Continental United States (CONUS) Interceptor Site

SECTION 3.3 – FCTC Sites

Environmental Impact Statement Draft

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3.3.1 Air Quality – FCTC Sites

An evaluation of the air quality environmental resource requires an evaluation of both the potentially affected environment, as well as the environmental consequences (including potential mitigation measures) of the potential CIS deployment. The evaluation of the potentially affected environment provided in this section includes an assessment of existing climate and meteorology, air quality in the surrounding area, existing FCTC emissions sources, and air regulations potentially applicable to the potential deployment should the decision be made to deploy and one of the FCTC sites is selected. The evaluation of the environmental consequences and mitigation options provided in this section includes an assessment of impacts from construction and operation.

3.3.1.1 Regulatory Framework – Air Quality – FCTC Sites

This section summarizes notable regulatory requirements, both at the federal and state levels, required to authorize construction and subsequent operation of the substantial air emissions sources should the decision be made to deploy and FCTC selected. The discussion here is intended to illustrate how the air permitting process, if undertaken at a later date, would assist in controlling the emissions to comply with all federal state and air quality regulations.

The federal air quality regulatory framework is laid out in the Clean Air Act (CAA), which originally became law in 1970 and was revised in 1977 and 1990. The USEPA, which is charged with executing the CAA's requirements at the federal level, delegates much of the monitoring, enforcement, and permitting responsibilities stipulated by the CAA to individual states. Michigan's state air quality regulations, which adopt and incorporate various key federal regulations, are codified under Michigan Administrative Code, Parts 1-19, and are enforced by the Michigan Department of Environmental Quality (MDEQ). The notable state and federal air quality requirements identified as applicable to the potential deployment include:

- Michigan Rule 201 – Permits to Install Greenhouse Gas Tailoring Rule.
- Title V Operating Permits.
- Michigan Rule 224-226 – Toxic Air Contaminants.
- National Emissions Standards for Hazardous Air Pollutants (NESHAPS).
- New Source Performance Standards (NSPS).

3.3.1.1.1 Michigan Rule 201 – Permits to Install

A proposed new emissions source or a proposed modification to an existing emissions source is required to apply for and obtain an air construction permit prior to the commencement of construction. In Michigan, an air construction permit is known as a "Permit to Install" (PTI). According to Michigan Rule 201, "[…] a person shall not install, construct, reconstruct, relocate, or modify any process or process equipment, […] , which may emit any of the following, unless a PTI which authorizes such action is issued by the department: (a) Any air pollutant regulated by Title I of the clean air act and its associated rules, including 40 CFR Parts 51.165 and 51.166, adopted by reference in R 336.1299 (b) Any air contaminant."

The construction of each emissions source included in the potential CIS deployment would need to be authorized by a PTI unless an exemption from the requirement to obtain a PTI for a particular emissions source is applicable under the Michigan rules.

Major Source Permitting

New Source Review (NSR), which is outlined in the CAA, is the process that major stationary sources of air pollution or major modifications to major stationary sources must undergo in order to obtain an air construction permit to authorize their construction and initial operation. NSR is executed on a pollutant-by-pollutant basis and can take one of two paths for a given pollutant depending on whether a project is proposed to be located in an area not attaining the National Ambient Air Quality Standards (NAAQS) (i.e., nonattainment) for one or more pollutants, or in an area that is in attainment of the NAAQS for a given pollutant. The following are the regulatory requirements for each path:

- Nonattainment New Source Review (NA NSR).
    - Federal rule codified at 40 CFR Part 51.165.
    - State rule outlined in Michigan Rules 901-908.
    - The requirements of NA NSR are designed to ensure that proposed major sources of air pollution do not impede a non-attainment area's progress towards improving air quality such that the NAAQS is attained.
- Prevention of Significant Deterioration New Source Review (PSD NSR).
    - Federal rule codified at 40 CFR Part 51.166.
    - State rule outlined in Michigan Rules 801-823.
    - The requirements of PSD NSR are designed to ensure that proposed major sources of air pollution do not cause significant deterioration of an area's air quality such that a violation of the NAAQS occurs.

Currently, both Kalamazoo and Calhoun Counties are designated as in attainment of the NAAQS for all criteria pollutants (USEPA, 2015c). Therefore, only the requirements of PSD NSR would be applicable to the potential CIS deployment should the project be applicable as a major stationary source.

PSD Permitting. The existing air emission sources currently located at FCTC are listed in Section 3.3.1.2.1.2 and are exempt from requiring an air permit. Thus, FCTC would be considered a new stationary emissions source. Should the decision be made to deploy and FCTC

Site 1 is selected, the potential deployment would not qualify as one of the 28 listed sources and, as such, the determination of whether it would constitute a PSD major source (thus triggering PSD NSR) is made by comparing the CIS's potential to emit (PTE) for each criteria pollutant (i.e., sulfur dioxide [SO_2], carbon monoxide [CO], particulate matter [PM], nitrogen oxides [NO_x], and volatile organic compounds [VOC]) against the 250 tons per year (tpy) major source threshold. As indicated, within areas where the project's location is classified as in attainment with the NAAQS, the requirements of PSD NSR would be applicable should the project's estimated level of air emissions trigger specific thresholds that would classify the project as a major source. The major source classification is triggered when the project's maximum potential annual emissions (i.e., PTE) on a pollutant-by-pollutant basis is equal to or greater than 100 tpy for a facility that is one of the 28 sources listed in 40 CFR Part 68, or 250 tpy for sources that are not one of the 28 sources listed in 40 CFR Part 68. Should the CIS's PTE exceed the major source threshold for one or more pollutants, the project would be required to undergo PSD NSR for each of those pollutants. PSD NSR requires the following exercises and analyses:

- One year of preconstruction ambient air monitoring;
- Air Quality Impact Analyses using air dispersion models;
- Case-by-case Best Available Control Technology (BACT) analysis;
- Additional Impact Analysis examining the project's impacts on visibility, soils, vegetation, and residential and industrial growth; and
- A demonstration that the project would not negatively impact the air quality and visibility at Federal Class I areas.

Conversely, should the CIS's PTE be less than the major source threshold for each criteria pollutant, the project would be considered a minor source and would therefore not be required to undergo PSD NSR.

Emissions of greenhouse gas (GHG) are also regulated under USEPA's PSD permitting rules and trigger PSD permitting under a separate major source threshold. Emission sources that exceed major source threshold(s) for one or more traditionally regulated pollutants (i.e., NO_x, VOC, PM_{10}, $PM_{2.5}$, CO, SO_2) and exceed separate GHG major source thresholds (New: 100,000 tpy/Modified: 75,000 tpy) are required to obtain a PSD and/or Title V permit for GHG emissions.

Minor Source Permitting

Should the potential CIS deployment's PTE be less than the applicable major source threshold for each criteria pollutant, the project would be considered a minor source and would therefore not be required to undergo PSD NSR. In this case, the potential CIS deployment would require a minor source PTI.

3.3.1.1.2 Title V Operating Permit

Depending on the magnitude of emissions, the authorization of on-going operations would be handled via either a PTI[1] for minor sources or a major source Title V Renewable Operating Permit (ROP). The need for a PTI was discussed as part of the construction permitting process for minor sources.

Title V of the federal CAA, codified under 40 CFR Part 70, requires individual states to establish an air operating permit program. Michigan's Title V operating permit program, which establishes ROPs, is outlined in Michigan Rules 210-219. The ROP, which is required to authorize long term operation of a Title V major source, essentially combines all regulated emissions sources and their associated state and federal regulatory requirements at a facility into a single comprehensive permit. Title V major source applicability is determined by comparing a facility's total PTE against the following Title V major source thresholds[2]:

- 100 tpy of any criteria pollutant.
- 100 tpy GHG on a mass basis and 100,000 tpy GHG on a carbon dioxide equivalent (CO_2e) basis [3].
- 10 tpy of a single hazardous air pollutant (HAP).
- 25 tpy of cumulative HAPs.

3.3.1.1.3 Michigan Rules 224-226 Toxic Air Contaminants

Michigan Rules 224 and 225 apply to new sources that are required to obtain a PTI and that emit toxics. Rule 224 requires that such sources are required to apply (BACT) for toxics (T-BACT) and demonstrate that the emissions of toxic air contaminants (TACs) by the proposed source remain below applicable health based screening levels. Sources that emit only small amounts of low-potency TACs or already meet BACT requirements are exempt from T-BACT requirements. Rule 225 requires a tiered approach to demonstrate compliance with health based screening levels which can culminate with an extensive air dispersion modeling analysis. Finally, Rule 226 provides various exemptions from the Rule 225 health based screening level requirements. The

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[1] According to Michigan Rule 201(6), long term operation of a project that is a non-Title V source (i.e. minor source) is authorized under the project's PTI. The MDEQ requires notification once the facility has been constructed and begins operation.

[2] Title V major source thresholds are more stringent than PSD major source thresholds for sources that are not included in the group of 28 listed sources (i.e., 100 tpy vs. 250 tpy). Additionally, Title V applicability considers emissions from every emissions source operating at a facility, whereas PSD applicability only considers sources included in a particular project (i.e., construction of new emissions source or modification of existing emissions source).

[3] Federal Title V permitting requirements cannot be applied to sources based solely on their GHG emissions. Rather, a source must exceed major source thresholds for at least one other regulated pollutant and GHG in order to be considered a major Title V source for GHGs.

exemptions are generally based on the quantitative and qualitative nature of a source's TAC emissions or on whether a source is applicable under certain existing federal standards.

3.3.1.1.4 National Emissions Standards for Hazardous Air Pollutants

Unlike permit authorizations which must be obtained prior to installing a new source of air emissions, there are other regulations that set standards which certain emissions units must meet regardless of major or minor source permit requirements. A certain set of such standards are addressed in Section 112 of the CAA regarding emissions of HAPs for major and certain area sources of HAP emissions. A major source of HAPs is a site that emits, or has the potential to emit, any single HAP at a rate of 10 tons or more per year, or any combination of HAPs at a rate of 25 tons or more per year. An area source of HAPs is a source that is not a major source of HAPs. For major sources, Section 112 requires the maximum degree of reduction in HAP emissions per standards that are commonly referred to as maximum achievable control technology (MACT) standards. For area sources, generally available control technologies (GACT) or management practices are used to reduce emissions of HAPs. These MACT/GACT standards are found in 40 CFR Part 63. Various NESHAPS, which can entail emissions limits, work and management practices, and/or reporting requirements, may be applicable to the potential emissions sources included in the CIS's design. One such notable emissions source would be the use of diesel generator engines for backup power generation.

3.3.1.1.5 New Source Performance Standards

Similar to the standards discussed previously, Section 111 of the CAA authorized the USEPA to develop technology-based standards which apply to specific categories of stationary sources for criteria pollutants. These standards are referred to as NSPS and are found in 40 CFR Part 60. NSPS establish minimum emissions control requirements, or "best demonstrated technology", for all facilities within a specified category. Various NSPS, which can entail emissions limits, work and management practices, and/or reporting requirements, may be applicable to the proposed emissions sources included in the potential deployment's design. The diesel generator engines would be emission sources that may be subject to NSPS.

3.3.1.2 Affected Environment – Air Quality – FCTC Sites

3.3.1.2.1 FCTC Site 1

3.3.1.2.1.1 Climate and Meteorology

The FCTC site is located in southern Michigan and experiences long cold winters and mild summers. Southern Michigan generally has a humid continental climate interspersed with frequent intrusions of continental polar air throughout the year. Maritime polar air that originates over the Pacific Ocean also can make it to Michigan during any of the four seasons. These air masses are carried over the Rocky Mountains by the predominant westerly upper level winds and are modified to continental polar air. This leads to mainly dry and mild to cool conditions, depending upon the season. Occasional arctic air is not uncommon during the cold season.

The warm season features occasional continental tropical air. The continental tropical air originates in the southwestern U.S. and can bring periods of extreme heat to the region. The continental tropical air often mixes with maritime tropical air from the Gulf of Mexico, thus creating periods of hot and humid conditions in the region (NWS, 2010; TAMU, 2014).

Temperatures are typically highly variable from season to season. The summer is generally warm and periods of prolonged heat occur occasionally. Spring and fall are transitional periods. The winter is cold with periods of arctic air intrusions and with persistent cloudiness. A maximum high temperature of 109 degrees Fahrenheit (°F) (has been recorded in the region, with a coldest minimum regional temperature of -25°F (WRCC, 2014b). Average temperatures range from as low as 23.6°F in January, to as high as 70.9°F in July. The temperature exceeds 90°F on average 6.7 days per year during the summer period. During the cold season, air temperatures fall below 32°F an average of 144.5 days per year (NCDC, 2014h).

Precipitation amounts slightly vary from season to season throughout the year. The average precipitation for the area is 33.15 inches, 62 percent of which falls between May and October. There are approximately 132 days per year with at least 0.01 inch of precipitation recorded in the region. The area around the FCTC site averages 58.1 inches of snow per year, some of which is caused by lake effect snow from Lake Michigan. The region averages 65.8 days per year with at least 1 inch of snow on the ground (NCDC, 2014h). The region also averages around 23 days per year with dense fog (1/4 mile or less) and 34 thunderstorm days per year (NCDC, 2014b).

Persistent winds are out of the south-southwest approximately 10-11 percent of the time. Winds are southwest 10 percent of the time. The average wind speed is 7.6 knots. The annual wind rose is provided on Figure 3.3.1-1 (NCDC, 2014e).

3.3.1.2.1.2 Regional Air Quality

This section provides a description of the existing air quality near FCTC Site 1. Impacts on air quality from construction and operation are described in Section 3.3.1.3.

Air Quality Standards

The CAA requires the USEPA to establish NAAQS. The USEPA developed these ambient air quality standards for six criteria pollutants: SO_2, CO, ozone (O_3), NO_x, lead (Pb), and PM. PM includes two subspecies: particles with diameters less than or equal to 10 microns (PM_{10}), and particles with diameters less than or equal to 2.5 micrometers ($PM_{2.5}$). The NAAQS are based on total concentrations of criteria pollutants in the ambient air (i.e., outdoor air that is accessible to the public [40 CFR Part 50.1(e)]). The NAAQS are comprised of both primary and secondary standards. The primary standards protect the health of particularly vulnerable populations such as asthmatics, children, the sick, and the elderly. Secondary standards are welfare-based and protect against visibility decreases and damage to crops, animals, vegetation, and buildings (USEPA, 2014c).

In the State of Michigan, the MDEQ is the responsible agency for monitoring air quality and assessing compliance with the NAAQS for each of the criteria pollutants. Table 3.3.1-1 lists the applicable NAAQS for each of the six criteria pollutants.

Table 3.3.1-1 National and Michigan Ambient Air Quality Standards - FCTC

Pollutant	Averaging Period	Primary Limit (Health Based) ($\mu g/m^3$)	Secondary Limit (Welfare Based) ($\mu g/m^3$)	NAAQS Basis
CO	1-Hour	40,000	---	High-2nd-High – Not to be exceeded (NTBE) more than once per year
CO	8-Hour	10,000	---	High-2nd-High - NTBE more than once per year
NO_x	1-Hour	188	---	98th percentile 3-Year average per receptor
NO_x	Annual	100	100	High-1st-High
PM_{10}	24-Hour	150	150	24-hour average not to be exceeded more than once every 3-years
$PM_{2.5}$	24-Hour	35	35	98th percentile 3-year average
$PM_{2.5}$	Annual	12	15	High-1st-High Ave – Annual mean averaged over 3-years Secondary is an annual mean
SO_2	1-Hour	196	---	99th percentile 3-year average
SO_2	3-Hour	---	1,300	NTBE more than once per year
Ozone	8-hour	147	147	High-4st-High - 3-Year Average
Pb	Quarterly	0.15	0.15	Maximum 3-month rolling average
Source: USEPA, 2014c; MDEQ, 2014c.				

Existing Air Quality

FCTC Site 1 is located in Kalamazoo County, Michigan, and northwestern Calhoun County, Michigan. The air quality of the site is largely influenced by the nearby Kalamazoo, Michigan, metropolitan area, the W. K Kellogg Airport, and, to a lesser degree, the Chicago, Illinois, metropolitan area, which is located about 120 miles to the west-southwest of Fort Cluster. Kalamazoo County is part of the South Central Michigan Intrastate Air Quality Control Region.

Monitored ambient concentrations of criteria pollutants during the 2013 annual period for locations within Kalamazoo County or in counties near FCTC Site 1 are listed in Table 3.3.1-2 (MDEQ, 2014b). In some cases in which no data were available from a nearby representative county, data from the nearest monitor were used as a substitute. Data from the monitors are used to demonstrate attainment with the NAAQS and develop pollution control strategies.

Both Kalamazoo and Calhoun Counties were classified as Subpart 1 nonattainment areas for the 1997 ozone standard from 2004-2006, but in 2007 both counties were determined to be to in attainment with the 1997 8-hour ozone standard and were redesignated as maintenance areas. A maintenance area is defined as a former nonattainment area that is now classified as in attainment; however, the maintenance area must implement certain required safeguards to help keep the area in attainment. Both counties are classified as attainment for all other criteria pollutants (USEPA, 2015c).

Table 3.3.1-2 Monitored Michigan Background Concentrations - FCTC

Pollutant	Averaging Period	2013 Background ($\mu g/m^3$)	Standard Primary/ Secondary ($\mu g/m^3$)	Background Monitoring County
CO	1-Hour	2,096	40,760	Kent
CO	8-Hour	1,281	10,481	Kent
NO_x	1-Hour	47	188	Ingham
NO_x	Annual	6.6	100	Ingham
PM_{10}	24-Hour	35	150	Kent
$PM_{2.5}$	24-Hour	18	35	Kalamazoo
$PM_{2.5}$ [2]	Annual	8.8	12/15	Kalamazoo
SO_2	1-Hour	51	200	Ingham
SO_2	3-Hour	---	---	---
Ozone	8-hour	136	150	Kalamazoo
Pb	Quarterly	0.01	0.15	Kent
Source: MDEQ, 2014a.				

<u>Existing Emission Sources</u>

The existing emission sources at the FCTC site include comfort heating boilers, furnaces, tube heaters, space heaters, AHUs, water heaters, kitchen and laundry equipment, cold cleaners, emergency backup generators, and storage tank breathing/working losses. An inventory of the quantity of each type of emission source is included in Table 3.3.1-3. The emission sources at the FCTC site are exempt from obtaining an air quality permit based on MDEQ's air regulations.

Table 3.3.1-3 Inventory of Existing Emission Sources at FCTC Site 1

Type of Emission Source	Total Units of Each Emission Source Type
Boiler	35
Furnace	60
Tube Heater	11
Space Heater	35
Air Handler	1
Water Heater	9
Kitchen Equipment	1
Laundry equipment	10
Cold cleaners	4
Backup generators	22
Storage tanks	7

3.3.1.2.2 FCTC Site 2

The affected environment for air quality for FCTC Site 2 is the same as that described for FCTC Site 1 except that FCTC Site 2 is entirely located within Kalamazoo County, Michigan. Existing air quality in Kalamazoo County is discussed in Section 3.3.1.2.1.2.

3.3.1.3 Environmental Consequences and Mitigation – Air Quality – FCTC Sites

This section addresses the potential air quality impacts that would result from the construction and operation phases of the structures and components of the potential CIS deployment, as well as the potential measures that could be undertaken to mitigate the air quality impacts.

It should be noted that operations impacts and mitigation analyses are provided for the baseline and expedited schedule. This is because the vehicle and equipment factors established by USEPA and industry vary by year. As such, emission estimates for operations that initiate in Year 6 (baseline) could differ from emission estimates for operations that initiate in Year 4 (expedited).

3.3.1.3.1 Construction – Baseline Schedule

Under implementation of the potential CIS deployment, various types of site preparation and construction activities and their associated equipment would emit criteria air pollutants and GHGs. Therefore, if a decision is made to deploy and FCTC Site 1 or FCTC Site 2 is selected, then construction of the potential deployment would cause some impact to the air quality;

however, any such construction impacts would be temporary in nature. The following sections discuss the methods for assessing potential impacts, the types of potential impacts to the surrounding air quality, and possible mitigation measures for reducing such impacts for the baseline construction schedule.

3.3.1.3.1.1 Methods for Assessing Construction Impacts – FCTC Sites

Factors Considered in Air Quality Impact Analysis

The following key factors are typically considered in assessing the intensity and duration of construction-related air quality impacts:

- Construction activities (types, durations, etc.).
- Construction schedule.
- Construction equipment and vehicle emissions (types, number, duration of operation, etc.).

These factors were reviewed in evaluating the air quality impacts from construction of the potential deployment. Their contributions to the potential deployment's air quality analysis modeling and any respective assumptions that were used in the analysis are further described in Section 3.3.1.3.1.2.

Air Quality Impact Analysis Modeling

The U.S. Air Force Air Conformity Applicability Model (ACAM), Version 5.06 (USAF, 2016) was used in this analysis to estimate both the combustion and fugitive source emissions from potential construction activities. The ACAM was used because it has the capability to develop an air emission estimate based on certain assumptions regarding the preliminary construction schedule, preliminary construction equipment list, and the total acreage disturbed.

3.3.1.3.1.2 Environmental Consequences

3.3.1.3.1.2.1 FCTC Site 1

The type and extent of air quality impacts depend on various construction characteristics including activities, schedule, equipment, acreage of construction site disturbed, equipment emission characteristics, and other factors.

Emission Sources

Emission Types. Generally, emissions of criteria pollutants (i.e., PM_{10}, $PM_{2.5}$, NO_x, SO_2, VOC, and CO) and GHGs (i.e., mostly CO_2) during construction activities would occur from one of two processes: (1) combustion of fuels in engines which propel or otherwise operate mobile or stationary construction equipment; or (2) fugitive dust activities which introduce particles into the air through the disturbance and movement of materials. In more project-specific terms, the air emissions from combustion of fuels in mobile engines (both on-road and non-road) during construction would be primarily driven by the following construction activities:

- Construction workers traveling from surrounding counties in the maintenance area to and from the construction site.
- Trucks that travel through the maintenance area and deliver construction materials to the construction site.
- Trucks that travel from the construction site through the maintenance area hauling soil and waste materials to a local disposal site.
- Operation of heavy equipment such as cranes, bulldozers, and scrapers.
- Use of support vehicles to transport materials around the construction site.
- Operation of other miscellaneous mobile fossil-fuel combustion sources such as generators necessary for construction activities.

Construction activities would also result in fugitive dust emissions (in the form of direct PM_{10} and $PM_{2.5}$ emissions) in the construction area and nearby surrounding area. In general, the levels of fugitive dust released depend on the type of construction activity, the level of activity conducted, the weather during the construction activity, and the composition of the soil disturbed. In more project-specific terms, the fugitive dust emissions during construction would be primarily caused by the following construction activities:

- Tree clearing.
- Ground clearing, grading, and excavation.
- Bulk handling of materials such as spoils, backfill, and aggregate.
- Disturbance from the movement of vehicle tires over paved and non-paved surfaces.

Air emissions from construction of the potential deployment can be further categorized as being either direct or indirect emissions. Both direct and indirect emissions are those emissions of criteria pollutants and precursors that are initiated by the federal approval of the potential CIS deployment, originate in the maintenance area, and are reasonably foreseeable. Direct emissions are those that occur at the same time and place as the potential CIS deployment. Air emissions resulting from operation of construction equipment, stationary emission sources (i.e., generators, air compressors, etc.), and other construction activities that occur at the construction site would be considered direct emissions.

Indirect emissions are those emissions that occur at a different time or place as the location of the potential CIS deployment. Indirect air emission resulting from construction activities include worker vehicles, trucks that deliver dirt and construction materials to the construction site, and trucks that transport dirt and waste materials from the construction site to an off-base disposal site. These types of construction activities would have the potential to occur away from the potential CIS construction footprint and within the maintenance area.

Effects of Construction Schedule on Emissions Estimates. The construction of the potential CIS deployment, which would include the deployment of up to 60 GBIs total and the associated buildings and components, would occur over approximately a 5-year period under the baseline construction schedule as discussed in Section 2.5.1. Design and permitting activities would occur throughout Year 1; however, tree and brush clearing would last 6 months starting in October of year 1, referenced as Month 1 in the emission analysis. This would be followed by 12 months of site preparation activities, such as grading and cut and fill activities. The construction phase of the project (i.e., building foundations, erection of structures, and build-out) could last an additional 3 years after the site preparation phase. The emissions analysis assumed the following construction schedule:

- Tree Clearing: Months 1 through 6, beginning October of Year 1.
- Site Preparation: Months 7 through 18, beginning April of Year 2.
- Heavy/intrusive construction: Months 19 through 42, beginning April of Year 3.
- Build-out and completion: Months 43 through 54, beginning April of Year 5.

The baseline schedule assumes that all construction activities would occur 6 days per week and with one 10-hour shift per day.

Construction Equipment. As the construction plan for the potential CIS deployment has not yet been developed, there is no detailed equipment list for the construction equipment. However, a preliminary equipment list was developed for the purpose of developing an air emission estimate for the construction of the potential CIS deployment (see Appendix D.1). The preliminary equipment list was based on construction information from previous MDA projects similar to the potential CIS deployment. The preliminary construction list includes an inventory of the construction equipment (i.e., type and amount) and hours per day that the construction equipment would operate and be used to perform work. This preliminary equipment list and the assumptions listed previously were used as input into the ACAM to estimate both the combustion and fugitive source emissions from tree and brush clearing, site preparation, and construction activities.

Construction Site Disturbance. Should the decision be made to deploy and FCTC Site 1 is selected, the construction footprint for the potential CIS deployment would require approximately 805 acres and include a lay-down area, associated mission facilities, mission support structures, and the upgrade to certain roads. This analysis assumed that the entire acreage for the CIS footprint would be graded. In reality, however, some of the acreage would not be graded or require construction activities, a factor which further supports this analysis as representing the upper bounds of the actual expected air emissions.

Emissions Estimates

Construction Equipment. The criteria air pollutant and GHG emissions from construction equipment during the construction of the potential CIS deployment were estimated based on the inputs and assumptions discussed in the previous paragraphs pertaining to construction activities, preliminary construction schedule, preliminary equipment list, and acreage disturbed during construction. The emission factors used in ACAM for non-road construction equipment are specific to Kalamazoo and Calhoun Counties from USEPA's Motor Vehicle Emission Simulator (MOVES) model (USEPA, 2014b). The fugitive and combustion source air emissions from construction equipment are provided in Table 3.3.1-4 for each year of construction.

Worker Vehicles. Vehicles transporting construction workers to and from the site on a daily basis would emit criteria pollutants and GHGs into the air shed surrounding the CIS footprint. During each month of construction, the number of construction workers and site activation personnel would vary depending on the phases of the project, as well as the construction activities that would be conducted. The emissions estimate for worker vehicles traveling to FCTC Site 1 assumed 100 workers during tree and brush clearing, 400 workers during site preparation, 600 workers during 2 years of construction involving heavy/intrusive construction activities, and 400 workers during the final year of construction that would involve build-out. It was further assumed that the construction workers would travel 50 miles roundtrip 6 days per week with the vehicle types divided between 50 percent passenger cars and 50 percent light-duty trucks fueled by gasoline. Mobile emission factors used to estimate the emissions from worker vehicles were from the ACAM, which utilizes emission factors for mobile on-road vehicles specific to Kalamazoo and Calhoun Counties from USEPA's MOVES model (USEPA, 2014b). The emission factors were used along with the other inputs to create an estimate of the worker vehicle emissions. The air emissions estimated from construction worker vehicles are provided in Table 3.3.1-4 for each year of construction.

Haul/Delivery Trucks. During site preparation and construction activities, there would be on-road trucks that remove dirt and other construction waste materials from the construction site and deliver them to off-base locations, as well as deliver dirt and construction materials needed for certain construction activities.

For on-road haul/delivery trucks, the analysis assumed the following:

- The on-road haul/delivery trucks would make 90 trips per day.
- The on-road haul/delivery trucks would operate 6 days per week.
- The on-road haul/delivery trucks would travel a roundtrip distance of 20 miles for each trip.

Table 3.3.1-4 Estimated Annual Emissions from Construction Activities – Baseline Schedule – FCTC Site 1

Emission Activity (1)(2)(3)	Annual Period (4)					
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
VOC (tons)						
Construction Equipment	0.23	3.75	4.83	4.93	1.69	0.16
Worker Vehicles	0.25	2.76	4.17	4.08	2.76	0.61
On-Road Haul/Delivery Trucks	0.11	0.40	0.36	0.33	0.30	0.08
Total Annual Emissions	0.6	6.9	9.4	9.3	4.8	0.9
CO (tons)						
Construction Equipment	1.12	19.42	24.15	24.21	10.48	1.49
Worker Vehicles	2.65	29.90	46.82	47.39	33.24	7.39
On-Road Haul/Delivery Trucks	0.37	1.35	1.24	1.15	1.07	0.27
Total Annual Emissions	4.1	50.7	72.2	72.8	44.8	9.1
PM_{10} (tons)						
Construction Equipment	0.09	3,768.79	1,257.55	1.76	0.53	0.03
Worker Vehicles	0.01	0.08	0.12	0.12	0.08	0.02
On-Road Haul/Delivery Trucks	0.05	0.16	0.14	0.12	0.11	0.03
Total Annual Emissions	0.1	3,769.0	1,257.8	2.0	0.7	0.1
$PM_{2.5}$ (tons)						
Construction Equipment	0.09	1.39	1.75	1.76	0.53	0.03
Worker Vehicles	0.01	0.07	0.10	0.10	0.07	0.02
On-Road Haul/Delivery Trucks	0.04	0.15	0.13	0.11	0.10	0.02
Total Annual Emissions	0.1	1.6	2.0	2.0	0.7	0.1
NO_x (tons)						
Construction Equipment	1.59	25.07	31.80	32.14	11.28	1.10
Worker Vehicles	0.30	2.82	4.10	3.86	2.53	0.56
On-Road Haul/Delivery Trucks	1.14	4.14	3.74	3.40	3.09	0.77
Total Annual Emissions	3.0	32.0	39.7	39.4	16.9	2.4
CO_2e (5) (metric tons)						
Construction Equipment	222	3,770	4,693	4,698	2,406	412
Worker Vehicles	162	2,051	3,377	3,582	2,610	580
On-Road Haul/Delivery Trucks	216	856	848	840	833	208
Total Annual Emissions	600	6,676	8,917	9,120	5,850	1,201
SO_2 (tons)						
Construction Equipment	0.003	0.044	0.055	0.055	0.028	0.005
Worker Vehicles	0.003	0.014	0.024	0.026	0.019	0.004
On-Road Haul/Delivery Trucks	0.002	0.008	0.008	0.008	0.008	0.002
Total Annual Emissions	0.01	0.07	0.09	0.09	0.06	0.01

Notes:

1. The annual air emissions of criteria pollutants for construction equipment include both fugitive and combustion source related emissions from non-road type construction equipment.
2. The annual emissions for worker vehicles are based on the maximum number of construction workers that would commute to and from FCTC Site 1 for the construction phase of the CIS.
3. The annual emissions from on-road trucks represents the activities for heavy-duty trucks that 1) remove dirt, debris, and construction waste from FCTC Site 1 to an off-base location and 2) deliver dirt and construction-related materials to FCTC Site 1.
4. The preliminary baseline schedule assumes that tree clearing will commence in October of Year 1 and last for 6 months. The start of site preparation activities commences during April of Year 2 and would last a full 12 months. The heavy intrusive construction activities would start during April of Year 3 and continue until March of Year 5. Build-out would start during April of Year 5 and continue until March of Year 6.
5. The air emissions of carbon dioxide equivalents are provided in metric tpy. The air emissions of criteria pollutants are provided in tpy.

Additionally, the analysis for the on-road trucks assumes each trip is a roundtrip distance of 20 miles. The emission factors used to estimate the emissions from the on-road truck activities are from the U.S. Air Force ACAM. As discussed for the worker vehicle emissions, ACAM utilizes emission factors for heavy-duty trucks from USEPA's MOVES model. The emission factors for the on-road truck were used along with the other inputs described previously to create an estimate of on-road truck emissions. The air emissions estimated from the on-road haul/delivery trucks is provided in Table 3.3.1-4 for each year of construction.

Air Quality Impacts

Should a decision be made to deploy and FCTC Site 1 is selected, the potential deployment would be located within the boundaries of Kalamazoo and Calhoun Counties, Michigan. The criteria pollutant and CO_2e emissions for Kalamazoo and Calhoun Counties are provided in Table 3.3.1-5. The annual emissions data for Kalamazoo and Calhoun Counties is from the National Emission Inventory (NEI) databases for the year 2011 (USEPA, 2013d). Table 3.3.1-5 also contains, for comparison purposes, the maximum annual emissions for each pollutant displayed in Table 3.3.1-4. Although there would be emissions that occur outside of Kalamazoo and Calhoun Counties due to worker commuting and delivery of equipment and materials, the magnitude of such emissions and associated impacts would be negligible compared to the Kalamazoo and Calhoun County emissions.

As illustrated in Table 3.3.1-5, the maximum annual emissions estimated for criteria pollutants and CO_2e from the construction of the potential CIS deployment at FCTC Site 1 would be a small percentage of the existing total emissions currently emitted within Kalamazoo and Calhoun Counties. The emissions of PM_{10} presented in Table 3.3.1-4 would be mostly associated with site grading activities that generate fugitive dust emissions during the site preparation phase of construction (Months 7-18). A BMP for controlling fugitive dust emissions during construction would be developed and used to control the estimated PM_{10} air emissions. Overall, the air quality impacts from the construction of the CIS would be temporary, local to the construction area and nearby surrounding area, and would be minor for each year of construction.

Table 3.3.1-5 Comparison of Construction Emissions to Existing Kalamazoo and Calhoun County Annual Emissions - Baseline Schedule – FCTC Site 1

Location	Emissions (tons)						
	VOC	**CO**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**CO_2e**	**SO_2**
Kalamazoo County [(1)]	13,937	51,203	8,266	2,341	7,697	1,515,600	1,459
Calhoun County [(1)]	11,387	33,864	7,405	2,075	6,523	1,125,271	354
FCTC Site 1 Maximum Annual Emissions During Construction [(2)]	9.4	72.8	3,769.0	2.0	39.7	9,120	0.09
Percentage of FCTC Site 1 Construction Emissions to Kalamazoo County Emissions	0.07	0.14	45.60	0.08	0.52	0.60	0.01
Percentage of FCTC Site 1 Construction Emissions to Calhoun County Emissions	0.08	0.21	50.90	0.10	0.61	0.81	0.03

Notes:
1. Annual air emissions for Kalamazoo and Calhoun Counties are from USEPA's NEI database representing the 2011 annual period.
2. Maximum annual baseline construction emissions for FCTC Site 1 are the maximum emission values for each air pollutant from Table 3.3.1-4. CO_2e is given in metric tons.

Considerations for Greenhouse Gas

Table 3.3.1-5 provides the estimated annual emissions of CO_2e expected during construction of the potential deployment at FCTC Site 1. The annual emissions of CO_2e included in this analysis would be generated by operation of non-road construction equipment, worker vehicles that commute to and from FCTC Site 1, and on-road trucks that transport materials to and from FCTC Site 1 for construction. The CEQ has published guidance that indicates when GHG emissions from a project warrant a quantitative analysis (CEQ, 2014). The CEQ has provided a reference point of 25,000 metric tons of CO_2e on annual bases, which indicates which projects are large enough to warrant a full quantitative GHG emission analysis. The estimated CO_2e annual emissions from construction are below 25,000 metric tons 'recommended as a reference point by CEQ' indicating the minor nature of the potential CIS deployment's GHG impacts and that a full quantitative emissions analysis of GHG would not be required.

3.3.1.3.1.2.2 FCTC Site 2

The following sections discuss the methods for assessing potential impacts, the types of potential impacts to the air quality surrounding FCTC Site 2, and possible mitigation measures for reducing such impacts associated with the baseline schedule. The focus of the discussion is on assumptions or conditions that would be different for FCTC Site 2 than for FCTC Site 1.

The assumptions and characteristics for the construction under the baseline schedule for FCTC Site 2 would be the same as that described for the FCTC Site 1, except for those discussed in the following paragraphs.

<u>Emission Sources</u>

Construction Site Disturbance. The estimated acreage that would be disturbed for construction at FCTC Site 2 is the only characteristic that is different than the air estimate for the baseline schedule for FCTC Site 1. FCTC Site 2 would require approximately 831 acres, as opposed to the 805 acres required for FCTC Site 1.

<u>Emissions Estimates</u>

Construction Equipment. The construction equipment assumptions such as the number of each equipment and hours per day each piece of equipment would operate for the FCTC Site 2 baseline schedule would remain the same as the FCTC Site 1 baseline construction schedule. However, the estimated acreage that would be disturbed for construction at FCTC Site 2 would be approximately 831 acres, as opposed to the 805 acres required for FCTC Site 1. The fugitive and combustion source air emissions from construction for FCTC Site 2 are provided in Table 3.3.1-6 for each year of construction for the baseline schedule.

<u>Air Quality Impacts</u>

Should a decision be made to deploy and FCTC Site 2 is selected, the potential CIS deployment would be located within the boundary of Kalamazoo County. As listed in Table 3.3.1-7, the maximum annual emissions estimated for criteria pollutants and CO_2e from construction of the potential deployment at FCTC Site 2 would be a small percentage of the existing total emissions currently emitted within Kalamazoo County. The unmitigated emissions of PM_{10} would be mostly associated with site grading activities during site preparation. A BMP for controlling fugitive dust emissions during construction would be developed and used to reduce the estimated PM_{10} air emissions. Overall, the air quality impacts from the construction of the potential CIS deployment would be temporary, local to the construction area and surrounding area, and would be small for each year of construction.

<u>Considerations for Greenhouse Gas</u>

Table 3.3.1-6 provides the estimated annual emissions of CO_2e associated with construction activities during the baseline construction schedule of the potential CIS deployment at FCTC Site 2. Although the annual CO_2e emissions for the baseline schedule at FCTC Site 2 are higher than the emissions at FCTC Site 1, they are still below the 25,000 metric tons indicating that a full quantitative emissions analysis of GHG would not be required.

Table 3.3.1-6 Estimated Annual Emissions from Construction Activities - Baseline Schedule - FCTC Site 2

Emission Activity (1)(2)(3)	Annual Period (4)					
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
VOC (tons)						
Construction Equipment	0.23	3.75	4.83	4.93	1.69	0.16
Worker Vehicles	0.25	2.76	4.17	4.08	2.76	0.61
On-Road Haul/Delivery Trucks	0.11	0.40	0.36	0.33	0.30	0.08
Total Annual Emissions	0.6	6.9	9.4	9.3	4.8	0.9
CO (tons)						
Construction Equipment	1.12	19.42	24.15	24.21	10.48	1.49
Worker Vehicles	2.65	29.90	46.82	47.39	33.24	7.39
On-Road Haul/Delivery Trucks	0.37	1.35	1.24	1.15	1.07	0.27
Total Annual Emissions	4.1	50.7	72.2	72.8	44.8	9.1
PM_{10} (tons)						
Construction Equipment	0.09	3,890.47	1,298.11	1.76	0.53	0.03
Worker Vehicles	0.01	0.08	0.12	0.12	0.08	0.02
On-Road Haul/Delivery Trucks	0.05	0.16	0.14	0.12	0.11	0.03
Total Annual Emissions	0.1	3,890.7	1,298.4	2.0	0.7	0.1
$PM_{2.5}$ (tons)						
Construction Equipment	0.09	1.39	1.75	1.76	0.53	0.03
Worker Vehicles	0.01	0.07	0.10	0.10	0.07	0.02
On-Road Haul/Delivery Trucks	0.04	0.15	0.13	0.11	0.10	0.02
Total Annual Emissions	0.1	1.6	2.0	2.0	0.7	0.1
NO_x (tons)						
Construction Equipment	1.59	25.07	31.80	32.14	11.28	1.10
Worker Vehicles	0.30	2.82	4.10	3.86	2.53	0.56
On-Road Haul/Delivery Trucks	1.14	4.14	3.74	3.40	3.09	0.77
Total Annual Emissions	3.0	32.0	39.7	39.4	16.9	2.4
CO_2e (5) (metric tons)						
Construction Equipment	222	3,770	4,693	4,698	2,406	412
Worker Vehicles	162	2,051	3,377	3,582	2,610	580
On-Road Haul/Delivery Trucks	216	856	848	840	833	208
Total Annual Emissions	600	6,676	8,917	9,120	5,850	1,201
SO_2 (tons)						
Construction Equipment	0.003	0.044	0.055	0.055	0.028	0.005
Worker Vehicles	0.003	0.014	0.024	0.026	0.019	0.004
On-Road Haul/Delivery Trucks	0.002	0.008	0.008	0.008	0.008	0.002
Total Annual Emissions	0.01	0.07	0.09	0.09	0.06	0.01

Notes:

1. The annual air emissions of criteria pollutants for construction equipment include both fugitive and combustion source related emissions from non-road type construction equipment.
2. The annual emissions for worker vehicles are based on the maximum number of construction workers that would commute to and from FCTC Site 2 for the construction phase of the CIS.
3. The annual emissions from on-road trucks represents the activities for heavy-duty trucks that 1) remove dirt, debris, and construction waste from FCTC Site 2 to an off-base location and 2) deliver dirt and construction-related materials to FCTC Site 2.
4. The preliminary baseline schedule assumes that tree clearing will commence in October of Year 1 and last for 6 months. The start of site preparation activities commences during April of Year 2 and would last a full 12 months. The heavy intrusive construction activities would start during April of Year 3 and continue until March of Year 5. Build-out would start during April of Year 5 and continue until March of Year 6.
5. The air emissions of carbon dioxide equivalents are provided in metric tpy. The air emissions of criteria pollutants are provided in tpy.

Table 3.3.1-7 Comparison of Construction Emissions to Existing Kalamazoo County Annual Emissions - Baseline Schedule - FCTC Site 2

Location	Emissions (tons)						
	VOC	CO	PM_{10}	$PM_{2.5}$	NO_x	CO_2e	SO_2
Kalamazoo County (1)	13,937	51,203	8,266	2,341	7,697	1,515,600	1,459
FCTC Site 2 Maximum Annual Emissions During Construction (2)	9.4	72.8	3,890.7	2.0	39.7	9,120	0.09
Percentage of FCTC Site 2 Construction Emissions to Kalamazoo County Emissions	0.07	0.14	47.07	0.08	0.52	0.60	0.01

Notes:

1. Annual air emissions for Kalamazoo County are from USEPA's NEI database representing the 2011 annual period.
2. Maximum annual baseline construction emissions for FCTC Site 2 are the maximum emission values for each air pollutant from Table 3.3.1-6. CO_2e is given in metric tons.

3.3.1.3.1.3 Mitigation

3.3.1.3.1.3.1 FCTC Site 1

Mitigation techniques could be considered during construction to reduce any impacts to the air quality as the need could arise during actual construction. Examples of such measures could include, but not be limited to, the following:

- Re-vegetating disturbed areas.
- Properly maintaining construction vehicles and equipment.
- Mandating in contract for construction use of newer construction equipment or construction equipment retrofitted with exhaust control technologies.
- Using cleaner fuels in construction vehicles and equipment.
- Application of anti-idling procedures.

Although the construction activities would cause an increase in air pollutants, the impact would be both temporary and local to the construction area and surrounding area. The specific measures that could be used should be determined during the project's air permitting process.

3.3.1.3.1.3.2 FCTC Site 2

The mitigations for air quality during construction for the baseline schedule at FCTC Site 2 would be the same as those described in the baseline schedule for FCTC Site 1.

3.3.1.3.2 Construction - Expedited Schedule

Another possibility for the potential CIS deployment could be to expedite the construction schedule and complete construction within 3 years as discussed in Section 2.5.1. Under this expedited construction scenario certain assumptions discussed for the baseline schedule would change and result in different estimated annual air emissions.

This section discuss the methods for assessing potential impacts, the types of potential impacts to the surrounding air quality, and possible mitigation measures for reducing such impacts associated with the expedited schedule. The focus of the discussion for the expedited construction schedule is on assumptions that change.

3.3.1.3.2.1 Methods for Assessing Construction Impacts – FCTC Sites

The methods for assessing construction impacts for FCTC Sites 1 and 2 for the expedited schedule are the same as those described in the baseline schedule in Section 3.3.1.3.1.1.

3.3.1.3.2.2 Environmental Consequences

3.3.1.3.2.2.1 FCTC Site 1

<u>Emission Sources</u>

Effects of Construction Schedule on Emissions Estimates. The expedited schedule assumes that construction of the potential CIS deployment would be completed within an approximately 3-year period as discussed in Section 2.5.1. The expedited schedule assumes that the final design and required air permits would be obtained during Year 1 (i.e., Months 1-3). The emissions analysis assumed the following expedited construction schedule:

- Tree clearing: Months 4 through 7, begins January of Year 2.
- Site preparation: Months 8 through 14, begins May of Year 2.
- Heavy/intrusive construction: Months 15 through 29, begins December of Year 2.
- Buildout and completion: Months 30 through 36, begins March of Year 4.

The expedited schedule assumes that all construction activities would occur 7 days per week and with two 10-hour shifts per day.

Emissions Estimates

Construction Equipment. The construction equipment assumptions for the expedited schedule would be the same as that described in the baseline schedule, except for the number of hours per day each piece of equipment would operate on a daily basis and the number of days per week construction activities would occur. The expedited schedule assumes that construction activities would occur 7 days per week and with two 10-hour shifts per day. The preliminary equipment list that includes the number and hours per day for each type of construction equipment is contained in Appendix D.1. The fugitive and combustion source air emissions from construction equipment for the expedited schedule are provided in Table 3.3.1-8 for each year of construction.

Worker Vehicles. The expedited schedule assumes construction activities would occur 7 days per week and that two shifts per day would be necessary to complete the construction of the potential CIS deployment within 3 years. The number of construction workers and site activation personnel for the expedited schedule is assumed to be twice the number of workers as discussed for the baseline schedule. The emissions estimate for worker vehicles traveling to FCTC Site 1 each day of construction assumes 200 workers during tree and brush clearing, 800 workers during site preparation, 1,200 workers during heavy/intrusive construction activities, and 800 workers during build-out. The air emissions from worker vehicles are provided in Table 3.3.1-8 for each year of construction.

Haul/Delivery Trucks. The haul/delivery truck assumptions such as miles per trip and number of trips per day for the expedited schedule would remain the same as the baseline schedule. However, for the expedited schedule the haul/delivery truck would operate 7 days per week. The air emissions from haul/delivery trucks are provided in Table 3.3.1-8 for each year of construction.

Air Quality Impacts

The comparison of the maximum annual emissions for each pollutant displayed in Table 3.3.1-8 to the Kalamazoo and Calhoun County emissions are provided in Table 3.3.1-9. As illustrated in Table 3.3.1-9, the maximum annual emissions estimated for criteria pollutants and CO_2e from construction of the potential deployment at FCTC Site 1 would be a small percentage of the existing total emissions currently emitted within Kalamazoo and Calhoun counties. The unmitigated emissions of PM_{10} would be mostly associated with site grading activities during site preparation. A best management plan for controlling fugitive dust emissions during construction would be developed and used to reduce the estimated PM_{10} air emissions. Overall, the air quality impacts from the construction of the potential CIS deployment would be temporary, local to the construction area and surrounding area, and would be minor for each year of construction.

Table 3.3.1-8 Estimated Annual Emissions from Construction Activities - Expedited Schedule – FCTC Site 1

Emission Activity (1)(2)(3)	Annual Period (4)		
	Year 2	Year 3	Year 4
	VOC (tons)		
Construction Equipment	7.71	13.80	2.54
Worker Vehicles	6.33	10.63	5.27
On-Road Haul/Delivery Trucks	0.46	0.42	0.29
Total Annual Emissions	14.5	24.9	8.1
	CO (tons)		
Construction Equipment	39.55	65.38	15.09
Worker Vehicles	68.53	119.51	61.27
On-Road Haul/Delivery Trucks	1.58	1.45	1.01
Total Annual Emissions	109.7	186.3	77.4
	PM_{10} (tons)		
Construction Equipment	3,351.64	1,679.50	0.82
Worker Vehicles	0.18	0.30	0.15
On-Road Haul/Delivery Trucks	0.19	0.16	0.11
Total Annual Emissions	3,352.0	1,680.0	1.1
	$PM_{2.5}$ (tons)		
Construction Equipment	2.84	5.10	0.82
Worker Vehicles	0.15	0.27	0.13
On-Road Haul/Delivery Trucks	0.17	0.15	0.10
Total Annual Emissions	3.2	5.5	1.1
	NO_x (tons)		
Construction Equipment	51.36	90.65	17.17
Worker Vehicles	6.46	10.48	5.00
On-Road Haul/Delivery Trucks	4.84	4.38	2.97
Total Annual Emissions	62.7	105.5	25.1
	CO_2e (5) (metric tons)		
Construction Equipment	8,102	10,996	4,032
Worker Vehicles	4,700	8,619	4,631
On-Road Haul/Delivery Trucks	1,001	992	735
Total Annual Emissions	13,803	20,606	9,397
	SO_2 (tons)		
Construction Equipment	0.090	0.147	0.040
Worker Vehicles	0.032	0.060	0.033
On-Road Haul/Delivery Trucks	0.009	0.009	0.007
Total Annual Emissions	0.13	0.22	0.08

Notes:

1. The annual air emissions of criteria pollutants for construction equipment include both fugitive and combustion source related emissions from non-road type construction equipment.
2. The annual emissions for worker vehicles are based on the maximum number of construction workers that would commute to and from FCTC Site 1 for the construction phase of the CIS.
3. The annual emissions from on-road trucks represents the activities for heavy-duty trucks that 1) remove dirt, debris, and construction waste from FCTC Site 1 to an off-base location and 2) deliver dirt and construction-related materials to FCTC Site 1.
4. The preliminary expedited schedule assumes that tree clearing would commence in January of Year 2 and last for 4 months. The start of site preparation activities commences during May of Year 2 and would last 7 months. The heavy intrusive construction activities would start during December of Year 2 and continue until February of Year 4. Build-out would start during March of Year 4 and continue until September of Year 4.
5. The air emissions of carbon dioxide equivalents are provided in metric tpy. The air emissions of criteria pollutants are provided in tpy.

Table 3.3.1-9 Comparison of Construction Emissions to Existing Kalamazoo and Calhoun Counties Annual Emissions - Expedited Schedule – FCTC Site 1

Location	Emissions (tons)						
	VOC	CO	PM_{10}	$PM_{2.5}$	NO_x	CO_2e	SO_2
Kalamazoo County (1)	13,937	51,203	8,266	2,341	7,697	1,515,600	1,459
Calhoun County (1)	11,387	33,864	7,405	2,075	6,523	1,125,271	354
FCTC Site 1 Maximum Annual Emissions During Construction (2)	24.85	186.34	3,352.01	5.51	105.50	20,606	0.22
Percentage of FCTC Site 1 Construction Emissions to Kalamazoo County Emissions	0.18	0.36	40.55	0.24	1.37	1.36	0.01
Percentage of FCTC Site 1 Construction Emissions to Calhoun County Emissions	0.22	0.55	45.27	0.27	1.62	1.83	0.06

Notes:
1. Annual air emissions for Kalamazoo and Calhoun Counties are from USEPA's NEI database representing the 2011 annual period.
2. Maximum annual expedited construction emissions for FCTC Site 1 CIS are the maximum emission values for each air pollutant from Table 3.3.1-8. CO_2e is given in metric tons.

Considerations for Greenhouse Gas

Table 3.3.1-8 provides the estimated annual emissions of CO_2e associated with construction activities during the expedited construction schedule at FCTC Site 1. Although the expedited annual CO_2e emissions are higher in the expedited schedule than the emissions in the baseline schedule, they are still below the 25,000 metric tons indicating that a full quantitative emissions analysis of GHG is not required.

3.3.1.3.2.2.2 FCTC Site 2

The assumptions and characteristics for the expedited schedule for FCTC Site 2 would be the same as that described in the expedited schedule for FCTC Site 1 except for those discussed in the following paragraphs.

Emission Sources

Construction Site Disturbance. The estimated acreage that would be disturbed for construction at FCTC Site 2 is the only characteristic that is different than the air estimate for the expedited schedule for FCTC Site 1. FCTC Site 2 would require approximately 831 acres, as opposed to the 805 acres required for FCTC Site 1.

Emissions Estimates

Construction Equipment. The construction equipment assumptions such as the number of each equipment and hours per day each piece of equipment would operate for the expedited schedule for FCTC Site 2 would remain the same as the expedited schedule for FCTC Site 1. The fugitive and combustion source air emissions from construction for FCTC Site 2 are provided in Table 3.3.1-10 for each year of construction for the expedited schedule.

Air Quality Impacts

Should a decision be made to deploy and FCTC Site 2 is selected, the CIS would be located within the boundary of Kalamazoo County. The comparison of the maximum annual emissions for each pollutant displayed in Table 3.3.1-10 to the Kalamazoo County emissions is provided in Table 3.3.1-11. The air quality impacts resulting from construction for the expedited schedule for FCTC Site 2 would be the same as those described for the expedited schedule for FCTC Site 1.

Considerations for Greenhouse Gas

Table 3.3.1-10 provides the estimated annual emissions of CO_2e associated with construction activities during the expedited construction schedule at FCTC Site 2. The estimated annual emissions of CO_2e for the expedited schedule for FCTC Site 2 are the same as the CO2e emissions for expedited schedule for FCTC Site 1.

3.3.1.3.2.3 Mitigation

3.3.1.3.2.3.1 FCTC Site 1

Mitigation techniques could be considered during the expedited schedule for FCTC Site 1 to reduce any impacts to the air quality as the need could arise during actual construction. The mitigation for air quality during construction for the expedited schedule for FCTC Site 1 would be the same as those described for the baseline schedule for FCTC Site 1.

Table 3.3.1-10 Estimated Annual Emissions from Construction Activities - Expedited Schedule - FCTC Site 2

Emission Activity (1)(2)(3)	Annual Period (4)		
	Year 2	Year 3	Year 4
		VOC (tons)	
Construction Equipment	7.71	13.80	2.54
Worker Vehicles	6.33	10.63	5.27
On-Road Haul/Delivery Trucks	0.46	0.42	0.29
Total Annual Emissions	14.5	24.9	8.1
		CO (tons)	
Construction Equipment	39.55	65.38	15.09
Worker Vehicles	68.53	119.51	61.27
On-Road Haul/Delivery Trucks	1.58	1.45	1.01
Total Annual Emissions	109.7	186.3	77.4
		PM_{10} (tons)	
Construction Equipment	3,459.80	1,733.58	0.82
Worker Vehicles	0.18	0.30	0.15
On-Road Haul/Delivery Trucks	0.19	0.16	0.11
Total Annual Emissions	3,460.2	1,734.0	1.1
		$PM_{2.5}$ (tons)	
Construction Equipment	2.84	5.10	0.82
Worker Vehicles	0.15	0.27	0.13
On-Road Haul/Delivery Trucks	0.17	0.15	0.10
Total Annual Emissions	3.2	5.5	1.1
		NO_x	
Construction Equipment	51.36	90.65	17.17
Worker Vehicles	6.46	10.48	5.00
On-Road Haul/Delivery Trucks	4.84	4.38	2.97
Total Annual Emissions (tons)	62.7	105.5	25.1
		CO_2e (5) (metric tons)	
Construction Equipment	8,102	10,996	4,032
Worker Vehicles	4,700	8,619	4,631
On-Road Haul/Delivery Trucks	1,001	992	735
Total Annual Emissions	13,803	20,606	9,397
		SO_2 (tons)	
Construction Equipment	0.090	0.147	0.040
Worker Vehicles	0.032	0.060	0.033
On-Road Haul/Delivery Trucks	0.009	0.009	0.007
Total Annual Emissions	0.13	0.22	0.08

Notes:

1. The annual air emissions of criteria pollutants for construction equipment include both fugitive and combustion source related emissions from non-road type construction equipment.
2. The annual emissions for worker vehicles are based on the maximum number of construction workers that would commute to and from FCTC Site 2 for the construction phase of the CIS.
3. The annual emissions from on-road trucks represents the activities for heavy-duty trucks that 1) remove dirt, debris, and construction waste from FCTC Site 2 to an off-base location and 2) deliver dirt and construction-related materials to FCTC Site 2.
4. The preliminary expedited schedule assumes that tree clearing would commence in January of Year 2 and last for 4 months. The start of site preparation activities commences during May of Year 2 and would last 7 months. The heavy intrusive construction activities would start during December of Year 2 and continue until February of Year 4. Build-out would start during March of Year 4 and continue until September of Year 4.
5. The air emissions of carbon dioxide equivalents are provided in metric tpy. The air emissions of criteria pollutants are provided in tpy.

Table 3.3.1-11 Comparison of Construction Emissions to Existing Kalamazoo County Annual Emissions Activities - Expedited Schedule - FCTC Site 2

Location	Emissions (tons)						
	VOC	CO	PM_{10}	$PM_{2.5}$	NO_x	CO_2e	SO_2
Kalamazoo County (1)	13,937	51,203	8,266	2,341	7,697	1,515,600	1,459
FCTC Site 2 Maximum Annual Emissions During Construction (2)	24.9	186.3	3,460.2	5.5	105.5	20,606	0.22
Percentage of FCTC Site 2 Construction Emissions to Kalamazoo County Emissions	0.18	0.36	41.86	0.24	1.37	1.36	0.01

Notes:
1. Annual air emissions for Kalamazoo County are from USEPA's NEI database representing the 2011 annual period.
2. Maximum annual expedited construction emissions for FCTC Site 2 are the maximum emission values for each air pollutant from Table 3.3.1-10. CO_2e is given in metric tons.

3.3.1.3.2.3.2 FCTC Site 2

Mitigation techniques could be considered during the expedited schedule for FCTC Site 2 to reduce any impacts to the air quality as the need could arise during actual construction. The mitigation for air quality during construction for the expedited schedule for FCTC Site 2 would be the same as those described for the expedited schedule for FCTC Site 1.

3.3.1.3.3 Operation – Baseline Schedule

If a decision is made to deploy and if either FCTC Site 1 or FCTC Site 2 is selected, then stationary and mobile sources (both combustion and non-combustion) would emit both criteria and GHG air pollutants during each year of operation for the potential CIS deployment. The air pollutant emissions from operation of the CIS would be a long-term impact on an on-going annual basis; however, the impacts would be limited to the local and regional area. The following sections discuss the methods for assessing potential impacts, the types of potential impacts to the surrounding air quality, and possible mitigation measures for reducing such air quality impacts due to the operation.

Environmental consequences for air quality from operation of the CIS would be the same for FCTC Site 1 and FCTC Site 2. No separate analysis is provided.

3.3.1.3.3.1 Methods for Assessing Operation Impacts

Factors Considered in Air Quality Impact Analysis

The following key emission sources and factors were considered in assessing the intensity and duration of operation-related air quality impacts:

- Backup power plant and comfort heating boiler operating characteristics.
- Commuter/work vehicles.
- Operation schedule.
- Fuel storage tanks

The respective contributions of these factors to the project's air quality analysis modeling and any respective assumptions used in the analysis are further described in Section 3.3.1.3.3.2.

Air Quality Impact Analysis Modeling

The ACAM Version 5.06 (USAF, 2016) model was used in this analysis to estimate source emissions from operation. The ACAM was used because it has the capability to develop an air emission estimate based on certain assumptions regarding the schedule, equipment and other variables.

3.3.1.3.3.2 Environmental Consequences

Air emissions from the operation of the CIS can be categorized as being either direct or indirect emissions. As previously indicated, both direct and indirect emissions are those emissions of criteria pollutants and precursors that are initiated by the federal approval of the potential CIS deployment, originate in the maintenance area, and are reasonably foreseeable. Direct emissions are those that occur at the same time and place as the CIS footprint. Air emissions resulting from operation of the backup power plant, other stationary emission sources (i.e., generators, boilers, etc.), and fuel storage tanks would be all considered direct emissions.

Indirect emissions are those emissions that occur at a different time or place as the location of the CIS. Indirect air emissions resulting from operation activities include operational staff vehicles that would occur off-base. These types of operational activities have the potential to occur away from the CIS footprint and within the maintenance area.

The following paragraphs describe the emission sources and assumption for the baseline schedule that would produce direct and indirect emissions from operation.

Power Plant and Heating Boiler

Commercial electrical power would be the primary source of power, which would be supplied by off-base public power generation sources. The GBI fields and structures associated with the CIS would, however, require backup power to ensure continuous operation abilities. The backup power would be supplied by four 3-MW reciprocating internal combustion engines (RICE). The purpose of the backup RICE would be to provide power to the CIS when utility power is lost or possibly when there is a potential for the power at the facility to be lost. The backup generators would be designed to handle backup power to operate up to 60 GBIs total.

The CIS would also include installation of a 7 million British thermal units (MBtu) diesel-fired boiler that would generate heat for the buildings and structures of the potential CIS deployment on an as-needed basis.

The air permitting effort for the four 3-MW backup RICE and comfort heating boiler would be conducted at a later time prior to construction of the facility to ensure compliance with federal and state air permit regulations. The air permitting assessment which would determine the categorization of the engines (i.e., emergency, non-emergency) as defined by the federal NESHAP[4] and NSPS[5] regulations that cover these types of engines. The categorization of the engines in combination with the air permitting assessment that would be conducted prior to construction of the CIS would determine the annual number of hours each engine would be allowed to operate. The permitting assessment would also determine any regulations that may be applicable to the diesel-fired comfort heating boiler. The following bullets provide the major assumptions used to estimate emissions for the four 3-MW engines and 7-Mbtu comfort heating boiler for the CIS:

- The engines would be categorized as emergency engines (i.e., subject to, and therefore not exempt from, the applicable NSPS).
- The air emissions assessment used 500 hours per year of operation for the emergency engines based on USEPA guidance that indicates the number of hours per year an emergency engine could be expected to operate under worst case conditions, which includes hours for emergencies, emergency-related operations (i.e., maintenance and readiness testing), and non-emergency operations allowed by USEPA’s regulations.
- The four 3-MW engines would be subject to the emission standards for Tier 2 engines manufactured after 2010 and greater than 900 kilowatts (kW), as prescribed in 40 CFR Part 89.112(a). Using these emission factors to estimate the emissions from the four 3-MW engines is conservative because they are higher emission factors for NO_x, VOC, and $PM_{2.5}$ than using the emission standards for a Tier 4 engine, which are more stringent.
- The comfort heating boiler would be permitted to operate up to 8,760 hours per year.
- The air emissions estimate for the comfort heating boiler is based on emission factors for boilers with heat input of less than 100 MBtu/hr from USEPA AP-42.

[4] 40 CFR Part 63, Subpart ZZZZ – National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines.
[5] 40 CFR Part 60, Subpart IIII – Standards of Performance for Stationary Compression Ignition Internal Combustion Engines

- The sulfur dioxide emission estimate was based on the assumption that the four 3-MW engines and comfort heating boiler would use ultra-low sulfur fuel oil (ULSFO) with a sulfur content of no more than 0.0015 percent.
- GHG emission factors for the engines were based on emission factors contained in Tables C-1 and C-2 of 40 CFR Part 98, Subpart C.

Mobile Vehicles

During operation, various types of mobile vehicles would emit air pollutants. The potential mobile vehicle activities would primarily include staff arrivals and dismissals. The estimated emissions from the types of mobile vehicles and activities for the operation of the CIS were developed using emission factors derived from the ACAM, which utilizes emission factors from USEPA's MOVES model (USEPA, 2014b). The emissions estimate for the mobile vehicles assumed the staff would travel 50 miles roundtrip with vehicle types divided between 50 percent passenger cars and 50 percent light-duty trucks fueled by gasoline. The vehicle emissions estimate was also based on the estimated maximum number of staff that would travel to and from FCTC Site 1 per day, which is a total of 850 military, civilian and contractor support maintenance personnel. This provides a bounding estimate of potential air emissions emitted annually for the staff vehicles, because the analysis does not consider carpooling or the fact that not all staff would be required to travel to FCTC Site 1 each day. The emission factors and inputs were used to create an estimate of the potential staff vehicle emissions which are provided in Table 3.3.1-12 for each annual period of operation.

Fuel Storage Tanks

Each of the four 3 MW backup RICE would have dedicated AST for fuel ranging in capacity from approximately 300 to 1,500 gallons. Three larger fuel storage tanks (each 30,000 gallons) would also be built to store fuel for the backup RICE for longer term operations. The fuel storage tanks and associated fuel loading operations to fill the tanks would be fugitive sources of VOCs. Air emissions from storage tanks are created by breathing and working loss activities. Breathing losses are produced by pressure variations that occur as the temperature of the stored fuel changes based on ambient conditions. Working losses occur due to the filling of the storage tank or as liquid is withdrawn from the storage tank. The ACAM was used to estimate potential fugitive VOC emissions from the AST and larger fuel storage tanks (USAF, 2015). Table 3.3.1-12 contains the estimated emissions of VOCs from the fuel storage tanks during operation of the potential CIS.

Schedule of Operation Activities

The air emission analysis for the baseline schedule assumed operation would begin during October of Year 5, which is the month after construction of the potential CIS would be completed. The operation would be 24 hours per day for each day of the year.

Table 3.3.1-12 Estimated Emissions from Operations - Baseline Schedule - FCTC Sites 1 and 2

Emission Activity (1)(2)	Annual Period (3)	
	Year 6	Year 7
	VOC (tons)	
Power Plant and Heating Boiler	31.79	42.39
Staff Vehicles	4.60	6.10
Fuel Storage Tanks	0.05	0.06
Total Annual Emissions	36.4	48.6
	CO (tons)	
Power Plant and Heating Boiler	18.20	24.27
Staff Vehicles	55.33	73.44
Fuel Storage Tanks	--	--
Total Annual Emissions	73.5	97.7
	PM_{10} (tons)	
Power Plant and Heating Boiler	1.27	1.69
Staff Vehicles	0.14	0.18
Fuel Storage Tanks	--	--
Total Annual Emissions	1.4	1.9
	$PM_{2.5}$ (tons)	
Power Plant and Heating Boiler	1.06	1.41
Staff Vehicles	0.12	0.15
Fuel Storage Tanks	--	--
Total Annual Emissions	1.2	1.6
	NO_x (tons)	
Power Plant and Heating Boiler	35.10	46.80
Staff Vehicles	4.21	11.82
Fuel Storage Tanks	--	--
Total Annual Emissions	39.3	58.6
	CO_2e (metric tons) (4)	
Power Plant and Heating Boiler	6,626	8,835
Staff Vehicles	4,346	5,768
Fuel Storage Tanks	--	--
Total Annual Emissions	10,972	14,604
	SO_2 (tons)	
Power Plant and Heating Boiler	0.069	0.092
Staff Vehicles	0.032	0.043
Fuel Storage Tanks	--	--
Total Annual Emissions	0.10	0.13

Notes:

1. The annual emissions for vehicles are based on the maximum number of staff that would commute to and from FCTC Sites 1 and 2 for the operation of the CIS.
2. The preliminary baseline schedule assumes the start of operation would commence during April of Year 6.
3. The annual air emissions estimated for Year 7 are representative of a full year of operation of the CIS and does not include any concurrent future projects and as such represents emissions from all remaining years of operation.
4. The air emissions of carbon dioxide equivalents are provided in metric tpy. The air emissions of criteria pollutants are provided in tpy.

Air Quality Impacts

Should the decision be made to deploy and FCTC Site 1 or FCTC Site 2 were selected, the CIS would be located within the boundaries of Kalamazoo and Calhoun Counties, Michigan. The criteria pollutant and CO_2e emissions for Kalamazoo and Calhoun Counties are provided in Table 3.3.1-13. The annual emissions data for Kalamazoo and Calhoun Counties were from the NEI databases for the year 2011 (USEPA, 2013d). Table 3.3.1-13 also contains, for comparison purposes, the maximum annual emissions for each pollutant from Table 3.3.1-12. The maximum annual emissions estimated for criteria pollutant and CO_2e from construction are a small percentage of the existing total emissions currently emitted within Kalamazoo and Calhoun Counties. Overall, the air quality impacts from the operation of the potential deployment would be small for each year of operation.

Considerations for Greenhouse Gas

Table 3.3.1-12 provides the estimated annual emissions of CO_2e that would be expected during operation of the CIS at FCTC Site 1 or FCT Site 2. The CEQ has published guidance that indicates when GHG emissions from a project warrant a quantitative analysis (CEQ, 2014). The CEQ has provided a reference point of 25,000 metric tons of CO_2e on annual basis, which indicates which projects are large enough to warrant a full quantitative GHG emission analysis. The estimated annual emissions from operation of the potential CIS at FCTC Site 1 or FCTC Site 2 under the baseline schedule would be below 25,000 metric tons indicating the minor nature of the CIS's GHG impact and that a full quantitative emissions analysis of GHG would not be required.

Finally, the CIS would be required to obtain all required air permits at a later date that would allow operation of the emission sources associated with operation of the CIS. Ultimately, the air permit that would be required for the CIS is stipulated by the CAA and the state's air regulations to prevent the degradation of the local and regional air quality. The air permits that could be required would ensure the operation of the potential CIS would not cause exceedances of air quality related to the national and Michigan ambient air quality standards or conflict with any local or regional air quality management plans. Due to the nature of the air emissions for the CIS and the air quality regulations that would be applicable to the emissions sources, the impacts related to the operation of the CIS would be small.

Table 3.3.1-13 Comparison of Operation Emissions to Existing Kalamazoo and Calhoun Counties Annual Emissions - Baseline Schedule – FCTC Sites 1 and 2

Location	Emissions (tons)						
	VOC	CO	PM_{10}	$PM_{2.5}$	NO_x	CO_2e	SO_2
Kalamazoo County (1)	13,937	51,203	8,266	2,341	7,697	1,515,600	1,459
Calhoun County (1)	11,387	33,864	7,405	2,075	6,523	1,125,271	354
FCTC Sites 1 and 2 Maximum Annual Emissions During Operation (2)	48.6	97.7	1.9	1.6	52.4	14,604	0.13
Percentage of FCTC Sites 1 and 2 Operation Emissions to Kalamazoo County Emissions	0.35	0.19	0.02	0.07	0.68	0.96	0.01
Percentage of FCTC Sites 1 and 2 Operation Emissions to Calhoun County Emissions	0.43	0.29	0.03	0.08	0.80	1.3	0.04

Notes:
1. Annual air emissions for Kalamazoo and Calhoun Counties are from USEPA's NEI database representing the 2011 annual period.
2. Maximum annual baseline operation emissions for FCTC Sites 1 and 2 CIS are the maximum emission values for each air pollutant from Table 3.3.1-12. CO_2e is given in metric tons.

3.3.1.3.3.3 Mitigation

Mitigation techniques to reduce air quality impacts from emission sources during operation of the potential CIS under the baseline schedule would be considered as necessary. Example of such measures could include maintaining equipment in working order, voluntarily accepting enforceable limits on the number of hours the power plant engines could operate per year, or installing air emissions controls to the engines. However, the emission sources for the CIS would be required to have the appropriate air operating permit and operate in accordance with all state and federal air quality regulations, which would ensure air quality impacts to local and regional air quality from the CIS would be small and not be a major impact to the local and regional air quality. The specific measures that would be used should be determined during the air permitting process.

3.3.1.3.4 Operation – Expedited Schedule

The following sections discuss the methods for assessing potential impacts, the types of potential impacts to the air quality surrounding FCTC Sites 1 and 2, and mitigation measures for reducing such impacts due to operation of the CIS with the expedited schedule. The focus of this is the assumptions and characteristics that are different under the expedited schedule versus the baseline schedule. The methods for assessing operation impacts for the expedited schedule are the same as those discussed for the baseline schedule in Section 3.3.1.3.3.1.

3.3.1.3.4.1 Environmental Consequences

The assumptions and characteristics for the expedited schedule for operation would be the same as that described in the baseline schedule for operation except for certain assumptions regarding when operation would commence.

Schedule of Operation Activities

The expedited schedule assumes that construction of the CIS for FCTC Sites 1 and 2 would be completed within an approximately a 3-year period as discussed in Section 2.5.1. The expedited schedule assumes construction of the CIS could be completed during September of Year 4 and that operation could begin the month after construction ends, which would be October of Year 4. The first full year of operation is expected to be during Year 5. The total estimated air emissions for the expedited schedule are provided in Table 3.3.1-14.

Mobile Vehicles

The assumptions for mobile vehicles for the expedited schedule are the same as those used in the baseline schedule, except for the emission factors used to estimate air emissions from mobile vehicles. The emission factors for the operation staff vehicles traveling to and from FCTC Sites 1 and 2 from ACAM reduce slightly in future annual periods. It is assumed that the start year of operation for the expedited schedule would be earlier than the baseline schedule; as such the air emission estimate uses different emission factors for the mobile equipment. The total estimated air emissions from mobile vehicles for the expedited schedule are provided in Table 3.3.1-14.

Air Quality Impacts

Table 3.3.1-15 contains the comparison of the maximum annual emissions for each pollutant displayed in Table 3.3.1-14 with the Kalamazoo and Calhoun County existing air emissions. As illustrated in the table, although the annual emissions for the pollutants are higher with the expedited schedule in comparison to the baseline schedule, they would be a small percentage of the existing total emissions currently emitted within Kalamazoo and Calhoun Counties. The air quality impacts during the operation for the expedited schedule for FCTC Sites 1 and 2 are the same as those discussed for the baseline schedule.

Table 3.3.1-14 Estimated Emissions from Operations - Expedited Schedule - FCTC Sites 1 and 2

Emission Activity [1][2]	Annual Period [3]	
	Year 4	Year 5
	VOC (tons)	
Power Plant and Heating Boiler	10.60	42.39
Staff Vehicles	1.70	6.75
Fuel Storage Tanks	0.02	0.06
Total Annual Emissions	12.3	49.2
	CO (tons)	
Power Plant and Heating Boiler	6.07	24.27
Staff Vehicles	19.80	78.55
Fuel Storage Tanks	--	--
Total Annual Emissions	25.9	102.8
	PM_{10} (tons)	
Power Plant and Heating Boiler	0.42	1.69
Staff Vehicles	0.05	0.20
Fuel Storage Tanks	--	--
Total Annual Emissions	0.5	1.9
	$PM_{2.5}$ (tons)	
Power Plant and Heating Boiler	0.35	1.41
Staff Vehicles	0.04	0.17
Fuel Storage Tanks	--	--
Total Annual Emissions	0.4	1.6
	NO_x (tons)	
Power Plant and Heating Boiler	11.70	46.80
Staff Vehicles	1.61	6.40
Fuel Storage Tanks	--	--
Total Annual Emissions	13.3	53.2
	CO_2e (metric tons) [4]	
Power Plant and Heating Boiler	2,209	8,835
Staff Vehicles	1,496	5,937
Fuel Storage Tanks	--	--
Total Annual Emissions	3,705	14,772
	SO_2 (tons)	
Power Plant and Heating Boiler	0.023	0.092
Staff Vehicles	0.011	0.043
Fuel Storage Tanks	--	--
Total Annual Emissions	0.03	0.13

Notes:

1. The annual emissions for vehicles are based on the maximum number of staff that would commute to and from FCTC Sites 1 and 2 for the operation of the CIS.
2. The preliminary expedited schedule assumes the start of operation would commence during October of Year 4.
3. The annual air emissions estimated for Year 5 are representative of a full year of operation of the CIS and does not include any concurrent future projects and as such represents emissions from all remaining years of operation.
4. The air emissions of carbon dioxide equivalents are provided in metric tpy. The air emissions of criteria pollutants are provided in tpy.

Table 3.3.1-15 Comparison of Operation Emissions to Existing Kalamazoo and Calhoun Counties Annual Emissions - Expedited Schedule – FCTC Sites 1 and 2

Location	Emissions (tons)						
	VOC	**CO**	**PM_{10}**	**$PM_{2.5}$**	**NO_x**	**CO_2e**	**SO_2**
Kalamazoo County (1)	13,937	51,203	8,266	2,341	7,697	1,515,600	1,459
Calhoun County (1)	11,387	33,864	7,405	2,075	6,523	1,125,271	354
FCTC Sites 1 and 2 Maximum Annual Emissions During Operation (2)	49.2	102.8	1.9	1.6	53.2	14,772	0.13
Percentage of FCTC Sites 1 and 2 Operation Emissions to Kalamazoo County Emissions	0.35	0.20	0.02	0.07	0.69	0.97	0.01
Percentage of FCTC Sites 1 and 2 Operation Emissions to Calhoun County Emissions	0.43	0.30	0.03	0.08	0.82	1.31	0.04

Notes:
1. Annual air emissions for Kalamazoo and Calhoun Counties are from USEPA's NEI database representing the 2011 annual period.
2. Maximum annual expedited operation emissions for FCTC Sites 1 and 2 potential CIS deployment are the maximum emission values for each air pollutant from Table 3.3.1-14. CO_2e is given in metric tons.

Considerations for Greenhouse Gas

Table 3.3.1-14 provides the estimated annual emissions of CO_2e for operational activities during the expedited construction schedule of the potential CIS deployment at FCTC Sites 1 and 2. Although the expedited annual CO_2e emissions are slightly higher in the expedited schedule than the emissions in the baseline schedule, they are still below the 25,000 metric tons indicating that a full quantitative emissions analysis of GHG is not required.

3.3.1.3.4.2 Mitigation

Mitigation techniques to reduce air quality impacts from emission sources during operation of the potential CIS under the expedited schedule should be considered necessary. The operation mitigation techniques for air quality for the expedited schedule for FCTC Sites 1 and 2 would be the same as those described for the baseline schedule.

3.3.1.3.5 General Conformity Related Discussion

The CAA requires federal agencies to ensure their actions (i.e., license, permit, or approval) conform to the applicable state implementation plan (SIP). The purpose of the conformity regulation is to ensure federal actions: (1) do not interfere with the SIP; (2) do not cause or contribute to new violations of the NAAQS; and (3) do not impede the ability to attain or maintain the NAAQS. The SIP is a plan that provides for implementation, maintenance, and enforcement of the NAAQS, and includes emission budgets and control measures to attain (for non-attainment areas) and maintain (for maintenance areas) the NAAQS. 40 CFR 93, Subpart B requires that a federal action undergo a general conformity determination for non-attainment or maintenance areas[6] where the emissions of the affected criteria pollutant or its precursor(s) would equal or exceed emission thresholds set forth in the regulation.

The CIS would be constructed within Kalamazoo and Calhoun Counties, which, as discussed previously, are both designated by USEPA as maintenance areas with the 1997 8-hour ozone standard. As such, a general conformity determination would be required for this federal action if the CIS-related emissions of the maintenance area pollutants or their precursors (i.e., NO_x, SO_2, or VOC) equal or exceed the 100 tpy conformity determination thresholds stated in 40 CFR Part 93.153(b)(2) on a pollutant-by-pollutant basis. This estimate of emissions is also known as the conformity applicability analysis and determines if 40 CFR Part 93, Subpart B is triggered and a general conformity determination is required for the potential deployment.

3.3.1.3.5.1 General Conformity – Baseline Schedule

3.3.1.3.5.1.1 FCTC Site 1

The annual air emissions for the construction and operation of the potential CIS for the baseline schedule for FCTC Site 1 were developed and presented in previous sections. Table 3.3.1-16 shows the comparison of the estimated total direct and indirect construction emissions associated with construction and operation of the potential deployment with the general conformity thresholds. The values in the table demonstrate that the direct and indirect emissions during each calendar year of construction and operation would be expected to be below the general conformity thresholds for the baseline schedule for FCTC Site 1, which indicates the project would not be required to undergo a general conformity determination.

[6] For areas that were non-attainment but have attained the NAAQS, USEPA requires as part of the re-designation process that states develop a 10-year plan (i.e., SIP) to ensure maintenance (or continued attainment) of the NAAQS. During this 10-year period these re-designated areas are known as maintenance areas.

Table 3.3.1-16 Estimated Annual Air Emissions from Construction and Operation in Comparison to General Conformity Thresholds - Baseline Schedule - FCTC Site 1

Emission Activity (1)	Annual Period (2)							Conformity Threshold (3) (tpy)
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	
VOC (tons)								
Construction	0.6	6.9	9.4	9.3	4.8	0.9	--	--
Operation	--	--	--	--	--	36.4	48.6	--
Total Annual Emissions	0.6	6.9	9.4	9.3	4.8	37.3	48.6	100
NO_x (tons)								
Construction	3.0	32.0	39.7	39.4	16.9	2.4	--	--
Operation	--	--	--	--	--	39.3	52.4	--
Total Annual Emissions	3.0	32.0	39.7	39.4	16.9	41.7	52.4	100
SO_2 (tons)								
Construction	0.01	0.07	0.09	0.09	0.06	0.01	--	--
Operation	--	--	--	--	--	0.10	0.13	--
Total Annual Emissions	0.01	0.07	0.09	0.09	0.06	0.11	0.13	100

Notes:
1. The annual air emissions of criteria pollutants for the baseline schedule from construction and operation of the CIS are from Tables 3.3.1-5 and 3.3.1-12, respectively.
2. The preliminary baseline construction schedule assumes the start of tree clearing commences during October of Year 1. Site preparation activities commences during April of Year 2 and would last a full 12 months, the heavy/intrusive construction activities start during April of Year 3 and continues until March of Year 5. Build-out construction activities start during April of Year 5 and ends during March of Year 6. Operation commences during April of Year 6. The estimated annual air emissions during Year 7 are representative of a full year of operations for the CIS.
3. The general conformity thresholds are from 40 CFR Part 93.153(b)(2).

Also, because the estimated air emissions for construction and operation of the CIS would not exceed the general conformity thresholds, the project should not need to apply mitigation or offsets that are prescribed by the general conformity regulation.

3.3.1.3.5.1.2 FCTC Site 2

The annual air emissions for the construction and operation of the potential CIS deployment for the baseline schedule for FCTC Site 2 were developed and presented in previous sections. Table 3.3.1-17 shows the comparison of the estimated total direct and indirect construction emissions associated with construction and operation of the CIS for FCTC Site 2 for the baseline schedule with the general conformity thresholds. The values in the table demonstrate that the direct and indirect emissions during each calendar year of construction and operation would be expected to be below the general conformity thresholds, which indicates the project would not be required to undergo a general conformity discussion.

Table 3.3.1-17 Estimated Annual Air Emissions from Construction and Operation in Comparison to General Conformity Thresholds - Baseline Schedule - FCTC Site 2

Emission Activity (1)	Annual Period (2)							Conformity Threshold (3) (tpy)
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	
				VOC (tons)				
Construction	0.6	6.9	9.4	9.3	4.8	0.9	--	--
Operation	--	--	--	--	--	36.4	48.6	--
Total Annual Emissions	0.6	6.9	9.4	9.3	4.8	37.3	48.6	100
				NO_x (tons)				
Construction	3.0	32.0	39.7	39.4	16.9	2.4	--	--
Operation	--	--	--	--	--	39.3	52.4	--
Total Annual Emissions	3.0	32.0	39.7	39.4	16.9	41.7	52.4	100
				SO_2 (tons)				
Construction	0.01	0.07	0.09	0.09	0.06	0.01	--	--
Operation	--	--	--	--	--	0.10	0.13	--
Total Annual Emissions	0.01	0.07	0.09	0.09	0.06	0.11	0.13	100

Notes:

1. The annual air emissions of criteria pollutants for the baseline schedule from construction and operation of the CIS are from Tables 3.3.1-6 and 3.3.1-12, respectively.
2. The preliminary baseline construction schedule assumes the start of tree clearing commences during October of Year 1. Site preparation activities commences during April of Year 2 and would last a full 12 months, the heavy/intrusive construction activities start during April of Year 3 and continues until March of Year 5. Build-out construction activities start during April of Year 5 and ends during March of Year 6. Operation commences during April of Year 6. The estimated annual air emissions during Year 7 are representative of a full year of operations for the CIS.
3. The general conformity thresholds are from 40 CFR Part 93.153(b)(2).

Also, because the estimated air emissions for construction and operation of the potential deployment would not exceed the general conformity thresholds, the project would not need to apply mitigation or offsets that are prescribed by the general conformity regulation.

3.3.1.3.5.2 General Conformity – Expedited Schedule

3.3.1.3.5.2.1 FCTC Site 1

The annual air emissions for the expedited schedule for FCTC Site 1 from construction and operation of the CIS were developed and discussed in previous sections. Table 3.3.1-18 shows the comparison of the estimated total direct and indirect air emissions associated with the expedited schedule from construction and operation of the CIS for the expedited schedule for FCTC Site 1 with the general conformity thresholds. The values in the table demonstrate that the direct and indirect air emissions of NO_x for Year 3 (construction) would be expected to exceed the general conformity thresholds, which indicates the project would be required to undergo a general conformity determination for these pollutants. Should the decision be made to deploy and FCTC Site 1 be selected in conjunction with the expedited schedule, MDA would comply with the requirements of the general conformity regulation to demonstrate compliance with the State of Michigan SIP, which could include applying mitigation or securing offsets such that the estimated air emissions of NO_X during construction are reduced below the general conformity thresholds.

3.3.1.3.5.2.2 FCTC Site 2

The annual air emissions for the expedited schedule for FCTC Site 2 from construction and operation of the CIS were developed and discussed in previous sections. Table 3.3.1-19 shows the comparison of the estimated total direct and indirect air emissions associated with the expedited schedule from construction and operation of the CIS for the expedited schedule for FCTC Site 2 with the general conformity thresholds. The values in the table demonstrate that the direct and indirect air emissions of NO_x for Year 3 (construction) would be expected to exceed the general conformity thresholds, which indicates the project would be required to undergo a general conformity determination for these pollutants. Should the decision be made to deploy and FCTC Site 2 be selected in conjunction with the expedited schedule, MDA would comply with the requirements of the general conformity regulation to demonstrate compliance with the State of Michigan SIP, which could include applying mitigation or securing offsets such that the estimated air emissions of NO_X during construction are reduced below the general conformity thresholds.

Table 3.3.1-18 Estimated Annual Emissions from Construction and Operation in Comparison to General Conformity Thresholds - Expedited Schedule - FCTC Site 1

Emission Activity (1)	Annual Period (2)				Conformity Threshold (3) (tpy)
	Year 2	Year 3	Year 4	Year 5	
			VOC (tons)		
Construction	14.5	24.9	8.1	--	--
Operation	--	--	12.3	49.2	--
Total Annual Emissions	14.5	24.9	20.4	49.2	100
			NO_x (tons)		
Construction	62.7	105.5	25.1	--	--
Operation	--	--	13.3	53.2	--
Total Annual Emissions	62.7	105.5	38.4	53.2	100
			SO_2 (tons)		
Construction	0.13	0.22	0.08	--	--
Operation	--	--	0.03	0.13	--
Total Annual Emissions	0.13	0.22	0.11	0.13	100

Notes:
1. The annual air emissions of criteria pollutants for the expedited schedule from construction and operation of the CIS are from Tables 3.3.1-8 and 3.3.1-14, respectively.
2. The preliminary expedited construction schedule assumes the start of tree clearing commences during January of Year 2. Site preparation activities commences during May of Year 2 and would last 7 months, the heavy/intrusive construction activities start during December of Year 2 and continues through February of Year 4. Build-out construction activities start during March of Year 4 and continue through September of Year 4. Operation commences during October of Year 4. The estimated annual emissions during Year 5 are representative of a full year of operations of the CIS.
3. The general conformity thresholds are from 40 CFR Part 93.153(b)(2).

Table 3.3.1-19 Estimated Annual Emissions from Construction and Operation in Comparison to General Conformity Thresholds - Expedited Schedule - FCTC Site 2

Emission Activity (1)	Annual Period (2)				Conformity Threshold (3) (tpy)
	Year 2	Year 3	Year 4	Year 5	
			VOC (tons)		
Construction	14.5	24.9	8.1	--	--
Operation	--	--	12.3	49.2	--
Total Annual Emissions	14.5	24.9	20.4	49.2	100
			NO_x (tons)		
Construction	62.7	105.5	25.1	--	--
Operation	--	--	13.3	53.2	--
Total Annual Emissions	62.7	105.5	38.4	53.2	100
			SO_2 (tons)		
Construction	0.13	0.22	0.08	--	--
Operation	--	--	0.03	0.13	--
Total Annual Emissions	0.13	0.22	0.11	0.13	100

Notes:
1. The annual air emissions of criteria pollutants for the expedited schedule from construction and operation of the CIS are from Tables 3.3.1-10 and 3.3.1-14, respectively.
2. The preliminary expedited construction schedule assumes the start of tree clearing commences during January of Year 2. Site preparation activities commences during May of Year 2 and would last 7 months, the heavy/intrusive construction activities start during December of Year 2 and continues through February of Year 4. Build-out construction activities start during March of Year 4 and continue through September of Year 4. Operation commences during October of Year 4. The estimated annual emissions during Year 5 are representative of a full year of operations of the CIS.
3. The general conformity thresholds are from 40 CFR Part 93.153(b)(2).

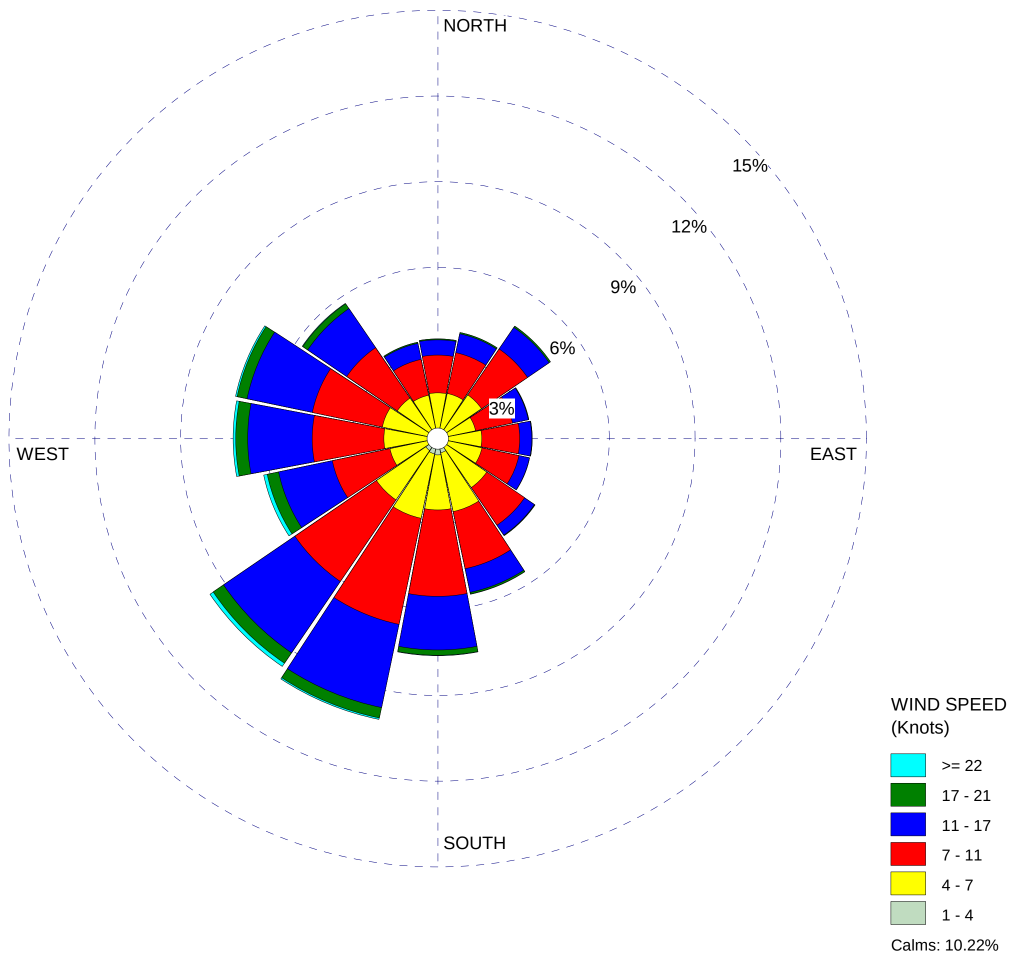
Figure 3.3.1-1 Annual Wind Rose, Battle Creek, MI 1994-2013 - FCTC

WIND ROSE PLOT:

Battle Creek, MI

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:

1994-2013 Annual Wind Rose

DATA PERIOD:

Start Date: 1/1/1994 - 00:00
End Date: 12/31/2013 - 23:00

COMPANY NAME:

MODELER:

CALM WINDS:

10.22%

TOTAL COUNT:

152741 hrs.

AVG. WIND SPEED:

7.63 Knots

DATE:

11/11/2014

PROJECT NO.:

WRPLOT View - Lakes Environmental Software

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3.3.2 Airspace – FCTC Sites

This section provides the assessment of airspace for the FCTC Sites. Airspace is defined as that ordinate space which lies above a nation and considered part of that nation's jurisdiction. Airspace, in this context, is a finite resource designated by vertical and horizontal boundaries. It can also consist of a time component and can be considered transient, in regards to its use for aviation purposes, which is a very substantial factor in airspace management and air traffic control (ATC).

3.3.2.1 Regulatory Framework – Airspace – FCTC Sites

Under the Federal Aviation Act of 1958, as amended (42 United States Code [USC] 1301 et seq.), the FAA is charged with the safe and efficient use of our nation's airspace. In the U.S., airspace is categorized as regulatory and non-regulatory. Within these categories exist controlled (Classes A, B, C, D, and E) and uncontrolled (Class G) airspace. These designations are based on which ATC service is provided to Instrument Flight Rules (IFR) flights and certain Visual Flight Rules (VFR) flights. Class F is not used in the U.S. Other airspace type designations include Special Use and Other Airspace.

3.3.2.2 Affected Environment – Airspace – FCTC Sites

3.3.2.2.1 FCTC Site 1

For the purpose of this document, the existing state of controlled and uncontrolled airspace and the requirements for airspace above critical system facilities within the CIS would be evaluated for potential impacts related to the applicable principal airspace attribute type listed and described in the following sections. The Region of Influence (ROI) is defined as that which could be affected by either the ongoing No Action Alternative or which could potentially be affected by the potential deployment. Applicable for this document, the ROI is defined as that airspace within 50 nautical miles of the CIS footprint, in addition to air traffic generated by commercial and military airports within 10 miles and flight patterns which bring aircraft within 5/8 miles of the CIS footprint are considered.

3.3.2.2.1.1 Controlled and Uncontrolled Airspace

Controlled and uncontrolled airspace is divided into six classes, dependent upon location, use, and degree of control. Class A airspace, which is not specifically charted, is generally, that airspace from 18,000 ft mean sea level (MSL) up to 60,000 ft. Unless otherwise authorized, all aircraft must be operated under instrument flight rules. Class B airspace is generally that airspace from the surface to 10,000 ft MSL surrounding the nation's busiest airports in terms of IFR operations or passenger enplanements. An ATC clearance is required for all aircraft to operate in the area, and all aircraft that are cleared receive separation services within the airspace. Class C airspace is generally that airspace from the surface to 4,000 ft above the airport elevation. It surrounds those airports that have an operational control tower, are serviced by a radar approach control, and have a certain number of IFR operations or passenger enplanements. Class D airspace is generally that airspace from the surface to 2,500 ft above the airport elevation that surrounds those airports having an operational control tower. Class E airspace is controlled airspace that is not Class A, Class B, Class C, or Class D airspace.

Uncontrolled airspace, or Class G airspace, has no specific definition but generally refers to airspace not otherwise designated. No ATC service to aircraft operating under either instrument or visual flight rules is provided other than possible traffic advisories when the ATC workload permits and radio communications can be established (Illman, 1993).

The airspace over the FCTC Site 1 footprint is located within the airspace jurisdiction of W.K. Kellogg Airport and the Kalamazoo/Battle Creek International Airport (Airnav, 2015). Airspace above the FCTC footprints under the jurisdiction of W.K. Kellogg ranges from the surface to 2,500 ft above ground level (AGL), whereas the airspace under the jurisdiction of Kalamazoo/Battle Creek Airport ranges from 4,000 to 6,000 ft AGL.

