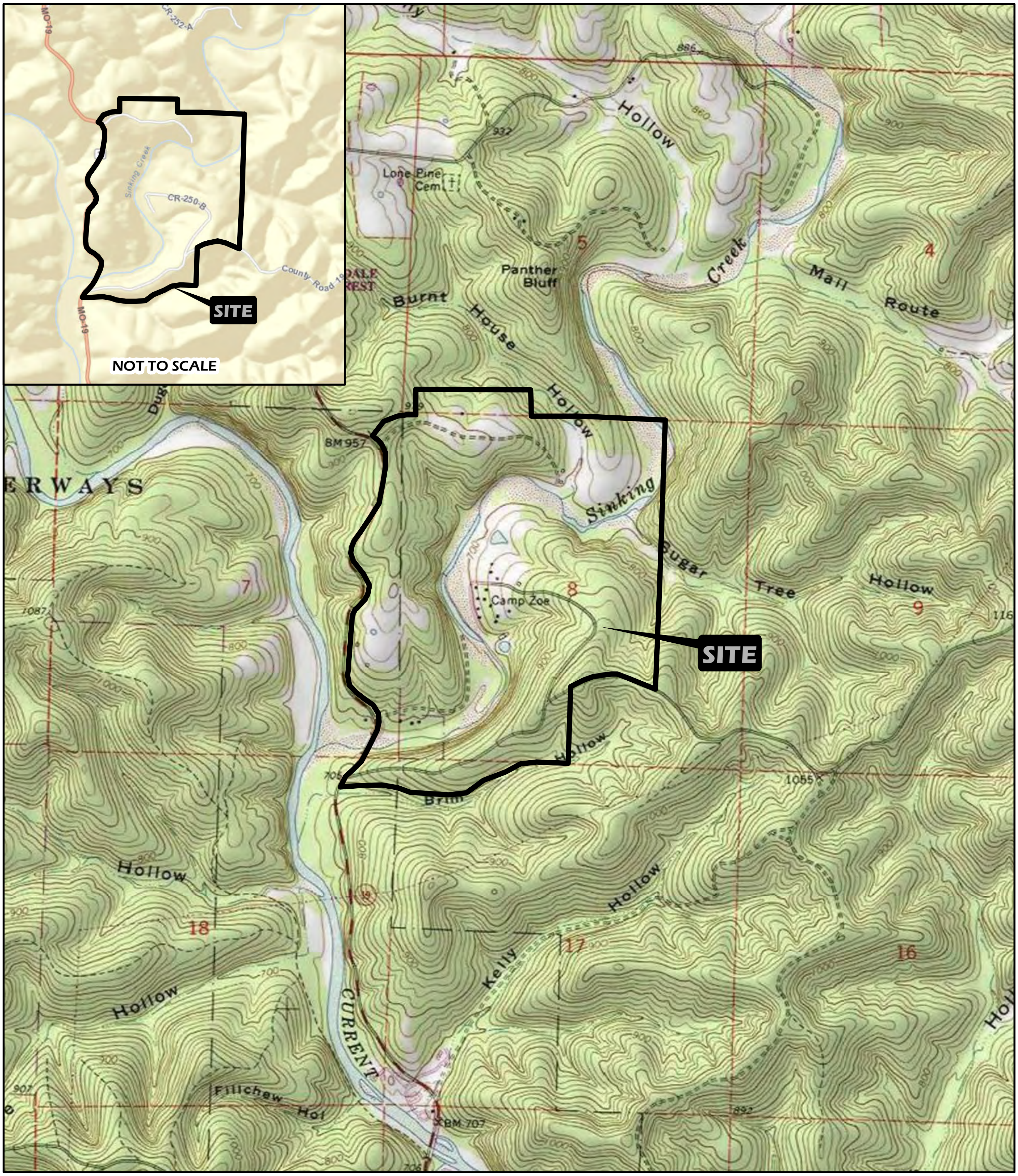
Trucks and machinery used for construction produce noise which may affect some land uses and activities during the construction period. Receptors along the alignment will at some time experience perceptible construction noise from implementation of the project. To minimize or eliminate the effect of construction noise on these receptors, mitigation measures have been incorporated into the MoDOTs standard construction practices.

7.0 SUMMARY

This traffic noise study has been conducted to evaluate traffic noise for the proposed upgrade and relocation of existing county access roads for a new 407-acre state park.

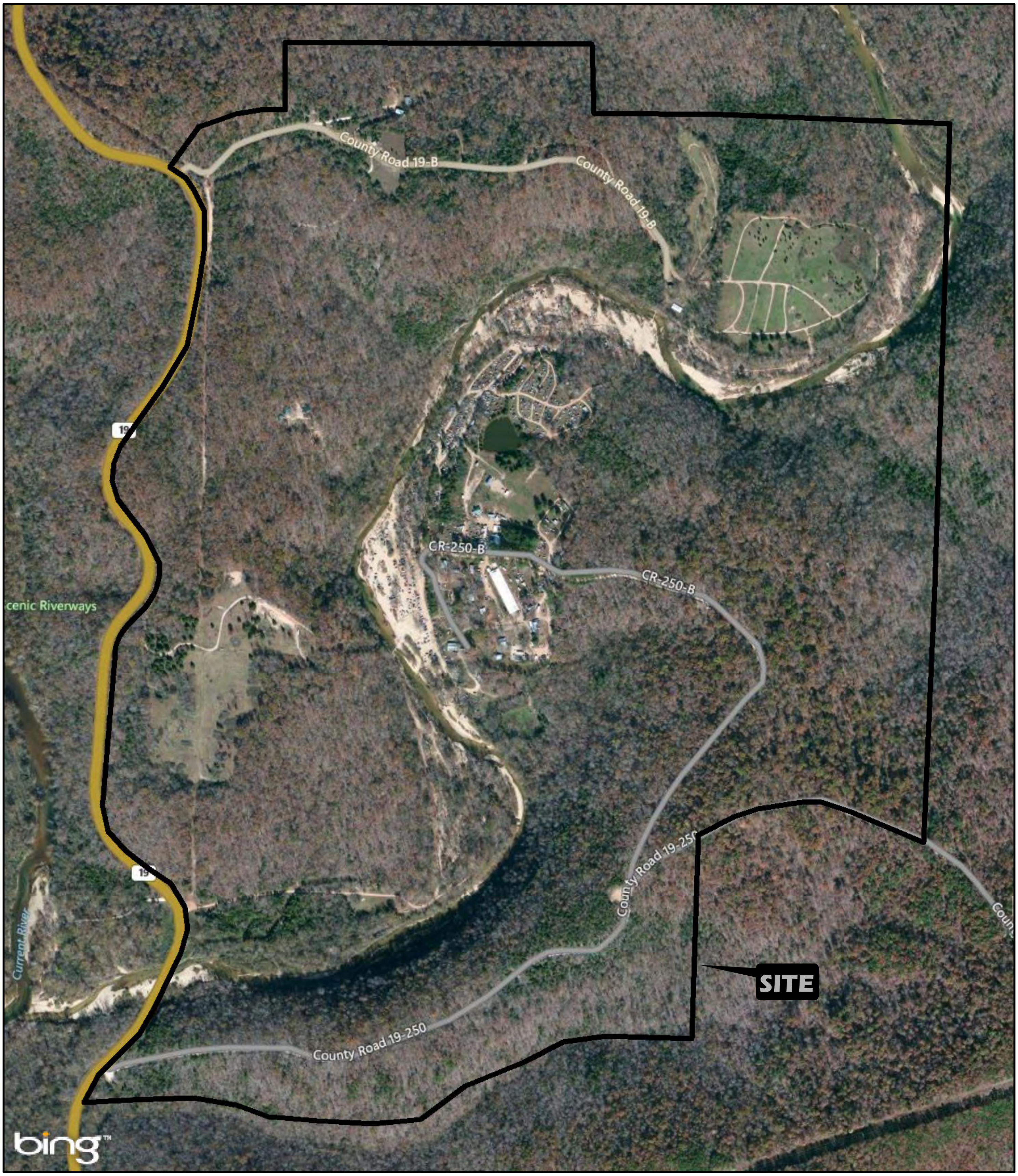
The projected build 2034 traffic noise levels range from 29.0 dB(A) at the Cabins 4 receptor location to 46.3 dB(A) at the Cabins 2 receptor location. The projected build 2034 noise levels changed from the existing conditions from a decrease of 6.0 dB(A) to an increase of 11.1 dB(A).

Under the 2034 build scenario, no receptor locations approach or exceed the FHWA NAC. Additionally, no receptor locations are considered impacted due to a substantial increase in traffic noise levels. Therefore, a noise abatement analysis is not warranted.

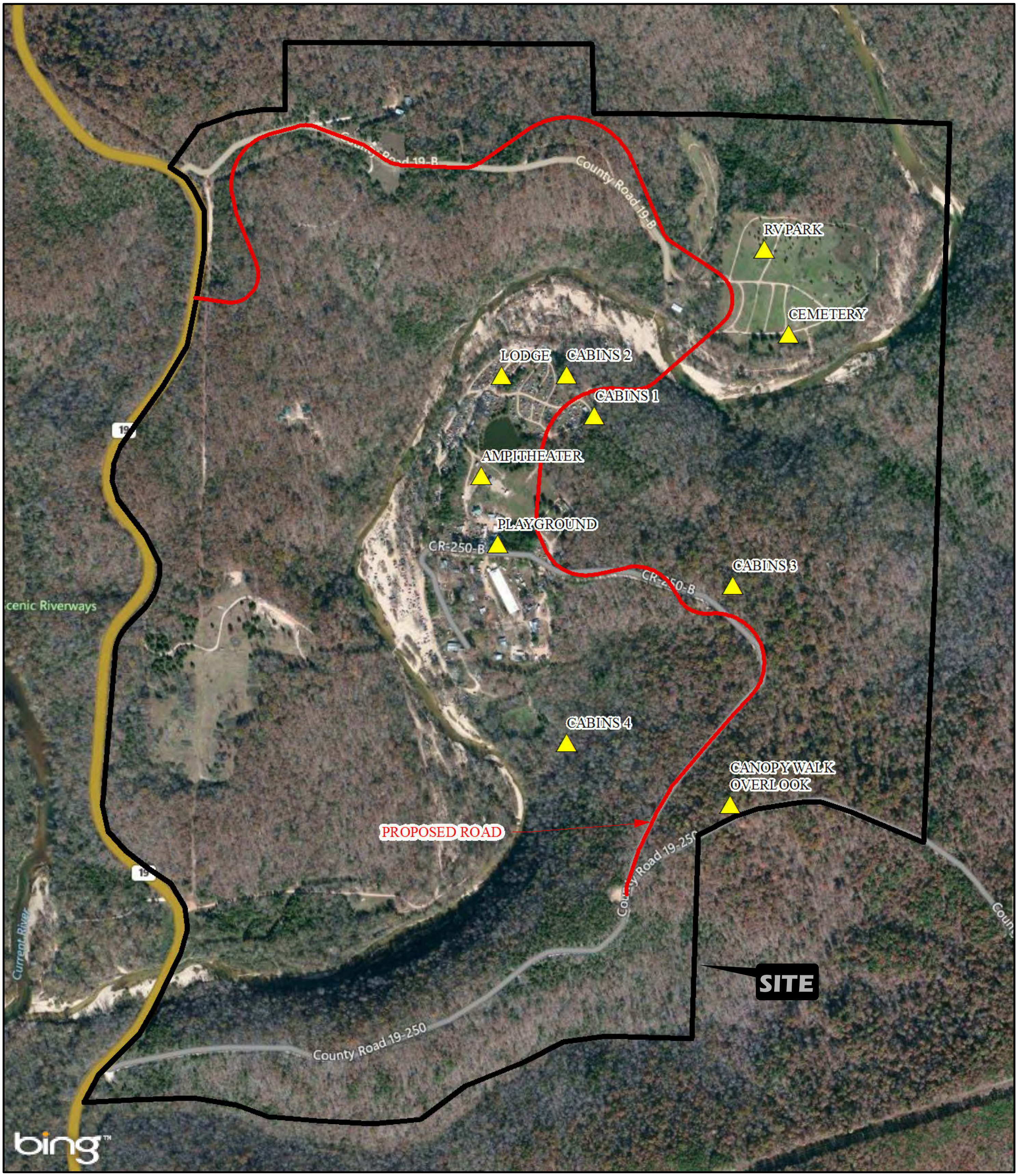


PROJECT NAME	GENERAL NOTES/LEGEND	
CAMP ZOE SHANNON COUNTY, MISSOURI	USGS TOPOGRAPHIC MAP ROUND SPRING, MISSOURI QUADRANGLE DATED 1982 PHOTO REVISED 1985 20' CONTOURS	N / W / E / S
VICINITY AND TOPOGRAPHIC MAP		SCALE 1" = 2000'

DRAWN BY	RCV	DATE	JOB NUMBER	FIGURE
CHECKED BY	EPG	10/2014	2014-7007.23	1



PROJECT NAME CAMP ZOE SHANNON COUNTY, MISSOURI				**GENERAL NOTES/LEGEND** AERIAL PHOTOGRAPH OBTAINED FROM ARCGIS ONLINE - WORLD IMAGERY, DATED 12/2012.
AERIAL PHOTOGRAPH				
DRAWN BY	RCV	**DATE**	**JOB NUMBER**	**SCALE** 1" = 750'
CHECKED BY	EPG	10/2014	2014-7007.23	**FIGURE** 2



PROJECT NAME	GENERAL NOTES/LEGEND
CAMP ZOE SHANNON COUNTY, MISSOURI	▲ INDICATES APPROXIMATE RECEPTOR LOCATIONS.
NOISE RECEPTOR LOCATION MAP	
DRAWN BY: RCV; CHECKED BY: EPG; DATE: 10/2014; JOB NUMBER: 2014-7007.23	AERIAL PHOTOGRAPH OBTAINED FROM ARCGIS ONLINE - WORLD IMAGERY, DATED 12/2012.

SCALE 1" = 750'

FIGURE 3

X1414-04 CAMP ZOE
SHANNON COUNTY, MISSOURI
SCI No. 2014-7007.23

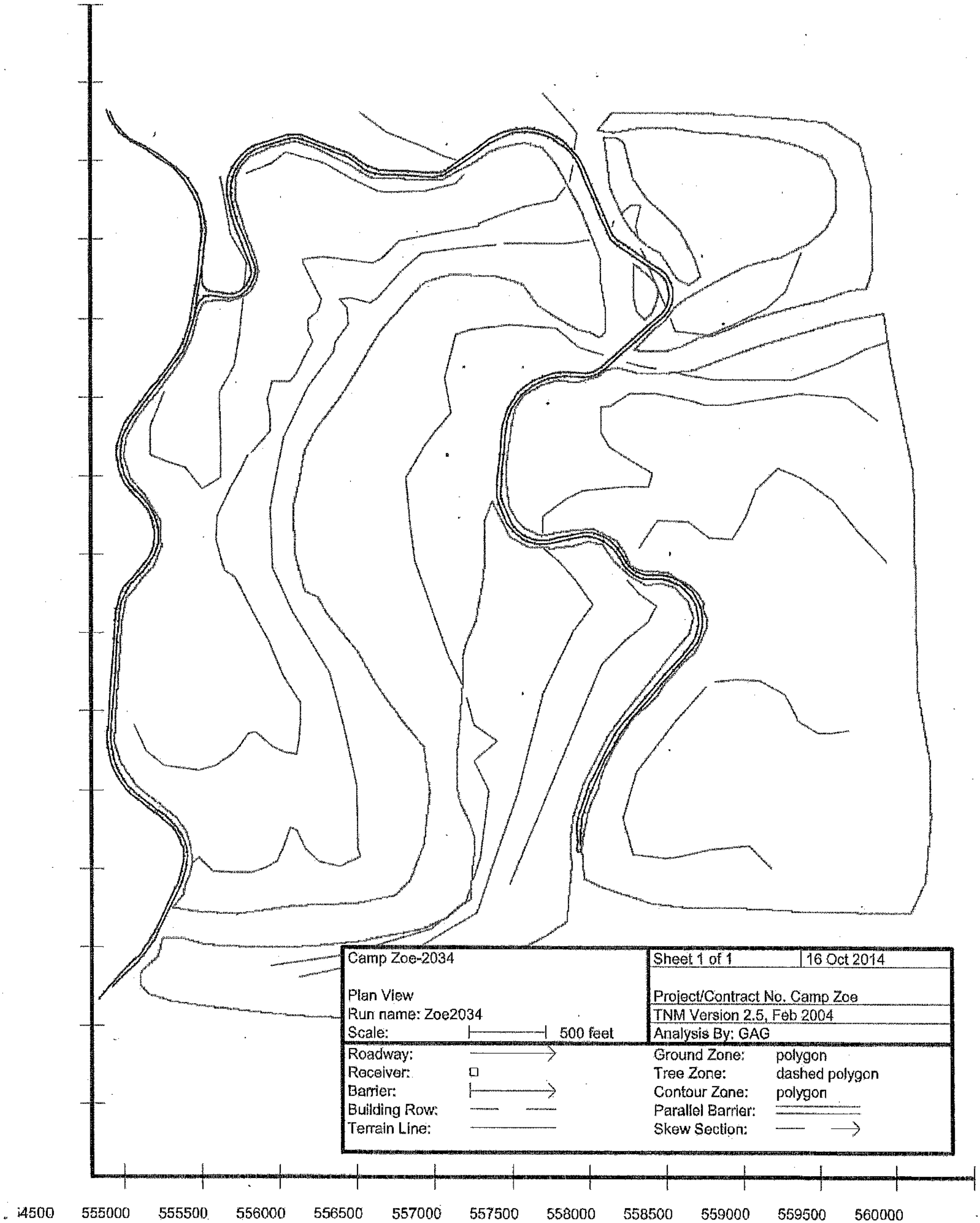
Table 2 – Noise Receptor Locations

Receptor	Activity Category	Nearest Roadway	Distance to Nearest Centerline
Lodge	C	Park access road	390
Amphitheater	C	Park access road	330
RV park	C	Park access road	280
Canopy walk overlook	C	Park access road	320
Cabins 3	C	Park access road	170
Cabins 1	C	Park access road	130
Cabins 2	C	Park access road	140
Playground	C	Park access road	240
Cemetery	C	Park access road	360
Cabins 4	C	Park access road	640

Table 3 – Noise Modeling Locations

Receptor Location	Model Point	Height	Criterion	Estimate Existing Noise Level dB(A)	Build 2034 Noise Level dB(A)	Increase Build Over Existing dB(A)
Lodge	1	4.92	67	35	36.6	1.6
Amphitheater	2	4.92	67	35	37.7	2.7
RV park	5	4.92	67	35	40.0	5.0
Canopy walk overlook	7	4.92	67	35	34.5	-0.5
Cabins 3	9	4.92	67	35	36.8	1.8
Cabins 1	11	4.92	67	35	32.4	-2.6
Cabins 2	12	4.92	67	35	46.1	11.1
Playground	14	4.92	67	35	38.1	3.1
Cemetery	16	4.92	67	35	32.1	-2.9
Cabins 4	18	4.92	67	35	29.0	-6.0

APPENDIX A



Camp Zoe-2034
Plan View
Run name: Zoe2034
Scale: 500 feet
Sheet 1 of 1
16 Oct 2014
Project/Contract No. Camp Zoe
TNM Version 2.5, Feb 2004
Analysis By: GAG
Roadway:
Receiver:
Barrier:
Building Row:
Terrain Line:
Ground Zone: polygon
Tree Zone: dashed polygon
Contour Zone: polygon
Parallel Barrier:
Skew Section:
i4500
555000
555500
556000
556500
557000
557500
558000
558500
559000
559500
560000

<Organization?>
GAG

24 October 2014
TNM 2.5

INPUT: RECEIVERS
PROJECT/CONTRACT: Camp Zoe
RUN: Camp Zoe-2034

Receiver

Name	No.	#DUs	Coordinates (ground)			Height	Input Sound Levels and Criteria				Active
			X	Y	Z	above Ground	Existing LAeq1h	Impact Criteria LAeq1h	Sub'l	NR Goal	in Calc.
			ft	ft	ft	ft	dBA	dBA	dB	dB	
Lodge	1	1	556,692.1	539,704.8	720.00	4.92	35.00	66	15.0	8.0	Y
Amphitheater	2	1	556,581.8	539,145.7	720.00	4.92	35.00	66	15.0	8.0	Y
RV Park	5	1	558,238.4	540,412.5	730.00	4.92	35.00	66	15.0	8.0	Y
Canopy Walk Overlook	7	1	558,016.8	537,267.2	1,020.00	4.92	35.00	66	15.0	8.0	Y
Cabins 3	9	1	558,023.4	538,520.4	910.00	4.92	35.00	66	15.0	8.0	Y
Cabins 1	11	1	557,236.4	539,476.7	750.00	4.92	35.00	66	15.0	8.0	Y
Cabins 2	12	1	557,074.6	539,704.8	735.00	4.92	35.00	66	15.0	8.0	Y
Playground	14	1	556,655.2	538,748.5	740.00	4.92	35.00	66	15.0	8.0	Y
Cemetery	16	1	558,376.0	539,980.8	700.00	4.92	35.00	66	15.0	8.0	Y
Cabins 4	18	1	557,067.9	537,628.1	750.00	4.92	35.00	66	15.0	8.0	Y

<Organization?>
GAG

16 October 2014
TNM 2.5

INPUT: ROADWAYS
PROJECT/CONTRACT: Camp Zoe
RUN: Camp Zoe-2034

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with the approval of FHWA

Roadway		Points								Segment	
Name	Width	Name	No.	Coordinates (pavement)			Flow Control				
				X	Y	Z	Control Device	Speed Constraint	Percent Vehicles Affected	Pvmt Type	On Struct?
	ft			ft	ft	ft		mph	%		
HWY 19-Northbound	12.0	point281	1	554,419.2	535,755.1	700.00				Average	
		point280	2	554,479.0	535,817.2	700.00				Average	
		point279	3	554,515.3	535,851.6	700.00				Average	
		point278	4	554,568.4	535,903.1	700.00				Average	
		point277	5	554,622.9	535,961.1	700.00				Average	
		point276	6	554,663.8	536,016.4	700.00				Average	
		point275	7	554,685.4	536,053.6	700.00				Average	
		point272	8	554,719.0	536,122.9	680.00				Average	
		point271	9	554,850.4	536,393.6	690.00				Average	
		point270	10	554,865.9	536,427.5	700.00				Average	
		point269	11	554,880.2	536,464.6	700.00				Average	
		point268	12	554,891.4	536,505.4	700.00				Average	
		point267	13	554,896.8	536,534.1	700.00				Average	
		point266	14	554,900.2	536,573.5	700.00				Average	
		point265	15	554,898.0	536,619.9	700.00				Average	
		point264	16	554,889.9	536,661.2	700.00				Average	
		point263	17	554,875.2	536,700.7	700.00				Average	
		point262	18	554,862.5	536,726.4	700.00				Average	
		point261	19	554,855.7	536,738.6	710.00				Average	
		point260	20	554,848.9	536,749.7	710.00				Average	
		point259	21	554,835.3	536,772.5	710.00				Average	
		point258	22	554,815.2	536,794.9	710.00				Average	
		point257	23	554,792.6	536,818.8	710.00				Average	
		point256	24	554,760.9	536,846.2	710.00				Average	
		point255	25	554,737.9	536,862.9	720.00				Average	

		point254	26	554,712.3	536,880.9	720.00				Average	
		point253	27	554,661.4	536,916.7	720.00				Average	
		point252	28	554,586.8	536,974.1	730.00				Average	
		point251	29	554,574.7	536,984.2	730.00				Average	
		point250	30	554,[illegible]3.3	536,998.8	730.00				Average	
		point249	31	554,537.2	537,020.1	730.00				Average	
		point248	32	554,524.3	537,034.4	730.00				Average	
		point247	33	554,511.2	537,050.3	730.00				Average	
		point246	34	554,490.7	537,078.2	730.00				Average	
		point245	35	554,471.6	537,109.4	730.00				Average	
		point244	36	554,465.3	537,120.9	740.00				Average	
		point243	37	554,459.0	537,133.4	740.00				Average	
		point242	38	554,450.9	537,150.9	740.00				Average	
		point241	39	554,443.1	537,169.9	740.00				Average	
		point240	40	554,429.1	537,211.2	740.00				Average	
		point239	41	554,422.6	537,236.8	740.00				Average	
		point238	42	554,415.5	537,274.1	740.00				Average	
		point237	43	554,411.2	537,320.1	740.00				Average	
		point236	44	554,412.1	537,382.3	740.00				Average	
		point235	45	554,412.9	537,393.2	750.00				Average	
		point234	46	554,425.4	537,576.3	760.00				Average	
		point233	47	554,439.3	537,757.5	770.00				Average	
		point232	48	554,453.4	537,952.9	780.00				Average	
		point231	49	554,463.1	538,088.4	780.00				Average	
		point229	50	554,467.5	538,133.9	790.00				Average	
		point228	51	554,471.4	538,162.5	790.00				Average	
		point227	52	554,477.2	538,187.2	790.00				Average	
		point226	53	554,483.4	538,207.9	790.00				Average	
		point225	54	554,490.9	538,228.9	790.00				Average	
		point224	55	554,511.5	538,271.1	790.00				Average	
		point223	56	554,526.9	538,296.0	790.00				Average	
		point222	57	554,539.2	538,312.8	800.00				Average	
		point221	58	554,540.1	538,313.8	800.00				Average	
		point220	59	554,548.4	538,324.1	800.00				Average	
		point219	60	554,562.6	538,339.8	800.00				Average	
		point218	61	554,580.0	538,357.8	800.00				Average	
		point217	62	554,602.6	538,381.9	800.00				Average	
		point216	63	554,620.3	538,402.1	800.00				Average	

		point215	64	554,633.7	538,417.8	800.00				Average	
		point214	65	554,640.7	538,426.6	810.00				Average	
		point213	66	554,649.2	538,437.8	810.00				Average	
		point212	67	554,662.1	538,454.4	810.00				Average	
		point211	68	554,673.2	538,470.3	810.00				Average	
		point210	69	554,682.6	538,486.1	810.00				Average	
		point209	70	554,694.1	538,508.6	810.00				Average	
		point208	71	554,704.2	538,533.4	810.00				Average	
		point207	72	554,710.6	538,553.2	820.00				Average	
		point206	73	554,711.4	538,555.6	820.00				Average	
		point205	74	554,712.6	538,560.1	820.00				Average	
		point204	75	554,716.5	538,576.8	820.00				Average	
		point203	76	554,720.2	538,607.0	820.00				Average	
		point202	77	554,720.7	538,636.3	820.00				Average	
		point201	78	554,718.9	538,664.5	820.00				Average	
		point200	79	554,716.4	538,683.8	830.00				Average	
		point198	80	554,715.6	538,687.8	830.00				Average	
		point197	81	554,705.2	538,732.4	830.00				Average	
		point196	82	554,696.9	538,756.1	830.00				Average	
		point195	83	554,683.3	538,786.2	830.00				Average	
		point193	84	554,664.0	538,815.9	840.00				Average	
		point192	85	554,638.2	538,849.8	840.00				Average	
		point191	86	554,606.6	538,885.2	840.00				Average	
		point190	87	554,582.5	538,908.2	840.00				Average	
		point189	88	554,571.2	538,918.2	840.00				Average	
		point188	89	554,563.7	538,926.6	840.00				Average	
		point187	90	554,547.2	538,946.5	840.00				Average	
		point186	91	554,540.3	538,955.7	850.00				Average	
		point184	92	554,533.2	538,965.6	850.00				Average	
		point183	93	554,519.8	538,987.2	850.00				Average	
		point182	94	554,508.6	539,008.2	850.00				Average	
		point181	95	554,497.4	539,033.3	850.00				Average	
		point180	96	554,486.4	539,065.9	850.00				Average	
		point179	97	554,482.6	539,082.6	850.00				Average	
		point178	98	554,476.8	539,125.0	850.00				Average	
		point177	99	554,475.8	539,144.1	860.00				Average	
		point176	100	554,476.1	539,168.2	860.00				Average	
		point175	101	554,478.1	539,192.1	860.00				Average	

		point174	102	554,479.8	539,205.0	860.00				Average	
		point173	103	554,482.8	539,221.8	860.00				Average	
		point172	104	554,485.9	539,235.2	860.00				Average	
		point171	105	554,491.2	539,254.8	860.00				Average	
		point170	106	554,499.4	539,274.8	860.00				Average	
		point169	107	554,511.7	539,302.1	860.00				Average	
		point168	108	554,518.1	539,314.6	870.00				Average	
		point167	109	554,537.7	539,350.1	870.00				Average	
		point166	110	554,561.2	539,386.4	870.00				Average	
		point165	111	554,582.1	539,414.8	870.00				Average	
		point163	112	554,616.1	539,457.4	880.00				Average	
		point162	113	554,632.5	539,478.1	880.00				Average	
		point161	114	554,664.1	539,517.7	880.00				Average	
		point159	115	554,727.9	539,597.6	890.00				Average	
		point158	116	554,758.2	539,636.9	890.00				Average	
		point157	117	554,830.1	539,733.1	890.00				Average	
		point156	118	554,844.9	539,753.7	900.00				Average	
		point155	119	554,845.8	539,755.1	900.00				Average	
		point154	120	554,852.8	539,765.3	900.00				Average	
		point153	121	554,865.7	539,785.9	900.00				Average	
		point152	122	554,891.2	539,833.1	900.00				Average	
		point151	123	554,911.1	539,878.3	900.00				Average	
		point150	124	554,927.0	539,925.4	900.00				Average	
		point149	125	554,941.2	539,976.2	910.00				Average	
		point148	126	554,946.8	539,997.8	910.00				Average	
		point147	127	554,952.9	540,025.4	910.00				Average	
		point146	128	554,962.0	540,076.1	910.00				Average	
		point145	129	554,976.3	540,161.9	910.00					
Camp Road	12.0	point1218	130	554,959.1	540,043.2	910.00	Stop	0.00	100	Average	
		point1216	131	554,979.2	540,104.6	910.00				Average	
		point1212	132	554,992.3	540,127.0	920.00				Average	
		point1208	133	555,016.1	540,145.5	920.00				Average	
		point1202	134	555,049.2	540,152.9	930.00				Average	
		point1199	135	555,103.1	540,145.2	930.00				Average	
		point1197	136	555,142.5	540,138.9	930.00				Average	
		point1195	137	555,172.6	540,136.9	930.00				Average	
		point1193	138	555,202.6	540,140.0	930.00				Average	
		point1190	139	555,231.6	540,148.2	930.00				Average	

		point1188	140	555,258.7	540,161.5	920.00				Average	
		point1185	141	555,291.6	540,187.2	910.00				Average	
		point1183	142	555,316.2	540,218.1	910.00				Average	
		point1180	143	555,337.5	540,267.9	900.00				Average	
		point1178	144	555,342.2	540,297.6	900.00				Average	
		point1176	145	555,340.9	540,333.2	900.00				Average	
		point1173	146	555,322.9	540,389.6	890.00				Average	
		point1259	147	555,278.8	540,499.6	890.00				Average	
		point1168	148	555,234.5	540,609.5	890.00				Average	
		point1167	149	555,219.1	540,655.2	890.00				Average	
		point1165	150	555,204.2	540,714.5	890.00				Average	
		point1163	151	555,196.6	540,748.2	900.00				Average	
		point1161	152	555,188.4	540,792.8	900.00				Average	
		point1160	153	555,187.3	540,810.4	900.00				Average	
		point1158	154	555,187.4	540,843.0	910.00				Average	
		point1156	155	555,192.6	540,879.5	910.00				Average	
		point1155	156	555,199.4	540,906.9	910.00				Average	
		point1154	157	555,211.4	540,940.1	910.00				Average	
		point1153	158	555,222.6	540,962.6	910.00				Average	
		point1150	159	555,243.8	540,995.1	910.00				Average	
		point1147	160	555,263.9	541,019.4	920.00				Average	
		point1145	161	555,290.9	541,044.9	920.00				Average	
		point1143	162	555,316.7	541,063.9	920.00				Average	
		point1142	163	555,348.0	541,082.1	920.00				Average	
		point1140	164	555,408.0	541,103.9	920.00				Average	
		point1135	165	555,568.1	541,148.8	920.00				Average	
		point1133	166	555,617.1	541,150.3	920.00				Average	
		point1132	167	555,649.3	541,144.2	920.00				Average	
		point1255	168	555,740.5	541,109.9	920.00				Average	
		point1256	169	555,831.8	541,075.6	920.00				Average	
		point1124	170	555,922.9	541,041.2	920.00				Average	
		point1123	171	555,944.6	541,029.2	920.00				Average	
		point1120	172	556,067.4	540,945.5	920.00				Average	
		point1118	173	556,122.2	540,926.5	920.00				Average	
		point1117	174	556,156.2	540,923.9	920.00				Average	
		point1251	175	556,273.7	540,918.9	920.00				Average	
		point1252	176	556,391.1	540,913.9	920.00				Average	
		point1111	177	556,508.6	540,908.9	920.00				Average	

		point1109	178	556,524.3	540,910.3	910.00				Average	
		point1107	179	556,552.8	540,916.6	910.00				Average	
		point1105	180	556,580.5	540,927.9	910.00				Average	
		point1103	181	556,641.9	540,968.4	910.00				Average	
		point1246	182	556,713.9	541,017.8	903.33				Average	
		point1247	183	556,785.9	541,067.1	896.67				Average	
		point1100	184	556,857.9	541,116.5	890.00				Average	
		point1096	185	556,903.6	541,145.8	880.00				Average	
		point1090	186	556,954.5	541,169.9	870.00				Average	
		point1081	187	557,014.5	541,187.8	860.00				Average	
		point1073	188	557,098.4	541,196.1	850.00				Average	
		point1068	189	557,155.6	541,191.2	840.00				Average	
		point1066	190	557,183.2	541,185.9	840.00				Average	
		point1064	191	557,227.0	541,172.8	840.00				Average	
		point1062	192	557,249.6	541,163.9	840.00				Average	
		point1059	193	557,287.8	541,144.6	830.00				Average	
		point1057	194	557,308.9	541,131.6	830.00				Average	
		point1054	195	557,344.1	541,105.2	820.00				Average	
		point1050	196	557,374.5	541,077.0	810.00				Average	
		point1046	197	557,413.0	541,029.7	810.00				Average	
		point1042	198	557,444.2	540,975.9	810.00				Average	
		point1241	199	557,487.7	540,874.9	797.50				Average	
		point1242	200	557,531.1	540,773.9	785.00				Average	
		point1243	201	557,574.5	540,672.9	772.50				Average	
		point1032	202	557,617.9	540,571.8	760.00				Average	
		point1030	203	557,628.6	540,548.0	750.00				Average	
		point1028	204	557,646.4	540,520.1	750.00				Average	
		point1026	205	557,666.9	540,498.2	740.00				Average	
		point1024	206	557,699.3	540,474.4	740.00				Average	
		point1237	207	557,795.9	540,409.6	720.00				Average	
		point1017	208	557,892.6	540,344.9	700.00				Average	
		point1015	209	557,931.0	540,319.1	700.00				Average	
		point1013	210	557,963.1	540,296.8	700.00				Average	
		point1004	211	558,000.1	540,254.8	710.00				Average	
		point1002	212	558,018.6	540,213.1	710.00				Average	
		point1000	213	558,024.7	540,155.4	710.00				Average	
		point996	214	558,007.2	540,092.0	710.00				Average	
		point992	215	557,981.8	540,054.9	710.00				Average	

		point1234	216	557,881.8	539,967.1	707.50				Average	
		point1235	217	557,781.7	539,879.1	705.00				Average	
		point1236	218	557,681.6	539,791.2	702.50				Average	
		point984	219	557,581.6	539,703.4	700.00				Average	
		point980	220	557,542.7	539,678.9	710.00				Average	
		point977	221	557,492.6	539,667.2	710.00				Average	
		point973	222	557,383.3	539,670.1	720.00				Average	
		point971	223	557,315.2	539,669.7	730.00				Average	
		point969	224	557,276.1	539,664.8	730.00				Average	
		point967	225	557,240.9	539,657.1	740.00				Average	
		point965	226	557,200.0	539,644.0	740.00				Average	
		point964	227	557,152.7	539,623.1	740.00				Average	
		point962	228	557,092.4	539,584.0	740.00				Average	
		point960	229	557,039.8	539,535.1	740.00				Average	
		point959	230	557,016.9	539,507.4	740.00				Average	
		point958	231	556,996.6	539,477.8	740.00				Average	
		point956	232	556,974.4	539,437.0	740.00				Average	
		point954	233	556,955.9	539,391.2	740.00				Average	
		point952	234	556,941.7	539,338.8	730.00				Average	
		point950	235	556,933.3	539,271.5	720.00				Average	
		point1230	236	556,922.0	539,147.5	735.00				Average	
		point946	237	556,910.7	539,023.6	750.00				Average	
		point945	238	556,904.3	538,950.8	750.00				Average	
		point944	239	556,901.8	538,918.7	750.00				Average	
		point942	240	556,902.1	538,888.0	750.00				Average	
		point939	241	556,914.1	538,833.7	760.00				Average	
		point935	242	556,968.6	538,712.8	770.00				Average	
		point934	243	556,990.2	538,681.9	770.00				Average	
		point933	244	557,009.6	538,658.9	770.00				Average	
		point931	245	557,030.2	538,640.4	780.00				Average	
		point929	246	557,049.6	538,625.1	780.00				Average	
		point928	247	557,070.2	538,612.2	780.00				Average	
		point926	248	557,099.4	538,598.1	780.00				Average	
		point924	249	557,131.7	538,587.3	790.00				Average	
		point923	250	557,154.7	538,582.4	790.00				Average	
		point921	251	557,185.8	538,579.0	800.00				Average	
		point919	252	557,223.3	538,579.8	800.00				Average	
		point917	253	557,273.7	538,588.7	810.00				Average	

		point914	254	557,375.8	538,610.7	830.00				Average	
		point912	255	557,423.7	538,621.1	830.00				Average	
		point909	256	557,469.7	538,627.8	840.00				Average	
		point906	257	557,511.1	538,626.3	850.00				Average	
		point904	258	557,540.6	538,621.1	850.00				Average	
		point901	259	557,569.3	538,611.6	860.00				Average	
		point899	260	557,598.1	538,598.1	860.00				Average	
		point897	261	557,625.2	538,580.1	870.00				Average	
		point895	262	557,649.9	538,558.7	870.00				Average	
		point892	263	557,677.8	538,525.3	880.00				Average	
		point891	264	557,697.8	538,493.4	880.00				Average	
		point890	265	557,722.5	538,453.2	880.00				Average	
		point887	266	557,748.6	538,419.2	880.00				Average	
		point883	267	557,793.4	538,384.4	890.00				Average	
		point881	268	557,824.0	538,370.6	890.00				Average	
		point879	269	557,854.2	538,362.9	900.00				Average	
		point877	270	557,901.5	538,360.4	900.00				Average	
		point874	271	557,958.9	538,360.1	910.00				Average	
		point872	272	557,988.1	538,356.3	910.00				Average	
		point870	273	558,022.5	538,347.8	910.00				Average	
		point867	274	558,065.3	538,329.5	910.00				Average	
		point865	275	558,084.6	538,318.1	920.00				Average	
		point864	276	558,121.9	538,288.9	920.00				Average	
		point862	277	558,153.1	538,254.2	920.00				Average	
		point861	278	558,165.6	538,236.2	930.00				Average	
		point860	279	558,187.2	538,193.5	930.00				Average	
		point859	280	558,200.8	538,149.0	930.00				Average	
		point857	281	558,206.3	538,100.2	940.00				Average	
		point855	282	558,203.8	538,056.3	940.00				Average	
		point853	283	558,192.5	538,008.3	950.00				Average	
		point852	284	558,181.4	537,981.6	950.00				Average	
		point851	285	558,163.1	537,948.1	950.00				Average	
		point850	286	558,142.8	537,921.3	950.00				Average	
		point849	287	558,119.4	537,895.6	950.00				Average	
		point848	288	558,108.8	537,884.2	960.00				Average	
		point847	289	558,044.8	537,815.9	970.00				Average	
		point846	290	558,029.3	537,799.3	970.00				Average	
		point844	291	557,987.8	537,751.6	970.00				Average	

		point843	292	557,955.1	537,714.1	970.00				Average	
		point842	293	557,918.4	537,671.8	970.00				Average	
		point841	294	557,858.6	537,602.8	970.00				Average	
		point840	295	557,816.9	537,553.5	970.00				Average	
		point839	296	557,740.7	537,463.6	970.00				Average	
		point838	297	557,686.3	537,399.6	970.00				Average	
		point837	298	557,661.1	537,361.4	970.00				Average	
		point836	299	557,609.9	537,273.0	980.00				Average	
		point834	300	557,579.2	537,216.4	980.00				Average	
		point833	301	557,556.7	537,169.0	990.00				Average	
		point831	302	557,526.3	537,105.1	990.00				Average	
		point830	303	557,506.8	537,063.9	990.00				Average	
		point828	304	557,487.3	537,021.5	990.00				Average	
		point827	305	557,478.0	536,993.8	990.00				Average	
		point826	306	557,464.9	536,954.7	990.00				Average	
		point825	307	557,447.4	536,901.9	990.00				Average	
		point824	308	557,435.6	536,866.3	990.00				Average	
		point823	309	557,424.2	536,830.1	990.00				Average	
		point822	310	557,419.5	536,787.4	990.00				Average	
		point821	311	557,417.9	536,747.0	980.00				Average	
		point820	312	557,420.2	536,693.2	970.00				Average	
		point818	313	557,419.4	536,634.2	960.00				Average	
		point1224	314	557,420.1	536,622.6	960.00				Average	
		point1225	315	557,428.4	536,617.7	960.00				Average	
		point1226	316	557,437.8	536,619.3	960.00				Average	
		point660	317	557,444.7	536,636.2	960.00				Average	
		point659	318	557,443.2	536,694.3	970.00				Average	
		point657	319	557,443.4	536,746.2	980.00				Average	
		point656	320	557,444.6	536,787.6	980.00				Average	
		point654	321	557,448.8	536,824.6	980.00				Average	
		point653	322	557,458.4	536,855.3	980.00				Average	
		point652	323	557,466.9	536,880.2	990.00				Average	
		point651	324	557,509.0	537,007.8	990.00				Average	
		point650	325	557,583.8	537,167.6	990.00				Average	
		point649	326	557,608.1	537,218.9	990.00				Average	
		point648	327	557,633.6	537,263.9	980.00				Average	
		point646	328	557,665.8	537,319.7	980.00				Average	
		point644	329	557,697.5	537,373.2	980.00				Average	

		point643	330	557,717.9	537,398.1	980.00				Average	
		point642	331	557,747.5	537,433.0	980.00				Average	
		point641	332	557,765.6	537,454.3	980.00				Average	
		point640	333	557,835.9	537,537.2	980.00				Average	
		point639	334	557,912.4	537,626.9	980.00				Average	
		point638	335	557,939.1	537,657.6	980.00				Average	
		point637	336	557,972.8	537,696.2	980.00				Average	
		point636	337	557,994.8	537,721.6	980.00				Average	
		point635	338	558,047.9	537,782.6	980.00				Average	
		point633	339	558,079.7	537,816.1	970.00				Average	
		point632	340	558,122.3	537,861.1	970.00				Average	
		point630	341	558,169.9	537,913.1	960.00				Average	
		point629	342	558,197.9	537,955.9	960.00				Average	
		point628	343	558,213.2	537,990.5	960.00				Average	
		point626	344	558,223.1	538,021.5	950.00				Average	
		point625	345	558,230.1	538,057.9	950.00				Average	
		point624	346	558,232.1	538,084.0	950.00				Average	
		point622	347	558,230.8	538,123.3	940.00				Average	
		point620	348	558,219.8	538,179.1	940.00				Average	
		point618	349	558,200.8	538,226.5	940.00				Average	
		point616	350	558,180.5	538,260.1	930.00				Average	
		point615	351	558,163.6	538,282.3	930.00				Average	
		point612	352	558,123.4	538,321.9	920.00				Average	
		point611	353	558,105.9	538,334.9	920.00				Average	
		point610	354	558,077.6	538,352.4	920.00				Average	
		point609	355	558,049.9	538,365.2	920.00				Average	
		point607	356	558,006.0	538,379.4	920.00				Average	
		point606	357	557,975.6	538,384.6	920.00				Average	
		point604	358	557,911.8	538,385.0	910.00				Average	
		point602	359	557,874.8	538,384.4	910.00				Average	
		point600	360	557,840.8	538,390.6	910.00				Average	
		point596	361	557,802.8	538,406.8	900.00				Average	
		point594	362	557,783.4	538,419.9	900.00				Average	
		point591	363	557,758.2	538,444.4	900.00				Average	
		point589	364	557,740.9	538,469.2	900.00				Average	
		point587	365	557,718.4	538,506.9	890.00				Average	
		point584	366	557,685.8	538,556.1	880.00				Average	
		point581	367	557,660.1	538,583.6	880.00				Average	

		point578	368	557,627.2	538,609.4	870.00				Average	
		point576	369	557,596.4	538,626.9	860.00				Average	
		point575	370	557,573.1	538,636.9	860.00				Average	
		point572	371	557,531.8	538,648.4	850.00				Average	
		point570	372	557,501.6	538,652.6	850.00				Average	
		point567	373	557,463.6	538,652.9	840.00				Average	
		point564	374	557,385.5	538,638.4	830.00				Average	
		point563	375	557,295.6	538,619.0	820.00				Average	
		point561	376	557,242.8	538,607.8	810.00				Average	
		point556	377	557,202.4	538,603.7	810.00				Average	
		point553	378	557,174.1	538,604.7	800.00				Average	
		point552	379	557,153.4	538,607.8	800.00				Average	
		point551	380	557,133.3	538,612.6	800.00				Average	
		point548	381	557,107.1	538,622.0	790.00				Average	
		point546	382	557,079.6	538,635.6	790.00				Average	
		point543	383	557,042.8	538,661.8	780.00				Average	
		point541	384	557,014.4	538,691.2	780.00				Average	
		point540	385	556,998.9	538,713.1	780.00				Average	
		point538	386	556,978.5	538,751.9	780.00				Average	
		point535	387	556,939.8	538,838.7	770.00				Average	
		point533	388	556,930.1	538,874.1	770.00				Average	
		point532	389	556,927.8	538,890.1	760.00				Average	
		point531	390	556,930.1	538,946.6	760.00				Average	
		point530	391	556,937.4	539,031.9	750.00				Average	
		point1229	392	556,947.8	539,151.5	740.00				Average	
		point527	393	556,958.1	539,271.1	730.00				Average	
		point525	394	556,962.1	539,316.8	730.00				Average	
		point523	395	556,971.6	539,360.3	730.00				Average	
		point521	396	556,988.3	539,410.1	730.00				Average	
		point520	397	556,999.9	539,434.6	740.00				Average	
		point519	398	557,029.2	539,482.8	740.00				Average	
		point518	399	557,067.4	539,529.1	740.00				Average	
		point517	400	557,098.6	539,557.8	740.00				Average	
		point516	401	557,139.5	539,587.8	740.00				Average	
		point515	402	557,187.8	539,613.1	740.00				Average	
		point513	403	557,242.2	539,632.7	740.00				Average	
		point511	404	557,296.8	539,644.8	740.00				Average	
		point509	405	557,346.9	539,645.9	730.00				Average	

		point506	406	557,478.9	539,642.1	730.00				Average	
		point504	407	557,523.9	539,646.6	730.00				Average	
		point501	408	557,569.3	539,664.4	720.00				Average	
		point498	409	557,590.7	539,678.6	710.00				Average	
		point497	410	557,623.1	539,706.4	700.00				Average	
		point1231	411	557,716.0	539,787.5	702.50				Average	Y
		point1232	412	557,808.9	539,868.6	705.00				Average	
		point1233	413	557,901.9	539,949.8	707.50				Average	
		point493	414	557,994.8	540,030.9	710.00				Average	
		point491	415	558,020.2	540,062.4	710.00				Average	
		point489	416	558,040.6	540,104.2	710.00				Average	
		point486	417	558,050.7	540,157.3	710.00				Average	
		point484	418	558,047.5	540,203.9	710.00				Average	
		point482	419	558,034.9	540,243.8	710.00				Average	
		point479	420	558,009.4	540,286.5	710.00				Average	
		point475	421	557,976.4	540,319.2	710.00				Average	
		point473	422	557,948.2	540,338.8	710.00				Average	
		point470	423	557,890.1	540,377.5	700.00				Average	
		point469	424	557,810.1	540,430.8	700.00				Average	
		point466	425	557,764.9	540,460.9	720.00				Average	
		point465	426	557,729.6	540,484.4	730.00				Average	
		point463	427	557,693.6	540,508.7	730.00				Average	
		point459	428	557,658.6	540,545.9	740.00				Average	
		point456	429	557,643.4	540,575.8	750.00				Average	
		point1238	430	557,602.0	540,672.6	760.00				Average	
		point1239	431	557,560.6	540,769.4	770.00				Average	
		point1240	432	557,519.2	540,866.2	780.00				Average	
		point445	433	557,477.8	540,963.0	790.00				Average	
		point442	434	557,445.6	541,025.8	790.00				Average	
		point436	435	557,395.9	541,090.9	800.00				Average	
		point433	436	557,356.1	541,127.8	810.00				Average	
		point431	437	557,334.1	541,144.6	810.00				Average	
		point428	438	557,298.3	541,167.3	820.00				Average	
		point425	439	557,248.4	541,191.8	820.00				Average	
		point422	440	557,200.9	541,207.2	830.00				Average	
		point420	441	557,146.5	541,218.1	830.00				Average	
		point418	442	557,107.9	541,221.2	830.00				Average	
		point414	443	557,036.1	541,217.2	840.00				Average	

		point408	444	556,956.6	541,197.3	860.00				Average	
		point403	445	556,872.4	541,156.3	880.00				Average	
		point1244	446	556,778.2	541,091.4	886.67				Average	
		point1245	447	556,683.9	541,026.6	893.33				Average	
		point391	448	556,589.8	540,961.8	900.00				Average	
		point390	449	556,569.5	540,949.3	900.00				Average	
		point388	450	556,545.6	540,939.5	900.00				Average	
		point386	451	556,520.4	540,934.0	900.00				Average	
		point1248	452	556,425.9	540,938.1	905.00				Average	
		point1249	453	556,331.2	540,942.2	910.00				Average	
		point1250	454	556,236.6	540,946.4	915.00				Average	
		point379	455	556,142.1	540,950.6	920.00				Average	
		point376	456	556,069.6	540,974.7	920.00				Average	
		point373	457	556,015.9	541,011.0	920.00				Average	
		point372	458	555,975.7	541,038.3	920.00				Average	
		point371	459	555,950.5	541,055.4	920.00				Average	
		point1253	460	555,845.4	541,094.6	920.00				Average	
		point1254	461	555,740.4	541,133.8	920.00				Average	
		point364	462	555,635.3	541,172.9	920.00				Average	
		point361	463	555,601.1	541,176.2	930.00				Average	
		point359	464	555,552.2	541,171.0	930.00				Average	
		point1257	465	555,451.7	541,140.9	930.00				Average	
		point353	466	555,351.2	541,110.7	930.00				Average	
		point352	467	555,328.6	541,099.9	930.00				Average	
		point349	468	555,294.9	541,079.4	930.00				Average	
		point344	469	555,254.1	541,045.2	930.00				Average	
		point340	470	555,214.9	540,998.0	930.00				Average	
		point338	471	555,194.7	540,962.6	930.00				Average	
		point335	472	555,173.7	540,908.1	920.00				Average	
		point333	473	555,165.5	540,871.8	920.00				Average	
		point331	474	555,162.3	540,838.3	920.00				Average	
		point327	475	555,164.1	540,786.8	910.00				Average	
		point326	476	555,175.0	540,730.3	910.00				Average	
		point325	477	555,185.2	540,685.4	910.00				Average	
		point323	478	555,193.3	540,654.8	910.00				Average	
		point321	479	555,211.3	540,600.2	900.00				Average	
		point1258	480	555,259.1	540,481.3	900.00				Average	
		point317	481	555,306.9	540,362.4	900.00				Average	

		point313	482	555,316.4	540,305.4	900.00				Average	
		point310	483	555,308.6	540,261.9	900.00				Average	
		point308	484	555,298.2	540,238.5	900.00				Average	
		point306	485	555,282.7	540,216.0	910.00				Average	
		point305	486	555,266.0	540,198.8	910.00				Average	
		point303	487	555,245.3	540,183.8	910.00				Average	
		point301	488	555,222.2	540,172.6	920.00				Average	
		point299	489	555,194.1	540,165.0	920.00				Average	
		point297	490	555,172.1	540,162.8	920.00				Average	
		point295	491	555,132.8	540,166.8	930.00				Average	
		point293	492	555,063.7	540,177.8	930.00				Average	
		point291	493	555,045.9	540,183.0	930.00				Average	
		point290	494	555,029.3	540,192.9	930.00				Average	
		point288	495	555,012.2	540,212.2	930.00				Average	
		point286	496	555,001.8	540,242.4	920.00				Average	
		point284	497	555,001.9	540,269.0	920.00				Average	
		point283	498	555,001.2	540,312.3	920.00					
HWY 19-Southbound-2	12.0	point1228	499	554,971.4	540,280.1	920.00				Average	
		point128	500	554,961.1	540,214.6	920.00				Average	
		point127	501	554,942.8	540,097.2	920.00				Average	
		point126	502	554,933.4	540,044.8	920.00				Average	
		point125	503	554,926.1	540,011.8	900.00				Average	
		point124	504	554,922.9	539,998.1	900.00				Average	
		point123	505	554,917.1	539,973.2	900.00				Average	
		point122	506	554,902.8	539,925.2	900.00				Average	
		point121	507	554,882.1	539,870.9	900.00				Average	
		point120	508	554,871.5	539,846.9	900.00				Average	
		point119	509	554,858.1	539,820.4	900.00				Average	
		point118	510	554,849.9	539,805.2	890.00				Average	
		point117	511	554,819.2	539,757.4	890.00				Average	
		point116	512	554,763.7	539,679.9	890.00				Average	
		point115	513	554,730.2	539,636.3	890.00				Average	
		point114	514	554,726.1	539,631.0	890.00				Average	
		point113	515	554,715.4	539,617.5	890.00				Average	
		point112	516	554,683.7	539,577.7	890.00				Average	
		point111	517	554,613.3	539,489.2	890.00				Average	
		point110	518	554,601.9	539,474.6	880.00				Average	
		point109	519	554,561.0	539,422.2	880.00				Average	

		point108	520	554,536.4	539,390.7	880.00				Average	
		point107	521	554,523.6	539,372.9	880.00				Average	
		point106	522	554,507.6	539,347.1	880.00				Average	
		point105	523	554,482.8	539,294.9	870.00				Average	
		point104	524	554,471.9	539,269.4	870.00				Average	
		point103	525	554,465.2	539,248.4	870.00				Average	
		point102	526	554,454.2	539,194.8	870.00				Average	
		point101	527	554,452.6	539,177.0	870.00				Average	
		point100	528	554,450.8	539,135.8	870.00				Average	
		point99	529	554,454.9	539,104.9	860.00				Average	
		point98	530	554,459.8	539,077.1	860.00				Average	
		point97	531	554,467.9	539,045.8	860.00				Average	
		point96	532	554,481.9	539,008.1	860.00				Average	
		point95	533	554,501.6	538,971.9	860.00				Average	
		point94	534	554,528.8	538,932.2	860.00				Average	
		point93	535	554,543.4	538,913.9	850.00				Average	
		point92	536	554,557.8	538,897.6	850.00				Average	
		point91	537	554,572.5	538,882.5	850.00				Average	
		point90	538	554,584.1	538,871.4	850.00				Average	
		point89	539	554,611.8	538,844.6	850.00				Average	
		point87	540	554,624.8	538,829.7	840.00				Average	
		point86	541	554,626.5	538,827.6	840.00				Average	
		point85	542	554,640.1	538,809.6	840.00				Average	
		point84	543	554,652.1	538,791.2	840.00				Average	
		point83	544	554,661.3	538,775.1	840.00				Average	
		point82	545	554,669.7	538,757.8	840.00				Average	
		point81	546	554,677.6	538,738.6	840.00				Average	
		point80	547	554,683.0	538,722.2	830.00				Average	
		point79	548	554,691.4	538,687.6	830.00				Average	
		point78	549	554,695.2	538,657.8	830.00				Average	
		point77	550	554,696.3	538,637.4	830.00				Average	
		point76	551	554,696.1	538,622.4	830.00				Average	
		point75	552	554,694.5	538,601.9	820.00				Average	
		point74	553	554,691.4	538,576.4	820.00				Average	
		point73	554	554,688.0	538,559.9	820.00				Average	
		point72	555	554,679.9	538,533.1	820.00				Average	
		point71	556	554,670.4	538,510.6	820.00				Average	
		point70	557	554,661.6	538,493.8	820.00				Average	

		point69	558	554,655.3	538,483.6	820.00				Average	
		point68	559	554,643.4	538,466.2	810.00				Average	
		point67	560	554,625.7	538,446.2	810.00				Average	
		point66	561	554,584.3	538,399.7	810.00				Average	
		point65	562	554,559.4	538,371.4	810.00				Average	
		point64	563	554,524.8	538,331.9	810.00				Average	
		point63	564	554,510.7	538,315.8	810.00				Average	
		point62	565	554,504.8	538,306.9	800.00				Average	
		point61	566	554,500.9	538,300.6	800.00				Average	
		point60	567	554,484.5	538,271.8	800.00				Average	
		point59	568	554,467.5	538,233.6	800.00				Average	
		point58	569	554,455.5	538,196.9	800.00				Average	
		point57	570	554,447.2	538,159.2	800.00				Average	
		point56	571	554,443.8	538,133.4	790.00				Average	
		point55	572	554,443.2	538,127.2	790.00				Average	
		point54	573	554,440.3	538,087.7	790.00				Average	
		point53	574	554,435.2	538,014.1	790.00				Average	
		point52	575	554,432.1	537,969.0	780.00				Average	
		point51	576	554,417.2	537,765.1	770.00				Average	
		point50	577	554,403.3	537,579.1	760.00				Average	
		point49	578	554,391.1	537,404.1	760.00				Average	
		point48	579	554,389.8	537,383.5	750.00				Average	
		point47	580	554,388.7	537,310.7	750.00				Average	
		point46	581	554,392.2	537,271.7	750.00				Average	
		point45	582	554,401.0	537,224.9	750.00				Average	
		point44	583	554,411.1	537,189.1	750.00				Average	
		point43	584	554,427.6	537,145.4	750.00				Average	
		point42	585	554,456.2	537,089.4	750.00				Average	
		point41	586	554,466.1	537,072.6	740.00				Average	
		point40	587	554,498.8	537,028.7	740.00				Average	
		point39	588	554,529.2	536,994.9	740.00				Average	
		point38	589	554,571.2	536,957.3	740.00				Average	
		point37	590	554,589.0	536,943.6	730.00				Average	
		point36	591	554,665.2	536,887.6	730.00				Average	
		point35	592	554,693.7	536,866.1	730.00				Average	
		point34	593	554,710.7	536,853.2	720.00				Average	
		point33	594	554,720.2	536,845.9	720.00				Average	
		point32	595	554,745.5	536,826.8	720.00				Average	

		point31	596	554,790.6	536,788.8	720.00				Average	
		point30	597	554,810.9	536,766.3	720.00				Average	
		point29	598	554,817.9	536,757.2	710.00				Average	
		point28	599	554,818.7	536,756.2	710.00				Average	
		point27	600	554,851.1	536,702.1	710.00				Average	
		point26	601	554,864.4	536,668.2	710.00				Average	
		point25	602	554,873.2	536,645.4	710.00				Average	
		point24	603	554,880.4	536,586.5	710.00				Average	
		point23	604	554,877.8	536,562.1	700.00				Average	
		point22	605	554,877.0	536,552.6	700.00				Average	
		point21	606	554,865.1	536,487.0	700.00				Average	
		point20	607	554,845.2	536,430.4	700.00				Average	
		point19	608	554,838.1	536,411.6	690.00				Average	
		point18	609	554,834.5	536,404.1	690.00				Average	
		point17	610	554,824.5	536,383.6	680.00				Average	
		point16	611	554,700.8	536,129.6	680.00				Average	
		point15	612	554,695.1	536,118.0	690.00				Average	
		point14	613	554,685.2	536,098.4	700.00				Average	
		point13	614	554,666.1	536,062.9	700.00				Average	
		point12	615	554,654.1	536,044.3	700.00				Average	
		point11	616	554,645.2	536,031.0	700.00				Average	
		point10	617	554,634.9	536,016.2	700.00				Average	
		point9	618	554,612.8	535,986.9	700.00				Average	
		point8	619	554,589.2	535,958.8	700.00				Average	
		point7	620	554,560.6	535,927.9	700.00				Average	
		point6	621	554,524.1	535,891.2	700.00				Average	
		point5	622	554,477.4	535,846.6	700.00				Average	
		point4	623	554,430.6	535,800.7	700.00				Average	
		point3	624	554,392.2	535,759.8	700.00				Average	
		point2	625	554,362.4	535,721.5	700.00				Average	
		point1	626	554,334.7	535,678.8	700.00					
HWY 19-Southbound-Roadway17	12.0	point1271	627	554,388.9	541,333.8	1,010.00				Average	
		point1270	628	554,413.2	541,272.0	1,010.00				Average	
		point1269	629	554,433.0	541,236.8	1,000.00				Average	
		point1268	630	554,472.7	541,179.4	990.00				Average	
		point1267	631	554,552.1	541,128.7	980.00				Average	
		point1266	632	554,651.3	541,078.0	970.00				Average	
		point1265	633	554,719.6	541,027.2	960.00				Average	

		point1264	634	554,812.2	540,965.6	955.00				Average	
		point1263	635	554,887.2	540,890.6	950.00				Average	
		point1262	636	554,942.3	540,806.8	945.00				Average	
		point1261	637	554,973.2	540,742.9	940.00				Average	
		point1260	638	554,993.1	540,654.7	930.00				Average	
		point137	639	554,994.6	540,645.1	930.00				Average	
		point136	640	554,997.8	540,624.9	930.00				Average	
		point135	641	555,000.0	540,602.8	930.00				Average	
		point134	642	555,001.2	540,580.6	930.00				Average	
		point133	643	555,001.3	540,558.4	930.00				Average	
		point132	644	555,001.1	540,552.3	930.00				Average	
		point131	645	554,998.6	540,490.9	930.00				Average	
		point130	646	554,991.5	540,436.2	920.00				Average	
		point129	647	554,971.4	540,280.1	920.00					
Roadway18-HWY 19-Northbound-2	12.0	point1227	648	554,976.3	540,161.9	910.00				Average	
		point144	649	554,995.4	540,292.1	910.00				Average	
		point143	650	555,009.1	540,394.4	920.00				Average	
		point142	651	555,013.4	540,426.0	920.00				Average	
		point141	652	555,025.2	540,546.3	920.00				Average	
		point140	653	555,025.1	540,584.9	920.00				Average	
		point139	654	555,023.4	540,610.3	920.00				Average	
		point138	655	555,021.8	540,623.8	920.00				Average	
		point1272	656	555,019.5	540,639.2	920.00				Average	
		point1273	657	554,999.6	540,738.4	930.00				Average	
		point1274	658	554,964.4	540,809.0	940.00				Average	
		point1275	659	554,909.2	540,897.2	950.00				Average	
		point1276	660	554,832.1	540,972.2	960.00				Average	
		point1277	661	554,713.0	541,053.8	970.00				Average	
		point1278	662	554,633.6	541,104.4	980.00				Average	
		point1279	663	554,545.4	541,146.3	990.00				Average	
		point1280	664	554,494.8	541,181.6	1,000.00				Average	
		point1281	665	554,444.1	541,243.4	1,010.00				Average	
		point1282	666	554,411.0	541,313.9	1,010.00					

<Organization?> 16 October 2014
GAG TNM 2.5

INPUT: TRAFFIC FOR LAeq1h Volumes
PROJECT/CONTRACT: Camp Zoe
RUN: Camp Zoe-2034

Roadway	Points												
Name	Name	No.	Segment										
			Autos		MTrucks		HTrucks		Buses		Motorcycles		
			V	S	V	S	V	S	V	S	V	S	
			veh/hr	mph	veh/hr	mph	veh/hr	mph	veh/hr	mph	veh/hr	mph	
HWY 19-Northbound	point281	1	79	55	4	55	0	0	0	0	0	0	
	point280	2	79	55	4	55	0	0	0	0	0	0	
	point279	3	79	55	4	55	0	0	0	0	0	0	
	point278	4	79	55	4	55	0	0	0	0	0	0	
	point277	5	79	55	4	55	0	0	0	0	0	0	
	point276	6	79	55	4	55	0	0	0	0	0	0	
	point275	7	79	55	4	55	0	0	0	0	0	0	
	point272	8	79	55	4	55	0	0	0	0	0	0	
	point271	9	79	55	4	55	0	0	0	0	0	0	
	point270	10	79	55	4	55	0	0	0	0	0	0	
	point269	11	79	55	4	55	0	0	0	0	0	0	
	point268	12	79	55	4	55	0	0	0	0	0	0	
	point267	13	79	55	4	55	0	0	0	0	0	0	
	point266	14	79	55	4	55	0	0	0	0	0	0	
	point265	15	79	55	4	55	0	0	0	0	0	0	
	point264	16	79	55	4	55	0	0	0	0	0	0	
	point263	17	79	55	4	55	0	0	0	0	0	0	
	point262	18	79	55	4	55	0	0	0	0	0	0	
	point261	19	79	55	4	55	0	0	0	0	0	0	
	point260	20	79	55	4	55	0	0	0	0	0	0	
	point259	21	79	55	4	55	0	0	0	0	0	0	
	point258	22	79	55	4	55	0	0	0	0	0	0	

INPUT: TRAFFIC FOR LAeq1h Volumes

Camp Zoe

	point257	23	79	55	4	55	0	0	0	0	0	0
	point256	24	79	55	4	55	0	0	0	0	0	0
	point255	25	79	55	4	55	0	0	0	0	0	0
	point254	26	79	55	4	55	0	0	0	0	0	0
	point253	27	79	55	4	55	0	0	0	0	0	0
	point252	28	79	55	4	55	0	0	0	0	0	0
	point251	29	79	55	4	55	0	0	0	0	0	0
	point250	30	79	55	4	55	0	0	0	0	0	0
	point249	31	79	55	4	55	0	0	0	0	0	0
	point248	32	79	55	4	55	0	0	0	0	0	0
	point247	33	79	55	4	55	0	0	0	0	0	0
	point246	34	79	55	4	55	0	0	0	0	0	0
	point245	35	79	55	4	55	0	0	0	0	0	0
	point244	36	79	55	4	55	0	0	0	0	0	0
	point243	37	79	55	4	55	0	0	0	0	0	0
	point242	38	79	55	4	55	0	0	0	0	0	0
	point241	39	79	55	4	55	0	0	0	0	0	0
	point240	40	79	55	4	55	0	0	0	0	0	0
	point239	41	79	55	4	55	0	0	0	0	0	0
	point238	42	79	55	4	55	0	0	0	0	0	0
	point237	43	79	55	4	55	0	0	0	0	0	0
	point236	44	79	55	4	55	0	0	0	0	0	0
	point235	45	79	55	4	55	0	0	0	0	0	0
	point234	46	79	55	4	55	0	0	0	0	0	0
	point233	47	79	55	4	55	0	0	0	0	0	0
	point232	48	79	55	4	55	0	0	0	0	0	0
	point231	49	79	55	4	55	0	0	0	0	0	0
	point229	50	79	55	4	55	0	0	0	0	0	0
	point228	51	79	55	4	55	0	0	0	0	0	0
	point227	52	79	55	4	55	0	0	0	0	0	0
	point226	53	79	55	4	55	0	0	0	0	0	0
	point225	54	79	55	4	55	0	0	0	0	0	0
	point224	55	79	55	4	55	0	0	0	0	0	0
	point223	56	79	55	4	55	0	0	0	0	0	0

INPUT: TRAFFIC FOR LAeq1h Volumes

Camp Zoe

	point222	57	79	55	4	55	0	0	0	0	0	0
	point221	58	79	55	4	55	0	0	0	0	0	0
	point220	59	79	55	4	55	0	0	0	0	0	0
	point219	60	79	55	4	55	0	0	0	0	0	0
	point218	61	79	55	4	55	0	0	0	0	0	0
	point217	62	79	55	4	55	0	0	0	0	0	0
	point216	63	79	55	4	55	0	0	0	0	0	0
	point215	64	79	55	4	55	0	0	0	0	0	0
	point214	65	79	55	4	55	0	0	0	0	0	0
	point213	66	79	55	4	55	0	0	0	0	0	0
	point212	67	79	55	4	55	0	0	0	0	0	0
	point211	68	79	55	4	55	0	0	0	0	0	0
	point210	69	79	55	4	55	0	0	0	0	0	0
	point209	70	79	55	4	55	0	0	0	0	0	0
	point208	71	79	55	4	55	0	0	0	0	0	0
	point207	72	79	55	4	55	0	0	0	0	0	0
	point206	73	79	55	4	55	0	0	0	0	0	0
	point205	74	79	55	4	55	0	0	0	0	0	0
	point204	75	79	55	4	55	0	0	0	0	0	0
	point203	76	79	55	4	55	0	0	0	0	0	0
	point202	77	79	55	4	55	0	0	0	0	0	0
	point201	78	79	55	4	55	0	0	0	0	0	0
	point200	79	79	55	4	55	0	0	0	0	0	0
	point198	80	79	55	4	55	0	0	0	0	0	0
	point197	81	79	55	4	55	0	0	0	0	0	0
	point196	82	79	55	4	55	0	0	0	0	0	0
	point195	83	79	55	4	55	0	0	0	0	0	0
	point193	84	79	55	4	55	0	0	0	0	0	0
	point192	85	79	55	4	55	0	0	0	0	0	0
	point191	86	79	55	4	55	0	0	0	0	0	0
	point190	87	79	55	4	55	0	0	0	0	0	0
	point189	88	79	55	4	55	0	0	0	0	0	0
	point188	89	79	55	4	55	0	0	0	0	0	0
	point187	90	79	55	4	55	0	0	0	0	0	0

INPUT: TRAFFIC FOR LAeq1h Volumes — Camp Zoe

	point186	91	79	55	4	55	0	0	0	0	0	0
	point184	92	79	55	4	55	0	0	0	0	0	0
	point183	93	79	55	4	55	0	0	0	0	0	0
	point182	94	79	55	4	55	0	0	0	0	0	0
	point181	95	79	55	4	55	0	0	0	0	0	0
	point180	96	79	55	4	55	0	0	0	0	0	0
	point179	97	79	55	4	55	0	0	0	0	0	0
	point178	98	79	55	4	55	0	0	0	0	0	0
	point177	99	79	55	4	55	0	0	0	0	0	0
	point176	100	79	55	4	55	0	0	0	0	0	0
	point175	101	79	55	4	55	0	0	0	0	0	0
	point174	102	79	55	4	55	0	0	0	0	0	0
	point173	103	79	55	4	55	0	0	0	0	0	0
	point172	104	79	55	4	55	0	0	0	0	0	0
	point171	105	79	55	4	55	0	0	0	0	0	0
	point170	106	79	55	4	55	0	0	0	0	0	0
	point169	107	79	55	4	55	0	0	0	0	0	0
	point168	108	79	55	4	55	0	0	0	0	0	0
	point167	109	79	55	4	55	0	0	0	0	0	0
	point166	110	79	55	4	55	0	0	0	0	0	0
	point165	111	79	55	4	55	0	0	0	0	0	0
	point163	112	79	55	4	55	0	0	0	0	0	0
	point162	113	79	55	4	55	0	0	0	0	0	0
	point161	114	79	55	4	55	0	0	0	0	0	0
	point159	115	79	55	4	55	0	0	0	0	0	0
	point158	116	79	55	4	55	0	0	0	0	0	0
	point157	117	79	55	4	55	0	0	0	0	0	0
	point156	118	79	55	4	55	0	0	0	0	0	0
	point155	119	79	55	4	55	0	0	0	0	0	0
	point154	120	79	55	4	55	0	0	0	0	0	0
	point153	121	79	55	4	55	0	0	0	0	0	0
	point152	122	79	55	4	55	0	0	0	0	0	0
	point151	123	79	55	4	55	0	0	0	0	0	0
	point150	124	79	55	4	55	0	0	0	0	0	0

INPUT: TRAFFIC FOR LAeq1h Volumes

Camp Zoe

	point149	125	79	55	4	55	0	0	0	0	0	0
	point148	126	79	55	4	55	0	0	0	0	0	0
	point147	127	79	55	4	55	0	0	0	0	0	0
	point146	128	79	55	4	55	0	0	0	0	0	0
	point145	129										
Camp Road	point1218	130	77	15	9	15	0	0	0	0	0	0
	point1216	131	77	15	9	15	0	0	0	0	0	0
	point1212	132	77	15	9	15	0	0	0	0	0	0
	point1208	133	77	15	9	15	0	0	0	0	0	0
	point1202	134	77	15	9	15	0	0	0	0	0	0
	point1199	135	77	15	9	15	0	0	0	0	0	0
	point1197	136	77	15	9	15	0	0	0	0	0	0
	point1195	137	77	15	9	15	0	0	0	0	0	0
	point1193	138	77	15	9	15	0	0	0	0	0	0
	point1190	139	77	15	9	15	0	0	0	0	0	0
	point1188	140	77	15	9	15	0	0	0	0	0	0
	point1185	141	77	15	9	15	0	0	0	0	0	0
	point1183	142	77	15	9	15	0	0	0	0	0	0
	point1180	143	77	15	9	15	0	0	0	0	0	0
	point1178	144	77	15	9	15	0	0	0	0	0	0
	point1176	145	77	15	9	15	0	0	0	0	0	0
	point1173	146	77	15	9	15	0	0	0	0	0	0
	point1259	147	77	15	9	15	0	0	0	0	0	0
	point1168	148	77	15	9	15	0	0	0	0	0	0
	point1167	149	77	15	9	15	0	0	0	0	0	0
	point1165	150	77	15	9	15	0	0	0	0	0	0
	point1163	151	77	15	9	15	0	0	0	0	0	0
	point1161	152	77	15	9	15	0	0	0	0	0	0
	point1160	153	77	15	9	15	0	0	0	0	0	0
	point1158	154	77	15	9	15	0	0	0	0	0	0
	point1156	155	77	15	9	15	0	0	0	0	0	0
	point1155	156	77	15	9	15	0	0	0	0	0	0
	point1154	157	77	15	9	15	0	0	0	0	0	0
	point1153	158	77	15	9	15	0	0	0	0	0	0

INPUT: TRAFFIC FOR LAeq1h Volumes Camp Zoe

	point1150	159	77	15	9	15	0	0	0	0	0	0
	point1147	160	77	15	9	15	0	0	0	0	0	0
	point1145	161	77	15	9	15	0	0	0	0	0	0
	point1143	162	77	15	9	15	0	0	0	0	0	0
	point1142	163	77	15	9	15	0	0	0	0	0	0
	point1140	164	77	15	9	15	0	0	0	0	0	0
	point1135	165	77	15	9	15	0	0	0	0	0	0
	point1133	166	77	15	9	15	0	0	0	0	0	0
	point1132	167	77	15	9	15	0	0	0	0	0	0
	point1255	168	77	15	9	15	0	0	0	0	0	0
	point1256	169	77	15	9	15	0	0	0	0	0	0
	point1124	170	77	15	9	15	0	0	0	0	0	0
	point1123	171	77	15	9	15	0	0	0	0	0	0
	point1120	172	77	15	9	15	0	0	0	0	0	0
	point1118	173	77	15	9	15	0	0	0	0	0	0
	point1117	174	77	15	9	15	0	0	0	0	0	0
	point1251	175	77	15	9	15	0	0	0	0	0	0
	point1252	176	77	15	9	15	0	0	0	0	0	0
	point1111	177	77	15	9	15	0	0	0	0	0	0
	point1109	178	77	15	9	15	0	0	0	0	0	0
	point1107	179	77	15	9	15	0	0	0	0	0	0
	point1105	180	77	15	9	15	0	0	0	0	0	0
	point1103	181	77	15	9	15	0	0	0	0	0	0
	point1246	182	77	15	9	15	0	0	0	0	0	0
	point1247	183	77	15	9	15	0	0	0	0	0	0
	point1100	184	77	15	9	15	0	0	0	0	0	0
	point1096	185	77	15	9	15	0	0	0	0	0	0
	point1090	186	77	15	9	15	0	0	0	0	0	0
	point1081	187	77	15	9	15	0	0	0	0	0	0
	point1073	188	77	15	9	15	0	0	0	0	0	0
	point1068	189	77	15	9	15	0	0	0	0	0	0
	point1066	190	77	15	9	15	0	0	0	0	0	0
	point1064	191	77	15	9	15	0	0	0	0	0	0
	point1062	192	77	15	9	15	0	0	0	0	0	0

	point1059	193	77	15	9	15	0	0	0	0	0	0
	point1057	194	77	15	9	15	0	0	0	0	0	0
	point1054	195	77	15	9	15	0	0	0	0	0	0
	point1050	196	77	15	9	15	0	0	0	0	0	0
	point1046	197	77	15	9	15	0	0	0	0	0	0
	point1042	198	77	15	9	15	0	0	0	0	0	0
	point1241	199	77	15	9	15	0	0	0	0	0	0
	point1242	200	77	15	9	15	0	0	0	0	0	0
	point1243	201	77	15	9	15	0	0	0	0	0	0
	point1032	202	77	15	9	15	0	0	0	0	0	0
	point1030	203	77	15	9	15	0	0	0	0	0	0
	point1028	204	77	15	9	15	0	0	0	0	0	0
	point1026	205	77	15	9	15	0	0	0	0	0	0
	point1024	206	77	15	9	15	0	0	0	0	0	0
	point1237	207	77	15	9	15	0	0	0	0	0	0
	point1017	208	77	15	9	15	0	0	0	0	0	0
	point1015	209	77	15	9	15	0	0	0	0	0	0
	point1013	210	77	15	9	15	0	0	0	0	0	0
	point1004	211	77	15	9	15	0	0	0	0	0	0
	point1002	212	77	15	9	15	0	0	0	0	0	0
	point1000	213	77	15	9	15	0	0	0	0	0	0
	point996	214	77	15	9	15	0	0	0	0	0	0
	point992	215	77	15	9	15	0	0	0	0	0	0
	point1234	216	77	15	9	15	0	0	0	0	0	0
	point1235	217	77	15	9	15	0	0	0	0	0	0
	point1236	218	77	15	9	15	0	0	0	0	0	0
	point984	219	77	15	9	15	0	0	0	0	0	0
	point980	220	77	15	9	15	0	0	0	0	0	0
	point977	221	77	15	9	15	0	0	0	0	0	0
	point973	222	77	15	9	15	0	0	0	0	0	0
	point971	223	77	15	9	15	0	0	0	0	0	0
	point969	224	77	15	9	15	0	0	0	0	0	0
	point967	225	77	15	9	15	0	0	0	0	0	0
	point965	226	77	15	9	15	0	0	0	0	0	0

INPUT: TRAFFIC FOR LAeq1h Volumes

Camp Zoe

	point964	227	77	15	9	15	0	0	0	0	0	0
	point962	228	77	15	9	15	0	0	0	0	0	0
	point960	229	77	15	9	15	0	0	0	0	0	0
	point959	230	77	15	9	15	0	0	0	0	0	0
	point958	231	77	15	9	15	0	0	0	0	0	0
	point956	232	77	15	9	15	0	0	0	0	0	0
	point954	233	77	15	9	15	0	0	0	0	0	0
	point952	234	77	15	9	15	0	0	0	0	0	0
	point950	235	77	15	9	15	0	0	0	0	0	0
	point1230	236	77	15	9	15	0	0	0	0	0	0
	point946	237	77	15	9	15	0	0	0	0	0	0
	point945	238	77	15	9	15	0	0	0	0	0	0
	point944	239	77	15	9	15	0	0	0	0	0	0
	point942	240	77	15	9	15	0	0	0	0	0	0
	point939	241	77	15	9	15	0	0	0	0	0	0
	point935	242	77	15	9	15	0	0	0	0	0	0
	point934	243	77	15	9	15	0	0	0	0	0	0
	point933	244	77	15	9	15	0	0	0	0	0	0
	point931	245	77	15	9	15	0	0	0	0	0	0
	point929	246	77	15	9	15	0	0	0	0	0	0
	point928	247	77	15	9	15	0	0	0	0	0	0
	point926	248	77	15	9	15	0	0	0	0	0	0
	point924	249	77	15	9	15	0	0	0	0	0	0
	point923	250	77	15	9	15	0	0	0	0	0	0
	point921	251	77	15	9	15	0	0	0	0	0	0
	point919	252	77	15	9	15	0	0	0	0	0	0
	point917	253	77	15	9	15	0	0	0	0	0	0
	point914	254	77	15	9	15	0	0	0	0	0	0
	point912	255	77	15	9	15	0	0	0	0	0	0
	point909	256	77	15	9	15	0	0	0	0	0	0
	point906	257	77	15	9	15	0	0	0	0	0	0
	point904	258	77	15	9	15	0	0	0	0	0	0
	point901	259	77	15	9	15	0	0	0	0	0	0
	point899	260	77	15	9	15	0	0	0	0	0	0

INPUT: TRAFFIC FOR LAeq1h Volumes Camp Zoe

	point897	261	77	15	9	15	0	0	0	0	0	0
	point895	262	77	15	9	15	0	0	0	0	0	0
	point892	263	77	15	9	15	0	0	0	0	0	0
	point891	264	77	15	9	15	0	0	0	0	0	0
	point890	265	77	15	9	15	0	0	0	0	0	0
	point887	266	77	15	9	15	0	0	0	0	0	0
	point883	267	77	15	9	15	0	0	0	0	0	0
	point881	268	77	15	9	15	0	0	0	0	0	0
	point879	269	77	15	9	15	0	0	0	0	0	0
	point877	270	77	15	9	15	0	0	0	0	0	0
	point874	271	77	15	9	15	0	0	0	0	0	0
	point872	272	77	15	9	15	0	0	0	0	0	0
	point870	273	77	15	9	15	0	0	0	0	0	0
	point867	274	77	15	9	15	0	0	0	0	0	0
	point865	275	77	15	9	15	0	0	0	0	0	0
	point864	276	77	15	9	15	0	0	0	0	0	0
	point862	277	77	15	9	15	0	0	0	0	0	0
	point861	278	77	15	9	15	0	0	0	0	0	0
	point860	279	77	15	9	15	0	0	0	0	0	0
	point859	280	77	15	9	15	0	0	0	0	0	0
	point857	281	77	15	9	15	0	0	0	0	0	0
	point855	282	77	15	9	15	0	0	0	0	0	0
	point853	283	77	15	9	15	0	0	0	0	0	0
	point852	284	77	15	9	15	0	0	0	0	0	0
	point851	285	77	15	9	15	0	0	0	0	0	0
	point850	286	77	15	9	15	0	0	0	0	0	0
	point849	287	77	15	9	15	0	0	0	0	0	0
	point848	288	77	15	9	15	0	0	0	0	0	0
	point847	289	77	15	9	15	0	0	0	0	0	0
	point846	290	77	15	9	15	0	0	0	0	0	0
	point844	291	77	15	9	15	0	0	0	0	0	0
	point843	292	77	15	9	15	0	0	0	0	0	0
	point842	293	77	15	9	15	0	0	0	0	0	0
	point841	294	77	15	9	15	0	0	0	0	0	0

INPUT: TRAFFIC FOR LAeq1h Volumes Camp Zoe

	point840	295	77	15	9	15	0	0	0	0	0	0
	point839	296	77	15	9	15	0	0	0	0	0	0
	point838	297	77	15	9	15	0	0	0	0	0	0
	point837	298	77	15	9	15	0	0	0	0	0	0
	point836	299	77	15	9	15	0	0	0	0	0	0
	point834	300	77	15	9	15	0	0	0	0	0	0
	point833	301	77	15	9	15	0	0	0	0	0	0
	point831	302	77	15	9	15	0	0	0	0	0	0
	point830	303	77	15	9	15	0	0	0	0	0	0
	point828	304	77	15	9	15	0	0	0	0	0	0
	point827	305	77	15	9	15	0	0	0	0	0	0
	point826	306	77	15	9	15	0	0	0	0	0	0
	point825	307	77	15	9	15	0	0	0	0	0	0
	point824	308	77	15	9	15	0	0	0	0	0	0
	point823	309	77	15	9	15	0	0	0	0	0	0
	point822	310	77	15	9	15	0	0	0	0	0	0
	point821	311	77	15	9	15	0	0	0	0	0	0
	point820	312	77	15	9	15	0	0	0	0	0	0
	point818	313	77	15	9	15	0	0	0	0	0	0
	point1224	314	77	15	9	15	0	0	0	0	0	0
	point1225	315	77	15	9	15	0	0	0	0	0	0
	point1226	316	77	15	9	15	0	0	0	0	0	0
	point660	317	77	15	9	15	0	0	0	0	0	0
	point659	318	77	15	9	15	0	0	0	0	0	0
	point657	319	77	15	9	15	0	0	0	0	0	0
	point656	320	77	15	9	15	0	0	0	0	0	0
	point654	321	77	15	9	15	0	0	0	0	0	0
	point653	322	77	15	9	15	0	0	0	0	0	0
	point652	323	77	15	9	15	0	0	0	0	0	0
	point651	324	77	15	9	15	0	0	0	0	0	0
	point650	325	77	15	9	15	0	0	0	0	0	0
	point649	326	77	15	9	15	0	0	0	0	0	0
	point648	327	77	15	9	15	0	0	0	0	0	0
	point646	328	77	15	9	15	0	0	0	0	0	0

INPUT: TRAFFIC FOR LAeq1h Volumes

Camp Zoe

	point644	329	77	15	9	15	0	0	0	0	0	0
	point643	330	77	15	9	15	0	0	0	0	0	0
	point642	331	77	15	9	15	0	0	0	0	0	0
	point641	332	77	15	9	15	0	0	0	0	0	0
	point640	333	77	15	9	15	0	0	0	0	0	0
	point639	334	77	15	9	15	0	0	0	0	0	0
	point638	335	77	15	9	15	0	0	0	0	0	0
	point637	336	77	15	9	15	0	0	0	0	0	0
	point636	337	77	15	9	15	0	0	0	0	0	0
	point635	338	77	15	9	15	0	0	0	0	0	0
	point633	339	77	15	9	15	0	0	0	0	0	0
	point632	340	77	15	9	15	0	0	0	0	0	0
	point630	341	77	15	9	15	0	0	0	0	0	0
	point629	342	77	15	9	15	0	0	0	0	0	0
	point628	343	77	15	9	15	0	0	0	0	0	0
	point626	344	77	15	9	15	0	0	0	0	0	0
	point625	345	77	15	9	15	0	0	0	0	0	0
	point624	346	77	15	9	15	0	0	0	0	0	0
	point622	347	77	15	9	15	0	0	0	0	0	0
	point620	348	77	15	9	15	0	0	0	0	0	0
	point618	349	77	15	9	15	0	0	0	0	0	0
	point616	350	77	15	9	15	0	0	0	0	0	0
	point615	351	77	15	9	15	0	0	0	0	0	0
	point612	352	77	15	9	15	0	0	0	0	0	0
	point611	353	77	15	9	15	0	0	0	0	0	0
	point610	354	77	15	9	15	0	0	0	0	0	0
	point609	355	77	15	9	15	0	0	0	0	0	0
	point607	356	77	15	9	15	0	0	0	0	0	0
	point606	357	77	15	9	15	0	0	0	0	0	0
	point604	358	77	15	9	15	0	0	0	0	0	0
	point602	359	77	15	9	15	0	0	0	0	0	0
	point600	360	77	15	9	15	0	0	0	0	0	0
	point596	361	77	15	9	15	0	0	0	0	0	0
	point594	362	77	15	9	15	0	0	0	0	0	0

INPUT: TRAFFIC FOR LAeq1h Volumes

Camp Zoe

	point591	363	77	15	9	15	0	0	0	0	0	0
	point589	364	77	15	9	15	0	0	0	0	0	0
	point587	365	77	15	9	15	0	0	0	0	0	0
	point584	366	77	15	9	15	0	0	0	0	0	0
	point581	367	77	15	9	15	0	0	0	0	0	0
	point578	368	77	15	9	15	0	0	0	0	0	0
	point576	369	77	15	9	15	0	0	0	0	0	0
	point575	370	77	15	9	15	0	0	0	0	0	0
	point572	371	77	15	9	15	0	0	0	0	0	0
	point570	372	77	15	9	15	0	0	0	0	0	0
	point567	373	77	15	9	15	0	0	0	0	0	0
	point564	374	77	15	9	15	0	0	0	0	0	0
	point563	375	77	15	9	15	0	0	0	0	0	0
	point561	376	77	15	9	15	0	0	0	0	0	0
	point556	377	77	15	9	15	0	0	0	0	0	0
	point553	378	77	15	9	15	0	0	0	0	0	0
	point552	379	77	15	9	15	0	0	0	0	0	0
	point551	380	77	15	9	15	0	0	0	0	0	0
	point548	381	77	15	9	15	0	0	0	0	0	0
	point546	382	77	15	9	15	0	0	0	0	0	0
	point543	383	77	15	9	15	0	0	0	0	0	0
	point541	384	77	15	9	15	0	0	0	0	0	0
	point540	385	77	15	9	15	0	0	0	0	0	0
	point538	386	77	15	9	15	0	0	0	0	0	0
	point535	387	77	15	9	15	0	0	0	0	0	0
	point533	388	77	15	9	15	0	0	0	0	0	0
	point532	389	77	15	9	15	0	0	0	0	0	0
	point531	390	77	15	9	15	0	0	0	0	0	0
	point530	391	77	15	9	15	0	0	0	0	0	0
	point1229	392	77	15	9	15	0	0	0	0	0	0
	point527	393	77	15	9	15	0	0	0	0	0	0
	point525	394	77	15	9	15	0	0	0	0	0	0
	point523	395	77	15	9	15	0	0	0	0	0	0
	point521	396	77	15	9	15	0	0	0	0	0	0

INPUT: TRAFFIC FOR LAeq1h Volumes

Camp Zoe

	point520	397	77	15	9	15	0	0	0	0	0	0
	point519	398	77	15	9	15	0	0	0	0	0	0
	point518	399	77	15	9	15	0	0	0	0	0	0
	point517	400	77	15	9	15	0	0	0	0	0	0
	point516	401	77	15	9	15	0	0	0	0	0	0
	point515	402	77	15	9	15	0	0	0	0	0	0
	point513	403	77	15	9	15	0	0	0	0	0	0
	point511	404	77	15	9	15	0	0	0	0	0	0
	point509	405	77	15	9	15	0	0	0	0	0	0
	point506	406	77	15	9	15	0	0	0	0	0	0
	point504	407	77	15	9	15	0	0	0	0	0	0
	point501	408	77	15	9	15	0	0	0	0	0	0
	point498	409	77	15	9	15	0	0	0	0	0	0
	point497	410	77	15	9	15	0	0	0	0	0	0
	point1231	411	77	15	9	15	0	0	0	0	0	0
	point1232	412	77	15	9	15	0	0	0	0	0	0
	point1233	413	77	15	9	15	0	0	0	0	0	0
	point493	414	77	15	9	15	0	0	0	0	0	0
	point491	415	77	15	9	15	0	0	0	0	0	0
	point489	416	77	15	9	15	0	0	0	0	0	0
	point486	417	77	15	9	15	0	0	0	0	0	0
	point484	418	77	15	9	15	0	0	0	0	0	0
	point482	419	77	15	9	15	0	0	0	0	0	0
	point479	420	77	15	9	15	0	0	0	0	0	0
	point475	421	77	15	9	15	0	0	0	0	0	0
	point473	422	77	15	9	15	0	0	0	0	0	0
	point470	423	77	15	9	15	0	0	0	0	0	0
	point469	424	77	15	9	15	0	0	0	0	0	0
	point466	425	77	15	9	15	0	0	0	0	0	0
	point465	426	77	15	9	15	0	0	0	0	0	0
	point463	427	77	15	9	15	0	0	0	0	0	0
	point459	428	77	15	9	15	0	0	0	0	0	0
	point456	429	77	15	9	15	0	0	0	0	0	0
	point1238	430	77	15	9	15	0	0	0	0	0	0

INPUT: TRAFFIC FOR LAeq1h Volumes Camp Zoe

	point1239	431	77	15	9	15	0	0	0	0	0	0
	point1240	432	77	15	9	15	0	0	0	0	0	0
	point445	433	77	15	9	15	0	0	0	0	0	0
	point442	434	77	15	9	15	0	0	0	0	0	0
	point436	435	77	15	9	15	0	0	0	0	0	0
	point433	436	77	15	9	15	0	0	0	0	0	0
	point431	437	77	15	9	15	0	0	0	0	0	0
	point428	438	77	15	9	15	0	0	0	0	0	0
	point425	439	77	15	9	15	0	0	0	0	0	0
	point422	440	77	15	9	15	0	0	0	0	0	0
	point420	441	77	15	9	15	0	0	0	0	0	0
	point418	442	77	15	9	15	0	0	0	0	0	0
	point414	443	77	15	9	15	0	0	0	0	0	0
	point408	444	77	15	9	15	0	0	0	0	0	0
	point403	445	77	15	9	15	0	0	0	0	0	0
	point1244	446	77	15	9	15	0	0	0	0	0	0
	point1245	447	77	15	9	15	0	0	0	0	0	0
	point391	448	77	15	9	15	0	0	0	0	0	0
	point390	449	77	15	9	15	0	0	0	0	0	0
	point388	450	77	15	9	15	0	0	0	0	0	0
	point386	451	77	15	9	15	0	0	0	0	0	0
	point1248	452	77	15	9	15	0	0	0	0	0	0
	point1249	453	77	15	9	15	0	0	0	0	0	0
	point1250	454	77	15	9	15	0	0	0	0	0	0
	point379	455	77	15	9	15	0	0	0	0	0	0
	point376	456	77	15	9	15	0	0	0	0	0	0
	point373	457	77	15	9	15	0	0	0	0	0	0
	point372	458	77	15	9	15	0	0	0	0	0	0
	point371	459	77	15	9	15	0	0	0	0	0	0
	point1253	460	77	15	9	15	0	0	0	0	0	0
	point1254	461	77	15	9	15	0	0	0	0	0	0
	point364	462	77	15	9	15	0	0	0	0	0	0
	point361	463	77	15	9	15	0	0	0	0	0	0
	point359	464	77	15	9	15	0	0	0	0	0	0

INPUT: TRAFFIC FOR LAeq1h Volumes

Camp Zoe

	point1257	465	77	15	9	15	0	0	0	0	0	0
	point353	466	77	15	9	15	0	0	0	0	0	0
	point352	467	77	15	9	15	0	0	0	0	0	0
	point349	468	77	15	9	15	0	0	0	0	0	0
	point344	469	77	15	9	15	0	0	0	0	0	0
	point340	470	77	15	9	15	0	0	0	0	0	0
	point338	471	77	15	9	15	0	0	0	0	0	0
	point335	472	77	15	9	15	0	0	0	0	0	0
	point333	473	77	15	9	15	0	0	0	0	0	0
	point331	474	77	15	9	15	0	0	0	0	0	0
	point327	475	77	15	9	15	0	0	0	0	0	0
	point326	476	77	15	9	15	0	0	0	0	0	0
	point325	477	77	15	9	15	0	0	0	0	0	0
	point323	478	77	15	9	15	0	0	0	0	0	0
	point321	479	77	15	9	15	0	0	0	0	0	0
	point1258	480	77	15	9	15	0	0	0	0	0	0
	point317	481	77	15	9	15	0	0	0	0	0	0
	point313	482	77	15	9	15	0	0	0	0	0	0
	point310	483	77	15	9	15	0	0	0	0	0	0
	point308	484	77	15	9	15	0	0	0	0	0	0
	point306	485	77	15	9	15	0	0	0	0	0	0
	point305	486	77	15	9	15	0	0	0	0	0	0
	point303	487	77	15	9	15	0	0	0	0	0	0
	point301	488	77	15	9	15	0	0	0	0	0	0
	point299	489	77	15	9	15	0	0	0	0	0	0
	point297	490	77	15	9	15	0	0	0	0	0	0
	point295	491	77	15	9	15	0	0	0	0	0	0
	point293	492	77	15	9	15	0	0	0	0	0	0
	point291	493	77	15	9	15	0	0	0	0	0	0
	point290	494	77	15	9	15	0	0	0	0	0	0
	point288	495	77	15	9	15	0	0	0	0	0	0
	point286	496	77	15	9	15	0	0	0	0	0	0
	point284	497	77	15	9	15	0	0	0	0	0	0
	point283	498										

INPUT: TRAFFIC FOR LAeq1h Volumes Camp Zoe

HWY 19-Southbound-2	point1228	499	79	55	4	55	0	0	0	0	0	0
	point128	500	79	55	4	55	0	0	0	0	0	0
	point127	501	79	55	4	55	0	0	0	0	0	0
	point126	502	79	55	4	55	0	0	0	0	0	0
	point125	503	79	55	4	55	0	0	0	0	0	0
	point124	504	79	55	4	55	0	0	0	0	0	0
	point123	505	79	55	4	55	0	0	0	0	0	0
	point122	506	79	55	4	55	0	0	0	0	0	0
	point121	507	79	55	4	55	0	0	0	0	0	0
	point120	508	79	55	4	55	0	0	0	0	0	0
	point119	509	79	55	4	55	0	0	0	0	0	0
	point118	510	79	55	4	55	0	0	0	0	0	0
	point117	511	79	55	4	55	0	0	0	0	0	0
	point116	512	79	55	4	55	0	0	0	0	0	0
	point115	513	79	55	4	55	0	0	0	0	0	0
	point114	514	79	55	4	55	0	0	0	0	0	0
	point113	515	79	55	4	55	0	0	0	0	0	0
	point112	516	79	55	4	55	0	0	0	0	0	0
	point111	517	79	55	4	55	0	0	0	0	0	0
	point110	518	79	55	4	55	0	0	0	0	0	0
	point109	519	79	55	4	55	0	0	0	0	0	0
	point108	520	79	55	4	55	0	0	0	0	0	0
	point107	521	79	55	4	55	0	0	0	0	0	0
	point106	522	79	55	4	55	0	0	0	0	0	0
	point105	523	79	55	4	55	0	0	0	0	0	0
	point104	524	79	55	4	55	0	0	0	0	0	0
	point103	525	79	55	4	55	0	0	0	0	0	0
	point102	526	79	55	4	55	0	0	0	0	0	0
	point101	527	79	55	4	55	0	0	0	0	0	0
	point100	528	79	55	4	55	0	0	0	0	0	0
	point99	529	79	55	4	55	0	0	0	0	0	0
	point98	530	79	55	4	55	0	0	0	0	0	0
	point97	531	79	55	4	55	0	0	0	0	0	0
	point96	532	79	55	4	55	0	0	0	0	0	0

	point95	533	79	55	4	55	0	0	0	0	0	0
	point94	534	79	55	4	55	0	0	0	0	0	0
	point93	535	79	55	4	55	0	0	0	0	0	0
	point92	536	79	55	4	55	0	0	0	0	0	0
	point91	537	79	55	4	55	0	0	0	0	0	0
	point90	538	79	55	4	55	0	0	0	0	0	0
	point89	539	79	55	4	55	0	0	0	0	0	0
	point87	540	79	55	4	55	0	0	0	0	0	0
	point86	541	79	55	4	55	0	0	0	0	0	0
	point85	542	79	55	4	55	0	0	0	0	0	0
	point84	543	79	55	4	55	0	0	0	0	0	0
	point83	544	79	55	4	55	0	0	0	0	0	0
	point82	545	79	55	4	55	0	0	0	0	0	0
	point81	546	79	55	4	55	0	0	0	0	0	0
	point80	547	79	55	4	55	0	0	0	0	0	0
	point79	548	79	55	4	55	0	0	0	0	0	0
	point78	549	79	55	4	55	0	0	0	0	0	0
	point77	550	79	55	4	55	0	0	0	0	0	0
	point76	551	79	55	4	55	0	0	0	0	0	0
	point75	552	79	55	4	55	0	0	0	0	0	0
	point74	553	79	55	4	55	0	0	0	0	0	0
	point73	554	79	55	4	55	0	0	0	0	0	0
	point72	555	79	55	4	55	0	0	0	0	0	0
	point71	556	79	55	4	55	0	0	0	0	0	0
	point70	557	79	55	4	55	0	0	0	0	0	0
	point69	558	79	55	4	55	0	0	0	0	0	0
	point68	559	79	55	4	55	0	0	0	0	0	0
	point67	560	79	55	4	55	0	0	0	0	0	0
	point66	561	79	55	4	55	0	0	0	0	0	0
	point65	562	79	55	4	55	0	0	0	0	0	0
	point64	563	79	55	4	55	0	0	0	0	0	0
	point63	564	79	55	4	55	0	0	0	0	0	0
	point62	565	79	55	4	55	0	0	0	0	0	0
	point61	566	79	55	4	55	0	0	0	0	0	0

	point60	567	79	55	4	55	0	0	0	0	0	0	
	point59	568	79	55	4	55	0	0	0	0	0	0	
	point58	569	79	55	4	55	0	0	0	0	0	0	
	point57	570	79	55	4	55	0	0	0	0	0	0	
	point56	571	79	55	4	55	0	0	0	0	0	0	
	point55	572	79	55	4	55	0	0	0	0	0	0	
	point54	573	79	55	4	55	0	0	0	0	0	0	
	point53	574	79	55	4	55	0	0	0	0	0	0	
	point52	575	79	55	4	55	0	0	0	0	0	0	
	point51	576	79	55	4	55	0	0	0	0	0	0	
	point50	577	79	55	4	55	0	0	0	0	0	0	
	point49	578	79	55	4	55	0	0	0	0	0	0	
	point48	579	79	55	4	55	0	0	0	0	0	0	
	point47	580	79	55	4	55	0	0	0	0	0	0	
	point46	581	79	55	4	55	0	0	0	0	0	0	
	point45	582	79	55	4	55	0	0	0	0	0	0	
	point44	583	79	55	4	55	0	0	0	0	0	0	
	point43	584	79	55	4	55	0	0	0	0	0	0	
	point42	585	79	55	4	55	0	0	0	0	0	0	
	point41	586	79	55	4	55	0	0	0	0	0	0	
	point40	587	79	55	4	55	0	0	0	0	0	0	
	point39	588	79	55	4	55	0	0	0	0	0	0	
	point38	589	79	55	4	55	0	0	0	0	0	0	
	point37	590	79	55	4	55	0	0	0	0	0	0	
	point36	591	79	55	4	55	0	0	0	0	0	0	
	point35	592	79	55	4	55	0	0	0	0	0	0	
	point34	593	79	55	4	55	0	0	0	0	0	0	
	point33	594	79	55	4	55	0	0	0	0	0	0	
	point32	595	79	55	4	55	0	0	0	0	0	0	
	point31	596	79	55	4	55	0	0	0	0	0	0	
	point30	597	79	55	4	55	0	0	0	0	0	0	
	point29	598	79	55	4	55	0	0	0	0	0	0	
	point28	599	79	55	4	55	0	0	0	0	0	0	
	point27	600	79	55	4	55	0	0	0	0	0	0	

INPUT: TRAFFIC FOR LAeq1h Volumes

Camp Zoe

	point26	601	79	55	4	55	0	0	0	0	0	0
	point25	602	79	55	4	55	0	0	0	0	0	0
	point24	603	79	55	4	55	0	0	0	0	0	0
	point23	604	79	55	4	55	0	0	0	0	0	0
	point22	605	79	55	4	55	0	0	0	0	0	0
	point21	606	79	55	4	55	0	0	0	0	0	0
	point20	607	79	55	4	55	0	0	0	0	0	0
	point19	608	79	55	4	55	0	0	0	0	0	0
	point18	609	79	55	4	55	0	0	0	0	0	0
	point17	610	79	55	4	55	0	0	0	0	0	0
	point16	611	79	55	4	55	0	0	0	0	0	0
	point15	612	79	55	4	55	0	0	0	0	0	0
	point14	613	79	55	4	55	0	0	0	0	0	0
	point13	614	79	55	4	55	0	0	0	0	0	0
	point12	615	79	55	4	55	0	0	0	0	0	0
	point11	616	79	55	4	55	0	0	0	0	0	0
	point10	617	79	55	4	55	0	0	0	0	0	0
	point9	618	79	55	4	55	0	0	0	0	0	0
	point8	619	79	55	4	55	0	0	0	0	0	0
	point7	620	79	55	4	55	0	0	0	0	0	0
	point6	621	79	55	4	55	0	0	0	0	0	0
	point5	622	79	55	4	55	0	0	0	0	0	0
	point4	623	79	55	4	55	0	0	0	0	0	0
	point3	624	79	55	4	55	0	0	0	0	0	0
	point2	625	79	55	4	55	0	0	0	0	0	0
	point1	626										
HWY 19-Southbound-Roadway17	point1271	627	121	55	6	55	0	0	0	0	0	0
	point1270	628	121	55	6	55	0	0	0	0	0	0
	point1269	629	121	55	6	55	0	0	0	0	0	0
	point1268	630	121	55	6	55	0	0	0	0	0	0
	point1267	631	121	55	6	55	0	0	0	0	0	0
	point1266	632	121	55	6	55	0	0	0	0	0	0
	point1265	633	121	55	6	55	0	0	0	0	0	0
	point1264	634	121	55	6	55	0	0	0	0	0	0

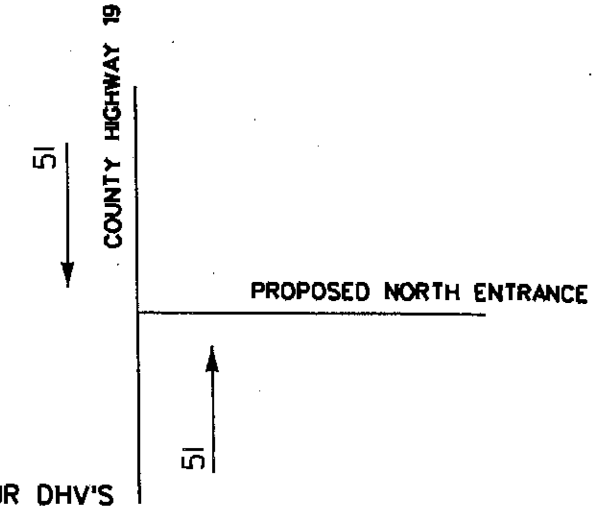
	point1263	635	121	55	6	55	0	0	0	0	0	0
	point1262	636	121	55	6	55	0	0	0	0	0	0
	point1261	637	121	55	6	55	0	0	0	0	0	0
	point1260	638	121	55	6	55	0	0	0	0	0	0
	point137	639	121	55	6	55	0	0	0	0	0	0
	point136	640	121	55	6	55	0	0	0	0	0	0
	point135	641	121	55	6	55	0	0	0	0	0	0
	point134	642	121	55	6	55	0	0	0	0	0	0
	point133	643	121	55	6	55	0	0	0	0	0	0
	point132	644	121	55	6	55	0	0	0	0	0	0
	point131	645	121	55	6	55	0	0	0	0	0	0
	point130	646	121	55	6	55	0	0	0	0	0	0
	point129	647										
Roadway18-HWY 19-Northbound-2	point1227	648	121	55	6	55	0	0	0	0	0	0
	point144	649	121	55	6	55	0	0	0	0	0	0
	point143	650	121	55	6	55	0	0	0	0	0	0
	point142	651	121	55	6	55	0	0	0	0	0	0
	point141	652	121	55	6	55	0	0	0	0	0	0
	point140	653	121	55	6	55	0	0	0	0	0	0
	point139	654	121	55	6	55	0	0	0	0	0	0
	point138	655	121	55	6	55	0	0	0	0	0	0
	point1272	656	121	55	6	55	0	0	0	0	0	0
	point1273	657	121	55	6	55	0	0	0	0	0	0
	point1274	658	121	55	6	55	0	0	0	0	0	0
	point1275	659	121	55	6	55	0	0	0	0	0	0
	point1276	660	121	55	6	55	0	0	0	0	0	0
	point1277	661	121	55	6	55	0	0	0	0	0	0
	point1278	662	121	55	6	55	0	0	0	0	0	0
	point1279	663	121	55	6	55	0	0	0	0	0	0
	point1280	664	121	55	6	55	0	0	0	0	0	0
	point1281	665	121	55	6	55	0	0	0	0	0	0
	point1282	666										

APPENDIX B

N.T.S.

ASSUMPTIONS:

1) BASED ON 2012 AADT DATA PROVIDED BY MoDOT
2) PEAK HOUR DHV = 15% 2012 AADT
3) 1% ANNUAL BACKGROUND GROWTH RATE
4) 50/50 SPLIT NB & SB TRAFFIC

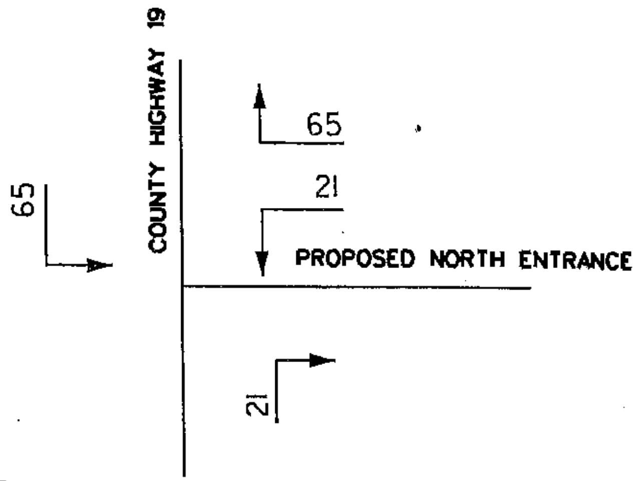


2014 PEAK HOUR DHV'S

N.T.S.

ASSUMPTIONS:

1) BASED ON "REGIONAL PARK" LAND USE: HIGH WEEKEND PK. HR. OF GENERATOR: ACRES; I.T.E. TRIP GEN. MANUAL 9TH ED.
2) ENTERING = 86 VPH; EXITING = 86 VPH
3) 75% TO/FROM NORTH; 25% TO/FROM SOUTH

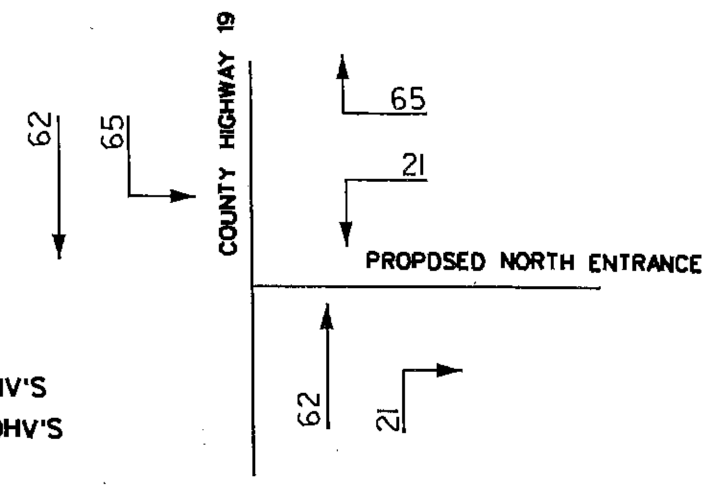


SITE-GENERATED DHV'S

N.T.S.

ASSUMPTIONS:

1) 1% ANNUAL BACKGROUND GROWTH RATE APPLIED TO 2014 PEAK HOUR DHV'S FOR 20 YEARS = 2034 BASELINE PEAK HOUR DHV'S
2) 2034 BASELINE DHV'S + SITE-GENERATED DHV'S = 2034 FORECAST PEAK HOUR DHV'S



2034 FORECAST PEAK HOUR DHV'S

CAMP ZOE DEVELOPMENT
PROJECTED TRAFFIC VOLUMES
CH 19 & PROP. NORTH SITE ENT.
08/18/14

Farnsworth GROUP
20 ALLEN AVE., SUITE 200
ST. LOUIS, MO 63119
314/962-7900, 314/962-1253 FAX

APPENDIX C

<Organization?>
GAG

24 October 2014
TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS
PROJECT/CONTRACT: Camp Zoe
RUN: Camp Zoe-2034
BARRIER DESIGN: INPUT HEIGHTS

ATMOSPHERICS: 68 deg F, 50% RH

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

Receiver													
Name	No.	#DUs	Existing LAeq1h	No Barrier					With Barrier				
				LAeq1h		Increase over existing		Type Impact	Calculated LAeq1h	Noise Reduction			
				Calculated	Crit'n	Calculated	Crit'n Sub'l Inc			Calculated	Goal	Calculated minus Goal	
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB	
Lodge	1	1	35.0	36.6	66	1.6	15	—	36.6	0.0	8	-8.0	
Amphitheater	2	1	35.0	37.7	66	2.7	15	—	37.7	0.0	8	-8.0	
RV Park	5	1	35.0	40.0	66	5.0	15	—	40.0	0.0	8	-8.0	
Canopy Walk Overlook	7	1	35.0	34.5	66	-0.5	15	—	34.5	0.0	8	-8.0	
Cabins 3	9	1	35.0	36.8	66	1.8	15	—	36.8	0.0	8	-8.0	
Cabins 1	11	1	35.0	32.4	66	-2.6	15	—	32.4	0.0	8	-8.0	
Cabins 2	12	1	35.0	46.1	66	11.1	15	—	46.1	0.0	8	-8.0	
Playground	14	1	35.0	38.1	66	3.1	15	—	38.1	0.0	8	-8.0	
Cemetery	16	1	35.0	32.1	66	-2.9	15	—	32.1	0.0	8	-8.0	
Cabins 4	18	1	35.0	29.0	66	-6.0	15	—	29.0	0.0	8	-8.0	

Dwelling Units	# DUs	Noise Reduction		
		Min	Avg	Max
		dB	dB	dB
All Selected	10	0.0	0.0	0.0
All Impacted	0	0.0	0.0	0.0
All that meet NR Goal	0	0.0	0.0	0.0

APPENDIX F

Phase I Cultural Resource Survey of Camp Zoe Project Area and Phase II Testing of Site 23SH1550 Shannon County, Missouri

Prepared for:
Missouri Department of Natural Resources,
Missouri State Parks
And the
State Historic Preservation Office

Prepared by:
ARCHAEOLOGICAL RESEARCH CENTER OF ST. LOUIS INC.
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Principal Investigator
Robin Machiran

Report Authors
Robin Machiran, Joe Harl, Meredith Hawkins-Trautt

Research Report #715 July 2014

Acknowledgement

We wish to thank Jim Newberry and Dan Files for their invaluable assistance and information during this project. We also would like to thank Jane Bigham, Archaeologist, and Kim Dillon, Cultural Resource Management Section Chief, of Missouri State Parks, for all of their assistance. Without the efforts of these individuals, the completion of the cultural resource survey and testing of the newly acquired Camp Zoe Project Area would not have been possible.