3.3.2.2.1.2 Special Use Airspace

Complementing the classes of controlled and uncontrolled airspace described previously are several types of special use airspace used by the military to meet its particular needs. Special use airspace consists of that airspace wherein activities must be confined because of their nature, or wherein limitations are imposed upon aircraft operations that are not a part of these activities, or both. Except for Controlled Firing Areas, special use airspace areas are depicted on aeronautical charts, which also include hours of operation, altitudes, and the controlling agency. Typical kinds of special use airspace include:

- Restricted Areas: Restricted Areas contain airspace identified by an area on the surface of the earth within which the flight of aircraft, while not wholly prohibited, is subject to restriction. Activities within these areas must be confined because of their nature, or limitations imposed upon aircraft operations that are not a part of these activities, or both. Restricted Areas denote the existence of unusual, often invisible, hazards to aircraft such as artillery firing, aerial gunnery, or guided missiles. Restricted Areas are published in the FR and constitute Federal Aviation Regulation (FAR) Part 73 Aeronautical Information Manual (FAR/AIM, 1998).
- Military Operations Areas: Military Operations Areas consist of airspace of defined vertical and lateral limits established for the purpose of separating certain non-hazardous military training activities from IFR traffic and to identify (for visual flight rules) traffic where these activities are conducted. Whenever a military operations area is being used, non-participating IFR traffic may be cleared through a military operations area if IFR separation can be provided by ATC. Otherwise, ATC will reroute or restrict non-participating instrument flight rules traffic (FAR/AIM, 1998).

Upon review of the airways within each ROI for FCTC Sites 1 and 2 (Airnav, 2015), relative proximity major air traffic corridors that cross Michigan, Indiana, and Wisconsin could be impacted.

There are currently no special use airspace designations over the FCTC Site 1 or FCTC Site 2 footprint or the FCTC installation.

3.3.2.2.1.3 Other Airspace Areas

Other types of airspace include airport advisory area, military training routes, temporary flight restrictions areas, flight limitations/prohibitions areas, parachute jump aircraft operations areas, published visual flight rules routes, and terminal radar service areas (FAR/AIM, 1998).

There are currently no other airspace area designations over the FCTC Site 1 or FCTC Site 2, or the FCTC installation.

3.3.2.2.1.4 Enroute Airways and Jet Routes

Upon review of the airways within each ROI for FCTC Sites 1 and 2 (Airnav, 2015), numerous air traffic corridors that cross Michigan, Indiana, and Wisconsin are present within the vicinity of FCTC Sites. The low and high altitude airway and jet routes in the vicinity of the FCTC Sites 1 and 2 are shown for reference in Figures 3.3.2-1 and Figure 3.3.2-1, respectively.

3.3.2.2.1.5 Airports and Airfields

There are several airports and airfields located in the vicinity of the FCTC installation. As indicated previously, there is no controlled airspace for these airports or airfields within the FCTC Site 1 CIS footprint or FCTC installation. As indicated previously the potential FCTC Site 1 footprint, is within the airspace jurisdiction of W.K. Kellogg Airport as well as the Kalamazoo/Battle Creek International Airport (Airnav, 2015). Provided for reference are the distances from the FCTC Site 1 footprint and controlled air classification for these two airfields/airports (Airnav, 2015):

- W.K. Kellogg Airport: 2 nautical miles from FCTC Site 1, Class D airspace (during the hours from 1100 to 0300), other times Class E.
- Kalamazoo/Battle Creek International Airport: 12 nautical miles from FCTC Site 1, Class D airspace (during the hours from 1100 to 0300), other times Class E.
- Gerald R. Ford International Airport: 42 nautical miles from FCTC Site 1, Class C airspace.
- Several other small private and commercial airports and airfield are also within the ROI.

3.3.2.2.2 FCTC Site 2

The affected environment for airspace the FCTC Site 2 is the same as that described for FCTC Site 1 with the following exceptions related to distance from existing airports:

- W.K. Kellogg Airport: 6 nautical miles from FCTC Site 2, Class D airspace (during the hours from 1100 to 0300), other times Class E.
- Kalamazoo/Battle Creek International Airport: 9 nautical miles from FCTC Site 2, Class D airspace (during the hours from 1100 to 0300), other times Class E.
- Gerald R. Ford International Airport: 40 nautical miles from FCTC Site 2, Class C airspace.

3.3.2.3 Environmental Consequences and Mitigation – Airspace – FCTC Sites

The affected airspace environment characterized by principal airspace attributes, are evaluated in the following sections as applicable, for periods during construction and operations. These principal attributes consists of controlled and uncontrolled airspace, special use airspace and other airspace areas. Additional attributes to be evaluated as applicable are enroute airways and jet routes, airports and airfields and air navigation facilities.

3.3.2.3.1 Construction – Baseline Schedule

3.3.2.3.1.1 FCTC Site 1

3.3.2.3.1.1.1 Environmental Consequences and Mitigation

No CIS-related structures or equipment would occur at heights that would affect airspace during construction. Therefore, no impacts from, or during, construction would occur within the ROI for the FCTC Site 1 footprint related to principal airspace attributes.

3.3.2.3.1.1.2 Mitigation

Because no airspace construction impacts would occur, no mitigation would be required.

3.3.2.3.1.2 FCTC Site 2

The construction impacts and mitigations for airspace under the baseline schedule for FCTC Site 2 would be the same as described for FCTC Site 1.

3.3.2.3.2 Construction – Expedited Schedule

The environmental consequences and mitigations for airspace under the expedited construction schedule for both FCTC Site 1 and FCTC Site 2 would be the same as under the baseline construction schedule. There would be no impacts; therefore, no mitigations would be required.

3.3.2.3.3 Operations

Potential operations impacts and mitigations to the applicable principal airspace attributes are described in the following sections.

3.3.2.3.3.1 Environmental Consequences

3.3.2.3.3.1.1 FCTC Site 1

Controlled and Uncontrolled Airspace

Airspace encroachment could exist at the FCTC sites due to the proximity of W.K. Kellogg Airport and Kalamazoo/ Battle Creek International airport (both controlled airspace above the FCTC footprint). Operations efforts related to the CIS would need to be coordinated with this airport. However, no adverse impacts to airspace related to these facilities would occur. No mitigation would be required.

Special Use Airspace

There is currently no special use airspace over the FCTC installation and no additional special use airspace requirements for the CIS would be required. Therefore, no mitigation would be required for special use airspace

Other Airspace Areas

Additional navigation warnings and controls could be required for the potential CIS deployment to separate activities related to CIS operations from current FCTC activities and operations. The establishment of prohibited and restricted areas in coordination with the FAA and local ATC facilities is an effective means of mitigation. Restricted areas contain airspace identified by an area on the surface of the earth within which the flight of aircraft, while not wholly prohibited, is subject to restrictions. Flight restrictions are a measure established to protect persons and property in the air or on the surface from an existing or imminent hazard associated with an incident on the surface when the presence of low-flying aircraft would magnify, alter, spread, or compound that hazard. The ATC Center having jurisdiction would enforce the flight restriction.

A supplemental measure where current airspace restrictions exist would be to designate a pre-established avoidance zone. In the absence of a flight restriction, a pre-established avoidance area would be considered more effective than attempting to divert aircraft in the event of an exercise, or real world event. The avoidance zone would be published in the NOTAMS and coordinated directly with FCTC.

"Other Airspaces" for FCTC Site 1 where pre-established avoidance zones and associated NOTAMs may be provided would include the following (MDA, 2015b).

IDT. Based on electromagnetic modeling, avoidance zones would need to be established over the IDT because of the associated energy being transmitted vertically above the facility. No adverse health impacts from the potential deployment of the IDTs would occur as the energy produced by the maximum radiation of the IDT would be less than 200 volts per meter, a level safe for any civilian or military aircraft, fixed-wing or rotorcraft; however, electromagnetic radiation (EMR) could adversely affect or cause interference with aircraft guidance and instrumentation systems. IDTs would typically be tested daily and used during heightened periods of threat. The anticipated cone would be up to 10,000 feet Above Ground Level (AGL). Establishing an avoidance zone would allow pilots time to divert or keep clear of impending radar beaming and protect against interference. A permanently established avoidance zone, based on the volume of air traffic, would need to be negotiated with the FAA.

Minor impacts would occur from establishing this avoidance zone provision.

SATCOM Facilities. An avoidance zone would need to be established over the SATCOM antennas to facilitate the functional requirements of the R&CF. The anticipated cone above these antennas would be up to 10,000 feet AGL. The airspace above would be allowed for over flights above 10,000 feet except for security and preapproved flights with ground controllers.

Minor impacts, would occur from establishing this avoidance zone provision.

GBI Site. Although no designated airspace restriction would be established above the missile field and support facilities at the FCTC Site 1 CIS footprint under normal conditions, temporary airspace sanitization procedures in the form of a Joint Letter of Procedure would need to be developed to establish authorities, responsibilities, and procedures for activation of a temporary flight restriction during homeland defense operations.

A permanent Flight Safety Advisory would need to be established to discourage the potential for circling, loitering, and routine encroachment of civilian flights over the FCTC Site 1 CIS footprint.

The Joint Letter of Procedure and Flight Safety Advisory would be developed in accordance with similar policies and procedures as those established at the Fort Greely, Alaska, GMD site.

Negligible impacts would occur over the GBI site; therefore, no mitigation would be required.

Military Exercise/Training Areas and Training Routes. In regard to controlled firing areas, the Michigan National Guard acknowledges the loss of the 7.62 mm caliber live firing at FCTC due to conflicts associated with a CIS deployment at FCTC Site 1. To compensate, it has been agreed that the Michigan National Guard would relocate all future 7.62 mm caliber live firing to the existing range capacity at Camp Grayling, Michigan, upon CIS deployment. It has been noted that this relocation would not require any additional range construction to accommodate the displaced live fire training.

Additional information on the relocation of this facility is provided in Section 3.3.9, Land Use.

Enroute Airways and Jet Routes

Although there are numerous air traffic corridors from Michigan (Detroit), Indiana to Wisconsin within the vicinity of the FCTC Site 1 footprint; no impacts have been identified that would require mitigation.

Airports and Airfields

Airports which are located in close proximity of FCTC having relevance in regards to potential CIS deployment are W.K. Kellogg Airport and Kalamazoo/Battle Creek International Airport. However, due to the controlled airspace associated with these airports, impacts would be negligible and no mitigation measures would be required. The proximity of the FCTC Site 1 footprint to the approach and departure runway at Kellogg Regional Airport has been noted as being a runway incursion safety concern. In addition to these airway corridors, an area of potential concern had been noted regarding the area designated for FCTC Site 1 and its proximity being a runway incursion safety concern relative to the approach and departure runway at Kellogg Regional Airport 1. During of a site survey performed by MDA's Mission Assurance and Manufacturing Engineering Directorate Safety in September 2013, it was observed that the Western Michigan University Flight Training School was conducting training exercises over the Fort Custer Fire Arms Training Range. The site survey team also learned that student pilot training exercises were being conducted over the FCTC Site 1 footprint. It has been estimated that the Kellogg Regional Airport conducts approximately 100 to 130 flights per day, 4 to 5 days per week, 42 weeks per year. This equates to approximately 63,000 plus flights per year (MDA, 2015a). However, no crashes have been noted date from the use of this facility as a flight school (MDA, 2015b).

Coordination with the local ATC would be required to determine the appropriate measures for mitigation associated with potential CIS deployment.

An evaluation would need to be made on whether to relocate training activities associated with the Western Michigan University student pilot training conducted at Kellogg Regional Airport or to establish appropriate airspace controls for mitigation.

3.3.2.3.3.1.2 FCTC Site 2

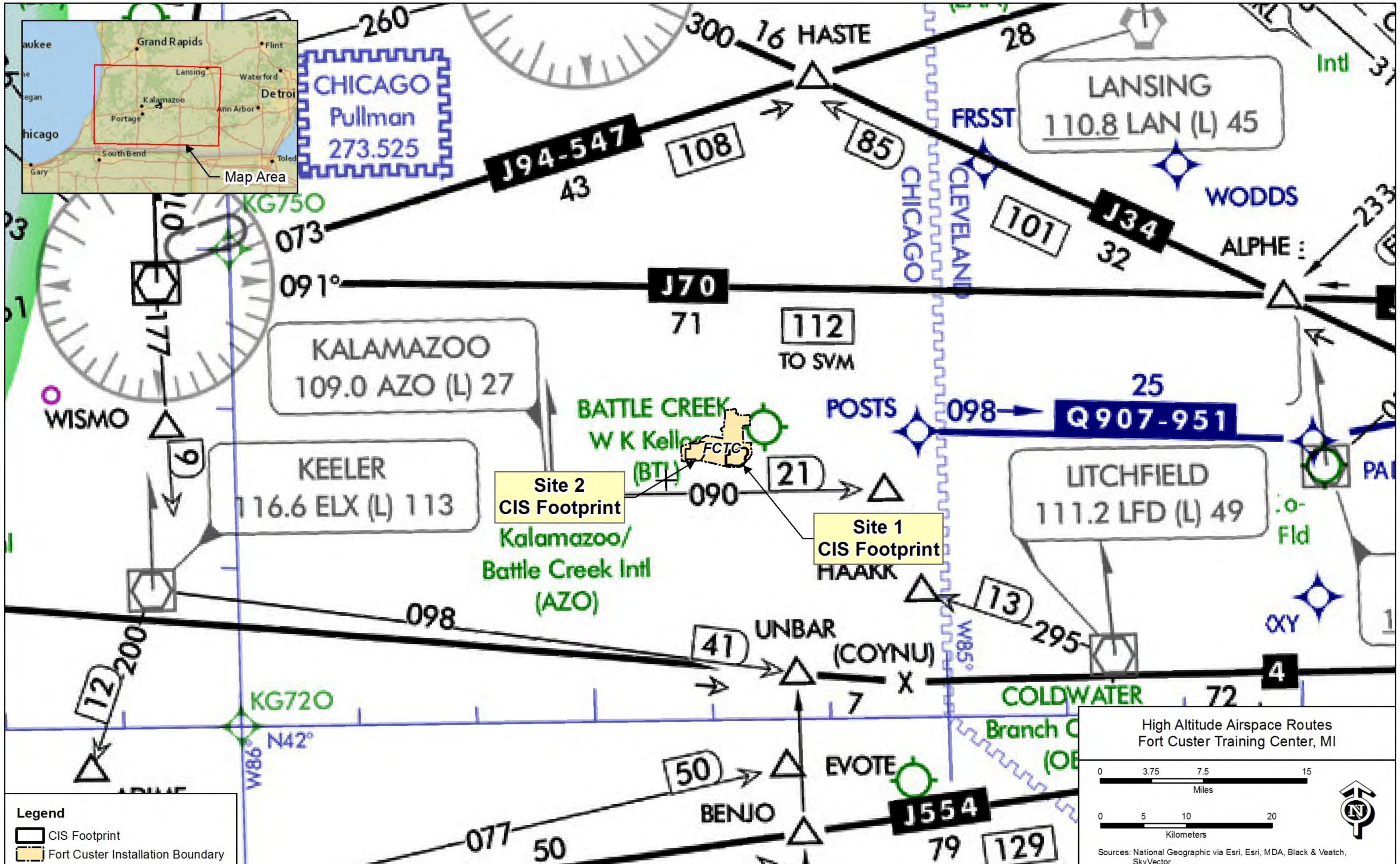
The operation impacts for airspace for FCTC Site 2 would be the same as described for FCTC Site 1.

3.3.2.3.3.2 Mitigation

Overall, because the impacts identified are negligible to minor, no mitigation would be required.

Figure 3.3.2-1 Low Altitude Airspace Routes – FCTC Sites

Figure 3.3.2-2 High Altitude Airspace Routes – FCTC Sites



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3.3.3 Biological Resources – FCTC Sites

Biological resources include flora, fauna, and terrestrial and aquatic habitats. Existing specific information on flora and fauna species and habitat types on and near the candidate CIS footprints at FCTC Sites 1 and 2 was reviewed for this EIS.

The general intent in the EIS is to assess the impacts of the deployment of the CIS on biological resources within the CIS footprint and surrounding areas.

This section includes an overview of regulatory framework, a description of the terrestrial and aquatic resources present within the CIS footprint and surrounding area, and identification of federal and state-listed special status species listed as rare, threatened, or endangered.

3.3.3.1 Regulatory Framework – Biological Resources – FCTC Sites

The following are statutes with specific regulatory requirements pertaining to biological resources located at FCTC. This list is not exhaustive, but it characterizes those regulations with the most relevance to the potential CIS deployment at FCTC.

<u>Federal</u>

- Endangered Species Act (ESA) of 1973, (16 USC 1531 et seq.) - The purpose of the ESA is to protect and recover imperiled species and the ecosystems upon which they depend. Under Section 7 of the ESA, federal agencies are required to coordinate their actions with the USFWS and the National Oceanic and Atmospheric Administration (NOAA) to prevent jeopardizing the continued existence of species. The ESA protects endangered and threatened species and their habitats by prohibiting the "take" of listed animals and the interstate or international trade in listed plants and animals, including their parts and products, except under federal permit.
- Migratory Bird Treaty Act (MBTA) of 1918 (16 USC 703-712) - The MBTA prohibits take of migratory bird species, including nests, parts of migratory birds or products derived from migratory birds, and implements a series of international treaties protecting migratory birds that cross international boundaries on migration.
- Fish and Wildlife Conservation Act (FWCA) of 1980 (16 USC 2901-2911) - The FWCA authorizes financial and technical assistance to the states for development, revision, and implementation of conservation plans and programs for nongame fish and wildlife.
- Bald and Golden Eagle Protection Act (BGEPA) of 1940 (16 USC 668-668c) - The BGEPA contains provisions for the protection of Bald Eagles and Golden Eagles, including prohibitions of take, habitat destruction including nests, or use of eagle parts and products without a permit.
- Sikes Act - The Sikes Act seeks to ensure that ecosystems on military lands are protected and enhanced while allowing military lands to meet the needs of military operations. The Act includes provisions for preparation and implementation of Integrated Natural

Resource Management Plans (INRMPs) in cooperation with the USFWS, National Marine Fisheries Service (NMFS), and the applicable state fish and wildlife agency.

- Army Regulation (AR) 200-1, Environmental Protection and Enhancement (Chapter 4; 13 December 2007) - This regulation covers U.S. Army environmental protection and enhancement for all Army organizations and agencies (except civil works under USACE jurisdiction) and provides the framework for the Army Environmental Management System.

<u>State of Michigan</u>

- Natural Resources and Environmental Protection Act – An act to protect the environment and natural resources of the state; to codify, revise, consolidate, and classify laws relating to the environment and natural resources of the state; to regulate the discharge of certain substances into the environment; to regulate the use of certain lands, waters, and other natural resources of the state; to protect the people's right to hunt and fish; to prescribe the powers and duties of certain state and local agencies and officials; to provide for certain charges, fees, assessments, and donations; to provide certain appropriations; to prescribe penalties and provide remedies; and to repeal acts and parts of acts [Natural Resources and Environmental Protection Act, 1994, Public Act 451, as amended (Act 451)].

3.3.3.2 Affected Environment – Biological Resources – FCTC Sites FCTC Site 1

The affected environment for biological resources includes a description of terrestrial resources (vegetation communities and wildlife), aquatic resources, and special status species.

3.3.3.2.1.1 Terrestrial Resources – FCTC Site 1

Terrestrial resources include vegetation communities and wildlife such as birds, mammals, reptiles, amphibians, and insects.

3.3.3.2.1.1.1 Vegetation Communities – FCTC Site 1

The general discussion on vegetation communities within the FCTC Site 1 footprint is based on information collected during an onsite vegetation alliance mapping effort conducted in 2009 by staff from the Michigan Natural Features Inventory (MNFI) (MFNI, 2009; Thomas et. al., 2009). General plant information is based on an inventory conducted by the MNFI in 2012.

<u>Vegetation Alliances</u> – FCTC Site 1

The vegetation alliance mapping was conducted across the entire FCTC installation. A vegetation alliance is defined as a "*characteristic range of species composition, habitat conditions, physiognomy, and diagnostic species, typically at least one of which is found in the uppermost or dominant stratum of the vegetation layer, and reflecting regional to subregional* *climate, substrates, hydrology, moisture/nutrient factors and disturbance regimes*" (FGDC, 2008). In general, vegetation alliances are unique vegetation assemblages that represent habitats functioning under natural conditions.

The FCTC Site 1 footprint was overlaid onto MNFI (2009) plant alliance mapping data to determine which alliances occur within the footprint (see Figure 3.3.3-1). A total of eight vegetation alliances and two non-alliance habitat features are noted to occur within the FCTC Site 1 footprint. Field descriptions reflect the state of these alliances as they occurred on FCTC in 2009. These alliances and features are listed in Table 3.3.3-1 and described in the following paragraphs.

Table 3.3.3-1 Vegetation Alliances within the FCTC Site 1 Footprint

Vegetation Alliance Type	Estimated Acreage
Potential Vegetation Alliance(s)	502.51
Tussock Sedge Seasonally Flooded Herbaceous Alliance (isolated, inundated)	5.24
Red-osier Dogwood – Willow species Seasonally Flooded Shrubland Alliance	3.01
Black Oak – (Northern Pin Oak) Wooded Herbaceous Alliance	10.87
Bur Oak – (White Oak) Wooded Herbaceous Alliance	10.04
Northern Red – (Sugar Maple) Forest Alliance	4.72
White Oak – (Northern Red Oak, Hickory species) Forest Alliance	50.76
Field (Non-Alliance)	214.33
Vernal Wetland	0.27
Open Water (Non-Alliance)	3.12
Total	**805**

Potential Vegetation Alliance(s) FCTC field description - Adventive or planted woodlands or shrublands. Usually dry-mesic or mesic, occasionally wet mesic. Usually occur on loamy sands or sandy loams on flat or gently sloping areas. Common species: black oak *(Quercus velutina),* black cherry *(Prunus serotina),* black walnut *(Juglans nigra),* white pine *(Pinus strobus),* black locust *(Robinia pseudoacacia),* red cedar *(Juniperus virginiana),* sassafras *(Sassafras albidum),* pignut hickory *(Carya glabra),* black raspberry *(Rubus occidentalis),* Eurasian honeysuckle *(Lonicera maackii),* Japanese barberry *(Berberis thunbergii),* multiflora rose *(Rosa multiflora),* orchardgrass *(Dactylis glomerata),* tall goldenrod *(Solidago altissima),* and garlic mustard *(Alliaria petiolata)* (Thomas et. al., 2009).

Tussock Sedge Seasonally Flooded Herbaceous Alliance (isolated, inundated) FCTC field description – Wet, seasonally flooded wetlands. Often with 12 inches or more standing water in spring, but likely only saturated by summer. Clayey or silty loam bottoms. Closed depressions. Common species: willows (*Salix* spp.), dewberry (*Rubus pensylvanicus*), bluejoint grass

(*Calamagrostis canadensis*), broad-leaved cat-tail (*Typha latifolia*), reed canary grass (*Phalaris arundinacea*), late goldenrod (*Solidago gigantea*), and stinging nettle (*Urtica dioica)* (Thomas et al., 2009).

Red-osier Dogwood – Willow species Seasonally Flooded Shrubland Alliance FCTC field description - Shrubby wetlands. Wet due to high water tables or seasonal inundation. Occurring on mucks or highly organic mineral soils. Flat to gently sloped. Can include scattered trees and patches of wet meadow. Common species: peach-leaved or black willow (*Salix amygdaloides* or *Salix nigra*), green ash (*Fraxinus pennsylvanica*), American elm (*Ulmus americana*), red maple (*Acer rubrum*), pussy willow (*Salix discolor*), silky dogwood (*Cornus amomum*), red-osier dogwood (*Cornus stolonifera*), gray dogwood (*Cornus foemina)*, poison sumac (*Toxicodendron vernix*), sedges (*Carex* spp.), bluejoint grass (*Calamagrostis canadensis*), wool-grass (*Scirpus cyperinus*), and goldenrods (*Solidago* spp.) (Thomas et al., 2009).

Black Oak – (Northern Pin Oak) Wooded Herbaceous Alliance FCTC field description - Open woodland or barrens-like communities. Usually dry-mesic to dry, but occasionally mesic. Sandy soils with thin A-horizon. Terrain often somewhat flat to gently rolling. Common species: white oak (*Quercus alba*), black oak (*Quercus velutina*), Pennsylvania sedge (*Carex pensylvanica*), Indian grass (*Sorghastrum nutans*), tall coreopsis (*Coreopsis tripteris*), wild strawberry (*Fragaria virginiana*), and wood betony (*Pedicularis canadensis*) (Thomas et al., 2009).

Bur Oak – (White Oak) Wooded Herbaceous Alliance FCTC field description - Current degraded form is forested uplands, but occurred historically as a savanna. Mesic, occasionally dry-mesic, or wet-mesic. Sandy loam or loam soils. On broad, somewhat flat ridges or shallow swales. Existing degraded status is due to fire suppression. Common species: bur oak (*Quercus macrocarpa*), white oak (*Quercus alba*), hickories (*Carya* spp.), and black walnut (*Juglans nigra*) (MNFI, 2009).

Northern Red – (Sugar Maple) Forest Alliance FCTC field description - Forested uplands. Wet-mesic or sometimes mesic on sandy-loams, silt-loams, or sandy clayloam soils. In ravine heads or landscape pits or hollows. Common species: tulip tree (*Liriodendron tulipifera*), red oak (*Quercus rubra*), big-toothed aspen *(Populus grandidentata),* bitternut hickory *(Carya cordiformis*), white ash (*Fraxinus americana*), black cherry (*Prunus serotina*), black walnut (*Juglans nigra*), red maple (*Acer rubrum*), spicebush (*Lindera benzoin*), Japanese barberry (*Berberis thunbergii*), and multiflora rose (*Rosa multiflora*).

White Oak – (Northern Red Oak, Hickory species) Forest Alliance FCTC field description - Forested uplands. Usually dry-mesic, occasionally mesic, and rarely wet-mesic. Often on rocky sandy loams, but sometimes on loamy sands. Often on gentle to moderate slopes, and sometimes steep slopes. Common species: black oak (*Quercus velutina*), pignut hickory (*Carya glabra*), red maple (*Acer rubrum*), black cherry (*Prunus serotina*), big-toothed aspen (*Populus* *grandidentata*), white oak (*Quercus alba*), sassafras (*Sassafras albidum*), multiflora rose (Rosa multiflora), raspberries/blackberries (*Rubus* spp.), Pennsylvania sedge (*Carex pensylvanica*), bottlebrush grass (*Hystrix patula*), and sedges (*Carex* spp.) (Thomas et al., 2009). Note that the White Oak – (Northern Red Oak, Hickory species) Forest Alliance corresponds to the Dry-mesic Southern Forest S3 vegetation community. Dry-mesic Southern Forest is listed as an S3 vegetation community within Michigan (MNFI, 2016).

Field (Non-Alliance) FCTC field description - Fields containing native and non-native graminoid, herbaceous, and shrub species. Usually drymesic with sandy soils on flatter areas. Could transform into native wooded or prairie type depending upon management. Some of these areas have been planted with native prairie grass. Common species: raspberries/blackberries (*Rubus* spp.), spotted knapweed (*Centaurea maculosa*), wild bergamot (*Monarda fistulosa*), bush clovers (*Lespedeza* spp.), wild carrot (*Daucus carota*), timothy (*Phleum pratense*), quack grass (*Agropyron repens*), big bluestem (*Andropogon gerardii*), broomsedge (*Andropogon virginicus*), Canada bluegrass (*Poa compressa*), and smooth brome (*Bromus inermis*) (Thomas et al., 2009).

Vernal Wetland. FCTC field description - Wet, inundated pockets surrounded by upland forest. Sandy clay bottoms. Largely unvegetated in spring but by summer likely to contain species such as false nettle (*Boehmeria cylindrica*), clearweeds (*Pilea* spp.), jewelweed (*Impatiens capensis*), and trees seedlings such as red maple (*Acer rubrum*).

Open Water (Non-Alliance) FCTC field description - Lakes, ponds, or other water bodies with no apparent vegetation (Thomas et al., 2009). These were determined to be seasonally occurring (non-perennial) surface waters susceptible to colonization by vegetation.

<u>Plants</u> – FCTC Site 1

An inventory conducted by the MNFI documented 835 species of plants to occur within the FCTC boundary (MDMVA, 2012). Of the 835 documented species, 18 percent (150 species) of this total are comprised of non-native species. The large number of plant species encountered at FCTC is correlated to the diversity of upland and wetland habitats that occur within FCTC.

3.3.3.2.1.1.2 Wildlife – FCTC Site 1

Birds. Bird surveys conducted at FCTC indicate the presence of a variety of avian species using FCTC grassland and forest terrestrial habitats. Some of the species documented at FCTC in grassland habitats include: eastern meadowlark (*Sturnella magna*), horned lark (*Eremophila alpestris*), vesper sparrow (*Pooecetes gramineus*), savanna sparrow (*Passerculus sandwichensis*), bobolink (*Dolichonyx oryzivorus*), and the eastern kingbird (*Tyrannus tyrannus*).

Surveys have documented seventeen forest interior bird species using FCTC habitats. Some of these species include the scarlet tanager (*Piranga olivacea*), wood thrush (*Hylocichla mustelina*), pileated woodpecker (*Dryocopus pileatus*), and Cooper's hawk (*Accipiter cooperi*).

Mammals. FCTC contains a diversity of mammal species. Common species include white-tailed deer (*Odocoileus virginianus*) raccoon, (*Procyon lotor*), southern flying squirrel (*Glaucomys volans*), and meadow vole (*Microtus pennsylvanicus*).

Bat species reliably documented via mist netting and acoustical surveys within FCTC include the big brown bat (*Eptesicus fuscus*), hoary bat (*Lasiurus cinereus*), and red bat (*Lasiurus borealis*) (MDMVA, 2012). Bat biologists conducing acoustical surveys within FCTC concede the presence of Myotis species, though based on call acoustic signatures alone a species assignment would be inconclusive. Bat biologists suggest the calls may likely be the little brown bat (*Myotis lucifugus*) and the eastern pipistrelle (*Pipistrellus subflavus*), the latter of which is a Michigan special concern species (MDMVA, 2012).

Reptiles. Fifteen of the state's 30 species of reptiles have been found at FCTC (Legge et al., 1995; Tobin , 2005).

Insects. A total of 226 species were documented, representing 31 families, from 6 taxonomic orders (Legge et al., 1995).

3.3.3.2.1.2 Aquatic Resources – FCTC Site 1

This section focuses on the fauna that is associated with FCTC aquatic resources. Aquatic resources include the fauna dependent on the hydrologic regimes of wetland and open water resources.

3.3.3.2.1.2.1 Aquatic Habitat – FCTC Site 1

FCTC contains a variety of aquatic habitats. A discussion of water resources and wetlands within the FCTC Site 1 footprint is provided Sections 3.3.14 and 3.2.15, respectively.

3.3.3.2.1.2.2 Aquatic Organisms – FCTC Site 1

Birds. Avian surveys conducted at FCTC have identified 18 avian species associated with wetland and open water habitats. These include a nesting colony of great blue herons (*Ardea herodias*), alder flycatcher (*Empidonax alnorum*), willow flycatcher (*Empidonax traillii*), wood duck (*Aix sponsa*) and pied-billed grebe (*Podilymbus podiceps*).

Fish. Fourteen species of fish have been found at FCTC during a 2-year inventory conducted by MNFI (Legge el al., 1995).

Reptiles. Surveys conducted at FCTC documented the presence of Blanding's turtle (*Emydoidea blandingii*) (Legge et al., 1995), a Michigan special concern species noted to occur state-wide. Blanding's turtle is a semi-aquatic species which inhabits clean, shallow waters with abundant aquatic vegetation and soft muddy bottoms over firm substrates (MNFI, 2016).

Amphibians. Of the amphibians known from Michigan, 14 of the state's 25 species have been found in surveys at FCTC (Legge et al., 1995; Tobin, 2005). All but one of these species (Blanchard's cricket frog, *Acris crepitans blanchardi*), are widely distributed in Michigan. Common frogs and toads in Michigan include: bull frog (*Rana catesbeiana*), eastern American toad (*Bufo americanus americanus*), gray tree frog (*Hyla versicolor* and *Hyla chrysoscelis*), green frog (*Rana clamitans melanota*), northern leopard frog (*Rana pipiens*), northern spring peeper (*Pseudacris crucifer crucifer*), western chorus frog (*Pseudacris triseriata triseriata*), and wood frog (*Rana sylvatica*) (MDNR, 2016).

3.3.3.2.1.3 Special Status Species – FCTC Site 1

Special status species are endangered, threatened, or rare and sensitive species of conservation concern, whether listed at federal or state levels.

Federally-listed species, state-listed species, and species of special concern, and state-listed vegetation communities documented to occur within the FCTC Site 1 footprint are presented in Table 3.3.3-2.

Table 3.3.3-2 Biological Resources Documented within FCTC Site 1 Footprint

Common Name	Scientific Name	Federal Status	State Status
Purple Twayblade	*Liparis liliifolia*	none	special concern
Hooded Warbler	*Wilsonia citrina*	none	special concern
Cerulean Warbler	*Dendroica cerulea*	none	threatened
Eastern Box Turtle	*Terrapene carolina carolina*	none	special concern
Dry-Mesic Southern Forest	N/A	none	S3*
*S3 - Vulnerable in the state due to a restricted range, relatively few occurrences (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation (MNFI, 2016). Source: SDSFIE, 2016.			

3.3.3.2.1.3.1 Federally-Listed Species – FCTC Site 1

The publically available Information for Planning and Conservation Tool (IPaC) developed by the USFWS was queried to identify federally-listed species noted for occurrence in the vicinity of the FCTC Site 1 footprint (USFWS, 2016).

Currently no federal-listed species are known to exist at FCTC (MDMVA, 2012). No critical habitat occurs within or adjacent to FCTC. The following review addresses the potential for the presence of federally-listed threatened and endangered species to occur within the FCTC Site 1 footprint. Federally-listed biological resources with potential for occurrence (suitable habitat) within FCTC is presented in Table 3.3.3-3.

Table 3.3.3-3 Federally-Listed Biological Resources with Potential for Occurrence within FCTC

Common Name	Scientific Name	Federal Status
Indiana bat	*Myotis sodalis*	endangered
Northern long-eared bat	*Myotis septentrionalis*	threatened
Copperbelly watersnake	*Nerodia erythrogaster neglecta*	threatened
Eastern Massasauga	*Sistrurus catenatus*	proposed threatened
Mitchell's satyr	*Neonympha mitchellii mitchellii*	endangered
Monarch butterfly*	*Danaus plexippus plexippus*	under review
*Included for analysis, though the listing status is yet to be determined. Source: USFWS, 2016.		

Mitchell's Satyr Butterfly. The Mitchell's Satyr Butterfly (*Neonympha mitchellii mitchellii*) is a species of butterfly in the Nymphalidae family (brush-footed butterflies). Mitchell's Satyr has been documented to use prairie fen complexes. Fen soils are characterized as peat developed by carbonate-rich groundwater seeps. The prairie fen complexes are usually dominated by sedges (*Carex* spp.). Plant species correlated as essential components of this species habitat include tussock sedge (*Carex stricta*), though scattered tamarack (*Larix laricina*), and poison sumac (*Toxicodendron vernix*) are also noted as present in breeding population habitats.

The FCTC Site 1 footprint contains suitable fen habitat for Mitchell's satyr. Butterfly surveys were completed in 2005 (MDMVA, 2012), with additional focused surveys in 2014 and 2015 (KNC, 2015). Surveys to date have not documented Mitchell's satyr species to occur on FCTC.

Indiana Bat. The Indiana bat (*Myotis sodalis*) is a medium sized bat in the Vespertilionidae family (evening bats). This species uses hibernacula for winter hibernation, with hibernacula predominately occurring as caves in the karst regions of Kentucky, Indiana, and Missouri. Within Michigan, Indiana bats begin colonizing suitable habitats from late April through May. Riparian, bottomland, and upland forests containing a variety of trees with maternity colony requirements (cavities, loose bark, etc.) provide the preferred habitat for this species. Mature dead trees (snags) are an important habitat structure for the species, which use snags for roosting and maternity colonies.

The FCTC Site 1 footprint contains suitable habitat for the Indiana bat. Mist net and acoustic surveys conducted in 1993 found no Indiana bats on FCTC and determined that there was little likelihood of their occurrence due to the type and quality of the limited habitat present (Kurta, 1993). Subsequent mist net and acoustic surveys conducted at FCTC in 2005 resulted in no Indiana bats being detected (Kurta and Foster, 2005). Two additional years of acoustic survey data collected in 2014-2015 within FCTC , including acoustic sample locations within the Site 1 (and Site 2) CIS footprint, also indicated that the bats were not present (CEC, 2015a; CEC, 2015b). Based on the survey results it is expected that Indiana bats do not roost on FCTC.

Northern Long-eared Bat. The northern long-eared bat (*Myotis septentrionalis*) is a medium-sized bat in the Vespertilionidae family (evening bats). This species uses hibernacula for winter hibernation, with hibernacula predominately occurring as caves and mines located across a large region in the United States, including the Midwest, Eastern, and Northeastern states. Within Michigan, northern long-eared bats begin colonizing suitable habitats in late spring. Riparian, bottomland, and upland forests containing a variety of trees with maternity colony requirements (cavities, loose bark, etc.) provide the preferred habitat for this species. Mature dead trees (snags) are an important habitat structure for the species, which uses snags for roosting and maternity colonies.

The FCTC Site 1 footprint contains suitable habitat for the northern long-eared bat. Mist net and acoustic surveys conducted in 1993 found no northern long-eared bats on FCTC and determined that there was little likelihood of their occurrence due to the type and quality of the limited habitat present (Kurta, 1993). Subsequent mist net and acoustic surveys conducted at FCTC in 2005 resulted in no northern long-eared bats being detected (Kurta and Foster, 2005). Two additional years of acoustic survey data collected in 2014-2015 within FCTC, including acoustic sample locations within the Site 1 (and Site 2) CIS footprint, also indicated that this species was not present (CEC, 2015a; CEC, 2015b). Based on the survey results it is expected that northern long-eared bats do not roost on FCTC.

Copperbelly Watersnake. The copperbelly watersnake (*Nerodia erythrogaster neglecta*) is a medium to large sized snake in the Colubridae family (the largest family of snake species, also non-venomous). The copperbelly watersnake is found in wetland habitats, and is considered a relatively terrestrial species of water snake, spending much time outside of water. Wetland habitats used by this species in Michigan have been documented as pond, emergent marsh, wet meadow, shrub swamp, floodplain forest, and hardwood swamp. In general, the species prefers wetland habitats with perennial hydrology and dense shrub or herbaceous vegetation strata. Upland habitats used for hibernation and birthing consist of mesic to dry-mesic forests.

FCTC contains suitable habitat (wetlands) for the copperbelly water snake, in areas within and adjacent to the FCTC Site 1 footprint. To date, this species has not been documented to occur at FCTC.

Eastern Massasauga Rattlesnake. The eastern massasauga rattlesnake (*Sistrurus catenatus*) is a medium-sized venomous rattlesnake in the Viperidae family (pit vipers and vipers). The eastern massasauga inhabits wetland habitats and has been documented to use bogs, fens, peatlands, shrub/carr thickets, wet meadows, emergent marshes, moist grasslands, wet prairies, floodplain forests, and forested swamps within Michigan. Populations in southern Michigan (in proximity to FCTC) are typically associated with open or early to mid-successional wetlands.

Monarch Butterfly. The monarch butterfly (*Danaus plexippus plexippus*) is currently in status review by the USFWS to determine if the species warrants listing under ESA. To date, the 90-

day finding on the petition to list the monarch butterfly resulted in the USFWS stating that the petition presented substantial information indicating that the petition action may be warranted, and that as of December 31, 2014, the USFWS will initiate a status review of the species (79 FR 78775). This species has been documented to occur on FCTC (Legge et al., 1995), and is therefore considered for inclusion in this document, though the future listing status is still to be determined. The federal listing status of this species is noted by the USFWS as "under review". The monarch butterfly has no state-listing status for Michigan.

The following milkweed species, which supply food for monarch larva (Monarch Joint Venture, 2016) were documented to occur within the FCTC installation boundary during a pedestrian survey conducted in 1995 by MNFI staff: common milkweed (*Asclepias syriaca*), swamp milkweed (*Asclepias incarnata*), butterfly milkweed (*Asclepias tuberosa*), poke milkweed (*Asclepias exaltata*), and green milkweed (*Asclepias viridiflora*) (Legge et al., 1995).

The latitude of FCTC is approximated to be 42.29 decimal degrees, which according to Table 3.3.3-4, shows that the peak in monarch abundance (fall migration) occurs from September 3 through September 20 of any given year. During the fall migration monarchs cease to breed and head for their overwintering roosts sites, which for the monarchs coming from the eastern U.S. are several high altitude mountain forest locations in Mexico (Monarch Watch, 2016).

Table 3.3.3-4 Latitude versus Peak in Monarch Abundance - FCTC

Latitude	Peak in Monarch Abundance
45	August 29 – September 10
43	September 3 – September 15
42.29	*FCTC dates approximated between Latitudes 41 and 43*
41	September 8 – September 20
39	September 14 – September 26
Source: Monarch Watch, 2016.	

Adult monarchs (spring, summer, and fall alike) feed on nectaring plants, which include a wide variety of wildflower species which can supply a diet of nectar that can be taken up by the butterfly's specialized feeding tube. Data is currently inconclusive at northern latitudes to determine if the CIS footprint occurs within a distinct migration route. Regardless, the FCTC Site 1 CIS footprint likely contains nearing plants which could be utilized by adult monarchs during fall migration.

3.3.3.2.1.3.2 State-Listed Species – FCTC Site 1

Due to the exhaustive list of Michigan species of special concern noted for Calhoun and Kalamazoo Counties, these species have been omitted from this section. These species can be referenced at http://mnfi.anr.msu.edu/data/specialanimals.cfm. Michigan species of special concern known to occur or have the potential to occur within the FCTC Site 1 footprint is discussed in this EIS as appropriate. A list of state-listed faunal species noted for Calhoun and Kalamazoo Counties is presented in Table 3.3.3-5.

A total of 66 plant species listed as state threatened/endangered are noted to occur in Calhoun and Kalamazoo Counties (MNFI, 2016). Some of the listed species occur on FCTC, and location records were available for review. Based on Spatial Data for Facilities, Infrastructure, and Environment (SDSFIE) FCTC Geographic Information Systems (GIS) data reviewed, no state-listed plants occur within the FCTC Site 1 footprint (SDSFIE, 2016).

<u>Special Concern Species</u> – FCTC Site 1

Vegetation. Purple twayblade, a Michigan special concern species, was documented to occur within the FCTC Site 1 footprint during the 2012 MNFI survey (MDMVA, 2012). Purple twayblade is an orchid and can be recognized by two large basal leaves and when in flower, a short stalk rises above the leaves displaying small purple flowers. According to MNFI, there are a little over 20 known populations of this species documented to occur within the state, though new populations continue to be discovered. Over half of the known populations in Michigan occur in Washentaw and Kalamazoo Counties (MNFI, 2016).

Birds. A variety of raptor species have been documented to use FCTC. The northern harrier (*Circus cyaneus*), a Michigan special concern species, has been documented to use FCTC grassland habitats. The bald eagle (*Haliaeetus leucocephalus*), a Michigan special concern species, has been reported to nest on FCTC installation in 2011 and 2012 (MDMVA, 2012) and continue to nest on FCTC (Richards, 2015). The marsh wren (*Cistothorus palustris*), a Michigan special species of concern, has been documented to use wetland habitats within FCTC.

Reptiles. Surveys conducted at FCTC documented the presence of the eastern box turtle, a Michigan special concern species (Legge et al., 1995; Tobin, 2005). According to the SDSFIE dataset GIS records, this species occurs within the FCTC Site 1 footprint (SDSFIE, 2016). Within Michigan eastern box turtles typically occur in forested habitats with sandy soils near a source of water such as a stream, pond, lake, marsh, or swamp. They also may be found in adjacent thickets, old fields, pastures, or vegetated dunes (MNFI, 2016).

Surveys conducted at FCTC documented the presence of Blanding's turtle (*Emydoidea blandingii*) (Legge et al., 1995), a Michigan special concern species noted to occur state-wide. Blanding's turtle is a semi-aquatic species which inhabits clean, shallow waters with abundant aquatic vegetation and soft muddy bottoms over firm substrates (MNFI, 2016).

Table 3.3.3-5 State-listed Faunal Species in Vicinity of FCTC Site 1 Footprint

Species Name	Scientific Name	State Listing Status	Notes
Birds			
Cerulean Warbler	*Dendroica cerulea*	threatened	Calhoun and Kalamazoo Counties MNFI Occurrence Records, IPaC Trust Resource Report for FCTC, FCTC Site 1 and FCTC Site 2 footprint
Least Bittern	*Ixobrychus exilis*	threatened	IPaC Trust Resource Report for FCTC
Louisiana Waterthrush	*Seiurus motacilla*	threatened	Kalamazoo County MNFI Occurrence Record
Merlin	*Falco columbarius*	threatened	FCTC breeding bird survey
Trumpeter Swan	*Cygnus buccinator*	threatened	FCTC breeding bird survey
Mammals			
Indiana Bat	*Myotis sodalis*	endangered	Calhoun County MNFI County Occurrence Record, IPaC Trust Resource Report for FCTC
Prairie Vole	*Microtus ochrogaster*	endangered	Kalamazoo County MNFI Occurrence Record, FCTC inventory, MDMVA 2012
Least Shrew	*Cryptotis parva*	threatened	Kalamazoo County MNFI Occurrence Record
Reptiles			
Copperbelly Water Snake	*Nerodia erythrogaster neglecta*	endangered	Calhoun County MNFI Occurrence Record, IPaC Trust Resource Report for FCTC
Kirtland's Snake	*Clonophis kirtlandii*	endangered	Kalamazoo County MNFI Occurrence Record
Spotted Turtle	*Clemmys guttata*	threatened	Calhoun and Kalamazoo Counties MNFI Occurrence Records
Amphibians			
Blanchard's Cricket Frog	*Acris crepitans blanchardi*	threatened	Calhoun and Kalamazoo Counties MNFI Occurrence Records, FCTC inventory, MDMVA 2012, Legge et al. 1995
Insects			
Mitchell's Satyr	*Neonympha mitchellii mitchellii*	endangered	Kalamazoo County MNFI Occurrence Record, IPaC Trust Resource Report for FCTC
Regal Fritillary	*Speyeria idalia*	endangered	Calhoun and Kalamazoo Counties MNFI Occurrence Records
Frosted Elfin	*Incisalia irus*	threatened	Kalamazoo County MNFI Occurrence Record
Persius Dusky Wing	*Erynnis persius persius*	threatened	Kalamazoo County MNFI Occurrence Record
Molluscs			
A land snail (no common name)	*Catinella protracta*	endangered	Calhoun County MNFI Occurrence Record
Purple Wartyback	*Cyclonaias tuberculata*	threatened	Kalamazoo County MNFI Occurrence Record
Slippershell	*Alasmidonta viridis*	threatened	Calhoun and Kalamazoo Counties MNFI Occurrence Records
Fish			
Creek Chubsucker	*Erimyzon claviformis*	endangered	Calhoun and Kalamazoo Counties MNFI Occurrence Records
Pugnose Shiner	*Notropis anogenus*	endangered	Calhoun and Kalamazoo Counties MNFI Occurrence Records, FCTC inventory, Legge et al., 1995
Lake Herring	*Coregonus artedi*	threatened	Kalamazoo County MNFI Occurrence Record
River Redhorse	*Moxostoma carinatum*	threatened	Calhoun County MNFI Occurrence Record
Sources: MDMVA, 2012; MNFI, 2016.			

Fish. Surveys conducted at FCTC documented the presence of the pugnose shiner (*Notropis anogenus*), a Michigan special concern species. This species was found in a small lake within the northern region of FCTC, and is connected to the offsite Hart's Lake via a small tributary. FCTC has few tributaries, with most water resources occurring as densely vegetated wetlands. A low number of species was encountered during site surveys conducted at FCTC due to the lack of suitable habitat (MDMVA, 2012).

Insects. Surveys conducted at FCTC for terrestrial insects have included a wide variety of sampling techniques designed to locate specific species. To date, only three rare species have been documented to occur on FCTC. One of these is the Sprague's pygarctia (*Pygarctia spraguei*), a species of tiger moth (Legge et al., 1995). Sprague's pygarctia is a Michigan special concern species. The species was captured in a degraded oak opening. Aside from this location, only four other locations are known for the documentation of this species in Michigan (MNFI, 2016). Sprague's pygarctia is found in openings of oak barrens, oak-pine barrens, prairie, old fields, savanna, and dry hardwood and forest opening habitats wherever the larval host plant flowering spurge (*Euphorbia corollata*) is found (MNFI, 2016).

The two other Michigan special concern insect species documented to occur on FCTC are species of leafhoppers; *Flexamia delongi*, and *Flexamia reflexus* (no common names). *Flexamia delongi* is obligate to little bluestem (*Schizachyrium scoparium*), a common native species of grass which has been recorded to occur on FCTC (MDMVA, 2012). Little bluestem grass is commonly found growing in prairies, savannas, and glades. *Flexamia reflexus* is obligate to indiangrass (*Sorghastrum nutans*), a common native species of grass which has been recorded to occur on FCTC (MDMVA, 2012). Indian grass is commonly found growing on prairies, savannas, and wet meadows.

Molluscs. Surveys conducted at FCTC documented the presence of the watercress snail (*Fontigens nickliniana*), a Michigan special concern species. This species is found on watercress (*Nasturtium officinale*), an exotic plant which grows in cool, clear water in springs, and spring-fed streams (MNFI, 2016). Four locations were discovered to contain this species within FCTC (MDMVA, 2012).

3.3.3.2.1.3.3 Birds of Conservation Concern – FCTC Site 1

Based on the IPaC Trust Resource Report generated for FCTC, a total of 23 bird species of conservation concern are noted to occur in the general vicinity of FCTC. Table 3.3.3-6 summarizes the birds of conservation concern as provided in the IPaC Trust Resource Report.

Table 3.3.3-6 Birds of Conservation Concern – FCTC Sites 1 and 2

Common Name	Scientific Name	State Status	Notes*
American Bittern	*Botaurus lentiginosus*	special concern	Kalamazoo County MNFI Occurrence Record, IPaC Trust Resource Report for FCTC
Bald Eagle	*Haliaeetus leucocephalus*	special concern	Calhoun and Kalamazoo Counties MNFI Occurrence Records, IPaC Trust Resource Report for FCTC, FCTC breeding bird surveys
Black Tern	*Chlidonias niger*	special concern	IPaC Trust Resource Report for FCTC
Black-billed Cuckoo	*Coccyzus erythropthalmus*		IPaC Trust Resource Report for FCTC
Blue-winged Warbler	*Vermivora pinus*		IPaC Trust Resource Report for FCTC
Bobolink	*Dolichonyx oryzivorus*		IPaC Trust Resource Report for FCTC, FCTC breeding bird surveys
Brown Thrasher	*Toxostoma rufum*		IPaC Trust Resource Report for FCTC
Cerulean Warbler	*Dendroica cerulea*	threatened	Calhoun and Kalamazoo Counties MNFI Occurrence Records, IPaC Trust Resource Report for FCTC, FCTC Site 1 footprint
Common Tern	*Sterna hirundo*		IPaC Trust Resource Report for FCTC
Dickcissel	*Spiza americana*	special concern	Calhoun and Kalamazoo Counties MNFI Occurrence Records, IPaC Trust Resource Report for FCTC, FCTC breeding bird surveys
Golden-winged Warbler	*Vermivora chrysoptera*		IPaC Trust Resource Report for FCTC
Henslow's Sparrow	*Ammadramus henslowii*	endangered	Calhoun and Kalamazoo Counties MNFI Occurrence Records, IPaC Trust Resource Report for FCTC, FCTC breeding bird survey
Least Bittern	*Ixobrychus exilis*	threatened	IPaC Trust Resource Report for FCTC
Marsh Wren	*Cistothorus palustris*	special concern	IPaC Trust Resource Report for FCTC
Peregrine Falcon	*Falco peregrinus*	endangered	Calhoun County MNFI Occurrence Record, IPaC Trust Resource Report for FCTC
Pied-billed Grebe	*Podilymbus podiceps*		IPaC Trust Resource Report for FCTC, FCTC breeding bird surveys
Prothonotary Warbler	*Protonotaria citrea*	special concern	Calhoun and Kalamazoo Counties Occurrence Records, IPaC Trust Resource Report for FCTC
Red-headed Woodpecker	*Melanerpes erythrocephalus*		IPaC Trust Resource Report for FCTC
Rusty Blackbird	*Euphagus carolinus*		IPaC Trust Resource Report for FCTC
Short-eared Owl	*Asio flammeus*	endangered	IPaC Trust Resource Report for FCTC
Upland Sandpiper	*Bartramia longicauda*		IPaC Trust Resource Report for FCTC
Willow Flycatcher	*Empidonax traillii*		IPaC Trust Resource Report for FCTC, FCTC breeding bird surveys
Wood Thrush	*Hylocichla mustelina*		IPaC Trust Resource Report for FCTC, FCTC breeding bird surveys
Sources: USFWS, 2016; MDMVA, 2012; MNFI, 2016.			

3.3.3.2.2 FCTC Site 2

The affected environment description provided for FCTC Site 1 applies to FCTC Site 2 except for the information in the following sections.

3.3.3.2.2.1 Terrestrial Environments - FCTC Site 2

Biological survey data referenced for this review was obtained through communication with FCTC. Federally-listed species, state-listed species, and species of concern, and state-listed vegetation communities documented to occur within terrestrial environments of FCTC Site 2 footprint are listed in Table 3.3.3-7.

Table 3.3.3-7 Biological Resources Documented within FCTC Site 2 Footprint

Common Name	Scientific Name	Federal Status	State Status
Cut-leaved Water Parsnip	*Berula erecta*	none	threatened
Goldenseal	*Hydrastis canadensis*	none	threatened
Upland Boneset	*Eupatorium sessilifolium*	none	threatened
Queen-of-the-Prairie	*Filipendula rubra*	none	threatened
Showy Orchis	*Galearis spectabilis*	none	threatened
Ginseng	*Panax quinquefolius*	none	threatened
Stiff Gentian	*Gentianella quinquefolia*	none	threatened
Hooded Warbler	*Wilsonia citrina*	none	special concern
Cerulean Warbler	*Dendroica cerulea*	none	threatened
Eastern Box Turtle	*Terrapene Carolina carolina*	none	special concern
Watercress Snail	*Fontigens nickliniana*	none	special concern
Dry-Mesic Southern Forest	N/A	none	S3*
Prairie Fen	N/A	none	S3*
Southern Hardwood Swamp	N/A	none	S3*
*S3 - Vulnerable in the state due to a restricted range, relatively few occurrences (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation (MNFI, 2016). Source: SDSFIE, 2016.			

3.3.3.2.2.1.1 Vegetation Communities – FCTC Site 2

The general discussion regarding vegetation communities within FCTC Site 2 footprint is based on the same information reviewed for FCTC Site 1.

<u>Vegetation Alliances</u> – FCTC Site 2

The FCTC Site 2 footprint was overlaid onto MNFI (2009) plant alliance mapping data to determine which alliances occur within the footprint. A total of ten recognizable vegetation alliances, and two non-alliance habitat features are noted to occur within the FCTC Site 2 footprint as shown on Figure 3.3.3-2. Field descriptions reflect the state of these alliances as they occurred on FCTC in 2009. These alliances and features are listed in Table 3.3.3-8 and described in the following paragraphs.

Table 3.3.3-8 Vegetation Alliances within the FCTC Site 2 Footprint

Vegetation Alliance Type	Estimated Acreage
White Oak – (Northern Red Oak, Hickory species) Forest Alliance.	91.69
Skunk-cabbage – Yellow Marsh-marigold Saturated Herbaceous Alliance.	5.66
American Beech – Sugar Maple – (Tuliptree) Forest Alliance.	5.65
Green Ash - American Elm - (Common Hackberry, Sugarberry) Temporarily Flooded Forest Alliance.	1.92
Black Ash - Red Maple Saturated Forest Alliance.	34.63
Common Buttonbush Semipermanently Flooded Shrubland Alliance.	0.36
Northern Red – (Sugar Maple) Forest Alliance.	42.2
Red-osier Dogwood – Willow species Seasonally Flooded Shrubland Alliance.	0.81
Tussock Sedge Seasonally Flooded Herbaceous Alliance (isolated, inundated).	1.02
Tussock Sedge Seasonally Flooded Herbaceous Alliance (non-isolated, free draining).	2.31
Potential Vegetation Alliance(s) (Non-Alliance).	640.51
Open Water (Non-Alliance).	3.4
Total	**830**

White Oak – (Northern Red Oak, Hickory species) Forest Alliance (see description provided in FCTC Site 1 – Vegetation Alliances). Note that the white oak – (Northern red oak, hickory species) Forest Alliance corresponds to the Dry-mesic Southern Forest S3 vegetation community. Dry-mesic Southern Forest is listed as an S3 vegetation community within Michigan (MNFI, 2016).

Skunk-cabbage – Yellow Marsh-marigold Saturated Herbaceous Alliance. FCTC field description - Open to semi-shrubby wetlands with groundwater flow at or below the surface. Muck soils on gentle to moderate slopes. Common species: poison sumac *(Toxicodendron vernix),* silky dogwood *(Cornus amomum),* willows *(Salix* spp.*),* spicebush *(Lindera benzoin),* red-osier dogwood *(Cornus stolonifera),* winterberry *(Ilex verticillata),* elderberry *(Sambucuscanadensis),* marsh timothy/satin grass *(Muhlenbergia* spp.), skunk cabbage *(Symplocarpus foetidus),* swamp goldenrod *(Solidago patula),* spring cress *(Cardamine sp.),* golden ragwort *(Senecio aureus),* marsh marigold *(Caltha palustris),* sedges *(Carex* spp.), willowherb *(Epilobium coloratum),* sensitive fern *(Onoclea sensibilis),* and joe-pyeweed *(Eupatorium maculatum).*

American Beech – Sugar Maple – (Tuliptree) Forest Alliance. FCTC field description - Forested uplands. Mesic or dry-mesic, sometimes wet-mesic, on sandy or loamy soils. Often on steep slopes, in ravines, on north slopes, and where there is some protection from fire. Common species: basswood *(Tilia americana),* sugar maple *(Acer saccharum),* black cherry *(Prunus serotina),* red oak *(Quercus rubra),* American beech *(Fagus grandifolia),* tulip tree *(Liriodendron tulipifera),* red maple *(Acer rubrum),* sometimes black oak *(Quercus velutina) or* white oak *(Quercus alba),* and spring beauty *(Claytonia virginica).*

Green Ash - American Elm - (Common Hackberry, Sugarberry) Temporarily Flooded Forest Alliance. FCTC field description - Forested wetlands. Wet to wet-mesic terraces adjacent to streams. Muck soil or high organic mineral soil. Flat to gently sloped. Common species: American elm *(Ulmus americana),* basswood *(Tilia americana),* black walnut *(Juglans nigra),* red maple *(Acer rubrum),* swamp white oak *(Quercus bicolor),* hackberry *(Celtis occidentalis),* tulip tree *(Liriodendron tulipifera*), musclewood *(Carpinus caroliniana),* spicebush *(Lindera benzoin),* poison ivy *(Toxicodendron radicans*), and skunk cabbage *(Symplocarpus foetidus).* On slightly higher points, sugar maple *(Acer saccharum),* black cherry *(Prunus serotina), and* red oak *(Quercus rubra).*

Black Ash - Red Maple Saturated Forest Alliance. FCTC field description - Forested or densely shrubby wetlands with groundwater flow at or below the surface. Muck soils on gentle to steep slopes. Common species: red oak *(Quercus rubra),* musclewood *(Carpinus caroliniana),* ironwood *(Ostrya virginiana),* chinquapin oak *(Quercus muehlenbergii),* basswood *(Tilia americana),* shagbark hickory *(Carya ovata),* black ash *(Fraxinus nigra),* red maple *(Acer rubrum),* swamp white oak *(Quercus bicolor*) (in more open areas), spicebush *(Lindera benzoin),* skunk cabbage *(Symplocarpus foetidus),* sharplobed hepatica *(Hepatica acutiloba),* sedges *(Carex* spp.*)*, golden ragwort *(Senecio aureus),* and spring cress *(Cardamine spp.).*

Common Buttonbush Semipermanently Flooded Shrubland Alliance. FCTC field description - Shrubby wetlands. Wet and inundated in spring (24 to 36 inches or more standing water in deepest areas). Clayey or silty loam bottoms. Closed depressions. Common species: buttonbush *(Cephalanthus occidentalis),* southern blue flag *(Iris virginica),* and small duckweed *(Lemna minor).*

Northern Red – (Sugar Maple) Forest Alliance. See description provided for FCTC Site 1 Vegetation Alliances, Section 3.3.3.2.1.1.1.

Red-osier Dogwood – Willow species Seasonally Flooded Shrubland Alliance. See description provided for FCTC Site 1 Vegetation Alliances, Section 3.3.3.2.1.1.1.

Tussock Sedge Seasonally Flooded Herbaceous Alliance (isolated, inundated). See description provided for FCTC Site 1 Vegetation Alliances, Section 3.3.3.2.1.1.1.

Tussock Sedge Seasonally Flooded Herbaceous Alliance (non-isolated, free draining). See description provided for FCTC Site 1 Vegetation Alliances, Section 3.3.3.2.1.1.1.

Potential Vegetation Alliance(s). See description provided for FCTC Site 1 Vegetation Alliances Section, 3.3.3.2.1.1.1.

Field (Non-Alliance). See description provided for FCTC Site 1 Vegetation Alliances, Section 3.3.3.2.1.1.1.

Open Water (Non-Alliance). See description provided for FCTC Site 1 Vegetation Alliances, Section 3.3.3.2.1.1.1.

Plants – FCTC Site 2

The plant inventory described for FCTC Site 1 in Section 3.3.3.2.1.1 applies to FCTC Site 2.

3.3.3.2.2.1.2 Wildlife – FCTC Site 2

Birds. The same information provided for FCTC Site 1 regarding general avian species and use applies to FCTC Site 2 with the following exception: grassland bird species (including songbirds and raptors) would be of limited occurrence within the FCTC Site 2 footprint as no open grassland habitats are noted to occur within this area.

Mammals. The same information presented for FCTC Site 1 mammals applies to FCTC Site 2 with the following exception: grassland mammal species (including voles and ground squirrels) would not be expected to occur within the FCTC Site 2 footprint as no open grassland habitats are noted to occur within this area.

Insects. The same information presented for FCTC Site 1 insects applies to FCTC Site 2 with the following exception: grassland leafhopper species (*Flexamia delongi, Flexamia reflexus*) would be of limited occurrence within the FCTC Site 2 footprint as no open grassland habitats are noted to occur within this area which would support large populations of the host plants for these insect species.

3.3.3.2.2.2 Aquatic Resources – FCTC Site 2

A discussion of wetlands and water resources within the FCTC Site 2 footprint is provided in Section 3.3.14 Water Resources and 3.3.15 Wetlands.

3.3.3.2.2.2.1 Aquatic Habitat – FCTC Site 2

Information on aquatic habitat is provided in Sections 3.3.14 Water Resources and 3.3.15 Wetlands.

3.3.3.2.2.2.2 Aquatic Organisms – FCTC Site 2

Reptiles. The information provided for FCTC Site 1 regarding reptiles applies to FCTC Site 2 with the following exception: the presence of prairie fen within the FCTC Site 2 footprint may provide more suitable habitat for Blanding's turtle and the eastern massasauga rattlesnake than FCTC Site 1 footprint habitats.

Amphibians. The information provided for FCTC Site 1 regarding amphibians applies to FCTC Site 2 with the following exception: the presence of prairie fen within the FCTC Site 2 footprint may provide more suitable habitat for Blanchard's cricket frog than FCTC Site 1 footprint habitats.

Molluscs. The information provided for FCTC Site 1 regarding molluscs applies to FCTC Site 2 with the following exception: the presence of spring seeps within the FCTC Site 2 footprint may provide more suitable habitat for the watercress snail than FCTC Site 1 footprint habitats.

3.3.3.2.2.3 Special Status Species – FCTC Site 2

Special status species are endangered, threatened, or rare and sensitive species of conservation concern, whether listed at federal or state levels.

Federally-listed species, state-listed species, and species of special concern, and state-listed vegetation communities documented to occur within terrestrial environments of the FCTC Site 2 footprint are presented in Table 3.3.3-4.

Federally-Listed Species – FCTC Site 2

No federally-listed species have been recorded to occur within the FCTC Site 2 footprint. The federally-listed species information presented for FCTC Site 1 applies to FCTC Site 2 with the following exception: FCTC Site 2 may contain suitable habitat for the eastern massasauga rattlesnake in wetlands that occur adjacent to boundaries of Fort Custer Recreation Area and Hart's Lake (Michele Richards, FCTC personal communication, December 17, 2015), both of which have previously documented the species utilizing wetland habitats within their borders. Though FCTC Site 2 is in proximity to recorded sightings and may contain suitable habitat, a 3-year survey for the eastern massasauga rattlesnake was conducted on FCTC with no documentation of the species being present within the installation (MDMVA, 2012). This could be due to low prey (crayfish) populations, fluctuating water levels in wetlands, and past agricultural use (MDMVA, 2012). As of the date of this EIS, the eastern massasauga rattlesnake has not been documented to occur within FCTC.

State-Listed Species – FCTC Site 2

A total of 66 plant species listed as state-threatened or endangered are documented for occurrence in Calhoun and Kalamazoo Counties (MNFI, 2016). Some of the listed species occur on FCTC and location records were available for review. Based on SDSFIE FCTC GIS data, seven Michigan threatened plant species occur within the FCTC Site 2 footprint (SDSFIE, 2016). These are cut-leaved water parsnip, goldenseal, upland boneset, queen-of-the-prairie, showy orchis, ginseng, and stiff gentian.

Cut-leaved water parsnip (*Berula neglecta*) and queen-of-the-prairie (*Filipendula rubra*) have been documented to occur within the FCTC Site 2 footprint. Cut-leaved water parsnip, a member of the carrot family (*Apiaceae*) exhibits the characteristic umbel of small flowers like most members of this family. Queen-of-the-prairie, a member of the rose family (Rosaceae), is recognized by a showy inflorescence of small pink flowers. Both plant species are correlated to the Prairie Fen S3 vegetation community. Of a list of rare plants and animals described by MNFI as associated with Prairie Fen, the FCTC Site 2 footprint has been documented to contain three. These include two plants; Cut-leaved water parsnip, queen-of-the-prairie; and one reptile – Eastern box turtle. These correlate directly to those species listed in Table 3.3.3-4, and further corroborate the presence and habitat function of Prairie Fen within the FCTC Site 2 footprint.

Goldenseal (*Hydrastis canadensis*), ginseng (*Panax quinquefolius*), stiff gentian (*Gentianella quinquefolia*), and showy orchis (*Galearis spectabilis*) have been documented to occur within the FCTC Site 2 footprint. Goldenseal, a member of the buttercup family (*Ranunculaceae*), is so named because its' roots are bright yellow. Ginseng, a member of the ginseng family (*Araliaceae*), is often sought for reputed medical properties thought to reside in the root. Stiff gentian, a member of the gentian family (*Gentianaceae*) is an annual to biennial wildflower found in wet soil. Showy orchis, a member of the orchid family (*Orchidaceae*) is recognized by two basal leaves and single thick flower stalk bearing from one to ten pink flowers. These four plant species are correlated to the Southern Hardwood Swamp S3 vegetation community.

As mentioned previously, upland boneset has been documented to occur within the FCTC Site 2 footprint and correlates to the Dry-Mesic Southern Forest S3 vegetation community, which is synonymous to The White Oak – (Northern Red Oak, Hickory species) Forest Alliance.

Special Concern Species – FCTC Site 2

Birds. Similar to discussion for FCTC Site 1 Special Concern Species, Section 3.3.3.2.1.3.3 with the following exceptions: due to the absence of grassland habitat the northern harrier would not be expected to occur within the FCTC Site 2 footprint.

The hooded warbler (*Wilsonia citrina*), a Michigan special concern species, has been reported to occur within the FCTC Site 2 footprint. Preferred habitat in Michigan includes American Beech – Sugar Maple – (Tuliptree) Forest Alliances and floodplain forests (MNFI, 2016). The preferred habitat forest alliance occurs within the FCTC Site 2 footprint.

Reptiles. See discussion for FCTC Site 1 Special Concern Species, Section 3.3.3.2.1.3.3.

Fish. See discussion for FCTC Site 1 Special Concern Species, Section 3.3.3.2.1.3.3.

Insects. Similar to discussion for FCTC Site 1 Special Concern Species, Section 3.3.3.2.1.3.3 with the following exception: Due to the absence of grassland habitat, the leafhoppers *Flexamia* *delongi*, and *Flexamia reflexus* (no common names) would not be expected to occur within the FCTC Site 2 footprint.

Molluscs. The watercress snail, a Michigan special concern species, has been documented to occur within the FCTC Site 2 footprint. This species is found on watercress, an exotic plant which grows in cool, clear water in springs, and spring-fed streams (MNFI, 2016). Four locations were discovered to contain this species within FCTC (MDMVA, 2012).

<u>Birds of Conservation Concern</u> – FCTC Site 2

The birds of conservation concern information presented for the FCTC Site 1 Footprint applies to the FCTC Site 2 footprint with the following exception: grassland bird species (including songbirds and raptors) would be of limited occurrence within the FCTC Site 2 footprint as no open grassland habitats are noted to occur within this area.

3.3.3.3 Environmental Consequences and Mitigation – Biological Resources – FCTC Sites

3.3.3.3.1 Construction – Baseline Schedule

3.3.3.3.1.1 Environmental Consequences

The potential impacts to existing biological resources from construction of the CIS at FCTC Sites 1 and 2 are discussed in this section.

3.3.3.3.1.1.1 FCTC Site 1

The major CIS construction phases are discussed in Section 2.5.1. The FCTC Site 1 footprint is approximately 1,008 acres, of which 805 acres would be cleared and graded. Existing vegetation would be cleared, including grubbing tree roots, and the site would be graded during CIS construction to produce a level site. Construction of the CIS at FCTC Site 1 would remove approximately 230 acres of grassland and 575 acres of forest. Impacts to water resources and wetlands due to construction of the CIS are detailed in Sections 3.3.14 and 3.3.15, respectively.

<u>Terrestrial Resources</u> – FCTC Site 1

Vegetation Alliances. All vegetation alliances within the FCTC Site 1 footprint (805 acres) would be lost due to mechanical clearing, grubbing, and cut/fill activities. The result of site construction activities would be a flat surface that would be stabilized with maintained turf grasses. By definition, maintained turf grass areas are not considered a vegetation alliance (FGDC, 2008).

The loss of the white oak – (Northern red oak, hickory species) Forest Alliance (Dry-mesic Southern Forest S3 vegetation community) would be a minor impact. Dry-mesic Southern Forest is listed as an S3 vegetation community within Michigan, and within the FCTC Site 1 footprint may contain the purple twayblade, Eastern box turtle, hooded warbler, and the cerulean warbler.

Dry-mesic Southern Forest vegetation communities remaining in Michigan are primarily secondary growth and are not subject to prescribed fire, a management activity which promotes regeneration and maintenance of this vegetation community. The loss of this vegetation community from FCTC Site 1, regardless of quality, might increase the conservation needs of the remaining Dry-mesic Southern Forest vegetation communities in Michigan.

Plants. An indirect minor impact to plant diversity at FCTC could result from increasing edge habitat resulting from clearing 805 acres for the FCTC Site 1 footprint. Edge habitat often provides adequate opportunities for the establishment of non-native species. According to the INRMP (2012), a total of 153 non-native and introduced plant species were documented to occur within FCTC, 17 percent of which are considered invasive. Though not an exhaustive list of invasive species, glossy buckthorn (*Rhamnus frangula*), purple loosestrife (*Lythrum salicaria*), garlic mustard (*Alliaria petiolata*), and autumn olive (*Elaeagnus umbellata*) currently occur on FCTC and have the ability to increase in disturbed habitats and spread into conservative vegetation alliances.

Birds. The loss of all vegetation alliances within the FCTC Site 1 footprint would result in negligible indirect impacts to all avian species currently using the area. Most notable would be the loss of interior forest areas and the white oak – (Northern red oak, hickory species) Forest Alliance.

Grassland areas converted to maintained turf grasses may not be able to provide essential habitat for grassland birds such as the dickcissel, eastern meadowlark, horned lark, vesper sparrow, savanna sparrow, bobolink, eastern kingbird, and grasshopper sparrow, though the loss of such habitat would be considered a negligible impact to these widespread species.

The active bald eagle nest located northeast of Whitman Lake is located approximately 1,500 feet north of the FCTC Site 1 CIS footprint. According to the *National Bald Eagle Management Guidelines* (USFWS 2007), it is recommended that construction activities be conducted no closer than 330 of the nest, though where the activity is clearly visible from the nest, the recommended buffer increases to 660 feet. hese buffer distances are recommended for voluntary compliance only. Based on these recommendations and distance of the bald eagle nest from the CIS footprint boundaries, the construction/operation of the FCTC Site 1 CIS would not result in a disruption to bald eagle nesting activities at the know nest location.

Impacts to birds under the baseline construction schedule would likely be most prevalent during the site clearing phase of the project when trees, shrubs, and other vegetation are removed. However, to the extent practicable, the site clearing process would be scheduled to coincide with the non-nesting periods of local and migratory bird life cycles when bird populations (particularly brooding parents and nesting eggs and young) are more mobile and less vulnerable to construction-induced disturbances. Although this measure would not completely eliminate all impacts to birds, it would reduce them to a level of negligible impact.

Current MBTA regulations authorize permits for take of migratory birds for activities such as scientific research, education, and depredation control, though there is no permit systems for the incidental take of migratory birds associated with otherwise lawful activities. Section 315 of the NDAA (2003) exempts military readiness activities of the Armed Forces from the take prohibitions of the MBTA. BTA Regulations implementing Section 315 state that the Armed Forces may take migratory birds incidental to military readiness activities and requires that for their activities that may result in a significant adverse effect on a population of a migratory bird species, they must confer and cooperate with the USFWS to develop appropriate and reasonable conservation measures to minimize or mitigate identified significant adverse effects (50 CFR Part 21.15).

To address this issue, MBTA-protected species noted to use habitats on FCTC were reviewed to determine if any such species populations would be significantly adversely affected by the development and operation of the FCTC Site 1 CIS. A list of all avian species noted to utilize FCTC habitats is summarized in the FCTC INRMP (MDMVA 2012), and is based on both breeding bird and raptor surveys conducted within the FCTC boundary. It was determined that of the MBTA protected species noted to utilize FCTC habitats none would be subject to significant adverse effects at the population level considering construction and operational activities for the CIS.

Mammals. The removal of all vegetation alliances within the CIS footprint would result in the displacement of many mammal species. Perimeter fencing would directly impede the movement of larger mammals. Mammal species affected by fencing would include, but not be limited to deer, coyote (*Canis latrans*), raccoon, red fox (*Vulpes vulpes volva*) and opossum (*Didelphus virginiana*).

Small, grassland mammal species such as the meadow vole, thirteen-lined ground squirrel, and the prairie vole would be directly impacted by land clearing activities. Although not documented for occurrence within the FCTC Site 1 footprint, the large grassland area within the footprint may currently provide suitable habitat for these species, which have been documented to use the FCTC installation.

The thirteen-lined ground squirrel prefers short vegetation and may possibly benefit from the maintained turf grass area planned for the CIS footprint. This species needs to see over vegetation when it stands on its hind legs. Examples of suitable habitat used by the thirteen-lined ground squirrel include golf courses, cemeteries, parks, roadsides, and airport lands as these are maintained as short, turf grass areas (Illinois State Museum, 2016).

The big brown bat, hoary bat, and red bat would be indirectly adversely affected by loss of available foraging/roosting habitat by converting the CIS footprint to a managed turf grass area. The little brown bat and the eastern pipistrelle would be similarly impacted, though their presence within FCTC is based on interpretation of call frequency only, as these later two species have not been captured via mist-net surveys on FCTC.

Aquatic Resources – FCTC Site 1

Birds. The loss of vegetation alliances and open water features within the FCTC Site 1 footprint would result in indirect impacts to all avian species currently using wetland and open water habitats within the CIS footprint. Based on aerial mapping and land cover data, it appears that true open water habitat within the FCTC Site 1 footprint is limited to two locations, both identified as Open Water (Non-Alliance) (Thomas et. al., 2009). These habitats would be filled by construction earth moving activities.

Large bodies of open water exist to the north of the FCTC Site 1footprint and may provide suitable habitat for wetland birds. Bird species associated with wetland and open water habitats at FCTC are predominately migratory species, and clearing and grading would be conducted outside of the primary nesting season, then no direct impacts would occur to these species. Indirect impacts would be minor and would include the loss of aquatic habitat for breeding/foraging opportunities.

Amphibians. The loss of wetland vegetation alliances and open water (non-alliances) within the FCTC Site 1 footprint would result in direct and indirect impacts to all amphibian species currently using wetland and open water habitats within the CIS footprint. If present, construction would directly impact amphibian species. Indirect impacts would include habitat conversion to a managed lawn within the cleared area of the CIS. Amphibians are susceptible to adverse impacts resulting from water quality degradation. During construction BMPs would be implemented for controlling offsite sedimentation and runoff in order to minimize adverse impacts to offsite water quality.

Special Status Species (Federal and State) – FCTC Site 1

Plants. The loss of the white oak – (northern red oak, hickory species) Forest Alliance would result in direct impacts to the purple twayblade, which has previously been noted to occur within the FCTC Site 1 footprint. This orchid is a Michigan special concern species. There are numerous other documented locations of this plant species throughout the state. Purple twayblade has scattered occurrences throughout the southern half of Michigan's Lower Peninsula. Though rare and scattered within Michigan, the population status in North America is apparently secure (MNFI, 2016). Considering this information, the direct loss of the purple twayblade within the FCTC Site 1 footprint due to land clearing activities would be considered a negligible impact.

Birds. A single state-listed threatened species, the cerulean warbler, has been documented to occur within the FCTC Site 1 footprint. Impacts due to clearing and grading of the CIS may include the destruction of nests, eggs, or disturbance during breeding. Indirect impacts would include the loss of breeding/foraging habitat within the FCTC Site 1 footprint. The hooded warbler, if present, would be subject to direct impacts if disturbed during the primary nesting season. The loss of a block of interior forest habitat would result in fragmenting remaining interior forest habitat otherwise available for the cerulean and hooded warbler.

The state-listed threatened prairie warbler may be directly impacted by construction activities conducted during the primary nesting season, though this species has not specifically been identified to occur within the FCTC Site 1 footprint. If present, impacts may include the destruction of nests, eggs, or disturbance during breeding.

The state-listed threatened Henslow's sparrow may be directly impacted by construction activities conducted during the primary nesting season, though this species has not specifically been identified to occur within the FCTC Site 1 footprint. If present, impacts may include the destruction of nests, eggs, or disturbance during breeding. The grassland habitat available within the FCTC Site 1 footprint may attract Henslow's sparrows, though the current intensive use of the area by motorized equipment for maneuver training may limit nesting opportunities for this species.

Many birds of conservation concern listed in the IPaC Trust Resource Report list have been documented within the FCTC installation boundary, though specific locations of sightings are not available. No direct impacts would occur to adult birds of conservation concern by construction of the CIS. Young birds of conservation concern may be vulnerable to destruction by land clearing activities. Indirect impacts to birds of conservation concern would include the loss of breeding/foraging habitat within the FCTC Site 1 footprint.

Mammals. One state-listed endangered mammal species, the prairie vole (*Microtus ochrogaster*) has been documented to occur within the FCTC installation boundary in dry grassland habitats. Though not specifically documented to occur within the FCTC Site 1 footprint, if present, the species would be directly impacted by construction. Indirect impacts would include the conversion of available habitat to a maintained turf grass area, which would not provide suitable habitat for the species. Within Michigan, the prairie vole is found in a few counties in the southwest corner of the Lower Peninsula. Though occurrences are rare in Michigan, The population of this species is stable throughout its range in North America (MNFI, 2016). Considering this information, impacts to this species due to land clearing activities within the FCTC Site 1 footprint would be negligible.

No threatened/endangered bat species (Indiana bat, Northern Long-eared bat) or hibernacula are documented to occur within FCTC or the FCTC Site 1 footprint. Based on survey data, the construction of the FCTC Site 1 footprint will have no effect on federal or state-listed threatened/endangered species.

Fish. The pugnose shiner, a Michigan special concern species, has been documented to occur in a small lake within the northern region of FCTC, and is connected to the offsite Hart's Lake via a small tributary. The presence of this species has not been confirmed for the open water habitats that occur within the FCTC Site 1 footprint, which appear to have no direct surface water connection to the documented location. During construction BMPs would be implemented for controlling offsite sedimentation and runoff in order to minimize adverse impacts to offsite water quality.

Reptiles. The eastern box turtle, a Michigan special concern species, has been documented to occur within the FCTC Site 1 footprint. Construction would directly affect the species. Indirect impacts would include habitat conversion to a managed turf grass area, and perimeter fencing would present a barrier to the movement of this species, resulting in habitat fragmentation. The managed turf grass area would not provide suitable habitat for this species.

Blanding's turtle, a Michigan special concern species, has been documented to occur within FCTC. The loss of wetland vegetation alliances and open water (non-alliances) within the FCTC Site 1 footprint would result in indirect impacts to all reptile species currently using wetland and open water habitats within the CIS footprint. The Blanding's turtle is a semi-aquatic species which inhabits clean, shallow waters with abundant aquatic vegetation and soft muddy bottoms over firm substrates. If present, construction would directly impact the species. Indirect impacts would include habitat conversion to a managed turf grass area, and perimeter fencing would present a barrier to the movement of this species, resulting in habitat fragmentation. The managed lawn within the cleared area of the CIS would not provide suitable habitat for this species.

Insects. Sprague's pygarctia, a Michigan special concern species, has been documented to occur on FCTC in a degraded oak opening. The removal of all vegetation alliances within the CIS footprint would result in the destruction of a local population of this species, if present. As habitat for this species is very specific, survival by displacement is not likely. Records of occurrence for this species within Michigan are sparse, any impacts to this species or suitable habitat from construction would adversely affect Michigan's population of this insect.

The two other Michigan special concern insect species documented to occur on FCTC (*Flexamia delongi*, and *Flexamia reflexus*) are restricted to habitats that contain their host plants. *Flexamia delongi* is obligate to little bluestem, and *Flexamia reflexus* is obligate to Indian grass. The removal of all vegetation alliances within the CIS footprint which contain little bluestem and indiangrass would result in the destruction of local populations of this species, if present.

The monarch butterfly may be directly impacted by development of the CIS footprint. Adverse direct impacts to the species may include the destruction of monarch caterpillars if present on larval food plants within areas scheduled for land grading activities. Land clearing activities may also result in indirect adverse impacts to the species by the destruction of nearing and larval plant species, which would result in loss of available habitat for the species.

Molluscs. The watercress snail, a Michigan special concern species, has been documented to occur within FCTC. This species is found on watercress, an aquatic plant which grows in cool, clear water in springs, and spring-fed streams. If present within the FCTC Site 1 footprint, the species would be directly impacted by construction. Indirect impacts would include habitat conversion to a managed turf grass area. Watercress is susceptible to water quality degradation. During construction BMPs would be implemented for controlling offsite sedimentation and runoff in order to minimize adverse impacts to offsite water quality.

<u>Lighting</u>

General Wildlife. Nighttime construction activities and associated temporary construction lighting are not expected to be part of CIS construction for most of the baseline construction period. However, for safety reasons, construction activities would require lighting during portions of the fall, winter, and early spring when the length of natural daylight is decreased. Seasonal construction lighting would be used for an estimated 1 to 2 hours in the early morning and 1 to 2 hours in the late afternoon and early evening each workday. Artificial lighting could affect wildlife by altering behaviors and possibly circadian rhythm (Frank, 2006; Beier, 2006).

Lighting effects on wildlife tend to vary considerably, with some individuals and species more sensitive than others. Most wildlife evolved under a reliable cycle of day and night and behavior, certain cycles, predator/prey relationships, and reproduction can be affected by light pollution. Lighting effects can be generalized as follows; artificial lighting tends to:

- Attract some organisms (e.g., moths, mayflies), concentrating them as a food source to be preyed upon. Among those organisms not predated, they can be caught in a light trap that eventually exhausts or kills the trapped animals (Frank, 2006).
- Displace some animals, excluding them from habitat where they might otherwise successfully forage. For example, seed collection by small mammals is reduced in lit areas because of the higher risk of predation (Beier, 2006). The effect is a reduction in the extent of suitable habitat.
- Disrupt foraging behaviors and increase the risk of predation (Beier, 2006; Rydell, 2006).
- Affect the time available for finding forage, shelter, or mates (Wise and Buchanan, 2006).
- Disorient animals that use the stars for navigation, losing their way when exposed to artificial lights (Gauthreaux and Belser, 2006).
- Alter day/night (circadian) patterns, resulting in disturbed sleep patterns, reproductive cycles, and mistiming of certain behaviors, such as foraging (Frank, 2006; Beier, 2006).

For animals that are highly habitat specific, relocation or displacement may not be an option. Under conditions of artificial light these animals may be predated or fail to reproduce at levels that can affect population growth and stability (Wise and Buchanan, 2006). For species that can move to new areas, as lighting encroaches on dark areas, the areas dark enough to move to become fewer, ultimately reducing the available habitat.

The use of security lighting or temporary construction lighting would affect wildlife near the CIS footprint. Because construction activities requiring lighting would be temporary and would largely occur seasonally during the second through fourth years of construction, there would be minimal impact to wildlife from lighting during construction. Much of this impact would be in the form of formerly dark areas and by skyglow, which would be most visible on cloudy nights and would have the same effects as a full moon, reducing prey and predator species activity. It is not expected that constant security lighting would be used during construction because under the baseline construction schedule most work would cease shortly after sundown.

Moths attracted to security lights would be selectively predated by some bat species, but not others. *Myotis* spp. (such as northern long-eared bat) typically avoid lights, so these species would not benefit and they could be adversely affected as a result because of reduced prey species availability. Owl hunting could be reduced in lit areas, potentially affecting reproductive success if additional foraging areas are not available to individuals.

Birds. Over half of the avian species which migrate through some portion of the United States travel at night. Avian taxa (by common name) which practice nocturnal migration include owls, thrushes, thrashers, catbirds, wood warblers, vireos, kinglets, nuthatches, creepers, wrens, gnatcatchers, cuckoos, buntings, rails, woodcocks, tanagers, orioles, blackbirds, bobolinks, and most species of sparrows. Avian taxa (by common name) that migrate either by day or by night include loons, grebes, ducks, geese, swans, shorebirds, swifts, and swallows hummingbirds, auks, and murres (CWBO, 2016).

Of several factors that may encourage nocturnal migration for avian species, scientists have observed that navigation using environmental sensory of light sources may be one. Light, supplied by the moon’s albedo (reflection of sunlight), or stars, is thought to provide navigational cues to avian species aiding in their nighttime journeys to and from summer and winter habitats. Light may play other roles in avian species life history, such as fledging, nesting behavior, and habitat selection, though this review was focused on light impacts and migration.

The impacts of nighttime lighting to avian species, particularly nocturnal migrants, are well documented, with many studies previously conducted at lighted tower sites. Nocturnal neotropical migrants, such as warblers, may be particularly vulnerable to artificial light during migration, as this taxon in general travels at low altitudes, and their attraction to artificial light sources is often combined with collision mortality, such as hitting towers, guy wires, or building windows (Bower, 2000; Todd and Zink, 2011). Artificial light sources may also be used by birds when heavy fog otherwise obscures natural light sources, and birds would be susceptible to collision mortality or become grounded from exhaustion.

The USFWS acknowledges that lighted towers pose a risk to avian species, noting that communication towers pose a significant threat to migratory birds. The USFWS agrees with scientific data indicating that neotropical migratory songbirds, particulary thrushes (*Muscicapidae*), vireos (*Vireonidae*), and warblers (*Parulidae*) are apparently the most vulnerable, and high mortality events are often correlated to foggy, misty, or low-cloud-ceiling nights during migration. Lights on the towers seem to be the primary factor causing large mortality events (NMDGF, 2001).

Nighttime lighting associated with the baseline construction schedule may include temporary work lights on short poles, and headlamps on earthmoving equipment and vehicles, and few aerial obstacles (towers, guy wires, building windows). Thrushes, vireos, and warblers, which are sensitive to nighttime lighting, do occur at FCTC. However, there are no federally-listed species present. The lighting scenario associated with the construction baseline schedule is not expected to result in excessive take nocturnally migrating avian species.

<u>Noise</u>

Wildlife species rely on biologically meaningful sounds for communication, navigation, avoiding danger, and finding food. Noise is any sound generated that alters or interferes with these activities. Disruption from noise may be characterized as disturbance (causing a detectable adverse change in behavior) or harm (adversely affecting health, reproduction, survivorship, habitat use, distribution, or abundance). There are four primary ways animals are adversely affected by noise pollution:

- Hearing loss, resulting from (chronic) noise levels of 85 dB or greater;
- Masking, which is the inability to hear important environmental cues and signals;
- Physiological effects, such as increased heart rate and respiration and general stress reaction; and,
- Behavioral effects resulting in abandonment of territory or lost reproduction opportunities (NSS, 2003).

Site preparation, construction, and utility line installation may temporarily disturb wildlife in the immediate area of construction activities. However, these activities would be limited and intermittent (daily halt to activities and inactive overnight) in duration under the baseline construction schedule, and long-term wildlife disturbance or harm arising from direct auditory impacts are not anticipated. The effects of noise on wildlife vary from no effect to serious in different species and different situations. Behavioral responses to noise also vary from alarm to departure from favorable habitat, due partly to the fact that wildlife can be very sensitive to sounds in some situations (e.g., during breeding) and insensitive to the same sounds in other situations (Larkin, 1996).

Most of the site preparation and construction noise and human activity would be caused by heavy traffic to and from the CIS footprint and the short-term, intermittent use of heavy machinery during construction. The increased human presence may cause birds and other mobile wildlife species to temporarily evacuate areas subject to the highest level of noise and activity. However, noise tends to attenuate with distance (Larkin et al., 1996) so long-term impacts to wildlife from construction noise affecting populations are not anticipated.

Summary of Environmental Consequences

Overall, minor impacts would occur. Loss of suitable habitat for several federally-listed threatened and endangered species would occur from construction of a CIS at FCTC Site 1. Because, however, seasonal restrictions on tree clearing would be implemented to the maximum extent practicable, construction under the baseline schedule may affect, but is not likely to adversely affect federally-listed threatened and endangered species.

3.3.3.3.1.1.2 FCTC Site 2

Terrestrial Resources – FCTC Site 2

Vegetation Alliances. All vegetation alliances within the FCTC Site 2 footprint (831 acres) would be lost due to mechanical clearing, grubbing, and cut/fill activities. The result of site construction activities would be a flat surface that would be stabilized with maintained turf grasses. By definition, maintained turf grass areas are not considered a vegetation alliance (FGDC, 2008).

The loss of the white oak – (northern red oak, hickory species) Forest Alliance (Dry-mesic Southern Forest S3 vegetation community) would be a minor impact. Dry-mesic Southern Forest vegetation communities remaining in Michigan are primarily secondary growth and are not subject to prescribed fire, a management activity which promotes regeneration and maintenance of this vegetation community (MNFI, 2016). The loss of this community from FCTC Site 2, regardless of quality, might increase the conservation needs of the remaining Dry-mesic Southern Forest vegetation communities in Michigan.

The loss of the Prairie Fen S3 vegetation community would be a moderate impact. The Prairie Fen within the FCTC Site 2 footprint may contain cut-leaved water parsnip, queen-of-the-prairie, and eastern box turtle. Prairie Fen vegetation communities remaining in Michigan are primarily not subject to prescribed fire, a management activity which promotes regeneration and maintenance of this vegetation community (MNFI, 2016). The loss of this community from FCTC Site 2, regardless of quality, would increase the conservation needs of the remaining Prairie Fen vegetation communities in Michigan.

The loss of the Southern Hardwood Swamp S3 vegetation community would be a minor impact. The Southern Hardwood Swamp within the FCTC Site 2 footprint may contain goldenseal, ginseng, stiff gentian, showy orchis, and eastern box turtle. Surface and groundwater are the dominant factors for the regeneration and maintenance of this vegetation community (MNFI, 2016). The loss of this community from FCTC Site 2, regardless of quality, would increase the conservation needs of the remaining Southern Hardwood Swamp vegetation communities in Michigan.

Plants. The discussion for FCTC Site 1 in Section 3.3.3.3.1.1.1 would apply to FCTC Site 2.

Birds. The discussion for FCTC Site 1 in Section 3.3.3.3.1.1.1 would apply to FCTC Site 2 with the following exception: grassland bird species (including songbirds and raptors) would be of limited occurrence within the FCTC Site 2 footprint as no open grassland habitats are noted to occur within this area. Construction activities within FCTC Site 2 would have negligible direct and indirect impacts to grassland birds.

Mammals. The discussion for FCTC Site 1 in Section 3.3.3.3.1.1.1 would apply to FCTC Site 2 with the following exception: grassland mammal species (voles and ground squirrels) would be of limited occurrence within the FCTC Site 2 footprint as no open grassland habitats are noted to occur within this area. Construction activities within FCTC Site 2 would have negligible direct and indirect impacts to grassland mammals.

<u>Aquatic Resources</u> – FCTC Site 2

Birds. The discussion for FCTC Site 1 in Section 3.3.3.3.1.1.1 would apply to FCTC Site 2.

Amphibians. The discussion for FCTC Site 1 in Section 3.3.3.3.1.1.1 would apply to FCTC Site 2.

<u>Special Status Species (Federal and State)</u> – FCTC Site 2

Plants. No federally-listed threatened/endangered plant species are known to occur within the FCTC Site 2 footprint. There is potential for many of the state-listed plant species to occur within the FCTC Site 2 footprint, and if present, would be directly lost to construction activities. State-listed threatened plant species documented to occur within the FCTC Site 2 footprint are described below.

The loss of the white oak – (northern red oak, hickory species) Forest Alliance may result in direct impacts to upland boneset, which has previously been noted to occur within the FCTC Site 2 footprint. This plant is a Michigan threatened species. There are few counties in the state which contain populations of this species. The population status in North America is apparently secure (MNFI, 2016). The impact to this species conservation status would be negligible.

The loss of the Prairie Fen vegetation community may result in direct impacts to cut-leaved water parsnip and queen-of-the-prairie, both of which have been previously noted to occur within the FCTC Site 2 footprint and are Michigan threatened species. cut-leaved water parsnip is restricted to growing in cold, headwater streams and seeps, and requires direct sunlight. This species range in Michigan is primarily the western third of the Lower Peninsula. The population status in North America is apparently secure (MNFI, 2016). The impact to this species conservation status would be negligible.

Populations of queen-of-the-prairie within Michigan are restricted to Prairie Fens. There are few counties in the state which contain populations of this species. According to MNFI (2016), only two populations within the state occur on protected land (one population occurs on a nature preserve, and the other occurs on federal land), though no further information was provided regarding location. The population status in North America is apparently secure, though the species is considered rare throughout its range (MNFI, 2016). The impact to this species conservation status would be negligible.

Goldenseal, ginseng, stiff gentian, and showy orchis have been documented to occur within the FCTC Site 2 footprint and are associated with the Southern Hardwood Swamp S3 vegetation community. Goldenseal has scattered occurrences throughout the southern half of Michigan's Lower Peninsula. Though rare and scattered within Michigan, the population status in North America is apparently secure (MNFI, 2016). The impact to this species conservation status would be negligible.

Ginseng has scattered occurrences throughout Michigan and extends to several localities in Michigan's Upper Peninsula. The primary threat to this plant is overharvesting, which requires digging out the root. The roots are reported to have medicinal properties. The population status in North America is vulnerable to apparently secure (MNFI, 2016). The impact to this species conservation status would be negligible.

Stiff gentian has scattered occurrences throughout the southern half of Michigan's Lower Peninsula. Though rare and scattered within Michigan, the population status in North America is apparently secure (MNFI, 2016). The impact to this species conservation status would be negligible.