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SECTION 106 SURVEY MEMO
Missouri Dept. of Natural Resources
Historic Preservation Program
P.O. Box 176
Jefferson City, Missouri 65102-0176
(573) 751-7858

REVIEWER

Date________________SHPO Log #

___________Accepted _____________Rejected
SHPO USE ONLY

1) HPP 106 Project #

Location Information and Survey Conditions:

2) County(s): Shannon

3) Quadrangle: Round Springs 7.5' USGS Series (Figure 1)

4) Project Type/Title: Phase I Cultural Resource Survey of Camp Zoe property and Phase II Testing of Site 23SH1550 Shannon County, Missouri. Archaeological Research Center of St. Louis, Inc., Research Report # 715.

5) Funding/Permitting Federal Agency(s): Undetermined

6) Section: Sections 7, 8, 17, 18 7) Township: 30N 8) Range: 4W

9) U.T.M.: 15

NE:	N: 4131184	E: 642071
NW:	N: 4131184	E: 640455
SE:	N: 4129887	E: 642076
SW:	N: 4129427	E: 640560

10) Project Description: Phase I survey of new Camp Zoe Project Area and phase II testing of site23SH1550.

11) Topography: Ridge tops, ridge slopes, and steam terraces.

12) Soils: See Environmental Setting section and Figure 3

13) Drainage: Current watershed of the East White drainage (Weston and Weichman 1987).

14) Land Use/Ground Cover (Including % Visibility): Varied see results section.

15) Survey Limitations: None

Historical Background Information:

X 16) HPP - Cultural Resource Inventory

_____ 17) Archaeological Survey of Missouri

X 18) GIS Database

19) Historic Plats/Atlases/Sources: 1930 Atlas of Shannon County (W.W. Hixson 1930, Figure 4); 1945 15' USGS quadrangle (Figure 5), 1967 7.5' quadrangle (Figure 6).

20) Previously Reported Sites: See Previous Investigations Section.

21) Previous Surveys: See Previous Investigations Section.

22) Regional Sources Utilized: Missouri State Historic Preservation Office, Jefferson City; Missouri State Historical Society, Columbia, MO; Missouri State Parks, Jefferson City; and Shannon County Courthouse and Eminence Public Library, Eminence.

23) Master Plan Recommendation: N/A

24) Investigation Techniques: For the phase I survey, visual inspection of ground where visibility was above 30% and shovel tests in areas where visibility dropped below 30%. The phase II testing consisted of machine trenching of areas throughout the site.

25) Time Expended: 88 Person Hours

26) Sites Located: 23SH1551, 23SH1552, 23SH1553.

27) Cultural Resources: See Results Section.

28) Curated At: Missouri State Parks

29) Collection Techniques: The location of all artifacts was documented using a handheld GPS unit. All artifacts excluding building materials or historic dump items were collected. In compliance of the National Park Service policy non-diagnostic artifacts were noted, but not collected within the National Park Service area (Area 3, Figure 1). All artifacts were collected during the phase II testing of site 23SH1550.

30) Area Surveyed (Acres and Square Meters): 564.23 acres/2,283,357.8 square meters

31) Results of Investigation and Recommendations:

______ a) No Cultural Resources Located.

______ b) No National Register Eligible Cultural Resources Located.

__X__ c) National Register Eligible Cultural Resources Located.

______ d) Resources May Meet Requirements For National Register Eligibility; Phase II Testing Is Recommended.

e) Comments: See Results and Recommendation Section.

Cultural Resource Management Contractor Information:

32) Archaeological Contractor: Archaeological Research Center of St. Louis, Inc.

33) Address/Phone: 2812 Woodson Road St. Louis, MO 63114

Phone 314-426-2577 Fax 314-426-2599 Email arc@arcstl.com

34) Surveyor(s): Robin Machiran, Joe Harl, Meredith Hawkins-Trautt.

35) Survey Date(s): Feb. 17-21, March 20-21, April 14, May 20-22, 2014.

36) Report Compiled By: Robin Machiran, Joe Harl and Meredith Hawkins Trautt.

37) Date: July 14, 2014

38) Submitted By (Signature and Title): Robin Machiran (Principle Investigator)

39) Attachment Checklist:(Required)

__X__ 1) Relevant Portion of USGS 7.5' Topographic Quadrangle Map(s) Showing Project Location and Any Recorded Sites;

__X__ 2) Project Map(s) Depicting Survey Limits and, when applicable, Approximate Site Limits, and Concentrations of Cultural Materials;

__X__ 3) Site Form(s): One Copy of Each Form;

_____ 4) All Relevant Project Correspondence;

__X__ 5) Additional Information Sheets As Necessary.

40) Address of Owner/Agent/Agency to Whom SHPO Comment Should Be Mailed:

Missouri State Parks, Cultural Resource Management Section

PO Box 176

Jefferson City, Missouri 65102

41) Contact Person: Kim Dillon

42) Phone Number: 573-526-0976, Fax: 573-751-8656, email: kim.dillon@dnr.mo.gov

INTRODUCTION

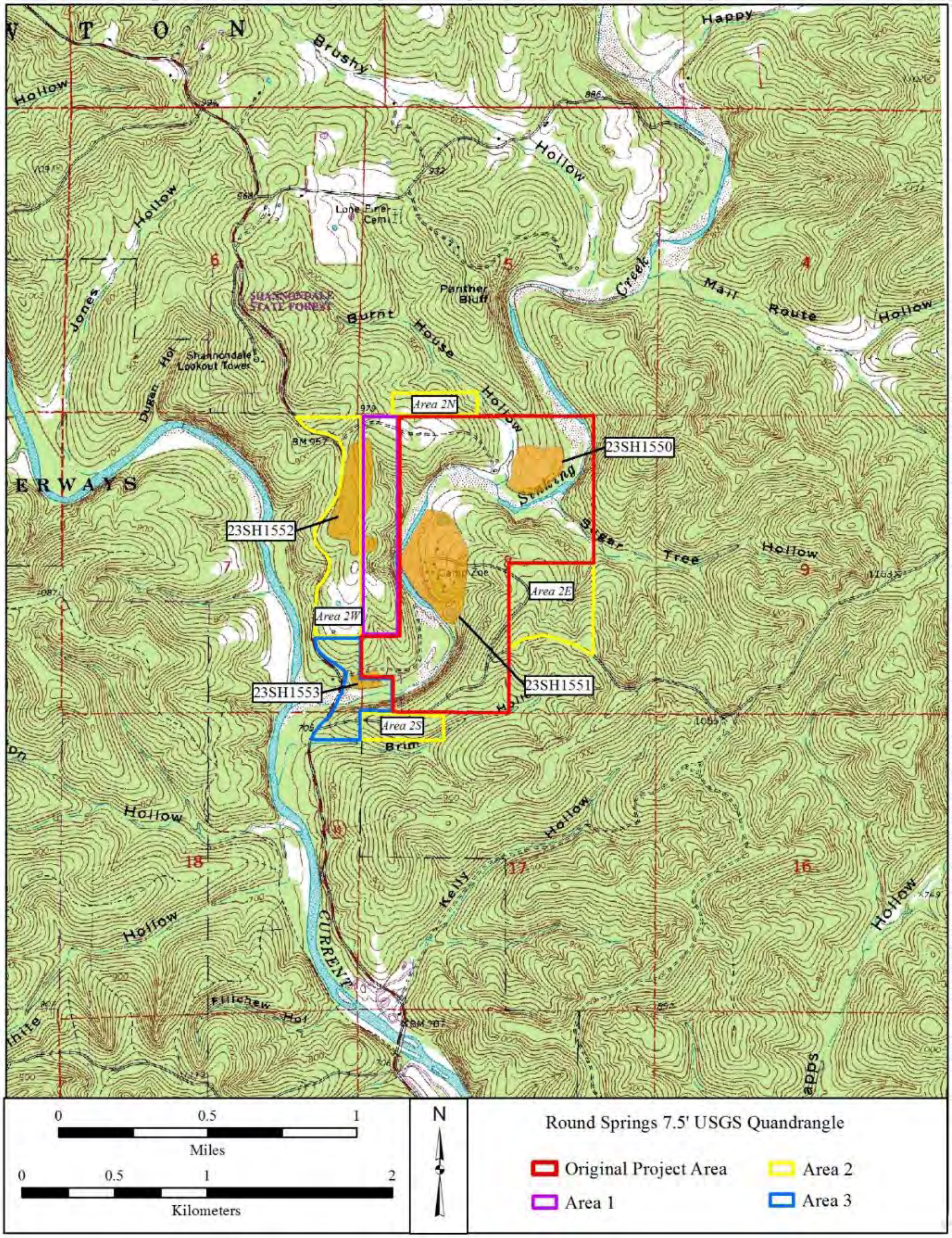
Missouri State Parks requested that a cultural resource assessment be conducted of the newly acquired Camp Zoe Project Area. It is located in Shannon County, Missouri specifically situated within Sections 5, 7, 8, 17, and 18 of Township 30 North, Range 4 West, as depicted on the Round Springs 7.5' USGS quadrangle (Figure 1).

An archaeological survey was performed within the Camp Zoe Project Area between February and May of 2014. In addition, archaeological testing of previously recorded site 23SH1550 was completed in the northeast portion of project tract on February 17-19, 2014. These archaeological investigations were conducted to identify any unknown cultural resources within the original Camp Zoe and newly acquired areas, as well as assess site 23SH1550 for inclusion in the National Register of Historic Places (NRHP).

The original property has a varied history. It was initially used as farmland by several individuals. By 1929, a girls summer camp was established and named Camp Zoe. The camp was later made coed and continued to run summer programs through the summer of 1986 (Missouri State Parks 2013). Most recently, the initial property acquisition was owned by James Tebeau who produced concerts and provided camping areas for the concert goers between 1998-2010. In 2010, the Federal Government confiscated the area citing that an "open air drug market" was permitted at the events (Currier 2013:1). Missouri State Parks acquired the property in 2013 with plans to develop this property as a recreational area. In 2014, Areas 1-3 were added to the project area.

Three new archaeological sites were identified during the current work. Site 23SH1551 represented the remains of Camp Zoe Youth Camp within the original project area. Prior work by Missouri State Parks documented extant buildings at the site. The current work documented any remains of the camp and looked for evidence of any further cultural resources. Historic mining was identified at 23SH1552 in Areas 1 and 2W. In Area 3, evidence of both historic habitation and prehistoric use was found at 23SH1553.

Figure 1: Location of Camp Zoe Project Area, Shannon County, Missouri



PREVIOUS CULTURAL RESOURCE INVESTIGATIONS

A search of the records of the Missouri Department of Natural Resources, State Historic Preservation Office (SHPO) in Jefferson City, Missouri was completed on January 31, 2014. The search revealed that two archaeological surveys have been conducted (CT-31 AND CT-39), and one archaeological site (23SH1550) has been recorded within the current project area (Figure 2). In addition, four archaeological surveys were conducted and three sites have been recorded within one mile of the current tract (Figure 2).

Survey CT-31 was conducted along the Ozark National Scenic Riverways in Carter, Dent, Shannon and Texas Counties by Lincoln University (Lynott 1981). The study area covered about 130 miles of riverway; however, no fieldwork was conducted within the current project area (Figure 2). The survey located 12 new sites (23CO164-175).

One of these sites (23SH97) was within one mile of the current study area. It was described as a prehistoric site located at the confluence of Current River and Sinking Creek (Lynott 1981:121). Lithic debris was recovered during the survey and Lynott (1981:121) reports that a private collection from this location included dart points, a Clovis point and ceramic sherds. This would indicate that the site had been occupied over several time periods.

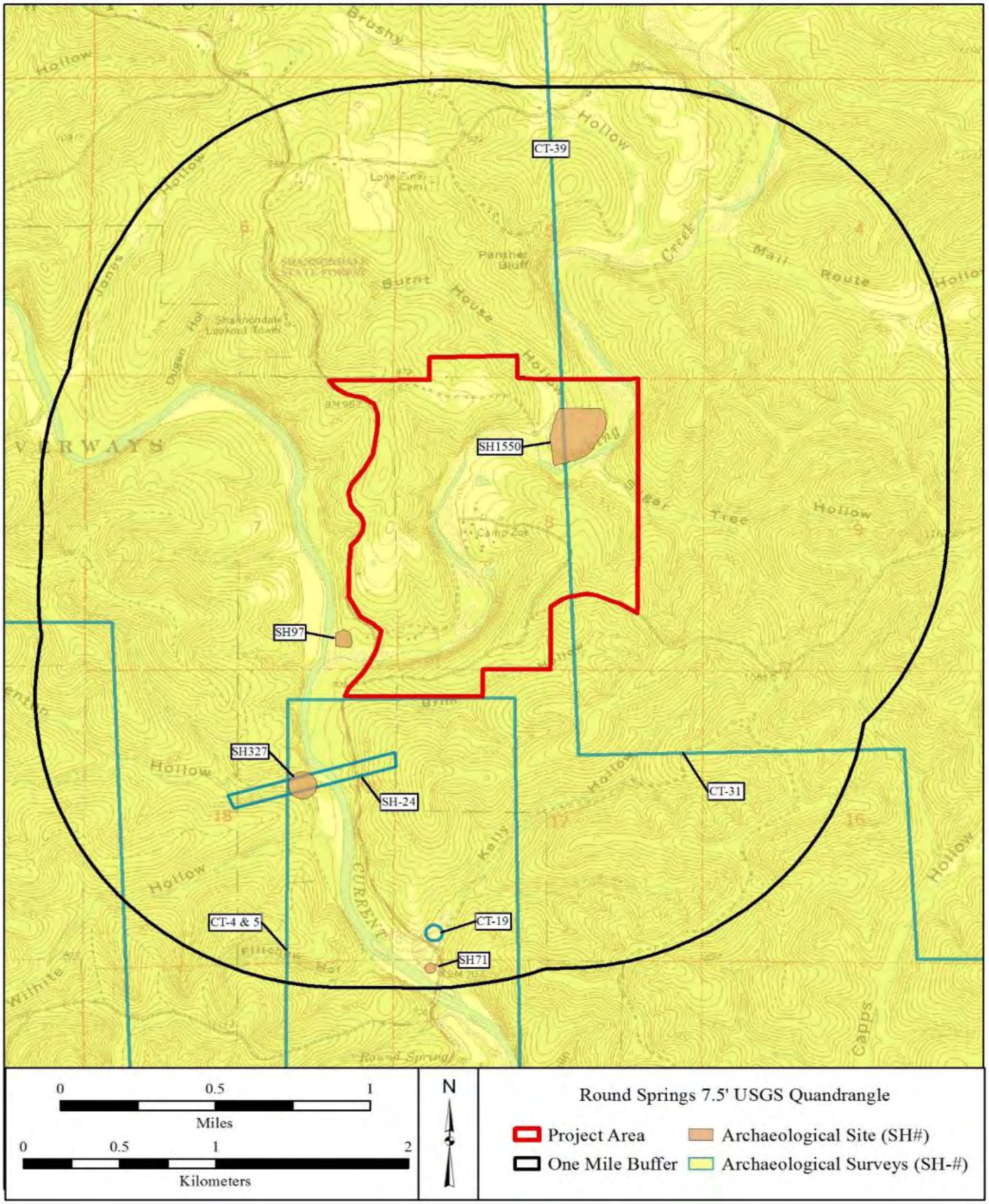
Midwest Archaeological Center conducted a phase I survey within the Ozark National Scenic Riverways (Survey CT-39) at selected locations in advance of road improvements (DeVore 1986). Although the survey area passes through the western portion of Camp Zoe (Figure 2), the main focus of the survey was at locations that were going to be heavily impacted by road construction. The work did not locate or evaluate any archaeological sites within the current project area.

Site 23SH1550, to be tested during the current work, was identified in 2013 by Jane Bigham as a multi-component historic and prehistoric site (Figure 2). The historic component was the Carpenter-Union Hill Cemetery. The fenced portion of the cemetery contained about 40 marked and likely additional unmarked graves. Bigham (2013) noted that interments ceased by approximately 1960, although there was evidence that visitation at the cemetery continued. The prehistoric component consisted of a moderate scatter of lithic debris. Bingham recommended further testing of the area north of the cemetery prior to any construction activities.

Missouri State Parks also conducted a documentation of all standing buildings in the original project area. Twenty-five buildings and paved walkways were documented during the work (Missouri State Parks 2013). In addition, a natural resource assessment was completed of the tract (McCarty et al. 2013).

Work within one mile of the project tract included archaeological survey of three areas, Round Spring, Big Spring and Powder Mill, within the Ozark National Scenic Riverways. This work is reported in surveys CT-004, a field progress report (Graham 1972) and CT-005, the final report (Garrison et al. 1976). The survey was completed by the University of Missouri-Columbia for National Park Service in advance of development in these areas. The Round Spring survey area lies just south of the current project tract (Figure 2). Seventeen

Figure 2: Archaeological Sites and Surveys in and within One Mile of the Current Project Area (State Historic Preservation Office 2014)



archaeological sites were examined during their survey, only one (23SH71) was within a mile of the Camp Zoe Project Area (Garrison et al. 1976). This site was identified by the presence of a bi-face and other lithic debris. The site area had been damaged by historic construction and flooding episodes and no further work was recommended (Graham 1972:88, Garrison et al. 1976:86).

Survey CT-19 was completed for the National Park Service on four locations within the Ozark National Scenic Riverways, one of which was south of the current project area (Figure 2). The work at this locale was conducted in advance of the installation of a sewage chopper adjacent to an existing sewage lagoon. No cultural resources were located in the area and it was recommended construction plans proceed as planned (C. Price 1980).

South of the Camp Zoe Project Area, a survey was conducted in 1990 by the Southeast Missouri Archaeological Research Center prior to work by Sho-Me Power Corporation. Prehistoric site 23SH327 was identified by the presence of lithic material and although no diagnostics were found, Price (1990:21) felt it likely dated to the Late Archaic. It was recommended that the site be avoided or data recovery be conducted prior to any construction activities (Price 1990:24).

A survey was conducted in 1998 for the National Park Service in advance of road construction just west of Camp Zoe. The work was performed to assess the condition of previously recorded site 23SH97 (Price 1998). Examination of this site through the years had identified occupation as far back as the Paleoindian period, evidenced by the presence of a Clovis point. Also found at the site was prehistoric pottery indicating a later occupation at the site and the presence of a stone wall showed its historic use (Price 1998:5-6). Price (1998:6) recommended the construction of the road be allowed to progress, but that the stone wall should be avoided and when heavy stripping of the topsoil occurred, monitoring by an archaeologist take place.

ENVIRONMENTAL SETTING

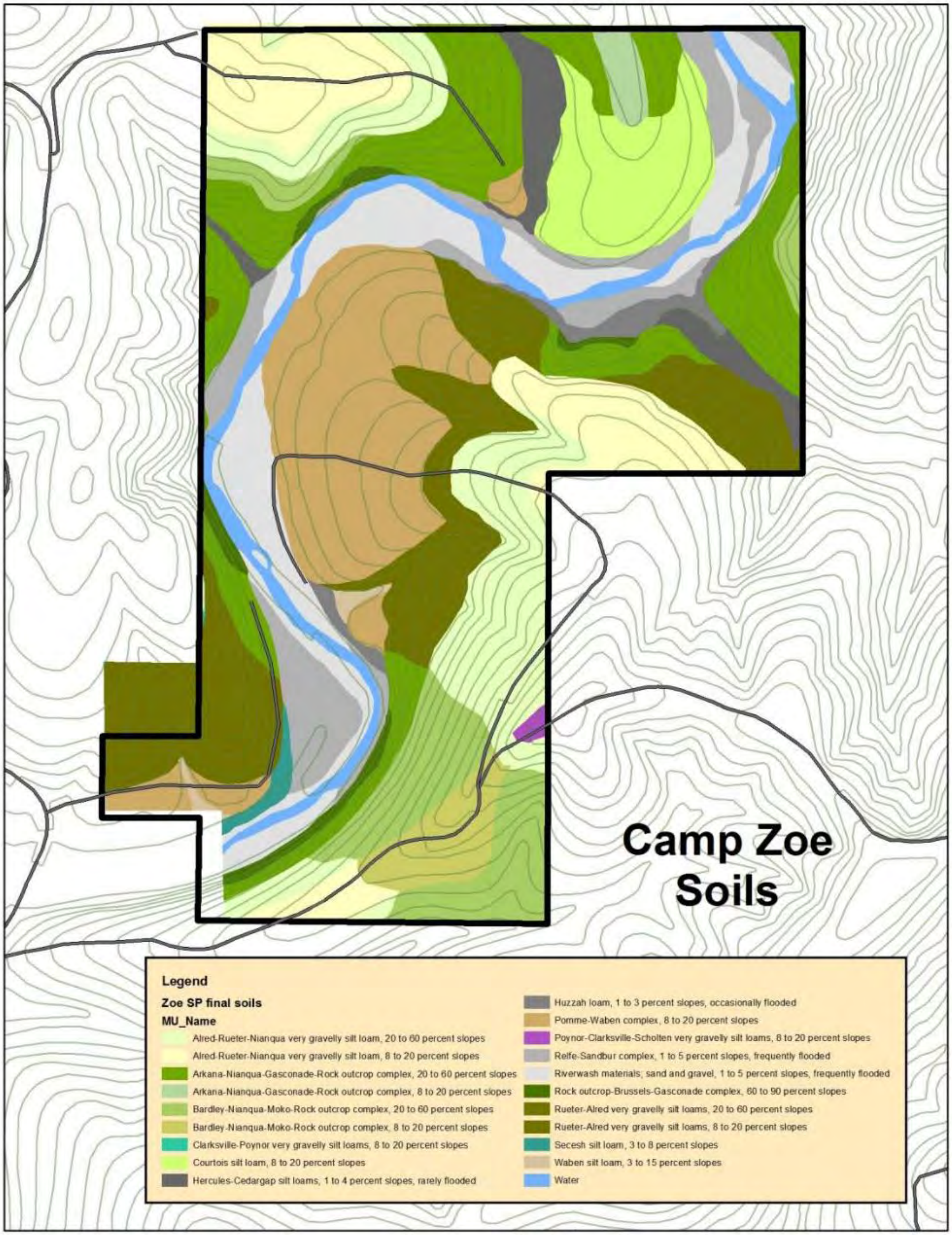
Camp Zoe is located along Sinking Creek just before it enters the Current River. A natural resource evaluation was conducted in 2013 by the Natural Resource Management Section of Missouri State Parks. The results of the assessment are presented in “Camp Zoe Natural Resource Assessment Phase I: Initial Inventory and Data Review” (McCarty et al. 2013).

During the assessment they found that the bottomlands consist of typical Ozark floodplain forests of sycamores, basswoods and walnut trees with witch hazel, buttonbush and willow along the stream edge (McCarty et al. 2013:1). The uplands contain oak, hickory, pine and cedar. The slopes exhibit many rock outcroppings with glades and dry woodlands along their expanses. Gravel bars and washes have formed along the Sinking Creek with sheer bluffs of Eminence Dolomite along areas of the creek. Springs and seeps occur throughout the area with five documented during the evaluation. Fives caves also were documented within the study area, where evidence of past human activity may be present.

Landforms are varied with narrow ridges, stream terraces, moderately to very steep slopes and bluffs. Overall the area consists of gravelly, well drained soils with loess as a minor component (Figure 3, McCarty et al 2013:4). Soil development occurs mostly on the ridge tops, foot slopes and stream terraces. In these areas intact cultural features are most likely to remain. Little or no soil development is present on the slopes and dolomite outcroppings are evident throughout.

People would have been drawn to this area to procure the natural resources present including riverine and forest faunal and floral resources such as mammals, migratory birds, waterfowl, fish, mussels, crayfish and a variety of nut trees (McCarty et al. 2013:14-16). In addition, the Gasconade and Eminence Dolomite outcroppings that contained chert horizons would have been exploited by humans for use in tool making prehistorically. It has been shown in similar environmental settings that historically local landowners mined various minerals to supplement to their income (Hawkins and Harl 2010, Harl 2011). Therefore, small, historic mining pits are likely to be present within the Camp Zoe area.

Figure 3: Soils in Project Area
(McCarty et al. 2013)



PREHISTORIC CULTURAL OVERVIEW

People altered their society over time in order to take advantage of new economic or social opportunities, resulting in the emergence of different cultural profiles that can be divided into distinct temporal periods. General cultural overviews of Missouri prepared by Carl Chapman (1975, 1980), and O'Brien and Wood (1998) were used to summarize these various cultural periods as well as recent information supplied for the upper Ozarks that was recently prepared by Ahler et al. (2010). This information was supplemented by data obtained from recent archaeological investigations associated primarily with cultural resource management studies.

Pre-Clovis Period (? - 9500 B.C.)

Archaeological evidence indicates that the Ozarks within central Missouri were occupied early, since the last Ice Age. The earliest defined cultural period is the Pre-Clovis Period. Sites dating to this time are extremely rare and are usually controversial. People probably lived in small, widely scattered groups, resulting in an elusive archaeological record. It is assumed that these first human settlers were nomadic groups, pursuing megafaunal species such as mastodon, mammoth, muskox, ground sloth, and horse. However, like most hunters and gatherers, their subsistence base was probably more diversified, consisting of a variety of plant and animal resources.

The first people in this region probably used a settlement strategy similar to that utilized by later Paleoindian groups. These groups were probably nomadic and established camp sites often placed on bluff tops or high terraces near major waterways. Elevated locations allowed people to monitor resources in the surrounding area. Only one potential Pre-Clovis site has been identified within southwestern Missouri, the Big Eddy site (23CE426) located along the lower Sac River in Cedar County, Missouri (Ray and Lopinot 2000). Flakes and charcoal flecks, radiocarbon dated roughly between 11,000 and 13,000 B.C. (corrected dates), were found near the base of excavations. However, it has been questioned if these flakes dated as early as the Pre-Clovis Period because they may have been redeposited from the upper deposits which contained cultural materials, or they could have been formed by natural processes; many of the flakes were associated with natural gravel bars. Some large rocks that appeared to have been used as anvil stones also were discovered. These stones were not local, although they could have been transported by the river to this location. When subjected to microwear analysis using a high powered electronic microscope, Tom Dillehay (2000:229), who performed the analysis concluded:

> The majority of the surfaces on the chert and sandstone cobbles show naturally "unfresh" and water worn cortex that often formed a bright heavily stained polish and striae that may have been produced by ancient cultural agency or by modern scars showing fresh modification.

> Possible human-modified areas showed more sheen combined with particle residues and generally distinctive frosty, ruffled, grainy, and darkened matte areas, either resulting from human-induced grinding or hammering or from an unknown source of natural action . . . Viewed from the perspective of micro- use-wear analysis, none of these interpretations should be considered conclusive until more systematic experimental, taphonomic, and comprehensive studies are carried out on the archaeological assemblage from the Big Eddy site.

Paleoindian Period (9500 - 8900 B.C.)

Few sites dating to the Paleoindian Period have been excavated and information about these people is limited. Chapman (1975:60-69) and Shippee (1964) suggested that Paleoindians lived in small nomadic groups and relied on large Pleistocene animals for subsistence. People hunted these animals using collaterally flaked and fluted projectile points or lanceolates (Chapman 1975:79-93). The view that Paleoindian groups relied heavily on large animals for subsistence has been challenged by archaeologists who maintain that subsistence strategies were much more diversified (Meltzer and Smith 1985). At the few sites where flotation samples have been obtained, the subsistence base was varied, including small and large faunal species as well as a variety of flora, especially fruits and nuts.

Sites of this period are typically located on upland ridge tops. Ridge top sites allowed occupants to monitor resources in the surrounding river and creek valleys. In addition, these areas had better air circulation, and were less infested with biting insects than locations within the bottomlands. The few Paleoindian kill sites that have been identified in the state are generally found near waterways and marshy areas attractive to megafaunal species (O'Brien and Wood 1998:64-65). Paleoindian hunters could watch these locations, attacking weaker members of the herd or scavenge animals killed by other predators.

Dalton Period (8900 - 7800 B.C.)

The Dalton Period is characterized as a time of transition from a wide-ranging nomadic subsistence strategy to hunting and gathering within a more restricted territory. The shift was perhaps precipitated by a climatic change that produced a drier and warmer environment which, together with over-hunting by Paleoindian hunters, may have contributed to the extinction of megafaunal species. The settlement scheme used at this time involved the use of a seasonal round within more restricted territories. Family units moved from one area to another as resources were available for exploitation within their territories. They then returned to the original location the following year to repeat the cycle. In this way, people would not have to carry all of their equipment with them. Instead these tools were stored in pits or rock shelters where they would be ready for use the following year. Groups continued to use this round until resources were depleted, then would shift to a new location, either within their territory or to a new territory, allowing the resources to replenish.

Early Archaic Period (7800 - 6000 B.C.)

Trends that began during the Dalton Period continued during the Early Archaic Period. Subsistence strategies were based on a broad spectrum approach as reflected in the varied artifact assemblage (Chapman 1975:127-129). A diversity of hafting styles used on projectile points was adopted and used on points such as Breckenridge, Rice Lanceolate, Rice Lobed, Graham Cave, and Hidden Valley points in the central and western half of the state, and Hardin Barbed, St. Charles Notched, and Thebes within the eastern half. Dalton points continued to be produced into the first part of this period, but fluted types gradually dropped out. Diverse tools needed to process plants were used, which suggests the importance of flora in the subsistence system. Ray and Lopinot (2005a) suggested that in southwestern Missouri there was a difference in when the points were utilized, with Breckenridge and Dalton points utilized between 7800 - 7700 B.C., Scottsbluff between 7700 and 7500 B.C., Cache River points between 7000 - 6600 B.C., Graham Cave points between 6600 - 6200 B.C., Rice Lobed points utilized between 6200 and 6000 B.C. and contracting stemmed Hidden Valley points utilized between 5900 - 5200 B.C. These latter points usually lacked a beveled blade on the left side common on the earlier points.

Early Archaic people generally lived in small groups of less than 50 people. Utilizing a residential mobility pattern as part of a seasonal round within a restricted territory, sites tended to be clustered near desired resources. Many sites were located near the bluffs and ridge tops overlooking major waterways. More Early Archaic sites are located within the interior uplands than during the following prehistoric periods because a climate milder than that of today ensured a greater number of usable resources.

Middle Archaic Period (6000 - 3000 B.C.)

The Middle Archaic Period coincides with the Hypsithermal Climatic Episode which peaked around 5000 B.C. At that time, the climate was slightly dryer than today, resulting in the maximum expansion of glades within the Ozarks. Chapman (1975:172) suggests that groups may have moved to newly exposed terraces along the major waterways. Archaeological investigations within Illinois indicate that riverine environments were heavily exploited by Middle Archaic populations because of the varied resources available in backwater areas (Brown and Vierra 1983; Jeffries and Lynch 1983; R. Lewis 1983). Asch et al. (1972) have argued that the lower Illinois River valley, and by analogy the waterways in Missouri, acted as a buffer against the drying climate. In addition, these areas were in marginal zones between the forest and riverine environments, providing a variety of resources for the inhabitants of these settlements. As the water table dropped, more locations within the bottoms became habitable. The shallower streams supported a greater diversity of plant and animal resources making these bottomlands desirable for exploitation.

Although diverse resources were still utilized, groups increasingly focused on obtaining favored foods. Resource selectivity is indicated by the quantity of certain species such as nuts (especially hickory), fish, and mussel shells found at some sites. Specialized tools and techniques were developed to procure and process preferred foods more effectively. For example, using basins filled with boiling water, Middle Archaic groups could process large quantities of hickory nuts in a short period of time. The tool assemblage was varied (Chapman

1975: 158-159), consisting of full grooved axes, various woodworking tools, and numerous styles of projectile points dominated by side notched (e.g., Burkett and Big Sandy) and expanding stemmed forms (e.g., Jakie Stemmed and Helton). People developed this expanded tool kit to improve their ability to obtain and process preferred foods. Evidence also suggests that people experimented with domesticating plants during this period (Asch and Asch 1982). The first cultivated plants were gourds (*Cucurbita pepo*), which were probably more important for uses other than food. Its rind could be used as a container or a net float.

Late Archaic Period (3000 - 600 B.C.)

The Late Archaic Period is characterized by a greater diversity and number of sites than identified during the previous cultural periods. It has been suggested that a relatively rapid increase in human population levels forced people to exploit resources within smaller territories, resulting in greater site diversity, the development of specialized tools, and regional differentiation (Chapman 1975:195). Although this may have been the case, another explanation is possible. A preference for certain resources may have led Late Archaic groups to concentrate their efforts within a smaller territory and develop specialized tools in order to more effectively procure and process the selected resources. With improved efficiency, available resources could have supported a greater number of people and spurred population growth.

A clearer understanding of the changes that occurred during the Late Archaic Period could be obtained by dividing this period into various phases. Ray and Lopinot (2005b) suggested dividing this period into various phases based on changes in the use of projectile points. For example, the Williams points utilized between 2040 and 1905 B.C. Harl (1999) suggested that during this time groups continued to use a seasonal round, but established base camps, usually within river or large creek valleys, where several groups would coalesce to spend the winters and exchange information.

This is followed by the use of Smith Basal Notched/Etley points 2180 - 1500 B.C. The broad bladed Williams point was replaced by long bladed styles or even by lanceolates. McMillan (1971:187) and Chapman (1975:184) argue, based on the presence of the lanceolate-like objects and long bladed spear points, that there was a movement of Plains groups into this region, probably in response to the effects of the Hypsithermal Climatic Episode. This drier climatic period had subsided by 3000 B.C., nearly 800 years before the start of this phase. Recent archaeological investigations within the Plains and in Missouri have shown no mass movement of people out of the prairies. Other than the presence of long bladed projectile points and lanceolates, the lifestyle of Missouri groups does not appear to have been altered drastically. The use of long bladed points does not reflect a movement of new groups into this area, but social changes within indigenous groups. Long bladed points were more conspicuous, providing the user with increased prestige and status (Harl 1995a). Long distance exchanges occurred during this time with Burlington chert being brought into the Ozarks in exchange for rhyolite, galena, granite, gabbro, and hematite.

During the final phase(s) of the Late Archaic Period, Kings corner notched and Afton notched points were utilized (ca. 1770 - 600 B.C.). The use of long bladed projectile points decreased in popularity in favor of these smaller, dart varieties. In addition to changes in projectile point styles, archaeological investigations within western Illinois (Fortier et al.

2006) and eastern Missouri (Harl 1995b:123-129) suggest people occupied some settlements on a permanent basis, constructing larger, more permanent dwellings and larger storage facilities. The long distance exchanges, however, appear to have ceased during this time, with people relying more on local resources. Formal burial grounds with marked graves are often associated with these communities. These communities were generally placed on terraces or near the bluff margins of major waterways.

Early Woodland Period (600 - 200 B.C.)

The Early Woodland Period is characterized by the refinement of Late Archaic culture. Sites dating to this period tend to be situated within the lowlands and represent small residential habitations (Martin 1999:88-89). Although the number of Early Woodland sites is limited, it is assumed that population density continued to increase.

The artifact assemblage appears to have remained relatively unchanged, except for the addition of contracting stem projectile points such as Burkett, Adena, and Gary Stemmed varieties. Also, medium sized points with long stems, such as Kramer points, were produced during this time.

Another hallmark of the Early Woodland Period is the introduction of pottery (i.e. Marion Thick and Black Sand). Pottery vessels may have first been utilized within the Nebo Hill Complex of the Late Archaic Period in western Missouri. Some sites associated with that complex have produced small clay particles that may be fiber or sand tempered sherds, but these may have been associated with other activities. Obvious pottery vessels have been found at sites in Missouri during the Early Woodland Period. The technology could have been brought to this region by the movement of groups from the south or east. However, there is no substantial evidence for a migration at this time and the new technology could have been spread to this area through trade.

Few Early Woodland sites have been identified in Missouri. It may be that portions of the state were abandoned during this period, however, it is more likely that people continued to utilize a Late Archaic lifestyle, making Early Woodland sites difficult to distinguish. Although pottery may have been known, it may not have been popular with these groups. Baskets and gourd vessels could have continued to satisfy the need for containers. Further work is needed in order to better understand this period of prehistory.

Middle Woodland Period (200 B.C. - A.D. 300)

The Middle Woodland Period is characterized by the widespread adoption of pottery manufacturing. A variety of vessel styles was produced with plain, cordmarked, or otherwise decorated surfaces. Projectile points distinctive of this period include contracting stemmed forms (e.g., Dickson and Langtrys) and ovate points (such as Snyders and Mankers). A number of Middle Woodland sites, including large villages, have been identified in the Kansas City and Big Bend area along the Missouri River (Kay 1979 and 1980), and along the Mississippi River. Johnson (1979) argues for a migration of people from the Illinois River Valley, but Reid (1980) suggests that local populations were taking advantage of trade and communications along the river.

Extensive trade networks were established at this time as evidenced by the widespread use of exotic goods such as copper ornaments, conch shells, obsidian tools, and buffalo skulls. Raw materials such as galena, copper, mica, obsidian, hematite, and chert were also exchanged. Some sites located near the rivers may have served as market or redistribution centers for raw materials and manufactured goods obtained from smaller settlements situated along the upper portions of tributary drainages (Kay 1979, 1980). The importance of these sites is suggested by the frequent presence of adjacent burial mounds. Shared ideas are implied by the widespread construction of these mounds, which may have served to integrate populations on a local scale.

For the Ozarks there is little evidence of Middle Woodland habitation. It is possible that groups in this region maintained a Late Archaic type of existence. However, resources within this region such as gabbro, lead, and hematite were widely traded during this time and it is unlikely that this area was completely untouched by the broader Middle Woodland developments.

Late Woodland Period (A.D. 300 - 1050)

During the Late Woodland Period, native seed cultigens were the primary crops. Most people lived in small farming communities that were established within river or creek valleys, the exchange of exotic goods waned, and pottery became less elaborately decorated. Vessels had only cordmarked exteriors, with occasional cordwrapped or plain dowel impressions on the lip.

Generally, it is assumed that this was a period of cultural degeneration or social isolation. Braun (1977), however, has argued that it was a time of continued evolutionary development with increasing social interaction. He suggests that the similarity of pottery styles throughout the Midwest was due to widespread trade and communication throughout the region. However, traders tended to favor luxury goods that yielded a high profit. The relatively undecorated conical vessels typical of the period could have been produced anywhere. The low demand for these undecorated pieces would not offset the cost of transportation or the risk of entering new territories. Instead, the changes in pottery style, the decline in exotic goods, and less elaborate burials could represent a change in social attitudes away from objects that reflected individual success towards those that emphasized community cohesion and a more egalitarian society.

Several new innovations were adopted during the Late Woodland Period. Hunting was improved by the rapid and widespread adoption of the bow and arrow around A.D. 600. After this time, small (<2cm long) Scallorn points were popular in this region. Grier (1974) suggests that groups in central Missouri continued to rely on hunting and gathering. Asch et al. (2010) and Reeder (1982:469) suggest that seeds associated with native seed cultigens are present at sites within the Ozarks. Although maize was known since the Middle Woodland Period when it was probably introduced into this region as a luxury item, it was not widely grown. Maize may not have been popular due to its original association with high status, which was de-emphasized during this time.

Farming communities were generally small. These settlements occurred within a variety of topographic zones, including both upland and bottomland contexts. The majority of these sites, however, were situated along the major waterways, where fertile soils exist.

Terminal Late Woodland or Mississippian Period (A.D. 1050 - 1400)

After A.D. 1050, groups along major rivers re-established trade networks of exotic goods and created numerous large communities with powerful leaders. The settlement system ranged from isolated farmsteads to large civic-ceremonial centers. Larger communities, present primarily along the Mississippi and Missouri rivers, were highly organized and often contained a variety of mound types. Most people resided within smaller farming hamlets or isolated farmsteads generally located near fertile soils (Milner et al 1984:186). The inhabitants of these isolated communities were involved in and benefitted from the expanded trade system.

Within the Ozarks only isolated Mississippian sites have been found. These sites were generally identified by the presence of triangular projectile points and the presence of plain and loop handled vessels. It has been suggested that a Late Woodland type of existence was maintained within this region (Asch et al. 2010). However, lead, hematite, fire clays, granite, and salt from this region were widely popular and exchanged during the Mississippian Period. It is unlikely that these groups were completely untouched by the Mississippian culture, although they seemed to have maintained many aspects of their indigenous culture. Much more work is needed within this region in order to better understand how these various groups developed and how they related to each other, as well as to groups in the larger centers to the east and west. The latter is especially important for understanding the overall Mississippian cultural system.

Protohistoric Period (A.D. 1400 - 1700s)

The Protohistoric Period began with the disintegration of the larger Mississippian centers around A.D. 1400, and lasted until the arrival of European-Americans. The Mississippian economic system seems to have declined during this time, although it continued to thrive in the southern and southeastern U.S. Groups in central Missouri may have continued a Terminal Late Woodland lifestyle, with some people continuing to rely on agriculture, and others returning to a hunter-gatherer style of subsistence. The Osage arrived into the western part of the state about this time, probably from the northern Plains. The eastern half of the state, on the other hand, appears to have been almost completely abandoned. Early European-American settlers reported that area served as an open territory utilized for hunting and trapping by various Native American tribes who lived at the outer edges of the state.

HISTORIC BACKGROUND

Shannon County was formed in 1841 from Ripley County with Eminence named as its county seat, which is approximately 14 miles south of the current project area. The county was named after George "Peg Leg" Shannon, a member of the Lewis and Clark expedition and a U.S. attorney. Shannon was born in Pennsylvania in 1785 to a Revolutionary War soldier. At 19 years old he joined the Lewis and Clark expedition. After the expedition Shannon went to Philadelphia to help with the publication of the journal at William Clark's request. He received his moniker in 1807, when his leg was amputated on an expedition with Nathaniel Pryor. Shannon later settled in St. Charles and died there in 1836 (Moser 1981; Simmons and Childress 2005:12).

The natural resources of Shannon County originally fueled its economy. The rivers and springs were used to power mills and later to create electricity. Roads and railroads brought mining and logging interests and several small copper and iron mines were developed in the 1800s (Simmons and Childress 2005:12). The county was divided into various townships, with the project area in Newton Township.

Like most of southern Missouri, the Civil War brought much unrest to Shannon County. Guerilla warfare broke out in the county with many towns being destroyed and citizens killed. Eminence, south of the current project area, was burned to the ground and it was not until the end of the war that the courts were re-established and the town reconstructed (Moser 1981). By the early 1900s, the county began to revitalize and a large sawmill was operating out of West Eminence (Simmons and Childress 2005:12).

According the General Land Office (GLO) records, the earliest known landowners of Section 8 in the project area are William Lambert (Document MO4200.320), who acquired the south ½ and the northwest ¼ of northwest ¼ in 1857, Patrick Kelly (Document MO4090.058), who owned the eastern ½ of the section in 1860 and Patrick McCartney (Document MO4000.160), who bought the southwest portion of in 1861. Joshua Spencer acquired the south½ of section 5, including Area 2N of the current project tract, in 1859 (Document MO3960.492). In 1859, Area 2S in section 18 was bought by John Smith (Document MO4040.495) and the portion in section 17 was acquired by Robert M. Watson (Document MO4000067). None of these landowners appeared to have ever resided in the area with Patrick McCartney listed as being from Jefferson County, MO and remainder of the owners all shown as being from St. Louis (GLO 1859-1866). Lambert and Spencer almost immediately sold their lands, Lambert to Whedon in 1859 and Spencer to Boyce in 1860 (Appendix A) indicating they likely were land speculators.

Subsequent landowners were traced through deed records located at the Shannon County Courthouse in Eminence, Missouri (Appendix A: Deeds Database 1859-2013). While many of these people may have resided in Shannon County, as evidenced by those who are now buried at the Carpenter-Union Hill Cemetery in the northeastern portion of the study area (highlighted in yellow in Appendix A: Deeds Database 1859-2013), it is difficult to say which actually resided within the Camp Zoe Project Area. The earliest atlas available for the project area is the one published in 1930. Unfortunately, it does not show buildings (Figure 4). Two historic topographic maps were located that give indications of prior activities within the project area

Figure 4: 1930 Atlas of Camp Zoe Project Area
(W.W. Hixson 1930)

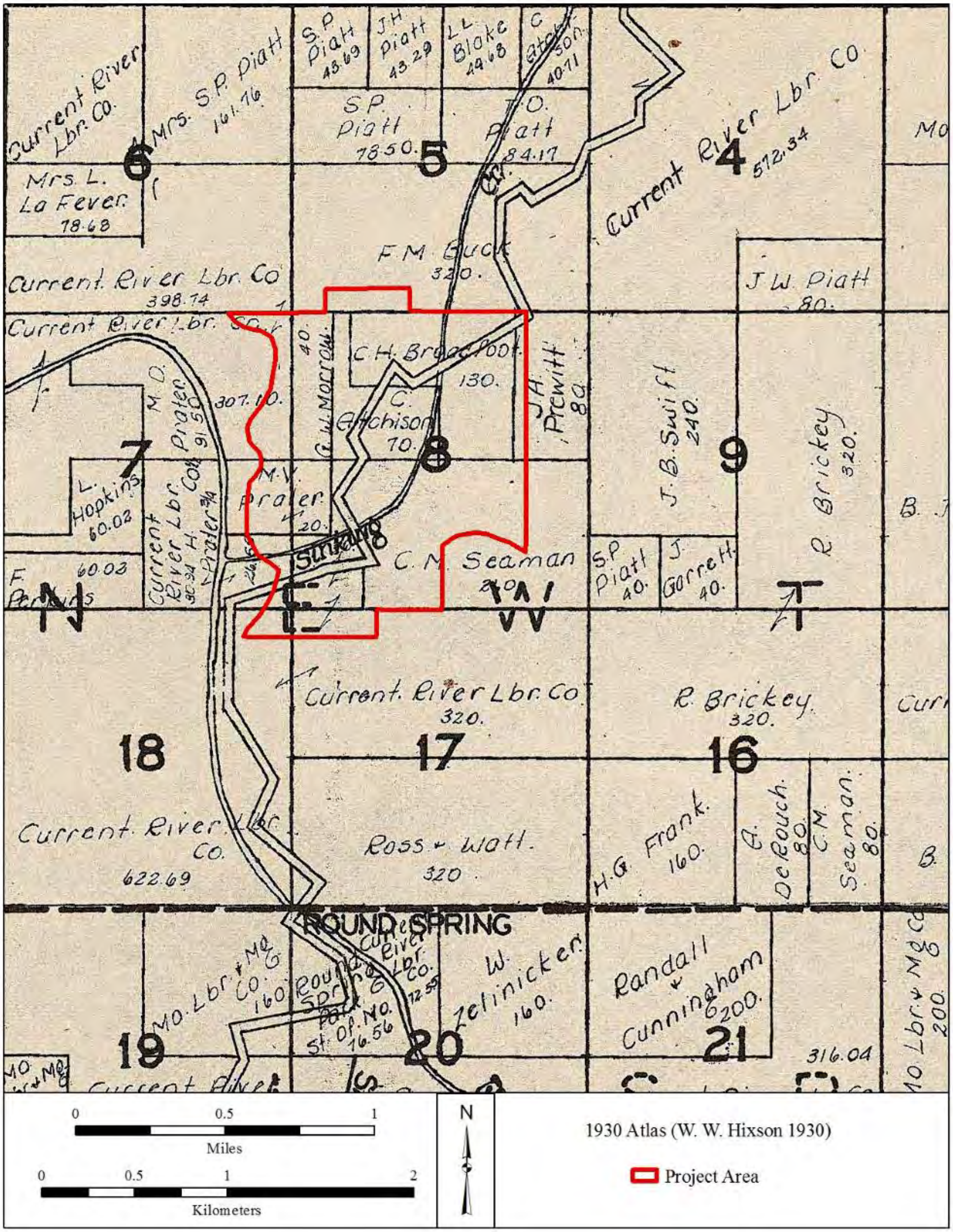


Figure 5:1945 Topographic Map of Camp Zoe Project Area

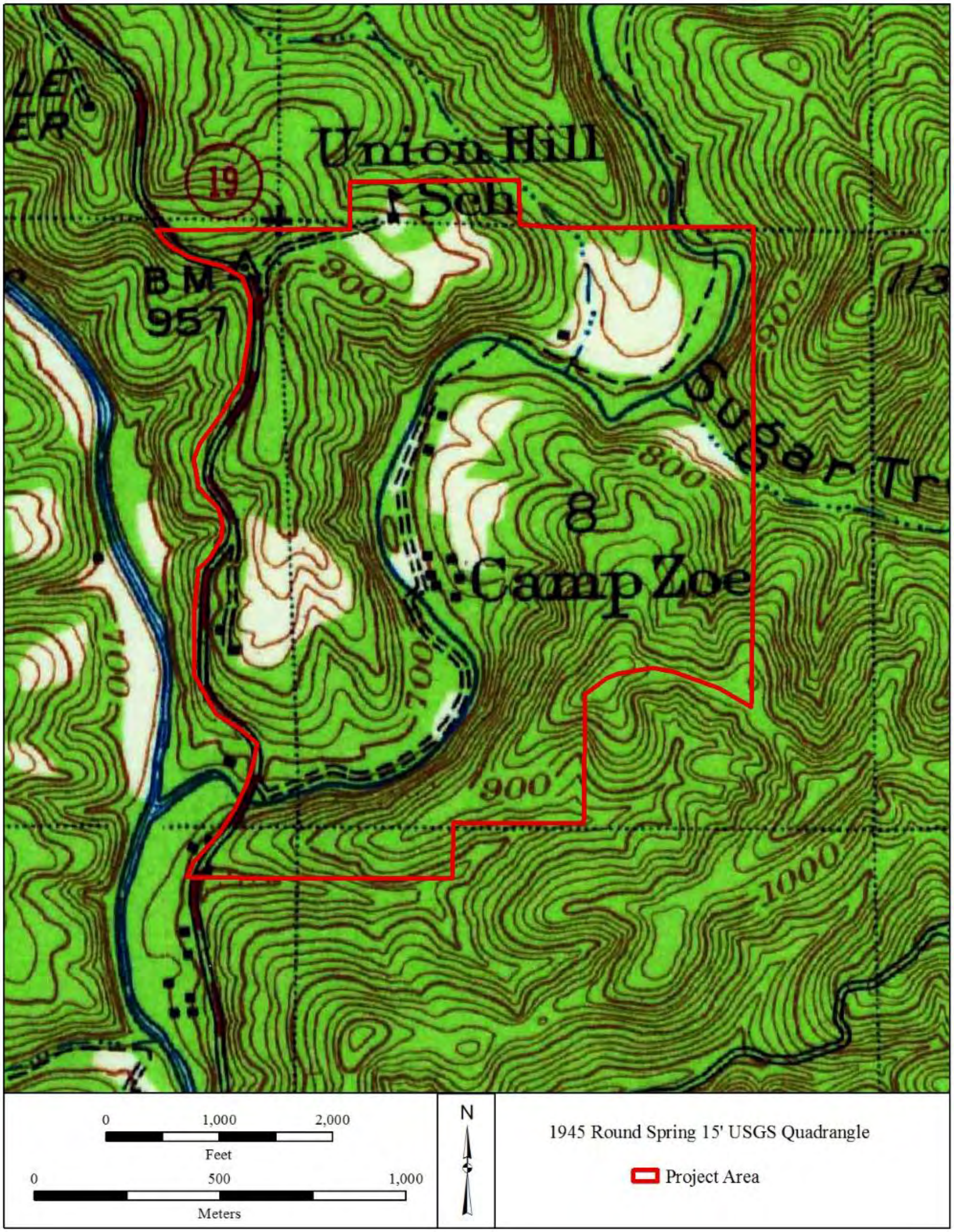
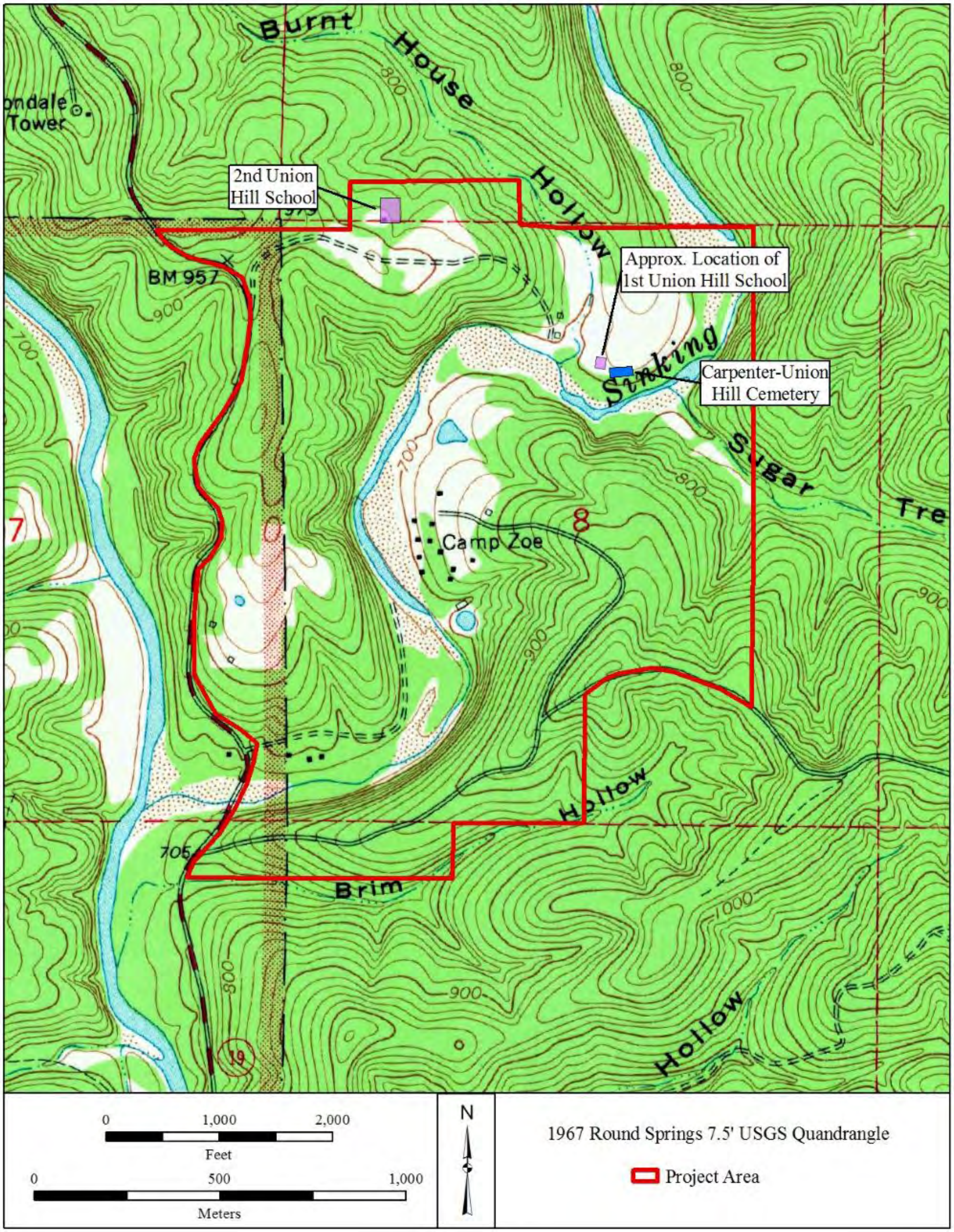


Figure 6: 1967 Topographic Map of Camp Zoe Project Area

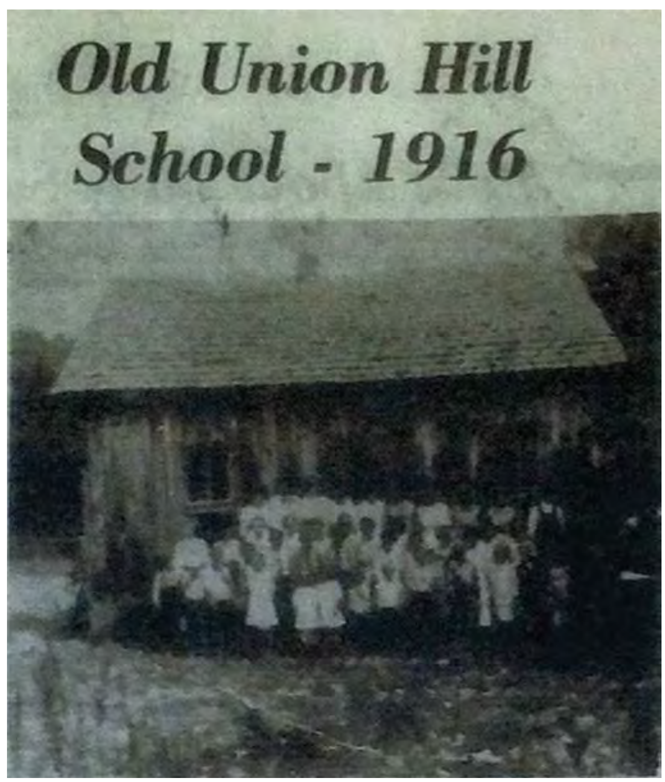


(Figures 5 and 6). A building is shown on the 1945 map in the northeastern portion of current study area next to the outlet of an intermittent stream that runs through Burnt House Hollow. By 1967 this area showed two buildings, both outbuildings (Figure 6). Two buildings in the west central portion of the project tract on the 1945 map also remain on the subsequent map, again shown as outbuildings. The presence of this type of building suggests that the area was used for farming, pastureland or possibly timber procurement rather than a residential area.

Union Hill School was established within the project area, likely in the late 1800's. The first school building was placed next to the Carpenter-Union Hill Cemetery (Lewis 1997). A picture of this first school shows a wooden building built on stone piers (Figure 7). In the mid-1930's, the school was relocated on a hill abovethe first one original site. The location of this second building is shown on 1945 map in the northern portion of the project area (Figure 5). This building was later turned into a residence (Lewis 1997). It is unknown exactly when the building was converted, but the 1967 map does not identify it as a school, suggesting that by that time it was being used as a residence.

The location of Carpenter-Union Hill Cemetery was not documented on any of the historic maps. The earliest marked burial is that of Green Carpenter in 1902. However, Lewis (1997) believes that the unmarked graves probably date back to Civil War times, although he gives no reason for this assessment. Of those interred at the cemetery, Green Carpenter, Charles V. and Martha Conway and Tom and Jane Dooley were identified as owning land in project area.

Figure 7: First Union Hill School (Lewis 1997)



Green Carpenter was originally from Tennessee but by 1860 was residing in Taney County, Missouri, southwest of the current project area. At that time he was living with his wife Rebecca and two children, Mary (age 3) and William (age 1). Both children were born in Missouri so the Carpenters had been in the state at least 3 years prior to that. Carpenter's sympathies stayed with south as he served in the 2nd Arkansas Calvary during the Civil War (U. S. Census 1890a). By 1870 he had moved his family to Newton Township in Shannon County at which time he is shown as living with his wife and six children. Where he was living at that time is unclear.

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Carpenter purchased land in Section 8 in 1880 from James M. Marrow. His holdings included the north ½ and SW ¼ of the NW section. As he was already established in the area prior to this purchase, it is likely he never actually resided in the project area but used it as a farm or pasture land. This is further suggested by his will, dated April 14, 1898, in which he leaves land in Section 7 to all his heirs. The land in Section 8 he left to his son Thomas as well as the "black smith shop & bench tools farming implements belonging to it" along with two mares, further indicating this locale was used as a work area. It is possible the building shown on the 1945 map along the stream in Burnt Creek Hollow was the blacksmith shop.

Several members of the Conway family are buried at Carpenter-Union Hill Cemetery, two of whom owned property in the project area, Charles V. and Martha Conway and their daughter Jane Conway Dooley and her husband Tom. Charles was born in Illinois and Martha in Tennessee. They had 10 children, but by 1910 only 8 were still living (U. S. Census 1910). The Conways acquired land in the project area in 1910 (Appendix A: Deeds Database 1859-2013). Prior to that time, they were living elsewhere in Newton Township, although the exact location is unknown (U. S. Census 1900). It is possible that they moved to the project area after the purchase. However, many of the same neighbors are listed on both the 1900 and 1910 census, so it is likely the land purchased in the project area was used to expand his farmland.

Tom and Jane (Conway) Dooley, bought 40 acres in the project area in 1920 (Appendix A: Deeds Database 1859-2013). It also is uncertain if they ever lived on this land. The 1920 census lists them as renting their home and only retained ownership of the land in Section 8 for a short time as they sold it to C. M. Seaman by 1925 (Appendix A: Deeds Database 1859-2013). It was this land along with an additional 60 acres owned by Seaman that was purchased by the McMahan's in 1929 to establish Camp Zoe Youth Camp.

R. S. McMahan and his wife Margaret purchased the 100 acres from C. M. Seaman and named the camp in honor of Margaret's mother, Zoe. Camp Zoe was set up as a girls summer camp, but in later years went coed. They were joined in the enterprise by Edna Winkelmeyer and their son R. S. McMahan, Jr. (Figure 8; Vickery 1970:77). The owners all were St. Louis teachers, where they lived during the camp's off season. The three McMahans taught in the Kirkwood District and Winkelmeyer in Webster Groves. The McMahans built cabins, a stable, a large dining hall and open shelters. A variety of activities were offered:

> The activities at Camp Zoe include canoeing, swimming, horseback riding, tennis, marksmanship, archery, fishing, and arts and crafts. There are floats on Current River for those who can meet the requirements. Bus trips are taken to points of interest and to the State Parks nearby. There are evening cook-outs over an open fire, dancing and games on the tennis courts, and training in camp life [Vickery1970:77].

Camp Zoe Youth Camp is shown to have six buildings by 1945 (Figure 5).

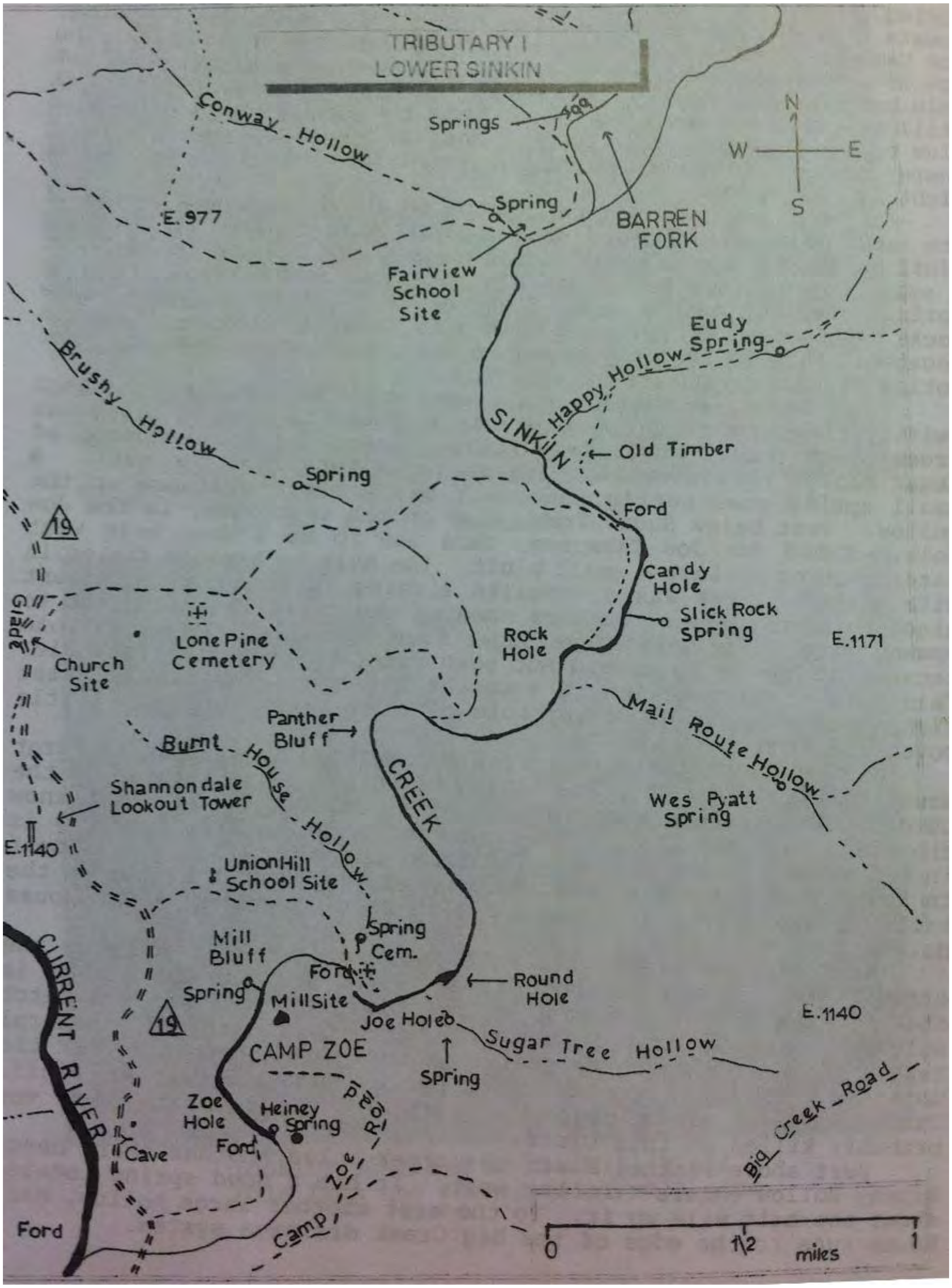
In 1967, the camp was sold to Mr. and Mrs. Harold Smith and Mr. and Mrs. Baltz and incorporated as Camp Zoe, Inc. (Vickery 1970:78, Appendix A: Deeds Database 1859-2013).By this time the camp had grown, with 13 buildings present, 2 of which were outbuildings (Figure 6). The camp continued to run programs with varying degrees of success until it closed in 1986. The decline in camp attendance was attributed, in part, to the loss of the St. Louis connection after the McMahans left, but also to escalating camp fees and mostly to the fact that families were taking vacations together resulting in this type of camp becoming less popular (Lewis 1997).

Figure 8: Camp Zoe Youth Camp's Original Owners
Left to Right: Miss Edna Winkelmeyer, Mrs. Margaret McMahan, R. S. McMahan Jr., R. S. McMahan
(Vickery 1970:85)

In 1997 the camp buildings still stood and the owners used the area as a weekend retreat. They also would rent the bunkhouses to groups who had spent the day on the Current River and a primitive campground had been established across Sinking Creek from the youth camp (Lewis 1997).

On the 1945 map (Figure 5), two buildings are shown north of Camp Zoe Youth Camp, adjacent to Sinking Creek, but it is unclear if these are associated with activities at the camp. Their location along the creek could indicate they are associated with the mill site shown on Lewis's (1997) sketch map of lower Sinking Creek (Figure 9). By 1967 the buildings are no longer present (Figure 6).

Figure 9: Sketch of “Lower Sinkin”
(Lewis 1997)



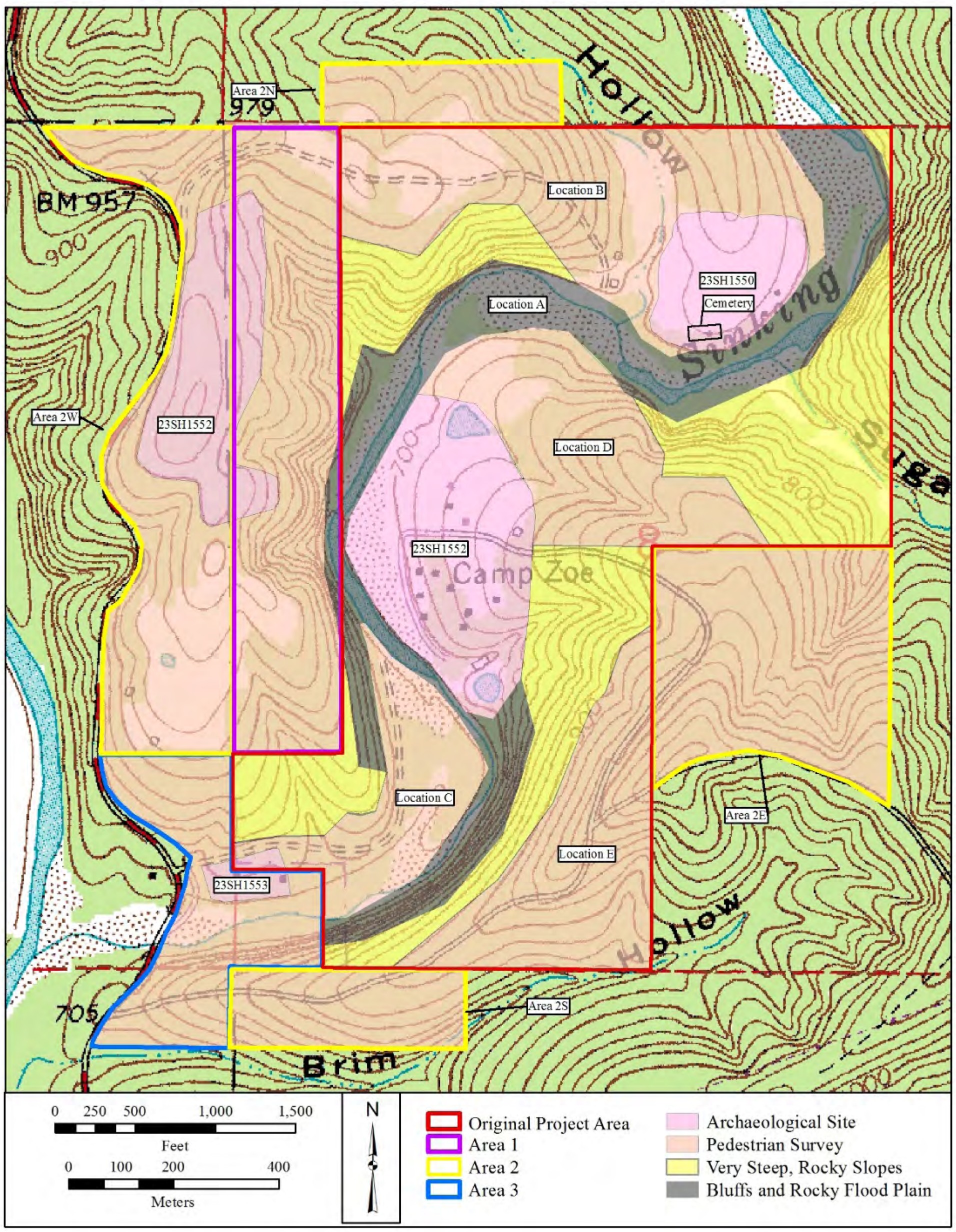
The most recent use of the major portion of the Camp Zoe Project Area was as a concert venue. James Tebeau purchased the land within the original project area (Figure 1, Page 2) in 2004 (Deed Database 1859-2013). He hosted weekend-long music festivals that came to be known as "Schwagstock." The name was derived from Tebeau's Grateful Dead tribute band, The Schwag (Currier 2013). Camp Zoe Youth Camp buildings were again reused for the events. Tebeau's residence was located in the northern portion of the current project area where the second Union Hill School once stood. The Federal Government seized the property in 2010 citing its use as an open-air drug market. Tebeau forfeited the property as part of his plea bargain. Missouri State Parks bought it at auction in 2013 (Currier 2013).

RESULTS OF FIELDWORK

Phase I Cultural Resource Survey Results

Phase I survey of the original project area, outside the 23SH1550 site area, was completed February 19-21, 2014, on Area 1 March 20-21, 2014 and on Area 3 April 4, 2014. The Phase I work consisted of pedestrian survey of all areas where intact soils were encountered; both shovel testing (in areas where visibility dropped below 30%) and visual inspection of the ground (where visibility was above 30%) were employed during the survey. Very steep, rocky slopes where habitation was not possible were not inspected (Figure 10, Yellow Areas).

Figure 10: Field Areas in Camp Zoe Project Area



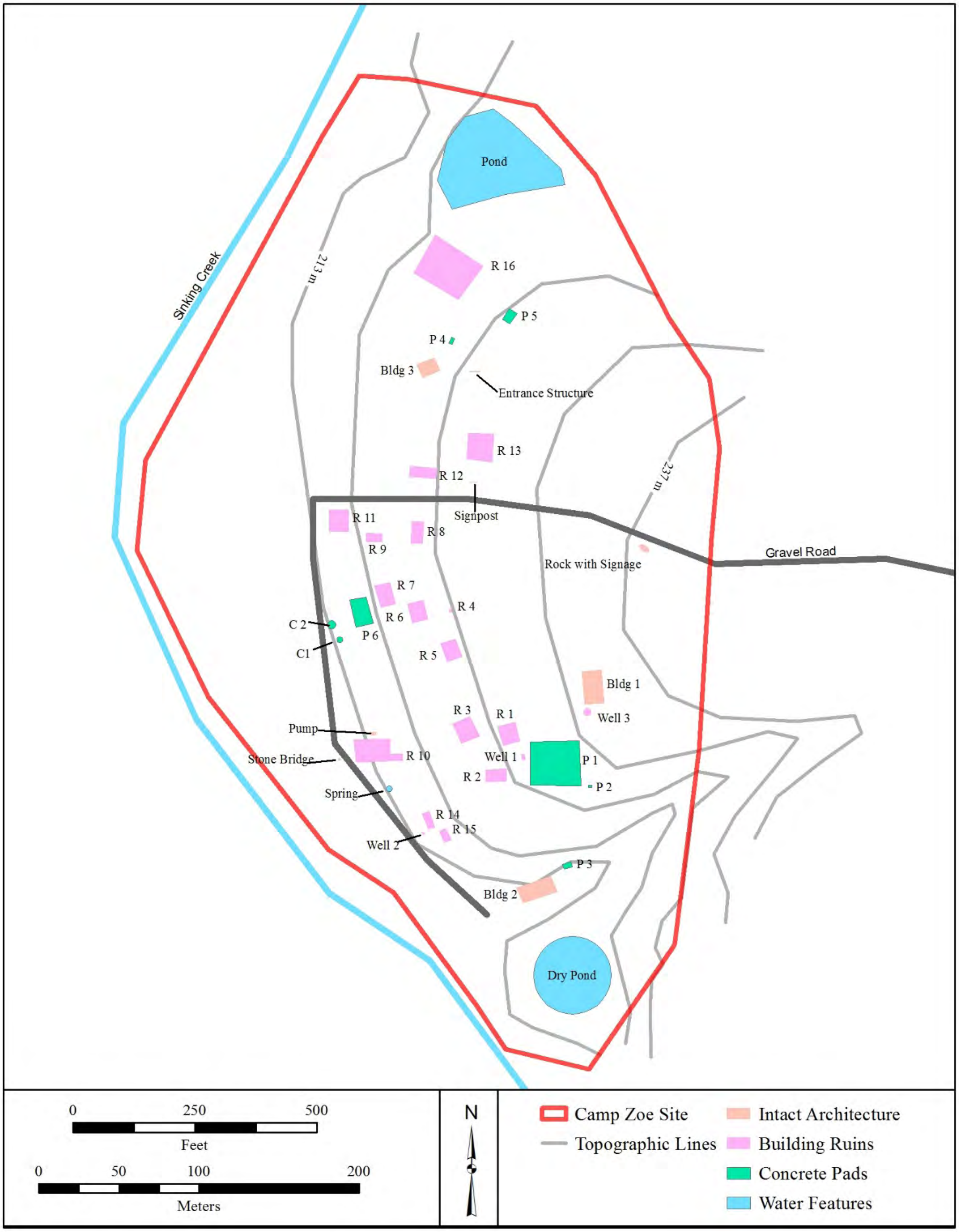
Survey Results in Original Project Area, Site 23SH1551

One new archaeological site was recorded during the phase I survey of the original project area. The Camp Zoe Youth Camp Site (23SH1551), located in the central portion of the project tract (Figure 10), consisted of 3 standing buildings, 16 ruins, 9 concrete pads, 2 wells, 1 cistern, and other features associated with its use between 1929-2010 at the time of the current survey (Figure 11). The features at the site relate its activities as a youth camp from 1929-1986 and its later reuse as a concert venue by landowner Jimmy Tebeau 2004-2010. At least 1 building, 4 concrete pads and 1 of the ruins were added to the site during the later use of the area. Many of the Camp Zoe buildings had recently been razed; however, Missouri State Parks documented all standing buildings in the area before demolition (Missouri State Parks 2013). Table 1 correlates the current study's findings with those of that previous documentation.

Table1: Building Reference Table

ARC ID (Figures 3 &4)	State Parks ID
Bldg 1	100 Miss Patty's
Bldg 2	111 Stable
Bldg 3	119 Eat at Zoes/Bar
C 2	-
C 3	101 Well # 1
C1	-
P 1	Second Stage
P 2	Second Stage Area
P 3	-
P 4	-
P 5	Main Stage Area
P 6	-
Pump	133 Cistern
R 1	103 Cabin # 1
R 10	106 Rec. Hall
R 11	117 First Aid
R 12	118 Small Shed
R 13	Collapsed Structure
R 14	108 Shower House
R 15	109 Motel
R 2	104 Cabin # 2
R 3	105 Restroom # 1
R 4	-
R 5	112 Barracks # 1
R 6	113 Staff Quarters
R 7	114 Snack Shack
R 8	115 Admin Bldg
R 9	116 Barracks # 2
R 16	Main Stage
Well 1	102 Well 2
Well 2	132 Well # 3

Figure 11: Camp Zoe Youth Camp Site (23SH1551)



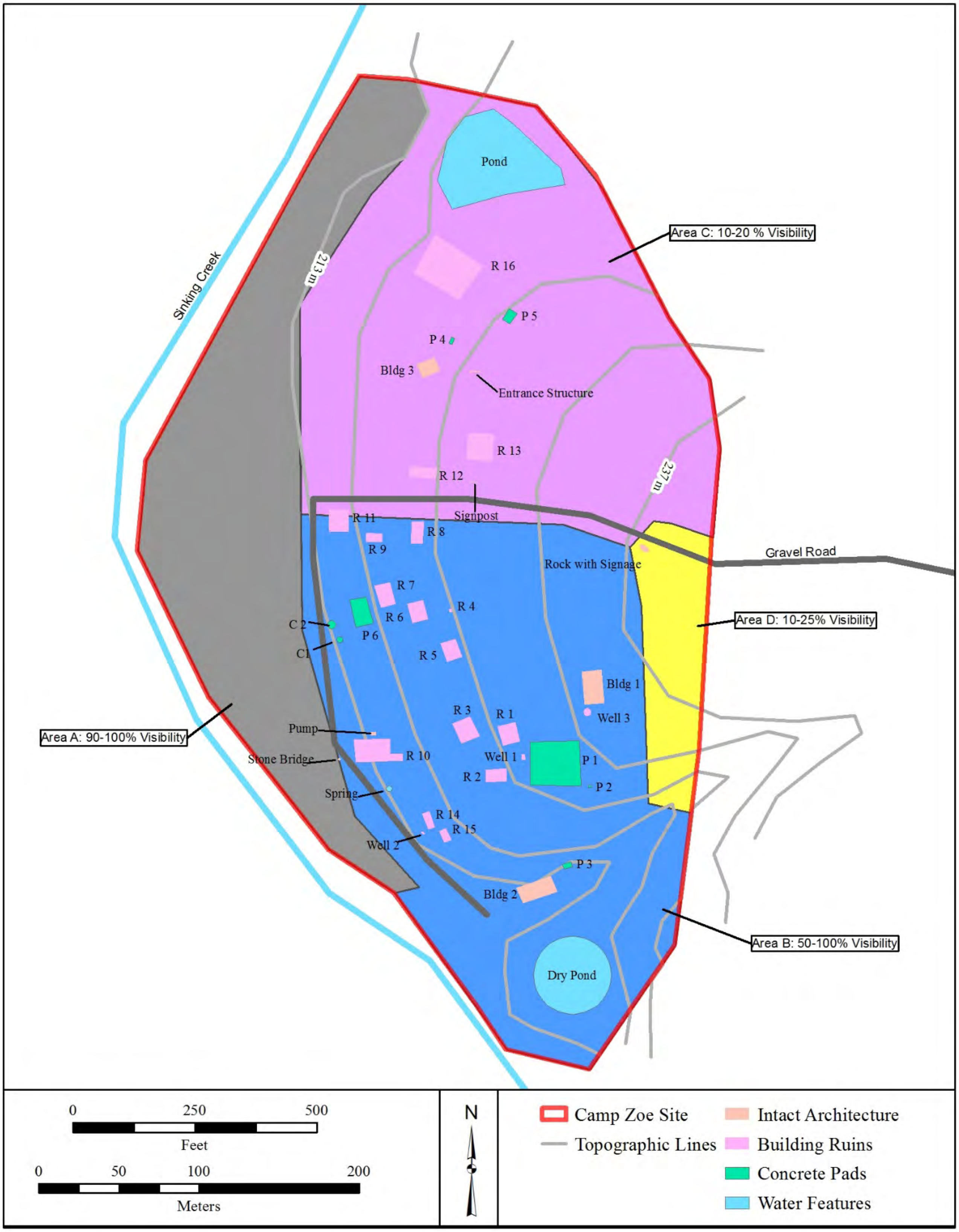
Visibility varied within the site (Figure 12). The westernmost portion, Area A, consisted of gravel bars formed along Sinking Creek (Photo 1). Although habitation was unlikely in this floodplain, the remains of temporary camping and other activities were possible. Visibility was 90-100% and the ground was visually inspected. No cultural resources were located within Area A.

Photo 1: Area A
Facing Southwest

Areas B and C, where construction and demolition activities have taken place, exhibited truncated soils throughout. The locations of all historic features related to the site's use as a youth camp and later as a concert venue were documented using handheld GPS units (Figure 11) and photographs were taken of each feature. Area B had visibility of 60-100% so the ground around the buildings and ruins was visually inspected. Most of these, except 5 concrete pads, were original to the youth camp. It is indeterminate when three of these (circular pads C1 & 2 and parking area P6) were added to the site but, P1 and P2 were a stage added for the concert venue.

The two extant buildings in Area B were constructed in 1929 for the original camp's operation. Building 1 is a one and a half story, vernacular building with Craftsman attributes (Photos 2-5). The Craftsman style (also referred to as Bungalow), common from 1905 to 1930, derived from the work of the architects Greene and Greene. Their Gamble House in Pasadena, California is considered among the finest examples of this style. It is a direct descendent of the English Arts and Crafts movement and consequently owes a debt to both Ruskin and Pugin and the whole of 19th century Romantic theorists. The style was influenced by the prevailing 19th century fascination with Japan and sought to emulate the wood craftsmanship of Asian joinery.

Figure 12: Visibility at the Camp Zoe Youth Camp Site (23SH1551)



In practice, high style examples such as the Gamble House are intricately detailed, using an exposed wood structure, projecting beams, and a broad, overhanging low pitched roof. Elements of the style that translates to more moderate examples include low pitched, overhanging gabled roofs, unenclosed eaves, false bracing under the gable and rafters, and half to full width porches supported by partially or fully battered columns (Blumenson 1981:71; McAlester and McAlester 1996:453-455; Poppliers *et al*.1983:76-79; Whiffen 1996:217-221).

Building 1 has a stone foundation along with stone walls on the first story and board and batten walls on the half story (Photos 2-5). According to Missouri Preservation (2013), the building was constructed of timbers harvested from the area and native Ozark stone. A full width porch with a shed, corrugated metal roof is located on three of the walls. The porch has concrete steps and three, plywood stairs with a wood handrail that leads from the porch to the front door. The east wall has four, twenty light fixed windows that surround a centrally located, stone chimney. The main entrance to the building is located on the west wall. It consists of a modern, six panel door that is surrounded by two vertical windows that have been partially covered with plywood and two, twenty light fixed windows. Craftsman attributes identified on the building include false bracing under the gables on the west and east walls and the full width porch with stone porch supports and square wooden columns.

In addition to the modern door on the main entrance and the plywood steps, other changes have been made to the building. Two additional rooms have been added to the north and south walls by enclosing the porch. The north wall of the porch has weatherboard between the stone porch supports (Photos 2-3). Board and batten has been placed between the square wooden columns along the eastern portion of the wall along with a modern, vinyl window and an opening for a vent or air conditioning unit. Window screen mesh is located between the square wooden columns on the western portion. The south wall of the porch has weatherboard between the stone porch supports and square wooden columns on the eastern portion of the wall (Photos 4-5). A modern, six panel door also is located on the eastern portion of the south wall. Like the north wall, window screen mesh is located between the square wooden columns on the western portion of the south wall. The northern and southern portion of the east wall of the porch has been enclosed with weatherboard that wraps around the stone porch supports to the building. Window mesh is inserted between some of the square wooden columns of the building (Photos 2 and 5). Two screen doors lead from the porch into each of these new rooms.

It is not known when these changes were made, but a 1966 photograph of the building indicates that the porches had been enclosed by that time (Figure 13). Patty Allen, a 1964 Camp Zoe camper, stated that the enclosed porches were utilized as bunks for the campers (Personal Communication Patty Allen). The bunks could be accessed by the entrances on the porch or doorways from inside the building. The modern doors, window, and plywood steps were most likely added in the 1990s or 2000s during Jimmy Tebeau’s ownership of the property.

Photo 2: Building 1
Facing Southeast

Photo 3: Building 1
Facing Southwest

Photo 4: Building 1
Facing Northwest

Photo 5: Building 1
Facing Northeast

Figure 13: 1966 Photo of Building 1
(Photo Courtesy of Kristi Rein)

Building 2 is the stable which is located southwest of Building 1 (Figure 11, Page 26). It has a board-formed concrete foundation, vertical wood siding, and a corrugated metal gambrel roof (Photos 6-9). A corrugated metal shed roof addition, is on the south wall of the building. The addition also has a board-formed concrete foundation and vertical wood siding. The west gable end has a hinged, double door that is off-center and a hinged double loft door (Photos 6 and 9). A sign stating "Camp Zoe Riding Stable" is above the loft door and a brass light fixture is located just north of the door. Three openings covered with chicken wire are on the north and south walls of the stable and another opening covered with chicken wire is on the west gable end of the addition. The east gable end has sliding double doors and two openings above the double doors (Photos 7-8). The openings possibly had chicken wire and might have been used for vents and/or sunlight similar to the other openings on the building. A front-gable roof that aligns with the shed roof of the addition existed along this gable end. The roof most likely went with a building that had been attached to the west wall of Building 2, as seen in a 2013 photograph (Figure 14). This building was most likely removed due to its dilapidated state. Currently, only a gravel pad and impressions of the foundation on the berm wall are still present (Photo 10). In addition to the removal of this building, the double doors and frame on the west gable end of the building have been replaced along with some of the siding above the doors (Photo 11). The building also has missing and rotting siding and portions of the roof on the addition are coming off.

Photo 6: Building 2, Stable,
Facing Southeast

Photo 7: Building 2, Stable
Facing Southwest

Photo 8: Building 2, Stable
Facing Northwest

Photo 9: Building 2, Stable
Facing Northeast

Figure 14: 2013 Photo of Building 2 with Gable Building on East Wall
(Photo Courtesy of Jim Searles)

Photo 10: Building 2, Stable, Location of Former Building
Facing Southwest

Photo 11: Building 2, Stable, Replaced Wagon Door and Siding
Facing East

Other features identified in Area B include a drained pond just south of Building 2. The pond has a berm between it and the building. A pipe ran from the pond towards a board formed concrete structure that likely held a pump. A second pipe exited the structure on the opposite side of the pond. (Photos 12 and 13). On top of the berm, south of the pump and southwest of Building 1, was a wood loading chute for horses that appears to be movable (Photo 14). A concrete pad is located to the northeast of the stable, likely used in connection with this building (Figure 11, Page 26).

Photo 12: Remains of a Pond, and Portion of Pipe and Pump
Facing Southwest

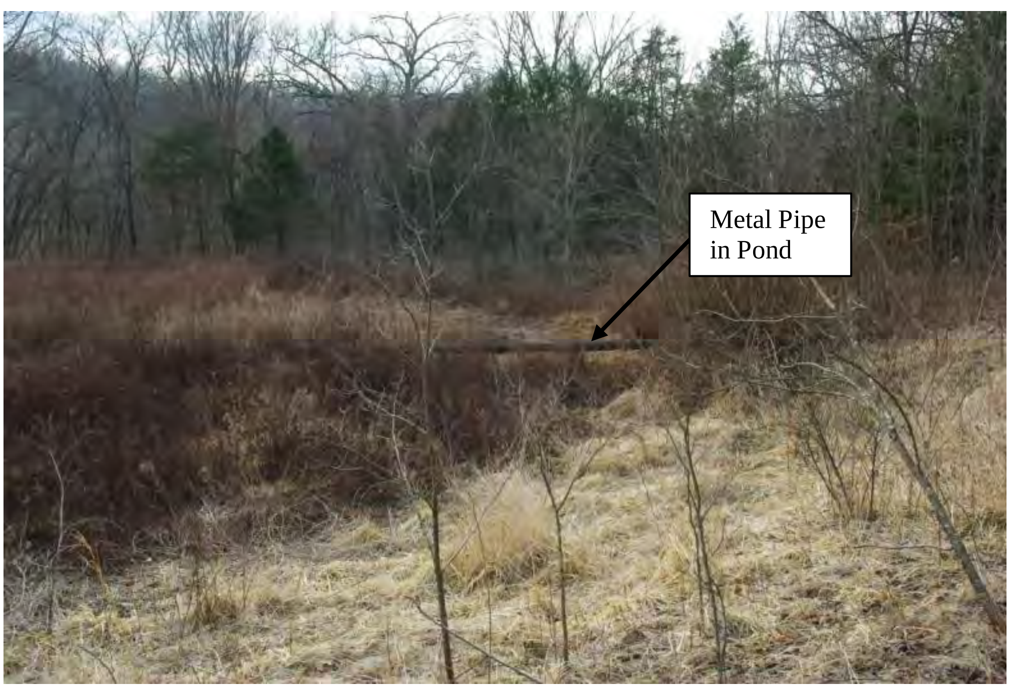


Photo 13: Pipe and Pump
Facing Northwest

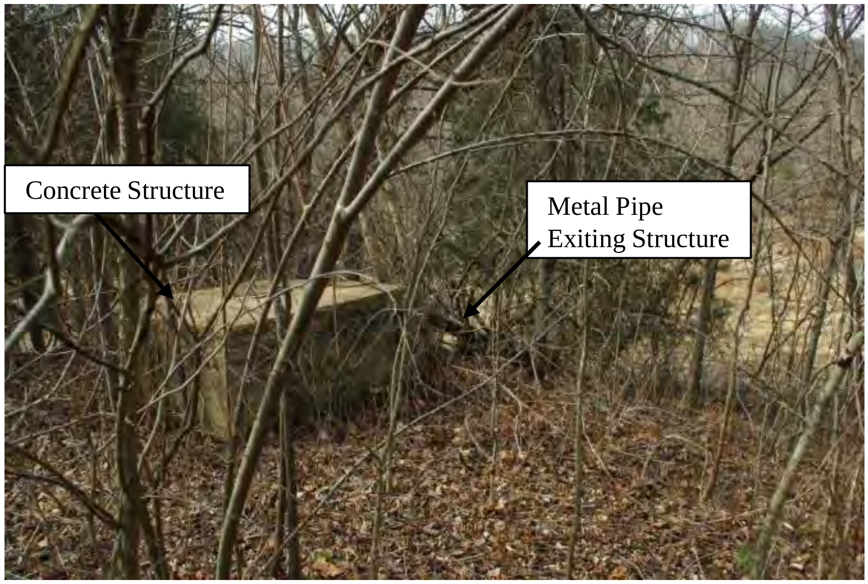


Photo 14: Loading Chute
Facing Southwest

A hand pump (Photo 15) was located next to R10 identified as a cistern during the State Park Survey (Missouri State Parks 2013). A small stone bridge, by R10, spans a drainage ditch (Photo 16). There are 2 concrete pads with concentric circle designs, likely used for games (Photo 17). In addition, a series of stone and concrete sidewalks and stairways connect the camp buildings throughout Area B (Photo 18). Two concrete culverts with metal rails are present to span drainages. No other cultural resources were located in Area B (Photo 19).

Photo 15: Pump
Facing Northeast

Photo 16: Stone Bridge
Facing Northwest

Photo 17: Concrete Circle with Markings
Facing Northeast

Photo 18: Stone Sidewalk
Facing East

Photo 19: Culvert with Metal Handrail
Facing Northeast

Area C had poor visibility of 10-20 % so shovel tests were conducted throughout this area (Figure 12, Page 28). It contained 2 ruins from the youth camp (R 12 & 13) and several remains from its use as a concert venue (Figure 11, Page 26). The remains of the main stage (R16) consisted of a leveled area outlined with railroad ties on the southeast edge. Two concrete pads (P4 & P5) were present in the area (Figure 11, Page 26). Located just east of the main stage, P5 was likely used to set up lighting for the concerts. P4 was behind an extant building (Bldg. 3) and its use is unknown.

Building 3 was a modern building likely constructed by Tebeau (Figure 11, Page 26). This building has a poured concrete foundation, vertical wood siding, and a corrugated metal roof (Photos 20 and 21). According to the park rangers, Building 6 was used to store equipment during concerts. It also appears to have been a concession stand as the writing on the south side of the building reads "Good Eatz Cold Drinkz" above two large openings.

Photo 20: Building 3
Facing Southwest

Photo 21: Building 3,
Facing Northeast

Photo 22: Wooden Sign Post
Facing

Two structures were located in Area C. These include a wooden entrance way to the youth camp that at one time held a sign (Photo 22; Figure 11, Page 26). A metal structure was identified, which likely served as an entryway to the main stage area (Photo 23; Figure 11, Page 26). No additional cultural resources were located in Area C.

Photo 23: Metal Entrance Structure
Facing North

Area D, on the easternmost portion of the site, did have intact soils (Figure 12, Page 28). Visibility was poor at 10-25% so shovel tests were completed (Photo 24). A large stone with signage attached marked the entrance into the Camp Zoe Youth Camp area (Photo 25). The sign's references to the Grateful Dead band indicated they were placed there during Tebeau's ownership as his Grateful Dead tribute band was a draw to the venue. No other cultural resources were located in Area D.

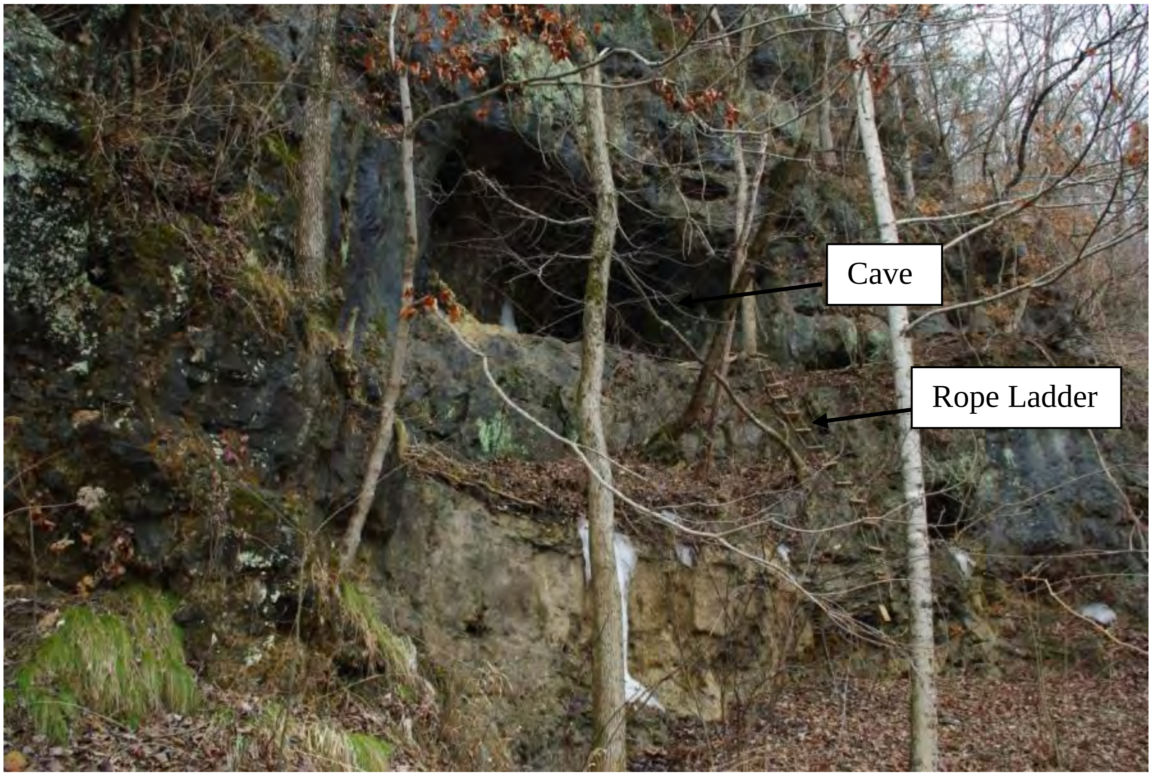
Photo 24: Area D
Facing West

Photo 25: Rock with Signage Referencing Grateful Dead
Facing Southwest

Other Locations Surveyed in Original Project Area

The bluffs along Sinking Creek were visually inspected for caves and rock shelters (Figure 10, Location A; Page 24). It was noted that many cracks and crevices were visible within the bluffs but they were not accessible as they are located on a sheer bluff. As noted by a previous Natural Resource Assessment of the Camp Zoe Project Area (McCarty et al. 2013), there are both caves and rock shelters present along these bluffs (Photo 26). One of the best known of these is a large cave located directly across from Camp Zoe Youth Camp. Evidence of recent visitation of the cave is a rope ladder leading to the mouth of the cave from the gravel bar below (Photo 27).

Photo 26: Bluff Along Sinking Creek
Facing Southwest



Survey of the remainder of the original Camp Zoe Project Area consisted of four locations where soils formation indicated there was a possibility of intact cultural features (Figure 10, Locations B-E, Page 24). Location B, at the northern end of the project area, had visibility of 20-30% so shovel tests were conducted throughout the area (Photo 28-29). Gravel County Road 19B was used to access the area from State Route 19. The remains of three stone fire rings were identified that were likely used during the time this portion of the property was used as a camping area for concert attendees (Figure 15, Photo 30). Just west of site 23SH1550, a carved tree stump, which may have been used as a trail marker from the campground to the concert location (Photo 31) and the remains of a concrete root cellar (Photo 32) were located (Figure 15). The cellar was in disrepair and did not possess significant architectural elements and therefore would not be eligible for nomination to the National Register of Historic Places (NRHP).

Photo 28:Area B Groundcover on Ridge Areas
Facing Southeast

Photo 29:Floodplain Groundcover in Area B
Facing South

Figure 15: Detail of Location B

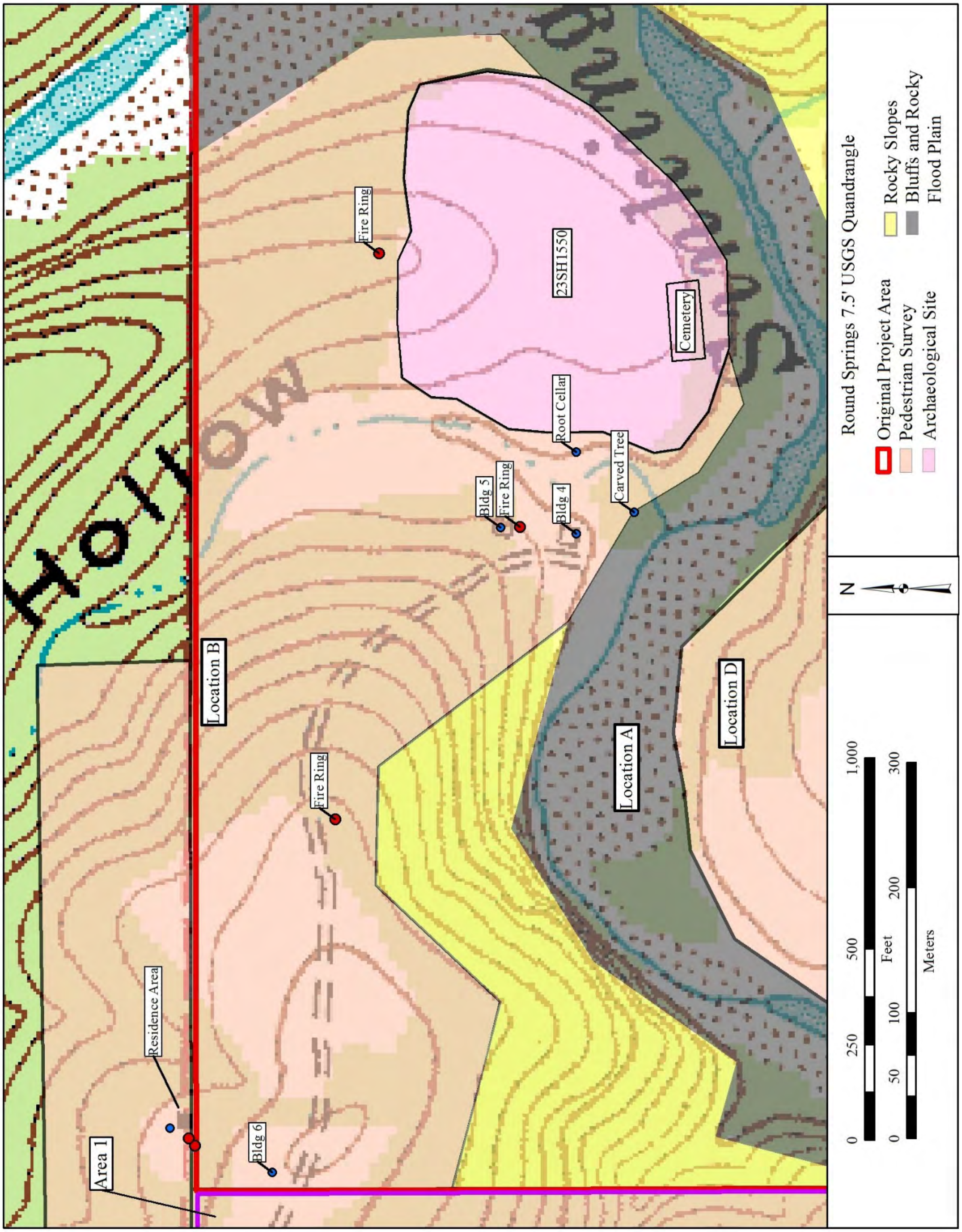


Photo 30: Stone Fire Ring
Facing Southeast

Photo 31: Carved Tree Stump
Facing West

Photo 32: Root Cellar
Facing West

Also present was one barn (Building 4) and two pole shed (Buildings 5 & 6). (Bldgs. 4-6, Figure 15). Building 4 is a wood pole barn located north of Sinking Creek and west of site 23SH1550. This building was documented by Missouri State Parks, designated as building CZOE124, during their survey of the area (Missouri State Parks 2013). It has vertical wood siding and a gabled, corrugated metal roof (Photos 33-36). A drive-through machine shed is located on the south side of the barn. The west wall has a wood door and the east wall has a loft door (Photos 34-37). The barn is in extremely poor condition. The siding on the north wall is no longer present and much of the siding on the other three walls is missing or rotten. Also, small portions on the western side of the roof are missing. It is not known when this building was constructed and Missouri State Parks has decided to demolish it (Photo38).

Photo 33: Building 4, Pole Barn
Facing Southeast

Photo 34: Building 4, Pole Barn
Facing Southwest

Photo 35: Building 4, Pole Barn
Facing Northwest

Figure 36: Building 4, Pole Barn
Facing Northeast

Photo 37: Building 4, Pole Barn,
Door on West Wall
Facing East

Photo 38: Building 4, Pole Barn, Demolition Notice
Facing Southeast

Two pole sheds were identified during the survey (Bldg. 5 & 6, Figure 15, Page 47). Building 5 is located immediately northwest of Building 4. It is a small, dilapidated shed with vertical wood siding, corrugated metal roof, and may or may not have had a southern wall (Photos 39-40). A portion of the west wall also is gone. A window frame covered with a metal bed frame is located on the east wall (Photo 41). The siding below the window frame is missing. A large concrete block is present in the center of the shed, but it is unclear if was used in the shed or dumped there. Like Building 4, the date of construction and purpose of this building is unknown, but it is in existence by 1945 when it appears on that topographic map. It is likely that the most recent landowner, Tebeau, used this building to construct and/or store the portable bridges used to cross Sinking Creek during the music festivals (Personal Communication, Jim Newberry Feb. 14, 2014). At least one completed bridge and three partially completed bridges were identified around Building 5 (Photo 42).

Building 6 is located in the northwest of the project area. It is a modern pole shed constructed of wood and corrugated metal (Photo 43).

Photo 39: Building 5, Pole Shed
Facing Northwest

Photo 40: Building 5, Pole Shed
Facing Southeast

Photo 41: Building 5, Metal Frame Over Window
Facing West

Photo 42: Completed Bridge Near Building 5
Facing Northwest

Photo 43: Building 6, Modern Pole Shed
Facing Northwest

Location C, in the southwest portion of the project area, represented a campground with a gravel road used to access this portion of the property (Figure 16). It is unknown when the camping area was established, but it was at least by 1997 when Lewis mentions it in his description of the area (Lewis 1997). This area was predominantly within the floodplain of Sinking Creek with moderate visibility at 40-70 % with groundcover consisting of sparse grass and fallen leaves, so the ground was directly observed for cultural resources. Two concrete camping pads with electrical outlets, one building ruin with modern plumbing and six fire rings were identified in the area (Figure 16). The ruin represented a razed restroom building that was documented as CZOE124 by Missouri State Parks (2013) prior to its destruction (Photo 44). Also found were electric lights (Photo 45) and campsite marker signs (Photo 46). Many of these amenities were likely added by Tebeau since Lewis (1997) describes the campground as “primitive”.

This camping area was located directly across Sinking Creek from the Camp Zoe site (23SH1551). Evidence of recent usage includes the remains of a modern restroom, the electrical outlets next to camping pads as well as electric lights still found affixed to trees. Further, one of the mobile bridges was along a gravel bar adjacent to the creek that would have been used to get the campers across the water to the stage area during Tebeau’s music festivals (Photo 47). As a consequence, these remains would not be eligible for inclusion in the NRHP.

Figure 16: Detail of Location C

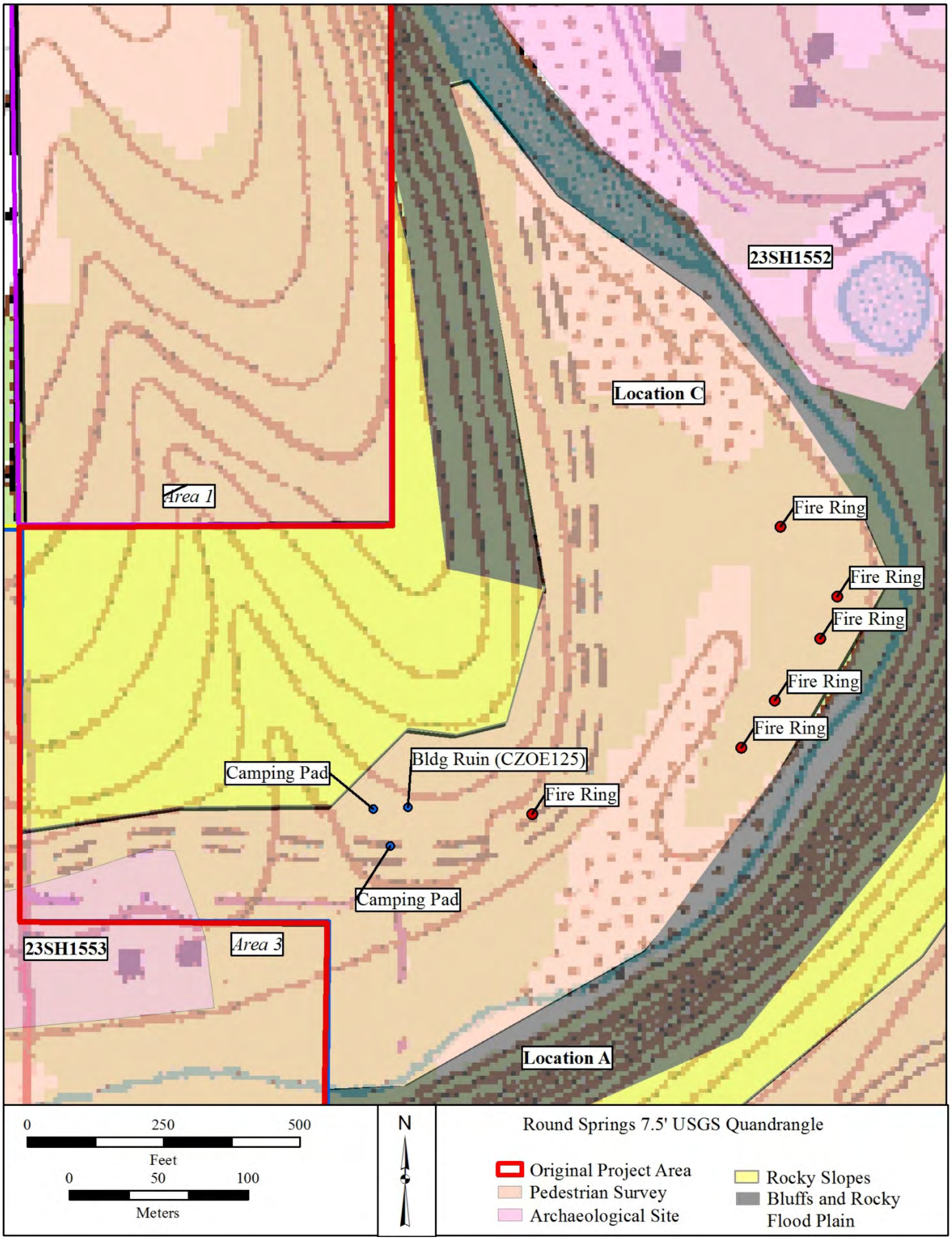


Photo 44: Ruins of Restroom (CZOE124)
Facing Northeast

Photo 45: Electric Lights Attached
to Tree Stump
Facing North

Photo 46: Campsite Marker
Facing East

Photo 47: Portable Bridge next to Sinking Creek in Location C:
Facing Northwest

Location D, adjacent to the Camp Zoe site to the north (Figure 17) had poor visibility of 20-30% with the ground cover consisting predominately of high grass (Photo 48). In the northeastern portion of the area, the soils were cut for unknown reasons, although, it could have been to acquire gravel for the various roads (Photo 49). These truncated soils contained no intact cultural resources. Shovel tests were conducted throughout the remainder of the area. No significant cultural resources were identified in Location D.

Area E was situated along a ridge on the southeastern portion of the property cut by County Road 19-250 giving access to Camp Zoe Youth Camp from State Route 19 (Figure 18). The visibility was poor at 20-30% so shovel tests were completed (Photo 50). No cultural resources were present in this area.

Photo 48: Ground Cover in Location D
Facing East

Figure 17: Detail of Locations D and E

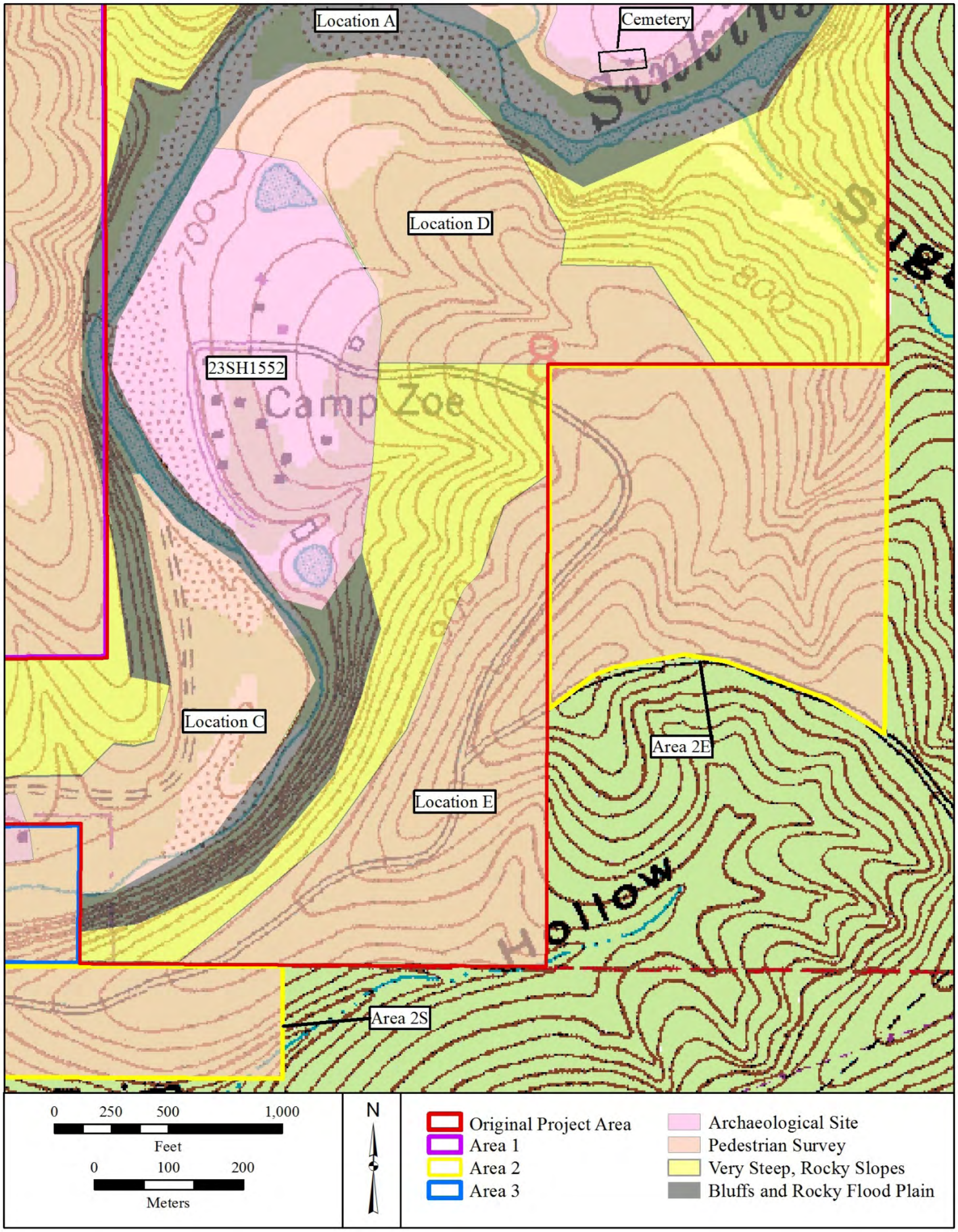


Photo 49: Cut Area in Location D
Facing Northeast

Photo 50: Location E
Facing Northeast

Survey Results in Area 1

A cultural resource survey was conducted on March 20-21, 2014 of the 59 acre Area 1 to be added to the Camp Zoe Project Area. This area was located immediately west of the original project (Figure 18). It was surveyed by Meredith Hawkins Trautt and Joe Harl of the Archaeological Research Center of St. Louis Inc. At the time of the survey, the weather was clear and mild with high temperatures in the low 50s degrees Fahrenheit.

The majority of the project area was forested and covered by leaf debris affording 20-40% visibility (Photos 51-52). Shovel testing, however, was not possible as the soils consisted of a rocky silt, with the bedrock exposed on the steeper slopes. As a result, bare patches in the vegetation were examined for artifacts and the ground across a meter square area was cleared of leaf debris to expose the surface.

Some potential rock shelters were identified within Area 1 along the natural drainage that passes through the northern portion of Area 1 (Photos 51-52). The leaf debris was swept away just below these shelters and the bare areas below the rock overhangs were examined for cultural remains. No artifacts, however, were found. A spring was identified issuing from one of the rock formations (Photo 53). The area around this small spring was examined but no cultural remains were identified.

Near the center of Area 1, a residence and outbuilding were built on a shelf of the ridge slope in 2009 (Figure 18, Modern House Area). A road leading to this home from the northeast was graded across the natural drainage from old County Road 19B. The landowner had constructed some rock lined paths leading down to Sinking Creek, just southeast of his home. These paths pass several exposed rock formations. No artifacts were found in this area.

The southern portion of Area 1 was located within Little Camp Zoe. Much of this area had been cleared of vegetation and the soils appear to have been eroded due to the use of this area as a campground (Figure 19). Surface visibility was better at this location at 60-70%. The rocky ground was directly examined for remains, but other than some modern debris, no artifacts were identified.

Figure 18: Detail of Area 1

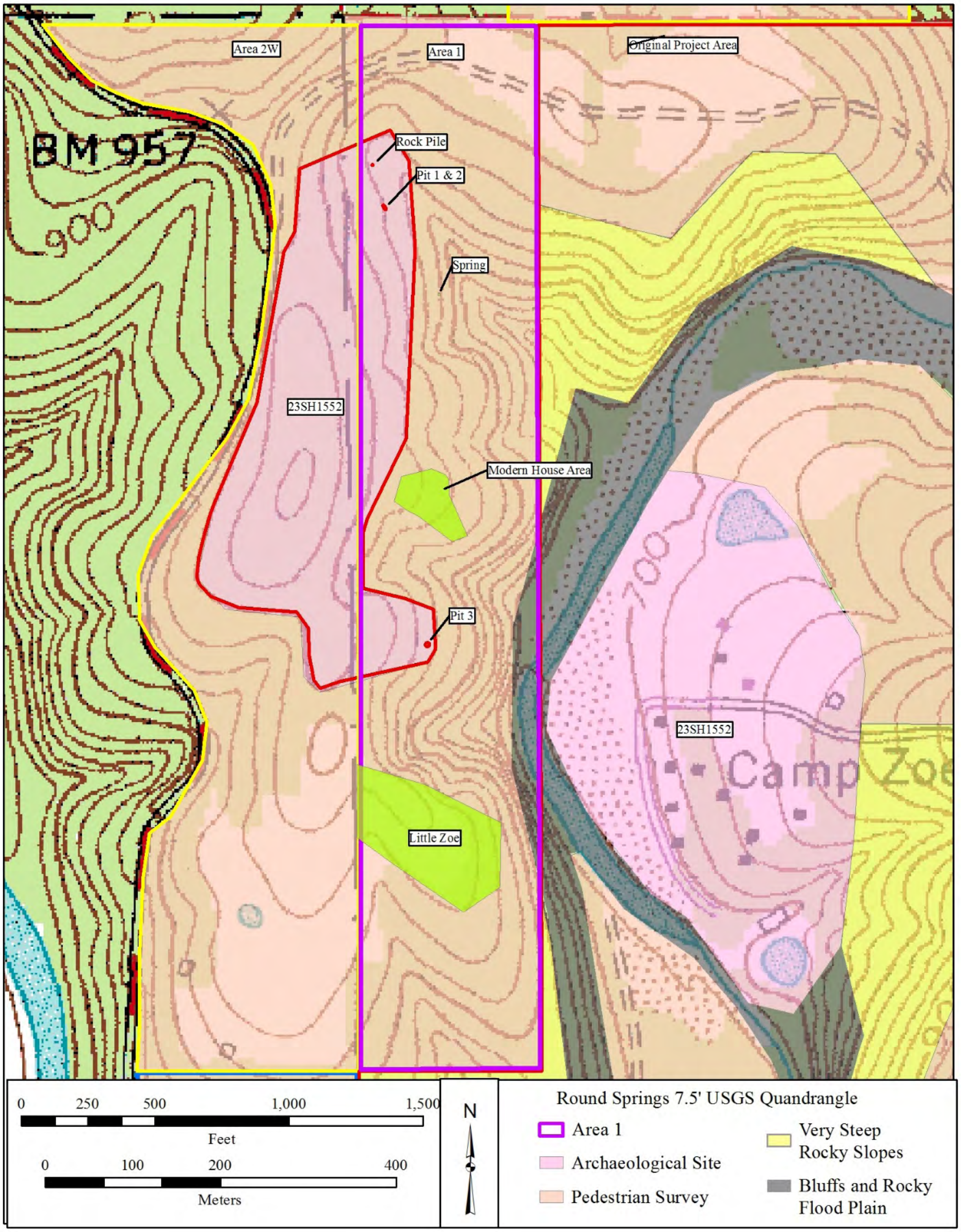


Photo 51: Rockshelter About 4 feet High
Facing Northwest

Photo 52: Rockshelter About 7 Feet High
Facing Southwest

Photo 53: Spring
Facing Southwest

Figure 19: Aerial View of
Little Camp Zoe Showing Disturbance

During the cultural resource survey, one archaeological site was identified, 23SH1552. It represented activities associated with historic mining. Two mining pits placed near each other were identified near the base of a ridge slope (Figure 20: Pits 1 and 2). Pit 1 was circular, with diameter of 3 meters, and a depth of 1.5 to 2 meters (Figure 21). Back dirt was placed on the upslope side to the north, south, and west (Photo 54). This pit was filled with a number of tin cans, a graniteware bowl, and a piece of a glass bowl (Photo 55). Two unknown metal objects also were left in this pit (Photo 56). There is a depression, likely an erosion gully, about 1 meter wide leading out of the east side of the pit and ending at Pit 2, about 2 meters down slope (Photo 57). The second pit is rectangular shaped, measuring 3.5 meters long and 1.5 meters wide, and it is about 50 cm deep. Cans also were found in this pit, but fewer than in the circular depression.

Photo 54: Circular Mining Pit 1 Filled with Artifacts, Site 23SH1552, Facing West

Photo 55: Closeup of Artifacts in Pit 1 Facing West

Figure 20: Detail of camp Zoe Mining Site, 23SH1552

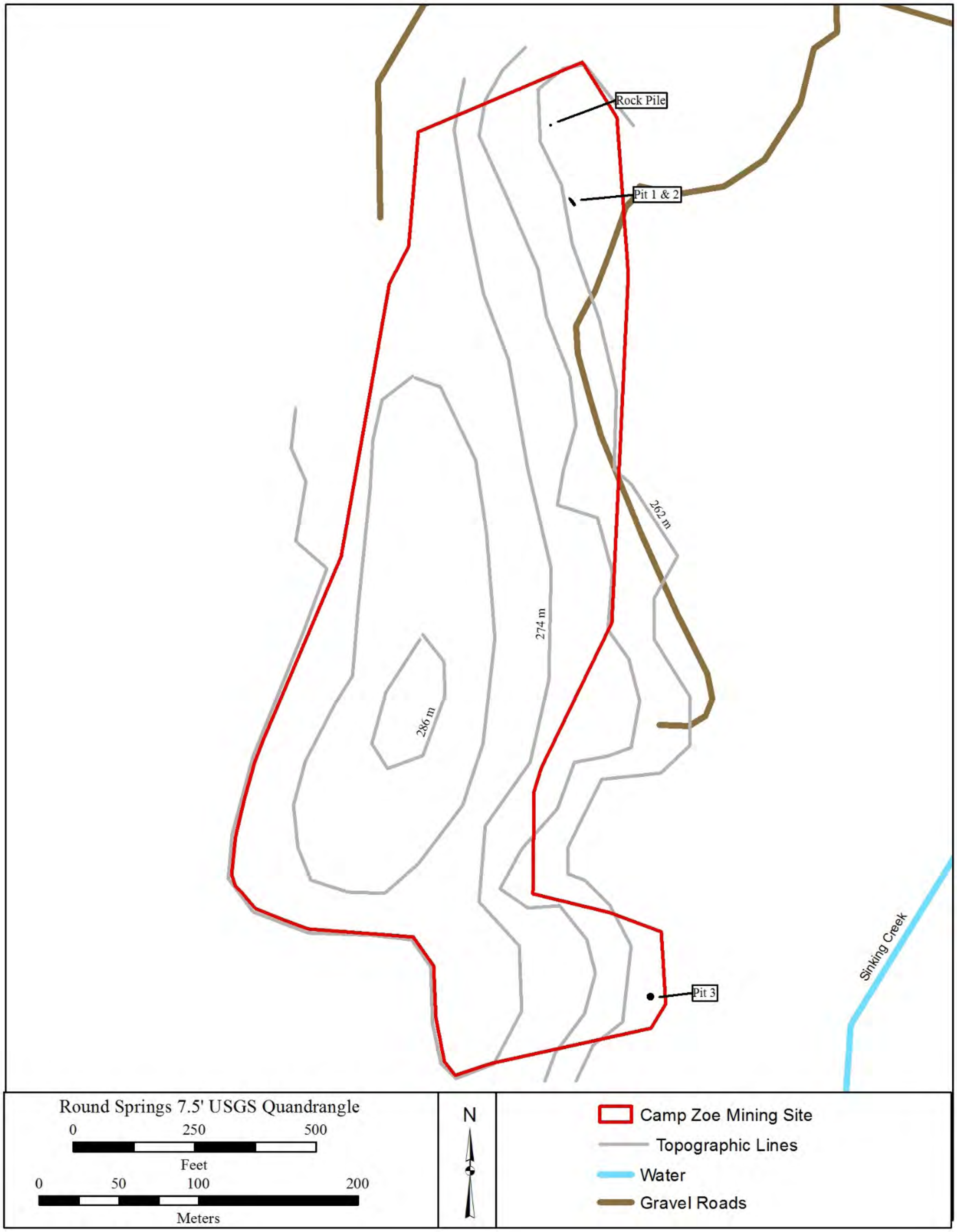


Figure 21: Drawing of Pits 1 and 2

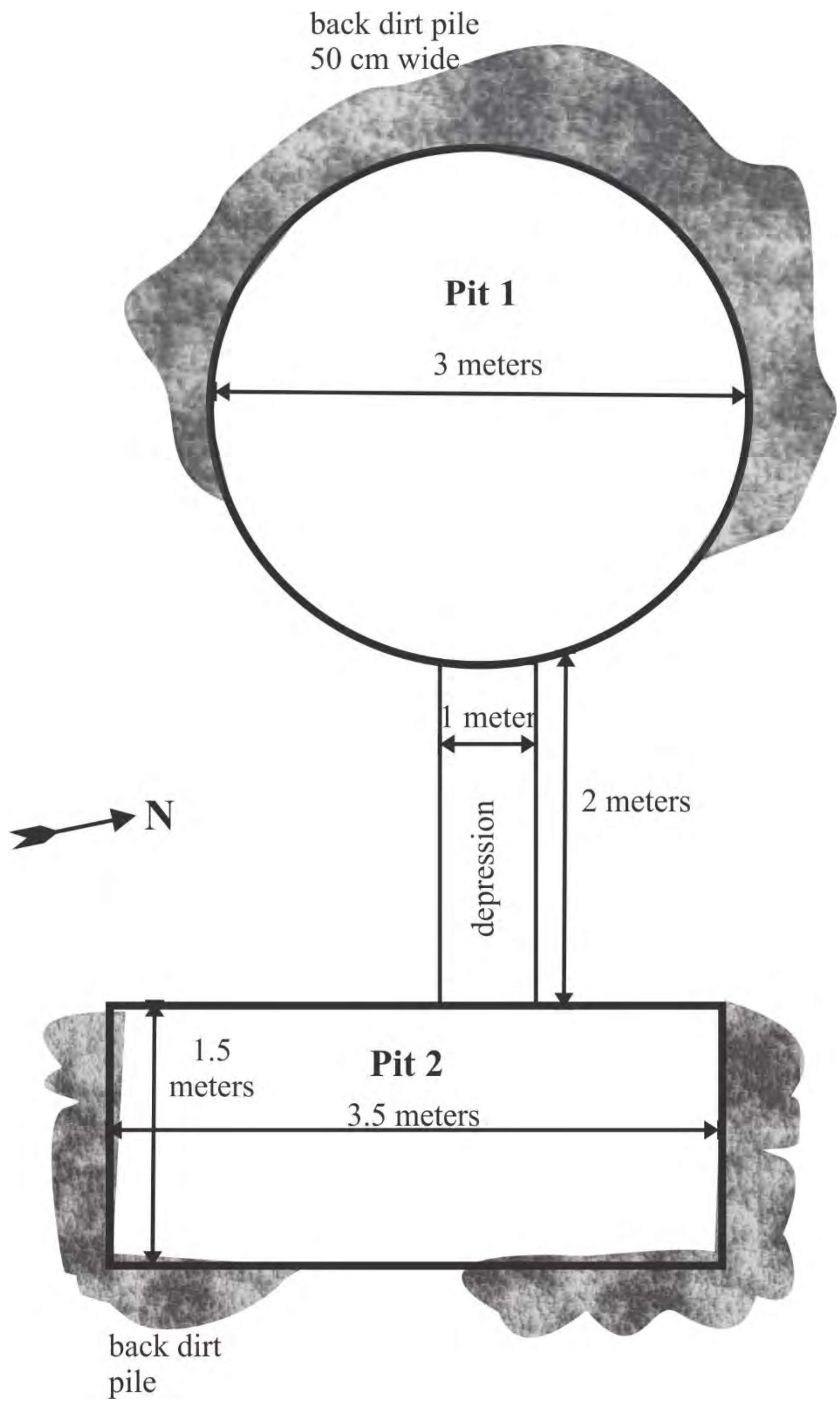


Photo 56: Pit 1 Showing Artifacts Including Unknown Metal Objects
Facing West

Photo 57: Location of Rectangular Pit 2, Where Person is Standing
Facing Southwest

It's possible that these materials were deposited into these pits from a nearby field kitchen. The site was utilized for historic pit mining activities, probably during the early 20th century, based on the presence of numerous cans and the graniteware bowl. During the survey, it was observed that even more pits existed on the ridge top within Area 2, where the crew did not have access during the present survey. The site boundary was expanded to include this ridge top until the site can be properly surveyed and the mining activities more accurately determined on the western portion of the site.

A third circular pit associated with historic mining was identified on the ridge slope to the south (Figure 20). The pit was 2 meters in diameter and about 1.5 meters deep. No artifacts were associated with this pit.

North of these three pits near the natural drainage was found a pile of stones (Figure 20). This pile measured at least 2 meters in diameter and was about 40 cm high (Photo 58). This feature most likely was the result of mining activities, but there is a slight possibility that this it represents a small prehistoric burial cairn.

Photo 58: Rock Pile Identified within Site 23SH1552
Facing North

It is unclear as to what types of minerals that the miners may have been seeking at this location. The artifacts suggested that the mining activities took place during the early 1900s. Most mines excavated in Shannon County were used to extract iron, copper, or manganese (U.S. Mining 2013). The types of pits however, were similar to mines used to recover tiff or barite (Figure 22). Although this area is beyond the region of where barite is typically found, it is possible that a deposit of this mineral does exist. Barite mining, while common from at least the late 1800s, was particularly popular during the Depression and local miners used as a way of earning an extra income. At that time, Barite was most commonly used by the oil industry as a weighting agent for drilling wells (Geological Survey Program 2014).

Figure 22: Baryta (Barite) Mines Illustrated
by Berninghaus, 1920

TYPICAL MINING SCENE, WASHINGTON COUNTY, MO.
BARYTA FIELDS

Survey Results in Area 2

Area 2 to be added to the Camp Zoe Project Area, consisted of four different tracts covering a total of approximately 135 acres (Figure 23). A survey of Area 2 was conducted between May 20-22, 2014, by Robin Machiran and Joe Harl of the Archaeological Research Center of St. Louis, Inc. At the time of the survey, the weather was partly sunny, with high temperatures in the upper 80s degrees Fahrenheit.

The majority of the tracts had little soil formation with rocky subsoil, representing residuum from the underlying bedrock, exposed at or near the surface, making shovel testing impossible. Leaves covered the ground's surface and there was sparse undergrowth. The base of trees afforded some visibility of the surface as did occasional bare patches in the vegetation. Shovels also were used to scrape away the leaf cover to look for any cultural remains.

Area 2N

Area 2N consisted of 13.5 acres (Figure 24). It once contained the home of the last owner of Camp Zoe, James Tebeau. Missouri State Parks (2013) previously documented the architecture including the residence (numbered CZOE125), the garage/barn (CZOE132), and the well (CZOE135). A small portion of this area near where the residence once stood originally was surveyed on April 6, 2014, but additional land later was acquired by Missouri State Parks, increasing this tract to its present size, which was investigated on May 20. At the time of the April survey, the residence had been razed (Photo 59). Only the Butler type garage/barn (Photo 59) continued to stand. Also remaining was the well, which was located just northeast of the home (Photo 60), and either a cistern or septic tank, capped by a metal lid (Photo 61) located just behind the home to the southeast.

The 1945 topographic map suggested that the Union Hill School was at this location (see Figures 5 and 6, Pages 17 and 18). The original school was located near Sinking Creek near the Carpenter-Union Hill Cemetery, but was moved onto the ridge top during the mid-1930s. It was "later converted into a house and is still standing there" (Lewis 1998). Any standing remains of the school were destroyed, when the residence was razed.

During the surveys, surface visibility was very good around the razed residence at 80-100%. Within the surrounding forested areas, visibility was only moderate, 40-50%.

Figure 23: Location of Area 2 Tracts within the Project Area

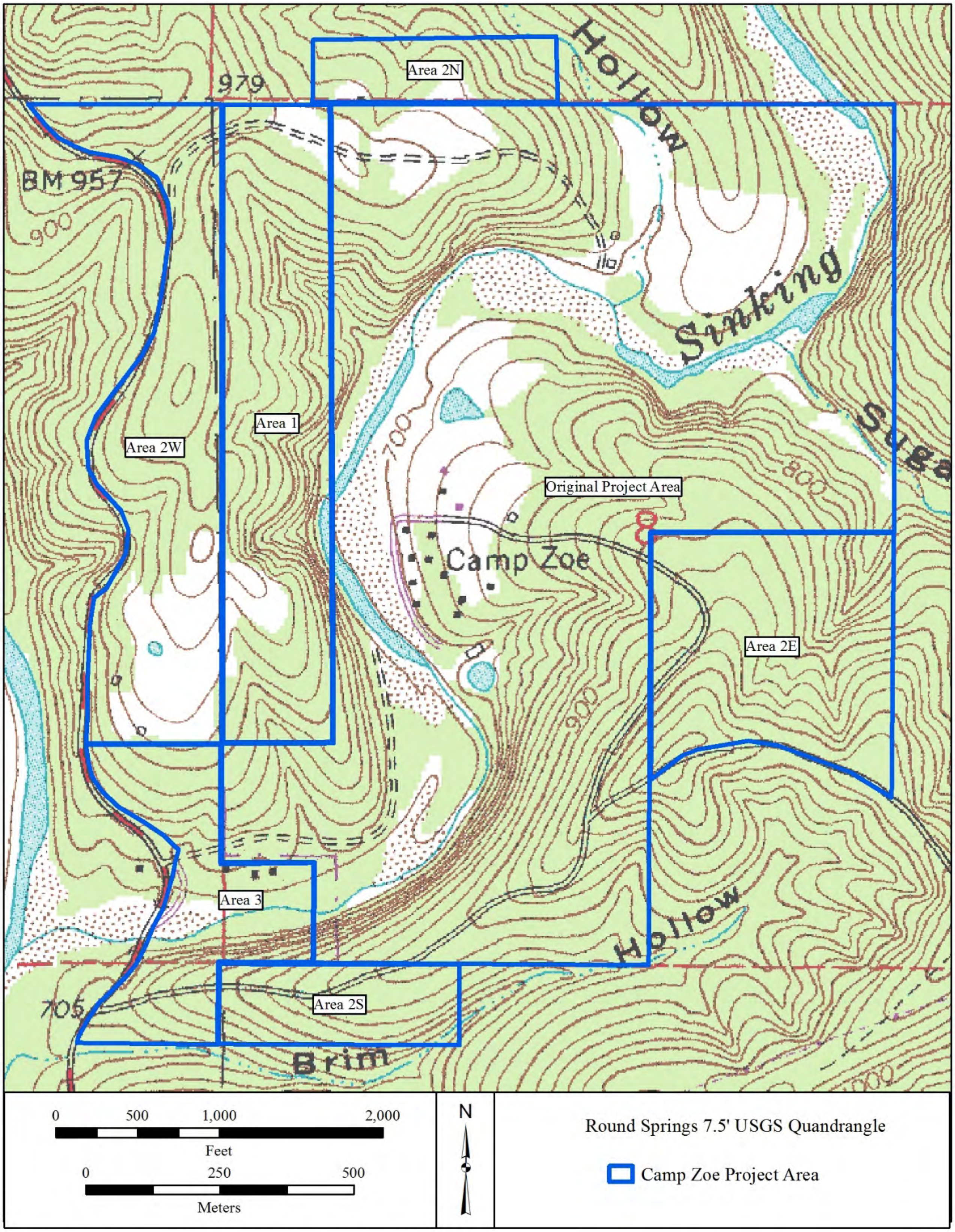


Figure 24: Area 2N Detail

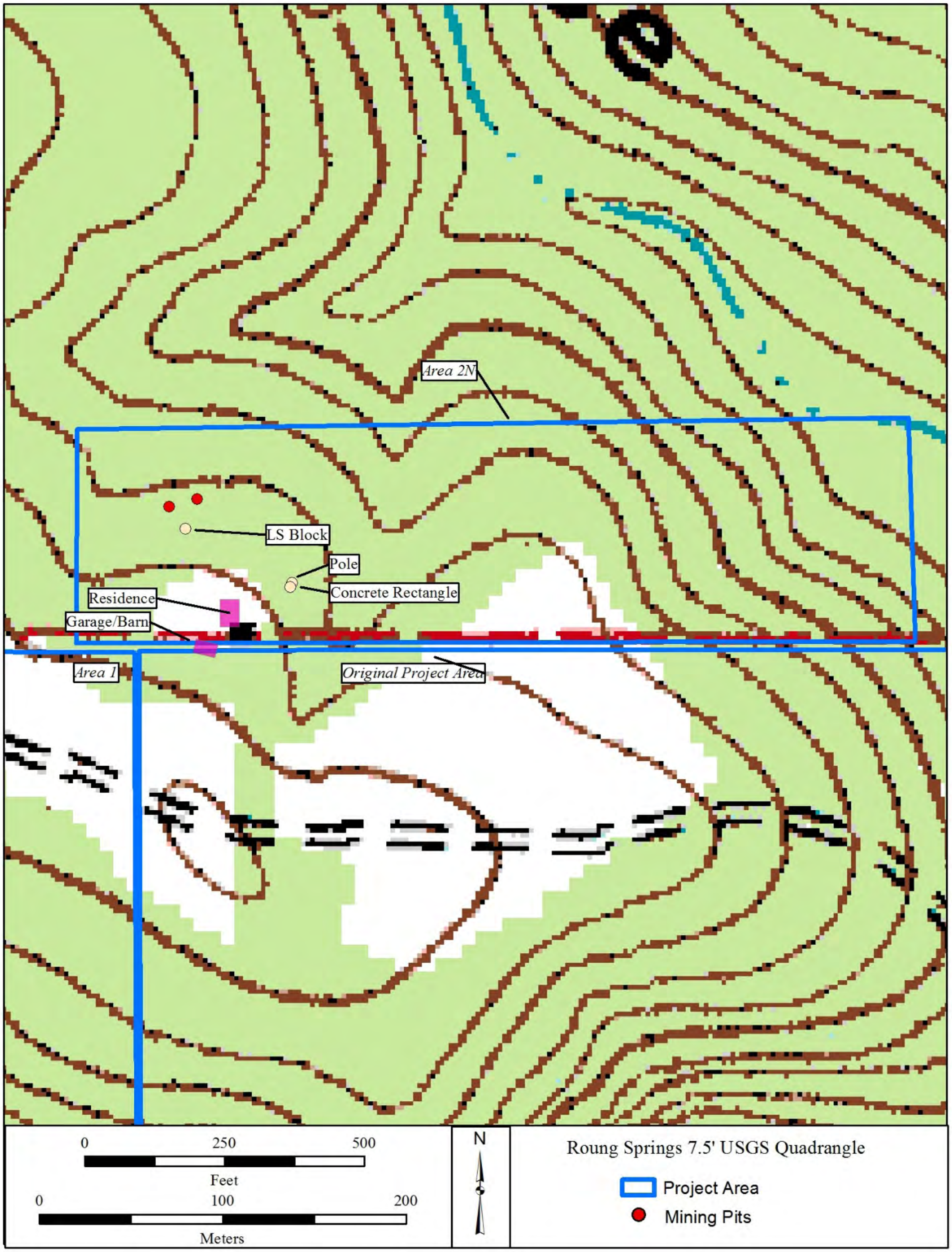


Photo 59: Location of Razed Residence (in Foreground) and
Butler Style Garage/Barn (in Background) Still Standing within Area 2N,
Facing Southwest

Photo 60: Well in Area 2N
Facing Southeast

Photo 61: Top of Septic Tank or Cisterns, Facing Southeast

No evidence of privies or any other features associated with the school were identified. This ridge top does appear to have been graded with soils pushed down slope to the east. It is possible that privies associated with this school could exist under this fill. However, given the rocky conditions of the soils it is possible that pits for the privies were never excavated, but instead the outhouses were placed on the steep slopes. No evidence of prehistoric artifacts was found within this tract. Two pits, possibly associated with mining activity, were discovered on the ridge top, just north of where the residence once stood. These pits measured about 2 meters in diameter and were about 50 cm deep (Photos 62-63). They may have been associated with mining activity similar to the pits identified within Area 1 at site 23SH1552. However, it is possible that these pits were formed as the result of a large tree having fallen over or being pushed over during logging activities (Photo 64). Since it was unclear if these pits were caused by trees having fallen or been pushed over, or by mining, they were not assigned a site number from the Missouri State Historic Preservation Office.

Also discovered was a wooden pole in very good condition that was likely associated with one of the more recent landowners, possibly erected during Tebeau's tenure on the property. The post is located in a clearing northeast of where the residence once stood (Photo 65). This pole stood about 3 meters above the surface and had hewing marks from an axe having been used to remove the bark and branches (Photo 66). It is not clear how this pole was utilized by the owner. There was a concrete rectangle about 2.5 meters northwest of the pole that may have been associated with it.

Photo 62: Pit 1 within Area 2N
Facing Southwest

Photo 63: Pit 2 within Area 2N
Facing Northwest

Photo 64: Fallen Tree Forming a Rectangular Pit Similar to Mining Pits
Facing South

Photo 65: Location of Post in Cleared Area Northeast of Residence
and Cement Block Placed Just in Front of Post
Facing Northeast

Photo 66: Close-up of Post, Notice Hewing Marks from an Axe,
Facing Northeast

Area 2W

Area 2W, represented the largest portion added to Camp Zoe, consisting of 58 acres. It was located between the Area 1 addition and Route 19, and was north of Area 3. The northern part of this tract, north of the present gravel access road, consisted of a steep slope (Photo 67). This area was forested with leaves covering portions of the ground affording 30-50% visibility. Exposures of bedrock occur near the middle of this slope (Photo 68). Some overhangs existed in this area, but they were not very high with the largest only about 1.5 meters high, and about 2 meters deep (Photo 69). Slopes in front of the overhangs were examined for any evidence of artifacts by scraping away the leaves, but no cultural remains were found.

Photo 67: Steep Slopes on Northern Portion of Area 2W
Facing West

Photo 68: Rock Outcroppings in Middle of the Northern Section of Area 2W
Facing Northeast

Photo 69: Larger Rock Overhang to the Left, Only 1 Meter High
Facing Northwest

The middle section of this tract represented the apex of two ridge tops. These areas were forested with moderate undergrowth and leaf cover, affording 20-50% visibility (Photo 70), however, visibility was better on the southern part of the ridge top at 60-70%. During the survey of Area 1, mining pits were observed across the northern ridge apex, identified as site 23SH1552. At least 38 pits were documented within this area during the present survey. Most of these were circular pits measuring about 2 by 1 meters, but some pits were nearly 3 meters in diameter. These pits varied from 50 to 100 cm deep (Photo 71). At least one pit was rectangular shape measuring 3.5 meters by 2 meters (Photo 72).

A small scatter of trash, measuring 7 meters north-south by 4 meters east-west, was identified on the northwestern edge of this site (Photo 73). The trash dump was just east of a roadway that existed at this location since at least the 1930s. Between the dump and the road was an oval shaped area that had been cut. This may have been used as a borrow or once contained a small pond. The dump consisted mostly of bottles and cans, but a graniteware vessel also was found at this location (Photo 74). None of the artifacts were collected, but one of the food packing jars contained a T within a keystone. This mark was used by the Knox Bottle Company, of Palestine, Texas, between 1941 and 1953 (Glass Bottle Marks 2014). This could suggest that the mining activities at site 23SH1552 took place during the 1940s or that the trash dump may have been used by one of the local residents.

Photo 70: Central Portion of Tract 2, Area 2 West, Showing Bare Patches in the Leaf Cover and Better Visibility at the Base of Trees within the Northern Portion of this Tract, Facing Northwest

Photo 71: Example of Mining Pits Found within Site 23SH1552, Area 2W
Facing West

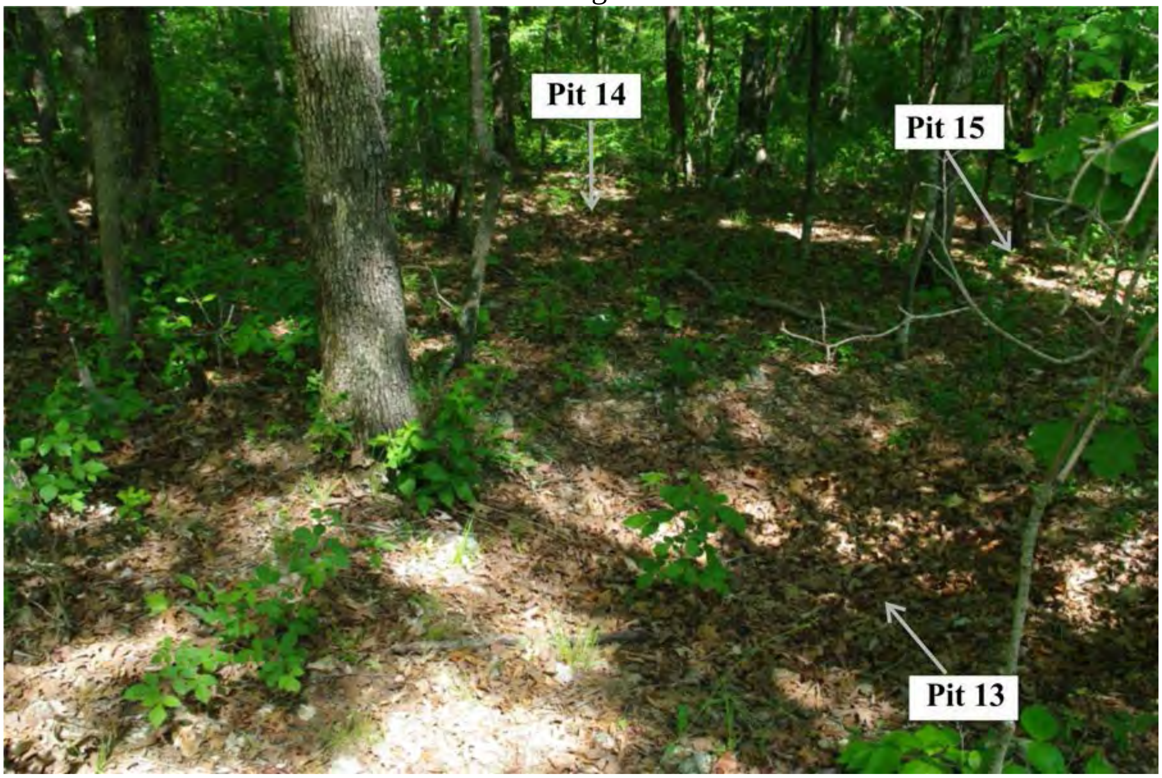


Photo 72: Rectangular Pit within Site 23SH1552 in Area 2W
Facing East

Photo 73: Overview of the Trash Dump, Site 23SH1552, Area 2W
Facing Northwest

Photo 74: Close-up of Some of the Artifacts Found within the Trash Dump
Facing West

The southern portion of Area 2W was within the camping area known as “Little Zoe” This portion of the tract had been cleared of most trees (Figure 25). The northern end had been severely disturbed and used for parking various vehicles and other equipment used at Little Zoe. Rocky soils were exposed at the surface throughout this area, which afforded good visibility at 50-70% (Photo 75). The rest of the property was mostly covered by grass affording 10-30% visibility or a high brush with 0% visibility. The slopes were forested and had surface visibility similar to the rest of Area 2 (Photo 76). Shovel tests revealed that the ridge top had a very shallow soil, only about 5-10 cm deep, consisting of a dark yellowish brown (10YR4/4) silt. Below this soil and at the surface on the slopes was the rocky subsoil. Shovel tests failed to identify any artifacts. An unpaved roadway around the edges of the ridge top through this area did produce some angular pieces of Gasconade chert (Figure 4). These were most likely produced by vehicles using this road, but it is possible that some of the pieces could have been from prehistoric use. However, no definitive flaking debris was found on this ridge top. A group of port-a-potties existed near the southern portion of this tract. These were colorfully decorated and likely were originally used at Camp Zoe for its concert venue (Photo77).

Photo 75: Disturbed Northern Portion of Little Zoe
Facing Northeast

Figure 25: Area 2W Details

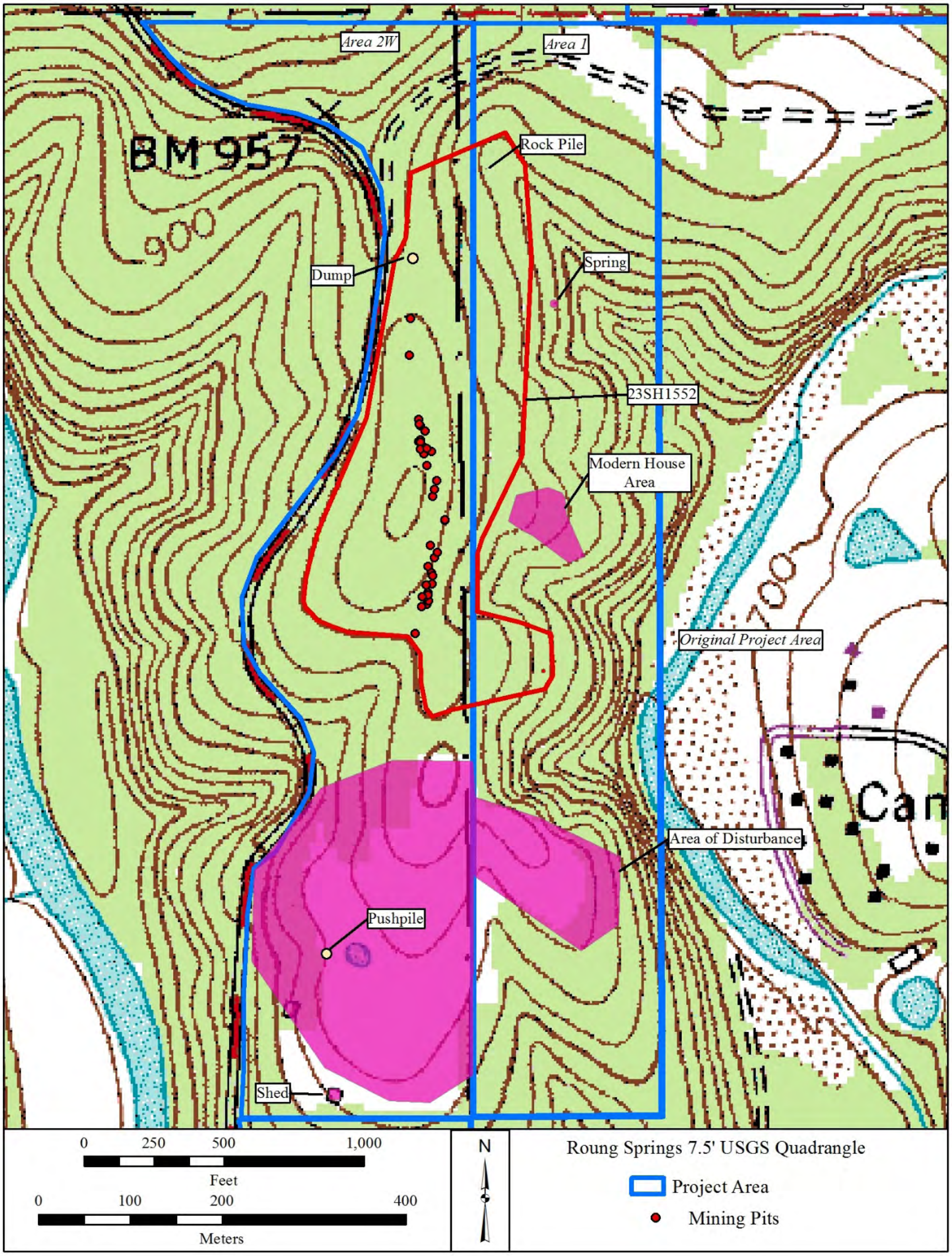


Photo 76: Most of Little Zoe Portion of Area 2W,
Showing Grass Cover, Dense Brush, and Trees on the Ridge Slope
Facing South

Photo 77: Colorful Port-A-Potties Likely Originally Used at Camp Zoe,
Facing Southwest

The recent and 1945 topographic quadrangles suggested that there were two buildings on the southwestern portion of Area 2W (see Figures 5 and 6, Pages 17 and 18). Visibility was very poor at this location as weeds were over 5 feet high and very dense with a number of thorn bushes and honey locust trees (Photo 78). Other areas contained piles of cut trees and brush further limiting the survey of this portion of the tract (Photo 79). Shovel testing in this area also was difficult as the rocky subsoil was exposed at the surface. However, the ruins of the southern-most building were identified (Photo 80). The ruins suggested that this building measured approximately 12 by 12 meters. It was constructed of logs whose bark had been removed. The logs were notched and nailed with large wire nails to support the joists (Photo 81). Remaining portions of the roof showed that it was made of sheet metal (Photo 82). These remains would have served as an outbuilding.

No evidence of the second building, also shown as an outbuilding on the topographic map, was identified within this dense brush. However, an area that had been cut into the ridge slope was identified near the location of this building. The edge of this rectangular shaped cut had a number of large stones around it, but these were not associated with an intact foundation. It was unclear if this area only served as a borrow pit or was the remains of a building.

Photo 78: Dense Brush near Location of Two Buildings
on the Southwestern Portion of Area 2W
Facing East

Photo 79: Piles of Trees and Brush in Area of Two Buildings
Southwestern Portion of Area 2W
Facing Northwest

Photo 80: Ruins of Outbuilding, Area 2W
Facing Southwest

Photo 81: Notched Logs Used in Outbuilding Discovered within Area 2W
Facing Southeast

Photo 82: Remains of Metal Roof on Outbuilding in Area 2W
Facing Southwest

Area 2S

Area 2S was located just east of Area 3 and extends to the southern limits of Camp Zoe. This area, approximately 16.5 acres, consists predominately of steep ridge slopes (Figure 26). These slopes had the rocky subsoil exposed at the surface similar to the other portions of Area 2, making shovel testing impossible, but the surface was exposed especially around the base of trees (Photo 83). No prehistoric artifacts were discovered within this area, but a scatter of rusted cans was found (Figure 26). These consisted of three large cans with a diameter of about 20 cm and a small beverage can with a diameter of 6 cm (Photo 84). The beverage can had a small slit on one side for the extraction of the liquid and a small rounded hole on the opposite side to allow for air flow. This could indicate that the cans were older than 50 years old. However, no evidence of mining or other activities were obvious at this location. It is possible that the cans were left by campers or dumped here by local residents. As a result, this area was not assigned a site number.

Figure 26: Area 2s Detail

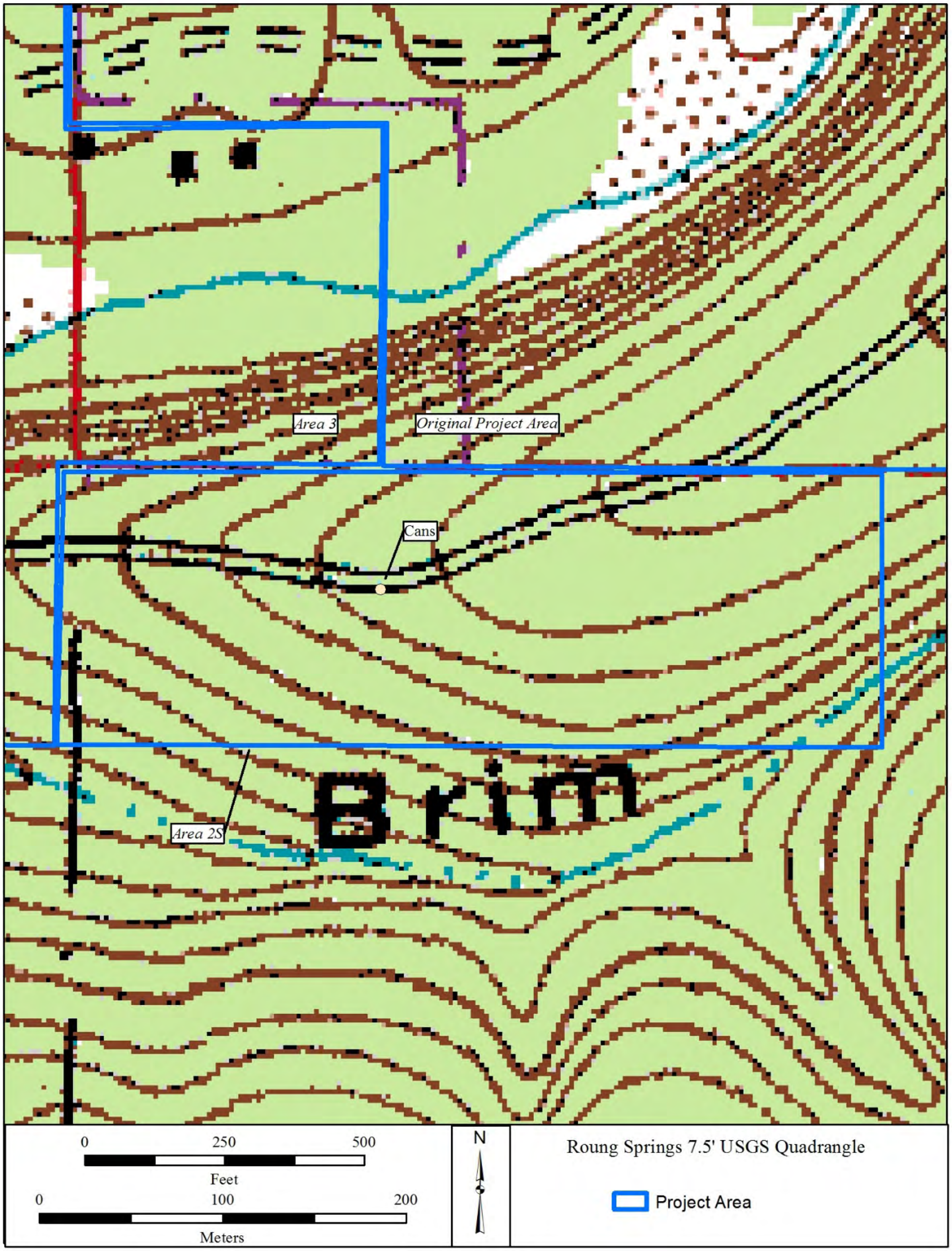


Photo 83: Surface Visibility within Area 2S,
Showing Bare Patches and Visibility Around Trees,
Facing West

Photo 84: Cans Identified on Ridge Slope within Area 2S
Facing Southeast

Area 2E

Area 2E was located near the southeastern portion of the original Camp Zoe property. This tract, covering approximately 47 acres, consisted of two ridge slopes with moderate to steep slopes to the north. Most of the tract was forested with 20 to 40% surface visibility (Photo 85). At other locations, the leaf cover was moved away with shovels and the ground examined for artifacts. Surface visibility was better on the southeastern ridge top, where the trees had recently been removed for lumber, affording 50-60% visibility.

No artifacts were discovered, but two pits were identified near the southeastern edge of the tract (Figure 27). One of the pits was oval shaped, measuring approximately 3 by 2 meters (Photo 86). The second pit was rectangular shape, measuring 5 by 2 meters (Photo 87). These could represent isolated mining pits, but it is possible that they were tree falls or were pushed over during past lumbering activities forming the pits.

Photo 85: Overview of Area 2E
Showing Bare Patches and Visibility at Base of Trees
Facing Southwest

Figure 27: Area 2E Detail

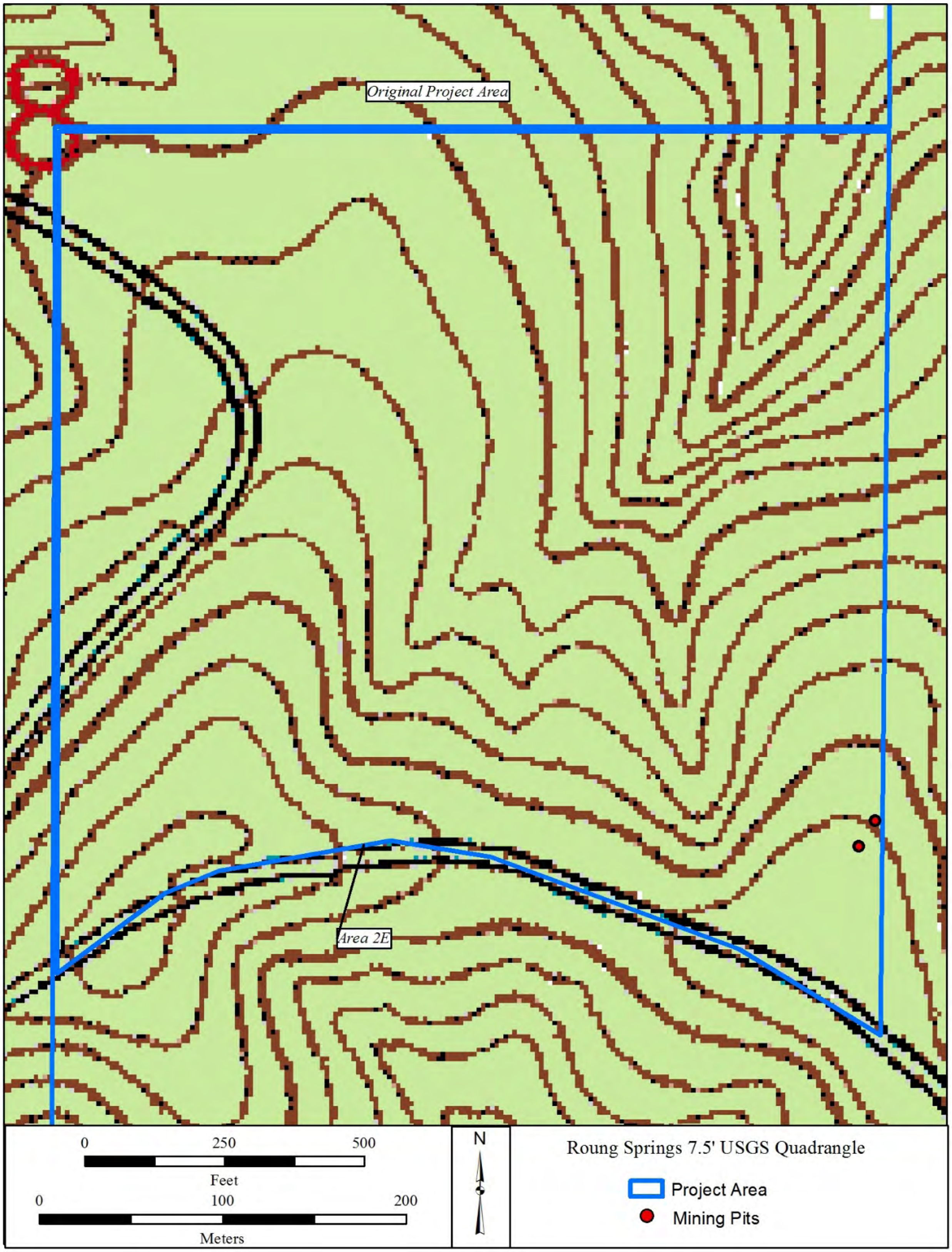


Photo 86: Oval Shaped Pit within Area 2E
Facing East

Photo 87: Rectangular Pit within Area 2E
Facing Northeast

Survey Results in Area 3

A third area, consisting of 31 acres, was added to the Camp Zoe Project Area. Area 3 was located just southwest of the original project tract (Figure 28). The survey was conducted on April 6, 2014, by Robin Machiran and Joe Harl of the Archaeological Research Center of St. Louis, Inc. At the time of the survey, the weather was cloudy with high temperatures in the upper 50s degrees Fahrenheit. The exact boundaries between the original Camp Zoe property and Area 3 were not clear during the two field surveys. As a result, some locations thought to be in Area 3 were actually within the original property limits.

The majority of Area 3 was forested and partially covered by leaf debris affording 40-50% visibility, with bare patches in the leaf debris and the base of trees allowing some visibility of the surface. These areas were examined for artifacts. The southern portion of Area 3 was so steep that rock outcroppings were exposed on the ridge slopes (Photo 88). Just south of Sinking Creek was a vertical slope (Photo 89), with some rock overhangs and possible caves (Photo 90). This slope could not be safely surveyed, so the potential caves and overhangs could not be examined for artifacts. A portion of Area 3, just north of Sinking Creek appears to have been cut by bulldozers, exposing the rocky subsoil at the surface (Photo 91). This area contained more undergrowth than other areas including numerous briars. Surface visibility in this area was slightly poorer (30-40%) due to the undergrowth. The western portion of the ridge slope, south of the gravel access road, had better soil formation with a dark brown (10YR3/3) silt to a depth of 15 cm covering the yellowish red rocky subsoil. A flake was found on the surface in this area, which represented the western portion of site 23SH1553.

Figure 28: Area 3 Details

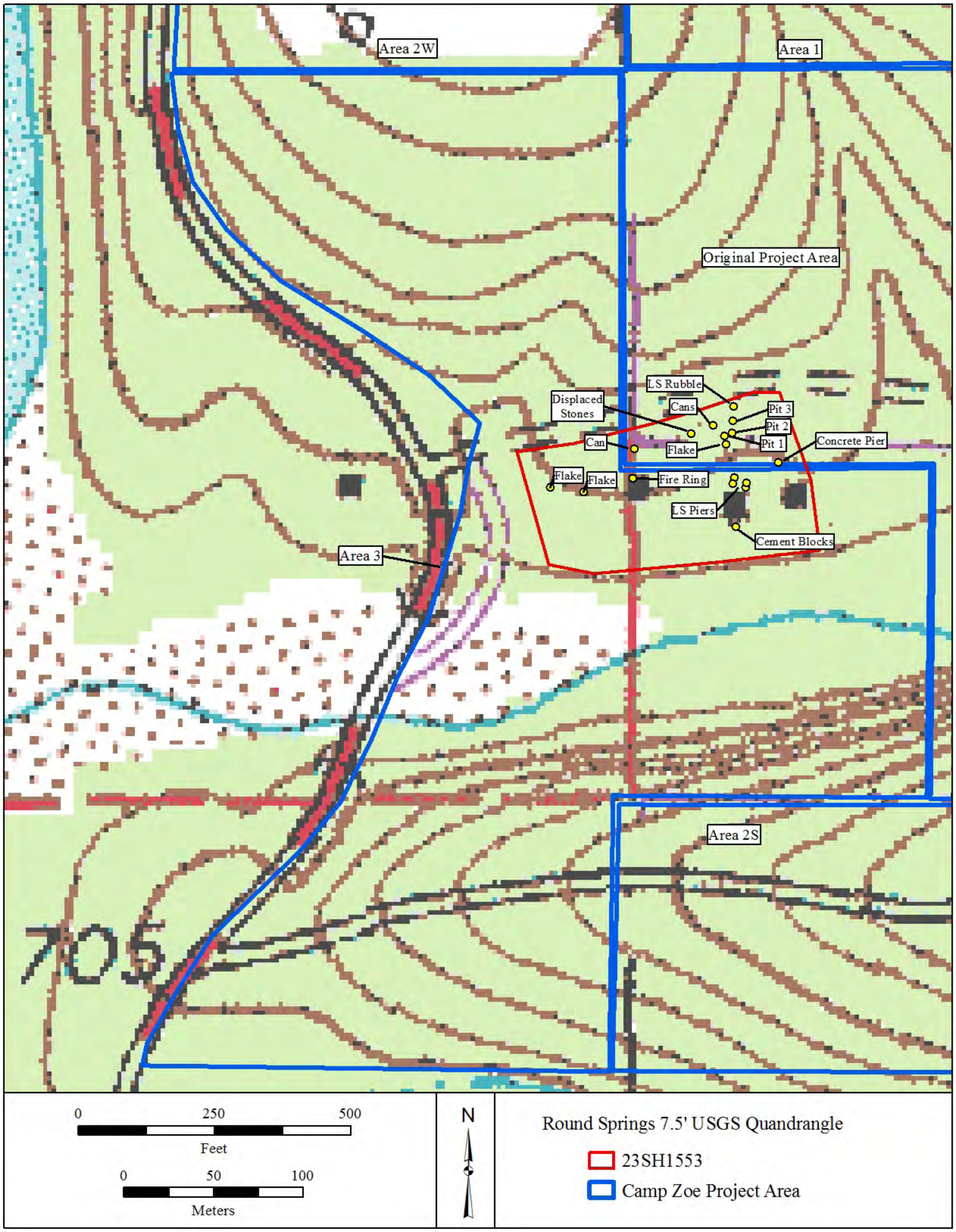


Photo 88: Rock Exposures on Ridge Slope within the Southern Portion of Area 3, Facing East

Photo 89: Vertical Rock Exposures South of Sinking Creek in Area 3, Facing Southwest

Photo 90: Possible Caves and Rock Formations South of Sinking Creek, Facing Southeast

Photo 91: Bulldozed Piles on the Ridge Slope North of Sinking Creek
Notice Rocky Soils Piled Around Trees, Facing West

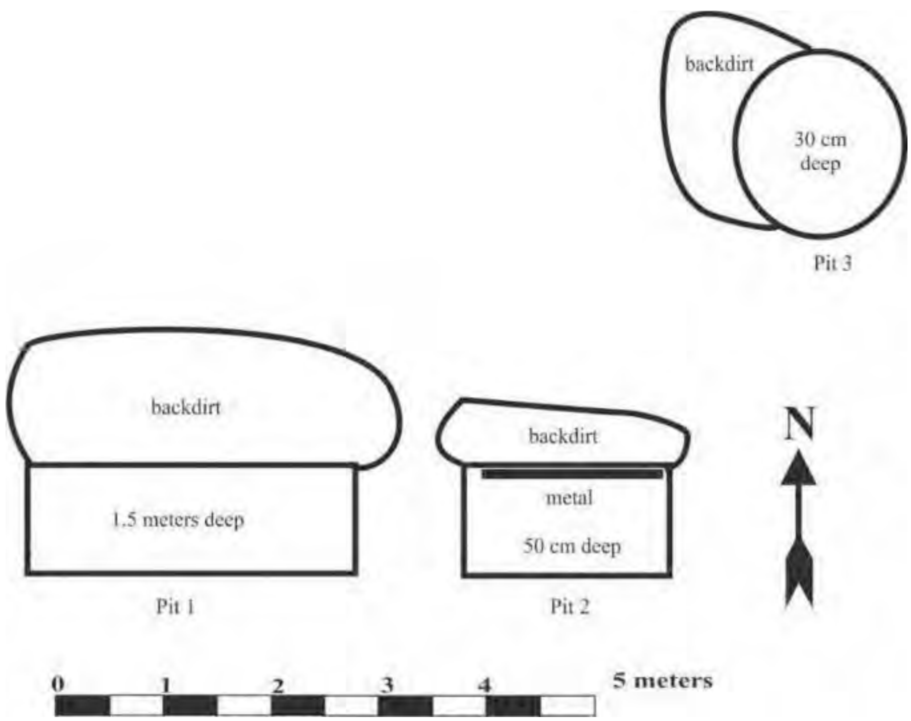
Site 23SH1553

A multi-component site was identified on the lower portion of the ridge slope, north of Sinking Creek and south of the gravel access road. A flake made of Eminence chert was discovered on the surface near the southern edge of the ridge slope (Photo 92). A search of bare areas in the leaf debris and shovel tests failed to locate any additional artifacts. Another two flakes made from Gasconade chert were found to the east in the area previously disturbed by bulldozer activity (Figure 28). The prehistoric flakes could indicate that this may have been an extension of site 23SH97 located just to the west of Route 19, where five flakes and a core were discovered (Price 1998). However, it was decided to designate this a new site since there was a slight break between the two and due to the different historical activity also conducted at this location.

Photo 92: Location of Flake on the West Side of Site, Facing North

The historical component included three pits, discovered near each other on the northeastern portion of the site (Figure 28). Pit 1 was rectangular shaped, measuring approximately 3.0 meters east-west by 1.0 meter north-south (Figure 29). It was at least 1.5 meters deep, with the spoil pile placed to the north, on the upslope side (Photo 93). Pit 2, located approximately 1 meter to the east of Pit 1, also was rectangular shaped, but smaller, measuring about 2 meters east-west by 1 meter north-south. It was dug at least 50 cm deep. A piece of metal was placed against the north wall and appears to have been used to hold back the spoil pile at that location (Photo 94). Pit 3 was located about 6 meters to the northeast of Pits 1 and 2. Different than the other two, Pit 3 was circular; measuring about 1.5 meters in diameter, and it was about 30 cm deep. The spoil pile was placed on the west side.

Figure 29: Location of Three Pits



Similar to site 23SH1552 on the ridge top to the north, it is possible these pits were associated with mining activities during the early 1900s. However some of the dirt on the spoil pile near Pit 1 appears to have been removed recently (Photo 93). Rusted cans were found at the northwestern edge of this spoil pile (Photo 95). It's possible that this pit once contained artifacts left by the miners, similar to two pits found at site 23SH1552. This may have attracted looters to this location. Just upslope was found a scattered pile of stones (Photo 96). The main concentration was across an area 3 meters in diameter, but scattered stones were found four meters down slope. These stones could further suggest that this area was used for mining, possibly for barite (see Figure 22, Page 72).

Photo 93: Pit 1 in Foreground and Pit 2 in Background,
Notice more recently removed reddish yellow soil on Pit 1 spoil pile,
Facing Northeast

Photo 94: Pit 2 with Piece of Metal Holding Back Spoil Pile,
Facing West

Photo 95: Cans Northwest of Spoil Pile Associated with Pit 1, Facing Southeast

Photo 96: Rock Pile Where Person is Standing, With Additional Stones Extending 4 Meters Down Slope, Facing North

In addition, cut dolomite used in pier foundations to support buildings was identified within this site. Four piers were located on the eastern portion, overlooking the drainage just to the east (Figure 28). The piers were placed at the four corners suggesting that this building measured about 3.5 to 4 meters north-south by 5 meters east-west (Photo 97). The southeastern pier was particularly large with two stacked stones, each about 1 meter square (Photo 98). Just southeast of this building and on the east side of the drainage was a group of five concrete blocks (Photo 99). There was a level area, just north of these blocks measuring 2 by 2 meters that could indicate that these were used to support a small outbuilding, but they may have been dumped at this location. A metal car wheel hub also was found here possibly supporting that this area was used as a dump.

Photo 97: Piers Still in Place at Four Corners of a Building Just Above a Drainage, Facing Southeast

Photo 98: Two Larger Slabs in the Southeast Corner, in Background, in Foreground, Facing Sough

Photo 33: Cinder Blocks on South Portion of Possible Leveled Area, Facing Northeast

West of this location, building piers were found scattered about the site area. This area has been cut by construction equipment, likely used to raze the buildings, resulting in the cut stone piers being displaced. The clustering of some of the stone piers could indicate where buildings once existed. For example, a camp fire made of several cut pieces of pier stones was found in the northwestern portion of the site (Figure 28). A level area just north of this camp fire could have been where the building once stood (Photo 100).

Photo 100: Stone Piers found in Camp Fire, in Foreground,
With a Level Area Possibly Where the Building Once Stood, in Background,
Facing North

A second possible building was indicated by a scattering of four cut stones (Photo 101). Just west of this location is a level area that contained a number of briars and more weedy plants that could mark the location of a building (Photo 102).

Photo 101: Three of the Four Displaced Cut Dolomite Piers, Facing Northwest

Photo 102: Four Displaced Stones and Level Area Where Building May Have Stood, in Background, Facing West

All of these buildings were placed on stone pier foundations instead of concrete, which could suggest that they date to the 19th or early 20th century. However, no evidence of buildings exists at this location until the 1967 USGS quadrangle. This map shows three buildings at this location, which was close to where two of the building remains were identified. No buildings are shown on the 1945 map that was photorevised in 1964, which could indicate that the buildings were constructed between 1964 and 1967, thus the buildings were less than 50 years old.

Phase II Testing of Site 23SH1550

Site 23SH1550 is situated on stream terrace above a bend in Sinking Creek (Photo 103, Figure 30). It was first recorded by Jane Bigham in December of 2013 as a multi-component prehistoric and historic site. The historic component included the Carpenter-Union Hill Cemetery located in the southern portion of the site (Figure 30), with the prehistoric component scattered across the entire site. The Phase II testing, of the prehistoric portion of site 23SH1550, occurred between February 17 and 19, 2014. As the ground was still frozen and hand excavations were not possible, it was decided to use a mini excavator to remove soils from the test trenches (Photo 104). The operator, Michael Watson, and the mini excavator were provided by Missouri State Parks.

The location of the trenches was determined by the topography, with all trenches placed on high areas that possessed the greatest likelihood for intact features. Survey of the areas just off the terrace to the east and west showed that these soils were depleted and intact features would not remain (Figure 31). The area had been used previously as a camping area and several gravel roads were present, these were also avoided when determining trench placement (Figure 32). In addition, a 50 foot buffer was established around the Carpenter-Union Hill Cemetery to avoid the inadvertent discovery of possible unmarked graves outside the formal cemetery as some limestone pieces were observed outside the cemetery fence. A total of 13 test trenches were excavated throughout the site uncovering 6 intact historic cultural features (Tables 2-3, Figures 31-32).

Photo 103: Site 23SH1550
Facing North

Figure 30: Location of Site 23SH1550

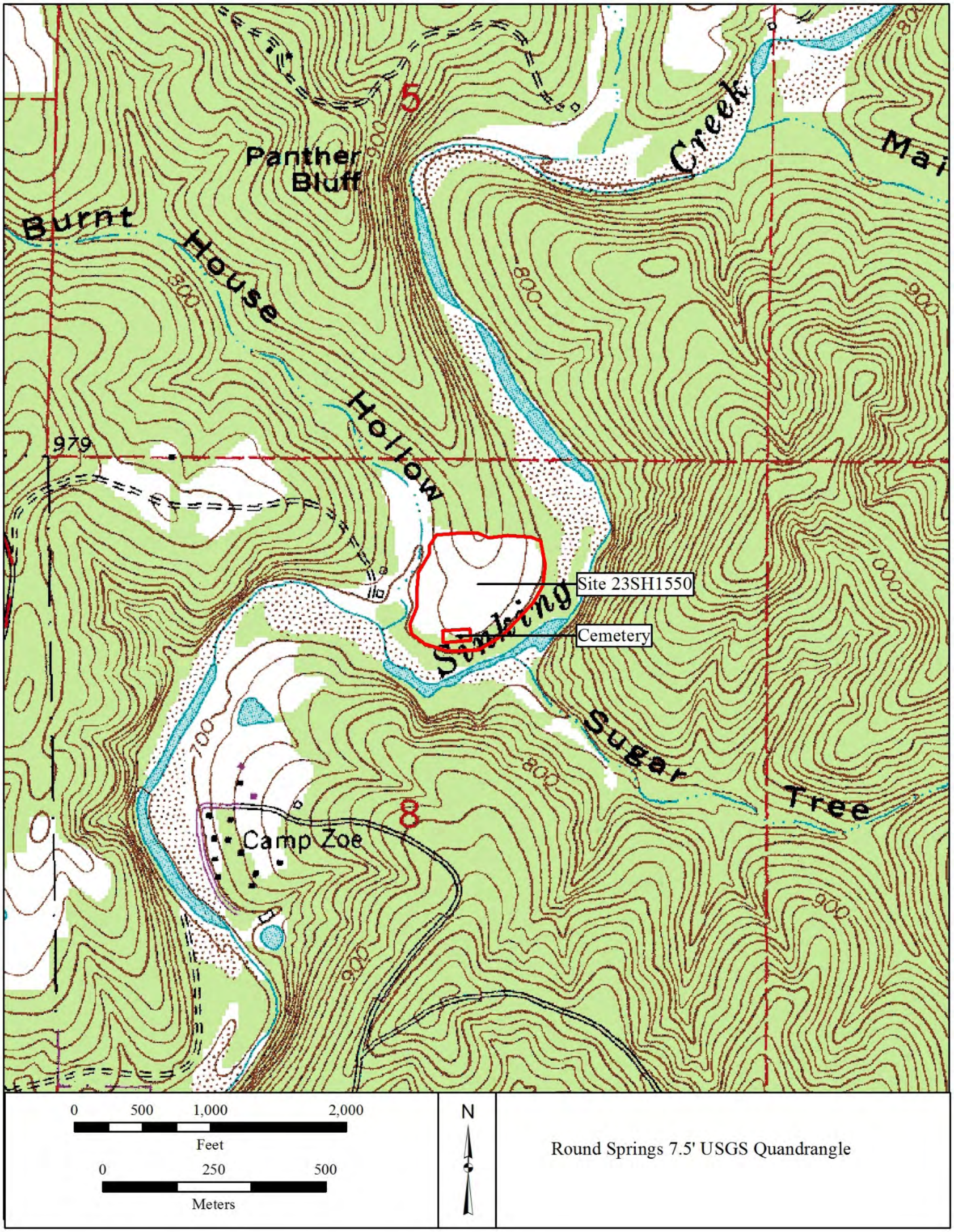


Figure 31: Test Trenches at Site 23SH1550

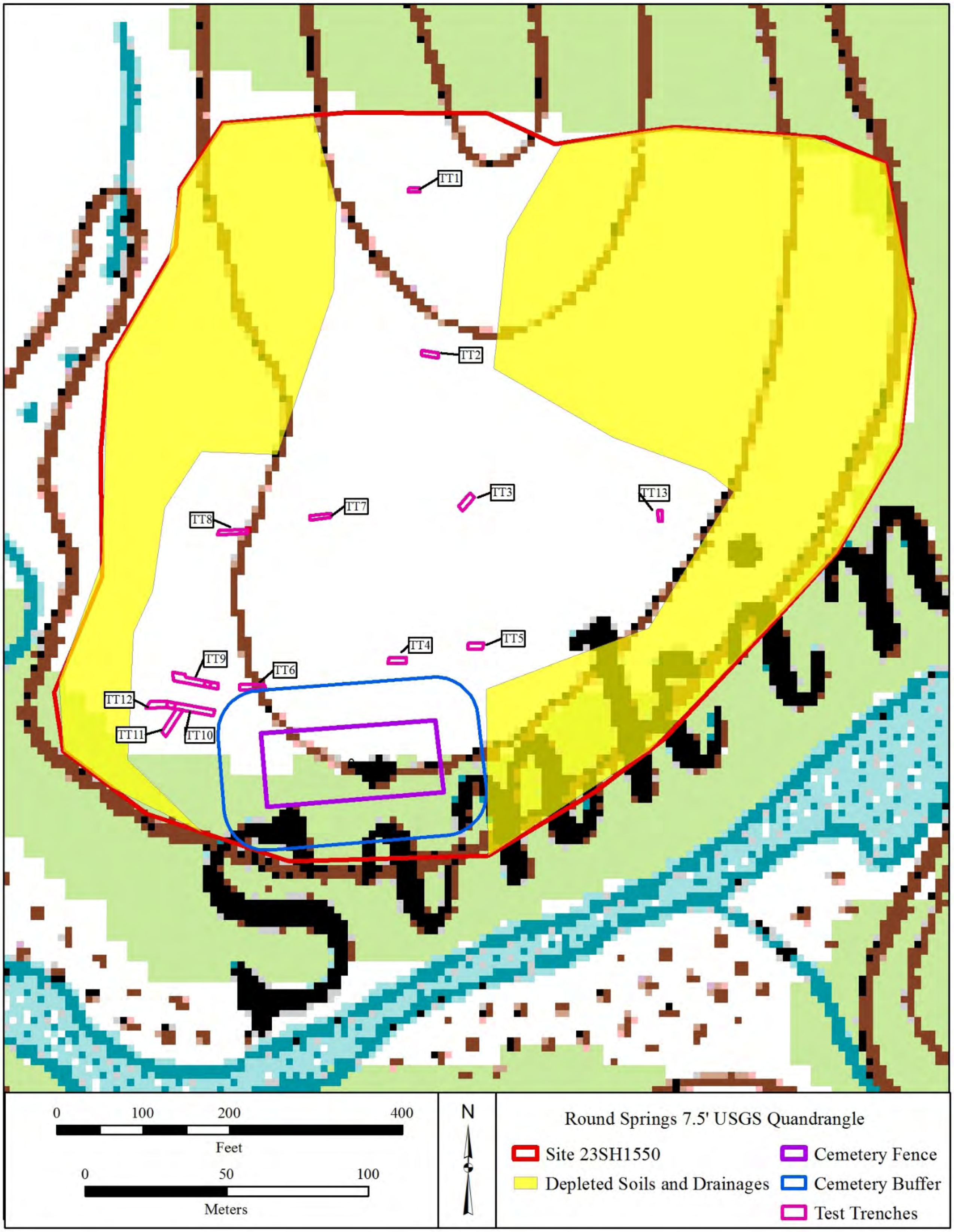


Figure 32: Test Trenches at Site 23SH1550 Overlain on Current Aerial Map

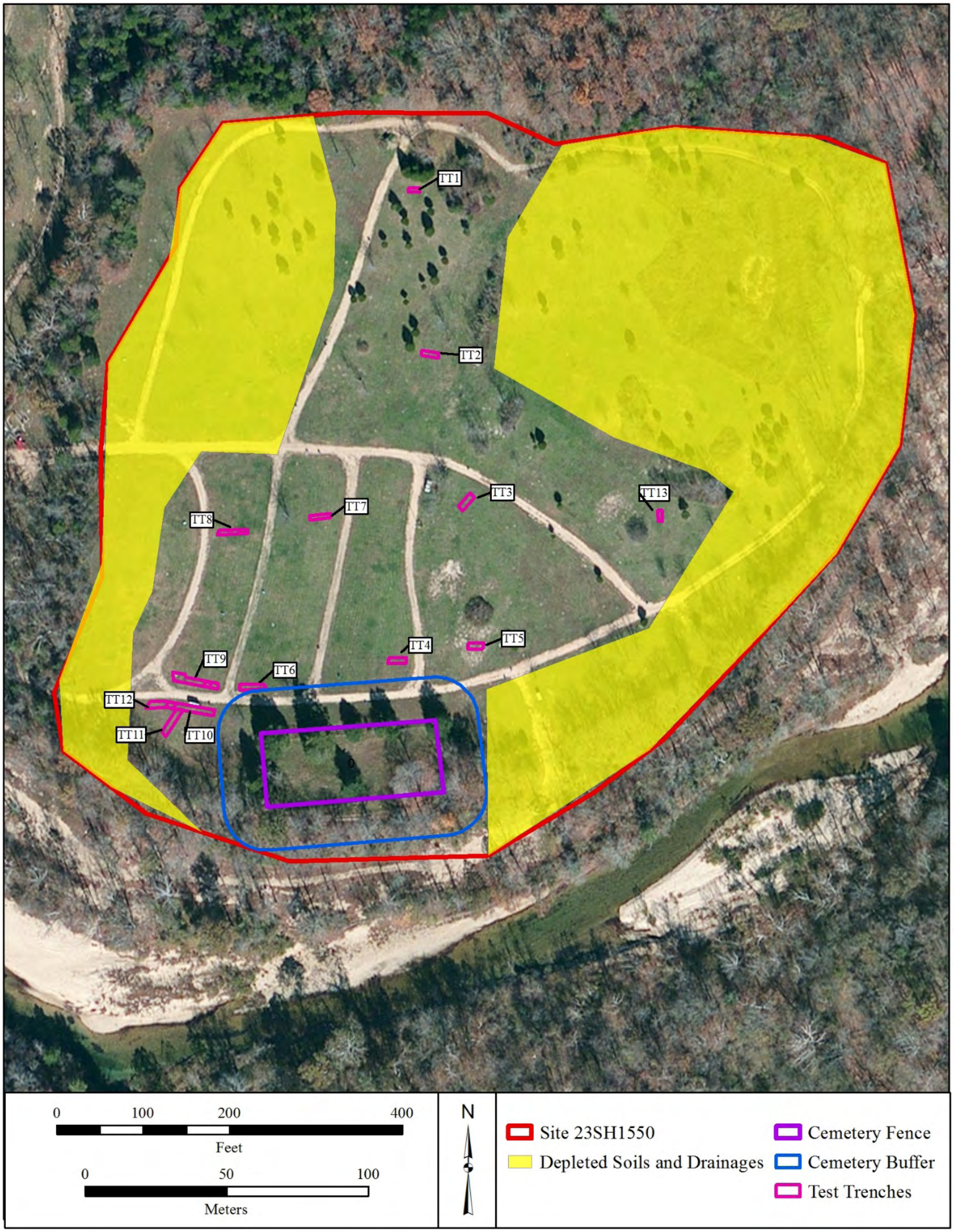


Photo 104: Mini Excavator Excavating Test Trench 1
Facing Northwest

All trenches had an A Zone consisting of 7.5YR4/6 strong brown clayey silt ranging in depth from 15-39 centimeters (Figure 33a and b). Two of the trenches (TT 6 and 9, B1 Zone) had a B Zone of 7.5YR4/6 strong brown gravelly clayey silt with lenses of 5YR yellowish red silty clay. The remainder of the trenches had a B Zone consisting of 5YR4/6 yellowish red gravelly silty clay with lenses of 7.5YR4/6 strong brown clayey silt. Both B and B1 were consistent with the Arkana and Courtois series subsoils noted in the site area (Simmons and Childress 2005)

Five of the trenches were excavated beneath the subsoil to ensure there were no buried cultural deposits. Test Trenches 3 and 8 exhibited a C Zone of 5YR4/6 yellowish red gravelly silty clay. Excavation of Test Trench 8 was ceased at 125 centimeters below surface at which point C Zone measured 72 centimeters thick and continued below the trench floor (Photo 105). A C1 Zone in Test Trenches 6, 9 and 10 (Photo 106) was similar to the C Zone having a matrix of 5YR4/6 yellowish red gravelly silty clay, but also contained lenses of 7.35YR4/6 strong brown clayey silt. These C horizons also were consistent with the Arkana and Courtois series soils in the area. No buried cultural deposits were identified.

Historic features were identified in Test Trench 9 so the trench was extended to the existing road. A total of 5 features were located and the western end of the trench was expanded slightly to the north and the south to search for additional features, however, no additional features were identified (Figure 34).

Figure 33a: Profiles of Test Trenches 1-7

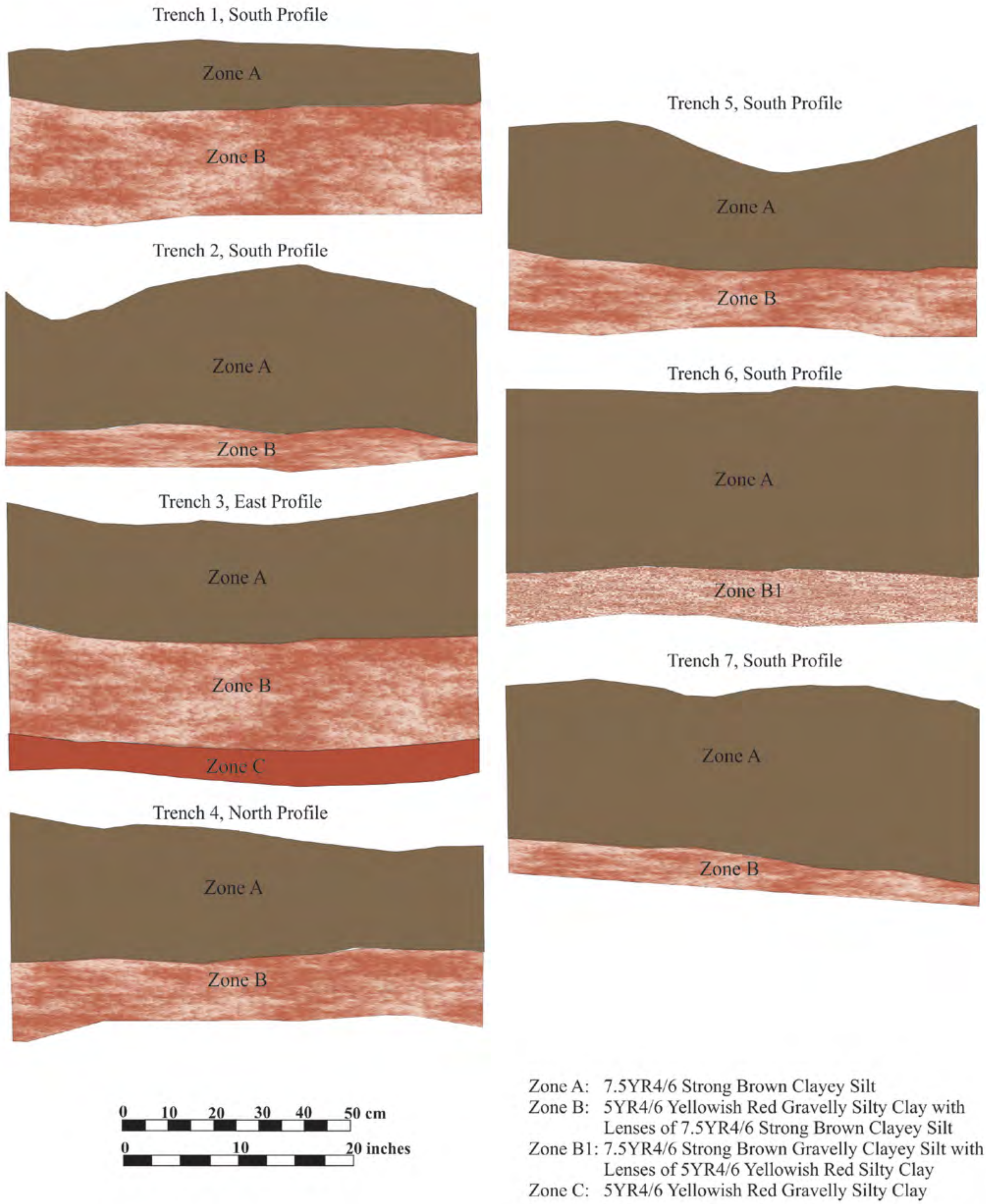


Figure 33b: Profiles of Test Trenches 1-7

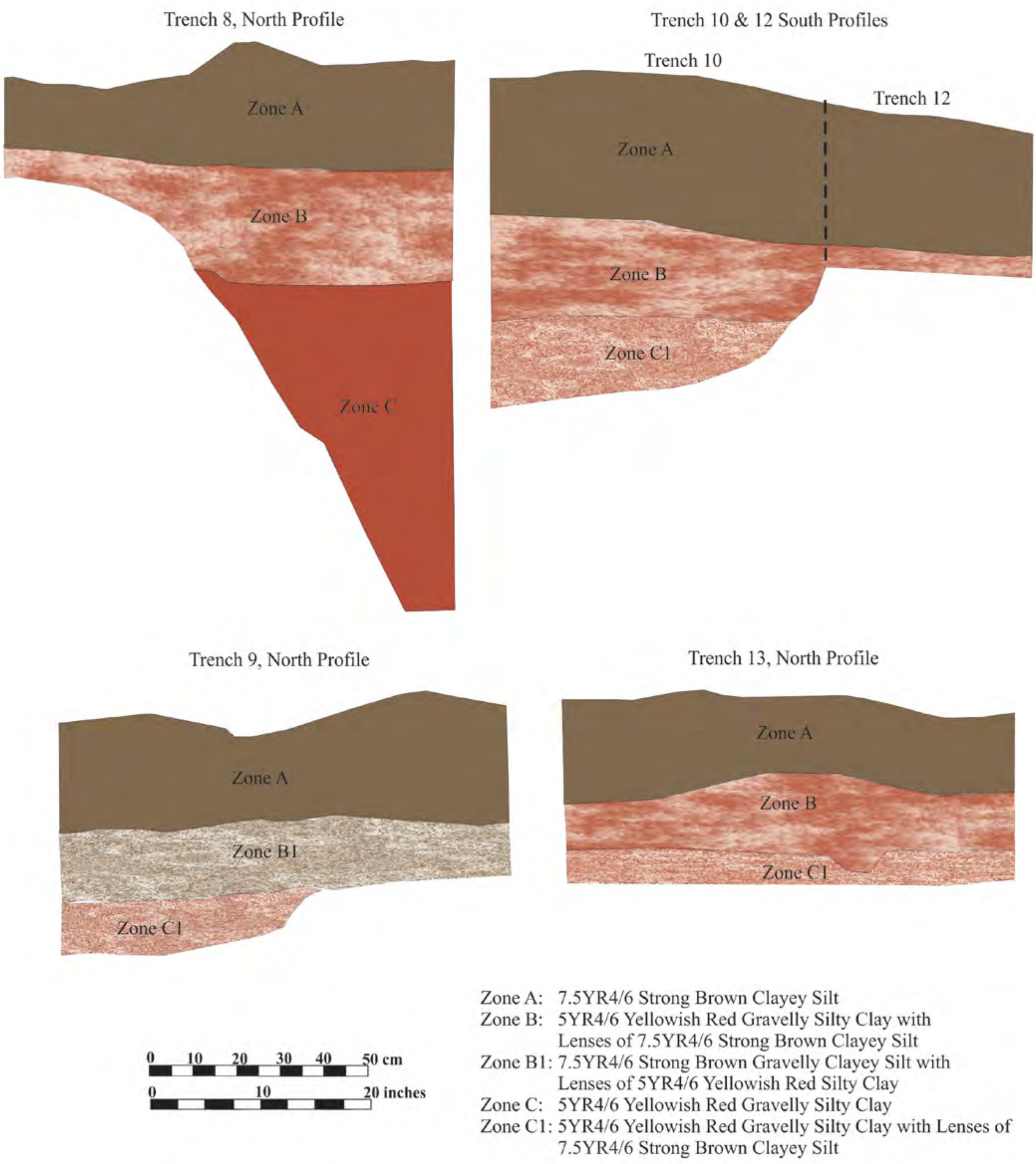


Photo 105: North Wall Profile of Test Trench 8

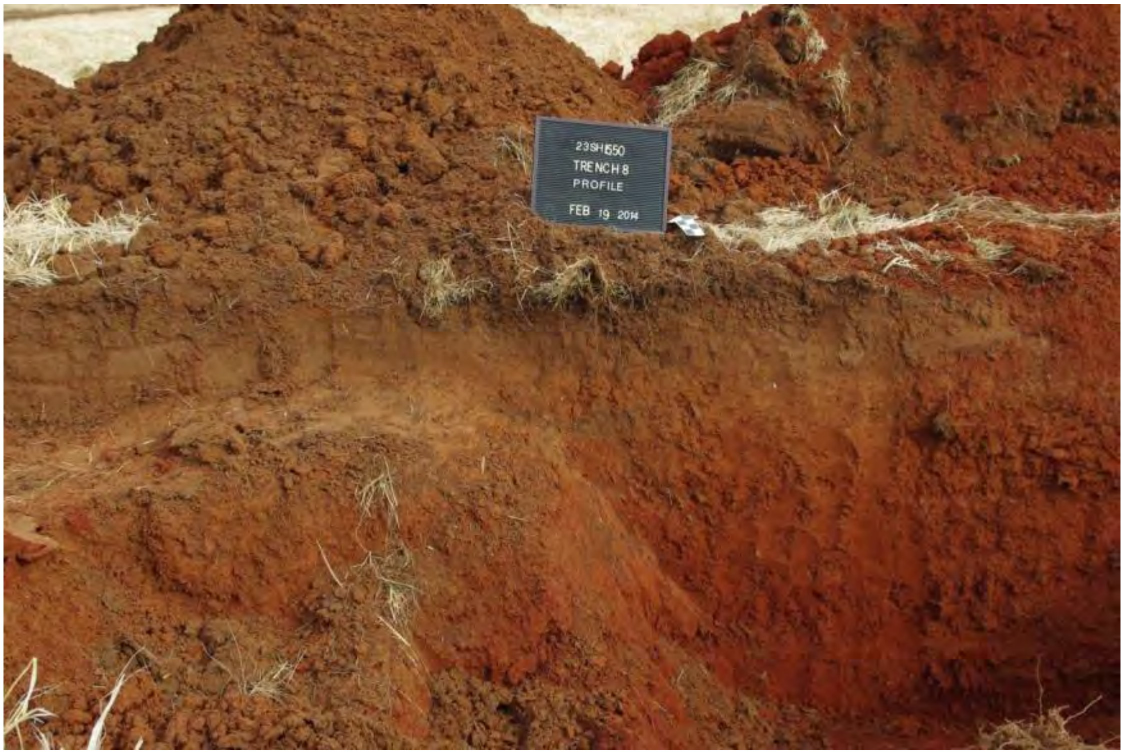


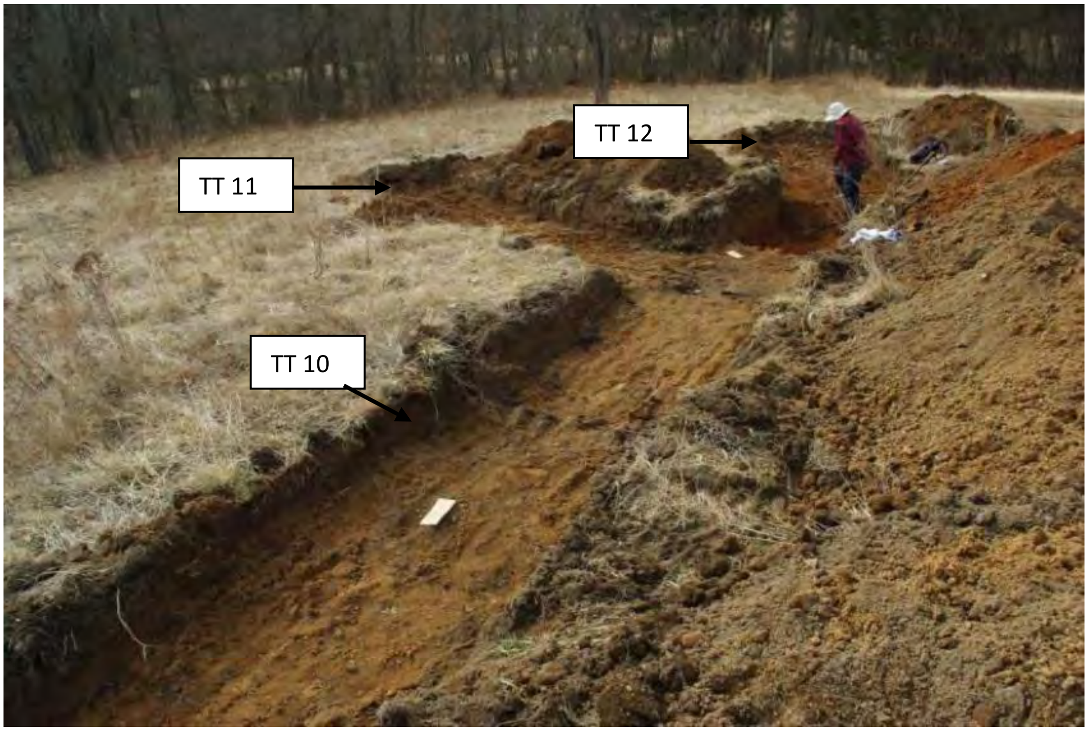
Photo 106: Test Trenches 10 and 12 Profile
Facing South

Test Trench 10 contained the highest concentration of both historic and prehistoric artifacts, including an Archaic period projectile point. Trench 10 was extended about 10 meters further to the east and Test Trench 11 was excavated south of the location to search for the presence of prehistoric features (Figure 34, Photo 107). A historic feature was located in the eastern extension of Test Trench 10 but none were identified in Test Trench 11. Test Trench 12 was excavated off the western end of trench 10 to further search of any cultural features, but none were found (Figure 34, Photo 107). The dimensions of the various trenches are summarized in Table 2.

Table 2: Attributes of Test Trenches at Site 23SH1550

Trench #	Length (m)		Width (m)		Depth (cm)	Deep Area (cm)	Length of Deep area	Sq. Meters	Soil Anomalies Located
1	4	E/W	1.5	N/S	42			6	-
2	4	E/W	1.7	N/S	45			6.8	-
3	6	NE/SW	2	NW/SE	64			12	-
4	6	E/W	2	N/S	46			12	-
5	6	E/W	2	N/S	46			12	-
6	8.8	E/W	1.8	N/S	50			15.84	-
7	7.5	E/W	1.5	N/S	42			11.25	-
8	10	E/W	1.5	N/S	32	125	2.5 m	15	1
9a	10	E/W	2	N/S	41	58	2 m	20	2-3
9b	6.4	E/W	3	N/S	41			19.2	6
10	16	E/W	2	N/S	42	74	2.7 m-west end	32	7-8
11	11	N/S	2	E/W	42			22	
12	7	E/W	2	N/S	42			14	
13	5.5	N/S	1.7	E/W	43			9.35	

Photo 107: Test Trench 10, 11 and 12



There were eight soil anomalies investigated within the trenches revealing 6 intact historic cultural features (Table 3). The remains of the first Union Hill School were identified in Test Trench 9 represented by 5 posts (Features 2-6, Figures 34 and 35a and b). Also located was a historic pit feature in Trench 10 (Feature 8, Figures 34 and 35a and b). The historic artifacts recovered from the trenches and features indicated a late 19th to early 20th century use of this area, which coincides with the time the school was in use.

Table 3: Attributes of Features Identified at Site 23SH1550

Feature #	**Length (cm)**	**Orient-ation**	**Width (cm)**	**Orient-ation**	**Depth (cm)**	**Feature Type**	**Plan**	**Profile**	**Trench #**
1	-	-	-	-	-	Root	-	-	8
2	19	N/S	14	E/W	12	Stone Pier	-	-	9
3	43	N/S	27	E/W	15	Historic Post	Oval	Basin	9
4	53	N/S	28	E/W	16	Historic Post	Oval	Basin	9
5	28	E/W	27	N/S	10	Stone Pier	Square	Conical	9
6	73	NW/SE	72	SW/NE	17	Historic Post/Pier	Circular	Basin	9
7	-	-	-	-	-	Root	-	-	10
8	52	N/S	51	E/W	17	Historic Pit	Circular	Basin	10

Figure 34: Location of Historic Features within Test trenches 9 and 10

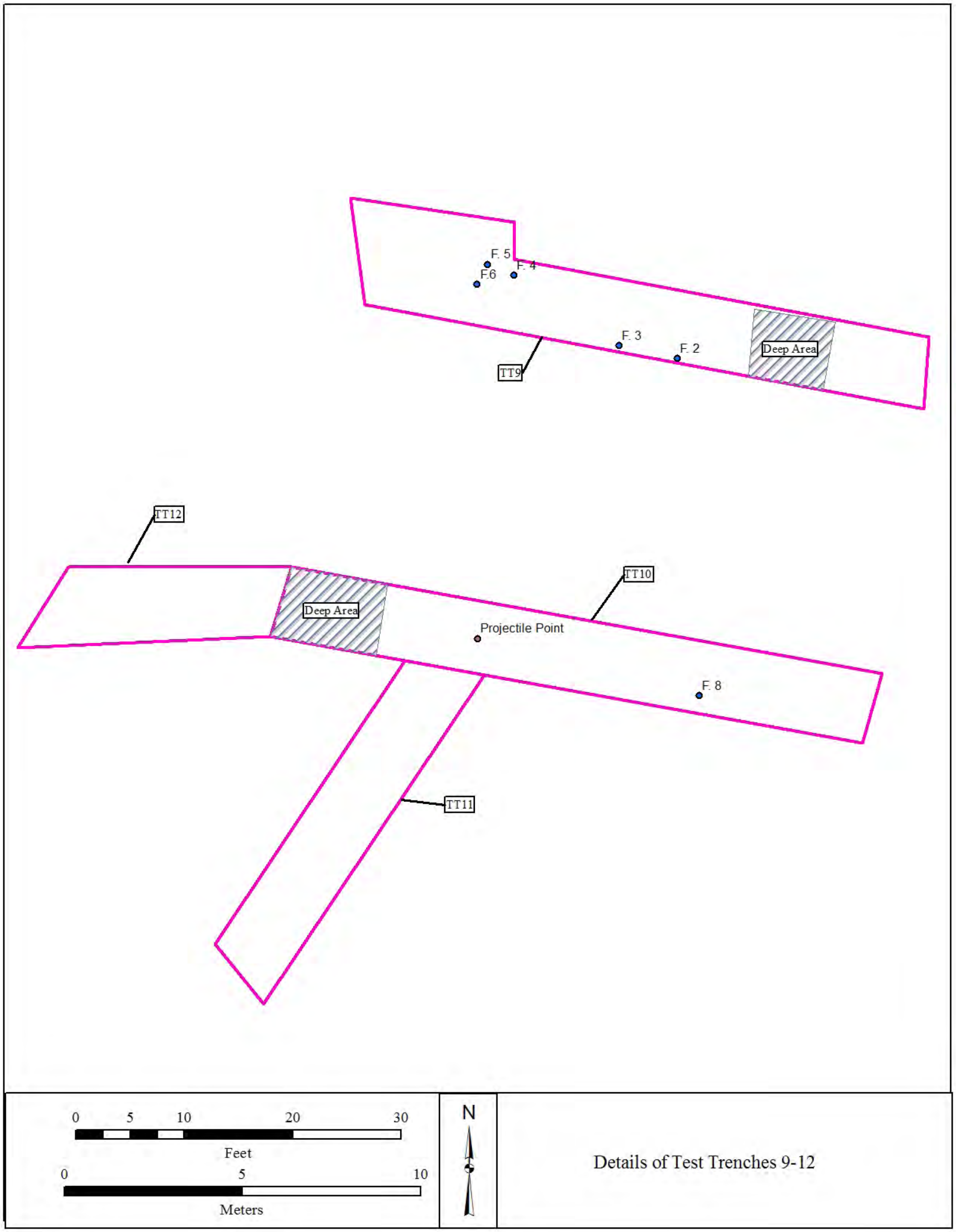


Figure 35a: Historic Features 2, 3 and 4

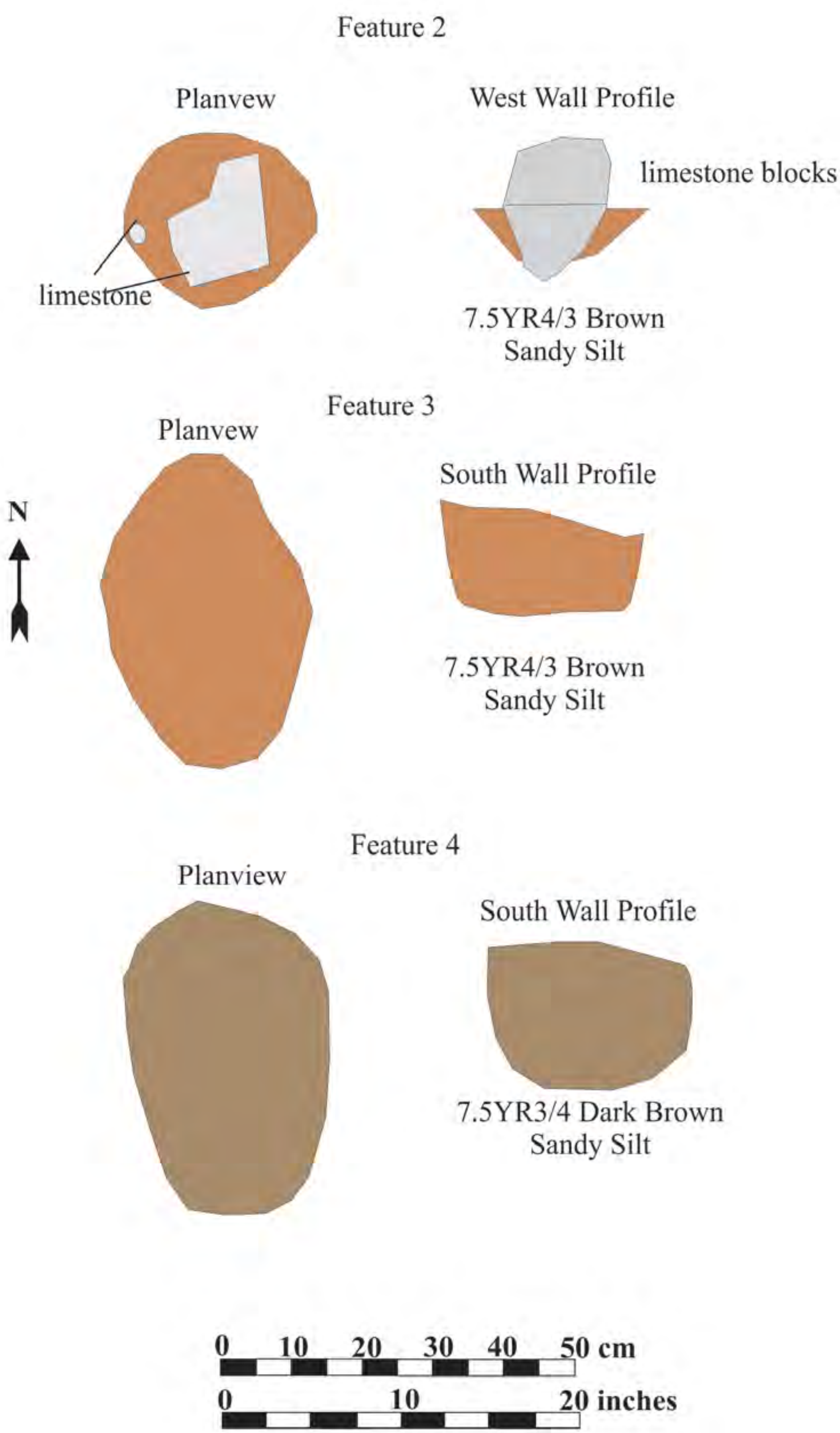
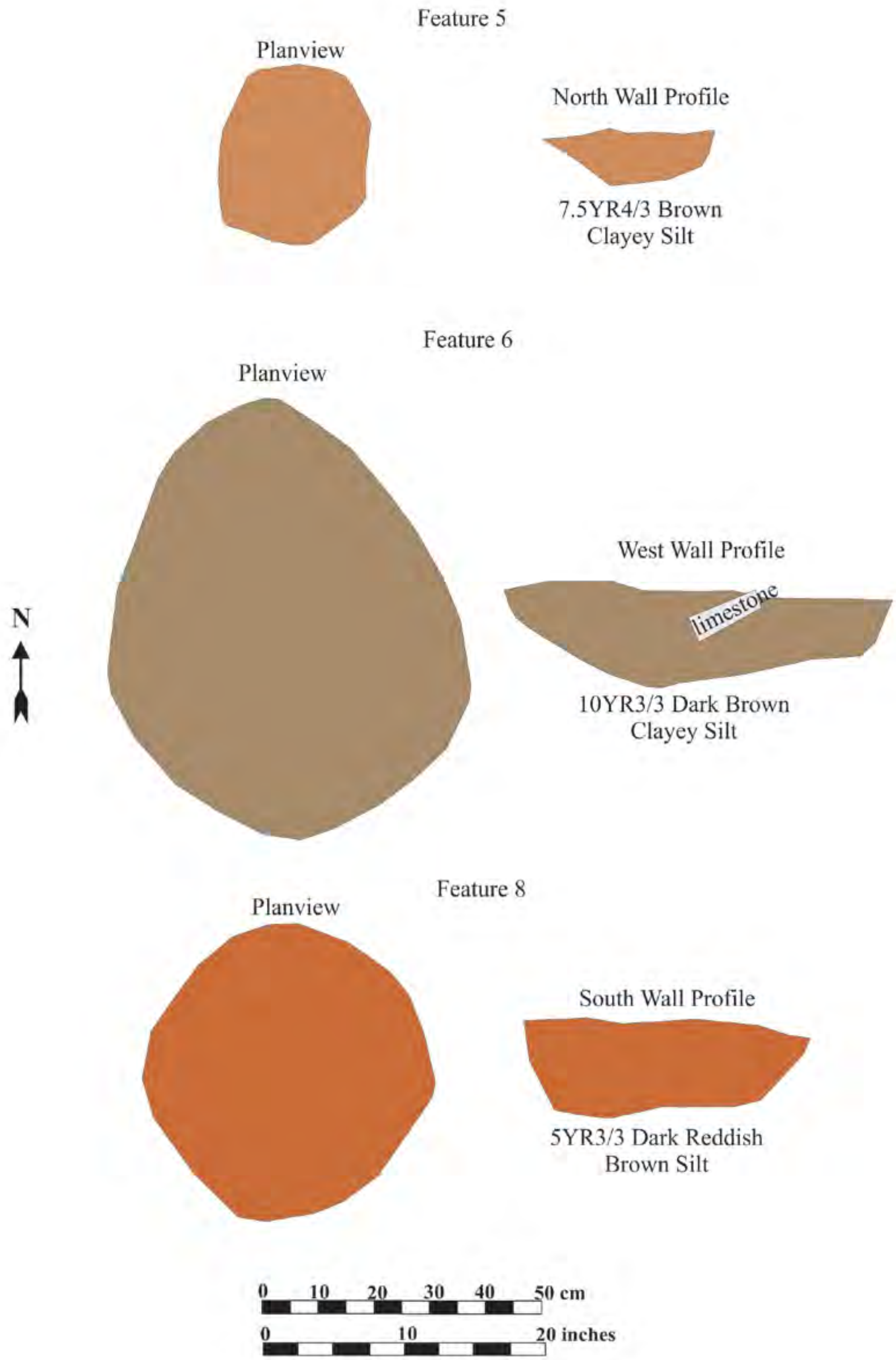


Figure 35b: Historic Features 5, 6 and 8



Although prehistoric artifacts were recovered during the testing, no intact prehistoric features were identified at site 23SH1550. The prehistoric artifacts recovered within the trenches consisted of chert flaking debris, manufacturing debris and a side notched projectile point, suggestive of an Archaic period use of the area. The lack of intact features indicates the people of that time likely used the area as a short term extraction camp.

The Carpenter-Union Hill Cemetery is located within the south central portion of the site (Figures 30-32, Photo 108). A total of 53 graves were identified during the survey, 15 of which were marked with stones containing no inscriptions (Appendix B Table B1). Some of these stones appear to be rocks native to the area (Photo 109) while others are remnants of broken formal stones (Photo 110). A few stones were found outside the cemetery fence that may hint that graves could exist at that location, however, the stones may have been discarded from the cemetery when they were replaced by formal headstones. Missouri State Parks and MoDOT conducted remote sensing investigations both inside and outside the fenced area in April 2014. Results of that work are still pending.

Interments began with Green Carpenter either in 1898 or 1902. His date of death is unclear as two stones mark his burial (Photos 111-112). No death record could be located for him to verify either date; however, his will was located. The document was written by him in 1898, and shown to have been entered into the deeds records in 1902 by his heirs indicating the 1902 date of death is the correct one.

Burial within the cemetery continued into the mid-1900s with the most recent that of Annabell Conway in 1963 (Photo 113). Interments are no longer taking place at this location; however, continued visitation of the cemetery by surviving relatives is evidenced by the presence of flowers placed on the graves (Photo 114).

In addition to the information gained in the field, two websites were utilized, Shannon County MOGenWeb (2008) and Find A Grave (n.d.), to gain additional information about the burials. Information found on these sites is included on Table 4. The websites listed eighteen burials that were not found in the field (Appendix B Table B2). It is likely that many of these are the unmarked stones identified during the survey.

The headstones of two of those interred at the cemetery indicated they served in the Civil War, Green Carpenter and Thomas Warren. Both fought with the South, Carpenter with Company A of the 2nd Arkansas Calvary and Warren with Company H of 2nd Arkansas Infantry (Photos 111 and 115). According to Find A Grave (n.d.), Charles Conway also served and was taken prisoner by the Union Army at Pea Ridge, Arkansas.

Photo 108: Carpenter-Union Hill Cemetery
Facing West

Photo 109: Grave 1, Native Stone
Facing West

Photo 110: Grave 8, Broken Headstone
Facing West

Photo 111: Green Carpenter Headstone with 1898 Death Date
Facing West

Photo 112: Green Carpenter Headstone with 1902 Date of Death
Facing West

Photo 113: Most Recent Marked Burial at Carpenter-Union Hill Cemetery
Facing West

Photo 114: Flowers Left at Graves
Facing Southwest

Photo 115: Thomas Warren Headstone
Facing West

Prehistoric Artifacts

A total of 101 (460.6) prehistoric artifacts were recovered during the trenching and displaced into the historic features. The artifacts consisted of lithic debris made predominately of Gasconade chert. Gasconade Dolomite formation, representing the lower portion of the Ordovician, is present at the surface on the ridge tops within Camp Zoe (Figure 36). Thompson (1995:24) describes this formation as "predominately a light brownish-gray, cherty dolomite. The formation contains a persistent sandstone unit in its lowermost part". The upper portion, known as Richland, contains only a small amount of chert, while the lower portion has up to 50% chert. However, large quantities of Gasconade chert is "highly fractured and vuggy and, thus, unknappable" (Ray 2007:77). The chert is present in discontinuous beds ranging from 1 cm to 1 meter thick, with the chert present in irregular pieces to elliptical nodules. It varies in color from white to gray to bluish gray. Fossils are usually rare, but mollusk shell fragments can occur. Gasconade chert has a rugged internal structure and contains many vugs surrounded by quartz. Highly weathered pieces are unknappable. "Due to the abundance of deleterious inclusions such as vugs, quartz druse, granular quartz, and incipient fractures, the majority of Gasconade chert exhibits poor knapping quality" (Ray 2007:77-78). However, some of the nodules do produce fair to good quality chert that can be knapped (Ray 2007:77-78).

Three pieces including two flakes from Test Trench 9 and 11, and a projectile point from Trench 10 were made of Eminence chert. This formation occurs along the lower portion of the ridge slopes along Sinking Creek (Figure 35). It represents the upper most formation dating to the Upper Cambrian. Eminence Dolomite "is composed principally of medium-to massive-bedded, light gray, medium-to coarse-grained dolomite. It contains a small amount of chert in the form of small nodules and angular fragments that is present mostly in the upper half of the formation" (Thompson 1995:21). This chert has a white, gray, or pale brown color. Gastropods and occasionally a trilobite can be found in this stone. Eminence chert is present in "irregular masses and was sandy, drusy, vuggy, and extremely coarse grained. Most of it resembled granular quartz" (Ray 2007:74), making this chert difficult to knap.

The majority of the prehistoric artifacts recovered consisted of flaking debris (Figure 37). Only a small percentage of additional tool manufacturing debris was recovered. In addition, a small percentage of these pieces represented expedient flake tools and one formal tool, a projectile point.

Figure 36: Local Surficial geology

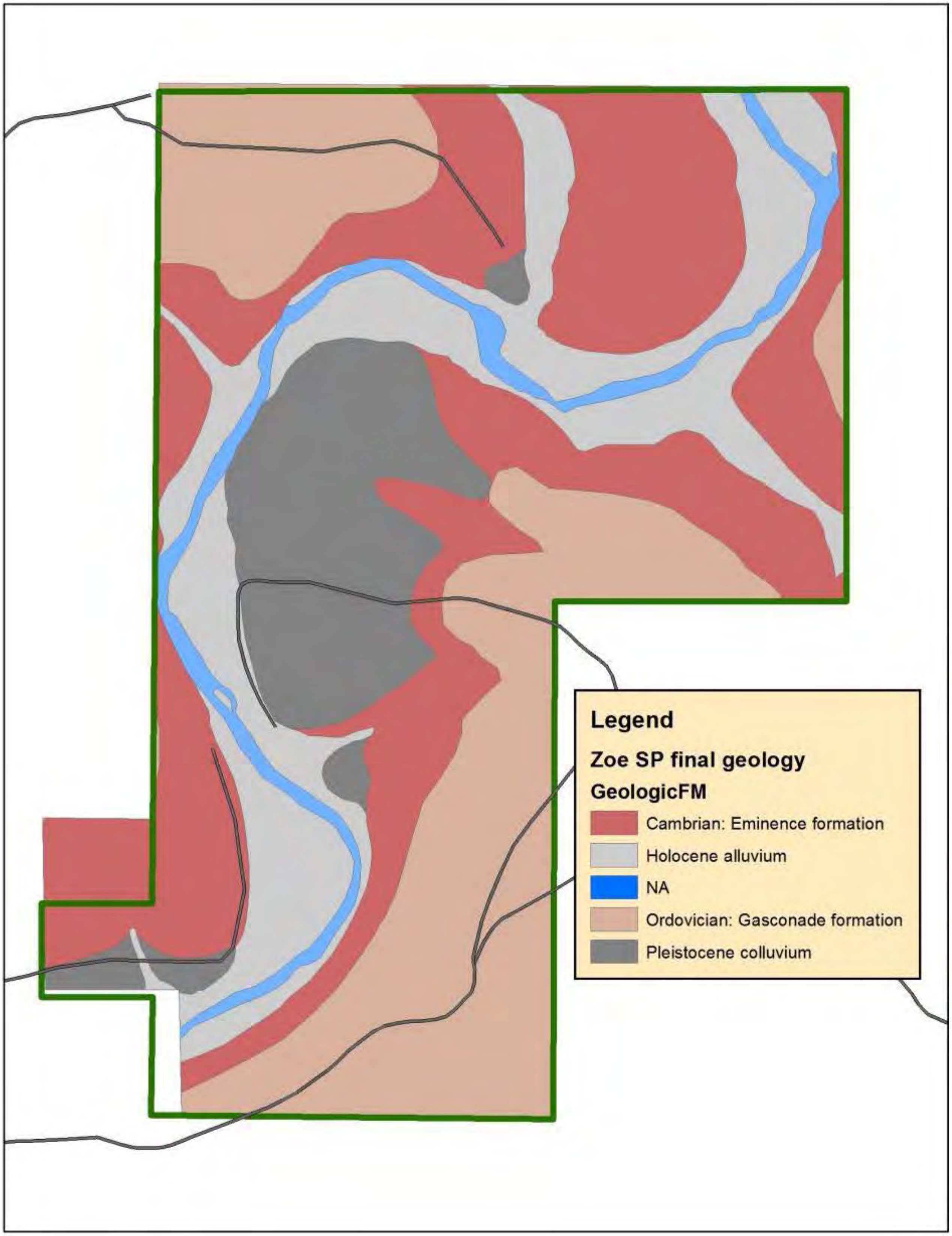
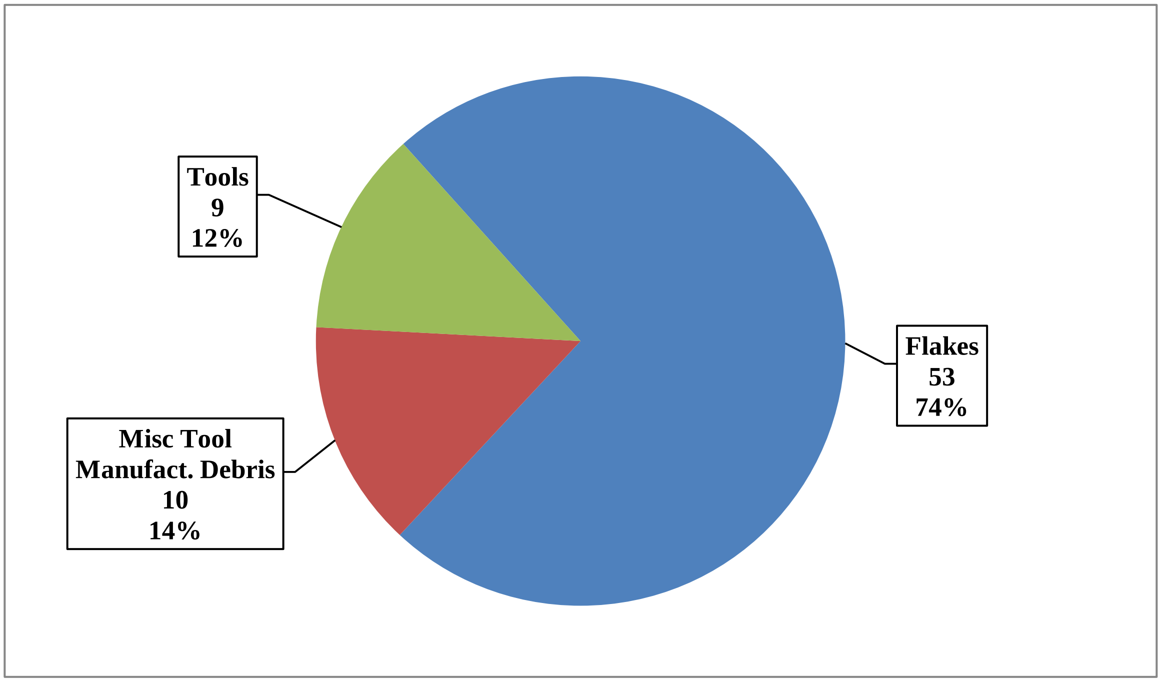


Figure 37: Percentage of Various Types of Prehistoric Artifacts



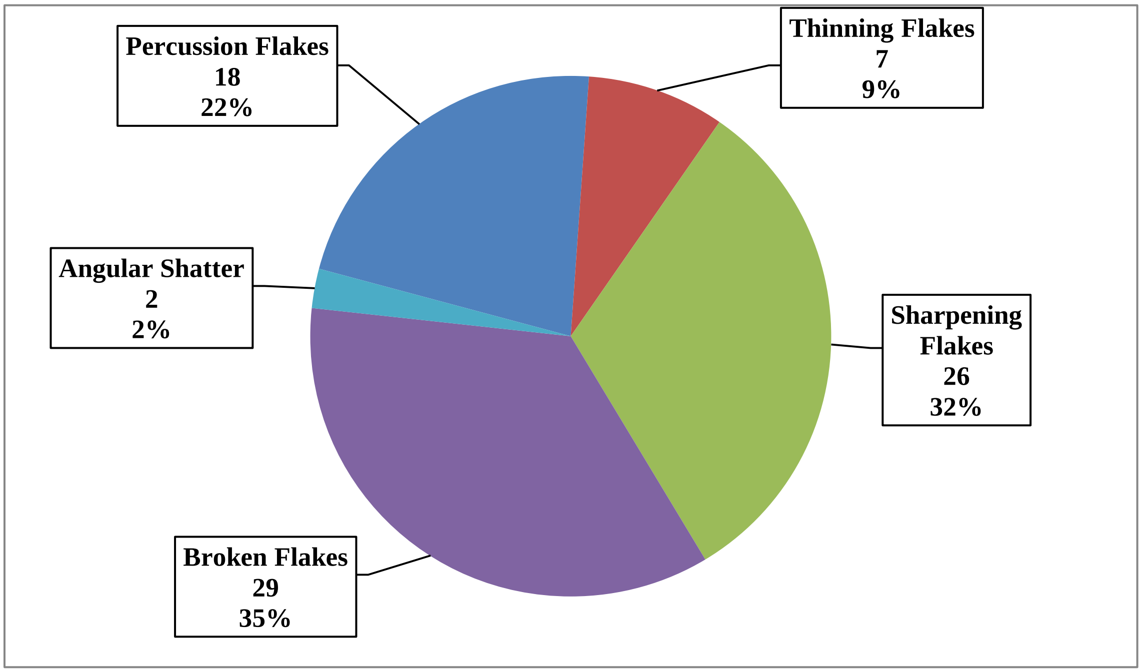
Flakes were produced during the manufacture of lithic tools or during the maintenance of tools. The flakes were divided into five major categories: percussion flakes, thinning flakes, sharpening flakes, broken flakes, and angular shatter, based on their morphology and when they were removed during tool production.