Showy orchis has scattered occurrences throughout the southern half of Michigan's Lower Peninsula, and several populations occurring in the Northern Peninsula. Though rare and scattered within Michigan, the population status in North America is apparently secure (MNFI, 2016). The impact to this species conservation status would be negligible.

Birds. The discussion for FCTC Site 1 in Section 3.3.3.3.1.1.1 would apply to FCTC Site 2 with the following exception: the state-listed threatened Henslow's sparrow, which occurs within the FCTC Site 1 CIS footprint, would not be expected to nest within the FCTC Site 2 CIS footprint as no grassland habitat is available.

Mammals. The discussion for FCTC Site 1 in Section 3.3.3.3.1.1.1 would apply to FCTC Site 2 with the following exception: the prairie vole, a Michigan endangered species which occurs within the FCTC Site 1 CIS footprint, would not be expected to occur within the FCTC Site 2 footprint as no open grassland habitat is available.

Lighting

Similar lighting impacts to those defined for FCTC Site 1 would occur for FCTC Site 2.

Noise

Similar noise impacts to those defined for FCTC Site 1 would occur for FCTC Site 2.

Summary of Environmental Consequences

Overall, minor impacts would occur. Loss of suitable habitat for several federally-listed threatened and endangered species would occur from construction of a CIS at FCTC Site 2. Because, however, seasonal restrictions on tree clearing would be implemented to the maximum extent practicable, construction under the baseline schedule may affect, but is not likely to adversely affect federally-listed threatened and endangered species.

3.3.3.3.1.2 Mitigation

3.3.3.3.1.2.1 FCTC Site 1

No mitigation measures (compensatory, offsetting activities, or otherwise) have been identified for biological resources that would be impacted by construction activities within FCTC Site 1 footprint under the baseline construction schedule.

3.3.3.3.1.2.2 FCTC Site 2

No mitigation measures (compensatory, offsetting activities, or otherwise) have been identified for biological resources that would be impacted by construction activities within the FCTC Site 2 footprint under the baseline construction schedule.

3.3.3.3.2 Construction – Expedited Schedule

Under the expedited schedule, the types and amounts of habitat clearing would remain the same for both FCTC Sites 1 and 2, but the timing of the clearing and other construction activities would be compressed. As such, the types of biological impacts would largely be the same as those that would occur under the baseline schedule, but the intensity and timing of the impacts would differ.

3.3.3.3.2.1 Environmental Consequences

3.3.3.3.2.1.1 FCTC Site 1

In general, the impacts for the baseline schedule and the expedited schedule would be similar with the exception that the season timing of vegetation clearing/grubbing may result in impacts to nesting songbirds and other wildlife.

The effects of construction/operation activities on the active bald eagle nest associated with the construction expedited schedule would be the same as those described for the construction baseline schedule.

The MBTA military readiness exemption review described in the construction baseline schedule would apply to the construction expedited schedule.

Overall, because of more intensified construction activities from the compressed/expedited schedule, moderate impacts would occur. Loss of suitable habitat for several federally-listed threatened and endangered species would occur from construction of a CIS at FCTC Site 1. Because, however, there are no known occurrences of federally-listed threatened and endangered species within the CIS footprint, construction under the expedited schedule may affect but is not likely to adversely affect federally-listed threatened and endangered species.

Lighting

General Wildlife. Lighting effects from an expedited construction schedule could be more extensive than the baseline construction schedule because of the longer period when lighting would be used. This would have the effect of further displacing some species, forcing them to seek new dark areas in which to forage and carry out other activities under the cover of darkness. Insects would be affected through an attraction to the lights, which could benefit bats as they exploit the concentrated prey. Some moth species react to light by failing to fly, seek mates, or other essential activities (Frank, 2006). Because of the extended period in which lighting would be used, some moderate impacts, altering of population dynamics of some species, particularly insects, could occur.

Birds. Nighttime lighting which may be required for the expedited schedule may pose higher risk to nocturnal avian migrants over the baseline construction schedule, as the expedited schedule lighting scenario would likely require increased use of lights, and longer durations of nighttime work. The construction expedited schedule is not expected to result in excessive take nocturnally migrating avian species.

Noise

Noise impacts during the expedited schedule, would be similar to the baseline similar, but intensified due to the around the clock and nighttime work activities. To minimize noise impacts to wildlife and birds, the more noise-intense construction activities would be limited during nighttime hours.

3.3.3.3.2.1.2 FCTC Site 2

The impacts for FCTC Site 2 would be the same as those described for FCTC Site 1 (moderate impacts).

3.3.3.3.2.2 Mitigation

3.3.3.3.2.2.1 FCTC Site 1

No mitigation measures (compensatory, offsetting activities, or otherwise) have been identified for biological resources that would be impacted by construction of the CIS at FCTC Site 1 under the expedited schedule.

To minimize the effects of lighting on wildlife, positioning the light source at lower heights and using longer wavelength lighting (ambers and reds rather than blues or white light) are the preferred measures. Light fixtures could be mounted as low as possible to illuminate just the area needed for safety and comfort with minimal overlap into the surrounding areas. Where necessary, lighting could be shielded to prevent overlap into the surrounding areas where light is not required. Shielding would also reduce skyglow. Wherever feasible, long wavelength light sources could also be used. Long wavelength light alters the exposure of wildlife to lighting effects at night while providing illumination. The use of reflective surfaces under lights could also be avoided as wildlife may be confused and attracted to what appears to be water.

3.3.3.3.2.2.2 FCTC Site 2

The impacts for FCTC Site 2 would be the same as those described for FCTC Site 1.

3.3.3.3.3 Operation

3.3.3.3.3.1 Environmental Consequences – FCTC Sites

Following construction, the CIS would be relatively static except periodically for maintenance of various structures during the service life of the CIS. Flight testing of missiles is not a planned operational activity, although in-ground tests and other hardware test exercises could occur. These types of testing activities would not result in measurable impacts to biological resources because most tests would occur inside structures and they would not result in environmental impacts that could affect biological resources.

The primary impacts from CIS operation on vegetation management would be related to maintenance of the clear zone and landscaping within the CIS and its perimeter. Specific activities may include selective use of mowing, herbicides, or similar methods. These impacts would be minor. The application of herbicide and mechanical trimming of the perimeter could result in the establishment of a variety of non-native plant species. These non-native plant species would have the ability to increase in disturbed habitats and spread into adjacent vegetation communities. In the event of herbicide spills, the CIS maintenance and spill response team would follow established SPCC plans to contain and clean up a spill.

In addition to vegetation, minor impacts from facility and security lighting and some noise due to the impacts from backup power generation equipment would occur. Impacts from lighting would be minimized by the use of fully recessed lighting that directs lighting downward. Noise impacts would occur during temporary back-up situations (power outages or during test and maintenance activities).

3.3.3.3.3.2 Mitigation – FCTC Sites

No mitigation measures (compensatory, offsetting activities, or otherwise) have been identified for biological resources that would be impacted by operation of the CIS at either FCTC Site 1 or FCTC Site 2.

Figure 3.3.3-1 Vegetation Community Alliances – FCTC Site 1

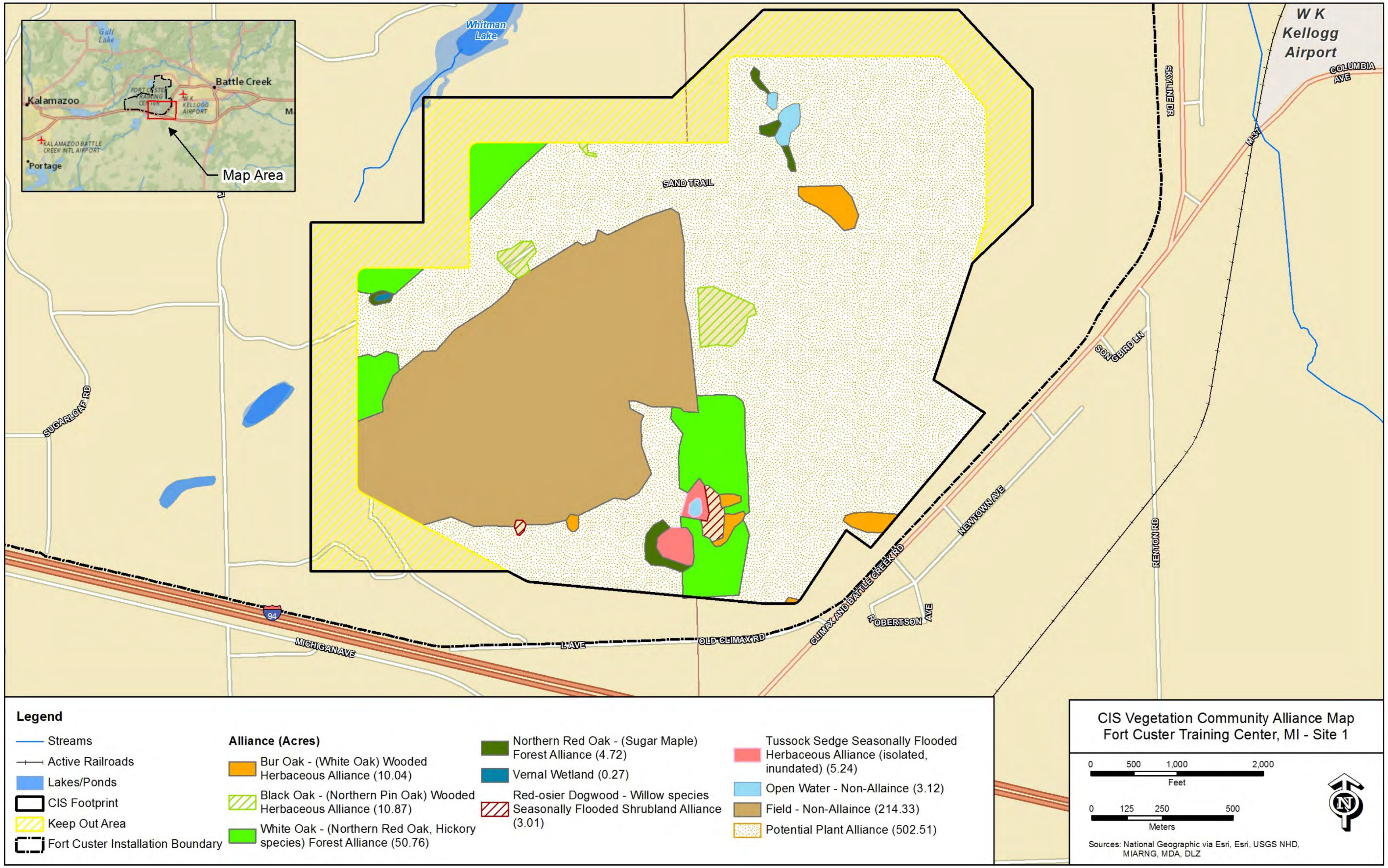
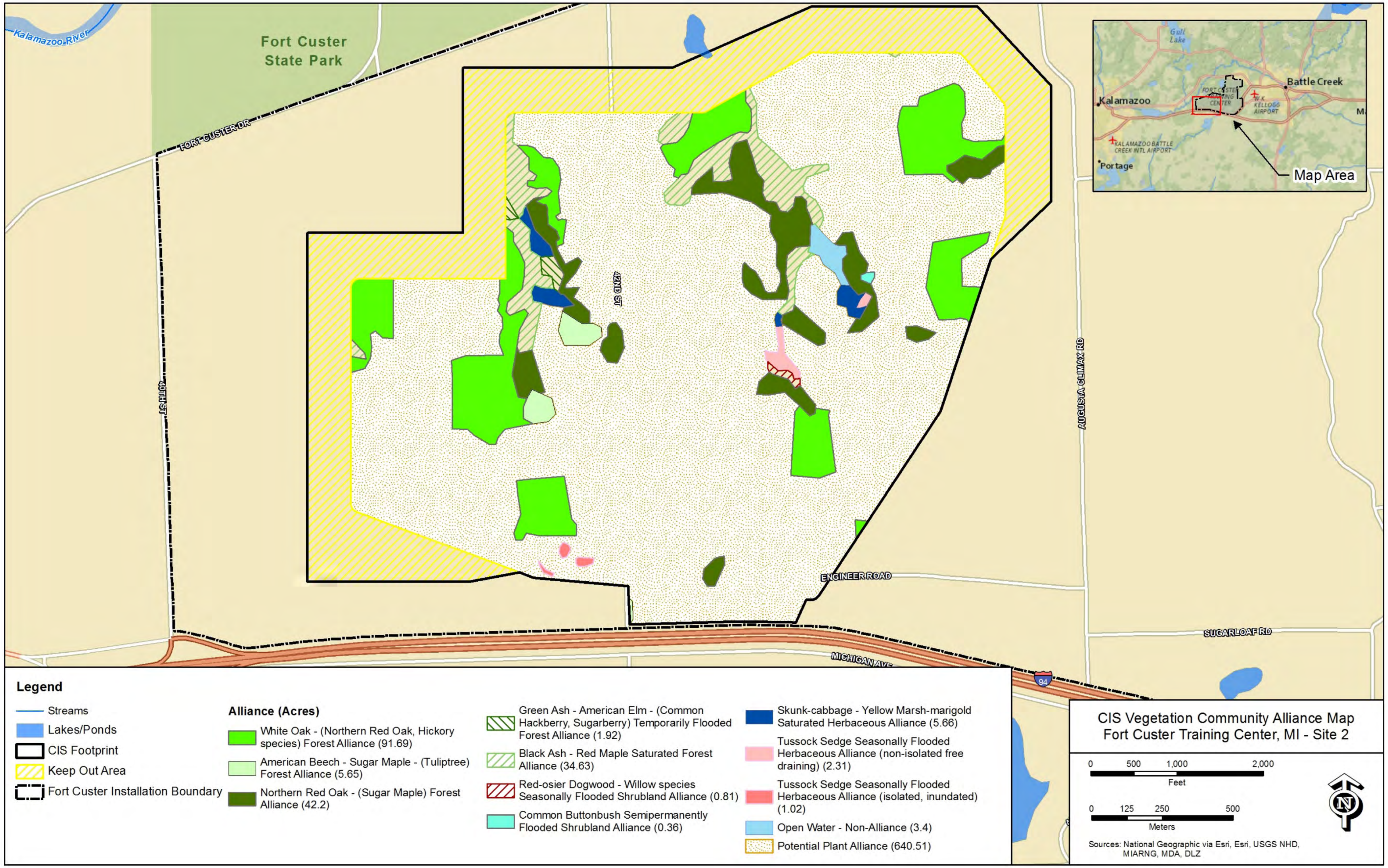


Figure 3.3.3-2 Vegetation Community Alliances – FCTC Site 2



3.3.4 Cultural Resources – FCTC Sites

Cultural resources include prehistoric and historic sites, structures, districts, artifacts, or any other physical evidence of human activity considered important to a culture, subculture, or community for scientific, traditional, religious, or any other reason. Cultural resources are typically discussed in terms of archaeological resources (prehistoric and historic), historic buildings and structures, and native populations/ traditional resources (e.g., Native American sacred or ceremonial sites). Prehistoric and historic archaeological resources are the physical remnants of human activity. They include archaeological sites, features, ruins, artifacts, and other evidence of prehistoric or historic human behavior. Historic buildings and structures (i.e., architectural features) consist of above ground, standing properties postdating the advent of written records (e.g., homesteads, ranchsteads, World War II buildings, Cold War structures). Traditional resources may be prehistoric sites and artifacts, historic areas of occupation and events, historic and contemporary sacred areas, materials used to produce implements and sacred objects, hunting and gathering areas, and other botanical, biological, and geological resources of importance to contemporary culture groups.

This section discusses the existing cultural resources at and in the vicinity of the CIS footprint, the potential project impacts, and potential mitigation measures associated with the project.

3.3.4.1 Regulatory Framework – Cultural Resources – FCTC Sites

There are several laws, regulations, and other requirements that must be taken into consideration with determining effects of a potential deployment or its alternatives on cultural resources, including, but not limited to the following:

- NEPA – NEPA provides a broad national framework for protecting our environment. NEPA's basic policy is to assure that all branches of government give proper consideration to the environment prior to undertaking any major federal action that significantly affects the environment.
- National Historic Preservation Act (NHPA), as amended (16 USC 470 et seq.) – NHPA is legislation intended to preserve historical and archaeological sites in the United States of America. The act authorized the creation of the National Register of Historic Places (NRHP), the list of National Historic Landmarks, and the SHPOs.
- Archeological Resources Protection Act (ARPA) of 1979, as amended (16 USC 470aa-470mm) – ARPA strengthened the permitting procedures required for conducting archeological fieldwork on federal lands, originally mandated by the Antiquities Act. It also establishes more rigorous fines and penalties for unauthorized excavation on federal land.
- Antiquities Act of 1906 (16 USC 431–433) - Provides for the protection of historic and prehistoric ruins and objects of antiquity on federal lands, and authorizes scientific investigation of antiquities on federal lands subject to permits and other regulatory

requirements. This act also provides information on penalties for damage and destruction of antiquities.

- Archeological and Historic Data Preservation Act of 1974 (16 USC 469-469c) - This statute requires that federal agencies provide for the preservation of historical and archeological data (including relics and specimens) which might otherwise be irreparably lost or destroyed as the result of any alteration of the terrain caused as a result of any federal construction project of federally licensed activity or program.
- American Indian Religious Freedom Act (AIRFA) of 1978 (42 USC 1996) – AIRFA was enacted to protect and preserve the traditional religious rights and cultural practices of American Indians, Eskimos, Aleuts, and Native Hawaiians.
- National American Graves Protection and Repatriation Act (NAGPRA) (25 USC 3001 et seq.) - The NAGPRA requires federal agencies and institutions that receive federal funding to return Native American cultural items to lineal descendants and culturally affiliated Indian tribes and Native Hawaiian organizations. Cultural items include human remains, funerary objects, sacred objects, and objects of cultural patrimony.
- Curation of Federally Owned and Administered Archeological Collections (36 CFR Part 79) – These regulations provide minimum standards for the long-term management and care of archeological collections, including the associated records and reports.
- Presidential Memorandum for Heads of Executive Departments and Agencies on Government-to-Government Relations with Native American Tribal Governments (1994) – The purpose of this memorandum was to clarify the responsibility of the federal government during interactions with Native American Tribal governments.
- EO 13175, Consultation and Coordination with Indian Tribal Governments – This EO requires consultation and collaboration with Indian tribal governments; strengthening of the government-to-government relationship between the U.S. and Indian tribes; and reducing the imposition of unfunded mandates upon Indian tribes.
- EO 13007, Indian Sacred Sites – This EO requires executive agencies with administrative responsibility of federal land management to accommodate access to and ceremonial use of Indian sacred sites and avoid adversely affecting the physical integrity of sacred sites.
- EO 13084, Consultation and Coordination with Indian Tribal Governments – This EO reaffirms the unique legal relationship between the U.S. and Indian tribal governments; stressing that federal agencies maintain regular and meaningful collaboration with Indian tribal governments when formulating policies that would uniquely affect such governments being guided by the principle of respect for their self-government and sovereignty.
- EO 13287, Preserve America – This EO establishes a federal policy to provide leadership in preserving the nation's heritage by actively advancing the protection, enhancement, and contemporary use of historic properties owned by the federal government and by promoting intergovernmental cooperation and partnership for the preservation and use of historic properties.

- DoD Instruction 4710.02, Interactions with Federally Recognized Tribes – This DoD Instruction implements DoD policy, assigns responsibilities, and provides procedures for DoD interactions with federally-recognized tribes as required by federal regulations.
- DoD Instruction 4715.16, Cultural Resources Management – This Instruction establishes DoD policy and assigns responsibilities to comply with applicable federal statutory and regulatory requirements, EOs, and Presidential memorandums for the integrated management of cultural resources on DoD-managed lands.
- DoD Instruction 4715.3, Environmental Conservation Program - Promotes DoD-wide conservation program cooperation to guarantee continued access to land, air, and water resources for realistic military training and testing while ensuring that the natural and cultural resources, air and water continue to be sustained for future generations. Includes the requirement that all installations have an INRMP and/or Integrated Cultural Resources Management Plan (ICRMP).
- AR 200-1, Environmental Protection and Enhancement - This regulation addresses the environmental responsibilities of all Army organizations and agencies. It covers environmental protection and enhancement and provides the framework for the Army Environmental Management System.

These laws, regulations, and requirements outline the process of compliance, define responsibilities of the federal agency proposing an undertaking, and prescribe the relationships among other federal, state, and local agencies and stakeholders. An "undertaking" is a project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a federal agency, including those carried out by or on behalf of a federal agency, those carried out with federal financial assistance, or those requiring a federal permit, license, or approval (36 CFR Part 800.16).

Sections 106 and 110 (16 USC Part 470 et seq.) of the NHPA require that for any federal undertaking, prior to the approval of the expenditure of any federal funds on that undertaking, the effect of the undertaking on any district, site, building, structure of object that is included in or eligible for inclusion in the NRHP must be taken into account. To be considered eligible for inclusion in the NRHP, a property must meet the NRHP listing criteria, which is specified in the Department of the Interior (DOI) regulations (36 CFR Part 60.4 and NRHP Bulletin 15). To determine NRHP eligibility, all potential prehistoric, part historic, Native American and traditional historic properties in the footprint and vicinity of the undertaking (e.g., potential deployment or its alternatives) must be evaluated. "Historic properties" include any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the NRHP maintained by the Secretary of the Interior. This includes artifacts, records, and remains that are related to, and located within, such properties and properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization, and that meet the NRHP criteria (36 CFR Part 800.16). In addition to identification and evaluation of historic properties, the regulations also state the need to determine what potential impacts could occur to historic properties if the potential deployment or its alternatives were implemented.

Compliance under Section 106 of the NHPA requires consultation with the SHPO, local governments, associated federal agencies, federally recognized Native American tribes and the interested public, as appropriate.

3.3.4.2 Prehistoric and Historic Background – FCTC Sites

Managing cultural resources at FCTC is guided, in accordance with AR 200-1, by an INRMP and an ICRMP, which are required to be updated every 5 years. These documents contain detailed information on area prehistory and history, regulatory frameworks and compliance, agency roles and responsibilities, studies conducted at FCTC to date, known site data, Standard Operating Procedures (SOPs) for inadvertent discoveries, and memoranda and agreements applicable to managing cultural resources at FCTC. The most recent INRMP and ICRMP for FCTC were prepared in 2012 (MDMVA, 2012; AMEC E&I, 2013a). The following sections provide a brief summary of the prehistory of southwestern lower Michigan and the history of Kalamazoo and Calhoun Counties and FCTC based on a review of the INRMP, ICRMP, and previous cultural resource investigations conducted at FCTC.

3.3.4.2.1 Prehistoric Background

The prehistory of southwestern lower Michigan, which includes FCTC, is generally divided into the following three major periods (CCRG, 2006):

- Paleoindian
- Archaic
- Woodland

In general, the Paleoindian Period includes the first human occupation of southwestern Michigan which occurred sometime after the retreat of the last glacial front in 11,000 B.C. (10,000 B.C. to 8,000 B.C.). The Paleoindian population hunted big game animals like caribou and elk. Paleoindian typology is largely comprised of large fluted, lanceolate projectile points, often with concave bases, as well as large chopping implements, gravers, and unifacial scrapers (CCRG, 2006).

The Archaic Period includes the period from approximately 8,000 B.C. to 500 B.C. Only isolated occurrences of Early and Middle Period sites (through about 2,500 B.C.) have been found in southwestern Lower Michigan, which may be due to fluctuations in the water levels of Lake Michigan and changing landscapes this caused. The Late Archaic Period is well represented in southwestern Lower Michigan. Typically, the Archaic Period is marked by a proliferation of projectile points and styles and a pattern of settlements that suggests hunting was an important subsistence activity (CCRG, 2006).

The Woodland period, occurring from approximately 600 B.C. to A.D. 1600, was marked by two important developments: making pottery and constructing burial mounds. During the Woodland period, a very important cultural development occurred. While the hunting and gathering way of life continued in the Woodland Period, Native peoples planted and harvested crops marking the beginning of agriculture. The bow and arrow was introduced during the Woodland period, around A.D. 800, which is about 1200 years ago (CCRG, 2006).

3.3.4.2.2 Historic Background – State of Michigan, Kalamazoo and Calhoun Counties, and FCTC

This section provides a brief historic background of the State of Michigan, Kalamazoo and Calhoun Counties, and FCTC based on a review of the FCTC ICRMP and previous archaeological investigations conducted at FCTC.

<u>State of Michigan</u>

Indian tribes were living in the Michigan region when the first Europeans from France arrived in the 1600s. The first permanent settlement was established in 1668 at Sault Ste. Marie. France was ousted from the territory by Great Britain in 1763, following the French and Indian Wars.

After the Revolutionary War, the U.S. acquired most of the region, which remained the scene of constant conflict between the British and U.S. forces and their respective Indian allies through the War of 1812. Michigan became the 26th state in 1837.

<u>Kalamazoo and Calhoun Counties</u>

Kalamazoo County was organized in 1830 and was named for the Kalamazoo River. The name Kalamazoo originated from a Native American word, but its exact origin and meaning are unclear.

Calhoun County was organized in 1833 and was named after a Senator from South Carolina. The Territorial Road passed through Kalamazoo and Calhoun Counties, bringing with it pioneer settlement to the area and promoting the population and commercial growth in the area. Fur trading began in Kalamazoo County as early as the 1810s. (CCRG, 2006; Calhoun, 2015a). Limited settlement in the area continued through the 1800s mainly along the Territorial Road and the Kalamazoo River.

<u>FCTC</u>

FCTC was established in 1917, when a General Order of the War Department established "Camp Custer" honoring Michigan native, George Armstrong Custer. FCTC originally encompassed about 8,300 acres and was designed as an active training and staging facility for World War I combat troops. In the first 6 months, nearly 2,000 buildings were erected at FCTC, quickly followed by the arrival of some 36,000 men from Wisconsin and Michigan destined to become the "doughboys" of World War I. Following the Armistice of 1918, Camp Custer became a post-war demobilization center for upwards of 100,000 returning soldiers. The post was officially renamed Fort Custer in 1940, when it was made into a permanent military installation. Shortly thereafter, an additional 6,100 acres of land, primarily farmland, were acquired (CCRG, 2006; CCRG, 2008; MDMVA, 2012).

3.3.4.3 Affected Environment – Cultural Resources – FCTC Sites

The affected environment for cultural resources is identified through determination of the Area of Potential Effects (APE). The APE is defined by 36 CFR Part 800.16 as the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist.

3.3.4.3.1 Affected Environment – FCTC Site 1

The APE of the CIS footprint for the FCTC Site 1 includes an approximately 1,000-acre area which was determined by FCTC cultural resources staff in consultation with the Michigan SHPO. The FCTC Site 1 APE is slightly larger than the CIS footprint as presented on Figure 3.3.4-1.

For the purposes of this EIS, cultural resources have been divided into the following categories:

- Prehistoric and historic archaeological resources.
- Architectural resources.
- Native populations/traditional resources.

The following sections discuss the affected environment for cultural resources within the CIS APE based on review of the INRMP, ICRMP, and previous cultural resource investigations conducted at FCTC Site 1.

3.3.4.3.1.1 Prehistoric and Historic Archaeological Resources – FCTC Site 1

Prehistoric and historic archaeological resources, according to the ARPA of 1979, include any material remains of past human life or activities which are of archeological interest and include items such as pottery, basketry, bottles, weapons, tools, structures/foundations, rock paintings, rock carvings, graves, human skeletal material or any portion or piece of such items.

There are no prehistoric or historic archaeological sites within the FCTC Site 1 APE that are listed in the NRHP, potentially eligible, or eligible for listing in the NRHP. This is based on several archaeological investigations conducted near or within the FCTC Site 1 APE. Cultural resource surveys of FCTC began in 1973. All areas of FCTC have been surveyed for historic sites except the Impact Area due to risk of unexploded ordnance (UXO). The surveys have identified 68 historic period sites, eight Native American sites, and three sites with both historic and Native American elements at FCTC (AMEC E&I, 2013a; MDMVA, 2012). In 1994, the Fort

Custer segment of the Territorial Road was determined to be eligible for listing in the NRHP. No other sites potentially eligible or eligible for listing in the NRHP have been identified at FCTC or within the FCTC Site 1 APE.

Table 3.3.4-1 lists the cultural resource investigations conducted since 2006 at FCTC, including within the FCTC Site 1 APE. A brief summary of the results of each of these cultural resources investigations is provided in this section in descending order by date.

Figure 3.3.4-2 presents the general locations of the study areas at FCTC, including within the FCTC Site 1 APE, that were evaluated during each cultural resource investigation listed in Table 3.3.4-1.

Orbis Environmental Consulting (2015). A targeted Phase I Archeological Survey was completed in support of the potential CIS deployment by Orbis Environmental Consulting (Orbis) of selected sites within the potential CIS APEs for FCTC Sites 1 and Sites 2 (Figure 3.3.4-2, Area 1). The results of this survey were sent by the FCTC Cultural Resources Manager to the Michigan SHPO on November 24, 2015, for review and concurrence with the conclusions. A copy of the letter and information sent to the Michigan SHPO is provided in Appendix E.1. The Michigan SHPO did not provide a response within the required 30 days per 36 CFR Part 800. Therefore, in accordance with 36 CFR Part 800.05(c)(1), the FCTC has assumed Michigan SHPO concurrence of a determination of no historic properties affected.

Table 3.3.4-1 Cultural Resource Investigations Conducted at FCTC

Survey No. (see Figures 3.3.4-2 locations)	Title	Report Date	Prepared By
1	Targeted Phase I Archeological Survey of Selected Areas at Fort Custer Army National Guard Training Center in Kalamazoo County, Michigan	August 2015	Orbis Environmental Consulting
2	Maintenance, Treatment, and Management Plan for the Fort Custer Segment of Territorial Road for the Michigan Army National Guard	December 2013	AMEC Environment & Infrastructure, Inc.
3	Phase II Archaeological Survey, Fort Custer Army National Guard Training Center, Kalamazoo and Calhoun Counties, Michigan	April 2008	Commonwealth Cultural Resources Group, Inc.
4	Phase I Archaeological Survey, Fort Custer Army National Guard Training Center, Kalamazoo and Calhoun Counties, Michigan	July 2006	Commonwealth Cultural Resources Group, Inc.

AMEC Environment & Infrastructure, Inc. (2013). A 5-mile segment of the Territorial Road is the only site on FCTC that has been identified as eligible for listing in the NRHP. In 2013, AMEC Environment & Infrastructure, Inc., (AMEC E&I) prepared a plan to provide guidance for the maintenance, treatment, preservation, planning, future mitigation, interpretation, and overall management of this rural, vernacular, linear historic cultural landscape at FCTC. This segment of the Territorial Road was determined to be eligible for listing in the NRHP as a historic landscape due to its role as an early transportation route; its part in the settlement and agricultural development of the Michigan Territory and later, state; and because it retains most of the character-defining features from its historic period. The 5-mile segment of the Territorial Road is outside the FCTC Site 1 APE as shown on Figure 3.3.4-2.

Commonwealth Cultural Resources Group, Inc. (2008). A Phase II Archeological Investigation was completed by Commonwealth Cultural Resources Group, Inc. (CCRG) in April 2008 to determine the potential eligibility of 13 sites for listing in the NRHP. Portions of the Phase II investigations were within the FCTC Site 1 footprint (Figure 3.3.4-2, Area 3). The survey noted that at all 13 sites there was a mixture of disturbed fill deposits dominated with later layers. None of the sites investigated produced any artifactual deposits deemed worthy of further investigation and none of the 13 sites are recommended eligible for listing in the NRHP and no further work was recommended.

Commonwealth Cultural Resources Group, Inc. (2006). A Phase I Archeological Survey was conducted by CCRG in July 2006 that targeted 70 farmstead/homesteads and other archaeological structures and one potential prehistoric site (20KZ15) throughout the property (Figure 3.3.4-2, Area 4). The Phase I survey identified 64 historic period archaeological sites, three multicomponent sites with both historic and prehistoric elements, and three sites that could either not be located or have been destroyed. Of the 67 located sites, 32 represent homesteads, 26 are farmsteads, two are barns, two represent possible commercial/homestead/school sites, two are surface artifact scatters, and three are multicomponent sites comprised of farmsteads with small assemblages of prehistoric lithic debris. Thirteen sites were recommended for further evaluation including six farmsteads, four homestead sites, two sites that potentially represent a school and store, and one multicomponent historic farmstead prehistoric lithic debitage location. None of the remaining sites were recommended eligible for listing in the NRHP and no further work was recommended.

3.3.4.3.1.2 Architectural Resources – FCTC Site 1

Architectural resources include aboveground historic structures and buildings. There are no architectural sites that are listed in the NRHP or eligible for listing present within the FCTC Site 1 APE.

Materials and equipment necessary for the construction of the CIS would be transported via interstate, state, and local roads as described in Section 3.3.12. Several historic properties and two historic districts listed in the NRHP were identified directly on (i.e., roadside) the transportation route. These properties are listed in Table 3.3.4-2. However, because no roads along the transportation route would require any ground disturbance, road widening, or bridge modifications for the potential CIS deployment, there should be no impacts to these historic properties.

Table 3.3.4-2 NRHP-Listed Sites along Potential Transportation Route

Name on the NRHP	Location	Listing Date
Coldwater Downtown Historic District	W. Chicago Street from Division to Clay Streets, Coldwater, MI	07/26/1990
East Chicago Street Historic District	Chicago Street from Wright Street to Division Street including parks, Coldwater, MI	05/12/1975
Doll Benedict House	665 W. Chicago Street Coldwater, MI	08/20/1990
U.S. Government Land Office Building	113 W. Chicago Road White Pigeon, MI	02/07/1989
Wahbeneme Burial Site and Monument	Junction of U.S. 12 and U.S. 131, Mottville Township, White Pigeon, MI	07/21/1995
Mason District Number 5 Schoolhouse	17049 U.S. 12, Edwardsburg, MI	09/12/1985
Source: NPS, 2014.		

3.3.4.3.1.3 Native Populations/Traditional Resources – FCTC Site 1

Traditional resources include burial grounds, sacred or religious sites, and/or artifacts (tools, arrowheads, pottery, etc.) that are related to native populations that have had an affiliation with a site. The following 10 Federally-recognized Tribes are on record as having an interest in Calhoun and Kalamazoo Counties according to the U.S. Department of Housing and Urban Development Tribal Directory Assessment Tool (version 1.0) (TDAT, 2014):

- Citizen Potawatomi Nation, Oklahoma.
- Forest County Potawatomi Community, Wisconsin.
- Hannahville Indian Community, Michigan.
- Little River Band of Ottawa Indians, Michigan.
- Match-e-be-nash-she-wish Band of Potawatomi Indians of Michigan.
- Nottawaseppi Huron Band of the Potawatomi, Michigan.
- Ottawa Tribe of Oklahoma.
- Pokagon Band of the Potawatomi Indians, Michigan and Indiana.
- Prairie Band of Potawatomi Nation, Kansas.
- Saginaw Chippewa Indian Tribe of Michigan.

All federally recognized tribes with historic or current affiliation to FCTC Site 1 have been invited to participate in the consultation process for the potential CIS. Initial consultation letters were mailed on November 7, 2014, from FCTC to 12 local tribes and six additional tribes within the region. Responses were received from the following tribes: Nottawaseppi Huron Band of the Potawatomi and Pokagon Band of the Potawatomi Indians of Michigan. Copies of the consultation letters and responses are provided in Appendix E.1.

3.3.4.3.2 Affected Environment – Cultural Resources – FCTC Site 2

The affected environment for prehistoric and historic archaeological resources, the architectural resources, and the Native populations/traditional Resources for FCTC Site 2 would be same as for FCTC Site 1 with the following exceptions:

- The CIS APE for the FCTC Site 2 is shown on Figure 3.3.4-3. The FCTC Site 2 APE includes approximately 1,000 acres and is slightly larger than the CIS footprint.
- The Territorial Road (Area 2 on Figure 3.3.4-2) is outside the CIS APE for FCTC Site 2, but is within 100 feet of the potential keep-out area. The Territorial Road is discussed in more detail in Section 3.3.16 Visual-Aesthetics.

3.3.4.4 Environmental Consequences and Mitigation - Cultural Resources - FCTC Sites

The following sections provide an evaluation of the environmental consequences that could occur and the mitigation that would be required as a result of construction and operation the potential CIS at FCTC.

3.3.4.4.1 Construction – Baseline Schedule

The following sections describe the environmental consequences and mitigations, as appropriate, associated with construction under the baseline schedule as described in Section 2.7.1.

3.3.4.4.1.1 Environmental Consequences

Nearly all of the potential for impacts to cultural resources would occur during construction of the potential CIS, specifically during ground disturbing activities (e.g., clearing and grading) within the footprint of the potential CIS. Any cultural resources that occur within the limits of the disturbance would likely be altered or destroyed during construction of the potential CIS.

3.3.4.4.1.1.1 FCTC Site 1

Based on the cultural resource investigations conducted within the FCTC Site 1 APE and summarized in Section 3.3.4.3, and the concurrence from the Michigan SHPO (see Section 3.3.4.3 and Appendix E-1), there are no known historic, archaeological, or architectural properties that are listed on, or eligible for listing on, the NRHP within the FCTC Site 1 APE;

therefore, no known historic properties would be affected by the construction of the potential CIS.

It should be noted that there are eight to nine non-eligible archaeological historic farmstead foundations present within the FCTC Site 1 footprint that would be destroyed if the project is constructed.

Based on consultation with the tribes affiliated with FCTC Site 1, no traditional resources of concern occur within the CIS APE. As a result, no traditional resources would be impacted by construction of the potential CIS.

As discussed in Section 3.3.4.3.1.2, several properties listed in the NRHP are located along the transportation route. However, because no roads along the transportation route would require any ground disturbance, road widening, or bridge modifications for the potential CIS deployment, there should be no impacts to these historic properties.

3.3.4.4.1.1.2 FCTC Site 2

Based on the cultural resource investigations conducted within the FCTC Site 2 APE and summarized in Section 3.3.4.3, and the concurrence from the Michigan SHPO (see Section 3.3.4.2 and Appendix E.1), there are no known historic, archaeological, or architectural properties that are listed in, or eligible for listing in, the NRHP within the FCTC Site 2 APE; therefore, no known historic properties would be affected by the construction of the potential CIS.

There would be no visual impacts to Territorial Road, which is eligible for listing in the NRHP, from FCTC Site 2 as discussed in detail in Section 3.3.16 Visual-Aesthetics.

It should be noted that there are five to six non-eligible archaeological historic farmstead foundations present within the FCTC Site 2 CIS footprint that would be destroyed if the project is constructed.

3.3.4.4.1.2 Mitigation

3.3.4.4.1.2.1 FCTC Site 1

No impacts to archaeological, historic, or architectural resources would occur due to project construction at FCTC Site 1. Therefore, there would be no mitigation required for impacts to cultural resources as a result of construction of the potential CIS. However, should previously undiscovered archaeological resources be uncovered during construction activities, the MDA would follow procedures described in the ICRMP for coordination with FCTC and the Michigan SHPO. As discussed in Section 3.3.4.4.1.1.1, there are eight to nine non-eligible archaeological historic farmstead foundations present within the FCTC Site 1 footprint that would be destroyed if the project is constructed. However, because these properties were determined to not be eligible for listing in the NRHP and no mitigation would be required.

3.3.4.4.1.2.2 FCTC Site 2

No impacts to archaeological, historic, or architectural resources would occur due to project construction at FCTC Site 2. Therefore, there would be no mitigation required for impacts to cultural resources as a result of construction of the potential CIS. However, should previously undiscovered archaeological resources be uncovered during construction activities, the MDA would follow procedures described in the ICRMP for coordination with FCTC and the Michigan SHPO. As discussed in Section 3.3.4.4.1.1.2, there are five to six non-eligible archaeological historic farmstead foundations present within the FCTC Site 1 footprint that would be destroyed if the project is constructed. However, because these properties were determined to not be eligible for listing in the NRHP and no mitigation would be required.

3.3.4.4.2 Construction – Expedited Schedule

The environmental consequences and mitigations associated with the construction under the expedited schedule described in Section 2.7.1 for the FCTC Sites would be same as those described for the baseline schedule in Section 3.3.4.4.1.1.1.

3.3.4.4.3 Operation - Cultural Resources - FCTC Sites

3.3.4.4.3.1 Environmental Consequences

3.3.4.4.3.1.1 FCTC Site 1

Once construction is complete, any cultural resources onsite would be destroyed, protected, or excavated and removed for preservation; therefore, the potential for impacts during operation is negligible. Based on the information summarized in Section 3.3.4.3, there are no historic properties identified within the FCTC Site 1 APE that require further study, protection, or preservation.

3.3.4.4.3.1.2 FCTC Site 2

The environmental consequences from operation of the potential CIS for cultural resources for FCTC Site 2 would be the same as those described for FCTC Site 1.

3.3.4.4.3.2 Mitigation

3.3.4.4.3.2.1 FCTC Site 1

No historic properties (e.g., NRHP-listed, potentially eligible or eligible for listing) were identified within the potential CIS FCTC Site 1 APE; therefore, no mitigation would be required for impacts to cultural resources as a result of operation of the potential CIS.

3.3.4.4.3.2.2 FCTC Site 2

No historic properties (e.g., NRHP-listed, potentially eligible or eligible for listing) were identified within the FCTC Site 2 APE; therefore, no mitigation would be required for impacts to cultural resources as a result of operation of the potential CIS.

Figure 3.3.4-1 Area of Potential Effects – FCTC Site 1

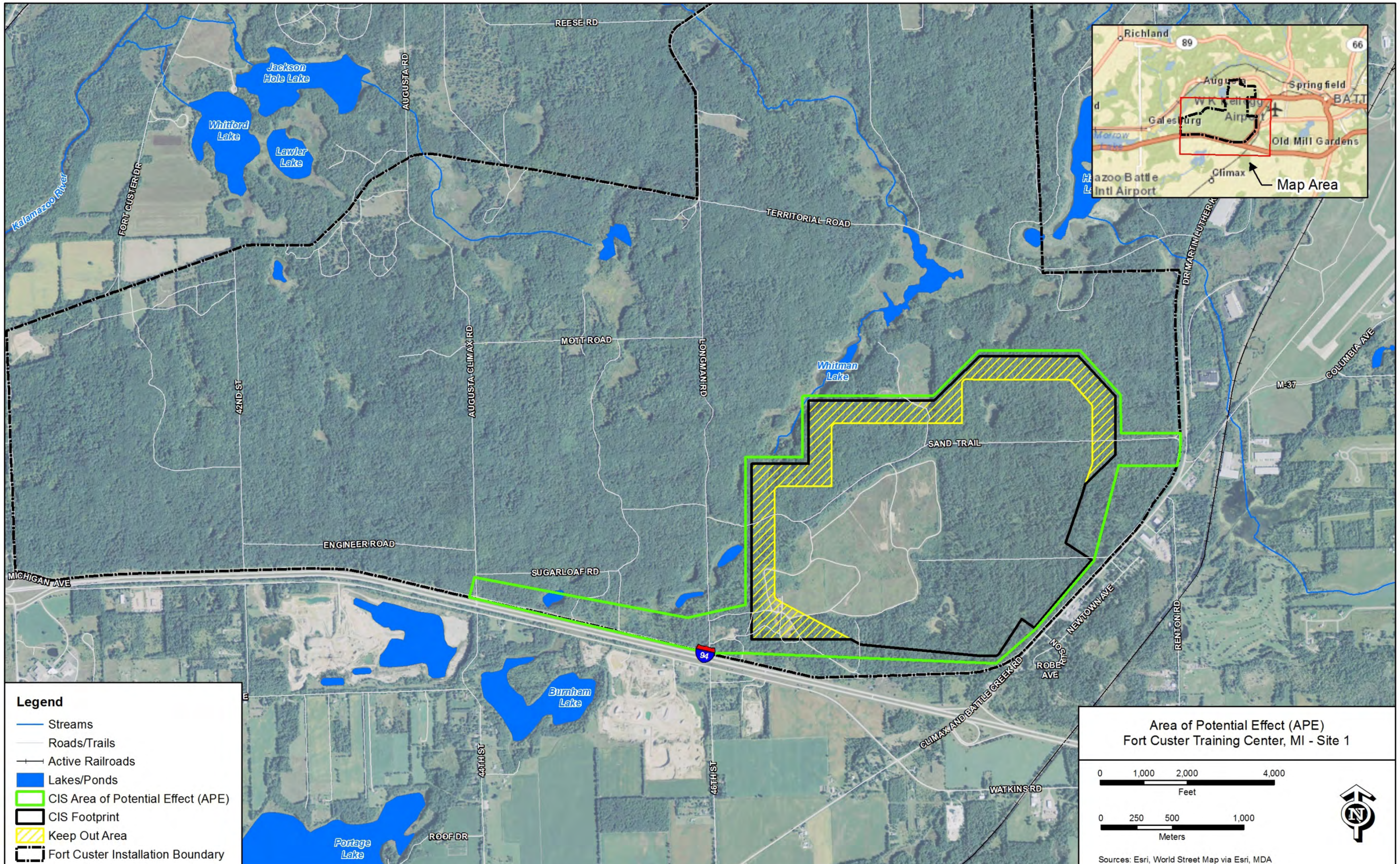


Figure 3.3.4-2 Previous Cultural Resource Investigations – Study Areas at FCTC Sites

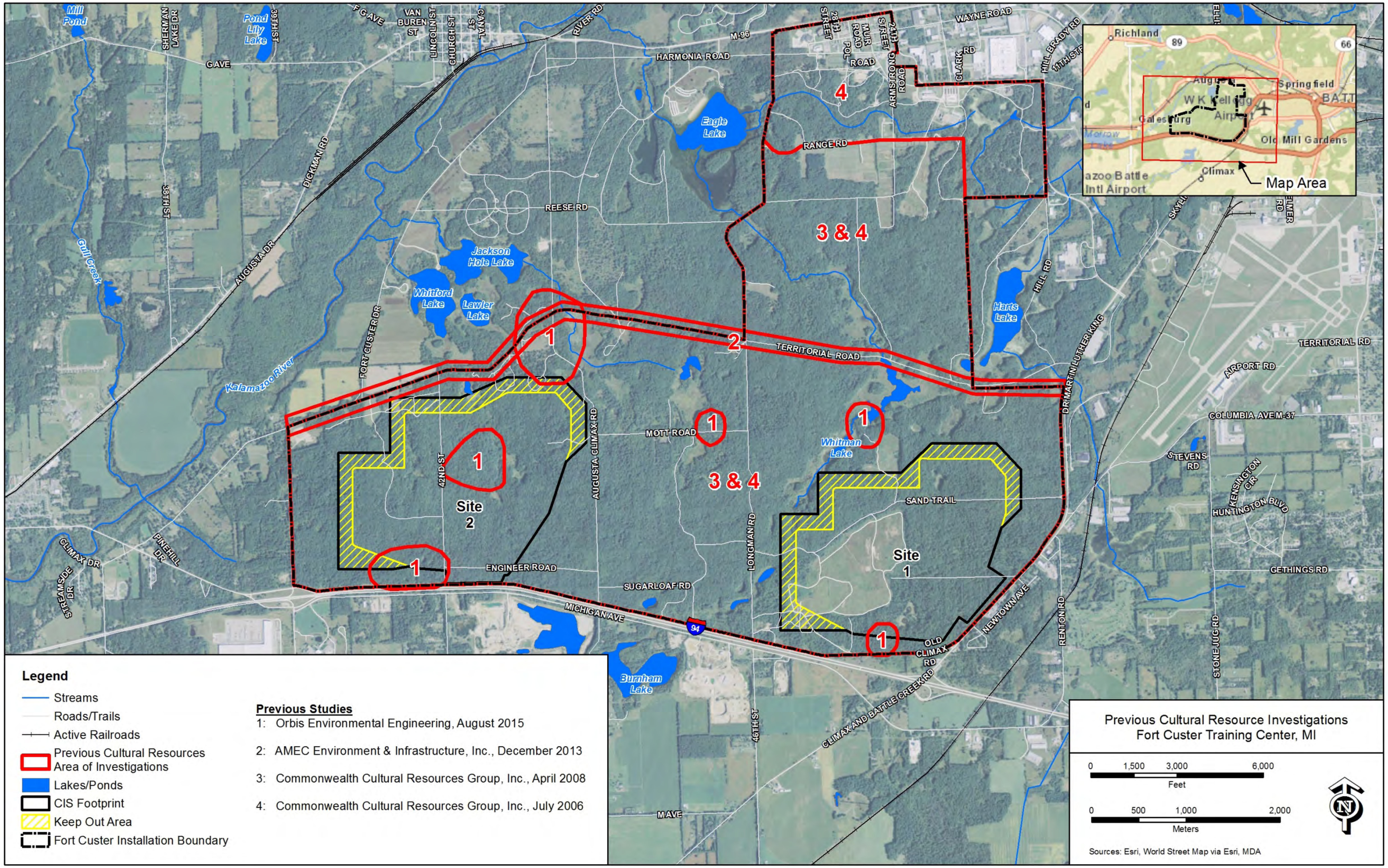
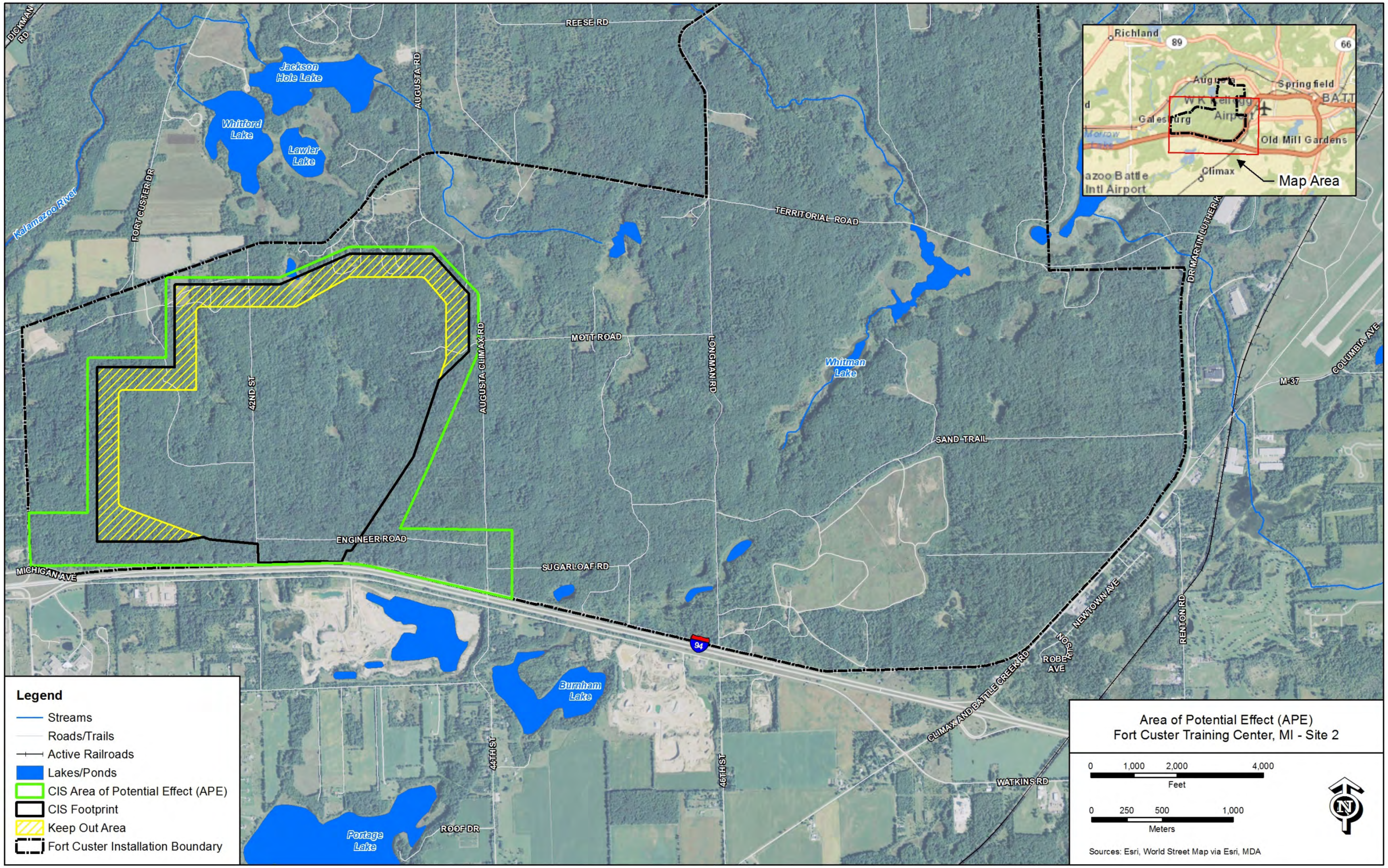


Figure 3.3.4-3 Area of Potential Effects – FCTC Site 2



3.3.5 Environmental Justice – FCTC Sites

Environmental justice reviews involve identification of offsite environmental impacts, their geographic locations, minority and low-income populations that may be affected, community health, the significance of such effects, and whether they are disproportionately high and adverse compared to the population within the geographic area. Available mitigation measures and those that would be implemented are also part of the review and analysis.

The first step in analyzing this issue is to identify minority and low-income populations that might be affected by implementation of the potential CIS deployment or its considered alternatives. Demographic information on ethnicity, race, and economic status is provided in this section as the baseline against which potential environmental justice effects can be identified and analyzed.

3.3.5.1 Regulatory Framework – Environmental Justice – FCTC Sites

On February 11, 1994, President Clinton issued EO 12898, *Federal Actions to Address Environmental Justice in Minority and Low-Income Populations*. The purpose of the EO is to avoid the disproportionate placement of adverse environmental, economic, social, or health effects from federal Proposed Actions and policies on minority and low-income populations.

On February 27, 2012, federal agencies, led by the CEQ and the USEPA, released environmental justice strategies, implementation plans, and progress reports outlining the steps that agencies will take to protect certain communities facing health and environmental risks. Through the NEPA environmental impact analysis process, federal agencies incorporate compliance with EO 12898 to ensure that their potential deployments will not have disproportionate impacts on minority and low-income populations. This approach is consistent with the USEPA objectives concerning environmental justice, which include “the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies” (USEPA, 2012).

3.3.5.2 Affected Environment – Environmental Justice – FCTC Sites

FCTC Site 2 is located in close enough proximity to FCTC Site 1 that there is no discernable difference in the environmental justice affected environment.

3.3.5.2.1 Environment Justice Methods

Kalamazoo and Calhoun Counties comprised the study area for the potential CIS deployment at FCTC. Census blocks are the smallest unit of geographic area for which the U.S. Census Bureau (Census) collects and tabulates 10-year census data. Census block boundaries are defined by streets, roads, railroads, streams and other bodies of water, other visible physical and cultural features, and the legal boundaries shown on Census Bureau maps.

Census data for these areas serve as a valuable source for small-area geographic studies. Census block groups are the next larger geographic unit above census blocks. They are comprised of census blocks and are the units that make up a Census tract. Block groups can include varying numbers and sizes of blocks depending on their boundaries, which themselves can vary based on topographic or other geographic features. Based on 1990s Census guidelines, an ideal size for a block group is 400 housing units, but can range between a 250 and 550 housing units (DOC, 1994). This analysis used Census block group level data because they were sufficient to support a meaningful environmental justice analysis.

The Census's American FactFinder reports numbers of both minorities and people with incomes below poverty level (individuals and families). Minority populations included in the census are identified as Black; American Indian, Eskimo or Aleut; Asian or Pacific Islander; Hispanic; or other/multiple races. For purposes of this environmental justice analysis, low income is considered the same as income below the poverty level.

Persons and organizations known or thought to have a potential interest in the CIS project, including minority, low-income, disadvantaged, and Native American groups, were identified, informed, and given the opportunity to participate in scoping meetings and public information sessions. Refer to the summary of the Scoping Report in Section 1.7 of this EIS for further information on consideration of potential environmental justice concerns.

Environmental justice for potential deployment of the CIS at FCTC was evaluated based on screening level information available from public resources such as the Census block data and the USEPA's EJSCREEN (upgrade of former EJView) environmental justice online database and associated tools.

3.3.5.2.2 Minority Populations

Generally, to qualify as a minority area, the associated population would need to be either 50 percent or more minority, or the minority population in an area would need to be 20 percent or more larger than the minority population in an area of comparison, such as another nearby community, county, or the state.

Private residences in the vicinity of FCTC are mixed between more rural in nature in the immediate area (outside FCTC) and to the north and south, with more suburban residences nearer to the Springfield and Battle Creek area to the east and Kalamazoo to the west. Evidence of substantial minority populations was not found in Census or other data; however, there are greater numbers of minority residents in the outlying cities around FCTC than near the site or in the general surrounding area. The percentage of minorities in Kalamazoo County was 17.9; in all of Michigan, it was 20.1 percent. Calhoun County had 17 percent minority population (Census, 2014b). Percentages of minorities in the FCTC area are substantially lower than those in the state.

According to Census data at the block group level, the nearest minority (50 percent or more minority) block groups were approximately 3.7 miles east of the CIS footprint in the western part of the City of Battle Creek. Minority block groups are also present north of Kalamazoo, about 11.7 miles west of the closest point on FCTC Site 1. Other than those areas surrounding the nearest cities, most of the area overlapping and around FCTC has a low to moderate percentage of minority residents (between 3 and 32 percent) that is lower than or generally comparable to the percentage for the counties and the state. The majority of this area has 15 to 20 percent minority residents, with the higher minority area coinciding with the location of residential areas north of the FCTC installation boundary (USEPA, 2013b).

While racial and ethnic minorities are reported in Census data as 17 to 18 percent of Kalamazoo and Calhoun Counties' populations, minorities generally represent a higher proportion of the population in certain areas, such as the cities of Springfield (23 percent) and Battle Creek (28 percent) (Census, 2010e).

3.3.5.2.3 Low Income Populations

For an area to be termed low income, it would have to meet one of the following criteria:

- Its population would need to have either 50 percent or more residents living with incomes below poverty level
- The population in an area would need to have 20 or more percent greater rate of people living below the poverty level than the population in an area of comparison, such as another nearby community, county, or the state.

The 2015 federal poverty level for an individual is $11,770. For each additional person in a household, there is a determined poverty level that is incrementally increased from the individual level. For a family of four people, the poverty level in 2015 is $24,250 (FR, 2015).

Private residences in the vicinity of FCTC are a blend of rural, suburban, and urban in nature. Evidence of substantial low income populations was found in Census data, with several Census block groups around the cities of Battle Creek and Kalamazoo having a large disparity in percentages of low income residents when compared to the majority of the FCTC immediate area. According to Census data, the nearest low income (50 percent or more of the people having incomes below the poverty level) block group about 3 miles east of FCTC, southwest of Battle Creek. Multiple Census block groups north-northwest and south of Battle Creek have percentages of low income residents ranging from 75 to 84 percent, which is substantially higher than the percentage in the area of FCTC at 1, 15, 15, and 20 percent for the four Census block groups overlapping and adjacent to the site. The area with 20 percent of residents falling in the low income category coincides with the residential areas north of the FCTC installation boundary. There are also high percentages of low income residents in the area surrounding the City of Kalamazoo, with two Census blocks southeast of the central portion of the city showing 95 and 100 percent low income residents. Many residents within the 1 to 2-mile area east of Kalamazoo fall into areas with more than 50 percent low income residents. In Calhoun County, the total percentage of residents receiving cash public assistance and food stamps in 2013 was 23 percent, while the percentage in Kalamazoo County was almost 22 percent. In contrast, approximately 46.5 percent of Kalamazoo County households and 42.3 percent of Calhoun County households had incomes of $50,000 or more (Census, 2014b).

The percentage of all people in Kalamazoo County with incomes below poverty level was 17.7, while the percentage of all people in the State of Michigan was 16.2. The percentages of families with incomes below the poverty level are 12.0 in Kalamazoo County and 12.0 in the state. In Calhoun County, the percentage of all people with incomes below poverty level was 18.7, and 13.4 for all families (Census, 2014b). The overall percentages of people with incomes below poverty level in the area around FCTC are roughly equivalent to the percentage in the state, but appear to be trending slightly higher, especially in Calhoun County to the east of FCTC (in which approximately half of FCTC Site 1 lies). Calhoun County includes one of the larger cities in the site vicinity, the City of Battle Creek.

3.3.5.2.4 Environmental Justice Data by Census Block

Table 3.3.5-1 shows both the percentages of minorities and people living with incomes below poverty level for each individual census block group that overlaps or is adjacent to the FCTC installation, which gives a more site-specific picture of these factors. The block groups are listed Table 3.3.5-1 in counterclockwise order as shown on Figure 3.3.5-1, are l beginning with the block group covering the area of the FCTC Site 1 footprint.

Table 3.3.5-1 Summary of Environmental Justice Factors in FCTC Area

Census Block Group	Percent Minority	Percent Below Poverty	County	Portion of FCTC Within Block Group
260770067011	3	36	Kalamazoo	All of FCTC Site 2 and western part of Site 1; western 2/3 of FCTC installation
260770067012	15	14	Kalamazoo	Southern sliver of west side of FCTC installation; no CIS facilities
260250015003	20	9	Calhoun	Southeast corner of FCTC Site 1 and FCTC installation
260250026001	32	62	Calhoun	East half of FCTC Site 1 and east 1/3 of FCTC installation
260770026015	11	22	Kalamazoo	Sliver of the northern point of the FCTC installation; no CIS facilities
Source: USEPA, 2013b.				

Often, individuals or groups of people who rely on natural resources for food and/or income, or live at a subsistence level, may be associated with very low income areas. Information about these groups and individuals is not typically captured in Census or other population data. Based on socioeconomic data and information reviewed and input from FCTC personnel, no populations or local groups are known to principally rely on fish or wildlife for subsistence on FCTC or in the surrounding vicinity (Krupp, 2016).

3.3.5.2.5 Community Health

Community health was evaluated primarily using county and state health department information and was supplemented with information from USEPA's EJSCREEN database (USEPA, 2013; NCHCP, 2013). The County Health Rankings & Roadmaps compiles county health profile information, which is summarized in Table 3.3.5-2 for Kalamazoo and Calhoun Counties.

Table 3.3.5-2 Community Health Indicators for Kalamazoo and Calhoun Counties – FCTC Sites

Kalamazoo County	Calhoun County
No health insurance: 12 percent of residents are uninsured	No health insurance: 14 percent of residents
2,477 deaths per year that are deemed premature (before age 75)	1,957 deaths per year that are deemed premature (before age 75).
Chronic disease risk factors: --18 percent smoke cigarettes (adults) --29 percent obese	Chronic disease risk factors: --26 percent smoke cigarettes (adults) --35 percent obese
Cancer is the leading cause of premature death	Cancer is the leading cause of premature death
Source: UW, 2015c; MDCH, 2011.	

In addition, data provided by the USEPA in their EJSCREEN online tool was used to compile information on several general indicators of community health status in the area around FCTC in Kalamazoo and Calhoun Counties. This data includes the most recent available statistics for cancer risk, respiratory risk, and neurological risk in accordance with the National-Scale Air Toxics Assessment (NATA), which is USEPA's ongoing comprehensive evaluation of air toxics that is used to prioritize pollutants, emission sources, and locations of interest and to better understand potential health risks. The NATA results have been reported every 3 years by the USEPA in the past; however, the information in the most current NATA dates to 2004 and 2005 (USEPA, 2013b; USEPA, 2013c).

The NATA-determined health risks for the region around FCTC are included in Table 3.3.5-3. As can be seen in the table, Kalamazoo and Calhoun Counties have higher potential health risks for all categories than the state as a whole.

Table 3.3.5-3 Estimated Health Risks for FCTC Region

Area	Cancer Risk (Persons per Million)	Neurological Hazard Risk	Respiratory Hazard Risk
Kalamazoo County	36.55 (75 Percentile)	0.05 (87.7 Percentile)	1.1 (73.9 Percentile)
Calhoun County	32.59 (62.5 Percentile)	0.04 (82.4 Percentile)	0.88 (64.6 Percentile)
State of Michigan	43.51 (63.5 Percentile)	0.06 (61.5 Percentile)	1.56 (51.9 Percentile)
Note: Values are derived from 2005 NATA Cancer Risk Estimates and Non-Cancer Hazard Index. Scores. Percentiles are ranking of counties and states from 0 (lowest) to 100 (highest). Source: USEPA, 2013b; USEPA, 2013c.			

USEPA information about the FCTC area shows the following numbers of sites reporting under various USEPA within approximately 1 mile of the FCTC installation boundary. The information indicates that most emission sources are congregated near small towns or other more developed areas, such as the industrial park near the FCTC installation entrance and the general vicinity of Battle Creek (USEPA, 2013c):

- 76 sites reporting hazardous waste generation.
- 21 sites with reported air emissions.
- 8 sites reporting water discharges in addition to FCTC.
- 17 sites reporting release of toxics in addition to FCTC.

3.3.5.2.6 Presence of Contamination at FCTC

The greatest potential for contamination on FCTC is associated with the release of petroleum-based products to the environment due to spills or leaks from vehicles or generators. Releases are associated with the unit training and equipment site, the regional training site for maintenance, and other training exercises in more remote areas on post. The nearest groundwater monitoring wells are located to the southwest at a lower elevation than the project site. Regular monitoring of surface water at various locations and groundwater from 30 wells within the installation is ongoing. Surface and groundwater from the small arms ranges were sampled in 1999. Elevated levels of lead were found in Training Area 2 in association with a storm drain at the unit training and equipment site. Remediation has occurred and there is an on-going monitoring program in place. A Draft Environmental Condition of Property Report revealed no evidence of recognized environmental conditions in connection with the CIS footprint (USACE, 2009b).

FCTC implements an Installation Spill Prevention, Control, and Countermeasures (SPCC) Plan that provides guidance concerning the containment and cleanup of spills (for all types of hazardous materials) identified in the Installation Spill Contingency Plan.

Potential construction activities at the CIS could disturb existing (unknown) areas of contamination because the soil surface, surface waters, and groundwater would be disturbed during filling and grading of the site as well as excavation of the deep vaults needed for placement of the GBIs. However, there is no known contamination in the CIS footprints of either FCTC Site 1 or FCTC Site 2 or the surrounding areas. Impacts on community health related to potential mobilization of existing contamination are, therefore, not major.

3.3.5.3 Environmental Consequences and Mitigation – Environmental Justice – FCTC Sites

For there to be a notable concern that low-income or minority populations would be subject to a disproportionate share of negative impacts from a facility, the following statements generally need to be true: 1) high percentages of minority and low income populations would be present in close proximity to the site; 2) negative cultural, economic, or health impacts on such populations would be expected; and 3) minority and low-income areas would bear a disproportionate share of negative impacts from the facility.

3.3.5.3.1 Construction – Baseline Schedule

3.3.5.3.1.1 Environmental Consequences

3.3.5.3.1.1.1 FCTC Site 1

Examples of potential environmental justice-related effects could include increased health risks from air and toxics emissions, increased noise levels from potential activities, a reduction in employment opportunities, and/or adverse effects on fish and wildlife used for subsistence by local groups.

Impacts on Minority Populations

Given the expectation that most negative impacts to all populations in the area would be temporary and related to noise and traffic near the site, minority areas would not be directly affected by CIS construction because the nearest minority area is approximately 4 miles from the CIS footprints for FCTC Site 1 or Site 2. If the approximately 60 to 90 construction workers (approximately 15 percent of the estimated 400 to 600 total construction workers) assumed to relocate to the FCTC area do so in a distribution pattern that is reflective of the current demographics of the population in the region, very few workers and their families would be expected to establish residences in one of the closest minority areas. Given that the estimated number of relocating construction workers would be a very minimal change in population for the FCTC surrounding area, the impacts on health and culture would be negligible.

Neither Kalamazoo nor Calhoun County would be considered a minority area, nor would any of the Census block groups that overlap the FCTC installation or the CIS footprint. Most impacts from construction for the potential CIS deployment would be limited to the CIS footprint, the FCTC installation, and the immediate surrounding area, with Kalamazoo County being the focus because the entire FCTC Site 2 footprint and the majority of the FCTC Site 1 footprint are within its boundaries. Calhoun County, which overlaps only a small eastern portion of the FCTC installation and a portion of the FCTC Site 1 footprint, would be expected to experience negligible negative impacts. Disproportionate impacts to the small minority populations in these two counties would not occur.

As described throughout this EIS document, any air, water, noise, dust, or other emissions from construction of the CIS that could have an impact on community health would be minimized through the use of BMPs and potential mitigation measures. These measures would ensure that emissions from CIS construction would have negligible contributions to the existing level of emissions in the FCTC vicinity or to the potential impact from those emissions on community health.

In summary, any negative impacts on minority populations would be negligible, and not disproportional to the overall population impacts. Therefore, no mitigation measures would be required.

Impacts on Low Income Populations

As previously discussed, there are no low-income areas in the FCTC vicinity, and the nearest area that qualifies as low income is a Census block group about 4 miles east, near the City of Battle Creek.

As discussed in Section 3.3.8, the potential health impacts on local populations from construction for the potential CIS deployment would be limited to minor noise impacts and possibly impacts related to the increased emissions and traffic delays associated with worker vehicles and transportation of materials and supplies to the site. These impacts would be temporary and largely limited to the CIS footprint and areas near the FCTC installation main entrance. Because of the limited geographic nature of such impacts, the nearest low income area near the City of Battle Creek would not be disproportionately impacted.

Based on communications with FCTC personnel, no known subsistence level hunting, fishing, or trapping occurs at FCTC or in the surrounding area (Krupp, 2016). Therefore, no impacts to subsistence populations would occur.

The socioeconomic impact analysis for CIS construction in Section 3.3.11 concluded that the impacts from CIS construction would be major and largely positive and beneficial to the FCTC surrounding region. Primary among these positive impacts are employment and income benefits and increased tax revenues to local jurisdictions. Although the most extensive economic benefit would likely occur in Kalamazoo and Calhoun Counties because of increased property and sales tax revenues, it is expected that the wider surrounding area would also benefit economically as a result of the CIS project. Generally, low income populations can be assumed to benefit from these impacts to a comparable degree as other regional populations.

Community Health Needs Assessments conducted in Kalamazoo County in 2012 and 2013 indicate a strong need for jobs for many low income residents of the area surrounding FCTC.

There may be a perceived environmental justice concern from these residents if a large project like the CIS construction needed 400 to 600 workers, but did not make an attempt to hire local people for at least a portion of those jobs. This concern may be tempered if the local low income population does not have the skills needed for the construction positions to support the CIS construction at FCTC.

In summary, the overall project-related impacts on low income populations would be positive. However, such impacts likely would be negligible because most of the jobs that low income workers would benefit from (particularly in the services industry) would be relatively low-paying and not substantial enough to meaningfully change the economic status of most low income people.

Impacts on Community Health

General Community Health. The overall health of the community surrounding FCTC would not be impacted by construction of the potential CIS. The majority of potential impacts on community health from CIS construction would be temporary. Measures to protect air quality, water quality, pollution prevention, BMPs, distance from residential and other sensitive receptors, and other mitigation measures discussed throughout this EIS would ensure that potential CIS construction impacts to community health would be minimized and remain minor.

Children's Health. There are two important areas of difference between children and adults regarding potential health impacts. First, there are differences in exposure to pollutants and in the nature and magnitude of health effects resulting from the exposure that relate to greater vulnerability of children to certain effects (body systems still in development) and the differences in children's behavior (crawling, ingestion) that may place them at greater risk. Second, there may be a different economic value placed on reducing health risks to children compared to reducing such risks to adults. Additionally, short-term exposure of children to environmental contaminants such as lead or mercury can lead to life-long health consequences (USEPA, 2014a).

Disproportionate impacts to children's health (compared to adults) would not occur from construction of the CIS project at FCTC. Because of the large size of the project site, many of the impacts such as air emissions from construction equipment, noise, VOCs from paints, chemicals, and fuel tanks, and similar activities are likely to remain largely within the CIS footprint and FCTC installation boundary. Although these emissions may travel the short distance to the residential area east of FCTC Site 1, air and other emissions would dissipate into the air and/or to an undetectable level before reaching this area east of the site.

Children generally are not present at FCTC, as it is an active military training installation. The nearest school to the site is Martin School, just east (0.62 mile) of the eastern installation and FCTC Site 1 boundary. CIS construction traffic along Interstate (I)-94 is therefore unlikely to disproportionately impact children living in residences outside the FCTC site or attending schools in the surrounding area.

Summary. The potential for negative environmental impacts during construction would largely be minimized through the application of routine construction procedures, BMPs, and the location of the CIS at an existing military installation that includes a relatively large forested buffer area. Routine procedures include those in the areas of site security, employment screening, fire protection, medical preparedness, spill containment measures, dust suppression, noise minimization, traffic control, and other measures that would minimize negative impacts to the surrounding area. Overall, no specific populations, including minority, low income, or children, would be disproportionately impacted by construction of the CIS.

3.3.5.3.1.1.2 FCTC Site 2

The environmental consequences for environmental justice for FCTC Site 2 under the baseline schedule would be the same as that described for FCTC Site 1.

3.3.5.3.1.2 Mitigation

Because no disproportionate environmental justice impacts would occur during construction for the potential CIS deployment, no mitigation measures are required. Construction mitigation measures discussed throughout this EIS to minimize impacts to air quality, water quality, traffic, ambient noise environment, health and safety, socioeconomics, and land use would also serve to minimize the potential for adverse impacts to community health in the area around FCTC.

3.3.5.3.2 Construction – Expedited Schedule

3.3.5.3.2.1 Environmental Consequences

Environmental justice impacts under the expedited schedule would to be similar to the baseline schedule because, although impacts from the overall project would occur faster and with greater intensity, the impacts would occur to the same area as that evaluated in the baseline scenario and would not disproportionately impact low income and minority areas. With the more urgent need to hire construction workers so that construction could begin and progress more quickly, there might be an increased perception on the part of people seeking employment in the area surrounding the potential CIS deployment that they are being denied job opportunities if an effort is not made to hire local labor for construction of the project. However, the number of direct jobs that a project provides to the local community is not a regulated factor, depends on the skills of the job-seekers, and is outside the environmental justice focus on low income and minority population impacts.

Environmental consequences for FCTC Site 1 and FCTC Site 2 for environmental justice under the expedited construction schedule would be the same.

3.3.5.3.2.2 Mitigation

Mitigations for environmental justice under the expedited schedule for both FCTC Site 1 and FCTC Site 2 would be the same as that discussed for the baseline schedule.

3.3.5.3.3 Operation

Environmental consequences and mitigations for environmental justice would be the same for both FCTC Site 1 and FCTC Site 2 as discussed in the following sections.

3.3.5.3.3.1 Environmental Consequences

Based on the information included in Section 3.3.5.2, the nearest areas to FCTC that qualify as minority and low income areas are specific Census block groups in the vicinity of the City of Battle Creek and are approximately 5 miles east of the FCTC Site 1 and FCTC Site 2 footprints. In light of these characteristics of the area in the region around FCTC and the expectation that any impacts during operation of the CIS would be largely contained within the CIS footprint and FCTC installation boundaries, it is reasonable to conclude that there would not be specific populations near the site that would raise environmental justice concerns.

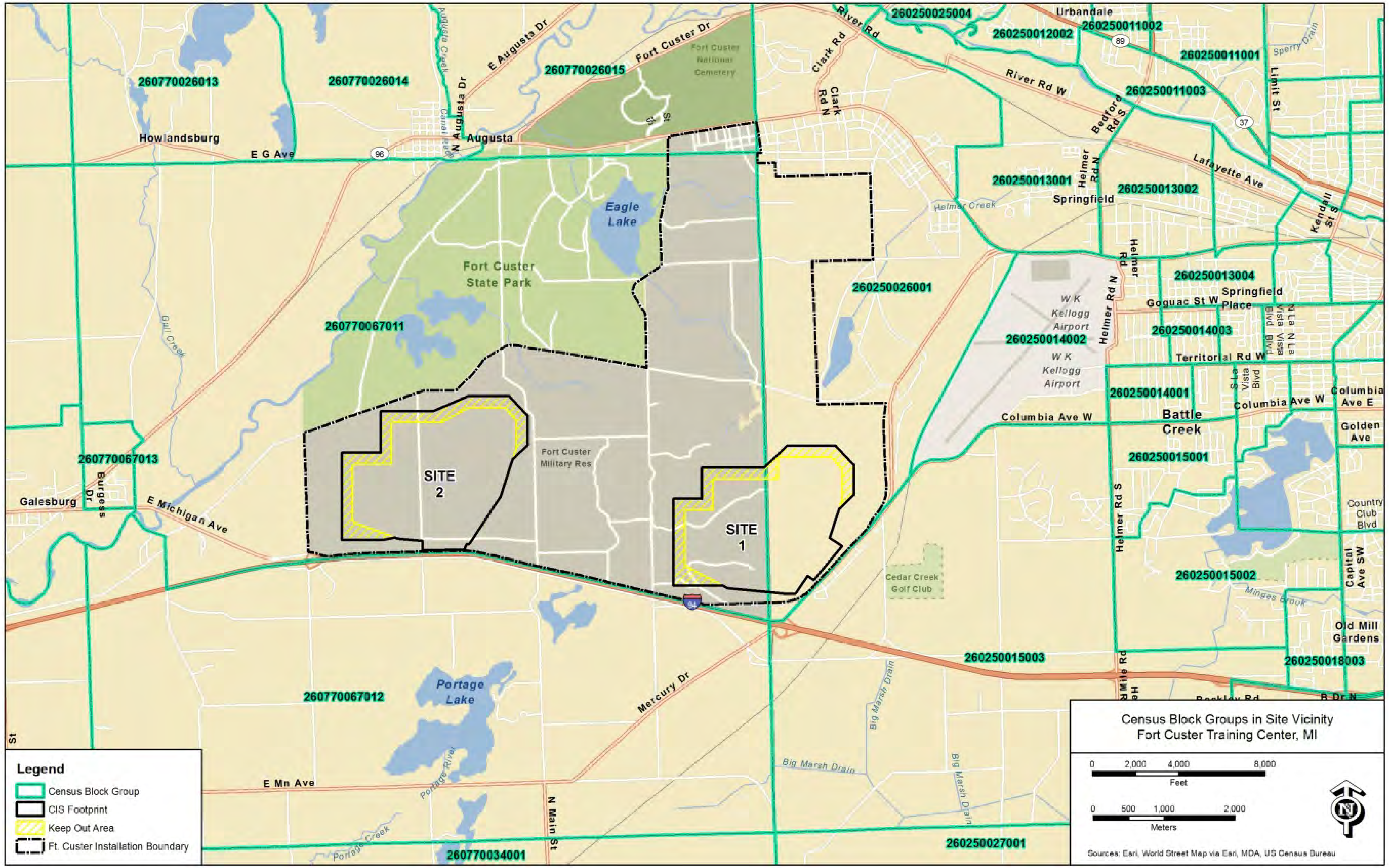
The absence of substantial minority or low income populations, and the general absence of children from an active military training site further reduces the potential for impacts from CIS operational activities.

The three conditions required for environmental justice impacts are not present in the FCTC area. Namely, 1) low income or minority populations are not in close proximity to the site; 2) during operation, only minor negative impacts would occur, other than potentially larger traffic impacts near the FCTC installation main entrance; and 3) low income and minority populations would not be subject to a disproportionate share of any negative impacts from the operation of the CIS because low income, minority, or subsistence populations are not located near the site.

3.3.5.3.3.2 Mitigation

Because environmental justice impacts from operation of the potential CIS would not occur, no mitigation measures would be required. Operational BMPs and other measures discussed throughout this EIS to minimize impacts to air quality, water quality, traffic, ambient noise environment, health and safety, socioeconomics, and land use would also serve to minimize the potential for adverse impacts to community health in the area around FCTC.

Figure 3.3.5-1 Census Block Groups in the FCTC Vicinity



3.3.6 Geology and Soils – FCTC Sites

Geology and soils are those earth resources that may be described in terms of landforms, geology, and soil conditions. The makeup of geology and soils, including freshwater and marine sediments, could influence erosion, depletion of mineral or energy resources, seismic risk or landslide, structural design, and soil and groundwater contamination resulting from potential construction and operational activities (DoD, 2007).

3.3.6.1 Regulatory Framework – Geology and Soils – FCTC Sites

The following Army regulation applies to geology and soils:

- AR 200-1, Environmental Protection and Enhancement - Covers environmental protection and enhancement and provides the framework for the U.S. Army Environmental Management System.

3.3.6.2 Affected Environment – Geology and Soils – FCTC Sites

The following site location and history information was obtained from the FCTC INRMP (MDMVA, 2012). FCTC is located in portions of Kalamazoo and Calhoun Counties, in the southwestern lower peninsula of Michigan.

The installation occupies approximately 7,570 acres of contiguous land, situated between Interstate 94 to the south and FCRA and the Kalamazoo River to the north. More than 90 percent of FCTC exists in an undeveloped condition, most of this being in second growth forest cover and in natural areas of fens, swamp and prairie remnants including several high quality rare communities. The remaining 10 percent is developed for training and cantonment areas and occupies the northern-most portion of the post.

3.3.6.2.1 Affected Environment – FCTC Site 1

3.3.6.2.1.1 Physiography and Topography – FCTC Site 1

FCTC is located within the Hilly Moraines region that dominates much of the interior part of the lower half of Michigan's Lower Peninsula (MDMVA, 2012). This region is largely made up of a series of looping end moraines from 10 to 25 miles apart. The moraines are low ridges, and the area between them, is often much flatter and is generally composed of outwash plains or ground moraine. Topographic elevations in the vicinity of FCTC Site 1 range from approximately 880 to 1030 ft above MSL. Much of FCTC Site 1 is located on the upper elevations of the hilly moraines, which are recharge areas of the local aquifer. The northern portions of FCTC Site 1 installation are part of the outwash plains and ground moraine, where northwest-southeast trending ridges lead to lower elevation and where groundwater intercepts ground surface. Several lakes and streams are present within the footprint of FCTC Site 1.

3.3.6.2.1.2 Geology and Hydrogeology – FCTC Site 1

Glacial and surficial geology of FCTC Site 1 consists primarily of glacial outwash sands and gravels and post glacial alluvium and end moraines of coarse textured glacial till. Majority of the sediments that underlay FCTC Site 1 consist of various sizes and gradations of sands and gravels. The northern portions of FCTC Site 1 are underlain by the same sands and gravels but also a dense glacial clayey till of various thicknesses. The bedrock geology of the area consists entirely of Mississippian age shale, overlain by the glacial drift. Bedrock was not encountered during a recent site investigation but is thought to be over 100 ft below ground surface (bgs) at FCTC Site 1 (BVSPC, 2015a).

There are no known mineral resources at the FCTC Site 1 footprint location.

Groundwater aquifers are found in both the unconsolidated glacial sediments as well as bedrock at FCTC. The unconfined surficial aquifer varies in depth underneath FCTC Site 1 ranging from approximately 70 ft bgs in the south to 10 ft bgs in northern portions of the site (BVSPC, 2015a). However, the groundwater level was typically greater than 50 ft within the FCTC Site footprint. FCTC lies in the southwestern outwash plain, which formed between the three major glacial lobes that occupied Lake Michigan, Lake Erie, and the Saginaw Bay basins. This plain encompasses numerous small lakes, wetlands, and small ridges of ground moraine.

3.3.6.2.1.3 Soils – FCTC Site 1

FCTC is more than half covered by outwash deposits of gravel and sand. More than 80 percent of the outwash in the section is in the 0 to 6 percent slope class. Scattered throughout the outwash plain are small areas of end and ground moraine. The moraines slopes are usually in the 0 to 6 percent or 6 to 12 percent slope classes. Majority of FCTC Site 1 is underlain by the Coloma-Sprinks-Oshtema association which is classified as well to moderately drained, erodible soils, which have a sandy or loamy subsoil and are found on ridges and upland plains of the site. Some areas at lower elevations, exhibit poorly drained mucky soils of the Houghton and Adrian complex and are the main soils of the wetland complexes.

3.3.6.2.1.4 Geologic Hazards – FCTC Site 1

Seismic activity in Michigan is very low and the probabilistic hazard mapping identifies the New Madrid zone as a major contribution to the seismic hazard and, therefore, results in the low seismic risk at FCTC Site 1.

This area is not identified as a known karst area (features that are naturally occurring solution cavities within the bedrock) by the MNFI; therefore, land subsidence and collapsible soils would not occur. A review of the relative densities of the sand layers, fines content, shear wave velocity profiles, depth to groundwater and low seismic accelerations show that liquefaction would not be a concern. There are no substantial slopes on the FCTC Site 1 footprint and landslides would not be a hazard.

Mapping by the Federal Emergency Management Agency (FEMA) of the potential flooding areas show the potential facilities areas would not be within flood zones.

3.3.6.2.2 Affected Environment – Geology and Soils – FCTC Site 2

The affected environment for Geology and Soils for FCTC Site 2 would be the same as that described for FCTC Site 1 except for the following:

- Topographic elevations in the vicinity of FCTC Site 2 range from approximately 800 to 1000 ft above MSL.
- The upper elevations of the hilly moraines consist of various sizes and gradations of sands and gravels above dense silts and clays. At lower elevations, the geology is composed of outwash plains and ground moraines. For FCTC Site 2, mucky silts and dense tills of varying thickness are closer to the ground surface than those of FCTC Site 1.
- Southern portions of FCTC Site 2 are recharge areas where higher elevations slope to northwest-southeast trending ridges. Leading to lower elevation and where groundwater intercepts the ground surface.

3.3.6.3 Environmental Consequences and Mitigation – Geology and Soils – FCTC Sites

This section addresses the potential geologic hazards and environmental impacts that may affect the design and construction for the structures and foundations at the FCTC Sites. The project activities evaluated include construction and operation impacts.

3.3.6.3.1 Construction – Baseline Schedule

3.3.6.3.1.1 Environmental Consequences

3.3.6.3.1.1.1 FCTC Site 1

Construction of a new CIS and support facilities at FCTC Site 1 would require disturbing approximately 805 acres for grubbing and grading. Traditional drilling and excavation would be used at FCTC Site 1. The existing available soil material should be suitable for site grading. Soils at FCTC Site 1 were identified as sandy silts, silty sands, and sandy clays. The soils are not expansive. The soils could be used for general site grading, structural fill, and slopes. The density of the existing sands and stiffness of the clays and silts show there should be sufficient bearing capacity to support conventional loads. The existing subgrades should undergo immediate settlement in areas where substantial site grading would be required. Groundwater would be a concern for shallow excavations at FCTC Site 1. A more in depth constructability evaluation for FCTC Site 1 is provided in the CONUS Site Analysis Report (BVSPC, 2015a).

To establish proper topography at the site, construction and potential CIS deployment activities would require ground surface grading, including both excavation (cut) and placing of compacted fills. Large quantities of the amount of cut and fill have been estimated to maintain a 2 percent grade for specific areas within the CIS footprint. By using existing topographic elevations, a conservative estimate of earthwork at FCTC Site 1 may include 10 to 15 MCY of cut material and approximately 10 to 15 MCY of fill material (MDA, 2016a). Reuse of the soil onsite would be implemented to the extent possible in lieu of material importing and exporting. Due to the estimated quantities of cut and fill, the project construction would not require the export of excavated materials or the import of fills from offsite source. There would be potential for the use of onsite sand and gravel resources as part of the construction process.

Several former and potential active gravel pits exist on or are in close proximity to FCTC if extra cut or additional fill is required. The exact quality, extent, and economic potential of the aggregate resources are unknown. Minimizing the construction footprint through phased earthwork at these onsite areas would be sufficient for staging during construction. There are no known mineral resources within the FCTC Site 1 footprint; therefore, development of land for the potential CIS at this site would not affect mineral resources. All clearing, staging, and disposal of excavated soils would be provided in accordance with local, state, and federal regulations.

Though most soils at FCTC Site 1 are well drained and slopes are not substantial, BMPs would be used to stabilize soil erosion in sloped and previously forested or vegetated areas during construction. BMPs would be implemented to minimize negative short-term effects of the construction activities including clearing and grubbing, excavations, and grading for connecting infrastructure, roadways and parking.

Dewatering techniques would be required in areas where groundwater intercepts construction activities. Due to the sensitive nature of the aquifer/wetland hydrology at the site, proper aquifer and watershed management would be encouraged. Though there is not a contamination potential at FCTC, analytical testing of water generated during construction would be needed to determine if treatment would be required before discharge. Extraction wells to reduce infiltration in deep excavations would be discouraged and shoring systems that prevent seepage would be encouraged.

There is potential for hazardous material and hazardous waste spills affecting the soils and geology during construction. Hazardous materials and hazardous waste including gasses, solvents and any other substances that, because of their quantity, concentration, or physical, chemical, or infectious characteristics, may present substantial danger to the public health, welfare, or the environment if an unlikely release. Minimization of hazardous materials spills would occur through implementation of site-specific hazardous material management plans and procedures.

3.3.6.3.1.1.2 FCTC Site 2

The construction environmental consequences for geology and soils for FCTC Site 2 would be the same as those described for FCTC Site 1 except for the following:

- Deployment of a potential CIS at FCTC Site 2 would require disturbing approximately 830 acres for grubbing and grading.
- Groundwater would be a concern for shallow excavations. Groundwater depths at FCTC Site 2 are from near ground surface to 55 ft bgs, although typical ground level depths are less than 50 ft bgs within the FCTC Site 2 footprint.
- The earthwork at FCTC Site 2 is estimated to consist of 15 to 20 MCY of cut material and approximately 15 to 20 MCY of fill (MDA, 2016a).

3.3.6.3.1.2 Mitigation

3.3.6.3.1.2.1 FCTC Site 1

The impacts associated with construction activities would be reduced from moderate impacts to minor impacts with the implementation of BMPs. Therefore, implementation of mitigation measures would not be required.

BMPs would be used to reduce the potential for soil erosion during construction. BMPs recommended would include reduction of slopes, partially grading streets, and pads minimizing clearing areas, frequent watering of graded areas and the use of soil stabilizers, and revegetation of slopes where applicable during construction.

Any fill material would be tested to ensure proper engineering characteristics and would be properly compacted to ensure stability of the surface and to reduce the potential for erosion. Shallow and deep excavations would be completed with traditional equipment. Deep excavations would be shored with the use of conventional braced sheeting, secant columns, or jet grout columns. Concrete plugs or thickened seal slabs would be needed at the base of the excavations to prevent heave due to groundwater inflow within wet sands. Heave could also be prevented with the use of soil cement columns or other binding soil modification methods that would provide a cementation at the subgrade level prior to the start of excavation. Dewatering techniques including sumps and pumps could be adequate for shallow excavations; groundwater may be mitigated with the use of extraction wells to reduce groundwater pressure and low permeable shoring during deep excavations. As noted in the groundwater modeling report (Shu-Guang Li, 2015) construction and operation of the CIS would influence prairie fen and wetland recharge though the impact would be minimal. Site hydrology would be monitored during construction.

Investigations indicated that soils and groundwater contamination are minimal to non-existent at FCTC Site 1. Contaminated soils and groundwater generated during construction would require initial analytical laboratory testing during excavation and dewatering. Treatment and disposal of the media would be in accordance with federal, state, and local requirements before discharge or disposal.

3.3.6.3.1.2.2 FCTC Site 2

The construction mitigation for geology and soils for FCTC Site 2 would be the same as those described for FCTC Site 1 (minor impacts) except for the following:

- Due to shallower groundwater depth at FCTC Site 2 versus FCTC Site 1, enhanced dewatering techniques including sumps and pumps might be required for shallow excavations.

3.3.6.3.2 Construction – Expedited Schedule

3.3.6.3.2.1 Environmental Consequences

3.3.6.3.2.1.1 FCTC Site 1

The environmental consequences associated with the construction under the expedited schedule would be similar to those described for the FCTC Site 1 baseline schedule in Section 3.3.6.3.1.1. Due to the expedited schedule and the amount of earthwork required, larger expanses of land that would have to be cleared and exposed at a time during construction. The shortened duration on construction would increase the intensity and context of the open construction areas and phased cutting and grubbing, including excavating and placement of site soils may not be achievable. Though impacts would be minor to moderate, local and state regulations for earthwork, such as limiting the number of distributed acres at one time, may not be able to be met. Site BMPs would need to be aggressively implemented to properly minimize negative short-term effects of the construction activities.

The expedited schedule could also have moderate impacts on construction where groundwater intercepts construction activities and dewatering techniques would be implemented. The intensity of groundwater extraction could affect site aquifers, fens, and wetland. Site hydrology may require monitoring during construction. Refer to Section 3.3.14 Water Resources and Section 3.3.15 Wetlands for information regarding impacts to site hydrology, wetlands and fens and associated mitigative measures).

3.3.6.3.2.1.2 FCTC Site 2

The environmental consequences associated with the construction under the expedited schedule would be similar to those described for the FCTC Site 2 baseline schedule in Section 3.3.6.3.1.1 but more intensified due to the compressed/expedited schedule, so moderate impacts would occur.

3.3.6.3.2.2 Mitigation

3.3.6.3.2.2.1 FCTC Site 1

Although moderate impacts to geology and soil would occur due to expedited construction activities, no mitigation measures would be required.

3.3.6.3.2.2.2 FCTC Site 2

Although moderate impacts to geology and soil would occur due to expedited construction activities, no mitigation measures would be required.

3.3.6.3.3 Operation

Impacts from potential CIS operation would be negligible. Following construction the potential CIS, the potential operation impacts would be relatively minor except periodically for maintenance of various structures during the service life of the potential CIS operation.

3.3.6.3.3.1 Environmental Consequences

3.3.6.3.3.1.1 FCTC Site 1

Similar to construction activities, during normal operations of the potential CIS soil erosion and slope stabilization could impact the geology and soils of the site and would be addressed using an erosion control plan. Likewise, impacts to soil and groundwater from potential hazardous materials used during daily activities would be addressed by storm water prevention procedures. Refer to Section 3.3.14 Water Resources for site hydrology impacts and mitigative measures.

3.3.6.3.3.1.2 FCTC Site 2

The operation environmental consequences for geology and soils for FCTC Site 2 would be the same as those described for FCTC Site 1.

3.3.6.3.3.2 Mitigation

3.3.6.3.3.2.1 FCTC Site 1

Operations impacts would be negligible and further mitigation would not be warranted.

3.3.6.3.3.2.2 FCTC Site 2

The operation mitigations for geology and soils for FCTC Site 2 would be the same as those described for FCTC Site 1.

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3.3.7 Hazardous Materials and Hazardous Waste Management – FCTC Sites

3.3.7.1 Regulatory Framework – Hazardous Materials and Hazardous Waste Management – FCTC Sites

This section provides the assessment of hazardous waste and hazardous material for the FCTC Sites.

Hazardous materials are defined as any items or agents (biological, chemical, and physical) which have the potential to cause harm to humans, animals, or the environment, either by themselves or through interaction with other factors. A hazardous material can be a solid, liquid, gas, or combination with toxic, flammable, reactive, or corrosive characteristics. These materials are regulated at FCTC by laws and regulations administered by USEPA, U.S. Occupational Safety and Health Administration (OSHA), DOT, and DoD.

Hazardous materials must be disclosed to personnel in accordance with the OSHA 29 CFR Part 1910.1200 Hazardous Communications (HazCom) standards. The materials are to be labeled and stored in accordance with the HazCom standards and the Resource Conservation and Recovery Act (RCRA) 40 CFR Parts 264/265 requirements.

In addition to the federal requirements, responsible personnel who sign shipping papers or manifests for hazardous materials must attend specialized transportation training in accordance with DoD Regulation 4500.9-R, Part II, Chapter 204. Handlers who do not sign shipping papers only receive general awareness, function specific, safety, and security training as indicated in the DoD Regulation. All drivers of hazardous material receive driver's training per 49 CFR Part 177.816 (Army, 2014b).

Hazardous wastes are characterized in accordance with 40 CFR Part 261. Once waste materials are identified as being hazardous the waste would then be managed in accordance with 40 CFR Parts 262-264. These standards outline the requirements for storage, transport, disposal, and associated manifesting for differing types of waste (USEPA, 2015d). Army installations also address environmental issues in their own regulatory document in AR 200-1.