Percussion flakes are characterized as having a distinct striking platform and bulb of percussion immediately below the platform on the flake's ventral side. A total of 18 (127.1g) percussion flakes were recovered from site 23SH1550. Experimental archaeology has shown that these flakes are generally removed during the early stages of lithic reduction in order to produce a core, a blank, or an expedient tool. Percussion flakes represent only a small percentage (22%) of the flakes recovered (Figure 38).

Thinning flakes have a more diffuse bulb of percussion and the striking platform is faceted, forming an obtuse angle of 130 to 155 degrees to the flake's length. These flakes were removed from the edge of a biface as it was being thinned during tool production or from a tool as it is being reworked. Only 7 (12.5g) thinning flakes were discovered. These represented 9% of the flake total.

A greater number of sharpening flakes, 26 were discovered, representing 32% of the recovered flakes. These weighed only 9.3g due to the small size of these artifacts. Sharpening flakes lack a distinct platform or bulb of percussion, and may have a U-shaped notch instead. They were removed using a pressure flaker (e.g., deer antler) in order to resharpen or finish tool edges.

Figure 38: Percentage of Various Flake Type

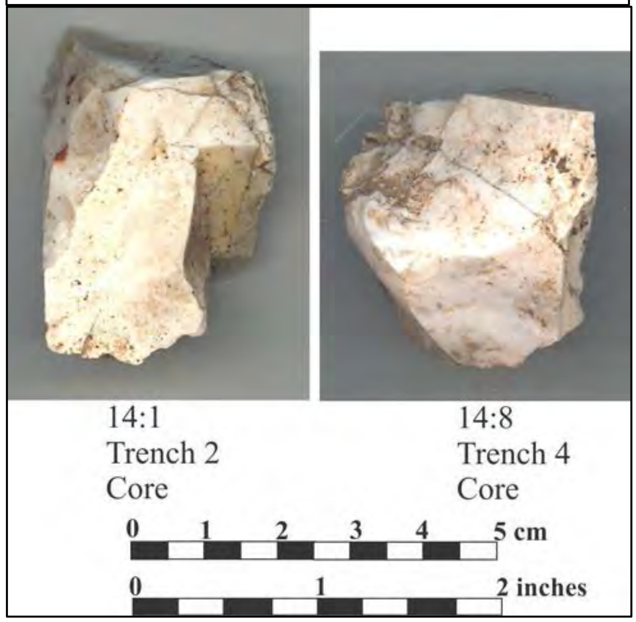


A slightly greater number of broken flakes were recovered than sharpening flakes, represented by 29 flakes (24.0g). Although the dorsal and ventral sides of these flakes could be identified, they were missing their upper portion, so it could not be determined if they originated from percussion, thinning, or sharpening flakes. Broken flakes represented a slightly greater percentage (35%) of the flaking debris. These pieces were separated out as they could represent more than one fragment from a single flake, and a count of broken flakes does not necessarily reflect the amount of lithic tool manufacturing conducted at a site. Many of these flakes probably broke during the manufacturing process, especially given the nature of the Gasconade and Eminence cherts to have natural fractures and inclusions in them where unintended breaks can occur. Other flakes may have broken due to post depositional events such as freeze thaw action and historic farming activities.

Angular shatter is defined as blocky pieces of chert that cannot be re-oriented to the parent material. Shatter was generally produced during the early to middle stages of tool production when the heaviest blows were made with a hammerstone, but it can be made at any point during tool manufacturing or maintenance, especially given the nature of the Gasconade and Eminence cherts. Shatter also can result from the same post-depositional events that formed some of the broken flakes. Surprisingly, few angular shatter pieces were recovered from this site, only two (4.9g).

Additional tool manufacturing debris represented only a small percentage of the artifacts (14%) found at this site. The largest percentage of these artifacts, 70%, consisted of cores. Cores were represented by 7 pieces (132.8g). These artifacts were defined as chert flaked in various directions resulting in a rounded, plano-convex, or blocky shape. Flakes removed from cores were used as expedient flake tools, or were worked into bifacial shaped tools that were repeatedly utilized for certain tasks. All of the cores recovered were made from Gasconade chert and these pieces tended to be small (Photo 116), probably due to the small size of the original fragments that could be worked. The chert for the cores could have been found within the exposed bedrock, but most likely was collected from gravel bars along Sinking Creek.

Photo 116: Cores

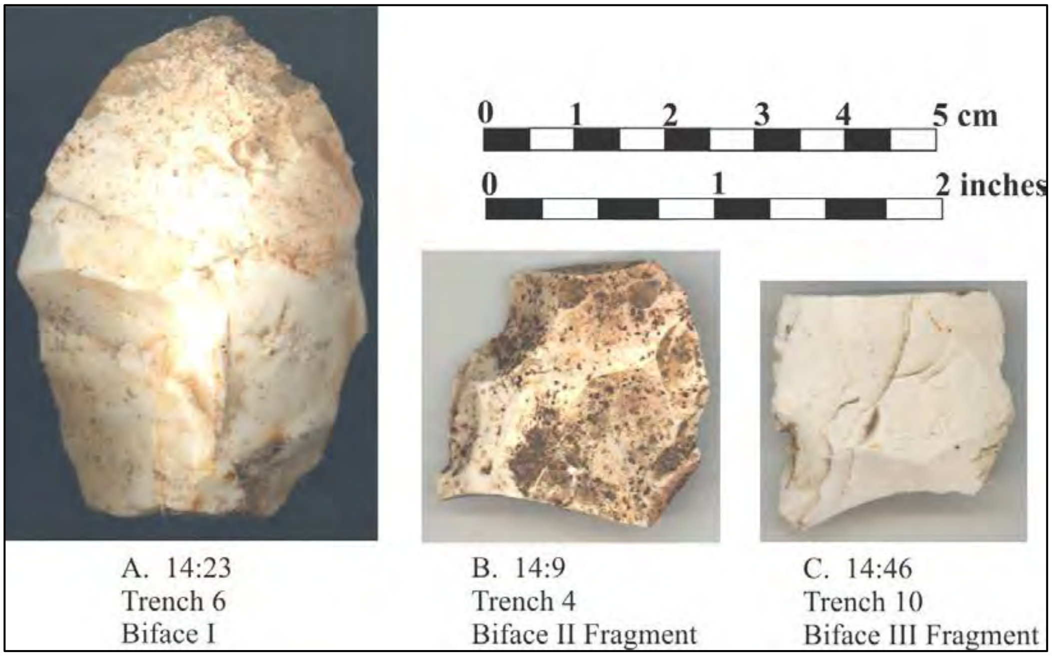


The only other tool manufacturing debris recovered was bifaces, represented by three pieces, which were worked to different degrees. One (49.3g) artifact recovered from Trench 6 was a complete Biface I, or early stage biface (Photo 117:A). The biface only has primary flakes removed across its surfaces resulting in this piece having thicker appearance that the other bifaces. Its edges are uneven due to secondary thinning flakes not being removed. This artifact likely represents a blank intended to be made into a tool, but it was either discarded during the early stages of tool production or was lost.

A fragment (9.1g) of a Biface II, or middle stage biface was found in Test Trench 4. This artifact has some thinning and sharpening flakes removed from it, resulting in this artifact being thinner than a Biface I, but still having a wavy edge (Photo 117:B). The Biface II was broken and likely discarded during tool production.

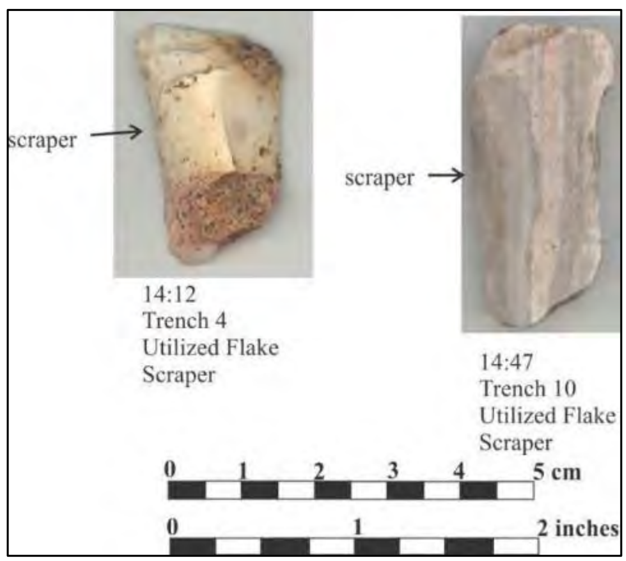
A small fragment (7.4g) of a Biface III, late stage biface, was recovered from Test Trench 10. This biface has sharpening flakes and thinning flakes removed from its edge, resulting in this piece being thinner and having a straighter edge than the other two bifaces (Photo 117:C).

Photo 117: Bifaces



A small percentage (12%) of tools was discovered within the trenches. These consisted predominately (N=8) of utilized flakes that were used once or a few times as tools and then discarded. Small flakes were removed from the edges of these tools during use or they were slightly modified to be used. Immediately after being removed, chert flakes are extremely sharp and can be used for a variety of purposes (Figure 39).

Photo 118: Utilized Flake Scrapers



Scrapers were represented by two flakes (12.4g). These tools are distinguished by having a straight edge, with regular flake scars removed during use that were uniform in size and shape (Photo 118). These flakes came off only the dorsal side during use resulting in this edge having a beveled shape.

Gouges are formed with rounded tips that are nearly twice as long as they are wide. The tip is beveled on its dorsal surface and flake scars removed during use came off of only this side. This tip also is polished from having been used to groove wood or bone (Photo 119).

Figure 39: Percentage of Utilized Flake Types

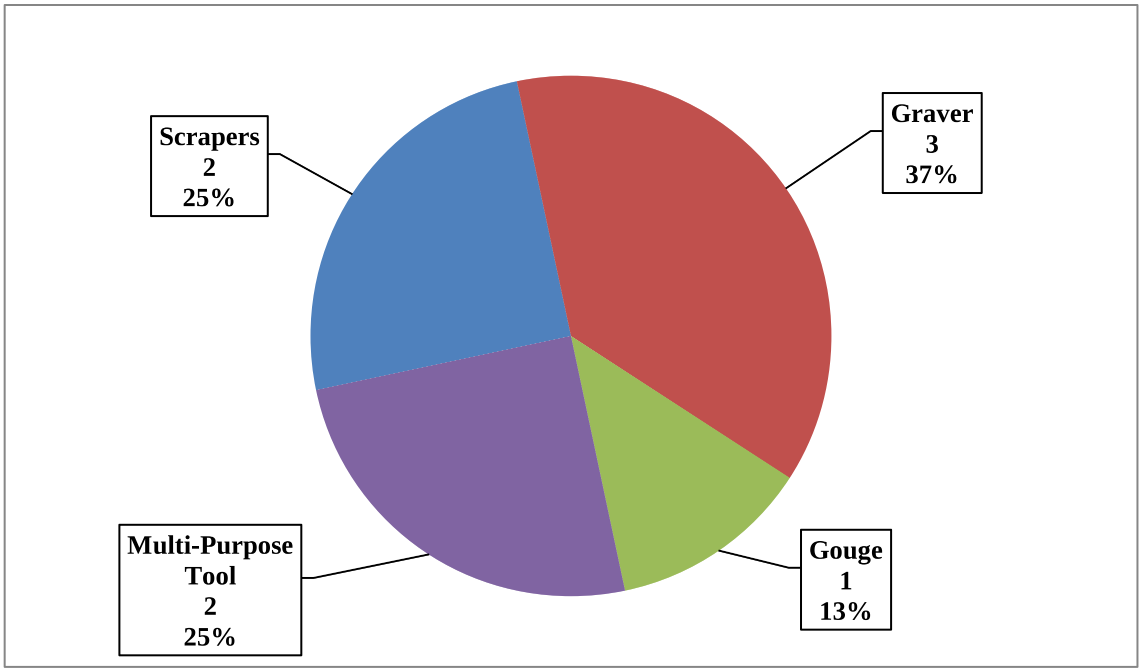


Photo 119: Utilized Flake Gouge

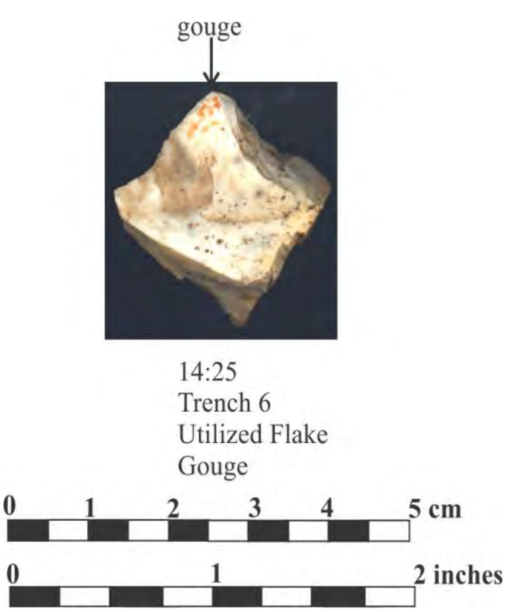
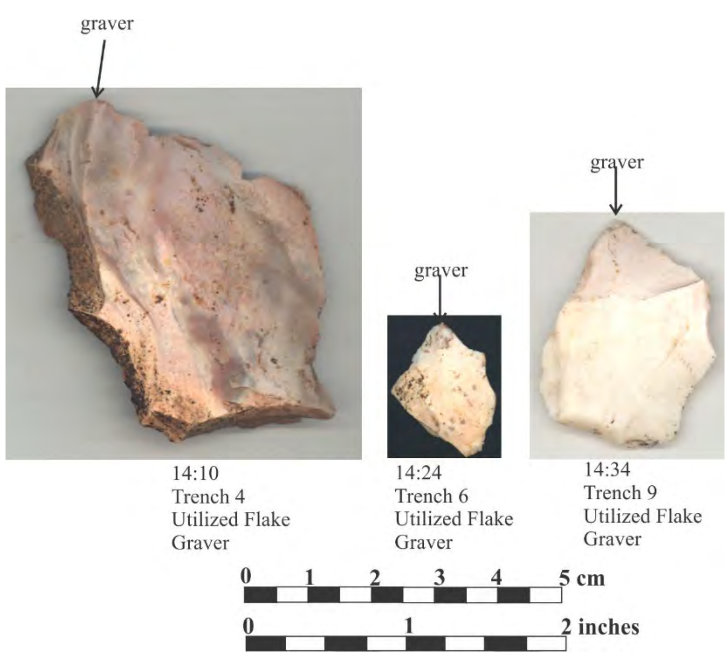


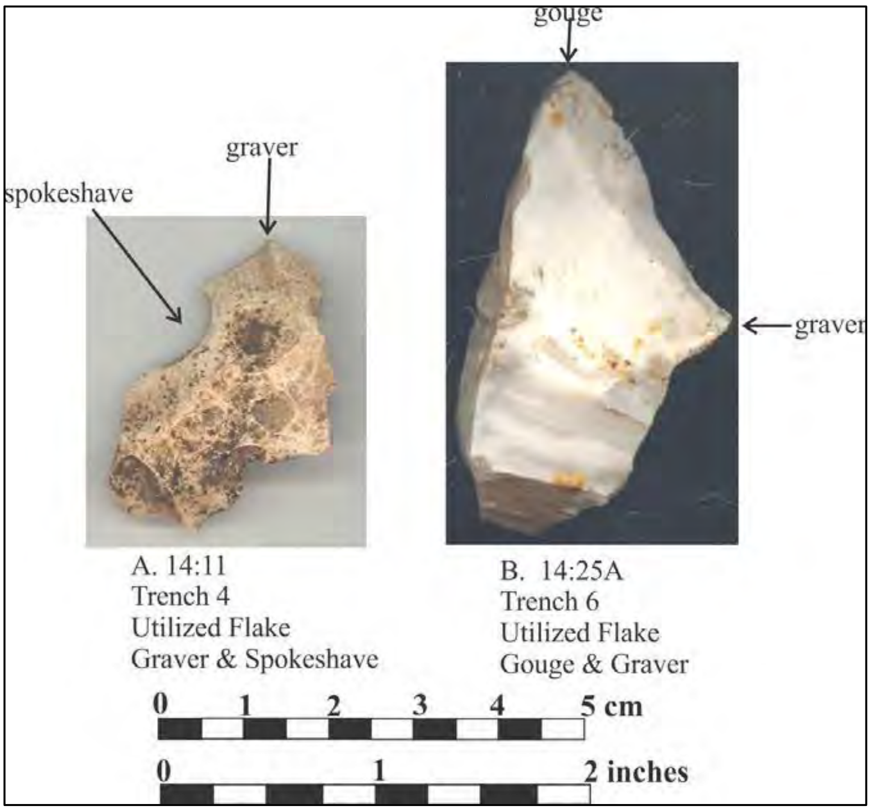
Photo 120: Utilized Flake Gravers



A slightly greater number of gravers (N=3, 27.1g) were discovered in the trenches. These tools were similar to gouges, except they have pointed versus rounded edges used to etch fine lines in wood or bone (Photo 120).

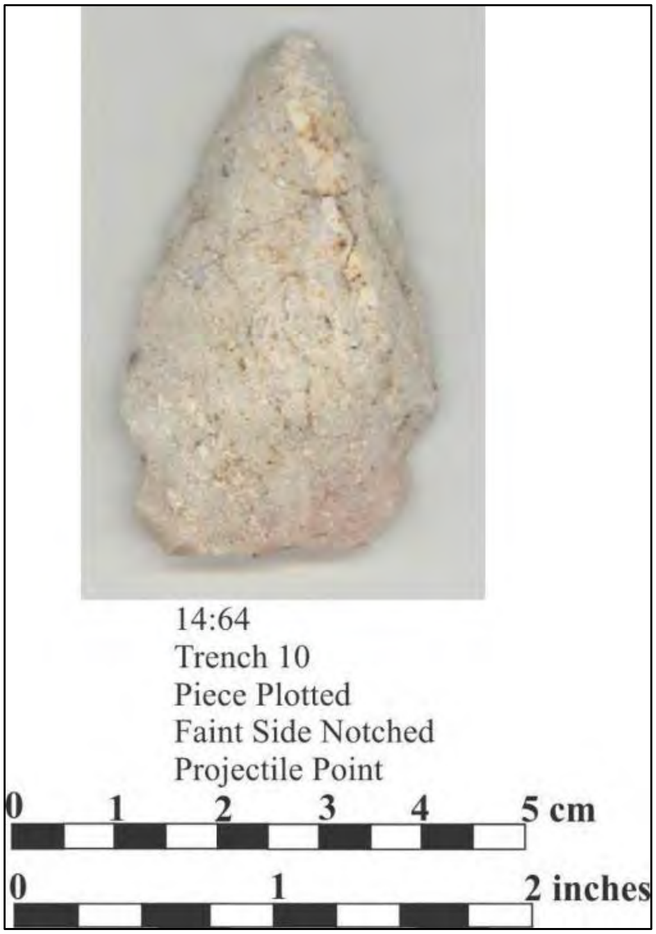
Two additional flakes (27.2g) were recovered that had more than one use. One from Trench 6 served as a gouge on one edge and as a graver on another edge (Photo 121:B). A second flake found in Trench 4 was used as a graver as well as a spokeshave (Photo 121:A). Spokeshaves have a steeply beveled U-shaped notch resulting from flakes being removed only from the dorsal side. These tools were used to scrape wood or bone in order to produce smooth rounded pieces, such as spear shafts.

Photo 121: Multi-Purpose Utilized Flakes



Only one formal tool was recovered from site 23SH1550. This was a projectile point found in Trench 10 (Photo 122). The point was made from the poorer quality Eminence chert. It measured 5.2 cm long and 3.2 cm wide, at its rounded shoulders. The point has faint side notches measuring 0.7 cm wide and 0.3 cm deep. This type of side notched projectile point was most popular during the Middle Archaic Period, but continued to be produced during the Late Archaic Period.

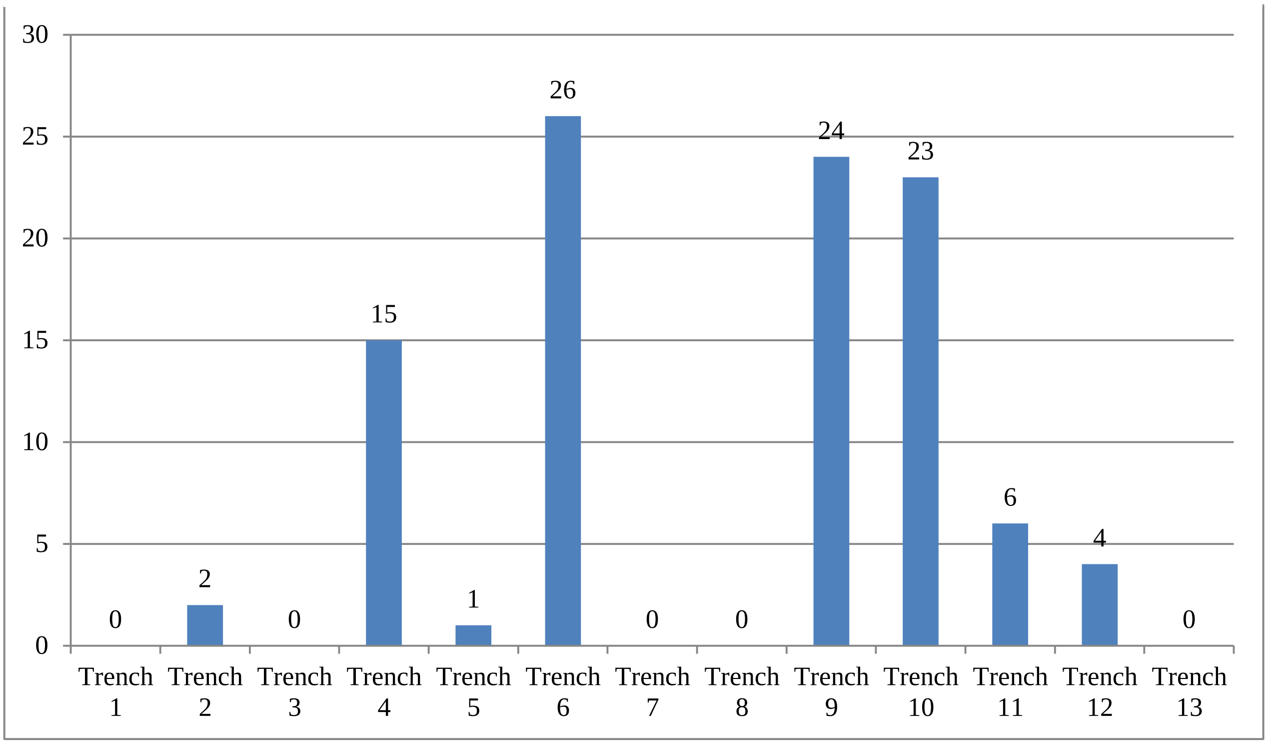
Photo 122: Faint Side Notched Projectile Point



Discussion of Prehistoric Occupation

Prehistoric artifacts appear to be particularly concentrated in the trenches at the lower margin of the ridge slope immediately north of the cemetery (Figure 40). However, it should be noted that prehistoric artifacts were noted within the cemetery as well. These materials suggested that a limited number of activities were conducted at site 23SH1550.

Figure 40: Number of Artifacts Recovered From Test Trenches



The flaking debris was indicative of a site where tools were predominately resharpened and repaired. Johnson (1981) and Morrow (1982:1298-1301) found that the ratio of percussion flakes to thinning or sharpening flakes varied according to the stage of lithic reduction performed at a site. Percussion flakes were more commonly removed during the early stages of lithic reduction when the heaviest blows were made, and thinning/sharpening flakes were removed during the middle to latter stages and during tool maintenance. Johnson found that sites near quarries or other locations where chert was collected yielded a ratio of nearly 160 percussion flakes to 1 thinning/sharpening flake. Investigations at quarry sites in Missouri, however, indicated that the ratio is not as large, producing nearly 7 percussion flakes to 1 thinning flake, and sharpening flakes tend to be rare (Harl 2001). At habitation sites, where Burlington chert was worked into tools, the ratio of percussion flakes to thinning/sharpening flakes was at least 1:3, with slightly more sharpening flakes than thinning flakes.

Flaking debris at site 23SH1550 produced a ratio of 1 percussion flake to 1.83 thinning/sharpening flakes indicating that the site was not used to preliminary process Gasconade or Eminence chert collected from a nearby source. Further, sharpening flakes were present in higher percentages (32%) than thinning flakes (9%) and percussion flakes (22%) (see Figure 38, page 132). This could indicate that tools were more often being repaired or resharpened at this site than manufactured. Tool maintenance was further indicated by the low number of angular shatter (N=2) found at this site. Angular shatter generally is more common where chert is being preliminarily worked when the heaviest blows are made with the hammerstones to produce a blank (biface I) or a core. However, due to the nature of Gasconade and Eminence chert, angular shatter can be produced at any point in the manufacturing or maintenance process. The small number of shatter could further reflect that tools were predominately being resharpened or repaired at this site.

Further suggesting that tool manufacture was not an important activity at this site was the general lack of miscellaneous tool manufacturing debris (14% of the overall prehistoric artifacts, see Figure 36, page 139). These artifacts were represented by only 7 core fragments, a complete Biface I, and fragments from Biface II and Biface III. The latter may represent a formal tool that broke during use and the fragment was just too small to determine its function.

Tools recovered from site 23SH1550 suggest that in addition to tools being repaired that other activities took place. The majority, however, were expedient utilized flake tools, probably produced by removing a flake from a core, with the only formal tool recovered a projectile point. Utilized flakes consisted of two scrapers, generally used to remove and prepare animal hides, but some may have been used to shape wood or bone, or remove meat from bone. The other utilized flakes were used to shape or engrave wood or bone. These include a spokeshave, two gouges, and five gravers. The projectile point does indicate that hunting was conducted at this location as well.

Overall, this site appears to have been used to predominately repair and resharpen tools. Few formal tools were bought to this location, and the tools recovered suggested that only a limited number of activities were conducted here, possibly hide working, wood or bone working, and hunting. This along with the lack of any prehistoric features suggest that this site was not a permanent habitation and that it was not used to preliminary work chert recovered from a nearby source. Instead, it served as a temporary short term camp site, perhaps a hunting camp or a plant extraction location. Few features were likely left here.

Historical Artifacts

In addition to the prehistoric artifacts, 58 (943.8g) historical artifacts were discovered during the trenching of site 23SH1550. Some of these materials represented habitational debris. These include 13 (108g) pieces of ironstone dinner settings.

Dinnerwares at the start of the 19th century consisted of a soft nonvitreous paste creamwares, pearlwares, whitewares, and redwares. In 1800, William Turner was the first to develop a semi-vitreous ware that was harder than these wares and more closely imitated porcelain, but was cheaper to manufacture and could be mass produced. He did this by mixing whitish colored clay with powdered slag. Others experimented with his formula and in 1813, Charles James Mason, received a patent for a new ware, which was produced by adding feldspar. In 1827, his patent ended and a number of other potters experimented with this ware (Hillier 1965:22; Miller 1991), which was referred to by as many as 61 different names, chief among these were:

china stone	ironstone china	white granite
semi-porcelain	stone china	opaque porcelain
demi-porcelain	porcelain de terre	porcelain opaque

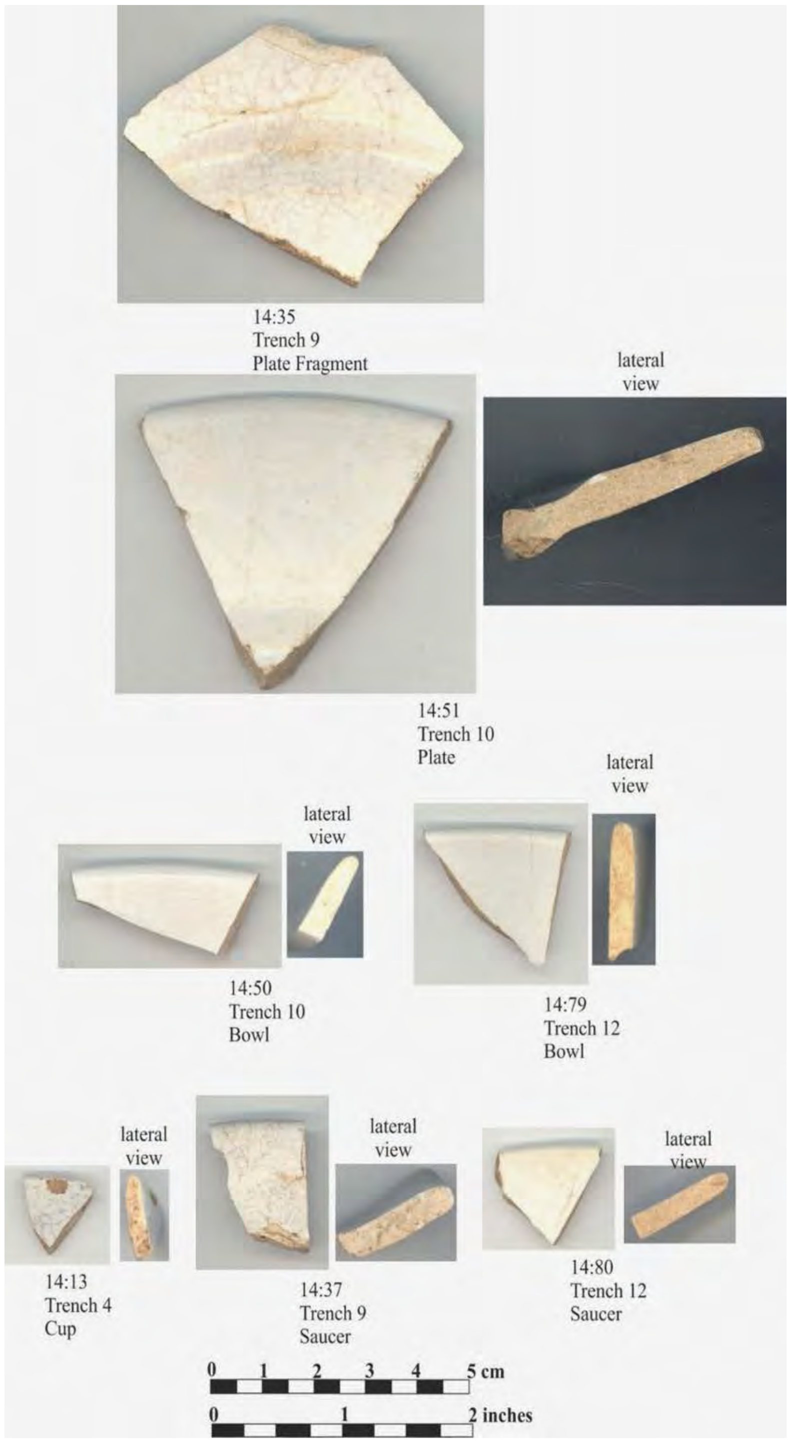
This ware type is most commonly known as ironstone (Majewski 1987:46). These early pieces were highly decorated with painted and transfer print decorations that often copied designs or imitated patterns used on Chinese porcelains. Although ironstone dinner settings were used by middle class customers during the first part of the 19th century, these early pieces never gained wide appeal because they tended to be thick and heavy.

It was only after 1850 that ironstones became widely popular. At that time due to growing influence of Victorian ideology, plain white ironstones became more popular because these reflected the purity and the wholesomeness of the food being served. Ornate vessels used prior to this time became less popular because it was feared that the decorations could hide tainted foods. It was believed that consuming tainted food not only impact your health and mental well being, but could ultimately affect your morality as well (Wells 1868). These mid 19th century ironstones were sometimes decorated with broad molded designs (Miller 1980, 1991; Snyder 1995:11, 36; Wetherbee 1996:8-9).

By the 1880s, more delicate ironstone settings with finer molded designs, more intricate shapes, and simple transfer print or decal decorations became popular. Most of these innovations were introduced by American manufacturers allowing them to take over the ceramic market that had been dominated by England for most of the 19th century. This ware type continued to be popular until the 20th century, when more vitreous wares began to be introduced (Snyder 1995; Wetherbee 1996; Majewski 1987). However, Harl (2008:69) suggests that in rural areas, plain ironstones continued to be popular until the mid-1900s. This could be due to their economic situation and inability to purchase the newer pieces. Another possibility is that rural residents mostly entertained relatives and close friends. Having showy table settings may have been perceived as being too extravagant and threatening to these relationships.

The ironstones recovered from site 23SH1550 consisted predominately of plain, undecorated pieces, consisting of at least two plates (22 cm in diameter), two bowls (11 and 14 cm in diameter), 1 cup (6 cm in diameter), and two saucers (14 cm in diameter) (Photo 123).

Photo 123: Plain Ironstone Dinner Settings



A scalloped rim from Test Trench 10 represented a serving bowl, only 3 mm thick. It contained a fine molded line near its edge typical of ceramics produced after 1880 (Photo 124).

One ironstone sherd found in Test Trench 12 contained a portion of a manufacturer's mark (Photo 125). Unfortunately, not enough of the mark was present to be certain of its design. A search was made to find a similar mark in Kovel and Kovel (1986) and Kowalsky and Kowalsky (1999) but it could not be identified.

Another ironstone sherd found in Test Trench 11 was not a dinner setting, but a wash basin (Photo 126). The basin had a diameter of 28 cm and like most of the dinnerwares was undecorated.

Photo 124: Fine Serving Vessel

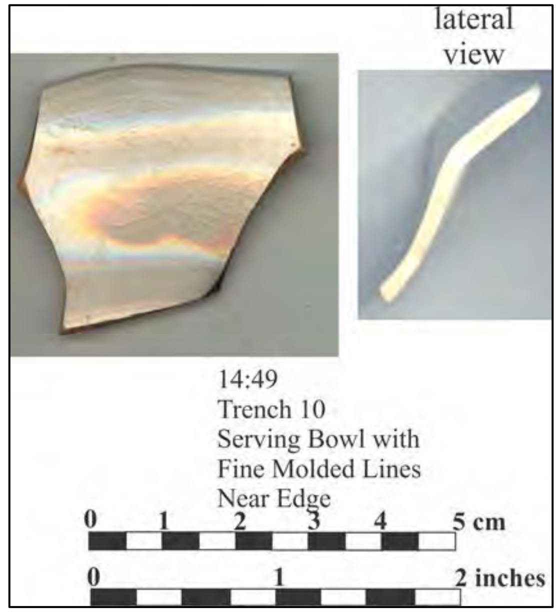


Photo 125: Portions of a Manufacturer's Mark Discovered on Ironstone Basal Sherd in Trench 12

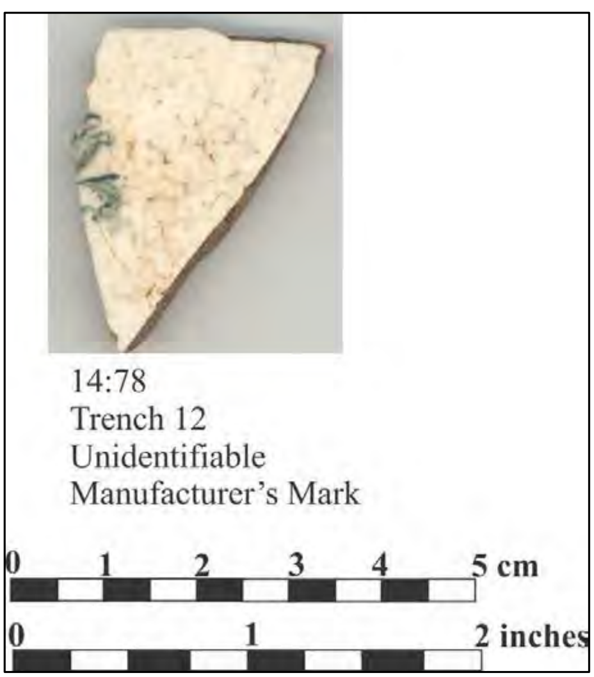
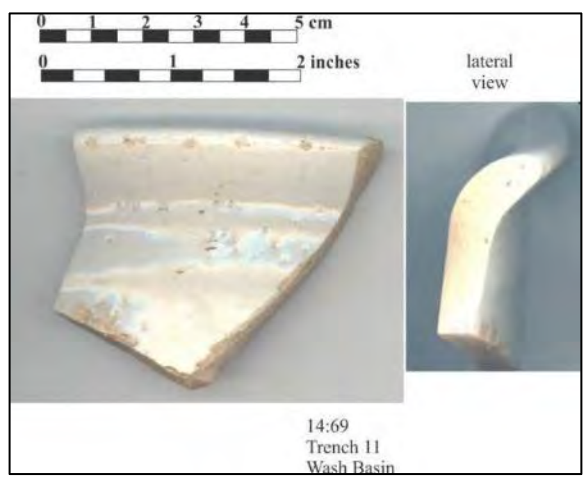
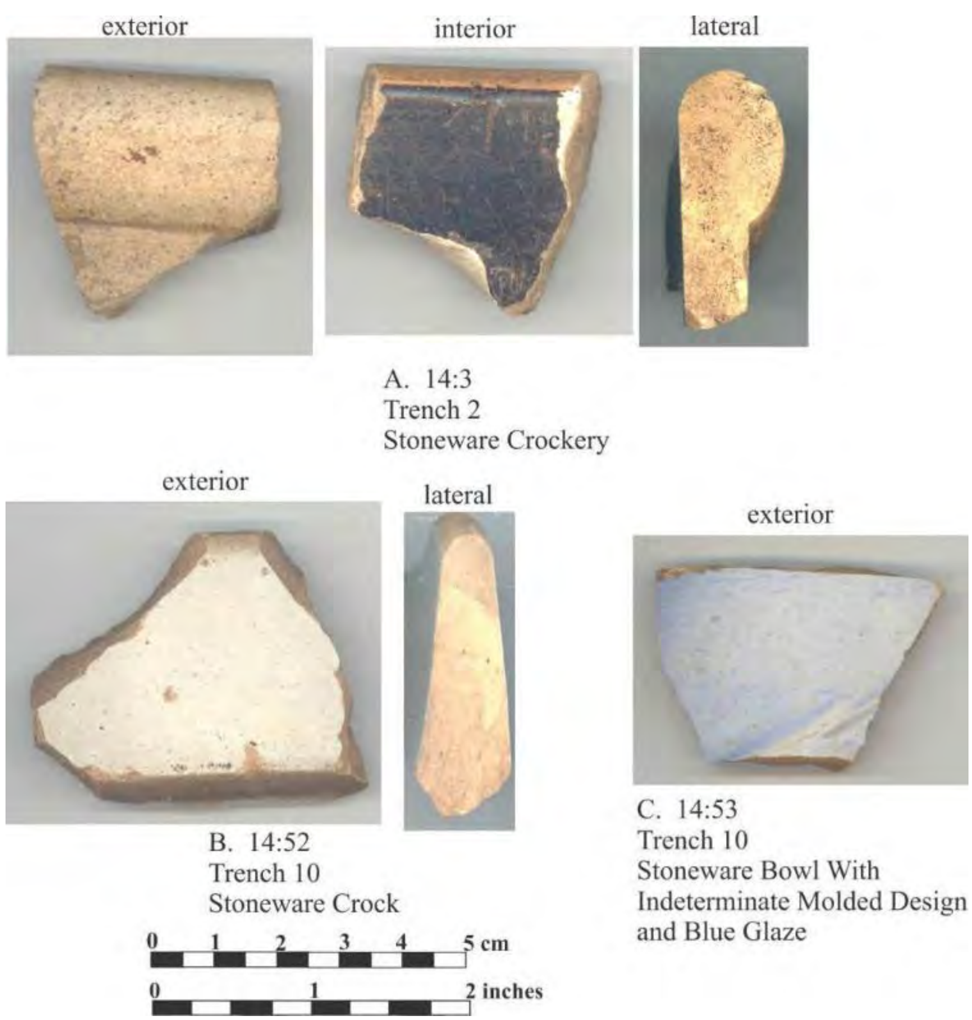


Photo 126: Wash Basin



Another four (174.0g) sherds consisted of stonewares. Stonewares, similar to ironstones, were fired at higher temperatures making them semi-vitreous. These vessels typically were covered by slips, and a lead or more often a salt glaze. They were first produced in Germany during the Middle Ages and by the mid-1500s were exported throughout Europe and later to the U.S. (Lewis 1969:51). These vessels were viewed as a safer alternative to tin glazed dinnerwares common at that time, but stonewares tended to have a thick and heavy appearance that did not make them widely popular at the dinner table. The knowledge of their manufacture was brought to the U.S. by German immigrants who operated local potteries and produced vessels primarily for kitchen use, such as mixing bowls and storage crockery. Two of the sherds recovered from site 23SH1550 did come from crockery vessels (Photo 127:A-B). One sherd found in Test Trench 10 had a ribbed interior, this may have been crockery, but could have been a drainage pipe used to displace rain water from the building. Another body sherd found in the same trench had a molded floral decoration on its exterior and a blue colored glaze (Photo 127:C). This could possibly be from a mixing or serving bowl.

Photo 127: Stoneware Vessels



Other storage vessels recovered included fragments from two (29.5g) canning jars. Canning jars were first developed by John L. Mason in 1858; a few years later, Lewis R. Boyd improved on the design by adding an opaque glass liner that separated the contents within the jar from the zinc lid, which would have contaminated the food (Lief 1965:8). The use of a glass liner continued until the invention of a vacuum seal cap using a rubber gasket, which was developed in 1929 and quickly becoming popular during the 1930s (Lief 1965:32). One of the jars recovered from site 23SH1550 represented a clear glass lid (Photo 128). A popular alternative to the opaque glass liner was a glass lid closed with a lightning fastener (Figure 41). In 1882, Henry Putnam of Bennington, Vermont, patented this type of fastener for fruit jars which held a glass lid in place with a metal clamp. The clamp also made it easier to open and seal the jars, hence the name “Lightning”. The Atlas Company improved on the Lightning fastener by adding a raised lip to keep the lid from cracking (Society of Historical Archaeology 2013; Lief 1965:8-9).

Photo 128: Glass Canning Jar Lid

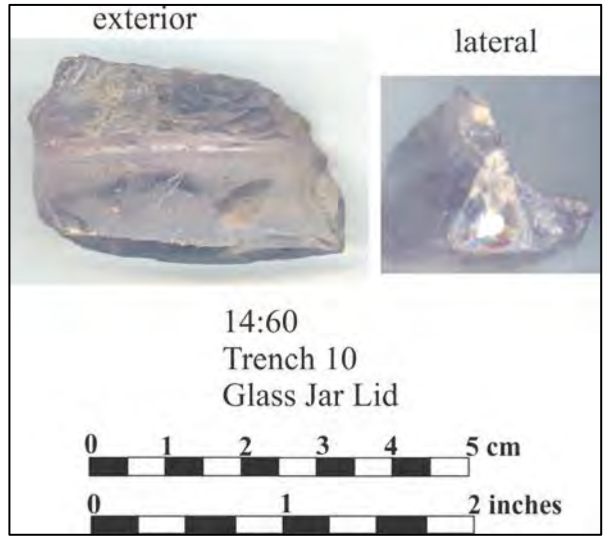
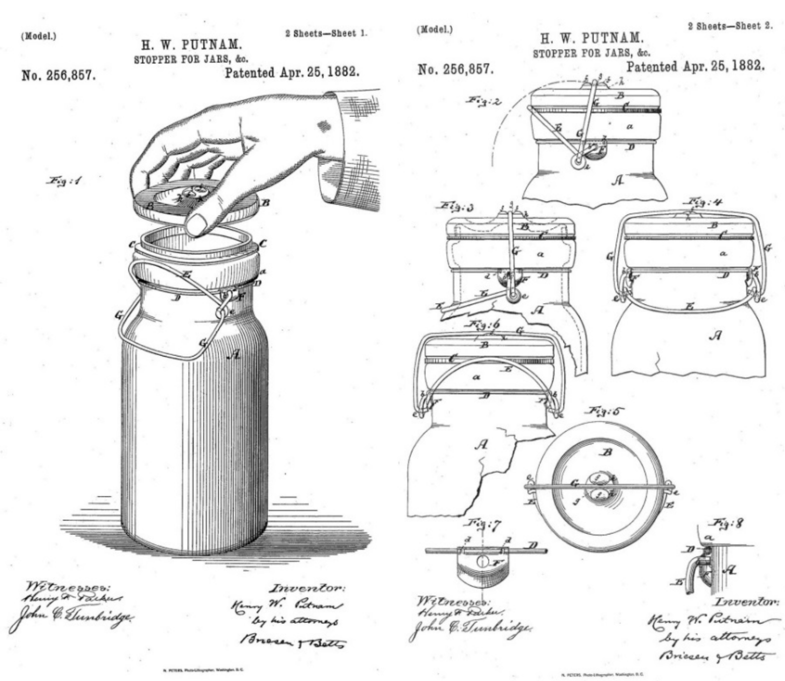


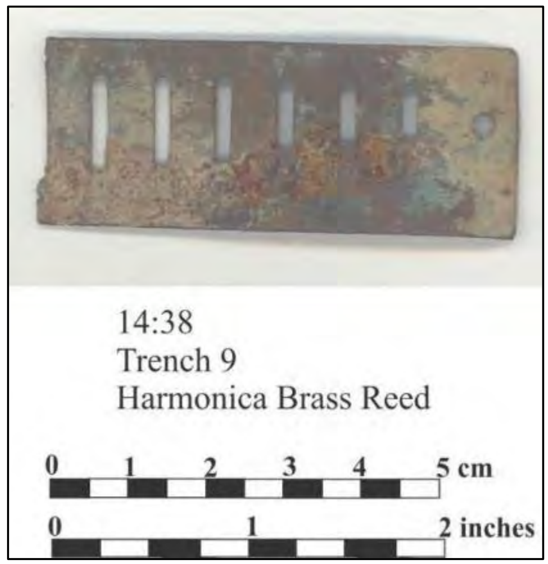
Figure 41: Putnam’s Patent for Lightening Fastener
(Society for Historical Archaeology 2013)



Another 14 (66.9g) artifacts represented pieces of bottle glass. A thick olive green colored fragment found in Feature 6 of Test Trench 9 could have been from a wine bottle. Another piece found in Test Trench 10 had an amber color and may have been from a beer bottle. By the 1890s, beer manufacturers discovered that an amber colored bottle provided beer with the best protection from light rays, which caused a photochemical reaction with the hops resulting in beer having a "skunky" flavor. However, it was only after the end of Prohibition that most beer bottles were amber colored, primarily due to beer being nationally distributed, with fewer local brewers (Society for Historical Archaeology 2012). Other parts of bottles found in the feature could have been from soda or condiments, but some may have come from medicine bottles as well. The pieces found were too small to accurately determine their use.

A personal item discovered in Test Trench 9, near Features 5 and 6, was a (8.8g) brass reed from a harmonica (Photo 129). The harmonica was developed in 1821 by 16 year old, Christian Friedrich Buschmann. In 1826, his instrument was improved upon by a Bohemian instrument maker, Richter, consisting of ten holes and twenty reeds, with separate blow and draw reed plates mounted on either side of a cedar comb. Known as a "Mundharmonika, or mouth organ", this became the standard configuration in Europe. In 1857, German clock maker Matthias Hohner began to manufacture harmonicas. In 1862, Hohner introduced harmonicas to America and by 1887, his company was producing more than one million harmonicas annually, with 90 different models (Euxton n.d.). By 1902, harmonicas in the Sears Roebuck Catalogue (1986) were sold as cheaply as 7 cents, but more expensive harmonicas could be acquired, which ranged in price from 65 cents to $1.30.

Photo 129: Harmonica Reed



Other metal objects found include a small (9.6g) brass rivet discovered in Feature 6 (Photo 130:A). This may have been associated with a saddle. Five larger iron fragments (488.2g) were recovered from Test Trenches 10 and 12 (Photo 130:B-E). These may represent parts from a stove.

Test Trench 10 also produced a small (1.1g) piece of glass. The thinness of the glass suggests that it was probably from a lamp chimney.

Photo 130: (A) Rivet from Saddle (B-E) Stove Parts

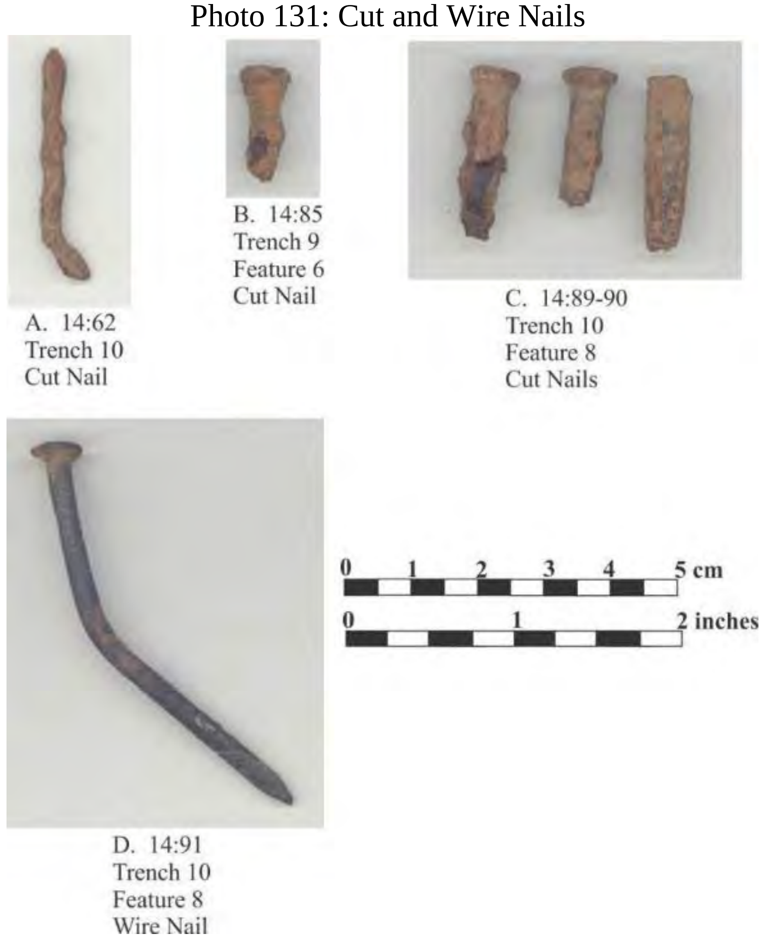
A. 14:84
Trench 9
Feature 6
Brass Tack Rivet

Other objects were related to building construction. These include a piece (3.1g) of slate, likely from a writing slate.

Five (8.7g) cut nail fragments were discovered in Features 6 and 8 (Photo 131: B-C), with one recovered in Test Trench 10 (Photo 131:A). A machine that produced cut nails was first introduced in the 1780s, which drastically reduced the amount of time and cost of making nails that before this time were forged. In 1830, the nail machine was improved by automatically flipping the metal after every cut, allowing for larger quantities of nails to be produced at less cost.

Also recovered from Feature 8 was one (4.5g) complete wire nail (Photo 131:D). Rounded or wire nails were first introduced into the American market from France in the 1850s, but they were not popular because their heads tended to break off and wire nails did not hold as effectively as cut nails. Wire nails finally took over the market by 1890 because in 1885-1886, the cut nail manufacturers were embroiled in an often violent labor strike, so wire nails were the only option available to consumers (Cooper 1985). Also during the 1880s, the wire nail manufacturers banded together into a cartel, agreeing to lower their prices and use a better grade steel that would not snap as easily (Edgerton 1897; Nelson 1965). Cut nails nearly dropped out of existence by the 1920s.

Photo 131: Cut and Wire Nails



Discussion of Historical Occupation

Artifacts associated with the historical occupation, similar to the prehistoric materials, were concentrated in the trenches on the lower margin of the ridge slope immediately northwest of the cemetery (Figure 42). Unlike the prehistoric occupation, remains of five historical features were identified that appear to be associated with at least one building. According to Lewis (1998), the Union Hill School was originally located near Sinking Creek, next to the Carpenter/Union Cemetery, on the land owned by Green Carpenter. Lewis even provided a photograph of the original school taken in 1916 (Figure 43), before it was moved to the ridge top within the Area 2N in the mid-1930s. The photograph shows that the school was placed on stone piers, similar to those found during the Phase II investigations.

Figure 42: Number of Historic Artifacts Recovered from Trenches

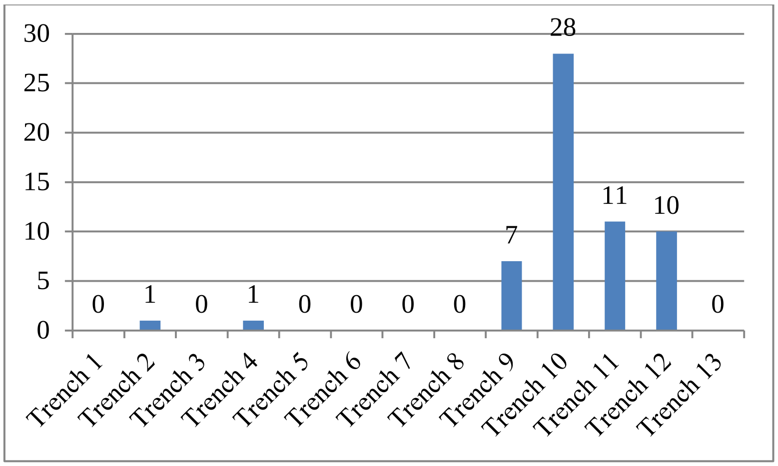
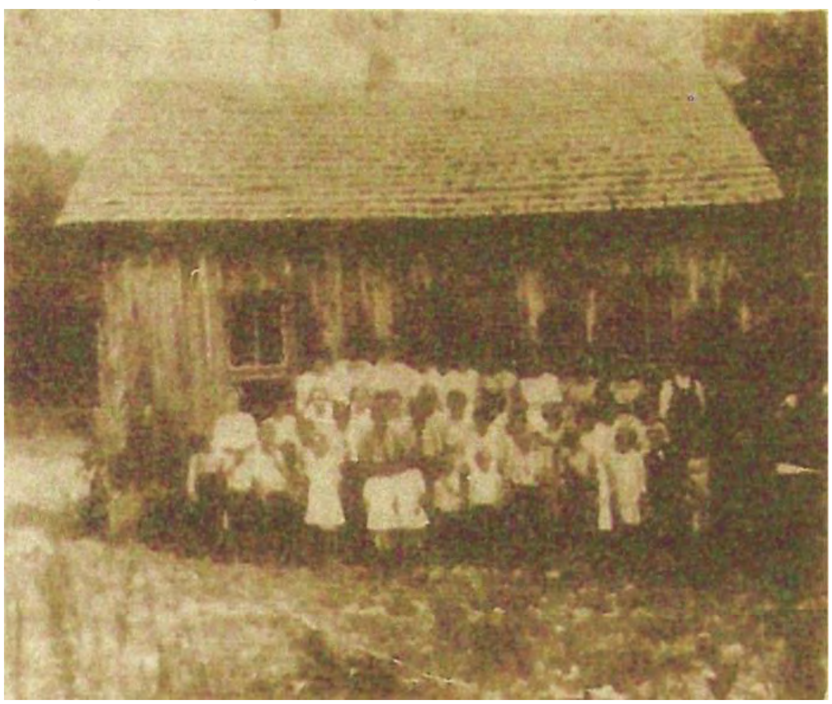


Figure 43: Original Union School (Lewis 1998)



The presence of 23 pieces of ironstone ceramics suggest that foods were consumed at this school. These include dinnerwares consisting of at least two plates, two bowls, one cup, and two saucers. One of the ironstone pieces represented a wash basin. With the exception of the cup found in Test Trench 4, all of these were discovered near the remains of the building. In addition, a glass lid from a mason jar with a lightning fastener, two stoneware food storage vessels suggesting that foods were brought to the school. Also recovered was a rim fragment from a stoneware bowl, possibly a mixing bowl. It is possible that food and plates or bowls were packed and carried to the school for lunch by the students or teachers. Also schools served as places for social gatherings and the dinnerwares could have been associated with foods served with these events. Supporting this use was the presence of wine and beer bottles.

Alternatively, it is possible that some of these items, especially the cups and saucers, were left by people picnicking near the cemetery. It was popular during the late 1800s to pack a meal and linger for a time near cemeteries. After 1830, the rural cemetery movement became popular. Cemeteries were constructed to reflect a bit of heaven on earth by being landscaped, having floral arrangements, planted trees, and meandering lanes. In urban areas, they represented one of the few green spaces in a highly polluted city environment and it was not uncommon for families to visit these places and use them similar to parks, bringing guests and eating meals at these locations (Linden-Ward 1989). Cemeteries further reflected the continued connections that the living had with the deceased, which was popular during the mid to late 19th century. Queen Victoria (for which this period is named) continued fidelity to her deceased husband, Albert, which resonated with people across England, Europe, and especially with Americans at that time. After the Civil War, many wives were left as widows and various outbreaks of contagious diseases meant that death touched most people’s lives. As a result, it became popular to show continued closeness to a person even after death, with the belief that they would be reunited in heaven. Mementos of the deceased were saved and photographs of the dead were displayed in homes reflecting this continued closeness. These ideas were especially popular in rural areas as reflected in the sentiments and decorations used at these more remote burial places, such as the cemetery associated with site 23SH1550. While urban cemeteries reflect family success as displayed by elaborate decorations on headstones or large obelisks, rural cemeteries typically reflect sentiments that the dead person is in a better place and reassurance that the family will one day be reunited. These rural cemeteries were not only visited by family members, but also served as natural gathering places to remember the dead as well as reinforce family, friendship, and community connections. It is possible, that some of the dinner settings recovered from site 23SH1550 were left after some of these gatherings or possibly by the celebration of a wake after a funeral at the cemetery.

The ironstones, one having a fine molded decoration, further indicated that this area was utilized after 1880. The number of cut nails and one wire nail also revealed that these remains dated after Carpenter acquired the property in 1880, possibly suggesting that the school and cemetery were established by him just prior to 1900.

Other artifacts included a complete harmonica that was likely lost or discarded by one of the students. However, it may have been lost during one of the social gatherings. A part of a graphite slate was discovered, that likely was used with a writing stylus used by the students.

One of the stoneware fragments recovered was from a drainage pipe. This pipe was likely used to direct rain water, collected by gutters, into a cistern that would exist near the school. This feature was not found during the Phase II investigations. It is likely that other features exist at this location including conical and medium deep pits similar to Feature 8 in Test Trench 10. It is unclear if this pit was used as a small storage facility or related to some other activity conducted near the school. Pits associated with the girls and boys privies also probably exist nearby. Since the features were likely used for only short durations, they could contain discrete artifacts reflecting changes that may have taken place over time until the school was moved to the ridge top in the 1930s.

RECOMMENDATIONS

A phase I survey was completed of Camp Zoe Project Area to assess the condition of any previously recorded cultural resources and to identify any new cultural resources within the project area. The significance of these cultural resources was determined to prevent the destruction of a portion of Missouri's cultural heritage. Resources are considered significant according to the criteria for nomination to the National Register of Historic Places (NRHP), which states:

> *The quality of significance in American history, architecture, archaeology, and culture is present in districts, sites, buildings, structures, and objects of state and local importance that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and;*
>
> *(a) That are associated with events that have made a significant contribution to the broad patterns of our history; or*
>
> *(b) That are associated with the lives of persons significant in our past; or*
>
> *(c) That embody distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or*
>
> *(d) That have yielded, or may be likely to yield, information important in history or prehistory.*

Additionally, properties eligible to the NRHP must be 50 years or older or qualify under Criterion Consideration G, properties less than 50 years old that are of exceptional importance (Federal Register 1974, 2005).

Original Survey Area Recommendations

The phase I survey of the original Camp Zoe Project Area located one new site, the Camp Zoe Youth Camp site (23SH1552). Prior work at the site by Missouri State Parks documented the Camp Zoe Youth Camp buildings before their demolition (Missouri State Parks 2013). During the current work, documentation of both the ruins, after the demolition took place, and of the buildings left standing was completed. No further documentation of the Camp Zoe buildings is recommended. In addition, the depleted nature of the soils in Areas B and C indicate that intact features would not remain. Phase I survey of Areas A and D located no new cultural resources.

Building 1, the Administration building, and Building 2, the stable, were constructed in 1929 for the operation of Camp Zoe. Building 1 is a vernacular building constructed of native Ozark stone and locally harvested timber with Craftsman attributes. It has been modified since its original construction, most notably with the enclosure of portions of the porch to make two additional rooms. Building 2 is a vertical wood siding building with a gambrel, corrugated metal roof and a pen with shed, corrugated metal roof. Changes have been made to the building, including the removal of a gabled roof building attached to its east gable side and the possible addition. Further, the building is in disrepair with portions of the siding rotting and parts of the roof on the addition coming off.

These two buildings have been significantly altered making them ineligible to the NRHP for Criterion C, architecture. However, in 2013, Missouri Preservation identified Camp Zoe as one of Missouri's Most Endangered Historic Places. Citing the camp's history and natural beauty, Missouri Preservation listed the 350 acre camp because "…it faces an uncertain future brought about by the federal seizure…It is hoped that listing Camp Zoe on Missouri's list of Most Endangered Places could bring wider attention to a place that could be lost to neglect but has the potential of once again function as a camping/lodging or retreat facility…" (Missouri Preservation 2013). Although the 350 acres have been purchased by Missouri State Parks, only Buildings 1 and 2 remain of the historical camp. For these reasons, Buildings 1 and 2, although not eligible nationally, are determined to be significant to the local history of the park. Construction should proceed as planned in the remainder of the Camp Zoe Youth Camp site.

Survey along the Sinking Creek bluffs (Location A) identified caves and several possible rock shelters. In order to avoid impact to potentially sensitive caves and shelters, it is recommended that no alterations of the bluff faces should take place within the project area. Three buildings and the remains of a possible root cellar were present at Location B. Building 4 has been documented by Missouri State Parks. The north wall and some of the interior walls are no longer intact therefore it no longer retains its integrity and would not be eligible for the NRHP. No further work is necessary on this building. Building 5 has had many alterations and is in severe disrepair and also, therefore, not eligible for NRHP consideration. Survey around this building and the ruins of the root cellar did not identify any artifacts associated with their time of use. Further work at these two locations is not likely to produce any further information. Building 6 is modern and contains no significant attributes that would make it eligible for the NRHP. For these reasons, it is recommended development plans in Area B should be allowed to proceed.

Phase I survey of the remainder of the original Camp Zoe Project Area located no significant cultural resources. Construction plans in Locations C-E should proceed as planned.

The phase II testing of site 23SH1550, outside the Carpenter Union Cemetery, identified subsurface features associated with one historic building and an associated pit feature. These remains are likely those of the first Union Hill School. Although no primary sources were found locally, the State Archives or State Historical Society to confirm the location for the school, the testing suggests these were the remains of the school. This was further indicated by the picture of the school showing stone pier construction like that uncovered at the site. Thus, this portion of the site is recommended eligible under Criterion D and should be investigated further or avoided by construction. The Carpenter-Union Hill Cemetery is protected under Missouri Statute 214.131-132 and should be avoided by construction activities. In addition, a ground penetrating radar (GPR) survey was completed by Missouri Department of Transportation, Historic Preservation section both inside and around the perimeter of the cemetery fence. The results found anomalies outside of the fenced area (Appendix C). It is, therefore, recommended that a 50 foot buffer around the cemetery be maintained to avoid the inadvertent discovery of possible unmarked burials outside the fenced area during construction. No other cultural remains were located and construction plans should proceed in the remainder of the site.

Area 1 Recommendations

Pits 1 and 2 appear to be a significant part of site 23SH1552 since they were filled with rubbish left during dining and other activities conducted by the miners. Further exploration of these remains could provide unique insights into activities conducted by the miners away from their homes at a temporary mining camp. In addition, excavation of the spoil piles could provide some traces of the mineral being mined at this location. Therefore, it is recommended that these two pits containing cultural remains could make at least this portion of site 23SH1552 eligible for inclusion into the National Register of Historic Places under Criterion D. These pits should either be avoided by future construction or they should be mitigated to recover this valuable cultural information.

The rock pile within site 23SH1552 most likely is associated with mining activities as well. However, there is a slight possibility that this pile was used to cover prehistoric graves, although most cairns are placed near the margins of ridge tops to make them visible. Since unmarked graves are protected by Missouri Statute RSMO 194.400-401 and the Native American Graves Protection and Repatriation Act of 1990. It is recommended that a 50 foot buffer be maintained around the rock pile and the entire area be avoided by future construction.

Area 2 Recommendations

Area 2 consisted of 4 tracts. Area 2N contained one standing building, the barn/garage of the most recent landowner. This building was documented by Missouri State Parks and is a modern building not eligible according to criterion G for the NRHP. The residence that once stood in the area was documented then razed. According to historic maps this was the location of the second Union Hill School. Local lore has suggested that the second Union Hill School was converted into the residence that was used by Tebeau, although no evidence of the school was identified during the survey. Any remains of the school was likely destroyed when the building was razed. In both Areas 2N and 2E possible mining pits were identified. No artifacts were discovered in these areas and it is possible the pits were formed as a result of natural tree falls. Area 2S only contained a small scatter of cans that were dumped on the surface, no other cultural resources were identified in this area. No significant cultural resources were located in Areas 2E or 2S and construction activities should proceed as planned.

Area 2W was the largest tract in this area and contained the continuation of the mining site 23SH1552. An additional 38 mining pits were documented, all within the boundaries of the site. A small surface dump area was discovered within the site, but its contents are not likely to provide any significant information. None of the mining pits contained any artifacts and all pits were documented during the survey so no further work is recommended for this area of the site. Just south of the mining site is an area known as Little Zoe. Soils in this area were severely disturbed and the rocky subsoil was present on the surface throughout. No significant cultural resources were found in this portion of the tract. In the southernmost part of Area 2W, the remains of a shed that first appeared on the 1945 topographic map was identified. Survey around the ruins produced no artifacts from its time of use. This ruin is not likely to produce any significant information. A second outbuilding appears in this area on the 1967 topographic map. No evidence of this building was found during the survey; however, this area contained several brush piles that could have hidden the remains. If present, these remains are not likely to produce any significant information as the building appears to have been later in origin, sometime between 1945 and 1967. As all mining pits within site 23SH1552 have been documented, much of the area consists of depleted soils and no other significant cultural resources were discovered, it is recommended that construction proceed as planned in Area 2W

Area 3 Recommendations

The cultural resource survey of Area 3 and the location of the home northwest of the existing Camp Zoe Project Area resulted in the identification of only one site, 23SH1553, and a find spot consisting of four rusted cans. Site 23SH1553 was a multi-component site. It was utilized at least on sporadic occasions during the Prehistoric Era as suggested by the presence of only three flakes. Other than the ridge slope on the western portion of Area 3, most of this area contained rocky soils at the surface or had been disturbed by construction machines during the removal of buildings at this location. Shovel tests conducted where the soils were more intact, and observation of bare patches on the ground on the western ridge slope, failed to locate any additional prehistoric artifacts. This could suggest that this area was only used for short durations it is unlikely that intact subsurface features exist at this location.

Site 23SH1553 also may have been used during the early 1900s for mining activities. No artifacts were discovered within the three pits, but it is possible that unauthorized digging did take place at this location as suggested by some of the dirt on the spoil pile north of Pit 1. It's possible that Pit 1 and possibly Pit 2 had artifacts left in them from the miners that attracted looters. It is unlikely that further excavation of these potential mining pits would produce new information.

This site also had evidence of historic buildings. These were constructed with stone pier foundations. Stone piers were typically used on buildings dating to the 19th and early 20th centuries, with concrete more common after that time, as evidenced by most of the buildings constructed at Camp Zoe. It's possible that these buildings were used by the miners working in this area. However, USGS quadrangles indicated the buildings were not this old, but constructed between 1964 and 1967. At that time, the buildings likely used as cabins associated with recreational use of this area. Given the isolated location of this site and the sporadic recreational use of these buildings, it is possible that only local stones were used for their construction, especially due to their small size (around 20 square meters, 215 square feet). Being less than 50 years old, these remains would not be considered eligible for the National Register.

For these reasons, 23SH1553 is not eligible for the NRHP and no further cultural resource investigations are needed.

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Appendix A:
Landowners in Project Area
Data Aquired from Deeds on File at Shannon County Courthouse, Eminance Missouri
(Deeds Database 1859-2013)

Land Sales in Township 30N Range 4W Within the Camp Zoe Project Area
(Deeds Database 1859-2013)

Grantee (Buyer)		Grantor (Seller)					
Last	***First***	***Last***	***First***	***Year***	***Amt Acres***	**Section**	***Portion***
Lambert	William	U.S. of America		1857	320	8	N1/2
Whedon	Harvey	Lambert	William	1859	320	8	N1/2
Boyce	Joseph N.	Spencer	Joshua	1860	320	5	S1/2 of section
Mc Cartney	Patrick	U.S. of America		1861	ns	8	SE1/4; N1/2,SW1/4; SE1/4,SW1/4
Rose	Samuel	Harvey	George	1869	120	8	W1/2,NW1/4; SE1/4,NW1/4
Rose	Samuel	Whedon	Edwin H.	1869	120	8	W1/2,NW1/4; SE1/4,NW1/4
Kincade	Joseph	Rose	Samuel	1870	120	8	W1/2,NW1/4; SE1/4,NW1/4;
Carpenter	*Green B.*	Marrow	James M.	1880	127	8	W1/2,NW1/4; SE1/4,NW1/4
Fox	James M.	Nettie	Fox	1900	160	8	SE1/4,
Mead		Carpenter	Rebecca L.	1902		8	Same sale as JW Lamborn to James Mead
Mead		Carpenter	William H.	1902		8	Same sale as JW Lamborn to James Mead
Mead		Carpenter	Thomas S.	1902		8	Same sale as JW Lamborn to James Mead
Mead		Carpenter	Martha A.	1902		8	Same sale as JW Lamborn to James Mead
Mead		Herren	Alice	1902		8	Same sale as JW Lamborn to James mead
Mead		Herron	J.J.	1902		8	Same sale as JW Lamborn to James mead
Mead	James	Lambom	J.W.	1902	ns	8	W1/2,NE1/4,NE1/4,NW1/4; 3A,NEc,SE1/4,NW1/4
Mead		Lamborn	*Elizabeth*	1902		8	Same sale as JW Lamborn to James mead
Piekenton	Robert	Fox	James M.	1902	160	8	SE1/4
Sherrells	Valentine	Mead	James	1902	133	8	W1/2,NE1/4,NE1/4,NW1/4; 3A,NEc,SE1/4,NW1/4
Parsons	Arthur	Piatt	S.P.	1904	440	16	SE1/4,E1/2;NW1/4,SW1/4;E1/2;SW1/4,NW1/4;SW1/4,NE1/4
Chilton	J. William	Dyer	Daniel B.	1905	320	5	S1/2 of section
Jackson	T.W.	Chilton	J. William	1905	320	5	S1/2 of section
Johnson	Harry M. and Paul E.	Current River Cattle Co.		1905	160	8	N1/2,SW1/4; SE1/4,SW1/4; part in Sec 9
Johnson	Harry M. and Paul E.	Orchard	James	1905	160	8	SE1/4
Altman	Mary L.	X		1906	320	15	S1/2 of section

Owners Highlighted in Yellow are Buried
in Carpenter-Union Hill Cemetery

Land Sales in Township 30N Range 4W Within the Camp Zoe Project Area
(Deeds Database 1859-2013)

Grantee (Buyer)		**Grantor (Seller)**					
Last	***First***	***Last***	***First***	***Year***	***Amt Acres***	**Section**	***Portion***
Current River Land and Cattle Co.		X		1907	320	25	N1/2 of section
Paulding	W.W.	Randall	C.L.U.	1907	ns	8	1/2interest,SE1/4; N1/2,SW1/4; SE1/4,SW1/4
Parker	D.L.	Davis	George P.	1908	160	8	SE1/4
Parker		Paulding	W.W.	1908			same sale as George Davis
Sherrells	Valentine	Shuck	ED. J.	1908	41	8	3/9interest,W1/2,NE1/4; NE1/4,NW1/4; 3A,NEc,SE1/4
Sherrill	Valentine	Morrow	Martha	1908	13.66	8	1/9interest,W1/2,NE1/4; NE1/4,NW1/4,NE1/4; 3A,NEc,SE1/4,NW1/4
Shuck	Ed J.	Groth	Henry	1908	ns	8	1/9interest,W1/2,NE1/4; NE1/4,NW1/4; 3A,Nec,SE1/4,NW1/4
Shuck	Ed. J.	Parrell	Mary A.	1908	123	8	W1/2,NE1/4; NE1/4,NW1/4; 3A,NEc,SE1/4,NW1/4
Shuck	Edward J.	Perrine	D.E.	1908	ns	8	W1/2,NE1/4,NE1/4,NW1/4; 3A,NEc,
Chilton	J. William	Dyer	Daniel B.	1909	320	5	S1/2 of section
Shuck	Ed. J.	Cobb	Geta	1909	123	8	1/9interest,W1/2,NE1/4; NE1/4,NW1/4; 3A,NEc,SE1/4,NW1/4
Conway	*C.V.*	Morrow	G.W.	1910	77	8	E1/2,NE1/2,NW1/4; 37A,SE1/4,NW1/4
Jackson	T.W.	Chilton	J. William	1910	320	5	S1/2 of section
Jackson	T.W.	Fuller	E.F.	1910	320	5	S1/2 of section
Goforth	C.H.	Moses	Jacob W.	1912	77	8	E1/2,W1/2,NW1/4; 37A,SE1/4,NW1/4
Beebe	Jacob W.	Parker	D.L.	1913	160	8	SE1/4
Breeden	A.D.	Goforth	C.H.	1913	7	8	NEc,NW1/4,NW1/4
Meade	J.A.	Goforth	C.H.	1913	70	8	E1/2,W1/2,NW1/4
Welch	L.B.	Jackson	T.W.	1913	320	5	S1/2 of section
Breeden	Dave	Sherrell	Valentine T.	1914	123	8	1/9interest,W1/2,Ne1/4; NE1/4,NW1/4; 3A,NEc,SE1/4,NW1/4
Buck	N.E.	Smith	C.T.	1914		5	S1/2 of section

Owners Highlighted in Yellow are Buried
in Carpenter-Union Hill Cemetery

Land Sales in Township 30N Range 4W Within the Camp Zoe Project Area
(Deeds Database 1859-2013)

Grantee (Buyer)		**Grantor (Seller)**					
Last	***First***	***Last***	***First***	***Year***	***Amt Acres***	**Section**	***Portion***
Mead	Neely	Paulding	W.W.	1914	60	8	NE1/4,SW1/4; E1/2,NW1/4,SW1/4
Peek	S.E.	Beebe	Jacob W.	1914	ns	8	SE1/4,
Prater	Martin D.	Meade	James	1914	70	8	E1/2,W1/2,NW1/4
Smith	C.T.	Welch	L.B	1914		5	S1/2 of section
Busby	Jeff	Mead	Neely	1915	ns	8	NE1/4,SW1/4; E1/2,NW1/4,SW1/4
Missouri Lumber and Mining Corp.		Heirs of Samuel Street	Samuel W.	1916		5	SE1/4,SW1/4
Missouri Lumber and Mining Corp.		Heirs of Samuel Street	Samuel W.	1916		7	SE1/4,NE1/4
Missouri Lumber and Mining Corp.		Heirs of Samuel Street	Samuel W.	1916		8	NE1/4,NW1/4;SW1/4,NW1/4
Brown	G.C.	Peek	Elsie L.	1917	160	8	SE1/4
Buck	Ivin	Buck	N.E.	1918	320	5	S1/2 of section
Buck	Florence M.	Buck	Ivin	1918	320	5	S1/2 of section
Williams	T.F.	Breeden	A.D.	1918	130	8	W1/2, NE1/4,NE1/4,NW1/4; 3A,NEc,SE1/4,NW1/4; pE1/2,NW1/4,NW1/4
Peek	S.E.	Brown	G.C.	1919	160	8	SE1/4
Dooley	*Thomas*	Piatt	S.P.	1920	40	8	SE1/4,SW1/4
Williams	E.B.	Williams	T.F.	1920	130	8	W1/2,NE1/4; NE1/4,NW1/4; 3A,NEc,SE1/4,NW1/4; E1/2,NW1/4,NW1/4
Hinecker	A.J.	Peek	S.E.	1921	160	8	SE1/4
Chrisio	A.A.	Bushy	J.D.	1922	60	8	NE1/4,SW1/4; E1/2,NW1/4,SW1/4

Owners Highlighted in Yellow are Buried
in Carpenter-Union Hill Cemetery

Land Sales in Township 30N Range 4W Within the Camp Zoe Project Area
(Deeds Database 1859-2013)

Grantee (Buyer)		Grantor (Seller)					
Last	***First***	***Last***	***First***	***Year***	***Amt Acres***	**Section**	***Portion***
Atchison	Claude	Busbey	John C.	1923	70	8	E1/2,NW1/4
Busby	John C.	Prater	Martin D.	1923	70	8	E1/2,W1/2,NW1/4
Copeland	J.W.	Davis	R.I.	1923	ns	8	1/4interest,SW1/4,SW1/4
Seaman	C.M.	Hineker	A.J.	1923	160	8	SE1/4
Seamon	C.M.	Chrisco	J.W. (wife Hazel	1923		8	NE1/4,SW1/4; E1/2,NW1/4,SW1/4
Williams	T.F.	Williams	E.B.	1923	130	8	W1/2,NE1/4; 3A,NEc,SE1/4,NW1/4; E1/2,NW1/4,NW1/4
Busby	John C.	Dulley	Jane	1924	40	8	SE1/4,SW1/4
Broadfoot	C.H.	Atchison	Claude	1925	3	8	Nec,SE1/4,NW1/4,
Broodfoot	C.H.	Mead	James	1925	123	8	W1/2,NE1/4,NE1/4,NW1/4; 3A,Nec,SE1/4,NW1/4
Broodfoot	E.H.	Williams	T.F.	1925	130	8	W1/2,NE1/4; NE1/4,NW1/4; 3A,NEc,SE1/4,NW1/4; E1/2,NW1/4,NW1/4
Current River Lumber Company		Missouri Lumber & Mining Company		1925		5,6,7,18,19 ,29,30,31	50 ft or railroad track through listed sections
Prater	M.U.	Piatt	heirs of S. P	1925	20	8	W1/2,NW1/4,SW1/4;
Seaman	C.M.	Busby	John C.	1925	ns	8	SE1/4,SW1/4
Seaman	C.M.	Dooley	Thomas	1925	40	8	SE1/4,SW1/4
Swiney	E.D.	Morrow	G.W.	1925	ns	8	W1/2,W1/2,NW1/4
Brickey	Ross	Seaman	C.M.	1927	160	8	SE1/4;
Copeland	J.W.	Summers	Alf	1927		8	3/4interest,SW1/4,SW1/4,SW1/4;
Copeland	J.W.	Summers	Alf	1927	30'x140'	8	30' wide,Sside,SW1/4,SW1/4

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Land Sales in Township 30N Range 4W Within the Camp Zoe Project Area
(Deeds Database 1859-2013)

Grantee (Buyer)		Grantor (Seller)					
Last	***First***	***Last***	***First***	***Year***	***Amt Acres***	**Section**	***Portion***
Prater	Henry	Atchison	Claude	1927	70	8	E1/2,W1/2, NW1/4
Summers	Alf	Copeland	J.W.	1927	ns	8	1/4interest; SE1/4,SW1/4,SW1/4; N1/2,SW1/4,SW1/4
Axon	E.R.	Copeland	J.W.	1929	2.5/3	8	NWc,SW1/4,SW1/4,SW1/4,165'E-W,630'N-S
Long	J.H.	Copeland	J.W.	1929	2.5/3	8	NWc,SW1/4,SW1/4,SW1/4,165'E-W,630'N-S
McMahan	R.S.	Seaman	C.M.	1929	100	8	E1/2,SW1/4; E1/2,NW1/4,SW1/4
Pioneeer Cooperage Co.		Buck	Florence	1929		5	S1/2 of section
Prewitt	J. Allen	Gibson	Thomas E.	1929	80	8	E1/2, NE1/4
Twyman	Carrie	Lapp	Caroline Twyman	1929	ns	8	E1/2,NE1/4
School District 16		Brickey	Ross	1930	2	8	NW1/4,E1/2,NW1/4,NW1/4. thence S150yds;E80yds;N150yds;W80yds
Shell Petroleum Corp.		Lewis	A.D.	1930		18	
Barnes	Gerry H.	Brickey	Ross	1931	68	8	E1/2,W1/2,NW1/4
Tyrsell	Frank L.	Broodfoot	C.H.	1932	130	8	W1/2,NE1/4; NE1/4,NW1/4; 3A,Nec,SE1/4,NE1/4;
Deatherage	Fred	Tyrrell	Frank L.	1933	130	8	W1/2,NE1/4; NE1/4,NW1/4; 3A,NEc,SE1/4,NW1/4; E1/2,NW1/4,NW1/4
McMahan	Margaret Boggs	Brown	W.R.	1934	30	8	N1/2,SW1/4,SW1/4; SE1/4,SW1/4,SW1/4
McElroy	Virgil J.	McElroy	Thomas J.	1935	ns	8	E1/2,NE1/4
Prater	Moses U.	Deatherage	Ferd	1935	130	8	W1/1,NE1/4,NE1/4,NW1/4; 3A,NEc,SW1/4,NW1/4; part of E1/2,NW1/4,NW1/4
Tyrrell	Frank L.	Prater	Moses U.	1935	130	8	W1/2,NE1/4; NE1/4,NW1/4; 3A,NEc,SE1/4,NW1/4

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Land Sales in Township 30N Range 4W Within the Camp Zoe Project Area
(Deeds Database 1859-2013)

Grantee (Buyer)		Grantor (Seller)					
Last	***First***	***Last***	***First***	***Year***	***Amt Acres***	**Section**	***Portion***
Gregg	S.E.	Prewett	Mary H.	1936	ns	8	E1/2,NE1/4
Prewitt	Mary H.	Gregg	S.E.	1936	ns	8	E1/2,NE1/4
Copeland	Everett M.	Copeland	John W.	1937		8	W1/2,E1/2,SW1/4,SW1/4,SW1/4
Robinson	D.L.	Prewett	Anna	1938	all timber	8	E1/2,NE1/4
McMahan	Russell S.	Thurshy	Janet	1942	100	8	N1/2,SW1/4,SW1/4; SE1/4,SW1/4,SW1/4; E1/2,SW1/4;E1/2,NW1/4,SW1/4
Thompson	Joe W.	Tyrrell	Frank L.	1942	130	8	W1/2,NE1/4; NE1/4,NW1/4; 3A,NEc,SE1/4,NW1/4; E1/2,NW1/4,NW1/4
Thurshy	Janet G.	McMahan	Margaret Boggs	1942	30	8	N1/2,SW1/4,SW1/4; SE1/4,SW1/4,SW1/4
Thurshy	Janet G.	McMahan	Margaret Boggs	1942	100	8	E1/2,SW1/4; E1/2,NW1/4,SW1/4
Carr	Walter	Corbett	J.J.	1943	2.5	8	1/4interest,SW1/4,SW1/4,SW1/4
Carr	Walter S.	Long	H.J.	1943		8	1/4interest,SW1/4,SW1/4,SW1/4
Hensley	B.W.	Carpenter	Green	1943	40	8	W1/2,W1/2,NW1/4
McMahan	Russell S.	Barnes	Gerry H.	1944	68	8	E1/2,W1/2, NW1/4
Brown	W.R.	Hensley	B.W.	1945	40	8	W1/2,NW1/4
Carr	Walter S.	Axon	Elmer R.	1945	ns	8	W1/4,SW1/4,SW1/4,SW1/4
Carr	Walter S.	Copeland	Eveertt M.	1948	ns	8	W1/2,E1/2,SW1/4,SW1/4,SW1/4
Bolin	Leonard	Wright	Anna P.	1949	80	8	E1/2,NE1/4;
Givens	Mrs. S.C.	Jarrell	Robin C.	1949	40	8	W1/2,W1/2,NW1/4
McMahan	R.S.	Thompson	Joe W.	1949	ns	8	W1/2,NE1/4; NE1/4,SE1/4,NW1/4; NEc,NW1/4
Buffington	M.F.	Bolin	Leonard	1952	ns	8	E1/2,NE1/4
Givens	Samuel C.	Woodard	Mabel	1952	40	8	W1/2,W1/2,NW1/4
Givens, Mrs. S.C.	Samuel C.	Jarrell	Robin C.	1952	40	8	W1/2,W1/2,NW1/4
Woodard	Mabel B.	Given	Samuel C.	1952	40	8	W1/2,W1/2,NW1/4;
Woods	Edward W.	Buffington	Marvin F. (Wife Ruby)	1954	ns	8	E1/2,NE1/4

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Land Sales in Township 30N Range 4W Within the Camp Zoe Project Area
(Deeds Database 1859-2013)

Grantee (Buyer)		**Grantor (Seller)**					
Last	***First***	***Last***	***First***	***Year***	***Amt Acres***	**Section**	***Portion***
McMahan	R.S.	School District 13		1956	2	8	NWc,E1/2,NW1/4,NW1/4
Hinkle	Iolyn J.	Carr	Walter S.	1958	ns	8	SW1/4,SW1/4,SW1/4
Camp Zoe, Inc.		McMahan	R.S. Jr.	1962	67	8	W1/2,W1/2NW1/4; W1/2,NW1/4,SW1/4
Camp Zoe, Inc.		McMahan	R.S.	1967	2	8	E1/2,NW1/4,NW1/4
Camp Zoe, Incorporated		McMahan	R.S.	1967	60	8	W1/2,NE1/4; E1/2,NW1/4; E1/2,W1/2,NW1/4; E1/2,SW1/4; E1/2,NW1/4,SW1/4; N1/2,SW1/4,SW1/4; SE1/4,SW1/4,SW1/4
McMahan	Russell S. Jr.	Camp Zoe, Inc.		1968	20	8	W1/2,W1/2,NE1/4
Ozark National Scenic Riverways		Hinkle	Iolyn	1975	10	8	SW1/4,SW1/4,SW1/4
McMahan	R.S. Jr.	McMahan	R.S.	1977	60	8	W1/2,W1/2,NW1/4; W1/2,NW1/4,SW1/4
Hinkle	Iolyn J.	Eminence Security Bank		1978		8	SW1/4,SW1/4,SW1/4
Land of Zoe, Inc.		1st National Bank		1989	ns	8	W1/2,NE1/4; E1/2,NW1/4; E1/2,W1/2,NW1/4; E1/2,SW1/4; E1/2,NW1/4,SW1/4; N1/2,SW1/4,SW1/4;SE1/4,SW1/4,SW1/4
Smith	Gary W.	McMahan	R.S. Jr.	1998	60	8	W1/2,W1/2,NW1/4; W1/2,NW1/4,SW1/4
Pioneer Forest, LLC.		Drey	Kay	2000		24	SW1/4;NW1/4,SE1/4;SE1/4,NE1/4
Pioneer Forest, LLC.		Drey	Kay	2000		23	E1/2,SW1/4;SE1/4
Pioneer Forest, LLC.		Drey	Kay	2000		1	E1/2,L6,NW1/4; L6,NE1/4
Pioneer Forest, LLC.		Drey	Kay	2000		30	NW1/4,NE1/4
Pioneer Forest, LLC.		Drey	Kay	2000		19	L1;L2,NW1/4;L1,SW1/4;SW1/4,SE1/4
Pioneer Forest, LLC.		Drey	Kay	2000		18	L1;L2,SW1/4;L1;L2,NW1/4

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Land Sales in Township 30N Range 4W Within the Camp Zoe Project Area
(Deeds Database 1859-2013)

Grantee (Buyer)		Grantor (Seller)					
Last	***First***	***Last***	***First***	***Year***	***Amt Acres***	**Section**	***Portion***
Pioneer Forest, LLC.		Drey	Kay	2000		7	L13;L14;L15,SW1/4
McDermott	Malcolm E.	Land of Zoe, Inc.		2001	ns	8	W1/2,NE1/4; E1/2,NW1/4; E1/2,W1/2,NW1/4; E1/2,SW1/4; E1/2,NW1/4,SW1/4; N1/2,SW1/4,SW1/4; SE1/4,SW1/4,SW1/4
McDermott	Malcolm E.	Tebeau	James	2004		8	W1/2,NE1/4; E1/2,NW1/4; E1/2,W1/2,NW1/4; E1/2,SW1/4; E1/2,NW1/4,SW1/4; N1/2,SW1/4,SW1/4; SE1/4,SW1/4,SW1/4
Pioneer Forest, LLC.		Drey	Kay	2004	535.42	7	E1/2;SW1/4;L1,NW1/4
Pioneer Forest, LLC.		Drey	Kay	2004	640	8	All of Section
Pioneer Forest, LLC.		Drey	Kay	2004	640	17	All of Section
Pioneer Forest, LLC.		Drey	Kay	2004	599.09	18	All of Section
Tebeau	James	Loan from Allegiant Bank for purchase of land		2004		8	W1/2,NE1/4; E1/2,NW1/4; E1/2,W1/2,NW1/4; E1/2,SW1/4; E1/2,NW1/4,SW1/4; N1/2,SW1/4,SW1/4; SE1/4,SW1/4,SW1/4
O'Neal	Stephen AKA McNair	1st National Bank		2007		8	W1/2,W1/2,NW1/4
O'Neal	Stephen	Smith	Gary W.	2007	ns	8	W1/2,W1/2,NW1/4
O'Neal	Stephen	Smith	Gary W.	2007	40	8	W1/2,W1/2,NW1/4
O'Neal AKA McNair	Stephen	1st National Bank		2007	ns	8	small portion of debt; W1/2,W1/2,NW1/4
Zoe Campitheater		Smith	Gary W.	2007	ns	8	W1/2,NW1/4,SW1/4;

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Land Sales in Township 30N Range 4W Within the Camp Zoe Project Area
(Deeds Database 1859-2013)

Grantee (Buyer)		Grantor (Seller)					
Last	***First***	***Last***	***First***	***Year***	***Amt Acres***	**Section**	***Portion***
Cullen	Robert Michael	Zoe Campitheater, LLC.		2008	ns	8	W1/2,NW1/4,SW1/4;
Millsap & Singer, P.C.		National City Real Estate Services		2009		8	W1/2,NE1/4; E1/2,NW1/4; E1/2,W1/2,NW1/4,SW1/4; N1/2,SW1/4,SW1/4; SE1/4,SW1/4,SW1/4
Tebeau	James	U.S. of America		2012	330	8	W1/2,NE1/4; E1/2,NW1/4; E1/2,W1/2,NW1/4; E1/2s,SW1/4; E1/2,NW1/4,SW1/4; N1/2,SW1/4,SW1/4; SE1/4,SW1/4,SW1/4
State of Missouri		U.S. of America		2013	330	8	W1/2,NE1/4; E1/2,NW1/4; E1/2,W1/2,NW1/4; E1/2s,SW1/4; E1/2,NW1/4,SW1/4; N1/2,SW1/4,SW1/4; SE1/4,SW1/4,SW1/4
Tebeau	James	McDermott	Malcolm E.	2013	ns	8	W1/2,NE1/4; E1/2,NW1/4; E1/2,W1/2,NW1/4; E1/2,SW1/4; E1/2,NW1/4,SW1/4; N1/2,SW1/4,SW1/4; SE1/4,SW1/4,SW1/4
Tebeau	James	McDermott	Malcolm E.	2013	330	8	W1/2,NE1/4; E1/2,NW1/4; E1/2,W1/2,NW1/4; E1/2s,SW1/4; E1/2,NW1/4,SW1/4; N1/2,SW1/4,SW1/4; SE1/4,SW1/4,SW1/4
Tebeau	James	PNC Bank, National City Bank		2013		8	W1/2,NE1/4; E1/2,NW1/4; E1/2,W1/2,NW1/4; E1/2,SW1/4; E1/2,NW1/4,SW1/4; N1/2,SW1/4,SW1/4; SE1/4,SW1/4,SW1/4
Pioneer Forest, LLC.		Drey	Leo A.	2004/2005	80	8	E1/2,NE1/4
McMahan	Russell S.	X		X		8	
Moses	Jacob	Conway	C.V.	X	77	8	E1/2,W1/2,NW1/4; 37A,SE1/4,NW1/4

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Appendix B: Carpenter-Union Hill Cemetery Interments

Table B1: Graves Located During Survey

Field #	Last Name	First Name	Date, Field	Information, Field	Information, Shannon County MOGenWeb 2008	Additional Information, Find A Grave n.d.
1	Unmarked Stone	-	-	-	-	-
2	Cooley		no dates	Dau. Of Joe & Lula Cooley		-
3	Unmarked Stone	-	-	-	-	-
4	Anderson	Glen	b. Feb. 25, 1928 d. Apr. 21, 1935	-	Glen Edward, Son of James R. Anderson and Ellen Conway	-
5	Conway	Eddie Dale	b. Jun. 7, 1939 d. Jul. 12, 1949	Pic of Lamb	Son of Thomas Vandoris "Tommie" Conway and Edith Street	-
6	Conway	Steve	1949-1949	"Steve Son of Cecil & June Conway"	Son of Cecil Hickman Conway and June Lay	Steve Cecil, b. Feb. 28, 1949 d. Feb. 28, 1949
7	Unmarked Stone	-	-	-	-	-
8	Unmarked Stone	-	-	-	-	-
9	Conway	Thomas H.	b. Jan. 16, 1881 d. Jan. 26, 1952	"Father"	Thomas Hickman; Son of Charles Vandoris Conway and Martha Herren: Married to Annabell Warren	-
10	Conway	Annabell	b. Dec. 13, 1881 d. Oct. 8, 1963	"Mother"	Married to Thomas H. Conway; Daughter of Thomas S and Hannah M. Warren born Dallas, TX	-
11	Warren	Peter	b. Jun. 13, 1870 d. Jul. 5, 1937	No markings on stone plaque on back	Son of Thomas S. Warren and Hannah M. Adams; Married Sarah Elizabeth "Lizzie" Herren 29 Sept 1985	Peter Long
12	Goforth	Euel H.	b. Aug. 21, 1921 d. Aug. 24, 1921	-	Euel H.	-
13	Warren	Thomas		"Co. F; 2 Ark. Inf." no dates on stone	Son of Stephen Warren and Sena Jane Holoman (Holliman)	b. Aug. 26, 1838 d. Aug. 16, 1917
14	Warren	Hannah	1842-1912	"Her Star Shines in Heaven"	Daughter of Spencer Adams and unknown Williams	b. Feb. 22, 1842 d. Jan. 9, 1919

Field #	Last Name	First Name	Date, Field	Information, Field	Information, Shannon County MOGenWeb 2008	Additional Information, Find A Grave n.d.
15	Lamborn	-	-	Very weathered difficult to read more than Elizabeth and Lamborn	Mother and baby buried together; Daughter of George "Green" Carpenter and Louisa Rebecca Unknown. Lamborn, Infant born and died 14 Feb. 1905	b. Oct. 12, 1869 d. Feb. 14, 1905; Died in Childbirth,
16	Waugh	Robert	June 8, 1900- Dec. 23, 1947	"Gone but not Forgotten"	Robert Lee "Bob", Son of James Waugh and Mary Jane Medley. Married to Frances	Robert Lee
17	Waugh	Francis	Feb 12, 1898- Feb 27, 1941	"Gone but not Forgotten"	Daughter of Thomas J. "Tom" Dooley and Jane Conway Sarah "Jane" Howell Conway; Married to Robert Waugh	Francis Dolly
18	Waugh	Thomas	June 9, 1921-Feb 1930	"Gone but not Forgotten"	Son of Robert Lee "Bob" Waugh and Frances Dooley	-
19	Unmarked Stone	-	-	-	-	-
20	Unmarked Stone	-	-	-	-	-
21	Busby	Cordell	b. Jun. 28, 1924 d. Sep. 7, 1940	-	Son of John R. Busby & Annie Dooley	-
22	Dooley	Jane	b. Jun. 10, 1869 d. Dec. 12, 1931	-	Sarah "Jane" Howell Conway; Daughter of Charles Vandoris Conway and Martha Herren; Married to Tom Dooley	-
23	Dooley	Tom	b. Aug. 11, 1860 d. Jan. 10, 1923	-	Married Sarah Brim Jane 4 Sept 1890; Married Jane Conway April 13, 1895: Also married Sylvia Belle Piatt and 2nd Nancy Thompson.	-
24	Unmarked Stone	-	-	-	-	-
25	Unmarked Stone	-	-	-	-	-

Field #	Last Name	First Name	Date, Field	Information, Field	Information, Shannon County MOGenWeb 2008	Additional Information, Find A Grave n.d.
26	Conway	Joseph Earl	b. 1911 d. 1912	"Son of Tom H. & Anna B. Conway	Son of Thomas Hickman Conway & Annabelle Warren	-
27	Conway	Chas	b. 1831 d. 1917	"Gone but not Forgotten"	Son of James Conway & Unknown, served in civil war; Married Martha Herren	Charles Vandoris. Taken prisoner of Union Army at Pea Ridge, AR.
28	Conway	Martha	b. 1835 d. 1911	"Gone but not Forgotten"	Daughter of Jackson Herren & Sarah Unknown; Married Charles Conway	-
29	Conway	James	b. 1859 d. 1916	-	May be the son of Joseph Conway and Mary Adams	-
30	Unmarked Stone	-	-	-	-	-
31	Carpenter	Green	b. 1832 d. 1902	2nd stone "Green Berry carpenter; Pvt Co A 2 Ark Cav Civil War; 1832-1898"	-	-
32	Unmarked Stone	-	-	-	-	-
33	Conway	Harley D.	b. Mar. 27, 1919 d. Aug. 31, 1922	"A Little bud of Love"	Son of Joseph Major Conway and Minnie Pearl Warren	-
34	Unmarked Stone	-	-	-	-	-
35	Displaced Stones	-	-	Grouping of stones one Marked with "HDC"		-
36	Conway	Ruth	b. Apr. 21, 1928 d. Apr. 26, 1933	"darling Dau of Jesse & Oma" Carved Angel	Daughter of Jesse Conway and Oma Allison	-
37	Counts	Willie	b. 1902 d. 1918	-	Typhoid fever; Son of John Counts & Mary Ann Conway	-
38	Unmarked Stone	-	-	-	-	-
39	Unmarked Stone	-	-	-	-	-

Table B1: Graves Located During Survey

Field #	Last Name	First Name	Date, Field	Information, Field	Information, Shannon County MOGenWeb 2008	Additional Information, Find A Grave n.d.
40	Piatt	Lizzie	b. Nov. 1, 1894 d. Aug. 29, 1945	-	Daughter of John Counts and Mary Conway; Married Samuel Franklin "Frank Piatt Aug. 13, 1911	-
41	Counts	John	1868-1940	-	John McDonald Counts married Mary Ann Conway June 17, 1892; Son of William Henry Counts and Sarah E. Conway	b. May 7, 1868 d. Dec. 8, 1940
42	Counts	Mary	b. 1868 d. 1936	-	Mary Ann Conway married John Counts; Daughter of Charles Vandoris Conway and Martha Herren	-
43	Pyatt	Daniel Ray	Mar. 19, 1960	"inf Son of Jonnie William and Bessie Mae Pyatt" carved angel	-	-
44	Pyatt	Ralph	b. Feb. 26, 1924 d. May 27, 1956	-	Son of James Wesley Pyatt and Anna " Annie Counts; died in Oregon in logging accident	-
45	Pyatt	Annie	b. Sep. 8, 1901 d. Aug. 31, 1940	"Mother"	Daughter of John Counts and Mary Ann Conway; Wife of James Wesley Pyatt	-
46	Pyatt	-	Aug. 6, 1940	"Inf. Son of J.W. & Annie Pyatt" Carved angel	-	-
47	Tucker	Harvey Gene	b. Jul. 6, 1934 d. Jun. 30, 1937	carved lamb	Son of John Tucker and Martha Conway	-
48	Pyatt	Shirley Mae	Feb. 28, 1942	"Inf. Dau. Of Johnnie William and Bessie Mae Pyatt"	-	-
49	Pyatt	Rickey John	Mar. 4, 1941	"Inf. Son of Johnnie William and Bessie Mae Pyatt"	-	-
50	Unmarked Stone	-	-	-	-	-

Table B1: Graves Located During Survey

Field #	Last Name	First Name	Date, Field	Information, Field	Information, Shannon County MOGenWeb 2008	Additional Information, Find A Grave n.d.
51	Conway	Harvey Floyd	b. Sep. 28, 1943 d. Sep. 28, 1943	Stone broken "Infant son of Mr. and Mrs. John D. Conway at rest"	Son of John D. Conway and Freda Irene Mahan	-
52	Unmarked Stone	-	-	-	-	-
53	Conway	Richard	Aug. 8, 1950	"Infant son of Jesse & Oma Conway" carved baby shoes and flower	Son of Jesse Conway and Oma Allison	-
54	Sullivan	Allen Ray	Nov 17, 1944-Dec 2, 1944	"ANK & NOR" is carved in cement base	Son of Allen Sullivan and Jessie M. Tucker	Allan Ray Sullivan, Jr.

Table B2: Interments Listed on Websites Not Found In The Field

Last Name	First Name	Dates	Comments	Citation
Busby	Jefferson Davis	Aug. 2, 1861-Feb. 5, 1936		Find A Grave (n.d.)
Marr	George	Unknown	Civil War Veteran	Find A Grave (n.d.)
Thompson	Ethel	Unknown-1916	Wife of Jess	Find A Grave (n.d.)
Thompson	Thomas	Unknown-1916	Son of Jess and Ethel	Find A Grave (n.d.)
Anderson	Clara Ellen	Jan 4, 1932-Feb 15, 1936	Daughter of James R. Anderson & Ellen Conway	Shannon County MOGenWeb (2008)
Carpenter	Alta E Thompson	b. Jun. 16, 1912 d. May 20, 1941	Daughter of Jess Thompson & Ethel Dooley. Wife of Vines Carpenter	Shannon County MOGenWeb (2008); Find A Grave (n.d.)
Counts	Edmond	b. 1904 d. 1904	Twin of Redmond; unmarked grave; son of John McDonald and Mary Ann Conway Counts; Marked with field stone	Shannon County MOGenWeb (2008); Find A Grave (n.d.)
Counts	Redmond	b. 1904 d. 1904	Twin of Edmond; unmarked grave; son of John McDonald and Mary Ann Conway Counts; Marked with field stone	Shannon County MOGenWeb (2008); Find A Grave (n.d.)
Dooley	Ethel	Unknown		Shannon County MOGenWeb (2008)
Hickman	Baby Pandies	Unknown		Shannon County MOGenWeb (2008)
Thompson	Carrie Arizona Price	b. Aug. 20, 1888 d. Apr. 5, 1947	Daughter of John Price and Lizzie Watson. Born I Reynolds Co. MO. Married to John Daniel	Shannon County MOGenWeb (2008); Find A Grave (n.d.)
Thompson	John Daniel	b. Aug. 8, 1876 d. Jul. 26, 1959	Son of Hiram Wade Thompson and Nancy Emaline Medley. Daniel and Carrie's Children: Henry Harrison, Otis, Irvin, Freda, Neva, Joseph, Unice,. Daniel married 2nd Lillie May Weber Piatt	Shannon County MOGenWeb (2008)
Summers	Harvey	Unknown		Shannon County MOGenWeb (2008)
Morrow	Willie	Unknown		Shannon County MOGenWeb (2008)
Unknown Infant Boy	-	May 19, 1960		Shannon County MOGenWeb (2008)
Unknown Infant Boy	-	Unknown		Shannon County MOGenWeb (2008)
Warren	Sylvia Nadine	March 8, 1928-March 9, 1928		Shannon County MOGenWeb (2008)
Waugh	George	May 9, 1894-Feb 15, 1935		Find A Grave (n.d.)

Appendix C: Results of the Ground Penetrating Survey
at the Carpenter-Union Hill Cemetery

Camp Zoe GPR Project at Union Hill/Carpenter Cemetery

On April 15th and 16th, 2014, MoDOT archaeologists conducted a Ground Penetrating Radar (GPR) survey of the Carpenter / Union Hill Cemetery in rural Shannon County along Sinking Creek. This cemetery is located on property that was purchased by the Missouri Department of Natural Resources, State Parks Division. The property is called Camp Zoe. It served as a girls' summer camp and more recently as a concert venue and campground. Missouri State Parks (MSP) purchased the property with the intent to develop it as a State Park near the Ozark National Scenic Riverways. MSP archaeologist, Jane Lee, contacted MoDOT and requested the GPR survey in hopes of determining if graves were located outside the cemetery boundaries and also, if possible, how many graves were inside the boundaries that were lacking documentation. This information could help guide the construction outside the cemetery and possibly reduce the "no construction" buffer around the cemetery.

The GSSI Terra SIRch SIR 3000 hardware along with data acquisition system RADAN was used to collect and process the data. The 400 MHz (Model 5103) antenna was chosen for this project. This antenna was used to penetrate to a depth of 2 meters, which is an adequate depth to identify burial shafts, caskets, or other evidence of graves.

The GPR was pushed across the site area utilizing the 3D Grid Mode function of the equipment. The grids were set up using measuring tapes and nails to define the corners. Additionally, the individual transect lines were marked with tape and lined up by a straight line. The size of the area that required investigation forced the use of multiple grids to make the collection and processing easier. A total of five grids were placed outside the cemetery and three grids inside the cemetery. Three grids were set up north of the northern cemetery boundary, with all three grids measuring 10 meters (North-South) by 20 meters (East-West). An additional 10 meter by 10 meter grid was placed at the East and West ends of the cemetery. All of the grids were scanned from North to South on an East-West axis. Small roots, stumps, and rocks did cause the equipment to lose surface contact occasionally.

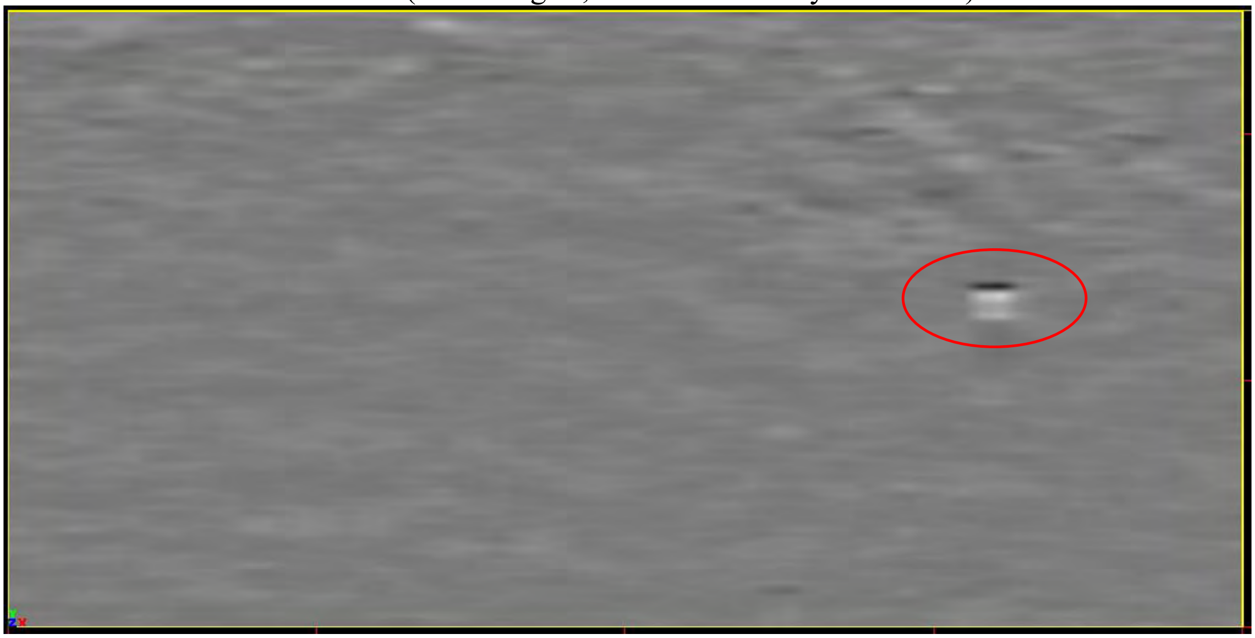
After collection of the data was completed, the data was downloaded and further processed with the RADAN software to search for anomalies; in this case, those consistent with burials. The current software only allows an image to be saved by using the Print Screen option, so the images experience a loss of resolution. Processed portions of data slices were saved as .jpegs.

The area that was surveyed had been recently cleared with saws and a brush hog. All vegetation was removed and the grass was mowed to a consistently short level. As mentioned before, small stumps and other anomalies caused the antenna to bounce along the ground surface at times, therefore, slightly skewing some results. There were also other obstacles that could not be avoided. For example, inside the cemetery, headstones, trees, and deep ditches were unavoidable. The antenna was pushed around as many obstructions as possible, again, slightly skewing results. The soil in the surveyed area consists of silt loam topsoil over cherty clay loam subsoil. Clayey soils limit the effectiveness of the GPR. Some GPR transects had to cut off early because of obstacles or steep inclines.