Waste minimization policies are used to recycle materials when feasible to reduce the volume, quantity, or toxicity of the waste. Material minimization methods are presented in 40 CFR Part 266. Non-chemical military munitions are specifically addressed in 40 CFR Part 266.205.The MIARNG must comply with the Michigan Natural Resources and Environmental Protection Act 451 of 1994 (NREPA), Part 111 – Hazardous Waste Management and Park 121 – Liquid Industrial Wastes (Michigan, 2015).

3.3.7.2 Affected Environment – Hazardous Materials and Hazardous Waste Management – FCTC Sites

The mishandling of hazardous materials onsite has the potential to impact several differing environmental matrices. Spillages of hazardous compounds have the potential to contaminate building components as well as soils. Soils saturated with contaminants can release hazardous substances into surface waters and associated sediments. Contaminated surface waters and percolation through soils then result in the hazardous substances arriving in the groundwater aquifers and migrating even further. The contamination of soils and waters result in the exposure of human and ecological receptors.

The MIARNG, current tenant of FCTC, manages hazardous materials and hazardous waste through the implementation of several installation-specific hazardous materials and management plans: the Pollution Incident Prevention Plan (PIPP), SPCC Plan, and Hazardous Materials and Waste Management Plan (HMWMP), (MIARNG, 2011). Implementation of these site-specific plans has been incorporated into a single document referred to as the Integrated Contingency Plan (ICP) (DLZ, 2013).

3.3.7.2.1 FCTC Site 1

3.3.7.2.1.1 Hazardous Materials

This section discusses the hazardous materials that currently exist at FCTC and where they are located. These materials are handled, stored, and managed in accordance with DoD, Army, federal, and state regulations.

The MIARNG created a HMWMP to meet the requirements of NREPA regulations in 2011 (MIARNG, 2011). The HMWMP describes responsibilities, policies, and procedures for storing and managing hazardous materials (pollution prevention) as well as the accumulation, management, and transfer/disposal of hazardous waste within the MIARNG facilities as required by AR 200-1. The SPCC outlines planning procedures and documentation to address contingency planning for the prevention and control of the release of hazardous materials and wastes. To protect human health and the environment, this information has been incorporated in the FCTC's ICP (DLZ, 2013).

Hazardous materials are used regularly at the FCTC and primarily used within the installation's cantonment area which is concentrated in approximately 125 acres and consisting of approximately 112 structures at the installation. Specific facilities of primary interest for the management of hazardous materials and wastes within the cantonment area include vehicle maintenance and storage areas. Engine oil, gear oil, grease, hydraulic fluid, brake fluid, gasoline, diesel fuel, antifreeze, solvents, asbestos brake linings, and paints are used at the motor pool and maintenance facilities. All locations of materials and storage quantities are defined by procedures listed in the ICP as well as procedures to follow in the event of a release (DLZ, 2013).

Cleaning products, asbestos containing materials (ACMs), lead-based paint (LBP), polychlorinated biphenyls (PCBs), and fluorescent light bulbs are used or present in administrative buildings. Herbicides, pesticides, and fertilizers are also used throughout the installation and are stored in accordance with the HMWMP Plan (MIARNG, 2011).

All asbestos containing building materials have been removed from Fort Custer (ANL, 1993). Asbestos containing brake linings are still in use in motor pool maintenance facilities and are to be disposed in accordance with the requirements of the HMWMP Plan (MIARNG, 2011).

Due to the age of existing structures, all painted surfaces must be assumed to contain lead. No LBP survey has been generated for the installation. LBP surveys and removal are performed on an as-needed basis for building demolition or renovations in accordance with applicable regulations. There are no existing buildings to be demolished in the CIS footprint; therefore, there would be no environmental impact by the removal of LBP.

Electrical transformers containing PCBs have been either taken out of service or replaced with non-PCB equipment.

No hazardous materials are currently being stored within the boundaries of the FCTC Site 1 footprint.

3.3.7.2.1.2 Hazardous Waste Management

MIARNG prepared a HMWMP in 2011 in accordance with RCRA, NREPA, and AR 200-1 (MIARNG, 2011). The HMWMP focuses on the management of all hazardous waste generated, stored, or treated throughout the installation. FCTC has been identified as a small–quantity generator of hazardous wastes by RCRA regulations (MIARNG, 2011).

In accordance with the HMWMP, materials categorized as hazardous are containerized in designated satellite storage locations (MIARNG, 2011). When the storage containers are full they are moved within 72 hours from the satellite storage locations to one of two hazardous waste generator accumulation areas to await pick-up and disposal by a licensed contractor.

All used oil and antifreeze generated from motor pool maintenance activities are stored and recycled. Used batteries are also gathered and recycled. Fluorescent light bulbs are recycled and removed from the HMWMP (MIARNG, 2011).

FCTC is an active training center with several ranges for weapons training. There are eight small arms ranges, three small and medium caliber ranges, and a practice grenade range in the northernmost portion of the installation. These ranges continue to accumulate lead as weapons training exercises perpetuate. Maneuver training areas have the potential to incur fuel and oil spills during exercises. These spills are identified when created and addressed in accordance with the appropriately implemented management plan. FCTC has a program in place to monitor surface water and groundwater for the presence of lead and other heavy metals associated with these ranges (URS, 2013b).

3.3.7.2.1.3 Installation Restoration Program

The U.S. Army established the Installation Restoration Program (IRP) in 1975 in concurrence with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as was amended by the Superfund Amendments and Reauthorization Act (SARA).

These regulations were implemented to identify, monitor, and remediate hazardous waste sites at federal facilities. This requirement was satisfied with a Preliminary Assessment conducted by the Argonne National Laboratory (ANL, 1993). The Preliminary Assessment identified four operations that were considered environmentally significant operations at FCTC consisting of the storage of hazardous wastes and materials, storage of fuels, washing of vehicles and equipment, and weapons training ranges. Over time, procedures and planning documents including those like the HMWMP and ICP have been developed to address the environmentally significant operations as well as the development and implementation of an IRP. As part of the IRP, site investigation and environmental monitoring has been implemented and is on-going. Specific investigations including a 1999 site investigation (Snell, 2000) identified elevated heavy metals (lead and arsenic) in both soil and groundwater in arms range areas which are located in the northern portion of FCTC and have been addressed as part of the IRP. This area of concern (AOC) is not located near the CIS FCTC Site 1 footprint. Annual groundwater sampling is also provided in conjunction with the IRP. Based on recent groundwater data results from this annual monitoring (DLZ, 2014) and recent monitoring (surface and subsurface soil, sediment, surface water, and groundwater) provided in conjunction with the CIS site analysis (BVSPC, 2015a), no hazardous materials or hazardous wastes related to the FCTC's IRP AOCs have been noted within the CIS FCTC Site 1 footprint.

3.3.7.2.2 FCTC Site 2

The assessment for Hazardous Materials and Hazardous Waste Management for FCTC Site 2 is similar to that for FCTC Site 1, see Section 3.3.7.2.1.

3.3.7.3 Environmental Consequences and Mitigation – Hazard Materials and Hazardous Waste – FCTC Sites

FCTC currently operates with hazardous materials and wastes under state and federal regulatory guidelines. Using existing installation hazardous waste spill prevention programs and management procedures, along with the additional contractor's HazCom and HazWst management program, would minimize the potential for any environmental impacts during construction efforts.

3.3.7.3.1 Construction – Baseline Schedule

3.3.7.3.1.1 Environmental Consequences

3.3.7.3.1.1.1 FCTC Site 1

A HazCom Program for the site would need to be established during the initial planning stages of construction. At least one member of the construction team would need to be designated with the responsibility for the enforcement of the HazWst Management Program at the site. A controlled hazardous material storage area with spill containment areas including pallets for drums, containment cabinets, spill containment equipment, etc., should be established during construction activities and secured by the contractor's HazWst Manager. The additional quantities of hazardous materials, and associated wastes, involved with construction would be reduced by incorporating existing installation management plans coordinating tracking, purchasing, and storage procedures.

The operation and maintenance of motorized vehicles during the construction of the CIS would involve the same types of materials and wastes that are currently in use at the installation motor pools. All fuels, oils, solvents, coolants, and wastes associated with motorized equipment would need to be stored and managed in accordance with the Construction HazCom program. Waste disposal would need to be coordinated with the FCTC's HMWMP and ICP.

Paints, coatings, and solvents used during construction would need to be addressed in the contractor's HazWst management plan and stored and staged in the contractor's HazWst storage area.

Hazardous wastes generated would be stored temporarily within the potential CIS secure area prior to transfer to the FCTC main hazardous waste storage facility for disposal or recycling. This hazardous waste stream would reflect maintenance activities at the motor pool and building services. Waste materials would consist of paints, solvents, oil, lubricants, antifreeze, and batteries.

Impacts throughout the construction process would be alleviated to negligible impacts by strict adherence to established contractor and installation hazardous materials management programs and policies and associated BMPs.

3.3.7.3.1.1.2 FCTC Site 2

The environmental construction consequences for hazardous materials and hazardous waste management for FCTC Site 2 would be same as those described for FCTC Site 1.

3.3.7.3.1.2 Mitigation

3.3.7.3.1.2.1 FCTC Site 1

Because impacts would be negligible, no mitigation measures would be required.

3.3.7.3.1.2.2 FCTC Site 2

Because impacts would be negligible, no mitigation measures would be required.

3.3.7.3.2 Construction – Expedited Schedule

Environmental consequences and mitigations for hazardous materials and hazardous waste management for the FCTC Sites 1 and 2 under the expedited construction schedule would be the same as those described for the baseline construction schedule in Section 3.3.7.3.1.

3.3.7.3.3 Operation

3.3.7.3.3.1 Environmental Consequences

3.3.7.3.3.1.1 FCTC Site 1

As described is Section 2.7.1, several potential CIS-specific facilities would involve the use and storage of hazardous materials. Some hazardous waste would also be generated and temporarily stored prior to disposal. For these activities, a CIS-specific hazardous materials and hazardous waste management plan would need to be developed and implemented. By implementation of the hazardous materials and hazardous waste management plan, the potential for accidental release of hazardous materials would be very limited for the operation of the potential CIS and the potential for impacts would be negligible. The following is a summary of CIS operations involving hazardous materials and hazardous wastes.

The potential for accidental release of hazardous materials is very limited for the operation of the CIS. The additional quantities of hazardous materials, and associated wastes, involved with CIS operations would be reduced by incorporating existing installation management plans coordinating tracking, purchasing, and storage procedures.

<u>General Operations</u>

Similar to construction activities, during normal operations of the potential CIS, materials containing hazardous substances and materials may be brought onsite, such as cleaning supplies, paints, solvents, oil, lubricants, etc. These products would be managed in accordance with the CIS facility plans and or coordinated with pre-existing installation plans such as FCTC's HMWMP and ICP.

Fuel Management

As described in Section 2.4.1, the potential CIS installation would require several fuel storage tanks for the emergency power plant (approximate three 30,000-gallon ASTs) and associated fuel unloading facilities. These facilities would be designed and constructed in accordance with federal, state, and local SPCC requirements and managed in accordance with CIS facility plans to address SPCC requirements and coordinated with FCTC's ICP. Fuel storage tanks would include provisions such as double-walled tanks, secondary containment, and cathodic protection as SPCC measures.

CIS-Specific Activities

The following information is a summary of CIS-specific activities that could involve hazardous materials and hazardous waste management. This information was obtained from the Ground-based Missile Defense Validation of Operations Concept Environmental Assessment (EA) (SMDC, 2002).

KV fuel (hydrazine) and oxidizer (nitrogen tetroxide) are new hazardous materials that would be brought to the facility. These materials are listed on the USEPA's Toxic Substances Control Act Inventory and would be transported in accordance with DOT requirements, arrive at the CIS facility in preloaded tanks (<5 gallons each), and would be stored in separate structures until loaded into the GBI for placement in launch silos. USEPA's Emergency Planning and Community Right-to-Know Act (EPCRA) would be followed by the adequate reporting to the local authorities of the hydrazine which is included in the USEPA's Extremely Hazardous Substance List. A sensor system would be installed which would monitor the status of the propellants. Specially trained emergency response personnel would accompany the transport of these materials onsite to all destinations in the event of a spill.

The current KV system includes beryllium components in the sunshade and telescope. Beryllium is listed on the USEPA's Toxic Substances Control Act Inventory. These components are deeply embedded in the kill vehicle and would never be removed at the missile site. The kill vehicle would be shipped intact to the manufacturer should maintenance on these parts be required.

Small explosive components are used to blow the silo hatch covers during deployment and for GBI booster stage separation. These components would be stored in a separate building prior to installation in the silos and during GBI assembly. The explosive exposure potential would only exist during initial installation and assembly and later during silo maintenance procedures.

Appropriate hazardous materials and waste management plans for specific CIS activities would be developed for the facility. Any hazardous waste generated would be handled in accordance with appropriate federal, state, and local regulations.

3.3.7.3.3.1.2 FCTC Site 2

The environmental operations consequences for hazardous materials and hazardous waste management for FCTC Site 2 would be same as those described for FCTC Site 1.

3.3.7.3.3.2 Mitigation

The operations mitigations for hazardous materials and hazardous waste management for FCTC Site 2 would be same as those described for FCTC Site 1.

3.3.7.3.3.2.1 FCTC Site 1

During normal operations, impacts related to hazardous materials would be minimized by adhering to the policies and procedures outlined in the CIS-specific plans and coordinated with installation plan such as the FCTC's HMWMP and ICP.

Environmental and personnel exposure risks involving the KV fueling operations would only be present during initial delivery, assembly, and loading operations. These risks are reduced through the use of preloaded tanks, supervision by emergency response personnel, and adherence to CIS-specific plans and procedures.

Overall, impacts would be negligible; therefore, no mitigation measures would be required.

3.3.7.3.3.2.2 FCTC Site 2

The operations mitigations for hazardous materials and hazardous waste management for FCTC Site 2 would be same as those described for FCTC Site 1.

3.3.8 Health & Safety – FCTC Sites

This section provides the assessment of health and safety for the FCTC Sites.

3.3.8.1 Regulatory Framework – Health & Safety – FCTC Sites

The statutes and regulatory requirements pertaining to health and safety are as follows:

- AR 385-10, *Army Safety Program* (3 September 2009) - Implements requirements of the Occupational Safety and Health Act of 1970 and establishes policy on Army safety management procedures.
- *Occupational Safety and Health Act of 1970* (29 USC 651) - Legislation designed to ensure that workplaces are free from recognized hazards to safety and health, such as exposure to toxic chemicals, excessive noise levels, mechanical dangers, heat or cold stress, or unsanitary conditions.
- EO 12196, *Occupational Safety and Health Programs for Federal Employees* (26 February 1980) – Provides guidance for the implementation of Section 19 of the Occupational Safety and Health Act of 1970 which includes provisions to ensure safe and healthful working conditions for federal sector employees.
- AR 40-5, *Preventative Medicine* (25 May 2007) - Establishes practical measures for the preservation and promotion of health and the prevention of disease and injury.
- DoDI 6050.5, *DoD Hazardous Communication (HAZCOM) Program* (15 August 2006) - Implements the Hazardous Materials Process Controls and Information Management requirements relevant to product hazard data.
- DoDI 6055.5, *DoD Occupational Health* (11 November 2008) - Implements policies and prescribes procedures for maintaining deployment health activities and reduce occupational and environmental health.
- DoDI 6055.12, *DoD Hearing Conservation Program* (5 March 2004) - Protects DoD personnel from hearing loss resulting from operational (to include combat) and occupational noise exposure.

3.3.8.2 Affected Environment – Health & Safety – FCTC Sites

The evaluation of health and safety considers actions or operations which could affect or provide safety risks and the well-being of construction workers, facility workers, the general public, and the environment. Potential safety risks are typically assessed for activities that primarily occur during construction and operation. These risks are characterized prior to the initiation of actions, documented, and relayed to affected parties, then continually updated throughout the activity as additional safety risks are identified.

3.3.8.2.1 FCTC Site 1

For FCTC Site 1, the primary health and safety issues consist of those related to on-base safety (current training hazards and emergency response systems), the EMR environment, and explosion hazards. Additional health and safety issues and hazards related to specific resources including those related to hazardous materials and hazardous waste management and transportation-related hazards are described within the sections for those specific and respective resources.

3.3.8.2.1.1 On-Base Safety

FCTC Site 1 is used by the MIARNG for training exercises throughout the year for deployment of troops, weapons firing, tactical maneuvers, and responses to disaster conditions. For these activities, safety procedures and hazard prevention are addressed through polices and plans established by MIARNG. As part of these safety procedures, FCTC Site 1 has designated established surface danger zones (SDZs), zones for specific facilities and to further protect personnel based on training activity being conducted. Currently a 7.62 mm range SDZ extends down within the FCTC 1 footprint. If the CIS was deployed at FCTC Site 1 this activity would be moved to another installation with existing training capability. Additional details regarding relocation of the 7.62 mm range are provided in Section 3.3.9 Land Use.

On-base safety also considers the presence of emergency response systems, including those specifically related to fire protection. Currently, FCTC relies on offsite (off base) sources for emergency response systems including fire protection (FCTC, 2016). Some firefighting capabilities are present at W.K Kellogg airport located adjacent to FCTC.

3.3.8.2.1.2 Electromagnetic Radiation Environment

EMR is the radiant energy released by certain electromagnetic processes. EMR is usually classified as one of two types: ionizing radiation (typically produced by x-rays, cosmic rays, and gamma rays) and non-ionizing radiation (typically produced by a wide variety of equipment such as cellular phones, radios, television, and radar). For the potential CIS, issues related to EMR are important due to the potential for interferences with communications equipment, human exposure, and exposure to fuel or explosive devices.

Currently there are no EMR issues at FCTC Site 1 related to current activities. However, to determine the potential for communications equipment, a background assessment of the electromagnetic environment (EME) at the FCTC Sites was conducted as part of the potential CIS siting process by the Joint Spectrum Center (MDA, 2014b). To accurately define the EME at FCTC Site 1, site RF measurements were obtained in the 100 MHz (megahertz) to 45 GHz (gigahertz) frequency band from existing frequency related radiation sources (such as RF-related equipment within the vicinity of the FCTC Site 1 footprint). The measurements obtained from the EME assessment were compared to the frequencies of potential CIS systems to determine compatibilities and if adequate space or distances would be available at FCTC Site 1 to mitigate these potential interferences without special procedures.

Based on the EME assessment conducted, the database searches and onsite measurements indicated that the potential CIS systems would be compatible with the current usage of the electromagnetic spectrum within the vicinity of FCTC Site 1 footprint and that there is adequate distance for the potential CIS to be operated without the interference with EMR source (e.g., radio gear, etc.) that may be in the vicinity of FCTC Site 1 without the use of special procedures (MDA, 2014a).

3.3.8.2.1.3 Explosive Hazards

No areas within the FCTC Site 1 footprint are used for explosives storage. Due to FCTC Site 1 use as an military training area there could be some risk, although perceived low risk from previous survey including a specific survey of the FCTC Site 1 footprint (USACE, 2014d), associated with the presence of munitions of explosive concern (MEC) and UXO. Recommendations from previous survey of the FCTC Site 1 footprint indicated that although encountering MEC and UXO would be low risk during construction activities, standard ordnance awareness training was recommended for construction personnel prior to construction (USACE, 2014d).

3.3.8.2.2 Terrorist Threats

Terrorism is a growing concern throughout the U.S. To counter the threat, facilities such as those to be provided for the CIS are designed and constructed in accordance with the UFC and DoD anti-terrorist building standards, which are designed to address a range of terrorist attack scenarios, including explosives, fire and chemical, biological, and radiological weapons In evaluating installation security for the CIS, MDA considered the potential impacts of threats to the site and community and incorporated commensurate levels of physical security and anti-terrorism mitigation measures in accordance with DoD standards. Measures are in place to secure the CIS facilities with a strong and integrated system. First, FCTC is a closed military installation with its own internal security force and cooperative agreements with local law enforcement agencies. Only personnel with valid credentials are permitted access. Second, restricted areas within the CIS would be completely fenced with access control. The restricted area fencing would be equipped with intrusion detection sensors that are linked to installation security and local law enforcement. Finally, the restricted areas within the CIS also have a dedicated security force that patrols the site and controls access on a 24-hour/7-day basis.

3.3.8.2.3 FCTC Site 2

The affected environment for FCTC Site 2 would be the same as that described for FCTC Site 1 in Section 3.3.8.2.1 with the following exceptions:

- On-base Safety: There are no SDZs (e.g., no safety influence from the 7.62 mm firing range) that currently affects FCTC Site 2.

3.3.8.3 Environmental Consequences and Mitigation–Health & Safety - FCTC Sites

3.3.8.3.1 Construction – Baseline Schedule

3.3.8.3.1.1 Environmental Consequences

3.3.8.3.1.1.1 FCTC Site 1

General Construction Hazards. Some typical risks that would be associated with the construction of the potential CIS could include trips and falls, equipment hazards, dermal contact and inhalation of toxic materials, electrocution, overhead, and lifting hazards, confined space entry, and trenching activities. Each potential CIS construction activity would be evaluated and documented in a formal Job Hazard Analysis (JHA) in accordance with OSHA guidelines. Contractors would prepare and implement JHA and Safety Plan documentation to ensure safe working conditions during construction activities in accordance with applicable guidelines

Explosive Hazards. Because the site was a former ammunition arsenal and a military installation, there is a low risk hazard during construction for encountering MEC and UXO. A survey was conducted at this site which indicated that the risk of exposure is extremely low, however, standard ordnance awareness training was recommended for personnel providing construction activities (USACE, 2014d).

CIS Transportation Hazards. There will be a potential transportation hazard associated with construction. GBI boosters and unfueled KV, payloads, and support equipment would be transported separately by air and then transported over-the-road by common carrier truck to the potential CIS. All shipping would be conducted in accordance with applicable U.S. Air Force, U.S. Army, FAA, and DOT regulations. Transportation of hazardous materials would be in accordance with DOT regulations for interstate shipment of hazardous materials found in 49 CFR Parts 100-199.

Once onsite, the GBI components would be placed in the MAB for assembly, integration, and check-out or ISF for storage prior to assembly or emplacement. The KV bi-propellant tanks would be stored in the KV fuel and oxidizer storage facilities until mounted onto the KV subassembly. From storage, the GBI and KV components are brought separately to the MAB to be assembled. Hazards associated with onsite transportation would be addressed through preparation and implementation of safety procedures and through training.

Based on over 15 years of operations and transport of GBIs to and from sites similar to that anticipated for the potential CIS (e.g., Vandenberg Air Force Base, CA, and Fort Greely, AK), there have been no reported transportation incidents or accidents. As a standard of practice and to alleviate transportation related health and safety issues, prior to any shipments of GBI components, a transportation safety plan would be written in accordance with the appropriate DoD and DOT regulations, and transportation crews would receive the appropriate training in accordance with the plan. In addition, the emergency response personnel and equipment would accompany the GBI components during transport to handle and contain hazardous materials in the unlikely event of a release during transport.

Other Hazards. As previously indicated, a 7.62 mm training range SDZ extends within the CIS FCTC Site 1 footprint. If the potential CIS is constructed at FCTC, FCTC has proposed to relocate this operation to an existing range on another MIARNG installation.

3.3.8.3.1.1.2 FCTC Site 2

The environmental construction consequences for health and safety for FCTC Site 2 would be same as those described for FCTC Site 1, with the exception of the hazards associated with the 7.62 mm firing range which is not located in the FCTC Site 2 footprint.

3.3.8.3.1.2 Mitigation

3.3.8.3.1.2.1 FCTC Site 1

Mitigation of safety hazards related to the 7.62 mm training range would be address by relocating this range to another MIARNG installation. As acknowledged by FCTC and MIARNG the relocation of this range would have minor impacts (MIARNG, 2016). Additional details regarding the relocation of this range are discussed in Section 3.3.9 Land Use.

Other safety issues for construction would be addressed by the implementation of common safety practices. Therefore, no additional mitigation measures would be required.

3.3.8.3.1.2.2 FCTC Site 2

Similar to FCTC Site 1, because health and safety issues would be addressed through common safety practices, no mitigation measures would be required.

3.3.8.3.2 Construction – Expedited Schedule

3.3.8.3.2.1 Environmental Consequences

3.3.8.3.2.1.1 FCTC Site 1

In comparison with the baseline schedule, increased health and safety risks may be incurred during for the expedited construction schedule. Although the exact form of schedule expedition on specific work activities has not yet been specifically defined, the shortened schedule could result an increase numbers of workers onsite, longer work hours, overlapping shifts, and night work. To address these increased health and safety risks, in additional to the common safety practices defined for the baseline schedule, some added but commonly used safety practices (e.g., lighting for night work) could be provided to reduced and eliminate the increased safety risks.

The safety hazards associated with the 7.62 mm firing range, as described for the baseline schedule, would also apply to the expedited schedule.

3.3.8.3.2.1.2 FCTC Site 2

The environmental consequences of an expedited schedule for FCTC Site 2 would be the same as those described for FCTC Site 1, with the exception of the hazards associated with the 7.62 mm firing range which is not located in the FCTC Site 2 footprint.

3.3.8.3.2.2 Mitigation

3.3.8.3.2.2.1 FCTC Site 1

Similar and as defined for the baseline schedule, mitigation of safety hazards related to the 7.62 mm firing range would be addressed by relocating this range to another MIARNG installation.

Other safety issues for construction would be addressed by the implementation of common safety practices. Therefore, no additional mitigation measures would be required.

3.3.8.3.2.2.2 FCTC Site 2

Similar to FCTC Site 1, because health and safety issues would be addressed through common safety practices, no mitigation measures would be required.

3.3.8.3.3 Operation

3.3.8.3.3.1 Environmental Consequences

3.3.8.3.3.1.1 FCTC Site 1

On-Base Safety. If the potential CIS is installed at FCTC Site 1, as described in Section 2.9.1, additional emergency response infrastructure, including those related to fire protection would be required and augmented to the extent necessary, thus reducing potential emergency response related health and safety impacts. The requirements of the enhanced EMS services would be defined during the design of the facilities.

Electromagnetic Radiation Environment. EMR issues related to the potential CIS include communications interference, personnel hazards, and potential explosive hazards.

As described previously, the EME for the potential CIS would include the potential for in-band frequency interference associated when two pieces of communications-electronics equipment (offsite radio equipment versus CIS facility equipment) that are operating within the same frequency band. However, based on the EME assessment in conjunction for the potential; CIS

(MDA, 2014a), the CIS systems would be compatible with the current EME within the FCTC Site 1 footprint and there would be adequate distance for the potential CIS to be operated without the interference without the use of special procedures. Therefore, no impacts related to communications interference from EMR would be required.

EMR can also impact personnel health due to radiation effects and act as a potential explosive/ignition source for fuel and ordnance. However, safety risks and impacts from the operation of facilities similar to the potential CIS have been evaluated and the potential appears to be low due to the implementation of established safety provisions, including use of facility separation and explosive safety distances. Therefore, no impacts related to from EMR to human health or as explosive/ignition sources would occur.

Explosive Hazards. In addition to potential fuels explosive hazards from sources alleviated through standard practices and establishment of explosion/safety distances, CIS facilities, including those related directly to the GBIs, would provide some ordnance-related hazards. Explosive safety quantity distances would be established to reduce hazards based on the net explosive weight of each GBI and its function, thus alleviating explosive hazards and associated impacts.

KV Assembly. The GBI components would be placed in the MAB for assembly, integration, and check-out or ISF for storage prior to assembly or emplacement. The KV bi-propellant tanks would be stored in the KV Fuel and Oxidizer Storage facilities until mounted onto the KV subassembly. From storage, the GBI and KV components are brought separately to the MAB to be assembled.

Inherent health and safety hazards and risks to GBI maintenance personnel and equipment damage would be mitigated by the multi-layer design of the tanks, protective packaging during transport, and proven operating procedures that have been in place for more than 10 years.

The KV contains liquid hypergolic propellants. Hypergolic propellants are fuels and oxidizers that ignite on contact with each other and need no ignition source. A release of either propellant could result in the release of hazardous materials inside the canister.

An indoor release of liquid propellants could result in localized concentrations that exceed both the Immediately Dangerous to Life or Health (IDLH) or Permissible Exposure Limit (PEL) for workers. Nitrogen tetroxide is the greater hazard due to its lower IDLH limit and lower boiling point. Risk from inadvertent release would be mitigated by design of the tanks, atmospheric monitoring, and monitoring, and procedure as summarized below. The most likely area for this to occur would be within the MAB, ISF, and the GBI missile field. Exposure to propellant released below the PEL level for the nitrogen tetroxide as a result of a release would not cause irreversible damage. Exposure at these levels would be mildly irritating to the eyes and nose and could include coughing.

Facility and equipment designs would incorporate the following measures to minimize the potential for and impact of accidents.

- The liquid bi-propellant tanks would have multiple safeguards, such as an internal bladder system, requiring several system failures before a release would occur, thereby making the potential for a release very remote.
- A sensor system would be used to monitor the condition/status of the KV propellant system during bi-propellant tank installation and checkout operations. In addition, the following operating procedures and training would be instituted to minimize the potential for and impact of accidents.
- Specific health and safety plans would be developed including evacuation plans, and notification of local and offsite emergency response as required.
- An emergency response team would be on call during tank installation and emergency equipment would be near the facility.
- The local fire departments would be notified through the existing cooperative agreements with the installation.
- In the event of a liquid bi-propellant release, the emergency response team would ensure the area would be evacuated, ignition sources would be removed, and vapors would be ventilated. All liquid would be contained for treatment and neutralization and disposed of in accordance with all applicable regulations. Releases would be absorbed with appropriate materials and transferred to containers for disposal.

GBI Integration. Integration and assembly of the GBI components could include installing electronics, wiring, and ordnance in each of the stages; mating the stages together; and mating the KV to the flight vehicle.

The Class 1.3 propellant used in the GBI is principally considered a blast hazard for overpressure from gases generated by inadvertent ignition. There is also a secondary fire hazard from residual propellant spread from any blast.

Accidental ignition of solid propellant can be caused by static discharge, lightning, or a nearby fire or explosion. Additionally, impact of the rocket motor casing against any object or penetration of the rocket motor's casing may produce enough internal or external frictional energy release to cause ignition. However, detonation resulting solely from an impact is considered impossible because Class 1.3 propellants are not shock sensitive as defined by the DOT. Data show that even when subjected to explosive shock from explosives (C4) Class 1.3 propellants with HTPB (hydroxyl-terminated polybutadiene) binders, AP (ammonium perchlorate) oxidizer, and AL (aluminum powder) fuel do not exhibit burn rates in excess of 3000 meters per second (m/sec) that is the accepted lower limit for detonation (Merrill et al., 1994).

To address GBI integration hazard concerns, the site would be designed such that facilities would be spaced out in accordance with safety quantity distances based on the net explosive weight of each GBI. It should be noted that there is no warhead on the GBI. The net explosive weight is based on the weight of the propellant. The appropriate separation of the GBIs in the silos would prevent any potential for a mishap impacting more than one GBI at any time. In addition, inhabited buildings, traffic routes, etc., would be located at a distance from the GBI's to minimize any potential health and safety hazards.

In addition, the following operating procedures and training would be instituted to minimize the potential for and impact of accidents such as accidental launch.

- Measures would be taken to prevent static buildup during transportation and GBI handling would be in accordance with standard safety procedures developed by DoD for the handling of solid and liquid propellants.
- A health and safety plan would be prepared that would include procedures to handle emergencies involving the GBI. This plan would describe how to handle each type of emergency, the appropriate base and off-base contacts, and an evacuation plan, if necessary.

Cooperative agreements with local fire departments would need to be updated to inform them of the additional hazards and safety considerations.

Terrorist Threats. The counter terrorist measures described in Section 3.3.8.2.1.4 are expected to prevent unauthorized personnel from entering the CIS facilities, damage to defense assets or injury to personnel, adverse effects to the general health and safety of site personnel or the general public, and adverse effects to the environmental attributes of the site. Environmental consequences due to damage to GBIs and fuel tanks caused by terrorist threats would have the similar results as those caused by accidents and would be addressed in similar manners as previously discussed in the hazardous materials and hazardous waste operations section, Section 3.3.7.3.3.1.1.

3.3.8.3.3.1.2 FCTC Site 2

The environmental operations consequences for health and safety for FCTC Site 2 would be same as those described for FCTC Site 1 with the following exception:

- On-base Safety: There are no SDZs or related facilities that currently affect FCTC Site 2 and, therefore, no need for relocation of such a facility which would be required for FCTC Site 1.

3.3.8.3.3.2 Mitigation

3.3.8.3.3.2.1 FCTC Site 1

Based on assessments provided during the facility design, enhancement of emergency response related services could be provided to mitigate potential impacts from the lack of emergency responses, including those related to fire protection.

Other safety issues for operations would be addressed by the implementation of the site-safety and associated facility design practices. Therefore, no additional mitigation measures would be required.

3.3.8.3.3.2.2 FCTC Site 2

Mitigations for health and safety for operations required for FCTC Site 2 would be the same as those for FCTC Site 1.

3.3.9 Land Use – FCTC Sites

Land use can be defined as the human use of land resources for various purposes including economic production, natural resources protection, or institutional uses. Land uses are frequently regulated by management plans, policies, ordinances, and regulations that determine the types of uses that are allowable or protect specially designated or environmentally sensitive uses. Potential issues typically stem from encroachment of one land use or activity on another, or an incompatibility between adjacent land uses that leads to encroachment.

This section presents information on the current land use conditions at the CIS footprint and in the vicinity, project-related construction and operation impacts, and mitigation measures.

3.3.9.1 Regulatory Framework – Water Resources – FCTC Sites

Land use surrounding the FCTC is governed by federal legislation, as well as, regional and local management plans.

3.3.9.1.1 Federal Programs

- AR 210-20, Real Property Master Planning for Army Installations (16 May 2005) – Defines the real property master planning concept and requirements and establishes policies and responsibilities for implementing the real property master planning process for U.S. Army communities.
- AR 405-20, Federal Legislative Jurisdiction (21 February 1974) - Provides for implementation of the additional authority granted to the military departments by Congress relative to relinquishment of legislative jurisdiction of Defense Directive 5160.63.
- AR 405-80, Management of Title and Granting Use of Real Estate (10 October 1997) - States the policy on management of title, unauthorized use, and granting use of U.S. Army controlled real property.
- AR 405-90, Disposal of Real Estate (10 May 1985). Includes policy for disposing of U.S. Army controlled real estate.
- Federal Land Policy and Management Act (FLPMA) of 1976 (Public Law 94-579; 43 USC 35) – Calls for establishment of procedures for managing federal lands.
- EO 12372, Intergovernmental Review of Federal Programs - Encourages consultations between federal, state and local governments in use of federal financial assistance and planning for federal development.

3.3.9.1.2 Regional Land Management Plans

Charleston Township Land Use Plan. The Charleston Township Land Use Plan is the Planning Commission and Township Board’s guide on matters such as rezoning requests, capital improvement programming, as well as neighborhood and business development activities. The

Land Use Plan is intended to provide guidance over a period of 5 to 15 years (Charleston Township, 2005).

City of Battle Creek Master Plan/Comprehensive Plan. The City of Battle Creek Master Plan/Comprehensive Plan is a long-range plan used to guide the growth and development of the community and region. The Master Plan/Comprehensive Plan identifies goals for economic sustainability, future land use, the downtown area of Battle Creek, industrial development, commercial development, residential development and neighborhoods, environmental and natural resource protection, open space and recreation, infrastructure including transportation and utilities, public services, health, education, aesthetic character, citizen opportunities, intergovernmental cooperation, and coordinating policy (City of Battle Creek, 2015b).

Fort Custer Recreation Area General Management Plan. The objective of the FCRA General Management Plan is to bring together Michigan Department of Natural Resources (MDNR) staff, stakeholders, and the public who use the FCRA in a planning process to define and clarify the unique purpose of the recreation resource. The General Management Plan approaches land use by identifying four different management zones: 1) natural features; 2) historic and cultural features; 3) education; and 4) recreational opportunities. In doing so, planning decisions are made to protect and preserve FCRA (MDNR, 2009).

3.3.9.1.3 FCTC Land Management Plans

Real Property Master Plan. The Real Property Master Plan (RPMP) evaluates existing real property assets and identifies real property needs to meet mission requirements. Any proposed military construction (MILCON) project must be included in the RPMP before design and construction funds are authorized (FCTC, undated).

Integrated Cultural Resources Management Plan. The ICRMP, prepared in consultation with the Michigan SHPO and the Advisory Council on Historic Preservation (ACHP), provides detailed guidelines and procedures to enable FCTC managers to meet the legal responsibilities for the identification, evaluation, and treatment of historic properties (AMEC E&I, 2013a).

Integrated Natural Resources Management Plan. The INRMP describes the baseline conditions of the natural resources and provides guidance to allow for the completion of the military mission while providing for the conservation of renewable resources, preservation of unique and rare resources, and long-term sustainability of ecosystems. The major management programs addressed in the INRMP include land management and grounds maintenance, forest management, fish and wildlife management, and agricultural management. The INRMP is coordinated with federal, state, and local natural resources managements and agencies with natural resources expertise (MDMVA, 2012).

Installation Hazardous Material and Waste Management Plan. The Installation HMWMP identifies state, federal, and Army regulations required to ensure that all hazardous waste generated, accumulated, stored, or treated at FCTC is managed to protect human health and the environment through established procedures. This plan is a component of the ICP (MIARNG, 2011).

Integrated Wildland Fire Management Plan. The Integrated Wildland Fire Management Plan addresses the potential occurrence of wildland fire at the installation and provides a program framework for the use of prescribed fire at the installation (DLZ, 2007).

3.3.9.2 Affected Environment – FCTC Sites

3.3.9.2.1 FCTC Site 1

3.3.9.2.1.1 Regional Land Use

FCTC is located in the southwestern portion of Michigan's Lower Peninsula. Regional land use (i.e., comprised of Kalamazoo and Calhoun Counties) is a mix of urban, suburban, and rural properties. Most adjacent parcels are large land holdings and the majority is public property. The northern boundary of the installation along Dickman Road to the Kalamazoo River is owned by the federal government. This 625-acre area includes the Fort Custer National Cemetery and the Veterans Affairs Hospital. Along the northeast and east boundaries of FCTC is the 2,340-acre Fort Custer Industrial Park. There is a small area of undeveloped wetlands, a small lake (Harts Lake) and mature woodlot that borders the eastern perimeter of the installation. A 326-acre Army Compatible Use Buffer (ACUB) area is located east, adjacent to the FCTC installation boundary. The ACUB protects current installation land for training and testing. There is also the 570-acre W.K. Kellogg air transportation complex located east of the installation. Immediately southeast of the installation is a residential area and the land located south of the installation is devoted to agriculture activities. South of I-94, there are several sand and gravel quarries and light industry. Land that is adjacent to FCTC to the west and northwest is the FCRA, which is owned by the MDNR (MDMVA, 2012) (refer to Figure 3.3.9-1).

Portions of FCTC are located within the Charleston Township in Kalamazoo County. The Charleston Township land use designation for the FCRA is recreation; the land use designations for the area immediately west of FCTC is medium density residential and commercial; and the land use designation for the area immediately south of FCTC is light industrial, low density residential, and commercial land use (Charleston Township, 2005).

The Charleston Township has developed zoning designation for areas adjacent to FCTC that are within Kalamazoo County. The zoning designation for the FCRA is state recreation area. The zoning designation for the area immediately west of FCTC is single family and two family residential; the zoning designation for areas immediately south of FCTC include industrial, commercial, and agricultural (refer to Figure 3.3.9-2) (Charleston Township, 2001).

The City of Battle Creek land use map identifies the eastern portion of FCTC that is located in Calhoun County as undeveloped land (City of Battle Creek, 2015c). The City of Battle Creek zoning map also identifies the extreme east portion of the FCTC installation as industrial. Areas immediately east of the FCTC installation boundary are also zoned industrial (refer to Figure 3.3.9-2) (City of Battle Creek, 2012).

3.3.9.2.1.2 Site Land Use

FCTC is located near Battle Creek, Michigan, between Interstate Highway 94 (I-94) to the south, and FCRA and the Kalamazoo River to the north (MDMVA, 2012). It is home to the Fort Custer Training Site Command which provides a warrior-focused training environment in support of deployment operations, unit readiness, homeland security, and state emergencies. Resources provided to support the mission include weapon ranges, training areas, land navigation courses, military operations in urban terrain training sites, training simulators, leadership reaction course, helicopter landing zones, fuel distribution point, billets (non-military lodging facility for soldiers), classrooms, ammunition supply point, and other resources, as needed (MDMVA, 2012).

In 1940, the FCTC installation covered 14,400 acres. In 1947, 625 were transferred to the Veteran's Administration; 3,033 acres were transferred to the State of Michigan to develop the FCRA from 1971 to 1973; nearly 2,600 acres were purchased by the City of Battle Creek in the early 1970's to develop the Fort Custer Industrial Park; and approximately 112 acres were relinquished to different municipalities and private interests from 1960 to 1985. As a result of these land transfers, approximately 8,032 acres remain under ownership of the DoD (MDMVA, 2012).

Of the approximately 8,032 acres, approximately 7,570 acres are undeveloped and dedicated to training/military use. Approximately 460 acres are developed for training purposes and cantonment areas that occupy the northern portion of the installation. Charleston Township owns and maintains the Lawler Cemetery, which comprises 2.5 acres of land within the FCTC boundaries (MDMVA, 2012). The Lawler Cemetery is located approximately 3 miles northwest of the CIS footprint (refer to Figure 3.3.9-3).

The land use associated with the location of the CIS footprint is military use and training. The CIS footprint encompasses 1,008 acres and includes Training Sites 5B, 6A, 6B, 6C, 6D, medevac (MV) landing zone MV6, the southern-most portion of the dudded impact area, and the 7.62 mm firing range (refer Figure 3.3.9-3). The dudded impact area is an area used to contain non-sensitive, high-explosive, military munitions (Army, 2006).

3.3.9.2.1.3 Recreation

Regional Recreation

The largest recreation area near the FCTC Site 1 footprint is the FCRA, which comprises 3,033 acres and is located approximately 0.45 mile northwest of the FCTC installation. Many outdoor activities occur throughout the year at FCRA including boating, cross country skiing, disc golf, dog sledding, equestrian, fishing, hiking, hunting, mountain biking, paddle sports, snowmobiling, swimming, and winter camping. FCRA features three lakes (Whitford Lake, Lawler Lake, and Eagle Lake), campground sites, and an extensive trail system used for mountain biking, equestrian, hiking, and dog sledding (MDNR, 2015b). The MDNR and FCTC actively engage in FCRA cooperative efforts for stewardship activities such as sharing seed stock (MDNR, 2009) (refer to Figure 3.3.9-4).

Cold Brook Park, which is associated with Portage Lake, is another recreation area that is located approximately 0.55 mile southeast of the CIS footprint. The park is a popular campground area and offers swimming, boating, disc golf, fishing, hiking, and sports activities (Kalamazoo County, 2015c) (refer to Figure 3.3.9-4).

The Cedar Creek Golf Club is located southwest approximately 2.2 miles from the project site. This golf club has 18 holes and is open 7 days a week. There are golf tournaments and other events throughout the year. In addition to the course itself, facilities at the golf club include a clubhouse and driving range (Cedar Creek Golf Club, 2015) (refer to Figure 3.3.9-4).

The Custer Greens Golf Course is located approximately 3 miles north from the FCTC Site 1 footprint. It is a 9-hole, public golf course that opened in 1955. The golf course also features a driving range and people can rent golf clubs and golf carts (refer to Figure 3.3.9-4).

Site Recreation

The only recreation opportunity at FCTC is hunting. Public and military personnel are permitted to deer hunt within FCTC. Deer hunting is classified as a reserved use. Reserved uses are those uses that are required so as to comply with a regulation or to sustain a natural resource. The deer hunting season in Michigan extends from late September to January 1 (MDNR, 2015a). Turkey hunting is allowed during late April through late May. The turkey hunting season avoids the most active training period at FCTC, which is summer through early fall. Fishing is prohibited within FCTC based upon the potential safety risks and limited opportunities for a sports fishery. The only fishable water body within FCTC is Whitman Lake, but it is located in the firearms impact area which poses a safety hazard; thus, fishing is prohibited (MDMVA, 2012).

3.3.9.2.2 FCTC Site 2

Existing Land Use Management Plans

The existing land use management plans for FCTC Site 2 would be the same as those described for FCTC Site 1 in Section 3.3.9.2.1.1.

Regional Land Use

The regional land use surrounding FCTC Site 1 is the same for FCTC Site 2. For a description of regional land use refer to Section 3.3.9.2.1.1 and Figure 3.3.9-1.

Zoning designations of areas located immediately beyond the FCTC installation boundary are the same for FCTC 1 and FCTC 2. For a description of zoning refer to Section 3.3.9.2.1.1 and Figure 3.3.9-2.

Site-Specific Land Use

A general description of FCTC land use is the same for FCTC Site 1 and FCTC Site 2; thus, refer to Section 3.3.9.2.1.2 for the general FCTC land use description. A description of site land use specific to FCTC Site 2 is presented in the following paragraph.

The land use associated with the location of the CIS footprint is military use and training. The CIS footprint encompasses Training Sites 3B; 3C; 3D; 3E; 3F; 4A; 4B; 4C; 4D; 4E; 4F; and MV3 (refer to Figure 3.3.9-3).

Regional Recreation

The nearest recreation area is the FCRA, which is located less than one mile north of the CIS footprint. Other recreation resources within the immediate proximity of the CIS footprint includes Cold Brook Park, which is approximately 1.6 miles south of the CIS footprint; and Crum Park, which is approximately two miles northwest of the CIS footprint. For additional details refer to Section 3.3.9.2.1.3 for a description of the FCRA and Cold Brook Park. Crum Park is a community park located in Kalamazoo County. There is an equine boarding stable and equine trails located within Crum Park (Crum Park Farm, 2015) (refer to Figure 3.3.9-4).

Site Recreation

Site recreation for FCTC Site 2 is the same as described for FCTC Site 1. For a description of site recreation resources refer to Section 3.3.9.2.1.3.

3.3.9.3 Environmental Consequences and Mitigation – Land Use – FCTC Sites

3.3.9.3.1 Construction – Baseline Schedule

3.3.9.3.1.1 Environmental Consequences

3.3.9.3.1.1.1 FCTC Site 1

Compatibility with Existing Regional Land Use Plans

Based upon information in the Charleston Township Land Use Plan and the City of Battle Creek Master Plan/Comprehensive Plan, construction of the CIS would not conflict with regional land use. Federal actions are not required to conform to local and regional land use management plans. However, the federal government does consider regional land use and zoning policies and cooperates with state and local agencies to avoid conflicts when feasible (ARNG, 2011).

Land Use Conversion. Construction of the CIS would be restricted to the FCTC installation and thus would not alter off-installation land use designations. Therefore, impact would be minor to land use activities, patterns, or policies in the areas surrounding FCTC would occur.

Under the baseline schedule, construction of the CIS would occur over a 5-year period, as discussed in Section 2.5.1. Over the course of construction, there would be potential minor, temporary impacts to off-installation land uses from fugitive dust emissions and noise emissions, which could interfere with certain off-installation activities such as recreation which are discussed later in this section.

Recreation. The nearest off-installation recreation areas include the FCRA, Cold Brook Park, Cedar Creek Golf Club, Custer Greens Golf Course, and Crum Park. Potential impacts to these recreation resources include fugitive dust emissions and noise which could detract from the enjoyment of and/or participation in certain recreational activities as discussed in Section 3.3.9.2.2.1. Visitors to the FCRA, Cold Brook Park, Cedar Golf Club, Custer Greens Golf Course, and Crum Park could potentially hear some distant construction equipment engines and possibly backup signals from machinery being used on the site. Given the temporary nature of construction, potential impacts to recreation resources would be minor.

Compatibility with Existing Site Land Use/ Management Plans and Policies

Based upon general information provided in this section, construction of CIS would not conflict with existing FCTC land use/management plans except for the INRMP. In addition, FCTC has acknowledged that portions of its training ranges would be impacted (MIARNG, 2016) and these impacts are discussed in this section.

Real Property Master Plan. The CIS would not conflict with the RPMP.

Integrated Cultural Resources Management Plan. The CIS would not conflict with the ICRMP. In terms of land use, the ICRMP establishes procedures to comply with regulations, which includes Section 106 of the NHPA, which requires assessment of the effects of federal actions on cultural resources. There are no known historic, archaeological, or architectural properties within the CIS footprint that are listed on, eligible for listing on, or potentially eligible for listing in the NRHP (refer to Section 3.3.4 for a discussion of cultural resources). There are SOPs within the ICRMP that have been established in the event that cultural and/or archeological resources are found during instances of development and land disturbance; therefore, conflicts with the ICRMP would not occur.

Integrated Natural Resources Management Plan. The CIS would conflict with the INRMP in that the INRMP calls for no net loss of military training areas and the conservation of natural resources and habitat. Using 7,570 acres currently dedicated to military training within FCTC, and excluding the acreage associated with the cantonment area and Lawler Cemetery, the FCTC Site 1 footprint would result in a net loss of approximately 13 percent of land currently available for military training and natural resource areas.

Integrated Contingency Plan and Installation Hazardous Materials and Hazardous Waste Management Plan. The CIS would not conflict with the ICP or the HMWMP. Construction activities would comply with the plan requirements as required by FCTC.

Integrated Wildland Fire Management Plan. The CIS would not conflict with the Integrated Wildland Fire Management Plan. Construction and operation activities would comply with the plan requirements and goals associated with landscape fire.

Land Use Conversion. FCTC Site 1 would comprise a total of 1,008 acres of area for the CIS footprint. The potential impact to current land use from the construction of the CIS would be a conversion of the land use designation. A new land use designation would be assigned to the CIS to reflect the functional land use. The CIS would be a military use, which would be compatible with the military use of FCTC. Therefore, potential impacts to land use would be minor.

FCTC Site 1 Training Areas. Training Sites 5B; 6A; 6C; 6D; MV6; the southern-most portion of the dubbed impact area; and the 7.62 mm firing range are currently located within the CIS FCTC Site 1 footprint. These training areas would be closed and activities transferred to other existing MIARNG ranges. Potential impacts to current land use from the relocation of training areas within the CIS footprint to other areas of FCTC would be minor because the FCTC general land use is for training/military use. Thus, the relocation of facilities to other areas within FCTC would conform to military training/use land use designations. The 7.62 mm firing range located within the CIS footprint would be discontinued at FCTC. However, there is an existing, underutilized 7.62 mm firing range at a different installation (MIARNG, 2016). Thus, 7.62 mm training would no longer occur at FCTC, but would continue at a different installation. Potential impacts from discontinuing the 7.62 mm firing range at FCTC and using an existing firing range at a different installation would be minor because training activities would continue, uninterrupted, only at a different installation. This would require military personnel that currently use the 7.62 mm firing range on FCTC to travel a greater distance (approximately 200 miles) for training.

3.3.9.3.1.1.2 FCTC Site 2

FCTC Site 2 Training Areas. The land use associated with the potential location of the project is military use and training. The FCTC Site 2 footprint would encompass Training Sites 3B; 3C; 3D; 3E; 3F; 4A; 4B; 4C; 4D; 4E; 4F; and Medivac landing zone MV3 (refer to Figure 3.3.9-3). Potential impacts to current land use from the relocation of training areas within the CIS footprint to other areas of FCTC would be minor because the FCTC general land use is for training/military use. Thus, the relocation of facilities to other areas within FCTC would conform to military training/use land use designations.

Land Use Conversion. FCTC Site 2 would comprise 1,040 acres for the CIS footprint. The environmental consequences of the land use conversion for FCTC Site 2 would be the same as that discussed for FCTC Site 1.

Recreation. The land available for public and military personnel deer and turkey hunting would not be allowed within the CIS footprint during construction. However, other areas within FCTC could still be used for hunting. Recreation is a secondary land use while the primary land use is military use/training. Consequently, a reduction in lands available for recreational use would be minor compared to the overall land use purpose of national defense.

3.3.9.3.1.2 Mitigation

3.3.9.3.1.2.1 FCTC Site 1

The level of impact to regional and site-specific land use in terms of CIS facilities' construction would be minor; therefore, no mitigation measures would be required .

3.3.9.3.1.2.2 FCTC Site 2

The level of impact to regions and site-specific land use in terms of the CIS's construction for FCTC Site 2 would be minor; therefore, no mitigation measures would be required.

3.3.9.3.2 Construction - Expedited Schedule

Potential environmental consequences and mitigations to regional and site-specific land use and recreation resources from construction of the CIS at both FCTC Site 1 and FCTC Site 2 would be the same for an expedited construction schedule as the baseline schedule discussed in Section 3.3.9.3.1.

3.3.9.3.3 Operation

Operation activities would consist of activities related to monitoring for enemy activities and sustaining a state of battle readiness. Maintenance activities would consist of equipment inspection, testing, and repair; and building and landscaping activities. There would be no flight testing of the missiles; however, the system could participate in ground tests and other daily maintenance schedules. The technical status of each missile would be monitored (DoD, 2015).

3.3.9.3.3.1 Environmental Consequences

3.3.9.3.3.1.1 FCTC Site 1

<u>Regional Land Use</u>

Land Use. Potential impacts to off-installation land use would be minor because operation of the CIS would not alter land use designations or land management policies.

Recreation. The nearest off-installation recreation areas include the FCRA, Cold Brook Park, Cedar Creek Golf Club, and Crum Park. Potential impacts to these recreation resources from CIS operations and maintenance would be minor because operations would be localized and would proceed inside the CIS footprint, within the FCTC installation boundary. The distances between these recreation resources and the CIS footprint, and other features in the area including screening of the view by forested areas, would make operation of the CIS facilities unlikely to be noticed by recreationists.

<u>Site-Specific Land Use</u>

Land Use. Safety arcs for the CIS facilities would be within the CIS footprint and would not affect any offsite public or private properties or facilities. Public roadways would be prohibited within these safety arcs and there would be specific separation distances established between explosives and inhabited buildings. As such, land use within these safety arcs would be restricted. However, these restrictions would have a negligible impact on existing land uses because there are no public roadways or inhabited buildings that are currently within the area that would be covered by the safety arcs.

Recreation. Operations would not interfere with permitted recreation activities allowed in other parts of FCTC. The permanent decrease in recreation area due to the CIS facilities would be minor because recreation is secondary to the primary land use which is for military use/training.

3.3.9.3.3.1.2 FCTC Site 2

The environmental consequences of operation of the CIS at FCTC Site 2 would be the same as those for FCTC Site 1.

3.3.9.3.3.2 Mitigation

3.3.9.3.3.2.1 FCTC Site 1

The level of impact to regional and site-specific land use in terms of CIS operation and maintenance for FCTC Site 1 would be minor; therefore, no mitigation measures would be required.

3.3.9.3.3.2.2 FCTC Site 2

The level of impact to regions and site-specific land use in terms of the CIS operation for FCTC Site 2 would be minor; therefore, no mitigation measures would be required.

Figure 3.3.9-1 Regional Land Use – FCTC Sites

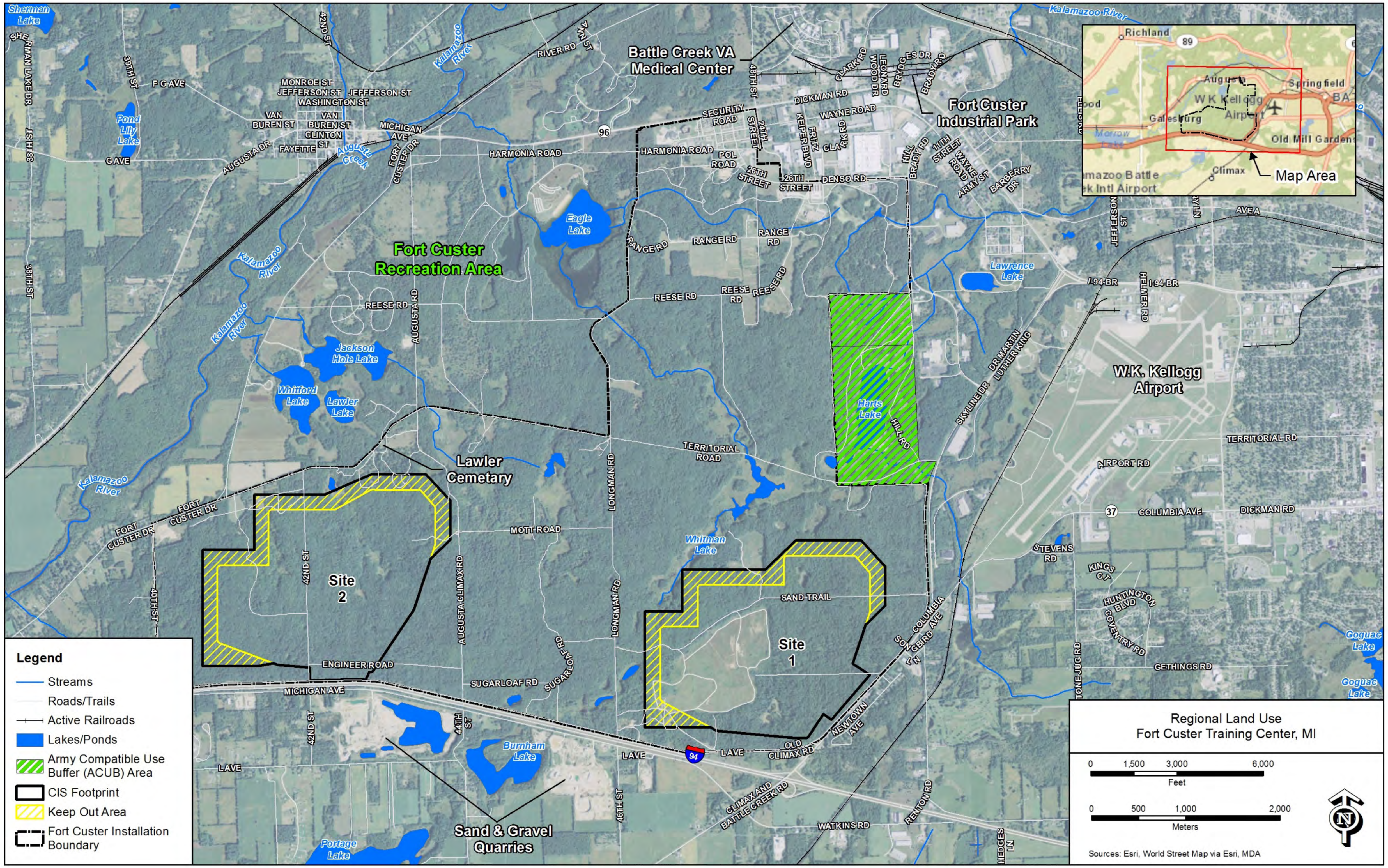


Figure 3.3.9-2 Regional Zoning - FCTC Sites

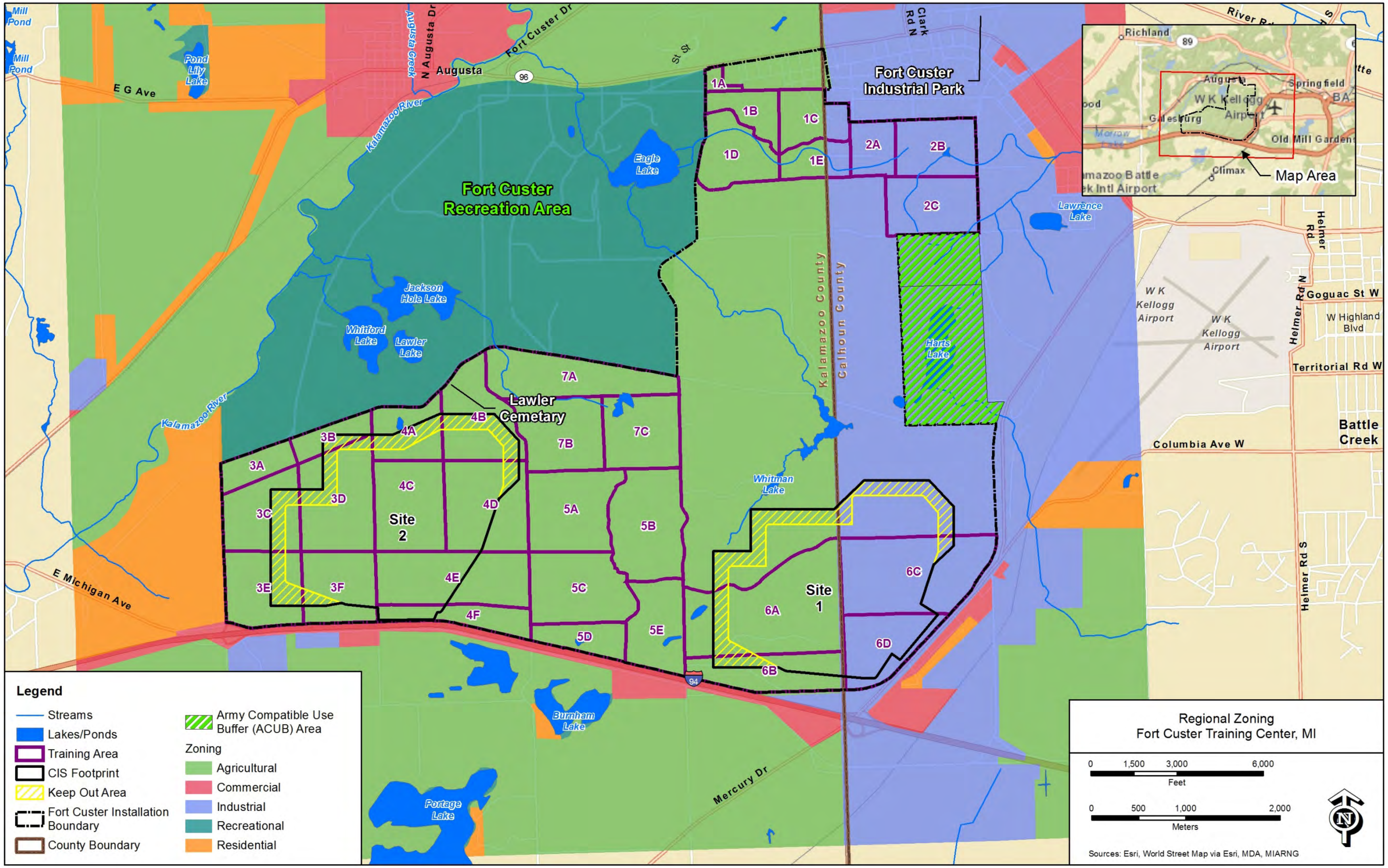


Figure 3.3.9-3 Site-Specific Land Use – FCTC Sites

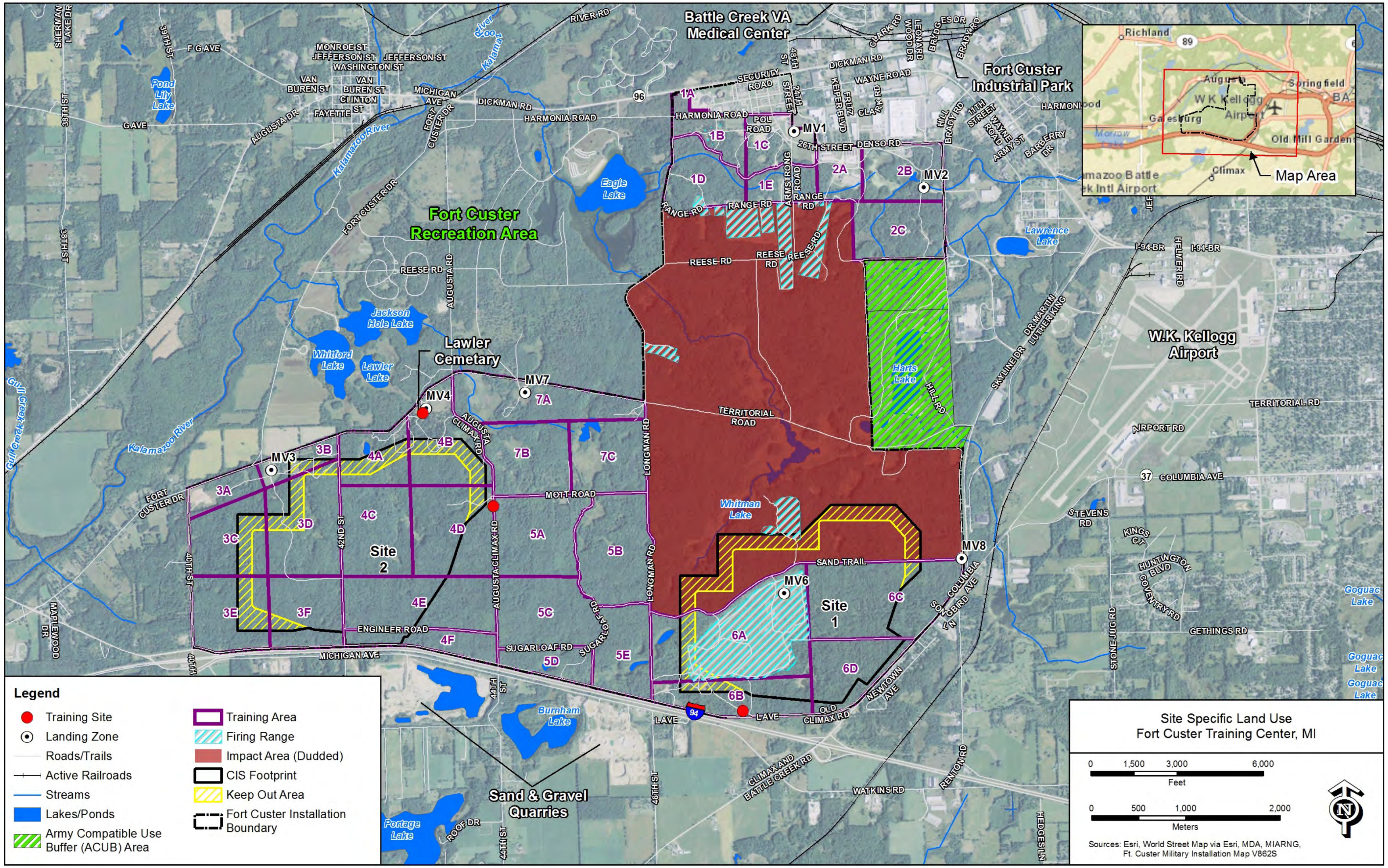
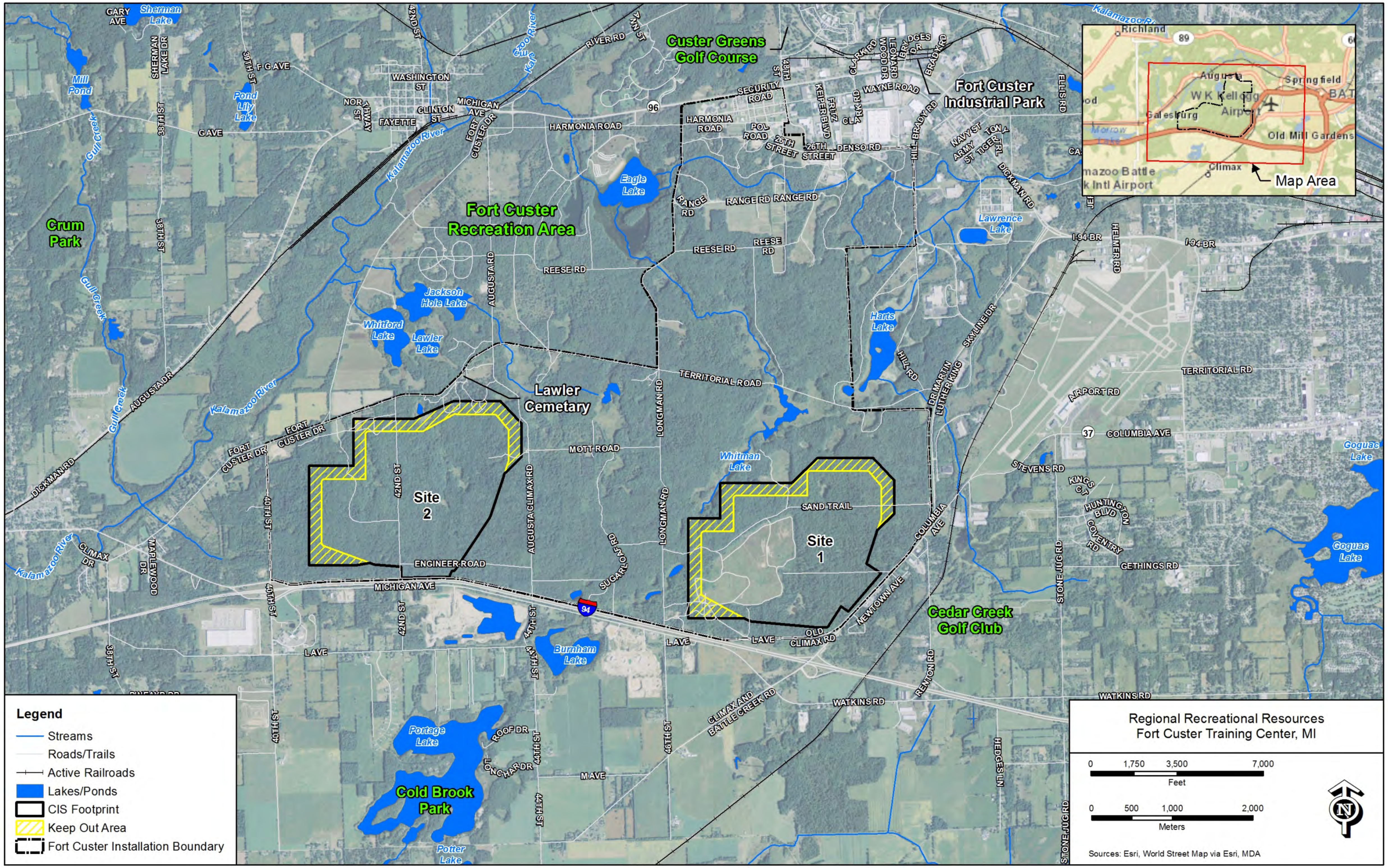


Figure 3.3.9-4 Regional Recreational Resources – FCTC Sites



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3.3.10 Noise – FCTC Sites

3.3.10.1 Noise Regulations and Guidelines – FCTC Sites

3.3.10.1.1 Local Noise Regulations

FCTC is located in Charleston and Ross Townships, Kalamazoo County, and in the City of Battle Creek, Calhoun County, in the State of Michigan. There are no extant state or county laws, ordinances, or regulations that establish quantitative environment noise limits. The Battle Creek noise ordinance (City of Battle Creek, 2015a) prohibits "unreasonable noise," which is defined as "any noise which unreasonably annoys or disturbs, does injury to, or endangers the comfort, repose, health, peace or safety of others within the City." Otherwise, the Battle Creek noise ordinance does not include quantifiable sound level limits.

The portion of FCTC located in Charleston Township is subject to the agricultural zoning sound level limits in the township noise ordinance. The Charleston Township sound level limits are applicable at the FCTC property line (Charleston Township, 1973; Charleston Township, 2000). Sound levels resulting from FCTC operations- which would include potential CIS operations- cannot exceed 65 dBA during daytime hours (07:00 to 22:00) and 55 dBA during nighttime hours (22:00 to 07:00) when measured at FCTC boundaries located in Charleston Township. Additionally, sound levels resulting from CIS construction or operations would be limited to 80 dBA during daytime hours and 75 dBA during nighttime hours when measured at FCTC boundaries located in Charleston Township.

The portion of FCTC located in Ross Township is subject to the Ross Township Zoning Ordinance, which states that "(n)oise emanating from any use shall not exceed the level of ordinary conversation at the boundaries of the lot. Short intermittent noise peaks may be expected during daylight hours if they do not exceed normal traffic noise peaks at any point on the lot boundaries. " These requirements are not quantifiable because conversation sound levels and peaks in traffic sound levels are not fixed quantities. Regardless of this, the FCTC boundaries located in Ross Township are at least 3 miles from the potential FCTC Site 1 or Site 2 footprints. Therefore, sound level limits and guidelines applicable at property boundaries or noise-sensitive receptors that are closer to the FCTC Site 1 or Site 2 footprints would indirectly minimize CIS construction and operation noise impacts at receptors in Ross Township.

3.3.10.1.2 Federal Noise Guidelines

The USEPA guidelines for environmental noise can be used for areas lacking quantifiable sound level limits. The USEPA has established a guideline limiting the day-night average sound level (L_{dn}) at noise-sensitive receptors, such as residences and schools, to 55 dBA (USEPA, 1974). The L_{dn} is based on the 1-hour L_{eq} measured over a 24-hour period with a +10 dBA penalty applied to the sound levels measured during the nighttime hours (22:00 to 07:00). The 1-hour sound levels for a 24-hour period are then logarithmically averaged to determine the L_{dn}.

The ARNG has established a policy that uses L_{dn} to assess the potential environmental noise impacts on people on- and off-post. The ARNG NEPA Handbook states that “noise-sensitive land uses, such as housing, schools, and medical facilities, are compatible with the noise environment in Zone I. ” The Zone I noise environment is defined as areas where the L_{dn} is < 65 dBA (ARNG, 2011). Because the ARNG policy recommends a higher sound level for Zone I compatibility, the USEPA L_{dn} recommendation of ≤ 55 dBA at noise-sensitive receptors is a more stringent guideline. Consistency with the ARNG policy can be inferred from consistency with the USEPA guideline.

3.3.10.2 Noise Introduction – FCTC Sites

3.3.10.2.1 Acoustical Terminology

Environmental sound levels are quantified by a variety of parameters and metrics. This section introduces general concepts and terminology related to acoustics and environmental noise.

3.3.10.2.2 Sound Energy Characteristics

Sound energy is physically characterized by amplitude and frequency. Sound amplitude is measured in decibels (dB) as the logarithmic ratio of a sound pressure to a reference sound pressure (20 micropascals). The reference sound pressure corresponds to the typical threshold of human hearing.

Noise is often considered unwanted sound. However, human response to noise is complex and is influenced by a variety of acoustic and non-acoustic factors. Acoustic factors generally include the sound's amplitude, duration, spectral content, and fluctuations. Non-acoustic factors typically include the listener's ability to become used to the noise, the listener's attitude towards the noise and the noise source, the listener's view of the necessity of the noise, and the predictability of the noise. As such, response to noise is highly individualized. Nonetheless, average listener reactions to changes in sound level are shown in Table 3.3.10-1.

Frequency is measured in hertz (Hz), which is the number of cycles per second. The typical human ear can hear frequencies ranging from approximately 20 Hz to 20,000 Hz. Typically, the human ear is most sensitive to sounds in the middle frequencies (1,000 to 8,000 Hz) and is less sensitive to sounds in the low and high frequencies. As such, the A-weighting scale was developed to simulate the frequency response of the human ear to sounds at typical environmental levels. The A-weighting scale emphasizes sounds in the middle frequencies and de-emphasizes sounds in the low and high frequencies. Any sound level to which the A-weighting scale has been applied is expressed in A-weighted decibels, dBA. For reference, the A-weighted sound pressure levels associated with some common noise sources are shown in Table 3.3.10-2.

Table 3.3.10-1 Human Reaction to Increases in Sound Pressure Level - FCTC

Increase in Sound Pressure Level (dB)	Human Reaction
Under 5	Unnoticed to tolerable
5 to 10	Intrusive
10 to 15	Very noticeable
15 to 20	Objectionable
Over 25	Very objectionable to intolerable
Source: Down and Stocks, 1977.	

Table 3.3.10-2 Typical Sound Pressure Levels Associated with Common Noise Sources - FCTC

Sound Pressure Level (dBA)	Subjective Evaluation	Environment	
		Outdoor	Indoor
140	Deafening	Jet aircraft at 75 ft	
130	Threshold of pain	Jet aircraft takeoff at 300 ft	
120	Threshold of feeling	Elevated train	Rock band concert
110	Extremely Loud	Jet flyover at 1000 ft	Inside propeller plane
100	Very Loud	Motorcycle at 25 ft, auto horn at 10 ft, crowd noise at football game	
90	Very Loud	Propeller plane flyover at 1000 ft, noisy urban street	Full symphony or band, food blender, noisy factory
80	Moderately Loud	Diesel truck (40 mph) at 50 ft	Inside auto at high speed, garbage disposal, dishwasher
70	Loud	B-757 cabin during flight	Close conversation, vacuum cleaner, electric typewriter
60	Moderate	Air-conditioner condenser at 15 ft, near highway traffic	General office
50	Quiet		Private office
40	Quiet	Farm field with light breeze, birdcalls	Soft stereo music in residence
30	Very quiet	Quiet residential neighborhood	Bedroom, average residence (without t. v. and stereo)
20	Very Quiet	Rustling leaves	Quiet theater, whisper
10	Just audible		Human breathing
0	Threshold of hearing		
Sources: Egan, 1988; Ramsey and Sleeper, 1994.			

3.3.10.2.3 Environmental Noise Metrics

Noise in the environment is constantly fluctuating, such as when a car drives by, a dog barks, or a plane passes overhead. Several noise metrics have been developed to quantify fluctuating noise levels. These metrics include the equivalent-continuous sound level and the exceedance sound levels.

The equivalent-continuous sound level, L_{eq}, is the level of a hypothetical steady sound that has the equivalent sound energy as the actual fluctuating sound over a given time duration. For example, L_{eq} (1-hour) is the equivalent-continuous sound level measured over a 1-hour period and provides an indication of the average sound energy over the 1-hour period.

The exceedance sound level, L_x, is the sound level exceeded "x" percent of the sampling period and is referred to as a statistical sound level. The most common L_x values are L_{90}, L_{50}, and L_{10}. L_{90} is the sound level exceeded 90 percent of the sampling period. L_{90} is referred to as the residual sound level because it measures the background sound level without the influence of loud, transient noise sources (ANSI, 2013a). L_{50} is the sound level exceeded 50 percent of the sampling period or the median sound level. L_{10} is the sound level exceeded 10 percent of the sampling period. L_{10} is often referred to as the intrusive sound level because it measures the occasional louder noises.

3.3.10.3 Affected Environment – Noise – FCTC Sites

3.3.10.3.1 Environmental Noise Survey

3.3.10.3.1.1 Survey Methodology

An FCTC Environmental Noise Survey (ENS) was completed in November 2014 in order to characterize the existing acoustical conditions. The ENS was conducted in accordance with industry standard methods (ANSI, 2005; ANSI, 2011; ANSI, 2013a; ANSI, 2013b; ANSI, 2013c; ANSI, 2014a; ANSI, 2014b; ANSI, 2014c; ASTM, 2008; ISO, 2003; and ISO, 2007) and included the measurement of the L_{eq} and L_{90} sound levels.

Locations of the nearest off-post noise-sensitive receptors (i.e., residences) that could be impacted by CIS construction and operation noise were identified during the ENS. Noise Measurement Locations (NMLs) were selected based on the locations of the noise-sensitive receptors. The NMLs selected during the ENS, numbered 1 through 4, are shown on Figure 3.3.10-1. Military training exercises were not being conducted at FCTC during the ENS period. One location, NML3, was situated close to on-post barracks.

Weather conditions during the ENS were conducive to the measurement of sound levels: clear to overcast conditions with low winds. Some light precipitation occurred during the survey period, but was not substantial enough to have affected the sound level measurements. Meteorological data from nearby W. K. Kellogg Airport (BTL) as well as in situ measurements of meteorological conditions are shown on Figure 3.3.10-2.

Sound levels were monitored at three of the NMLs for 24 hours. Sound level monitors were secured and inspected periodically to ensure continuous operation, but were otherwise unmanned. Short-term sound levels were also measured at each NML for 2-minute to 20-minute periods during both the daytime and nighttime hours. Extant noise sources were observed and documented. A summary of sound level measurement and monitoring equipment is provided in Table 3.3.10-3. As shown, equipment was laboratory-calibrated within 12 months of the ENS. Additionally, sound level meters were field-calibrated before and after each monitoring period and measurement series, and the change in calibration level did not exceed 0.3 dB (a change exceeding 1.0 dB would have required measurements to be repeated).

Table 3.3.10-3 Sound Level Measurement and Monitoring Equipment – FCTC Sites

Model	Serial Number	Laboratory Calibration Date
Rion Model NL-22	01110135	15 July 2014
Rion Model NL-22	01110133	15 July 2014
Rion Model NA-27	01191119	17 July 2014
Rion Model NL-52	01232541	16 July 2014
Norsonic 1251 Acoustic Calibrator	25762	15 July 2014
Rion NC-73 Acoustic Calibrator	10527795	15 July 2014

3.3.10.3.1.2 Survey Results

NML1

NML1 was representative of residences on the east side of West Columbia Avenue. NML1 was situated along the property boundary abutting West Columbia Avenue, within the portion of FCTC located in Battle Creek. The sound level monitor was placed at a distance from the centerline of West Columbia Avenue that was judged to be similar to the observed setback distance of the closest Battle Creek residences on the southeast side of West Columbia Avenue. The main source of noise observed at NML1 during the ENS was traffic on West Columbia Avenue. The West Columbia Avenue traffic counts documented during the ENS were approximately 1,500 vehicles per hour (vph) in the afternoon and approximately 350 vph during the nighttime.

The sound levels measured at NML1 during the ENS are shown on Figure 3.3.10-3. The L_{dn} corresponding to the measured 1-hour L_{eq} data was 71 dBA. The median, measured 10-minute L_{90} was 56 dBA during the daytime and 49 dBA during the nighttime. The measured sound levels were typical for a location situated close to a busy road. The L_{dn} measured at NML1 during the ENS exceeded the ≤ 55 dBA USEPA guideline for noise-sensitive receptors (and the

< 65 dBA ARNG policy for Zone I compatibility). However, the primary source of noise (traffic) was not related to any FCTC activity.

NML2

NML2 was representative of residences along the west side of South 40th Street. NML2 was situated along the property boundary abutting South 40th Street, approximately 2,500 ft north I-94, and within the portion of the FCTC installation located in Charleston Township. The sound level monitor was placed at a location representative of Charleston Township residences on the west side of South 40th Street. Noise sources observed at NML2 during the ENS included I-94, as well as occasional birds, barking dogs, backup alarms (distant), and aircraft flyovers.

The sound levels measured at NML2 during the ENS are shown on Figure 3.3.10-4. The L_{dn} corresponding to the measured 1-hour L_{eq} data was 58 dBA. The median, measured 10-minute L_{90} was 46 dBA during both daytime and nighttime periods. The measured sound levels were typical for a residential area situated near a major highway. The L_{dn} measured at NML2 during measured at NML2 did not exceed the Charleston Township sound level limits during the daytime or nighttime periods of the ENS. The primary sources of noise were not related to any FCTC activity.

NML3

NML3 represented the existing acoustical environment at on-post receptors. NML3 was situated near the intersection of McMahon Road and 26th Street, outside of an on-post barracks building. Noise sources observed at NML3 during the ENS included Denso Manufacturing operations (east of NML3 on Dickman Road), highway traffic (distant), and occasional aircraft flyovers.

The sound levels measured at NML3 during the ENS are shown on Figure 3.3.10-5. The L_{dn} corresponding to the measured 1-hour L_{eq} data was 52 dBA. The median, measured 10-minute L_{90} was 42 dBA during the daytime and 37 dBA during the nighttime. The measured sound levels were typical for a quiet residential area. The L_{dn} measured at NML3 during the ENS was consistent with the ≤ 55 dBA USEPA guideline for noise-sensitive receptors (and with the < 65 dBA ARNG policy for Zone I compatibility). The primary sources of noise were not related to any FCTC activity.

NML4

NML4 was situated in FCRA on Augusta Climax Road. Noise sources observed at NML3 during the ENS included distant highway traffic and distant industrial noise. NML4 was selected to quantify the acoustical conditions within the state park. Due to the steady, quiet conditions at NML4, 2-minute sound levels were measured once during the daytime and once during the nighttime. The measured daytime L_{90} sound level was 39 dBA and the measured nighttime L_{90} sound level was 33 dBA. The primary sources of noise were not related to any FCTC activity.

ENS Summary

Table 3.3.10-4 summarizes the existing conditions at FCTC NMLs, as measured during the ENS, as well as the guidelines and regulations that would be used to assess potential environmental impacts.

Table 3.3.10-4 Summary of Ambient Sound Level Environmental Noise Survey Results and CIS Sound Level Design Criteria – FCTC Sites

Location	Measured sound level	Applicable regulation / guideline	Notes
NML1	L_{dn}: 71 dBA	USEPA: $L_{dn} \leq 55$ dBA	(1)
NML1	Median L_{90}: 56 dBA (Daytime)	Assess potential increase to L_{90}	(1)
NML1	Median L_{90}: 49 dBA (Nighttime)	Assess potential increase to L_{90}	(1)
NML2	L_{dn}: 58 dBA	USEPA: $L_{dn} \leq 55$ dBA	(1)
NML2	Median L_{90}: 46 dBA (Daytime)	Assess potential increase to L_{90}	(1)
NML2	Median L_{90}: 46 dBA (Nighttime)	Assess potential increase to L_{90}	(1)
NML3	L_{dn}: 52 dBA	USEPA: $L_{dn} \leq 55$ dBA	(2)
NML3	Median L_{90}: 42 dBA (Daytime)	Assess potential increase to L_{90}	(1)
NML3	Median L_{90}: 37 dBA (Nighttime)	Assess potential increase to L_{90}	(1)
NML4	Measured L_{90}: 39 dBA (Daytime)	Assess potential increase to L_{90}	(1)
NML4	Measured L_{90}: 33 dBA (Nighttime)	Assess potential increase to L_{90}	(1)

Notes:
1. Addition of CIS noise contribution should minimize cumulative impact at residences near NML.
2. The addition of CIS noise contribution should result in a cumulative L_{dn} that is consistent with the USEPA guideline.

3.3.10.4 Environmental Consequences and Mitigation – Noise – FCTC Sites

3.3.10.4.1 Noise Impact Assessment Guidelines

Potential cumulative environmental noise impacts at all locations, regardless of jurisdiction, are evaluated by determining the potential changes to the ambient, or residual, sound level. The residual sound level is quantified by the L_{90} exceedance level (ASTM, 2002). Potential changes in L_{90} sound level resulting from CIS construction and operation are compared to the guideline criteria shown in Table 3.3.10-1 to determine the potential reaction of neighbors.

3.3.10.4.2 Construction – Baseline Schedule

Environmental noise impacts associated with the baseline construction schedule discussed in Section 2.5.1 were evaluated.

3.3.10.4.2.1 Environmental Consequences

3.3.10.4.2.1.1 Calculation Basis

Major CIS construction phases would consist of mobilization, site preparation, and individual facility construction. The individual facility construction phase for the potential CIS deployment would generally include foundation construction, building erection, and site clean-up / start-up.

Noise emissions would vary with each phase of construction depending on the specific construction activity, the location of the activity on the CIS, and the associated construction equipment required for each phase or activity. Accurately predicting the actual sound levels at off-post receptors resulting from construction activities is difficult due to the mobility and time-varying usage of construction equipment. Nonetheless, the variable nature of construction noise can be represented by an "average" sound level, which is determined in accordance with methodologies outlined by the USEPA and other construction noise resources (USEPA, 1971; BBN, 1977). The "average" construction sound levels account for the type and quantity of equipment, the expected usage of each piece of equipment over a typical 8 to 12-hour shift, and the typical sound levels of the equipment used during each phase of construction. A list of construction equipment that would be anticipated to be used for CIS construction is provided in Table 3.3.10-5. The typical sound level at a reference distance of 50 feet from each piece of equipment is also provided. Estimated quantities of each piece of equipment and the estimated usage percentages were provided for the mobilization, site preparation, and facility construction phases. Note that Table 3.3.10-5 provides all the equipment that could be used over the entire CIS construction period; actual type and quantity of equipment components in individual CIS construction areas would depend on the specific construction activity.

3.3.10.4.2.1.2 FCTC Site 1

The potential worst-case "average" sound levels in nearby residential areas were determined using the aforementioned methods (USEPA, 1971; BBN, 1977). Distances from construction areas to the nearest noise-sensitive receptors (i.e., residences) shown on Figure 3.3.10-6 were determined. The nearest noise-sensitive receptors are generally consistent with the NMLs from the ENS, but are the actual locations of, e.g., residential buildings determined based on examining available aerial imagery. Table 3.3.10-6 provides the distance from each receptor on Figure 3.3.10-6; "R1S1", "R1S2", "R2", and "R3;" to the closest CIS footprint boundary. The range of worst-case "average" construction sound levels was determined based on these distances. Note that this is a very conservative estimate because it assumed that all construction equipment would be collocated at a point on the closest CIS footprint boundary, and it assumed attenuation only from the geometrical spreading of sound, i.e., sound attenuation over distance. Other attenuation factors such as ground and atmospheric absorption, and shielding from local terrain were not considered.

Table 3.3.10-5 Combined List of Continental United States Interceptor Site Construction Equipment for All Phases – FCTC Sites

Construction Equipment	Typical sound level at 50 ft	Construction Equipment	Typical sound level at 50 ft
Air Compressor	76 dBA	Grader	77 dBA
Asphalt Paver	89 dBA	Grinder	79 dBA
Auger, Large (18') Excavator Mounted	85 dBA	Impact Wrench	85 dBA
Bobcat	84 dBA	Light Set (with Generator)	71 dBA
Bush Hammer	75 dBA	Man Lift	71 dBA
Chain Saw	85 dBA	Mobile Crane	80 dBA
Chop Saw	66 dBA	Pile Driver - Impact	101 dBA
Sheepsfoot Compactor	79 dBA	Rock Hammer	75 dBA
Concrete Pumper Truck	74 dBA	Rock Crusher	88 dBA
Concrete Saw	88 dBA	Roller	79 dBA
Concrete Truck	85 dBA	Scraper/Pan	88 dBA
Concrete Vibrator	68 dBA	Sump Pump	76 dBA
Crawler Excavator	86 dBA	Threading Machine	85 dBA
Diesel Generator	71 dBA	Torque Wrench	88 dBA
Dozer	77 dBA	Truck with Trailer	81 dBA
Drill	83 dBA	Troweling Machine	81 dBA
Dump Truck	81 dBA	Truck	81 dBA
Forklift	76 dBA	Vibratory Tamper	78 dBA
Front End Loader	77 dBA	Welder	81 dBA

The results in Table 3.3.10-6 were used to evaluate potential worst-case construction noise impacts by comparing the worst-case "average" sound level at a receptor to the median measured ambient daytime L_{90} sound level. The worst-case "average" construction sound level was then combined with the median daytime ambient sound level and the potential worst-case increase to the ambient sound level is determined. Finally, a potential reaction to the change in sound level was provided based on the guideline criteria in Table 3.3.10-1. Based on the results in Table 3.3.10-6, there could be times when construction noise would be potentially very noticeable at the closest residence represented by R1S1 on Figure 3.3.10-6. However, it should be noted that the estimated sound levels in Table 3.3.10-6 are conservative and that any impacts, while potentially major, would be temporary.

Table 3.3.10-6 Continental United States Interceptor Site Construction Noise Calculation Results – Baseline Schedule – FCTC Sites

	Nearby Noise-sensitive Receptor (1)			
	R1S1	**R1S2**	**R2**	**R3**
Estimated distance to nearest construction area	750 ft	2,230 ft	2. 5 mi	2. 3 mi
Worst-case "average" construction sound levels (2)	35 to 65 dBA	32 to 56 dBA	30 to 40 dBA	28 to 42 dBA
Median measured daytime ambient (L_{90}) sound level (3)	56 dBA	56 dBA	42 dBA	39 dBA
Worst-case sound levels during construction	56 to 66 dBA	46 to 66 dBA	42 to 44 dBA	39 to 43 dBA
Potential worst-case sound level increase	0 to 10 dBA	0 to 10 dBA	0 to 2 dBA	0 to 5 dBA
Potential reaction from nearest noise-sensitive neighbors (4)	Unnoticed to very noticeable	Unnoticed to very noticeable	Unnoticed	Unnoticed to tolerable

Notes:
1. See Figure 3.3.10-6.
2. Based on USEPA, 1971 and BBN, 1977.
3. Based on Table 3.3.10-4.
4. Based on Table 3.3.10-1.

3.3.10.4.2.1.3 FCTC Site 2

The environmental consequences for construction noise for the baseline construction schedule for FCTC Site 2 would be the same as for FCTC Site 1 except that at FCTC Site 2, there could be times when the construction noise would be potentially very noticeable at the closest residence represented by R1S2 in Table 3.3.10-6.

3.3.10.4.2.2 Mitigation

3.3.10.4.2.2.1 FCTC Site 1

Implementation of BMPs would adequately address construction noise so that mitigation measures would not be required. Construction noise BMPs would consist of the following:

- Where possible, select vibratory pile-driving in lieu of impact pile-driving because the former is typically roughly 10 dBA quieter than the latter.
- Outfit diesel engines with engine exhaust mufflers, as recommended by the manufacturers.
- Ensure noise control equipment, such as engine mufflers, are maintained and inspected regularly to ensure it is functioning properly.

- Implement provisions, in accordance with guidelines, that would limit noisier construction periods, whenever practical, especially during the nighttime hours.

3.3.10.4.2.2.2 FCTC Site 2

Mitigation for noise for the baseline construction schedule for FCTC Site 2 would be the same as that described for FCTC Site 1.

3.3.10.4.3 Construction - Expedited Schedule

3.3.10.4.3.1 Environmental Consequences

3.3.10.4.3.1.1 FCTC Site 1

Environmental noise impacts associated with the expedited schedule were also evaluated. Although the worst-case "average" construction sound levels associated with the expedited schedule would be identical to the baseline schedule potential 24/7 construction activities could result in additional nighttime acoustical impacts. Calculated nighttime acoustical impacts at the nearby noise sensitive receptors are detailed in Table 3.3.10-7.

Table 3.3.10-7 Continental United States Interceptor Site Construction Noise Calculation Results - Expedited Schedule – FCTC Sites

	Nearby Noise-sensitive Receptor (1)			
	R1S1	**R1S2**	**R2**	**R3**
Estimated distance to nearest construction area	750 ft	2,230 ft	2.5 mi	2.3 mi
Worst-case "average" construction sound levels (2)	35 to 65 dBA	32 to 56 dBA	30 to 40 dBA	28 to 41 dBA
Median measured nighttime ambient (L_{90}) sound level (3)	49 dBA (NML 1)	46 dBA (NML 2)	37 dBA (NML 3)	33 dBA (NML 4)
Worst-case sound levels during construction	56 to 66 dBA	46 to 56 dBA	42 to 44 dBA	39 to 43 dBA
Potential worst-case sound level increase	8 to 17 dB	3 to 10 dB	6 to 8 dB	7 to 10 dB
Potential reaction from nearest noise-sensitive neighbors (4)	Intrusive to Objectionable	Unnoticed to very noticeable	Intrusive	Intrusive to very noticeable

Notes:
1. See Figure 3.3.10-6.
2. Based on USEPA, 1971 and BBN, 1977.
3. Based on Table 3.3.10-4.
4. Based on Table 3.3.10-1.

3.3.10.4.3.1.2 FCTC Site 2

The environmental consequences for construction noise for the expedited construction schedule for FCTC Site 2 would be the same as for FCTC Site 1 except that at FCTC Site 2, there could be times when the construction noise would be potentially very noticeable at the closest residence represented by R1S2 in Table 3.3.10-7.

3.3.10.4.3.2 Mitigation

In addition to efforts described for the baseline construction schedule, noisier construction activities could be limited to the daytime hours as much as possible.

3.3.10.4.4 Operations

3.3.10.4.4.1 Environmental Consequences

The results herein conservatively assumed continuous (24-hour) operation of the CIS backup power plant and a power plant location that would be centrally located in the CIS footprint (note that power plant operation would normally be intermittent and limited to testing periods and during power outages).

3.3.10.4.4.1.1 Calculation Basis

The primary permanent CIS noise sources from potential CIS deployment at FCTC would be associated with the backup power plant, which would consist of no more than two 3-MW diesel engine-generators inside the power plant building although four generators could operate for short durations (5 to 10 minutes). This analysis uses the worst-case, short-duration situation. The most substantial noise sources for the power plant would include the engine-generator exhausts, the air intakes and the engine-generator operation. The engine-generator exhausts would be ducted to the outside of the building via an exhaust stack, and would be furnished with standard acoustical silencers ("mufflers") to reduce their environmental noise contribution.

The engine-generators are typically cooled via forced air from large AHUs having air intakes on the outside of the building. There is typically one AHU for each engine-generator. The AHU air intakes are typically outfitted with hoods and standard louvers and/or bird screens.

Typical equipment sound levels for power plant noise sources are as follows:

- Engine-generator exhaust stack exits: Sound power level of 100 to 105 dBA, including effects of silencers.
- AHU air intakes: Sound power level of 90 to 95 dBA.
- Engine-generator room noise leaking out through AHU air intakes: Interior sound pressure level of approximately 120 to 125 dBA (combined sound level from multiple operating engine-generators and AHUs).

In addition to the power plant, the MEBs could also radiate some noise from indoor or outdoor equipment, such as compressors, pumps, blowers, ventilation units, and /or transformers. Noise from indoor sources would be reduced considerably by the building walls and roof. Outdoor sources, such as small transformers and air conditioning units, would not be major environmental noise contributors due to their small size.

3.3.10.4.4.1.2 FCTC Site 1

The potential environmental sound levels at the nearest noise-sensitive receptors resulting from the operation of the potential CIS sources were estimated using standardized calculation methodology (ISO, 1993; ISO, 1996). The standard methodology accounts for source sound power, directivity, and height, and for acoustical shielding from local terrain and CIS buildings and structures. Ground inside the FCTC Site 1 footprint was assumed to be acoustically reflective (e g., packed dirt or pavement). Ground outside the FCTC Site 1 footprint was assumed to be acoustically porous (e.g., loose dirt, grass, or foliage). Only potential CIS sources of sound would be included in the calculations; other sources of sound such as background sound (e. g., traffic) would not be included. Meteorological conditions were conservatively assumed to be downwind from source to receptor with a moderate temperature inversion, which bends sound propagating through the atmosphere back toward the ground.

The estimated CIS sound levels are summarized in Table 3.3.10-8 and Table 3.3.10-9 for the nearby noise-sensitive receptors shown on Figure 3.3.10-6. R1S1 was representative of the nearest off-post residence to FCTC Site 1. R2 was representative of the nearest on-post residence (barracks) to FCTC Site 1. R3 was representative of locations within FCRA. Table 3.3.10-7 provides the calculated future L_{dn} for R1S1, R1S2, and R2 considering continuous, 24-hour power plant operation. The L_{dn} at R1S1, R1S2, and R2 would not be expected to change, even during continuous power plant operation.

Table 3.3.10-8 Summary of Predicted Continental United States Interceptor Site Sound Levels and Predicted Future L_{dn} Sound Levels: Operation – FCTC Sites

Location	Predicted CIS Sound Level	Existing L_{dn}	Predicted Future L_{dn} Including CIS	Potential Increase	Consistent with USEPA Guidelines?
R1S1	43 dBA	71 dBA (1)	71 dBA	0 dBA	Yes (2)
R1S2	40 dBA	58 dBA (3)	58 dBA	0 dBA	Yes (2)
R2	20 dBA	52 dBA (4)	52 dBA	0 dBA	Yes
R3	Not assessed (5)				

Notes:
1. Based on L_{dn} measured at NML1; see Table 3.3.10-4.
2. Existing L_{dn} exceeds USEPA guideline; CIS contribution would not increase existing L_{dn}.
3. Based on L_{dn} measured at NML2; see Table 3.3.10-4.
4. Based on L_{dn} measured at NML3; see Table 3.3.10-4.
5. R3 located within FCRA which is closed at night; therefore, Ldn not assessed.

Table 3.3.10-9 Summary of Predicted Continental United States Interceptor Site Sound Levels and Potential Reactions at Residential Receptors: Operation – FCTC Sites

Location	Predicted CIS Sound Level	Period	Existing Ambient Sound Level (L_{90})	CIS + Existing Ambient Sound Level	Potential Increase	Potential Reaction (1)
R1S1	43 dBA	Daytime	56 dBA (2)	56 dBA	0 dBA	Unnoticed
R1S1	43 dBA	Nighttime	49 dBA (2)	50 dBA	1 dBA	Unnoticed
R1S2	40 dBA	Daytime	46 dBA (3)	47 dBA	1 dBA	Unnoticed
R1S2	40 dBA	Nighttime	46 dBA (3)	47 dBA	1 dBA	Unnoticed
R2	20 to 21 dBA	Daytime	42 dBA (4)	42 dBA	0 dBA	Unnoticed
R2	20 to 21 dBA	Nighttime	37 dBA (4)	37 dBA	0 dBA	Unnoticed
R3	≤ 21 dBA	Daytime	39 dBA (5)	39 dBA	0 dBA	Unnoticed
R3	≤ 21 dBA	Nighttime	33 dBA (5)	33 dBA	0 dBA	Unnoticed

Notes:
1. Based on Table 3.3.10-1.
2. Based on median L_{90} measured at NML1; see Table 3.3.10-4.
3. Based on median L_{90} measured at NML21; see Table 3.3.10-4.
4. Based on median L_{90} measured at NML3; see Table 3.3.10-4.
5. Based on measured L_{90} measured at NML4; see Table 3.3.10-4.

The potential increases in ambient sound level (L_{90}) and the expected reactions to the increases are summarized in Table 3.3.10-9. As shown, sound contributions from the potential CIS would not be noticeable at R1S1, R1S2, R2, or R3.

3.3.10.4.4.1.3 FCTC Site 2

The environmental consequences for operation noise for FCTC Site 2 would be the same as for FCTC Site 1. The expected potential increases in ambient sound (LD_{90}) at the nearest off-post residence to the FCTC Site 2 footprint are represented by R1S2 in Tables 3.3.10-8 and 3.3.10-9. As shown, sound contributions from the potential CIS would not be noticeable.

3.3.10.4.4.2 Mitigation

The overall environmental noise impact from the CIS would be negligible for the surrounding residential area. BMPs commonly used to reduce noise impacts during operations would include the following:

- Standard noise control equipment for continuous 24-hour operation of the CIS power plant equipment.
- Silencers for engine exhausts.
- Acoustical louvers and/or silencers, as needed, for AHU air intakes.
- Standard noise control equipment for outdoor equipment packages, as needed.

Because negligible noise impacts would occur from operations and implementation of BMPs could further address impacts from noise, no mitigation measures would be required.

Figure 3.3.10-1 Noise Monitoring Locations – FCTC Sites

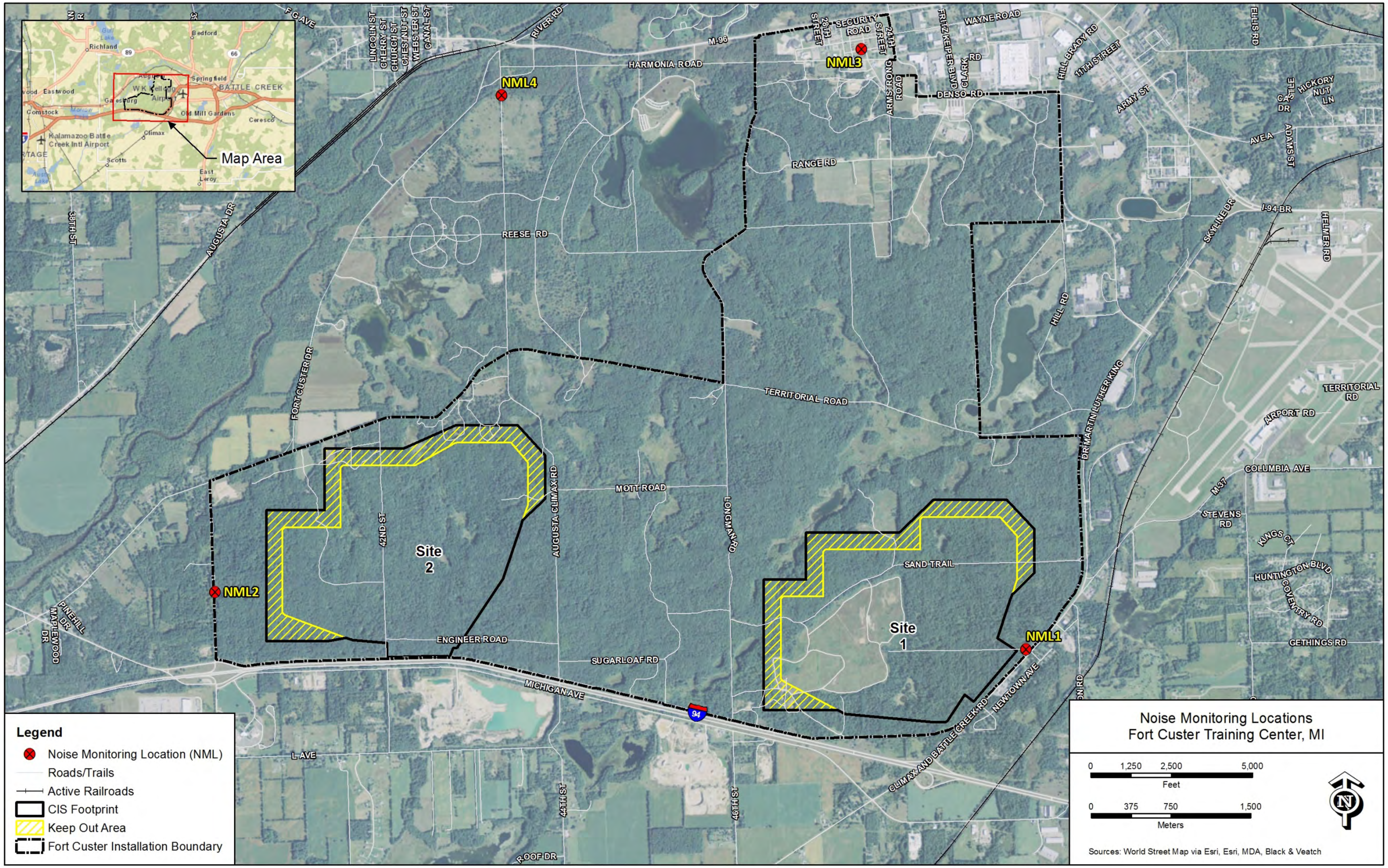
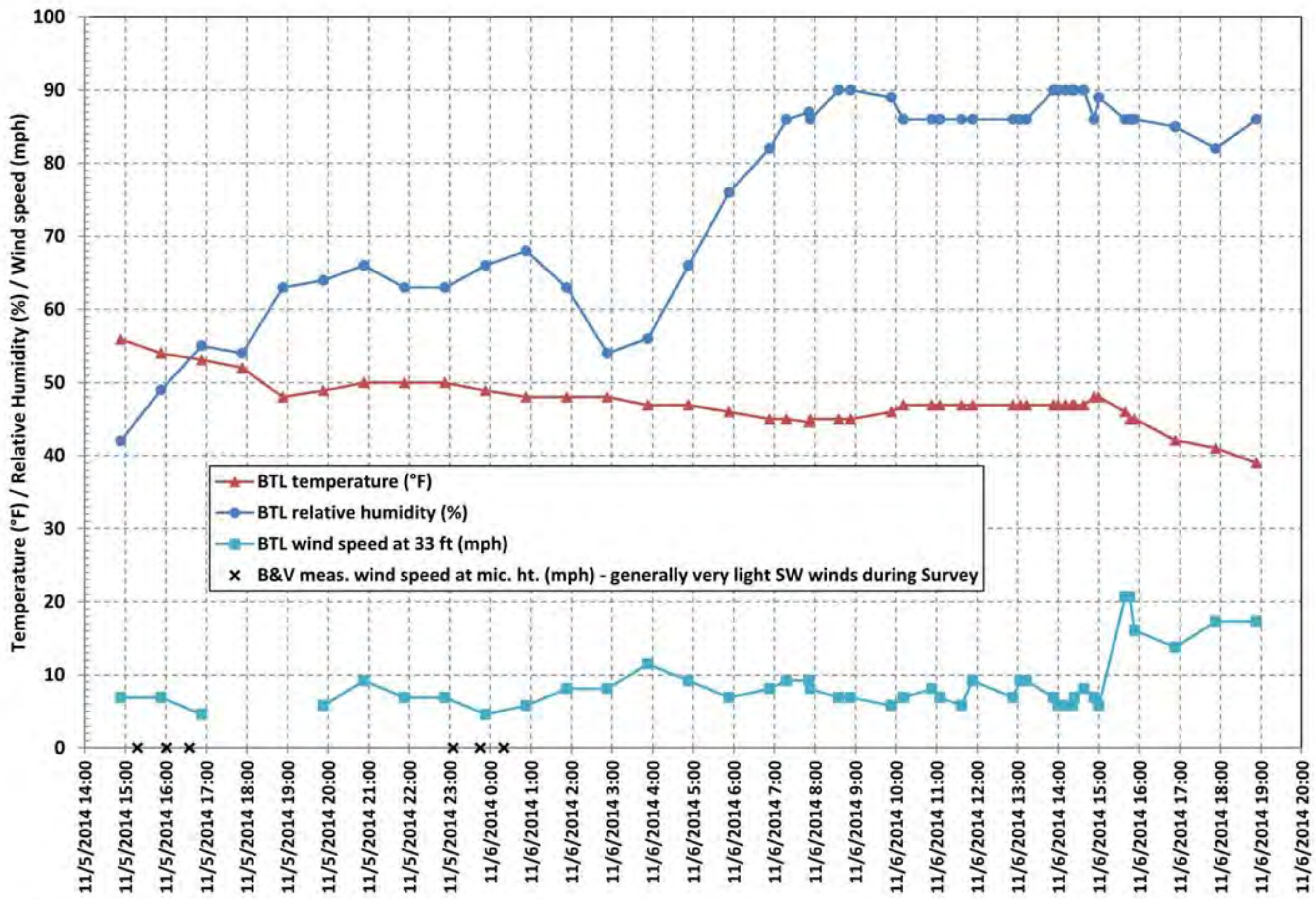


Figure 3.3.10-2 Meteorological Data for ENS Period – FCTC Sites



Source: Hourly data from BTL airport meteorological station accessed 4 December 2014 via http://www.wunderground.com.

Figure 3.3.10-3 Measured Ambient Sound Levels at Noise Measurement Location 1– FCTC Sites

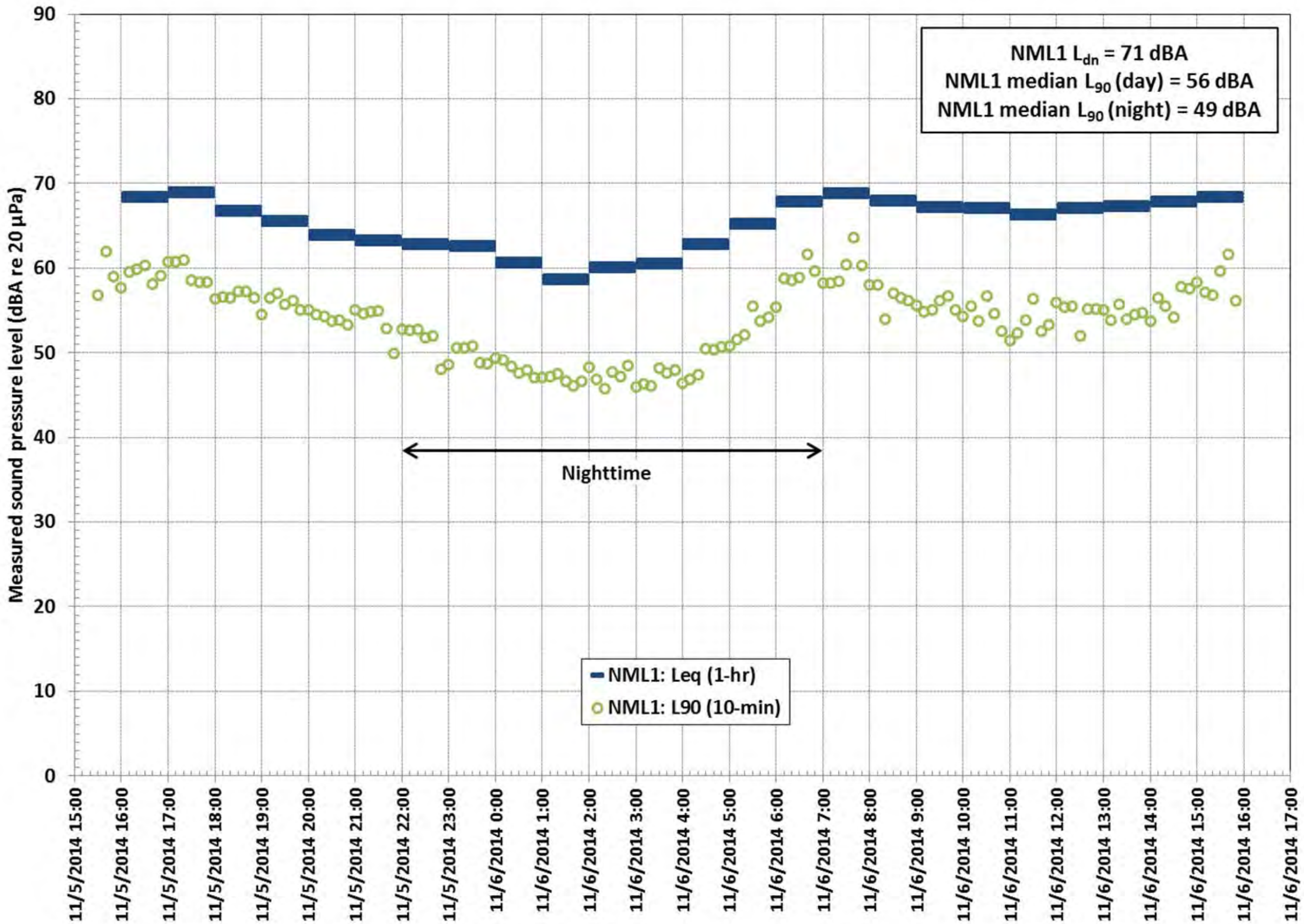


Figure 3.3.10-4 Measured Sound Levels at Noise Measurement Location 2 – FCTC Sites

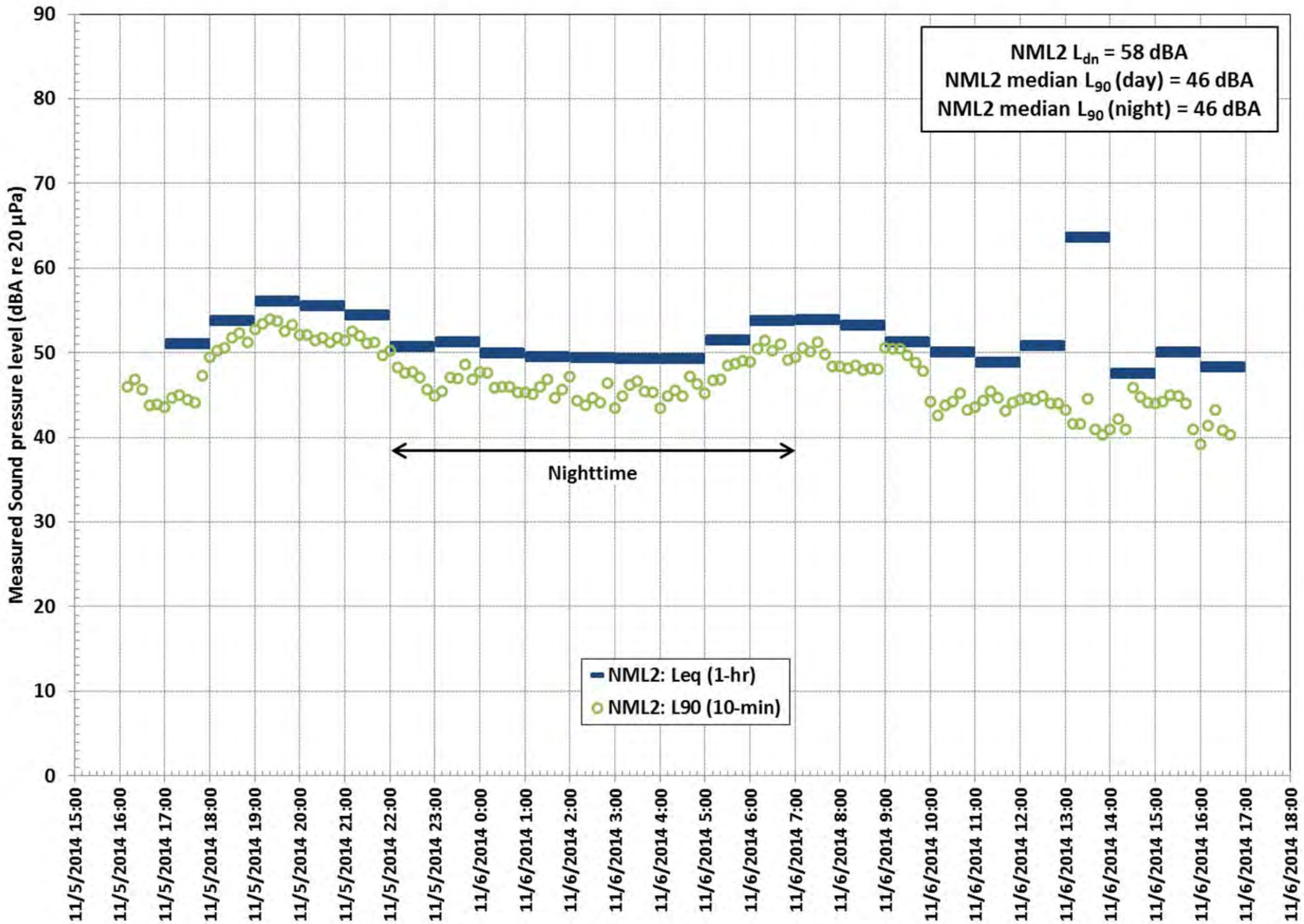


Figure 3.3.10-5 Measured Sound Levels at Noise Measurement Location 3 – FCTC Sites

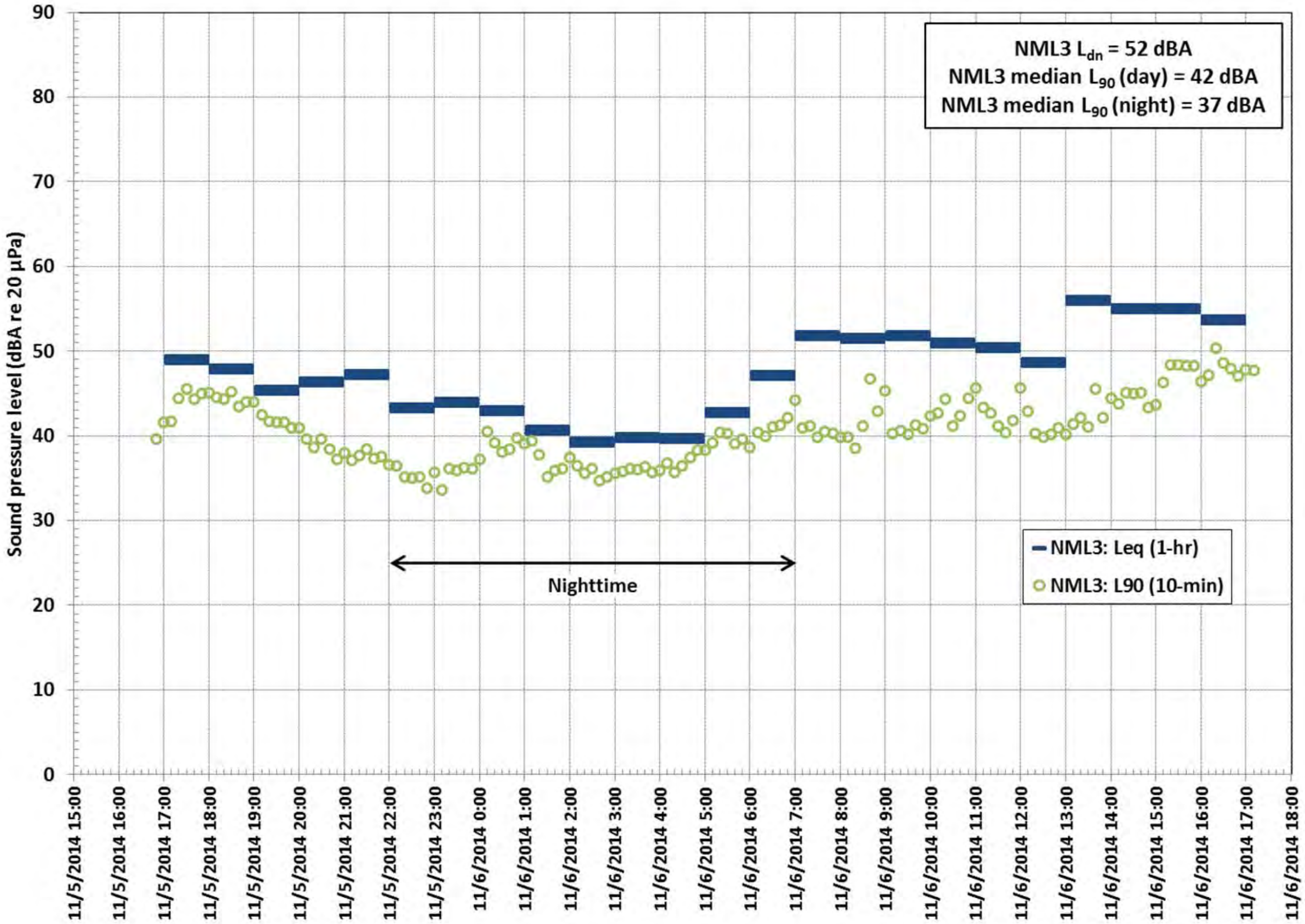
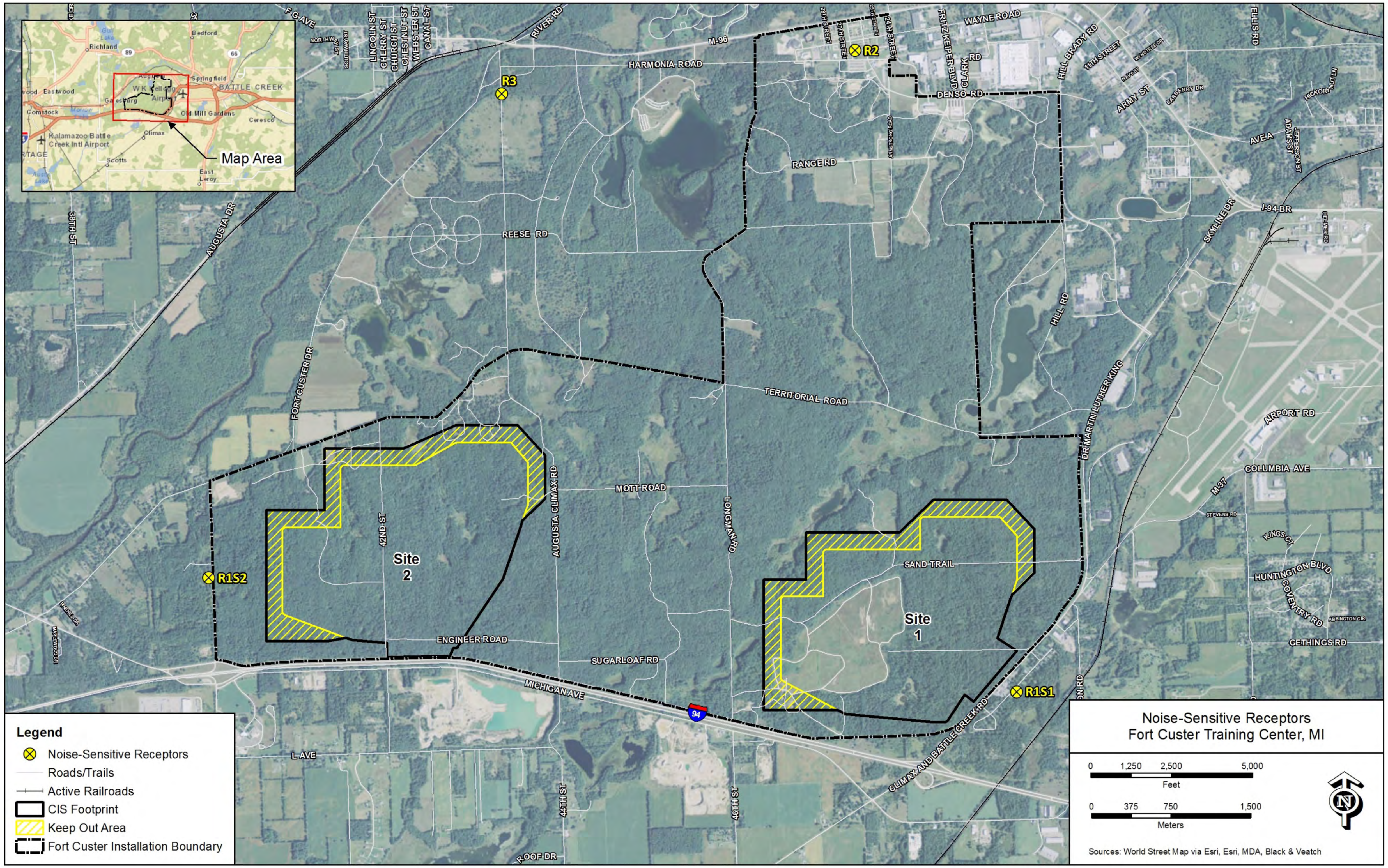


Figure 3.3.10-6 Noise-Sensitive Receptors– FCTC Sites



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3.3.11 Socioeconomics – FCTC Sites

FCTC is located in portions of Kalamazoo and Calhoun Counties within the southwest portion of Michigan's Lower Peninsula. The 7,570-acre military training installation is situated between Interstate 94 to the south and FCRA and the Kalamazoo River to the north. Over 6,813 acres (includes the 2,601-acre Impact Area) exist in an undeveloped condition comprised of forested areas and natural area of fens, swamp and prairie remnants including several high quality rare communities. The remaining acreage, which occupies the northern portion of the base, is developed for training and cantonment areas.

3.3.11.1 Regulatory Framework – Socioeconomics – FCTC Sites

There are no U.S. Army or federal regulations that apply specifically to the assessment of socioeconomic impacts for an EIS.

3.3.11.2 Affected Environment – Socioeconomics – FCTC Sites

The FCTC Site 1 footprint lies within Kalamazoo and Calhoun Counties. The FCTC Site 2 footprint lies entirely within Calhoun County. However, because the construction and operation workforces for the potential CIS deployment for either FCTC Site 1 or FCTC Site 2 would likely present in Kalamazoo and Calhoun Counties on a daily basis, it has been assumed that the majority of the socioeconomic impacts would be felt in these counties. Therefore, Kalamazoo and Calhoun Counties have been emphasized in the following analysis. Some effects of the construction, and operation of the CIS would occur in the larger region surrounding the area and are discussed as needed.

The following counties comprise the socioeconomics study area for the FCTC sites: Kalamazoo, Calhoun, Barry, Eaton, and Ingham. These counties are within commuting range of FCTC (the commuting range is discussed in more detail in Section 3.3.11.3.1.1) and include the largest cities in southwestern Michigan; so it is assumed that they would provide a substantial portion of the labor pool, at least for the construction phase of the potential CIS deployment. Also, the area supports a wide variety of industrial, commercial and institutional businesses and services that could serve some of the project's need for contractor services, equipment and materials, business supplies, etc., and the workers' needs for housing, medical services, schools, shopping, entertainment, etc. The project-related impacts to the study area are the focus of the following socioeconomic evaluation.

The affected environment presented in this section for socioeconomics would the same for both FCTC Site 1 and FCTC Site 2.

3.3.11.2.1 Population

Kalamazoo County was founded in 1830. The estimated county population in 1840 was 7,380 people. The population estimate for the county was 257,211 in 2013. This population increase represents 3,385 percent growth for Kalamazoo County's population over 173 years. The State of Michigan's population increased at 4,556 percent over the same period of time (Census, 2012e).

Table 3.3.11-1 Population of Kalamazoo County – FCTC Sites

Year	Population
1840	7,380
1860	24,646
1880	34,342
1900	44,310
1920	71,225
1940	100,085
1960	169,712
1980	212,378
2000	238,603
2013 (est.)	257,211
All numbers taken directly from Census data. Source: Census, 2012e.	

Based on the data in Table 3.3.11-1, Kalamazoo County has been consistently growing since at least 1840. There are established industrial job markets in construction and business operations, which could bring in additional people if the potential CIS deployment were to occur at the FCTC Site 1 or 2. However, the 2020 projected population of the county is expected to decrease to 247,500. This may be attributed to more of the population moving to nearby cities, such as Lansing, where employment and education options are more available (Census, 2012e).

As shown in Table 3.3.11-2, the Calhoun County population has been growing since at least 1840. The 2020 projected population is 147,200, trending above the current population and indicating that the population of the area will slowly grow in the future (Census, 2012d). Unlike Kalamazoo County, Calhoun County may be seeing an increase in population due to the county's location close to the major City of Battle Creek.

The nearest large population centers to FCTC include the cities of Kalamazoo (population 75,548, approximately 13 miles to the west), Battle Creek (population 51,848, approximately 8 miles to the east), and Lansing (population 113,972, approximately 50 miles to the northeast) (Census, 2012e).

Table 3.3.11-2 Population of Calhoun County – FCTC Sites

Year	Population
1840	10,599
1860	29,564
1880	38,452
1900	49,315
1920	72,918
1940	94,206
1960	138,858
1980	141,557
2000	137,985
2013 (est.)	134,830
All numbers taken directly from Census data. Source: Census, 2012d.	

3.3.11.2.2 Demographics

The racial demographic information for Kalamazoo County and Calhoun County are presented in Tables 3.3.11-3 and 3.3.11-4, respectively.

Table 3.3.11-3 Kalamazoo County Population by Race (2010) – FCTC Sites

Population By Race	Number	Percent
Total Population	250,331	
White	200,047	79.9
African-American	26,677	10.7
Native American	923	0.4
Asian	5,146	2.1
Pacific Islander	73	0.0
Other	381	0.2
Two or More Races	7,085	2.7
Hispanic (may be of any race)	9,959	4.0
All numbers taken directly from Census data. Source: Census, 2012e.		

Table 3.3.11-4 Calhoun County Population by Race (2010) - FCTC Sites

Population By Race	Number	Percent
Total Population	136,146	
White	108,664	79.8
African-American	14,630	10.7
Native American	714	0.5
Asian	2,154	1.6
Pacific Islander	45	0.0
Other	142	0.1
Two or More Races	3,620	2.7
Hispanic (may be of any race)	6,177	4.5
All numbers taken directly from Census data. Source: Census, 2012d.		

Kalamazoo County is dominated by the white demographic, with 79.9 percent of the population identified as part of this race. The largest minority population in Kalamazoo County is African-American at 10.7 percent of the total population in 2010. The population of Calhoun County is predominantly white (79.8 percent). The largest minority population in Calhoun County is also African-American at 10.7 percent of the total 2010 population.

As shown in Table 3.3.11-5, the Kalamazoo County age distribution shows that the majority of the population is in the age group that is active in the work force, 15 to 64 years old, with a median age of 34.1 years old.

Table 3.3.11-5 Kalamazoo County Population by Age (2010) – FCTC Sites

Population By Race	Number	Percent
Total Population	250,331	
Under 5 years	15,646	6.3
5 to 14 years	31,607	12.6
15 to 29 years	65,111	26
30 to 44 years	44,881	17.9
45 to 64 years	62,306	24.9
65 years and more	30,780	12.3
All numbers taken directly from Census data. Source: Census, 2012e.		

Table 3.3.11-6 shows the Calhoun County age distribution, with the majority of the population in the age group that is active in the work force (15 to 64 years old). Calhoun County has a median age of 39.2 years of age.

Table 3.3.11-6 Calhoun County Population by Age (2010) – FCTC Sites

Population	Number	Percent
Total Population	136,146	100.0
Under 5 years	8,752	6.4
5 to 14 years	18,242	13.3
15 to 29 years	26,482	19.5
30 to 44 years	24,797	18.2
45 to 64 years	37,764	27.7
65 years and more	20,109	14.7
All numbers taken directly from Census data. Source: Census, 2012d.		

3.3.11.2.3 Employment

Kalamazoo County has an estimated 133,293 people in the civilian work force. The highest employment percentage for an industry in Kalamazoo County is in the category of "educational services, and health care and social assistance" at 18.1 percent of employed people. The second highest employment sector is manufacturing at 15.0 percent (Census, 2012e). In Calhoun County, manufacturing has the highest employment percentage at 23.8 percent with "health care and social assistance" second at 18.3 percent (Census, 2012d).

Private wage and salary workers make up the largest group of workers in Kalamazoo County, at 83.0 percent of the work force. Government workers make up the second largest group at 11.7 percent (Census, 2012e). Tables 3.3.11-7 and 3.3.11-8 summarize the employers, industry sectors, employees, and total wages for Kalamazoo and Calhoun Counties, respectively.

Kalamazoo and Calhoun Counties currently have strong construction and business operations employment statistics. Construction and manufacturing employment is an indicator of economic health, so the substantial amount of incomes being derived from the construction and manufacturing in both Kalamazoo and Calhoun Counties indicates that there are skilled workers present in the FCTC socioeconomics study area.

Unemployment rates and number of construction workers for the study area counties near Kalamazoo County are listed in Table 3.3.11-9. The unemployment rate was estimated at 11.8 percent for civilian workers in Kalamazoo County (Census, 2012d) and 13.2 percent in Calhoun County (Census, 2012e).

Table 3.3.11-7 Kalamazoo County Establishments, Employment, and Total Wages by Sector (2012) – FCTC Sites

Industrial Sector	Number of Establishments	Average Employment	Total Wages
Total, all sectors	5,507	103,221	$4,561,350,000
Agriculture, Forestry, Fishing, Hunting	4	0-19	N/A
Mining, Quarrying, and Oil and Gas Extraction	10	38	$2,408,000
Utilities	4	250-499	N/A
Construction	391	3,529	$198,446,000
Manufacturing	311	15,549	$951,236,000
Wholesale Trade	281	4,628	$381,650,000
Retail Trade	867	12,969	$297,846,000
Transportation and Warehousing	108	2,238	$91,490,000
Information	91	1,172	$54,764,000
Finance and Insurance	387	5,937	$366,193,000
Real Estate and Rental/Leasing	193	2,397	$77,205,000
Professional, Scientific, and Technical Services	540	3,868	$230,280,000
Management of Companies and Enterprises	39	3,815	$406,137,000
Administrative and Support, Waste Management, Remediation Services	288	7,596	$238,756,000
Educational Services	72	2,485	$85,052,000
Health Care and Social Assistance	657	18,684	$840,228,000
Arts, Entertainment and Recreation	99	1,583	$30,256,000
Accommodation and Food Services	541	11,604	$155,514,000
Other Services	622	4,836	$130,574,000
Industries not Classified	2	0-19	N/A
Source: Census, 2013.			

Table 3.3.11-8 Calhoun County Establishments, Employment, and Total Wages by Sector (2012) – FCTC Sites

Industrial Sector	Number of Establishments	Average Employment	Total Wages
Total, all sectors	2,630	50,801	$2,256,764,000
Agriculture, Forestry, Fishing, Hunting	6	7	$106,000
Mining, Quarrying, and Oil and Gas Extraction	4	20-99	N/A
Utilities	5	100-249	N/A
Construction	170	1,036	$56,102,000
Manufacturing	153	12,096	$653,779,000
Wholesale Trade	111	995	$52,967,000
Retail Trade	491	6,077	$143,444,000
Transportation and Warehousing	70	1,603	$80,169,000
Information	36	344	$11,527,000
Finance and Insurance	166	988	$43,387,000
Real Estate and Rental/Leasing	80	405	$10,366,000
Professional, Scientific, and Technical Services	203	2,018	$111,165,000
Management of Companies and Enterprises	18	2,291	$370,271,000
Administrative and Support, Waste Management, Remediation Services	124	3,274	$77,313,000
Educational Services	27	1,000-2,499	N/A
Health Care and Social Assistance	316	9,284	$407,545,000
Arts, Entertainment and Recreation	48	551	$11,389,000
Accommodation and Food Services	274	6,309	$120,119,000
Other Services	322	1,921	$58,285,000
Industries not Classified	6	0-19	$67,000
Source: Census, 2013.			

Table 3.3.11-9 Unemployment Rates and Number of Construction Worker for Study Area – FCTC Sites

County	Unemployment Rate	Construction Workers
Kalamazoo	11.8%	4,155
Calhoun	13.2%	2,346
Barry	10.2%	1,919
Eaton	10.3%	2,365
Ingham	10.8%	4,325
Source: Census, 2012f.		

The Michigan unemployment rate was 12.7 percent in 2013, which makes only Calhoun County's unemployment rate higher than the Michigan average (Census, 2012f). While Kalamazoo County appears to have a high number of construction workers within the county, the county also has a lower than Michigan average unemployment rate. Based on the number of construction workers and the unemployment rates in the study area counties, an adequate workforce would be available and could be drawn from the most populous counties around the project site to a project of the duration, size, and scope of the CIS. The likely commuting range for construction workers is discussed in Section 3.3.11.3.1.1.

3.3.11.2.4 Income

In 2012, the median household income in Kalamazoo County was $45,775, which is 5.4 percent below the average for the State of Michigan at $48,411. Approximately 46.5 percent of households had an income greater than $49,999. In 2012, 12.6 percent of Kalamazoo County households were living below the poverty level. Figure 3.3.11-1 illustrates the range of median household incomes in Kalamazoo County.

3.3.11.2.5 Housing, Education, and Health

3.3.11.2.5.1 Housing

Kalamazoo County had 109,911 housing units in 2013, according to the U.S. Census. Of these, 9.0 percent were vacant. Table 3.3.11-10 lists the Kalamazoo County housing characteristics using an estimate of data for the year 2010. The housing units in Kalamazoo County are focused in the City of Kalamazoo. Additionally, vacant housing units make up only 8.5 percent of Kalamazoo County's housing units. Neighboring Calhoun County, described in Table 3.3.11-11, has a smaller population than Kalamazoo County with the majority of housing located in and around the City of Battle Creek (Census, 2012e). According to the 2010 Census, 12.2 percent of the housing units in Calhoun County were vacant (Census, 2012d). Whether this amount of vacant housing is sufficient for housing the project's labor force would depend on the condition of the vacant housing, the proximity of the housing to the project site, and the cost of the housing.

Table 3.3.11-10 Kalamazoo County Housing Characteristics (2010) – FCTC Sites

General Housing Data	2010 Census Est.	Percent of Est. Total
Total Housing Units	110,007	
Occupied	100,610	91.5
Vacant	9,397	8.5
Owner-Occupied Units	64,254 (of 100,610)	63.9
Median Value of Owner-Occupied Units	$136,700	
Source: Census, 2012e.		

Table 3.3.11-11 Calhoun County Housing Characteristics (2010) – FCTC Sites

General Housing Data	2010 Census Est.	Percent of Est. Total
Total Housing Units	60,837	
Occupied	53,428	87.8
Vacant	7,409	12.2
Owner-Occupied Units	37,214	69.7
Median Value of Owner-Occupied Units	$98,300	
Source: Census, 2012d.		

3.3.11.2.5.2 Education

The Kalamazoo Regional Educational Service Agency serves the area surrounding FCTC, including the City of Kalamazoo. It provides educational services pre-kindergarten through twelfth grade, including special education, college placement courses, and work-study programs (KRESA, 2015). Additionally, four higher education campuses are located in Kalamazoo County, including Western Michigan University in Kalamazoo. According to the 2010 Census, Kalamazoo County had 80,162 students in some form of educational institution, including kindergarten through high school and higher education. Of the residents in Kalamazoo County, 25.9 percent have earned a high school diploma, while 20.7 percent achieved a Bachelor's degree (Census, 2012e). The graduation rate for high school students in Kalamazoo County in 2011 was 79.87 percent, compared to a Michigan average of 74.33 percent (KCHCS, 2012). Kalamazoo County has a student-to-teacher ratio of 17:1, which is less than the state average of 18:1 (PSR, 2015d). Calhoun County has 55 public schools and serves 20,557 students. Calhoun County has a student-to-teacher ratio of 16:1, which is also less than the state average of 18:1 (PSR, 2015e). There are also seven higher education campuses located in Battle Creek, MI, including Western Michigan University.

The most common level of academic achievement for the residents of Kalamazoo County is a high school diploma (see Table 3.3.11-12). The lowest percentage of educational achievement for Kalamazoo County residents is not completing high school. A substantial portion of Kalamazoo County (34.1 percent) achieves a degree from higher education. The most common level of academic achievement for the residents of Calhoun County is a high school diploma (see Table 3.3.11-13). The lowest percentage of educational achievement for Calhoun County residents is earning a Master's degree or higher. A small percentage of Calhoun County residents earned an Associate's degree.

Table 3.3.11-12 Kalamazoo County Educational Attainment (2013 ACS) – FCTC Sites

Educational Attainment	Number	Percent
Persons 25 years and over	156,259	
No high school diploma	11,563	7.3
High school graduate	38,752	24.8
Some college, no degree	38,596	24.7
Associate degree	14,219	9.1
Bachelor's degree	32,502	20.8
Master's degree or higher	20,782	13.3
Source: Census, 2012e.		

Table 3.3.11-13 Calhoun County Educational Attainment (2013 ACS) – FCTC Sites

Educational Attainment	Number	Percent
Persons 25 years and over	90,860	
No high school diploma	10,176	11.3
High school graduate	31,165	34.3
Some college, no degree	23,260	25.6
Associate degree	8,450	9.3
Bachelor's degree	11,448	12.6
Master's degree or higher	6,269	6.9
Source: Census 2012d.		

3.3.11.2.5.3 Health

The majority of hospital services in Kalamazoo and Calhoun Counties are provided by several hospitals located in Kalamazoo and Battle Creek. The closest hospital to FCTC would be the Borgess Medical Center approximately 12 miles west of FCTC.

Calhoun County has five hospitals that could serve workers for the CIS project. The largest facility, the Bronson Battle Creek Hospital, is located approximately 8 miles to the west of FCTC.

Using metrics that track the mortality, morbidity, health behaviors, clinical care, social, and economic factors and the physical environment, the University of Wisconsin compiles data to document and rank the overall health of counties. The most recent ranking available was from 2015. The Health Outcomes metric represents how healthy a county is while the Health Factors metric represents what influences the health of the county. Kalamazoo County ranked 17th in Health Factors and 37th in Health Outcomes out of the 82 counties in Michigan (UW, 2015c). These results suggest that the Kalamazoo County health services system is currently meeting the health requirements of its citizens better than most of the counties in Michigan.

Calhoun County has scored lower in the University of Wisconsin studies. Calhoun County is ranked 67th in Health Factors and 74th in Health Outcomes out of 82 counties in Michigan (UW, 2015c). Calhoun County has a higher occurrence of preventable health issues (such as diabetes, heart disease, and excessive drinking) than Kalamazoo County and the State of Michigan generally.

3.3.11.2.6 Services

This section focuses on the services available in the project counties of Kalamazoo and Calhoun. First responders and emergency management for incidents occurring at the site for the potential CIS deployment would come from Kalamazoo County first, with other counties responding as needed.

3.3.11.2.6.1 Police/Sheriff Departments

Kalamazoo County has its own sheriff's department that serves the county in addition to local municipal police forces. The cities of Kalamazoo and Portage also have police forces that would be available to respond to law enforcement issues in the area of FCTC. There is a military police force at FCTC at the training center to run the training center's security and access points (MIARNG, 2015). Additionally, the Kalamazoo County Sheriff's Office, Calhoun County Sheriff's Office, the City of Battle Creek Police Department, and the FCTC have also entered into an agreement under a Memorandum of Understanding that obligates the parties to all calls for service will be responded to by the nearest unit, regardless of jurisdiction. This agreement enables law enforcement in the FCTC area to coordinate and respond to incidents quickly.

No issues concerning a lack of law enforcement services were evident in the Kalamazoo or Calhoun County areas.

3.3.11.2.6.2 Fire/Emergency Services

The Kalamazoo County Fire Department directory documents 20 fire departments and fire stations in Kalamazoo County and within responding distance of a fire emergency (KCFD, 2015). Neighboring Calhoun County may also be able to lend support to fire control or assist in emergency situations if necessary, due to the jurisdiction's close proximity to FCTC.

No issues concerning a lack of fire or emergency response services were evident in the Kalamazoo or Calhoun County areas.

3.3.11.2.6.3 Emergency Management

The Kalamazoo County Office of Emergency Management was established under provisions of the Michigan Emergency Management Act, Public Act 390 of 1976 and the county's emergency management resolution from 1993 to ensure a coordinated public response in the event of a natural or man-made disaster. It provides comprehensive training for public officials and private citizens and maintains operational readiness of the County Emergency Operations Center for disaster management and all Homeland Security and Domestic Preparedness activities. The office maintains and deploys the mobile command post for use by local incident commanders during major events (OEM, 2015).

The mission of the Calhoun County Sheriff's Office of Emergency Management and Homeland Security is to lessen the effects of a disaster, both natural and manmade. The Office of Emergency Management coordinates and provides support to all agencies during the five phases of emergency management. This includes: mitigation, prevention, preparedness, response, and recovery. The emergency management mission includes identifying potential threats, decreasing vulnerabilities and increasing the capabilities to respond to an act of terrorism or other threats within Calhoun County (OEMHS, 2016).

No issues concerning a lack of emergency management services were evident in the Kalamazoo or Calhoun County areas.

3.3.11.2.7 Subsistence Living

Two churches in the area surrounding FCTC were contacted to gather information about any known local subsistence populations. The Kalamazoo Community Church and the Radiant Church were contacted. Neither church had any information regarding any subsistence populations. Information provided by FCTC personnel indicated that there have been occasional inquiries from the public about gathering mushrooms and medicinal plants. However, to the knowledge of FCTC personnel, there is no known regular subsistence food gathering as a means of subsistence living at FCTC.

3.3.11.2.8 Tax Revenues

In general, local government is financed through a number of tax sources and this revenue is allocated to various account funds. The largest of these funds is usually the general fund that typically generates revenues through property taxes. These taxes generally apply to all non-government and non-church property.

Kalamazoo County has one of the highest median property taxes in the U.S. and is ranked 312th out of 3,143 counties in order of median property taxes. The average yearly property tax paid by Kalamazoo County residents amounts to about 3.79 percent of their yearly income. Kalamazoo County is ranked 286th for property taxes as a percentage of median income (Kalamazoo, 2015a). Calhoun County also has one of the highest median property taxes in the U.S. and is ranked 568th in order of median property taxes. The average yearly property tax paid by Calhoun County residents amounts to about 3.45 percent of their yearly income. Calhoun County is ranked 396th for property taxes as a percentage of median income (Calhoun, 2015b).

3.3.11.3 Environmental Consequences and Mitigation – Socioeconomics – FCTC Sites

Generally, the social and economic impacts of construction are a function of the extent of site preparation and development work, the amount of equipment and materials purchased for construction, the size of the construction workforce, wages paid, and the number of relocating workers relative to the available community facilities and services. If negative impacts arise, the primary categories of concern usually include short-term traffic impacts and impacts that could arise if a large workforce is relocated to a region that has limited availability of housing or inadequate community facilities and services. The key information to make this determination is the size of the relocating construction workforce relative to the availability of housing and community facilities and services.

The majority of the economic impact from construction of a CIS at FCTC would likely occur in the immediate surrounding area of Kalamazoo and Calhoun Counties.

As discussed for the FCTC affected environment, because the construction and operations workforces for either FCTC Site 1 or FCTC Site 2 would be required to be present in Kalamazoo and Calhoun Counties on a daily basis, the environmental impacts for socioeconomics would the same for both FCTC Site 1 and FCTC Site 2.

3.3.11.3.1 Construction – Baseline Schedule

As presented in Section 2.5.1, between 400 and 600 employees and workers would be needed during CIS construction under the baseline schedule. These construction staff would be expected to be a mixture of commuting and permanent residents of the FCTC region (Kalamazoo, Calhoun, Barry, Eaton, and Ingham Counties) with the majority coming from Kalamazoo and Calhoun Counties.

3.3.11.3.1.1 Environmental Consequences

Tax Revenue Impacts

The main source of tax revenue in the FCTC area is sales tax (BLS, 2014). The potential CIS deployment at either FCTC Site 1 or 2 would increase the amount of taxes collected in the study area as construction-related goods and services are purchased during project development. Workers purchasing goods and services for their personal use would also contribute to tax increases in the study area. In order to calculate the additional tax revenue that the CIS project would bring to Kalamazoo County and Calhoun County, the number of expected workers and the amount each worker could be expected to spend was multiplied by the sales tax rate for Kalamazoo County and Calhoun County. Table 3.3.11-14 summarizes the estimates of tax revenue from the CIS project during construction.

Table 3.3.11-14 Estimated Sales Tax Revenue - Construction – FCTC Sites

Input	Construction
Number of Workers (middle of anticipated range of workers)	500
Assumed Expenditures Subject to Sales Tax (1) (per person/year in either Kalamazoo or Calhoun Counties)	$30,837
Sales Tax Rate (Kalamazoo and Calhoun Counties)	6.0%
Estimated Sales Tax Revenue(2) – Kalamazoo County (total for CIS workers/year)	$462,555
Estimated Sales Tax Revenue(2) – Calhoun County (2) (total for CIS workers/year)	$463,555
Estimated Total Sales Tax Revenue (total for CIS workers/year)	$925,110
Notes: 1. Data based on 2014 data – no escalation. 2. Assumes 50 percent of the expenditures would occur in each county. Source: BLS, 2014.	

As shown in Table 3.3.11-14, the estimated taxable expenditures include expenditures like food, transportation, and entertainment that workers employed by the CIS would likely be spending a portion of in Kalamazoo and Calhoun Counties regardless of where they have their permanent residence. Table 3.4.11-14 summarizes what the estimated tax revenue would be in Kalamazoo County and Calhoun County, respectively, if CIS workers spent 50 percent of their expenditure dollars in each of those counties. The total estimated sales tax revenue generated from the potential CIS deployment during construction could be approximately $925,110.

Any additional property tax collection for Kalamazoo and Calhoun Counties above what is currently being collected would depend on the number of workers that choose to move to the area and purchase newly constructed homes for use during the construction of the potential CIS. It is possible that the increase on demand for housing in the area may cause home values in

Kalamazoo and Calhoun Counties to increase, which would lead to an increase in the property taxes collected by the county. Conversely, construction workers hired for the potential CIS deployment may choose to commute to the construction site and would not contribute to the property tax revenue of Kalamazoo and Calhoun Counties.

Regional Economic Impact Estimates

For purposes of this socioeconomic impact analysis, the economic region surrounding the FCTC installation includes the counties of Kalamazoo, Calhoun, Barry, Eaton, and Ingham.

The total economic impact of the potential CIS deployment would be greater than the direct employment, income, and tax revenue impacts arising from the project workforce. The additional economic impact would arise from what are commonly called “multiplier effects” that are associated with the successive rounds of spending in the economy from a new investment. The total economic impact is measured in this study using the Regional Impact Multiplier System II (RIMS II) model. Regional input-output multiplier models such as RIMS II project how new expenditures will create changes in various economic categories within a defined geographic region. The specific economic categories include total gross output (sales), value added (gross domestic product), earnings, and employment.

In general, RIMS II multipliers are used by both the private and public sector to project future impacts arising from a project’s direct expenditures. Project construction expenditures would go primarily to workers (labor) and subcontractors. Yet these direct expenditures on construction are only a portion of the total economic impacts generated by the project construction. There are also indirect impacts (that arise from company-to-company purchases in support of the direct construction expenditures) and induced impacts that deal with the spending of wages by laborers. Regional input-out multipliers capture both direct and secondary (indirect) impacts, therefore, giving a fuller and more complete picture of the total economic impacts generated by the initial direct construction expenditures. In the end, the overall economic impact within the region would be greater than the project’s direct construction expenditures due to the secondary impacts. A more detailed explanation of how RIMS II was used in this analysis is provided in the following paragraphs.

The direct construction expenditures for the potential CIS deployment would have a major and direct impact on the FCTC region and would also impact the rest of Michigan. In addition to the primary or direct investment and expenditure impacts, there would be secondary impacts in the form of indirect and induced benefits.

To capture the total economic impact of the project investment and construction expenditures, it would be necessary to track expenditures as they work their way through the state and U.S. economy over a period of a few years after expenditures are first made. For example, firms that are hired to build the potential CIS would purchase materials and services from a diverse set of companies offering lumber, transportation, fuel, catering, etc. (any items purchased by the firm from another firm required to conduct their business). The suppliers of these goods and services would, in turn, use revenue to pay employees and to purchase inputs that allow the suppliers to meet their contract obligations. This process arising from the business to business purchases would continue through many rounds of spending in the economy and would create a total economic impact that is a multiple of the original purchase of material and service inputs by the firms hired to construct the CIS. This type of effect is called the "indirect effect." The indirect effect is measured in the RIMS II data based on recent survey information that measures the economic relationship among industries in terms of inputs purchased from other firms to produce output in a given industry.

Similarly, a substantial portion of the direct expenditures on the potential CIS deployment would be paid to workers who perform the construction work. Through what is called the "induced effect," these workers would use their disposable earned income to purchase goods and services such as clothing, rent, automobile payments, food, vacations, savings, etc. Establishments that receive the worker's income in exchange for goods and services would, in turn, use the revenue received to pay their own workers, to purchase supplies needed to provide additional goods and services, etc. This process would continue through multiple rounds of spending in the economy and create a total economic impact that is a multiple of the original wages received from the CIS workers. Generally, through each round of spending, the impact would lessen because not all of the income would be spent in the study area due to the purchase of imports, worker savings, taxes, etc. Thus, there would be an economic "ripple effect" with project expenditures that would lessen with time, as the successive rounds of spending work through the economy. While the models used to estimate the total impact of an investment do not estimate the timing of impacts, it is generally understood that most of the impacts from a new construction project will ripple through the economy within 2 to 3 years after the completion of a project.

While envisioning the successive rounds of spending in an economy is intuitive, in reality tracing the actual spending patterns of even a single construction project would be enormously difficult and expensive. Fortunately, there are mathematical methods and models available that estimate the economic impact of an investment on the economy; these models are commonly referred to as input-output models. These models are built upon detailed databases, including survey data that track the historical economic interrelationship and expenditure patterns among industries and households. Two widely used input-output models are the Regional Input-Output Modeling System (RIMS II) developed by the U.S. Bureau of Economic Analysis (BEA), and the IMPLAN (IMpact analysis for PLANning) model. RIMS II, which dates to the 1970s, was used in this analysis; its specific application to the potential CIS deployment project is described in the following paragraphs. The impact multipliers generated by RIMS II allow users to apply the multipliers to project expenditures and estimate the regional impact of the project on output (sales), value added (gross domestic product), earnings, and employment.

RIMS II incorporates data contained in national input-output accounts that capture the relationship between each major industry and other industries or final users that use or purchase the goods and services produced by each industry. Thus, as any industry increases production, the mathematical relationships in RIMS II that reflect the historical input-output accounts will determine the added output required from other industries, as well as the increase in earnings, employment, and value added.

When performing an analysis for a sub-national region, RIMS II adjusts the national input accounts for local conditions, based on available data such as the size of each industry within the region, and generates multipliers for the selected area. The study area can be as small as a single U.S. county. Multipliers will be different for all study areas because all study areas have unique economic conditions.

A few other aspects of RIMS II are appropriate to highlight. First, RIMS II assumes that a constant mix of inputs is used to produce outputs; this assumption is because the national input-output accounts reflect the structure of the economy at a point in time, when the data was collected. The current input-output relationships are from 2010. The model also assumes that all businesses in an industry use a similar production process, and it is assumed that there are no supply constraints that would increase prices for a particular input as demand for the input increases. Finally, RIMS II does not account for multi-regional feedback impacts, and the multipliers do not predict the period of time over which impacts would occur.

The end product from RIMS II is a series of economic multipliers. For this study, final demand multipliers were used. When a dollar change in final demand is applied to these multipliers, the estimated total economic impact from the expenditure in the selected region is produced. Final demand multipliers are produced by RIMS II for employment, earnings, value added (Gross Domestic Product), and output.

Government expenditures can be traced using RIMS II through a multi-step process that includes developing a breakdown of government expenditures by expected industry, an estimate of the local industries that will provide goods and services for the government project, and the application of final demand multipliers to the impacted industries.

Table F.1 in Appendix F lists the major expenditures for the potential CIS deployment and assigns these to a RIMS II industry. All categories but one were assigned to the RIMS II category of construction in the table. The first two columns listing estimated expenditure values for material and labor costs are presented in 2015 dollars and total approximately $201 million for materials and more than $48 million for labor costs. These estimates are based on a similarly sized government project operated at Fort Greely, AK. As the DoD has not decided to pursue an additional CIS, discussion of costs specific to a potential CIS are premature at this time. Before the RIMS II multipliers can be applied, however, several adjustments are required. First, when using a final demand multiplier, RIMS II requires that an adjustment be made for household purchases by workers who already live and work in the region, assumed to be 65 percent in this study[7]. This adjustment avoids inflated impact estimates as the spending of workers living in the region is already part of the multipliers. Following this adjustment, Table F.1 shows the combined material plus labor be applied to the final demand multipliers. Also, because the RIMS II multipliers are derived from a model using 2010 data, it is necessary to state the 2015 costs in 2010 dollars and to then apply the multipliers.

Table F.1 shows the multipliers estimated by RIMS II for the FCTC region. Applying these multipliers to the adjusted expenditure line items and then summing the total (converted back to 2015 dollars) yields the following estimated results for the total construction period:

- The total change in output that occurs in all industries from the potential CIS deployment would be more than $332 million in the selected region.
- The total incremental earnings in the region arising from the project would be more than $86 million.
- The project would create 2,008 indirect jobs that would be temporary and end when construction ends.
- Finally, the total value added arising in the region from the potential CIS deployment would be more than $193 million.

Employment and Industry

The amount of construction employment required at the potential CIS project site would vary substantially as the construction progresses. Between 400 and 600 workers would be onsite under the baseline schedule as discussed in Section 2.5.1. Although a workforce distribution plan has not yet been developed, he number of workers would likely be smaller during the first portions of site clearing and utility work and then increase substantially when heavy construction starts. The workforce would then decrease somewhat during the final build out period. Thus, the project workload pattern would be expected to generally follow a traditional “S curve” distribution, so named because when the cumulative hours of labor are plotted (on the vertical axis) against the months of construction (on the horizontal axis), an S-shape is usually formed. This S curve indicates that relatively few hours would be spent in the early and late stages of construction, and the largest expenditure of construction hours would occur in the middle of the construction period as multiple crafts are typically represented onsite and construction efforts would often be occurring at multiple places on the site.

Based on the construction plan and estimates from similar projects, approximately 50 to 85 percent of the construction workforce would come from the commuting area around the site (FCTC region), while 15 percent of the workforce would relocate from outside the region.

[7] This percentage is based on the population size in the FCTC vicinity and the impacts can also include those from workers assumed to be unemployed or, in some cases, if they leave a lower paying job for the project and this ultimately results in a net addition of one regional worker.

Construction workers brought into the area from outside the FCTC region for the potential CIS (assumed to be those with selected skills or experience not generally available in the region) would likely be living and commuting between 8 and 13 miles (or possibly farther) from the job site if they are renting housing in either Kalamazoo or Battle Creek. Due to the availability of vacant housing in Kalamazoo and Calhoun Counties, the new workforce would not likely experience difficulties while attempting to secure nearby living accommodations.

Workers from outside the FCTC region may decide to commute from their current living location rather than to compete for housing close to the job site. According to a 2010 study of commuter habits in the FCTC area, willingness to commute is determined both by the economic benefit to the commuter and by commuting costs (Westin and Sandow, 2010). The latter consists of the commuter's perceived value of commuting time plus the actual expense for traveling. The value of commuting time differs between individuals depending on their specific circumstances, personal preferences, and characteristics, including gender. Additionally, commuting must be possible in terms of accessibility to transportation routes and availability of transportation sources. Generally, construction workers are more willing to commute than other professions due to the nature of their work and because if they are not willing to commute, they could lose out on relatively local employment opportunities. In any case, the inclination to commute declines rapidly when commuting times exceed 45 minutes, regardless of gender, transportation mode, and socio-economic factors (Westin and Sandow, 2010).

The availability of amenities is another factor which appears to influence the settlement patterns of workers and thus, the willingness to commute (Westin and Sandow, 2010). In general, larger communities (usually with 10,000 residents or more) attract most of the immigrating construction workers. Based upon observed settlement patterns in Westin and Sandow (2010, it appears that key quality of life factors (amenities) influencing construction workers' choice of residence are schools, shopping facilities, local services (medical and dental are of special importance), and housing availability.

Because the cities of Kalamazoo, Battle Creek, western Lansing, Hastings, Charlotte, and Jackson are likely within the 45-minute commuting maximum (depending on traffic and road conditions), it is possible that project construction could draw commuting construction workers from these areas. It is unlikely that said workers would relocate closer to the job site due, in part, to the level of amenities available in their existing large home towns. Therefore, workers from these areas would be expected to spend most of their wages in their hometowns, which would lead to local increases in business, sales tax, and income tax revenues.

Of the many industries that operate in Kalamazoo and Calhoun Counties, the largest percentage of people in Kalamazoo County and the second largest percentage of people in Calhoun County are employed by the "health care and social assistance industry", which would see a moderate increase in demand as construction workers are brought into the area for the potential CIS project. The demand for health care and social assistance would largely depend on the amount of workers permanently moving to the counties during construction. Commuting construction workers would not likely impact the educational services, health care, and social assistance industry as they would likely take advantage of these services in their home area. If a substantial amount of workers move to Kalamazoo and Calhoun Counties during construction, the educational, health care, and social assistance industry would see increased demand for its services and would need to expand its ability to supply its services to the increased population.

Traffic

There is the potential for major, short-term, negative impacts on traffic patterns associated with the volume of workers accessing the site during the peak months of construction. For a detailed discussion of the transportation impacts from CIS construction, refer to Section 3.3.12 Transportation.

Public Services

Kalamazoo County ranks 46th out of 82 Michigan counties for positive health outcomes. Of the county's rankings, decreasing risky behaviors affecting one's health (e.g., smoking, inactivity, and sexually transmitted diseases) was the most positive, positioning Kalamazoo County as 10th in the state. Kalamazoo County scored the lowest in morbidity, or overall county health, and the physical environment which measures factors such as drinking water safety and access to recreational facilities (KCCAA, 2013). According to the Kalamazoo County Community Needs Assessment published in 2013, the largest public service need in Kalamazoo County is access to health care services. As access to health care is already an issue in Kalamazoo County, the addition of construction workers to the county may exacerbate the condition of the county's lack of health care facilities. Calhoun County published a Community Health Needs Assessment in 2013. This Calhoun County Community Health Needs Assessment identified lack of care options as a reason that treatable conditions are going untreated (PSC, 2013), so the county has identified similar public services issues to Kalamazoo County.

Some relocating workers may bring their children to live in the community and those children would need to attend the community schools. The area schools would likely see an increase in enrollment during both the construction and operational phases of the CIS. Based on the low average student to teacher ratio of the students in Kalamazoo and Calhoun County schools, the schools are not likely overcrowded. Because few construction workers would be expected to relocate to the area from outside of the region, the associated influx of new students to Kalamazoo and Calhoun County schools would not be expected to affect the availability or quality of education.

The level of emergency preparedness in the project area meets the needs of the current population. The Emergency Management Association (EMA) would likely need to investigate its current emergency response plans to assess whether they adequately address procedures for the potential additional construction and operational CIS workforces. The planning and preparation that would be needed from the EMA would not likely be a major impact on Kalamazoo and Calhoun Counties.

3.3.11.3.1.2 Mitigation

The socioeconomic impacts resulting from potential construction of the CIS at either FCTC Site 1 or FCTC Site 2 would be moderate and largely positive, particularly in the areas of increased revenue for local counties and numbers of jobs supported. Therefore, mitigation measures would not be required.

3.3.11.3.2 Construction – Expedited Schedule

Section 1683 of the 2016 NDAA includes the requirements to develop a plan to expedite CIS deployment by at least 2 years as discussed in Section 2.5.1. Execution of this plan would result in achieving a CIS initial defensive capability within 3 years following a deployment decision and site selection. The expedited schedule is approximately 60 percent of the baseline construction schedule. As discussed in Section 2.5.1.2, it has been assumed that the construction workforce would need to be doubled to meet the expedited schedule. Therefore, the impacts of 800 to 1200 construction workers would be felt in the FCTC area during expedited construction, increased from 400 to 600 construction workers during the baseline construction schedule.

Unless discussed in this section, impacts and mitigations for the expedited construction schedule would be the same as the impacts and mitigations discussed for the baseline construction schedule.

3.3.11.3.2.1 Environmental Consequences

<u>Tax Revenue Impacts</u>

Expedited schedule workers purchasing goods and services for their personal use would contribute to increased sales tax revenue in the study area above the amounts presented for the baseline schedule. Based on the fact that the workforce for the expedited schedule would need to be doubled over the workforce for the baseline schedule, the expected sales tax revenue from the expedited schedule would also roughly double over what was estimated.

<u>Regional Economic Impact Estimates</u>

The RIMS II baseline construction schedule analysis assumed a 5-year construction schedule. In the event the timeline would be reduced to 3 years, this change would not noticeably affect the results derived from RIMS II. This negligible impact is due to the fact RIMS II is a static model and does not take time into account—it is a snapshot of the economy at a given moment. Therefore, whether the construction period were to last 5 or 3 years, the estimated impacts would be the in the same order of magnitude. Of course, there would likely be some cost differences between the construction periods. The 3-year construction period would offer a savings due to a shorter onsite presence but there would be substantial over-time paid to workers which would off-set these savings. Overall, it is estimated that the savings and additional expenses for the expedited schedule would largely cancel each other out creating similar impacts for both the baseline and expedited schedules.

Traffic

The traffic patterns in the FCTC area would be affected by the around the clock construction schedule that would be required by the expedited schedule. There would likely be increased road noise during the night from construction truck and worker traffic that would affect the populations living near the FCTC construction area and transportation routes. A more detailed discussion of the traffic impacts can be found in Section 3.3.12 Transportation.

Public Services

If construction of the potential CIS were to be completed under the expedited schedule, there would be an increased impact on public services caused by the increased construction worker presence in the FCTC area. More construction workers would be sending their children to FCTC area schools. However, the expedited construction schedule workforce would be similar in size to the operational workforce discussed in Section 3.3.11.3.3. The increase of 650 to 850 new students attending area schools during operation was estimated to be approximately one more student per teacher and would not cause a major impact to the FCTC area schools. Because the total number of workers required for the expedited construction schedule would be less than the operational workforce, the expedited schedule workforce would also not have a major impact on FCTC area schools.

3.3.11.3.2.2 Mitigation

The socioeconomic impacts resulting from construction of the potential CIS would be moderate and largely positive, particularly in the areas of increased revenue for local counties and numbers of jobs supported. Therefore, mitigation measures would not be required.

3.3.11.3.3 Operation

As discussed in Section 2.7, between 650 and 850 employees and workers would be needed during potential CIS operation at either FCTC Site 1 or FCTC Site 2. This would include full time operating staff, plus contract operation and maintenance personnel. This operation staff would be expected to be a mixture of military, civilian, and other support staff.

3.3.11.3.3.1 Environmental Consequences

Tax Revenue Impacts

Impacts of the CIS's operation on the region and nearby communities could potentially include impacts on nearby populations, buildings, roads, and cultural or recreational facilities. There is the potential that the demand for a number of local public services in the primary impact area would be impacted by CIS operation. A positive impact of the potential CIS deployment on the surrounding area would be an increase in the population base, which would increase taxes and user fees for the continued funding of facilities and services. Sales tax collection from the operational workers would also have a positive impact on area counties. Refer to Table 3.3.11-15 for an analysis of the estimated impact that the CIS's operation would have on tax revenue in Kalamazoo and Calhoun Counties. The potential for negative impacts would also be present and could arise if the relocation of workers occurred rapidly and outpaced the ability of the area to provide for the sudden increase in demand for services. However, it is unlikely that this would occur due to the existing adequate level of services available in the commuting range of FCTC. The area's services should be able to expand at a reasonable rate to accommodate additional people moving to the area.

Table 3.3.11-15 Estimated Sales Tax Revenue – Operation – FCTC Sites

Input	Operation
Number of Workers (middle of given range of workers)	750
Assumed Expenditures Subject to Sales Tax(1) (per person/year in either Kalamazoo or Calhoun Counties)	$30,837
Sales Tax Rate (Kalamazoo and Calhoun Counties)	6%
Estimated Sales Tax Revenue(2) – Kalamazoo County (2) (total for CIS workers/year)	$693,833
Estimated Sales Tax Revenue(2) – Calhoun County (2) (total for CIS workers/year)	$693,833
Estimated Total Sales Tax Revenue (total for CIS workers/year)	$1,387,666

Notes:
1. Based on 2014 data – no escalation.
2. Assumes 50 percent of expenditures would occur in each county.

Source: BLS, 2014.

Regional Economic Impact Estimates

In addition to affecting Kalamazoo and Calhoun Counties, the potential CIS operation would be expected to influence the broader regional economy (i.e., Barry, Eaton, and Ingham Counties) by increasing demand for goods and services and industries generating additional employment, income, output, and value added in the region. For this impact analysis, it was assumed that 750 workers would be employed annually at the potential CIS, as this is the mid-point of the 650 to 850 worker range provided.

During the operation period, a substantial amount of materials would be purchased and earnings would be generated by workers at the facility. It is assumed that workers at the facility would be new to the area.

To estimate the multiplier impacts during operations, the process involved allocating expenditures for materials to specific industries and adding in the estimated earnings of CIS staff. The average earnings were based on 2014 wages for military personnel, escalated to 2015 at 2.5 percent. The resulting total wages assumed to be earned by the potential CIS staff during operations would be approximately $21.5 million per year in 2015 dollars. These earnings, plus the estimated material purchases, were set in 2010 dollars and the RIMS II multiplier was applied. The estimated regional impact from these expenditures is shown in Table F.1. The annual estimated expenditures for materials and earnings during operation of the potential CIS would produce the following impacts:

- The total change in output that occurs in all industries from the annual operation of the potential CIS would be more than $48 million in the selected region.
- The total incremental earnings (over and above the $21.5 million earned by the CIS staff) in the region arising from the project operation each year would be nearly $15 million.
- The potential CIS deployment would create 416 indirect jobs yearly during the operation (over and above the estimated 750 direct workers onsite).
- Finally, the total value added arising in the region from the potential CIS deployment would be nearly $29 million for each year of operation.

Employment and Industry

Based on information provided by MDA, the majority of the operational workforce (approximately 85 percent) would be brought into the area due to the need for specialized expertise. Local area contractors and other civilian services may be used for certain operations and maintenance activities as facility management deems appropriate.

The increase in population caused by the 650 to 850 new workers and their families that settle in Kalamazoo and Calhoun Counties and the region would increase the demand for certain services such as health care, schools, and restaurants. Consequently, the educational services, health care and social assistance, and services industries would see a moderate increase in employment. This increase in demand for service workers would continue throughout the operational phase of the facility. Increased hiring for services industry jobs to accommodate CIS operations staff may contribute to a small decrease in unemployment over the operating life of the CIS.

Traffic

Operational workers would likely be required to live within a certain distance of the facility in order to meet management requirements for response times in case of an emergency. In most instances, 30 miles or 30 minutes away from the facility is the management requirement for operational workers (Gilmore, 1982). Kalamazoo and Battle Creek are all within 30 miles of the project site, but Lansing is more than 30 miles away from the site.

Project operation could result in major, adverse impacts on local traffic patterns due to the volume of workers accessing the site from the region each day. The potential CIS operational workforce would likely consist of specialized expertise that would have to be brought in from outside the region. These workers would probably settle in, and commute to work from, various locations in the region that are within 30 minutes or 30 miles of the site. The resulting commuter traffic could increase traffic congestion on roadways in the region as well as around the site. Refer to Section 3.3.12 for further traffic impact analysis.

Public Services

As indicated previously, the Community Needs Assessments drafted for Kalamazoo and Calhoun Counties identified areas of public health need in Kalamazoo and Calhoun Counties. Based on these areas of need, the influx of operational workers for the CIS could negatively affect the two counties' ability to meet health care needs for the existing population. The 650 to 850 additional workers and their families would be expected to either move to the area or live within commuting distance of the CIS and, therefore, would increase the burden on the counties' healthcare facilities.

Schools in the area may also need to accommodate increased enrollment due to the new workforce present in the area. While exact numbers for the possibility of new students are not available, it can be assumed that a portion of the new workforce would have children that would be incorporated into the Kalamazoo County education system. Currently, Kalamazoo County has an approximately 17:1 student-to-teacher ratio, while Calhoun County has an approximately 16:1 student-to-teacher ratio (PSR, 2015d; PSR, 2015e). For a conservative estimate, if it is assumed that each worker has only one child, approximately 650 to 850 new students would be entering the area. Please see Table 3.3.11-16 for an analysis of the possible impacts of the new students in the extreme scenario in which all of the new students resided in either Kalamazoo or Calhoun County.

Table 3.3.11-16 Kalamazoo and Calhoun County Student-to-Teacher Ratios during Operation – FCTC Sites

County	Existing Values		Projected Estimates			
			Low Estimate of Potential CIS Operation Workers		High Estimate of Potential CIS Operation Workers	
	Total Students	Student: Teacher Ratio	Total Students [1]	Student: Teacher Ratio	Total Students [2]	Student: Teacher Ratio
Kalamazoo	41,258	17:1	41,908	17:1	42,108	17:1
Calhoun	23,711	16:1	24,361	16:1	24,561	17:1

Notes:
1. Assumes 650 new students.
2. Assumes 850 new students.
Source: PSR, 2015d; PSR, 2015e.

Nationwide, the year 1955 had the highest student-teacher ratio, 26.9:1, since the metric was first collected (DES, 2015). With current U.S. student-teacher ratios reported at approximately 15:1, the projected student-teacher ratio of 17:1 in Kalamazoo County and 17:1 in Calhoun County after the operational CIS staff would move into the area does not seem to be unreasonably above the national average. With an increase of no more than approximately one child per teacher over pre-CIS operation levels, the impact on the existing education system would be negligible.

The level of emergency preparedness for the site area meets the needs of the current population. The EMA would likely need to investigate its current emergency response plans to assess whether they adequately address procedures for the additional operational CIS workforces.

Other service-related impacts could include increases in the demand for safety and emergency services by the potential CIS deployment and by workers and families relocating to the area. This could include demands on police, fire, ambulance, and hospital services. For each of these services, the impact created in the area by the relocating population would be a function of the percentage increase in population. Based on the projected populations for Kalamazoo and Calhoun Counties, the 650 to 850 person population increase attributed to the relocation of the CIS workforce would have a minor impact on the 2020 projected populations for Kalamazoo and Calhoun Counties (Census, 2012d; Census, 2012e). The increase associated with the CIS operating personnel would create a negligible increase in the demand for safety and emergency services.

Another factor in reducing the potential for safety and emergency service impacts is the fact that the demand for public safety services should be small because the facility's design, emergency response programs, and operational practices would be established per appropriate safety standards. In fact, the CIS would be largely self-sufficient in terms of safety mitigation, which would include measures such as the following:

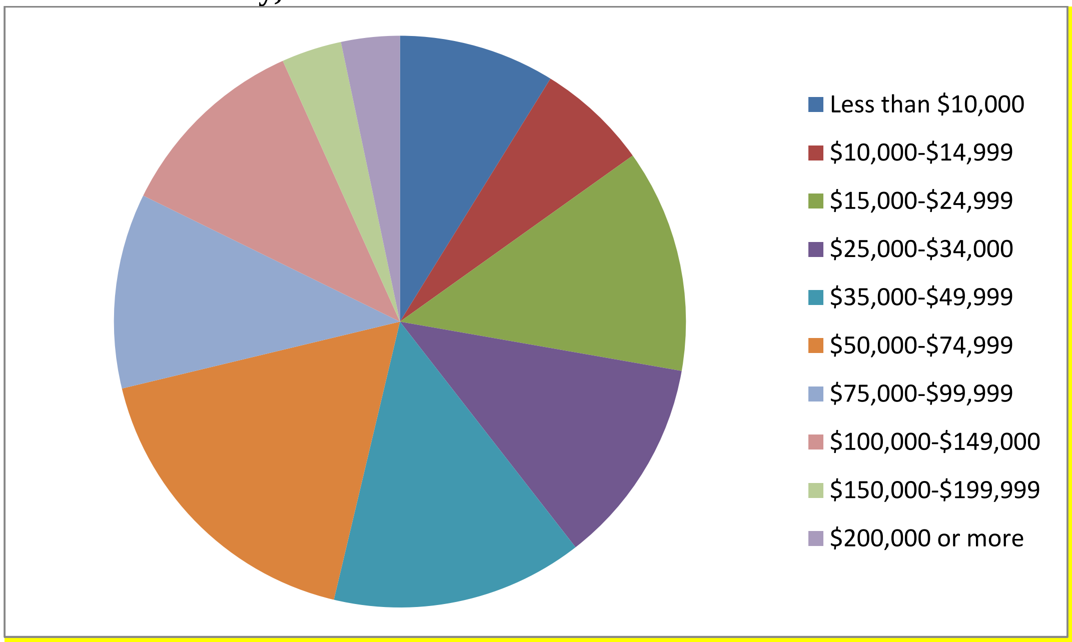
- Onsite personnel would be trained in facility response procedures as a condition of their employment.
- Security personnel posted onsite with a system in place to control personnel access.
- Security lighting, fire suppression equipment, and first aid stations throughout the facility site.
- Standard procedures for spill prevention and containment, injury response, and requests for assistance from local police, fire, and ambulance services.

3.3.11.3.3.2 Mitigation

The socioeconomic impacts that would result from operation of the potential CIS would be moderate and largely positive, particularly in the areas of increased revenue for local counties and numbers of jobs supported. Therefore, mitigation measures would not be required.

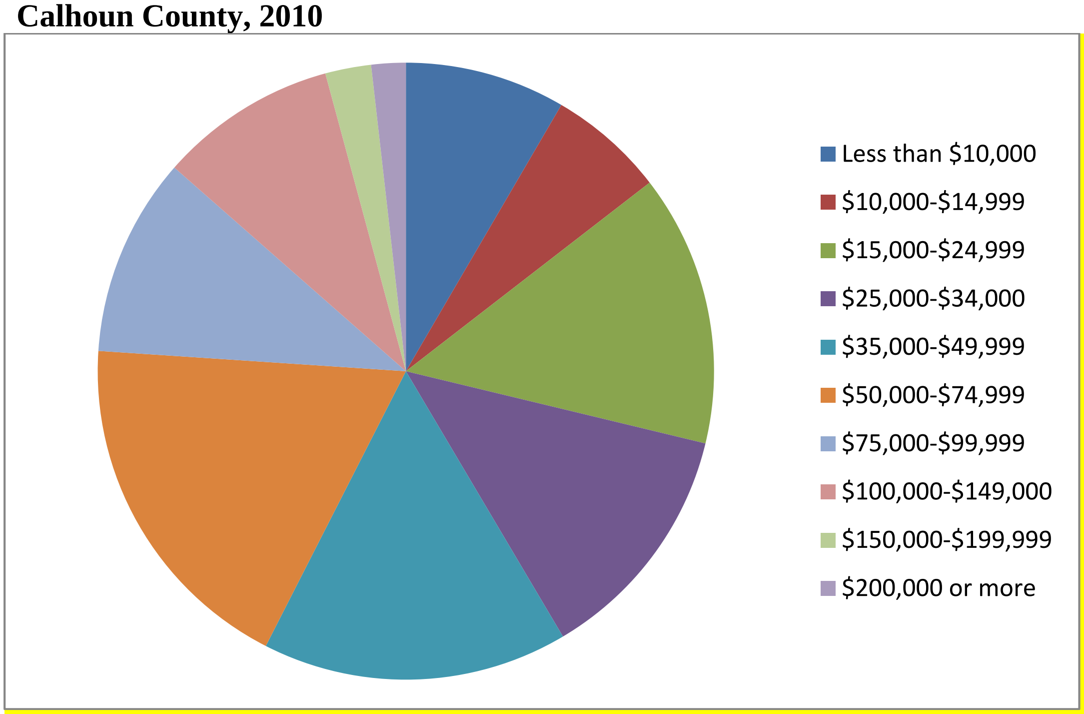
Figure 3.3.11-1 Median Household Incomes – FCTC Sites

Kalamazoo County, 2013



Source: Census, 2012e

Calhoun County, 2010



Source: Census, 2012d

3.3.12 Transportation – FCTC Sites

Transportation focuses on the availability, condition, and use of infrastructure for moving people and goods and materials (including heavy haul equipment) within and through a given geographic area. This section presents information on the current transportation conditions at the CIS footprint and in the vicinity, project-related construction and operation impacts, and mitigation measures.

3.3.12.1 Regulatory Framework – Transportation – FCTC Sites

Transportation infrastructure planning, design, and use are governed by various federal, state and local laws, regulations and ordinances. Key policies which influence how the federal government addresses environmental consequences include the following:

- EO 13274, Environmental Stewardship and Transportation Infrastructure Project Reviews (18 September 2002). EO 13274 promotes environmental stewardship in the Nation's transportation system and expedites environmental reviews of high-priority transportation infrastructure projects.
- EO 13693 Planning for federal Sustainability In the Next Decade (19 March 2015). This EO establishes and integrated strategy towards sustainability in the federal government and to make reduction of GHG emissions a priority for federal agencies.

Requirements and permits for the transportation of people, equipment, and materials are discussed in Section 3.3.12.3 and include a heavy haul permit from both the Michigan and Indiana Departments of Transportation (MDOT and INDOT) and an access permit from MDOT that requires a Traffic Impact Study (TIS) due to the volume of CIS-generated traffic. New traffic signals would be required at the ramp termini on the north and south sides of I-94 at Exit 92 for Site 1. In addition, for Site 1 modifications to the signal phasing/timing at the existing signalized intersection of I-94 BL/M 37 and Skyline Drive/Columbia Avenue would also be required.

3.3.12.2 Affected Environment – Transportation – FCTC Sites

There is a very good network of Interstate, U.S., and Michigan State Routes (M) in the south/southeastern portion of the State of Michigan. Those routes greatly enhance the ability to move both people and goods throughout the region. In the area around FCTC, there is I-94 that runs along the southern boundary of the installation, M 37 and I-94 Business Loop (BL) which run along a portion of the eastern boundary of FCTC, other primary routes in the area that connect with I-94 are US 131 to the west and to the east are I-194, M 66, and M 311, and to the north is M 96. Reference Figure 3.3.12-1 for the regional road network.

The area within the boundary of the CIS footprint at FCTC Site 1 and Site 2 has a few existing roads that are not paved. If a deployment decision is made and FCTC is selected, then based on the final site layout, if some of the existing roads and/or their corridors are to be used during construction and operation of the CIS then they would require improvements to meet pavement structural capacity, width and geometric requirements so they can adequately facilitate vehicular transport of materials, equipment, and personnel.

3.3.12.2.1 FCTC Site 1

3.3.12.2.1.1 Ground Transportation

The main route used to access FCTC Site 1 is I-94 and specifically the interchange at Exit 92, which connects I-94 to I-94BL/M 37. Therefore, the capacity of the intersections at the ramp termini with I-94BL/M 37 was evaluated for the EIS. This is a regional view of the potential impacts the CIS-generated traffic could have on the area roadways and is based on available existing traffic counts from the MDOT. The potential CIS gate to FCTC Site 1 would likely be at the existing intersection of I-94BL/M 37 and Columbia Avenue/Skyline Drive, located just south of the W.K. Kellogg ANGB Airport and less than 1.5 miles north of I-94.

Currently, improvements are being constructed for the I-94 and I-94BL/M 37 interchange, along with I-94BL/M 37 north up to Hill Brady Road/Logistics Drive, under a design/build project let by the MDOT. The overall configuration of the interchange will still be a folded diamond interchange and the bridge over I-94 will be widened and exclusive turn lanes will be provided at the ramp intersections. I-94BL/M 37 is being widened to accommodate a center turn lane at select locations and the intersection with Columbia Avenue/Skyline Drive has recently been reconfigured. In addition, an existing section of I-94 BL/M 37 and Skyline Drive is being removed from Hill Brady Road/Logistics Drive up to M 96. Therefore, a portion of Columbia Avenue will also be designated I-94 BL from Skyline Drive to Helmer Road. The most recent traffic counts available at the Exit 92 interchange are from 2013. As noted in Section 3.3.12.3, if FCTC Site 1 is chosen as the location for the potential CIS deployment then a TIS would be required for an access permit due to the potential CIS gate being off of I-94 BL/M 37 and at such time the traffic volumes/patterns would be normalized due to the current roadway improvements, particularly the closure of Skyline Drive to the north.

The majority of the CIS-generated traffic would travel through Exit 92 intersections and thus they were chosen for this EIS analysis. The intersections are the on- and off-ramp termini of I-94 as they access I-94BL/M 37. The intersections in the following tables are noted as “South side of Interchange” and “North side of Interchange”, which designates the I-94BL/M 37 intersections with the eastbound (EB) on- and off- ramps and the westbound (WB) on- and off-ramps respectively. The capacity analysis takes into account all of the movements at the intersection, yet only the following three approaches to the intersection are modeled in the analysis:

- South side of Interchange – I-94 EB Off-Ramp (WB) and I-94BL/M 37 northbound (NB) and southbound (SB).

- North side of Interchange – I-94 WB Off-Ramp (WB) and I-94BL/M 37 (NB) and (SB).

Turning movement counts were performed for MDOT (USR, 2013a) at the select intersections in 2013 and the morning and evening peak hours of those counts were used as the basis of the current traffic volumes and composition. For the analysis of unsignalized intersections, the peak hour volume (PHV), peak hour factor (PHF) and percent trucks are a few of the main inputs for the Highway Capacity Software (HCS) (UF, 2010). The PHV values in the tables are actually the hourly flow rates that incorporate the PHF. The HCS is based on the methodology of the Highway Capacity Manual (TRB, 2010). The Manual defines six Levels of Service (LOS) for criteria in determining the operating characteristics of an intersection, ranging from LOS A (free-flow condition, most desirable), through LOS F (extensive delays, saturated). The LOS criteria for unsignalized intersections is quantified in terms of the delay a motorist experiences while waiting to merge with or cross through traffic at the intersection. They are measures of driver discomfort, excess fuel consumption, and lost travel time.

The following describe the expected delay for each level of LOS:

- LOS A - little or no delay.
- LOS B - short traffic delays.
- LOS C - average traffic delays.
- LOS D - long traffic delays.
- LOS E - very long traffic delays.
- LOS F - severe congestion.

An average growth rate of 0.75 percent per year (MDOT, 2012), based on past growth, previous analyses and population projections, was used to escalate the year 2013 traffic volumes to the year 2015 traffic volumes for the existing condition in this analysis. A new CIS gate would be established off of I-94BL/M 37 at its intersection with Columbia Avenue/Skyline Drive and the majority of onsite roads for the CIS would be new as well. Thus, there is no traffic volume information for the yet to be established CIS gate nor the internal FCTC roads within the CIS footprint. The existing traffic volumes and LOS of the selected intersections in this capacity analysis are noted in Table 3.3.12-1 and Table 3.3.12-2.

Highway agencies typically design their intersections, and subsequently specific turning movements, to a LOS C with a minimum of LOS D in most cases. A lower LOS might be acceptable for some unsignalized intersection movements depending on the resultant queue length a particular movement might have due to the delay the motorist experiences. The existing LOS for the selected intersections are all within these acceptable limits, except for right turns for the I-94 WB off-ramp during the morning peak hour. See Appendix G.1 for the detailed HCS analysis results.

Table 3.3.12-1 Existing Traffic Volumes – FCTC Site 1

South Side of Interchange	I-94BL/M-37 Southbound				I-94 EB Off-Ramp Westbound				I-94BL Northbound			
Period of Analysis	Left	Thru	Right	App Total	Left	Thru	Right	App Total	Left	Thru	Right	App Total
AM PHV	116	148	0	264	4	0	532	536	0	200	52	252
PM PHV	272	212	0	484	4	0	240	244	0	156	72	228
North Side of Interchange	**I-94BL/M-37 Southbound**				**I-94 WB Off-Ramp Westbound**				**I-94BL/M-37 Northbound**			
Period of Analysis	Left	Thru	Right	App Total	Left	Thru	Right	App	Left	Thru	Right	App Total
AM PHV	0	220	240	460	64	0	304	368	16	704	0	720
PM PHV	0	424	480	904	52	0	84	136	16	428	0	444
Note: Traffic volumes are in vph based on (USR, 2013a) and (MDOT, 2012).												

Table 3.3.12-2 Existing Level of Service Results – FCTC Site 1

South Side of Interchange	I-94BL/M-37 Southbound	I-94 EB Off-Ramp Westbound		
Period of Analysis	Left	Left	Approach	Right
AM LOS	A	C	C	C
PM LOS	A	C	B	B
North Side of Interchange	**I-94BL/M-37 Northbound**	**I-94 WB Off-Ramp Westbound**		
Period of Analysis	Left	Left	Approach	Right
AM LOS	A	D	D	E
PM LOS	A	D	C	B
Note: LOS results from HCS (UF, 2010).				

There are very few existing internal roads that could provide access to various elements of the CIS. Figure 3.3.12-2 shows the existing roads within the CIS footprint that might be used at FCTC during the construction and operation of the CIS. However, the existing roads would need to be upgraded and several new roads constructed to adequately carry the CIS-generated traffic, both for pavement structure and roadway geometric conditions. The use of existing roadway corridors would be determined once the final layout of the CIS is established.

The location of the CIS gate for access to the CIS footprint is also shown on Figure 3.3.12-2. The delivery of the SIV and silos would ultimately enter FCTC via an abandoned access drive off of I-94 between Exits 92 and 88 and noted as the Augusta Climax Gate. This temporary gate would only be used to transport the SIV and silos to the site, due to geometric constraints via other avenues. The Augusta Climax Gate is at approximately mile marker 90. A more detailed discussion of the SIV and silo delivery is in Section 3.3.12.3.1.1.

3.3.12.2.1.2 Air Transportation

Air is the mode of transportation designated for initial transport of GBIs. The W.K. Kellogg Airport has the capability to accommodate C-17 aircraft and is less than 3 miles from the FCTC Site 1 footprint and approximately 6 miles to the FCTC Site 2 footprint.

3.3.12.2.1.3 Railroad Transportation

The Norfolk Southern Railway and Canadian National Railway cargo railroad systems are nearby, but there is no direct access to FCTC. For this EIS it is assumed that the majority of the equipment and materials would be via over-the-road vehicles and thus an emphasis has been placed on that mode of transportation.

3.3.12.2.2 FCTC Site 2

The affected environment for transportation for FCTC Site 2 would be the same as that described for FCTC Site except for the information presented in this section.

From a transportation perspective the main difference between the two sites is the primary route one would take to access each site. For FCTC Site 1 the primary route is I-94 and then north on I-94BL/M 37 approximately 1.5 miles to the CIS Gate for Site 1, which is at the existing intersection of I-94BL/M 37 and Columbia Avenue / Skyline Drive. Exit 92 represents the mile marker of the interchange of I-94 and I-94BL/M 37. The primary route for access to FCTC Site 2 is via I-94 and then north on 40th Street approximately 1,000 feet to the CIS gate for Site 2. Motorists on I-94 would take Exit 88 to access 40th Street. See Figure 3.3.12-1 for the regional road network in the area surrounding FCTC. Therefore, the capacity of the intersections at the ramp termini with 40th Street was evaluated for the EIS. This is a regional view of the potential impacts the CIS-generated traffic could have on the area roadways and is based on available existing traffic counts from the MDOT.

Currently a project to improve the I-94 and 40th Street interchange is being bid by MDOT, along with some improvements to E Michigan Avenue. This project would greatly enhance the movement of vehicles through this interchange. Because this improvement project would be completed prior to any potential CIS construction work at the FCTC Site 2, if it is selected for deployment, the tight diamond configuration of the proposed interchange would be used in the analysis for this EIS. The bridge over I-94 would be widened and exclusive turn lanes would be provided for the ramp approaches as they tie into 40th Street. The most recent traffic counts available from MDOT at the Exit 88 interchange are from 2014.