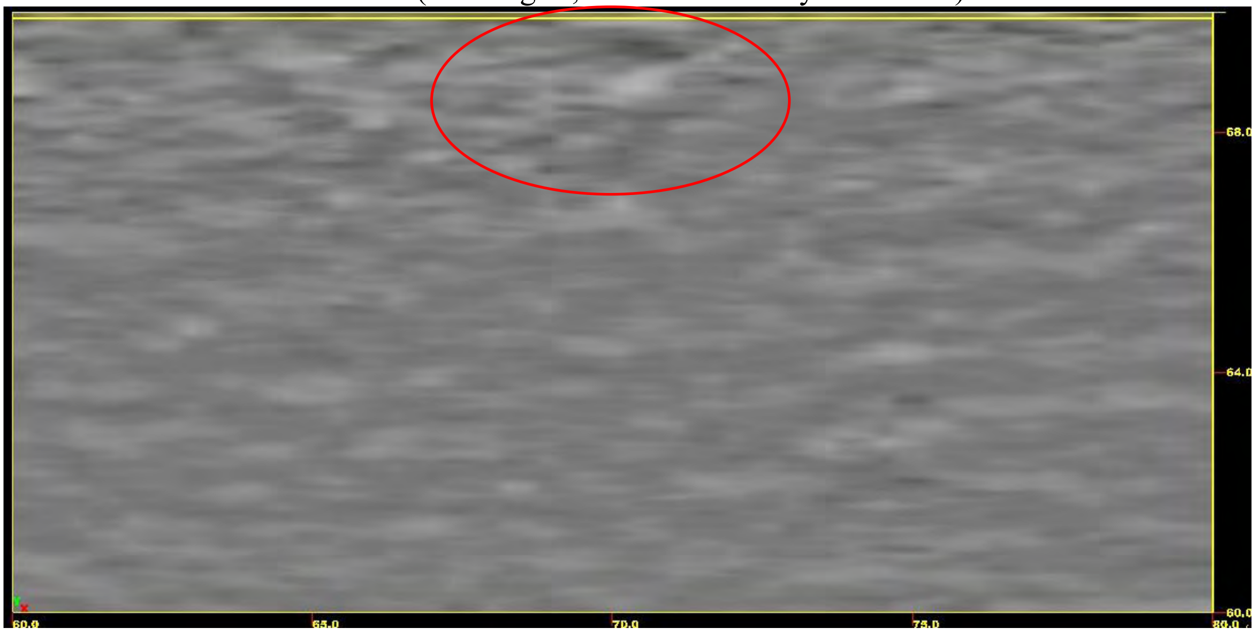
The GPR survey identified several anomalies inside the cemetery, with several labeled on the attached slices. Most of these anomalies are likely to be burials; however, no subsurface excavation was completed to provide evidence of what the anomalies were. Therefore, there is no definitive answer about the anomalies. The anomalies should be viewed cautiously as they could be burials or other subsurface features. Multiple slices were saved from each grid to highlight anomalies in the soil. There were also several anomalies outside the cemetery. Several of the anomalies are labeled on the attached pages, outlined in red. The grids to the north of the cemetery had very few anomalies. This was expected as graves outside a cemetery are usually not located at the front of the cemetery. They are usually on the sides or the back of the cemetery. The grid to the east of the cemetery had three anomalies with the one nearest the cemetery possibly appearing to have burial size and shape. The grid to the west of the cemetery also had two burial size and shape anomalies near the cemetery. The attached documentation grids were drawn based on observations from the GPR information.

Upon review of the information gathered with the GPR, it appears the results were mixed. Some of the burials from inside the cemetery appear to be easily identifiable; others were not seen at all. Additionally, some anomalies appear in the data that may not correlate to known burials inside the cemetery. Outside the cemetery, anomalies were seen, but no excavation was conducted to verify the validity of the anomalies. In areas where no anomalies were identified, it is still possible for burials or other subsurface features to exist. Based on the anomalies identified in the GPR data outside the cemetery fence, it is the recommendation of the GPR user that a reasonable buffer be placed around the cemetery to protect the cemetery and the possibility of burials outside the fences.

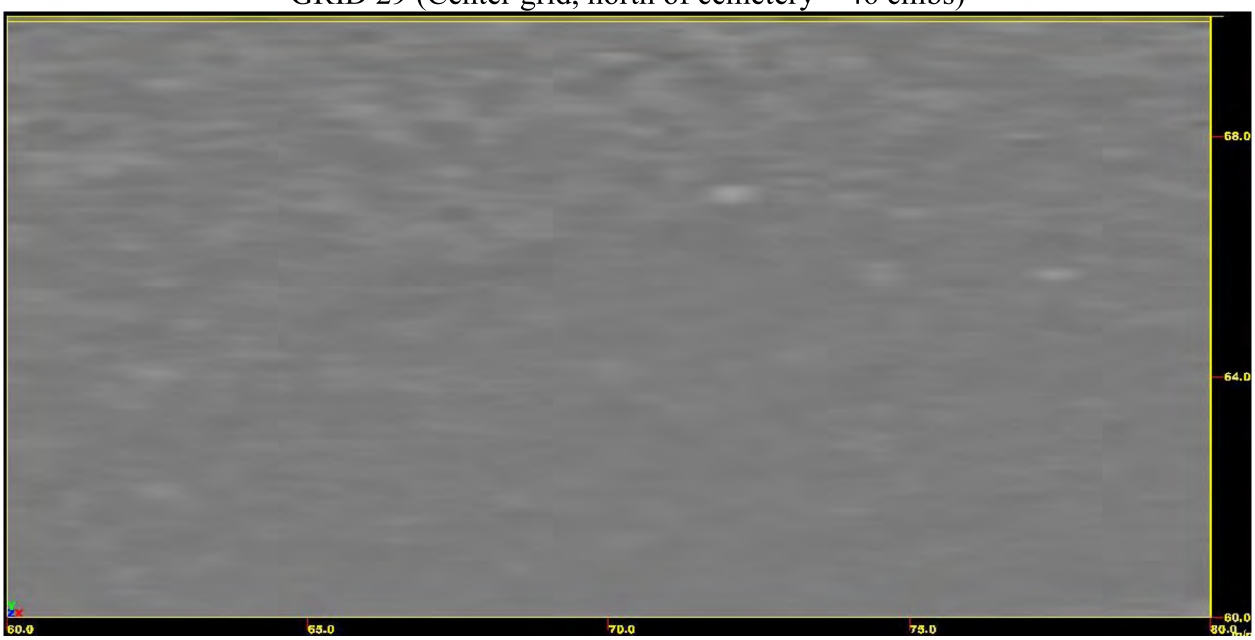
GRID 28 (Western grid, north of cemetery – 73 cmbs)



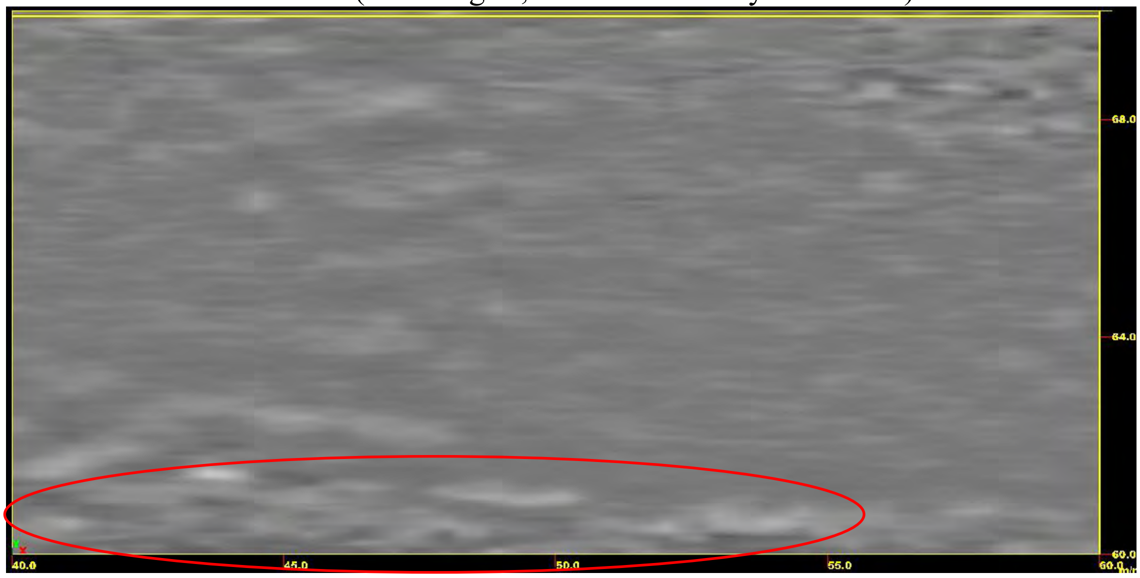
GRID 29 (Center grid, north of cemetery – 20 cmbs)



GRID 29 (Center grid, north of cemetery – 46 cmbs)

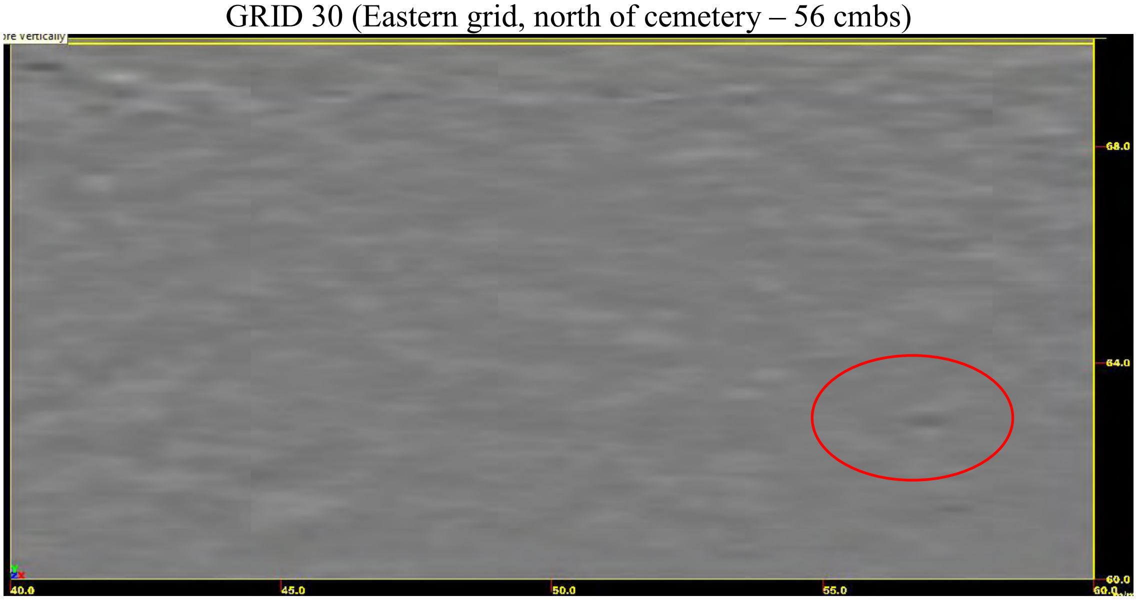


GRID 30 (Eastern grid, north of cemetery – 22 cmbs)

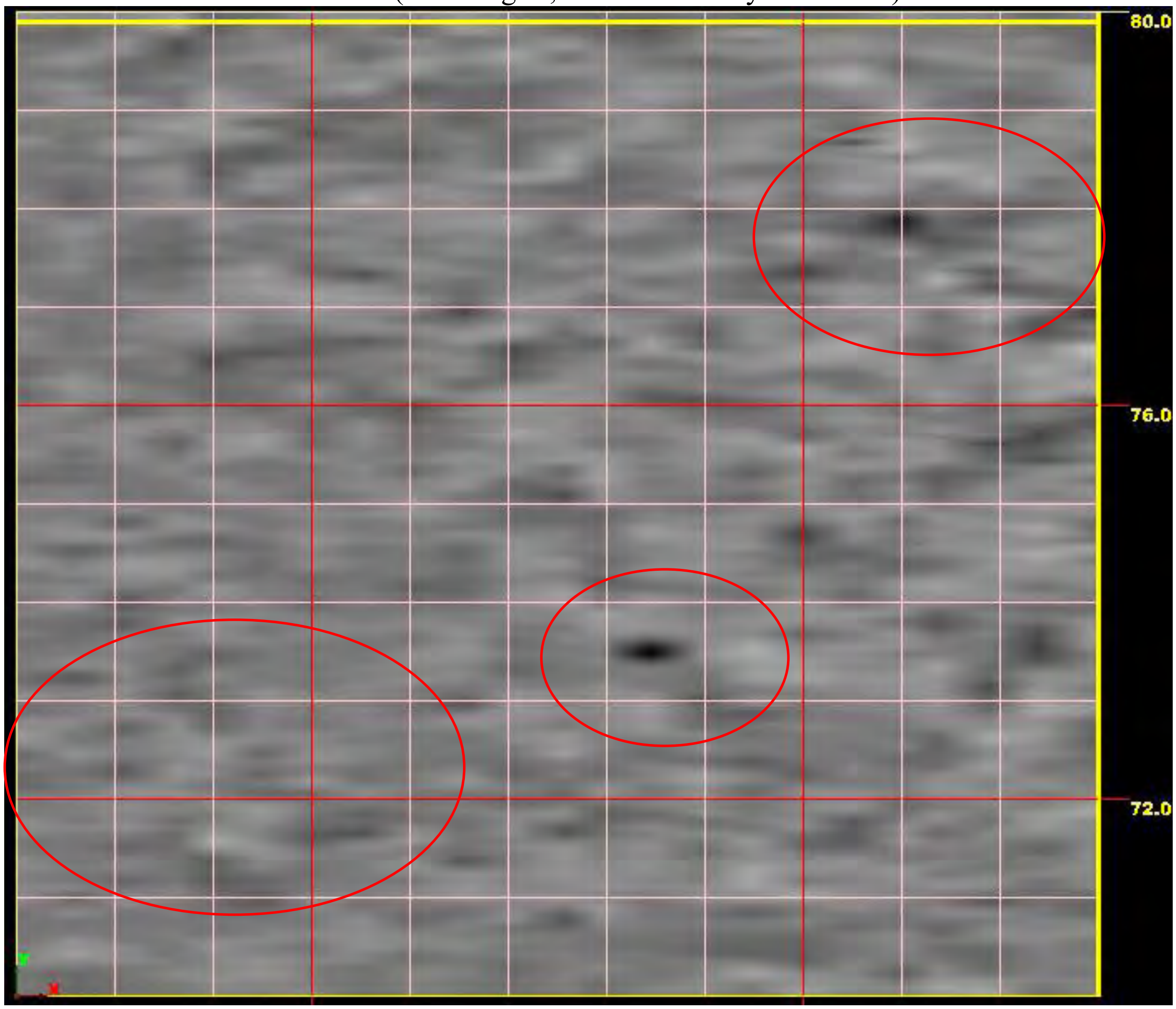


GRID 30 (Eastern grid, north of cemetery – 27 cmbs)

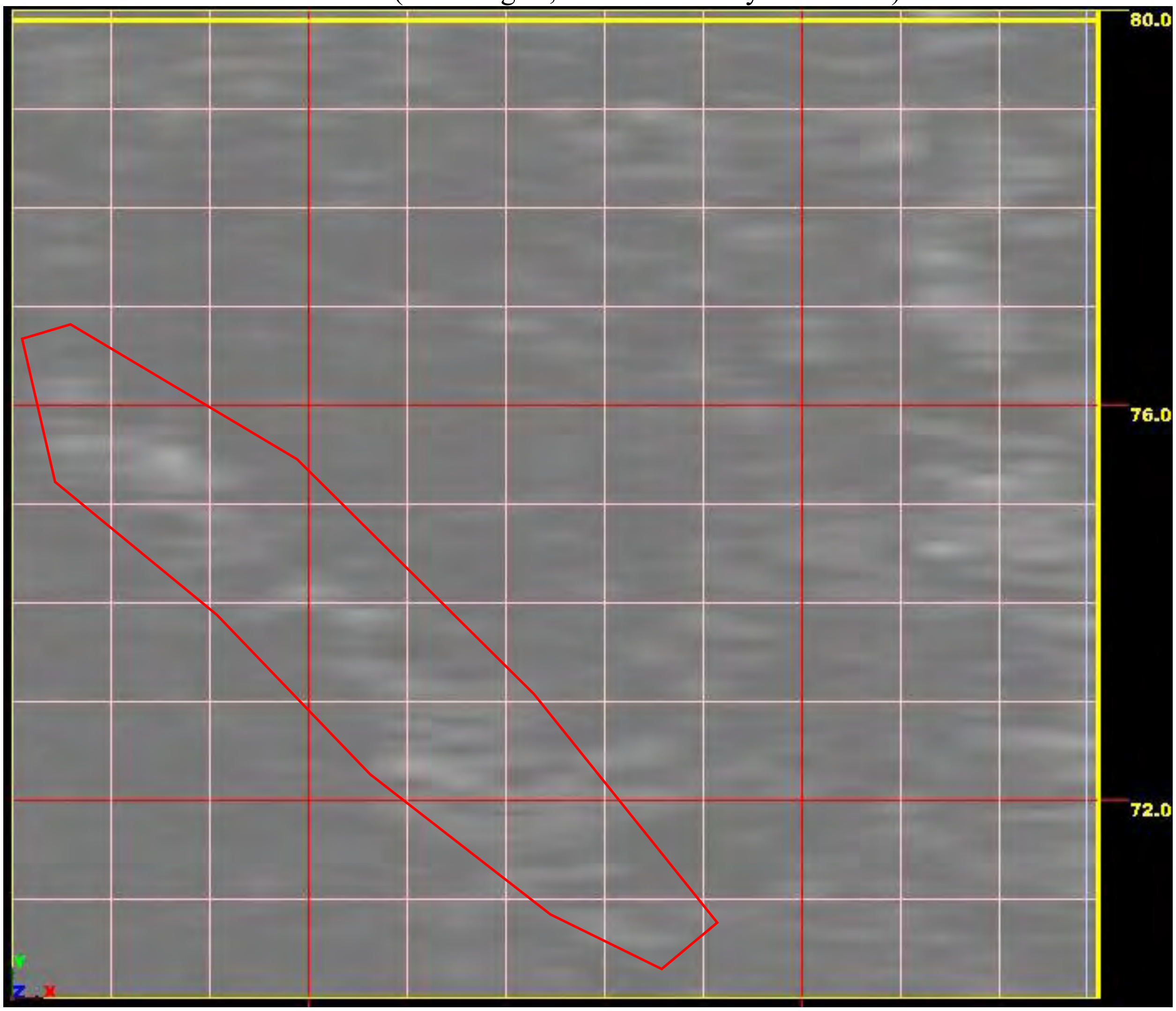
GRID 30 (Eastern grid, north of cemetery – 56 cmbs)



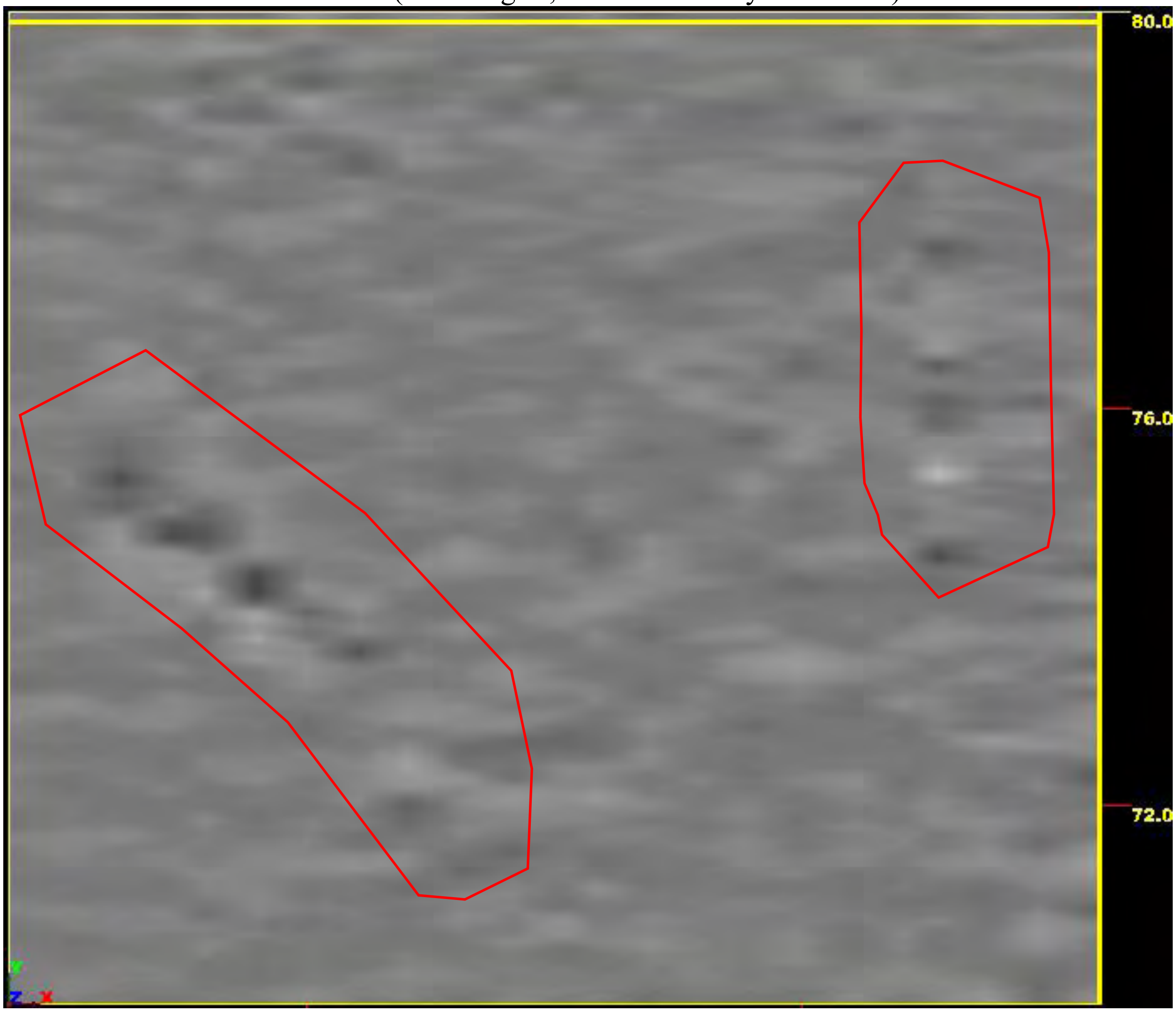
GRID 31 (Eastern grid, east of cemetery – 24 cmbs)



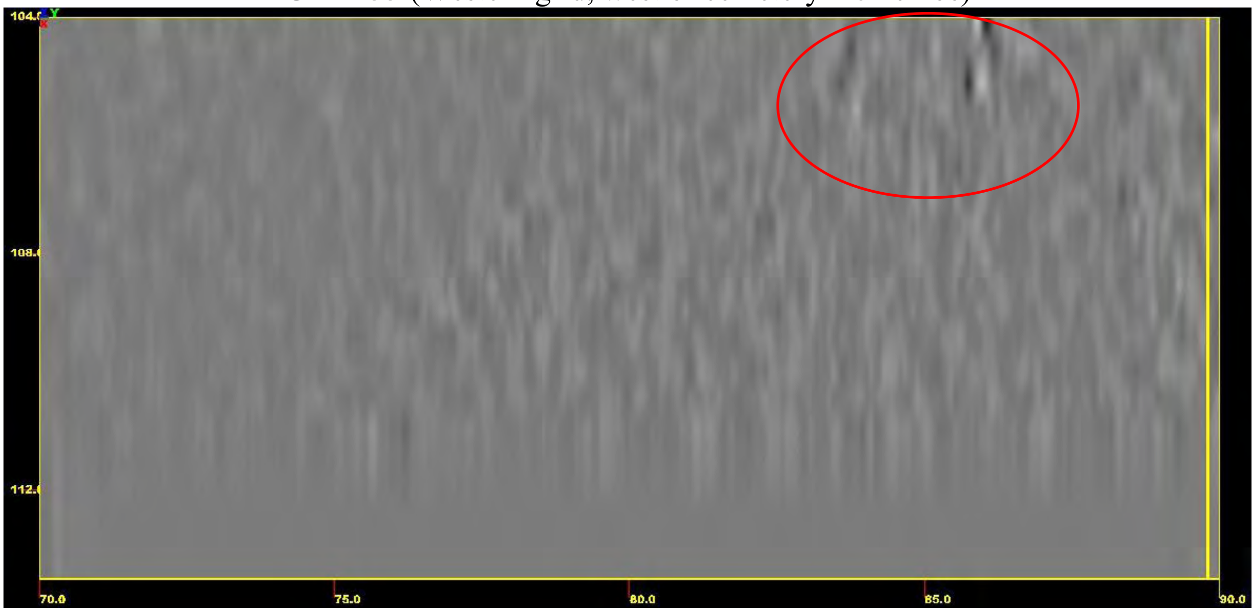
GRID 31 (Eastern grid, east of cemetery – 38 cmbs)



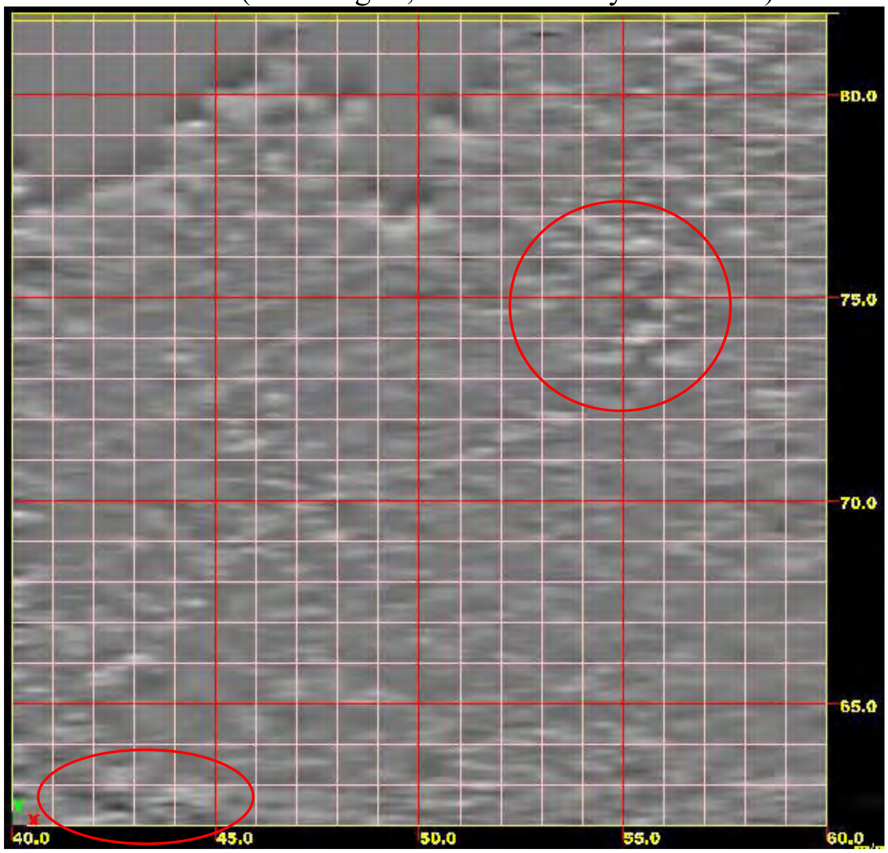
GRID 31 (Eastern grid, east of cemetery – 90 cmbs)



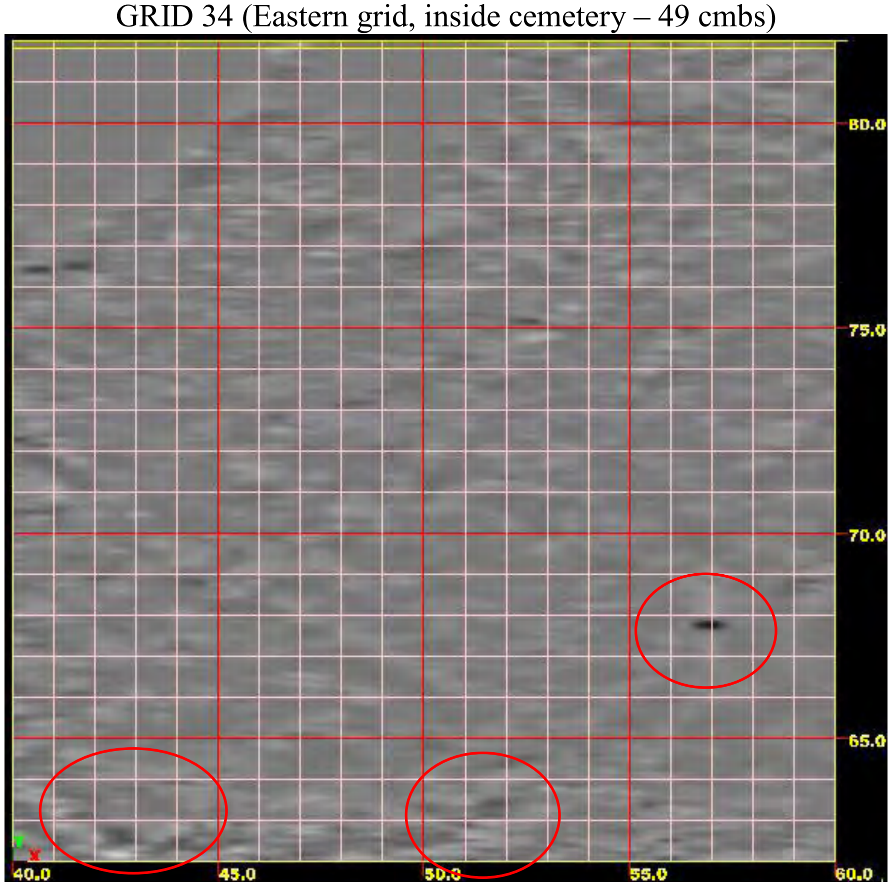
GRID 33 (Western grid, west of cemetery – 84 cmbs)



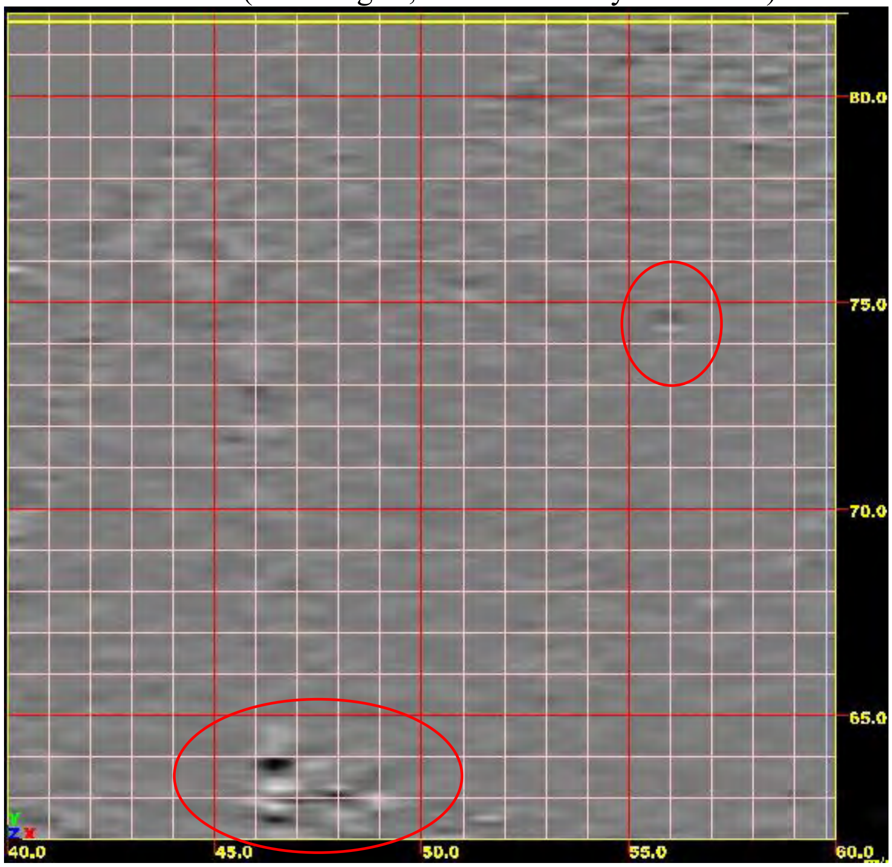
GRID 34 (Eastern grid, inside cemetery – 36 cmbs)



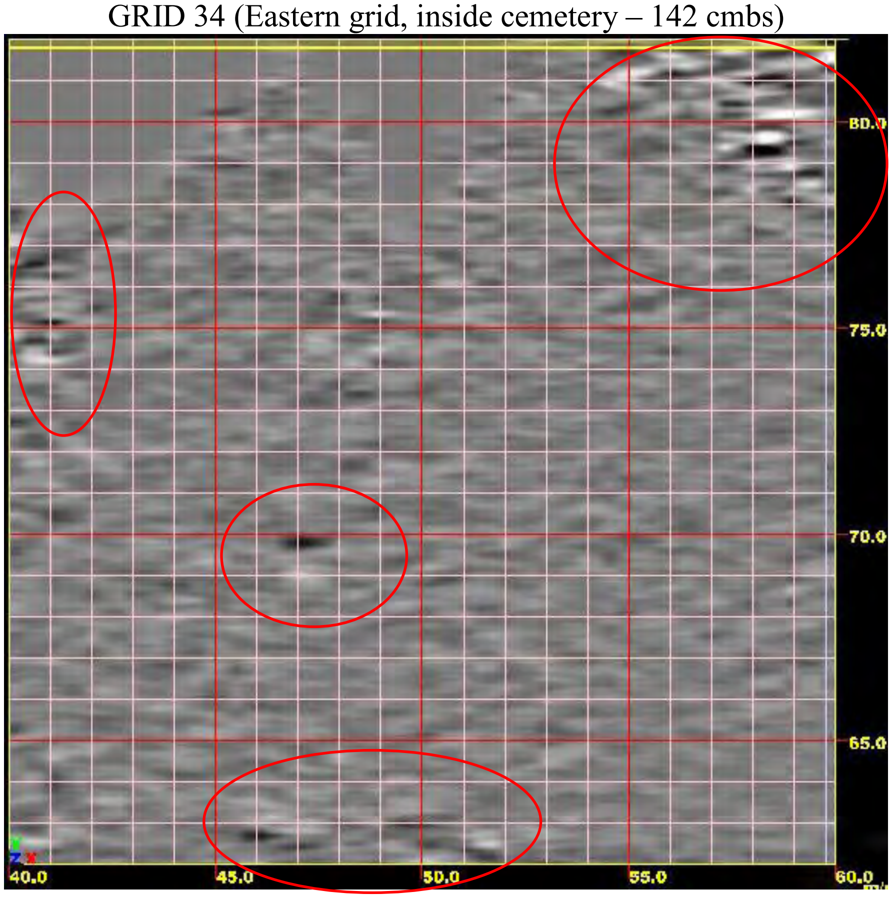
GRID 34 (Eastern grid, inside cemetery – 49 cmbs)



GRID 34 (Eastern grid, inside cemetery – 98 cmbs)

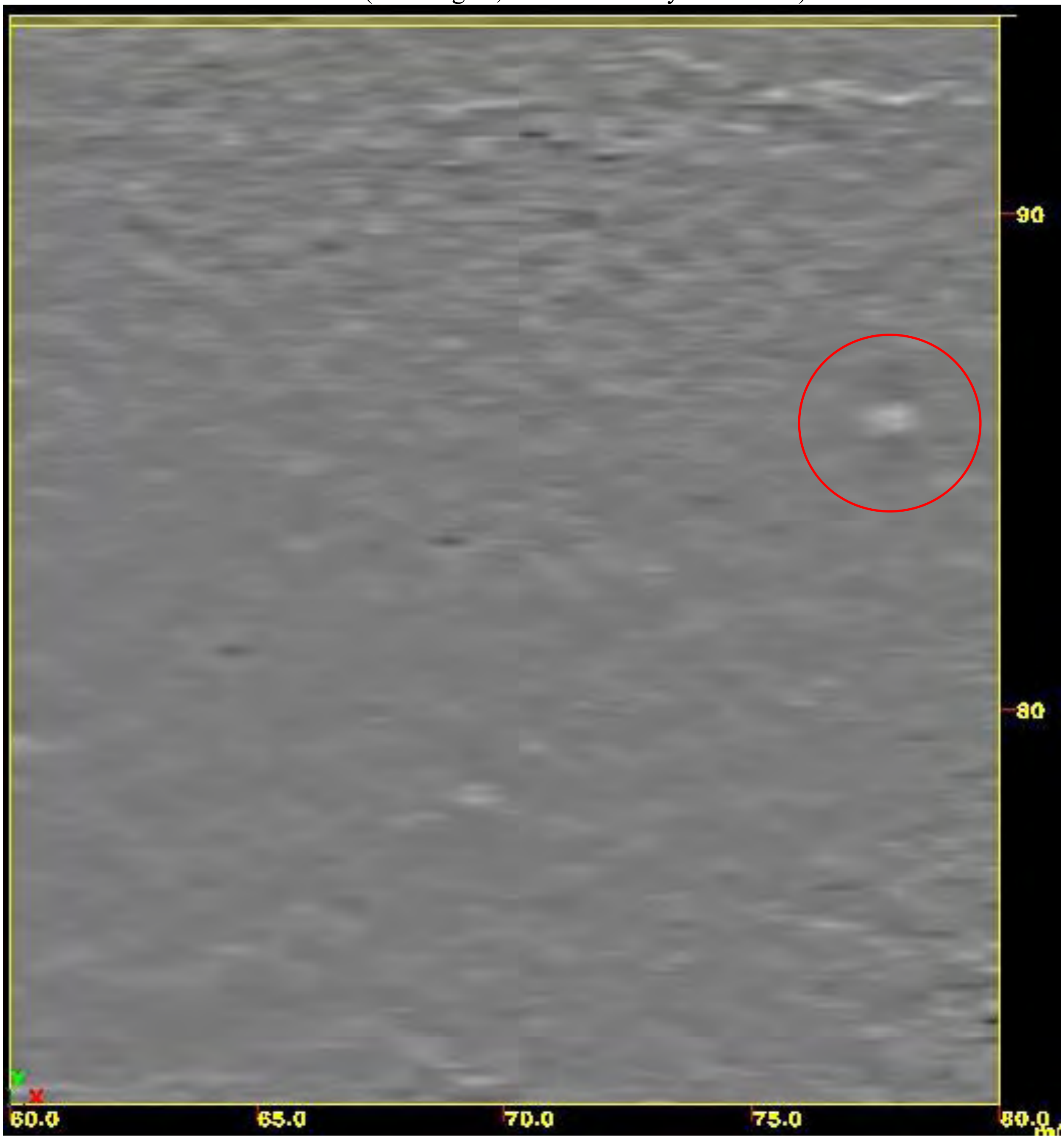


GRID 34 (Eastern grid, inside cemetery – 142 cmbs)



GRID 35 (Center grid, inside cemetery – 26 cmbs)

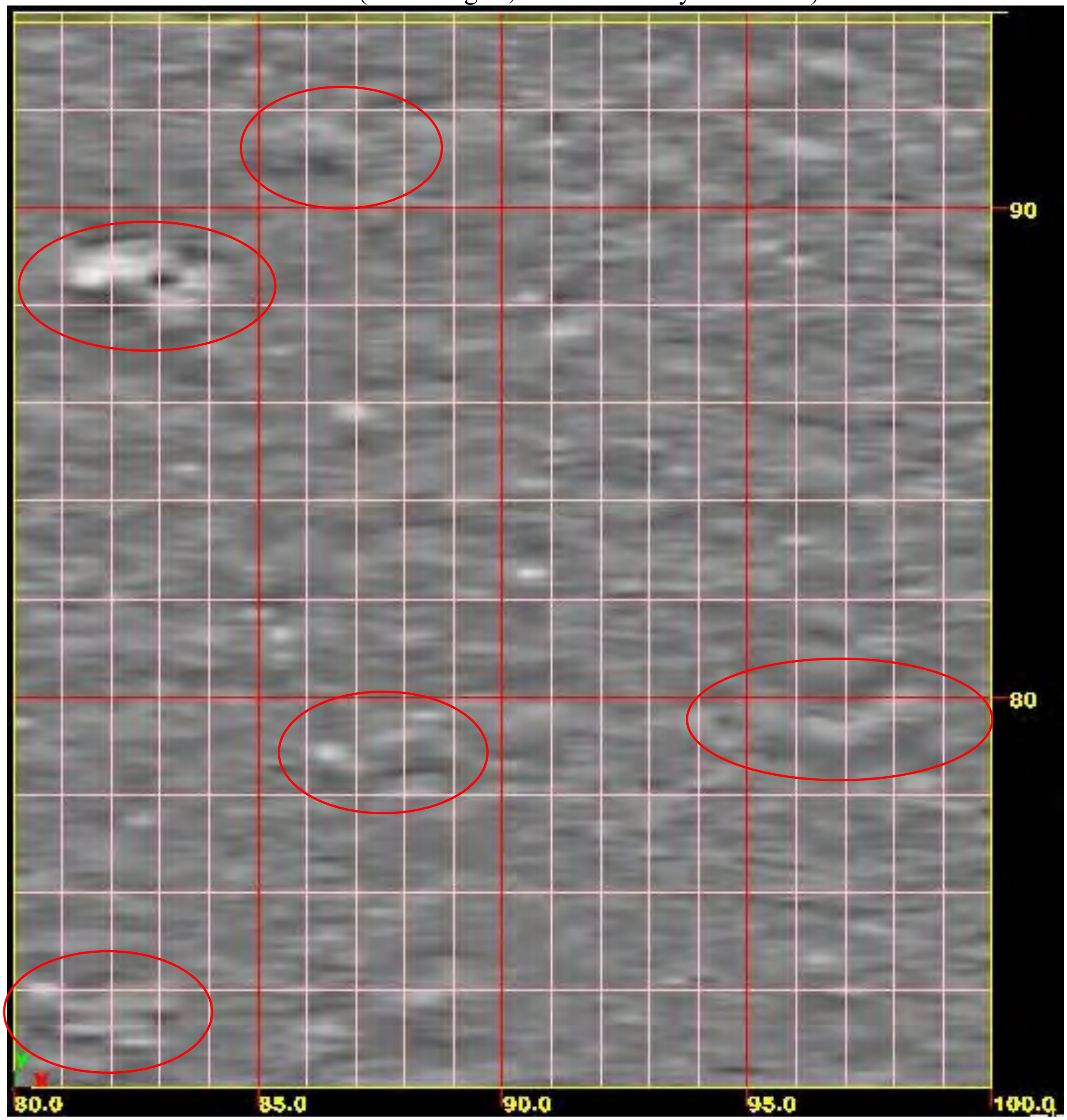
GRID 35 (Center grid, inside cemetery – 53 cmbs)



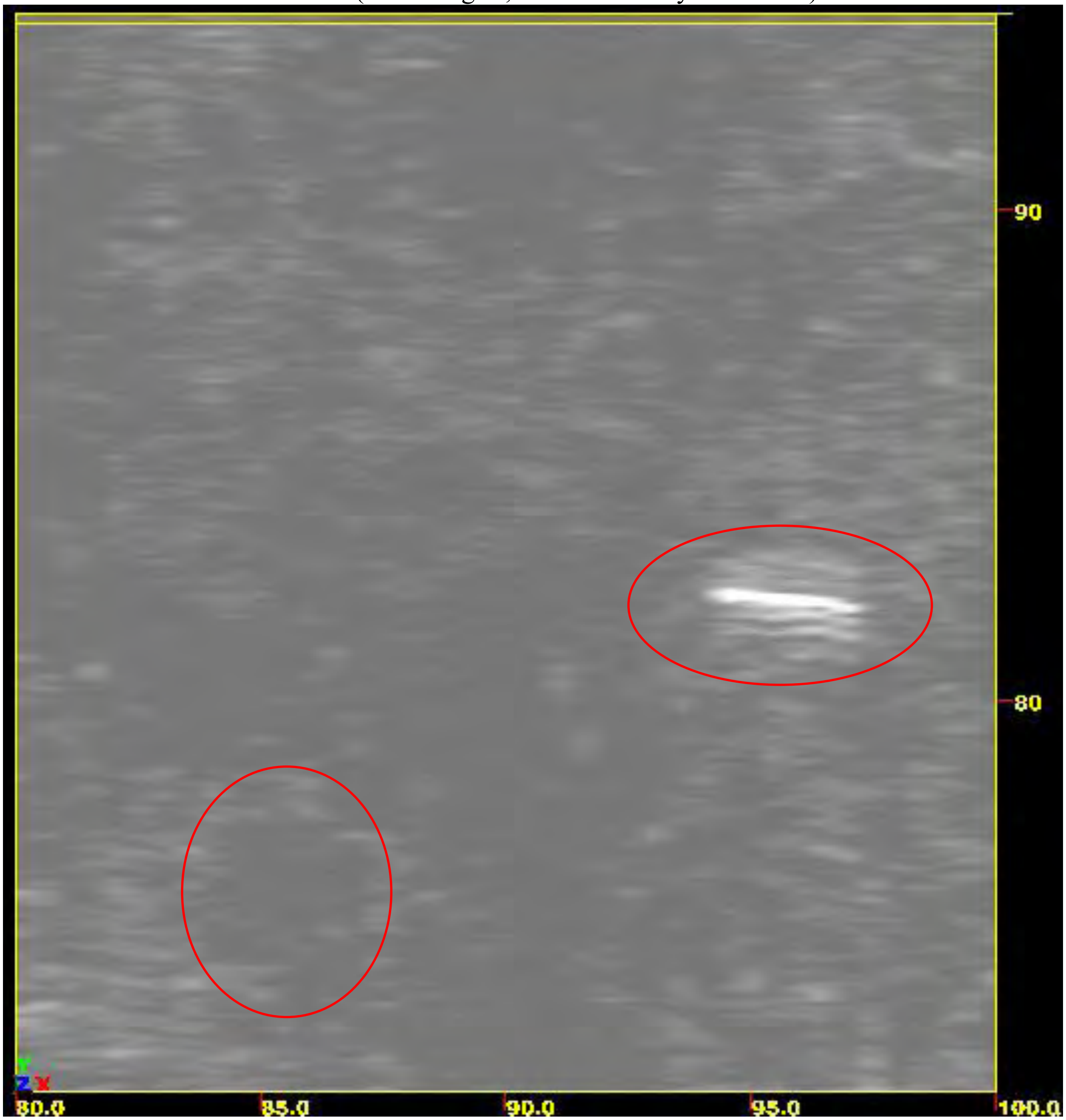
GRID 35 (Center grid, inside cemetery – 121 cmbs)

GRID 36 (Western grid, inside cemetery – 22 cmbs)

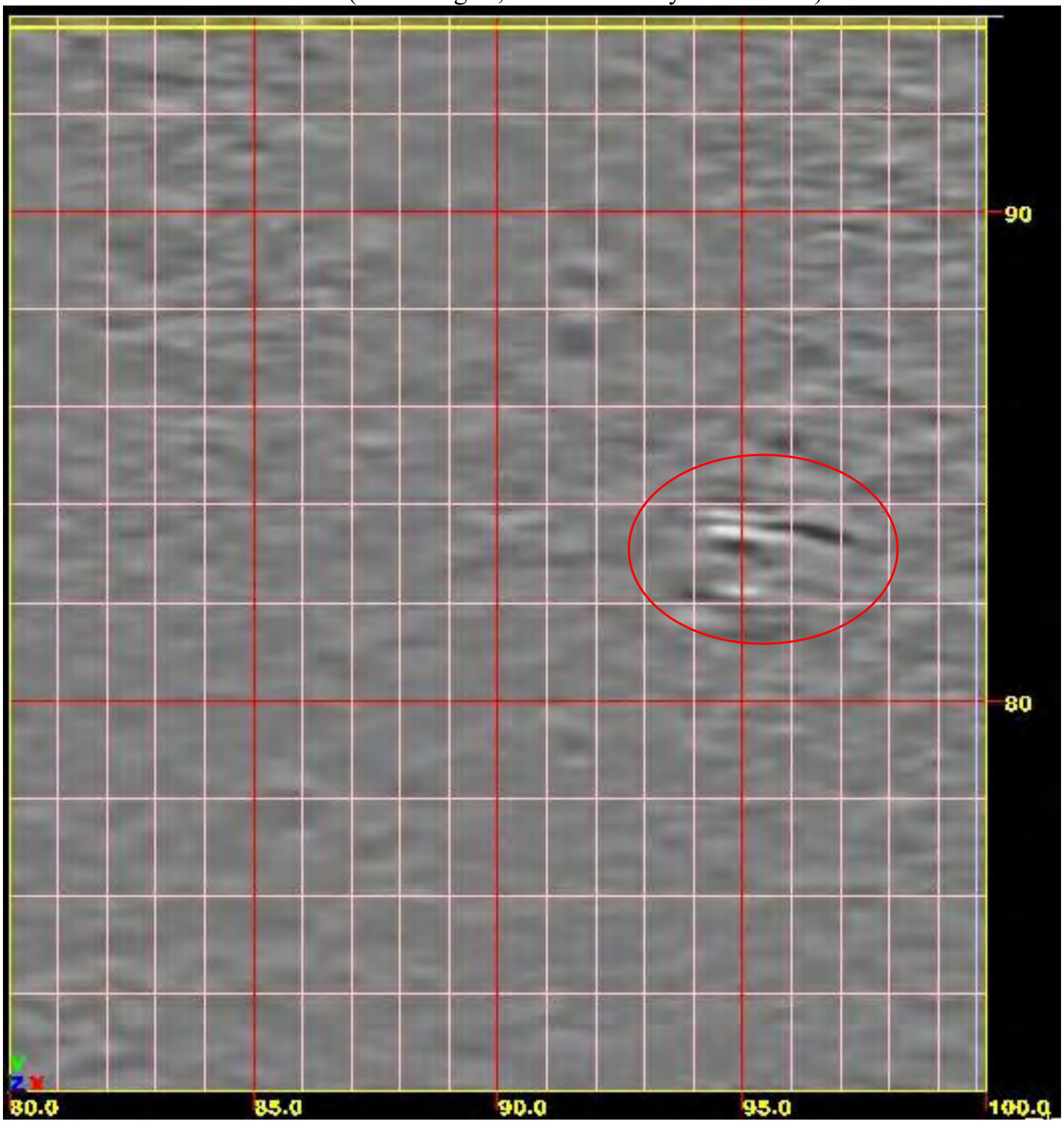
GRID 36 (Western grid, inside cemetery – 34 cmbs)



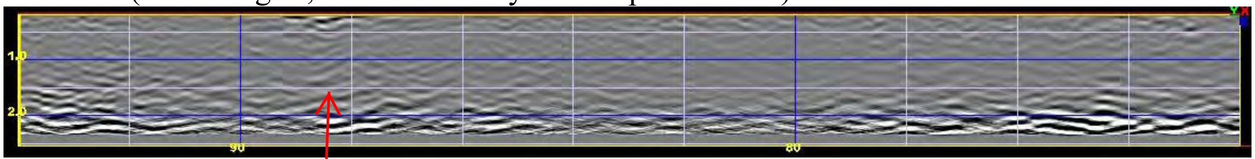
GRID 36 (Western grid, inside cemetery – 78 cmbs)



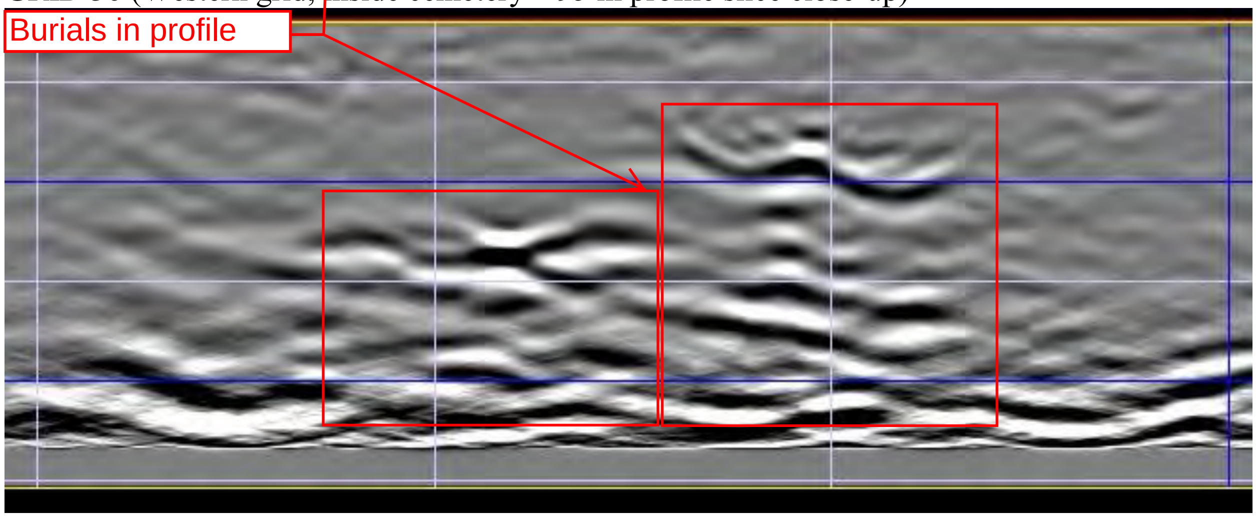
GRID 36 (Western grid, inside cemetery – 123 cmbs)



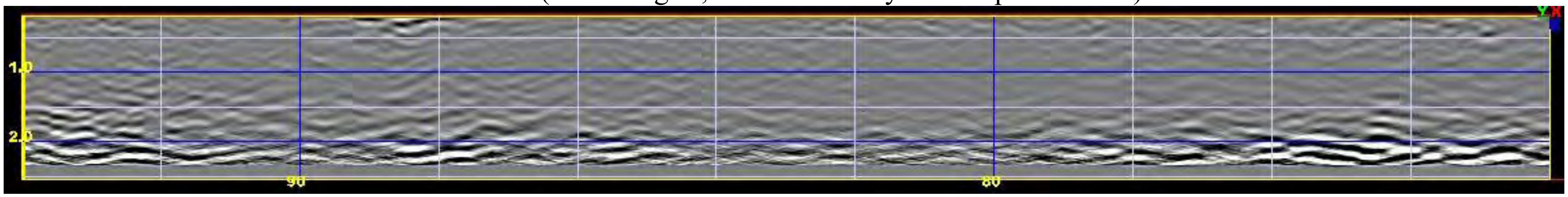
GRID 36 (Western grid, inside cemetery – 83 m profile slice)



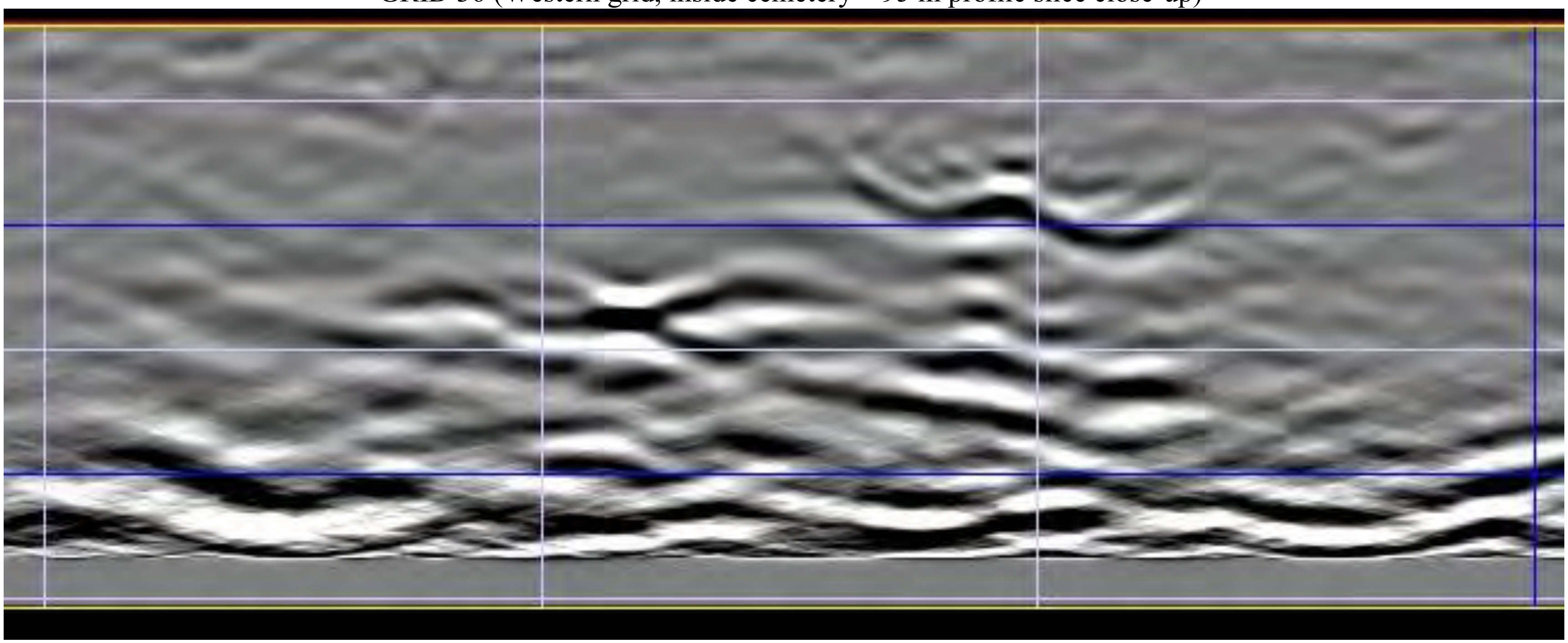
GRID 36 (Western grid, inside cemetery – 95 m profile slice close-up)



GRID 36 (Western grid, inside cemetery – 83 m profile slice)



GRID 36 (Western grid, inside cemetery – 95 m profile slice close-up)

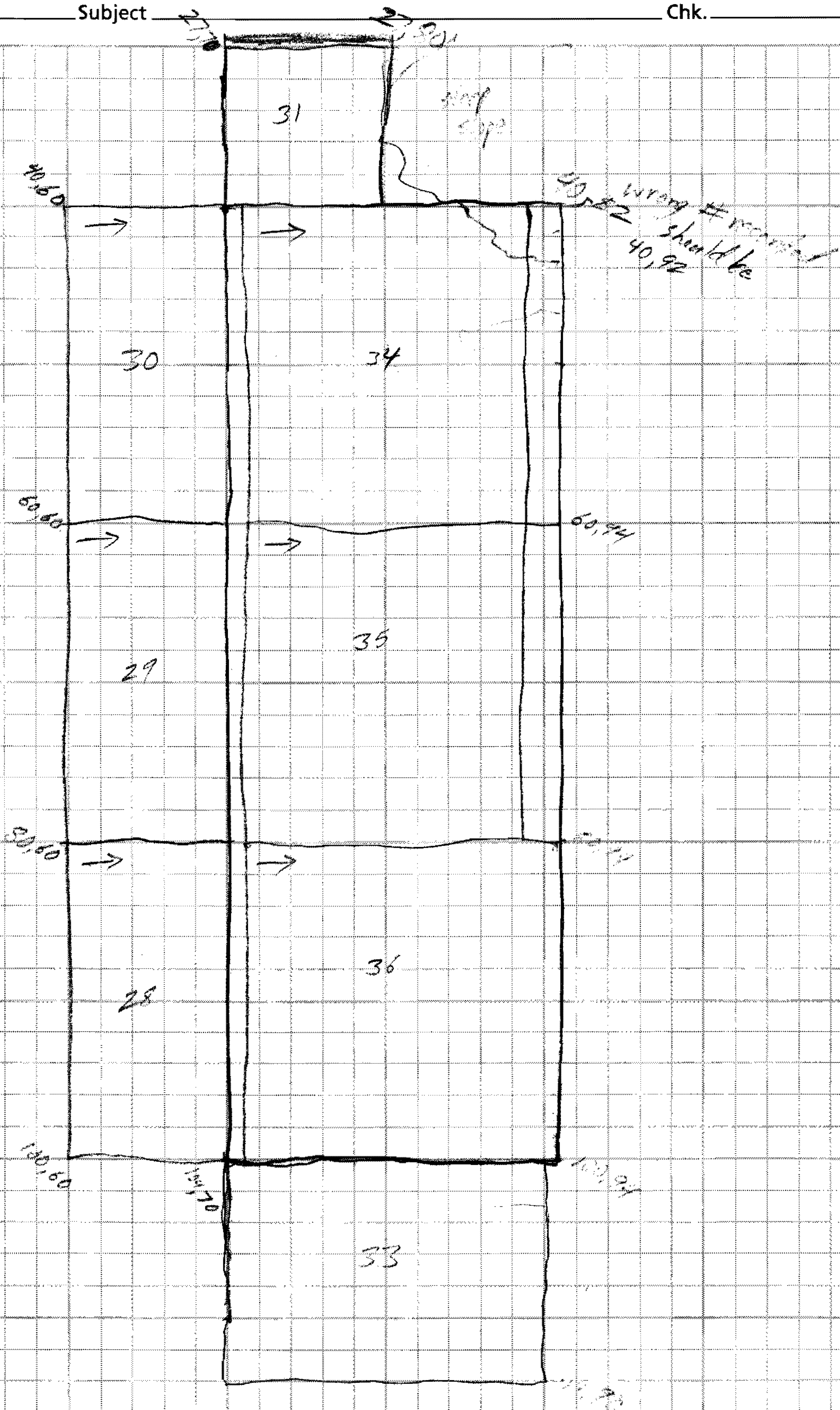


MoDOT **Design**

Date________ Sht.______ of______

Route______________ Co.____________________ Location__________________________ Author____________

Job No.____________ Subject____ Chk.____________



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Job No. _________ Subject _______________________________________ Chk. ________

GRID31

MoDOT **Design**

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Job No.______ Subject______ Chk.______

GR-D29

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S&P 106

MoDOT **Design**

Date________ Sht.______ of______

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Job No.____________ Subject____ Chk.__________

90,60

90,70

GRID28

90,60

90,70

S&P 106

100,60

100,70

Design

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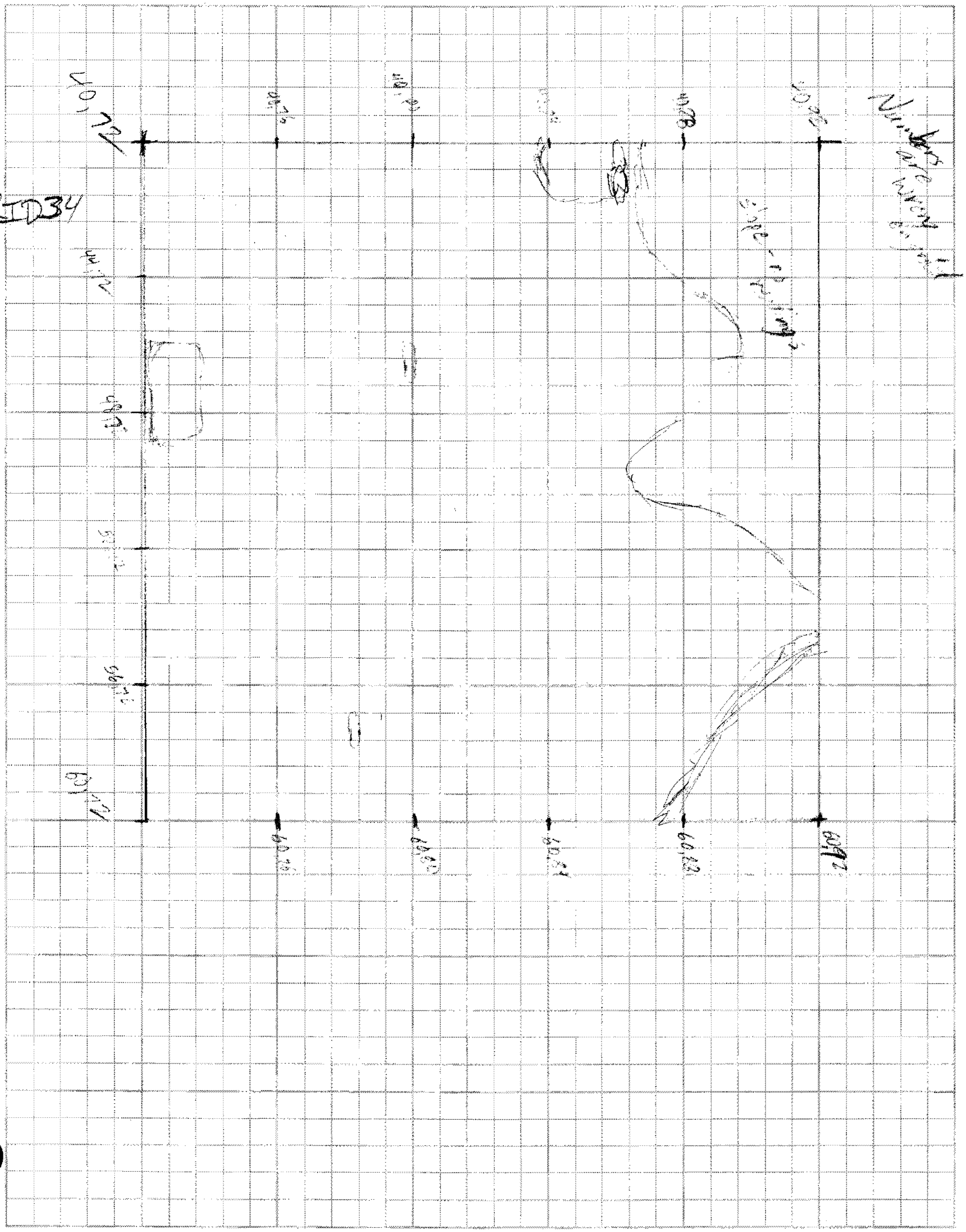
Job No.______ Subject______ Chk.______

GRID34



Design

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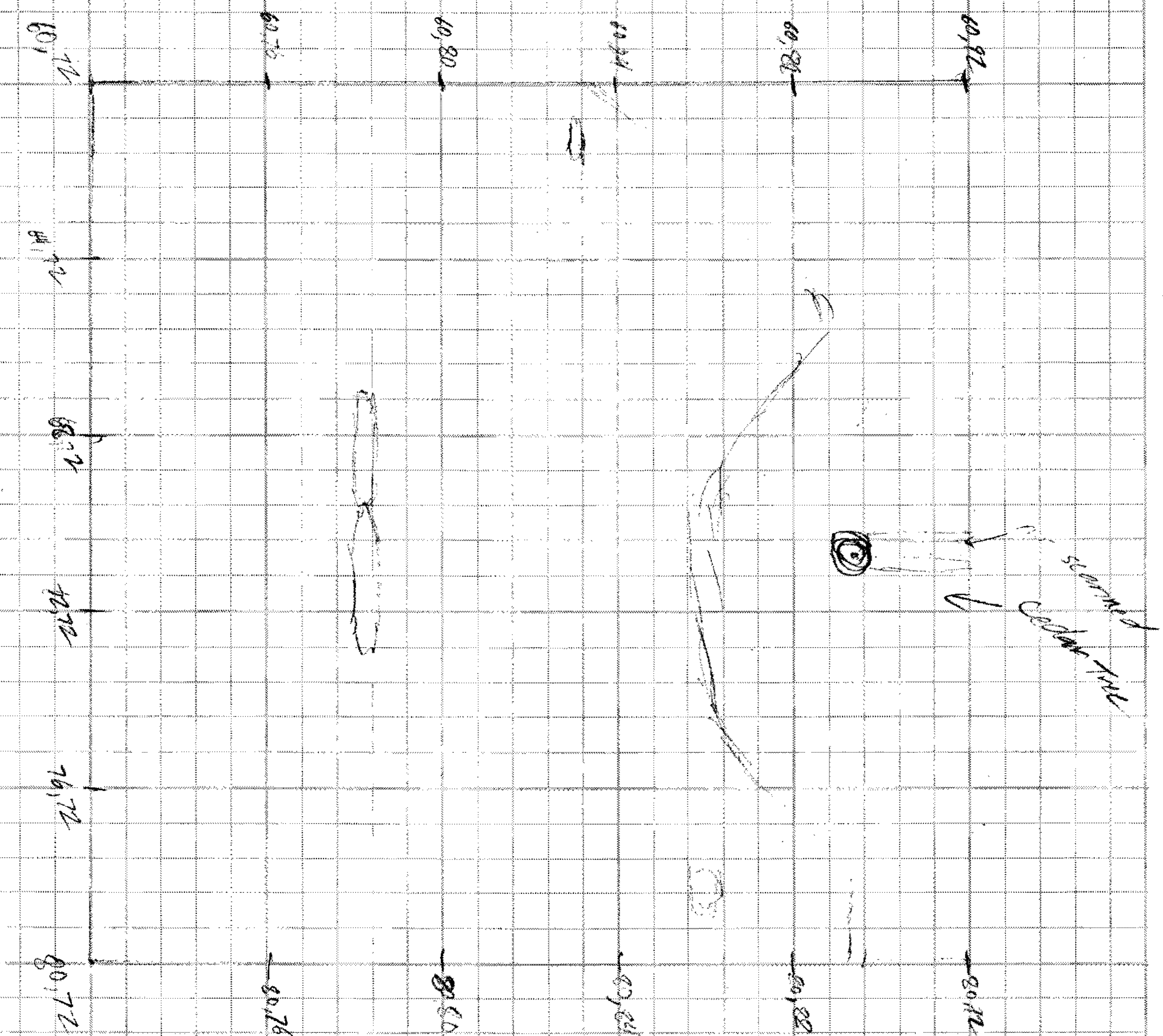
Route____________ Co.________________ Location______________________ Author__________

Job No.___________ Subject____ Chk.__________

GRID35



MoDOT **Design**

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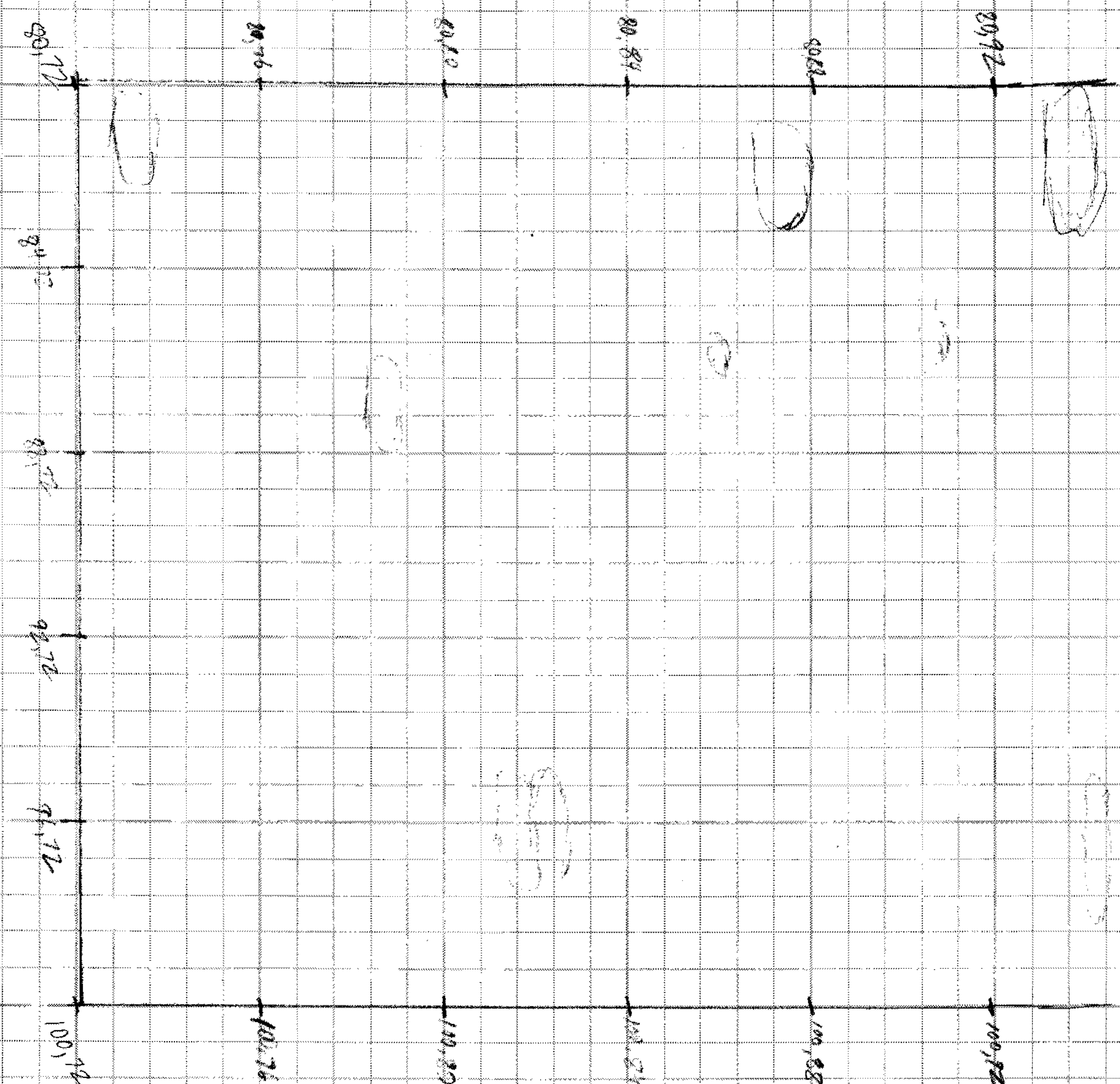
Route ______ Co. ______ Location ______ Author ______

Job No. ______ Subject ______ Chk. ______

GRID36



MoDOT **Design**

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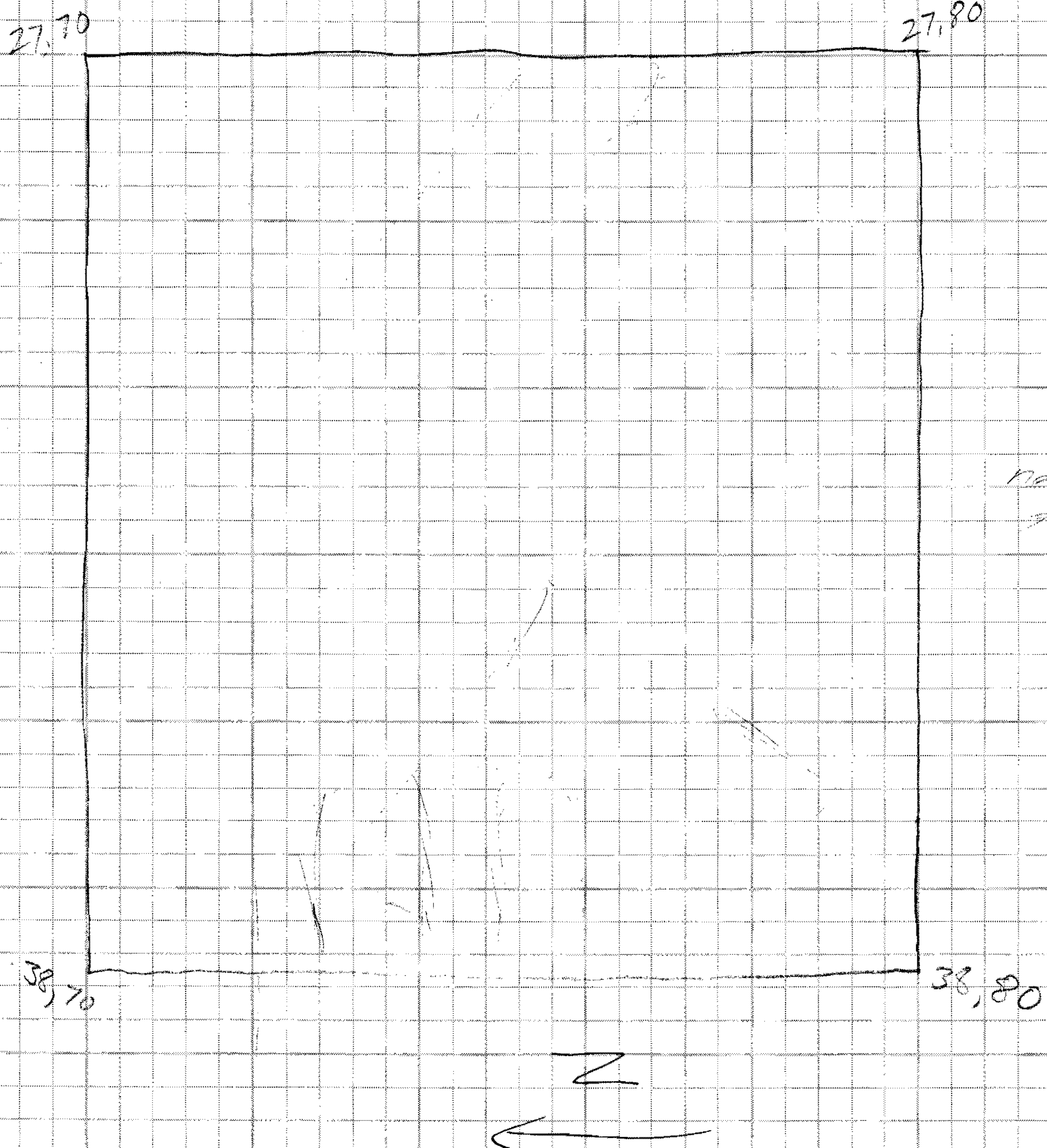
Route ____________ Co. ____________________ Location ___________________________ Author ____________

Job No. ____________ Subject ____ Chk. ____________

GRID 31



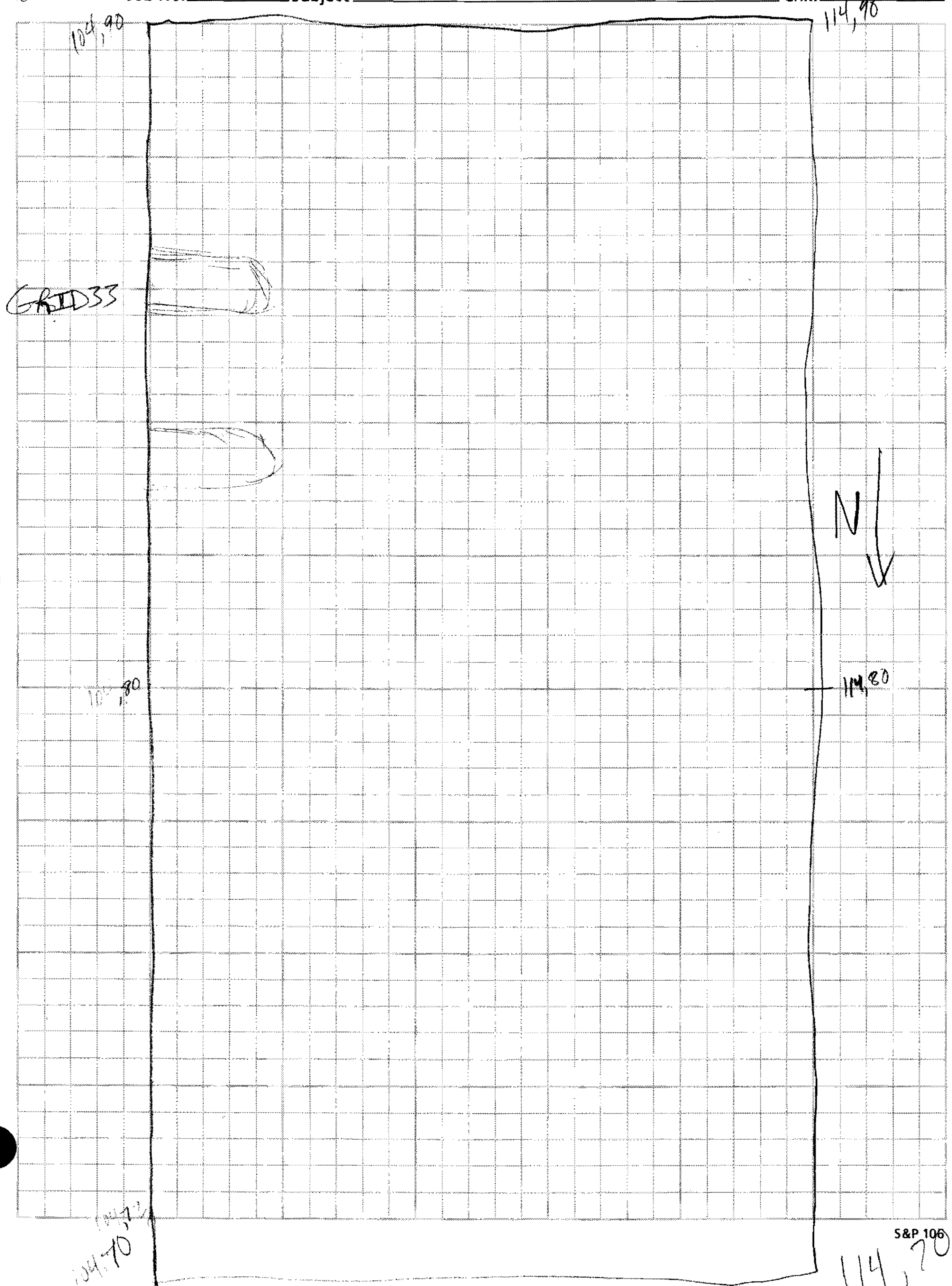
Design

Date______ Sht.______ of______

Route______ Co.______ Location______ Author______

.84

Job No.______ Subject______ Chk.______



S&P 106

Grid #   File name   Page ___ of ___

GPR FIELD FORM

Job: Camp Zoe DNR-GPR County: Shannon Route: Carpenter Union Hill Cemetery Grid #

Site No.: 23SH1550 Address (Street, City):

Nearest Intersecting Roads:

Operators by: T Tesmann & R Rahe

Date/Time Started: 4/15/2014

Positional Data Collection Method: NavCom___ TopCon___ GeoTrimble XT___XH___ GPS hand___

GRID Number 28-11:45am 29-2:30pm 30-3:00pm 31-3:30pm GPR File name

Site Map and Grid Map Must Be Drawn on Graph Paper.

Settings as they appear in the SIR-3000 **Setup file saved as** 013
(Bold Settings Should Not Be Changed)

RADAR
- **MHZ** 400
- **T_ Rate (100 KHZ)**
- MODE (Distance) Distance
- **GPS (Off)**

3D-GRID
- ORDER (Normal)
- X-START 80
- X-END 100
- Y-START 60
- Y-END 70
- Xln_SPC 0.00
- Yln_SPC 0.50

SCAN
- **SAMPLES (512)** 512
- **FORMAT (16)** 16
- RANGE 35
- DIEL 8
- **TEST_DIEL (Off)** off
- **RATE (120)** 120
- **SCAN/UNIT (50)** 50

GAIN
- AUTO
- POINTS 5
- GP1 -12
- GP2 -12
- GP3 4
- GP4 26
- GP5 44

Comments:

Two sided form, copy both sides

Grid # File name Page ___ of ___

FIELD DATA

Topography:

Flat ✓ Undulating ______ Swale ______ Hill ______

Comments: Grid farthest west on north side of fence

Ground Cover:

Maintained Lawn ____ Pasture ✓ Fallow Field ______ Woodlot ______

Comments: Mowed pasture

Rough along fenceline

Site Type:

Historic ✓ Prehistoric ✓ Both ✓

Comments: We are looking for graves outside the cemetery.

Additional Comments:

Two sided form, copy both sides

Grid # File name Page ___ of ___

GPR FIELD FORM

Job: Camp Zoe DNR-GPR County: Shannon Route: Carpenter Union Hill Cemetery Grid #

Site No.: 23SH1550 Address (Street, City):

Nearest Intersecting Roads:

Operators by: Tesvreau

Date/Time Started: 4/16/2014

Positional Data Collection Method: NavCom___ TopCon___ GeoTrimble XT___ XH___ GPS hand___

GRID Number ___ GPR File name ___

Site Map and Grid Map Must Be Drawn on Graph Paper.

Settings as they appear in the SIR-3000 **Setup file saved as** Setup 13 (changed DIEL)

(Bold Settings Should Not Be Changed)

RADAR

- **MHZ** 400
- **T_ Rate (100 KHZ)**
- MODE (Distance) Distance
- **GPS (Off)**

3D-GRID

- ORDER (Normal) Normal
- X-START 40
- X-END 60
- Y-START 72 (probably 62 & 82)
- Y-END 92
- XIn_SPC 0.00
- YIn_SPC 0.50

SCAN

- **SAMPLES (512)**
- **FORMAT (16)**
- RANGE 35
- DIEL 6.00
- **TEST_DIEL (Off)**
- **RATE (120)**
- **SCAN/UNIT (50)**

GAIN

- AUTO Manual
- POINTS 5
- GP1 -12
- GP2 -12
- GP3 4
- GP4 26
- GP5 44

Comments:

Two sided form, copy both sides

Grid # File name Page ___ of ___

FIELD DATA

Topography:

Flat _____ Undulating ______ Swale ______ Hill _______

Comments: ____

____

____

Ground Cover:

Maintained Lawn ____ Pasture _____ Fallow Field ______ Woodlot ______

Comments: ____

____

____

Site Type:

Historic ______ Prehistoric ______ Both ______

Comments: ____

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Additional Comments: ____

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APPENDIX G

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Missouri Ecological Services Field Office
101 Park DeVille Drive, Suite A
Columbia, Missouri 65203-0057
Phone: (573) 234-2132 Fax: (573) 234-2181

September 8, 2014

Rick Gundlach
SCI Engineering, Inc.
47 St. Andrews Drive
Union, Missouri 63084

Dear Mr. Gundlach:

This letter is in regards to potential impacts to federally listed species from the proposed Camp Zoe project in Shannon County, Missouri. This letter is provided by the U.S. Fish and Wildlife Service (Service) under the authority of the Fish and Wildlife Coordination Act (16 U.S.C. 661 et seq.), the National Environmental Policy Act of 1969 (42 U.S.C. 4321-4327), the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531-1543), and the Migratory Bird Treaty Act (16 U.S.C. 703-712).

According to information you provided in your April 29, 2014 letter, the State of Missouri is proposing to create a state park on the property previously referred to as Camp Zoe. The site is 407 acres and is located along Sinking Creek, approximately 0.3 miles from the confluence with the Current River. Current project plans include construction of a lodge, cabins, general store, new septic system, and realignment of roads within the existing campground. Through subsequent discussions with my staff, you indicated that the project will also involve expansion of existing utility corridor rights of way (ROW) and construction of a vehicular bridge and a pedestrian bridge across Sinking Creek.

Federally endangered, threatened, proposed, or candidate species which could occur within the project area and be impacted by project activities include the Ozark Hellbender (*Cryptobranchus alleganiensis bishopi*), gray bat (*Myotis grisescens*), Indiana bat (*Myotis sodalis*), and northern long-eared bat (*Myotis septentrionalis*). Although the Hine's emerald dragonfly (*Somatochlora hineana*) and Virginia sneezeweed (*Helenium virginicum*) are known from Shannon County, no suitable habitat exists within the project area.

<u>Ozark Hellbender (*Cryptobranchus alleganiensis bishopi*), Endangered</u>

The Ozark Hellbender is a large, aquatic salamander inhabiting cool, fast-flowing streams and rivers in the Ozark Highlands. Based on information you provided on the August 28, 2014 interagency conference call, the substrate within Sinking Creek consists of gravel and does not contain habitat suitable for the Ozark Hellbender.

Although Ozark Hellbenders do not occur within the immediate project area, individuals downstream of the project site in the Current River could be impacted by project activities if pollutants from equipment (e.g., oil, fuel, and other fluids) and/or excessive sediment are allowed to enter the stream during project activities. Therefore, we recommend that you incorporate the enclosed Best Management Practices for Construction Projects Affecting Missouri Streams and Rivers. Of particular importance, is implementing a structural design for the bridge across Sinking Creek which avoids impacts to the stream's natural flow pattern. Clearing of vegetation for bridge construction should be avoided or minimized for erosion and flood damage control purposes. We also recommend that you continue to coordinate waste water disposal plans with the Water Pollution Control Branch of the Missouri Department Natural Resources to ensure that contamination of groundwater or of Sinking Creek is avoided.

Gray bat (*Myotis grisescens*), Endangered

The gray bat occupies a limited geographic range in limestone karst areas of the southeastern United States, including Missouri. With rare exception, the gray bat roosts in caves year-round. In winter, most gray bats hibernate in vertical (pit) caves with cool, stable temperatures below 10 degrees Celsius. Summer caves, especially those used by maternity colonies, are nearly always located within a kilometer (0.6 mile) of rivers or reservoirs over which bats feed.

According to the Bat Survey Report you provided on August 6, 2014, acoustic and mist netting surveys were conducted at the Camp Zoe and utility corridor project sites from May 24th to May 30th, 2014 by a team led by Dr. Lynn Robins. Fifty-three gray bats were captured during mist netting surveys, all of which were males. Per the cave report you provided on August 28, 2014, two caves within the project area were surveying on May 3, 2014 by the Cave Research Foundation, and neither were found to harbor gray bats or provide suitable habitat for the species. However, other caves are present on the site, and these caves should be assessed to determine whether gray bats may be present (during any time of year).

Gray bats could be impacted if the prey base within foraging habitat is substantially reduced (e.g., by extensive pesticide application or removal of forested habitat within the riparian corridor) or if the connectivity of habitat between foraging and roosting sites is not maintained as gray bats primarily use forested corridors to travel between these areas. We recommend that pesticide use be avoided or minimized near water bodies or areas of karst topography and that removal of forested habitat within 100 feet of streams be avoided. Should gray bats be detected in caves on site, impacts to these caves should also be avoided.

Indiana bat (*Myotis sodalis*), Endangered

From late fall through winter, Indiana bats in Missouri hibernate in caves or habitats resembling caves. Indiana bats roost in trees during the day and forage for flying insects in and around the tree canopy at night during the active season (April 1- November 1). A variety of upland and wetland habitats are used as foraging areas, including a variety of forest habitats, pastures, clearings with early successional vegetation, cropland borders, and wooded fencerows. Roosting habitat requirements for the species are not well defined but the following are considered important:

1) Live or overly-mature trees and snags with peeling or exfoliating bark, split tree trunks, or cavities, which may be used as maternity or bachelor roosts;
2) Tree species including shellbark or shagbark hickory, while oak, cottonwood, and maple;
3) Stream corridors, riparian areas, and upland woodlots that provide foraging habitat

According to the Bat Survey Report conducted by Dr. Lynn Robbins, Indiana bats were detected acoustically at 2 of the 5 survey sites within the Camp Zoe area and at 1 of the 4 sites within the utility corridor. A male Indiana bat was also captured during mist netting at one of the Camp Zoe sites where Indiana bat calls were detected. Although this individual was equipped with a radio transmitter, it could not be relocated on or near the project area and it was possibly roosting in a cave. Per the cave report you provided on August 28, 2014, two caves within the project area were surveying on May 3, 2014 by the Cave Research Foundation, and neither were found to harbor Indiana bats or provide suitable habitat for the species. However, other caves are present on the site, and these caves should be assessed to determine whether Indiana bats may be present (during any time of year).

Project activities could adversely affect the Indiana bat if (1) the prey base within foraging habitat is substantially reduced (e.g., by improper use of pesticides that would diminish the prey base, removal of vegetation used for feeding, breeding, or sheltering, etc.), (2) trees are removed while occupied by roosting bats, (3) maternity roosting trees are removed, (4) the removal of forested habitat other than maternity roosts disrupts a maternity colony's roosting dynamics[1], or (5) caves supporting hibernating Indiana bats are impacted.

In order to avoid or minimize impacts to the Indiana bat from project activities, we recommend avoiding any activities that could substantially reduce the prey base. We also recommend minimizing the amount of forest habitat removal and removing trees between November 1 and April 1. Although the Indiana bat captured during mist netting was a male, Indiana bat calls were detected at two other sites and these calls could have been emitted by one or more females. Therefore, removal of large-diameter trees which could serve as maternity roost trees should be avoided. Should Indiana bats be detected in caves on site, impacts to these caves should also be avoided.

Northern long-eared bat (*Myotis septentrionalis*), Proposed Endangered

The northern long-eared bat occurs throughout Missouri and similar to the Indiana bat, roosts in caves (or habitats resembling caves) during the winter and under loose tree bark or in tree cracks or crevices during the summer. The species has been proposed for listing as endangered and a final listing determination by the Service is expected by April 2, 2015. Because project activities are not likely to be completed before the northern long-eared bat final listing decision, we recommend considering the species in your threatened and endangered species evaluations.

According to the Bat Survey Report, northern long-eared bats were detected acoustically at all 5 of the survey sites within the Camp Zoe project area and at 2 of the survey sites within the utility corridor. A pregnant female was also captured at one of the mist netting sites within the Camp Zoe project area. The female was tracked for 5 days to 3 different roosts. Two roosts were identified as maternity roosts based on the number of bats observed during emergence counts, and all three occur outside of the project area. Nonetheless, results of survey efforts provide evidence that the species utilizes habitats within the project area for foraging or the temporary use of alternate roosts. Per the cave report you provided on August 28, 2014, two caves within the project area were surveying on May 3, 2014 by the Cave Research Foundation, and neither were found to harbor northern long-eared

[1] Disruption of social dynamics could occur if a substantial amount of forested habitat within the roosting range of a maternity colony is removed.

bats or provide suitable habitat for the species. However, other caves are present on the site, and these caves should be assessed to determine whether northern long-eared bats may be present (during any time of year).

Similar to the Indiana bat, project activities could adversely affect the northern long-eared bat if (1) the prey base within foraging habitat is substantially reduced (e.g., by improper use of pesticides that would diminish the prey base, removal of vegetation used for feeding, breeding, or sheltering, etc.), (2) trees are removed while occupied by roosting bats, (3) maternity roosting trees are removed, (4) the removal of forested habitat other than maternity roosts disrupts a maternity colony's roosting dynamics[2], or (5) caves supporting hibernating northern long-eared bats are impacted.

In order to avoid or minimize impacts to the northern long-eared bat from project activities, we recommend avoiding any activities that could substantially reduce the prey base. We also recommend minimizing the amount of forest habitat removal and removing trees between November 1 and April 1. Tree removal and other disturbance should be avoided or minimized within the vicinity of the northern long-eared bat roosting area southeast of the project area. Removing or impacting trees which could serve as maternity roost trees should also be avoided as other maternity colonies may be roosting within the project site given the size of the area. In addition, impacts to any caves supporting northern long-eared bats should be avoided.

Due to the presence of several federally listed species within the project area, we anticipate that additional discussions with the Service will be necessary to determine if potential adverse effects of the proposed project activities have been adequately avoided or minimized. Pertinent to these discussions and the overall planning process will be a detailed project description with photos and a map indicating all suitable Indiana, gray, and northern long-eared bat roosting and foraging forest habitat within the project area slated for disturbance or removal. It will also be necessary to identify the lead Federal agency for the project.

We appreciate the opportunity to provide comments on the proposed development of the Missouri State Park at Camp Zoe. If you have questions or need additional information, please contact Trisha Crabill of my staff at 573-234-2132, extension 121.

Sincerely,

Amy Salveter
Field Supervisor

Enclosures

Cc: MODNR, Jefferson City, MO (Attn: Ken McCarty)
USACE, Regulatory Branch, Little Rock, AR (Attn: Louis Clarke)
FHWA, Jefferson City, MO (Attn: Raegan Ball)
MODOT, Jefferson City, MO (Attn: Gayle Unruh)
MDC, Jefferson City, MO (Attn: Emily Clancy)

[2] Disruption of social dynamics could occur if a substantial amount of forested habitat within the roosting range of a maternity colony is removed.

Introduction

The streams and rivers of Missouri support a wide and diverse community of wildlife that includes many species of mammals, birds, fishes, mussels, crayfish, and insects. The continued diversity and health of this community is dependent upon how well Missourians manage and protect this resource. While water quality is essential, maintaining a diverse array of habitat features also is essential for aquatic wildlife to persist. Since implementation of the Clean Water Act, point source pollution has been greatly reduced, but polluted and sediment-laden runoff (non-point source) from rural and urban development is still a serious problem.

There are management practices that can be implemented to prevent degradation of our streams and rivers. By adapting these best management practices we can prevent the loss of species diversity and maintain the quality of our lives as well. Preventative measures may require extra effort initially, but they provide long-term dividends by eliminating costly damage resulting from poor management practices.

Access and Staging Area Management Recommendations

Staging areas are those short- or long-term sites within a construction or development area where most equipment and materials are stored. These areas often are accessed frequently; and when fuel and oil are stored here, the potential for runoff and erosion in these areas may be high.

→ Erosion and sediment controls should be installed and maintained to prevent discharge from the site.

→ Staging areas for crew, equipment, and materials should be established well away from streams and rivers or highly erodible soils.

→ Stationary fuel and oil storage containers should remain within a staging area or another confined area to avoid accidental spills into the stream systems.

→ Excess concrete and wash water from trucks and other concrete mixing equipment should be disposed of where this material cannot enter the stream systems.

→ If temporary roadways must be built, ensure that roadways are of low gradient with sufficient roadbed and storm water runoff drains and outlets. Containment basins, silt fences, filter strips, etc. should be included for retention of storm water runoff for reducing sediment introduction into natural waterways.

→ Avoid stream crossings. If unavoidable, temporary crossings should be used. Temporary crossings should not restrict or interrupt natural stream flow. If temporary in-channel fill is necessary, culverts of sufficient size should be employed to avoid water impoundment and allow for fish passage.

Riparian Corridor Management Recommendations

The riparian corridor is the vegetation adjacent to a stream or river. This area is critical to the health and quality of the aquatic environment because of its ability to slow and reduce sediment and chemical runoff into the stream or river channel. A riparian corridor with a minimum width of 100 feet from the edge of the stream or river should be maintained along both sides of streams and rivers.

→ Limit clearing of vegetation, including both standing and downed timber, to that which is absolutely necessary for construction purposes.

→ Heavy equipment use within the riparian corridor should be restricted to minimize vegetation destruction and compaction of soils. Flagging or fencing areas that are not to be disturbed is helpful in alerting construction personnel.

→ General application of pesticides, herbicides, or fertilizers within the riparian corridor should be prohibited to avoid water contamination due to over-spray or runoff. Fertilizer use or spot application of pesticides and herbicides is acceptable if appropriate non-restricted chemicals are used.

→ Riparian areas located down slope of construction zones should be physically screened with sediment controls, such as silt fences or filter strips. Sediment controls should be monitored after rain and maintained for the duration of the project.

→ All riparian corridors disturbed by the project should be revegetated immediately following or concurrent with project implementation. Appropriate native bottomland or riparian trees, shrubs, and grasses should be planted to ensure long-term stability in areas where the soil erosion threat is not critical. Annual non-native grasses such as rye or wheat may be planted in conjunction with native species to provide short-term erosion control. Areas judged to be subject to immediate soil loss due to steep slopes or other factors causing critical erosion conditions may be planted with non-native mixtures to assure rapid establishment and erosion control.

→ Post-construction evaluation of vegetation establishment should be conducted at one month intervals for at least three months after completion of the project. Any recommended sediment controls should be inspected at these times. If determined beneficial to soil stability and not adversely impacting site function and/or aesthetics, recommended sediment controls should remain permanent.
→ All temporary erosion and sediment controls should be removed (unless removal would cause further disturbance) and properly disposed of within 30 days after final site stabilization is achieved or after temporary practices are no longer needed.

Bank and Channel Management Recommendations

The structure of a bank is an important feature of a stream or river. It defines and provides stability for the channel.
→ Bank stability will vary depending on height, slope, and soil conditions. Project engineers and hydrologists should thoroughly investigate the physical properties and hydrologic record of the proposed site before construction begins.
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→ Use of riprap for stream bank stabilization should be limited to those areas that could experience substantial erosion before adequate vegetation becomes established. The material for the rock blanket should consist of durable stone or broken concrete that is well graded. It is preferable that 40-60 percent of the material be as large as the thickness of the blanket, with enough smaller pieces of various sizes to fill the larger voids. It should not contain more than 10 percent of earth, sand, shale, and non-durable rock. Bank stabilization materials should allow for continuous passage of fish and other aquatic species.
→ No permanent fill materials, other than design-approved structures and related bank stabilization materials, should be placed in the stream channel. Avoid channelization. Excavated materials should not be stored or stockpiled below the high bank.
→ Work should be conducted during low flow periods when possible.
→ Care should be taken to keep machinery out of the waterway as much as possible.
→ Do not alter or remove natural stream features, such as riffles and pools.
→ Large woody debris is an important habitat component of a stream and should not be removed unless absolutely necessary for construction and maintenance purposes.

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Missouri Department of Conservation

Natural Heritage Review Report

Tammy Wolfe
Executive Assistant
SCI Engineering, Inc.
TWolfe@sciengineering.com

Project type:	Land Development
Location/Scope:	Sections 7 & 8 of T30N R04W
County:	Shannon
Query reference:	Camp Zoe Rehab – approx. 407 acre site: lodge, cabins, general store, new septic system, & realignment of roads
Query received:	April 29, 2014

This NATURAL HERITAGE REVIEW is not a site clearance letter. Rather, it identifies public lands and sensitive resources known to have been located close to and/or potentially affected by the proposed project. *On-site verification is the responsibility of the project. Natural Heritage records were identified at some date and location. This report considers records near but not necessarily at the project site. Animals move and, over time, so do plant communities. To say "there is a record" does not mean the species/habitat is still there. To say that "there is no record" does not mean a protected species will not be encountered. These records only provide one reference and other information (e.g. wetland or soils maps, on-site inspections or surveys) should be considered. Look for additional information about the biological and habitat needs of records listed in order to avoid or minimize impacts. More information is at http://mdc.mo.gov/discover-nature/places-go/natural-areas and mdc4.mdc.mo.gov/applications/mofwis/mofwis_search1.aspx. Contact information for the department's Natural History Biologist is online at http://mdc.mo.gov/contact-us.*

Records of federal-listed (these are also state-listed) species or critical habitats near the project site:

Natural Heritage records identify no wildlife preserves, no designated wilderness areas or critical habitats, no federal-listed species records within the provided PLSS. However, Sinking Creek feeds into a portion of the Current River that is within the known range for Ozark hellbender (*Cryptobranchus alleganiensis bishop*, federal and state listed endangered). Hellbenders are strictly aquatic salamanders whose well-being is dependent on high-quality water systems with constant levels of dissolved oxygen, temperature, and flow. These unusual animals are in serious decline, and information about best-management is available at:
http://mdc.mo.gov/sites/default/files/resources/2010/08/9482_6424.pdf.

The project should be managed to minimize erosion and sedimentation/runoff to nearby streams and lakes, including adherence to any "Clean Water Permit" conditions. Revegetate areas in which the natural cover is disturbed to minimize erosion using native plant species compatible with the local landscape and wildlife needs. Pollutants, including sediment, can have significant impacts on aquatic systems. Use silt fences and/or vegetative filter strips to buffer streams and drainages, and monitor those after rain events and until a well-rooted ground cover is reestablished. Best management recommendations relating to streams and rivers may be found at:
http://mdc.mo.gov/sites/default/files/resources/2013/02/constprojnearstreams_2013.pdf.

FEDERAL LIST species/habitats are protected under the Federal Endangered Species Act. ***Consult with the U.S. Fish and Wildlife Service*** *(101 Park Deville Drive Suite A, Columbia, Missouri 65203-0007; 573-234-2132).*

Records of state-listed (not federal-listed) endangered species AND / OR state-ranked (not state-listed endangered) species and natural communities of conservation concern. The Department tracks these species and natural communities due to population declines and/or apparent vulnerability.

Natural Heritage records identify plains spotted skunk (*Spilogale putorius interrupta*, state-listed endangered) within the vicinity of the project area. They have a smaller, more slender body than striped skunks. Plains spotted skunks typically can be identified by a white triangular patch on the forehead, a solid black tail and four to six broken white stripes extending from the neck along the back and sides. Their decline in numbers may be related to the changes in agriculture that stressed clean farming, thereby leaving little cover for skunks to live in. It also is possible that increased pesticide use in agricultural areas has affected insect abundance, which skunks commonly eat. See insert pertaining to Best Management Recommendations.

Natural Heritage records identify pygmy snowfly (*Allocapnia pygmaea*, state rank S3) within the vicinity of the project. This insect prefers spring branch habitats and was last observed in 1987. The state-rank S3 is defined as vulnerable in the state- this species is rare and uncommon, or found only in a restricted range (even if abundant in some locations), or because of other factors making it vulnerable to extirpation. Typically 21 to 100 occurrences or between 3,000 and 10,000 individuals.

See http://mdc.mo.gov/sites/default/files/resources/2010/04/2014_species_concern.pdf for a complete list of species and communities of conservation concern.

STATE ENDANGERED species are listed in and protected under the Wildlife Code of Missouri (3CSR10-4.111).

General recommendations related to this project or site, or based on information about the historic range of species (unrelated to any specific Natural Heritage records):

- Indiana bats (*Myotis sodalis*, federally and state listed endangered) hibernate during winter months in caves and mines. During the summer months, they roost and raise young under the bark of trees in riparian forests and upland forests near perennial streams. During project activities, avoid degrading stream quality and where possible leave snags standing and preserve mature forest canopy. Do not enter caves known to harbor Indiana bats, especially from September to April. **If any trees need to be removed by your project, please contact the U.S. Fish and Wildlife Service (Ecological Services, 101 Park Deville Drive, Suite A, Columbia, Missouri 65203-0007; Phone 573-234-2132).**
- Gray bats (*Myotis grisescens*, federal and state-listed endangered) are likely to occur in the project area, as they forage over streams, rivers, and reservoirs in this part of Missouri. Avoid entry or disturbance of any cave inhabited by gray bats and when possible retain forest vegetation along the stream and from the gray bat cave opening to the stream. See http://mdc.mo.gov/104 for best management recommendations.
- Shannon County has known karst geologic features (e.g. caves, springs, and sinkholes, all characterized by subterranean water movement). Few karst features are recorded in Natural Heritage records, and ones not noted here may be encountered at the project site or affected by the project. Cave fauna (many of which are species of conservation concern) are influenced by changes to water quality, so check your project site for any karst features and make every effort to protect groundwater in the project area. See http://mdc.mo.gov/nathis/caves/manag_construc.htm for best management information.
- Invasive exotic species are a significant issue for fish, wildlife and agriculture in Missouri. Seeds, eggs, and larvae may be moved to new sites on boats or construction equipment, so inspect and clean equipment thoroughly before moving between project sites.
  - Remove any mud, soil, trash, plants or animals from equipment before leaving any water body or work area.
  - Drain water from boats and machinery that have operated in water, checking motor cavities, live-well, bilge and transom wells, tracks, buckets, and any other water reservoirs.
  - When possible, wash and rinse equipment thoroughly with hard spray or HOT water (≧104° F, typically available at do-it-yourself carwash sites), and dry in the hot sun before using again.

These recommendations are ones project managers might prudently consider based on a general understanding of species needs and landscape conditions. Natural Heritage records largely reflect sites visited by specialists in the last 30 years. Many privately owned tracts have not been surveyed and could host remnants of species once but no longer common.

Best Management Practices

MISSOURI DEPARTMENT OF CONSERVATION

Plains spotted skunk

Spilogale putorius interrupta

Common name • Plains spotted skunk
Scientific name • Spilogale putorius interrupta
State status • Endangered

Ecology

Plains spotted skunks historically lived throughout the plains states of the United States from Minnesota south to Texas and from Missouri west to parts of Wyoming and Kansas. They have a smaller, more slender body than striped skunks. Plains spotted skunks typically can be identified by a white triangular patch on the forehead, a solid black tail and four to six broken white stripes extending from the neck along the back and sides. Spotted skunks are found most commonly in open grasslands, brushy areas and cultivated land. Their dens are located below ground in grassy banks, rocky crevices or along fence rows, as well as above ground in hay stacks, woodpiles, hollow logs or trees or brush heaps. Mating takes place in late winter, and the young are born from April to June. A litter usually contains five young. Plains spotted skunks are nocturnal and omnivorous in nature; they will eat insects, mice, rats, some birds and vegetables.

Reasons for Decline

The plains spotted skunk was formerly common in western Missouri, but their populations began declining in the mid-1900s. The decrease may be related to the changes in agriculture that stressed clean farming, thereby leaving little cover for skunks to live in. It also is possible that increased pesticide use in agricultural areas has affected insect abundance, which skunks commonly eat.

Specific Recommendations

Skunks contribute to the natural control of insects and rodents and should be considered an asset around farms.

→ Limit the use of pesticides and herbicides.
→ Avoid burning or clearing fence rows, brush piles and downed logs or trees where skunks may be present.
→ Where skunks are unwanted, remove scrap lumber piles, hay stacks and unused farm machinery to eliminate potential skunk habitat.

Information Contacts

For further information regarding regulations for development near prairies, contact:

Missouri Department of Conservation
Policy Coordination Section
P.O. Box 180
2901 W. Truman Blvd
Jefferson City, MO 65102-0180
Telephone:573/751-4115

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www.sciengineering.com

Bat Survey Report

X1414-04 CAMP ZOE
SHANNON COUNTY, MISSOURI

August 5, 2014

Prepared for:
FARNSWORTH GROUP, INC
MISSOURI OA/FMDC
MISSOURI DNR/DIVISION OF PARKS

SCI No. 2014-7007.30, Task 200

SCI ENGINEERING, INC.
CONSULTANTS IN DEVELOPMENT, DESIGN AND CONSTRUCTION
GEOTECHNICAL
ENVIRONMENTAL
NATURAL RESOURCES
CULTURAL RESOURCES
CONSTRUCTION SERVICES

August 5, 2014

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20 Allen Avenue, Suite 200
St. Louis, Missouri 63119

RE: Bat Survey Report
X1414-04 Camp Zoe
Shannon County, Missouri
SCI No. 2014-7007.30, Task 200

Dear Mr. Polk:

SCI is pleased to submit the attached bat survey report, dated August 5, 2014. Our services consisted of conducting acoustic and mist-netting endangered bat surveys. This survey effort was designed to determine the presence or probable absence of the federally endangered Indiana bat (*Myotis sodalis*) as well as the proposed endangered northern long-eared Bat (*Myotis septentrionalis*). Acoustic and mist-net surveys were conducted from May 24th through to May 30th, 2014.

Seven species were captured in mist nets on the area (*Perimyotis subflavus*, *Lasiurus borealis*, *Nycticeius humeralis*, *Eptesicus fuscus*, *Myotis grisescens*, *Myotis septentrionalis*, and *Myotis sodalis*) for a total of 84 individual bats. Additional species were classified by either Bat Call Identification (BCID) or Kaleidoscope call identification software (*Lasionycteris noctivagans*, *Lasiurus cinereus*, *Myotis lucifugus*, and *Myotis leibii)*. A total of 3,016 bat passes were classified by BCID while a total of 3,321 passes were classified by Kaleidoscope. One female northern long-eared bat was successfully tracked, leading to the discovery of three off-site roost trees, two of which were maternity colonies.

As you move forward with project planning, please keep in mind the U.S. Fish and Wildlife (USFWS) has the sole authority to regulate any action which may affect a listed endangered or threatened species. We have prepared this report in accordance with the January 2013 U.S. Fish and Wildlife Service's Draft Revised Rangewide Indiana Bat Summer Survey Guidelines and in accordance with local practices accepted by the Columbia, Missouri Sub-Office of the USFWS.

The attached report should be read in its entirety. We appreciate the opportunity to provide you with our natural resource services.

You may reach me at (636) 757-1017 or rgundlach@sciengineering.com if you have any questions or concerns.

Respectfully,

SCI ENGINEERING, INC.

Rick J. Gundlach
Senior Staff Scientist

Scott D. Harding, CPSS/SC
Vice President

RJG/SDH/tlw

Enclosure

C: Dr. Lynn Robbins, Missouri State University

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Bat Survey Report

X1414-04 CAMP ZOE
SHANNON COUNTY, MISSOURI

1.0 EXECUTIVE SUMMARY

A Missouri State University (MSU) research team, through SCI Engineering, Inc. (SCI) conducted an acoustic and mist-netting, endangered bat survey across a proposed state natural area in Shannon County, Missouri. This survey was designed to determine the presence or probable absence of the federally endangered Indiana bat (*Myotis sodalis*) as well as the proposed endangered northern long-eared Bat (*Myotis septentrionalis*). The survey was conducted from May 24th through to May 30th, 2014.

Mist-nets and bat detectors (Anabat II and Song Meter 2) were used in combination to maximize the possibility of documenting the presence of bat species in the area. Methodology was based on the guidelines in the Indiana Bat Revised Recovery Plan and the Draft Recovery Plan (USFW, 2007, 2014b). Acoustic and mist-netting sites were established at five locations throughout the project area, located in potential bat flyways and near suitable bat habitat. Additionally, four acoustic detector locations were established throughout the existing utility corridor that is proposed to be improved.

Seven species (*Perimyotis subflavus*, *Lasiurus borealis*, *Nycticeius humeralis*, *Eptesicus fuscus*, *Myotis grisescens*, *Myotis septentrionalis*, and *Myotis sodalis*) were captured in mist nets on the subject site for a total of 84 individual bats. Additional species (*Lasionycteris noctivagans*, *Lasiurus cinereus*, *Myotis lucifugus*, and *Myotis leibii*) were classified by either Bat Call Identification (BCID) or Kaleidoscope call identification software. A total of 3,016 bat passes were classified by BCID while a total of 3,321 passes were classified by Kaleidoscope. One female northern long-eared bat was successfully tracked, leading to the discovery of three off-site roost trees, two of which were maternity colonies.

2.0 INTRODUCTION

2.1 Project Description and Background

The site is located at the northeast corner of State Route 19 and County Road 19-250, approximately 10 miles north of Eminence, Missouri (Township 30 North, Range 4 West, Sections 7 and 8). The proposed project features a new State Park, which will include construction of a lodge, cabins, general store, roads, utilities, septic systems and the realignment of roads within the existing campground. Additionally, the existing overhead utility corridor will be widened to accommodate a higher voltage 3-phase system, in anticipation of the above-referenced improvements at Camp Zoe.

Because of the proximity of this site to overwintering populations of the endangered Indiana bat and gray bat, as well as the candidate northern long-eared bat, and the presence of potentially suitable summer and winter habitat for these bats at this new site, the USFWS has recommended that a survey be conducted to determine possible presence and habitat use prior to the potential impact of this habitat.

2.2 Area Description

The Camp Zoe area consists of approximately 410 acres in Shannon County, Missouri. The location of the site is shown on the *Vicinity and Topographic Map*, Figure 1. It contains a portion of lower Sinking Creek and includes floodplains with common bottomland flora such as sycamores, buttonbush, and willow. Camp Zoe also has high vertical bluffs and upland hardwood forests, glades, two moderate springs, and five caves. Nearby areas are documented to have species of conservation concern, including birds and bats (McCarty et. al 2013).

2.2.1 Indiana Bats

Indiana bats (*Myotis sodalis*) have been listed as an endangered species since 1966, and continue to steeply decline within the Kentucky to Missouri portion of their range. Within the last 40 years, hibernacula population estimates have declined 84 percent in Missouri, from 400,000 in 1965, to 65,000 in 2005. Species population declines have been attributed to both habitat and contaminant sources and recent reports of white-nose fungus devastating hibernating bats in the eastern U.S. has further increased alarm among bat professionals. Indiana bats utilize karst regions for cave hibernating habitat, and depend on the connectivity and conservation of roosting habitat and foraging and migration corridors. Indiana bats favor maternity roosts in large trees, often dead or dying, with a high degree of solar exposure, and are known to forage in agricultural areas. Often, these roosts are found either adjacent to forest clearings or above canopy gaps (Dey, 2009). A preliminary desk-top survey of the area indicates that it does contain potentially suitable habitat for Indiana bats.

2.2.2 Northern Long-eared Bats

On October 2, 2013, the USFWS proposed the northern long-eared bat (NLEB, *Myotis septentrionalis*) for listing as endangered under the Endangered Species Act (ESA). Based on conversations with Ms. Trisha Crabill of the USFWS, the NLEB could potentially be listed as early as April 2015. The USFWS has prepared a guidance document to address the immediate information needs for Section 7 conferences and conservation planning for the NLEB should it be listed. This species has been found overwintering less than 3 miles from this site.

The 2007 Indiana Bat Draft Recovery Plan (USFWS, 2007) and the Range-Wide Indiana Bat Summer Survey Guidelines (USFWS, 2014) have compiled available information on known characteristics of summer, fall, and wintering life history needs, and described the guidelines for determining presence or presumed absence and for determining habitat use and roost tree characteristics. The guidance document for NLEB provides similar recommendations for surveys of this species. All activities described in this project have been approved by of the USFWS.

2.3 Project Investigators

The principal investigator is Dr. Lynn W. Robbins, professor in the Department of Biology at Missouri State University, Springfield, Missouri. Dr. Robbins has completed a study on the management of habitat relating to the presence of Indiana bats at Ozarks National Scenic Riverways (NPS), Dr. Robbins has been investigating Indiana bats since 2001, however his research includes all bat species in Missouri including evaluating the effects of dormant season fire on ground-dwelling bats on Missouri Department of Conservation lands. The principal investigator has completed studies in northern Missouri, and was successful in locating maternity colonies and radio-tracking Indiana bats, Northern Long-eared bats and other species to determine foraging patterns and habitat associations. He is familiar with U.S. Fish and Wildlife Service endangered species regulations, and with the communities and habitats of the Ozark region. He and his graduate students are currently working on White-Nose Syndrome related projects including analyses of acoustic data, band returns, and radio-telemetry to determine movements of Gray Bats from hibernacula to maternity sites. He currently holds all necessary federal and state permits. Dr. Robbins is a research associate with the Indiana State University Center for North American Bat Research and Conservation and Research Coordinator for Springfield's Dickerson Park Zoo. Ms. Cheyenne Gerdes and Mr. Ben Smith (both assisted with this scope of work) are graduate students at MSU and both have the qualifications to be included on Robbins' endangered species recovery permit issued by the USFWS.

3.0 SURVEY METHODOLOGY

3.1 Acoustic Surveys

Detectors were set prior to sunset and bat calls were recorded from approximately 1 hour before sunset (20:00 hours) until the next morning (06:00 hours). Each detector was placed on a stand approximately 2 feet off the ground with a cone funnel aimed upward at 45 degrees (See Photos 4 and 5). The sensitivity of each device was site specific, based on the amount of ambient noise, and ranged from about 5 to 7. Division ratio was set to 16.

All Anabat detectors were equipped with a two or four gigabyte compound flash (CF) card for storing recorded calls. All detector data were downloaded from CF cards following each detector night. Call data was converted into individual time stamped call files using CFread software (Titley Scientific, Ballina, New South Wales, Australia). Call sequences were identified to species level by comparing call structure to known calls using Bat Call Identification (BCID) software (Allen et al., 2008) and Kaleidoscope Pro (Wildlife Acoustics, Inc.) Calls identified by BCID required a minimum of five consecutive identifiable pulses, while calls identified by Kaleidoscope had a minimum of two consecutive pulses.

3.2 Mist-netting Surveys

A minimum of two mist-nets were established per site, though some locations had an additional net established when locations were available (See Photos 1 thru 3). Net locations included ponds and suspected flyways with canopy cover, as these placements are known for successful sites (Carroll et al 2002). Mist-nets were set during the day and opened approximately 30 minutes before sunset each night. Nets remained open a minimum of five hours, from approximately 20:30 hours until 01:30 hours. Researchers remained within 5 minutes of the mist-nets and constantly monitored them. Each net was checked for captured animals at approximately 10 minute intervals, and any captured bats were immediately removed for measurement. Bats were transported to processing tables in cloth bat bags to reduce the stress of paper bag transport. All bats were released at the capture site immediately after handling. The location of capture, net of capture, and time of capture were recorded for each bat. Recorded biometric data included species, sex, age, reproductive status, mass, forearm length, and White-nose wing damage score 0 to 3. White-nose syndrome disinfection protocols were followed in accordance with the USFWS National Decontamination Protocol (USFWS, 2012). All captured individuals in the genus Myotis were banded with 2.6mm aluminum clamp “BRR” forearm bands.

3.3 Radio Telemetry

All reproductive Indiana and northern long-eared bats were radio tagged with Holohil 0.31 gram radio transmitters, attached with the recommended Perma-Type brand surgical glue (Carter et al 2009). Transmitters are activated by soldering two small wires on the transmitter together, starting the battery. A small amount of hair is clipped from the individual’s intrascapular region, and surgical glue is used to secure the transmitter to the skin. The transmitter can last up to 21 days, and the glue typically lasts no more than 17 days (Holohil 2011, Carter et al 2009).

4.0 RESULTS

4.1 Survey Effort

Five sites within the Camp Zoe project area were surveyed with mist-nets and ultrasonic bat detectors during two non-sequential net nights (Figure 2). One net night is defined as one net used in a location for one night, while one detector night is one detector in a location for one night. Total effort for this project was 24 net nights at 5 sites and 12 detector nights (Table 4.1, Table 4.2). Detectors were also established along a proposed transmission corridor to the project area, totaling 4 detector nights (Table 4.2). Two bats were radio-tracked -- a pregnant northern long-eared bat and a male Indiana bat.

Table 4.1 - Summary of mist-net effort at Camp Zoe

Site	Net Size	Date
1	2x12	May 24, May 27
1	2x9	May 24, May 27
1	2x6	May 24, May 27
2	3x12	May 25, May 28
2	3x9	May 25, May 28
3	2x4	May 25, May 28
3	2x6	May 25, May 28
4	1x4	May 26, May 29
4	1x4	May 26, May 29
4	2x9	May 26, May 29
5	2x4	May 26, May 29
5	3x6	May 26, May 29

Table 4.2 - Summary of bat detector effort at Camp Zoe and proposed corridor

Detectors/night	Size	Detector Type	Date
2	Zoe 1	Anabat	24 May, 27 May
1	Zoe 2	Anabat	25 May, 28 May
1	Zoe 3	Anabat	25 May, 28 May
1	Zoe 4	Anabat	26 May, 29 May
1	Zoe 5	Anabat	26 May, 29 May
1	Corridor 1	Anabat	30-May
1	Corridor 2	Anabat	30-May
1	Corridor 3	Anabat	30-May
1	Corridor 4	SM2	30-May

4.2 Acoustic Detection

All echolocation calls were captured using Anabat SD2 detectors and evaluated using both Kaleidoscope and BCID call identification software. All calls identified as either Indiana bats or northern long-eared bats were visually identified or hand vetted. A total of 10 species were classified by the two software packages used (*Eptesicus fuscus, Nycticeius humeralis, Lasionycteris noctivagans, Lasiurus borealis, Lasiurus cinereus, Myotis grisescens, Myotis sodalis, Myotis septentrionalis, Myotis leibii, Myotis lucifugus, and Perimyotis subflavus*; Table 4.3). BCID classified a total of 3,016 bat passes while Kaleidoscope classified a total of 3,321. Of the 24 passes classified as Indiana bats and 9 passes classified as northern long-eared bats by BCID, 2 Indiana and 5 northern long-eared bat passes were visually confirmed (Table 4.4). The one call classified as an Indiana bat by Kaleidoscope was visually confirmed, and an additional call originally classified as a northern long-eared bat determined to be an Indiana bat call. Of 19 calls classified as northern long-eared bats by Kaleidoscope, 4 were visually confirmed (Table 4.4).

Table 4.3 - Results of BCID and Kaleidoscope analysis of recorded bat calls at Camp Zoe

Species	Site 1		Site 2		Site 3		Site 4		Site 5	
	BCID	Kscope	BCID	Kscope	BCID	Kscope	BCID	Kscope	BCID	Kscope
EPFU	58	58	42	37	18	17	17	13	4	6
NYHU	71	30	45	78	8	21	29	17	33	76
LANO	27	46	13	25	2	3	5	6	0	0
LABO	36	111	147	108	19	8	115	121	113	72
LACI	0	0	0	6	1	3	0	4	0	0
MYGR	605	869	277	377	207	258	214	276	162	237
MYSO	7	0	8	0	4	0	4	0	1	1
MYSE	1	2	3	5	2	6	1	3	2	3
MYLE	1	5	0	0	0	1	3	1	0	0
MYLU	21	3	31	4	13	0	18	0	38	1
PESU	343	201	91	47	156	152	50	25	50	15
Total	**1170**	**1325**	**657**	**650**	**430**	**469**	**456**	**466**	**403**	**411**

Table 4.4 - Visually confirmed identifications of Indiana and northern long-eared bat calls at Camp Zoe

Visually Confirmed Calls for Files Identified as Target Species				
	Indiana bat		Northern Long-eared bat	
	BCID	Kaleidoscope	BCID	Kaleidoscope
Site 1	0	0	0	1
Site 2	1	1	2	1
Site 3	0	0	1	3
Site 4	1	1	1	1
Site 5	0	0	1	2

Calls obtained along the utility corridor were more difficult to identify via visual analysis due to the heavy clutter in the area. Those that were visually ambiguous or unidentifiable were labeled as unidentified/no ID. Due to the cluttered nature of the environment along the utility corridor, we do not believe it is sufficient to only use the call data collected there to decide species presence. Capture data from nearby sites (Camp Zoe) should also be taken into consideration. The corridor sites had 898 passes analyzed by BCID and 697 passes analyzed by Kaleidoscope. The same species classified at Camp Zoe were classified on the utility corridor with the exception of the hoary bat (*Lasiurus cinereus*; Table 4.5). Of the 28 northern long-eared bat and 25 Indiana bat passes classified by either program, 1 Indiana bat pass was hand confirmed from BCID and none from Kaleidoscope, while 5 northern long-eared bat passes were hand confirmed by BCID and 8 from Kaleidoscope (Table 4.6).

Table 4.5 - Results of BCID and Kaleidoscope analysis of recorded bat calls at proposed utility corridor

Species	Site 1		Site 2		Site 3		Site 4	
	BCID	Kscope	BCID	Kscope	BCID	Kscope	BCID	Kscope
EPFU	2	5	3	5	3	3	1	2
NYHU	3	5	4	6	3	2	7	6
LANO	4	1	1	0	0	0	6	6
LABO	4	20	6	31	8	22	1	8
LACI	0	0	0	0	0	0	0	0
MYGR	102	70	216	145	229	197	25	35
MYSO	6	0	9	0	6	0	0	0
MYSE	0	0	0	2	3	2	0	0
MYLE	1	0	1	0	0	0	0	0
MYLU	6	10	13	27	13	20	0	1
PESU	28	8	49	30	18	10	17	18
Total	**156**	**119**	**302**	**246**	**283**	**256**	**57**	**76**

Table 4.6 - Visually confirmed identifications of Indiana and northern long-eared bat calls at the proposed utility corridor

Visually Confirmed Calls for Files Identified as Target Species				
	Indiana bat		Northern Long-eared bat	
	BCID	Kaleidoscope	BCID	Kaleidoscope
Site 1	0	0	0	0
Site 2	0	0	1	2
Site 3	1	0	3	2
Site 4	0	0	0	0

4.3 Net Captures

A total of 84 bats were captured during the 24 nets nights of this survey. These captures included 4 tri-colored bats (PESU), 8 big brown bats (EPFU), 53 gray bats (MYGR), 11 red bats (LABO), 2 evening bats (NYHU), 5 northern long-eared bats (MYSE), and one Indiana bat (MYSO) (Table 4.7). Reproductive status of four captured reproductive females is indicated in Table 4.8. The locations of captured northern long-eared bats and Indiana bats are shown in Figures 3 and 4, respectively.

Table 4.7 - Summary of mist-net captures at Camp Zoe

Site	PESU	EPFU	MYGR	LABO	NYHU	MYSE	MYSO	Total
1	3	5	6	1	1	1	0	17
2	1	2	17	3	0	2	0	25
3	0	0	4	1	0	0	0	5
4	0	1	9	4	1	2	1	18
5	0	0	17	2	0	0	0	19
Total	4	8	53	11	2	5	1	84

Table 4.8 - Reproductive individuals captured

Species	Site #	Reproduction
PESU	1	Pregnant
LABO	3	Pregnant
MYSE	2	Pregnant
LABO	5	Pregnant

4.4 Radio Telemetry

One pregnant northern Long-eared Bat (MYSE) was captured and subsequently radio-tagged (See Photo 6). This individual was tracked for 5 days, leading to the discovery of 3 roosts (Table 4.9). Of these 3 roosts, 2 were considered maternity colonies. All recorded roosts were located off of the proposed project area in the adjacent forest (Figure 2). Five total exit counts were performed on the three roost trees (Table 4.10, Photos 7 to 12). The two documented maternity colonies were both significant colonies for this species as both trees contained over ten bats. Tracking was stopped on the fifth day when it was suspected that the transmitter had fallen from the bat, as the signal was still strong but no bats were emerging from the roost tree. The minimum convex polygon bounding this bat's known home range is shown in Figure 5.

Table 4.9 - Recorded northern long-eared bat roost trees

Bat	Roost	Zone	UTM X	UTM Y	Live/Dead	Species	Height	%Bark
MYSE 1	1	15	0641743	4130036	Live	Ash	21 m	100
MYSE 1	2	15	0641876	4129655	Dead	Oak	6 m	45
MYSE 1	3	15	0641932	4129767	Dead	Oak	14 m	80

Table 4.10 - Emergence count data for northern long-eared bat roost trees

Bat	Roost	Start	First Bat	Tagged Bat	Last Bat	Total	End
MYSE 1	1	7:15	no bats sighted	8:48 signal left area	no bats sighted	0	9:00
MYSE 1	2	7:25	8:25	8:26	8:36	15	8:50
MYSE 1	2	7:46	8:33	8:35	8:36	11	8:50
MYSE 1	3	7:52	8:09	bat did not emerge	8:20	23	8:52
MYSE 1	3	7:52	no bats sighted	bat did not emerge	no bats sighted	0	9:00

One male Indiana bat was captured and radio-tagged; however, this individual was not relocated on or near the project area (See Photo 13). It is possible that the individual roosted in a cave, preventing successful tracking.

5.0 DISCUSSION

Northern long-eared bats of both sexes were captured on the area, and the species was identified on acoustic recordings. A single male Indiana bat was captured, and acoustic recordings also confirm Indiana Bat presence. Due to the location of nearby hibernacula, it is likely that male Indiana bats are utilizing the area for summer foraging and possible roosting both in trees and cave sites. A pregnant female northern long-eared bat was captured and tracked, allowing for the location of three roost trees, two of which were maternity colonies. However, all of these trees were located outside of the Camp Zoe boundaries. Male gray bats (*Myotis grisescens*) were captured in abundance on the area, likely due to the nearby "Bat Cave Shannon" which is located at Current River State Park. This cave is a known gray bat hibernacula and contains a possible summer bachelor colony.

Acoustic studies on the area will be ongoing, as per a contract with the Missouri Department of Natural Resources. This will allow for comparison of species assemblage pre- and post-construction on the project area.

6.0 LIMITATIONS

This report has been prepared for the exclusive use of Farnsworth Group, the State of Missouri, and the USFWS. SCI is not responsible for independent conclusions or recommendations made by others. Furthermore, written consent must be provided by SCI should anyone other than our client or the aforementioned agencies wish to excerpt, or rely on the contents of this report. The findings of this report are valid as of the present date of the delineation. SCI is not responsible for surveys, calculations, or plans that were prepared by others.

Additionally, the intent of our services was to characterize the existing site conditions and determine the presence or probable absence of the federally endangered Indiana bat (*Myotis sodalis*) as well as the proposed endangered northern long-eared bat (*Myotis septentrionalis*). Based on our discussion with the USFWS, an assessment of impacts to the NLEB or its critical habitat will occur as part of the initial consultation process. Additional information will need to be provided to the USFWS should significant modifications to the site plan occur after the USFWS completes their review of the project. Survey methods were conducted in accordance with the January 2013 USFWS's Draft Revised Rangewide Indiana Bat Summer Survey Guidelines and in accordance with local practices accepted by the Columbia, Missouri Sub-Office of the USFWS. Please keep in mind the USFWS has the sole authority to regulate any action which may affect a listed endangered or threatened species.

7.0 LITERATURE CITED

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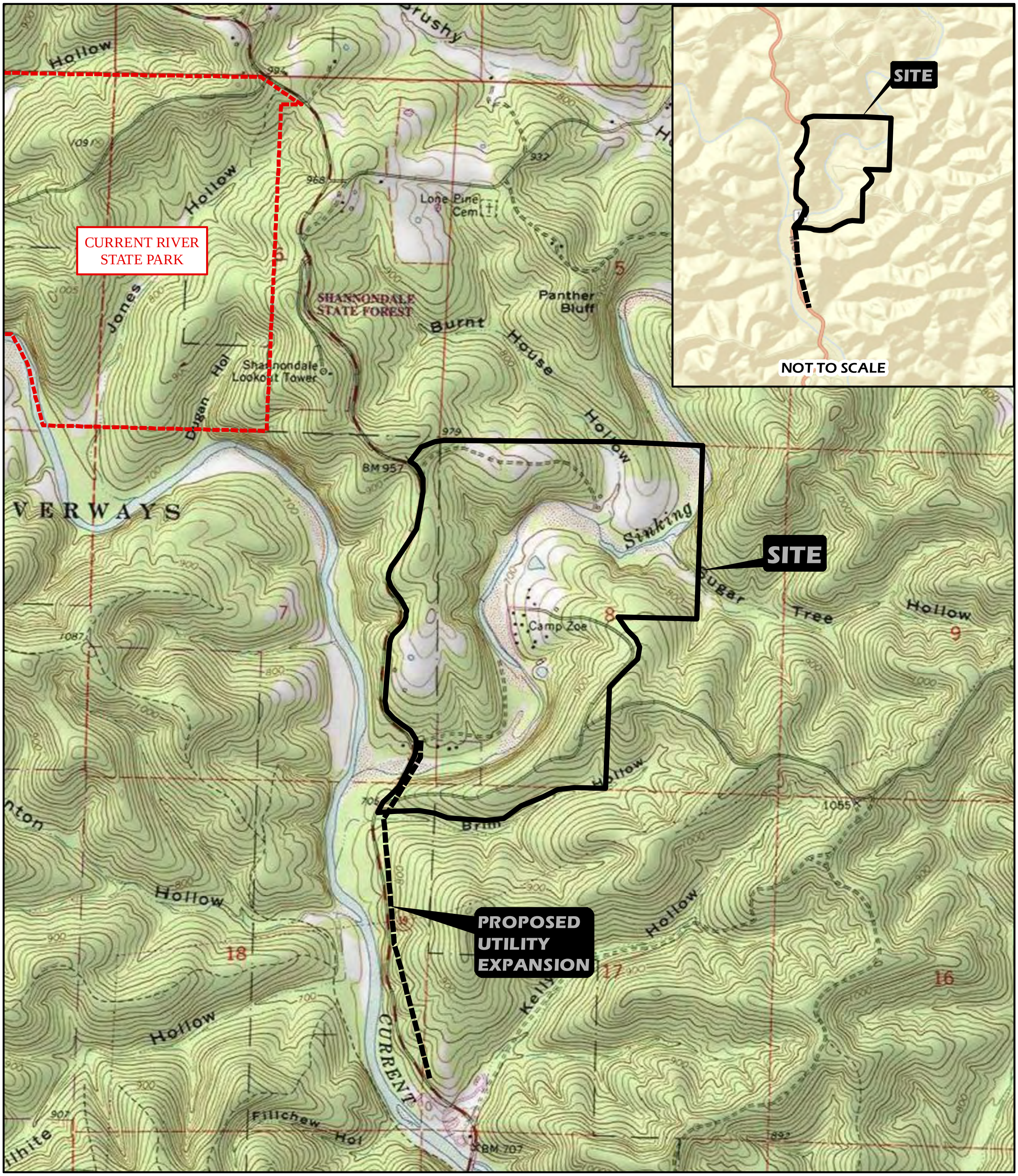


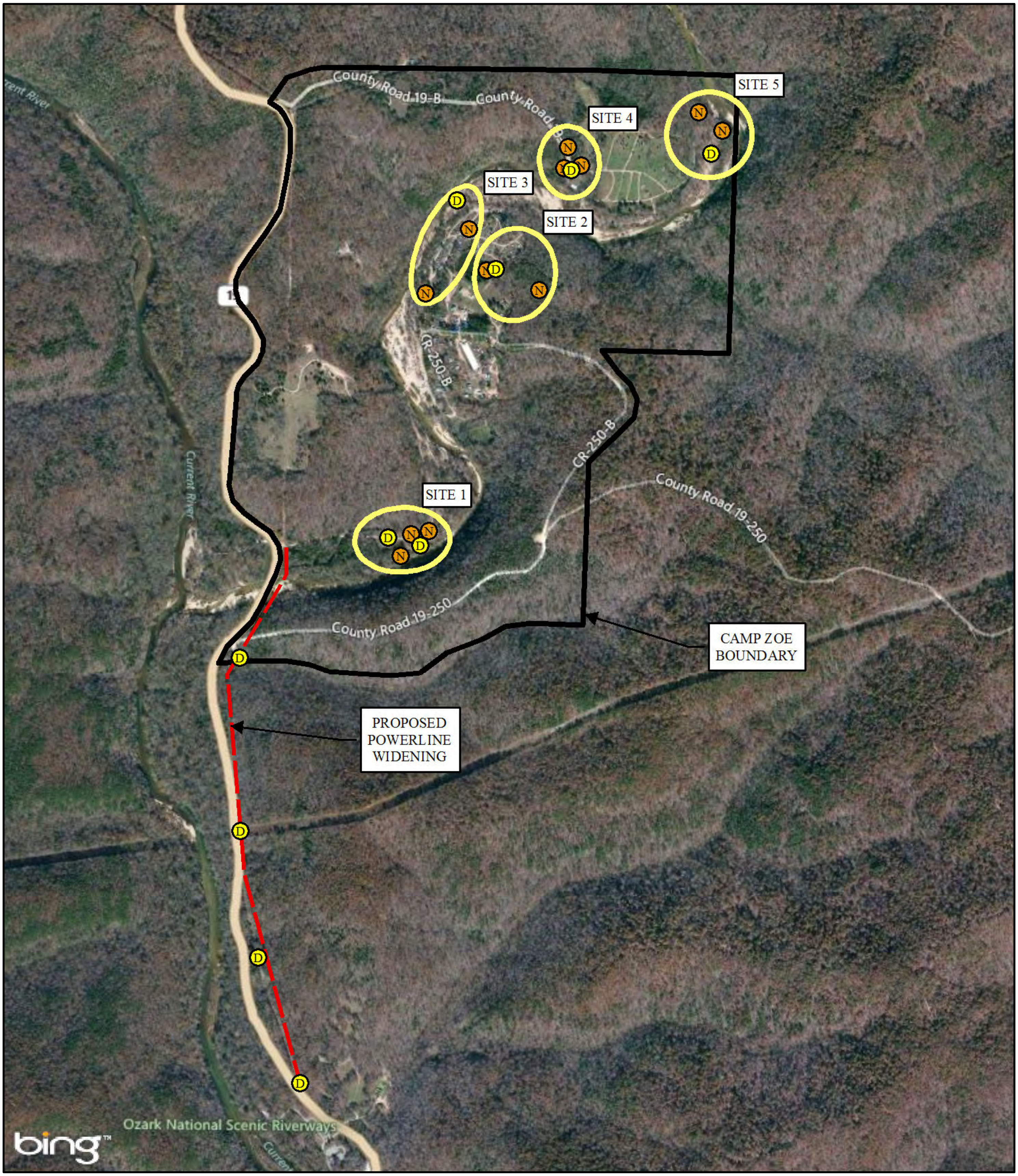
PROJECT NAME
X1414-04 CAMP ZOE
SHANNON COUNTY, MISSOURI

VICINITY AND TOPOGRAPHIC MAP

DRAWN BY	RCV	DATE	JOB NUMBER
CHECKED BY	SDH	07/2014	2014-7007.30

GENERAL NOTES/LEGEND
USGS TOPOGRAPHIC MAP
ROUND SPRING, MISSOURI QUADRANGLE
DATED 1982
PHOTO REVISED 1985
20' CONTOURS

SCALE 1" = 2,000'
FIGURE 1



PROJECT NAME
X1414-04 CAMP ZOE
SHANNON COUNTY, MISSOURI

AERIAL PHOTOGRAPH -
DEVICE LOCATIONS

DRAWN BY	RCV	DATE	JOB NUMBER
CHECKED BY	SDH	07/2014	2014-7007.30

GENERAL NOTES/LEGEND

N MIST NET LOCATIONS

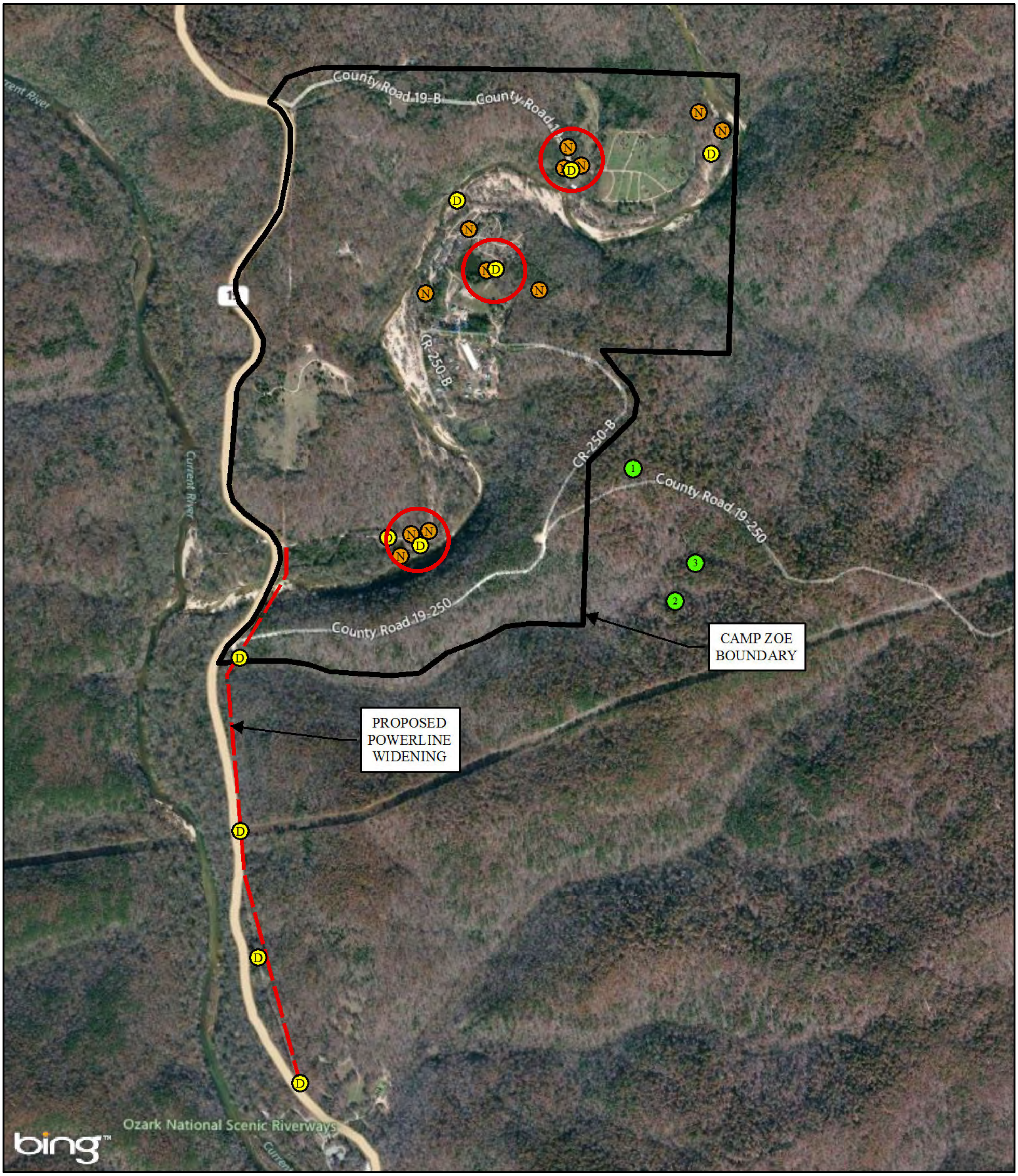
D ACOUSTIC DETECTOR LOCATIONS

AERIAL PHOTOGRAPH OBTAINED FROM BING MAPS VIA ARCGIS ONLINE.

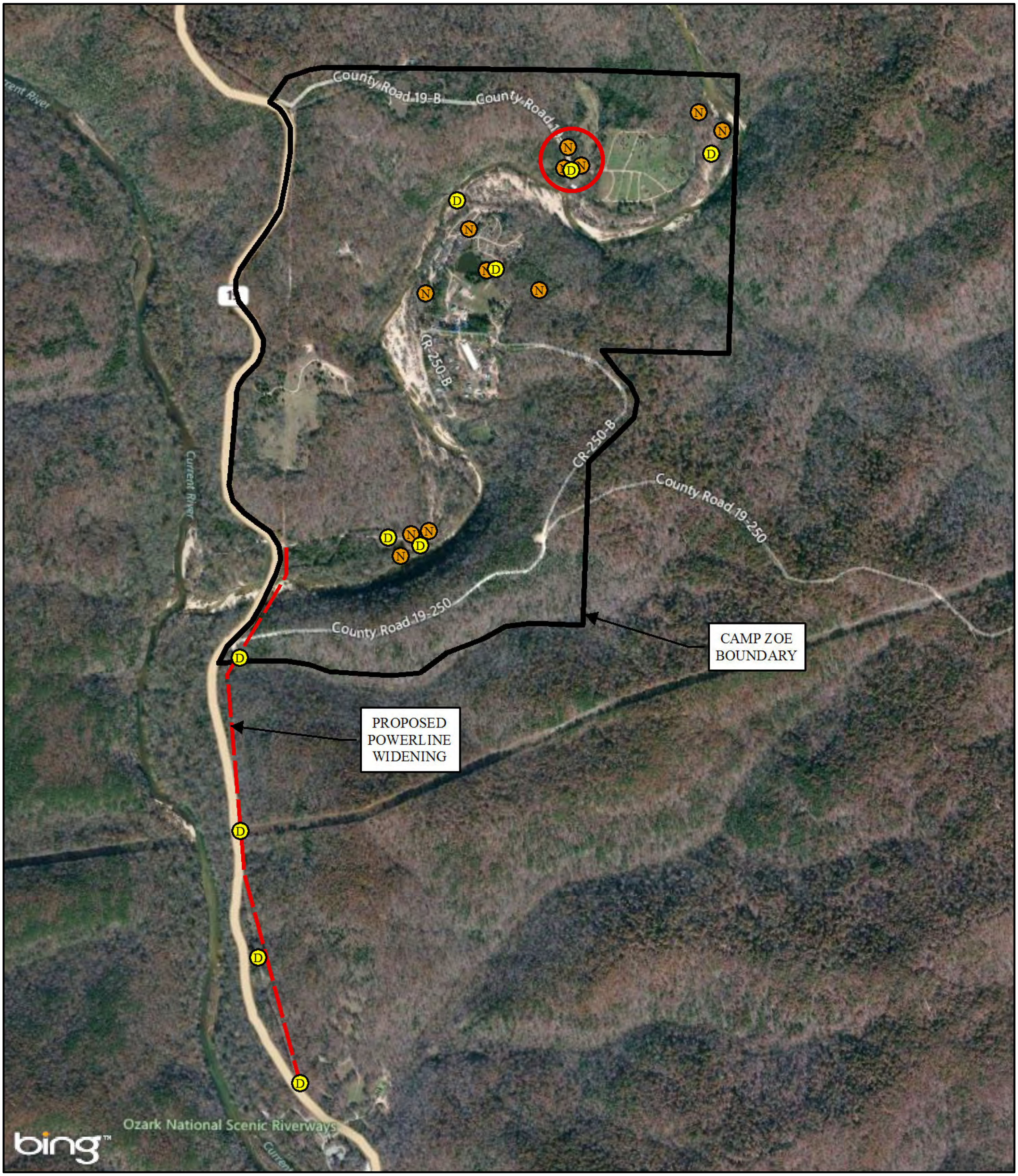
N W E S

SCALE 1" = 1000'

FIGURE 2



PROJECT NAME		GENERAL NOTES/LEGEND	
X1414-04 CAMP ZOE SHANNON COUNTY, MISSOURI		N MIST NET LOCATIONS D ACOUSTIC DETECTOR LOCATIONS # MYSE 1 ROOST TREES AREAS WITH MYSE PRESENCE	
AERIAL PHOTOGRAPH - MYSE PRESENCE			SCALE 1" = 1000'
DRAWN BY RCV	DATE / JOB NUMBER		FIGURE
CHECKED BY SDH	07/2014 / 2014-7007.30	AERIAL PHOTOGRAPH OBTAINED FROM BING MAPS VIA ARCGIS ONLINE.	3



PROJECT NAME

X1414-04 CAMP ZOE
SHANNON COUNTY, MISSOURI

AERIAL PHOTOGRAPH -
MYSO PRESENCE

DRAWN BY	RCV	DATE	JOB NUMBER
CHECKED BY	JCM	07/2014	2014-7007.30

GENERAL NOTES/LEGEND

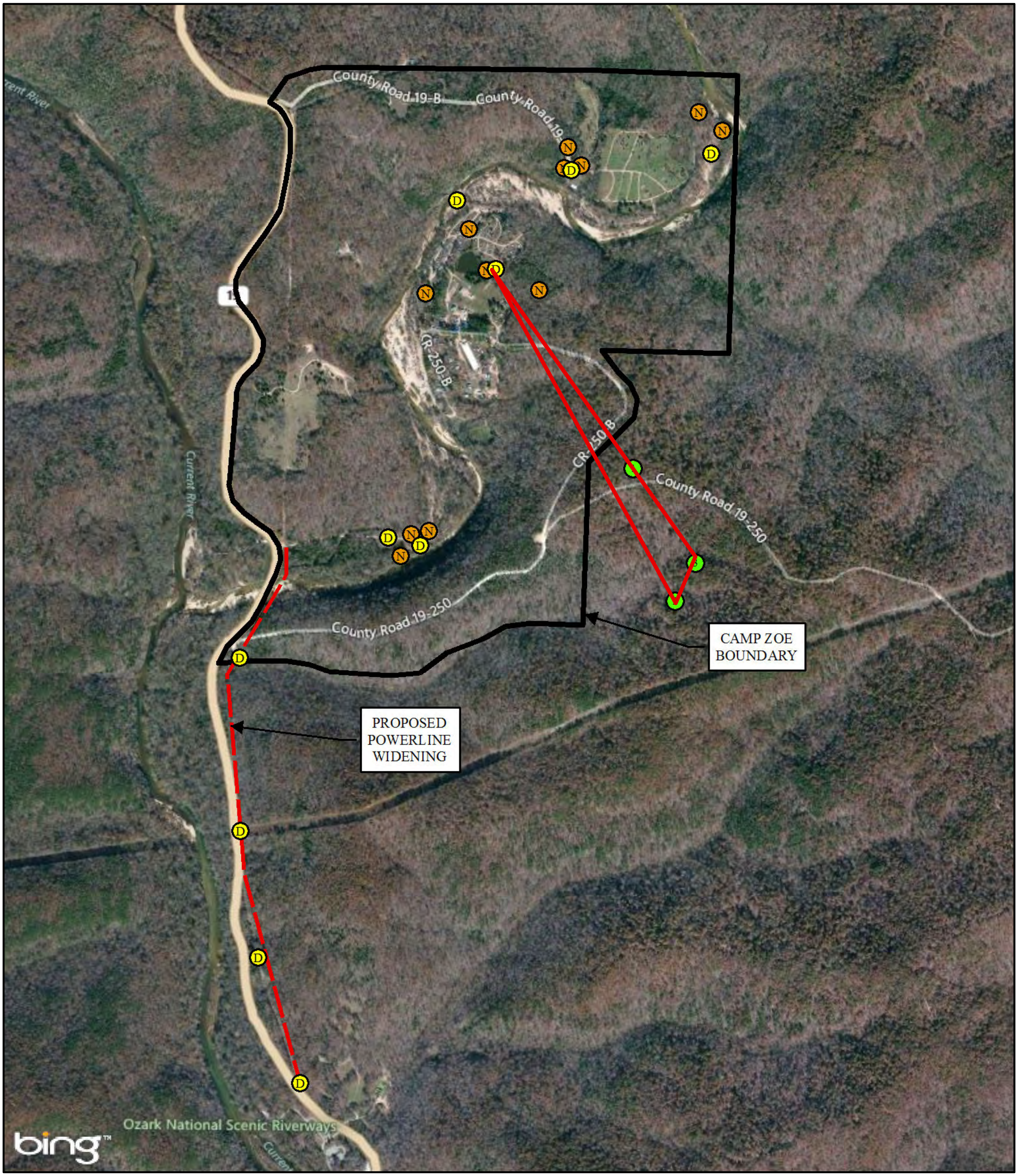
- N MIST NET LOCATIONS
- D ACOUSTIC DETECTOR LOCATIONS
- AREAS WITH MYSO PRESENCE

AERIAL PHOTOGRAPH OBTAINED FROM BING MAPS VIA ARCGIS ONLINE.

N W E S

SCALE 1" = 1000'

FIGURE 4



PROJECT NAME
X1414-04 CAMP ZOE
SHANNON COUNTY, MISSOURI

AERIAL PHOTOGRAPH -
MYSE RANGE

DRAWN BY	RCV	DATE	JOB NUMBER
CHECKED BY	JCM	07/2014	2014-7007.30

GENERAL NOTES/LEGEND
- N MIST NET LOCATIONS
- D ACOUSTIC DETECTOR LOCATIONS
- # MYSE 1 ROOST TREES
- MYSE HOME RANGE

AERIAL PHOTOGRAPH OBTAINED FROM BING MAPS VIA ARCGIS ONLINE.

N W E S

SCALE 1" = 1000'

FIGURE 5

Appendix A

Photo 1. Representative net sites.

Photo 2. Representative net sites.

Photo 3. Representative net sites.

Photo 4. Representative detector sites.

Photo 5. Representative detector sites.

Photo 6. MYSE 1, pregnant female northern long-eared bat.

Photo 7. MYSE 1, Roost 1. Live ash tree approximately 21 m high with 100% bark cover. Tree found in a stand of similar tall, live trees.

Photo 8. MYSE 1, Roost 1. Live ash tree approximately 21 m high with 100% bark cover. Tree found in a stand of similar tall, live trees.

Photo 9. MYSE 1, Roost 2. Oak snag approximately 6 meters high with 45% bark cover underneath 10% canopy cover. Tree was found among a stand of similar live oaks and oak snags

Photo 10. MYSE 1, Roost 2. Oak snag approximately 6 meters high with 45% bark cover underneath 10% canopy cover. Tree was found among a stand of similar live oaks and oak snags

Photo 11. MYSE 1, Roost 3. An oak snag approximately 14 meters high, with 80% bark cover underneath 35% canopy cover. Tree was found amidst a stand of similar live and dead oaks.

Photo 12. MYSE 1, Roost 3. An oak snag approximately 14 meters high, with 80% bark cover underneath 35% canopy cover. Tree was found amidst a stand of similar live and dead oaks.

Photo 13. MYSO 1, non-reproductive male Indiana bat.

SCI ENGINEERING, INC.
CONSULTANTS IN DEVELOPMENT, DESIGN AND CONSTRUCTION
GEOTECHNICAL
ENVIRONMENTAL
NATURAL RESOURCES
CULTURAL RESOURCES
CONSTRUCTION SERVICES

September 30, 2014

Mr. Robert Polk, PE, LEED AP
Farnsworth Group, Inc.
20 Allen Avenue, Suite 200
St. Louis, Missouri 63119

RE: Bat Habitat Assessment Summary
X1414-04 Camp Zoe
Shannon County, Missouri
SCI No. 2014-7007.31, Task 400

Dear Mr. Polk:

At the request of Farnsworth Group, Inc., SCI Engineering, Inc. (SCI) performed a bat roost habitat assessment at the above-referenced site. Our scope of work included performing a site reconnaissance to assess the suitability of roost habitat for the federally-endangered Indiana bat (*Myotis sodalis*) and the proposed-endangered northern long-eared bat (*Myotis septentrionalis*) within the project survey area. To facilitate the proposed redevelopment project at Camp Zoe, the State of Missouri desires to upgrade the existing utility infrastructure to a higher voltage 3-phase system. Approximately 700 linear feet (LF) of the Howard Electric Cooperative (HOEC) utility right-of-way is proposed to be widened from 30- to 60-feet wide. Additionally, approximately 5,900 LF of 3-phase service conductor is proposed to be placed underground.

The project survey area is located in the southwest corner of Camp Zoe, along the east side of State Route 19 in Shannon County, Missouri (Township 30 North, Range 4 West, Section 18). The habitat assessment survey area consists of two segments within the proposed utility corridor upgrade area. The first segment is located within the existing north-south overhead utility corridor which spans Sinking Creek. This area is approximately 700 feet long by 60 feet wide, with a proposed tree clearing area of approximately 0.3 acres. The second segment is located along an existing access road, just north of Sinking Creek. This area is approximately 2,000 feet long by 15 feet wide, with a proposed tree clearing area of approximately 0.7 acres. A copy of the *Vicinity and Topographic map* is enclosed as Figure 1.

On September 11, 2014, an SCI Natural Resource Scientist performed a field exploration of the project survey area for suitable Indiana bat and northern long-eared bat roost habitat. Some of the necessary characteristics include live or dead trees with shaggy or exfoliating bark and a typical diameter at breast height (DBH) of greater than 12 inches. The majority of the proposed power line corridor exists as forested areas with an existing power line right-of-way and gravel access road.

The purpose of our site walkover was to assess potential Indiana bat and northern long-eared bat summer habitat, as defined in the U.S. Fish and Wildlife Service (USFWS) Draft Revised Rangewide Indiana Bat Summer Survey Guidelines dated January 2013 (Draft Rangewide Guidelines). The *Indiana Bat Habitat*

1114 North Bishop, Rolla, Missouri 65401 ◆ phone 573-426-4901 ◆ fax 573-426-4853 ◆ www.sciengineering.com

Assessment Datasheets of the Draft Rangewide Guidelines, provided as Appendix A, were completed at representative locations within the survey area. The locations of these sample points can be found on the aerial photograph enclosed as Figure 2.

Sample Site 1 is located on the western bank of Sinking Creek, on the northern side of the proposed power line corridor. The site is mainly forested with dominant vegetation including: sugar maple (*Acer saccharum*), sycamore (*Platanus occidentalis*), and bur oak (*Quercus macrocarpa*) trees, with some understory vegetation such as tall goldenrod (*Solidago altissima*), riverbank rye (*Elymus riparius*), and tall fescue (*Festuca arundinacea*). Three standing dead sycamore snags with an average DBH of 10 inches were observed with small holes and good solar exposure present. The average DBH of remaining dominant trees was 4 to 8 inches, which likely decreases site suitability for Indiana and northern long-eared bats. However, due to the documented snags, the lack of midstory which impedes bat flight, and the close proximity to Sinking Creek, this area is moderately-suitable summer roost habitat for Indiana and northern long-eared bats.

Sample Site 2 is located along the middle of the power line right-of-way as it runs east to west along an existing gravel road. Sinking Creek is approximately 350 feet to the south of the sample site. The area is mainly forested with open areas associated with the gravel road. Dominant vegetation at the sample site included: bur oak (*Quercus macrocarpa*), black walnut (*Juglans nigra*), Eastern red cedar (*Juniperus virginiana*), and hackberry (*Celtis occidentalis*). Dominant trees have an average DBH of 4 to 6 inches, however no roost tree habitat characteristics such as exfoliating bark, holes, or crevices were observed. One bur oak tree with a DBH of 15 inches was present; however, it did not contain roost tree characteristics as listed above. Due to the overall small DBH of the dominant trees, this area is not likely considered suitable summer roost habitat for Indiana and northern long-eared bats.

Sample Site 3 is located on the western side of the proposed power line right-of-way where it runs east to west along an existing gravel road, with Sinking Creek 350 feet to the south. The area appeared to be mainly forested with the gravel access road to the south. Dominant vegetation within this sample site included: red oak (*Quercus rubra*), Eastern red cedar (*Juniperus virginiana*), and white ash (*Fraxinus americana*). The site was dominated by small trees with an average DBH of 4 to 8 inches and no exfoliating bark, cracks, or crevices were observed. As such, this area is not likely considered suitable summer roost habitat for Indiana and northern long-eared bats.

Sample Site 4 is located along the southwestern section of the project survey area, just north of Sinking Creek. The sample site appeared to be a mainly forested and adjacent to an existing power line right-of-way. Dominant trees at this site had an average DBH of 3 to 6 inches and consisted of box elder (*Acer negundo*), black walnut (*Juglans nigra*), honey locust (*Gleditsia triacanthos*), black cherry (*Prunus serotina*), sycamore (*Platanus occidentalis*), and gray dogwood (*Cornus racemosa*). One mature sycamore was present with a DBH of 10 inches, however, it lacked summer roost tree characteristics. No snags or trees with exfoliating bark were present in this area. Therefore this area is not likely considered suitable summer roost habitat for Indiana and northern long-eared bats.

Sample Site 5 is located south of Sinking Creek in the southern portion of the project survey area. The sample site appeared to be a mainly forested and adjacent to an existing power line right-of-way. Dominant trees at this site had an average DBH of 2 to 6 inches and consisted of white oak (*Quercus alba*), Eastern red cedar (*Juniperus virginiana*), red oak (*Quercus rubra*), sycamore (*Platanus occidentalis*), black walnut (*Juglans nigra*), chestnut oak (*Quercus prinus*). No snags or trees with exfoliating bark were present in this area. Therefore this area is not likely considered suitable summer roost habitat for Indiana and northern long-eared bats.

Based on our site reconnaissance, identification of potential roost trees and our previous mist-net and acoustic survey results, portions of the project area, specifically Sample Site 1, appear to contain suitable roost habitat for the Indiana or Northern long-eared bat. Although SCI is providing our professional opinion regarding what areas constitute suitable summer roost habitat for the Indiana and northern long-eared bats, the USFWS has the sole authority to determine which wooded areas are classified as suitable habitat. Additionally, the USFWS has the sole authority to regulate any action which may affect a listed endangered or threatened species.

If you have any questions regarding this summary letter or need additional information or assistance, please contact me at (636) 757-1017.

Respectfully,

SCI ENGINEERING, INC.

Rick J. Gundlach
Senior Staff Scientist

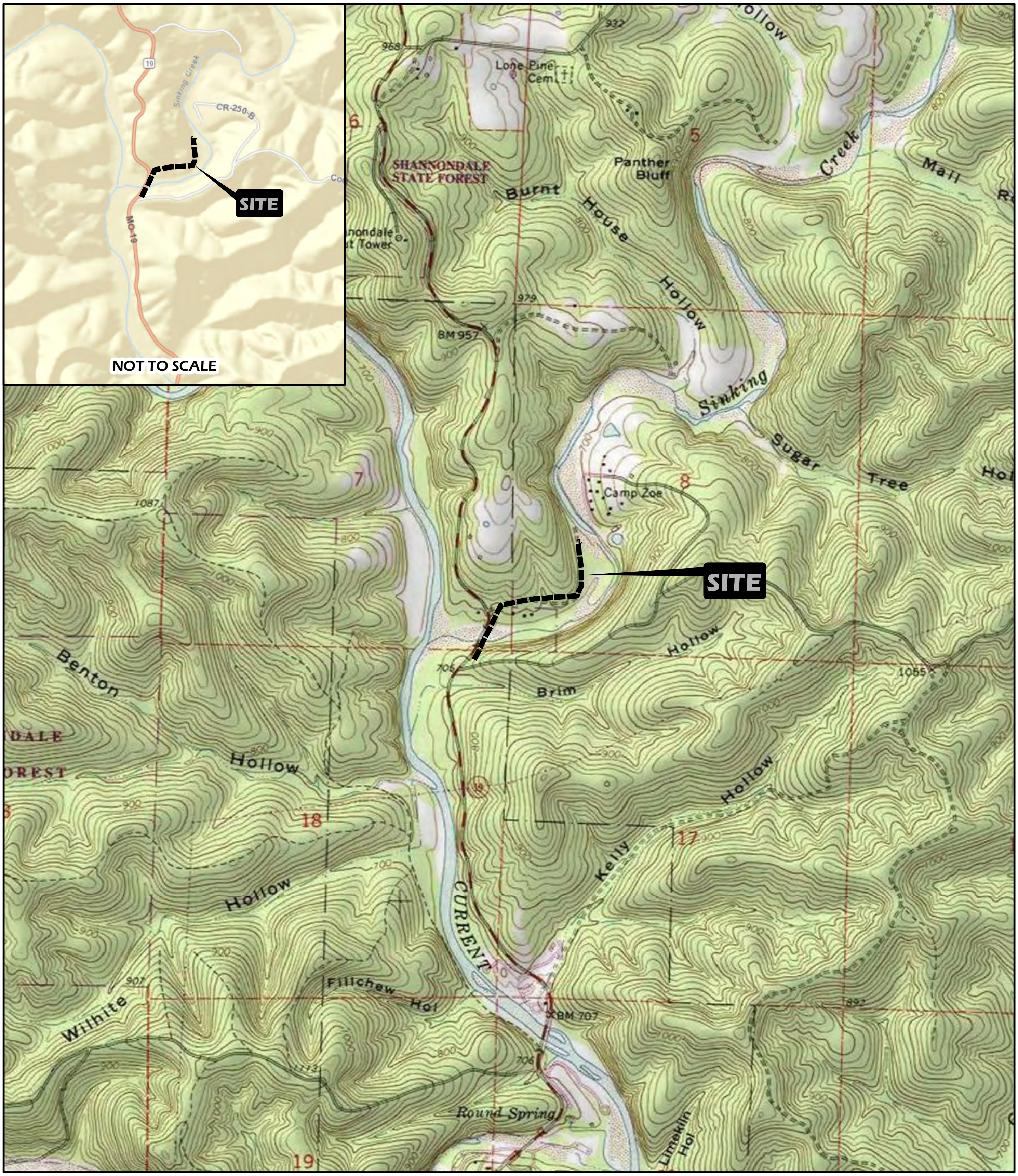
Scott D. Harding, CPSS/SC
Vice President

JCM/RJG/SDH/lf/tlw

Enclosures
- Figure 1 – Vicinity and Topographic Map
- Figure 2 – Aerial Photograph
- Photographic Summary
- Appendix A - Indiana Bat Habitat Assessment Datasheets

C: Ms. Trisha Crabill, U.S. Fish and Wildlife Service - Columbia Field Office
Dr. Lynn Robbins, Missouri State University

\\scieng\shared\StCharles\shared\1soils\1NEW\PROJECT FILES\Springfield\2014 Project Files\2014-7007 Camp Zoe Rehab\NR\31 (Utility ROW)\T&E\Task 400_ Bat Assessment\147007.31 T400 Habitat Assessment summary letter.doc



PROJECT NAME

X1414-04 CAMP ZOE HOEC UTILITY CORRIDOR
SHANNON COUNTY, MISSOURI

VICINITY AND TOPOGRAPHIC MAP

DRAWN BY	RCV	DATE	JOB NUMBER
CHECKED BY	RJG	09/2014	2014-7007.31

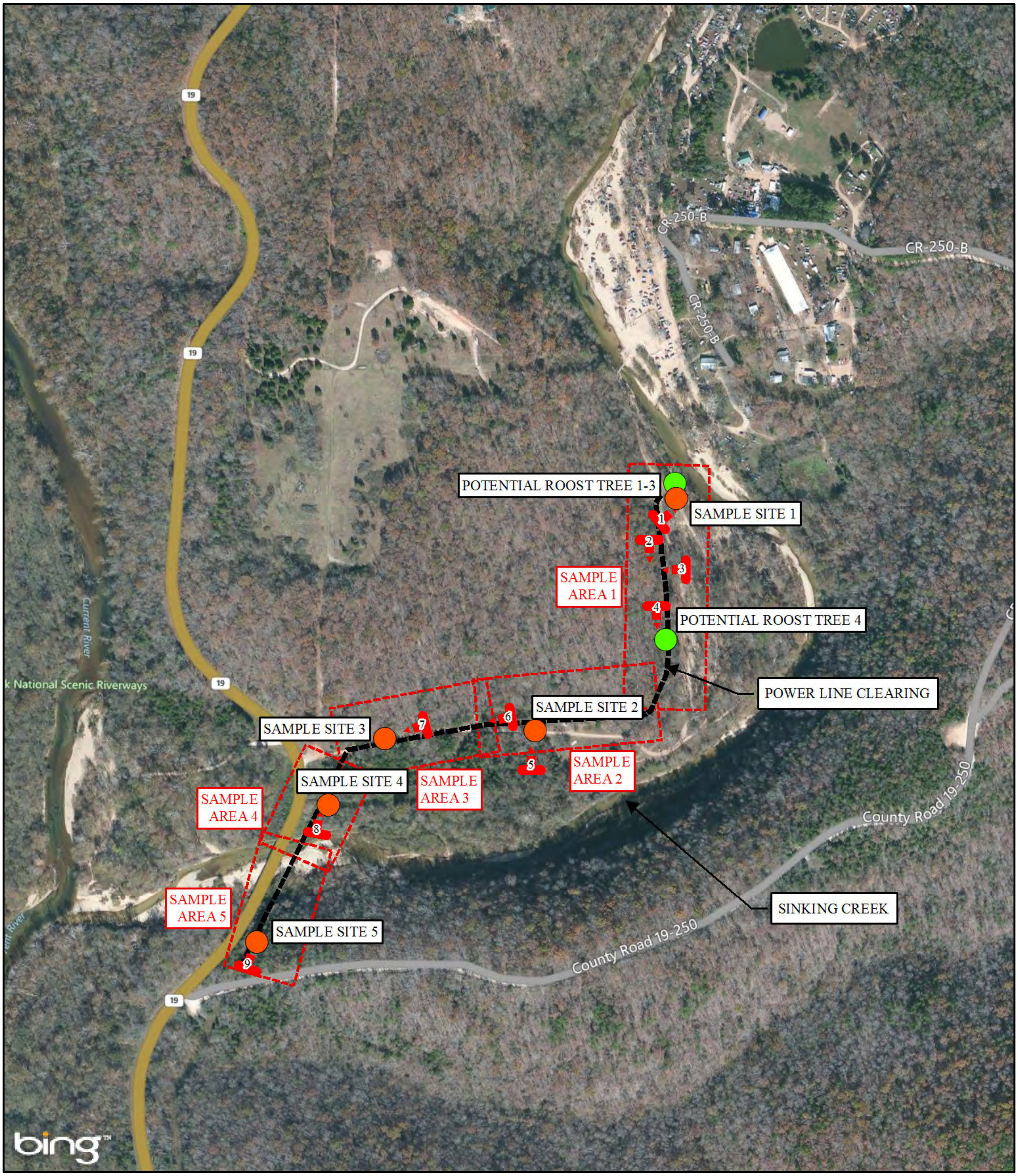
GENERAL NOTES/LEGEND

USGS TOPOGRAPHIC MAP
ROUND SPRING, MISSOURI QUADRANGLE
DATED 1982
PHOTO REVISED 1985
20' CONTOURS

N
W E
S

SCALE 1" = 2000'

FIGURE 1



PROJECT NAME			GENERAL NOTES/LEGEND	
X1414-04 CAMP ZOE HOEC UTILITY CORRIDOR SHANNON COUNTY, MISSOURI			INDICATES HABITAT ASSESSMENT SITES INDICATES POTENTIAL ROOST TREE LOCATIONS. INDICATES PHOTO DESIGNATION, ORIENTATION AND LOCATION INDICATES HABITAT ASSESSMENT AREAS	N W E S
BAT HABITAT ASSESSMENT & AERIAL PHOTOGRAPH				SCALE 1" = 500'
DRAWN BY RCV	DATE	JOB NUMBER	AERIAL PHOTOGRAPH OBTAINED FROM BING MAPS VIA ARCGIS ONLINE.	FIGURE 2
CHECKED BY RJG	09/2014	2014-7007.31		

Photo 1. Habitat Assessment Site 1 and Potential Roost Trees 1 to 3, facing northeast

Photo 2. Proposed utility corridor, facing south

Photo 3. Potential Roost Tree 4, facing west

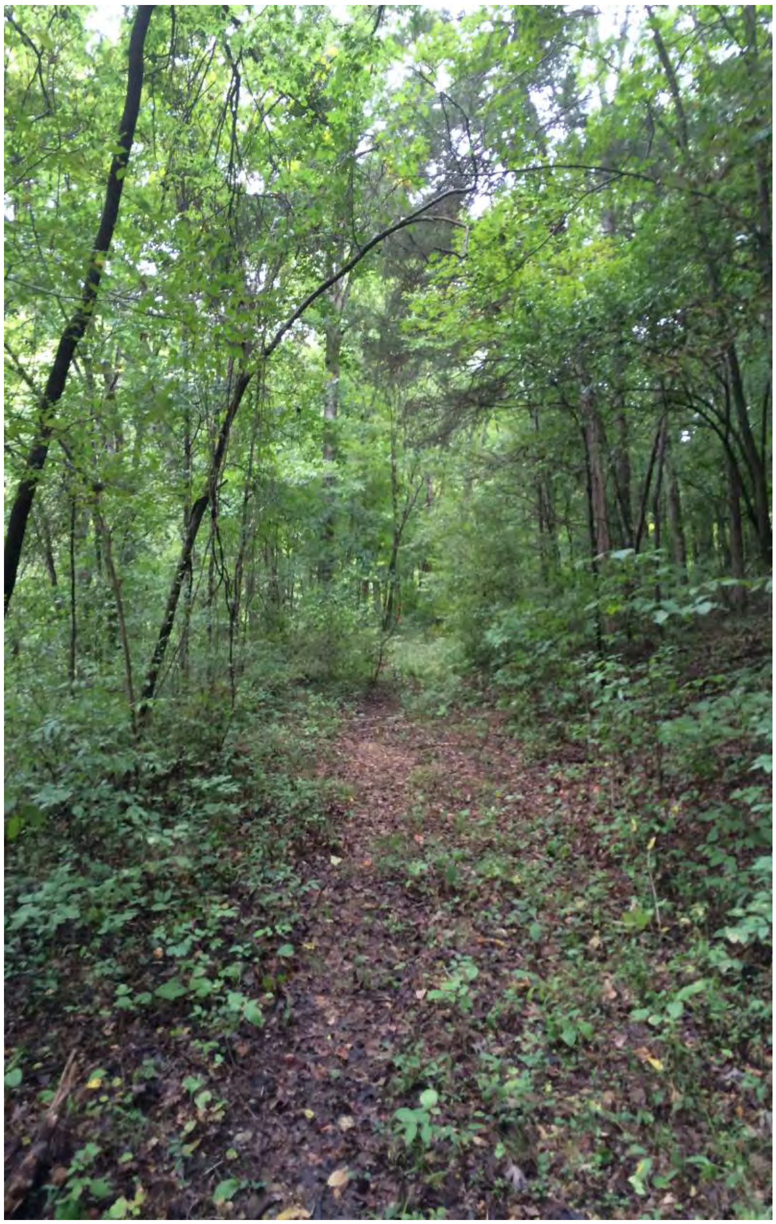


Photo 4. Proposed utility corridor, facing south

Photo 5. Habitat Assessment Site 2, facing north

Photo 6. Proposed utility corridor along gravel access road,
facing west

Photo 7. Habitat Assessment Site 3, facing west

Photo 8. Habitat Assessment Site 4, facing north

Photo 9. Habitat Assessment Site 5, facing north

Appendix A

PHASE 1 SUMMER HABITAT ASSESSMENTS

INDIANA BAT HABITAT ASSESSMENT DATASHEET

Project Name: X1414-04 Camp Zoe

Date: 9/17/14

Township/Range/Section: Township 30 North, Range 4 West, Section 18

Lat Long/UTM/ Zone: 37°18'10.61"N, 91°24'38.52"W

Surveyor: R. Gundlach (SCI)

Brief Project Description

To facilitate the proposed redevelopment project at Camp Zoe, the State of Missouri desires to upgrade the existing utility infrastructure to a higher voltage 3-phase system. Approximately 700 linear feet of Howard Electric Cooperative utility right-of-way is proposed to be widened from 30 to 60 feet wide. Additionally, approximately 5,900 LF of 3-phase service conductor is proposed to be placed underground.

Project Area

	Total Acres	Forest Acres	Open Acres
Project	1.0	0.8	0.2

	Completely cleared	Partially cleared (will leave trees)	Preserve acres- no clearing
Proposed Tree Removal (ac)	0.8 acres		

Vegetation Cover Types

Pre-Project	Post-Project
The forested areas within the project corridor consist of mixed oaks, white ash, sycamore, Eastern red cedar, black walnut, black cherry, and honey locust. A gravel road and existing power line right-of-way contain weedy vegetation such as amur honeysuckle.	The gravel road and existing power line right of way will be widened by 30 feet, therefore increasing that vegetation type and removing some forested areas.

Landscape within 5 mile radius

Flight corridors to other forested areas?

The surrounding area is forested, with open areas for streams and rivers. This provides a continuous flight corridor throughout the site and adjoining properties.

Describe Adjacent Properties (e.g. forested, grassland, commercial or residencial development, water sources)

The surrounding area is predominantly forested with multiple tributaries present, such as the Current River, Sinking Creek, and Brim Hollow. A State Park, private campground, and few residences are among the closest properties to the site.

Proximity to Public Land

What is the distance (mi.) from the project area to forested public lands (e.g., national or state forests, national or state parks, conservation areas, wildlife management areas)?

The project area is within a proposed State Park, and Current River State Park is directly to the west of the project site. The National Park Service and Missouri Department of Conservation own land easements directly to the west of the project site along the Current River.

APPENDIX A
PHASE 1 SUMMER HABITAT ASSESSMENTS

<u>Use additional sheets to assess discrete habitat types at multiple sites in a project area</u>

Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area

A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): 1

The sample site is adjacent to Sinking Creek, on the northeast side of the proposed right-of-way.

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources:
			Sinking Creek	Adjacent to north bank of Sinking Creek, a perennial tributary to the Current River.
Pools/Ponds (# and size)	None	Open and accessible to bats?		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	None	None		

Forest Resources at Sample Site

Closure/Density	Canopy (> 50 ')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60%, 5=61-80%, 6=81=100%
	1	1	1	
Dominant Species of Mature Trees	Sugar maple (Acer saccharum), Sycamore (Platanus occidentalis), Bur oak (Quercus macrocarpa)			
% Trees w/ Exfoliating Bark	1%			
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	25	70	5	
No. of Suitable Snags	3			

Standing dead trees with exfoliating bark, cracks, crevices, or hollows. Snags without these characteristics are not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? Yes

Additional Comments:

3 standing dead snags of Sycamore (8", 10", and 12" DBH) with small holes and good solar exposure. Understory for this site includes tall goldenrod (Solidago altissima), riverbank rye (Elymus riparius), and Festuca arundinacea.

The 3 snags were documented in the GPS and marked with orange spray paint.

Attach aerial photo of project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

APPENDIX A
PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area

Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area

A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): 2

North site of existing gravel road, where potential clearing could occur.

Water Resources at Sample Site				
Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources:
	N/A	N/A	N/A	Sinking Creek approximately 350 feet to the south.
Pools/Ponds (# and size)	N/A	Open and accessible to bats?		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site				
Closure/Density	Canopy (> 50 ')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60%, 5=61-80%, 6=81=100%
	2	5	6	
Dominant Species of Mature Trees	Bur oak (Quercus macrocarpa)			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	95		5	
No. of Suitable Snags	0			

Standing dead trees with exfoliating bark, cracks, crevices, or hollows. Snags without these characteristics are not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? Low suitability

Additional Comments:

Dominant tree species of sample site 2 included bur oak (Quercus macrocarpa), black walnut (Juglans nigra), Eastern red cedar (Juniperus virginiana), and hackberry (Celtis occidentalis). Dominant trees have an average DBH of 4-15 inches, however no habitat characteristics such exfoliating bark, holes, or crevices are present.

Attach aerial photo of project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

APPENDIX A
PHASE 1 SUMMER HABITAT ASSESSMENTS

<u>**Use additional sheets to assess discrete habitat types at multiple sites in a project area**</u>

Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area

A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): 3

Site is north of gravel access road

Water Resources at Sample Site

Stream Type (# and length)	Ephemeral: N/A	Intermittent: N/A	Perennial: N/A	Describe existing condition of water sources: Sinking Creek approximately 350 feet to the south.
Pools/Ponds (# and size)	N/A	Open and accessible to bats? N/A		
Wetlands (approx. ac.)	Permanent: N/A	Seasonal: N/A		

Forest Resources at Sample Site

Closure/Density	Canopy (> 50 ')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60%, 5=61-80%, 6=81=100%
	6	2	2	
Dominant Species of Mature Trees				
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	95	9	0	
No. of Suitable Snags	0			

Standing dead trees with exfoliating bark, cracks, crevices, or hollows. Snags without these characteristics are not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? low suitability

Additional Comments:

No mature trees were present, but dominant species included red oak (Quercus rubra), Eastern red cedar (Juniperus virginiana), and white ash (Fraxinus americana). Dominant trees had an average DBH of 4-8 inches, but no habitat characteristics such as holes, crevices, or exfoliating bark were present.

Attach aerial photo of project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

APPENDIX A
PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area

Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area

A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): 4

Site is within forested area adjacent to existing powerline ROW on north side of Sinking Creek.

Water Resources at Sample Site				
Stream Type (# and length)	Ephemeral	Intermittent	Perennial	Describe existing condition of water sources:
	N/A	N/A	1	Sinking Creek is <100 feet to the south
Pools/Ponds (# and size)	N/A	Open and accessible to bats?		
		N/A		
Wetlands (approx. ac.)	Permanent	Seasonal		
	N/A	N/A		

Forest Resources at Sample Site				
Closure/Density	Canopy (> 50 ')	Midstory (20-50')	Understory (<20')	1=1-10%, 2=11-20%, 3=21-40%, 4=41-60%, 5=61-80%, 6=81=100%
	1	6	6	
Dominant Species of Mature Trees	sycamore (Platanus occidentalis)			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	97	2	1	
No. of Suitable Snags	0			

Standing dead trees with exfoliating bark, cracks, crevices, or hollows. Snags without these characteristics are not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? low suitability

Additional Comments:

Dominant trees include box elder (Acer negundo), black walnut (Juglans nigra), honey locust (Gleditsia triacanthos), black cherry (Prunus serotina), sycamore (Platanus occidentalis), and Cornus spp. The dominant trees have an average DBH of 3-6 inches, with one sycamore having a 10 inch DBH. No habitat characteristics present at this site, and it is adjacent to ??? ROW.

Attach aerial photo of project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

APPENDIX A
PHASE 1 SUMMER HABITAT ASSESSMENTS

Use additional sheets to assess discrete habitat types at multiple sites in a project area

Include a map depicting locations of sample sites if assessing discrete habitats at multiple sites in a project area

A single sheet can be used for multiple sample sites if habitat is the same

Sample Site Description

Sample Site No.(s): 5

Site is south of Sinking Creek in a wooded area along a utility right-of-way

Water Resources at Sample Site				
Stream Type (# and length)	Ephemeral: N/A	Intermittent: N/A	Perennial: 1	Describe existing condition of water sources: Sinking Creek is <100 feet to the north.
Pools/Ponds (# and size)	N/A	Open and accessible to bats? N/A		
Wetlands (approx. ac.)	Permanent: N/A	Seasonal: N/A		

Forest Resources at Sample Site				
Closure/Density	Canopy (> 50 ')	Midstory (20-50')	Understory (<20')	
	6	2	2	
Dominant Species of Mature Trees	None mature			
% Trees w/ Exfoliating Bark	0	0	0	
Size Composition of Live Trees (%)	Small (3-8 in)	Med (9-15 in)	Large (>15 in)	
	99	1	0	
No. of Suitable Snags	0			

1=1-10%, 2=11-20%, 3=21-40%, 4=41-60%, 5=61-80%, 6=81=100%

Standing dead trees with exfoliating bark, cracks, crevices, or hollows. Snags without these characteristics are not considered suitable.

IS THE HABITAT SUITABLE FOR INDIANA BATS? low suitability

Additional Comments:

Dominant tree species: white oak (Quercus alba), Eastern red cedar (Juniperus virginiana), red oak (Quercus rubra), sycamore (Platanus occidentalis), black walnut (Juglans nigra), chestnut oak (Quercus prinus). Average DBH of dominant trees was 2-6 inches. No exfoliating bark, crevices, or holes present in the dominant trees, and no other habitat characteristics in the site besides the proximity to water resources.

Attach aerial photo of project site with all forested areas labeled and a general description of the habitat

Photographic Documentation: habitat shots at edge and interior from multiple locations; understory/midstory/canopy; examples of potential suitable snags and live trees; water sources

APPENDIX H

SCI ENGINEERING, INC.
1114 North Bishop
Rolla, Missouri 65401
573-426-4901 Fax 573-426-4853
www.sciengineering.com

Phase One Environmental Site Assessment

X1414-04 CAMP ZOE
SHANNON COUNTY, MISSOURI

August 15, 2014

Prepared for:

FARNSWORTH GROUP, INC.;

MISSOURI OA/FMDC; AND

MISSOURI DNR/DIVISION OF PARKS

SCI No. 2014-7007.20

SCI ENGINEERING, INC.
CONSULTANTS IN DEVELOPMENT,
DESIGN AND CONSTRUCTION
GEOTECHNICAL
ENVIRONMENTAL
NATURAL RESOURCES
CULTURAL RESOURCES
CONSTRUCTION SERVICES

August 15, 2014

Mr. Robert Polk
Farnsworth Group, Inc.
20 Allen Avenue, Suite 200
St. Louis, Missouri 63119

RE: Phase One Environmental Site Assessment
X1414-04 Camp Zoe
Shannon County, Missouri
SCI No. 2014-7007.20

Dear Mr. Polk:

SCI has completed the Phase One Environmental Site Assessment at the above-referenced site, the report of which is contained herein. Phase One activities consisted of historical and public records research, historical review, interviews, and a reconnaissance survey.

Based on the activities which were performed in general accordance with the ASTM Practice E 1527-13 for Phase One Environmental Site Assessments, SCI identified no evidence of recognized environmental conditions in connection with the subject site.

SCI appreciates being of service to you on this project. Please contact us if you have any questions or comments regarding this report.

Respectfully,

SCI ENGINEERING, INC.

Jarred M. Schmidt
Staff Scientist

Edwin P. Grimmer, P.E.
Senior Engineer, Associate

JMS/EPG/lf

Enclosure

Seven additional copies and electronic versions submitted.

N:\StCharles\shared\1soils\1NEW\PROJECT FILES\Springfield\2014 Project Files\2014-7007 Camp Zoe Rehab\ES\20\Task 300 LAD-Pioneer Forest Phase One\147007.20 Task 300 Phase One ESA.doc

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TABLES

FIGURES

APPENDICES

Phase One Environmental Site Assessment

X1414-04 CAMP ZOE
SHANNON COUNTY, MISSOURI

1.0 INTRODUCTION

SCI Engineering, Inc. (SCI) was retained by Mr. Robert W. Polk with Farnsworth Group, Inc. to perform a Phase One Environmental Site Assessment (Phase One) on an approximate 530-acre recreational campground with associated facilities located along lower Sinking Creek in Shannon County, Missouri (site or subject site). These services were performed in accordance with our proposal dated April 30, 2014.

The purpose of this assessment was to explore for evidence of the presence of Recognized Environmental Conditions (RECs), in accordance with the ASTM Practice E 1527-13 for Phase One Environmental Site Assessments. An REC means the presence or likely presence of any hazardous substances or petroleum products in, on, or at a property: (1) due to any release to the environment; (2) under conditions indicative of a release to the environment; or (3) under conditions that pose a material threat of a future release to the environment. The term includes hazardous substances or petroleum products even under conditions in compliance with laws. The term is not intended to include *de minimis* conditions that generally do not present a material risk of harm to public health or the environment and that generally would not be the subject of an enforcement action if brought to the attention of the appropriate governmental agencies.

The performance of this assessment may also identify Historical Recognized Environmental Conditions (HRECs) and/or Controlled Recognized Environmental Conditions (CRECs). An HREC is defined as a past release of any hazardous substances or petroleum products that has occurred in connection with the property and has been addressed to the satisfaction of the applicable regulatory authority or meeting unrestricted residential use criteria established by a regulatory authority, without subjecting the property to any required controls (for example property use restrictions, Activity and Use Limitations, Institutional Controls, or Engineering Controls). A CREC is identified as a recognized environmental condition which involves a past release of hazardous substances or petroleum products that has been addressed to the satisfaction of the applicable regulatory authority and that is subject to activity and use limitations.

Phase One activities included historical and public records research, interviews, and a reconnaissance (walkover) survey. The details of these activities are outlined herein.

2.0 SITE RECONNAISSANCE

On February 26, 2014 and July 10, 2014, a site reconnaissance was conducted by Mr. Jarred M. Schmidt, SCI's Staff Scientist. The site reconnaissance was performed under the guidance of Mr. Edwin P. Grimmer, P.E., SCI's Environmental Professional. The reconnaissance was performed by walking the perimeter of the site and by walking a grid pattern on the remainder of the property. The purpose of the site reconnaissance was to assess the physical conditions at and adjacent to the site. Observations of portions of the site were limited by thick vegetation onsite. Additionally, SCI was unable to observe all of the residential structures based on occupancy. A Vicinity and Topographic Map, Figure 1, a Site/Surrounding Properties Map, Figure 2, and an Aerial Photograph, Figure 3, are enclosed. Photographic documentation is enclosed in Appendix A.

2.1 Site Use

At the time of SCI's site reconnaissance, the subject site consisted of a 490-acre property that consisted of two residential properties, recreational properties for parking and camping, two recreational buildings, two barns, a shed, multiple foundations from previous structures, Country Road 19-250, County Road 19-B, and wooded/undeveloped property. Overhead electric lines were depicted intersecting through the western portion of the subject site. Several recent test pits were observed onsite. This issue is further discussed in Section 4.3. No evidence of stressed vegetation, stained soil or pavement, or waste water was observed onsite.

2.2 Heating and Cooling Systems

The subject site structures currently utilized propane and electric heating systems. No evidence of former heating oil use was observed onsite. Additionally, as further discussed in Section 4.7, residential structures were historically located onsite. The heating source for the previous structures is unknown and may have been heating oil contained in an AST or UST. Should a heating oil UST be encountered in conjunction with site development, it should be removed, along with any associated impact, and properly disposed.

2.3 Water and Sewage Systems

SCI observed multiple wells and a cistern on the recreational campground in the central portion of the subject site. It is likely that the wells and cistern serviced the previous structures on the subject site. Although not an REC, these should be properly abandoned in accordance with applicable regulations if no longer in use.

According to Mr. Robert Cullen, previous property owner, domestic water supply is provided to the residential property on the western portion of the subject site by a well that is north of the two residential trailers. Sanitary sewer services for the residential property are provided by a septic tank located near the trailers onsite. Based on the lack of hazardous materials, toxic chemicals, or petroleum products, significant discharges to the onsite septic system appears unlikely; therefore, SCI does not consider it to represent an REC. These wells and cistern should be properly abandoned in accordance with applicable regulations if no longer in use.

SCI observed multiples wells and cisterns on the residential property on the western portion of the subject site. It is likely that these wells and cisterns serviced the residence on the subject site and the previous recreational campground property. Although not an REC, the wells and cisterns should be properly abandoned in accordance with applicable regulations if no longer in use.

SCI observed a well and cistern on the residential property on the northwestern portion of the subject site. It is likely that this well and cistern serviced the residence on the subject site. Although not an REC, the well and cistern should be properly abandoned in accordance with applicable regulations if no longer in use.

SCI observed a pipe on the recreational campground on the central portion of the site. It is likely that this pipe serviced the dried pond onsite. Although not an REC, the pipe should be properly abandoned in accordance with applicable regulations if no longer in use.

2.4 Adjacent Property Use

Wooded/undeveloped property was located to the north, east, and south of the subject site. Missouri State Highway 19, undeveloped/wooded property, and the Current River were located to the west of the site.

2.5 Aboveground Storage Tanks (ASTs)/Underground Storage Tanks (USTs)

SCI observed an out-of-use UST located on the subject site near the residential property in the western portion of the site. This UST was aboveground and no evidence of leaking of petroleum product was observed. According to Mr. Robert Cullen, the previous property owner, the UST was used as a water tank for the recreational campground. Since no evidence of spilling, staining, or stressed vegetation in the vicinity of the former UST and it was utilized as a water tank, SCI does not consider the UST to represent an REC.

SCI observed two ASTs attached to trailers located near the residential property on the western portion of the subject site. According to Mr. Robert Cullen, the previous property owner, the ASTs were used as a water tank for the recreational campground. Based on the lack of evidence of spilling, staining, or stressed vegetation in the area of the ASTs and their past use as water tanks, SCI does not consider the UST to represent an REC.

SCI observed multiple propane ASTs located near the two residential properties on the subject site. Since any release from the propane ASTs would be to the atmosphere, SCI does not consider the propane ASTs to represent an REC.

2.6 Polychlorinated Biphenyl (PCB) Survey

SCI conducted a survey of the subject site for evidence of PCB-containing transformers, equipment, drums, storage containers, etc. Several pole-mounted transformers were observed in the general vicinity of the subject site. These transformers appeared to be in good condition with no signs of staining or leakage and, therefore, do not represent an REC to the subject site. No other suspect PCB-containing equipment was observed onsite.

Under EPA rules, transformers are assumed to contain fluid containing 50 to 499 parts per million (ppm) PCBs unless tested. The local utility company should be consulted should leakage from any of the transformers in the vicinity of the subject site be observed in the future. Any impact resulting from these transformers would be the responsibility of the utility company which owns them.

Additionally, a tractor which utilized hydraulic cylinders was present near the residential property on the northwestern portion of the site. This equipment appeared in overall poor condition; also minor staining and leaking hydraulic oil was observed. Based on the minimal quantity of oil observed and lack of evidence of significant leaking, SCI considers the minor evidence of leaking and staining associated with the hydraulic equipment to represent a *de minimis* condition.

2.7 Solid Waste/Hazardous Waste/Chemical Use

Solid waste was noted in several locations across the subject site. The solid waste included stockpiles of debris, gravel, and fill, trash dumpsters, concrete foundations from previous structures, tires, multiple portable toilets, scraps of wood, empty plastic and metal drums, scrap metal, and household materials was noted on the site. Based on the nature of the observed materials, SCI does not consider the surficial solid waste to represent an REC. Although not an REC, disposal of solid waste during site development can be a significant expense.

SCI observed general cleaning chemicals stored on the residential properties onsite. These cleaning chemicals were stored in small containers (less than five gallon) and no evidence of spilling or staining was observed. SCI does not consider the use and storage of small quantities of cleaning chemicals to represent an REC to the subject site.

Small containers with a flammable label were present on the residential property on the northwestern portion of the site. These chemicals were stored in small containers (less than five gallon) and no evidence of spilling or staining was observed. SCI does not consider the use and storage of small quantities of chemicals to represent an REC to the subject site.

Small gasoline containers were present on the northwestern portion of the site. These small containers of gasoline were stored in small containers (less than five gallon) and no evidence of spilling or staining was observed. SCI does not consider the use and storage of small quantities of gasoline to represent an REC to the subject site.

Additionally, multiple automobiles, a bus, and trailers were observed onsite. These automobiles appeared in overall good condition; no leaking of oil was observed. SCI does not consider the good conditions of the automobiles to represent an REC.

Although no evidence of a farm dump was observed during the site reconnaissance or the historical review, a farm dump which has been subsequently covered over could be present onsite. Municipal trash service was typically not available in most rural areas until recently. Dumps of this nature are typically small and consist of household trash and scrap metal and lumber. Dumps of this nature are generally not an environmental concern, but some cost can be incurred for their removal if required for site development. If trash from off-site sources has been dumped onsite, the potential size of a dump, if present, is much larger. Intrusive investigations would need to be performed to ascertain dump quantities, if present, and these investigations were not part of our assessment. In the event a farm dump is encountered during site development, SCI would be pleased to assist you with quantity estimation and disposal options.

No evidence of hazardous waste was observed onsite.

3.0 PHYSICAL SETTING

3.1 Topography

The elevation of the subject site is approximately 700 to 1,100 feet above mean sea level (msl), according to the Vicinity Map, contained as Figure 1. This map is a reproduction of a portion of the United States Geological Survey (USGS) topographic map for the Round Spring, Missouri quadrangle dated 1982 (photorevised 1985). Topography on the site is characterized by a north-south trending creek (sinking creek). The subject site is relatively hilly with high slopes to the east and west; with a downgradient slope towards the onsite creek.

SCI was not provided with a boundary or topographic survey for the subject site. Therefore, SCI was unable to compare the actual topography to that on the USGS map.

3.2 Hydrology and Hydrogeology

A dry pond was located on the central portion of the subject site. A small pond was also located near the residential area in the western portion of the subject site, and small pond was located on the central portion of the subject site. A creek and multiple drainageways were observed trending north/south of the subject site. Surface runoff on the subject site flowed primarily towards the onsite creek trending in the southern direction. Surface runoff would be expected from all of the adjacent properties towards the subject site. Surface runoff onto the site does not represent an REC.

The presence and flow direction of a perched groundwater table can only be conclusively verified by subsurface investigation. However, if present, its flow direction would normally parallel the undisturbed surface topography. Therefore, groundwater flow on the subject site would likely be towards the onsite creek trending in the southern direction. The site will likely receive groundwater flow from the adjoining property in every direction, which consisted primarily of undeveloped property. Based on the lack of evidence of petroleum, toxic, or hazardous materials at these properties, SCI does not consider subsurface groundwater flow on to the site to represent an REC.

According to the *National Water Summary* (1986), prepared by the USGS, the site is located within the Ozark Aquifer. The Ozark Aquifer consists of consolidated dolomite and minor layers of sandstone. This aquifer is confined except where it is exposed at the land surface. Recharge occurs from precipitation, from overlying and underlying aquifers, and from stream-aquifer interaction south of the Missouri River. The permeability varies considerably where solution activity has created karst conditions that allow rapid movement of water. Localized human-induced contamination occurs in this aquifer from hazardous waste, landfills, and other sources.

4.0 HISTORICAL USE INFORMATION

Historical records are used to determine past uses of the subject site and whether these past uses may be an environmental concern. The standard to which this report was conducted requires the identification of all past uses of the site, from the present to the first developed use. SCI used as many practically reviewable sources as necessary to identify the past uses of the subject site.

4.1 Owner Interview

SCI submitted an Environmental Assessment Questionnaire (EAQ) to the State of Missouri; the current owner of the subject site. As of the date of this report, no response has been received.

4.2 Key Site Manager Interview

SCI submitted an Environmental Assessment Questionnaire (EAQ) to the State of Missouri; the current owner of the subject site. As of the date of this report, no response has been received.

4.3 User Interview

SCI submitted an Assessment User Questionnaire to Mr. Robert W. Polk, Farnsworth Group, Inc.; the user of this report. Mr. Polk indicated that the State of Missouri was involved in the land sale transaction and they will be the end user of this report. Therefore, SCI was unable to perform an interview with the user of this report. Additionally, Mr. Polk stated that approximately ten test pits were recently advanced onsite to evaluate infiltration rates for potential absorption fields of wastewater effluent for the State of Missouri.

4.4 Past Owner Interview

The user of this report provided SCI with the names of the previous owners, Mr. Stephen O’Neal (owner of the residence in the northwestern portion of the site) and Mr. Robert Cullen (owner of the residence in the western portion of the site). SCI attempted to contact Mr. O’Neal; however, these attempts were unsuccessful. SCI contacted Mr. Cullen by telephone. Mr. Cullen indicated that the property was previously a portion of Camp Zoe’s campground and stated the he previously worked at the campground for maintenance purposes. SCI questioned Mr. Cullen regarding any information on hazardous material incidents or chemical spills in the vicinity of the subject site. Mr. Cullen stated he was unaware of any hazardous materials, toxic chemicals or petroleum products being stored or responses to spills on the subject site or adjacent properties.

4.5 Local Fire Department Interview

SCI submitted a letter of request to the Eminence Area Volunteer Fire Department and the Timber Community Fire Protection District-South Station regarding storage or spillage of petroleum, toxic, or hazardous materials on or adjacent to the subject site. Additionally, SCI contacted the Timber Community Fire Protection District-South Station by telephone. The fire department stated that they did not have any records of any hazardous materials, toxic chemicals or petroleum products being stored or records of responses to spills on the subject site or adjacent properties. A copy of SCI's requests is included in Appendix C.

4.6 Sanborn Map Review

Sanborn fire insurance maps were produced for the insurance industry starting in the late 1800s to assist in evaluating the fire risks of a building or area. Sanborn maps show structure locations and typically indicate the usage of the structure, whether it be a dwelling, store, or a manufacturing plant. The actual name of the company operating the facility is also sometimes given. These maps show the type of construction of buildings, and also show locations of USTs and ASTs used for the storage of highly flammable materials including solvents, paint, and motor fuels. The identification of USTs on Sanborn maps often makes them one of the only ways to identify past UST sites. Most large older towns and cities have some Sanborn coverage. Typically, the larger and older the area, the better the coverage.

SCI obtained a *Certified Sanborn® Map Report* for the subject site and surrounding properties from Environmental Data Resources, Inc. (EDR). The EDR report indicated that no fire insurance maps were available for the subject site and surrounding properties.

4.7 Historical Aerial Photograph Review

Aerial photographs are an important source for showing past conditions on a site. Vegetation and developments like structures, water bodies, or land disturbance are generally readily apparent. However, vegetation can often obscure from view activities taking place under the canopy of trees. The aerial photographs typically available for review as part of a Phase One are usually large-scale black and white photographs. For these reasons, small details may be difficult to discern.

SCI obtained *The EDR Aerial Photo Decade Package* from EDR for the subject site and adjacent properties. The EDR report indicated there were aerial photographs available for the years 2012, 2005, 1995, 1984, and 1966. A summary of this review is contained in Table 4.1.

Table 4.1 - Historical Aerial Photograph Summary

Year	Observations
2012	The subject site was developed with a creek, two ponds, roadways, and multiple structures along the eastern portion of the creek. A campground was depicted in the northeastern portion of the subject site. Three structures were depicted in the north/northwestern portion of the subject site. A structure was depicted in the northwestern portion of the subject site. A campground with multiple structures was depicted in the western portion of the subject site. Overhead electric lines were depicted on the western portion of the subject site. Wooded/undeveloped properties were located north, east, and south of the subject site. The subject site was bound to the west by a roadway.
2005	The subject site and surrounding properties appeared similar to the 2012 aerial photograph, except no structures were depicted in the western portion of the subject site.
1995	The subject site and surrounding properties appeared similar to the 2005 aerial photograph.
1984	The subject site and surrounding properties appeared similar to the 1995 aerial photograph.
1966	The subject site and surrounding properties appeared similar to the 1984 aerial photograph.

Review of the historical aerial photographs identified that structures were previously located on the subject site. Although the historic structures are not an REC, debris from the demolished structures may be buried on the subject site. Furthermore, the heating source for the previous structures are unknown and may have been heating oil contained in an AST or UST. Should a heating oil UST be encountered in conjunction with site development, it should be removed, along with any associated impact, and properly disposed. Therefore, SCI does not consider this to represent an REC. It is noted that the subject site has been developed back to at least 1966. Copies of the aerial photographs are contained in Appendix D.

4.8 City Directory Review

City directories, such as Polk or Hanes Criss-Cross directories are useful tools in determining the past use of urban properties. Most larger urban areas have had city directories published. City directories were published from the late 1800s until today. The most useful portion of the city directory for property research is the criss-cross directory which lists each street within the municipality and what is located at each address on that street. City directories are only useful for urban areas and are generally not published for rural or small municipalities.

Due to the rural nature of the subject site, city directories were not available for review.

4.9 Historical Topographic Map Review

Historical topographic maps can be used to identify changes in site topography as well as site development and usage. Differences in the topographic lines on the maps from one edition to the next can indicate areas where fill may have been placed on the subject site or show areas where soil may have been removed or cut. Most topographic maps depict man-made structures as well as natural features including wooded areas, streams, rivers, lakes, and ponds. However, if a property is located in an urban setting, the topographic map may not show individual structures.

SCI obtained the *EDR Historical Topographic Map Report* for the subject site and adjacent properties. SCI reviewed 7.5-minute topographic maps for the Round Spring, Missouri quadrangle from the years 1967 (photorevised 1985) and 1967. SCI also reviewed the 15-minute topographic map for the year 1949. A summary of this review is contained in Table 4.2.

Table 4.2 - Historical Topographic Map Summary

Year	Observations
1967 (photorevised 1985)	The elevation of the subject site is approximately 700 to 1,100 feet above msl. The subject site was occupied by fourteen structures in the central portion of the subject site along Sinking Creek, two structures in the northern portion of the site, three structures in the southwestern portion of the site, and two structures in the western portion of the site. Sinking Creek was depicted intersecting the subject site trending north/south. Two ponds were located on the central portion of the subject site and one pond was located on the western portion of the subject site. Roadways were depicted on the subject site in the northern, central and southern portions of the subject site. A structure, an intersecting creek, and undeveloped property were located north of the subject site. A roadway, an intersecting creek, and undeveloped property were located east of the subject site. A creek and undeveloped property were located south of the subject site. A roadway, Current River, one structure, intersecting creek, and undeveloped property were located west of the subject site.
1967	The subject site and surrounding properties appeared similar to the 1967 (photorevised 1985) historical topographic map, except two structures were not depicted in the central portion of the subject site.
1949	The subject site is depicted as less developed. The surrounding properties appeared similar to the 1967 historical topographic map, except a school was depicted to the adjacent north of the subject site. Nine additional structures were depicted to the adjacent south of the subject site. An additional structure was depicted to the adjacent west of the subject site.

This historical topographic map review has revealed no additional evidence of environmental conditions in connection with the subject site.

4.10 Chain-of-Title Review

Land title records contain information about historical fee ownership, which may include leases, contracts, AULs recorded in the place where land title records are, by law or custom, recorded for the local jurisdiction in which the property is located. Often this source will provide only names of previous owners, lessees, easement holders, etc. but when employed in combination with another source may provide helpful information about uses of the property. SCI did not review the Chain-of-Title for the subject site since one was unavailable for review.

4.11 City Permits

City permits were not readily available or reasonably ascertainable, and therefore were not reviewed.

5.0 REGULATORY AGENCY RECORDS REVIEW

SCI reviewed environmental records obtained from EDR. A copy of the report is contained in Appendix E. This search covered all lists required by ASTM E 1527-13 to the required approximate minimum search distance as shown on Table 5.1.

Table 5.1 - Environmental Record Sources

Records Sources[1]	Approximate Minimum Search Distance	Properties Identified
Federal National Priorities List (NPL)	1.0 mile	0
Federal Delisted NPL	0.5 mile	0
Federal Comprehensive Environmental Response, Compensation, & Liability Information System (CERCLIS)	0.5 mile	0
Federal CERCLIS No Further Remedial Action Planned (NFRAP)	0.5 mile	0
Federal Resource Conservation & Recovery Information System (RCRIS): - Treatment, Storage, and Disposal (TSD)	0.5 mile	0
Federal Resource Conservation & Recovery Information System (RCRIS): - Facilities List and Generators List	Site and adjacent properties	0
Federal RCRA TSD Facilities with Corrective Action Activities (CORRACTS)	1.0 mile	0
Federal Emergency Response Notification System (ERNS)	Site only	0
Federal Institutional/Engineering Control (IC/EC) Registries	Property only	0
Missouri Hazardous Waste Sites List	1.0 mile	0
Missouri Solid Waste Landfill List	0.5 mile	0
Missouri Leaking Underground Storage Tank (LUST) List	0.5 mile	0
Missouri Registered UST List	Site and adjacent properties	0

Table 5.1 - Environmental Record Sources (continued)

Records Sources[1]	Approximate Minimum Search Distance	Properties Identified
Missouri Institutional/Engineering Control (IC/EC) Registries	Property only	0
Additional Environmental Record Sources[2]	1.0 mile	0

[1]SCI is not aware of any environmental tribal records in Shannon County, Missouri.
[2]Missouri Confirmed dioxin sites, Former Manufactured Gas Plants, Former USDA Grain Bins, Lead and Zinc Smelters, Wood Treatment sites, and Voluntary Cleanup Program Sites.

The EDR report lists 39 orphan sites which are listings in a database that could not be mapped due to poor or inadequate information. Although the exact locations of the orphan sites are frequently unknown, SCI attempts to evaluate the potential adverse environmental impact that these sites may have on the subject site. This evaluation consists of reviewing street names in an effort to learn whether the street on which the site is located lies within the radius of the subject site, a drive-by view of surrounding properties during the site visit, and evaluating the site type and information provided by government agencies. Of the 39 orphan sites, none were included in the previous table since SCI does not expect them to be located within the applicable minimum search distance.

5.1 Federal NPL

Section 105(a)(8)(B) of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) requires the preparation of the NPL. The NPL is a list of national priorities among the known or threatened releases of hazardous substances, pollutants, or contaminants throughout the United States. The identification of a site for the NPL is intended to guide the USEPA in: determining which sites warrant further investigation to assess the nature and extent of the human health and environmental risks associated with a site; identifying what CERCLA-financed remedial actions may be appropriate; notifying the public of sites USEPA believes warrant further investigation; and serving notice to potentially responsible parties that USEPA may initiate CERCLA-financed remedial action.

No listings were encountered during the review of the NPL database within the ASTM prescribed minimum search distance of the subject site.

5.1.1 Federal Delisted NPL

The National Oil and Hazardous Substance Pollution Contingency Act (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425(e), sites may be deleted from the NPL where no further response is appropriate.

No listings were encountered during the review of the delisted NPL database within the ASTM prescribed minimum search distance of the subject site.

5.2 Federal CERCLIS

The Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) is the official repository for site and non-site specific Superfund data in support of CERCLA. It contains information on hazardous waste site assessments and remediation from 1983 to the present.

No listings were encountered during the review of the CERCLIS database within the ASTM prescribed minimum search distance of the subject site.

5.2.1 Federal NFRAP

As of February 1995, CERCLIS sites designated “No Further Remedial Action Planned” (NFRAP) have been removed from CERCLIS. NFRAP sites may be sites where, following an initial investigation, no contamination was found, contamination was removed quickly without the need for the site to be placed on the NPL, or the contamination was not serious enough to require Federal Superfund action or NPL consideration.

No listings were encountered on the NFRAP list within the ASTM prescribed minimum search distance of the subject site.

5.3 Federal RCRIS

Hazardous waste data is contained in the Resource Conservation and Recovery Information System (RCRIS) in support of the Resource Conservation and Recovery Act (RCRA). RCRA requires that generators and transporters of hazardous waste, as well as hazardous waste treatment, storage and disposal (TSD) facilities provide information concerning their activities to state environmental agencies. These agencies then provide information to regional and national USEPA offices. RCRIS is used by the USEPA to support its implementation of RCRA.

No listings were encountered during the review of the RCRIS database within the ASTM prescribed minimum search distance of the subject site.

5.4 Federal CORRACTS

The EPA maintains this database of RCRA TSD facilities that are undergoing corrective action. A corrective action order is issued pursuant to RCRA section 3008(h) if there has been a release of hazardous waste into the environment from a RCRA facility.

No listings were encountered during the review of the CORRACTS database within the ASTM prescribed minimum search distance of the subject site.

5.5 Federal ERNS

The Emergency Response Notification System (ERNS) is a database used to store information on notifications of oil discharges and hazardous substance releases. The ERNS program is a cooperative data sharing effort among the USEPA, the Department of Transportation, and the National Response Center. ERNS provides the most comprehensive data compiled on notifications of oil discharges and hazardous substance releases in the United States.

No listings were encountered during the review of the ERNS database within the ASTM prescribed minimum search distance of the subject site.

5.6 Federal IC/EC

Databases of institutional controls or engineering controls maintained by a federal agency for purposes of tracking sites that may contain residual contamination and activity and use limitations (AULs).

No listings were encountered during review of the IC/EC database within the ASTM prescribed minimum search distance of the subject site.

5.7 Missouri Hazardous Waste Sites List

The Missouri "Superfund Law" requires the Missouri Department of Natural Resources (MDNR) to annually publish a registry entitled *Missouri Registry Annual Report: Registry of Confirmed Abandoned or Uncontrolled Hazardous Waste Disposal Sites in Missouri.* The most current Registry was the Fiscal Year 2013 annual report.

No listings were encountered during the review of the Registry within the ASTM prescribed minimum search distance of the subject site.

5.8 Missouri Solid Waste Landfill List

The MDNR Solid Waste Management Program publishes and regularly updates the List of Sanitary Landfill Contacts in Missouri; the List of Demolition, Utility Waste and Special Waste Landfill Contacts (last updated April 10, 2014); the List of Transfer Station Contacts in Missouri; the List of Inactive Facilities; and the List of Closed Facilities.

No listings were encountered during the review of the landfill lists within the prescribed minimum search distance of the subject site.

5.9 Missouri LUST List

The MDNR Hazardous Waste Program publishes and regularly updates a List of Leaking Underground Storage Tanks Active Sites. This list was last published in May 6, 2014.

No listings were encountered during the review of the LUST database within the ASTM prescribed minimum search distance of the subject site.

5.10 Missouri Registered UST List

The MDNR maintains a regularly updated database of Registered USTs. This database was last updated in May 6, 2014.

No listings were encountered during the review of the registered UST database within the ASTM prescribed minimum search distance of the subject site.

5.11 Missouri IC/EC

Databases of institutional controls or engineering controls maintained by a state agency for purposes of tracking sites that may contain residual contamination and AULs.

No listings were encountered during review of the IC/EC database within the ASTM prescribed minimum search distance of the subject site.

5.12 Additional Environmental Record Sources

A review of the latest listing of *Confirmed Dioxin Sites Tracking List*, January 1999, supplied by the MDNR, revealed no known dioxin-contaminated properties within a one-mile radius of the subject site.

SCI also reviewed listings of wood treatment sites, former manufactured gas plants, lead and zinc treatment facilities, drycleaners, and VCP sites. No listings were identified within a one-mile radius of the subject site.

6.0 VAPOR ENCROACHMENT SCREENING

In accordance with ASTM Practice E 1527-13, SCI conducted an initial vapor encroachment screening to determine if there is a potential for vapors to occur in the subsurface below existing and/or proposed onsite structures, as a result of the presence of petroleum, hazardous or toxic materials that may contain volatile or semi-volatile organic compounds (VOCs/SVOCs). The initial vapor encroachment screening was performed using a "non-invasive" screening process which consists of a site reconnaissance as well as a review of regulatory database and historical resources. If the initial vapor encroachment screening determines that there is a potential vapor encroachment condition (pVEC) the pVEC should be identified as an REC to the subject site.

SCI has performed the vapor encroachment screening as part of the Phase One activities outlined herein. SCI did not encounter evidence of potential vapor encroachment issues.

7.0 ADDITIONAL INVESTIGATIONS

SCI is not aware of any other environmental or geotechnical assessments previously or currently being performed for the subject site.

8.0 FINDINGS

In the course of SCI's scope of service, we have identified the following environmental conditions in connection with the subject site:

- During the site reconnaissance and review of the historical topographic maps and aerial photographs, former structures were located on the subject site. Although the historic structures are not an REC, debris from the demolished structures may be buried on the subject site. Furthermore, the heating source for the previous structures are unknown and may have been heating oil contained in an AST or UST. Should a heating oil UST be encountered in conjunction with site development, it should be removed, along with any associated impact, and properly disposed. Therefore, SCI does not consider this to represent an REC. (Sections 2.2, 4.7, and 4.9)

- SCI observed multiple wells and cisterns on the recreational portion in the central portion of the subject site and the residential property in the northwestern portion of the subject site. It is likely that these wells and cisterns serviced the previous structures and residential property. Although not an REC, these wells and cistern should be properly abandoned in accordance with applicable regulations if no longer in use. (Section 2.3)

- Domestic water supply is provided to the residential property on the western portion of the subject site by a well that is north of the two trailers. Sanitary sewer services for the residential property are provided by a septic tank located near the residential trailers onsite. Based on the lack of hazardous materials, toxic chemicals, or petroleum products, significant discharges to the onsite septic system appears unlikely; therefore, SCI does not consider it to represent an REC. These wells and cistern should be properly abandoned in accordance with applicable regulations if no longer in use. (Section 2.3)

- SCI observed a pipe on the recreational portion in the central portion of the site. It is likely that this pipe serviced the dried pond onsite. Although not an REC, the pipe should be properly abandoned in accordance with applicable regulations if no longer in use. (Section 2.3)

- SCI observed an out-of-use UST located on the subject site near the residential property in the western portion of the site. This UST was aboveground and no evidence of leaking of petroleum product was observed. According to Mr. Robert Cullen, the previous property owner, the UST was used as a water tank for the recreational campground. Since no evidence of spilling, staining, or stressed vegetation in the vicinity of the former UST and it was utilized as a water tank, SCI does not consider the UST to represent an REC. (Section 2.5)

- SCI observed two ASTs attached to trailers located near the residential property on the western portion of the subject site. According to Mr. Robert Cullen, the previous property owner, the ASTs were used as a water tank for the recreational campground. Based on the lack of evidence of spilling, staining, or stressed vegetation in the area of the ASTs and their past use as water tanks, SCI does not consider the UST to represent an REC. (Section 2.5)

- SCI observed multiple propane ASTs located near the two residential properties on the subject site. Since any release from the propane ASTs would be to the atmosphere, SCI does not consider the propane ASTs to represent an REC. (Section 2.5)

- A tractor which utilized hydraulic cylinders was present near the residential property in the northwestern portion of the site. This equipment appeared in overall poor condition; also minor staining and leaking hydraulic oil was observed. Based on the minimal quantity of oil observed and lack of evidence of significant leaking, SCI considers the minor evidence of leaking and staining associated with the hydraulic equipment to represent *de minimis* conditions. (Section 2.6)

- Solid waste was noted in several locations across the subject site. The solid waste included stockpiles of debris, gravel, and fill, trash dumpsters, concrete foundations from previous structures, tires, multiple portable toilets, scraps of wood, empty plastic and metal drums, scrap metal, and household materials was noted on the site. Based on the nature of the observed materials, SCI does not consider the surficial solid waste to represent an REC. Although not an REC, disposal of solid waste during site development can be a significant expense. (Section 2.7)

- SCI observed general cleaning chemicals stored on the residential properties onsite. These cleaning chemicals were stored in small containers (less than five gallon) and no evidence of spilling or staining was observed. SCI does not consider the use and storage of small quantities of cleaning chemicals to represent an REC to the subject site. (Section 2.7)

- Small containers with a flammable label were present on the residential property on the northwestern portion of the site. These chemicals were stored in small containers (less than five gallon) and no evidence of spilling or staining was observed. SCI does not consider the use and storage of small quantities of chemicals to represent an REC to the subject site. (Section 2.7)

- Multiple small gasoline containers were present in the northwestern portion of the site. These small containers of gasoline were stored in small containers (less than five gallon) and no evidence of spilling or staining was observed. SCI does not consider the use and storage of small quantities of gasoline to represent an REC to the subject site. (Section 2.7)

- Additionally, multiple automobiles, buses, and trailers were observed onsite. These automobiles appeared in overall good condition; no leaking of oil was observed. SCI does not consider the good conditions of the automobiles to represent an REC. (Section 2.7)

9.0 DATA GAPS

A data gap is a lack of or inability to obtain information required by this practice despite good faith efforts to gather such data. In completing this Phase One, SCI encountered the following data gaps:

- Observations of portions of the site were limited by thick vegetation.

- The residential structures on the northwestern and western portions of the subject site were inaccessible at the time of SCI's site reconnaissance.

- SCI was unable to obtain an interview with the current owner of the subject site.

- SCI was unable to obtain an interview with the user of the report.

- SCI was unable to obtain an interview with the past owner of the subject site.

- No historical information was available for the subject site between 1949 and 1967 or 1966 and 1984.

- SCI was unable to review title documents for the subject site.

Observations of portions of the site were limited by thick vegetation. However, based on the observable portions of the site as well as the historic aerial and topographic map review, SCI does not consider this data gap significant as it is unlikely to result in the identification of RECs.

The structures on the northwestern and western portions of the subject site were inaccessible at the time of the site reconnaissance. However, based on interview with Mr. Cullen, Mr. Cullen’s residential property had been used as a portion of Camp Zoe’s campgrounds. Based on SCI's experience, it is unlikely there would be any RECs associate with this structure. Therefore, this data gap is not significant.

SCI was unable to obtain an interview with the current owner of the subject site. SCI believes this data gap is significant as the current owner of the subject site may have relevant information which would lead to the identification of additional RECs in connection with the subject site.

SCI was unable to obtain an interview with the user of the report. SCI believes this data gap is significant as the user of the report may have relevant information which would lead to the identification of additional RECs in connection with the subject site.

SCI was unable to obtain an interview with Mr. Stephen O'Neal (owner of the residence in the northwestern portion of the site), previous property owner. SCI believes this data gap is significant as the previous owners may have relevant information which would lead to the identification of additional RECs in connection with the subject site.

SCI was unable to locate any readily available and practically reviewable historical information for the subject site between 1949 and 1967 or 1966 and 1984. However, SCI does not believe this data gap is significant because the data reviewed showed the subject site similar in 1967 as compared to 1949 and 1984 as compared to 1966; therefore, significant changes to the property during the time gap appear unlikely.

SCI was unable to review title documents for the subject site. SCI does not consider this data gap to be significant because the primary use of the subject site was for residential purposes and recreational camp ground and is unlikely to have resulted in any RECs.

10.0 CONCLUSIONS

Phase One activities consisted of historical and public records research, historical review, interviews, and a reconnaissance survey. Based on the activities which were performed in general accordance with the ASTM Practice E 1527-13 for Phase One Environmental Site Assessments, SCI has identified no evidence of RECs in connection with the subject site.

11.0 ENVIRONMENTAL PROFESSIONAL STATEMENT

I declare that, to the best of my professional knowledge and belief, I meet the definition of *Environmental Professional* as defined in 312.10 of 40 CFR 312. I have the specific qualifications based on education, training, and experience to assess a property of the nature, history, and setting of the subject property. I have developed and performed all appropriate inquiries in conformance with the standards and practices set forth in 40 CFR Part 312. Resumes for myself and Jarred Schmidt, who performed the site reconnaissance, are contained in Appendix E.

12.0 REFERENCES CITED

ASTM International, 2013, *Standard Practice for Environmental Assessments: Phase I Environmental Site Assessment Process*, "Designation: E 1527-13," West Conshohocken, PA.

Environmental Data Resources, Inc., July 16, 2014, *Certified Sanborn® Map Report*.

Environmental Data Resources, Inc., July 17, 2014, *The EDR Aerial Photo Decade Package*.

Environmental Data Resources, Inc., July 21, 2014, *The EDR-City Directory Abstract.*

Environmental Data Resources, Inc., July 16, 2014, *EDR Historical Topographic Map Report.*

Environmental Data Resources, Inc., July 16, 2014, *The EDR Radius Map™ Report with GeoCheck®.*

Google™ Earth, ©2014 Google, (2013 Aerial Photograph). Electronic document www.earth.google.com, accessed July 17 and 24, 2014.

Missouri, *Missouri Registry Annual Report: Registry of Confirmed Abandoned or Uncontrolled Hazardous Waste Disposal Sites in Missouri*, Fiscal Year 2013, Jefferson City, Mo: Missouri Dept. of Natural Resources, Division of Environmental Quality, Hazardous Waste Program.

United States Geological Survey, 1988, "State Summaries of Ground-Water Quality," *National Water Summary 1986: Hydrologic Events and Ground-Water Quality*, U.S. Geological Survey Water-Supply Paper 2325, pp. 329-338.

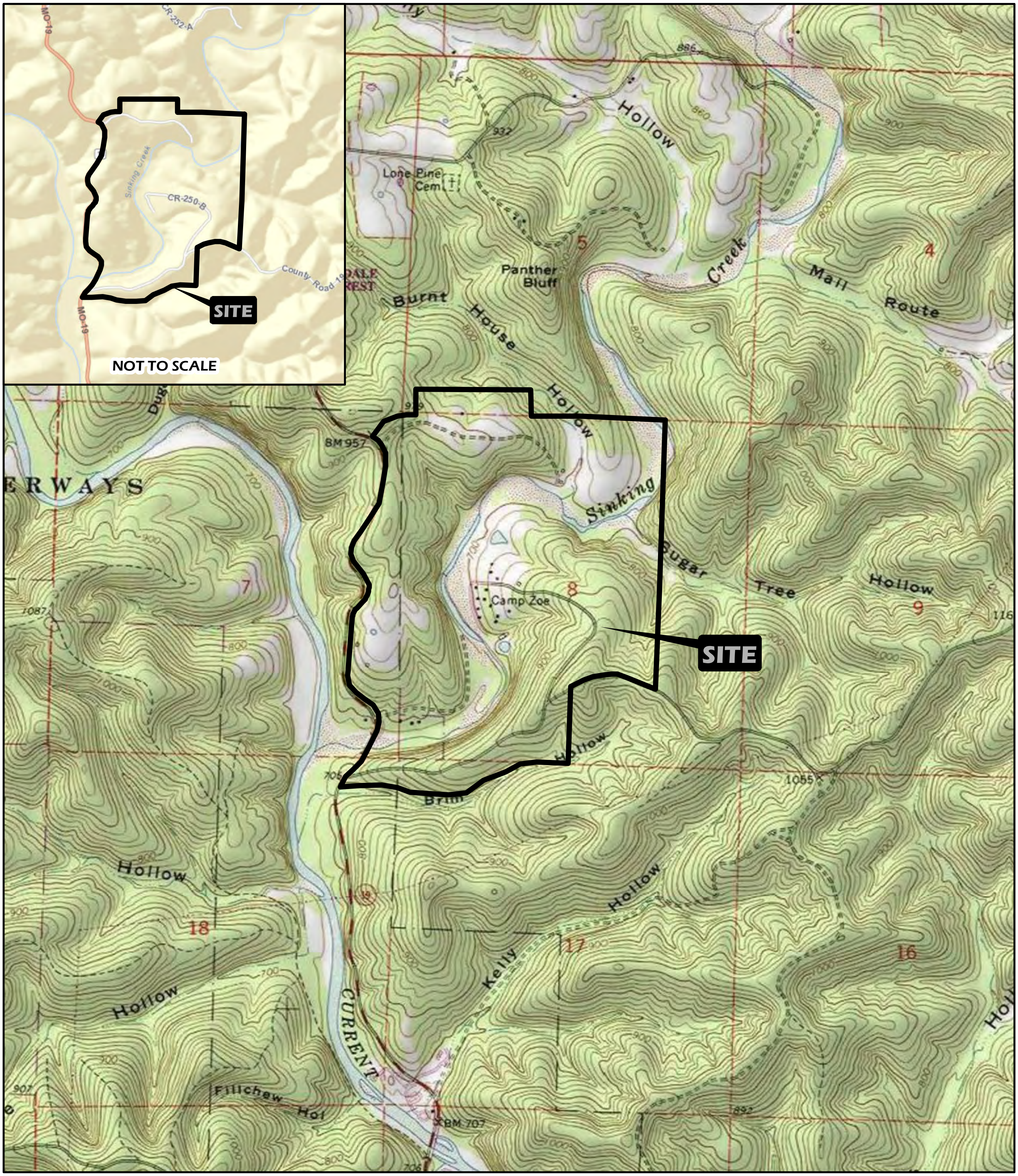
13.0 LIMITATIONS

This report has been prepared for the exclusive use of Farnsworth Group, Inc.; Missouri OA/FMDC; and Missouri DNR/Division of Parks. Our services were performed in accordance with a specific scope of work and are subject to the terms and conditions agreed to as part of that scope of work. SCI is not responsible for independent conclusions or recommendations made by others. Furthermore, written consent must be provided by SCI should anyone other than our client wish to excerpt, or rely on, the contents of this report. The services performed are generally consistent with those outlined in ASTM Practice E 1527-13. The findings of this report are valid as of the present date of the assessment.

Changes in surface and subsurface conditions of a property can occur with the passage of time, whether due to natural processes or the works of man on this or adjacent properties. In addition, changes in applicable or appropriate standards may occur, whether they result from legislation, the broadening of knowledge, or other reasons. Accordingly, the findings of this report may be invalidated in whole or in part by changes outside our control.

SCI should be contacted with any known or suspected variations from the conditions described herein. If further development of this site indicates the presence of hazardous, toxic, or petroleum materials, or other concerns of an environmental nature, SCI should be notified to perform a re-evaluation of the environmental conditions.

The following assumptions are made by SCI in this report. SCI relied on information derived from secondary sources including government agencies, the client, designated representatives of the client, property contact, property owner, property owner representatives, computer databases, and personal interviews. Except as set forth in this report, SCI has made no independent investigation as to the accuracy and completeness of the information derived from secondary sources including government agencies, the client, designated representatives of the client, property contact, property owner, property owner representatives, computer databases, or personal interviews and has assumed that such information is accurate and complete. SCI assumes information provided by or obtained from governmental agencies including information obtained from government websites is accurate and complete. Groundwater flow and depth to groundwater, unless otherwise specified by on-property well data, are assumed based on contours depicted on the United States Geological Survey topographic maps. SCI assumes the property has been correctly and accurately identified by the client, designated representative of the client, property contact, property owner, and property owner's representatives.