The majority of the CIS-generated traffic would travel through the Exit 88 intersections and thus they were chosen for this EIS analysis. The intersections are the on- and off-ramp termini of I-94 as they access 40th Street. The intersections in the following tables are noted as "South side of Interchange" and "North side of Interchange", which designates the 40th Street intersections with the EB on- and off- ramps and the WB on- and off-ramps respectively. The capacity analysis takes into account all of the movements at the intersection, yet only the three approaches to the intersection are modeled in the analysis and those intersections are the following:

- South side of Interchange – I-94 EB Off-Ramp EB and 40th Street NB and SB.
- North side of Interchange – I-94 WB Off-Ramp WB and 40th Street NB and SB.

Turning movement counts were performed for MDOT (MDOT, 2012) at the select intersections in 2012 and MDOT escalated them up to the year 2014 morning and evening peak hours. These counts were used as the basis of the current traffic volumes and composition.

The average growth rate noted previously was used to escalate the year 2014 traffic volumes to the year 2015 traffic volumes for the existing condition in this analysis. A new CIS gate would be established off of 40th Street just north of I-94 and the majority of onsite roads for the CIS would be new as well. Thus there is no existing traffic volume information for the yet to be established CIS Gate nor the internal FCTC roads within the CIS footprint. The existing traffic volumes and LOS of the selected intersections in this capacity analysis are noted in Table 3.3.12-3 and Table 3.3.12-4.

Table 3.3.12-3 Existing Traffic Volumes – FCTC Site 2

South Side of Interchange	**40th Street Southbound**				**I-94 EB Off-Ramp Eastbound**				**40th Street Northbound**			
Period of Analysis	Left	Thru	Right	App Total	Left	Thru	Right	App Total	Left	Thru	Right	App Total
AM PHV	44	173	0	217	0	0	197	197	0	56	13	69
PM PHV	24	86	0	110	5	0	67	72	0	243	26	269
North Side of Interchange	**40th Street Southbound**				**I-94 WB Off-Ramp Westbound**				**40th Street Northbound**			
Period of Analysis	Left	Thru	Right	App Total	Left	Thru	Right	App Total	Left	Thru	Right	App Total
AM PHV	0	166	6	172	50	0	44	94	28	27	0	55
PM PHV	0	95	7	102	14	0	65	79	132	116	0	248
Note: Traffic volumes are in vph. Based on (MDOT, 2012).												

Table 3.3.12-4 Existing Level of Service Results – FCTC Site 2

South Side of Interchange	**40th Street Southbound**	**I-94 EB Off-Ramp Eastbound**		
Period of Analysis	Left	Left	Approach	Right
AM LOS	A	B	B	B
PM LOS	A	B	A	A
North Side of Interchange	**40th Street Northbound**	**I-94 WB Off-Ramp Westbound**		
Period of Analysis	Left	Left	Approach	Right
AM LOS	A	B	A	A
PM LOS	A	B	A	A
Note: LOS results from HCS (UF, 2010).				

The existing LOS results for the selected intersections are all within the acceptable limits.

The location of the CIS Gate for Site 2 and the very few existing internal roads that could provide access to various elements of the CIS are shown on Figure 3.3.12-3. The existing onsite roads would need to be upgraded and several new roads constructed to adequately carry the CIS-generated traffic, both for pavement structure and roadway geometric conditions. The use of existing roadway corridors would be determined once the final layout of the CIS is established.

3.3.12.3 Environmental Consequences and Mitigation – Transportation – FCTC Sites

If a deployment decision is made and FCTC is selected, an access permit for access at the CIS Gate off of I-94 BL/M 37 for Site 1 would be required from MDOT which would require preparation of a TIS. In fact, the FCTC Site 2 would also require a TIS due to the volume of CIS-generated traffic and its potential impacts to the soon to be constructed tight diamond interchange intersections at the I-94 Exit 88. The future TIS would also be able to capture "normalized" traffic volumes, because the improvements to the interchanges at I-94 Exits 92 and 88 would be substantially complete, if not completed, at such time. If Site 1 was selected, new traffic signals would be required at the ramp termini with I-94 BL/M 37 (Exit 92). In addition for Site 1, modifications to the signal phasing/timing at the signalized intersection of I-94 BL/M 37 and Columbia Avenue / Skyline Drive would also be required because the potential CIS gate would be at this intersection.

The transportation of the SIV and silos would require a special hauling permit (oversized/ overweight) from the INDOT and MDOT. In addition, there are four specific bridges in Indiana that have speed limit restrictions due to the weight of this cargo.

3.3.12.3.1 Construction – Baseline Schedule

If a deployment decision is made and FCTC is selected, as discussed in Section 2.5, construction activities under the baseline schedule at FCTC would take a total of 5 years with tree clearing and site preparation (earthwork) occurring in the first 2 years, heavy construction (foundations, concrete, buildings, etc.) the next 2 years, and the final buildout occurring in the fifth year as presented in Section 2.5.1. The construction workforce would average approximately 400 personnel, with a maximum of 600 during the peak construction activities. The CIS-generated PHV of one-way traffic for construction workers is estimated to be 540 vph due to the assumption of potential varying shifts and some carpooling. These vehicles would be spread out over the various SRs, U.S. routes, and Interstate highways in the area around FCTC. It is assumed that there would be a total of 90 trucks associated with the construction activities that would be entering and exiting the site during this time of peak construction. A 10-hour work shift was also assumed and thus an average of 9 trucks would be entering and exiting the site each and every hour of this workday. Furthermore, it was assumed that there would be some traffic exiting the site during the peak hour and it was equated to 10 percent of the construction workforce which equals 54 vehicles. Using the morning peak hour as the period for analysis, this results in a total CIS-generated traffic of 549 vehicles (540 cars and 9 trucks) entering the CIS and 63 vehicles (54 cars and 9 trucks) exiting the CIS during this peak period. Conversely, for the evening peak hour there would be 549 vehicles exiting the CIS and 63 vehicles entering the CIS during this peak period. It is also assumed this construction traffic would travel the surrounding road network during the existing morning and evening peak hour of each respective roadway. The cut and fill volumes for site preparation would be balanced and, thus, there is no need to analyze traffic impacts for trucks during this earthwork phase because they would remain onsite and not have to haul fill material to the site nor haul excess material off the site.

3.3.12.3.1.1 FCTC Site 1

<u>Construction Traffic</u>

For the FCTC Site 1 footprint, the construction and operation workforce would use the CIS gate to access the CIS which is serviced exclusively by I-94BL/M 37, with the majority of the CIS-generated traffic using Exit 92 on I-94. The mobility of the construction workforce from Kalamazoo and Calhoun Counties, and those counties which abut them, was obtained from the 2010 Census (Census, 2010b). A weighted average of these populations relative to the total CIS-generated workforce was used to distribute the construction workforce over the regional road network, taking into account where the laborer lives and assumptions on the most viable routes they would take to the CIS. In order to factor up the existing traffic to a baseline condition for the peak construction period, an assumption was made that if a decision for deployment were made and FCTC Site 1 was selected, the earliest design and permitting work could start would be late 2016. Then, based on the schedule noted in Section 2.5.1, the peak construction period with 600 workers would occur in the year 2020. Therefore, the existing peak hour was escalated up to the year 2020 based on a yearly growth rate of 0.75 percent per year (MDOT, 2012) to establish a baseline condition. The construction workers and the construction truck traffic were then added to the year 2020 baseline peak hour traffic data along the selected routes of this analysis. The construction traffic added to the baseline and the LOS of the selected intersections are noted in Table 3.3.12-5 and Table 3.3.12-6 for the morning (AM) and evening (PM) peak hour analysis.

Table 3.3.12-5 Continental United States Interceptor Site Peak Construction Traffic Volumes – FCTC Site 1

South Side of Interchange	**I-94BL/M-37 Southbound**				**I-94 EB Off-Ramp Westbound**				**I-94BL Northbound**			
Period of Analysis	Left	Thru	Right	App Total	Left	Thru	Right	App Total	Left	Thru	Right	App Total
AM PHV	132	158	0	290	4	0	854	854	0	247	54	301
PM PHV	380	259	0	639	4	0	283	283	0	166	75	241
North Side of Interchange	**I-94BL/M-37 Southbound**				**I-94 WB Off-Ramp Westbound**				**I-94BL/M-37 Northbound**			
Period of Analysis	Left	Thru	Right	App Total	Left	Thru	Right		Left	Thru	Right	App Total
AM PHV	0	244	283	527	66	0	414	480	17	1072	0	1089
PM PHV	0	577	800	1377	54	0	99	153	17	482	0	499
Note: Traffic volumes include baseline plus CIS-generated Traffic.												

Table 3.3.12-6 Continental United States Interceptor Site Peak Construction Level of Service Results – FCTC Site 1

South Side of Interchange	**I-94BL/M- 37 Southbound**	**I-94 EB Off-Ramp Westbound**		
Period of Analysis	Left	Left	Approach	Right
AM LOS	A/A	C/C	F/D	F/D
PM LOS	A/A	E/D	B/B	B/B
North Side of Interchange	**I-94BL/M-37 Northbound**	**I-94 WB Off-Ramp Westbound**		
Period of Analysis	Left	Left	Approach	Right
AM LOS	A/A	F/E	F/F	F/F
PM LOS	B/B	F/E	D/C	B/B
Note: A/A = First LOS is 100% CIS-generated traffic, second LOS is 50% (split shift) CIS-generated traffic.				

The minor street movements (I-94 EB and WB off-ramps) that have to cross through and/or merge with traffic on the major street (I-94BL/M 37) are the movements analyzed for unsignalized intersections, in addition to the left turns of the major street (I-94BL/M 37). Therefore, the delay motorists experience while performing these conflicting movements are given a LOS rating based on the severity of the delay. The overall minor street approach (I-94 EB and WB off-ramps) delay is also noted in the results.

The left turns from I-94BL/M 37 were either LOS A or B for both intersections, which is very acceptable. It is specifically the right turning movements from the I-94 EB and WB off-ramps during the morning peak hour that causes major delays and might lead to vehicles being backed up to the entrance of the I-94 off-ramps and I-94 itself. The left turning movements from the I-94 EB and WB off-ramps varied from LOS C to LOS F. Although a LOS E and LOS F are long delays, the typical queue length for those waiting to turn left at the I-94 EB and WB off-ramps, is only one to three vehicles which is not major. However, the morning right turns from both I-94 EB and WB off-ramps would be the most impacted movements with major delays resulting in typical queue lengths of 87 to 57 vehicles waiting to merge with I-94 BL/M37 northbound traffic, respectively.

Queue lengths are related to intersections and are a measure of how many minor street vehicles are stopped and waiting to make a crossing or merging movement onto or across the major street. Major delays occur when the gaps for minor street motorists are not favorable due to large volumes of traffic on the major street, which leads to vehicles being stacked up and in queue ready to make the movement. The queue length discussion for FCTC Site 1 is to highlight the fact that there would be a major impact for those turning right from the two off-ramps and the queue of vehicles may potentially backup to I-94 and impact motorists on I-94 as well.

Existing onsite roads designated for the potential CIS construction traffic route would be upgraded to meet the necessary physical requirements. Potential modifications include curve widening at intersections and around curves to compensate for wheel off-tracking, surface stabilization (gravel roads) for augmented rut resistance and pavement thickness increase for added structural capacity. The majority of onsite roads would be new roads to provide access to individual mission and mission-support facility construction areas. These new roads would need to have sufficient width, structural capacity and meet longitudinal grade requirements.

Heavy Haul Equipment Transport

A viable route for heavy haul equipment transport was identified and coordinated with MDOT and INDOT for the transportation of the SIV and silos during construction. A detailed evaluation of the potential route is presented in the CIS Transportation Study (MDA, 2015a). The SIV and silos are heavy loads that also have height issues that need to be accounted for during transport over the road. If a deployment decision is made and FCTC is selected as the potential CIS location, at that time the exact route would be determined with the MDOT and INDOT while the heavy haul permit is obtained. The SIV and silos are anticipated to be manufactured on the West Coast and they would be transported via ship to the Port of Burns Harbor, IN. Figure 3.3.12-4 depicts a viable route of the SIV and silos from the Port of Burns Harbor to FCTC.

The transport route begins at the Port of Burns Harbor, IN, on Indiana State Route (IN) 249 exiting the port to I-94 east, US 12 east, I-69 north, and I-94 west to the abandoned access road at the Augusta Climax Gate. The transport would then use the FCTC perimeter road to access Site 1.

Preliminary discussions were held with the INDOT and MDOT were during the CIS Transportation Study (MDA, 2015a) and this viable route does not require any modifications/upgrades to the existing roadway network. The only limitation for the transport is over four bridges in Indiana where the transporter speed should be reduced so that it would reduce the impact load to the bridge. Again, the final route would be determined with INDOT and MDOT at the time the heavy haul permit would be obtained. The Port of Burns Harbor, IN, has sufficient infrastructure to receive and unload vessels, provides a secure temporary holding area, and has easy access to a road network that is capable of handling the transport of the SIV and silo components.

In addition to the SIV/silo transport, the GBIs and other equipment would be flown into W.K. Kellogg ANGB which has C-17 aircraft capabilities, and has adequate off loading facilities. From W.K. Kellogg ANGB, the GBIs and other equipment would be transported over public roads and FCTC roads to the CIS footprint.

Onsite transportation of materials and equipment for CIS construction would be along designated routes based on the final layout of the CIS and it is intended for those vehicles and trucks to enter the site through the CIS gate along I-94BL/M 37, see Figure 3.3.12-2. To accommodate missile transport, SIV/silo transport and delivery of materials and equipment, onsite roads would need to meet the requirements specified in Section 2.4.1.4. The dimensions and load characteristics of the SIV, silo, GBI, and their transporters are also noted in Section 2.6.1 and the CIS Transportation Study (MDA, 2015a).

3.3.12.3.1.1.1 Environmental Consequences

The main route for CIS-generated traffic in the area of FCTC Site 1 is via I-94 and then Exit 92 to northbound I-94BL/M 37 for just under 1.5 miles to the potential CIS gate at the intersection of I-94BL/M 37 and Columbia Avenue/Skyline Drive. For urban areas and their roads, intersections are typically analyzed to determine what impact a new site's generated traffic might have on the area road network. The traffic pattern and volumes at the intersection of I-94BL /M 37 would change with the closure of Skyline Drive north of Hill Brady Road/Logistics Drive. If the FCTC Site 1 is selected for the CIS then updated traffic counts once the traffic patterns have been established would be required to assess the potential impact to this intersection.

If a deployment decision is made and FCTC Site 1 is selected, the I-94 ramp termini intersections with I-94BL/M 37 have ample capacity geometrically with the number of lanes, yet the right turns from both I-94 EB and WB off-ramps have excessive delays due to the peak construction traffic accessing the potential CIS. The left turns from I-94 EB and WB off-ramps do have some increased delays as compared to the existing condition. However, the typical queue length for those waiting to turn left is only one to three vehicles. There are no bridge, highway, or intersection modifications required for the transport of the SIVs and silos from the Port of Burns Harbor to the CIS at FCTC Site 1. The majority of roads within the CIS footprint would be newly constructed two-lane roads and they would have adequate capacity to accommodate the estimated construction traffic.

There are likely to be environmental consequences associated with road improvements and new road construction at FCTC Site 1. Improvement of existing roads and the construction of new roads within the CIS footprint are necessary to ensure that the CIS construction traffic has functional access to all areas of site construction. The improvements would provide adequate pavement width, turn radius, alignment geometry, and structural capacity. In regards to turn radius, road edges would be impacted by off-tracking wheels if vehicle geometry and necessary curve widening are not considered properly. As a consequence, eroding pavement edges would become sedimentation source areas and would eventually weaken the roads. Construction activities for the CIS would result in major land disturbance.

3.3.12.3.1.1.2 Mitigation

The peak construction LOS results for the selected intersections show that the greatest impact is on the right turning movement from both the I-94 WB and EB off-ramps. The other movements were acceptable, with some impacts to left turning vehicles on the I-94 WB and EB off-ramps but those were fairly low turning volumes and resulted in typical queue lengths from one to three vehicles. A mitigation option could be to signalize these ramp connections along I-94BL/M 37. This would provide adequate cycles of green time to clear the ramps during the peak hours in the morning as people are commuting to work. This could be a temporary signal or permanent depending on the future traffic volumes at these intersections once the potential CIS is fully operational. Again, if a deployment decision is made and FCTC Site 1 is selected, then an access permit due to the volume of entering and exiting CIS-generated traffic at the potential CIS gate onto I-94 BL/M 37 would be required from MDOT which requires the preparation of a TIS. There appears to be ample pavement width along I-94BL/M 37 at the location of the potential CIS gate for there to be an exclusive northbound left turn lane at the existing signalized intersection. Modifications would also be required to the existing signal phasing/timings at this intersection to accommodate the CIS-generated traffic.

The LOS analysis conservatively assumed that all of the construction workers would travel to and from the CIS during the peak hour of traffic on the regional road network. A mitigation investigated for this construction traffic was to stagger the work schedules such that the majority of the workers are traveling on the regional roads prior to and/or after the peak hours of their respective roadways. A sensitivity case was performed, assuming only 50 percent of CIS-generated traffic would traverse the selected intersections during the peak hour of the regional road network and there would still be a fairly major impact to the movement of motorist's turning right from both the I-94 EB and WB off-ramps, see Table 3.3.12-6.

3.3.12.3.1.2 FCTC Site 2

Reference Sections 3.3.12.3.1 and 3.3.12.3.1.1 for a discussion on the peak construction CIS-generated traffic, their distribution amongst the area roadways, and the traffic growth rate used to develop baseline traffic volumes for the year 2020 (assumed year of peak construction).

Construction Traffic

For the FCTC Site 2 footprint, the construction and operation workforce would use the CIS Gate to access the CIS at FCTC Site 2 which is serviced exclusively by 40th Street, with the majority of the CIS-generated traffic using Exit 88 on I-94. The construction traffic added to the baseline and the LOS of the selected intersections are noted in Table 3.3.12-7 and Table 3.3.12-8.

Table 3.3.12-7 Continental United States Interceptor Site Peak Construction Traffic Volumes – FCTC Site 2

South Side of Interchange	**40th Street Southbound**				**I-94 EB Off-Ramp Eastbound**				**40th Street Northbound**			
Period of Analysis	Left	Thru	Right	App Total	Left	Thru	Right	App Total	Left	Thru	Right	App Total
AM PHV	66	180	0	246	303	0	205	508	0	71	13	84
PM PHV	210	102	0	312	40	0	69	109	0	253	27	280
North Side of Interchange	**40th Street Southbound**				**I-94 WB Off-Ramp Westbound**				**40th Street Northbound**			
Period of Analysis	Left	Thru	Right	App Total	Left	Thru	Right	App Total	Left	Thru	Right	App Total
AM PHV	0	195	41	236	53	0	230	283	29	344	0	373
PM PHV	0	296	310	606	14	0	88	102	137	156	0	293
Note: Traffic volumes include baseline plus CIS-generated Traffic.												

Table 3.3.12-8 Continental United States Interceptor Site Peak Construction Level of Service Results – FCTC Site 2

South Side of Interchange	**40th Street Southbound**	**I-94 EB Off-Ramp Eastbound**		
Period of Analysis	Left	Left	Approach	Right
AM LOS	A	C	C	B
PM LOS	A	C	B	A
North Side of Interchange	**40th Street Northbound**	**I-94 WB Off-Ramp Westbound**		
Period of Analysis	Left	Left	Approach	Right
AM LOS	A	B	B	B
PM LOS	A	C	B	A

The minor street movements (I-94 EB and WB off-ramps) that have to cross through and/or merge with traffic on the major street (40th Street) are the movements analyzed for unsignalized intersections, in addition to the left turns of the major street (40th Street). Therefore, the delay motorists experience while performing these conflicting movements are given a LOS rating based on the severity of the delay. The overall minor street approach (I-94 EB and WB off-ramps) delay is also noted in the results.

The LOS results of all the turning movements varied between LOS A and LOS C, which are acceptable levels of service. The only difference from the existing LOS results was a slight reduction from LOS B to LOS C for the morning and evening left turns from the I-94 EB off-ramp and a similar reduction for the evening left turns from the I-94 WB off-ramp. In addition, the approach LOS was lowered slightly from a LOS A to LOS B for both the I-94 off-ramp approaches to the intersection, along with morning right turns for I-94 WB off-ramp.

Existing onsite roads designated for the potential CIS construction traffic route would be upgraded to meet the necessary physical requirements. Potential modifications include curve widening at intersections and around curves to compensate for wheel off-tracking, surface stabilization (gravel roads) for augmented rut resistance and pavement thickness increase for added structural capacity. The majority of onsite roads would be new roads to provide access to individual mission and mission-support facility construction areas. These new roads would need to have sufficient width, structural capacity and meet longitudinal grade requirements.

Heavy Haul Equipment Transport

The route available for the transportation of the SIV and silos from the Port of Burns Harbor, IN to the FCTC is discussed in Section 3.3.12.3.1.1. For both Sites 1 and 2 at FCTC, the SIV and silos would exit I-94 at the abandoned access road at the EIS designated Augusta Climax Gate.

See Figure 3.3.12-3 for the location of this gate that would be used to access Site 2. The transport from this gate would then use Engineer Road to access Site 2.

Onsite transportation of materials and equipment for CIS construction would be along designated routes based on the final layout of the CIS and it is intended for those vehicles and trucks to enter the site through the CIS Gate along 40th Street, see Figure 3.3.12-3. To accommodate missile transport, SIV/silo transport and delivery of materials and equipment, onsite roads would need to meet the requirements specified in Section 2.4.1.4. The dimensions and load characteristics of the SIV, silo, GBI and their transporters are also noted in Section 2.6 and the CIS Transportation Study (MDA, 2015a).

3.3.12.3.1.2.1 Environmental Consequences

The main route for CIS-generated traffic in the area of FCTC Site 2 is via I-94 and then Exit 88 to northbound 40th Street for approximately 1,000 feet the potential CIS gate to the east of 40th Street. For urban areas and their roads, intersections are typically analyzed to determine what impact a new site's generated traffic might have on the area road network. The traffic pattern and volumes could change some due to the upgraded tight diamond interchange at Exit 88. If the FCTC Site 2 is selected for the CIS then updated traffic counts once the traffic patterns have been established would be required to assess the potential impact to the ramp intersections with 40th Street.

If a deployment decision is made and FCTC Site 2 is selected, the intersections of the I-94 ramp termini with 40th Street have the capacity to accommodate the peak construction CIS-generated traffic. There are some slight reductions in LOS from either LOS B to LOS C or LOS A to LOS B for some movements, yet these are still very acceptable LOS There are no bridge, highway, or intersection modifications required for the transport of the SIVs and silos from the Port of Burns Harbor to the potential CIS at FCTC Site 2. The majority of onsite roads (within the CIS footprint) would be newly constructed two-lane roads and they would have adequate capacity to accommodate the estimated construction traffic.

3.3.12.3.1.2.2 Mitigation

The peak construction LOS results for the selected intersections remained at acceptable levels. Thus no mitigation is required at these intersections. However, there is a mitigation required for 40th Street. The planned improvements to 40th Street, due to the tight diamond interchange project, should be extended approximately 300 feet to the north. Thus the road typical section would be two 12-foot lanes with 6-foot shoulders from the interchange north to the potential CIS gate. There might be some slight modifications required between the I-94 WB off-ramp and E Michigan Avenue to allow for a left turn lane onto E Michigan Avenue. The pavement width appears to be adequate for the development of a left turn, based on the construction drawings (MDOT, 2015a). Again, if FCTC Site 2 were selected as the location of the CIS then a TIS would be required to study select intersections once traffic patterns and volumes normalize after the improvements to the I-94 and 40th Street interchange.

3.3.12.3.2 Construction – Expedited Schedule

The 3-year expedited construction schedule, as presented in Section 2.5.1, assumes two 10-hour work shifts per day with the peak period of construction still employing 600 workers each shift. There would also be a 2-hour transition period between shifts so there would not be 600 workers going to and coming from the potential CIS area at the same time. Therefore, the analysis performed for the 5-year baseline construction schedule would be the same for the 3-year expedited construction schedule because the peak volume of CIS-generated traffic would be the same and that traffic is still conservatively assumed to occur during the peak hour period of the respective area roadways.

3.3.12.3.2.1 Environmental Consequences

The environmental consequences for transportation for both FCTC Site 1 and FCTC Site 2 would be the same under the expedited schedule as under the baseline schedule.

3.3.12.3.2.2 Mitigation

The mitigations for transportation for both FCTC Site 1 and FCTC Site 2 would be the same under the expedited schedule as under the baseline schedule.

3.3.12.3.3 Operation

3.3.12.3.3.1 FCTC Site 1

As discussed in Section 2.7, a range of 650 to 850 employees and workers over a total of three work shifts would be needed during the CIS operation. The personnel employed would be a mixture of military, civilian and contractor workforce. It is assumed that there would be approximately 350 employees during the typical daytime shift spread out over the various SRs, U.S. routes, and Interstate highways in the area of the potential CIS. Therefore, it is assumed that the CIS-generated traffic would be 350 one-way vehicles entering the CIS facility during the morning peak hour traffic. In addition, the personnel are assumed to arrive and depart within a 1-hour period (assumed no flex schedule) and it coincides with the peak hour traffic volumes on the regional road network. It is assumed that there would be an additional 10 percent of traffic that would be attributed to trucks associated with the operation of the site entering and exiting the site. A 9-hour work shift was also assumed and thus an average of 4 trucks would be entering and exiting the site each and every hour of the workday. The other two work shifts are assumed to have approximately 250 workers per shift. Furthermore, using the morning peak hour for this analysis it was conservatively assumed one half of the third shift would travel the area roadways during the peak hour of the regional road network, which equates to approximately 125 vehicles. These assumptions result in a total CIS-generated traffic of 354 vehicles (350 cars and 4 trucks) entering the CIS and 129 vehicles (125 cars and 4 trucks) exiting the CIS during this morning peak period. Conversely, for the evening peak hour there would be 354 vehicles exiting the CIS and 127 vehicles entering the CIS during this peak period.

The distribution of CIS-generated traffic over the regional road network during the operation of the CIS was similar to the construction worker distribution, with more workers coming from the closer populated cities located west of FCTC proper. In order to factor up the existing traffic to a baseline condition for the operations period, an assumption was made that if a decision for deployment is made and FCTC is selected the earliest design and permitting work could start would be late 2016. Then based on the schedule noted in Section 2.5.1, the first year of full operations would occur in the year 2022. Therefore, the existing design hour was escalated up to the year 2022 based on a yearly growth rate of 0.75 percent as described in Section 3.3.12.2.1.1 to establish a baseline condition. The operation workers and the operation truck traffic were then added to the year 2022 baseline peak hour traffic data along the selected routes of this analysis. The total traffic during operations and the LOS of the selected intersections are noted in Table 3.3.12-9 and Table 3.3.12-10.

The LOS results of the operations CIS-generated traffic are similar to the results of the construction CIS-generated traffic on the selected intersections. The left turns from I-94BL/M 37 were either LOS A or B for both intersections. The left turning movements from the I-94 EB and WB off-ramps varied from LOS C to LOS F. Although a LOS E and LOS F are long delays, the typical queue length for those waiting to turn left at the I-94 EB and WB off-ramps is only one to three vehicles which would be negligible. However, the morning right turns from both I-94 EB and WB off-ramps would have major delays that could lead to vehicles being backed up to the entrance of the I-94 off-ramps and I-94 itself, with typical queue lengths of 70 and 18 vehicles respectively, waiting to merge with I-94 BL/M37 northbound traffic.

Table 3.3.12-9 Continental United States Interceptor Site Operations Traffic Volumes – FCTC Site 1

South Side of Interchange	**I-94BL/M-37 Southbound**				**I-94 WB Off-Ramp Westbound**				**I-94BL/M-37 Northbound**			
Period of Analysis	Left	Thru	Right	App Total	Left	Thru	Right	App Total	Left	Thru	Right	App Total
AM PHV	163	162	0	325	4	0	717	721	0	229	55	284
PM PHV	399	241	0	640	4	0	309	313	0	170	76	246
North Side of Interchange	**I-94BL/M-37 Southbound**				**I-94 WB Off-Ramp Westbound**				**I-94BL/M-37 Northbound**			
Period of Analysis	Left	Thru	Right	App Total	Left	Thru	Right	App Total	Left	Thru	Right	App Total
AM PHV	0	278	309	587	67	0	434	501	17	917	0	934
PM PHV	0	578	662	1240	55	0	129	184	17	513	0	530
Note: Traffic volumes include baseline plus CIS-generated traffic.												

Table 3.3.12-10 Continental United States Interceptor Site Operations Level of Service Results – FCTC Site 1

South Side of Interchange	**I-94BL/M-37 Southbound**	**I-94 EB Off-Ramp Westbound**		
Period of Analysis	Left	Left	Approach	Right
AM LOS	A/A	C/C	E/D	E/D
PM LOS	A	D	B	B
North Side of Interchange	**I-94BL/M-37 Northbound**	**I-94 WB Off-Ramp Westbound**		
Period of Analysis	Left	Left	Approach	Right
AM LOS	A/A	F/E	F/F	F/F
PM LOS	B	F	D	B
Note: A/A = First LOS is 100% CIS-generated traffic, second LOS is 50% (split shift) CIS-generated traffic.				

If a deployment decision is made and FCTC Site 1is selected, during the design phase a network of new roads within the CIS footprint and parking areas would be designed and subsequently constructed to serve potential CIS operations. Parking capacity, traffic circulation patterns, security, and turning radius would be evaluated during the design phase.

Table 3.3.12-11 provides a comparison of the LOS during the three periods analyzed in this EIS.

Table 3.3.12-11 Comparison of Operations Level of Service Results – FCTC Site 1

South Side of Interchange	**I-94BL/M-37 Southbound**	**I-94 EB Off-Ramp Westbound**		
Period of Analysis	Left	Left	Approach	Right
AM LOS	A/A/A	C/C/C	C/F/E	C/F/E
PM LOS	A/A/A	C/D/D	B/B/B	B/B/B
North Side of Interchange	**I-94BL/M-37 Northbound**	**I-94 WB Off-Ramp Westbound**		
Period of Analysis	Left	Left	Approach	Right
AM LOS	A/A/A	D/F/F	D/F/F	E/F/F
PM LOS	A/B/B	D/E/F	C/D/D	B/B/B
Note: A/A/A = First LOS is for existing condition, second LOS is for peak construction condition, and third LOS is for operations condition.				

As noted previously, the peak construction and operations periods had major delays for both I-94 EB and WB off-ramps, especially for right turning movements. Therefore, the mitigation for this impact would be to signalize the I-94 ramp termini at the two intersections along I-94 BL/M 37.

The I-94 BL/M 37 left turning movements at both intersections either remained at the same LOS as existing or was lowered from LOS A to LOS B during the construction and operation periods. This slight reduction is acceptable.

3.3.12.3.3.1.1 Environmental Consequences

The I-94 ramp termini intersections with I-94BL/M 37 have ample capacity geometrically with the number of lanes, yet the right turns from both I-94 EB and WB off-ramps have excessive delays due to the operations traffic accessing the potential CIS. The left turns from I-94 EB and WB off-ramps do have some increased delays as compared to the existing condition. However, the typical queue length for those waiting to turn left is only one to three vehicles. Improvements to the internal roads as noted in Section 3.3.12.2.1 would have been made during the construction phase, so there are no environmental consequences related to the internal road network during the operation of the CIS. The internal roads would have adequate capacity to accommodate the CIS-generated traffic.

3.3.12.3.3.1.2 Mitigation

The operations LOS results for the selected intersections show that the greatest impact is on the right turning movement from both the I-94 WB and EB off-ramps during the morning peak hour. The other movements were acceptable, with some impacts to left turning vehicles on the I-94 during the morning peak hour WB and EB off-ramps but those were fairly low turning volumes and resulted in typical queue lengths from one to three vehicles. One mitigation could be for the traffic signals installed during construction to remain in-place to help facilitate the movement of vehicles, particularly the right turns from the off-ramps, through these intersections and not back traffic up onto I-94. The traffic signal timings at the I-94BL/M 37 and CIS gate and Columbia Avenue/Skyline Drive intersection might also need to be modified to improve the efficiency of this intersection.

Once the potential CIS is fully operational, then new hourly machine counts and manual turning movement counts should be taken at both the I-94 WB and EB intersections with I-94BL/M 37 to determine if the signals are warranted at these locations. The operations workforce that access the CIS may be different than what is estimated in this EIS and/or other developments in the area might change the projected baseline traffic volumes for the year 2022.

The LOS analysis conservatively assumed that all of the construction workers would travel to and from the CIS during the peak hour of traffic on the regional road network. A mitigation investigated for this operations traffic during the morning peak hour was to stagger the work schedules such that the majority of the workers are traveling on the regional roads prior to and/or after the peak hours of their respective roadways. A sensitivity case was performed, assuming only 50 percent of CIS-generated traffic would traverse the selected unsignalized intersections during the peak hour of the regional road network and there would still be a fairly major impact to the movement of motorist's turning right from both the I-94 EB and WB off-ramps, see Table 3.3.12-10.

3.3.12.3.3.2 FCTC Site 2

Reference Section 3.3.12.3.3 for a discussion on the operation CIS-generated traffic, their distribution amongst the area roadways, and the traffic growth rate used to develop baseline traffic volumes for the year 2022 (assumed first full year of operation).

The construction and operation workforce would use the CIS Gate to access the CIS at FCTC Site 2 which is serviced exclusively by 40th Street, with the majority of the CIS-generated traffic using Exit 88 on I-94. The operation site traffic added to the baseline and the LOS of the selected intersections are noted in Table 3.3.12-12 and Table 3.3.12-13.

Table 3.3.12-12 Continental United States Interceptor Site Operations Traffic Volumes – FCTC Site 2

South Side of Interchange	**40th Street Southbound**				**I-94 EB Off-Ramp Eastbound**				**40th Street Northbound**			
Period of Analysis	Left	Thru	Right	App Total	Left	Thru	Right	App Total	Left	Thru	Right	App Total
AM PHV	106	184	0	290	157	0	208	365	0	65	13	78
PM PHV	189	96	0	285	63	0	70	133	0	258	27	285
North Side of Interchange	**40th Street Southbound**				**I-94 WB Off-Ramp Westbound**				**40th Street Northbound**			
Period of Analysis	Left	Thru	Right	App Total	Left	Thru	Right	App Total	Left	Thru	Right	App Total
AM PHV	0	237	64	301	54	0	210	264	29	191	0	220
PM PHV	0	269	164	433	14	0	128	142	139	183	0	322
Note: Traffic volumes include baseline plus CIS-generated traffic.												

Table 3.3.12-13 Continental United States Interceptor Site Operations Level of Service Results – FCTC Site 2

South Side of Interchange	**40th Street Southbound**	**I-94 EB Off- Ramp Eastbound**		
Period of Analysis	Left	Left	Approach	Right
AM LOS	A	C	B	B
PM LOS	A	C	B	A
North Side of Interchange	**40th Street Southbound**	**I-94 WB Off- Ramp Westbound**		
Period of Analysis	Left	Left	Approach	Right
AM LOS	A	B	B	B
PM LOS	A	C	B	B

The LOS results of the operations CIS-generated traffic are similar to the results of the construction CIS-generated traffic on the selected intersections. All of the turning movements at the intersections varied between LOS A and LOS C, which are acceptable levels of service. The only difference from the existing LOS results was a slight reduction from LOS B to LOS C for the morning and evening left turns from the I-94 EB off-ramp and a similar reduction for the evening left turns from the I-94 WB off-ramp. In addition, the approach LOS was lowered slightly from a LOS A to LOS B for both the I-94 off-ramp approaches to the intersection along with right turns for the I-94 WB off-ramps.

If a deployment decision is made and FCTC Site 2 is selected, during the design phase a network of new roads within the CIS footprint and parking areas would be designed and subsequently constructed to serve CIS operations. Parking capacity, traffic circulation patterns, security, and turning radius would be evaluated during the design phase.

Table 3.3.12-14 provides a comparison of the LOS during the three periods analyzed in this EIS. As noted previously, the peak construction and operations periods had only a slight reduction in LOS for some movements. However, LOS A through LOS C are acceptable LOS.

Table 3.3.12-14 Comparison of Operations Level of Service Results – FCTC Site 2

South Side of Interchange	**40th Street Southbound**	**I-94 EB Off-Ramp Eastbound**		
Period of Analysis	Left	Left	Approach	Right
AM LOS	A/A/A	B/C/C	B/C/B	B/B/B
PM LOS	A/A/A	B/C/C	A/B/B	A/A/A
North Side of Interchange	**40th Street Northbound**	**I-94 WB Off-Ramp Westbound**		
Period of Analysis	Left	Left	Approach	Right
AM LOS	A/A/A	B/B/B	A/B/B	A/B/B
PM LOS	A/A/A	B/C/C	A/B/B	A/A/B
Note: A/A/A = First LOS is for existing condition, second LOS is for peak construction condition, and third LOS is for operations condition.				

3.3.12.3.3.2.1 Environmental Consequences

The intersections of the I-94 ramp termini with 40th Street have the capacity to accommodate the potential operations CIS-generated traffic. The left turns from I-94 EB and WB off-ramps would have a slightly lower LOS from a LOS B to LOS C as compared to the existing, yet that is an acceptable LOS. There would also be a slight reduction in LOS from a LOS A to LOS B for right turns from the I-94 WB off-ramp, but again those are still very acceptable LOS. Improvements to the roads within the CIS footprint as noted in Section 3.3.12.3.1.2 would have been made during the construction phase, so there are no environmental consequences related to the internal road network during the operation of the CIS. The internal roads would have adequate capacity to accommodate the CIS-generated traffic.

3.3.12.3.3.2.2 Mitigation

The operation LOS results for the selected intersections would remain at acceptable levels. Thus no mitigation would be required at these intersections. The extension of improvements along 40th Street to the potential CIS gate and the possible left turn lane to E Michigan Avenue would have been constructed already. Similar to the peak construction discussion, if a deployment decision is made and FCTC is selected, then a TIS would be required at that time to study select intersections with updated traffic data once traffic patterns and volumes normalize after the improvements to the I-94 and 40th Street interchange are complete.

Figure 3.3.12-1 Regional Road Network– FCTC Sites

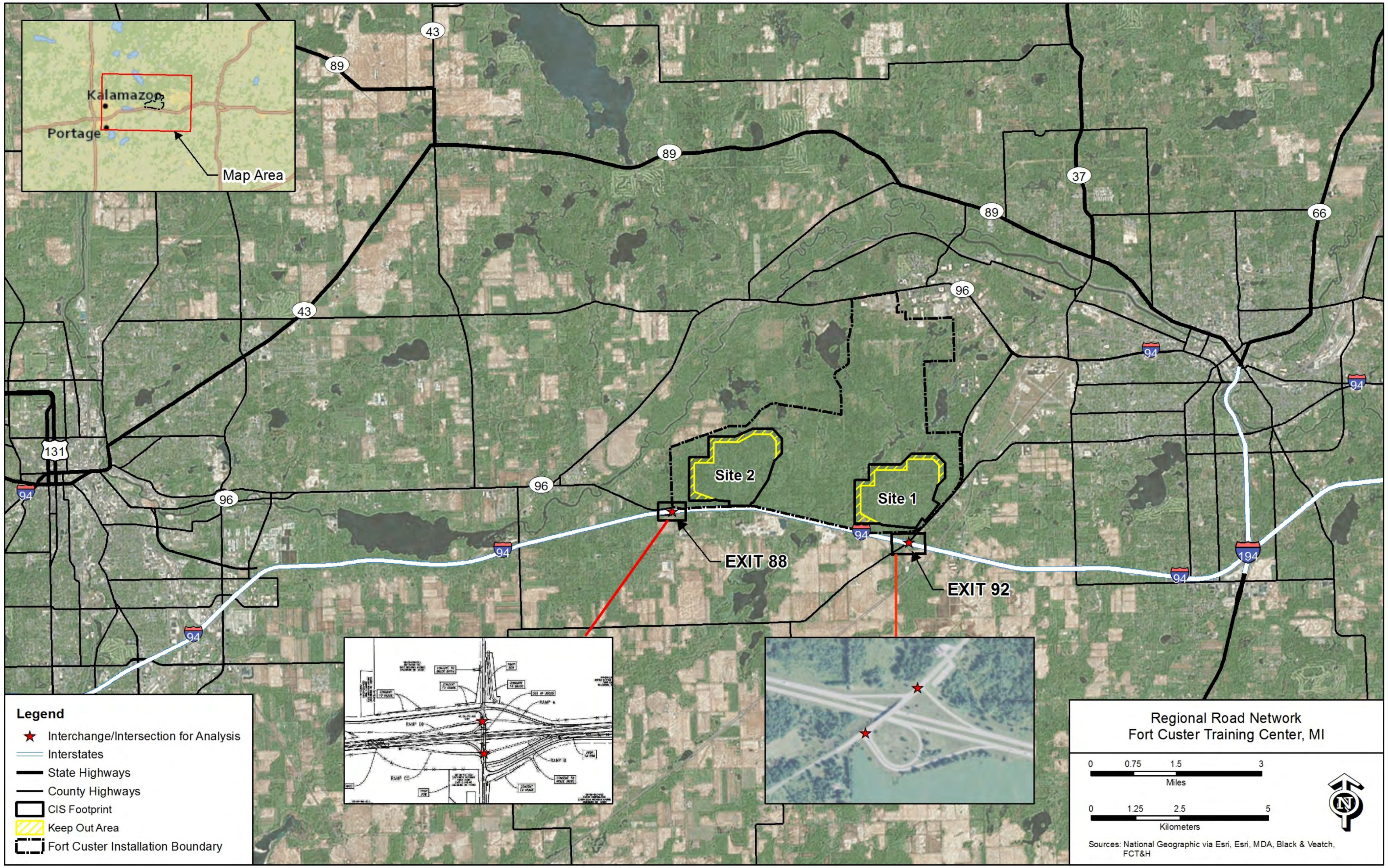


Figure 3.3.12-2 Road Network – FCTC Site 1

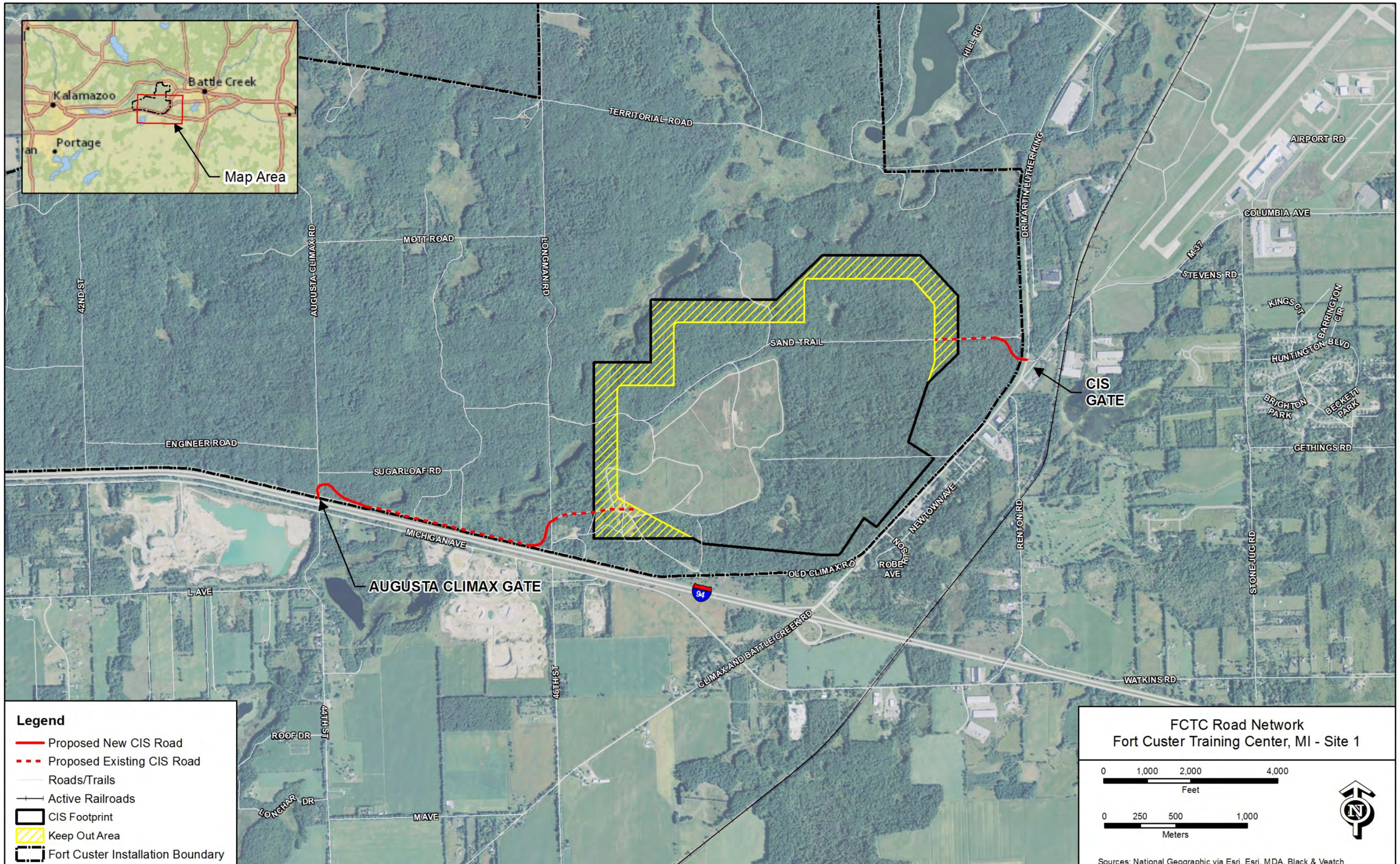


Figure 3.3.12-3 Road Network – FCTC Site 2

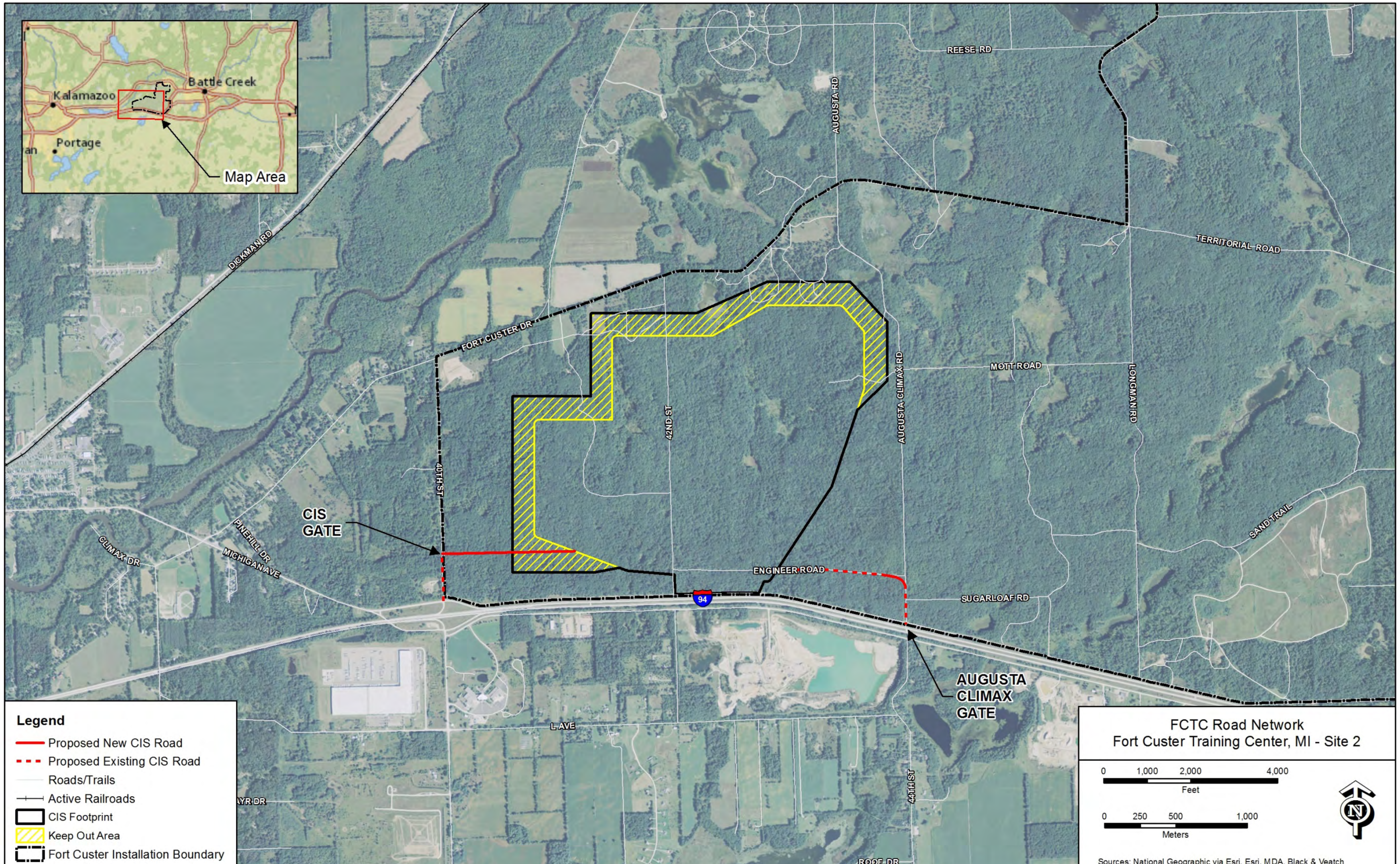
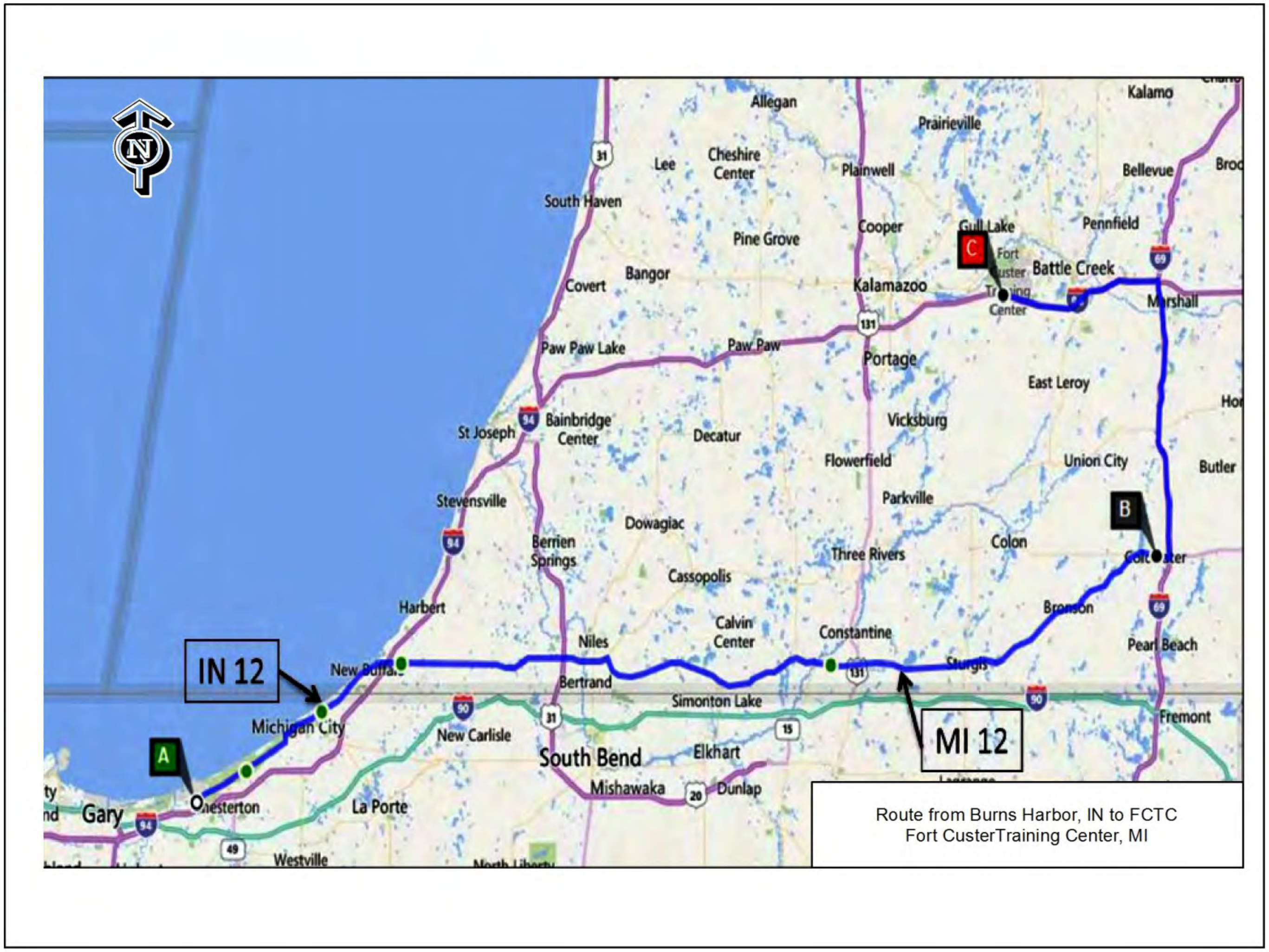


Figure 3.3.12-4 Route from Port of Burns Harbor, Indiana, to FCTC



3.3.13 Utilities – FCTC Sites

The utility systems addressed in this analysis include the facilities and infrastructure used for:

- **Water** services including pumping, treatment, storage, and distribution. Includes potable water, fire protection water, and water needed for facilities operation.
- **Wastewater** management including collection and treatment.
- **Solid waste** collection and disposal.
- **Electrical and natural gas or other fuel sources** used for energy generation and distribution.
- **Communication** services, specifically those related to telephone and internet services.

For this analysis both onsite and offsite service provisions were considered. The primary considerations for the utility services include abilities related to processing, distribution, storage capacities, and consumption demands, needed to determine the adequacy of services for future services related to the potential CIS deployment.

3.3.13.1 Regulatory Framework – Utilities – FCTC Sites

Utilities are governed by various federal, state, and local laws, regulations, and ordinances. Key guidance regarding how the federal government is to address the environmental compatibility of infrastructure is contained in the following:

- EO 13211 Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use (issued on May 18, 2001). EO 13211 requires that agencies address the effects of certain regulatory actions on energy supply, distribution, or use.
- EO 13693 Planning for Federal Sustainability in the Next Decade (issued on March 19, 2015). EO 13693 establishes an integrated strategy towards sustainability in the federal government and encourages federal agencies to reduce GHG emissions.

3.3.13.2 Affected Environment – Utilities – FCTC Sites

3.3.13.2.1 FCTC Site 1

Information and data gathered for this assessment was based primarily on correspondence and interviews held as part of the utility study (FCTC, 2015a; BVSPC, 2016a).

Currently utility services are only present at FCTC within the cantonment area, which is approximately 2.5 miles to the north of the FCTC Site 1 footprint. Following is a description of the existing services present within the cantonment area and description of the closest service connection or access point for these series to the FCTC Site 1 footprint.

3.3.13.2.1.1 Water Supply

Potable water services for the primary cantonment area are provided by the City of Battle Creek (TYJT, 2015; BCDPW, 2015). The City of Battle Creek is the nearest commercial connection to the FCTC Site 1 footprint. The City of Battle Creek's water plant and well field has a capacity of approximately 30 million gallons per day (MGD) which is well above the system average daily demand of 10 MGD and maximum daily demand of 18 MGD (BVSPC, 2016a). The closest water service access point to FCTC Site 1 would be within approximately 0.1 miles of the east footprint boundary.

In addition to commercial water, there are wells with limited capacity located near the FCTC Site 1 footprint (see the Section 3.3.14 Water Resource for additional details). However, based on previous geologic and hydrogeologic studies conducted by Charleston Township, supply wells within 3.7 miles west of the FCTC Site 1 footprint and within the Marshall Sandstone Aquifer formation (which is also below FCTC) can produce from 600 to 685 gpm, or greater (Prein & Newhof, 2000). Two specific wells within this formation, both installed at a depth of 160 ft bgs, produce daily capacities ranging from 150 to 200 gpm.

3.3.13.2.1.2 Wastewater Management

Wastewater services are currently only provided to the existing installation cantonment area by the City of Battle Creek (BCDPW, 2015). If a commercial connection is provided to the FCTC Site 1 footprint, it would be provided independently of the service lines to the cantonment area. Similar to the water service, the closest wastewater connections to the FCTC Site 1 footprint from to the City of Battle Creek's sanitary sewer main would be within approximately 0.1 miles of the east footprint boundary. This wastewater service access point would be directly upstream of a wastewater lift station which has capacity. The City of Battle Creek's wastewater plant has a permitted for a capacity of approximately 18 MGD, but currently only receives average daily flows of approximately 9 MGD (BVSPC, 2016a).

3.3.13.2.1.3 Solid Waste

Solid waste collection and disposal services for the installation cantonment area are currently provided by Waste Management, Inc. There are also several other commercial solid waste collection and disposal services available in the area of FCTC which could provide these services to the FCTC Site 1 (BVSPC, 2016a).

3.3.13.2.1.4 Energy

Energy includes both electrical power and natural gas or other heat fuel alternatives.

Commercial power is provided to FCTC by Consumers Energy. Electricity is distributed via underground cables throughout the FCTC's cantonment area. Electricity for the potential CIS would be provided independently from the existing power delivery service to the installation cantonment area. The closest access point for the electricity would be within approximately 0.1 miles of the FCTC Site 1 footprint. An additional electrical service access point is available approximately 1 mile to the southwest of the FCTC Site 1 footprint, (BVSPC, 2016a). For the electrical services, a substation may be needed outside of the FCTC boundary near the FCTC Site 1 footprint to support and transform the power source needed. If the substation is required, it would be provided by the utility and require approximately 1 to 2 acres of space.

Natural gas is provided to FCTC cantonment area by SEMCO Energy. Currently, there is no natural gas service provided to the area of the FCTC Site 1 footprint. However, there is a SEMCO Energy natural gas service line approximately 0.5 miles east of the FCTC Site 1 footprint (BVSPC, 2016a).

3.3.13.2.1.5 Communications

Telephone is currently available and provided to the cantonment area by TDS Metrocom (FCTC, 2015a).

Internet (fiber cable) services are available and provided by the Defense Information Systems Agency at the cantonment area. No internet service is currently provided to the southeastern portion of FCTC (the area of the FCTC Site 1 footprint). However, an available fiber cable connection point is also available within approximately 0.2 miles to the south of the FCTC installation boundary, but it has not yet been connected to provide internet services for this area (BVSPC, 2016a).

3.3.13.2.2 FCTC Site 2

FCTC Site 2 is located in both Calhoun and Kalamazoo counties. Currently utility services are only present at FCTC within the cantonment area, which is approximately 3.5 miles to the northeast of the FCTC Site 2 footprint.

The following sections present the affected environment for utilities for FCTC Site 2. Unless specifically discussed in the following sections, the affected environment is the same as that described in Section 3.3.13.2.1 for FCTC Site 1.

3.3.13.2.2.1 Water Supply

Potable water and sewer services for the cantonment area of the installation are provided by the City of Battle Creek (TYJT, 2015; BCDPW, 2015). However, the City of Battle Creek's water distribution system does not extend into Kalamazoo County where the FCTC Site 2 footprint is located. Therefore, commercial connection would be provided from Charleston Township.

The Charleston Township water system currently only serves two customers, Eaton Corporation and the Target Distribution Center, approximately both located within 1 mile of the FCTC Site 2 footprint. The water system consists of two wells approximately 0.9 miles southwest of the

FCTC Site 2 footprint. The Charleston Township water system has the capacity to provide approximately 0.36 MGD which is well above the system average daily demand of 0.013 MGD. The closest access point for commercial water is approximately 0.8 miles south of the FCTC Site 2 footprint.

In addition to commercial water, there are only wells with limited capacity near the FCTC Site 2 footprint (see Section 3.3.14 Water Resource for additional details). However, based on previous geologic and hydrogeologic studies conducted by Charleston Township, these two supply wells are within approximately 0.9 miles south of the FCTC Site 2 footprint and within the Marshall Sandstone Aquifer formation (also below the FCTC Site 2 footprint) and can produce from 600 to 685 gpm, or greater (Prein & Newhof, 2000). As indicated previously, the two Charleston Township wells within this formation, both installed at a depth of 160 ft bgs, produce daily capacities ranging from 150 to 200 gpm.

3.3.13.2.2.2 Wastewater Management

Wastewater services are currently only provided to the existing installation cantonment area by the City of Battle Creek (BCDPW, 2015). If a commercial connection is provided to the FCTC Site 2 footprint, it would be provided independently of the service lines to the cantonment area. The closest sanitary sewer service to the FCTC Site 2 footprint is Charleston Township's sanitary sewer main which runs west parallel to Michigan Avenue from the southwest corner of the installation boundary. Connection would require extension of approximately 0.5 miles of service lines. While the sewer is owned by Charleston Township, it is operated and maintained by the City of Kalamazoo. The City of Kalamazoo's wastewater treatment plant has a permitted capacity of 54 MGD well in excess of the average daily flow of 26 MGD. The wastewater service from the FCTC Site 2 footprint connection to Kalamazoo's wastewater treatment facility would be provided by a lift station (Lift Station 20) which has a capacity of approximately 750 gpm, but currently receives peak flows of approximately 100 gpm (BVSPC, 2016a).

3.3.13.2.2.3 Solid Waste

Solid waste collection and disposal services for FCTC Site 2 would be same as those described for FCTC Site 1.

3.3.13.2.2.4 Energy

Energy includes both electrical power and natural gas or other heat fuel alternatives.

Commercial power is provided to FCTC by Consumers Energy. Electricity is distributed via underground cables throughout the FCTC's cantonment area. Electricity for the potential CIS would be provided independently from the existing power delivery service to the installation cantonment area. The closest access point for the electricity would be near the southeast corner of the FCTC Site 2 footprint approximately within 0.6 miles (BVSPC, 2016a). For the electrical services, a substation may be needed outside of the FCTC boundary near the FCTC Site 2 CIS footprint to support and transform the power source needed. If the substation is required, it would be provided by the utility and require approximately 1 to 2 acres of space.

Natural gas is provided to FCTC cantonment area by SEMCO Energy. There is no current natural gas service provided to the area of the FCTC Site 2 footprint. However, there are two natural gas pipelines owned and operated by Consumer's Energy approximately 0.2 miles east of the FCTC Site 2 footprint that could provide natural gas service (BVSPC, 2016a).

3.3.13.2.2.5 Communications

Telephone is currently available at the primary cantonment area (located in the northern portion of the FCTC installation) within approximately 3.5 miles of the FCTC Site 2 footprint with services being provided by TDS Metrocom (BVSPC, 2016a).

Internet (fiber cable) services are available and provided by the Defense Information Systems Agency at the cantonment area. No internet service is currently provided to the southeastern portion of FCTC (the area of the FCTC Site 2 footprint). However, an available fiber cable connection point is also available within 0.2 miles to the south of the FCTC installation boundary (BVSPC, 2016a).

3.3.13.3 Environmental Consequences and Mitigation – Utilities - FCTC Sites

Based on preliminary estimates defined for the utility study, utility services required for the potential CIS operations would consist of the following (BVSPC, 2016a):

- **Water demand**: 275 gpm (assumed peak demand includes potable and fire water demand). An emergency backup water supply source would be provided for potential CIS operation.
- **Wastewater/sewer capacity**: 100 gpm.
- **Solid Waste**: 1.5 cubic yards (CY)/day.
- **Electric demand**: 10 MW. A total of four 3-MW generators would be provided as part of the CIS for emergency backup power.
- **Heating load:** 7 MBtu/hr. Load to be provided by natural gas or other fuel sources (fuel oil, etc.).
- **Communication usage**: To be determined based on personnel and system during CIS design.

Although not specifically defined, it has been assumed that the construction demand would be less than operations demand. However, to provide for a conservative estimate to the relative construction demands it has been assumed that they would be equal to operations demands.

For the utilities needed for the potential CIS, unless otherwise defined, it has been assumed that utility services would generally be provided from the existing commercial sources that were identified in Section 3.3.13.2. For these commercial utility services, it has been assumed that routing and the connection of new services would be provided within existing road right-of-ways (ROWs), and using low intrusive methods such as horizontal drilling if available and appropriate, in order to minimize impacts to the environment.

All utility infrastructure exterior to the installation boundary would require acquisition of ROW. Also, as needed, any permits required for utilities services would need to be obtained if a decision has been made to deploy the CIS and a preferred site is selected.

3.3.13.3.1 Construction – Baseline Schedule

For the analysis of the impacts from construction of utilities, it has been assumed that utilities services would be provided as follows:

- **Water services**: Commercial or onsite source to be provided though coordination with or by the construction contractor.
- **Wastewater/sewage services:** Commercial source or services to be provided by construction contractor.
- **Solid waste management**: Commercial services provided through/by the construction contractor.
- **Electric demand:** Commercial source coordinated with/through the construction contractor with some limited needs being directly provided by construction contractor-provided generators.
- **Heating load**: Assumed to be provided through/by construction contractor through a commercially provided existing service (natural gas) or by offsite fuel source provider (fuel oil).
- **Communications:** Assumed to be provided through/by the construction contractor through a commercial source or provider.

3.3.13.3.1.1 Environmental Consequences

3.3.13.3.1.1.1 FCTC Site 1

The following are environmental consequences attributed to utilities for construction-related activities:

Water Supply. Water for construction activities would be provided from either commercial sources or by use of onsite wells.

If commercial water sources are used, based on the assumed demand (275 gpm) versus the total capacity, no adverse impacts would occur. For the commercial water sources, it has also been assumed that the connections and piping would be provided along existing road ROWs or within areas to be developed within the FCTC Site 1 footprint; therefore environmental impacts would be negligible.

If the water supply for construction demand (275 gpm) would be provided by onsite wells, based on hydrogeologic information provided for aquifers in the area of the potential CIS deployment (to produce up to 600 gpm or greater), groundwater should be available to meet the demand incurred during the CIS construction activities. If a decision to deploy is made and FCTC Site 1 is selected, additional evaluation of well location, drilling of test wells, and pump test to determine well capacity and degree of potential water quality would be provided. Any wells installed at FCTC Site 1 for potable and non-potable water use would need to be drilled and installed in accordance to MDEQ well requirements, and also would be treated as needed in accordance with MDEQ requirements. Overall minor impacts may be incurred due to the potential groundwater use as a water source for construction activities via onsite wells.

Wastewater. Wastewater and sanitary sewage management during construction activities could be provided through commercial sources or provided via commercial services provided by the construction contractor. If connection to the commercial sources would be provided, based on the assumed demand versus the capacity no adverse impacts would occur. Also, if wastewater management would be provided by an existing commercial provider, it has been assumed that the connections and piping would be provided along existing road ROWs or within the FCTC Site 1 footprint and, therefore, environmental impacts would be negligible.

Otherwise, if wastewater and sanitary sewage management would be provided by the construction contractor's commercially provided service, it has been assumed that this service would be licensed to provide these services in accordance with MDEQ requirements. Therefore, environmental impacts associated with these services would be negligible.

Solid Waste. Collection and disposal of solid waste generated during construction activities would be coordinated by the construction contractor in accordance with MDEQ requirements. Therefore, no adverse impacts from solid waste disposal during the CIS construction activities for FCTC Site 1 would occur.

Electrical Power. Commercial power for the CIS construction activities could be provided by Consumers Energy. If a substation would need to be provided, it has been assumed that it would be provided by Consumers Energy at a location offsite. Routing of services from either of the source locations previously defined would be provided within existing road ROWs. In addition, the construction contractor could address localized construction needs by the use of generators. The use of generators has been accounted for in emissions estimates in the Air Quality section for FCTC Site 1 construction activities. Overall, based on the estimated electrical demand versus available power, routing of service lines in existing ROWs, and accountability of potential low emission impacts during construction activities from construction contractor generators, negligible impacts from electrical services to be provided for construction activities for the CIS at FCTC Site 1 would occur.

Natural Gas or Other Heating Fuel Sources. Construction activities, especially at its peak, would primarily be provided during limited spring, summer, and limited fall periods: therefore, minimizing the need for temporary heating systems and the need for natural gas. It has been assumed that natural gas service would be provided to the FCTC Site 1 footprint to accommodate for the construction heating load. Additionally, fuel oil (kerosene or diesel) fired-boilers could be used as an alternative to natural gas. Natural gas is available near the site and would require providing service lines to the site if used for construction services. Fuel oil is also available through several vendors within the vicinity of FCTC Site 1. Provisions for accounting for heat generated emissions have been provided for in the Air Quality section for FCTC Site 1 construction activities. Overall, based on the temporary heating system demands from construction activities, readily availability of natural gas or fuel oil and associated accountability of related emissions, there would be negligible impacts.

Communication (Telephone and Internet). Communication systems during the potential CIS construction would be the coordinated and the responsibility of the construction contractor. If communication systems are provided, they may be provided from existing sources (telephone and internet services) by connecting to existing services and routing them along existing ROWs or they may be provided by the construction contractor by other methods (e.g., cell phone service or wireless internet services). Overall, regardless of the communications method used, there would be negligible impacts for communication utilities during CIS construction activities.

3.3.13.3.1.1.2 FCTC Site 2

The environmental consequences for utilities under the baseline schedule for FCTC Site 2 would be the same as those described for FCTC Site 1.

3.3.13.3.1.2 Mitigation

3.3.13.3.1.2.1 FCTC Site 1

Water. Because only negligible or minor impacts would occur with use of either commercial or onsite water sources for CIS construction activities, no mitigation would be required.

Wastewater. Because negligible impacts would occur for both commercial and onsite provided wastewater management for CIS construction activities, no mitigation is would be required.

Solid Waste. Because no impacts associated with solid waste disposal from CIS construction activities would occur, no mitigation efforts would be required.

Electrical. Because negligible adverse impacts associated with providing electrical services during CIS construction activities would occur, no mitigation efforts would be required.

Natural Gas or Other Heating Fuel Sources. Due to negligible impacts associated with the use of natural gas or alternatives such as fuel oil for heating sources during construction, no mitigation efforts would be required.

Communication (telephone and Internet). Because negligible adverse impacts associated with providing communication services during CIS construction activities would occur, no mitigation efforts would be required.

3.3.13.3.1.2.2 FCTC Site 2

The mitigations for utilities under the baseline schedule for FCTC Site 2 would be the same as those described for FCTC Site 1.

3.3.13.3.2 Construction – Expedited Schedule

The environmental consequences and mitigations for utilities for construction under the expedited schedule would be the same as for the baseline schedule for both FCTC Site 1 and FCTC Site 2.

3.3.13.3.3 Operation

For utilities needed for operation of the potential CIS the following has been assumed:

- **Water services:** Water services would be provided for routine operations by commercial sources or for routine, and at a minimum emergency/backup conditions by onsite sources.
- **Wastewater/sewage services:** Wastewater services would be provided by commercial or onsite sources for the estimated demand required for the operation of the potential CIS.
- **Solid Waste:** Solid waste collection and disposal services would be provided by existing commercial offsite sources.
- **Electric demand:** Electrical demand would be provided for a commercial source(s), with an onsite power generation source provided for backup and emergency services.
- **Heating load**: Heating loads and demands would be provided by existing commercial services or by an offsite fuel source provider.
- **Communications:** Communication services would be provided by commercial sources or providers.

3.3.13.3.2.1 Environmental Consequences

3.3.13.3.3.1.1 FCTC Site 1

The following are environmental consequences attributed to utilities for operations-related activities:

Water Supply. Water for the potential CIS operations activities would be provided from either commercial sources or by onsite wells.

If commercial water sources would be used, based on the assumed demand (275 gpm) versus the total capacity, no adverse impacts would occur. For the commercial water sources, it has also been assumed that the connections and piping would be provided along existing road ROWs or within the FCTC Site 1 footprint; therefore, environmental impacts would be negligible.

If an onsite water supply were used to fulfil the routine demand (275 gpm), it would be provided by onsite wells. Based on hydrogeologic information provided for aquifers in the area of the CIS footprint (to produce up to 600 gpm or greater), onsite groundwater from wells should be adequate to meet the demand during the CIS operations. If FCTC Site 1 is selected, additional evaluation of well location, drilling of test wells, and a pump test to determine well capacity and degree of potential water quality would be provided. Any wells installed at FCTC Site 1 for potable and non-potable water use would need to be drilled and installed in accordance to MDEQ well requirements, and also would be treated as needed in accordance with MDEQ requirements.

Regardless, of whether onsite water was provided for routine operations, as described in Section 2.4.1.2, an on onsite source (groundwater provided by wells) would be provided and used for an emergency/backup water source. A water supply facility would be provided and designed to supply and distribute water to the CIS facilities for all necessary capabilities in an autonomous mode for a period should conditions warrant. This facility system would consist of wells, water treatment equipment, pumps, and storage tank to distribute potable water. In addition to the water supply system for potable water, a fire protection water supply and storage system would also be provided for the CIS. Both the potable water supply and fire protection systems would be designed and operated in accordance with and applicable state (including MDEQ) and local requirements. As described previously provisions to treat the groundwater would be provided in accordance with MDEQ requirements.

Overall, whether used for routine operations or only for backup/emergency potential use during operations, environmental impacts associated with use of an onsite groundwater for operations of the CIS facilities via onsite wells would have minor impacts.

Wastewater. Wastewater and sanitary sewage management during potential CIS operations are assumed to be provided through commercial sources (connected to existing sources) or as described in Section 2.4.1.2, provided by an onsite wastewater facility constructed as part of the CIS. For either of these wastewater management services, the demand is assumed to be 100 gpm.

If commercial sources are used, based on the assumed demand versus the capacity no adverse impacts would incur. Also if commercial wastewater management is provided, it has been assumed that the connections and piping would be provided along existing road ROWs or within the FCTC Site 1 footprint.

If provided by an onsite facility, as described in Section 2.4.1.2, the facility would be designed and built based on the unique size requirement for the specific CIS location. If provided, the onsite wastewater management facility would be designed and operated in accordance with UFC and applicable state (including MDEQ) and local requirements. Specific provisions would include those related to any treated and permitted wastewater discharge and/or residual waste disposal requirements.

Overall whether wastewater services are provided by commercial sources or by an onsite CIS-specific facility, environmental impacts related to these services would be negligible.

Solid Waste. Solid waste generated during operational activities would be addressed by an offsite commercial source. Therefore, negligible impacts from solid waste disposal during the CIS operations for FCTC Site 1 would occur.

Electrical Power. Electrical power for routine operations electrical power would be provided by a commercial source(s), whereas an onsite power generation source would be provided for backup and emergency services. A demand of 10 MW has been assumed for electrical power services.

Commercial power for the CIS operations could be provided by Consumers Energy. If a substation would need to be provided, it has been assumed that it would be provided by Consumers Energy at a location offsite. Routing of services from either of these sources would be provided within existing road ROWs.

In addition to commercial power sources for routine operations, a backup and emergency power generator system would also be provided for the CIS. As described in Section 2.4.1.2, the backup power plant would consist of an estimated four 3-MW diesel generators, switchgear, operations room, and maintenance area. The power plant would be operated with diesel supplied from dedicated day tanks supplied from larger fuel tanks. The impacts related to emissions generated from the operation of this power plant as well as fuel storage and use has been discussed in Section 3.3.1 Air Quality. Additional impacts related to fuel storage and use has also been discussed in Section 3.3.6 Hazardous Materials and Hazardous Waste Management. In addition to the power plant, as defined in Section 2.4.1.2, a substation would be provided for the CIS. This substation would provide electrical service interface with the commercial and the CIS power plant. The specific size of this substation would be determined during the design process. Infrastructure for electrical service lines throughout the CIS would be provided by buried duct banks.

Overall whether electrical services would be provided by commercial sources or by an onsite CIS facility, environmental impacts associated directly with these services would be negligible. As indicated, additional evaluation of impacts related to emissions and handling of fuel for the backup emergency electrical power generation plant has also been provided in the Section 3.3.1 Air Quality and Section 3.3.6 Hazardous Materials/Hazardous Waste.

Natural Gas or Other Heating Fuel Sources. Heating of the CIS facilities during operations would typically be provided with natural gas or provided with some alternative fuel source (kerosene or diesel), or by electricity. For the potential CIS operations, an estimated 7 MBtu/hr heating load capacity would be required. Due to the nearby supply natural gas would be the assumed fuel source for heating. Fuel oil (kerosene or diesel) fired-boilers could also be used as an alternative to natural gas to provide any required heating loads. Fuel oil is available through several vendors within the vicinity of FCTC. Provisions for accounting for natural gas fired-heating systems emissions have been provided for in Section 3.3.1 Air Quality for CIS operations.

Overall, because the source of natural gas or fuel oil appears readily available to meet the heating requirements for the CIS facilities, environmental impacts associated directly with these services would be negligible. As previously indicated, additional evaluation of impacts related to emissions have been provided in the Section 3.3.1 Air Quality.

Communication (telephone and Internet). Communication (telephone and internet) systems for the CIS operations would be provided from existing fiber cable sources and routed in or along existing ROWs and therefore environmental impacts would be negligible.

3.3.13.3.3.1.2 FCTC Site 2

The environmental consequences for operations for utilities at FCTC Site 2 would be the same as those described for FCTC Site 1.

3.3.13.3.3.2 Mitigation

3.3.13.3.3.2.1 FCTC Site 1

Water. Because impacts associated with use of a commercial water source for CIS operations would be negligible, no mitigation would be required.

Wastewater. Because impacts associated with use of either commercial or onsite wastewater management for CIS operations would be negligible, no mitigation would be required.

Solid Waste. Because impacts associated with solid waste disposal for CIS operations would be negligible, no mitigation would be required.

Electrical. Because impacts associated with providing electrical power for CIS operations would be negligible, no mitigation would be required.

Natural Gas or Other Heating Fuel Sources. Because impacts associated with providing heating of facilities by natural gas or fuel oil during CIS operations would be negligible, no mitigation would be required.

Communication (telephone and Internet). Because impacts associated with providing communication services during CIS operations would be negligible, no mitigation would be required.

3.3.13.3.3.2.2 FCTC Site 2

Mitigations from operation of the CIS at FCTC Site 2 would be the same as those described for FCTC Site 1.

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3.3.14 Water Resources – FCTC Sites

Water resources include the quality, quantity, physical characteristics, and use of groundwater and surface waters. This section describes the existing water resource conditions at the project site and construction and operations-related impacts and mitigation.

3.3.14.1 Regulatory Framework – Water Resources – FCTC Sites

There are a variety of laws, regulations, and requirements that must be taken into consideration when determining the effects of a potential deployment and alternatives on water resources including, but not limited to:

- Clean Water Act (CWA) Section 401, Water Quality Certification, 1986 provides states with the authority to ensure that federal agencies will not issue permits or licenses that violate the water quality standards.
- CWA Section 404, Permits for Dredged or Fill Material, 1977 establishes a program to regulate the discharge of dredged or fill material into the waters of the United States, including wetlands.
- CWA Section 402, National Pollutants Discharge Elimination System, 1972 regulates the discharge of storm water and wastewater to surface waters of the United States.
- CWA Section 303(d), 1972 requires that all states, territories and authorized tribes designate and prioritize cleanup of waters that are too degraded to meet water quality standards (impaired waters).
- Endangered Species Act, 1973 protects and provides for recovery programs for imperiled species and the ecosystems upon which they depend. Under Section 7 of the ESA, federal agencies are required to coordinate their actions with the USFWS and the NOAA to prevent jeopardizing the continued existence of species.
- NEPA, 1969 requires that water resources be fully considered prior to undertaking any major federal action that significantly affects the environment.
- 40 CFR Part 112, Oil Pollution Prevention establishes procedures, methods, equipment, and other requirements to prevent the discharge of oil from non-transportation-related onshore and offshore facilities into or upon the navigable waters of the United States.
- 40 CFR Part 651, Environmental Analysis of Army Actions regulates environmental protection and enhancement and provides the framework for the U.S. Army Environmental Management System.
- AR 200-1 Environmental Protection and Enhancement implements policy for the integrated management of natural resources (including biological and earth resources) on property and lands managed and/or controlled by the DoD.
- DoD Instruction 4715.03, Natural Resources Conservation Program implements the NEPA and establishes the U.S. Army's policies and responsibilities for considering environmental issues in planning and decision-making.

- U.S. Department of the Army, Technical Manual 5-633, Fish and Wildlife Management provides civil engineering requirements for all new and renovated government-owned facilities for the DoD.
- Michigan Natural Resources and Environmental Protection Act, 1994 PA 451 sets forth policies for protecting and preserving Michigan's lakes rivers, streams, pond, and groundwater to protect human and natural resources.
- UFC 3-210-01 Civil Engineering provides civil engineering requirements for all new and renovated government-owned facilities for the DoD.
- UFC 3-210-10 Low Impact Development provides technical criteria, technical requirements, and references for storm water planning and management at DoD projects.
- Section 438 of the Energy Independence and Security Act (EISA) implements requirements for the reduction of storm water runoff associated with new construction of current and future DoD projects.

These laws, regulations, and requirements identify the compliance process, define responsibilities of the federal agency proposing an action, and coordination with appropriate public agencies and institutions. A 'federal action' is a project or program funded in whole or in part by a federal agency, an action being implemented on behalf of a federal agency, or one that requires a federal permit, license, or approval.

3.3.14.2 Affected Environment – Water Resources – FCTC Sites

3.3.14.2.1 FCTC Site 1

3.3.14.2.1.1 Surface Waters - FCTC Site 1

Watersheds. A watershed represents a dividing ridge separating one drainage area from others or the area that drains into a river or lake. FCTC primarily lies within the Kalamazoo Watershed (U. S. Geological Survey [USGS] 8-digit hydrologic unit code (HUC) [HUC-8] 04050001), which covers 2,030 square miles (mi2), drains eight counties into Southwest Lower Michigan, discharges into Lake Michigan at Saugatuck, Michigan, and contains the Kalamazoo River. The Kalamazoo River above FCTC has a drainage area of approximately 910 mi2. A small portion of the south end of FCTC lies within the St. Joseph Watershed (HUC-8 04050001) which covers 4,694 mi2, spans the Michigan-Indiana border and drains into Lake Michigan at St. Joseph, Michigan via the St. Joseph River. Two sub-watersheds of the St. Joseph Watershed fall within the majority of the FCTC: (1) Eagle Lake-Kalamazoo sub-watershed (12-HUC (HUC-12) 040500030508); and (2) Harts Lake-Kalamazoo sub-watershed (HUC-12 040500030503), with drainage areas of approximately 30.5 mi2 and 24.6 mi2, respectively. A small, south-central portion of the FCTC is within the Headwaters Portage River sub-watershed (HUC-12 040500010501) which discharges into the St. Joseph River. The Headwaters Portage River sub-watershed above FCTC encompasses a drainage area of approximately 95.3 mi2.

Small portions of the extreme east side of the FCTC are within the Minges Brook sub-watershed (HUC-12 040500030410), which discharges into the Kalamazoo River. The Minges Brook Watershed, which is a sub-watershed to the Kalamazoo River Watershed, encompasses approximately 27.6 mi2 above FCTC (MDEQ, 2008; USACE, 2002) (refer to Figure 3.3.14-1).

None of the potential CIS deployment components lie within the St. Joseph Watershed or sub-watersheds. While a portion of the FCTC Site 1 footprint is within the Hart's Lake Kalamazoo sub-watershed, the majority of FCTC Site 1 footprint falls within the Eagle Lake-Kalamazoo sub-watershed (USEPA, 2013a) (refer to Figure 3.3.14-1).

Groundwater flows generally in a north and northwest direction toward the Kalamazoo River (refer to Figure 3.3.14-2). Surface water drainage of FCTC Site 1 follows surface elevations and tributaries of local surface waters, and also flows in a north and northwest direction toward the Kalamazoo River and into existing surface water features. The extreme southwest portion of FCTC Site 1 discharges in a southerly direction. Surface water drainage of the FCTC Site 1 is toward the north and northeast in the direction of the Kalamazoo River (USACE, 2002) (refer to Figure 3.3.14-3).

Surface Water Use. Surface waters in the region are primarily used for agricultural, industrial, navigational, and recreational uses. The only source for drinking water in the region is from groundwater due to the high groundwater recharge rates and good water quality (refer to Section 3.3.14.2.1.1.3 for further discussion of groundwater quality). According to available resources, FCTC does not appear to use surface waters; however, outside of FCTC, surface waters such as Whitford Lake, Lawler Lake, Eagle Lake (within FCRA) and Hart's Lake are primarily used for recreational purposes.

Prominent Local Surface Water Features. Prominent surface water resources within the FCTC installation are Whitman Lake (8.4 acres); the unnamed inflow and outflow streams associated with Whitman Lake; and unnamed streams located in the west central and northeast areas of FCTC. Other small, permanent and seasonal unnamed lakes are scattered within the FCTC area, most of which are surrounded by extensive wetlands (MDMVA, 2012) (refer to Figure 3.3.14-4). Three prairie fens (unique wetland communities where sedges, grasses, and other grass-like plants occur) are on the FCTC installation: Whitman Lake fen, Mott Road fen, and an unnamed fen.

The Whitman fen is located on the southern border of Whitman Lake. The unnamed fen is located approximately halfway between Whitman Lake and Eagle Lake. Mott Road fen is located within the CIS footprint southeast of Lawler Lake (Shu-Guang Li, 2015). Details regarding wetlands and prairie fens can be found in Section 3.3.15.

The tributary into Whitman Lake flows in a northeasterly direction and the outflow stream flows in a northwesterly direction into Eagle Lake (70.7 acres), located in the FCRA. The unnamed tributary located in the west central portion of FCTC flows into Jackson Hole Lake (61 acres), also located in the FCRA along with Lawler Lake and Whitford Lake. Eagle Lake and Jackson Hole, Lawler and Whitford Lakes are used for recreation including boating, fishing, and swimming. Tributaries that discharge into these lakes are through a series of wetland complexes and the outflow is into the Kalamazoo River. The prairie fens are associated with these tributaries and are maintained by groundwater that is sourced from seeps and springs (MDMVA, 2012).

Hart's Lake is a nearby surface water feature located beyond the east boundary of FCTC. The outflow from Hart's Lake, which migrates to the northeast, discharges into the Kalamazoo River. Hart's Lake (55 acres) is owned by the Calhoun Conservation District (MDNR, 2014). Hart's Lake is used for non-motorized, passive recreation, catch-and release fishing, hiking and birding (MDNR, 2014).

The MDEQ beneficial use designations for water bodies are identified in the Michigan Administrative Code (Water Resources Protection, Part 4, R 323.110, Designated Uses). Beneficial use designations describe existing or potential uses of waterbodies and include agriculture, navigation, industrial water supply, warm and cold water fishery, other indigenous aquatic life, partial and whole body contact recreation, and fish consumption. Designated beneficial uses are assigned to a water body or segment and correspond with surface water quality standards in that for each parameter there are specific numeric criteria for each designated use (MLARA, 2015).

Whitman Lake is off-limits to the public and has no designated use. Eagle Lake, Hart's Lake, Whitford Lake, and Lawler Lake all have designated uses for agriculture, industrial water supply and navigation. Jackson Hole Lake has not been assessed for designated uses. The portion of the Kalamazoo River that is located in HUC-12 040500030508 has designated uses that include cold water fishery, fish consumption, indigenous aquatic life and wildlife, body contact recreation, and warm water fishery (USEPA, 2013a).

Surface Water Features within FCTC Site 1 and Mission Support Facilities. While there are no identified lakes, rivers, or streams within CIS footprint, wetland areas are present. Approximately 20.25 acres of wetlands are located within the potential FCTC Site 1 footprint (DLZ, 2015) (refer to Figure 3.3.14-4). Further discussion of wetlands can be found in Section 3.3.15.

3.3.14.2.1.1.1 Surface Water Quality

Surface waters on and around the FCTC (including FCTC Site 1) exhibit moderate to good quality conditions, depending on the water body in question and assessed designated uses. Water quality in local water bodies has been degraded due to past industry-related pollutant discharges, a condition that persists to the present time. The following paragraphs describe water quality in greater detail, and cite several sources which were reviewed in assessing the current water quality conditions.

Regional Surface Water Quality

Locations along the Kalamazoo River and other hydraulically-connected surface waters are considered Superfund cleanup sites in the area that spans 80 miles from the Morrow Lake Dam to the mouth of the Kalamazoo River at the entrance to Michigan Lake due to PCB contamination. The USEPA took over as lead agency for the project in 2002 at the request of MDEQ. The sources of the PCBs are primarily from landfills and paper mills located along the river west of FCTC. The USEPA and MDEQ are currently conducting remedial investigations at the mouth of the Kalamazoo River and at specified locations designated as ‘operable units’. Three operable units have been identified: Allied Landfill, located in the City of Kalamazoo, Plainwell Paper Mill located in Plainwell, and Kalamazoo River Area 1, the 22-mile segment spanning from Morrow Dam to Plainwell Dam. Area 1 flows through the communities of Comstock, Kalamazoo, Parchment and Plainwell. A proposed cleanup plan for each operable unit has been posted on the USEPA’s website for public comment. No finalized plans have been issued at this time (USEPA, 2015e).

Kalamazoo River Watershed Management Plan. The Kalamazoo River Watershed Management Plan (WMP) further details the history and extent of PCB contamination. The WMP notes that, while there has been an elimination of PCB discharges due to a ban on their production, approximately 120,000 pounds of PCBs continue to contaminate sediments, soils and river segments within the river. The WMP acknowledges the USEPA/MDEQ cleanup efforts for the 80-mile river segment (KRWC, 2011). Further information regarding the specific watershed plan can be found in Section 3.3.14.2.1.3.4.

The Plan also identifies point sources and non-point sources that impair designated uses in the Kalamazoo River Watershed. Specific impaired designated uses to the Kalamazoo River include other indigenous aquatic life and fish consumption caused by mercury sources from coal-fired power generation facilities and PCBs in the water column, and PCBs in fish tissue from landfills, paper mills and industry recycling processes located west of FCTC. Hart’s Lake-Kalamazoo sub-watershed was also noted as the third largest nutrient and sediment non-point source contributor in 2011 (most recent data), with a mean runoff volume of 4,560 acre-feet/year (ac-ft/yr), total suspended solids (TSS) loading of 749 tons/year, and combined nutrient loading (nitrogen and phosphorus) of 40,267 tpy. In comparison, Eagle Lake-Kalamazoo sub-watershed was shown to contribute a mean runoff volume of 2,028 ac-ft/yr, TSS loading of 324 tpy, and a combined nutrient loading of 18,291 tpy.

Michigan Surface Water Information System. Information gathered from Michigan’s Surface Water Information System show approximately 22 river miles of the Kalamazoo River from Morrow Pond downstream to Battle Creek is listed as an AOC due to elevated concentrations of PCBs in the river sediment and fish tissue. This reach of the Kalamazoo River flows by FCTC Site 1 approximately 3 miles west. The 22-mile reach begins at a location that is approximately 5 miles west of FCTC Site 1 at Morrow Pond and ends approximately 6 miles east of FCTC Site 1 in the City of Battle Creek (MDEQ, 2015a).

This reach of the Kalamazoo River is located in USGS HUC 040500030508. Its designated uses include cold water fishery, fish consumption, indigenous aquatic life and wildlife, body contact recreation, and warm water fishery. It is not in attainment for fish consumption and indigenous aquatic life and wildlife uses; however, it is in attainment for cold water fishery and warm water fishery. A fish advisory was issued as far back as 2006 for this reach and it remains in effect today. Data have not been collected or analyzed to determine if this reach is in attainment for body contact recreation (MDEQ, 2015a).

USEPA MyWaters Mapper. USEPA MyWaters Mapper currently lists causes of impairment for reporting year 2010 for the segment of the Kalamazoo River that flows along the upper boundary of FCTC (HUC 040500030508). More recent data has not been updated for this segment. The causes of impairment are listed as mercury in the water column, PCBs in the water column, and PCBs in fish tissue. The USEPA does not show data to indicate which beneficial use or uses are impaired due to these impairments or their probable sources; however, the database does indicate that MDEQ is working to develop total maximum daily loads (TMDLs) for the river (USEPA, 2013a).

MDEQ Impaired Waterbody History Report. In MDEQ's 2014 303(d) Impaired Waterbody History Report, the Section 303(d) list consists of assessed HUC units where a TMDL is either developed or proposed to be developed to address causes of impairments. Development of a TMDL is preceded by collecting water quality data to document current pollutant loads within a water body of concern and locate potential sources of the contaminants. 303(d) report submittals by the states are required every 2 years per Section 303(d) of the CWA. The report details that the current impaired designated uses of the Kalamazoo River segment and unnamed tributaries within Fort Custer located in HUC 040500030508 (an approximate 19 mile reach) are fish consumption and other indigenous aquatic life, caused by mercury and PCBs in the water column and PCBs in fish tissue. Kalamazoo River's TMDL was scheduled for development in 2014, but has yet to be completed for this segment of the river (MDEQ, 2014a).

<u>Local Surface Water Quality</u>

As previously mentioned, the inflow and outflow from Whitman Lake located northwest of FCTC Site 1, is through a series of wetland complexes. Whitman Lake then flows into Eagle Lake. Michigan Surface Water Information System identifies the inflow and outflow segments from these water bodies, including the 22.3-mile segment of the Kalamazoo River that receives these flows (assessment unit identification number [AUID] 040500030508-01), as not supporting fish consumption due to PCB contamination in the river sediment and fish tissue. To elaborate, the AUID is assigned to identify water bodies or segments of streams that have been assessed, and typically reflects HUC identifiers. Likewise, the series of wetland complexes that comprise the inflow to Eagle Lake are also identified as not supporting fish consumption due to PCB contamination. The PCB contamination associated with Whitman Lake inflow and outflow segments as well as the inflow into Eagle Lake are included under the Kalamazoo River AOC (MDEQ, 2015a). The USEPA MyWaters Mapper reported similar findings for AUID 040500030508-01, with the addition of mercury found in the water column of the inflow and outflow streams of Whitman, Eagle and Jackson Hole Lakes, and further identifies the area as not supporting fish consumption or other indigenous aquatic life with a probable source listed as atmospheric deposition of toxics (refer to Figure 3.3.14-5). Sediment contamination data were not found. The MyWaters Mapper, however, did identify Eagle Lake, Hart's Lake and Whitford Lake as having 'good' quality and not having impairments to designated uses, although these water bodies were only assessed for agricultural use, industrial water supply and navigation, and did not have any further assessments for other designated uses (USEPA, 2013a).

MDEQ Water Quality Study. Surface water samples were collected in 1997 by the MDEQ from several wetlands and streams to establish baseline water quality (refer to Figure 3.3.14-6). A total of two samples were collected from within the FCTC, five samples along the installation perimeter, and one sample from a location downstream of Hart's Lake. The MDEQ compared the analytical results to corresponding surface water quality standards for public health. Michigan surface water quality standards are located in the Michigan Administrative Code, Part 4 Water Quality Standards, R323. 1057 Toxic Substances (Rule 57). Rule 57 identifies the chemical and corresponding numeric standards for the protection of public health, plant and animal life, and the designated water use. The public health numeric standards are categorized into human non-cancer values and human cancer values for 'drinking' and 'non-drinking.' 'Drinking' refers to drinking the water, consuming fish from the water, and conducting water-related activities, whereas 'non-drinking' refers to non-drinking surface water sources. The analytical results showed surface water samples did not exceed the 'drink' and 'non-drink' numeric standards (USACE, 2002).

Kellogg Biological Station 1996 Water Quality Study. The Kellogg Biological Station has collected surface water samples at FCTC and from surrounding properties since 1996 (refer to Figure 3.3.14-6). Analytical parameters for these sampling events include general water quality parameters such as pH, metals, dissolved oxygen, nitrate, and phosphate concentrations. Data and discussions on each sampling location along with conclusions were not available for inclusion in this discussion. The analytical results indicated elevated concentrations of nitrate, nitrite, potassium and sodium phosphate (MDMVA, 2012). However, there are no Rule 57 water quality criteria established for these parameters; thus, the elevated levels were not compared to established criteria (MDMVA, 2012).