PROJECT NAME

X1414-04 CAMP ZOE
SHANNON COUNTY, MISSOURI

VICINITY AND TOPOGRAPHIC MAP

DRAWN BY	RCV	DATE	JOB NUMBER
CHECKED BY	JMS	08/2014	2014-7007.20

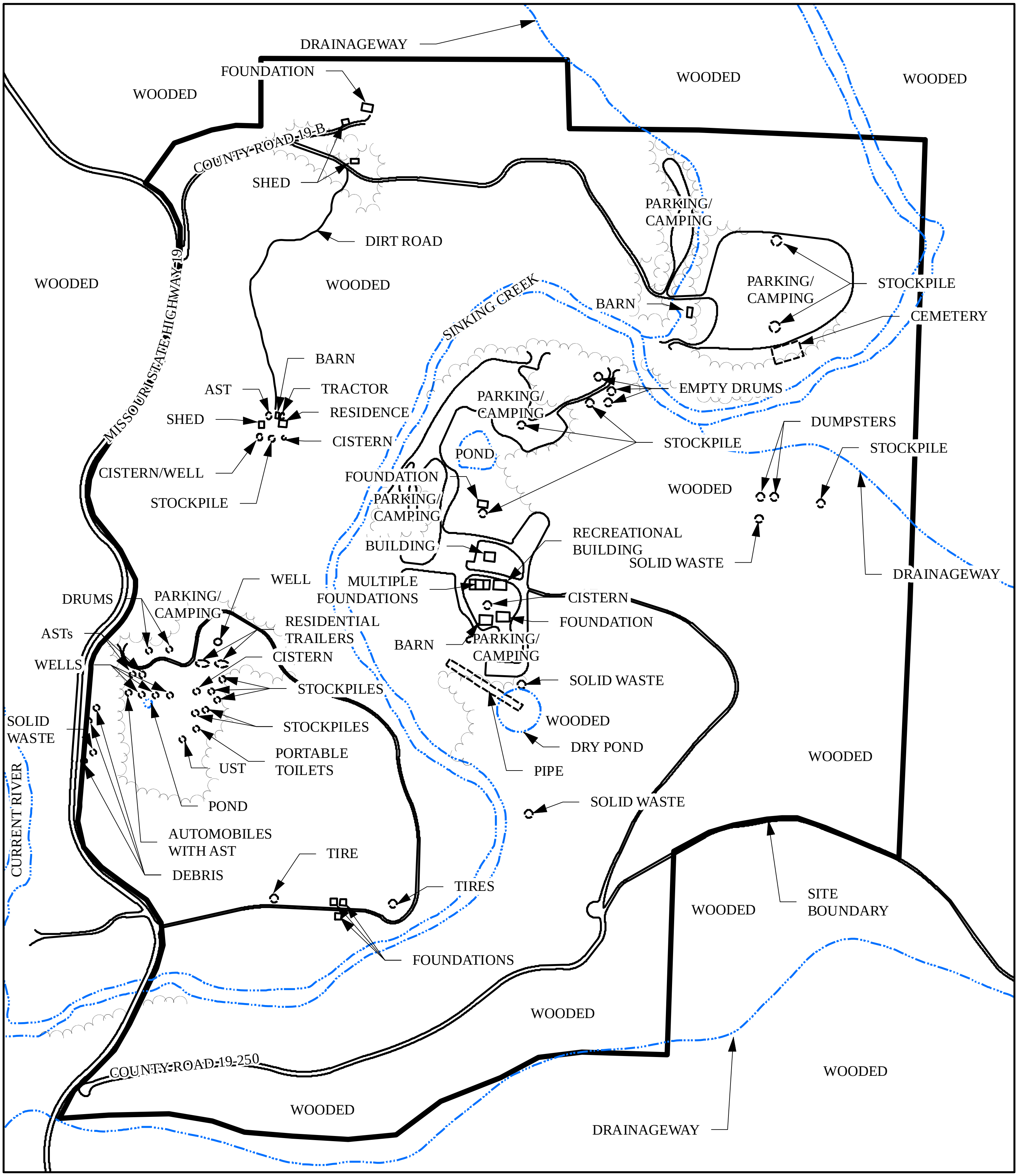
GENERAL NOTES/LEGEND

USGS TOPOGRAPHIC MAP
ROUND SPRING, MISSOURI QUADRANGLE
DATED 1982
PHOTO REVISED 1985
20' CONTOURS

N W E S

SCALE 1" = 2000'

FIGURE 1



PROJECT NAME X1414-04 CAMP ZOE SHANNON COUNTY, MISSOURI	GENERAL NOTES/LEGEND	
SITE/SURROUNDING PROPERTIES MAP	DIMENSIONS AND LOCATIONS ARE APPROXIMATE; ACTUAL MAY VARY. DRAWING SHALL NOT BE USED OUTSIDE THE CONTEXT OF THE REPORT FOR WHICH IT WAS GENERATED.	SCALE 1" = 750'
DRAWN BY RCV / CHECKED BY JMS / DATE 08/2014 / JOB NUMBER 2014-7007.20		FIGURE 2

PROJECT NAME	GENERAL NOTES/LEGEND
X1414-04 CAMP ZOE SHANNON COUNTY, MISSOURI	AERIAL PHOTOGRAPH OBTAINED FROM ARCGIS ONLINE - WORLD IMAGERY, DATED 12/2012.

AERIAL PHOTOGRAPH

DRAWN BY	RCV	DATE	JOB NUMBER
CHECKED BY	JMS	08/2014	2014-7007.20

N
W E
S

SCALE	1" = 750'
FIGURE	3

APPENDIX A

Photo 1. View of the adjacent property to the north of the subject site.

Photo 2. View of the adjacent property to the east of the subject site.

Photo 3. View of the adjacent property to the south of the subject site.

Photo 4. View of the adjacent property to the west of the subject site.

Photo 5. View of the on-site office building.

Photo 6. Example of stored hazardous waste located on the northern vicinity near the on-site residential structure.

Photo 7. Example of stockpile located on the northern vicinity near the on-site residential structure.

Photo 8. View of on-site UST located on the western vicinity near the residential structure.

Photo 9. Example of on-site solid waste located on the western vicinity near residential structure.

Photo 10. View of Sinking Creek on the western portion of the subject site.

Photo 11. View of County Road 19-250 on the southern portion of the subject site.

Photo 12. View of overhead electric lines on the western portion of the subject site.

APPENDIX B

SCI ENGINEERING, INC.
CONSULTANTS IN DEVELOPMENT, DESIGN AND CONSTRUCTION
GEOTECHNICAL
ENVIRONMENTAL
NATURAL RESOURCES
CULTURAL RESOURCES
CONSTRUCTION SERVICES

July 2, 2014

The State of Missouri
c/o Mr. Bob Polk
Farnsworth Group, Inc.
20 Allen Avenue, Suite 200
St. Louis, Missouri 63119

RE: Environmental Assessment Questionnaire
Camp Zoe Rehab
(LAD/Pioneer Forest Property)
Shannon County, Missouri
SCI No. 2014-7007.20

Dear Mr. Polk:

Please complete the following questionnaire to the best of your knowledge regarding the above-referenced site. The questionnaire is being provided to obtain information needed to complete an environmental assessment being performed at the above-reference location. Please attach copies of any documents or additional pages as needed. Completion of this questionnaire is necessary to finalize our environmental assessment, which is in turn necessary for the impending property transfer (if applicable). Therefore, it is necessary that this form be completed and returned to me as soon as possible. Your cooperation is greatly appreciated.

1. Are any other environmental site assessments currently being performed or have previously been performed for this property? If so, please detail below.

2. Have any environmental permits (for example, solid waste disposal permits, hazardous waste disposal permits, wastewater permits, NPDES permits, land disturbance permits) been issued or requested? If so, please detail below.

3. If a permit has been obtained for the site, who will be responsible for maintaining it after the transaction is complete?

4. Are there any and/or have there ever been any underground or above-ground storage tanks on the property or on adjoining properties? If so, please provide information regarding location, contents, and storage capacities.

5. Have any reports regarding hydrogeologic or geotechnical conditions (soil borings, foundation studies, water movement, etc.) on the property been performed? If so, please detail below.

6. Are there any notices or other correspondence from any government agency relating to past or current violations or environmental laws with respect to the property or relating to environmental liens encumbering the property? If so, please detail below.

7. Are there any hazardous waste generator notices or reports? If so, please detail below.

8. Is there any pending, threatened, or past litigation relevant to hazardous substances or petroleum products in, on, or from the property? If so, please detail below.

9. Are there any pending, threatened, or past administrative proceedings relevant to hazardous substances or petroleum products in, on, or from the property? If so, please detail below.

10. Are there any notices from any governmental entity regarding any possible violation of environmental laws or possible liability relating to hazardous substances or petroleum products? If so, please detail below.

11. Are there currently or to the best of your knowledge have there ever been any damaged or discarded automotive or industrial batteries, or pesticides, paints, or other chemicals in individual containers of greater than 5 gallons in volume or 50 gallons in the aggregate stored on the property or at the facility? If so, please detail below.

12. Are there currently, or to the best of your knowledge have there ever been any drums (typically 55 gallon) or sacks of chemicals (fertilizer, pesticide, etc.) located on the property or at the facility? If so, please detail below.

13. Missouri State Law (RSMO 260.213) requires anyone selling, conveying, or transferring property that contains construction and demolition waste or other solid waste (whether buried or not) to disclose the existence and location of the waste disposal site early in the negotiation process. Have fill materials (soil, rock, concrete rubble, garbage, yard waste, etc.) been placed on the property? (If this is affirmative, you will be contacted by an SCI representative to ascertain the source, location, and depth of this material.)

14. Have fill materials (Soil, rock, concrete, rubble, garbage, yard waste, etc.) been moved from one portion of the property to another?

15. Are there currently, or to the best of your knowledge have there ever been, any burn pits located on the property?

16. Are there currently, or to the best of your knowledge, is there or has there ever been any soil, flooring drains, or walls located on the property that are stained by substances other than water or are emitting foul odors? If so, please detail below.

17. To the best of your knowledge, have any hazardous substances or petroleum products, unidentified waste materials, tires, automotive or industrial batteries or any other waste materials been discharged, dumped above grade, buried, disposed, and/or burned on the property? If so, please detail below.

18. Is there or has there ever been a transformer, capacitor, or any hydraulic equipment for which there are any records indicating the presence of PCBs? If so, please detail below.

19. Are there currently, or to the best of your knowledge have there ever been, any hydraulic lifts or oil/water separators located on the property? If so, during what years were they in service?

20. If you are the owner or partial owner, how long have you owned the subject site **and from whom did you acquire it?**

21. If you are a partial owner, please indicate the names of the other owners.

22. If you are the owner or partial owner, please indicate the legal ownership name as presented on the property deed.

23. Are there any wells or cisterns located on the subject site? If so, please detail below.

24. Are you aware of a pipeline crossing the property? If so, have you, any of your employees, or equipment ever come in contact with the pipe? If so, please detail below.

25. Have there ever been any structures on the site which are no longer present? If so, please detail below.

26. How long has the current structure been on-site?

27. How is/was the structure heated and describe its water/sewage system (e.g. well/septic tank)?

28. Are you aware that any of the current or former structures on the site utilized heating oil? If so, please describe how the heating oil was stored.

29. Please describe the locations and anticipated depths of current/former farm dumps. Farm dumps include areas where household garbage/refuse were placed as well as any demolition debris, farming implements, scrap lumber/metal, etc.

30. Are there currently, or to the best of your knowledge have there ever been, any sink holes located on the property? If yes, please describe.

31. Please indicate whether you have any reason to suspect dioxin may have been applied on-site. For instance, indicate whether any form of waste oil or other compounds were used for dust control.

32. If the site has a structure or structures, are you aware of any sampling or remediation relative to mold that has previously been performed?

33. Please include a statement that describes the current and/or past (if known) use of the site or any structures located on the site.

34. Please indicate the fire department/district servicing your property.

35. Please indicate the electric utility/cooperative utility servicing your property.

36. Are you aware of any current or former water distribution systems on site? If so, are you aware of it containing any asbestos containing materials?

Completed By:____

Date:_____________________ Phone:______________________

Title:_____________________ Fax:_______________________

Respectfully,

SCI ENGINEERING, INC.

Jarred M. Schmidt
Staff Scientist

Edwin P. Grimmer, P.E.
Senior Engineer, Associate

JMS/EPG/lf

N:\StCharles\shared\1soils\1NEW\PROJECT FILES\Springfield\2014 Project Files\2014-7007 Camp Zoe Rehab\ES\20\Task 200 Environmental Assessment\Adt'l Phase One\EAQ (owner).doc

SCI ENGINEERING, INC.
CONSULTANTS IN DEVELOPMENT, DESIGN AND CONSTRUCTION
GEOTECHNICAL
ENVIRONMENTAL
NATURAL RESOURCES
CULTURAL RESOURCES
CONSTRUCTION SERVICES

July 2, 2014

The State of Missouri
c/o Mr. Bob Polk
Farnsworth Group, Inc.
20 Allen Avenue, Suite 200
St. Louis, Missouri 63119

RE: Assessment User Questionnaire
Camp Zoe Rehab
(LAD/Pioneer Forest Property)
Shannon County, Missouri
SCI No. 2014-7007.20

Dear Mr. Polk:

Please complete the following questionnaire to the best of your knowledge regarding the above-referenced site. The questionnaire is being provided to obtain information needed to complete an environmental assessment being performed at the above-referenced location. Please attach copies of any documents or additional pages as needed. Completion of this questionnaire is necessary to finalize our environmental assessment, which is in turn necessary for the impending property transfer (if applicable). Therefore, it is necessary that this form be completed and returned to me as soon as possible. Your cooperation is greatly appreciated.

In order to quality for one of the Landowner Liability Protections (LLPs) offered by the Small Business Liability Relief and Brownfields Revitalization Act of 2001 (the "Brownfields Amendments") the user must provide the following information (if available) to the environmental professional. Failure to provide this information could result in a determination that "all appropriate inquiry" is not complete.

1. Why is the Phase One required and/or which of the following Landowner Liability Protections do you seek?

   Circle one: , Innocent landowner[1], contiguous property owner[2], bona fide prospective purchaser[3] or other (if other, please explain).

[1] Innocent landowner – a person may qualify as one of three types of innocent landowners (i) a person who "did not know and had no reason to know" that contamination existed on the *property* at the time the purchaser acquired the *property*; (ii) a government entity which acquired the *property* by escheat, or through any other involuntary transfer or acquisition, or though the exercise of eminent domain authority by purchase or condemnation; and (iii) a person who "acquired the facility by inheritance or bequest." To qualify for the first type of innocent landowner LLP, such person must have made *all appropriate inquiry* on or before the date of purchase. Furthermore, the *all appropriate inquiry* must not have resulted in knowledge of the contamination. If it does, then such person did "know" or "had reason to know" of contamination and would not be eligible for the *innocent landowner defense.*
[2] Contiguous property owner – a person may qualify if such person owns real *property* that is contiguous to, and that is or may be contaminated by *hazardous substances* from other real *property* and did not know or have reason to know that the *property* was or could be contaminated by a release or threatened release from the contiguous *property*. The *all appropriate inquiry* must not result in knowledge of contamination.
[3] Bona fide prospective purchaser – a person may qualify if such person made "all appropriate inquiries" into the previous ownership and use of the facility in accordance with generally accepted good commercial and customary standards and practices." Knowledge of contamination resulting from *all appropriate inquiry* would not generally preclude this liability protection. (The Bona Fide Prospective Purchaser LLP indicates that you may have knowledge of environmental impacts on the property.)

2. Based on your review of the title, are you aware of any environmental cleanup liens against the property that are filed or recorded under federal, tribal, state or local law?

3. Are you aware of any activity and use limitations (AULs) such as engineering controls, land use restrictions or institutional controls that are in place at the site and/or have been filed or recorded in a registry under federal, tribal, state or local law?

4. As the user of this environmental site assessment (ESA) do you have any specialized knowledge or experience related to the property or nearby properties? For example, are you involved in the same line of business as the current or former occupants of the property or an adjoining property so that you would have specialized knowledge of the chemicals and processes used by this type of business?

5. Does the purchase price being paid for this property reasonably reflect the fair market value of the property? If you conclude that there is a difference, have you considered whether the lower purchase price is because contamination is known or believed to be present at the property?

6. Are you aware of commonly known or reasonably ascertainable information about the property that would help the environmental professional to identify conditions indicative of releases or threatened releases? For example, as user,

   a. Do you know the past use of the property?

   b. Do you know of any specific chemicals that are present or once were present at the property?

   c. Do you know of spills or other chemical releases that have taken place at the property?

   d. Do you know of any environmental cleanups that have taken place at the property?

7. As the user of this ESA, based on your knowledge and experience related to the property are there any obvious indicators that point to the presence or likely presence of contamination at the property?

8. Do you have any other knowledge of experience with the *property* that may be pertinent to the *environmental professional* (for example, copies of any available prior *environmental site assessment reports*, documents, correspondence, etc., concerning the property and its environmental condition)?

Completed By:____

Date:___________________________ Phone:____________________________

Title:___________________________ Fax:______________________________

Respectfully,

SCI ENGINEERING, INC.

Jarred M. Schmidt
Staff Scientist

Edwin P. Grimmer, P.E.
Senior Engineer, Associate

JMS/EPG/lf

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APPENDIX C

SCI ENGINEERING, INC.
CONSULTANTS IN DEVELOPMENT, DESIGN AND CONSTRUCTION
GEOTECHNICAL
ENVIRONMENTAL
NATURAL RESOURCES
CULTURAL RESOURCES
CONSTRUCTION SERVICES

July 16, 2014

Timber Community Fire Protection District, South Station
HC 62 Box 348
Salem, Missouri 65560

RE: Fire Department Information Request
Camp Zoe Rehab (LAD/Pioneer Forest Property)
Shannon County, Missouri
SCI No. 2014-7007.20

To Whom It May Concern:

Please provide information relating to the storage or spillage of toxic, petroleum, or hazardous substances you may have on file regarding the above-referenced site. The site consists of approximately 80 acres of undeveloped property located to the northwest, southwest, and southeast of a recreational campground (Camp Zoe) in Shannon County, Missouri. SCI also requests similar information for properties in the vicinity of the subject site.

A map of the site area has been enclosed for your reference.

Please fax a response at your earliest convenience to (618) 624-7099. Thank you for your time and consideration in this matter. Please contact Jarred Schmidt at (618) 624-6969 should you have any questions.

Respectfully,

SCI ENGINEERING, INC.

Ed Grimmer, P.E.
Senior Engineer, Associate

EPG/lf

Enclosure

C: Eminence Volunteer Fire Department

N:\StCharles\shared\1soils\1NEW\PROJECT FILES\Springfield\2014 Project Files\2014-7007 Camp Zoe Rehab\ES\20\Task 300 LAD-Pioneer Forest Phase One\FD Letter-Timber CFPD.doc

PROJECT NAME	X1414-04 CAMP ZOE SHANNON COUNTY, MISSOURI	
	AERIAL PHOTOGRAPH	
DRAWN BY	RCV	DATE: 08/2014
CHECKED BY	JMS	JOB NUMBER: 2014-7007.20

GENERAL NOTES/LEGEND

AERIAL PHOTOGRAPH OBTAINED FROM ARCGIS ONLINE - WORLD IMAGERY, DATED 12/2012.

N W E S

SCALE 1" = 750'

FIGURE 3

APPENDIX D


INQUIRY #: 3861811.8
YEAR: 2012
= 500'
N
EDR


INQUIRY #: 3861811.8
YEAR: 2012
= 500'
N
EDR


INQUIRY #: 3861811.8
YEAR: 2012
= 500'
N
EDR


INQUIRY #: 3861811.8
YEAR: 2012
= 500'
N
EDR


INQUIRY #: 3861811.8
YEAR: 2005
= 500'
N
EDR


INQUIRY #: 3861811.8
YEAR: 2005
= 500'
N
EDR


INQUIRY #: 3861811.8
YEAR: 2005
= 500'
N
EDR


INQUIRY #: 3861811.8
YEAR: 2005
= 500'
N
EDR

INQUIRY #: 3861811.8

YEAR: 1995

= 750'

N

EDR


INQUIRY #: 3861811.8
YEAR: 1966
= 750'
N
EDR

APPENDIX E

Camp Zoe Rehab
LAD Property
Salem, MO 65560

Inquiry Number: 4008338.2s
July 16, 2014

The EDR Radius Map™ Report with GeoCheck®

EDR® Environmental Data Resources Inc

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

TABLE OF CONTENTS

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc (EDR). The report was designed to assist parties seeking to meet the search requirements of EPA's Standards and Practices for All Appropriate Inquiries (40 CFR Part 312), the ASTM Standard Practice for Environmental Site Assessments (E 1527-13) or custom requirements developed for the evaluation of environmental risk associated with a parcel of real estate.

TARGET PROPERTY INFORMATION

ADDRESS

LAD PROPERTY
SALEM, MO 65560

COORDINATES

Latitude (North):	37.3083000 - 37˚ 18' 29.88''
Longitude (West):	91.4072000 - 91˚ 24' 25.92''
Universal Tranverse Mercator:	Zone 15
UTM X (Meters):	641155.2
UTM Y (Meters):	4130059.5
Elevation:	695 ft. above sea level

USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property Map:	37091-C4 ROUND SPRING, MO
Most Recent Revision:	1985

AERIAL PHOTOGRAPHY IN THIS REPORT

Portions of Photo from:	20120624
Source:	USDA

TARGET PROPERTY SEARCH RESULTS

The target property was not listed in any of the databases searched by EDR.

DATABASES WITH NO MAPPED SITES

No mapped sites were found in EDR's search of available ("reasonably ascertainable ") government records either on the target property or within the search radius around the target property for the following databases:

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL - National Priority List

EXECUTIVE SUMMARY

Proposed NPL - - - - - - - - Proposed National Priority List Sites
NPL LIENS - - - - - - - - Federal Superfund Liens

Federal Delisted NPL site list

Delisted NPL - - - - - - - - National Priority List Deletions

Federal CERCLIS list

CERCLIS - - - - - - - - Comprehensive Environmental Response, Compensation, and Liability Information System
FEDERAL FACILITY - - - - - - - - Federal Facility Site Information listing

Federal CERCLIS NFRAP site List

CERC-NFRAP - - - - - - - - CERCLIS No Further Remedial Action Planned

Federal RCRA CORRACTS facilities list

CORRACTS - - - - - - - - Corrective Action Report

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF - - - - - - - - RCRA - Treatment, Storage and Disposal

Federal RCRA generators list

RCRA-LQG - - - - - - - - RCRA - Large Quantity Generators
RCRA-SQG - - - - - - - - RCRA - Small Quantity Generators
RCRA-CESQG - - - - - - - - RCRA - Conditionally Exempt Small Quantity Generator

Federal institutional controls / engineering controls registries

US ENG CONTROLS - - - - - - - - Engineering Controls Sites List
US INST CONTROL - - - - - - - - Sites with Institutional Controls
LUCIS - - - - - - - - Land Use Control Information System

Federal ERNS list

ERNS - - - - - - - - Emergency Response Notification System

State- and tribal - equivalent CERCLIS

SHWS - - - - - - - - Registry of Confirmed Abandoned or Uncontrolled Hazardous Waste Disposal Sites

State and tribal landfill and/or solid waste disposal site lists

SWF/LF - - - - - - - - Permitted Facility List

State and tribal leaking storage tank lists

LUST - - - - - - - - Leaking Underground Storage Tanks
LAST - - - - - - - - Leaking Aboveground Storage Tanks
INDIAN LUST - - - - - - - - Leaking Underground Storage Tanks on Indian Land

State and tribal registered storage tank lists

UST - - - - - - - - Petroleum Storage Tanks

EXECUTIVE SUMMARY

AST Aboveground Petroleum Storage Tanks
INDIAN UST Underground Storage Tanks on Indian Land
FEMA UST Underground Storage Tank Listing

State and tribal institutional control / engineering control registries

AUL Sites with Controls

State and tribal voluntary cleanup sites

VCP Voluntary Cleanup Program Site Listing
INDIAN VCP Voluntary Cleanup Priority Listing

State and tribal Brownfields sites

BROWNFIELDS Brownfields Site List

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS A Listing of Brownfields Sites

Local Lists of Landfill / Solid Waste Disposal Sites

ODI Open Dump Inventory
DEBRIS REGION 9 Torres Martinez Reservation Illegal Dump Site Locations
HIST LF Solid Waste Facility Database List
SWRCY Solid Waste Recycling Facilities
INDIAN ODI Report on the Status of Open Dumps on Indian Lands

Local Lists of Hazardous waste / Contaminated Sites

US CDL Clandestine Drug Labs
DEL SHWS Registry Sites Withdrawn or Deleted
CDL Environmental Emergency Response System
US HIST CDL National Clandestine Laboratory Register

Local Land Records

LIENS 2 CERCLA Lien Information

Records of Emergency Release Reports

HMIRS Hazardous Materials Information Reporting System
SPILLS Environmental Response Tracking Database
SPILLS 90 SPILLS 90 data from FirstSearch

Other Ascertainable Records

RCRA NonGen / NLR RCRA - Non Generators / No Longer Regulated
DOT OPS Incident and Accident Data
DOD Department of Defense Sites
FUDS Formerly Used Defense Sites

EXECUTIVE SUMMARY

CONSENT	Superfund (CERCLA) Consent Decrees
ROD	Records Of Decision
UMTRA	Uranium Mill Tailings Sites
US MINES	Mines Master Index File
TRIS	Toxic Chemical Release Inventory System
TSCA	Toxic Substances Control Act
FTTS	FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
HIST FTTS	FIFRA/TSCA Tracking System Administrative Case Listing
SSTS	Section 7 Tracking Systems
ICIS	Integrated Compliance Information System
PADS	PCB Activity Database System
MLTS	Material Licensing Tracking System
RADINFO	Radiation Information Database
FINDS	Facility Index System/Facility Registry System
RAATS	RCRA Administrative Action Tracking System
RMP	Risk Management Plans
UIC	Underground Injection Wells Database
DRYCLEANERS	Drycleaners in Missouri Listing
MO RRC	Certified Hazardous Waste Resource Recovery Facilities
NPDES	Permitted Facility Listing
AIRS	Permit Facility Listing
INDIAN RESERV	Indian Reservations
SCRD DRYCLEANERS	State Coalition for Remediation of Drycleaners Listing
COAL ASH	Coal Ash Disposal Sites
PCB TRANSFORMER	PCB Transformer Registration Database
2020 COR ACTION	2020 Corrective Action Program List
EPA WATCH LIST	EPA WATCH LIST
MINES	Industrial Mineral Mines Database
SMARS	Site Management and Reporting System
LEAD SMELTERS	Lead Smelter Sites
PRP	Potentially Responsible Parties
US AIRS	Aerometric Information Retrieval System Facility Subsystem
COAL ASH EPA	Coal Combustion Residues Surface Impoundments List
COAL ASH DOE	Steam-Electric Plant Operation Data
Financial Assurance	Financial Assurance Information Listing
US FIN ASSUR	Financial Assurance Information

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

EDR MGP	EDR Proprietary Manufactured Gas Plants
EDR US Hist Auto Stat	EDR Exclusive Historic Gas Stations
EDR US Hist Cleaners	EDR Exclusive Historic Dry Cleaners

EDR RECOVERED GOVERNMENT ARCHIVES

Exclusive Recovered Govt. Archives

RGA HWS	Recovered Government Archive State Hazardous Waste Facilities List
RGA LUST	Recovered Government Archive Leaking Underground Storage Tank
RGA LF	Recovered Government Archive Solid Waste Facilities List

EXECUTIVE SUMMARY

SURROUNDING SITES: SEARCH RESULTS

Surrounding sites were not identified.

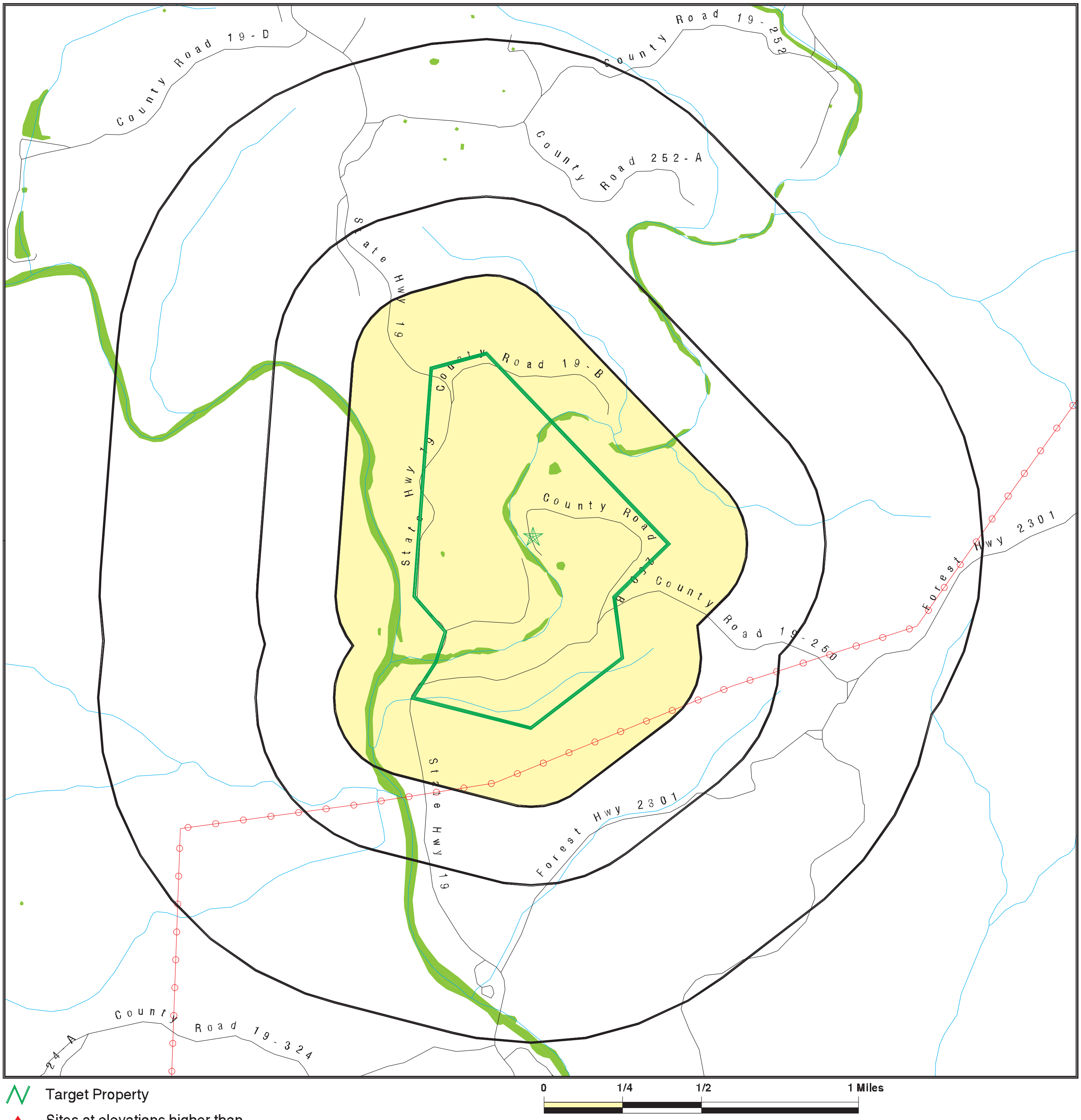
Unmappable (orphan) sites are not considered in the foregoing analysis.

EXECUTIVE SUMMARY

Due to poor or inadequate address information, the following sites were not mapped. Count: 39 records.

Site Name	Database(s)
TIMBER CHARCOAL COMPANY - TIMBER S	FINDS, US AIRS
SALEM MEMORIAL HOSPITAL	US AIRS
SALEM READY MIX	FINDS, US AIRS
CAPITAL QUARRIES-SALEM QUARRY	FINDS, US AIRS
ROYAL OAK ENTERPRISES	FINDS, NPDES, US AIRS
TIMBER INDUSTRIES	FTTS
TIMBER INDUSTRIES	HIST FTTS
	SPILLS, CDL
	SPILLS, CDL
	SPILLS, CDL
	SPILLS, CDL
	SPILLS, CDL
	SPILLS, CDL
	SPILLS, CDL
	SPILLS, CDL
	SPILLS, CDL
	SPILLS, CDL
	SPILLS, CDL
	SPILLS, CDL
	SPILLS, CDL
	SPILLS, CDL
TIMBER INDUSTRIES INC	CERC-NFRAP, RCRA NonGen / NLR, EPA WATCH LIST
TRADE WINDS	AST
CASEYS GENERAL STORE #2020	AST
RUNNING RIVER	AST
CASEYS GENERAL STORE #2245	AST
MFA OIL	AST
SALEM AIRPORT	AST
GAS PLUS CONVENIENCE STORE	AST
PIONEER FOREST LLC	RCRA-SQG
WAL MART SUPERCENTER #27	RCRA-SQG
RUAN	RCRA NonGen / NLR
DENT COUNTY ROAD MAINTENANCE	RCRA NonGen / NLR
72 AUTO BODY	RCRA NonGen / NLR
MO DEPT CONSERVATION SALEM MAINT	RCRA NonGen / NLR
CASEYS GENERAL STORE 2245	RCRA NonGen / NLR, FINDS
TIMBER INDUSTRIES TREATMENT PLANT	ICIS, FINDS
DELANO STATION BREAK	ICIS, FINDS
	ICIS, FINDS

overview MAP - 4008338.2s



Target Property

Sites at elevations higher than or equal to the target property

Sites at elevations lower than the target property

Manufactured Gas Plants

Sensitive Receptors

National Priority List Sites

Dept. Defense Sites

Indian Reservations BIA

Power transmission lines

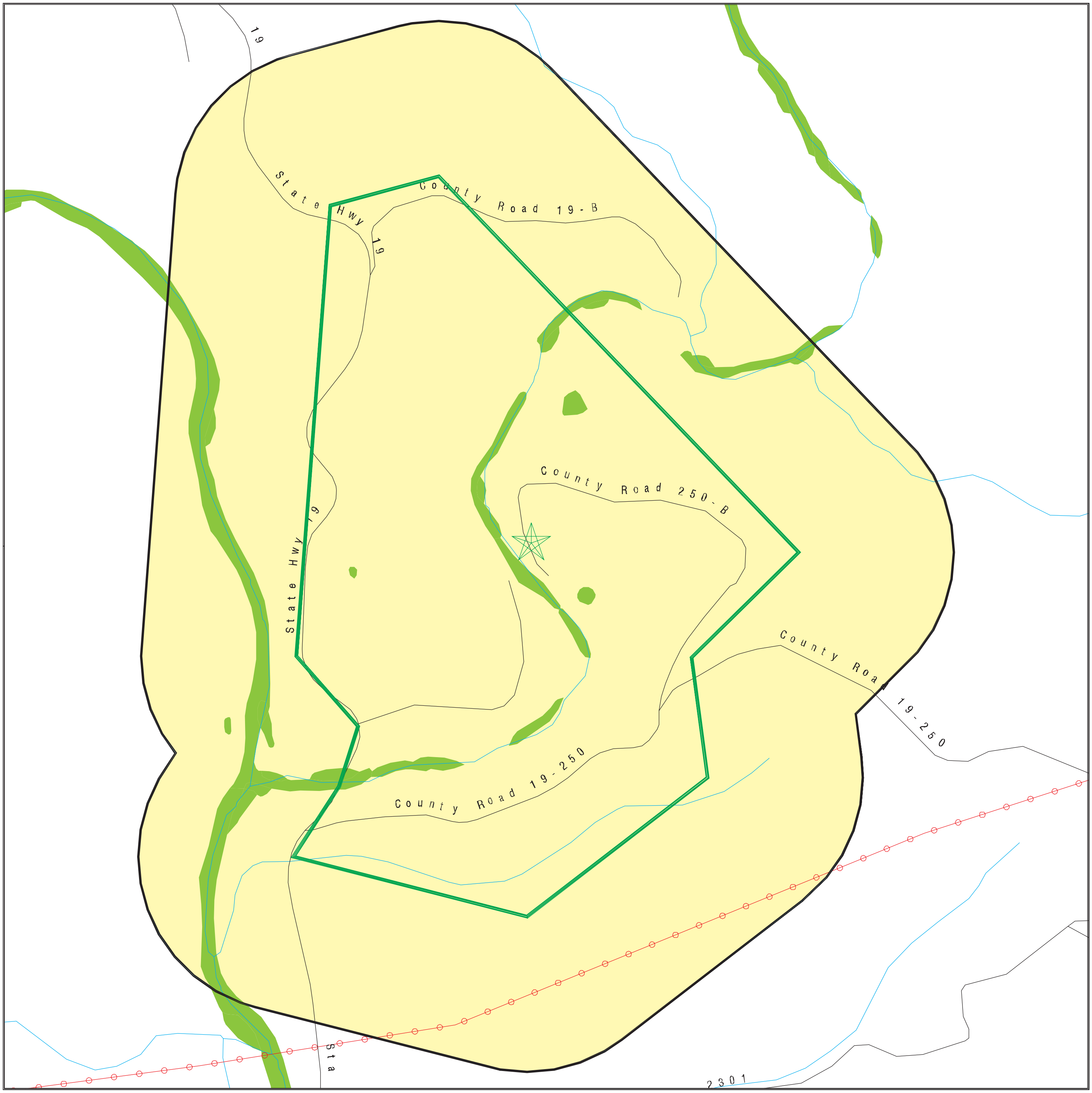
Oil & Gas pipelines from USGS

National Wetland Inventory

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME:	Camp Zoe Rehab	CLIENT:	SCI Engineering, Inc.
ADDRESS:	LAD Property Salem MO 65560	CONTACT:	Jarred Schmidt
		INQUIRY #:	4008338.2s
LAT/LONG:	37.3083 / 91.4072	DATE:	July 16, 2014 3:11 pm

detail MAP - 4008338.2s



0 1/8 1/4 1/2 Miles

- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Manufactured Gas Plants
- Sensitive Receptors
- National Priority List Sites
- Dept. Defense Sites
- Indian Reservations BIA
- Power transmission lines
- Oil & Gas pipelines from USGS
- National Wetland Inventory

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME:	Camp Zoe Rehab	CLIENT:	SCI Engineering, Inc.
ADDRESS:	LAD Property	CONTACT:	Jarred Schmidt
	Salem MO 65560	INQUIRY #:	4008338.2s
LAT/LONG:	37.3083 / 91.4072	DATE:	July 16, 2014 3:11 pm

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
STANDARD ENVIRONMENTAL RECORDS								
Federal NPL site list								
NPL	1.000		0	0	0	0	NR	0
Proposed NPL	1.000		0	0	0	0	NR	0
NPL LIENS	0.001		0	NR	NR	NR	NR	0
Federal Delisted NPL site list								
Delisted NPL	1.000		0	0	0	0	NR	0
Federal CERCLIS list								
CERCLIS	0.500		0	0	0	NR	NR	0
FEDERAL FACILITY	0.500		0	0	0	NR	NR	0
Federal CERCLIS NFRAP site List								
CERC-NFRAP	0.500		0	0	0	NR	NR	0
Federal RCRA CORRACTS facilities list								
CORRACTS	1.000		0	0	0	0	NR	0
Federal RCRA non-CORRACTS TSD facilities list								
RCRA-TSDF	0.500		0	0	0	NR	NR	0
Federal RCRA generators list								
RCRA-LQG	0.250		0	0	NR	NR	NR	0
RCRA-SQG	0.250		0	0	NR	NR	NR	0
RCRA-CESQG	0.250		0	0	NR	NR	NR	0
Federal institutional controls / engineering controls registries								
US ENG CONTROLS	0.500		0	0	0	NR	NR	0
US INST CONTROL	0.500		0	0	0	NR	NR	0
LUCIS	0.500		0	0	0	NR	NR	0
Federal ERNS list								
ERNS	0.001		0	NR	NR	NR	NR	0
State- and tribal - equivalent CERCLIS								
SHWS	1.000		0	0	0	0	NR	0
State and tribal landfill and/or solid waste disposal site lists								
SWF/LF	0.500		0	0	0	NR	NR	0
State and tribal leaking storage tank lists								
LUST	0.500		0	0	0	NR	NR	0
LAST	0.500		0	0	0	NR	NR	0
INDIAN LUST	0.500		0	0	0	NR	NR	0
State and tribal registered storage tank lists								
UST	0.250		0	0	NR	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
AST	0.250		0	0	NR	NR	NR	0
INDIAN UST	0.250		0	0	NR	NR	NR	0
FEMA UST	0.250		0	0	NR	NR	NR	0
State and tribal institutional control / engineering control registries								
AUL	0.500		0	0	0	NR	NR	0
State and tribal voluntary cleanup sites								
VCP	0.500		0	0	0	NR	NR	0
INDIAN VCP	0.500		0	0	0	NR	NR	0
State and tribal Brownfields sites								
BROWNFIELDS	0.500		0	0	0	NR	NR	0
ADDITIONAL ENVIRONMENTAL RECORDS								
Local Brownfield lists								
US BROWNFIELDS	0.500		0	0	0	NR	NR	0
Local Lists of Landfill / Solid Waste Disposal Sites								
ODI	0.500		0	0	0	NR	NR	0
DEBRIS REGION 9	0.500		0	0	0	NR	NR	0
HIST LF	0.500		0	0	0	NR	NR	0
SWRCY	0.500		0	0	0	NR	NR	0
INDIAN ODI	0.500		0	0	0	NR	NR	0
Local Lists of Hazardous waste / Contaminated Sites								
US CDL	0.001		0	NR	NR	NR	NR	0
DEL SHWS	1.000		0	0	0	0	NR	0
CDL	0.001		0	NR	NR	NR	NR	0
US HIST CDL	0.001		0	NR	NR	NR	NR	0
Local Land Records								
LIENS 2	0.001		0	NR	NR	NR	NR	0
Records of Emergency Release Reports								
HMIRS	0.001		0	NR	NR	NR	NR	0
SPILLS	0.001		0	NR	NR	NR	NR	0
SPILLS 90	0.001		0	NR	NR	NR	NR	0
Other Ascertainable Records								
RCRA NonGen / NLR	0.250		0	0	NR	NR	NR	0
DOT OPS	0.001		0	NR	NR	NR	NR	0
DOD	1.000		0	0	0	0	NR	0
FUDS	1.000		0	0	0	0	NR	0
CONSENT	1.000		0	0	0	0	NR	0
ROD	1.000		0	0	0	0	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
UMTRA	0.500		0	0	0	NR	NR	0
US MINES	0.250		0	0	NR	NR	NR	0
TRIS	0.001		0	NR	NR	NR	NR	0
TSCA	0.001		0	NR	NR	NR	NR	0
FTTS	0.001		0	NR	NR	NR	NR	0
HIST FTTS	0.001		0	NR	NR	NR	NR	0
SSTS	0.001		0	NR	NR	NR	NR	0
ICIS	0.001		0	NR	NR	NR	NR	0
PADS	0.001		0	NR	NR	NR	NR	0
MLTS	0.001		0	NR	NR	NR	NR	0
RADINFO	0.001		0	NR	NR	NR	NR	0
FINDS	0.001		0	NR	NR	NR	NR	0
RAATS	0.001		0	NR	NR	NR	NR	0
RMP	0.001		0	NR	NR	NR	NR	0
UIC	0.001		0	NR	NR	NR	NR	0
DRYCLEANERS	0.250		0	0	NR	NR	NR	0
MO RRC	0.001		0	NR	NR	NR	NR	0
NPDES	0.001		0	NR	NR	NR	NR	0
AIRS	0.001		0	NR	NR	NR	NR	0
INDIAN RESERV	1.000		0	0	0	0	NR	0
SCRD DRYCLEANERS	0.500		0	0	0	NR	NR	0
COAL ASH	0.500		0	0	0	NR	NR	0
PCB TRANSFORMER	0.001		0	NR	NR	NR	NR	0
2020 COR ACTION	0.250		0	0	NR	NR	NR	0
EPA WATCH LIST	0.001		0	NR	NR	NR	NR	0
MINES	0.250		0	0	NR	NR	NR	0
SMARS	0.500		0	0	0	NR	NR	0
LEAD SMELTERS	0.001		0	NR	NR	NR	NR	0
PRP	0.001		0	NR	NR	NR	NR	0
US AIRS	0.001		0	NR	NR	NR	NR	0
COAL ASH EPA	0.500		0	0	0	NR	NR	0
COAL ASH DOE	0.001		0	NR	NR	NR	NR	0
Financial Assurance	0.001		0	NR	NR	NR	NR	0
US FIN ASSUR	0.001		0	NR	NR	NR	NR	0

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

EDR MGP	1.000		0	0	0	0	NR	0
EDR US Hist Auto Stat	0.250		0	0	NR	NR	NR	0
EDR US Hist Cleaners	0.250		0	0	NR	NR	NR	0

EDR RECOVERED GOVERNMENT ARCHIVES

Exclusive Recovered Govt. Archives

RGA HWS	0.001		0	NR	NR	NR	NR	0
RGA LUST	0.001		0	NR	NR	NR	NR	0
RGA LF	0.001		0	NR	NR	NR	NR	0

NOTES:

TP = Target Property

NR = Not Requested at this Search Distance

Sites may be listed in more than one database

MAP FINDINGS

Map ID Direction Distance Elevation	Site	Database(s)	EDR ID Number EPA ID Number

NO SITES FOUND

Count: 39 records.

ORPHAN SUMMARY

City	EDR ID	Site Name	Site Address	Zip	Database(s)
SALEM	S107258604		ROUTE 1 BOX 4735		SPILLS, CDL
SALEM	S105359597		ROUTE 1 BOX 149		SPILLS, CDL
SALEM	S106490045		ROUTE 1, BOX 5100		SPILLS, CDL
SALEM	A100192587	TRADE WINDS	HWY 119	65560	AST
SALEM	A100342440	CASEYS GENERAL STORE #2020	HWY 19 S	65560	AST
SALEM	A100191958	RUNNING RIVER	HWY 19 HCR 13 BOX 368	65560	AST
SALEM	1016120195	TIMBER INDUSTRIES TREATMENT PLANT	HIGHWAY 19 NORTH	65560	ICIS, FINDS
SALEM	1011993701	TIMBER CHARCOAL COMPANY - TIMBER S	HWY 19 SOUTH & A		FINDS, US AIRS
SALEM	1011848282	DELANO STATION BREAK	HIGHWAY 19 AND 68	65560	ICIS, FINDS
SALEM	1010010698	TIMBER INDUSTRIES	HWY 19 N	65560	FTTS
SALEM	1008190949	TIMBER INDUSTRIES	HWY 19 N	65560	HIST FTTS
SALEM	1004539923		HIGHWAY 19 NORTH	65560	ICIS, FINDS
SALEM	S106341297		ROUTE 2, BOX 107		SPILLS, CDL
SALEM	S106143087		ROUTE 2/ROUTE K		SPILLS, CDL
SALEM	S106749506		ROUTE 3 BOX 8942		SPILLS, CDL
SALEM	S106143084		HIGHWAY 32 WEST		SPILLS, CDL
SALEM	A100342502	CASEYS GENERAL STORE #2245	800 E 32 HWY	65560	AST
SALEM	A100210476	MFA OIL	HWY 32 WEST	65560	AST
SALEM	A100192384	SALEM AIRPORT	HWY 32 & F	65560	AST
SALEM	1010565035	RUAN	HWY 32 1.25 MI E OF JCT W &EE	65560	RCRA NonGen / NLR
SALEM	1007109088	DENT COUNTY ROAD MAINTENANCE	HWY 32 & 72 JCT	65560	RCRA NonGen / NLR
SALEM	S106143083		ROUTE 4 BOX 976 COUNTY ROAD 74		SPILLS, CDL
SALEM	S106143088		ROUTE 4, BOX 976		SPILLS, CDL
SALEM	S106143085		ROUTE 6, BOX 2500		SPILLS, CDL
SALEM	S105362193		ROUTE 6; BOX 2900		SPILLS, CDL
SALEM	1014753947	SALEM MEMORIAL HOSPITAL	HIGHWAY 72 WEST	65560	US AIRS
SALEM	1007106461	72 AUTO BODY	HWY 72 S 1 MI S OF HWY C	65560	RCRA NonGen / NLR
SALEM	1000471178	MO DEPT CONSERVATION SALEM MAINT	HWY 72 & 32	65560	RCRA NonGen / NLR
SALEM	1006269913	SALEM READY MIX	HWY 72-32		FINDS, US AIRS
SALEM	1010020886	CAPITAL QUARRIES-SALEM QUARRY	COUNTY ROAD 522 (OFF HWY EE)		FINDS, US AIRS
SALEM	S105363402		NORTH HIGHWAY 19		SPILLS, CDL
SALEM	A100343055	GAS PLUS CONVENIENCE STORE	506 EAST HWY 32	65560	AST
SALEM	1016449374	PIONEER FOREST LLC	2265 N HWY 19	65560	RCRA-SQG
SALEM	1010322710	WAL MART SUPERCENTER #27	1101 W HWY 32	65560	RCRA-SQG
SALEM	1001493404	CASEYS GENERAL STORE 2245	800 E HWY 32		RCRA NonGen / NLR, FINDS
SALEM	1000162601	TIMBER INDUSTRIES INC	N HWY 19	65560	CERC-NFRAP, RCRA NonGen / NLR, EPA WATCH LIST
SALEM	1009325056	ROYAL OAK ENTERPRISES	HWY JJ		FINDS, NPDES, US AIRS
SALEM	S107258614		5 RURAL ROUTE 158		SPILLS, CDL
SALEM	S106143091		1425 ROUTE YY		SPILLS, CDL

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

To maintain currency of the following federal and state databases, EDR contacts the appropriate governmental agency on a monthly or quarterly basis, as required.

Number of Days to Update: Provides confirmation that EDR is reporting records that have been updated within 90 days from the date the government agency made the information available to the public.

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL: National Priority List

National Priorities List (Superfund). The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund Program. NPL sites may encompass relatively large areas. As such, EDR provides polygon coverage for over 1,000 NPL site boundaries produced by EPA's Environmental Photographic Interpretation Center (EPIC) and regional EPA offices.

Date of Government Version: 10/25/2013
Date Data Arrived at EDR: 11/11/2013
Date Made Active in Reports: 01/28/2014
Number of Days to Update: 78

Source: EPA
Telephone: N/A
Last EDR Contact: 07/08/2014
Next Scheduled EDR Contact: 10/20/2014
Data Release Frequency: Quarterly

NPL Site Boundaries

Sources:

EPA's Environmental Photographic Interpretation Center (EPIC)
Telephone: 202-564-7333

EPA Region 1
Telephone 617-918-1143

EPA Region 3
Telephone 215-814-5418

EPA Region 4
Telephone 404-562-8033

EPA Region 5
Telephone 312-886-6686

EPA Region 10
Telephone 206-553-8665

EPA Region 6
Telephone: 214-655-6659

EPA Region 7
Telephone: 913-551-7247

EPA Region 8
Telephone: 303-312-6774

EPA Region 9
Telephone: 415-947-4246

Proposed NPL: Proposed National Priority List Sites

A site that has been proposed for listing on the National Priorities List through the issuance of a proposed rule in the Federal Register. EPA then accepts public comments on the site, responds to the comments, and places on the NPL those sites that continue to meet the requirements for listing.

Date of Government Version: 10/25/2013
Date Data Arrived at EDR: 11/11/2013
Date Made Active in Reports: 01/28/2014
Number of Days to Update: 78

Source: EPA
Telephone: N/A
Last EDR Contact: 07/08/2014
Next Scheduled EDR Contact: 10/20/2014
Data Release Frequency: Quarterly

NPL LIENS: Federal Superfund Liens

Federal Superfund Liens. Under the authority granted the USEPA by CERCLA of 1980, the USEPA has the authority to file liens against real property in order to recover remedial action expenditures or when the property owner received notification of potential liability. USEPA compiles a listing of filed notices of Superfund Liens.

Date of Government Version: 10/15/1991
Date Data Arrived at EDR: 02/02/1994
Date Made Active in Reports: 03/30/1994
Number of Days to Update: 56

Source: EPA
Telephone: 202-564-4267
Last EDR Contact: 08/15/2011
Next Scheduled EDR Contact: 11/28/2011
Data Release Frequency: No Update Planned

Federal Delisted NPL site list

DELISTED NPL: National Priority List Deletions

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425.(e), sites may be deleted from the NPL where no further response is appropriate.

Date of Government Version: 10/25/2013	Source: EPA
Date Data Arrived at EDR: 11/11/2013	Telephone: N/A
Date Made Active in Reports: 01/28/2014	Last EDR Contact: 07/08/2014
Number of Days to Update: 78	Next Scheduled EDR Contact: 10/20/2014
	Data Release Frequency: Quarterly

Federal CERCLIS list

CERCLIS: Comprehensive Environmental Response, Compensation, and Liability Information System

CERCLIS contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLIS contains sites which are either proposed to or on the National Priorities List (NPL) and sites which are in the screening and assessment phase for possible inclusion on the NPL.

Date of Government Version: 10/25/2013	Source: EPA
Date Data Arrived at EDR: 11/11/2013	Telephone: 703-412-9810
Date Made Active in Reports: 02/13/2014	Last EDR Contact: 05/29/2014
Number of Days to Update: 94	Next Scheduled EDR Contact: 09/08/2014
	Data Release Frequency: Quarterly

FEDERAL FACILITY: Federal Facility Site Information listing

A listing of National Priority List (NPL) and Base Realignment and Closure (BRAC) sites found in the Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) Database where EPA Federal Facilities Restoration and Reuse Office is involved in cleanup activities.

Date of Government Version: 05/31/2013	Source: Environmental Protection Agency
Date Data Arrived at EDR: 07/08/2013	Telephone: 703-603-8704
Date Made Active in Reports: 12/06/2013	Last EDR Contact: 07/08/2014
Number of Days to Update: 151	Next Scheduled EDR Contact: 10/20/2014
	Data Release Frequency: Varies

Federal CERCLIS NFRAP site List

CERCLIS-NFRAP: CERCLIS No Further Remedial Action Planned

Archived sites are sites that have been removed and archived from the inventory of CERCLIS sites. Archived status indicates that, to the best of EPA's knowledge, assessment at a site has been completed and that EPA has determined no further steps will be taken to list this site on the National Priorities List (NPL), unless information indicates this decision was not appropriate or other considerations require a recommendation for listing at a later time. This decision does not necessarily mean that there is no hazard associated with a given site; it only means that, based upon available information, the location is not judged to be a potential NPL site.

Date of Government Version: 10/25/2013	Source: EPA
Date Data Arrived at EDR: 11/11/2013	Telephone: 703-412-9810
Date Made Active in Reports: 02/13/2014	Last EDR Contact: 05/29/2014
Number of Days to Update: 94	Next Scheduled EDR Contact: 09/08/2014
	Data Release Frequency: Quarterly

Federal RCRA CORRACTS facilities list

CORRACTS: Corrective Action Report

CORRACTS identifies hazardous waste handlers with RCRA corrective action activity.

Date of Government Version: 03/11/2014
Date Data Arrived at EDR: 03/13/2014
Date Made Active in Reports: 04/09/2014
Number of Days to Update: 27

Source: EPA
Telephone: 800-424-9346
Last EDR Contact: 07/02/2014
Next Scheduled EDR Contact: 10/13/2014
Data Release Frequency: Quarterly

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF: RCRA - Treatment, Storage and Disposal

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Transporters are individuals or entities that move hazardous waste from the generator offsite to a facility that can recycle, treat, store, or dispose of the waste. TSDFs treat, store, or dispose of the waste.

Date of Government Version: 03/11/2014
Date Data Arrived at EDR: 03/13/2014
Date Made Active in Reports: 04/09/2014
Number of Days to Update: 27

Source: Environmental Protection Agency
Telephone: 913-551-7003
Last EDR Contact: 07/02/2014
Next Scheduled EDR Contact: 10/13/2014
Data Release Frequency: Quarterly

Federal RCRA generators list

RCRA-LQG: RCRA - Large Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Large quantity generators (LQGs) generate over 1,000 kilograms (kg) of hazardous waste, or over 1 kg of acutely hazardous waste per month.

Date of Government Version: 03/11/2014
Date Data Arrived at EDR: 03/13/2014
Date Made Active in Reports: 04/09/2014
Number of Days to Update: 27

Source: Environmental Protection Agency
Telephone: 913-551-7003
Last EDR Contact: 07/02/2014
Next Scheduled EDR Contact: 10/13/2014
Data Release Frequency: Quarterly

RCRA-SQG: RCRA - Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Small quantity generators (SQGs) generate between 100 kg and 1,000 kg of hazardous waste per month.

Date of Government Version: 03/11/2014
Date Data Arrived at EDR: 03/13/2014
Date Made Active in Reports: 04/09/2014
Number of Days to Update: 27

Source: Environmental Protection Agency
Telephone: 913-551-7003
Last EDR Contact: 07/02/2014
Next Scheduled EDR Contact: 10/13/2014
Data Release Frequency: Quarterly

RCRA-CESQG: RCRA - Conditionally Exempt Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Conditionally exempt small quantity generators (CESQGs) generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month.

Date of Government Version: 03/11/2014
Date Data Arrived at EDR: 03/13/2014
Date Made Active in Reports: 04/09/2014
Number of Days to Update: 27

Source: Environmental Protection Agency
Telephone: 913-551-7003
Last EDR Contact: 07/02/2014
Next Scheduled EDR Contact: 10/13/2014
Data Release Frequency: Varies

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Federal institutional controls / engineering controls registries

US ENG CONTROLS: Engineering Controls Sites List

A listing of sites with engineering controls in place. Engineering controls include various forms of caps, building foundations, liners, and treatment methods to create pathway elimination for regulated substances to enter environmental media or effect human health.

Date of Government Version: 03/19/2014
Date Data Arrived at EDR: 03/21/2014
Date Made Active in Reports: 07/15/2014
Number of Days to Update: 116

Source: Environmental Protection Agency
Telephone: 703-603-0695
Last EDR Contact: 06/05/2014
Next Scheduled EDR Contact: 09/22/2014
Data Release Frequency: Varies

US INST CONTROL: Sites with Institutional Controls

A listing of sites with institutional controls in place. Institutional controls include administrative measures, such as groundwater use restrictions, construction restrictions, property use restrictions, and post remediation care requirements intended to prevent exposure to contaminants remaining on site. Deed restrictions are generally required as part of the institutional controls.

Date of Government Version: 03/19/2014
Date Data Arrived at EDR: 03/21/2014
Date Made Active in Reports: 07/15/2014
Number of Days to Update: 116

Source: Environmental Protection Agency
Telephone: 703-603-0695
Last EDR Contact: 06/05/2014
Next Scheduled EDR Contact: 09/22/2014
Data Release Frequency: Varies

LUCIS: Land Use Control Information System

LUCIS contains records of land use control information pertaining to the former Navy Base Realignment and Closure properties.

Date of Government Version: 05/28/2014
Date Data Arrived at EDR: 05/30/2014
Date Made Active in Reports: 06/17/2014
Number of Days to Update: 18

Source: Department of the Navy
Telephone: 843-820-7326
Last EDR Contact: 05/19/2014
Next Scheduled EDR Contact: 09/01/2014
Data Release Frequency: Varies

Federal ERNS list

ERNS: Emergency Response Notification System

Emergency Response Notification System. ERNS records and stores information on reported releases of oil and hazardous substances.

Date of Government Version: 09/30/2013
Date Data Arrived at EDR: 10/01/2013
Date Made Active in Reports: 12/06/2013
Number of Days to Update: 66

Source: National Response Center, United States Coast Guard
Telephone: 202-267-2180
Last EDR Contact: 07/03/2014
Next Scheduled EDR Contact: 07/14/2014
Data Release Frequency: Annually

State- and tribal - equivalent CERCLIS

HWS DETAIL: Registry Annual Report

Each site is described in detail in this annual report and includeds the following information: a general description of the site; a summary of any significant environmental problems at and near the site; a summary of any serious health problems in the immediate vicinity of the site; the status of any testing, monitoring or remedial actions in progress or recommended by the department.

Date of Government Version: 06/30/2012
Date Data Arrived at EDR: 03/14/2013
Date Made Active in Reports: 04/23/2013
Number of Days to Update: 40

Source: Department of Natural Resources
Telephone: 573-751-3176
Last EDR Contact: 06/02/2014
Next Scheduled EDR Contact: 07/02/5007
Data Release Frequency: Annually

SHWS: Registry of Confirmed Abandoned or Uncontrolled Hazardous Waste Disposal Sites

State Hazardous Waste Sites. State hazardous waste site records are the states' equivalent to CERCLIS. These sites may or may not already be listed on the federal CERCLIS list. Priority sites planned for cleanup using state funds (state equivalent of Superfund) are identified along with sites where cleanup will be paid for by potentially responsible parties. Available information varies by state.

Date of Government Version: 12/03/2013
Date Data Arrived at EDR: 12/05/2013
Date Made Active in Reports: 12/20/2013
Number of Days to Update: 15

Source: Department of Natural Resources
Telephone: 573-751-1990
Last EDR Contact: 06/16/2014
Next Scheduled EDR Contact: 09/15/2014
Data Release Frequency: Quarterly

State and tribal landfill and/or solid waste disposal site lists

SWF/LF: Solid Waste Facility List

Solid Waste Facilities/Landfill Sites. SWF/LF type records typically contain an inventory of solid waste disposal facilities or landfills in a particular state. Depending on the state, these may be active or inactive facilities or open dumps that failed to meet RCRA Subtitle D Section 4004 criteria for solid waste landfills or disposal sites.

Date of Government Version: 02/26/2014
Date Data Arrived at EDR: 02/28/2014
Date Made Active in Reports: 04/10/2014
Number of Days to Update: 41

Source: Department of Natural Resources
Telephone: 573-751-5401
Last EDR Contact: 05/19/2014
Next Scheduled EDR Contact: 09/01/2014
Data Release Frequency: Quarterly

State and tribal leaking storage tank lists

LUST: Leaking Underground Storage Tanks

Leaking Underground Storage Tank Incident Reports. LUST records contain an inventory of reported leaking underground storage tank incidents. Not all states maintain these records, and the information stored varies by state.

Date of Government Version: 04/22/2014
Date Data Arrived at EDR: 05/02/2014
Date Made Active in Reports: 05/06/2014
Number of Days to Update: 4

Source: Department of Natural Resources
Telephone: 573-751-0135
Last EDR Contact: 06/17/2014
Next Scheduled EDR Contact: 09/29/2014
Data Release Frequency: Semi-Annually

LAST: Leaking Aboveground Storage Tanks

A listing of leaking aboveground storage tanks.

Date of Government Version: 04/22/2014
Date Data Arrived at EDR: 05/02/2014
Date Made Active in Reports: 05/06/2014
Number of Days to Update: 4

Source: Department of Natural Resources
Telephone: 573-751-6822
Last EDR Contact: 06/17/2014
Next Scheduled EDR Contact: 09/29/2014
Data Release Frequency: Quarterly

INDIAN LUST R1: Leaking Underground Storage Tanks on Indian Land

A listing of leaking underground storage tank locations on Indian Land.

Date of Government Version: 02/01/2013
Date Data Arrived at EDR: 05/01/2013
Date Made Active in Reports: 11/01/2013
Number of Days to Update: 184

Source: EPA Region 1
Telephone: 617-918-1313
Last EDR Contact: 05/02/2014
Next Scheduled EDR Contact: 08/11/2014
Data Release Frequency: Varies

INDIAN LUST R10: Leaking Underground Storage Tanks on Indian Land

LUSTs on Indian land in Alaska, Idaho, Oregon and Washington.

Date of Government Version: 11/06/2013
Date Data Arrived at EDR: 11/07/2013
Date Made Active in Reports: 12/06/2013
Number of Days to Update: 29

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 04/28/2014
Next Scheduled EDR Contact: 08/11/2014
Data Release Frequency: Quarterly

INDIAN LUST R5: Leaking Underground Storage Tanks on Indian Land
Leaking underground storage tanks located on Indian Land in Michigan, Minnesota and Wisconsin.

Date of Government Version: 05/12/2014
Date Data Arrived at EDR: 05/12/2014
Date Made Active in Reports: 06/17/2014
Number of Days to Update: 36

Source: EPA, Region 5
Telephone: 312-886-7439
Last EDR Contact: 04/28/2014
Next Scheduled EDR Contact: 08/11/2014
Data Release Frequency: Varies

INDIAN LUST R9: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Arizona, California, New Mexico and Nevada

Date of Government Version: 03/01/2013
Date Data Arrived at EDR: 03/01/2013
Date Made Active in Reports: 04/12/2013
Number of Days to Update: 42

Source: Environmental Protection Agency
Telephone: 415-972-3372
Last EDR Contact: 04/28/2014
Next Scheduled EDR Contact: 08/11/2014
Data Release Frequency: Quarterly

INDIAN LUST R4: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Florida, Mississippi and North Carolina.

Date of Government Version: 04/24/2014
Date Data Arrived at EDR: 04/25/2014
Date Made Active in Reports: 06/17/2014
Number of Days to Update: 53

Source: EPA Region 4
Telephone: 404-562-8677
Last EDR Contact: 04/22/2014
Next Scheduled EDR Contact: 08/11/2014
Data Release Frequency: Semi-Annually

INDIAN LUST R6: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in New Mexico and Oklahoma.

Date of Government Version: 05/14/2014
Date Data Arrived at EDR: 05/15/2014
Date Made Active in Reports: 07/15/2014
Number of Days to Update: 61

Source: EPA Region 6
Telephone: 214-665-6597
Last EDR Contact: 02/21/2014
Next Scheduled EDR Contact: 05/12/2014
Data Release Frequency: Varies

INDIAN LUST R7: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Iowa, Kansas, and Nebraska

Date of Government Version: 04/28/2014
Date Data Arrived at EDR: 05/01/2014
Date Made Active in Reports: 06/17/2014
Number of Days to Update: 47

Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 04/28/2014
Next Scheduled EDR Contact: 08/11/2014
Data Release Frequency: Varies

INDIAN LUST R8: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Colorado, Montana, North Dakota, South Dakota, Utah and Wyoming.

Date of Government Version: 08/27/2012
Date Data Arrived at EDR: 08/28/2012
Date Made Active in Reports: 10/16/2012
Number of Days to Update: 49

Source: EPA Region 8
Telephone: 303-312-6271
Last EDR Contact: 04/28/2014
Next Scheduled EDR Contact: 08/11/2014
Data Release Frequency: Quarterly

State and tribal registered storage tank lists

UST: Petroleum Storage Tanks

Registered Underground Storage Tanks. UST's are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA) and must be registered with the state department responsible for administering the UST program. Available information varies by state program.

Date of Government Version: 04/22/2014
Date Data Arrived at EDR: 05/02/2014
Date Made Active in Reports: 05/06/2014
Number of Days to Update: 4

Source: Department of Natural Resources
Telephone: 573-751-0135
Last EDR Contact: 06/17/2014
Next Scheduled EDR Contact: 09/29/2014
Data Release Frequency: Semi-Annually

AST: Aboveground Petroleum Storage Tanks

Registered Aboveground Storage Tanks.

Date of Government Version: 04/18/2014
Date Data Arrived at EDR: 04/22/2014
Date Made Active in Reports: 05/06/2014
Number of Days to Update: 14

Source: Department of Agriculture
Telephone: 573-751-7062
Last EDR Contact: 04/18/2014
Next Scheduled EDR Contact: 09/08/2014
Data Release Frequency: Semi-Annually

INDIAN UST R1: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 1 (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont and ten Tribal Nations).

Date of Government Version: 02/01/2013
Date Data Arrived at EDR: 05/01/2013
Date Made Active in Reports: 01/27/2014
Number of Days to Update: 271

Source: EPA, Region 1
Telephone: 617-918-1313
Last EDR Contact: 05/02/2014
Next Scheduled EDR Contact: 08/11/2014
Data Release Frequency: Varies

INDIAN UST R4: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 4 (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee and Tribal Nations)

Date of Government Version: 04/24/2014
Date Data Arrived at EDR: 04/25/2014
Date Made Active in Reports: 06/17/2014
Number of Days to Update: 53

Source: EPA Region 4
Telephone: 404-562-9424
Last EDR Contact: 04/22/2014
Next Scheduled EDR Contact: 08/11/2014
Data Release Frequency: Semi-Annually

INDIAN UST R5: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 5 (Michigan, Minnesota and Wisconsin and Tribal Nations).

Date of Government Version: 05/12/2014
Date Data Arrived at EDR: 05/12/2014
Date Made Active in Reports: 06/17/2014
Number of Days to Update: 36

Source: EPA Region 5
Telephone: 312-886-6136
Last EDR Contact: 04/28/2014
Next Scheduled EDR Contact: 08/11/2014
Data Release Frequency: Varies

INDIAN UST R6: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 6 (Louisiana, Arkansas, Oklahoma, New Mexico, Texas and 65 Tribes).

Date of Government Version: 05/14/2014
Date Data Arrived at EDR: 05/15/2014
Date Made Active in Reports: 06/17/2014
Number of Days to Update: 33

Source: EPA Region 6
Telephone: 214-665-7591
Last EDR Contact: 01/27/2014
Next Scheduled EDR Contact: 05/12/2014
Data Release Frequency: Semi-Annually

INDIAN UST R7: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 7 (Iowa, Kansas, Missouri, Nebraska, and 9 Tribal Nations).

Date of Government Version: 05/28/2014
Date Data Arrived at EDR: 05/01/2014
Date Made Active in Reports: 06/17/2014
Number of Days to Update: 47

Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 04/28/2014
Next Scheduled EDR Contact: 08/11/2014
Data Release Frequency: Varies

INDIAN UST R8: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 8 (Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming and 27 Tribal Nations).

Date of Government Version: 05/07/2014
Date Data Arrived at EDR: 05/09/2014
Date Made Active in Reports: 06/17/2014
Number of Days to Update: 39

Source: EPA Region 8
Telephone: 303-312-6137
Last EDR Contact: 04/28/2014
Next Scheduled EDR Contact: 08/11/2014
Data Release Frequency: Quarterly

INDIAN UST R10: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 10 (Alaska, Idaho, Oregon, Washington, and Tribal Nations).

Date of Government Version: 04/04/2014
Date Data Arrived at EDR: 04/08/2014
Date Made Active in Reports: 06/17/2014
Number of Days to Update: 70

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 04/28/2014
Next Scheduled EDR Contact: 08/11/2014
Data Release Frequency: Quarterly

INDIAN UST R9: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 9 (Arizona, California, Hawaii, Nevada, the Pacific Islands, and Tribal Nations).

Date of Government Version: 05/12/2014
Date Data Arrived at EDR: 05/14/2014
Date Made Active in Reports: 06/17/2014
Number of Days to Update: 34

Source: EPA Region 9
Telephone: 415-972-3368
Last EDR Contact: 04/28/2014
Next Scheduled EDR Contact: 08/11/2014
Data Release Frequency: Quarterly

FEMA UST: Underground Storage Tank Listing

A listing of all FEMA owned underground storage tanks.

Date of Government Version: 01/01/2010
Date Data Arrived at EDR: 02/16/2010
Date Made Active in Reports: 04/12/2010
Number of Days to Update: 55

Source: FEMA
Telephone: 202-646-5797
Last EDR Contact: 07/08/2014
Next Scheduled EDR Contact: 10/27/2014
Data Release Frequency: Varies

State and tribal institutional control / engineering control registries

AUL: Sites with Controls

Activity and use limitations include both engineering controls and institutional controls.

Date of Government Version: 04/04/2014
Date Data Arrived at EDR: 05/21/2014
Date Made Active in Reports: 06/09/2014
Number of Days to Update: 19

Source: Department of Natural Resources
Telephone: 573-751-3176
Last EDR Contact: 05/21/2014
Next Scheduled EDR Contact: 09/01/2014
Data Release Frequency: Varies

State and tribal voluntary cleanup sites

INDIAN VCP R1: Voluntary Cleanup Priority Listing
A listing of voluntary cleanup priority sites located on Indian Land located in Region 1.

Date of Government Version: 03/20/2014
Date Data Arrived at EDR: 04/01/2014
Date Made Active in Reports: 06/17/2014
Number of Days to Update: 77

Source: EPA, Region 1
Telephone: 617-918-1102
Last EDR Contact: 07/01/2014
Next Scheduled EDR Contact: 10/13/2014
Data Release Frequency: Varies

INDIAN VCP R7: Voluntary Cleanup Priority Lisitng
A listing of voluntary cleanup priority sites located on Indian Land located in Region 7.

Date of Government Version: 03/20/2008
Date Data Arrived at EDR: 04/22/2008
Date Made Active in Reports: 05/19/2008
Number of Days to Update: 27

Source: EPA, Region 7
Telephone: 913-551-7365
Last EDR Contact: 04/20/2009
Next Scheduled EDR Contact: 07/20/2009
Data Release Frequency: Varies

VCP: Sites Participating in the Voluntary Cleanup Program
Sites participating in the Voluntary Cleanup Program.

Date of Government Version: 04/04/2014
Date Data Arrived at EDR: 05/21/2014
Date Made Active in Reports: 06/09/2014
Number of Days to Update: 19

Source: Department of Natural Resources
Telephone: 573-526-8913
Last EDR Contact: 05/21/2014
Next Scheduled EDR Contact: 09/01/2014
Data Release Frequency: Semi-Annually

State and tribal Brownfields sites

BROWNFIELDS: Brownfields Site List
Brownfields are sites where redevelopment and reuse is hampered by known or suspected contamination with hazardous substances. While many brownfield sites are minimally contaminated, potential environmental liability can be a problem for owners, operators, prospective buyers and financial institutions. Because of the large number of these sites, their economic impact especially in heavily industrial areas is substantial.

Date of Government Version: 04/04/2014
Date Data Arrived at EDR: 05/21/2014
Date Made Active in Reports: 06/09/2014
Number of Days to Update: 19

Source: Department of Natural Resources
Telephone: 573-526-8913
Last EDR Contact: 05/21/2014
Next Scheduled EDR Contact: 09/01/2014
Data Release Frequency: Semi-Annually

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS: A Listing of Brownfields Sites
Brownfields are real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. Cleaning up and reinvesting in these properties takes development pressures off of undeveloped, open land, and both improves and protects the environment. Assessment, Cleanup and Redevelopment Exchange System (ACRES) stores information reported by EPA Brownfields grant recipients on brownfields properties assessed or cleaned up with grant funding as well as information on Targeted Brownfields Assessments performed by EPA Regions. A listing of ACRES Brownfield sites is obtained from Cleanups in My Community. Cleanups in My Community provides information on Brownfields properties for which information is reported back to EPA, as well as areas served by Brownfields grant programs.

Date of Government Version: 03/20/2014
Date Data Arrived at EDR: 03/20/2014
Date Made Active in Reports: 04/09/2014
Number of Days to Update: 20

Source: Environmental Protection Agency
Telephone: 202-566-2777
Last EDR Contact: 07/03/2014
Next Scheduled EDR Contact: 10/06/2014
Data Release Frequency: Semi-Annually

Local Lists of Landfill / Solid Waste Disposal Sites

ODI: Open Dump Inventory
An open dump is defined as a disposal facility that does not comply with one or more of the Part 257 or Part 258 Subtitle D Criteria.

Date of Government Version: 06/30/1985
Date Data Arrived at EDR: 08/09/2004
Date Made Active in Reports: 09/17/2004
Number of Days to Update: 39

Source: Environmental Protection Agency
Telephone: 800-424-9346
Last EDR Contact: 06/09/2004
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

DEBRIS REGION 9: Torres Martinez Reservation Illegal Dump Site Locations
A listing of illegal dump sites location on the Torres Martinez Indian Reservation located in eastern Riverside County and northern Imperial County, California.

Date of Government Version: 01/12/2009
Date Data Arrived at EDR: 05/07/2009
Date Made Active in Reports: 09/21/2009
Number of Days to Update: 137

Source: EPA, Region 9
Telephone: 415-947-4219
Last EDR Contact: 04/28/2014
Next Scheduled EDR Contact: 08/11/2014
Data Release Frequency: No Update Planned

SWRCY: Solid Waste Recycling Facilities
A listing of recycling center locations.

Date of Government Version: 11/05/2009
Date Data Arrived at EDR: 12/23/2009
Date Made Active in Reports: 01/21/2010
Number of Days to Update: 29

Source: Department of Natural Resources
Telephone: 573-526-3944
Last EDR Contact: 06/05/2014
Next Scheduled EDR Contact: 09/15/2014
Data Release Frequency: Varies

HIST LF: Solid Waste Facility Database List
This database contains detailed information per site. It is no longer maintained by the Department of Natural Resources. For current information on solid waste facilities/landfills see the SWF/LF database.

Date of Government Version: 04/12/2005
Date Data Arrived at EDR: 07/19/2006
Date Made Active in Reports: 08/18/2006
Number of Days to Update: 30

Source: Department of Natural Resources
Telephone: 573-751-5401
Last EDR Contact: 01/12/2009
Next Scheduled EDR Contact: 04/13/2009
Data Release Frequency: No Update Planned

INDIAN ODI: Report on the Status of Open Dumps on Indian Lands
Location of open dumps on Indian land.

Date of Government Version: 12/31/1998
Date Data Arrived at EDR: 12/03/2007
Date Made Active in Reports: 01/24/2008
Number of Days to Update: 52

Source: Environmental Protection Agency
Telephone: 703-308-8245
Last EDR Contact: 05/02/2014
Next Scheduled EDR Contact: 08/18/2014
Data Release Frequency: Varies

Local Lists of Hazardous waste / Contaminated Sites

US CDL: Clandestine Drug Labs
A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 05/28/2014
Date Data Arrived at EDR: 06/20/2014
Date Made Active in Reports: 07/15/2014
Number of Days to Update: 25

Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 06/04/2014
Next Scheduled EDR Contact: 09/15/2014
Data Release Frequency: Quarterly

DEL SHWS: Registry Sites Withdrawn or Deleted

A list of sites that were removed from the Registry or for which Registry action was suspended due to cleanup.

Date of Government Version: 06/07/2013	Source: Department of Natural Resources
Date Data Arrived at EDR: 06/07/2013	Telephone: 573-522-3710
Date Made Active in Reports: 07/03/2013	Last EDR Contact: 06/16/2014
Number of Days to Update: 26	Next Scheduled EDR Contact: 09/15/2014
	Data Release Frequency: Annually

CDL: Environmental Emergency Response System

Incidents reported to the Department of Natural Resources where drug lab materials were involved.

Date of Government Version: 02/03/2014	Source: Department of Natural Resources
Date Data Arrived at EDR: 03/19/2014	Telephone: 573-751-3443
Date Made Active in Reports: 04/04/2014	Last EDR Contact: 06/17/2014
Number of Days to Update: 16	Next Scheduled EDR Contact: 09/29/2014
	Data Release Frequency: Varies

US HIST CDL: National Clandestine Laboratory Register

A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 05/28/2014	Source: Drug Enforcement Administration
Date Data Arrived at EDR: 06/20/2014	Telephone: 202-307-1000
Date Made Active in Reports: 07/15/2014	Last EDR Contact: 06/04/2014
Number of Days to Update: 25	Next Scheduled EDR Contact: 09/15/2014
	Data Release Frequency: No Update Planned

Local Land Records

LIENS 2: CERCLA Lien Information

A Federal CERCLA ('Superfund') lien can exist by operation of law at any site or property at which EPA has spent Superfund monies. These monies are spent to investigate and address releases and threatened releases of contamination. CERCLIS provides information as to the identity of these sites and properties.

Date of Government Version: 02/18/2014	Source: Environmental Protection Agency
Date Data Arrived at EDR: 03/18/2014	Telephone: 202-564-6023
Date Made Active in Reports: 04/24/2014	Last EDR Contact: 04/28/2014
Number of Days to Update: 37	Next Scheduled EDR Contact: 08/11/2014
	Data Release Frequency: Varies

Records of Emergency Release Reports

HMIRS: Hazardous Materials Information Reporting System

Hazardous Materials Incident Report System. HMIRS contains hazardous material spill incidents reported to DOT.

Date of Government Version: 03/31/2014	Source: U.S. Department of Transportation
Date Data Arrived at EDR: 04/01/2014	Telephone: 202-366-4555
Date Made Active in Reports: 07/15/2014	Last EDR Contact: 07/01/2014
Number of Days to Update: 105	Next Scheduled EDR Contact: 10/13/2014
	Data Release Frequency: Annually

SPILLS: Environmental Response Tracking Database

Releases of hazardous substances reported to the department's Environmental Emergency Response (EER) section.

Date of Government Version: 02/03/2014
Date Data Arrived at EDR: 03/19/2014
Date Made Active in Reports: 04/04/2014
Number of Days to Update: 16

Source: Department of Natural Resources
Telephone: 573-526-3349
Last EDR Contact: 06/17/2014
Next Scheduled EDR Contact: 09/29/2014
Data Release Frequency: Semi-Annually

SPILLS 90: SPILLS90 data from FirstSearch

Spills 90 includes those spill and release records available exclusively from FirstSearch databases. Typically, they may include chemical, oil and/or hazardous substance spills recorded after 1990. Duplicate records that are already included in EDR incident and release records are not included in Spills 90.

Date of Government Version: 06/27/2012
Date Data Arrived at EDR: 01/03/2013
Date Made Active in Reports: 02/22/2013
Number of Days to Update: 50

Source: FirstSearch
Telephone: N/A
Last EDR Contact: 01/03/2013
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

Other Ascertainable Records

RCRA NonGen / NLR: RCRA - Non Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Non-Generators do not presently generate hazardous waste.

Date of Government Version: 03/11/2014
Date Data Arrived at EDR: 03/13/2014
Date Made Active in Reports: 04/09/2014
Number of Days to Update: 27

Source: Environmental Protection Agency
Telephone: 913-551-7003
Last EDR Contact: 07/02/2014
Next Scheduled EDR Contact: 10/13/2014
Data Release Frequency: Varies

DOT OPS: Incident and Accident Data

Department of Transporation, Office of Pipeline Safety Incident and Accident data.

Date of Government Version: 07/31/2012
Date Data Arrived at EDR: 08/07/2012
Date Made Active in Reports: 09/18/2012
Number of Days to Update: 42

Source: Department of Transporation, Office of Pipeline Safety
Telephone: 202-366-4595
Last EDR Contact: 05/06/2014
Next Scheduled EDR Contact: 08/18/2014
Data Release Frequency: Varies

DOD: Department of Defense Sites

This data set consists of federally owned or administered lands, administered by the Department of Defense, that have any area equal to or greater than 640 acres of the United States, Puerto Rico, and the U.S. Virgin Islands.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 11/10/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 62

Source: USGS
Telephone: 888-275-8747
Last EDR Contact: 04/18/2014
Next Scheduled EDR Contact: 07/28/2014
Data Release Frequency: Semi-Annually

FUDS: Formerly Used Defense Sites

The listing includes locations of Formerly Used Defense Sites properties where the US Army Corps of Engineers is actively working or will take necessary cleanup actions.

Date of Government Version: 12/31/2012
Date Data Arrived at EDR: 02/28/2014
Date Made Active in Reports: 04/24/2014
Number of Days to Update: 55

Source: U.S. Army Corps of Engineers
Telephone: 202-528-4285
Last EDR Contact: 06/04/2014
Next Scheduled EDR Contact: 09/22/2014
Data Release Frequency: Varies

CONSENT: Superfund (CERCLA) Consent Decrees

Major legal settlements that establish responsibility and standards for cleanup at NPL (Superfund) sites. Released periodically by United States District Courts after settlement by parties to litigation matters.

Date of Government Version: 12/31/2013
Date Data Arrived at EDR: 01/24/2014
Date Made Active in Reports: 02/24/2014
Number of Days to Update: 31

Source: Department of Justice, Consent Decree Library
Telephone: Varies
Last EDR Contact: 06/30/2014
Next Scheduled EDR Contact: 10/13/2014
Data Release Frequency: Varies

ROD: Records Of Decision

Record of Decision. ROD documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid in the cleanup.

Date of Government Version: 11/25/2013
Date Data Arrived at EDR: 12/12/2013
Date Made Active in Reports: 02/24/2014
Number of Days to Update: 74

Source: EPA
Telephone: 703-416-0223
Last EDR Contact: 06/10/2014
Next Scheduled EDR Contact: 09/22/2014
Data Release Frequency: Annually

UMTRA: Uranium Mill Tailings Sites

Uranium ore was mined by private companies for federal government use in national defense programs. When the mills shut down, large piles of the sand-like material (mill tailings) remain after uranium has been extracted from the ore. Levels of human exposure to radioactive materials from the piles are low; however, in some cases tailings were used as construction materials before the potential health hazards of the tailings were recognized.

Date of Government Version: 09/14/2010
Date Data Arrived at EDR: 10/07/2011
Date Made Active in Reports: 03/01/2012
Number of Days to Update: 146

Source: Department of Energy
Telephone: 505-845-0011
Last EDR Contact: 02/25/2014
Next Scheduled EDR Contact: 06/09/2014
Data Release Frequency: Varies

US MINES: Mines Master Index File

Contains all mine identification numbers issued for mines active or opened since 1971. The data also includes violation information.

Date of Government Version: 01/30/2014
Date Data Arrived at EDR: 03/05/2014
Date Made Active in Reports: 07/15/2014
Number of Days to Update: 132

Source: Department of Labor, Mine Safety and Health Administration
Telephone: 303-231-5959
Last EDR Contact: 06/06/2014
Next Scheduled EDR Contact: 09/15/2014
Data Release Frequency: Semi-Annually

TRIS: Toxic Chemical Release Inventory System

Toxic Release Inventory System. TRIS identifies facilities which release toxic chemicals to the air, water and land in reportable quantities under SARA Title III Section 313.

Date of Government Version: 12/31/2011
Date Data Arrived at EDR: 07/31/2013
Date Made Active in Reports: 09/13/2013
Number of Days to Update: 44

Source: EPA
Telephone: 202-566-0250
Last EDR Contact: 05/30/2014
Next Scheduled EDR Contact: 09/08/2014
Data Release Frequency: Annually

TSCA: Toxic Substances Control Act

Toxic Substances Control Act. TSCA identifies manufacturers and importers of chemical substances included on the TSCA Chemical Substance Inventory list. It includes data on the production volume of these substances by plant site.

Date of Government Version: 12/31/2006
Date Data Arrived at EDR: 09/29/2010
Date Made Active in Reports: 12/02/2010
Number of Days to Update: 64

Source: EPA
Telephone: 202-260-5521
Last EDR Contact: 06/25/2014
Next Scheduled EDR Contact: 10/06/2014
Data Release Frequency: Every 4 Years

FTTS: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
FTTS tracks administrative cases and pesticide enforcement actions and compliance activities related to FIFRA, TSCA and EPCRA (Emergency Planning and Community Right-to-Know Act). To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 04/09/2009
Date Data Arrived at EDR: 04/16/2009
Date Made Active in Reports: 05/11/2009
Number of Days to Update: 25

Source: EPA/Office of Prevention, Pesticides and Toxic Substances
Telephone: 202-566-1667
Last EDR Contact: 05/22/2014
Next Scheduled EDR Contact: 09/08/2014
Data Release Frequency: Quarterly

FTTS INSP: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
A listing of FIFRA/TSCA Tracking System (FTTS) inspections and enforcements.

Date of Government Version: 04/09/2009
Date Data Arrived at EDR: 04/16/2009
Date Made Active in Reports: 05/11/2009
Number of Days to Update: 25

Source: EPA
Telephone: 202-566-1667
Last EDR Contact: 05/22/2014
Next Scheduled EDR Contact: 09/08/2014
Data Release Frequency: Quarterly

HIST FTTS: FIFRA/TSCA Tracking System Administrative Case Listing
A complete administrative case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2007
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

HIST FTTS INSP: FIFRA/TSCA Tracking System Inspection & Enforcement Case Listing
A complete inspection and enforcement case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2008
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

SSTS: Section 7 Tracking Systems
Section 7 of the Federal Insecticide, Fungicide and Rodenticide Act, as amended (92 Stat. 829) requires all registered pesticide-producing establishments to submit a report to the Environmental Protection Agency by March 1st each year. Each establishment must report the types and amounts of pesticides, active ingredients and devices being produced, and those having been produced and sold or distributed in the past year.

Date of Government Version: 12/31/2009
Date Data Arrived at EDR: 12/10/2010
Date Made Active in Reports: 02/25/2011
Number of Days to Update: 77

Source: EPA
Telephone: 202-564-4203
Last EDR Contact: 04/29/2014
Next Scheduled EDR Contact: 08/11/2014
Data Release Frequency: Annually

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

ICIS: Integrated Compliance Information System

The Integrated Compliance Information System (ICIS) supports the information needs of the national enforcement and compliance program as well as the unique needs of the National Pollutant Discharge Elimination System (NPDES) program.

Date of Government Version: 05/06/2014
Date Data Arrived at EDR: 05/16/2014
Date Made Active in Reports: 06/17/2014
Number of Days to Update: 32

Source: Environmental Protection Agency
Telephone: 202-564-5088
Last EDR Contact: 10/09/2014
Next Scheduled EDR Contact: 10/27/2014
Data Release Frequency: Quarterly

PADS: PCB Activity Database System

PCB Activity Database. PADS Identifies generators, transporters, commercial storers and/or brokers and disposers of PCB's who are required to notify the EPA of such activities.

Date of Government Version: 06/01/2013
Date Data Arrived at EDR: 07/17/2013
Date Made Active in Reports: 11/01/2013
Number of Days to Update: 107

Source: EPA
Telephone: 202-566-0500
Last EDR Contact: 04/18/2014
Next Scheduled EDR Contact: 07/28/2014
Data Release Frequency: Annually

MLTS: Material Licensing Tracking System

MLTS is maintained by the Nuclear Regulatory Commission and contains a list of approximately 8,100 sites which possess or use radioactive materials and which are subject to NRC licensing requirements. To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 07/22/2013
Date Data Arrived at EDR: 08/02/2013
Date Made Active in Reports: 11/01/2013
Number of Days to Update: 91

Source: Nuclear Regulatory Commission
Telephone: 301-415-7169
Last EDR Contact: 06/05/2014
Next Scheduled EDR Contact: 09/22/2014
Data Release Frequency: Quarterly

RADINFO: Radiation Information Database

The Radiation Information Database (RADINFO) contains information about facilities that are regulated by U.S. Environmental Protection Agency (EPA) regulations for radiation and radioactivity.

Date of Government Version: 04/08/2014
Date Data Arrived at EDR: 04/09/2014
Date Made Active in Reports: 06/17/2014
Number of Days to Update: 69

Source: Environmental Protection Agency
Telephone: 202-343-9775
Last EDR Contact: 07/10/2014
Next Scheduled EDR Contact: 10/20/2014
Data Release Frequency: Quarterly

FINDS: Facility Index System/Facility Registry System

Facility Index System. FINDS contains both facility information and 'pointers' to other sources that contain more detail. EDR includes the following FINDS databases in this report: PCS (Permit Compliance System), AIRS (Aerometric Information Retrieval System), DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes), FURS (Federal Underground Injection Control), C-DOCKET (Criminal Docket System used to track criminal enforcement actions for all environmental statutes), FFIS (Federal Facilities Information System), STATE (State Environmental Laws and Statutes), and PADS (PCB Activity Data System).

Date of Government Version: 11/18/2013
Date Data Arrived at EDR: 02/27/2014
Date Made Active in Reports: 03/12/2014
Number of Days to Update: 13

Source: EPA
Telephone: (913) 551-7003
Last EDR Contact: 06/13/2014
Next Scheduled EDR Contact: 09/22/2014
Data Release Frequency: Quarterly

RAATS: RCRA Administrative Action Tracking System

RCRA Administration Action Tracking System. RAATS contains records based on enforcement actions issued under RCRA pertaining to major violators and includes administrative and civil actions brought by the EPA. For administration actions after September 30, 1995, data entry in the RAATS database was discontinued. EPA will retain a copy of the database for historical records. It was necessary to terminate RAATS because a decrease in agency resources made it impossible to continue to update the information contained in the database.

Date of Government Version: 04/17/1995
Date Data Arrived at EDR: 07/03/1995
Date Made Active in Reports: 08/07/1995
Number of Days to Update: 35

Source: EPA
Telephone: 202-564-4104
Last EDR Contact: 06/02/2008
Next Scheduled EDR Contact: 09/01/2008
Data Release Frequency: No Update Planned

RMP: Risk Management Plans

When Congress passed the Clean Air Act Amendments of 1990, it required EPA to publish regulations and guidance for chemical accident prevention at facilities using extremely hazardous substances. The Risk Management Program Rule (RMP Rule) was written to implement Section 112(r) of these amendments. The rule, which built upon existing industry codes and standards, requires companies of all sizes that use certain flammable and toxic substances to develop a Risk Management Program, which includes a(n): Hazard assessment that details the potential effects of an accidental release, an accident history of the last five years, and an evaluation of worst-case and alternative accidental releases; Prevention program that includes safety precautions and maintenance, monitoring, and employee training measures; and Emergency response program that spells out emergency health care, employee training measures and procedures for informing the public and response agencies (e.g the fire department) should an accident occur.

Date of Government Version: 11/01/2013
Date Data Arrived at EDR: 12/12/2013
Date Made Active in Reports: 02/13/2014
Number of Days to Update: 63

Source: Environmental Protection Agency
Telephone: 202-564-8600
Last EDR Contact: 04/28/2014
Next Scheduled EDR Contact: 08/11/2014
Data Release Frequency: Varies

BRS: Biennial Reporting System

The Biennial Reporting System is a national system administered by the EPA that collects data on the generation and management of hazardous waste. BRS captures detailed data from two groups: Large Quantity Generators (LQG) and Treatment, Storage, and Disposal Facilities.

Date of Government Version: 12/31/2011
Date Data Arrived at EDR: 02/26/2013
Date Made Active in Reports: 04/19/2013
Number of Days to Update: 52

Source: EPA/NTIS
Telephone: 800-424-9346
Last EDR Contact: 05/30/2014
Next Scheduled EDR Contact: 09/08/2014
Data Release Frequency: Biennially

UIC: Underground Injection Wells Database

A listing of underground injection well locations. The UIC Program is responsible for regulating the construction, operation, permitting, and closure of injection wells that place fluids underground for storage or disposal.

Date of Government Version: 01/09/2014
Date Data Arrived at EDR: 01/10/2014
Date Made Active in Reports: 01/14/2014
Number of Days to Update: 4

Source: Department of Natural Resources
Telephone: 573-368-2183
Last EDR Contact: 06/09/2014
Next Scheduled EDR Contact: 09/08/2014
Data Release Frequency: Varies

DRYCLEANERS: Drycleaners in Missouri Listing

A listing of drycleaner facilities that are potentially eligible for reimbursement of department approved cleanup costs under the Drycleaning Environmental Response Trust Fund.

Date of Government Version: 03/17/2014
Date Data Arrived at EDR: 03/18/2014
Date Made Active in Reports: 04/04/2014
Number of Days to Update: 17

Source: Department of Natural Resources
Telephone: 573-526-8913
Last EDR Contact: 06/16/2014
Next Scheduled EDR Contact: 09/29/2014
Data Release Frequency: Varies

RRC: Certified Hazardous Waste Resource Recovery Facilities

Facilities that take hazardous waste material, either from on-site or off-site, and make it re-usable.

Date of Government Version: 03/14/2014
Date Data Arrived at EDR: 03/21/2014
Date Made Active in Reports: 04/08/2014
Number of Days to Update: 18

Source: Department of Natural Resources
Telephone: 573-751-3176
Last EDR Contact: 06/16/2014
Next Scheduled EDR Contact: 09/29/2014
Data Release Frequency: Semi-Annually

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

NPDES: Permitted Facility Listing

A listing of permitted facilities from the Water Pollution Branch.

Date of Government Version: 04/07/2014
Date Data Arrived at EDR: 04/08/2014
Date Made Active in Reports: 05/06/2014
Number of Days to Update: 28

Source: Department of Natural Resources
Telephone: 573-751-7023
Last EDR Contact: 07/02/2014
Next Scheduled EDR Contact: 10/20/2014
Data Release Frequency: Varies

AIRS: Permit Facility Listing

A listing of Air Pollution Control Program permits.

Date of Government Version: 03/19/2014
Date Data Arrived at EDR: 03/21/2014
Date Made Active in Reports: 04/04/2014
Number of Days to Update: 14

Source: Department of Natural Resources
Telephone: 573-751-4817
Last EDR Contact: 06/16/2014
Next Scheduled EDR Contact: 09/29/2014
Data Release Frequency: Varies

INDIAN RESERV: Indian Reservations

This map layer portrays Indian administered lands of the United States that have any area equal to or greater than 640 acres.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 12/08/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 34

Source: USGS
Telephone: 202-208-3710
Last EDR Contact: 04/18/2014
Next Scheduled EDR Contact: 07/28/2014
Data Release Frequency: Semi-Annually

SCRD DRYCLEANERS: State Coalition for Remediation of Drycleaners Listing

The State Coalition for Remediation of Drycleaners was established in 1998, with support from the U.S. EPA Office of Superfund Remediation and Technology Innovation. It is comprised of representatives of states with established drycleaner remediation programs. Currently the member states are Alabama, Connecticut, Florida, Illinois, Kansas, Minnesota, Missouri, North Carolina, Oregon, South Carolina, Tennessee, Texas, and Wisconsin.

Date of Government Version: 03/07/2011
Date Data Arrived at EDR: 03/09/2011
Date Made Active in Reports: 05/02/2011
Number of Days to Update: 54

Source: Environmental Protection Agency
Telephone: 615-532-8599
Last EDR Contact: 04/21/2014
Next Scheduled EDR Contact: 08/04/2014
Data Release Frequency: Varies

COAL ASH: Coal Ash Disposal Sites

A listing of power plants with coal ash ponds.

Date of Government Version: 04/14/2014
Date Data Arrived at EDR: 04/15/2014
Date Made Active in Reports: 05/06/2014
Number of Days to Update: 21

Source: Department of Natural Resources
Telephone: 573-526-1825
Last EDR Contact: 07/02/2014
Next Scheduled EDR Contact: 10/20/2014
Data Release Frequency: Varies

PCB TRANSFORMER: PCB Transformer Registration Database

The database of PCB transformer registrations that includes all PCB registration submittals.

Date of Government Version: 02/01/2011
Date Data Arrived at EDR: 10/19/2011
Date Made Active in Reports: 01/10/2012
Number of Days to Update: 83

Source: Environmental Protection Agency
Telephone: 202-566-0517
Last EDR Contact: 05/02/2014
Next Scheduled EDR Contact: 08/11/2014
Data Release Frequency: Varies

Financial Assurance 2: Financial Assurance Information Listing

Financial assurance information for solid waste facilities. Financial assurance is intended to ensure that resources are available to pay for the cost of closure, post-closure care, and corrective measures if the owner or operator of a regulated facility is unable or unwilling to pay

Date of Government Version: 06/10/2014
Date Data Arrived at EDR: 06/12/2014
Date Made Active in Reports: 07/14/2014
Number of Days to Update: 32

Source: Department of Natural Resources
Telephone: 573-751-5401
Last EDR Contact: 06/12/2014
Next Scheduled EDR Contact: 09/22/2014
Data Release Frequency: Varies

2020 COR ACTION: 2020 Corrective Action Program List

The EPA has set ambitious goals for the RCRA Corrective Action program by creating the 2020 Corrective Action Universe. This RCRA cleanup baseline includes facilities expected to need corrective action. The 2020 universe contains a wide variety of sites. Some properties are heavily contaminated while others were contaminated but have since been cleaned up. Still others have not been fully investigated yet, and may require little or no remediation. Inclusion in the 2020 Universe does not necessarily imply failure on the part of a facility to meet its RCRA obligations.

Date of Government Version: 11/11/2011
Date Data Arrived at EDR: 05/18/2012
Date Made Active in Reports: 05/25/2012
Number of Days to Update: 7

Source: Environmental Protection Agency
Telephone: 703-308-4044
Last EDR Contact: 05/16/2014
Next Scheduled EDR Contact: 08/25/2014
Data Release Frequency: Varies

EPA WATCH LIST: EPA WATCH LIST

EPA maintains a "Watch List" to facilitate dialogue between EPA, state and local environmental agencies on enforcement matters relating to facilities with alleged violations identified as either significant or high priority. Being on the Watch List does not mean that the facility has actually violated the law only that an investigation by EPA or a state or local environmental agency has led those organizations to allege that an unproven violation has in fact occurred. Being on the Watch List does not represent a higher level of concern regarding the alleged violations that were detected, but instead indicates cases requiring additional dialogue between EPA, state and local agencies - primarily because of the length of time the alleged violation has gone unaddressed or unresolved.

Date of Government Version: 08/30/2013
Date Data Arrived at EDR: 03/21/2014
Date Made Active in Reports: 06/17/2014
Number of Days to Update: 88

Source: Environmental Protection Agency
Telephone: 617-520-3000
Last EDR Contact: 05/16/2014
Next Scheduled EDR Contact: 08/25/2014
Data Release Frequency: Quarterly

LEAD SMELTER 2: Lead Smelter Sites

A list of several hundred sites in the U.S. where secondary lead smelting was done from 1931and 1964. These sites may pose a threat to public health through ingestion or inhalation of contaminated soil or dust

Date of Government Version: 04/05/2001
Date Data Arrived at EDR: 10/27/2010
Date Made Active in Reports: 12/02/2010
Number of Days to Update: 36

Source: American Journal of Public Health
Telephone: 703-305-6451
Last EDR Contact: 12/02/2009
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

PRP: Potentially Responsible Parties

A listing of verified Potentially Responsible Parties

Date of Government Version: 04/15/2013
Date Data Arrived at EDR: 07/03/2013
Date Made Active in Reports: 09/13/2013
Number of Days to Update: 72

Source: EPA
Telephone: 202-564-6023
Last EDR Contact: 07/01/2014
Next Scheduled EDR Contact: 10/13/2014
Data Release Frequency: Quarterly

SMARS: Site Management and Reporting System

SMARS currently houses information for Superfund, Federal Facility, Brownfields Voluntary Cleanup Program and Missouri?s other state response programs.

Date of Government Version: 04/04/2014
Date Data Arrived at EDR: 05/09/2014
Date Made Active in Reports: 06/09/2014
Number of Days to Update: 31

Source: Department of Natural Resources
Telephone: 573-751-3043
Last EDR Contact: 05/05/2014
Next Scheduled EDR Contact: 08/18/2014
Data Release Frequency: Varies

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

LEAD SMELTER 1: Lead Smelter Sites

A listing of former lead smelter site locations.

Date of Government Version: 01/29/2013
Date Data Arrived at EDR: 02/14/2013
Date Made Active in Reports: 02/27/2013
Number of Days to Update: 13

Source: Environmental Protection Agency
Telephone: 703-603-8787
Last EDR Contact: 07/01/2014
Next Scheduled EDR Contact: 10/20/2014
Data Release Frequency: Varies

FEDLAND: Federal and Indian Lands

Federally and Indian administrated lands of the United States. Lands included are administrated by: Army Corps of Engineers, Bureau of Reclamation, National Wild and Scenic River, National Wildlife Refuge, Public Domain Land, Wilderness, Wilderness Study Area, Wildlife Management Area, Bureau of Indian Affairs, Bureau of Land Management, Department of Justice, Forest Service, Fish and Wildlife Service, National Park Service.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 02/06/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 339

Source: U.S. Geological Survey
Telephone: 888-275-8747
Last EDR Contact: 04/18/2014
Next Scheduled EDR Contact: 07/28/2014
Data Release Frequency: N/A

MINES: Industrial Mineral Mines Database

This data set contains names, locations and additional data for active Industrial Mineral Mines permitted with the Missouri Department of Natural Resources, Division of Environmental Quality, Land Reclamation Program. Industrial Mineral Mines permitted are rock quarries, clay pits, sand and gravel pits, or in-stream sand and gravel operations.

Date of Government Version: 10/24/2008
Date Data Arrived at EDR: 12/17/2012
Date Made Active in Reports: 12/21/2012
Number of Days to Update: 4

Source: Department of Natural Resources
Telephone: 573-751-4041
Last EDR Contact: 04/25/2014
Next Scheduled EDR Contact: 08/04/2014
Data Release Frequency: Varies

COAL ASH EPA: Coal Combustion Residues Surface Impoundments List

A listing of coal combustion residues surface impoundments with high hazard potential ratings.

Date of Government Version: 08/17/2010
Date Data Arrived at EDR: 01/03/2011
Date Made Active in Reports: 03/21/2011
Number of Days to Update: 77

Source: Environmental Protection Agency
Telephone: N/A
Last EDR Contact: 06/11/2014
Next Scheduled EDR Contact: 09/22/2014
Data Release Frequency: Varies

COAL ASH DOE: Sleam-Electric Plan Operation Data

A listing of power plants that store ash in surface ponds.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 08/07/2009
Date Made Active in Reports: 10/22/2009
Number of Days to Update: 76

Source: Department of Energy
Telephone: 202-586-8719
Last EDR Contact: 04/18/2014
Next Scheduled EDR Contact: 07/28/2014
Data Release Frequency: Varies

Financial Assurance 1: Financial Assurance Information Listing

Financial Assurance information.

Date of Government Version: 06/09/2014
Date Data Arrived at EDR: 06/13/2014
Date Made Active in Reports: 07/14/2014
Number of Days to Update: 31

Source: Department of Natural Resources
Telephone: 573-751-3553
Last EDR Contact: 06/09/2014
Next Scheduled EDR Contact: 09/22/2014
Data Release Frequency: Varies

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

US AIRS (AFS): Aerometric Information Retrieval System Facility Subsystem (AFS)

The database is a sub-system of Aerometric Information Retrieval System (AIRS). AFS contains compliance data on air pollution point sources regulated by the U.S. EPA and/or state and local air regulatory agencies. This information comes from source reports by various stationary sources of air pollution, such as electric power plants, steel mills, factories, and universities, and provides information about the air pollutants they produce. Action, air program, air program pollutant, and general level plant data. It is used to track emissions and compliance data from industrial plants.

Date of Government Version: 10/23/2013
Date Data Arrived at EDR: 11/06/2013
Date Made Active in Reports: 12/06/2013
Number of Days to Update: 30

Source: EPA
Telephone: 202-564-2496
Last EDR Contact: 06/25/2014
Next Scheduled EDR Contact: 10/13/2014
Data Release Frequency: Annually

US AIRS MINOR: Air Facility System Data

A listing of minor source facilities.

Date of Government Version: 10/23/2013
Date Data Arrived at EDR: 11/06/2013
Date Made Active in Reports: 12/06/2013
Number of Days to Update: 30

Source: EPA
Telephone: 202-564-2496
Last EDR Contact: 06/25/2014
Next Scheduled EDR Contact: 10/13/2014
Data Release Frequency: Annually

US FIN ASSUR: Financial Assurance Information

All owners and operators of facilities that treat, store, or dispose of hazardous waste are required to provide proof that they will have sufficient funds to pay for the clean up, closure, and post-closure care of their facilities.

Date of Government Version: 02/25/2014
Date Data Arrived at EDR: 02/27/2014
Date Made Active in Reports: 04/09/2014
Number of Days to Update: 41

Source: Environmental Protection Agency
Telephone: 202-566-1917
Last EDR Contact: 05/16/2014
Next Scheduled EDR Contact: 09/01/2014
Data Release Frequency: Quarterly

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

EDR MGP: EDR Proprietary Manufactured Gas Plants

The EDR Proprietary Manufactured Gas Plant Database includes records of coal gas plants (manufactured gas plants) compiled by EDR's researchers. Manufactured gas sites were used in the United States from the 1800's to 1950's to produce a gas that could be distributed and used as fuel. These plants used whale oil, rosin, coal, or a mixture of coal, oil, and water that also produced a significant amount of waste. Many of the byproducts of the gas production, such as coal tar (oily waste containing volatile and non-volatile chemicals), sludges, oils and other compounds are potentially hazardous to human health and the environment. The byproduct from this process was frequently disposed of directly at the plant site and can remain or spread slowly, serving as a continuous source of soil and groundwater contamination.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

EDR US Hist Auto Stat: EDR Exclusive Historic Gas Stations

EDR has searched selected national collections of business directories and has collected listings of potential gas station/filling station/service station sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include gas station/filling station/service station establishments. The categories reviewed included, but were not limited to gas, gas station, gasoline station, filling station, auto, automobile repair, auto service station, service station, etc. This database falls within a category of information EDR classifies as "High Risk Historical Records", or HRHR. EDR's HRHR effort presents unique and sometimes proprietary data about past sites and operations that typically create environmental concerns, but may not show up in current government records searches.

Date of Government Version: N/A	Source: EDR, Inc.
Date Data Arrived at EDR: N/A	Telephone: N/A
Date Made Active in Reports: N/A	Last EDR Contact: N/A
Number of Days to Update: N/A	Next Scheduled EDR Contact: N/A
	Data Release Frequency: Varies

EDR US Hist Cleaners: EDR Exclusive Historic Dry Cleaners

EDR has searched selected national collections of business directories and has collected listings of potential dry cleaner sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include dry cleaning establishments. The categories reviewed included, but were not limited to dry cleaners, cleaners, laundry, laundromat, cleaning/laundry, wash & dry etc. This database falls within a category of information EDR classifies as "High Risk Historical Records", or HRHR. EDR's HRHR effort presents unique and sometimes proprietary data about past sites and operations that typically create environmental concerns, but may not show up in current government records searches.

Date of Government Version: N/A	Source: EDR, Inc.
Date Data Arrived at EDR: N/A	Telephone: N/A
Date Made Active in Reports: N/A	Last EDR Contact: N/A
Number of Days to Update: N/A	Next Scheduled EDR Contact: N/A
	Data Release Frequency: Varies

EDR RECOVERED GOVERNMENT ARCHIVES

Exclusive Recovered Govt. Archives

RGA HWS: Recovered Government Archive State Hazardous Waste Facilities List

The EDR Recovered Government Archive State Hazardous Waste database provides a list of SHWS incidents derived from historical databases and includes many records that no longer appear in current government lists. Compiled from Records formerly available from the Department of Natural Resources in Missouri.

Date of Government Version: N/A	Source: Department of Natural Resources
Date Data Arrived at EDR: 07/01/2013	Telephone: N/A
Date Made Active in Reports: 01/03/2014	Last EDR Contact: 06/01/2012
Number of Days to Update: 186	Next Scheduled EDR Contact: N/A
	Data Release Frequency: Varies

RGA LUST: Recovered Government Archive Leaking Underground Storage Tank

The EDR Recovered Government Archive Leaking Underground Storage Tank database provides a list of LUST incidents derived from historical databases and includes many records that no longer appear in current government lists. Compiled from Records formerly available from the Department of Natural Resources in Missouri.

Date of Government Version: N/A	Source: Department of Natural Resources
Date Data Arrived at EDR: 07/01/2013	Telephone: N/A
Date Made Active in Reports: 01/03/2014	Last EDR Contact: 06/01/2012
Number of Days to Update: 186	Next Scheduled EDR Contact: N/A
	Data Release Frequency: Varies

RGA LF: Recovered Government Archive Solid Waste Facilities List

The EDR Recovered Government Archive Landfill database provides a list of landfills derived from historical databases and includes many records that no longer appear in current government lists. Compiled from Records formerly available from the Department of Natural Resources in Missouri.

Date of Government Version: N/A	Source: Department of Natural Resources
Date Data Arrived at EDR: 07/01/2013	Telephone: N/A
Date Made Active in Reports: 01/15/2014	Last EDR Contact: 06/01/2012
Number of Days to Update: 198	Next Scheduled EDR Contact: N/A
	Data Release Frequency: Varies

OTHER DATABASE(S)

Depending on the geographic area covered by this report, the data provided in these specialty databases may or may not be complete. For example, the existence of wetlands information data in a specific report does not mean that all wetlands in the area covered by the report are included. Moreover, the absence of any reported wetlands information does not necessarily mean that wetlands do not exist in the area covered by the report.

CT MANIFEST: Hazardous Waste Manifest Data
Facility and manifest data. Manifest is a document that lists and tracks hazardous waste from the generator through transporters to a tsd facility.

Date of Government Version: 07/30/2013
Date Data Arrived at EDR: 08/19/2013
Date Made Active in Reports: 10/03/2013
Number of Days to Update: 45

Source: Department of Energy & Environmental Protection
Telephone: 860-424-3375
Last EDR Contact: 05/23/2014
Next Scheduled EDR Contact: 09/01/2014
Data Release Frequency: Annually

NY MANIFEST: Facility and Manifest Data
Manifest is a document that lists and tracks hazardous waste from the generator through transporters to a TSD facility.

Date of Government Version: 05/01/2014
Date Data Arrived at EDR: 05/07/2014
Date Made Active in Reports: 06/10/2014
Number of Days to Update: 34

Source: Department of Environmental Conservation
Telephone: 518-402-8651
Last EDR Contact: 05/07/2014
Next Scheduled EDR Contact: 08/18/2014
Data Release Frequency: Annually

PA MANIFEST: Manifest Information
Hazardous waste manifest information.

Date of Government Version: 12/31/2012
Date Data Arrived at EDR: 07/24/2013
Date Made Active in Reports: 08/19/2013
Number of Days to Update: 26

Source: Department of Environmental Protection
Telephone: 717-783-8990
Last EDR Contact: 04/21/2014
Next Scheduled EDR Contact: 08/04/2014
Data Release Frequency: Annually

RI MANIFEST: Manifest information
Hazardous waste manifest information

Date of Government Version: 12/31/2012
Date Data Arrived at EDR: 06/21/2013
Date Made Active in Reports: 08/05/2013
Number of Days to Update: 45

Source: Department of Environmental Management
Telephone: 401-222-2797
Last EDR Contact: 05/27/2014
Next Scheduled EDR Contact: 09/08/2014
Data Release Frequency: Annually

WI MANIFEST: Manifest Information
Hazardous waste manifest information.

Date of Government Version: 12/31/2012
Date Data Arrived at EDR: 08/09/2013
Date Made Active in Reports: 09/27/2013
Number of Days to Update: 49

Source: Department of Natural Resources
Telephone: N/A
Last EDR Contact: 06/16/2014
Next Scheduled EDR Contact: 09/29/2014
Data Release Frequency: Annually

Oil/Gas Pipelines: This data was obtained by EDR from the USGS in 1994. It is referred to by USGS as GeoData Digital Line Graphs from 1:100,000-Scale Maps. It was extracted from the transportation category including some oil, but primarily gas pipelines.