URS Operational Range Phase II Site Assessment. A 2013 Phase II study was performed by URS and Arcadis to determine whether munitions constituents of concern (MCOCs) were leaving the operational firing ranges, located in the northernmost areas of FCTC, by an identified pathway, which could pose a risk to downstream and downgradient receptors. MCOCs are defined as containing constituents of the following (all of which are chemical compounds found in explosives):

- Cyclotetramethylenetetranitramine.
- Cyclotrimethylenetrinitramine (RDX).
- Trinitrotoluene (TNT).
- Pentaerythritoltetranitrate.
- 2,4-Dinitrotoluene (2,4-DNT).
- 2,6-DNT
- Nitroglycerin.

Samples were also analyzed for metals (antimony, copper, Pb, and zinc) and perchlorate (URS, 2013b). The Phase II assessment included areas that were heavily used firing ranges with potential MCOC migration pathways via surface waters and groundwater with nearby receptors. These areas primarily consisted of the small arms range and the north-central portion of FCTC. A total of nine sampling events were conducted in the identified areas, including one sediment, four surface water, and four groundwater sampling events. The sampling events for surface water considered the potential diurnal and seasonal variations, and took place between August 2011 and March 2012 in wet and dry seasons (URS, 2013b).

Surface water, sediment, and groundwater sample locations can be found on Figure 3.3.14-7. Analytical results were compared to Project Action Limits (PALs). PALs are derived from the DoD Range and Munitions Use Subcommittee *Operational Range Assessment Screening Values*, the USEPA's *National Recommended Water Quality Criteria*, and the Michigan Part 201 *Generic Cleanup Criteria and Screening Levels, Residential Drinking Water Criteria* (URS, 2013b).

Surface water and sediment samples were collected in locations S1 through S4. RDX was detected in S1 (0.20 micrograms per liter [µg/L]), but was below the PAL (0.61 µg/L). Explosives were not detected in other sampling locations. Perchlorate was detected at location S3, but also was below the PAL (15 µg/L). Perchlorate was not detected at other locations. No metals detection in any of the surface water samples exceeded PALs. The highest measurement of metals was found in location S1, which is closest to the small arms ranges; however, this result was below the PAL. Location S2, downstream from S1, was found to have lower concentrations of metals, indicating that metals concentrations are being reduced as flow travels downstream. Background pH levels were taken during sampling collection and found to fall between 7.38 and 8.24 standard units. No explosives, metals or perchlorate were detected in any sediment samples above the PALs.

Groundwater samples were collected from 10 existing monitoring wells and three newly installed wells: MW-A1, MW-A2, and MW-B1 (refer to Figure 3.3.14-7). The analyses found that no explosives or perchlorate were detected in any groundwater samples. Copper, zinc, and antimony were detected, but were below PALs at all locations. Lead was detected and exceeded the PAL (4 µg/L) at three wells: MW-3, MW-4, and MW-6A. No additional metals were detected at other well locations.

Based on the locations of the wells, it is suspected that a lead plume has been present in a concentrated area of the small arms ranges. According to the report, the extent of the plume is located near MW-7A, downgradient from MW-3, where the lead concentrations were highest without exceeding the PAL. The report concludes that it is unlikely that lead is migrating offsite and posing a risk to receptors because lead was not detected in MW-A1 and MW-A2, further downgradient of MW-3, and given the overall distance to reach offsite locations. No unacceptable risk to offsite receptors was determined to be associated from potential contaminant sources and operations within FCTC (URS, 2013b).

Black & Veatch 2014 Environmental Sampling Event. Details regarding the surface water and sediment sampling as part of a comprehensive environmental study can be found in Section 3.3. 14.2.1.1.

3.3.14.2.1.2 Floodplains – FCTC Site 1

Floodplain mapping has not been performed at FCTC; therefore, baseline floodplain conditions are not known at the time of this writing. A formal evaluation would be required to determine existing floodplain conditions at FCTC Site 1.

3.3.14.2.1.3 Groundwater – FCTC Site 1

3.3.14.2.1.3.1 Groundwater Physical Attributes

The regional hydrogeology consists of both glacial outwash and bedrock aquifers. The principal aquifer that underlies FCTC Site 1 is the Marshall Sandstone formation. This is a glacial formation that extends throughout the central part of Michigan from Lake Michigan to Lake Huron. This formation results in a high yield and provides good water quality to the area.

Groundwater recharge located within FCTC is facilitated by large areas of very permeable Oshtemo complex soils lying over the northern third of the site. Groundwater flow moves to the north and northwest towards the Kalamazoo River (refer to Figure 3.3.14-2). Hydraulic conductivity within the site was recently calculated as 80 ft/day, which indicates a high recharge rate within the area (Shu-Guang Li, 2015). Perched water tables have also been found on the site, causing the depth to groundwater within this formation to vary from zero to approximately 135 ft bgs.

Specifically within the FCTC Site 1 footprint, groundwater was typically found greater than 50 ft bgs (BVSPC, 2015a). Groundwater and surface water are hydraulically connected and groundwater seeps and springs provide water source that maintain the wetlands, lakes and streams on FCTC (MDMVA, 2012). The glacial outwash water table moves downgradient to the north and northwest towards the Kalamazoo River and generally follows the surface water and topography (BVSPC, 2015a). The elevations in the area range from 1061 feet above MSL in the southeast portion of the FCTC Site 1 footprint to 741 feet near the Kalamazoo River (Shu-Guang Li, 2015).

3.3.14.2.1.3.2 Groundwater Use

Groundwater within the Kalamazoo River Watershed provides the only source of water for residences and communities, and a major source for industries, and agriculture. As a result of the complex hydrogeology in the region, typical groundwater yields range from 20 to 1,400 gpm (KRWC, 2011).

FCTC obtains its drinking water from the City of Battle Creek (Snell, 2001). There are no groundwater wells within FCTC registered with the MDEQ. There are four former homesteads located within the boundary of FCTC Site 1, established from previous agricultural use of the area, two of which have abandoned wells (refer to Figure 3.3.14-8). The USACE identified and abandoned these wells in accordance with the FCTC's Groundwater Protection Plan recommendations prescribed to Fort Custer. More information regarding the well identification and abandonment can be found in Section 3.3.14.2.1.3.5.

The nearest municipal well field is located in the Village of Augusta, about 3 miles northwest of FCTC. The Village of Augusta currently maintains a Wellhead Protection Plan, of which the southernmost area ends at the Kalamazoo River's edge (Snell 2001).

A map identifying the locations of registered groundwater wells within a 2-mile radius of the FCTC boundary can be seen on Figure 3.3.14-9. A 2-mile radius was selected to capture groundwater data for wells nearest to the installation. These well locations were found using MDEQ's Wellogic Database and GeoWebFace Interactive Map (MDEQ, 2015b; MDEQ, 2015c) and were assigned identification numbers by MDEQ.

3.3.14.2.1.3.3 Groundwater Quality

Groundwater in the vicinity of Fort Custer exhibits good quality conditions for uses such as drinking, commercial and industrial uses. In certain cases, groundwater within Fort Custer is considered contaminated, primarily in the northern region of Fort Custer, where Fort Custer's firing ranges as well as local commercial and industrial uses have caused elevated levels of contaminants to be detected. The following paragraphs describe water quality in greater detail, and cite several sources which were reviewed in assessing the current water quality conditions.

Drinking Water Quality. While groundwater is the primary source of drinking water in Kalamazoo County, it is also vulnerable to contamination from spills, leaks, and onsite sewage systems. Kalamazoo County reported that the predominant sources of groundwater contamination in the county are leaking underground storage tanks from industrial or commercial locations (Kalamazoo, 2015b). The county also reported elevated nitrate concentrations in groundwater in certain areas from onsite sewage treatment facilities and non-point sources alike; however, these locations were not identified and thus, the locations of the sources are unknown.

Information regarding the water quality of Calhoun County is not made readily available to the public.

Water quality data from the previously mentioned registered groundwater wells located in Kalamazoo County is publicly available via the Well Water Quality Search function within the Kalamazoo County Government website; however, not all wells located in Kalamazoo County have records made available online; therefore, only six of the identified wells have water quality data available. The data can be viewed in Table 3.3.14-1.

According to these data, local water is generally hard, with very few instances of falling out of the range of 'good' standards (not requiring further treatment) as determined by Kalamazoo County Environmental Health Division, and is considered generally 'good' for consumption (Kalamazoo, 2015b). While hardness levels are elevated, hardness generally does not provide a health impact. Water quality is assumed to be the same or similar to the data found in Kalamazoo County records.

Parsons Engineering Science, Inc. 1996 Water Quality Study. In 1996, Parsons Engineering Science, Inc. performed a groundwater investigation at the FCRA for MDEQ's Part 201 Residential and Nonresidential groundwater and soil Cleanup Criteria. Groundwater samples were collected from four FCRA wells and one private well. The wells were located in the Former Aerial Bombardment and Fuel Tank Drop Zone Area, the Cemetery Landfill Area, the Hand Grenade Training Area North and the Hand Grenade Training Area South. Based upon analytical results, the investigation concluded there was no impact to the environment at these locations.

However, it was recommended at that time that additional groundwater sampling occur at the Cemetery Landfill Area for suspected PCB contamination due to leachate leakage in the groundwater. Locations and data from this sampling event were not made publicly available for review (MDMVA, 2012).

Snell Environmental Group 1999 Sampling Analysis. A 1999 sampling event conducted by Snell Environmental Group for elevated metals in soil and groundwater was used to determine environmental risk associated with past and present use of small arms firing ranges at FCTC. While the sampling event was focused on the northern portion of FCTC where the firing ranges are located, several of the background sampling locations were located within or adjacent to FCTC Site 1. The following sampling locations were included during the sampling event: BGW-3 (west of FCTC Site 1), BGW-4 (east of FCTC Site 1), MW-14 (to the north and down gradient in groundwater flow to FCTC Site 1) and SW-9 (located adjacent to BGW-3). Samples collected at BGW-designated wells include soil borings and groundwater, while the SW-designated location was sampled only for surface water and sediment. MW-13 and MW-14 were sampled for solely for groundwater.

Table 3.3.14-1 Kalamazoo County Raw Water Quality Sampling Results - FCTC

Well ID	Well Type	Sample Date	Nitrate	Nitrite	Hardness[3]	Fluoride	Chloride	Sodium	Sulfate	Arsenic	Iron
39000011039	Other[7]	10-11-1989	0	0	323	0.2	0	0	0	0	0.9
		04-22-1987	0	0	249	0.2	0	0	0	0	0
		10-06-1986	0	0	28	0.2	0	93	0	0	0
		04-05-1986	0	0	256	0.2	0	0	0	0	0
		02-22-1984	0	0	243	0.2	0	0	0	0	0.1
		08-16-1983	0	0	241	0.2	0	0	0	0	0
		02-24-1983	0	0	216	0.2	0	0	0	0	0.1
		01-10-1983	0	0	282	0.1	4	0	0	0	0.1
39000011042	Type II Public[5]	04-30-1987	0	0	307	0.1	0	0	0	0	3.1
		09-19-1983	0	0	466	0.2	26	29	0	0	0.2
		03-08-1988	0	0	345	0.2	0	0	0	0	0
39000011687	Type I Public[4]	08-08-1985	0	0	265	0.1	0	0	0	0	0.2
		08-08-1985	0	0	261	0.1	0	0	0	0	0.3
39000011688	Type I Public	07-01-1993	0.2	0	316	0.1	10	0	67	0	0
		10-18-1991	0	0	322	0.2	0	0	0	0	0.2
		08-04-1988	0	0	334	0.1	0	0	0	0	0.2
		03-30-1988	0	0	294	0.2	0	0	0	0	0.1
		08-22-1986	0	0	308	0.2	0	0	0	0	0
		07-30-1986	0	0	304	0.2	0	0	0	0	0.8
		08-22-1983	0	0	313	0.1	0	0	0	0	0.1
39000016318	Household[6]	05-30-1986	3.7	0	241	0	0	18	0	0	0
39000016319	Household	08-20-2003	0	0	348	0.12	31.27	11	34.67	0	0
		05-07-2001	0.18	0.26	0	0	49.6	258	73.6	0	0.6
Kalamazoo County Environmental Health Division, mg/L[1]			≥ 3	≥ 0.3	25-100	1.0-1.2	≥ 20	≥ 20	≥ 50	≥ 0.010	≥ 0.2
National Primary Drinking Water Regulations, mg/L[2]			10	1	-	4.0	-	-	-	0.010	
National Secondary Drinking Water Regulations, mg/L[2]			-	-	-	2.0	250	-	250	-	0.3

Notes:

All results in milligrams per liter (mg/L).

1. Kalamazoo County Environmental Health Division Raw Water Quality Standards acceptable levels for 'good' quality.
2. USEPA's National Primary Drinking Water Regulations are legally enforceable standards that apply to public water systems (not 'household' or 'other') Comparisons are made for general water quality only.
3. Water with concentrations over 180 mg/L as $CaCO_3$ is considered to be 'hard'.
4. Type I Public wells are defined as providing year-round service to not less than 25 residents or not less than 15 living units.
5. Type II Public wells are defined as serving not less than 25 people for at least 6 months per year.
6. Household wells are defined as providing a private water supply to a single living unit.
7. Well type 'Other' indicates a non-potable water source.

Although the BGW-designated wells were meant only to analyze background soil conditions, results indicated that some metals, specifically arsenic and lead, had results higher than regulatory screening limits. According to the summary of sample results, screening limits were determined using MDEQ R 299.44, Generic Groundwater Cleanup Criteria, Residential Drinking Water Criteria and MDEQ R 57, Water Quality Values, Non-Drinking Water Human Noncancer Value. These results were determined to be a source of naturally-occurring elements in the soil at FCTC when compared to other background samples within FCTC boundaries. As a result, the data obtained from these sampling locations were used to establish upper background limits for comparison with other metal soil and sediment results obtained at FCTC. Since 2001, groundwater from these wells has been sampled annually. Throughout the historic sampling and analysis of groundwater sourced from the wells, metals have not been shown to exceed laboratory detection limits (BVSPC, 2015a) (refer to Figure 3.3.14-7).

2010 Petroleum Release. A confirmed petroleum release was identified in 2010 by MDEQ during the removal of underground storage tanks (USTs) at a site located southeast, beyond the FCTC installation boundary. A small portion of the contaminated groundwater plume extends onto the FCTC property; however, after remedial efforts by the responsible party, the source has been substantially reduced and natural attenuation by anaerobic biodegradation continues to occur. Groundwater contaminants from this event have not been detected in groundwater wells within FCTC (BVSPC, 2015a).

FCTC Annual Groundwater Monitoring. In the 2001 Groundwater Protection Plan, it was recommended to FCTC and USACE to install additional groundwater monitoring wells within FCTC to determine where potential groundwater contamination sources may occur. FCTC and USACE proceeded to install 21 monitoring wells to perform annual water quality sampling. Each groundwater sample is analyzed for total and dissolved antimony, arsenic, cadmium, chromium, copper, lead and zinc. Well sample locations are illustrated on Figure 3.3.14-10.

Results from the water quality sampling events are compared to Part 201 Residential Drinking Water Criteria and Part 201 Groundwater/Surface Water Interface Criteria. Based on the values, the Residential Drinking Water Criteria is generally the most stringent of limitations; however, Groundwater/Surface Water Interface Criteria have stricter limits for total and dissolved chromium (11 µg/L versus 100 µg/L as part of Drinking Water Criteria) (DLZ, 2014).

The 2014 sample results determined that MW-3 and MW-6A, located near the small arms firing ranges, outside of the FCTC Site 1 footprint, had levels of total and dissolved lead above the drinking water criteria. Referring to the URS 2013 study, this is located in the area of the lead plume. All other well locations were determined to be within Drinking Water and Groundwater/Surface Water Interface Criteria (DLZ, 2014).

Historically, results after 2009 indicate that metals concentrations in most wells decreased substantially until 2012, when levels increased slightly. However, since 2013, further reductions in metals concentrations were observed. This is likely due to the 2010 firing range berm reconstruction in the small arms ranges, which included sifting soil and removing lead bullet fragments and an addition of a lime and phosphate mixture to control lead migration (DLZ, 2014).

For wells nearest to FCTC Site 1 and Mission Support Facilities, BGW-3, BGW-4, and MW-14, concentrations of arsenic and lead were found above the Drinking Water Criteria from 2005 through 2006. Since 2006, the analytical results from these wells have generally shown values under the detection limits and below the thresholds of the Drinking Water Criteria (DLZ, 2014).

URS Operational Range Phase II Site Assessment. Details regarding the groundwater sampling as part of a comprehensive environmental study can be found in Section 3.3.14.2.1.1.

Black & Veatch 2014 Environmental Sampling Event. Black & Veatch performed additional environmental sampling events between September 29 and November 5, 2014 to further characterize and evaluate the presence of potential pollutants in the sediment, surface water, and groundwater. Samples were analyzed for VOCs, semi-volatile organic compounds (SVOCs), priority pollutant (PP) metals, pesticides, herbicides, PCBs, and explosive derivatives. The following discussion is a summary of the 2014 sampling event that occurred within FCTC Site 1 and subsequent analytical results.

The screening limits and upper background limits determined from Snell Environmental Group's 1999 sampling event was used as a basis for data evaluation. One monitoring well, MW-4, was installed to a depth of 22 feet, from which groundwater was analyzed for chemical parameters.

Site groundwater analysis consisted of reviewing existing groundwater data from wells, BGW-3 and BGW-4, along with a single sample taken from MW-4, all located in the FCTC Site 1 footprint. Only trace amounts of metals were detected from MW-4; however, the metals identified did not exceed screening limits. No other analytes were detected. 2013 data from BGW-3, BGW-4, and MW-14 concluded that no metals were detected; however, only metals have been historically analyzed from these wells.

One sediment sample was taken in the area of FCTC Site 1 (SWD1). The sediment contained low levels of VOCs and metals with one additional pesticide being detected. All compounds in the sediment were detected at levels below screening limits with the exception of arsenic, (result of 10.2 milligrams per kilogram (mg/kg), screening limit 5.8 mg/kg) which did not exceed the upper background limit (20.13 mg/kg). No other analytes were detected.

A total of three surface water samples were collected at FCTC, with only one sample located in the FCTC Site 1 area (FCTC-SWD1W). The surface water contained low levels of VOCs and metals, all of which were found to be below screening limits. No other analytes were detected (BVSPC, 2015a) (refer to Figure 3.3.14-7).

3.3.14.2.1.3.4 Regional Groundwater Management

Groundwater and surface water are connected where soils promote exchanges of water between the land surface, groundwater, streams, lakes, and wetlands. Thus, groundwater is susceptible to degradation of water quality where contaminants are mobile in groundwater. Urban and suburban land use reduces infiltration by diverting more water to drainage systems. Agriculture land with tile drainage systems result in less groundwater recharge. Groundwater quality is impacted by many human activities including fertilizer applications, septic system discharges, road salts, and the accidental release of oil or chemicals. One of the objectives associated with the Kalamazoo River WMP is to protect groundwater recharge and wellhead areas from contamination. To that end, the Kalamazoo River WMP identifies goals to protect groundwater (KRWC, 2011):

- Promote and implement coordinated land use planning in the Kalamazoo River Watershed.
- Protect open space and promote sustainable agriculture practices.
- Promote well head protection programs.
- Promote continued closure of abandoned wells.
- Determine current and future amount of groundwater withdrawal and its potential impacts.
- Develop strategies to prevent increased impervious surfaces in high recharge areas and to restore areas with high recharge potential.
- Promote stakeholder participation in state groundwater conservation programs and dispute resolution associated with groundwater withdrawal regulations.
- Encourage monitoring and increased regulation of commercial groundwater withdrawals.

3.3.14.2.1.3.5 Local Groundwater Management

A WMP was developed for FCTC by the USACE in 2002. The purpose of the WMP was to identify point and nonpoint source water pollution and apply BMPs to address water quality concerns. To accomplish this, three general tasks were developed:

- Compile all previous data and information describing the existing landscape, hydrology, and future development plans for FCTC that may identify potential sources of surface and groundwater contamination;
- Perform a field reconnaissance to verify the above information and characterize the dynamics of the watershed; and
- Conduct public meetings to provide a forum for exchange of information.

Snell Environmental Group was retained by the USACE in 2001 to develop a Groundwater Protection Plan for FCTC. The Groundwater Protection Plan is considered a component of the WMP. The primary objectives of the Groundwater Protection Plan were to a) locate and abandon drinking water sources associated with former homesteads within FCTC; b) develop regional and local hydrogeological and aquifer characterization for FCTC; and c) identify potential sources of groundwater contamination within and surrounding FCTC (USACE, 2002).

As part of the Groundwater Protection Plan, USACE conducted field reconnaissance to locate all former homesteads. As a result of the investigation, 48 former homesteads were found. Once the former homesteads were located, USACE initiated a search of each site for the former drinking water supply systems which included 2-inch or smaller diameter wells, crock wells, hand-dug wells and cisterns. USACE then obtained a drilling contractor to plug and abandon the discovered wells in accordance with Michigan Public Health Code. The USACE abandoned a total of 28 wells, 14 hand-dug wells, and 23 cisterns. The former homesteads were mapped, and abandonment records were provided to USACE. An additional 10 unidentified homestead sites may still be located within the northern section of FCTC near the small arms firing range (Snell, 2001).

3.3.14.2.2 FCTC Site 2

3.3.14.2.2.1 Surface Water – FCTC Site 2

Watersheds. Watersheds encompassing the FCTC and surrounding areas, including the FCTC Site 2 footprint, are described in Section 3.3.14.2.1.1 and are shown on Figure 3.3.14-1.

The FCTC Site 2 footprint falls within the Eagle Lake-Kalamazoo sub-watershed (USEPA, 2013) (refer to Figure 3.3.14-1).

Groundwater flow at the FCTC Site 2 is similar to that described for FCTC Site 1 in Section 3.3.14.2.1.1 and is shown on Figure 3.3.14-2. Similarly, surface water within the FCTC Site 2 generally flows in a northwest direction toward Lawler Lake, Whitford Lake, and the Kalamazoo River (refer to Figure 3.3.14-3).

Prominent Local Surface Water Features. Prominent surface water resources within the FCTC installation are described in Section 3.3.14.2.1.1 and are shown on Figure 3.3.14-4.

Surface Water Features within FCTC Site 2. While there are no identified lakes, rivers, or streams within the FCTC Site 2 footprint, wetland areas are present. Approximately 77.93 acres of wetlands are located within the FCTC Site 2 footprint (DLZ, 2015) (refer to Figure 3.3.14-4). Further discussion of wetlands can be found in Section 3.3.15.

Surface Water Quality. Surface waters on and around the FCTC (including FCTC Site 2) exhibit moderate to good quality conditions, depending on the water body in question. Water quality in local water bodies has been degraded due to past industry-related pollutant discharges, a condition that persists to the present time. The regional and local surface water quality conditions at FCTC Site 2 are the same as those described for FCTC Site 1.

3.3.14.2.2.2 Floodplains – FCTC Site 2

Floodplain mapping has not been performed at FCTC; therefore, baseline floodplain conditions are not known at the time of this writing. A formal evaluation would be required to determine existing floodplain conditions.

3.3.14.2.2.3 Groundwater – FCTC Site 2

3.3.14.2.2.3.1 Groundwater Physical Attributes

The general groundwater physical attributes for FCTC Site 2 are the same as those described for FCTC Site 1. However, groundwater was typically found at a depth less than 50 feet bgs within the footprint of FCTC Site 2.

3.3.14.2.2.3.2 Groundwater Use

Generally, the groundwater uses described for FCTC Site 2 are the same as those described for FCTC Site 1 with the exceptions discussed in this section. Three former homesteads, established from previous agricultural use of the area, are within the footprint of FCTC Site 2, all of which have abandoned wells (BCDPW, 2015; USACE, 2002). The USACE identified and abandoned these wells in accordance with FCTC's Groundwater Protection Plan recommendations prescribed to Fort Custer. The locations of the abandoned wells are shown on Figure 3.3.14-8. More information regarding the groundwater use and well identification and abandonment can be found in Section 3.3.14.2.1.5 (FCTC Site 1).

3.3.14.2.2.3.3 Groundwater Quality

Generally, the groundwater quality conditions described for FCTC Site 2 are the same as those described for FCTC Site 1 with the exceptions presented in the following paragraphs. Groundwater conditions are considered of good quality.

Black & Veatch 2014 Environmental Sampling Event. Site groundwater analysis pertinent to FCTC Site 2 consisted of a single sample taken from MW-3 which is located within the footprint of FCTC Site 2. Only trace amounts of metals were detected from MW-3, and the metals identified did not exceed screening limits.

Two surface water samples were located in the FCTC Site 2 area (FCTC-SWD2W and SWD3W). The surface water contained low levels of metals, all of which were found to be below available screening limits. No other analytes were detected (BVSPC, 2015a) (refer to Figure 3.3.14-7).

Two sediment samples were collected in the area of FCTC Site 2 (SWD2 and SWD3). The sediment contained low levels of VOCs and metals. All compounds in the sediment detected were below screening limits with the exception of arsenic, (result of 7.49 milligrams per kilogram (mg/kg), screening limit 5.8 mg/kg) which did not exceed the upper background limit (20.13 mg/kg). No other analytes were detected.

URS Operational Range Phase II Site Assessment (ORA Phase II). A 2013 surface water, groundwater, and sediment sampling event was performed to determine whether MCOCs were leaving the operational firing ranges, located in the northernmost areas of FCTC, by an identified pathway, which could pose a risk to downstream and downgradient receptors. Further background information regarding the study can be found in Section 3.3.14.2.1.1.

One groundwater sample from MW-13 was collected within the CIS footprint. The groundwater sample was analyzed for dissolved metals MCOC, explosives MCOC, and perchlorate. MCOCs and perchlorate concentrations in MW-13 were not detected above PALs as defined in Section 3.3.14.2.1.1.

3.3.14.2.2.3.4 Groundwater Management

Regional and local groundwater management goals and practices for FCTC Site 2 are the same as those described for FCTC Site 1 in Section 3.3.14.2.1.3.

3.3.14.3 Environmental Consequences and Mitigation – Water Resources – FCTC Sites

The environmental consequences and mitigations for water resources for the FCTC Sites are described in this section.

3.3.14.3.1 Construction – Baseline Schedule

3.3.14.3.1.1 Environmental Consequences

3.3.14.3.1.1.1 FCTC Site 1

<u>Surface Water</u>

Surface water impacts during the baseline construction schedule are described in the following paragraphs. No major, long-term impacts to surface water due to construction would occur.

Surface Water Runoff. Impacts to surface water could include the rerouting of surface water drainage at FCTC Site 1. The FCTC Site 1 footprint would be located atop an existing mound. Land disturbance activities such as clearing, grading, and excavation would have an effect on surface water runoff patterns and surface water velocity. Surface water migration and velocity could alter flow patterns and rates at which streams and lakes are recharged, leading to an increase in one water body's capacity and a decrease in another. This impact could also potentially impact aquatic and terrestrial flora and fauna by reducing or increasing the quality and/or quantity of aquatic habitat, and affecting the composition, abundance, distribution, and dynamics of individual species and the local biological communities as a whole.

In the case of the FCTC Site 1, these potential impacts would occur to some degree. However, impacts to surface water migration would be minor because the area within the FCTC Site 1 footprint is characterized by high permeability and recharge rates due to the hydrogeological characteristics. Prior to any construction activities, application would be made for a General Permit Authorization for storm water discharges associated with construction activity under the Michigan National Pollutant Discharge Elimination System (NPDES) General Permit and Soil Erosion and Sedimentation Control Program. Potential impacts to surface waters from erosion and sedimentation would be minimized through implementation of a Storm Water Pollution Prevention Plan (SWPPP) required by the MDEQ, administered and enforced through the appropriate County Enforcing Agency. The implementation of BMPs under the MDEQ General Permit for the discharge of storm water during construction would reduce potential impacts to surface water bodies receiving storm water flow. In addition, Section 438 of the Energy Independence and Security Act provides guidance for federal projects to implement storm water management practices to maintain, to the extent feasible, pre-development hydrology. Storm water management practices would be developed during the design phase of the project.

Soil Erosion and Sedimentation. Disturbance of land areas during land clearing and excavating, temporary laydown areas building and facilities construction, and roadway improvements could potentially impact surface water quality within Whitman Lake, Eagle Lake, Jackson Hole Lake, Lawler Lake, Whitford Lake, and the Kalamazoo River as well as associated inflow/outflow streams supporting local flora and fauna due to soil erosion and sedimentation. Sediment uptake, suspension and deposition from storm water runoff from project-related land clearing, excavating, and other construction activities can affect aquatic communities by eroding or washing away aquatic habitat and/or depositing suspended sediments on substrate, vegetation and other stands of habitat, or on organisms themselves. A reduction in the quantity and/or quality of aquatic habitat, accompanied by lowered production by all trophic levels (predators and prey), could result. Storm water flows could likewise entrain aquatic organisms and relocate them to less suitable habitat downstream, or expose them to predation, desiccation, suffocation, or temperature stress, especially after flows recede. Aquatic organisms (particularly non-motile organisms such as eggs or larvae) could be covered by settling sediments and adversely affect their respiratory and/or feeding functions.

Suspended sediments and the related increases in turbidity also tend to refract light, which can, in turn, affect the ability of aquatic flora and freshwater vegetation to photosynthesize and otherwise thrive, particularly if combined with the effects of other environmental stressors, such as pollution from point source and non-point source discharges. Increased turbidity due to initial suspension and re-suspension could also potentially impact the integrity and quality of aquatic habitat, as well as create respiratory stress in fish and other aquatic fauna. Soil erosion and sedimentation is also likely to carry and deposit other potential pollutants such as petroleum-based products or chemicals used during construction.

Nutrient loadings could also create eutrophic effects to surface waters within FCTC and Eagle Lake-Kalamazoo sub-watershed. Currently, non-point sources contribute a mean runoff volume of 2,028 ac-ft/yr, TSS loading of 324 tpy, and a combined nutrient loading of 18,291 tpy. As construction and land disturbance activities occur for the FCTC Site 1, contributions to these loadings into the Kalamazoo River would likely be made.

Surface water storage capacity may also be impacted due to sediment deposition and, therefore, cause a reduction in water volume, retention time and aquatic flora and fauna habitat.

These effects would likely occur to a certain degree during construction at the FCTC Site 1. However, impacts to surface water quality, aquatic and terrestrial fauna and flora due to soil erosion and sedimentation would be localized, temporary, and minor because of: (1) the implementation of sediment and erosion control BMPs under the MDEQ General Permit for the discharge of storm water during construction would reduce potential impacts to surface water bodies receiving storm water flow; (2) the implementation of a construction SPCC Plan would reduce potential impacts caused by petroleum-based products and chemicals; and (3) the temporary nature of the construction activities.

Other Pollutants Caused by Construction. Project construction could result in the inadvertent release of minor amounts of pollutants via oil leaks from equipment and vehicles; chemical releases from cleaning agents, paints, solvents, etc.; construction waste; and other sources. Nutrients could also be released during temporary or permanent land stabilization with the application of fertilizers and/or grass and vegetative seed, adding to the current nonpoint source nutrient loadings. However, the implementation of standard pollution control measures such as the use of chemical and petroleum spill prevention, control and cleanup facilities, equipment, and procedures would reduce the potential for major chemical or petroleum releases. Consequently, any adverse impacts to aquatic resources resulting from pollutant releases would be temporary and minor.

Placement of Fill into Existing Surface Water Features (Wetland Complexes and Fens). There are approximately 20.26 acres of wetlands within the FCTC Site 1 CIS footprint. The placement of fill material in wetlands and fens would have a permanent impact on the function in that the wetland would no longer provide aquatic or terrestrial habitat. Its function to improve water quality and recharge groundwater could also be permanently impacted. Fens would see a reduction in groundwater influx. Details regarding the potential impacts to wetlands are discussed in Section 3.3.15.

Fugitive Dust Generation. Elevated turbidity levels in local streams and wetlands can result not only from erosion, sedimentation, and re-suspension of soil, but also from the settling of dust generated from construction activity such as land clearing, grading, soil excavation, and the movement of equipment or vehicles across disturbed areas. As previously mentioned, turbidity refracts light and an increase in turbidity could affect the ability of freshwater vegetation to photosynthesize and otherwise thrive. Moreover, increases in turbidity could increase suspended and settleable solids concentrations, impacting aquatic respiratory function in aquatic fauna. Impacts to aquatic habitat could also occur depending upon specific settleable concentrations from dust that can settle into of the water column, covering aquatic flora. However, dust-related turbidity impacts would be localized, temporary, and minor due to: (1) the implementation of dust suppression procedures; and (2) the temporary nature of the construction activities. Fugitive dust would be controlled by BMPs. Control methods for fugitive dust emissions would be identified in the construction SWPPP and implemented by the construction contractor. Fugitive dust control methods could include water sprays, placing aggregate, wind fencing, and physical or vegetative stabilization practices, as appropriate.

Surface Water Use. No surface water withdrawals would occur for construction activities associated with FCTC Site 1. The primary water source of the site would be a connection to the City of Battle Creek's nearby distribution line or lines. Therefore, potential impacts to surface water use from construction activities would be negligible.

Groundwater

Groundwater impacts during the baseline construction schedule are described in the following paragraphs. No major, long-term impacts to groundwater due to construction would occur.

Groundwater Flows and Use. Groundwater withdrawal in terms of dewatering could be required for construction of deep excavations and foundations, such as the missile silos. In areas where groundwater is near the water surface, water removal would be addressed to provide stable excavations. For shallow excavations, drainage pumps or vacuum well systems could be used to control groundwater. Limited groundwater control and removal would occur with no treatment other than proper discharge being required. Furthermore, construction of deep foundations up to 75 feet could require the use of concrete plugs or thickened seal slabs and soil cement columns or other binding soil modification methods to provide a cementation at the subgrade level prior to excavation. The purpose of the cementation is to prevent water infiltration into the excavation. The specific volume of groundwater withdrawal would be estimated during detailed design. However, dewatering activities could result in a temporary, localized lowering of the groundwater table. The temporary, localized lowering of the groundwater table would likely not affect the registered groundwater wells or groundwater quality located within the 2-mile radius outside of the FCTC installation boundary due to: (1) their distance from the FCTC Site 1 footprint; and (2) the localized nature of the dewatering. Potential impacts to groundwater characteristics from cementation could include a modification in groundwater flow or a change in the level of the groundwater table. However, these potential impacts would be negligible because of the relatively small areas where cementation would be used.

Sediment and Groundwater Contamination. There is existing groundwater contamination in the northern areas nearby the small arms firing ranges, where the majority of environmental sampling events occurred. Minimal contamination has been identified in the areas of the FCTC Site 1 footprint. Metals, including mercury, PCBs, pesticides, herbicides, and VOCs have been found to be below screening limits for locations surrounding FCTC Site 1; however, arsenic is known to naturally occur in soils within FCTC at levels less than upper background limits. Groundwater withdrawals would be required during deep excavations (about 75 ft bgs). Because groundwater flow is away from the site, dewatering activities would not likely draw contaminants toward FCTC Site 1. Therefore, it is unlikely that groundwater contamination could potentially migrate due to dewatering activities.

3.3.14.3.1.1.2 FCTC Site 2

Surface Water

Soil Erosion and Sedimentation. At FCTC Site 2, disturbance of land areas during land clearing and excavating, temporary laydown areas building and facilities construction, and roadway improvements could potentially impact surface water quality of the Kalamazoo River, Whitford Lake, Lawler Lake, and the associated inflow/outflow unnamed tributaries supporting local flora and fauna due to soil erosion and sedimentation.

Potential, construction-related impacts to the surface water quality and aquatic flora and fauna includes sediment deposition and re-suspension from storm water runoff from the land clearing and excavating and construction activities within FCTC Site 2, which could degrade habitat features, sources and quality of food by reducing vegetative cover. Surface water storage capacity may also be impacted due to sediment deposition and, therefore, cause a reduction in water volume, retention time and aquatic flora and fauna habitat.

The suspended sediments and the related increases in turbidity tend to refract light, which can, in turn, affect the ability of aquatic flora and freshwater vegetation to photosynthesize and otherwise thrive, particularly if combined with the effects of other environmental stressors, such as pollution from point source and non-point source discharges. Increased turbidity due to initial suspension and re-suspension could also potentially impact the integrity and quality of aquatic habitat, as well as create respirational stress in fish and other aquatic fauna. Soil erosion and sedimentation is also likely to carry and deposit other potential pollutants such as petroleum-based products or chemicals used during construction.

Nutrient loadings could also create eutrophic effects to surface waters within FCTC and Eagle Lake-Kalamazoo sub-watershed. Currently, non-point sources contribute a mean runoff volume of 2,028 ac-ft/yr, TSS loading of 324 tons/year, and a combined nutrient loading of 18,291 tons/year. As construction and land disturbance activities occur for the FCTC Site 2, there would these loadings into the Kalamazoo River would likely increased.

However, impacts to surface water quality, aquatic and terrestrial fauna and flora due to soil erosion and sedimentation would be localized, temporary, and minor because: (1) the implementation of sediment and erosion control BMPs under the MDEQ General Permit for the discharge of storm water during construction would reduce potential impacts to surface water bodies receiving storm water flow; (2) the implementation of a construction SPCC Plan would reduce potential impacts caused by petroleum-based products and chemicals; and (3) the temporary nature of the construction activities.

Surface Water Runoff. Impacts to surface water could include the rerouting of surface water drainage at FCTC Site 2. Land disturbance activities such as clearing, grading and excavation, would likely have an effect on surface water migration and surface water velocity. Surface water migration and velocity could alter flow patterns and rates at which the Kalamazoo River, Whitford Lake, and Lawler Lake are recharged. This impact could also potentially impact aquatic and terrestrial flora and fauna; eliminating food and habitat sources for terrestrial flora and fauna with a flooding effect, while increasing food and habitat sources for aquatic flora and fauna for a lake that would receive an increased flow. The opposite effects would occur with a lake losing surface water flow. Both scenarios could potentially affect a water body's biochemical state, for example, an increase or decrease of nutrient loading and changes in the dissolved oxygen concentration.

The potential impacts would be minor because (1) the elevation differential across FCTC Site 2 is approximately 50 feet, and thus would have a minor impact to surface water velocity and would have minor influence on surface water migration, and (2) the area within the FCTC boundary is characterized by high permeability and recharge rates due to the hydrogeological characteristics. The implementation of BMPs under the MDEQ General Permit for the discharge of storm water during construction would reduce potential impacts to surface water bodies receiving storm water flow.

BMPs to control surface water runoff, soil erosion and sedimentation would be the same as those described in the baseline construction impacts for FCTC Site 1 (refer to Section 3.3.14.3.1.1).

Placement of Fill into Existing Surface Water Features (Wetland Complexes and Fens). There are approximately 77.93 acres of wetlands within the FCTC Site 2 CIS footprint. The placement of fill material in wetlands and fens would have a permanent impact on the function in that the wetland would no longer provide aquatic or terrestrial habitat. Its function to improve water quality and recharge groundwater could also be permanently impacted. Fens would see a reduction in groundwater influx; however, the reductions are not yet known and are conservatively estimated at 5 percent. Details regarding the potential impacts to wetlands are discussed in Section 3.3.15.

Surface Water Use. No surface water withdrawals would occur for construction activities associated with FCTC Site 2. The primary water source of the site would be a connection to the City of Battle Creek's nearby distribution line or lines. Therefore, there would be no impacts to surface water use from construction activities.

Groundwater

Sediment and Groundwater Contamination. There is existing groundwater contamination approximately 3 miles northeast near the small arms firing ranges. Minimal contamination has been identified in the area of FCTC Site 2. Metals (including mercury), PCBs, pesticides, herbicides, and VOCs have been found to be below screening limits at locations surrounding the FCTC Site 2 footprint; however, arsenic is known to naturally occur in soils within FCTC at levels less than upper background limits. Groundwater withdrawals would likely be required during deep excavations (about 75 feet bgs). Because groundwater flow from FCTC Site 2 is toward the Kalamazoo River to the west, dewatering activities would not likely draw contaminants towards FCTC Site 2. In addition, groundwater infiltration prevention methods would be implemented. Therefore, it is unlikely that groundwater contamination could potentially migrate due to dewatering activities.

3.3.14.3.1.2 Mitigation

3.3.14.3.1.2.1 FCTC Site 1

No surface water or groundwater mitigation would be required during baseline construction schedules. The BMPs discussed in Section 3.3.14.3.1.1.1 would adequately address impacts to groundwater and surface water during potential construction at FCTC Site 1.

3.3.14.3.1.2.2 FCTC Site 2

No surface water or groundwater mitigation would be required during baseline construction schedules. The BMPs discussed in Section 3.3.14.3.1.1.2 would adequately address impacts to groundwater and surface water during potential construction at FCTC Site 2.

3.3.14.3.2 Construction – Expedited Schedule

Environmental consequences for water resources from construction under an expedited schedule and potential mitigations are discussed in this section for the FCTC Sites.

3.3.14.3.2.1 Environmental consequences

3.3.14.3.2.1.1 FCTC Site 1

Surface Water

Surface Water Runoff. Impacts to surface water during the expedited construction schedule could include rerouting and instantaneous increases of surface water drainage and flow within FCTC Site 1 and to nearby surface water features such as Whitman, Eagle, and Jackson Hole Lakes. Expedited land disturbance activities are likely to have a greater impact by increasing surface water runoff rates as a larger area of disturbed land would be exposed to precipitation. To influence surface water migration in this way could have a greater, more immediate impact to flow patterns and rates at which streams and lakes are recharged, leading to an increase in one water body's capacity and a decrease in another. These conditions could also potentially impact aquatic and terrestrial flora and fauna more acutely by reducing or increasing the quality and/or quantity of aquatic habitat, and affecting the composition, abundance, distribution and dynamics of individual species and the local biological communities as a whole.

However, impacts to surface water migration would be minor, and would be addressed through the implementation of BMPs discussed for the baseline construction impacts in Section 3.3.14.3.1.1.1.

Soil Erosion and Sedimentation. Impacts to surface water quality and habitat within local water features such as Whitman, Eagle, and Jackson Hole Lakes as a result of soil erosion and sedimentation as described in the baseline construction schedule impacts are likely to occur more rapidly due to the increase in sediment loading in surface water runoff. Surface water migration could occur along further distances of the disturbed land, acquiring a higher concentration of sediment prior to migrating offsite and into local and regional surface water features.

However, impacts to surface water quality and habitat due to soil erosion and sedimentation would remain localized, temporary, and minor and would be adequately addressed through implementation of the BMPs discussed for the baseline construction impacts in Section 3.3.14.3.1.1.1.

Other Pollutants Caused by Construction. Project construction under the expedited construction schedule would likely increase the potential for inadvertent releases of minor amounts of pollutants described in the baseline construction impacts due to an increase in site mobilization and activities. However, the implementation of standard pollution control BMPs such as those described for the baseline construction would reduce the potential for chemical releases.

Fugitive Dust Generation. Dust generation during the expedited construction schedule would likely increase due to the exposure of a larger area of disturbed land to construction activities and weathering. The impacts of an increase in dust generation would either result in a more concentrated dust plume developed during construction or the overall increase of settled dust on adjacent lands, or both, in which case, turbidity levels in local water bodies such as Whitman, Eagle and Jackson Hole Lakes could substantially increase, resulting in a more dramatic impact to aquatic flora and fauna habitat and respiratory function. However, dust-related turbidity impacts would remain localized and minor due to: (1) the implementation of dust suppression BMPs as described in the baseline construction in Section 3.3.14.3.1.1.1; and (2) the temporary nature of the construction activities.

Groundwater

Groundwater Flows and Use. Groundwater dewatering during the expedited schedule would occur in the same manner as described in the baseline schedule; however, because groundwater withdrawal would occur in a shorter timeframe, the rate at which groundwater is withdrawn would increase. Methods to control groundwater infiltration within shallow and deep foundations are assumed to remain the same or similar to those described for the baseline construction schedule. The specific volume of groundwater withdrawal required would be estimated during detailed design.

Dewatering activities could result in a more rapid, albeit temporary and localized lowering of the groundwater table. The temporary, localized lowering of the groundwater table would occur to a greater degree than dewatering during the baseline construction schedule. Further groundwater modelling would need to be completed in order to determine the effects of higher dewatering rates on local and regional surface and groundwater hydrology.

Sediment and Groundwater Contamination. Although dewatering activities would occur more rapidly during the expedited construction schedule, dewatering activities would not likely draw contaminants located approximately 2 miles north of FCTC Site 1 footprint because existing groundwater flow is in the opposite direction of withdrawal, as well as groundwater infiltration prevention methods in excavated areas would be implementation. Therefore, it is unlikely that groundwater contamination would migrate such a distance due to dewatering activities.

3.3.14.3.2.1.2 FCTC Site 2

Surface Water Runoff. Impacts from surface water runoff that occur during the expedited construction schedule would be similar in nature to that of the FCTC Site 1 expedited construction schedule impacts, only that the local surface water bodies that would be impacted are the Kalamazoo River, Whitford Lake, and Lawler Lake.

However, impacts to surface water migration would be minor with the implementation of BMPs previously described for the baseline construction schedule in Section 3.3.14.3.1.

Soil Erosion and Sedimentation. Impacts from soil erosion and sedimentation that could occur during the expedited construction at FCTC Site 2 would be similar to those described for FCTC Site 1, except that an increase in land disturbance would, in turn, have a more profound and immediate impact on the Kalamazoo River, Whitford Lake, and Lawler Lake and associated aquatic habitats.

However, impacts to surface water quality and habitat due to soil erosion and sedimentation would remain localized, temporary, and minor with the implementation of BMPs previously described for the baseline construction schedule in Section 3.3.14.3.1.

Other Pollutants Caused by Construction. Project construction under the expedited construction schedule would likely increase the potential for inadvertent releases of minor amounts of pollutants at FCTC Site 2 the same as described for FCTC Site 1 because of an increase in site mobilization and activities, except that these impacts would specifically affect the Kalamazoo River, Whitford Lake, and Lawler Lake. However, the implementation of standard pollution control BMPs such as those described for the baseline construction schedule would reduce the potential for chemical releases (refer to Section 3.3.14.3.1.1).

Groundwater

Groundwater Flows and Use. Impacts from groundwater dewatering that occur during the expedited construction schedule at FCTC Site 2 would be similar in nature to those described for FCTC Site 1, except that an increase in the dewatering rate could, in turn, increase the impacts to the Kalamazoo River, Whitford Lake, and Lawler Lake recharge rates and nearby groundwater well pumping rates. Further groundwater modelling would need to be completed in order to determine the impacts of higher dewatering rates on local and regional surface and groundwater hydrology. The specific volume of groundwater withdrawal required would be estimated during detailed design.

Sediment and Groundwater Contamination. Although dewatering activities would occur more rapidly during the expedited construction schedule, dewatering activities would not likely draw contaminants toward FCTC Site 2 because existing groundwater flow is toward the Kalamazoo River. In addition, implementation of groundwater infiltration prevention methods in excavated areas would limit impacts to groundwater flow. Therefore, it is unlikely that groundwater contamination could potentially migrate toward FCTC Site 2 due to dewatering activities under the expedited construction schedule.

3.3.14.3.2.2 Mitigation

Mitigation for both FCTC Site 1 and FCTC Site 2 under the expedited construction schedule would be the same as under the baseline schedule presented in Section 3.3.14.3.1.2.

3.3.14.3.3 Operation

3.3.14.3.3.1 Environmental Consequences

3.3.14.3.3.1.1 FCTC Site 1

Operational Pollutants. Project operation could result in the inadvertent release of minor amounts of pollutants to surface water or groundwater from silo coolant, diesel from the backup power fuel storage and unloading, ammo/explosive storage facilities, oil leaks from equipment and vehicles; chemical releases from cleaning agents, paints, solvents, etc.; and other sources. Herbicides could also be used to control vegetation once established grass on previously disturbed areas is stabilized. However, the implementation of an SPCC Plan for operations, standard pollution control measures such as the use of chemical and petroleum spill prevention, control and cleanup facilities, equipment, procedures, and constructed spill containment would reduce the potential for major chemical or petroleum releases. Consequently, any adverse impacts to surface water or groundwater resources resulting from pollutant releases would be temporary, small, and minor.

To address potential releases of fuel, oil, or chemicals during operations, an SPCC Plan would be developed and implemented prior to start of operations. Onsite personnel would be trained in SPCC. The SPCC Plan for operations would include:

- A description of potential spill sources.
- Project and site information like drainage pathways, nearby surface waters and their distances.
- The identification of pre-existing contamination.
- Spill prevention and response procedures and training.

Impervious Areas. Permanent increases in the amount of impervious area would occur from new, permanent buildings and facilities, paved roadways, and concrete. Conceptually, such increases could result in reduced infiltration of surface water into groundwater which could affect groundwater recharge patterns. This, in turn, could affect the quantity, distribution, and availability of groundwater resources and impact the hydrological patterns of wetlands and lakes that are fed by seeps and springs within FCTC and FCRA. In such cases, the physical boundaries of affected water bodies could contract, and their associated water quality and biological communities could change accordingly. In the case of intermittent water bodies, "wet periods" could be shortened depending on the nexus between the water body and the groundwater source. Conversely, while an increase in impervious areas could reduce groundwater infiltration, it could increase surface water runoff.

For the FCTC Site 1, there would be an estimated 60 acres of impervious surfaces created due to new, permanent structures. The total combined acreage of FCTC Site 1 would be approximately 805 acres; therefore, the reduction of permeable surfaces would be an estimated 7 percent of the total disturbed area. Therefore, the permanent impacts to groundwater infiltration rates and surface water runoff rates would be negligible. In addition, Section 438 of the Energy Independence and Security Act provides guidance for federal projects to implement storm water management practices to maintain pre-development hydrology. Selected storm water management practices would be implemented during the operating life of the CIS.

Storm Water Pollution Prevention. Soil erosion and sedimentation caused by temporary land disturbance could impact surface waters as previously described. Likewise, impacts to both surface and groundwater from petroleum products, cleaners, solvents and other chemicals used during operation could migrate offsite via storm water runoff. Nutrients could also be released during temporary or permanent land stabilization with the application of fertilizers and/or grass and vegetative seed, adding to the current nonpoint source nutrient loadings. Operation and maintenance of permanent storm water controls, if determined to be necessary during the design phase, would be installed during initial construction and would minimize the potential for soil erosion and sedimentation during operations. Similarly, an operational SPCC plan would be implemented for spill prevention with control measures. Therefore, impacts to surface water from soil erosion and sedimentation would be temporary and minor.

Surface Water Runoff. Similar to construction impacts, operational impacts to surface water migration could include the permanent rerouting of surface water drainage at FCTC. The impacts of changes in surface water migration are similar to that of construction, without the concern of the inclusion of sediment. Over time, the water quality and hydrological characteristics of affected water bodies or streams would change; if excess flows from storm events predominantly flow into one water body, the water level and hydrologic characteristics of another could be negatively affected.

The potential impacts to surface water migration would be minor because, as explained in the construction impacts, the area within the FCTC boundary is characterized by high permeability and recharge rates due to the hydrogeological characteristics. Likewise, operational BMPs, including permanent storm water controls, would aid in the control of storm water runoff and quality.

A SWPPP would be completed prior to the start of operations, addressing the potential discharge of sediment and other potential pollutants into storm water during operations. Onsite personnel would be trained in storm water pollution prevention and response. The SWPPP for operations would include the following information:

- The potential for discharging sediment and the identification of other potential pollutants from operations including fuel, oils, and chemicals.
- Location and type of all permanent storm water control BMPs.
- Procedures for the operation and maintenance of permanent storm water controls.
- Site maps with final grades; post-construction storm water flows and volume; impervious areas and soil types; and the identification of all surface waters and existing wetlands potentially impacted from storm water pollution.
- Methods to be implemented for final site stabilization of all exposed soil areas.

Surface and Groundw1ater Use. No surface water would be required for CIS operations. Potable and service water for the potential CIS at FCTC Site 1would be provided by commercial sources or onsite wells. Additional information and mitigation on impacts elated to the groundwater source used for utilities is presented in Section 3.3.13.

3.3.14.3.3.1.2 FCTC Site 2

Impervious Areas. Permanent impacts to the area for infiltration of surface water to groundwater would occur due to the presence of new, permanent buildings and facilities, paved roadways, and concrete. Reduced infiltration of surface water into groundwater could also impact the capacity of the Kalamazoo River, Whitford Lake, Lawler Lake, and inflow and outflow streams to these lakes and wetlands within FCTC and FCRA.

There would be an estimated 60 acres of impervious surface created due to new, permanent structures. However, the total combined acreage of FCTC Site 2 is approximately 831 acres; therefore, the reduction of permeable surface would be an estimated 7 percent of the total disturbed area. Thus, permanent impacts to the infiltration of surface water into the ground would be minor.

Storm Water Pollution Prevention. Soil erosion and sedimentation, caused by temporary land disturbance, could impact surface waters. Likewise, impacts to both surface and groundwater from petroleum products, cleaners, solvents and other chemicals used during operation could migrate offsite via storm water runoff. Nutrients could also be released during temporary or permanent land stabilization with the application of fertilizers and/or grass and vegetative seed, adding to the current nonpoint source nutrient loadings. Operation and maintenance of permanent storm water controls, if determined to be necessary during the design phase, would be installed during initial construction and would minimize the potential for soil erosion and sedimentation during operations. Similarly, an operational SPCC plan would be implemented for spill prevention with control measures. Therefore, impacts to surface water from soil erosion and sedimentation would be temporary and minor.

Surface Water Runoff. Similar to construction impacts, operational impacts to surface water migration could include the permanent rerouting of surface water drainage to the Kalamazoo River, Whitford Lake, and Lawler Lake. The impacts of changes in surface water migration are similar to that of construction, without the concern of the inclusion of sediment. Over time, the water current water qualities and quantities of effected water bodies or streams would change by introducing increased hydraulic loading into one water feature and possibly reducing hydraulic loading in another.

The potential impacts to surface water migration would be minor because, as explained in the construction impacts, the area within the FCTC boundary is characterized by high permeability and recharge rates due to the hydrogeological characteristics. Likewise, an operational BMPs including permanent storm water controls, would aid in the control of storm water runoff and quality.

BMPs to control surface water runoff and storm water pollution during operation at FCTC Site 2 would be the same as those described for FCTC Site 1 (refer to Section 3.3.14.3.3.1.1).

Surface and Groundwater Supplies. Surface water or groundwater withdrawals and impacts would be the same as FCTC Site 1. Impacts and mitigation related to use of groundwater as a water source is provided on Section 3.3.13 Utilities.

3.3.14.3.3.2 Mitigation

No surface water or groundwater mitigation would be required during operation at either FCTC Site 1 or FCTC Site 2. The BMPs discussed in Section 3.3.14.3.1.1 would adequately address impacts to groundwater and surface water during potential operation of the CIS at either FCTC Site 1 or FCTC Site 2.

Figure 3.3.14-1 Watersheds - FCTC Sites

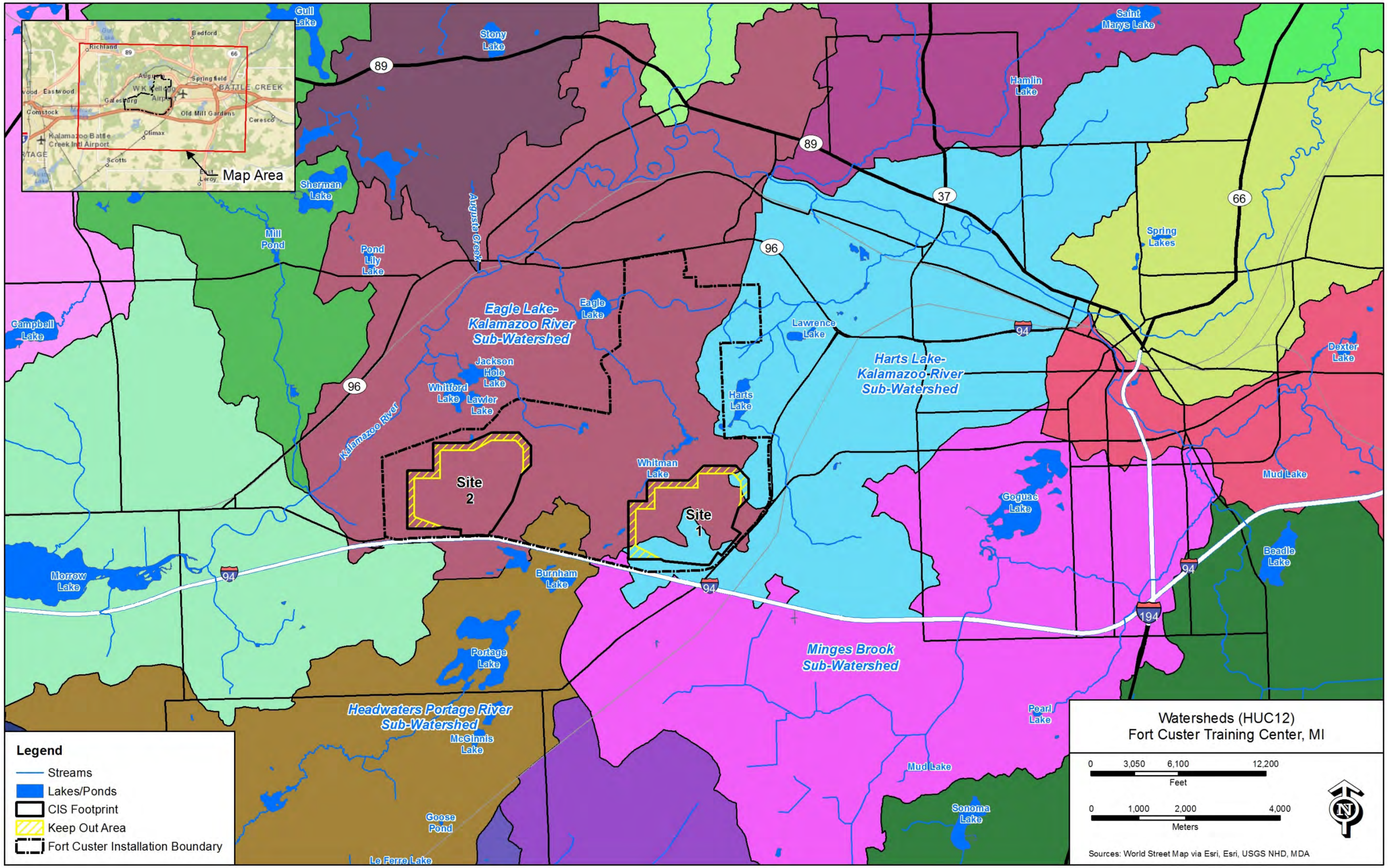


Figure 3.3.14-2 Regional Groundwater Flow - FCTC Sites

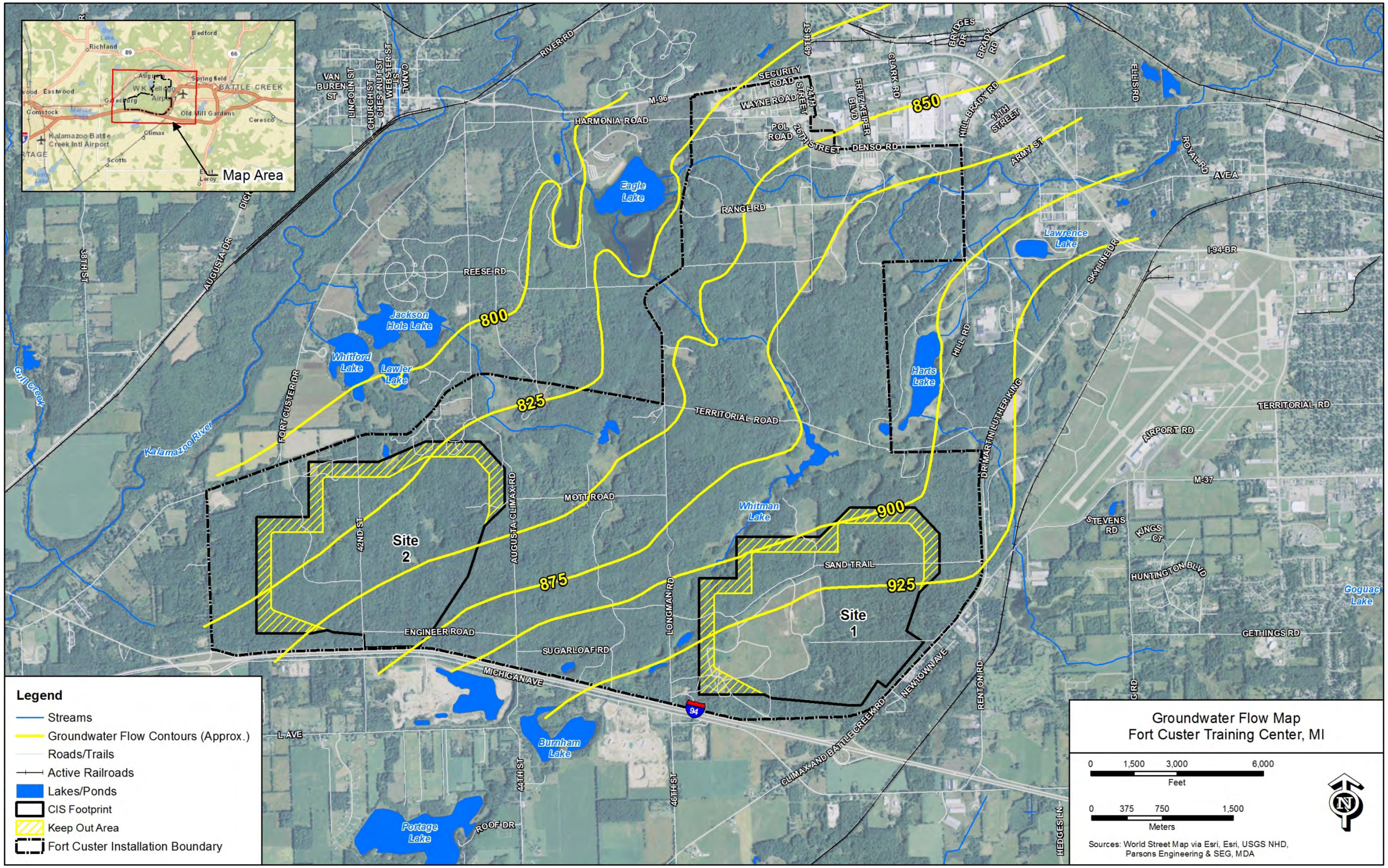


Figure 3.3.14-3 Regional Surface Water Flow – FCTC Sites

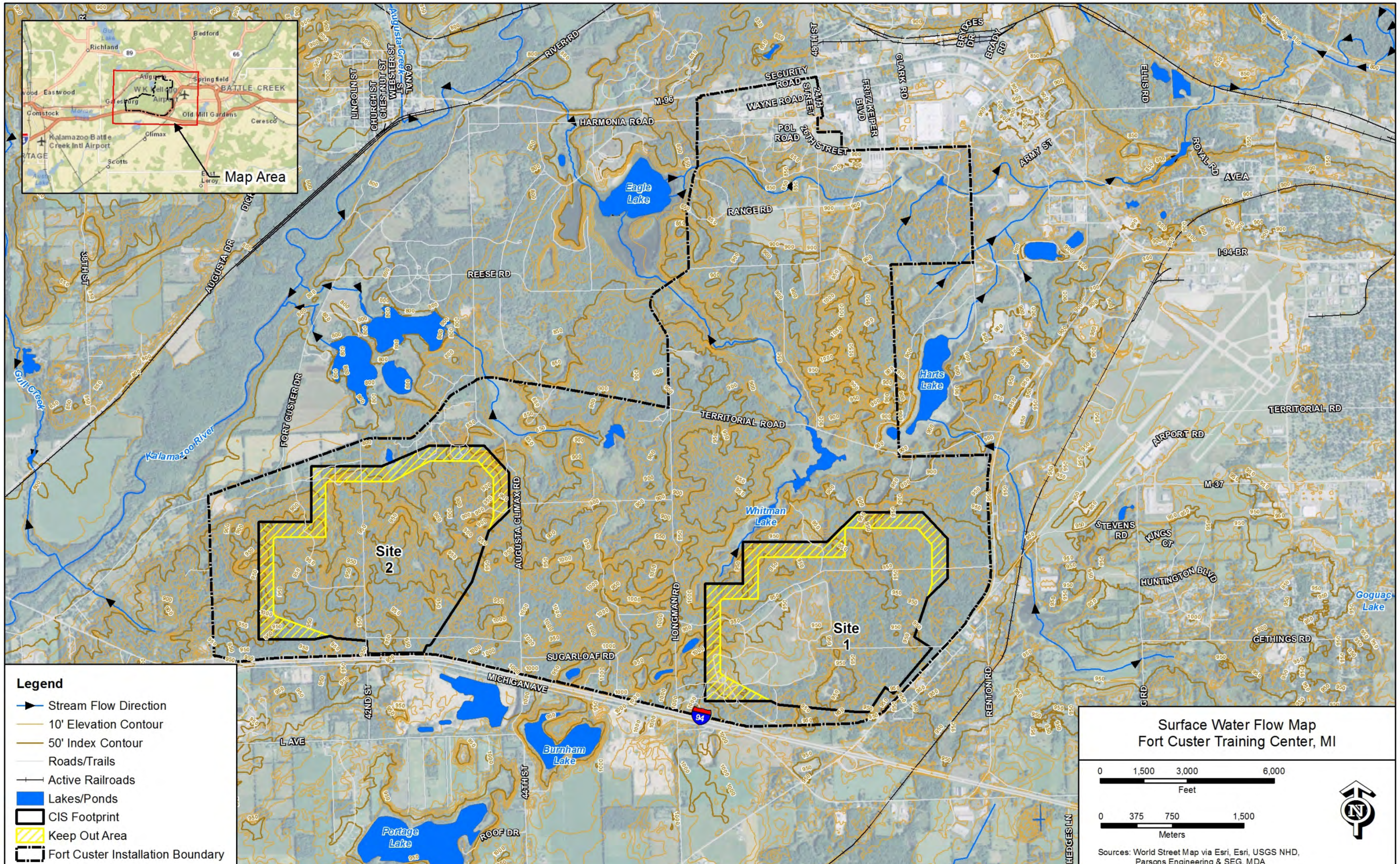


Figure 3.3.14-4 Surface Waters – FCTC Sites

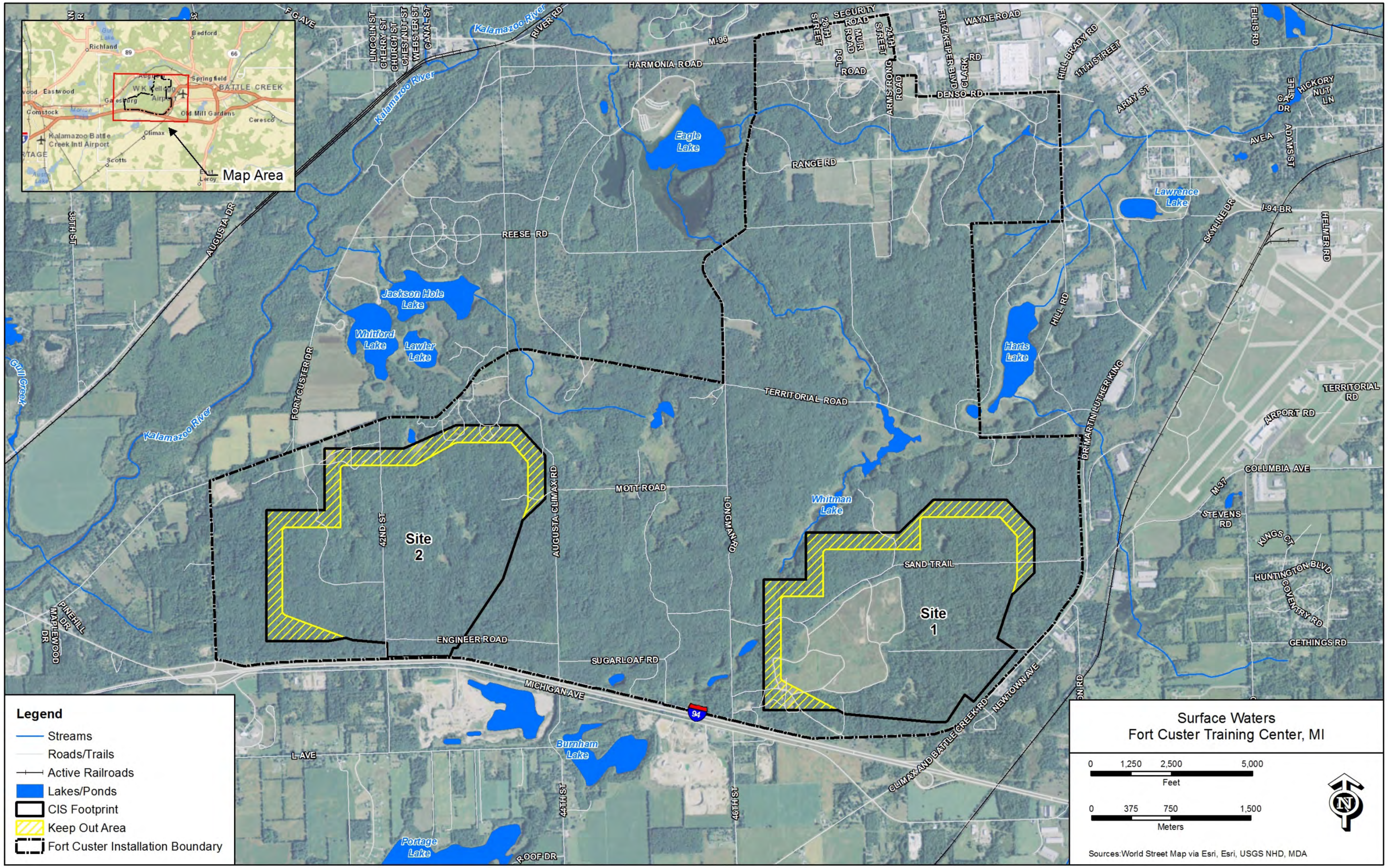


Figure 3.3.14-5 Impaired Rivers and Streams – FCTC Sites

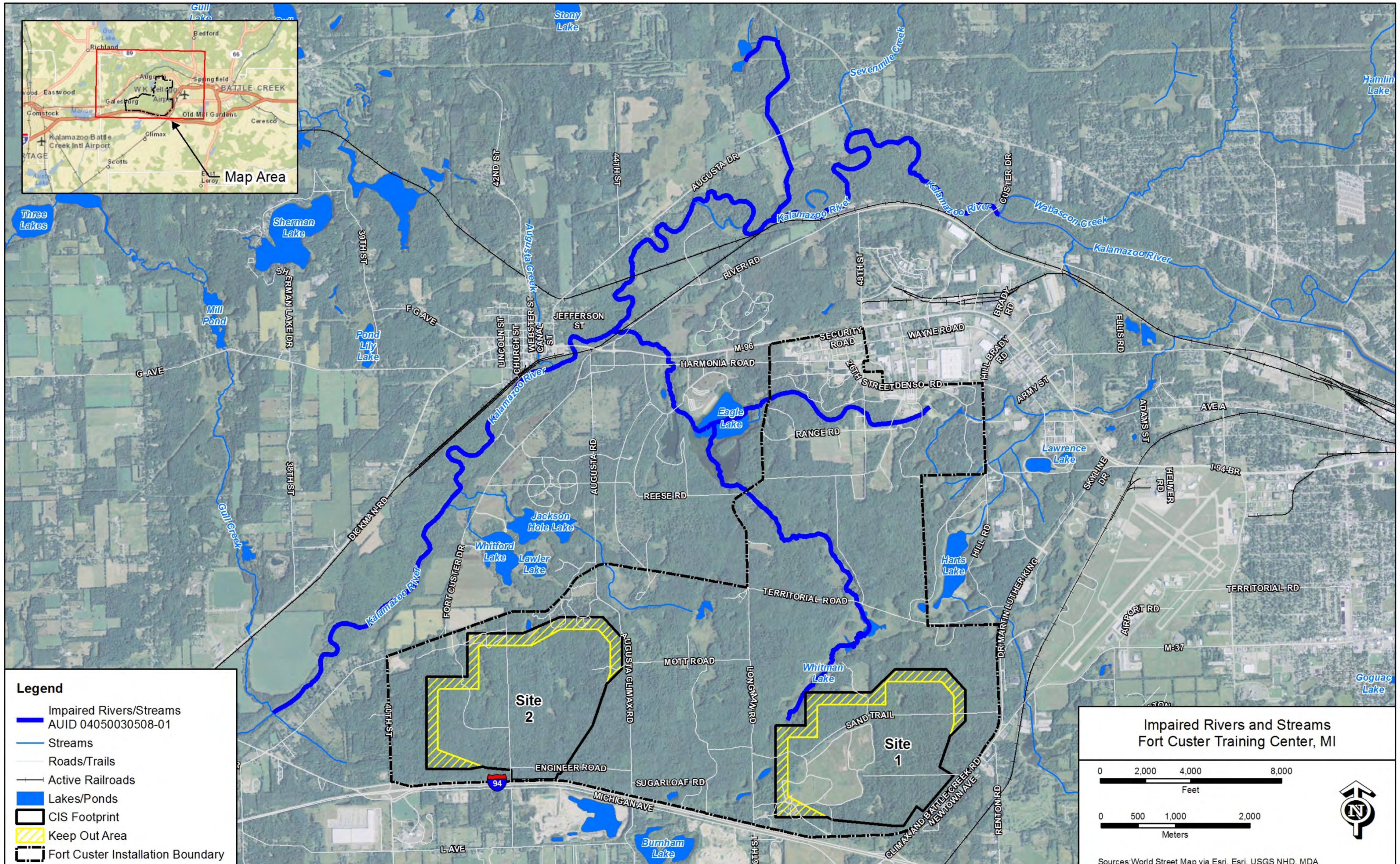


Figure 3.3.14-6 Surface Water Sample Locations – Kellogg Biological Station and Michigan Department of Environmental Quality – FCTC Sites

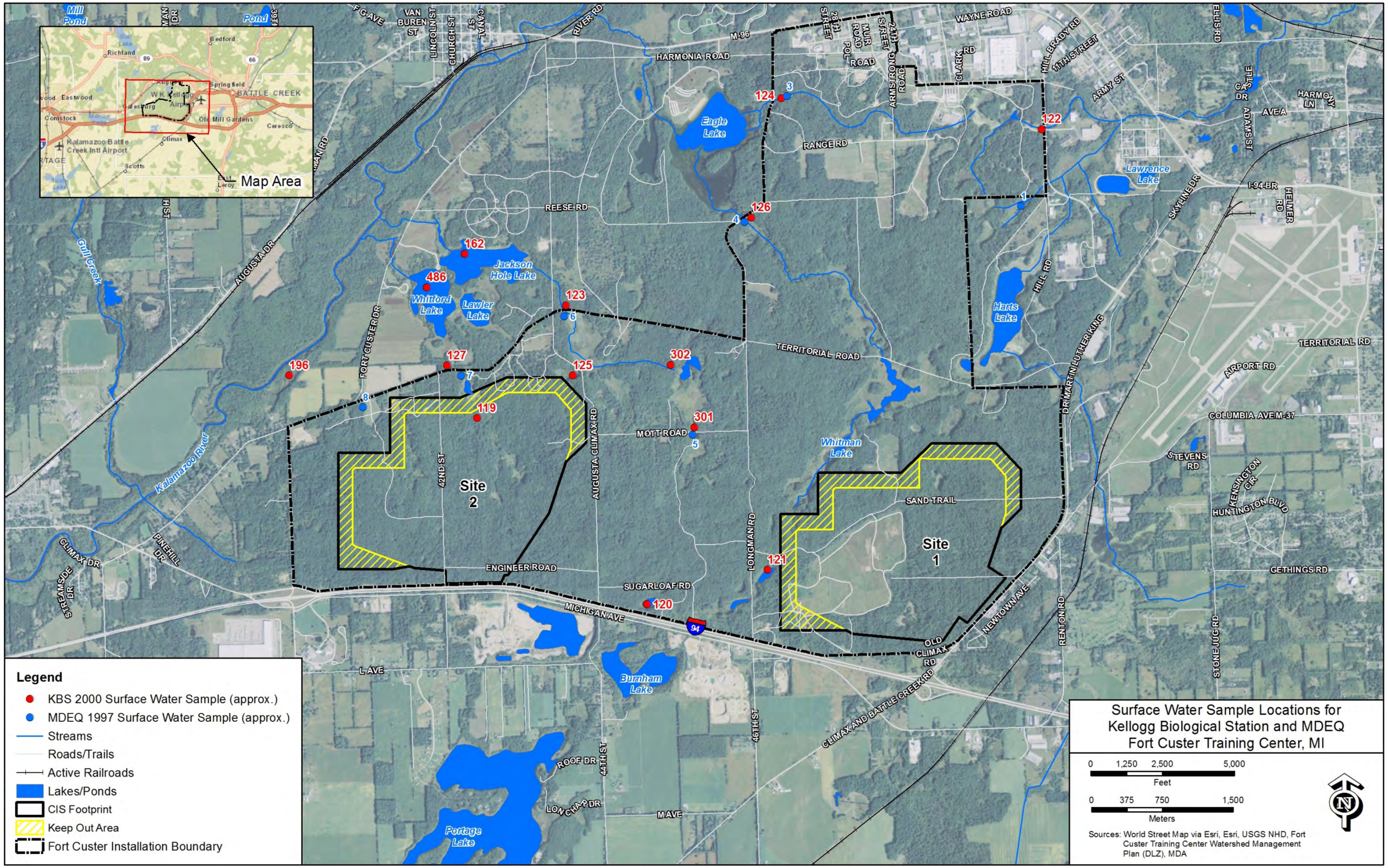


Figure 3.3.14-7 Surface Water Sample Locations – URS, Black & Veatch, and Snell Environmental Group – FCTC Sites

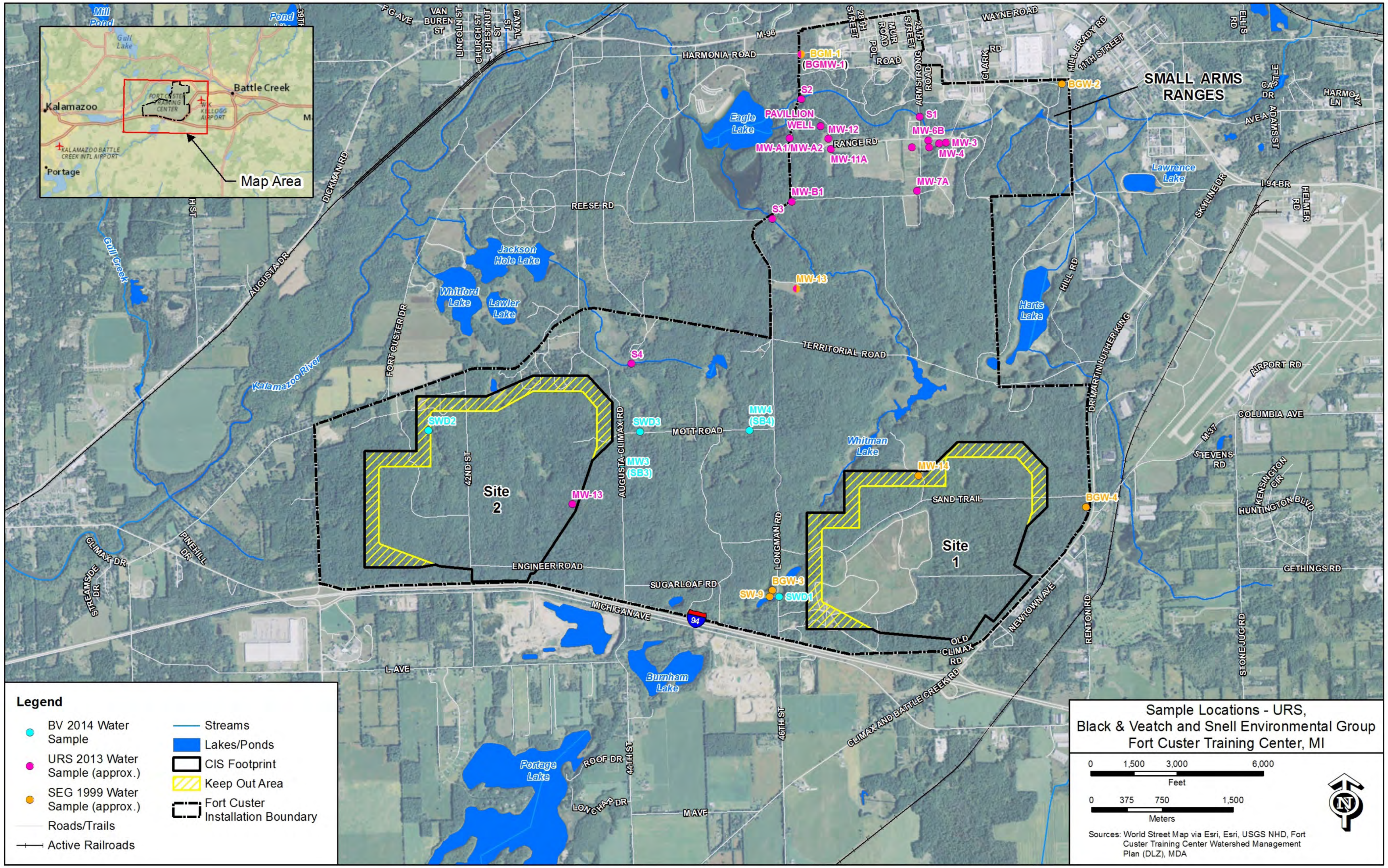


Figure 3.3.14-8 FCTC Homestead Wells

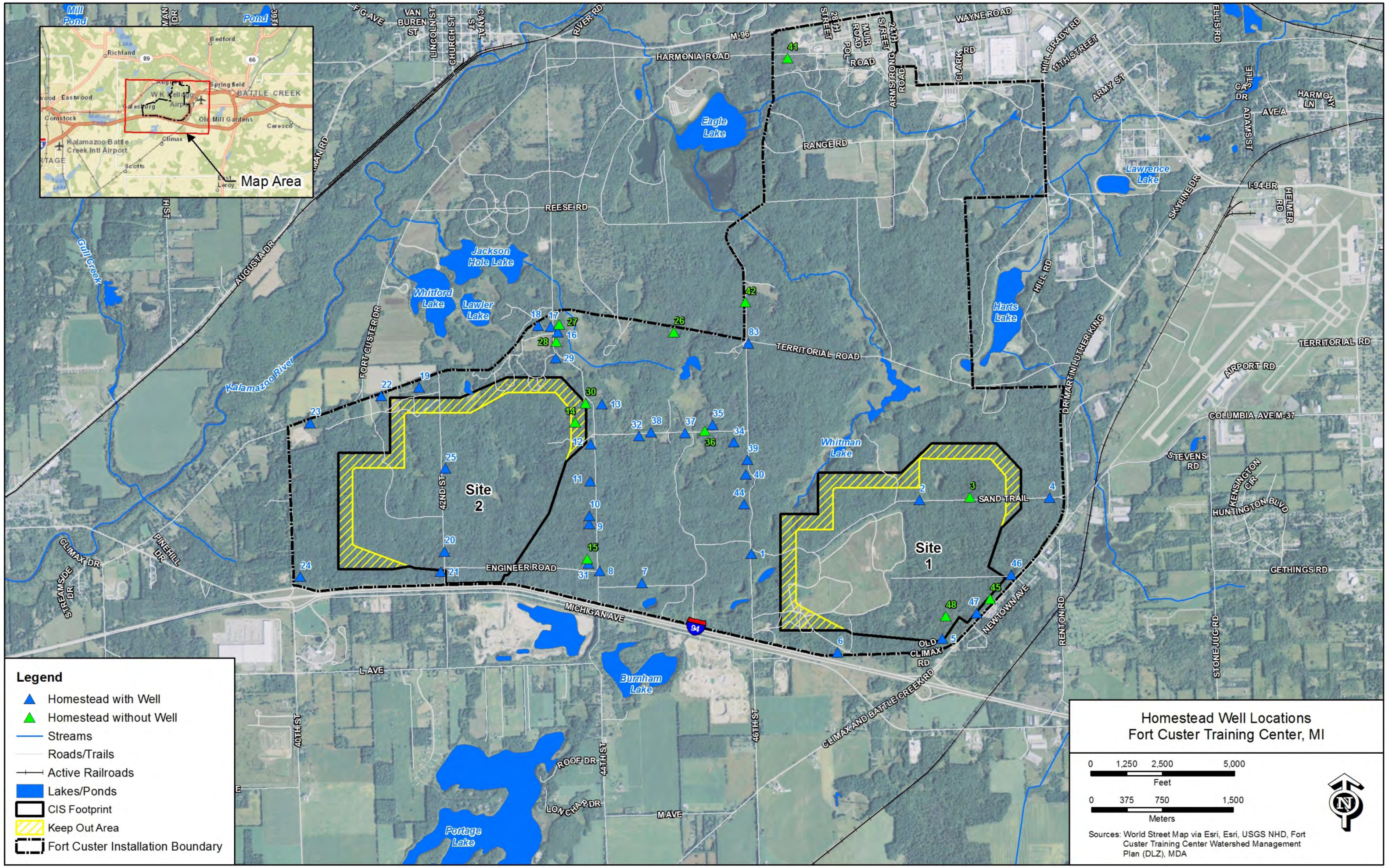


Figure 3.3.14-9 Regional Groundwater Wells – FCTC Sites

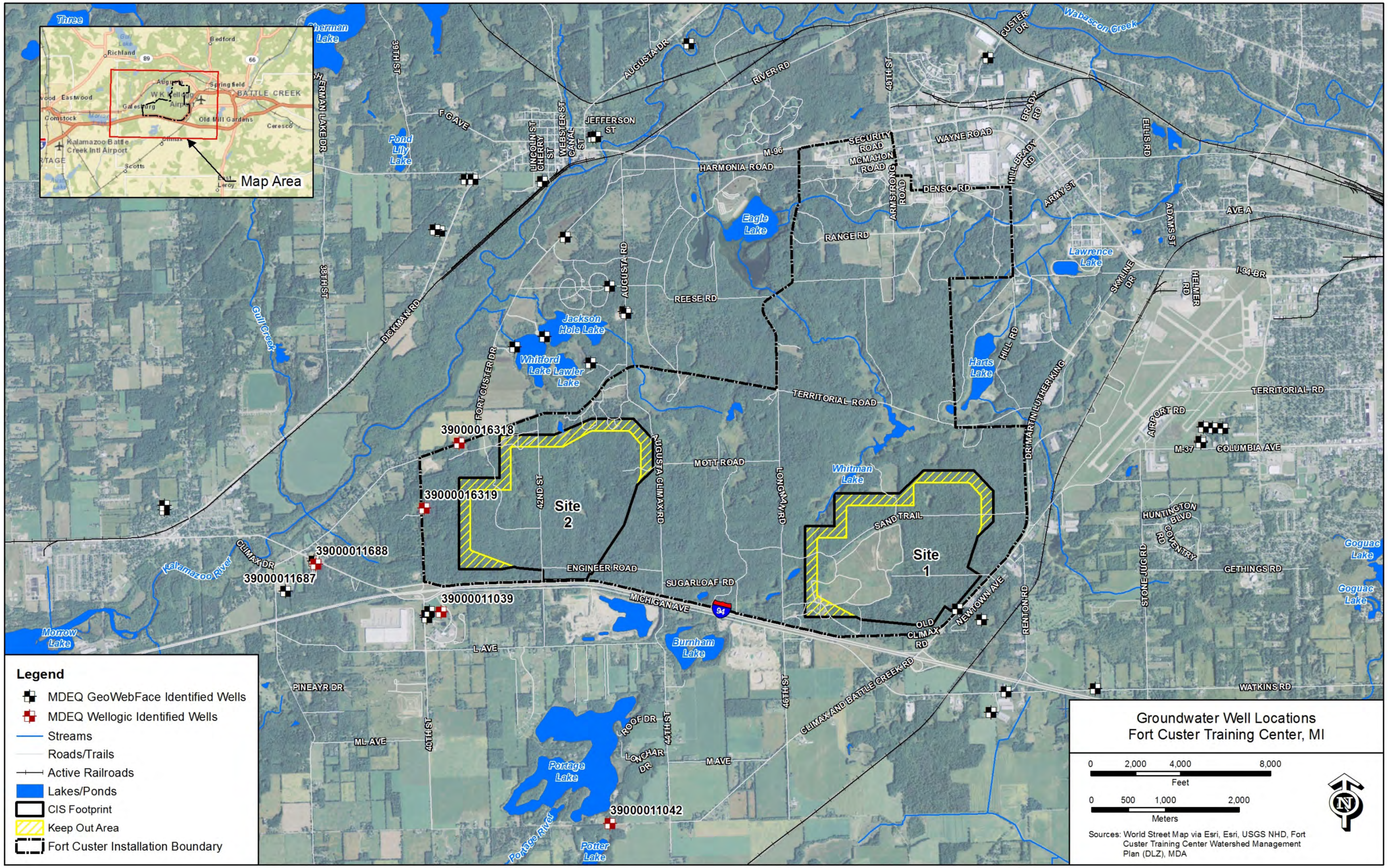
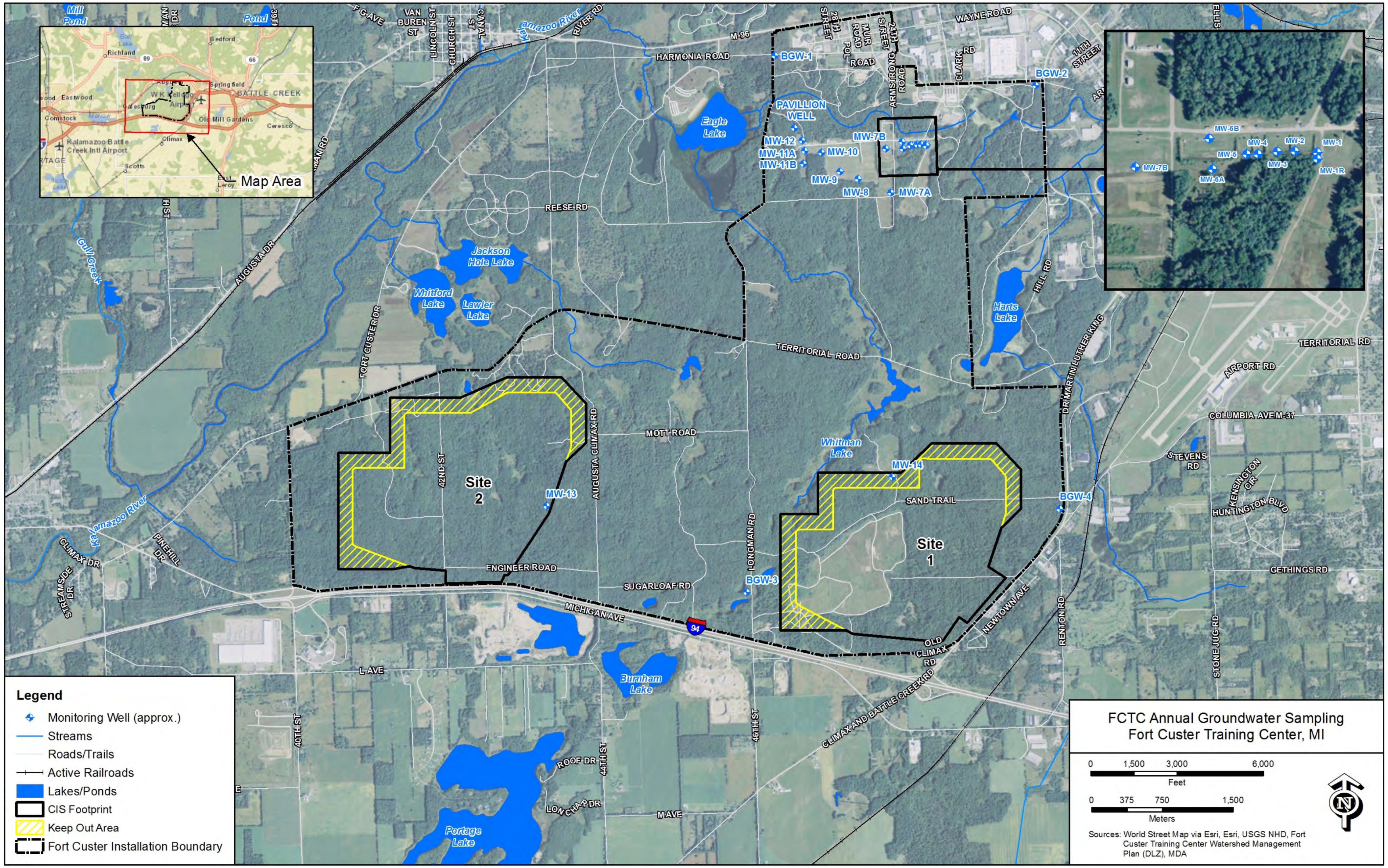


Figure 3.3.14-10 FCTC Annual Groundwater Sampling Locations



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3.3.15 Wetlands – FCTC Sites

This section describes the general wetland resources within FCTC, including detailed information regarding wetland resources within the CIS footprint for FCTC Sites 1 and 2. It also presents the regulatory framework for how wetlands are regulated in Michigan, the methodology for the wetland delineation, and environmental consequences of constructing the potential CIS at FCTC and potential required mitigation.

3.3.15.1 Regulatory Framework – Wetlands – FCTC Sites

The information provided in this section provides a basic federal and State of Michigan wetland regulatory background that is applicable to most situations. This summary is intended for basic informational purposes only and it should not be viewed as all-inclusive. In addition, federal, state, or local requirements may change frequently, which could alter some of the information provided.

3.3.15.1.1 Federal

Wetlands are defined by the USACE and the USEPA based on the presence of wetland vegetation, wetland hydrology, and hydric soils with certain land area considerations. The USACE regulatory definition of a wetland is "[t]hose areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas." (USACE, 1987). Identification and delineation of wetland areas is based on the technical criteria outlined in the Corps of Engineers Wetlands Delineation Manual (Technical Report Y-97-1) (USACE, 1987) and the appropriate Regional Supplement. Wetland identification includes consideration of the following three wetland parameters:

- Hydrophytic vegetation: The Corps of Engineers Wetlands Delineation Manual defines a hydrophytic vegetation community as one possessing greater than 50 percent of the dominant species from all strata being classified as obligate wetland (OBL – almost always observed in wetlands), facultative wetland (FACW – usually observed in wetlands), or facultative (FAC – observed in both wetlands and uplands) which are determined based on 2014 National Wetland Plant List version 3.2 (USACE, 2014a; Lichvar et al., 2014).
- Wetland hydrology: The Corps of Engineers Wetlands Delineation Manual defines wetland hydrology as "all hydrologic characteristics of areas that are periodically inundated or have soils saturated to the surface at some time during the growing season. Areas with evident characteristics of wetland hydrology are those where the presence of water has an over-riding influence on characteristics of vegetation and soils due to anaerobic and reducing conditions, respectively. Such characteristics are usually present

in areas that are inundated or have soils that are saturated to the surface for sufficient duration to develop hydric soils and support vegetation typically adapted for life in periodically anaerobic conditions."

- Hydric soils: The USDA defines a hydric soil as a soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part. The concept of hydric soils includes soils developed under sufficiently wet conditions to support the growth and regeneration of hydrophytic vegetation (USDA, 1987).

Areas that exhibit positive indicators of these three parameters are determined to be a wetland and may be under the jurisdiction of either the USACE Detroit District or the State of Michigan.

The USACE regulatory program is one of the oldest in the federal government, having originated in the 19th century with the Rivers and Harbors Act (RHA) of 1890 (Title 33--Navigation and Navigable Waters, Chapter 9--Protection of Navigable Waters and of Harbor and River Improvements). Generally, Section 401 (33 USC 401, et seq.) established protection of waters used for commerce. The basic mission of the regulatory program today is "…to protect the nation's aquatic resources, while allowing reasonable development through fair, flexible and balanced permit decisions."