Electric Power Transmission Line Data
Source: Rextag Strategies Corp.
Telephone: (281) 769-2247
U.S. Electric Transmission and Power Plants Systems Digital GIS Data

Sensitive Receptors: There are individuals deemed sensitive receptors due to their fragile immune systems and special sensitivity to environmental discharges. These sensitive receptors typically include the elderly, the sick, and children. While the location of all sensitive receptors cannot be determined, EDR indicates those buildings and facilities - schools, daycares, hospitals, medical centers, and nursing homes - where individuals who are sensitive receptors are likely to be located.

AHA Hospitals:
Source: American Hospital Association, Inc.
Telephone: 312-280-5991
The database includes a listing of hospitals based on the American Hospital Association's annual survey of hospitals.

Medical Centers: Provider of Services Listing
Source: Centers for Medicare & Medicaid Services
Telephone: 410-786-3000
A listing of hospitals with Medicare provider number, produced by Centers of Medicare & Medicaid Services, a federal agency within the U.S. Department of Health and Human Services.

Nursing Homes
Source: National Institutes of Health
Telephone: 301-594-6248
Information on Medicare and Medicaid certified nursing homes in the United States.

Public Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on elementary and secondary public education in the United States. It is a comprehensive, annual, national statistical database of all public elementary and secondary schools and school districts, which contains data that are comparable across all states.

Private Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on private school locations in the United States.

Daycare Centers: Licensed Child Care Facilities
Source: Department of Health & Senior Services
Telephone: 573-751-2450

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 2003 & 2011 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002, 2005 and 2010 from the U.S. Fish and Wildlife Service.

Scanned Digital USGS 7.5' Topographic Map (DRG)
Source: United States Geologic Survey
A digital raster graphic (DRG) is a scanned image of a U.S. Geological Survey topographic map. The map images are made by scanning published paper maps on high-resolution scanners. The raster image is georeferenced and fit to the Universal Transverse Mercator (UTM) projection.

STREET AND ADDRESS INFORMATION

GEOCHECK ®- PHYSICAL SETTING SOURCE ADDENDUM

TARGET PROPERTY ADDRESS

CAMP ZOE REHAB
LAD PROPERTY
SALEM, MO 65560

TARGET PROPERTY COORDINATES

Latitude (North):	37.3083 - 37˚ 18’ 29.88’’
Longitude (West):	91.4072 - 91˚ 24’ 25.92’’
Universal Tranverse Mercator:	Zone 15
UTM X (Meters):	641155.2
UTM Y (Meters):	4130059.5
Elevation:	695 ft. above sea level

USGS TOPOGRAPHIC MAP

Target Property Map:	37091-C4 ROUND SPRING, MO
Most Recent Revision:	1985

EDR’s GeoCheck Physical Setting Source Addendum is provided to assist the environmental professional in forming an opinion about the impact of potential contaminant migration.

Assessment of the impact of contaminant migration generally has two principal investigative components:

1. Groundwater flow direction, and
2. Groundwater flow velocity.

Groundwater flow direction may be impacted by surface topography, hydrology, hydrogeology, characteristics of the soil, and nearby wells. Groundwater flow velocity is generally impacted by the nature of the geologic strata.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW DIRECTION INFORMATION

Groundwater flow direction for a particular site is best determined by a qualified environmental professional using site-specific well data. If such data is not reasonably ascertainable, it may be necessary to rely on other sources of information, such as surface topographic information, hydrologic information, hydrogeologic data collected on nearby properties, and regional groundwater flow information (from deep aquifers).

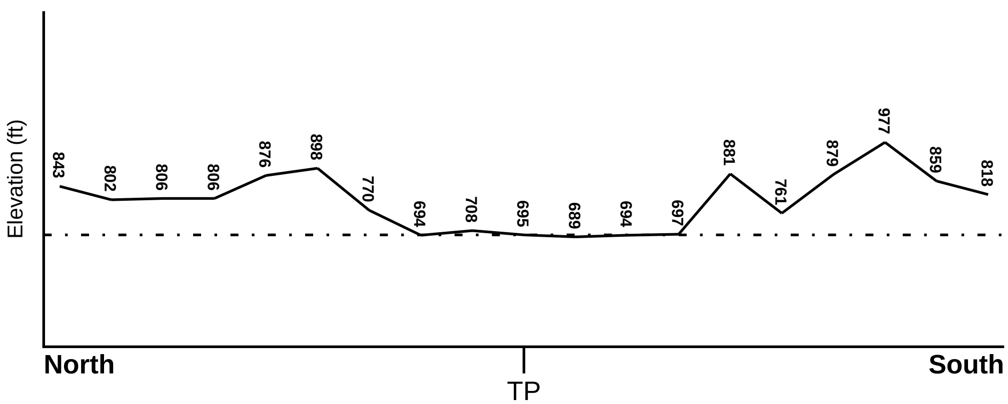
TOPOGRAPHIC INFORMATION

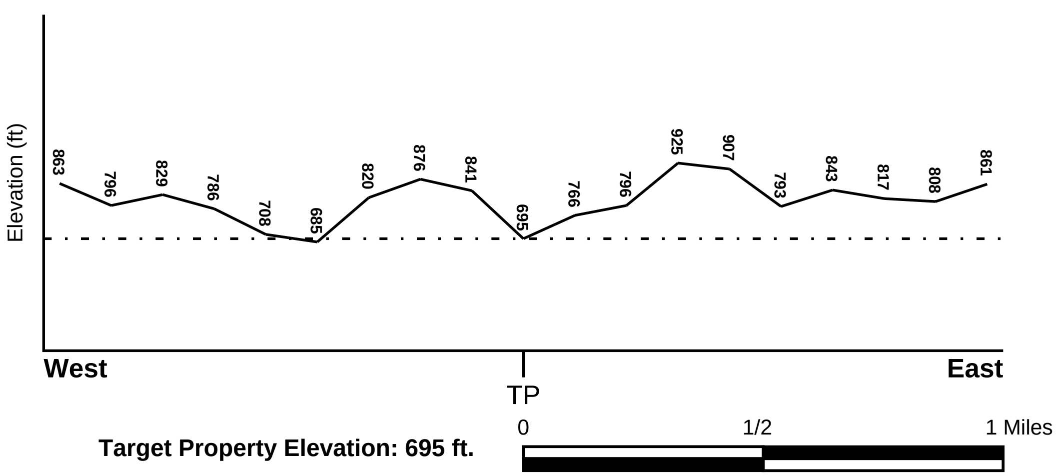
Surface topography may be indicative of the direction of surficial groundwater flow. This information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

TARGET PROPERTY TOPOGRAPHY

General Topographic Gradient: General ESE

SURROUNDING TOPOGRAPHY: ELEVATION PROFILES





Target Property Elevation: 695 ft.

Source: Topography has been determined from the USGS 7.5' Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

HYDROLOGIC INFORMATION

Surface water can act as a hydrologic barrier to groundwater flow. Such hydrologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

Refer to the Physical Setting Source Map following this summary for hydrologic information (major waterways and bodies of water).

FEMA FLOOD ZONE

Target Property County	FEMA Flood Electronic Data
SHANNON, MO	Not Available

Flood Plain Panel at Target Property: Not Reported

Additional Panels in search area: Not Reported

NATIONAL WETLAND INVENTORY

NWI Quad at Target Property	NWI Electronic Data Coverage
ROUND SPRING	YES - refer to the Overview Map and Detail Map

HYDROGEOLOGIC INFORMATION

Hydrogeologic information obtained by installation of wells on a specific site can often be an indicator of groundwater flow direction in the immediate area. Such hydrogeologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

AQUIFLOW®

Search Radius: 1.000 Mile.

EDR has developed the AQUIFLOW Information System to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted by environmental professionals to regulatory authorities at select sites and has extracted the date of the report, groundwater flow direction as determined hydrogeologically, and the depth to water table.

MAP ID	LOCATION FROM TP	GENERAL DIRECTION GROUNDWATER FLOW
Not Reported		

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW VELOCITY INFORMATION

Groundwater flow velocity information for a particular site is best determined by a qualified environmental professional using site specific geologic and soil strata data. If such data are not reasonably ascertainable, it may be necessary to rely on other sources of information, including geologic age identification, rock stratigraphic unit and soil characteristics data collected on nearby properties and regional soil information. In general, contaminant plumes move more quickly through sandy-gravelly types of soils than silty-clayey types of soils.

GEOLOGIC INFORMATION IN GENERAL AREA OF TARGET PROPERTY

Geologic information can be used by the environmental professional in forming an opinion about the relative speed at which contaminant migration may be occurring.

ROCK STRATIGRAPHIC UNIT

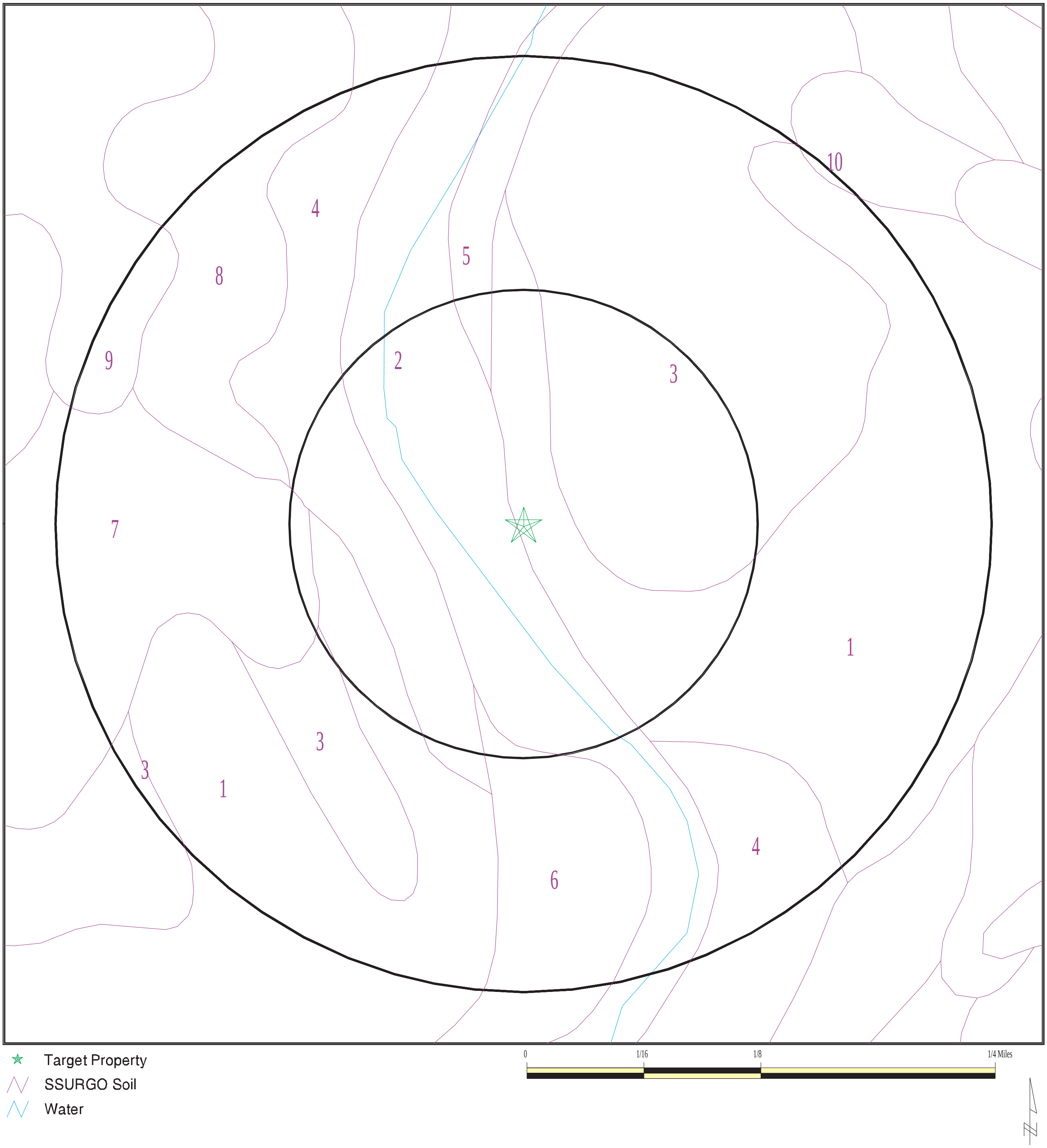
Era:	Paleozoic
System:	Cambrian
Series:	Cambrian
Code:	C *(decoded above as Era, System & Series)*

GEOLOGIC AGE IDENTIFICATION

Category: Stratified Sequence

Geologic Age and Rock Stratigraphic Unit Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - a digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

SSURGO SOIL MAP - 4008338.2s



SITE NAME: Camp Zoe Rehab	CLIENT: SCI Engineering, Inc.
ADDRESS: LAD Property	CONTACT: Jarred Schmidt
Salem MO 65560	INQUIRY #: 4008338.2s
LAT/LONG: 37.3083 / 91.4072	DATE: July 16, 2014 3:11 pm

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

DOMINANT SOIL COMPOSITION IN GENERAL AREA OF TARGET PROPERTY

The U.S. Department of Agriculture's (USDA) Soil Conservation Service (SCS) leads the National Cooperative Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. The following information is based on Soil Conservation Service SSURGO data.

Soil Map ID: 1

Soil Component Name: Alred

Soil Surface Texture: very gravelly silt loam

Hydrologic Group: Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.

Soil Drainage Class: Well drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: Moderate

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information

	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	
Layer	**Upper**	**Lower**	**Soil Texture Class**	**AASHTO Group**	**Unified Soil**		**Soil Reaction (pH)**
1	0 inches	6 inches	very gravelly silt loam	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	GC-GM	Max: 14 Min: 4	Max: 6 Min: 4.5
2	10 inches	29 inches	very gravelly silt loam	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	COARSE-GRAINED SOILS, Gravels, Gravels with fines, Clayey Gravel	Max: 14 Min: 4	Max: 5.5 Min: 4.5
3	29 inches	79 inches	gravelly clay	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit 50% or more), Fat Clay.	Max: 1.4 Min: 0.42	Max: 6.5 Min: 5.1

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
4	6 inches	10 inches	very gravelly silt loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	COARSE-GRAINED SOILS, Gravels, Gravels with fines, Clayey Gravel	Max: 14 Min: 4	Max: 6 Min: 4.5
5	0 inches	0 inches	slightly decomposed plant material	Not reported	Not reported	Max: 141 Min: 42	Max: 6.5 Min: 3.5

Soil Map ID: 2

Soil Component Name: Relfe

Soil Surface Texture: very gravelly sandy loam

Hydrologic Group: Class A - High infiltration rates. Soils are deep, well drained to excessively drained sands and gravels.

Soil Drainage Class: Excessively drained

Hydric Status: Partially hydric

Corrosion Potential - Uncoated Steel: Low

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	5 inches	very gravelly sandy loam	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	COARSE-GRAINED SOILS, Gravels, Gravels with fines, Clayey Gravel	Max: 42 Min: 14	Max: 7.3 Min: 5.1

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		Soil Reaction (pH)
2	5 inches	79 inches	stratified extremely cobbly coarse sand to very gravelly loamy sand	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	COARSE-GRAINED SOILIS, Gravels, Clean Gravels, Well-graded gravel. COARSE-GRAINED SOILS, Gravels, Gravels with fines, Clayey Gravel.	Max: 141 Min: 42	Max: 7.3 Min: 5.1

Soil Map ID: 3

Soil Component Name: Rueter

Soil Surface Texture: very gravelly silt loam

Hydrologic Group: Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.

Soil Drainage Class: Somewhat excessively drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: Moderate

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		Soil Reaction (pH)
1	0 inches	5 inches	very gravelly silt loam	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	COARSE-GRAINED SOILIS, Gravels, Clean Gravels, Well-graded gravel. COARSE-GRAINED SOILS, Gravels, Gravels with fines, Clayey Gravel.	Max: 14 Min: 4	Max: 6 Min: 4.5

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		Soil Reaction (pH)
2	5 inches	9 inches	gravelly silt loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	COARSE-GRAINED SOILIS, Gravels, Clean Gravels, Well-graded gravel. COARSE-GRAINED SOILS, Gravels, Gravels with fines, Clayey Gravel.	Max: 14 Min: 4	Max: 6 Min: 4.5
3	9 inches	27 inches	very gravelly silt loam	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	COARSE-GRAINED SOILS, Gravels, Gravels with fines, Clayey Gravel	Max: 14 Min: 4	Max: 5.5 Min: 4.5
4	27 inches	42 inches	very gravelly clay	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	COARSE-GRAINED SOILS, Gravels, Gravels with fines, Clayey Gravel	Max: 4 Min: 1.4	Max: 6 Min: 5.1
5	42 inches	79 inches	very cobbly clay	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	FINE-GRAINED SOILS, Silts and Clays (liquid limit 50% or more), Fat Clay.	Max: 4 Min: 1.4	Max: 6.5 Min: 5.1

Soil Map ID: 4

Soil Component Name: Brussels

Soil Surface Texture: gravelly silty clay loam

Hydrologic Group: Class C - Slow infiltration rates. Soils with layers impeding downward movement of water, or soils with moderately fine or fine textures.

Soil Drainage Class: Well drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: Moderate

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	9 inches	gravelly silty clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 4 Min: 1.4	Max: 7.8 Min: 6.1
2	9 inches	48 inches	very gravelly silty clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	COARSE-GRAINED SOILS, Gravels, Gravels with fines, Clayey Gravel	Max: 4 Min: 1.4	Max: 8.4 Min: 6.1
3	48 inches	70 inches	gravelly silty clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 4 Min: 1.4	Max: 8.4 Min: 6.1
4	0 inches	0 inches	slightly decomposed plant material	Not reported	Not reported	Max: 141 Min: 42	Max: 6.5 Min: 3.5

Soil Map ID: 5

Soil Component Name: Relfe

Soil Surface Texture: sandy loam

Hydrologic Group: Class A - High infiltration rates. Soils are deep, well drained to excessively drained sands and gravels.

Soil Drainage Class: Excessively drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: Low

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	7 inches	sandy loam	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	COARSE-GRAINED SOILS, Sands, Sands with fines, Clayey sand. COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 141 Min: 42	Max: 7.3 Min: 5.6
2	7 inches	64 inches	extremely gravelly sand	Granular materials (35 pct. or less passing No. 200), Stone Fragments, Gravel and Sand.	COARSE-GRAINED SOILIS, Gravels, Clean Gravels, Well-graded gravel.	Max: 141 Min: 42	Max: 7.3 Min: 5.6

Soil Map ID: 6

Soil Component Name: Wideman

Soil Surface Texture: fine sandy loam

Hydrologic Group: Class A - High infiltration rates. Soils are deep, well drained to excessively drained sands and gravels.

Soil Drainage Class: Excessively drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: Low

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	5 inches	fine sandy loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 141 Min: 42	Max: 7.3 Min: 5.1

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
2	21 inches	49 inches	sand	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 141 Min: 42	Max: 7.3 Min: 5.1
3	49 inches	70 inches	gravelly sandy loam	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	COARSE-GRAINED SOILS, Sands, Sands with fines, Clayey sand. COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 42 Min: 14	Max: 7.3 Min: 5.1
4	12 inches	21 inches	loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay. FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 42 Min: 14	Max: 7.3 Min: 5.1
5	5 inches	12 inches	fine sandy loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 141 Min: 42	Max: 7.3 Min: 5.1

Soil Map ID: 7

Soil Component Name: Rueter

Soil Surface Texture: gravelly silt loam

Hydrologic Group: Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.

Soil Drainage Class: Somewhat excessively drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: Moderate

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		Soil Reaction (pH)
1	0 inches	5 inches	gravelly silt loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay. FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 14 Min: 4	Max: 6 Min: 4.5
2	5 inches	11 inches	gravelly silt loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 14 Min: 4	Max: 6 Min: 4.5
3	11 inches	24 inches	very gravelly silt loam	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	COARSE-GRAINED SOILS, Gravels, Gravels with fines, Clayey Gravel	Max: 14 Min: 4	Max: 5.5 Min: 4.5
4	24 inches	42 inches	very gravelly silty clay loam	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	COARSE-GRAINED SOILS, Sands, Sands with fines, Clayey sand.	Max: 4 Min: 1.4	Max: 6 Min: 5.1
5	42 inches	79 inches	very cobbly clay	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	FINE-GRAINED SOILS, Silts and Clays (liquid limit 50% or more), Fat Clay.	Max: 4 Min: 1.4	Max: 6.5 Min: 5.1

Soil Map ID: 8

Soil Component Name: Clarksville

Soil Surface Texture: slightly decomposed plant material

Hydrologic Group: Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.

Soil Drainage Class: Somewhat excessively drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: Moderate

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 82 inches

Soil Layer Information

	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	
Layer	**Upper**	**Lower**	**Soil Texture Class**	**AASHTO Group**	**Unified Soil**		**Soil Reaction (pH)**
1	0 inches	0 inches	slightly decomposed plant material	Not reported	Not reported	Max: 141 Min: 42	Max: 6.5 Min: 3.5
2	0 inches	5 inches	gravelly silt loam	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	COARSE-GRAINED SOILS, Gravels, Gravels with fines, Silty Gravel	Max: 42 Min: 14	Max: 6 Min: 3.5
3	5 inches	12 inches	gravelly silt loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	COARSE-GRAINED SOILS, Gravels, Gravels with fines, Silty Gravel	Max: 42 Min: 14	Max: 6 Min: 3.5
4	12 inches	20 inches	very gravelly silt loam	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	COARSE-GRAINED SOILS, Gravels, Gravels with fines, Silty Gravel	Max: 42 Min: 14	Max: 5.5 Min: 4.5
5	20 inches	42 inches	extremely gravelly clay loam	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	COARSE-GRAINED SOILS, Gravels, Gravels with fines, Clayey Gravel	Max: 14 Min: 4	Max: 5.5 Min: 4.5

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
6	42 inches	65 inches	very gravelly clay	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	COARSE-GRAINED SOILS, Gravels, Gravels with fines, Clayey Gravel	Max: 14 Min: 4	Max: 5.5 Min: 4.5

Soil Map ID: 9

Soil Component Name: Alred

Soil Surface Texture: very gravelly silt loam

Hydrologic Group: Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.

Soil Drainage Class: Well drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: Moderate

Depth to Bedrock Min: > 77 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	7 inches	very gravelly silt loam	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	COARSE-GRAINED SOILS, Gravels, Gravels with fines, Clayey Gravel	Max: 14 Min: 4	Max: 6 Min: 4.5
2	7 inches	10 inches	gravelly silt loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	COARSE-GRAINED SOILS, Gravels, Gravels with fines, Clayey Gravel	Max: 14 Min: 4	Max: 6 Min: 4.5

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
3	10 inches	24 inches	very gravelly silt loam	Not reported	COARSE-GRAINED SOILS, Gravels, Gravels with fines, Clayey Gravel	Max: 14 Min: 4	Max: 5.5 Min: 4.5
4	24 inches	66 inches	cobbly clay	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit 50% or more), Fat Clay.	Max: 4 Min: 1.4	Max: 6.5 Min: 5.1

Soil Map ID: 10

Soil Component Name: Arkana

Soil Surface Texture: very gravelly silt loam

Hydrologic Group: Class C - Slow infiltration rates. Soils with layers impeding downward movement of water, or soils with moderately fine or fine textures.

Soil Drainage Class: Well drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 77 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	6 inches	very gravelly silt loam	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	COARSE-GRAINED SOILS, Gravels, Gravels with fines, Clayey Gravel	Max: 14 Min: 4	Max: 7.3 Min: 4.5

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
2	11 inches	29 inches	clay	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit 50% or more), Fat Clay.	Max: 14 Min: 4	Max: 7.3 Min: 4.5
3	29 inches	29 inches	bedrock	Not reported	Not reported	Max: 0.11 Min: 0	Max: Min:
4	0 inches	0 inches	slightly decomposed plant material	Not reported	Not reported	Max: 141 Min: 42	Max: 6.5 Min: 3.5
5	6 inches	11 inches	gravelly silty clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 14 Min: 4	Max: 7.3 Min: 4.5

LOCAL / REGIONAL WATER AGENCY RECORDS

EDR Local/Regional Water Agency records provide water well information to assist the environmental professional in assessing sources that may impact ground water flow direction, and in forming an opinion about the impact of contaminant migration on nearby drinking water wells.

WELL SEARCH DISTANCE INFORMATION

DATABASE	SEARCH DISTANCE (miles)
Federal USGS	1.000
Federal FRDS PWS	Nearest PWS within 0.001 miles
State Database	1.000

FEDERAL USGS WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
1	USGS40000689019	0 - 1/8 Mile NE
3	USGS40000689030	1/8 - 1/4 Mile NNE

FEDERAL FRDS PUBLIC WATER SUPPLY SYSTEM INFORMATION

MAP ID	WELL ID	LOCATION FROM TP

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

FEDERAL FRDS PUBLIC WATER SUPPLY SYSTEM INFORMATION

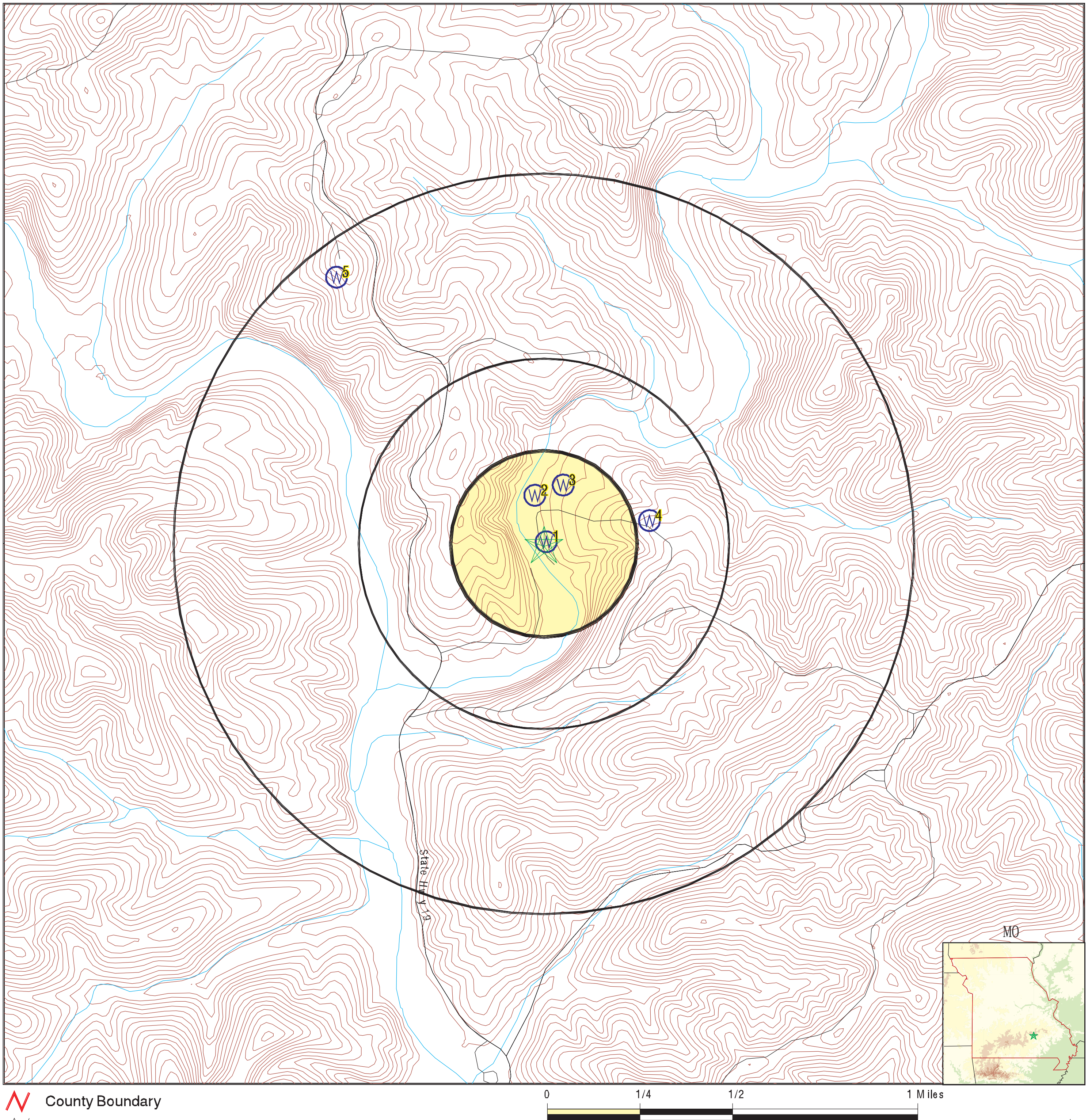
MAP ID	WELL ID	LOCATION FROM TP
No PWS System Found		

Note: PWS System location is not always the same as well location.

STATE DATABASE WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
2	MOLOG1000005711	1/8 - 1/4 Mile North
4	MOLOG1000005705	1/4 - 1/2 Mile ENE
5	MOLOG1000005774	1/2 - 1 Mile NW

PHYSICAL SETTING SOURCE MAP - 4008338.2s



County Boundary
Major Roads
Contour Lines
Earthquake epicenter, Richter 5 or greater
Water Wells
Public Water Supply Wells
Cluster of Multiple Icons

Groundwater Flow Direction
Indeterminate Groundwater Flow at Location
Groundwater Flow Varies at Location
Oil, gas or related wells

SITE NAME:	Camp Zoe Rehab	CLIENT:	SCI Engineering, Inc.
ADDRESS:	LAD Property	CONTACT:	Jarred Schmidt
	Salem MO 65560	INQUIRY #:	4008338.2s
LAT/LONG:	37.3083 / 91.4072	DATE:	July 16, 2014 3:11 pm

Map ID Direction Distance Elevation	Database	EDR ID Number
1 **NE** **0 - 1/8 Mile** **Higher**	**FED USGS**	**USGS40000689019**

Org. Identifier:	USGS-MO		
Formal name:	USGS Missouri Water Science Center		
Monloc Identifier:	USGS-371830091242501		
Monloc name:	T30N R04W 08CBA1		
Monloc type:	Well		
Monloc desc:	Not Reported		
Huc code:	11010008	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	37.3083795
Longitude:	-91.407082	Sourcemap scale:	24000
Horiz Acc measure:	10	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	700
Vert measure units:	feet	Vertacc measure val:	10
Vert accmeasure units:	feet		
Vertcollection method:	Interpolated from topographic map		
Vert coord refsys:	NGVD29	Countrycode:	US
Aquifername:	Ozark Plateaus aquifer system		
Formation type:	Eminence-Potosi Dolomites		
Aquifer type:	Not Reported		
Construction date:	19340601	Welldepth:	148
Welldepth units:	ft	Wellholedepth:	148
Wellholedepth units:	ft		

Ground-water levels, Number of Measurements: 1

Date	Feet below Surface	Feet to Sealevel
1934-06-01	14	

	Database	EDR ID Number
2 **North** **1/8 - 1/4 Mile** **Higher**	**MO WELLS**	**MOLOG1000005711**

Id:	022889	Located:	Not Reported
Notenough:	Not Reported	Scale:	100k
Locator:	VBProgram	Stname:	MISSOURI
Stabbrev:	MO	County:	SHANNON
Utm x:	641113		
Utm y:	4130269		
Latitude:	37.3102		
Longitude:	-91.40764		
Qtr3:	SE	Qtr2:	SW
Qtr1:	NW		
Section:	8		
Tnsp:	30		
Tnspdir:	Not Reported		
Rng:	4		
Rngdir:	W		
Plssx:	641613		
Plssy:	4130168		
Location p:	143		
Elev:	725		
Idnum:	22889		

Swl:	65		
Quadrangle:	ROUND SPRING	Site id:	MOLOG1000005711

Header Information:

Id:	022889	Well type:	Private Well
Agencyname:	GEOLOGICAL SURVEY (DGLS)	County:	SHANNON
Fips:	203	Stname:	MISSOURI
Stabbrev:	MO	Qtr3:	SE
Qtr2:	SW	Qtr1:	NW
Section:	08	Tnsp:	30
Tnspdir:	N	Rng:	04
Rngdir:	W		
Latitude:	37.3102		
Longitude:	-91.40764		
Utm x:	641113		
Utm y:	4130269		
Quadmap na:	ROUND SPRING	Ohio code:	37091C4
Llmeas:	D	Scale:	100k
Locator:	VBProgram	Typelog1:	Not Reported
Typelog2:	S	Typelog3:	Not Reported
Ownerind:	0	Owner:	Baltz, J.P. - Camp Zoe
Leasenam:	Not Reported	Driller:	Brasher, K.D.
Drldate:	1964/05/	Permit:	Not Reported
Logdate:	1964/11/	Logger:	Robertson, C.E.
Elev:	725		
Elevbase:	S	Prodyld:	20
Gpmcfs:	G		
Depthbed:	15		
Sampsav:	0	Swla:	65
Swlb:	Not Reported		
Water at:	Not Reported		
Totdepth:	135	Formation :	EMINENCE DOLOMITE
Formation1:	EMINENCE DOLOMITE		
Intcrdtp:	0		
Intcrdbt:	0		
Drawdown:	Not Reported	Aquclass:	Not Reported
Confind:	0	Reldate:	Not Reported
Probind1:	Not Reported	Probind2:	Not Reported
Probind3:	Not Reported	Additional:	Not Reported
Alagncy1:	Not Reported	Add databa:	Not Reported
Addition 1:	Not Reported	Add data 1:	Not Reported
Alnum2:	Not Reported	Add data 2:	Not Reported
Add data 3:	Not Reported	Rmkind:	N
Remarks:	formerly in name of Mack McMahan		
C total:	43	C plugind:	N
C remarks:	Not Reported		

Construction Information:

Id:	022889	Well type:	Private Well
Agencyname:	GEOLOGICAL SURVEY (DGLS)	Datecomp:	196405
Plugind:	N	Dateplug:	Not Reported
Casemat1:	Not Reported	Casemat2:	Not Reported
Cas1dpth:	43		
Cas1diam:	0		
Cas2dpth:	0		
Cas2diam:	0		
Cas3dpth:	0		
Cas3diam:	0		

Cas4dpth:	0		
Cas4diam:	0		
Inout1:	O	Typgrt1:	Not Reported
Typgrt2:	Not Reported	Typgrt3:	Not Reported
Mthgrout:	Not Reported	Rigtype:	Not Reported
Weltreat:	Not Reported	Rmkind:	Not Reported
Dateabnd:	Not Reported		
Plgdpt1b:	0		
Plgdpt1t:	0		
Multcase:	N		
Szcashol:	0		
Szbelcas:	0		
Sizscrn:	0		
Slotsize:	0		
Lenscrn:	0		
Typescrn:	Not Reported	Typedev:	Not Reported
Typepump:	Not Reported		
Pumpcap:	0		
Pumptdh:	0		
Pumpset:	0		
Typecomp:	Not Reported		
Perfintt:	0		
Perfintb:	0		
Oilprod:	Not Reported	Gasprod:	Not Reported
Tubepres:	Not Reported	Remarks:	Not Reported
Other data:	Not Reported	Formation :	EMINENCE DOLOMITE
Formation1:	EMINENCE DOLOMITE		

Strata Information:

Id:	022889	Stratordr:	0
Fmtop:	0		
Fmbot:	15		
Formation :	NO SAMPLES		
Primlith:	Not Reported		
Seclith:	Not Reported	Minlith:	Not Reported
Primmin:	Not Reported		
Primocc:	0		
Secmin:	Not Reported		
Secocc:	0		
Minrmin:	Not Reported		
Minrocc:	0		
Rmk20:	Not Reported		

Strata Information:

Id:	022889	Stratordr:	46600
Fmtop:	15		
Fmbot:	135		
Formation :	CAMBRIAN SYSTEM		
Primlith:	Not Reported		
Seclith:	Not Reported	Minlith:	Not Reported
Primmin:	Not Reported		
Primocc:	0		
Secmin:	Not Reported		
Secocc:	0		
Minrmin:	Not Reported		

Minrocc:	0		
Rmk20:	Not Reported		

Strata Information:

Id:	022889	Stratordr:	46700
Fmtop:	15		
Fmbot:	135		
Formation :	UPPER CAMBRIAN SERIES		
Primlith:	Not Reported		
Seclith:	Not Reported	Minlith:	Not Reported
Primmin:	Not Reported		
Primocc:	0		
Secmin:	Not Reported		
Secocc:	0		
Minrmin:	Not Reported		
Minrocc:	0		
Rmk20:	Not Reported		

Strata Information:

Id:	022889	Stratordr:	46800
Fmtop:	15		
Fmbot:	135		
Formation :	EMINENCE DOLOMITE		
Primlith:	DOLOMITE		
Seclith:	CHERT	Minlith:	DRUSE
Primmin:	Not Reported		
Primocc:	0		
Secmin:	Not Reported		
Secocc:	0		
Minrmin:	Not Reported		
Minrocc:	0		
Rmk20:	Not Reported		

Strata Information:

Id:	022889	Stratordr:	99900
Fmtop:	135		
Fmbot:	0		
Formation :	TOTAL DEPTH		
Primlith:	Not Reported		
Seclith:	Not Reported	Minlith:	Not Reported
Primmin:	Not Reported		
Primocc:	0		
Secmin:	Not Reported		
Secocc:	0		
Minrmin:	Not Reported		
Minrocc:	0		
Rmk20:	Not Reported		

3
NNE
1/8 - 1/4 Mile
Higher

FED USGS **USGS40000689030**

Org. Identifier:	USGS-MO		
Formal name:	USGS Missouri Water Science Center		
Monloc Identifier:	USGS-371838091242201		
Monloc name:	T30N R04W 08BCD		
Monloc type:	Well		
Monloc desc:	Not Reported		
Huc code:	11010008	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	37.3106017
Longitude:	-91.4062487	Sourcemap scale:	24000
Horiz Acc measure:	1	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	725
Vert measure units:	feet	Vertacc measure val:	10
Vert accmeasure units:	feet		
Vertcollection method:	Interpolated from topographic map		
Vert coord refsys:	NGVD29	Countrycode:	US
Aquifername:	Ozark Plateaus aquifer system		
Formation type:	Not Reported		
Aquifer type:	Unconfined single aquifer		
Construction date:	196405	Welldepth:	135
Welldepth units:	ft	Wellholedepth:	135
Wellholedepth units:	ft		

Ground-water levels, Number of Measurements: 1

Date	Feet below Surface	Feet to Sealevel
1964-05	65	

4
ENE
1/4 - 1/2 Mile
Higher

MO WELLS **MOLOG1000005705**

Id:	002875	Located:	Not Reported
Notenough:	Not Reported	Scale:	100k
Locator:	VBProgram	Stname:	MISSOURI
Stabbrev:	MO	County:	SHANNON
Utm x:	641613		
Utm y:	4130168		
Latitude:	37.30921		
Longitude:	-91.40202		
Qtr3:	C	Qtr2:	Not Reported
Qtr1:	Not Reported		
Section:	8		
Tnsp:	30		
Tnspdir:	Not Reported		
Rng:	4		
Rngdir:	W		
Plssx:	641613		
Plssy:	4130168		
Location p:	1142		
Elev:	700		
Idnum:	2875		

Swl:	14		
Quadrangle:	ROUND SPRING	Site id:	MOLOG1000005705

Header Information:

Id:	002875	Well type:	Private Well
Agencyname:	GEOLOGICAL SURVEY (DGLS)	County:	SHANNON
Fips:	203	Stname:	MISSOURI
Stabbrev:	MO	Qtr3:	C
Qtr2:	Not Reported	Qtr1:	Not Reported
Section:	08	Tnsp:	30
Tnspdir:	N	Rng:	04
Rngdir:	W		
Latitude:	37.30921		
Longitude:	-91.40202		
Utm x:	641613		
Utm y:	4130168		
Quadmap na:	ROUND SPRING	Ohio code:	37091C4
Llmeas:	D	Scale:	100k
Locator:	VBProgram	Typelog1:	D
Typelog2:	Not Reported	Typelog3:	S
Ownerind:	1	Owner:	McMahan, R.S. - Camp Zoe
Leasenam:	Not Reported	Driller:	Kelly, R.S.
Drldate:	1934/06/	Permit:	Not Reported
Logdate:	1935/01/05	Logger:	Farrar / Haseltine
Elev:	700		
Elevbase:	S	Prodyld:	7
Gpmcfs:	Not Reported		
Depthbed:	10		
Sampsav:	1	Swla:	14
Swlb:	Not Reported		
Water at:	25’, 60’, 110’, 124’		
Totdepth:	124	Formation :	EMINENCE DOLOMITE
Formation1:	POTOSI DOLOMITE		
Intcrdtp:	0		
Intcrdbt:	0		
Drawdown:	Not Reported	Aquclass:	Not Reported
Confind:	0	Reldate:	Not Reported
Probind1:	Not Reported	Probind2:	Not Reported
Probind3:	Not Reported	Additional:	Not Reported
Alagncy1:	Not Reported	Add databa:	Not Reported
Addition 1:	Not Reported	Add data 1:	Not Reported
Alnum2:	Not Reported	Add data 2:	Not Reported
Add data 3:	Not Reported	Rmkind:	N
Remarks:	ROUND SPRING		
C total:	0	C plugind:	Not Reported
C remarks:	Not Reported		

Strata Information:

Id:	002875	Stratordr:	0
Fmtop:	0		
Fmbot:	10		
Formation :	NO SAMPLES		
Primlith:	Not Reported		
Seclith:	Not Reported	Minlith:	Not Reported
Primmin:	Not Reported		
Primocc:	0		
Secmin:	Not Reported		
Secocc:	0		
Minrmin:	Not Reported		

Minrocc:	0		
Rmk20:	Not Reported		

Strata Information:

Id:	002875	Stratordr:	46600
Fmtop:	10		
Fmbot:	124		
Formation :	CAMBRIAN SYSTEM		
Primlith:	Not Reported		
Seclith:	Not Reported	Minlith:	Not Reported
Primmin:	Not Reported		
Primocc:	0		
Secmin:	Not Reported		
Secocc:	0		
Minrmin:	Not Reported		
Minrocc:	0		
Rmk20:	Not Reported		

Strata Information:

Id:	002875	Stratordr:	46700
Fmtop:	10		
Fmbot:	124		
Formation :	UPPER CAMBRIAN SERIES		
Primlith:	Not Reported		
Seclith:	Not Reported	Minlith:	Not Reported
Primmin:	Not Reported		
Primocc:	0		
Secmin:	Not Reported		
Secocc:	0		
Minrmin:	Not Reported		
Minrocc:	0		
Rmk20:	Not Reported		

Strata Information:

Id:	002875	Stratordr:	46800
Fmtop:	10		
Fmbot:	80		
Formation :	EMINENCE DOLOMITE		
Primlith:	DOLOMITE		
Seclith:	CHERT	Minlith:	SAND
Primmin:	Not Reported		
Primocc:	0		
Secmin:	Not Reported		
Secocc:	0		
Minrmin:	Not Reported		
Minrocc:	0		
Rmk20:	Not Reported		

Strata Information:

Id:	002875	Stratordr:	47000
Fmtop:	80		
Fmbot:	124		
Formation :	POTOSI DOLOMITE		
Primlith:	DOLOMITE		
Seclith:	CHERT	Minlith:	Not Reported
Primmin:	Not Reported		
Primocc:	0		
Secmin:	Not Reported		
Secocc:	0		
Minrmin:	Not Reported		

Minrocc:	0		
Rmk20:	Not Reported		

Strata Information:

Id:	002875	Stratordr:	99900
Fmtop:	124		
Fmbot:	124		
Formation :	TOTAL DEPTH		
Primlith:	Not Reported		
Seclith:	Not Reported	Minlith:	Not Reported
Primmin:	Not Reported		
Primocc:	0		
Secmin:	Not Reported		
Secocc:	0		
Minrmin:	Not Reported		
Minrocc:	0		
Rmk20:	Not Reported		

5
NW
1/2 - 1 Mile
Higher

MO WELLS **MOLOG1000005774**

Id:	028494	Located:	Not Reported
Notenough:	Not Reported	Scale:	100k
Locator:	VBProgram	Stname:	MISSOURI
Stabbrev:	MO	County:	SHANNON
Utm x:	640235		
Utm y:	4131203		
Latitude:	37.31874		
Longitude:	-91.41736		
Qtr3:	C	Qtr2:	SW
Qtr1:	SE		
Section:	6		
Tnsp:	30		
Tnspdir:	Not Reported		
Rng:	4		
Rngdir:	W		
Plssx:	640035		
Plssy:	4131816		
Location p:	289		
Elev:	1125		
Idnum:	28494		
Swl:	0		
Quadrangle:	ROUND SPRING	Site id:	MOLOG1000005774

Header Information:

Id:	028494	Well type:	Noncommunity Public Well
Agencyname:	GEOLOGICAL SURVEY (DGLS)	County:	SHANNON
Fips:	203	Stname:	MISSOURI
Stabbrev:	MO	Qtr3:	C
Qtr2:	SW	Qtr1:	SE
Section:	06	Tnsp:	30
Tnspdir:	N	Rng:	04
Rngdir:	W		
Latitude:	37.31874		
Longitude:	-91.41736		

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Utm x:	640235		
Utm y:	4131203		
Quadmap na:	ROUND SPRING	Ohio code:	37091C4
Llmeas:	D	Scale:	100k
Locator:	VBProgram	Typelog1:	Not Reported
Typelog2:	S	Typelog3:	Not Reported
Ownerind:	1	Owner:	Missouri Conservation Commission
Leasenam:	Shannondale Towersite	Driller:	Burge Drlg
Drldate:	1980/01/08	Permit:	Not Reported
Logdate:	Not Reported	Logger:	Bohm, Rex
Elev:	1125		
Elevbase:	S	Prodyld:	Not Reported
Gpmcfs:	Not Reported		
Depthbed:	30		
Sampsav:	0	Swla:	375
Swlb:	Not Reported		
Water at:	Not Reported		
Totdepth:	420	Formation :	GASCONADE DOLOMITE
Formation1:	EMINENCE DOLOMITE		
Intcrdtp:	0		
Intcrdbt:	0		
Drawdown:	45	Aquclass:	Not Reported
Confind:	0	Reldate:	Not Reported
Probind1:	Not Reported	Probind2:	Not Reported
Probind3:	Not Reported	Additional:	Not Reported
Alagncy1:	Not Reported	Add databa:	Not Reported
Addition 1:	Not Reported	Add data 1:	Not Reported
Alnum2:	Not Reported	Add data 2:	Not Reported
Add data 3:	Not Reported	Rmkind:	N
Remarks:	SHANNONDALE TOWER SITE		
C total:	175	C plugind:	N
C remarks:	Not Reported		

Construction Information:

Id:	028494	Well type:	Private Well
Agencyname:	GEOLOGICAL SURVEY (DGLS)	Datecomp:	198001
Plugind:	N	Dateplug:	Not Reported
Casemat1:	Not Reported	Casemat2:	Not Reported
Cas1dpth:	175		
Cas1diam:	6		
Cas2dpth:	0		
Cas2diam:	0		
Cas3dpth:	0		
Cas3diam:	0		
Cas4dpth:	0		
Cas4diam:	0		
Inout1:	O	Typgrt1:	Not Reported
Typgrt2:	Not Reported	Typgrt3:	Not Reported
Mthgrout:	Not Reported	Rigtype:	Not Reported
Weltreat:	Not Reported	Rmkind:	Not Reported
Dateabnd:	Not Reported		
Plgdpt1b:	0		
Plgdpt1t:	0		
Multcase:	N		

Szcashol:	0		
Szbelcas:	0		
Sizscrn:	0		
Slotsize:	0		
Lenscrn:	0		
Typescrn:	Not Reported	Typedev:	Not Reported
Typepump:	Not Reported		
Pumpcap:	0		
Pumptdh:	0		
Pumpset:	0		
Typecomp:	Not Reported		
Perfintt:	0		
Perfintb:	0		
Oilprod:	Not Reported	Gasprod:	Not Reported
Tubepres:	Not Reported	Remarks:	Not Reported
Other data:	Not Reported	Formation :	LOWER GASCONADE DOLOMITE
Formation1:	EMINENCE DOLOMITE		

Strata Information:

Id:	028494	Stratordr:	0
Fmtop:	25		
Fmbot:	30		
Formation :	NO SAMPLES		
Primlith:	Not Reported		
Seclith:	Not Reported	Minlith:	Not Reported
Primmin:	Not Reported		
Primocc:	0		
Secmin:	Not Reported		
Secocc:	0		
Minrmin:	Not Reported		
Minrocc:	0		
Rmk20:	Not Reported		

Strata Information:

Id:	028494	Stratordr:	100
Fmtop:	0		
Fmbot:	25		
Formation :	RESIDUUM & TOP SOIL		
Primlith:	CLAY		
Seclith:	CHERT	Minlith:	Not Reported
Primmin:	Not Reported		
Primocc:	0		
Secmin:	Not Reported		
Secocc:	0		
Minrmin:	Not Reported		
Minrocc:	0		
Rmk20:	Not Reported		

Strata Information:

Id:	028494	Stratordr:	39000
Fmtop:	30		
Fmbot:	275		
Formation :	ORDOVICIAN SYSTEM		
Primlith:	Not Reported		
Seclith:	Not Reported	Minlith:	Not Reported
Primmin:	Not Reported		
Primocc:	0		
Secmin:	Not Reported		
Secocc:	0		
Minrmin:	Not Reported		

Minrocc:	0		
Rmk20:	Not Reported		

Strata Information:

Id:	028494	Stratordr:	44800
Fmtop:	30		
Fmbot:	275		
Formation :	CANADIAN (IBEXIAN) SERIES		
Primlith:	Not Reported		
Seclith:	Not Reported	Minlith:	Not Reported
Primmin:	Not Reported		
Primocc:	0		
Secmin:	Not Reported		
Secocc:	0		
Minrmin:	Not Reported		
Minrocc:	0		
Rmk20:	Not Reported		

Strata Information:

Id:	028494	Stratordr:	46200
Fmtop:	30		
Fmbot:	275		
Formation :	GASCONADE DOLOMITE		
Primlith:	DOLOMITE		
Seclith:	CHERT	Minlith:	SAND
Primmin:	Not Reported		
Primocc:	0		
Secmin:	Not Reported		
Secocc:	0		
Minrmin:	Not Reported		
Minrocc:	0		
Rmk20:	Not Reported		

Strata Information:

Id:	028494	Stratordr:	46400
Fmtop:	30		
Fmbot:	255		
Formation :	LOWER GASCONADE DOLOMITE		
Primlith:	DOLOMITE		
Seclith:	CHERT	Minlith:	Not Reported
Primmin:	Not Reported		
Primocc:	0		
Secmin:	Not Reported		
Secocc:	0		
Minrmin:	Not Reported		
Minrocc:	0		
Rmk20:	Not Reported		

Strata Information:

Id:	028494	Stratordr:	46500
Fmtop:	255		
Fmbot:	275		
Formation :	GUNTER SANDSTONE MEMBER		
Primlith:	DOLOMITE		
Seclith:	SAND	Minlith:	Not Reported
Primmin:	Not Reported		
Primocc:	0		
Secmin:	Not Reported		
Secocc:	0		
Minrmin:	Not Reported		

Minrocc:	0		
Rmk20:	Not Reported		
Strata Information:			
Id:	028494	Stratordr:	46500
Fmtop:	255		
Fmbot:	275		
Formation :	GUNTER SANDSTONE MEMBER		
Primlith:	DOLOMITE		
Seclith:	SAND	Minlith:	Not Reported
Primmin:	Not Reported		
Primocc:	0		
Secmin:	Not Reported		
Secocc:	0		
Minrmin:	Not Reported		
Minrocc:	0		
Rmk20:	Not Reported		
Strata Information:			
Id:	028494	Stratordr:	46600
Fmtop:	275		
Fmbot:	420		
Formation :	CAMBRIAN SYSTEM		
Primlith:	Not Reported		
Seclith:	Not Reported	Minlith:	Not Reported
Primmin:	Not Reported		
Primocc:	0		
Secmin:	Not Reported		
Secocc:	0		
Minrmin:	Not Reported		
Minrocc:	0		
Rmk20:	Not Reported		
Strata Information:			
Id:	028494	Stratordr:	46700
Fmtop:	275		
Fmbot:	420		
Formation :	UPPER CAMBRIAN SERIES		
Primlith:	Not Reported		
Seclith:	Not Reported	Minlith:	Not Reported
Primmin:	Not Reported		
Primocc:	0		
Secmin:	Not Reported		
Secocc:	0		
Minrmin:	Not Reported		
Minrocc:	0		
Rmk20:	Not Reported		
Strata Information:			
Id:	028494	Stratordr:	46800
Fmtop:	275		
Fmbot:	420		
Formation :	EMINENCE DOLOMITE		
Primlith:	DOLOMITE		
Seclith:	Not Reported	Minlith:	CHERT
Primmin:	Not Reported		
Primocc:	0		
Secmin:	Not Reported		
Secocc:	0		
Minrmin:	Not Reported		

Minrocc:	0		
Rmk20:	Not Reported		

Strata Information:

Id:	028494	Stratordr:	99900
Fmtop:	420		
Fmbot:	0		
Formation :	TOTAL DEPTH		
Primlith:	Not Reported		
Seclith:	Not Reported	Minlith:	Not Reported
Primmin:	Not Reported		
Primocc:	0		
Secmin:	Not Reported		
Secocc:	0		
Minrmin:	Not Reported		
Minrocc:	0		
Rmk20:	Not Reported		

AREA RADON INFORMATION

State Database: MO Radon

Radon Test Results

Zipcode	Test Date	Result
65560	12/17/07	0.6

Federal EPA Radon Zone for SHANNON County: 2

Note: Zone 1 indoor average level > 4 pCi/L.
: Zone 2 indoor average level >= 2 pCi/L and <= 4 pCi/L.
: Zone 3 indoor average level < 2 pCi/L.

Federal Area Radon Information for Zip Code: 65560

Number of sites tested: 4

Area	Average Activity	% <4 pCi/L	% 4-20 pCi/L	% >20 pCi/L
Living Area - 1st Floor	0.375 pCi/L	100%	0%	0%
Living Area - 2nd Floor	Not Reported	Not Reported	Not Reported	Not Reported
Basement	1.550 pCi/L	100%	0%	0%

PHYSICAL SETTING SOURCE RECORDS SEARCHED

TOPOGRAPHIC INFORMATION

USGS 7.5' Digital Elevation Model (DEM)
Source: United States Geologic Survey
EDR acquired the USGS 7.5' Digital Elevation Model in 2002 and updated it in 2006. The 7.5 minute DEM corresponds to the USGS 1:24,000- and 1:25,000-scale topographic quadrangle maps. The DEM provides elevation data with consistent elevation units and projection.

Scanned Digital USGS 7.5' Topographic Map (DRG)
Source: United States Geologic Survey
A digital raster graphic (DRG) is a scanned image of a U.S. Geological Survey topographic map. The map images are made by scanning published paper maps on high-resolution scanners. The raster image is georeferenced and fit to the Universal Transverse Mercator (UTM) projection.

HYDROLOGIC INFORMATION

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 2003 & 2011 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002, 2005 and 2010 from the U.S. Fish and Wildlife Service.

HYDROGEOLOGIC INFORMATION

AQUIFLOW[R] Information System
Source: EDR proprietary database of groundwater flow information
EDR has developed the AQUIFLOW Information System (AIS) to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted to regulatory authorities at select sites and has extracted the date of the report, hydrogeologically determined groundwater flow direction and depth to water table information.

GEOLOGIC INFORMATION

Geologic Age and Rock Stratigraphic Unit
Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - A digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

STATSGO: State Soil Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Services
The U.S. Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) leads the national Conservation Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. Soil maps for STATSGO are compiled by generalizing more detailed (SSURGO) soil survey maps.

SSURGO: Soil Survey Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Services (NRCS)
Telephone: 800-672-5559
SSURGO is the most detailed level of mapping done by the Natural Resources Conservation Services, mapping scales generally range from 1:12,000 to 1:63,360. Field mapping methods using national standards are used to construct the soil maps in the Soil Survey Geographic (SSURGO) database. SSURGO digitizing duplicates the original soil survey maps. This level of mapping is designed for use by landowners, townships and county natural resource planning and management.

PHYSICAL SETTING SOURCE RECORDS SEARCHED

LOCAL / REGIONAL WATER AGENCY RECORDS

FEDERAL WATER WELLS

PWS: Public Water Systems
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Public Water System data from the Federal Reporting Data System. A PWS is any water system which provides water to at least 25 people for at least 60 days annually. PWSs provide water from wells, rivers and other sources.

PWS ENF: Public Water Systems Violation and Enforcement Data
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Violation and Enforcement data for Public Water Systems from the Safe Drinking Water Information System (SDWIS) after August 1995. Prior to August 1995, the data came from the Federal Reporting Data System (FRDS).

USGS Water Wells: USGS National Water Inventory System (NWIS)
This database contains descriptive information on sites where the USGS collects or has collected data on surface water and/or groundwater. The groundwater data includes information on wells, springs, and other sources of groundwater.

STATE RECORDS

Missouri Public Drinking Water Wells
Source: Department of Natural Resources
Telephone: 573-526-5448

OTHER STATE DATABASE INFORMATION

Oil and Gas Well Database
Source: Department of Natural Resources
Telephone: 573-368-2143

RADON

Area Radon Information
Source: USGS
Telephone: 703-356-4020
The National Radon Database has been developed by the U.S. Environmental Protection Agency (USEPA) and is a compilation of the EPA/State Residential Radon Survey and the National Residential Radon Survey. The study covers the years 1986 - 1992. Where necessary data has been supplemented by information collected at private sources such as universities and research institutions.

EPA Radon Zones
Source: EPA
Telephone: 703-356-4020
Sections 307 & 309 of IRAA directed EPA to list and identify areas of U.S. with the potential for elevated indoor radon levels.

OTHER

Airport Landing Facilities: Private and public use landing facilities
Source: Federal Aviation Administration, 800-457-6656

Epicenters: World earthquake epicenters, Richter 5 or greater
Source: Department of Commerce, National Oceanic and Atmospheric Administration

Earthquake Fault Lines: The fault lines displayed on EDR's Topographic map are digitized quaternary faultlines, prepared in 1975 by the United State Geological Survey

PHYSICAL SETTING SOURCE RECORDS SEARCHED

STREET AND ADDRESS INFORMATION

APPENDIX F

Edwin P. Grimmer, P.E.

Senior Engineer / Associate

Professional Summary

Mr. Grimmer joined SCI Engineering, Inc. (SCI) in June 1999. With over 20 years of environmental consulting experience, he has been responsible for projects throughout the United States with most of his experience focused in Missouri, Illinois, Indiana and Kansas. He specializes in the following areas:

- Hazardous Waste, Soil and Groundwater
- Phase One/Two Environmental Site Assessments
- National Environmental Policy Act (NEPA)
- Air Quality, including Transportation
- Spill Prevention, Control and Countermeasure Plans (SPCCC)
- Noise Assessments

Ed is also a Lieutenant Colonel in the US Army Reserve working for USTRANSCOM on Scott Air Force Base, Illinois.

Education

B.S., Chemical Engineering, University of Missouri – Rolla, 1992

Intermediate Level Education Course, U.S. Army Command and General Staff College, 2008

Transportation Officer Advanced Course (RC), U.S. Army Transportation School, Commandant's List, 1996

Chemical Officer Basic Course, U.S. Army Chemical School, Honor Graduate, 1993

Registrations and Certifications

Professional Engineer
Missouri 029254 (1998)
Illinois 062-052661 (1998)

FHWA-NHI-142005 NEPA and Transportation Decision Making, 2011

8-Hour OSHA 29 CFR Hazardous Materials Supervisor Course, 1993

40-Hour Hazardous Waste Operations and Emergency Response Course, 1993 with annual refreshers

FHWA Traffic Noise Course, 2011

Affiliations

Society of American Military Engineers, St. Louis Post, 2ndVice President, Small Business Liaison

Air and Waste Management Association

Project Experience

NEPA/Environmental Assessments

- **Governors' Parkway** [Madison County, Illinois] – SCI prepared the Environmental Led team that conducted re-evaluation of an FEIS approved in 1975. Under the direction of the IDOT and FHWA, SCI used the EA format for the re-evaluation of a 3-lane east-west roadway, to be approximately 4 miles in length. The project included socio-economic, land use, air quality, geological resources, cultural resources, ecology, water resources, wetlands, endangered species, special waste, and noise analyses.

- **Columbia Crossing Interchange** [Monroe County, Illinois] -- Conducted environmental services for the construction of a new interchange on Interstate 255. Scope of work included the preparation of the EA, which addressed the "no-action" alternative along with five "build" alternatives. The affected environment and environmental consequences related to water resources, wetlands, agricultural lands, threatened and endangered species, air quality, special waste, noise, socio-economics, land use, flood plains, and cultural resources were addressed in the EA.

- **Crosstown Road** [Madison County, Illinois] – SCI prepared an Environmental Assessment for the construction of a new 5-mile roadway. The project included socio-economic, land use, air quality, geological resources, cultural resources, Section 4(f) and 6(f) lands, ecology, water resources, wetlands, endangered species, special waste, and noise analysis.

- **Prairie DuPont Levee and Fishlake Levee** [Monroe and St. Clair County, Illinois] – Prepared an EA for USACE on two levees, totaling approximately 15 miles in length. The project involved certification of the levee through the United States Army Corp of Engineers

- **Waterloo School District No. 5** [Monroe County, IL] – Assisted in the preparation of the EA for the incorporation of seismic building standards into the construction of a new high school. Hazard Mitigation Grant Program funds were applied for by FEMA, requiring the preparation of the EA.

- Waterloo Bypass [Monroe County, IL] – Conducted a noise analysis for a road widening project for the Illinois Department of Transportation using Traffic Noise Model. Noise assessment services included traffic volumes, speeds, and distribution of vehicle types. The report included analysis of reasonableness and feasibility of sound wall construction and included recommendations for sound wall dimensions.

- **Fort Leonard Wood Substations #2 and #6** [Fort Leonard Wood, MO] – Senior Engineer to prepare an environmental baseline survey/environmental assessment for two substations at Ft. Leonard Wood. The EA evaluated the effects of implementing the rebuild/upgrade of Ft. Leonard Wood Substation #2 and the construction of Ft. Leonard Wood Substation #6.

Hazardous Waste

- **Interstate 64 Pedestrian Overpass** [East St. Louis, IL] – Senior Engineer to prepare Special/ Hazardous Waste Plans/Reports and to provide monitoring and prepare a Health and Safety Plan. The project featured 4,000 yards of soil classified as special waste and 1,000 yards of soil classified as hazardous waste by IDOT.

- **Contract 76C39, Item 33** [National City, IL] – Senior Engineer to prepare Special Waste Plans/Reports and conduct health and safety monitoring during the disposal of materials identified as non-special waste by IDOT.

- **National Railway Equipment Company** [Silvis, IL] -- Senior Engineer for remediation project at historic railroad manufacturing facility. Included negotiations with IEPA, completing Phase One and Phase Two ESAs, and designing remediation alternatives. This project also involved the development of a soil and groundwater contamination management plan.

- **Owens Glass** [Godfrey, IL] -- Senior Engineer to take a historic industrial/manufacturing facility through the IEPA SRP program. Received a NFR letter and conducted R-26 groundwater modeling per Illinois TACO.

- **Casino Queen** [East St. Louis, IL] -- Managed soil remediation during construction of a casino in a historic industrial area. Prepared Phase One and Phase Two ESAs.

- **American Cleaners** [Fairview Heights, IL] -- Senior Engineer to take a historic drycleaner facility through the IEPA SRP program. Received a NFR letter and conducted R-26 groundwater modeling per Illinois TACO. Prepared Health & Safety Plan for remedial construction.

- **Madison Metal Services** [Madison, IL] – Senior Engineer to guide the manufacturing facility through the Illinois Environmental Protection Agency's (IEPA) Site Remediation Program (SRP) with the goal of receiving a No Further Remediation (NFR) letter. Conducted groundwater modeling in accordance with IEPA TACO.

- **Former Wilson Aluminum** [O'Fallon, IL] – Senior Engineer for environmental consulting services at this facility to obtain a "No Further Remediation" (NFR) letter. Also performed low-flow purging and sampling of four on-site perimeter monitoring wells in accordance with IEPA procedures.

- **Mulberry Road Realignment** [Collinsville, IL] – Conducted a Soil Exploration for a ¼-mile road realignment project that involved the realignment of two existing roadways, construction of a bridge span, installation of a drainage ditch, and the installation of new water mains. Over 2,000 yards of lead impacted soil was removed from the site and properly disposed at a special waste landfill.

- **17th Street Abandoned Rail Line/Roadway Construction** [Belleville, IL] – Performed a lead-impacted soil remediation during the design phases of a proposed road extension to be constructed over an abandoned rail line. The material requiring disposal included over 1,000 cubic yards of special waste and 1,000 cubic yards of hazardous waste.

Jarred Schmidt

Staff Scientist

Education

B.S., Geology, Missouri State University, 2012

Certifications

OSHA 10-Hour Construction Health and Safety

Hazardous Waste Operations and Emergency Response (HAZWOPER)

Oklahoma Asbestos Inspector

Missouri Asbestos Inspector

Affiliations

Association of Environmental & Engineering Geologists

Association of Missouri Geologists

American Association of Petroleum Geologists

Professional Summary

Mr. Schmidt joined SCI Engineering, Inc. (SCI) in April 2013 to provide various environmental consulting services including field work and report writing. Mr. Schmidt currently conducts Phase One Environmental Site Assessments (Phase One ESA), and Limited Phase Two ESAs, Mr. Schmidt is also responsible for conducting indoor air quality surveys, asbestos, lead, and mold assessments and air monitoring.

His previous experience includes serving as a GIS Intern for the City of Springfield, Missouri. In this capacity, he collected and interpreted data for the Private Sewer Repair Pilot Project using GIS and GPS surveying.

Project Experience

- **Enbridge Energy Pipeline 51** [Missouri, Oklahoma] – Provided oversight in dealing with asbestos-containing pipe coating surrounding the pipeline. Provided air monitoring and bulk sample collection during inspection and abatement phases.
- **City of Wentzville** [Wentzville, MO] – Proviced monthly water quality sampling and reporting services for the City of Wentzville. Surface water samples were collected from city streams and creeks in accordance with National Pollutant Discharge and Elimination System regulations.
- **Jefferson Barracks Building 27 Annex** [St. Louis, MO] – Provided third party oversight services for asbestos abatement of Missouri National Guard facility.
- **Con-way Freight** [St. Louis, MO] – Conducted a limited subsurface investigation associated with a Phase Two ESA. Logged borings and collected soil and groundwater samples to be analyzed in an environmental laboratory for metals and other hazardous substances.
- **705 Olive Street** [St. Louis, MO] – Performed an asbestos survey for a fifteen story building in downtown St. Louis taking multiple samples and conducting overview of the entire condition of the building to determine the amount of asbestos within the building.
- **Keefe Group** [Earth City, MO] – Performed mold assessment in a manufacturing facility in Earth City Business Park to determine possible mold and soil vapor inside the building.
- **SRG Global** [Portageville, MO & Farmington, MO] – Assisted in quarterly water quality sampling for monitoring wells to be analyzed for metals and other hazardous substances.
- **Higginsville Habilitation Center** [Higginsville, MO] – Provided third party services for asbestos abatement. including oversight of asbestos abatement, daily air monitoring and overview of the conditions of the project.
- **7511 Rolling Acres Lane** [Belleville, Illinois] – Conducted a Phase One Environmental Site Assessment to document current site conditions. as they relate to Recognized Environmental Conditions. Produced a Phase One ESA report which included site reconnaissance observations, and a review of historical information related to the subject site as well as determinations about current and historic uses of the site

APPENDIX I

Ozark National Scenic Riverways Project Proposal Form

Today's Date: 10/16/2014

Project Title: Proposed State Park - Relocation of Co Rd 19B and various proposed secondary park roads PMIS Number:

Project Initiator: State of MO OA/FMDC and DNR Division of State Parks

Project Location: Shannon County, Missouri

Project Type: ☐ Cyclic ☐ Cultural Cyclic ☐ Repair/Rehab ☐ ONPS ☐ NRPP ☐ CRPP ☐ FLHP ☐ Line Item ☐ Fee Demo ☐ Concession Reimbursable ☒ Other (specify) Road Relocation/Improvements

PROJECT DESCRIPTION-SCOPE OF WORK (*Use attached Project Development Questionnaire to assist in the project description narrative. Be as detailed as possible, attach addition sheets or information as necessary.)*

On behalf of the State of Missouri (OA/FMDC) and the Department of Natural Resources Division of State Parks (DNR/MSP), the following is a description of proposed improvements to be constructed on NPS property and ONSR Scenic Easements as part of the overall development of a proposed state park covering 407 acres. Enclosed is a topographic map (Figure 1) and aerial image depicting the location and scope of work (Figure 2) as well as an exhibit indicating the limits of affected NPS property/ONSR Scenic Easement and a surrounding property ownership map (Figure 3).

There are three separate areas (Figure 2) where improvements are proposed on the NPS property and/or ONSR Scenic Easement: 1.) the relocated Co Rd 19B, 2.) a secondary park road to Area 1, and 3.) a secondary park road to Area 6.

As seen on Figure 2A, Co Rd 19B will be relocated to the south of the existing Co Rd 19B entrance and will also serve as the primary access road for the new state park. A portion of the relocated road will follow the existing Co Rd 19B alignment within the ONSR Scenic Easement. The existing Co Rd 19B is over 100 years old and does not meet current design and safety standards. Therefore Co Rd 19B will be relocated to meet current AASHTO and MoDOT standards and to meet the required stopping sight distances (SSD) at the new entrance location at Rte 19. The relocation will also provide improved ingress and egress from the ONSR Scenic Easement in the event fire suppression or other emergency actions are required within the easement or nearby. The relocation of Co Rd 19B results in unavoidable changes to the topography within the ONSR Scenic Easement. These changes include maximum cuts of 13.5 feet and maximum fills of 10 feet deep. These changes are necessary to meet minimum standards of care established by AASHTO and MoDOT regarding curves, grades, slopes, etc. The relocated road will not be visible from the Current River or Sinking Creek, preserving the scenic views of the area and the intent of the ONSR Scenic Easement. An exterior lighted state park sign will be installed at the intersection of Rte 19 and Co Rd 19B for way finding and a street light will be added at the intersection for safety. This primary access road is located on property owned by Pioneer Forest, LLC and is located within the ONSR Scenic Easement. The State of Missouri is currently working to obtain title to the property prior to construction. Approximately 1170 lf of the primary access road will be relocated within the ONSR

Scenic Easement. Of that total, 320 lf will be constructed over the existing alignment of Co Rd 19B. This grading will consist of approximately 14,000 cy of excavation, 4,000 cy of fill for a net of 10,000 cy of excavation. The existing Co Rd 19B will be restored by natural attenuation and native plantings (Figure 4). The timber from the relocation grading will be removed from the project area.

A secondary park road will be constructed from the relocated Co Rd 19B to a Bluff Top Event Pavilion, known as Area 1. The secondary park road to Area 1 will be located on property previously owned by Robert Cullen and Stephen O'Neil, now owned by the State of Missouri, and will require grading of side slopes within the ONSR Scenic Easement (Figure 2B). No new pavement will be constructed within the ONSR Scenic Easement for this secondary road. The grading will consist of approximately 1050 cy of excavation. The existing drive to Area 1 from Rte 19 on the old Cullen/O'Neil property will no longer be utilized and will be restored by natural attenuation and native plantings (Figure 4).

The existing access road, located on NPS property and within the ONPS Scenic Easement, just north of Sinking Creek will be reused and rehabilitated in place to serve a Group Camping location, known as Area 6 (Figure 2C). This existing access road will be improved to bring the road up to current design and safety standards. Approximately 345 lf of road will be improved on the NPS owned property. This grading will consist of approximately 190 cy of cut, 670 cy of fill for a net of 480 cy of fill, with all the construction occurring over the route of the existing road.

Knowing it is necessary to prepare a full ONSR Project Proposal, we have completed the following tasks:

1. Cultural Resources Survey for a Section 106 approval (dated July 2014).

2. Natural Resources Assessment (dated December 6, 2013).

3. Consultation with USFWS regarding the results of the completion of a Bat Survey Report (dated August 5, 2014).

4. Wetlands and Waterbodies Delineation (dated March 2014).

5. Completion of a Biological Assessment (BA) and submittal to USFWS for review. Currently responding to comments.

6. Submittal of a CE2 application to MODOT/FHWA. Currently responding to comments.

The new park project has the full support of Shannon County and will provide an exceptional recreational asset to the County, State and NPS.

Supporting Attachments:

☐ Photographs ☒ Maps ☐ Drawings ☒ Other ____________________________

Figures

- Figure 1- Topographic Map
- Figure 2 – Site Plan
- Figure 2A – Co Rd 19B Cut/Fill Exhibit
- Figure 2B – Area 1 Cut/Fill Exhibit
- Figure 2C – Area 6 Cut/Fill Exhibit
- Figure 3 - Surrounding Ownership Map
- Figure 4 – Restoration of existing roads in the ONSR Scenic Easement

Reports

- Phase One and Two Cultural Resource Survey
- Wetland and Waterbody Delineation Survey
- Camp Zoe Natural Resource Assessment .

Is project a hot topic (controversial or sensitive issues that should be brought to attention of Regional Director)? **Yes/No**

Level of priority: **High/Medium/Low**

Target start date: _March 2015___

****Division Chief Endorsement:________________________________**

****Management Team approval to proceed? Yes/No**

****Management Team determination that project requires compliance? Yes/No**
(If Yes, then forward to Management Assistant for compliance work.)

Project Development Questionnaire Form

(Use this form to help write a detailed project description-scope of work. Not all of the questions will be applicable to a particular project.)

Asset Questions

1. Does the proposed project involve either new construction or repair/rehab to existing structures/utilities/assets? Yes, the proposed project will consist of the relocation of County Road 19B to serve as the primary access road to the proposed state park as well as the rehabilitation of an existing road, just north of Sinking Creek. The existing road serving the previously owned O'Neil property will be restored to natural conditions and a new secondary road will be extended from CO Rd 19B to serve a new bluff top pavilion in Area 1. No new pavement will be constructed within the ONSR Scenic Easement for the secondary road to Area 1, only grading will take place within the ONSR Scenic Easement for this road.
2. Does the project take place in the same location/footprint/trench used as before? Or in a previously undisturbed area? The construction of new Co Road 19B entrance will not utilize the existing entrance location due to current design standards and safety requirements. A portion of the relocated Co Road 19B will follow the existing alignment of Co Rd 19B within the scenic easement. The rehabilitated secondary road, just north of Sinking Creek, to Area 6, will follow along the existing road corridor north of Sinking Creek.
3. Will there be any cut & fill materials? If so, how many cubic yards & where will materials be deposited (both temporarily and permanently)? Yes. Relocated Co Rd 19B will consist of approximately 14,000 cy of cut, 4,000 cy of fill for a net of 10,000 cy of cut. The secondary road to Area 1 on the previously owned Cullen property will consist of approximately 1050 cy of cut. The rehabilitated secondary road to Area 6, just north of Sinking Creek, will consist of approximately 190 cy of cut, 670 cy of fill for a net of 480 cy of fill.
4. If fill materials are taken, identify the specific site fill taken from and if the materials are native to the park. How will the fill be "stored"? Required fill material will be taken from the resulting cut material. Any fill will be stored outside of the NPS property and ONSR Scenic easement.
5. Will a staging area be required? If so, identify staging area(s) [describe or attach map], what type materials and/or equipment/how long? What is estimated square footage of staging area? Staging will take place off of NPS property and ONSR Scenic easement.
6. How/where will construction/project debris be disposed of? Any construction debris will be removed from NPS property and ONSR Scenic easement and disposed of legally.
7. Have any other alternatives been considered? If so, what were they? Yes, several alternatives were considered. For Co Rd 19B, reusing the existing location is not feasible due to the switchback turn from Rte 19 and does not meet current standards. The new alignment was chosen based on stopping sight distance safety and current AASHTO design standards. The old CO Rd 19B will be restored to a natural condition. For Area 1, the existing drive from Rte 19 (on the previously owned Cullen property) was not reused in order to minimize the number of entrances along Rte 19. Access instead will be provided from the relocated Co Rd 19B. Again, several alignments were analyzed. This alignment to Area 1 was chosen based on existing topography and to minimize disturbance in the ONSR Scenic Easement. The secondary road for Area 6, just north of Sinking Creek, follows an existing road corridor in order to minimize disturbed area within the ONSR Scenic Easement.

Wilderness Questions

1. Does this project occur in or adjacent to Designated, Recommended, Proposed, Study, Eligible, or Potential Wilderness? No.
2. How would the project contribute to the protection of wilderness character as defined by the Wilderness Act Section 2(c): Untrammeled, Undeveloped, Natural, Outstanding Opportunities for Solitude or a Primitive and Unconfined Type of Recreation and other unique components that reflect the character of each wilderness. The proposed project is aimed at constructing a primary access road and secondary roads for a proposed

state park, which are a necessary component for the overall success of the proposed state park. When complete, the park will offer the opportunity to experience the natural Ozark wilderness while enjoying various recreational activities.
3. Would the project adversely affect wilderness character as defined by the Wilderness Act Section 2(c)? No.
4. Does the project or any of its alternatives involve the use any of the Wilderness Act Section 4(c) prohibited uses: commercial enterprise, permanent road, temporary road, motor vehicles, motorized equipment, motorboats, landing of aircraft, mechanical transport, structure, or installation? No, the proposed relocated Co Rd 19B and other proposed secondary park access roads are necessary for the successful operation and administration of the proposed state park as well as the health and safety of persons in the proposed park.

Cultural/Historic Resource Questions

1. How much subsurface excavation will be necessary for utilities, footings, bore pits, etc? (Quantify by width, length, depth, cu. ft., number of lines, size of lines, etc.) In addition to the excavation necessary for the relocated and new roads described in the Asset Questions above, other excavations include approximately 160 lf of trench 8' wide by 7' deep for two cross road culverts and approximately 40 lf of trench 8" wide by 36" deep for electrical conduit to the light and sign near the entrance.
2. Will the project affect the historic landscape or change/alter historic design intent? (This includes historic fabric, materials used, structural integrity, vegetation, appearance, etc.) No, the only long term affect is the removal of trees to construct the relocated Co Rd 19B and improve the proposed park entrance roads. The relocated Co Rd 19B is not visible from the Current River or Sinking Creek and therefore does not change the intent of the easement to protect views from the river. The existing Co Rd 19B and the existing road to Area 1 (on the previously owned Cullen property) will be restored to a natural condition.
3. Does the project involve repair/rehab/construction in or near a known archeological site or resource? No. A Cultural Resource Survey did not identify any archaeological resources within the project area on the NPS property or ONSR Scenic Easement.

Natural/Water Resource Questions

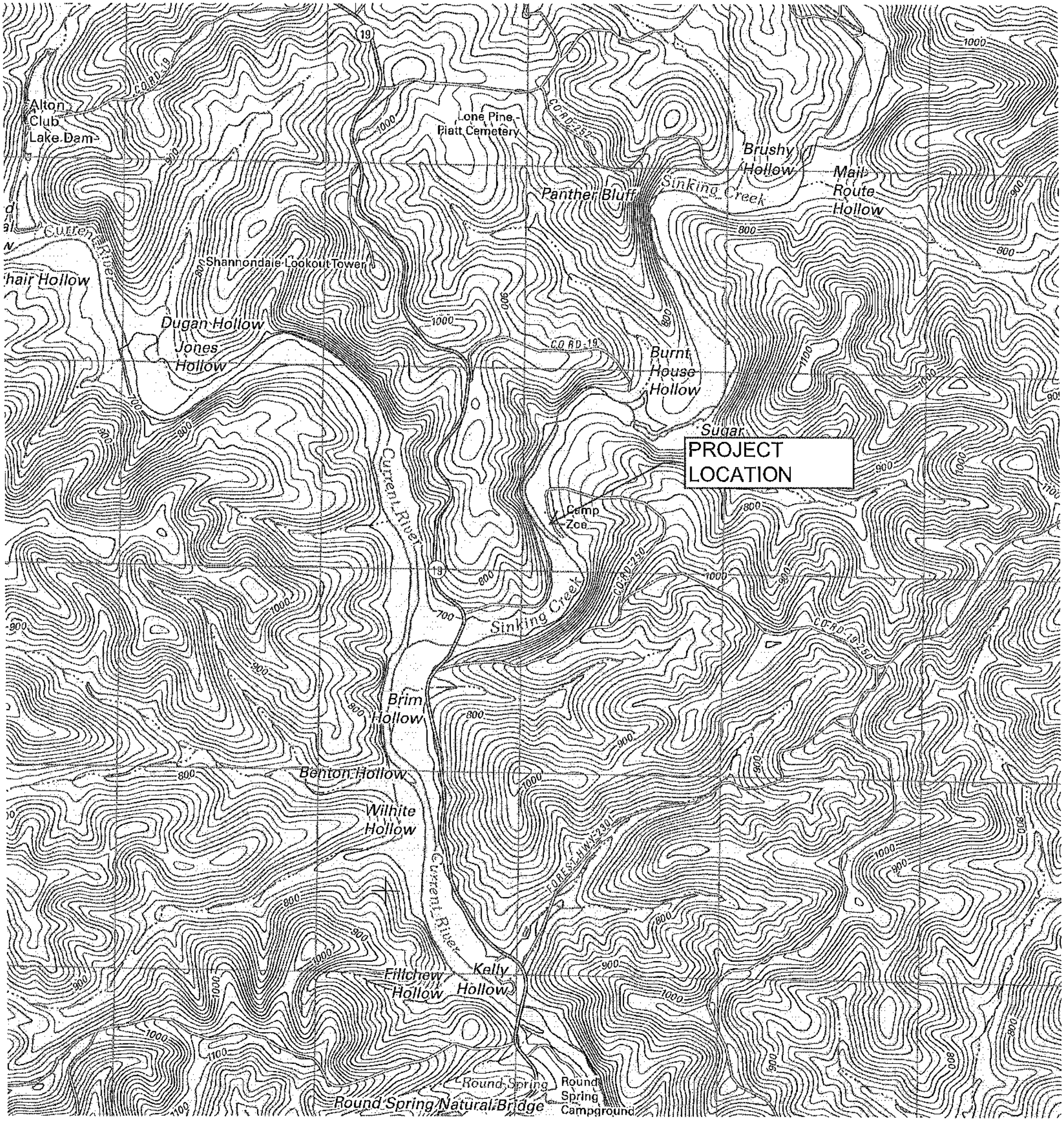
1. How much surface area will be disturbed, cleared, or denuded of vegetation? (Quantify by square footage, acres, number of trees removed, etc.) For relocated Co Rd 19B 3.08 acres will be disturbed. For the grading associated with the proposed secondary park road serving Area 1, 0.37 acres will be disturbed. For the rehabilitated secondary road to Area 6, 0.42 acres will be disturbed. Approximately 2.0 acres of the existing Co Rd 19B and existing road to the previously owned Cullen property will be restored to a natural condition.
2. Does the project involve subterranean resources or other geologic features? No subterranean resources or other geologic features will be impacted by this project.
3. Does the project propose altering stream courses, surface or ground water flow or quantity/quality? No impacts are proposed to existing stream corridors or groundwater flows.
4. Does the project involve structures, fill or discharge of dredged materials into water? (Example: bridge crossing, boardwalk, gravel, culverts, boat dock, etc.) No fill or discharge of dredged materials will be placed into waters of the United States.
5. Will the project impact drinking water supplies or distribution systems? No impacts are proposed to drinking water supplies or distribution systems.

Land/Visitor Use Questions

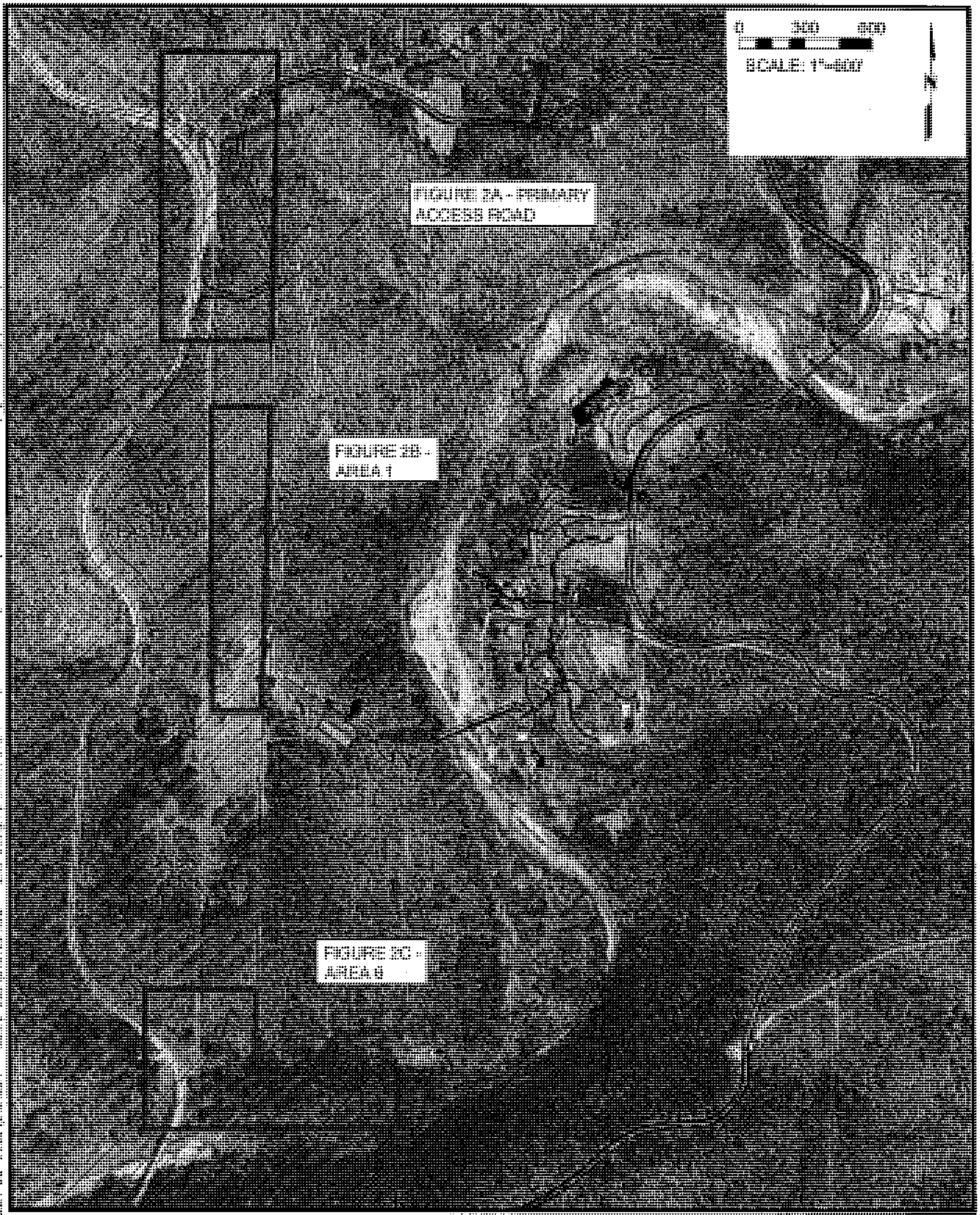
1. What changes will occur in land/facility use? (Example: converting pasture into leach field; existing facility into non-traditional use; boat ramp in previously undisturbed waters; road/trail/facility closures) Roads will be constructed that will allow access and enhance the use of the proposed state park.
2. Does the project change existing traffic flow or circulation (vehicular/off-road/marine/pedestrian/overflight)?

No, the project relocates existing Co Rd 19B and rehabilitates the existing road located just north of Sinking Creek.
3. Will the project alter available visitor services or activities (parking, trails, visitor center, recreation, handicapped access)? No impacts to the aforementioned visitor services or activities is proposed. The project will enhance services and activities.

Figure 1



PROJECT LOCATION
Alton Club Lake Dam
Lone Pine Piatt Cemetery
Brushy Hollow
Mail Route Hollow
Panther Bluff
Sinking Creek
Current River
Shannondale Lookout Tower
Dugan Hollow
Jones Hollow
Burnt House Hollow
Sugar
Camp Zoe
Brim Hollow
Benton Hollow
Wilhite Hollow
Fitchew Hollow
Kelly Hollow
Round Spring
Round Spring Natural Bridge
Round Spring Campground



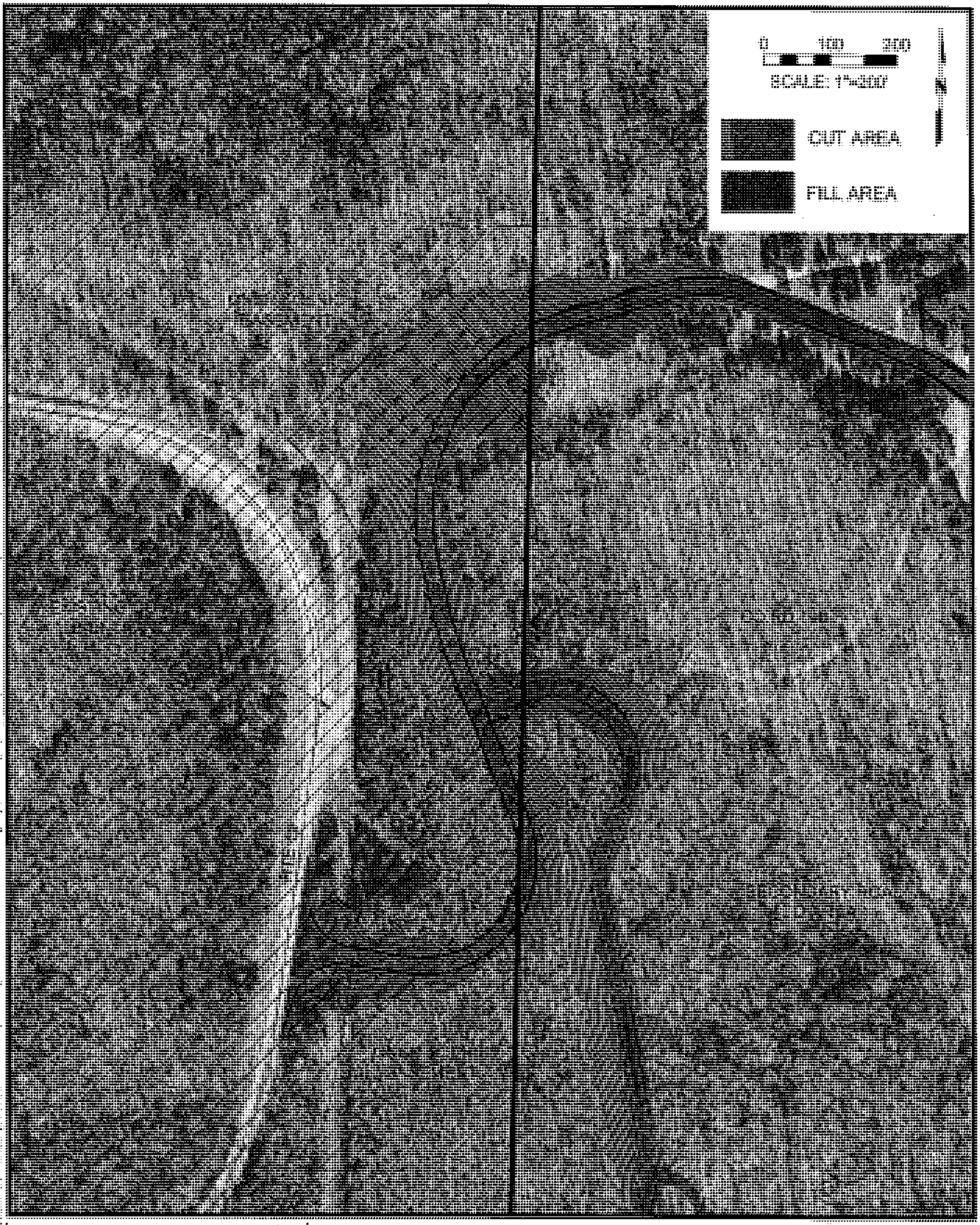
Farnsworth GROUP
20 ALLEN AVENUE, SUITE 200
ST LOUIS, MISSOURI 63119
(314) 962-7900 / (314) 962-1253 Fax

State of Missouri OA/FMDC and DNR/MSP

New State Park
Shannon County, MO
Site Plan

Project No:	0131554.00
Book No:	
Drawn by:	EMJ
Reviewed:	
Date:	10/13/2014

Figure 2



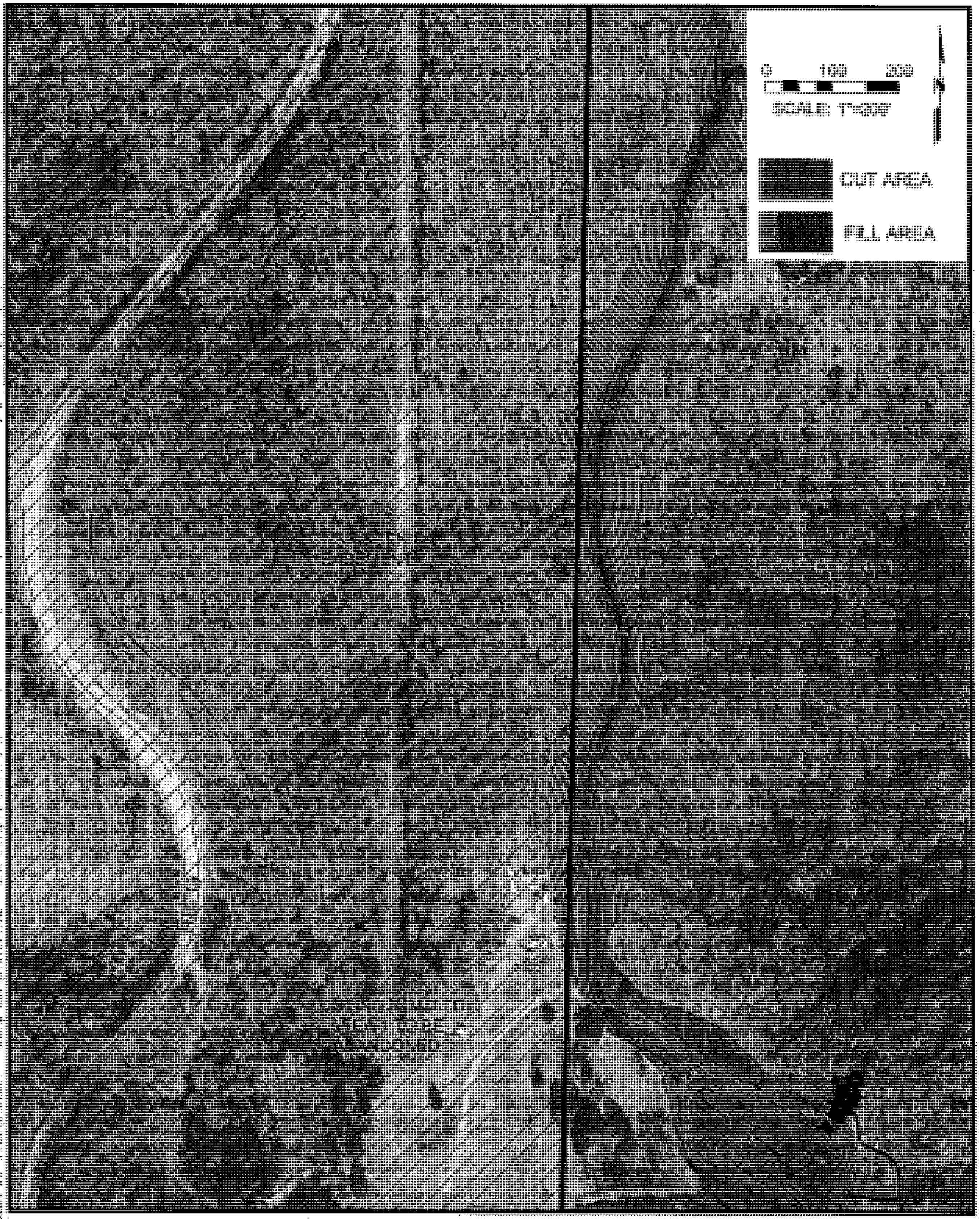
Farnsworth GROUP

State of Missouri OA/FMDC and DNR/MSP

New State Park
Shannon County, MO
Co Rd 10B Cut/Fill Exhibit

Drawn by: BMJ
Date: 10/13/2014

Figure 2A



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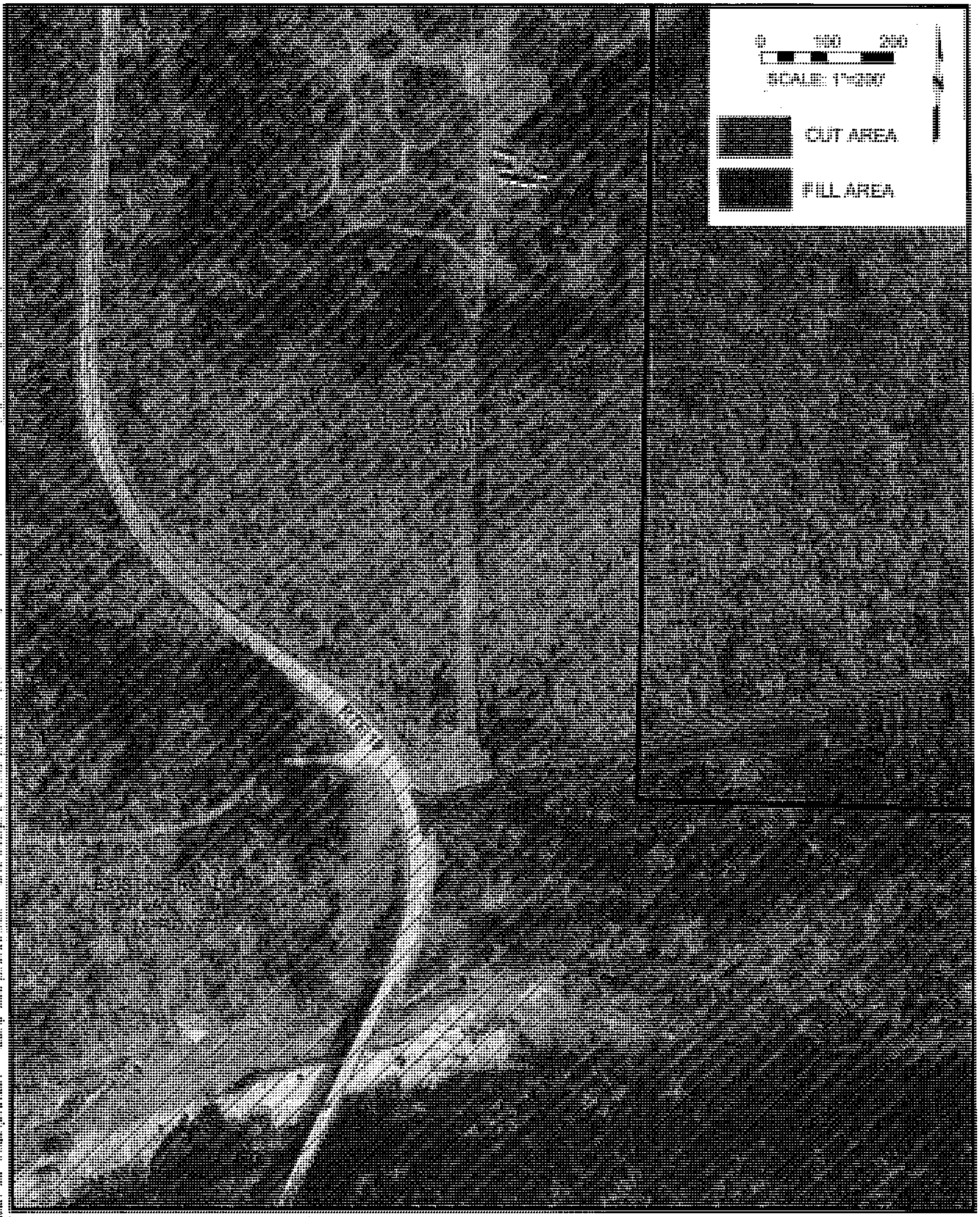
State of Missouri OA/FMDC and DNR/MSP

New State Park
Shannon County, MO
Area 1 Cut/Fill Exhibit

Project No: 0131554.00
Book No:
Drawn by: EMJ
Reviewed:
Date: 10/13/2014

Figure 2B



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State of Missouri OA/FMDC and DNR/MSP

New State Park
Shannon County, MO
Area 6 Cut/Fill Exhibit

Project No: 0131554.00
Book No:
Drawn by: EMJ
Reviewed:
Date: 10/13/2014

Figure 2C

FIGURE 3

Pulltight

A post office from 1891 to 1902. There is a large spring at this place and the entire valley is referred to as Pulltight Valley. A steep hill leads down to the spring and in the early days a large grist mill was located there. Bringing the grain wagons heavily loaded down the hill required the men to pull tight on their reins.

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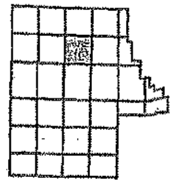
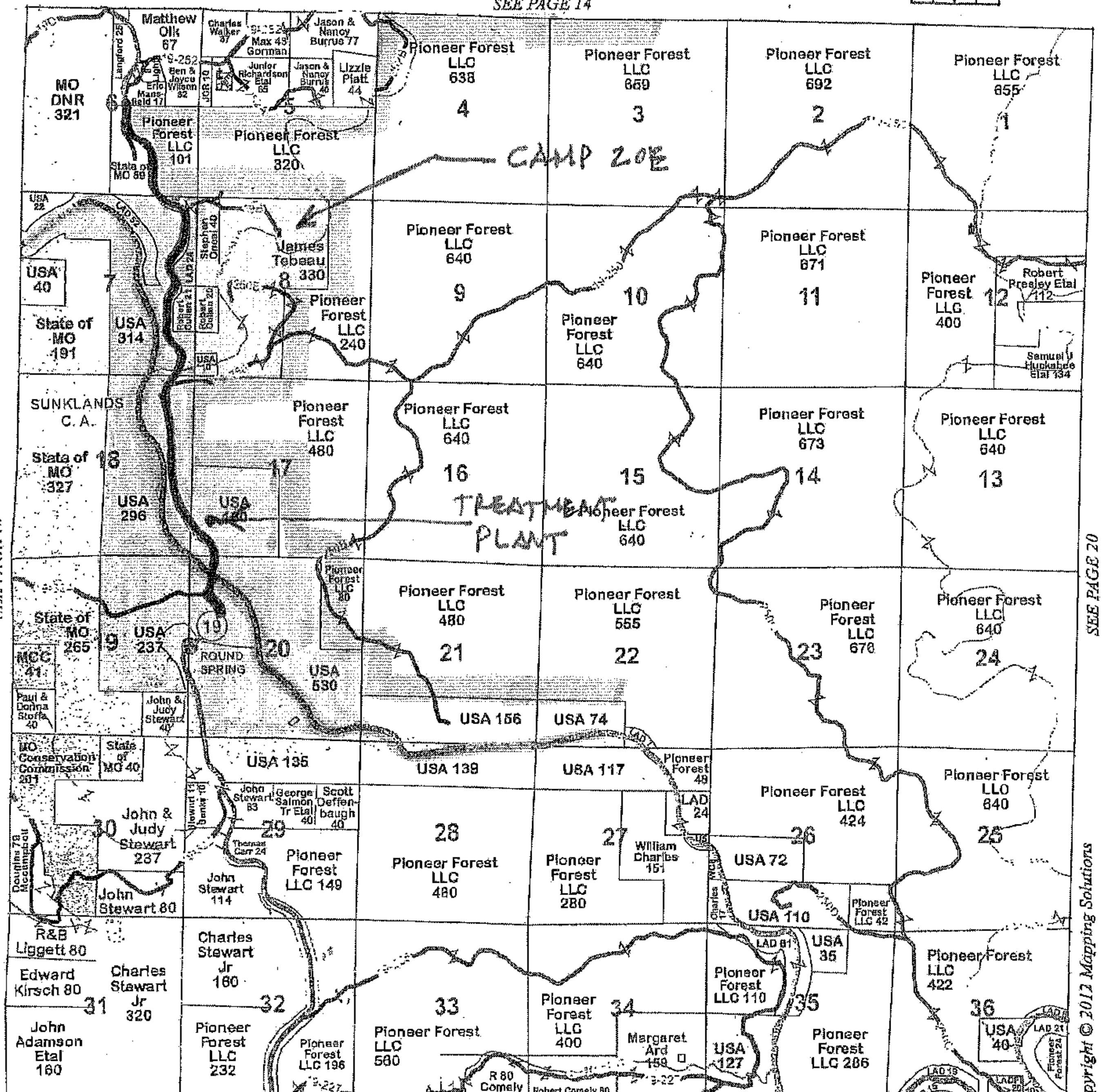
Township 30N • Range 4W



SEE PAGE 14



SEE PAGE 18

SEE PAGE 20

SEE PAGE 23

SEE PAGE 24

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State of Missouri OA/FMDC and DNR/MSP

New State Park
Shannon County, MO
Restoration of existing roads in the ONSR Scenic Easement

Project No:	0131554.00
Book No:	
Drawn by:	EMJ
Reviewed:	
Date:	10/13/2014

Figure 4

United States Department of the Interior

NATIONAL PARK SERVICE
Ozark National Scenic Riverways
404 Watercress Drive
P.O. Box 490
Van Buren, Missouri 63965

IN REPLY REFER TO:

Tract #07-123 (xL1425)

October 23, 2014

Raegan Ball
Federal Highway Administration
Missouri Division
3220 W. Edgewood, Suite H
Jefferson City, Missouri 65109

Dear Raegan Ball:

Thank you for the recent project proposal, as submitted by Farnsworth Group, Inc., regarding the relocation and road improvement of Shannon County Road 19B for the safe and convenient access to the new Missouri State Parks (MSP) unit formerly called Camp Zoe. The section of the project that is on tract #07-123 falls within National Park Service (NPS) jurisdiction in the form of a scenic easement. As of the date of this letter, our records show that the L-A-D Foundation is the owner of this tract, however we understand that negotiations are taking place that may transfer ownership to MSP. The park has reviewed the proposal and has made an evaluation of the various components of the project with regard to the restrictions of the scenic easement deed for the property.

Components of the proposal are identified as restrictions within the scenic easement deed. The removal of timber outside of the timber management agreement, erecting structures and changing the topography of the land are restricted activities. These components of your proposal would require authorization in writing.

An authorization in writing for approval of any activity over which the park exercises discretion on property subject to a scenic easement requires compliance with the National Environmental Policy Act (NEPA). According to NEPA and NPS policy, this would require, at a minimum, the screening of the affected environment, analysis of the level of impacts (which may require an environmental assessment), and a decision document to be drafted and signed. Responsibility for the completion of the NEPA documents rests with the landowner, however it can be completed by another organization. In this case, the NEPA compliance will be completed by the Federal Highway Administration (FHWA) as part of their review of the entire project. The NPS can accept categorical exclusions from other federal bureaus as long as there are no resource impacts above minor for the portion of the project that is under NPS jurisdiction. All NEPA analyses are subject to NPS review and approval.

The process that you described in your letter dated October 15, 2014 is adequate for our NEPA documentation requirements and will help to facilitate a discretionary decision on the relocation of the roadway. If you have any questions concerning this project or any other scenic easement issues, please call Joe Strenfel at 573-323-4933.

Sincerely,

William N. Black
Superintendent

cc: Bob Polk - Farnsworth Group, Inc.
Gayle Unruh - MoDOT
Chief Ranger - ONSR
Upper Current District Ranger - ONSR

APPENDIX J

Text of Exchange Scenic Easement Deed

OZARK NATIONAL SCENIC
RIVERWAYS

Tracts Nos. OZAR 134, 135, 209, 213, 218
221, 230, 231-2, 404, 412, 415,
451-2, 504, 507, 516, 518-2, 527, 528,
568, 613, 621, 657, 724, 1209, 1623

Exchange Scenic Easement Deed

THIS INDENTURE, made this 23rd day of July, 1970, by and between LEO A. DREY and RAY K. DREY, husband and wife, of the County of St. Louis, State of Missouri, parties of the first part, and the UNITED STATES OF AMERICA, Washington, D. C., party of the second part.

WITNESSETH: WHEREAS, Public Law 88-492, 88th Congress, August 27, 1964, 78 Stat. 608, provided for the establishment of the Ozark National Scenic Riverways in the State of Missouri for the purpose of conserving and interpreting unique scenic and other natural values and objects of historical interest and authorized the Secretary of the Interior to acquire lands and interests therein, including scenic easements; and

WHEREAS, the parties of the first part are the holders in fee simple of the real property hereinafter described, within the authorized boundaries of the said Ozark National Scenic Riverways, lying, being, and situate in Carter and Shannon Counties, State of Missouri, over which the Secretary of the Interior has determined it to be necessary to acquire a scenic easement for the preservation of the scenic values of the area described in said Act; and

WHEREAS, pursuant to the authority contained in an act of Congress enacted August 27, 1964, Public Law 88-492, the parties hereto have agreed to an exchange of lands located within the authorized boundaries of the Ozark National Scenic Riverways, for land of approximately equal value which lies outside the boundaries, but excess to the requirements thereof.

NOW THEREFORE, in consideration of the premises and the foregoing agreement, to convey said excess lands, the parties of the first part by these presents GRANT, BARGAIN AND SELL, CONVEY AND CONFIRM, in perpetuity, subject to the consideration hereinafter set forth, unto the party of the second part and its assigns, an estate, interest, and scenic easement in said hereinafter described real property of the nature and to the extent hereinafter described and they covenant on behalf of themselves and their heirs, successors and assigns (said covenant to run with said land) with the party of the second part and its assigns to do and refrain from doing severally and collectively upon the said lands hereinafter described in EXHIBIT "A" attached hereto and made a part hereof, the various acts hereinafter mentioned; it being hereby agreed and expressed that the doing of and the refraining from doing said acts, and each thereof, upon the said lands are and will be for the benefit of the party of the second party through the preservation of the scenic and other natural values and objects of historic interest to the Ozark National Scenic Riverways in accordance with Public Law 88-492 of August 27, 1964.

The scenic easement restrictions hereby imposed upon the use of said lands and the acts which the parties of the first part so covenant to refrain from doing upon the said hereinafter described lands are and shall be as follows:

1. Prohibiting ingress and egress over and across and use by the general public of any or all of the herein-described lands lying within 300 feet of the ordinary low water mark of the river for such uses and purposes as are not inconsistent with the restrictions and purposes of said scenic easement.

2. Using the said
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Superintendent m

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5. Permitting
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6. Cutting or
any timber or br
the Secretary of
tative. Provided,

2. Using the said lands for mining or industrial activity or for any purposes whatsoever except for noncommercial residential purposes or for such additional purposes as may be authorized in writing on such terms and conditions deemed appropriate by the Secretary of the Interior or his authorized representative. But the parties of the first part shall not be precluded hereby from farming the land nor from grazing livestock thereon provided the same be done in conformity with good husbandry practice. The permitted use for farming and grazing shall include the harvesting of timber, and gathering firewood for personal use but only from selected areas which the Park Superintendent may approve.

3. Erecting or building any structures on said lands, including major alterations to existing buildings, except as may be authorized in writing by the Secretary of the Interior or his duly authorized representative. There is specifically retained by the parties of the first part, their heirs, successors, and assigns the right to perform ordinary maintenance on all existing structures and buildings, together with the right to replace, rebuild, or substitute any building or structure now existing with similar buildings or structures in substantially the same location, if all or any of such existing buildings are destroyed or damaged by fire, storm, or other casualty.

4. Permitting any change in the character of the topography of said lands other than that caused by the forces of nature, except as may be authorized in writing by the Secretary of the Interior or his duly authorized representative.

5. Permitting the accumulation of any trash or foreign material which is unsightly or offensive.

6. Cutting or permitting to be cut, destroying, or removing any timber or brush, except as may be authorized in writing by the Secretary of the Interior or his duly authorized representative. Provided, however, that seedling trees or seedling shrub-

bery may be grubbed up or cut down in accordance with good farm practice on lands presently being cultivated or for residential maintenance purposes. Cultivated crops, including orchard fruit and nut trees, may be pruned, sprayed, harvested, and otherwise maintained in accordance with good farm practice.

7. No trailer shall be placed, used or maintained on said lands as a substitute for a residential building or other structure, and no sign, billboard, or advertisement shall be displayed or placed upon the land, except that one sign not geater than 24 inches by 26 inches in size, advertising the sale of products raised thereon or sale or lease of the lands may be displayed on appropriate occasions.

This conveyance is subject to existing easements for public roads and highways, public utilities, railroads and pipelines.

By acceptance of this deed, the party of the second part specifically agrees for the purpose of the parties of the first part retaining their present means and rights of ingress and egress, that the parties of the first part, their heirs, successors and assigns, or invitees, shall not be required to pay, when proceeding directly to and from such lands, park entrance or road fees.

The parties of the first part, for the consideration hereinabove set out, do further grant unto the party of the second part and its duly authorized representatives the right of ingress and egress upon and across said lands for the purpose of effecting emergency action with regard to the control and suppression of fires and for emergency action needed for visitor protection in relation to the operation of the Ozark National Scenic Riverways as established by the hereinabove mentioned Act.

TO HAVE AND TO HOLD the hereindescribed scenic easement and rights unto the party of the second part and its assigns forever.

The parties of the first part, for themselves, their heirs, successors and assigns do hereby covenant with the said party of the second party and its assigns that they are lawfully seized of an indefeasible estate in fee simple in the hereindescribed lands; that they have the right to sell and convey the estate, interest and scenic easement herein conveyed; except such lands under Forest Crop Law, and that they warrant and defend unto the party of the second part and its assigns, forever, the quiet and peaceable use and enjoyment of the herein granted easement against the lawful claims and demands of all persons whomsoever.

This instrument is made and delivered to the United States of American contemporaneously with the conveyance by it to the Grantors herein of all its interest in Parts of Tracts Nos. OZAR 112, 115, 155, 215, 222, 224, 225, 333, 444, 541, 542, 849, 965, 1125, 1203, 1205, 1227 and 1417.

IN WITNESS WHEREOF, the said parties of the first part do hereunto set their hands and seals the day and year first above written.

/s/ Leo A. Drey (SEAL)
Leo A. Drey
/s/ Kay K. Drey (SEAL)
Kay K. Drey

[Notarization and legal descriptions of lands omitted]