The geographic jurisdiction of the RHA includes all navigable waters of the U.S. (WOUS), which are defined at 33 CFR Part 329 as, "those waters that are subject to the ebb and flow of the tide and/or are presently used, or have been used in the past, or may be susceptible to use to transport interstate or foreign commerce." This jurisdiction extends seaward to include all ocean waters within a zone 3 nautical miles from the coastline (the "territorial seas"). Activities requiring RHA Section 10 permits include structures in navigable waters (e.g., piers, wharfs, breakwaters, bulkheads, jetties, weirs, and transmission lines) and work such as dredging or disposal of dredged material, or excavation, filling, or other modifications to navigable WOUS.

In 1972, amendments to the Federal Water Pollution Control Act added what is now known as Section 404 authority (33 USC 1344) to the program. The USACE is authorized to issue permits, after notice and opportunity for public hearings, for the discharge of dredged or fill material into WOUS, including wetlands at specified locations. Selection of such sites must be in accordance with guidelines developed by the USEPA in conjunction with the Secretary of the Army; which are known as the 404(b)(1) guidelines. The discharge of all other pollutants into WOUS is regulated under Section 402 of the Act (more commonly known as the NPDES). The Federal Water Pollution Control Act was further amended in 1977 and given the common name of CWA, and was again amended in 1987 to modify criminal and civil penalty provisions and to add an administrative penalty provision.

The CWA uses the term "navigable waters" which is defined at 33 CFR Part 329 as meaning "waters of the U.S., including the territorial seas." Thus, Section 404 jurisdiction is defined as encompassing Section 10 waters, their tributaries, and adjacent wetlands. Isolated waters are jurisdictional where the use, degradation, or destruction of such waters could affect interstate or foreign commerce. Pursuant to Section 404 of the CWA, the USACE regulatory program has jurisdiction over the placement of fill or dredged material in all jurisdictional WOUS, including wetlands.

The geographic extent of USACE jurisdiction has recently been modified by several U.S. Supreme Court Cases, most notably the Solid Waste Agency of Northern Cook County and Rapanos/Carabell which found that the term WOUS may be limited to traditional navigable waters (i.e., waters navigable in fact or "Section 10 waters"), relatively permanent waters and wetlands adjacent to these waters ("Section 404 waters"). Because of the court decisions, isolated wetlands, and non-permanent non-navigable waters usually are not jurisdictional, with the exceptional case where interstate commerce is supported by the waterbody (e.g., shellfish production or cypress bark harvested for interstate sale)." Most recently the USEPA and USACE finalized and published a Clean Water Rule: Definition of Waters of the U.S. on June 29, 2015, which became effective on August 28, 2015. However, as of October 2015, the Clean Water Rule was stayed by a federal court nationwide pending the outcome of several cases against the rule. As a result, any WOUS discussed in this section are based on the USACE regulations and guidance that were in effect in September 2014.

Under the CWA Section 404, placement of dredged or fill materials in WOUS is prohibited without a permit issued by the USACE. The determination that a wetland is subject to regulatory jurisdiction is made independently of procedures described in the delineation manual and the regional supplement.

EO 11990 – Protection of wetlands (42 FR 26961, 3 CFR, 1977, p. 121) was executed on May 24, 1977 in order to avoid to the extent possible the long and short term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative. The EO furthers Section 101(b)(3) of the NEPA (42 USC 4331(b)(3)) to improve and coordinate federal plans, functions, programs and resources so the Country may attain the broadest range of beneficial uses of the environment without degradation and risk to health or safety. Each agency is charged with avoiding, undertaking, or providing assistance for new construction located in wetlands unless the head of the agency finds that there is no practicable alternative and that the potential deployment includes all practicable measures to minimize harm to wetlands which may result from such use. For the CIS, it should be noted that all potential sites analyzed in this EIS contain wetlands. All practicable measures were taken to arrange the CIS footprints to minimize and avoid impacts to wetlands while still maintaining operational effectiveness. However, impacts to wetlands, regardless of the site, are unavoidable. If a deployment decision were made, consultations would be held with the USACE and applicable state regulatory agencies to determine appropriate mitigations for wetland impacts. A Finding of No Practicable Alternative (FONPA) would then be prepared. The FONPA would explain why there is no practicable alternative to impacting wetlands at the identified site. It is important to note that no proposed action or decision to deploy has been made to construct the additional CIS.

3.3.15.1.2 State of Michigan

The State of Michigan regulates wetlands under Part 303 of the Natural Resources and Environmental Protection Act, Public Act 451 of 1994, as amended. The state definition of a wetland is "land characterized by the presence of water at a frequency and duration sufficient to support, and that under normal circumstances does support wetland vegetation or aquatic life, and is commonly referred to as bog, swamp, or marsh."

In accordance with Part 303, wetlands are regulated if they meet any of the following categories:

- Connected to one of the Great Lakes or Lake St. Clair.
- Located within 1,000 feet of one of the Great Lakes or Lake St. Clair.
- Connected to an inland lake, pond, river, or stream.
- Located within 500 feet of an inland lake, pond, river, or stream.
- Not connected to one of the Great Lakes or Lake St. Clair, or an inland lake, pond, stream, or river, but are more than 5 acres in size.
- Not connected to one of the Great Lakes or Lake St. Clair, or an inland lake, pond, stream, or river, and less than 5 acres in size, but the MDEQ has determined that these wetlands are essential to the preservation of the state's natural resources and has notified the property owner.

In accordance with Section 404(g) of the CWA, the USACE retains federal jurisdiction over traditionally navigable waters, including the Great Lakes, connecting channels, other waters connected to the Great Lakes where navigational conditions are maintained, and wetlands directly adjacent to these waters. Activities in these waters require a joint permit application. Inland wetlands generally fall under state jurisdiction, subject to selective USACE oversight. Typically USACE and USEPA reviews of wetlands in Michigan are limited to activities involving critical, rare, or sensitive environmental resources, or large projects with considerable volumes of fill placement in wetlands or other waters.

3.3.15.2 Affected Environment – Wetlands – FCTC Sites

The sections that follow describe the environmental conditions present at FCTC Site 1 and FCTC Site 2 as an aid in evaluating potential impacts from the potential CIS at FCTC.

3.3.15.2.1 Wetland Identification Methodology

Wetlands at the FCTC installation (including both FCTC Sites 1 and 2) were initially identified by USFWS National Wetlands Inventory (NWI) during the 1980s. Subsequently, in 1993-1994, the MNFI conducted field verification of the NWI-mapped wetlands and other unidentified wetlands. Adverse modifications of wetlands were not reported at that time, with the exception of a road improvement at the east end of Territorial Road in the northeastern portion of the installation (outside the CIS footprint) (MDMVA, 2012). In 2005, FCTC hired the USGS to review the onsite wetlands using satellite imagery. This study determined that the NWI data was accurate enough at that time to not require a ground-based wetland delineation. The wetland data from the NWI was modified to reflect the minor changes detected by USGS (MDMVA, 2012).

After the NWI was implemented, MDEQ commenced a statewide wetland inventory update in the early 2000s. The maps covering the CIS footprint were completed in 2007. The wetland inventory maps were drafted by MDEQ pursuant to Part 303, Wetlands Protection, of the Natural Resources and Environmental Protection Act 451 of 1994, as amended. The wetland inventory maps show approximate locations of potential wetlands, similar to the NWI, but with the inclusion of mapped hydric soils, which may or may not be wetlands currently as determined using the wetland delineation technology. Wetland maps for each county were produced by overlaying data from the following sources

- The NWI data;
- Land Cover, as mapped by the Michigan Resource Inventory System (MIRIS); and,
- U.S. Department of Agriculture (USDA), National Resource Conservation Service (NRCS) soil survey.

The available planning or screening-level wetland information was reviewed to evaluate the existing wetland resources in FCTC Site 1 and Site 2. This review included the NWI (Cowardin et al., 1979), wetland data from the MIRIS, surface water information from the National Hydrography Dataset, hydric soils information from the NRCS web soil survey, and the INRMP for the FCTC installation (MDMVA, 2012).

The NWI and MIRIS wetland inventories represent existing information indicating a high probability that a wetland may exist in a given area. Areas depicted as wetlands, hydric soils, or open water on the maps are potential wetlands. These areas warrant further site investigation to verify if wetlands are actually present. The inventory maps may not identify all potential wetlands. The wetlands that are depicted on the inventory maps are not suitable for use in determining a regulatory boundary, but the inventory maps can be useful for screening level planning.

In 2015, a wetland delineation was conducted at FCTC Site 1 and Site 2 (DLZ, 2015). This wetland information was reviewed, along with aerial photographs, to locate the areas that contained wetlands within FCTC Site 1 and Site 2, and to evaluate the general quality of the wetlands.

When wetlands are identified as present on a site, a Jurisdictional Determination (JD) by the USACE is necessary to evaluate the regulatory status of the wetlands and other waters present. An approved JD remains valid for 5 years. A JD was not conducted at FCTC within the CIS footprint and would be necessary to determine what wetlands are subject to CWA Section 404 requirements, if a decision is made to deploy the CIS and FCTC is selected as the preferred alternative. For planning purposes, all wetlands delineated at FCTC and evaluated in this EIS have been treated as being subject to USACE and/or MDEQ jurisdiction.

3.3.15.2.2 Wetlands Delineated - FCTC Site 1

The delineated wetlands at FCTC Site 1 are presented on Figure 3.3.15-2. Per the NWI classification scheme, the major wetlands types present at Site 1 are emergent and scrub-shrub (Tables 3.3.15-1 and 3.3.15-2; Figure 3.3.15-3). The wetlands are arranged in clusters of different wetland plant communities forming a contiguous wetland complex, resulting in five wetland areas within FCTC Site 1.

Prairie fen is a wetland community dominated by sedges, grasses, and other grass-like plants that occur on moderately alkaline organic soil and marl (precipitated calcium carbonate) in southern lower Michigan. Prairie fens occur where cold, calcareous, groundwater-fed springs reach the surface. The flow rate and volume of groundwater through a fen strongly influence vegetation patterning causing multiple, distinct zones of vegetation to form. Because of the physical and chemical characteristics of prairie fens, several rare species of plants and animals inhabit this wetland type.

Table 3.3.15-1 Wetland Summary - FCTC Site 1

Wetland	Wetland Type	Wetland Size	
		Area (sq. ft)	Area (acres)
A	PSS1C	489,123	11.23
H	PEMC	8,127	0.19
I	PEMC	1,184	0.03
R	PEM2G	161,017	3.70
S	PSS1C	222,490	5.11
Totals		881,941	20.26

Wetland data obtained from DLZ (2015).
Acreage values are within the CIS footprint only and some wetlands may extend beyond it.

Table 3.3.15-2 Cowardin Classification Definition and Approximate Wetland Acreage in FCTC Site 1

Cowardin Class*	Cowardin Class Definition	Wetland Acreage
P	Palustrine System Wetlands - tidal and non-tidal marshy wetlands or shallow water, not Riverine (associated with a stream or river), Lacustrine (lakes and ponds over 20 acres), Estuarine (tidal and non-tidal wetlands associated with estuaries) or Marine (wetlands associated with near-shore marine environments that are not part of another system)	20.25
PEM2G	Palustrine (P); Emergent wetland (EM), vegetation is characterized by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens; Intermittently Exposed (G): Surface water is present throughout the year except in years of extreme drought.	3.70
PEMC	Palustrine (P); Emergent wetland (EM), vegetation is characterized by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens; Seasonally Flooded (C), surface water is present for extended periods, especially early in the growing season, but is absent by the end of the season in most years. When surface water is absent, the water table is often near the land surface.	0.21
PSS1C	Palustrine (P); Scrub-Shrub (SS), woody vegetation that is characterized as true shrubs, young trees and/or trees and shrubs that are small or stunted due to environmental conditions and are generally less than 20 feet in height; Broad-Leaved Deciduous (1), woody vegetation is predominantly deciduous and broad-leaved tree or shrub species; Seasonally Flooded (C), surface water is present for extended periods, especially early in the growing season, but is absent by the end of the season in most years. When surface water is absent, the water table is often near the land surface.	16.34
* Cowardin et al., 1979.		

Wetland A was characterized by the KNC (2015) as mostly wooded wetland habitat that lacks the seeps characteristic of fens. Two invasive plant species were abundant in the wetland [reed canary grass (*Phalaris arundinacea*) and cattails (*Typha* spp.)] Few fen indicator plant species were found during the KNC survey. In 2003, the wetland was dominated by reed canary grass and was mostly wet meadow and marsh.

Wetland H dominant vegetation consisted of red maple (*Acer rubrum*), slippery elm (*Ulmus rubra*), spicebush (*Lindera benzoin*), smartweed (*Persicaria pensylvanica*), false green Hellebore (*Veratrum viride*), and stinging nettles (*Urtica dioica*) (DLZ, 2015).

Wetland I dominant vegetation included willowleaf aster (*Symphyotrichum praealtum*), late goldenrod (*Solidago gigantea*), and Indian hemp (*Apocynum cannabinum*) (DLZ, 2015).

Wetland R dominant vegetation included black elderberry (*Sambucus nigra*), jewelweed (*Impatiens capensis*), common rush (Juncus effusus), and bluejoint grass (*Calamagrostis canadensis*), buttonbush (*Cephalanthus occidentalis*), Russian olive (*Elaeagnus angustifolia*), and glossy buckthorn (*Frangula alnus*) (DLZ, 2015).

Wetland S dominant vegetation included slippery elm, jewelweed, skunk cabbage (*Symplocarpus foetidus*), and spicebush (DLZ, 2015).

3.3.15.2.3 Wetlands Delineated - FCTC Site 2

The available planning or screening level information on wetlands for FCTC Site 2 (the NWI and MDEQ wetlands) is presented on Figure 3.3.15-4.

The onsite delineated wetlands (conducted by DLZ) at FCTC Site 2 are presented on Figure 3.3.15-5. Per the NWI classification scheme, the major wetlands types present at Site 2 are emergent (PEM), forested (PFO), and scrub-shrub (PSS), along with two ponds (PUBF) (Tables 3.3.15-3 and 3.3.15-4; Figure 3.3.15-6). The wetlands are arranged in clusters of different wetland plant communities forming a contiguous wetland complex, resulting in seven wetland areas within Site 2 (Table 3.3.15-2).

Table 3.3.15-3 Wetland Summary – FCTC Site 2

Wetland	Wetland Type	Wetland Size	
		Area (ft^2)	Area (acres)
B	PFO1C	18,751	0.43
C	PSS1C	1,713,173	39.34
D	PSS1C	26,178	0.60
J	PSS1C	1,456,948	33.45
M	PFO1C	111,008	2.55
Y	PUBF	28,546	0.66
Z	PUBF	39,353	0.90
Totals		3,393,957	77.93
Wetland data obtained from DLZ (2015). Acreage values are within the CIS footprint only and some wetlands may extend beyond it.			

Table 3.3.15-4 Cowardin Classification Definition and Approximate Wetland Acreage in FCTC Site 2

Cowardin Class*	Cowardin Class Definition	Wetland Acreage
P	Palustrine System Wetlands - tidal and non-tidal marshy wetlands or shallow water, not Riverine (associated with a stream or river), Lacustrine (lakes and ponds over 20 acres), Estuarine (tidal and non-tidal wetlands associated with estuaries), or Marine (wetlands associated with near-shore marine environments that are not part of another system)	77.91
PSS1C	Palustrine (P); Scrub-Shrub (SS), woody vegetation that is characterized as true shrubs, young trees and/or trees and shrubs that are small or stunted due to environmental conditions and are generally less than 20 feet in height; Broad-Leaved Deciduous (1), woody vegetation is predominantly deciduous and broad-leaved tree or shrub species; Seasonally Flooded (C), surface water is present for extended periods, especially early in the growing season, but is absent by the end of the season in most years. When surface water is absent, the water table is often near the land surface.	73.38
PFO1C	Palustrine (P); Forested wetland (FO), vegetation is dominated by forest tree species but also possess an understory of young trees and/or shrubs, and a sparse herbaceous layer; Broad-leaved Deciduous (1), broad-leaved deciduous tree species which are represented throughout the U.S.; Seasonally Flooded (C), surface water is present for extended periods, especially early in the growing season, but is absent by the end of the season in most years. When surface water is absent, the water table is often near the land surface.	2.98
PUBF	Palustrine (P); Unconsolidated Bottom (UB) - Includes all wetlands and deepwater habitats with at least 25% cover of particles smaller than stones (less than 2.4-2.8 in.), and a vegetative cover less than 30%. Semipermanently Flooded (F): Surface water persists throughout the growing season in most years. When surface water is absent, the water table is usually at or very near the land's surface.	1.56
* Cowardin et al., 1979.		

Within FCTC Site 2, the NWI and the MDEQ wetland inventory depicts seven wetlands on FCTC Site 2 between 53.23 acres (NWI) and 75.11 acres (MDEQ wetland inventory) (Figure 3.3.15-4). The apparent discrepancy in wetland acreage between the NWI and the MDEQ wetland inventory may be an artifact of the methods used in these programs or because of changes in hydrology resulting from nearby land use changes or other factors related to wetland extent changes. The onsite wetland delineation completed by DLZ (DLZ, 2015) indicates 77.93

acres of wetland are present within FCTC Site 2, ranging from 0.43 acre to nearly 40 acres in size (Table 3.3.15-3). The wetlands on FCTC Site 2 generally are arranged in clusters of different wetland plant communities forming a contiguous wetland complex.

Three natural areas including two wetland types and an upland forest community are bisected by the FCTC Site 2 boundary. The 42nd Road Seep is located southwest of Lawler Cemetery in Maneuver Area 4, corresponding with Wetland J in the 2015 wetland delineation report (DLZ, 2015). This wetland complex is described as a prairie fen by Legge et al. (1995). According to a later study (Cohen et al., 2009), the wetland was re-classified as a southern wet meadow based on plant species composition, landscape context (seepage), and soils (muck over mineral soil).

Swamp areas associated with the fen complex were dominated by Green Ash (*Fraxinus pennsylvanica*), red maple (*Acer rubrum*), poison sumac (*Toxicodendron vernix*), and spicebush (*Lindera benzoin*). Wet-mesic portions of the area were dominated by black walnut (*Juglans nigra*), blue ash (*Fraxinus quadrangulata*), hackberry (*Celtis occidentalis*), and pawpaw (*Asimina triloba*). In the seeps, common species included small lady's slipper (*Cypripedium calceolus* var. *parviflorum*), marsh marigold (*Caltha palustris*), angelica (*Angelica atropurpurea*), and purple meadow rue (*Thalictrum dasycarpum*) (Legge et al., 1995).

By 2009, common species in the area included tussock sedge (*Carex stricta*), lake sedge (*Carex lacustris*), goldenrods (*Solidago* spp.), sensitive fern (*Onoclea sensibilis*), spotted Joe Pye weed (*Eutrochium maculatum*), common boneset (*Eupatorium perfoliatum*), and skunk cabbage (*Symplocarpus foetidus*). Other species present were jewelweed (*Impatiens capensis*), wood nettle (*Laportea canadensis*), black-eyed Susan (*Rudbeckia hirta*), cut-leaved coneflower (*Rudbeckia laciniata*), Missouri ironweed (*Vernonia missurica*), and rice cut grass (*Leersia oryzoides*). Patches of shrub-carr are dominated by willows (*Salix* spp.) and dogwoods (*Cornus* spp.) including gray dogwood (*Cornus foemina*), silky dogwood (*Cornus amomum*), red-osier dogwood (*Cornus stolonifera*), Bebb's willow (*Salix bebbiana*), pussy willow (Salix discolor), and sandbar willow (*Salix exigua*). Glossy buckthorn (*Rhamnus frangula*) and multiflora rose (*Rosa multiflora*) occur locally within patches of shrub-carr. Scattered purple loosestrife (*Lythrum salicaria*), an invasive plant species, occurred within open areas of the wetland (MFNI, 2009).

According to the 2015 wetland delineation, many of the same species are present, indicating that general conditions are similar to those observed as much as 20 years earlier (DLZ, 2015).

East of the 42nd Road Seeps are the Cemetery Seeps and Cemetery Ridge. The Cemetery Seeps corresponds with Wetland C in the 2015 wetland delineation report (DLZ, 2015). This wetlands complex is a mosaic of calcareous seeps interspersed with mesic southern forest (Legge et al., 1995). Cemetery Ridge is a dry-mesic southern forest community on steep (10 to 35 percent) northeast-facing slopes (Legge et al., 1995).

The wetland areas were dominated by green ash, red maple, poison sumac, and spicebush. Wet-mesic portions of the wetland complex were dominated by black walnut, blue ash, hackberry, and paw paw. Seep areas contained small yellow lady's slipper, marsh marigold, angelica, and purple meadow rue. Two state threatened species, goldenseal (*Hydrastis canadensis*) and cut-leaved water parsnip (*Berula erecta*), were present in the wetland (Legge et al., 1995).

The presence of these natural communities elevates the value of the wetlands on FCTC Site 2. However, while Wetland C was ranked as a moderate quality fen habitat, Wetland J was considered to have poor quality fen habitat (KNC, 2015). Based on a Floristic Quality Assessment (Herman et al., 2001), the wetlands in FCTC Site 2 average one Floristic Quality Index point higher than wetlands at FCTC Site 1, which are more disturbed and tend to have less habitat fidelity than species present in FCTC Site 2 wetlands.

A study conducted by the Kalamazoo Nature Center to evaluate the potential for the FCTC Site 2 wetlands to provide habitat for two rare butterflies (KNC, 2015) determined that portions of Wetland J represent moderate quality fen habitat.

Many of the wetlands at FCTC shelter one, to as many as four state-listed plant species, indicating a relatively undisturbed condition (MDMVA, 2012). The information available to date for FCTC Site 2 indicates that the wetlands in the area would have a high potential for state-listed species. Legge et al. (1995) and MNFI (2009) reported state threatened species from this wetland complex. State threatened species found in the wetland complex and adjacent areas include cut-leaved water-parsnip (*Berula erecta*), stiff gentian (*Gentianella quinquefolia*), goldenseal (*Hydrastis canadensis*), and ginseng (*Panax quinquefolius*).

3.3.15.3 Environmental Consequences and Mitigation – Wetlands - FCTC Sites

If a decision is made to deploy the CIS and FCTC Site 1 or FCTC Site 2 is selected as the preferred alternative, wetlands would be impacted within the CIS cleared area, which is discussed further in the following sections. In each section, the potential direct and indirect wetland impacts are discussed, followed by a brief discussion of potential mitigation options.

3.3.15.3.1 Construction – Baseline Schedule

Construction of the CIS according to the baseline schedule as described in Section 2.5.1 of this EIS would result in unavoidable permanent impacts to wetlands. The specific types of impacts, quantity, and potential mitigation are described in this section. Construction of the CIS is estimated to take approximately 5 years as discussed in Section 2.5.1. The main construction effort would occur during the first 3 years, with most ground disturbing activities occurring during the first 2 years.

3.3.15.3.1.1 Environmental Consequences

3.3.15.3.1.1.1 FCTC Site 1

Permanent Direct Impacts

Permanent direct impacts would occur as a result of the filling, draining, trenching of wetlands within the cleared CIS footprint. Within FCTC Site 1 approximately 20.26 acres of wetlands would be filled within the CIS cleared area.

Permanent Indirect Impacts

Some wetlands within the CIS cleared area of FCTC Site 1 are hydrologically connected to offsite wetlands through groundwater flows (Shu-Guang Li, 2015), which could be altered by wetland fill. Wetland fill placement would alter the plant communities, converting scrub-shrub wetlands to emergent and with emergent wetlands housing a lower quality plant community. Some wetlands could be filled and converted to uplands. Erosion and sedimentation inputs to offsite locations could be increased as the existing vegetation is removed. Whitman Lake Fen, identified as a major natural feature by the MNFI (2009) that is located just outside of FCTC Site 1 to the northwest, may contract slightly as a result of decreased groundwater flows (Shu-Guang Li, 2015), which could allow more woody species (trees and shrubs) to invade the wetland, lowering its value as a natural feature.

Temporary Indirect Impacts to Wetlands

Wetlands occurring immediately downslope/downstream would also likely experience erosion/sedimentation and altered water quality during construction. As a result, these wetlands may fill in from uncontrolled sedimentation and/or become wetter due to the additional surface water runoff from the potential. These indirect impacts have the potential to alter the wetland plant communities in the short-term; however, these indirect impacts would be adequately addressed through the use of BMPs such as soil erosion sediment control devices and an approved and implemented storm water management plan and compensatory mitigation should not be required.

Wetlands further downstream and outside of the boundaries of the CIS footprint may experience indirect, temporary impacts such as a period of sedimentation/siltation caused by erosion of the CIS before the construction site is stabilized. However, these potential impacts would be adequately addressed by BMPs such as soil erosion and sediment control devices and implementation of an approved storm water management plan as described above and would not require compensatory mitigation.

3.3.15.3.1.1.2 FCTC Site 2

Permanent Direct Impacts

Permanent direct impacts within FCTC Site 2 would generally be the same as those described for FCTC Site 1 and would occur as a result of the filling, draining, trenching of wetlands within the cleared CIS footprint. Within FCTC Site 2, approximately 77.93 acres of wetlands would be filled within the CIS cleared area. In addition, seep wetlands and wooded fens identified as natural areas by the MNFI located partially within Site 2 (42nd Road Seeps, Cemetery Seeps, Cemetery Ridge) (Legge, et al., 1995) would be impacted by reduced groundwater flows (Shu-Guang Li., 2015).

Permanent Indirect Impacts

Permanent indirect impacts to wetlands located offsite at FCTC Site 2 (outside the CIS footprint) would be similar to those described for offsite wetlands at FCTC Site 1.

Temporary Indirect Impacts to Wetlands

Temporary indirect impacts to wetlands located offsite at FCTC Site 2 (outside the CIS footprint) would be similar to those described for offsite wetlands at FCTC Site 1.

3.3.15.3.1.2 Mitigation

3.3.15.3.1.2.1 FCTC Site 1

Before wetlands can be impacted by fill or dredge placement, a permit would be obtained from the MDEQ and/or the USACE. As part of the permitting process, justification for permanent wetland impacts (i.e., wetland loss) would be required, including avoidance and minimization of wetland impacts where feasible. Unavoidable wetland impacts to wetlands larger than 5 acres or to wetlands considered essential to conservation of the state's nature resources would require mitigation to replace lost wetland acreage and wetland functions. In addition, before wetlands are impacted by filling, a wetland functional assessment using the Michigan Rapid Assessment Method for Wetlands (MiRAM) (MDNR, 2010) would be necessary.

Mitigation for wetland loss is likely to involve a combination of wetland establishment (wetland creation) in off-installation uplands, and purchase of mitigation bank credits or in-lieu-fee program (ILFP) benefits. As of November 2014, there were two mitigation banks in the Kalamazoo River watershed with available credits, according to the MDEQ mitigation bank registry. The actual mitigation credits needed and the credits available would need to be determined before committing to a bank purchase, which also requires MDEQ and USACE approval to meet the mitigation requirement.

Onsite mitigation at FCTC would not be ideal because the wetland mitigation area is taken out of potential use in perpetuity, along with the overall costs associated with designing, developing and maintaining the site, and the risk of potential mitigation failure. Because of the lost use the preferred mitigation to compensate for lost function and value of aquatic resources including wetlands, is to use the ILFP or mitigation bank options. The type and amount of mitigation would not be determined until FCTC Site 1 were selected for CIS deployment and the permit application process under Section 404 of the CWA, and the Michigan water quality certification (Section 401) are initiated.

Wetland impacts from CIS construction at FCTC Site 1 are expected to be major based on the wetland acreage to be filled. Due to the major impacts that would occur to the FCTC Site 1 wetlands, the impacts would be considered to be “significant” impacts. Downstream and upstream impacts are expected to be alleviated by storm water management and are not expected to require mitigation.

3.3.15.3.1.2.2 FCTC Site 2

Mitigation for wetland loss for FCTC Site 2 would be similar to that discussed for FCTC Site 1, with the exception that some portions of the FCTC Site 2 wetlands may be considered higher quality, requiring a higher mitigation ratio than wetlands on FCTC Site 1.Similar to FCTC Site 1, due to the major impacts that would occur at FCTC Site 2 wetlands, the impacts would be considered to be “significant” impacts.

3.3.15.3.2 Construction – Expedited Schedule

Most wetland impacts under the expedited construction schedule would be similar to the impact types described for the baseline construction schedule. However, the intensity of these impacts could be greater because of the compressed time in which the impacts would occur. Likely impacts to wetlands under an expedited construction schedule would include earlier loss of wetland habitats and flora and fauna using these areas, erosion, and sedimentation in onsite and offsite wetlands and streams, and changes in groundwater flows.

Erosion and sedimentation would occur under either construction schedule, but overall effects related to an expedited construction schedule would likely be worse because a larger area could be unvegetated, the time to stabilize affected areas with vegetation and other erosion control BMPs could be extended, and larger soil deposits in streams or wetlands and alterations of flow volumes and rates would occur. Groundwater flows could be changed or reduced, which would affect offsite wetlands associated with Whitman Lake (Shu-Guang Li, 2015).

3.3.15.3.3 Operation

3.3.15.3.3.1 Environmental Consequences

3.3.15.3.3.1.1 FCTC Site 1

During normal operation of the site, there would not be any increase in the size of the CIS footprint or additional buildings constructed outside of the CIS footprint that would impact wetlands remaining after the construction of the site. The only potential impact to adjacent and nearby wetlands may occur due to erosion and sedimentation from the CIS footprint and storm water management facility failure. However, this potential impact would be temporary and short-term because slopes would need to be stabilized and storm water facilities would need to be repaired. As a result, any potential impact to wetland areas resulting from erosion and sedimentation or storm water facility failure would be negligible and not require compensatory mitigation.

3.3.15.3.3.1.2 FCTC Site 2

Environmental consequences to wetlands during operation of the potential CIS at FCTC Site 2 would be the same as those discussed for FCTC Site 1.

3.3.15.3.3.2 Mitigation

Mitigation for wetlands during the potential CIS operation at either FCTC Site 1 or FCTC Site 2 would not be required, because additional wetland impacts would not occur within the CIS footprint.

Figure 3.3.15-1 National Wetlands Inventory and Michigan Department of Environmental Quality Wetland Inventory Map – FCTC Site 1

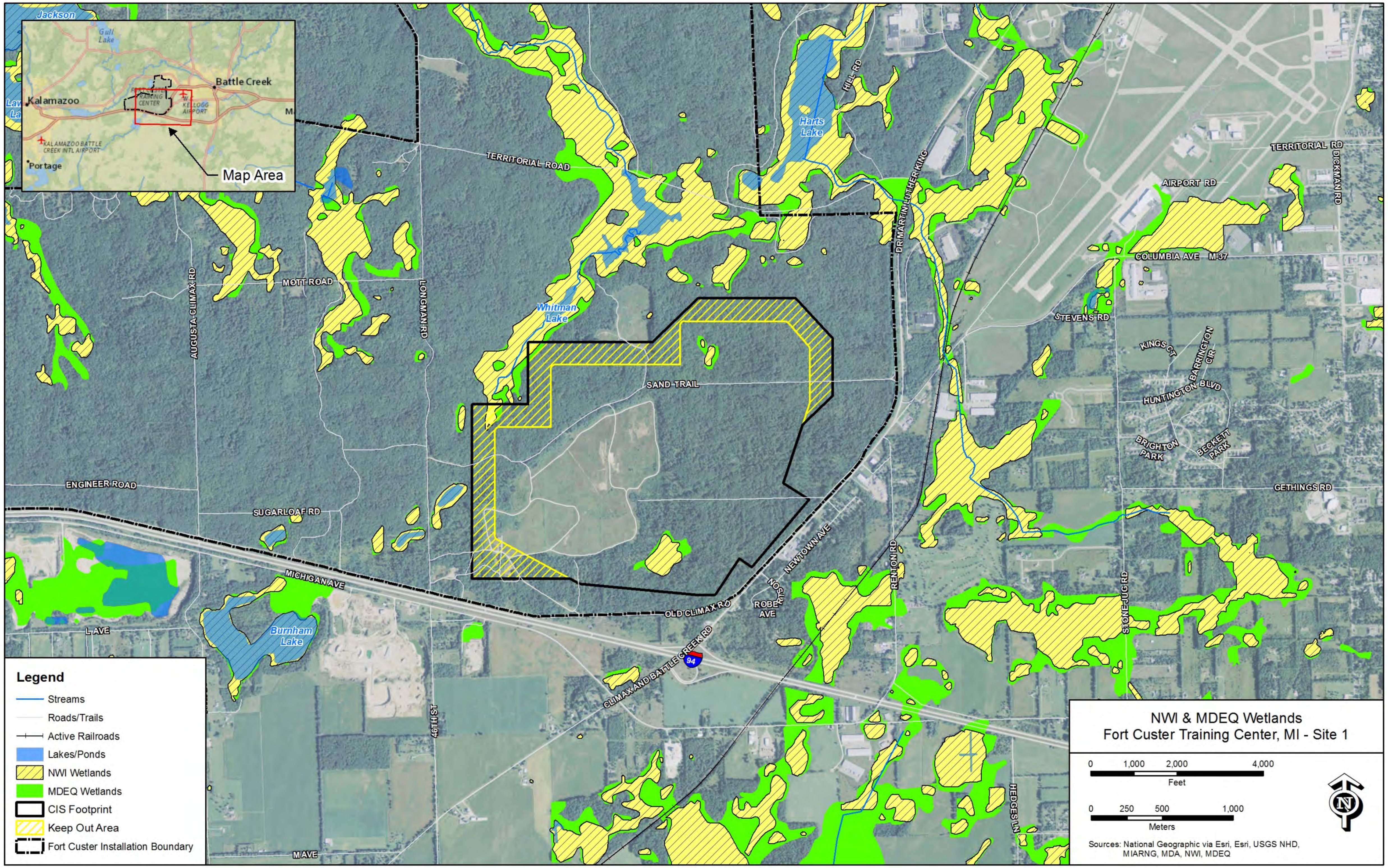


Figure 3.3.15-2 Continental United States Interceptor Site Delineated Wetlands - FCTC Site 1

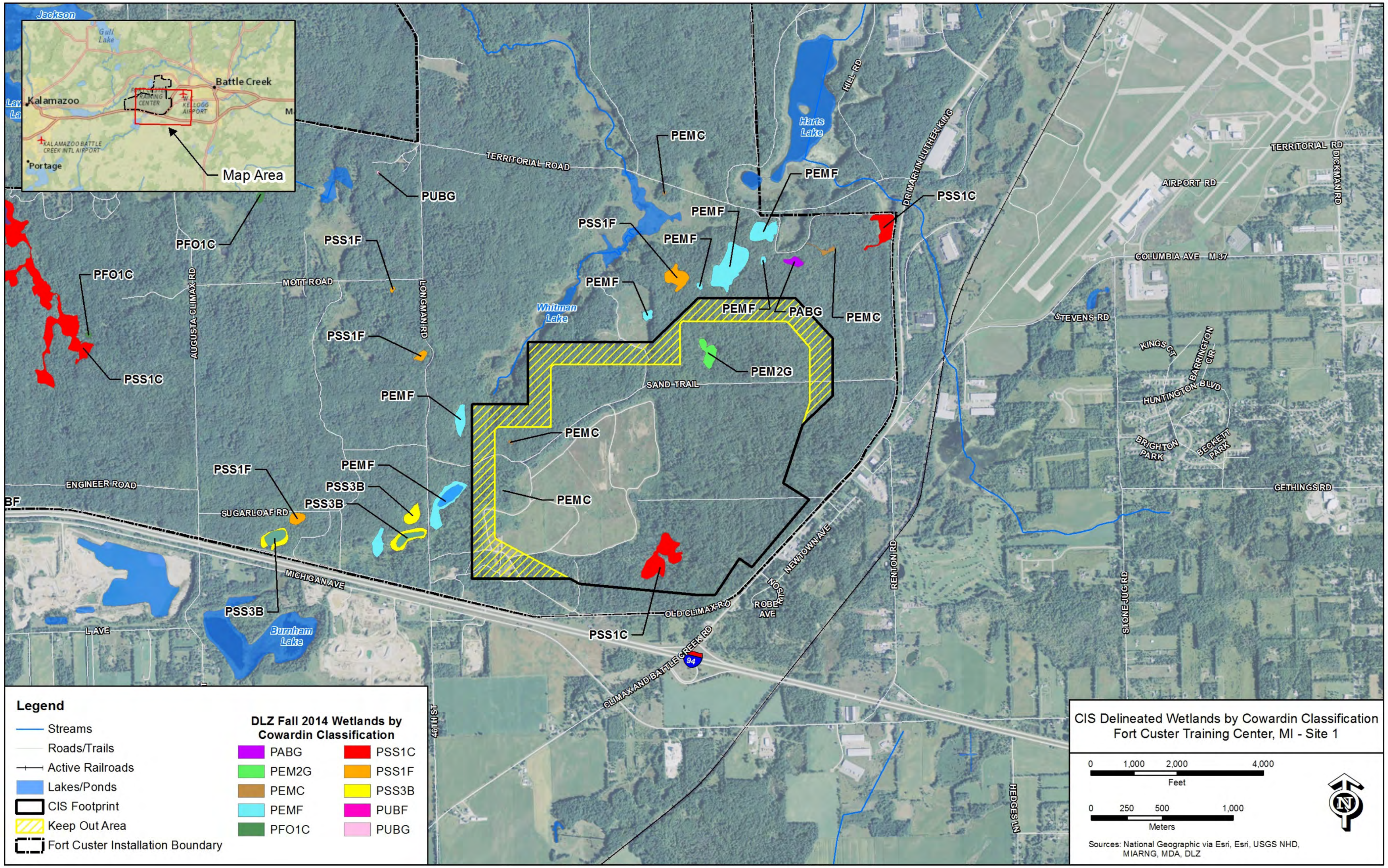


Figure 3.3.15-3 Wetlands in the Cleared Continental United States Interceptor Site Footprint – FCTC Site 1

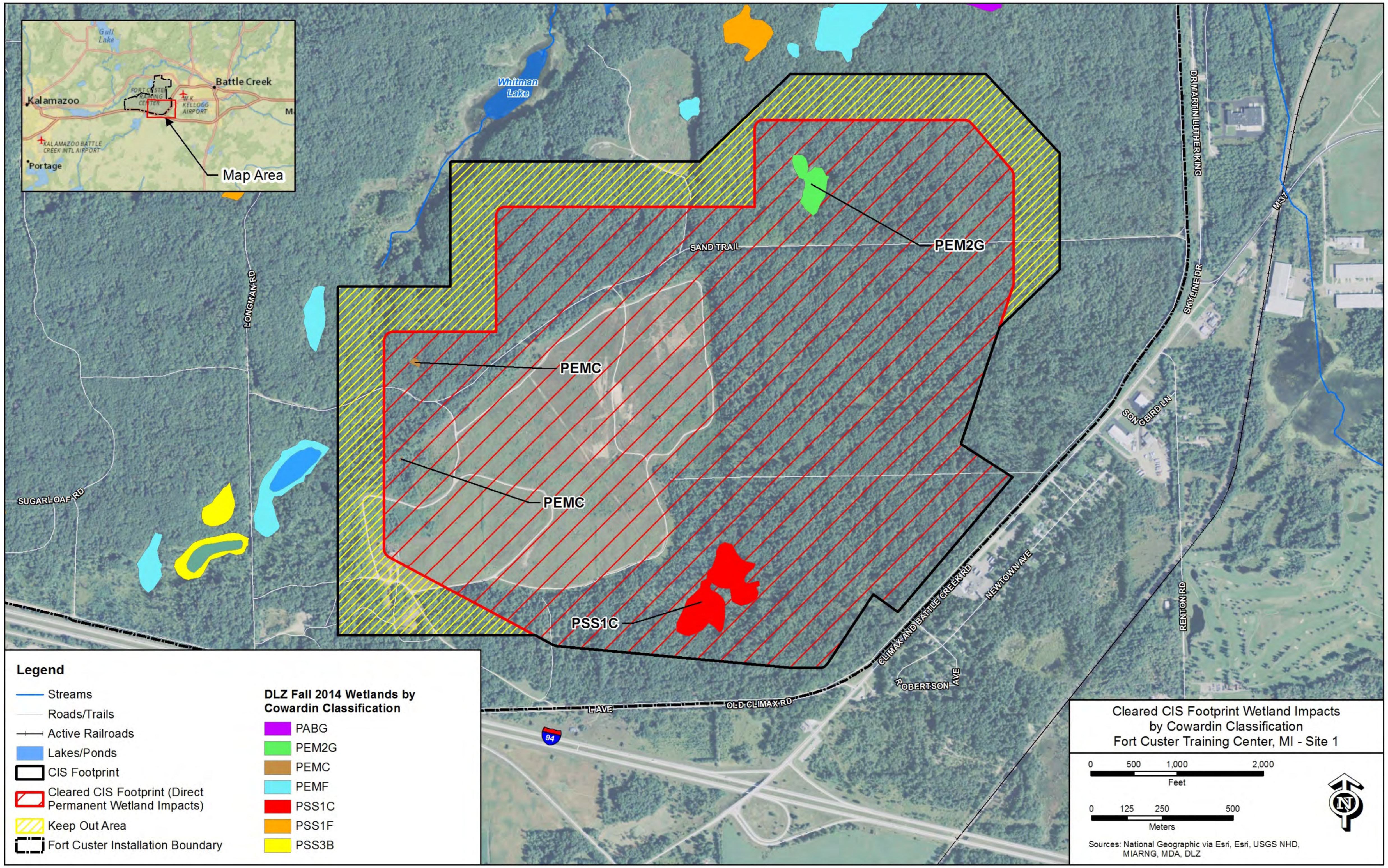


Figure 3.3.15-4 National Wetlands Inventory and Michigan Department of Environmental Quality Wetland Inventory Map – FCTC Site 2

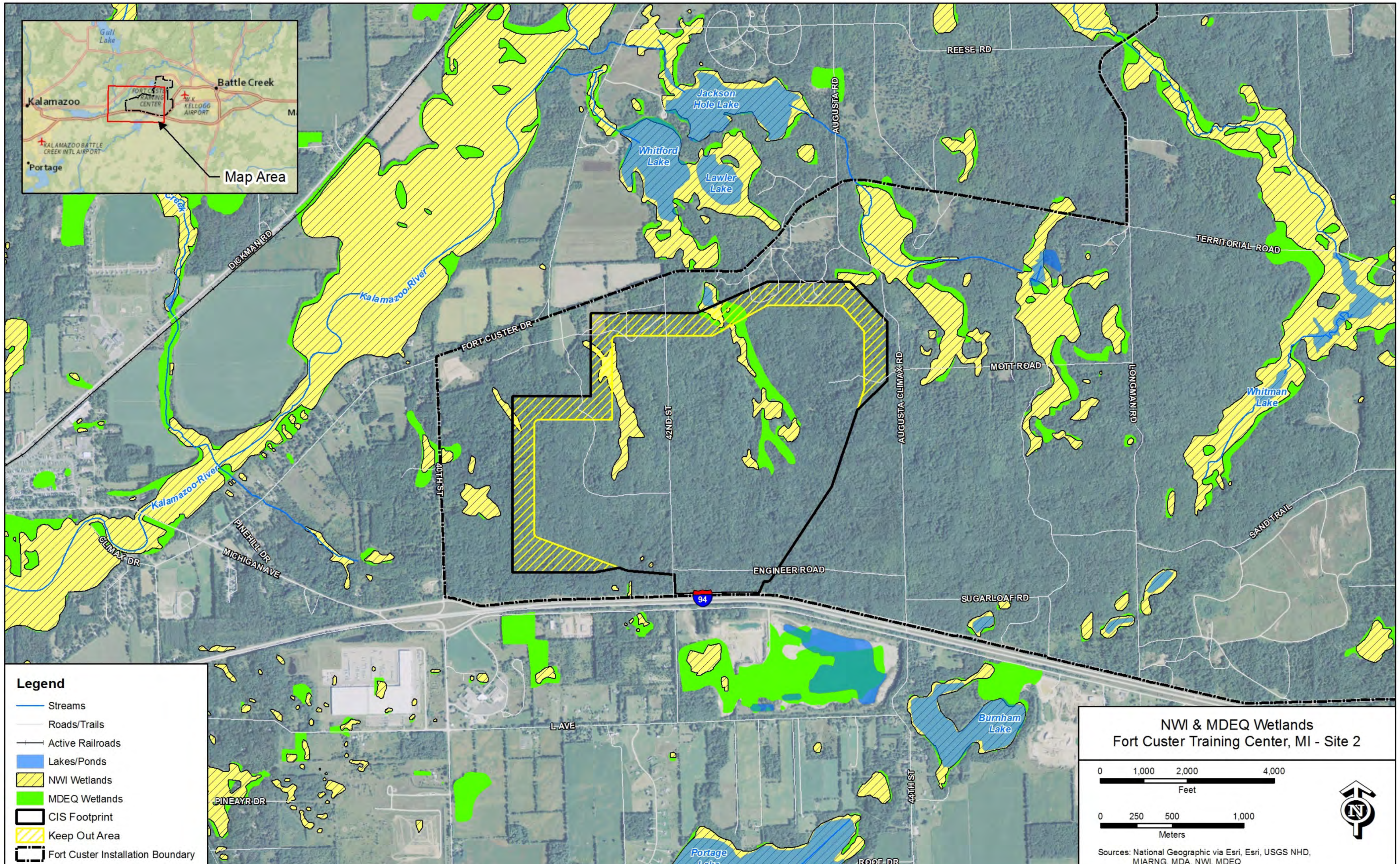


Figure 3.3.15-5 Continental United States Interceptor Site Delineated Wetlands- FCTC Site 2

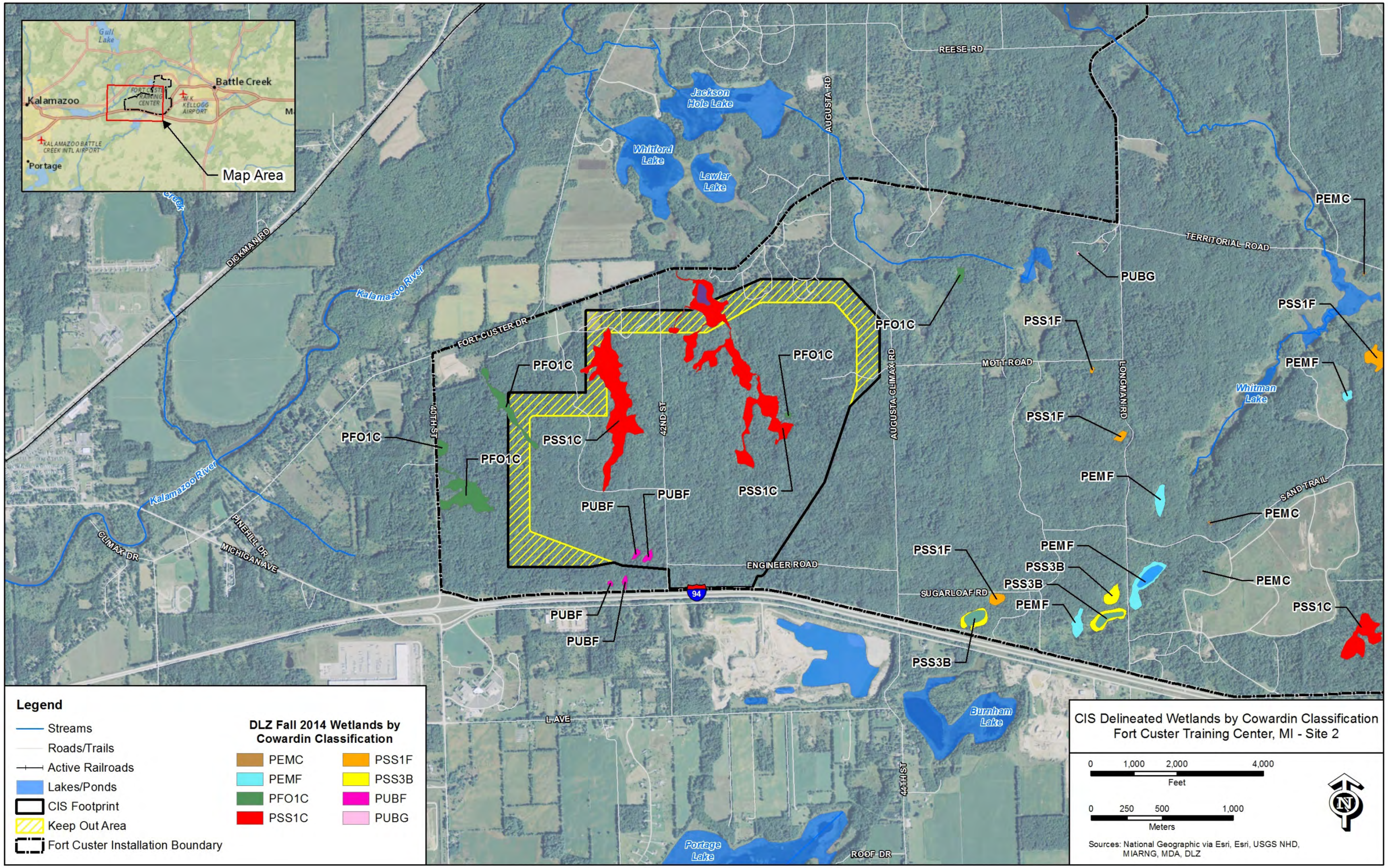
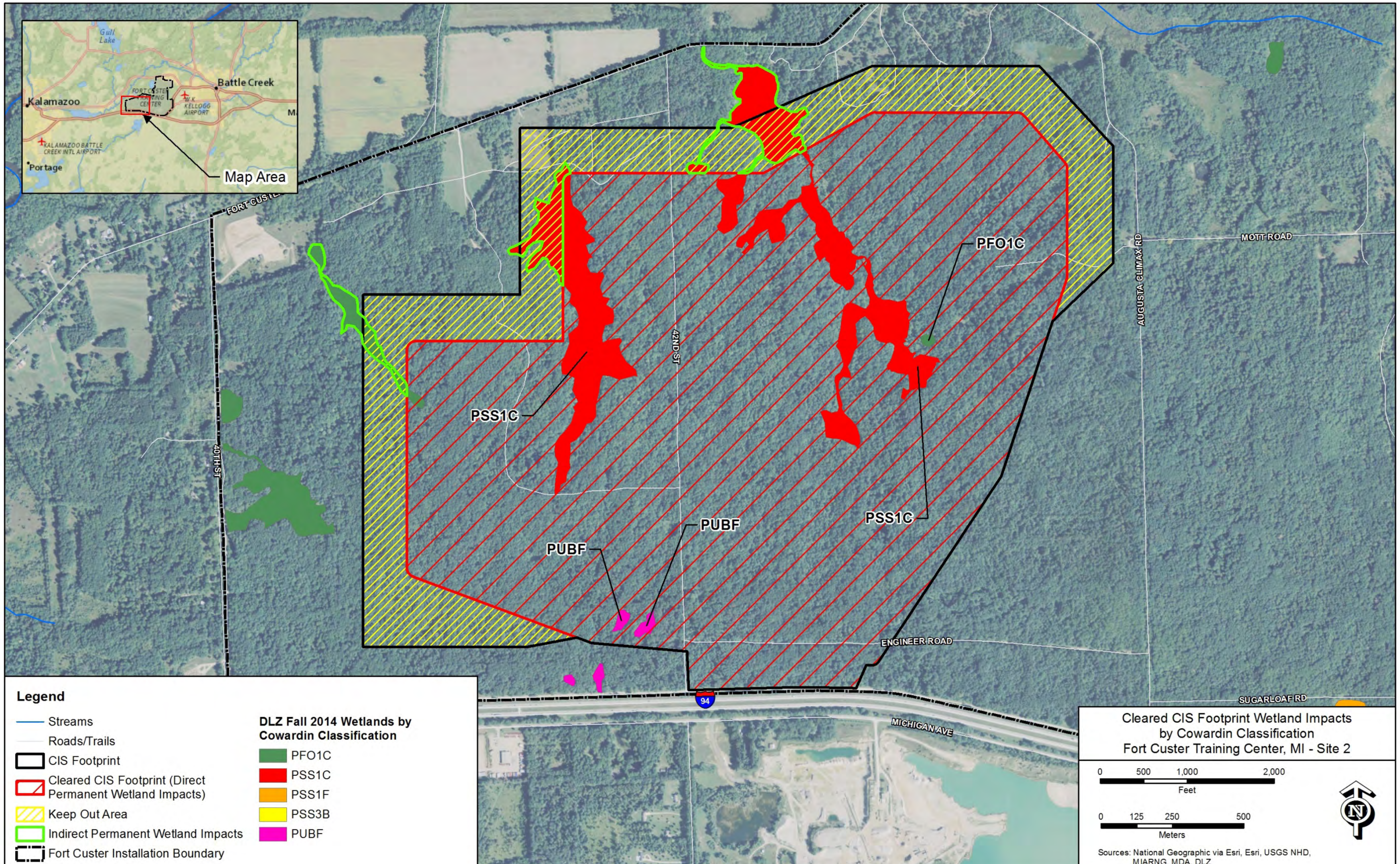


Figure 3.3.15-6 Wetlands in the Cleared Continental United States Interceptor Site Footprint - FCTC Site 2



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3.3.16 Visual/Aesthetics – FCTC Sites

Visual resources are the natural and man-made features that constitute the aesthetic character of an area. Topography, surface water, vegetation, and man-made features define the visual environment and form the overall impression that an observer receives of an area. The importance of visual resources and any changes in the visual character of an area is subjective and influenced by social considerations, including the public value placed on the area, public awareness of the area, and community concern about the visual resources in the area.

3.3.16.1 Visual/Aesthetics – Regulatory Framework – FCTC Sites

Viewsheds are regulated by federal, state, and local land use and zoning codes. For example, local jurisdictions may independently designate scenic highways or other features that are of local importance. Federal laws governing this resource include the following:

- Wild and Scenic Rivers Act of 1968 (16 USC 1271) - Preserves certain rivers with outstanding natural, cultural and recreational values in a free-flowing condition for the enjoyment of present and future generations. Preserves certain rivers with outstanding natural, cultural, and recreational values in a free-flowing condition for the enjoyment of present and future generations.
- National Trails System Act of 1968 (Public Law 90-543, 16 USC 1241) - Institutes a national system of recreation, scenic and historic trails and prescribes methods by which components may be added to the system. Institutes a national system of recreation, scenic and historic trails and prescribes methods by which components may be added to the system.
- NHPA of 1966, as amended (36 CFR Part 800) – Preserves historic and archaeological sites in the U.S. Preserves historic and archaeological sites in the U.S.

3.3.16.2 Visual Impact Assessment Methodology

The Visual Impact Assessment characterized the visual quality of the FCTC area and defined CIS-related effects on visual quality from the perspective of local residents and/or visitors. Specifically, the Visual Impact Assessment determined the following information about the potential CIS deployment at FCTC:

- Visibility from critical locations or vantage points by members of the general public.
- Effect on visual quality within the project viewshed. The total geographic area visible from a specified point is called the viewshed.
- Effect on scenic resources of state or national significance.

The potential CIS deployment at FCTC, including the security lighting associated with the project, may impact the rural landscape in the surrounding area.

The Visual Impact Assessment was conducted using GIS to determine the project viewshed (the areas from which the CIS footprint would be visible) and areas where there would be public sensitivity to views of the FCTC site. A site visit was also made to FCTC and the surrounding area to confirm the areas identified by GIS as having potentially sensitive views. Areas from which there would likely be public views, in the professional judgment of the visual impact assessment specialist, were documented through photographs. AutoDesk Revit and Adobe Photoshop software were used for day and night photograph-based simulations to estimate the visual impacts of the potential CIS deployment.

Viewshed Analysis

The project viewshed was determined using GIS-based elevation, land contour, and land cover data, and assuming the tallest structure on the CIS footprint would be 50 feet AGL. The majority of the potential CIS structures would be less than 50 feet tall; the communications tower(s) would be the tallest and would have heights of approximately 50 feet.

A 5-mile viewshed is typically considered adequate for viewshed analysis for most major actions. This 5-mile distance criterion originated from the U.S. Forest Service “distance zones” described in their 1973 landscape management journal (USDA, 1973). The USDA reasoned that an area that is 5 miles from an observer is still largely considered background, or a distance at which most activities are not a point of interest to a casual observer.

GIS viewshed data and Google Earth image investigations indicated that there would be relatively few publicly accessible views of the site from the surrounding area when vegetative screening is taken into account. It was verified during a field visit to FCTC that the forested areas near FCTC generally contain a predominance of mature trees, but also have trees of various sizes (height and spread) and ages and substantial understory plants throughout the installation.

Key Observation Points (KOPs)

As part of the desktop viewshed determination and evaluation, KOPs were identified within the viewshed. KOPs are intended to provide a representative view of the object of interest (in this case, the project site) from selected vantage points that are publicly accessible and/or have potential visual sensitivity.

KOPs for the visual assessment were selected based on the results of the viewshed analysis, desktop review of topography and sensitive features near the site, accessibility, and the professional judgment of the visual impact specialist. The KOP locations were verified during the field visit and were subsequently narrowed down to two areas to account for accessibility and location-specific conditions that were not as apparent during the desktop review. These field-verified areas are I-94 and the residences near I-94 and Independence Avenue east of FCTC Site 1. The KOPs evaluated included the locations listed in Table 3.3.16-1 and are shown on Figures 3.3.16-1 (FCTC Site 1) and 3.3.16-2 (FCTC Site 2).

Table 3.3.16-1 Key Observation Points at FCTC (Both FCTC Sites) and Field Observations

KOP or Location Visited (refer to Figure 3.3.16-1)	Field Observations
1-Homes on north and south 40th Street	Forest buffer around FCTC Site 2 prevents views from both areas.
2-NRHP Listing – Calhoun County, Michigan	Distance, forest, and buildings prevent views.
3-NRHP Listing – Calhoun County, Michigan	Distance, forest, and buildings prevent views.
4-NRHP Listing – Kalamazoo County, Michigan	Forested areas, FCRA, and distance prevent views.
5-NRHP Listing – Kalamazoo County, Michigan	Forest and distance prevent views.
6-NRHP Listing – Kalamazoo County, Michigan	Distance and forest buffer prevent views.
7-I-94 south of FCTC	Direct view of perimeter road, fence, and outer forest edge.
8-East L Ave/Old Climax Road	Forest buffer would prevent direct views.
9-West Columbia Avenue residences/businesses	Direct views and lightly screened views of vehicles using perimeter road; glimpses of lighting at night possible through the forest buffer.
10-Harts Lake	Not a public view area (inside FCTC).
11-Eagle Lake	Dense forest prevents views.
12-Lawler Lake	Dense forest prevents views.
13-Whitford Lake	Dense forest prevents views.
14-Kalamazoo River	Dense forest prevents views.
15-Trails in FCRA	Dense forest limits views to Territorial Road and the immediate area in the northwest portion of FCTC north of FCTC Site 2
16-South 46th Street	Not a public view area (inside FCTC).
17-North 44th Street	Not a public view area (inside FCTC).
18-Engineer Road	Not a public view area (inside FCTC).
19-Sand Trail Road	Not a public view area (inside FCTC).
20-Mott Road	Not a public view area (inside FCTC).
21-Territorial Road	Not a public view area (inside FCTC).

Facility View Simulations

Visual impact assessment fieldwork was conducted November 5 and 6, 2014, after the majority of trees in the FCTC region (with the exception of the many oak trees in the area) had dropped their leaves. For the purposes of full disclosure, it should be noted that the CIS footprint was modified after the field visit was conducted. However, the modifications were minor in terms of their effects on the outcomes of and data obtained from the field visit. Therefore, the field visit findings remain applicable to and valid for the visual impact analysis for the FCTC Sites.

The procedure for visual impact assessment fieldwork involved verifying the suitability of the KOPs identified during the desktop evaluation by visiting and taking photographs at the KOPs determined in the field to be public and/or visually sensitive. The photographs were taken from the perspective of a viewer located at the KOP and looking toward the site. The locations of the KOPs were field verified by first marking a representative area inside the CIS footprint with a visual reference point that could be seen from the surrounding area. This was done by using a large weather balloon that was anchored inside the CIS footprint and flown at a 50-foot height (representative of the tallest permanent structure expected to be part of the potential CIS). The balloon was located on the west side of the convoy reaction course, which is in the southwest corner of the FCTC Site 1 footprint. After installation of the balloon on the site, each of the identified KOPs was visited to verify whether the balloon could be seen, and thereby also verify the desktop viewshed determination shown on Figures 3.3.16-1 and 3.3.16-2. Photographs were taken at representative KOPs during daylight hours using a handheld digital camera.

Visual simulations of the potential CIS from the viewpoints judged to be most sensitive were created from field photos during daytime and nighttime, leaf-off conditions to estimate worst-case visual impacts. The visual simulations were conducted by superimposing CIS-type structures similar to those existing and operational at other MDA facilities onto photographs taken from FCTC viewpoints. Digital renderings of the estimated appearance of nighttime lighting conditions were developed from one viewpoint that could be seen by members of the public permitted to access FCTC for fishing at Whitman Lake northwest of FCTC Site 1, although it is unlikely that these members of the public would be on FCTC during conditions of darkness. For simulated night views, it was assumed that all light fixtures on the site would use light-emitting diodes (LEDs) that are fully recessed (International Dark Sky Association approved) such that light pollution and trespass, glare, and skyglow would be minimized to the extent practicable.

Light-related terms used in this visual impact assessment are defined as follows:

- Light pollution – an adverse effect of artificial light, including skyglow, light trespass, light clutter, and glare.
- Light trespass – poorly shielded or poorly aimed fixtures casting light into unwanted areas, such as buildings, neighboring property, and homes. Light trespass is a main contributor to skyglow.
- Glare – the effect of lighting within the visual field that is substantially greater than the light level to which the eyes are adapted, causing annoyance, discomfort, or loss in visual performance and visibility.
- Skyglow - the result of light fixtures that emit a portion of their light directly upward into the sky where light scatters, creating an orange, yellow, or pinkish glow above a city, town, or other intensely lit area.

In general, impacts would be less perceptible during the growing season and after forest regrowth occurs around the areas disturbed for potential CIS work (for views from certain locations).

3.3.16.3 Affected Environment – FCTC Sites

3.3.16.3.1 FCTC Site 1

3.3.16.3.1.1 Visual Character of the FCTC Site 1 Footprint and the FCTC Installation

The visual environment of FCTC Site 1 is characterized by mature second-growth forest over two-thirds of its approximately 1,008-acre area, with the remainder of the area occupied by the current FCTC installation's convoy reaction course, which is a 270-acre cleared area featuring maintained sand-based maneuver trails. There is limited presence of military infrastructure (installation roads, range security fencing, abandoned buildings, signs, and other features.

There are no formally recognized aesthetic or visual resources within the FCTC Site 1 footprint. In general, dense forest cover and limited or rolling topographic relief over most of the installation limits line-of-sight visibility and inhibits large-scale landscape viewing from most perspectives. Overall, FCTC Site 1 views are dominated by extensive areas of forest and one area of expansive view over the open area of the convoy reaction course, which is situated such that a higher elevation area on the west side overlooks the entire range. Most views in the FCTC Site 1 area are confined to the immediate area around interior installation gravel roads because of the dense forest cover.

There is permitted access to the FCTC installation for hunting and fishing recreational activities in some areas, including Whitman Lake near FCTC Site 1; however, many areas of the installation are off-limits because of the potential for UXO to be present away from maintained roads. There is, therefore, a limited area that could be viewed by the public within the installation.

FCRA comprises 3,033 acres located between Battle Creek and Kalamazoo. The property features three lakes, the Kalamazoo River, second growth forests, prairie restoration, and a comprehensive trail system used by hikers, equestrians, and mountain bikers. Boating access sites are available on Whitford, Lawler, and Eagle Lakes, with a universally accessible fishing pier at Whitford-Lawler Lake. The area also features a 219 site modern campground, group camping area, rustic cabins, swimming beach, beach house, and picnic area (KP&R, 2014). The nearest corner of FCRA is approximately 1.16 miles northwest of the closest edge of the potential CIS cleared area.

Because the FCTC installation is adjoined to the north-northwest by FCRA, aesthetics and visual concerns are considered more prominently for FCTC locations near the recreation area. From north of the FCTC installation fence along Territorial Road, the recreation area features trails, lakes, and wooded areas that allow visitors to view portions of FCTC. The view from the recreation area along Territorial Road is limited by the dense forest along Territorial Road in most areas, and recreation area users in this area would see largely the road and a natural looking second growth forest. During summer when the trees are leafed out, the view into the military property would be very limited by the understory brush, dense tree trunks, and leaves. In summer, the estimated distance that a viewer looking in from the outer fence of FCTC would be able to see into the installation would be about 100 feet. Winter conditions would allow recreation area users to see slightly farther into the forest in the absence of much of the leafy vegetative matter that would screen views in the summer; however, the trunks of trees in the forested areas throughout the central and western parts of the site are thick enough to block views even in winter beyond about 300 feet from the fence.

The nearest edge of the cleared area associated with the FCTC Site 1 footprint is about 175 feet from the installation boundary in the southeast corner near I-94. The intervening area between this cleared area boundary and I-94 is heavily forested, and the gravel perimeter road around the outside edge of the FCTC site is also present in this area.

3.3.16.3.1.2 Cultural and Historic Sites

The NHPA requires federal agencies to take into account the effect of their actions on cultural resources. Cultural resources may be affected when a potential project may directly or indirectly alter any of the characteristics of a historic property that qualify the property for inclusion in the NRHP in a manner that diminishes the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. The visual character of historic or cultural resources can be affected through such changes as physical destruction or damage, removal of the property from its historic location, change of the character of the property's use or of physical features within the property's setting that contribute to its historic significance, and introduction of visual elements that diminish the integrity of the property's significant historic features (BLM, 2012).

No buildings listed, eligible for listing, or potentially eligible for listing in the NRHP occur in the CIS footprint. FCTC has been completely surveyed for cultural resources (MDMVA, 2012). Investigations conducted in 2011 on a 5-mile stretch of Territorial Road indicate that the portion of road on the FCTC installation is eligible for listing in the NRHP because of its role as an historic transportation route first used by Native Americans; its part in the settlement and agricultural development of Michigan; and because Territorial Road characteristics remain largely the same as they were historically. The investigation concluded that the topography and vista views are of high value to the historic landscape of Territorial Road and that it appears that these aspects of the landscape have remained essentially intact and retained their cultural integrity even though some features have been improved (such as road pavement) and there is now visual evidence of military training land uses (AMEC E&I, 2013b).

Because the topography and views in the area of Territorial Road have retained their integrity through time, the 2011 investigation recommended that they should be stabilized and preserved as critical elements of the historic landscape. Some maintenance actions and improvements (bridge restoration and water management) are likely necessary to further preserve this section of Territorial Road while ensuring that its topography and views remain unchanged.

The nearest NRHP-listed properties to the FCTC installation are to the north in the Augusta-Battle Creek corridor; the nearest to the FCTC Site 1 footprint are south of the FCTC installation to the southeast and southwest. The NRHP-listed and eligible resources in Table 3.3.16-2 were identified during desktop evaluation as those that could be potentially visually impacted based on distance from the site and terrain and other features between the FCTC Site 1 and each listed property.

Table 3.3.16-2 National Register of Historic Places-Listed and Eligible Resources near FCTC

Name on the Register	Date Listed	Location	City or Town	Approximate Distance from FCTC Installation Boundary (nearest point)
Kalamazoo County				
Territorial Road	NA	FCTC northwest and east-central areas	Battle Creek area	Onsite
Richard and Mary Woodward Gregory House	June 20, 2002	913 E. Augusta Rd.	Augusta	1.7 miles northwest (heavy forest and distance to potential CIS footprint prevent views)
The Acres	May 19, 2004	10036, 10069, 11090, 11108, and 11185 Hawthorne Dr.	Charleston Township	2.2 miles southwest (heavy forest prevents views)
Climax Post Office Building	January 27, 1999	107 N. Main St.	Climax	2.8 miles south (distance and forest prevent views)
Calhoun County				
Camp Custer Veterans Administration Hospital (U.S. Veterans Hospital No. 100)	May 17, 2012	5500 Armstrong Rd.	Battle Creek	0.4 mile north (distance to CIS footprint and extensive forest prevent views)
Roosevelt Community House	August 20, 2001	107 Evergreen Rd.	Springfield	1.5 miles northeast (heavy forest and distance to FCTC Sites CIS footprints prevent views)
Sources: NRHP, 2014.				

Territorial Road in the northwestern part of the installation (partially adjacent to FCRA) and continuing across the eastern portion in a 5 mile length is considered a NRHP-eligible feature on the FCTC installation. Fort Custer National Cemetery is not listed, but is located outside and north of the installation on the north side of Dickman Road. Distance, the presence of industrial or other built structures, and forest cover on and near FCTC prevent existing views of cultural resource sites with the exception of Territorial Road.

Lawler Cemetery is located along Territorial Road north of FCTC Site 2. Fort Custer National Cemetery is outside the FCTC installation and would not have a view because of intervening forest vegetation and distance. These areas were field verified to assess potential visual impacts from the project. These features are in closer proximity to FCTC Site 2 and are described more detail in Section 3.3.16.3.2.

Territorial Road in the area of the FCTC Site 1 footprint is not visible outside the immediate extent of the road in light of the heavy forest cover surrounding the road as well as the topographic environment of the installation. The linear view in the Territorial Road area encompasses dense, mature forest and the road itself extending into the distance.

Further information on these resources is included in Section 3.3.4 (Cultural Resources).

3.3.16.3.1.3 Representative Views

Photographs were taken of representative views of the areas near the FCTC sites as shown on Figure 3.3.16-3. Figures 3.3.16-4 through 3.3.16-8 show representative views of areas near the FCTC Site 1 footprint, including Territorial Road, an area near where construction of the potential CIS would occur, and the view from a perimeter area. The photo numbers on Figure 3.3.16-3 correspond to the last digits of the figure number in the text. For example, the location of Photo 4 corresponds with the photo shown as Figure 3.3.16-4.

3.3.16.3.1.4 Visual Character of the Linear Corridors

The existing offsite linear corridors serving FCTC typically appear as cleared or low vegetation (grass) corridors through secondary growth forest and would be adequate to accommodate the CIS footprint with water and electrical service. Design work is ongoing to determine the locations of the offsite and onsite corridors that would be needed to serve the potential CIS. On the FCTC installation, new utilities, if needed, would likely be installed within a 25-foot corridor of each side of existing installation roads. The corridor boundary of 25 feet on each side of roads would also apply to utilities that would need to be installed outside of the FCTC installation. Refer to Section 3.3.13 for more information on utilities. Any new utility corridor to serve the potential CIS, if needed, would follow existing roads across the FCTC installation to the point where it would transition to an offsite corridor.

3.3.16.3.1.5 Visual Character of the Surrounding Area

Southwest Michigan is a largely rural and agricultural area, with a few larger cities in the area and Lake Michigan to the west. Generally, residents of the project area value the natural resources, agricultural heritage, and rural character associated with living in this region. Large infrastructure projects can compromise scenic integrity and the essence of why people choose to live in and visit this region. FCRA (adjacent to the north and west of FCTC) and other natural areas near FCTC may experience viewshed impacts depending on the season, especially during early morning and later evening hours when the security lighting for the project would be most visible. However, screening by forest vegetation between the installation site and these natural areas may prevent viewshed impacts beyond the FCTC property.

The Battle Creek-Kalamazoo, Michigan, area features a relatively flat landscape that is extensively forested in some areas, with a greater degree of development interspersed with more rural areas. Because at least some degree of forest shielding of most views beyond several hundred feet of major roads or highways is common in this area, the FCTC area would generally not be considered visually sensitive with the exception of public recreation areas such as FCRA.

The interior of FCTC is largely shielded from public view by dense forest; however, there is a clear public view of the east and south outer perimeter areas of the installation, as I-94 runs adjacent to these two sides of the property. Drivers using I-94 near FCTC would see the gravel road around the perimeter, inside which they would see a wall of mature forest that is occasionally broken by other, perpendicular gravel roads that branch off into the interior of the installation from the perimeter road. From the outside, drivers traveling at highway speeds would only momentarily glimpse these gravel roads for a short distance before each area would be passed.

3.3.16.3.1.5.1 Potentially Sensitive Viewpoints

Typically, potentially visually sensitive locations include residential areas, recreation areas, or parks and tourist attractions. One recreation/park area in the vicinity of the FCTC Site 1 footprint that would be considered visually sensitive is the FCRA, which is located adjacent to the north and west of the FCTC installation boundary. One of the main features of FCRA is Eagle Lake, which hosts beachgoers in the summer season. These areas can be seen on Figures 3.3.16-1 (FCTC Site 1 Viewshed Map), 3.3.16-2 (FCTC Site 2 Viewshed Map), and 3.3.16-3 (Photo Locations).

Existing FCTC perimeter road infrastructure and adjacent forests are visible from the southern part of FCRA that is adjacent to FCTC. In the area of the boundary between FCTC and FCRA, there are fewer trees and more open areas in FCRA such that users can easily see across the boundaries of these lands. The FCTC installation forest along the boundary just north of Territorial Road essentially blocks the view from FCRA any farther into FCTC than the edge of the forest. FCRA has existing man-made features such as overhead distribution lines, communication towers, and road infrastructure that reduce the level of visual sensitivity in certain places at the southern portion of the recreation area. Because FCTC has been an existing military installation in various forms since 1917 and generally appears unobtrusive from FCRA, it is likely to be accepted by most observers and recreational users as part of the expected view in the area.

3.3.16.3.1.5.2 Nighttime Views

At night, lighting is concentrated near the FCTC main entrance security booth and cantonment/barracks area at the northern extent of the installation, which makes it plainly visible along Denso Road within the industrial complex setting where FCTC is located. The FCTC main entrance security booth is brightly lit at night to facilitate identification of people entering the installation. The area visible from I-94 along the east and south borders of the installation at night is generally confined to that immediately adjacent to the highway because of the lack of on-installation lighting near the perimeter and the forest cover present on the installation. Figure 3.3.16-7 shows a nighttime view illustrating the limited lighting present along the east side of the FCTC installation boundary when no car headlights are present along I-94. This view shows the very limited effect of even existing, non-shielded street (intersection) lighting in the dark nighttime environment of the FCTC installation.

There is a moderate level of artificial night lighting in the immediate vicinity of the FCTC installation, including generally low-level lights from homes, commercial businesses, and industrial properties to the east and south along I-94 and to the north along Denso Road and in the industrial park area in addition to the bright lighting at the FCTC main entrance. The residential area west of the FCTC installation boundary is unlit during the night. Occasional residential streetlights are present in the surrounding area.

3.3.16.3.2 FCTC Site 2

3.3.16.3.2.1 Visual Character of the FCTC Site 2 Footprint

The visual character described for FCTC Site 1 in Section 3.3.16.3.1 also essentially describes FCTC Site 2 except for the particular visual characteristics applicable to the FCTC Site 2 immediate area. This section presents a description of the visual character of FCTC Site 2 where it differs from that of FCTC Site 1. FCTC Site 2 is located in such close proximity to FCTC Site 1 that there is no discernable difference in the majority of the affected environment on the FCTC installation or the environmental consequences applicable to the CIS footprint and facilities.

The FCTC Site 2 area is characterized by dense, mature forest interspersed with occasional wetland and pond areas. Two onsite gravel roads, 42nd and 44th Streets, traverse the CIS footprint in a north-south direction. These roads extend approximately 1.4 miles from Territorial Road in the north to the FCTC perimeter installation road in the south. Engineer Road, a shorter east-west gravel road, crosses the southeast corner of FCTC Site 2. A perimeter gravel road passes just south of the FCTC Site 2 area. Views in the FCTC Site 2 area are available generally from the gravel roads and are limited to the immediate area of the roads because of the density of the forest. Because 42nd and 44th Streets were constructed in straight lines and have considerable lengths, views extend for a long distance to the north and south in many locations along these two roads, but still consist only of the road and closely surrounding forest. The hilly topography of this western portion of the FCTC installation limits north-south views depending on the observer's location along the roads; however, some locations offer continuous views to the edge of the forest and the installation boundary.

I-94 and the industrial/residential area south of I-94 would be the closest areas to the site with a potential for public views; the area between the FCTC Site 2 footprint and these locations is heavily forested up to the FCTC perimeter road. The nearest edge of the cleared area within the FCTC Site 2 footprint is about 265 feet from the installation boundary in its southeast corner near I-94. The intervening area between this cleared area boundary and I-94 is heavily forested, and the gravel perimeter road around the outside edge of the FCTC installation is also present in this area.

FCRA is adjacent to the FCTC north and west boundaries, within approximately 1,000 feet of the northern edge of FCTC Site 2. Approximately 560,000 visitors use the FCRA on an annual basis, with approximately 10 percent of these visitors using the recreation area campground. Regular users of the FCRA include hunters, hikers, equestrians, mountain bikers, dog sledders, and daytime beachgoers.

Figures 3.3.16-9 through 3.3.16-13 show existing views in the FCTC Site 2 area. Locations of photos taken in the area of FCTC Site 2 are shown on Figure 3.3.16-3 along with those taken in the area of FCTC Site 1.

As described in the information provided for FCTC Site 1, the cultural resource nearest to the CIS footprints is closer to FCTC Site 2 than FCTC Site 1 and is on the FCTC installation. Territorial Road along its 5 mile length spanning the FCTC installation has been determined eligible for NRHP listing, with the largely intact visual character of the road compared with historic conditions a contributing factor in the determination of NRHP eligibility. The portion of Territorial Road nearest to FCTC Site 2 is about 1,000 feet north. Other NRHP-listed cultural resources in the FCTC area are located such that there are no existing views from these resources to FCTC Site 2 because of distance and the presence of surrounding forest vegetation. The Lawler Cemetery off of Territorial Road is approximately 1,400 feet north of the nearest portion of the FCTC Site 2 footprint to be cleared. Views between Lawler Cemetery and the FCTC Site 2 footprint are also blocked by forest.

3.3.16.4 Environmental Consequences and Mitigation – Visual/Aesthetics – FCTC Sites

3.3.16.4.1 Construction – FCTC Site 1 – Baseline Schedule

This section presents the impacts and mitigations associated with construction under the baseline schedule presented in Section 2.5.1.

3.3.16.4.1.1 Environmental Consequences

3.3.16.4.1.1.1 FCTC Site 1

Approximately 805 acres of largely undisturbed land would be cleared and graded during construction activities for FCTC Site 1. Blasting of bedrock would be necessary to construct the SIV/silos.

Onsite Impacts (CIS Footprint and FCTC Installation)

Construction would first require clearing the woody and shrubby vegetation from the project site, creating a more level ground surface, dewatering the cleared area, and constructing the access roads to the multiple groups of buildings that are part of the site. As indicated in Section 2.9.1, up to 805 acres would be cleared for the FCTC Site 1 footprint, mostly forest and scrub-shrub vegetation. The 270-acre convoy reaction course in the western portion of the FCTC Site 1 footprint would require minimal clearing, as the area is already cleared and maintained. Substantial work would be required to level this area from its existing topography, which slopes substantially from west to east.

Site Clearing and Construction Activities. Activities contributing to visual impacts would include clearing of trees and vegetation and associated piles of vegetative debris, and views of workers cutting the debris to smaller sizes or otherwise preparing it for sale or disposal. Views of construction workers and machinery, including bulldozers, chainsaws, and logging equipment, would be seen onsite during the site clearing stage. Figure 3.3.16-14 shows a simulated view of increased construction traffic during the construction stage on the FCTC south perimeter gravel road. The overall view of the site would change from largely natural or unmaintained rural landscape and forest to a denuded, flat expanse of soil through the site preparation and utilities construction stage. Underground water and other service lines and underground and aboveground lines as needed to connect the potential CIS into the local substation and electrical grid would appear during this time, with soil from buried lines being stockpiled, as well as accumulations of power line poles and other equipment in various areas of the site. The number of visible construction workers would substantially increase after site clearing, particularly with the onset of heavy construction. Incoming and outgoing vehicular traffic inside the FCTC installation would likewise increase substantially, especially along the relatively few roads that would provide access to the FCTC Site 1 footprint, although there are generally few stationary observers in the southern portion of the installation to experience the visual impact.

The majority of the visual impacts from the potential CIS deployment would be confined to the interior of the FCTC installation and would be most visible to personnel working at the installation, particularly those using the ranges, or to members of the public permitted to access interior areas of FCTC for recreational use. Public views of the major clearing and construction locations from outside FCTC would be very limited by the filtering effect of the various levels of understory and tree cover between the perimeter of the FCTC installation and the interior, where the potential FCTC Site 1 footprint would be located. There is a remote potential for quick glimpses of the potential CIS deployment (or associated lighting) closest to I-94 to be momentarily visible to motorists passing on I-94 through intervening stands of trees (the depth of which would be about 400 feet) and distance.

Fugitive Dust. A primary concern at many large construction sites is the potential for visible dust to be created by construction equipment traffic or windborne clouds of dust rising from cleared areas. Construction in the CIS footprint would involve large acreages of exposed soil and soil stockpiles after clearing is completed. This exposed soil could become windborne and, if present in large quantities, could accumulate on surfaces inside and outside the site, including vegetation, residences, highways and vehicles, and other nearby features. This type of fugitive dust can create a negative visual impression of the area as being unclean or less scenic than it would otherwise be if construction were not ongoing. Similarly, the visible presence of construction equipment exhaust, especially after machines are started after a period of suspended construction work (such as a weekend, holiday, or weather delay) or longer idle period before being used again at the site, may give the visual impression of air pollution in the area. Refer to Section 3.3.1 for further information about air emissions during construction.

Litter. Improperly discarded waste from construction worker meals, material packaging, and other activities could also become windborne and accumulate along fence lines or on properties outside the site, degrading the viewshed on the site and in the surrounding area and potentially creating a negative impression of the project from the perspective of local residents.

Erosion and Sedimentation. Erosion and sedimentation from storm water runoff entraining bare soil in the onsite cleared areas, if not properly controlled, could change the appearance of onsite streams near the construction area from the typical clear to a brown, sediment-filled or cloudy and turbid appearance. However, such impacts would be very short-term or negligible with the implementation of BMPs.

Views of Construction Equipment and Facilities. Aspects of construction that may also negatively affect public and/or local perceptions of the viewshed could include the location of large ASTs near construction areas, the presence of increased fencing and fenced areas, temporary parking and storage of construction equipment and materials, and large expanses of gravel surfacing over a former largely natural area. These types of changes could represent a positive impact to some viewers in terms of economic activity, while others may perceive this view in a negative way associated with the removal of the natural features that have been present over a long period of time at FCTC. However, it is highly unlikely that the public would have any views into the CIS footprint.

Summary. Because of the general lack of visual sensitivity of the FCTC area and the low likelihood of visual impacts outside the FCTC installation, the impacts of the potential CIS deployment at FCTC Site 1 on the aesthetics of the FCTC area would be minor from a general public perspective. From the viewpoint of members of the public permitted to access FCTC for recreation, the visual impact would be moderate because of the large degree of change over an 805-acre area from largely forested and open convoy reaction course with varying topography to expansive flat, cleared site featuring new buildings and structures surrounded by concrete, gravel, and limited maintained lawn areas. However, this type of change would be expected on a military installation where uses of certain portions of the property are modified based on training needs. There would be visual impacts related to increased traffic, but these would be confined to a largely industrial and commercial area that already experiences fairly heavy traffic. Because FCTC is surrounded by a developed area with heavy highway traffic, this visual impact of traffic would be less noticeable to observers in the FCTC area than it would be if the surrounding area were more rural or residential.

Overall, the magnitude of visual impacts would be minor to moderate, mostly because of traffic increases that would be visually obvious and the duration of the potential CIS construction under the baseline schedule. The 5-year duration of construction impacts would be considered temporary. The extent of impacts, which are largely onsite with limited offsite impacts mostly from traffic on local roads and near the FCTC entrance, would be considered localized and would not be noticeable in the wider region.

Linear Corridors and Substation – Onsite

Utility-related construction and installation of any new utilities needed would occur both outside the FCTC installation (new 2-acre electric substation and lines along existing road ROWs as well as along existing FCTC interior installation roads. Utilities installed in existing road ROWs may impact an area of up to 25 feet out from road edges on both sides of roads where they are installed.

The visual impacts from construction at the new substation, the location of which has not yet been finalized, would depend on the environmental features surrounding the location. Visual impacts would be moderated if the substation is constructed in an area removed from main local trafficways and residences and surrounded by forest vegetation; however, visual impacts would be greater if the substation is located in an agricultural area or open field or is near frequently used local roads or near residential areas. Linear corridor impacts would be experienced by both the public and onsite personnel, as utility lines would parallel existing roads on and offsite. These impacts would be very similar to the onsite construction impacts and would be temporary and minor because of the small area involved and the likelihood that at least part of the substation site would be screened from view outside the immediate area by surrounding forest, development, or other features. Construction visual impacts from linear corridors outside the FCTC site would be more clearly visible, but would likely be in industrial and/or commercial areas where infrastructure alongside roads is already present, which would somewhat reduce the degree of perceived impact and more easily blend with the character of the existing area.

If utilities were installed on the FCTC installation along existing roads, there would be a clear view of these construction activities from nearby areas on the installation. There would be no visibility to the public because of the distance from public viewpoints and the degree of screening by densely forested areas.

Offsite Impacts (Beyond FCTC Installation Boundaries)

Most construction impacts, such as visible dust and exhaust, landscape scars, visible equipment, decreased forest from thinning, views of the security fences around the disturbed areas, additional truck traffic, and the presence of workers and construction equipment, would occur below the tree line of the forest around the perimeter of the FCTC installation. Impacts would not likely be visible to nearby locations because of the screening forest cover, but there would be a small potential for views of mission support facilities at a few residences just outside the east installation boundary and from I-94. Based on visual assessment fieldwork and the potential FCTC Site 1 footprint, the surrounding area beyond these points would not have views into the CIS footprint during construction.

According to U.S. Army fieldwork studies conducted in 1963, in summer in a deciduous or coniferous forest, visibility was found to be limited to 330 feet or less into the forest in about 95 percent of cases. Visibility is between 100 and 200 feet in approximately 50 percent of cases, and visibility distances in forests with greater amounts of understory growth and taller understory plants decreases. In deciduous forests, visibility is generally about 40 percent greater in winter versus summer, or up to approximately 460 feet into a typical deciduous forest (DoD, 1964). The forested area between most residents nearest to FCTC along the east side of I-94 and the FCTC installation boundary and the south side along I-94 consists of a single line of trees and/or highway ROW area about 60 feet wide. The thickness of forest between most outside residents and observers and the FCTC Site 1 cleared area boundary ranges from as little as 324 feet along the east side to approximately 1,200 feet along most of the south side. Based on the visual impact assessment field visit, there is a variety of types, heights, and spreads of vegetation in these mature forested areas, even without leaves on most trees. Views of the potential CIS from homes and I-94 would be either screened out or would consist of small glimpses of structure colors (daytime) or small points of light (at night) because of this forest screening and the distance between the residences or motorists on the highway and the nearest edge of the cleared area for the FCTC Site 1 footprint.

Large infrastructure projects can be perceived to compromise what residents feel is part of the quality of life in this region and the character of an area. Recreational users of FCRA and other areas near FCTC may experience viewshed impacts depending on the season, especially during early morning and later evening hours when the security lighting for the project would be most visible and would have the highest contrast with the surrounding unlit environment. There would be the potential for skyglow over the FCTC Site 1 footprint, especially on cloudy nights, which would be minimized by the use of International Dark Sky Association approved lighting fixtures. However, screening by forest vegetation between the potential CIS and surrounding natural areas would prevent major viewshed impacts beyond the FCTC installation.

Major adverse impacts to visual aesthetics of the site and vicinity would generally not occur during the construction of a potential CIS at FCTC Site 1 because of the visual shielding of most of the potential project footprint from public view by forest.

Transportation. Getting to the main entrance into the FCTC installation that would be used to access FCTC Site 1 would require travel on local roads lined by a few residential areas, but mostly by commercial businesses, the W.K. Kellogg ANGB, and an industrial park closer to the installation main gate. Because of this less visually sensitive environment in the area where construction traffic would increase, the visual impacts of increased traffic would not likely be as noticeable near the installation as they would be in a more residential area.

The residential area east and southeast of FCTC Site 1 would likely notice a moderate increase in traffic on West Columbia Avenue (I-94) running roughly north-south past the east side of FCTC. This increase in traffic would come in the form of worker vehicles, construction deliveries, and other traffic approaching the main entrance to FCTC north of this area. This residential area is very close to I-94 and it is expected that the residents are accustomed to the high traffic levels on the highway. The sight of additional traffic on the same highway would not likely to be noticed by the residents, as it would be only a portion of the traffic approaching FCTC. Another portion of the traffic would be likely to come from the north and not pass this residential area before proceeding to the FCTC main entrance.

Drivers on I-94 south of FCTC would have an unobstructed view of any construction or other vehicles using the FCTC perimeter road to reach the potential CIS construction areas. Figure 3.3.16-14 shows an example of what the public may see while driving past FCTC on the south side. For drivers using this route on a regular basis, the difference in traffic from the existing perimeter road use to the much heavier use for construction access would be visibly apparent.

Lighting. Nighttime construction activities and associated temporary construction lighting are not expected to be part of potential CIS construction for the majority (approximately 70 percent) of the construction timeframe; however, construction activities will require lighting during portions of the fall, winter, and early spring seasons when the length of natural daylight is decreased. Construction lighting would be used for an estimated 1 to 2 hours in the early morning and an additional 1 to 2 hours in the late afternoon and early evening each work day during these shorter daylight seasons. Because these construction activities requiring lighting would be temporary and would largely occur seasonally during the second through fourth years of construction, there would be minimal impact to public views from lighting during construction. Much of this impact would be in the form of skyglow, which would be most visible on cloudy nights. Construction lighting impacts would be further minimized by the screening effect of forested areas surrounding the CIS footprint and the presence of existing street and security lighting as well as existing skyglow from I-94 and industrial site lighting in the surrounding vicinity. Lighting and glare from vehicle headlights on West Columbia Avenue and I-94 would further decrease the likelihood that any visible lighting from the potential CIS would be directly noticeable from public viewpoints. It is not expected that constant security lighting would be used during construction because the construction site is located inside an access-controlled military installation.

Linear Corridors

Utilities installed in existing road ROWs may impact an area of up to 25 feet out from road edges on both sides of roads where they are installed. The visual impacts of these offsite corridors would be very similar to impacts for onsite linear corridors, except that the offsite corridors would have their entire extents in public ROWs that would be visible to motorists on local roads and highways and to pedestrians and cyclists using area sidewalks and roads. Because the offsite utilities would be installed along existing road corridors and most roads already have cleared and maintained ROWs of 15 to 20 feet on each side, any forest or other vegetation clearing required and the visual impact from clearing and construction of the line would be relatively minimal, and substantially less than creating an entirely new corridor cleared through forest. The general area around FCTC is not considered scenic or visually sensitive except at FCRA; therefore, offsite utilities should have only a minor visual impact on existing road corridors as long as the state recreation area is avoided.

Baseline Construction - Overall Visual Impact Summary

Overall, there would be minor to moderate onsite impacts from forest removal and clearing, and the potential for fugitive dust. Minor to moderate offsite visual impacts would consist mainly of views of utility infrastructure and increased traffic on area roads. There would be a slight potential for heavily screened glimpses of structure construction. Higher levels of traffic on east and south FCTC perimeter roads would be visually obvious.

Nighttime impacts would be minor because construction would mainly be performed during the daytime. There would be a greater potential for skyglow and visibility of heavily screened lighting impact during the winter season when lighting is needed at the start and end of each day of construction work.

3.3.16.4.1.1.2 FCTC Site 2

Onsite Impacts (CIS Footprint and FCTC Installation).

As indicated in Section 2.9.1, up to 830 acres would be cleared for the FCTC Site 2 footprint, currently almost all mature forest vegetation. Substantial work would be required not only to clear the designated area within the FCTC Site 2 footprint, but also to level the site from its existing topography, which slopes substantially from south to north. Generally, FCTC Site 2 would only be visible to military personnel and construction workers already on the installation. The FCTC Site 2 visual character would completely change from a large-acreage mature forest to a construction site with views of felled trees, tree stumps, gravel roads and surfacing, large soil and rock piles, and the presence and movements of construction equipment and personnel.

FCTC Site 2 would require substantially more material to be excavated during site preparation compared to that required for FCTC Site 1 because of the rolling topography of the CIS footprint. It is estimated that 15 to 20 MCY of material would be excavated at FCTC Site 2 compared to the 10 to 15 MCY required for FCTC Site 1.

Offsite Impacts (Beyond FCTC Installation Boundaries).

FCRA is adjacent to the FCTC north and west boundaries, approximately 1,000 feet from the northern edge of FCTC Site 2 footprint. Because FCTC is adjoined to the north-northwest by FCRA, aesthetics and visual concerns are considered more prominently for areas of FCTC near the recreation area. From north of the FCTC installation fence along Territorial Road, the recreation area features trails, lakes, and wooded areas that allow visitors to view portions of FCTC. The view from the recreation area along Territorial Road is limited by the dense forest along Territorial Road in most areas, and recreation area users in this area would see the road and a natural looking second growth forest. During summer when the trees are leafed out, the view into the military property beyond Territorial Road would be very limited by the understory brush, dense tree trunks, and leaves. In summer, the estimated distance that a viewer looking in from the outer fence of FCTC would be able to see into the installation would be about 100 feet if looking directly into a forested area. Winter conditions would allow recreation area users to see slightly farther into the forest in the absence of much of the leafy vegetative matter that would screen views in the summer; however, the trunks of trees and the understory vegetation in the forested areas throughout the central and western parts of the site are thick enough to block views even in winter beyond about 300 feet from the fence.

Cultural Resources. Cultural resources, including the Fort Custer National Cemetery off the FCTC installation to the north, Lawler Cemetery along Territorial Road, and the length of Territorial Road itself, would all be shielded from direct views of FCTC Site 2 by thick stands of forest that occur between those locations and the FCTC Site 2 footprint. The smallest distance between any of these resources and FCTC Site 2 occurs in the area north of FCTC Site 2, where Territorial Road is very close to the northern FCTC installation boundary and southern FCRA boundary; however, even at this location, there is a band of dense, mature forest of approximately 1,000 foot thickness between the two areas. This forested band would be kept intact and a portion of it used as a “keep-out” area surrounding FCTC Site 2 (shown on Figure 3.3.16-3).

Noise, Dust, and Traffic. Construction noise or dust during a prolonged construction period could have a negative impact on the recreation experience for many users, including campers, hikers, equestrians, mountain bikers, and/or hunters using the FCRA.

These users typically want to visit a recreation area such as FCRA because of its natural aspects that are free from visual evidence of the everyday human impacts on the environment that they are accustomed to seeing. This expectation may lead to even small impacts being more noticeable to these users.

To access the FCTC Site 2 area, construction equipment and vehicles would need to travel on FCTC interior gravel roads. Because Territorial Road is a cultural resource and there are other routes available on the site to allow construction vehicle access to FCTC Site 2, construction traffic would not use Territorial Road to access the CIS footprint. Construction vehicles would be traveling on routes that approach the CIS footprint from the south, and these routes and the attendant impacts from their use, such as airborne dust, would not be visible to users of the FCRA.

Refer to Section 3.3.10 Noise and Section 3.3.1 Air Quality for further description of construction impacts related to the issues of noise and dust. Traffic impacts at FCTC Site 2 are described in Section 3.3.12.

Lighting. FCTC Site 2 would require approximately 5 MCY more excavation than FCTC Site 1. To accomplish this greater amount of excavation, construction nighttime lighting would be used for longer durations each day and potentially for more of the construction period than lighting for construction at FCTC Site 1. To accomplish the work in the desired construction timeframe, there is greater potential for more night construction activities along with the lighting. Impacts from this greater use of nighttime lighting would be blocked from direct public views by the extensive forest surrounding the FCTC Site 2 footprint; however, it is likely that minor to moderate skyglow would be seen over the FCTC Site 2 area, especially during cloudy conditions.

Water-Influenced Views. Because potential CIS deployment at FCTC Site 2 would involve deep excavation and alteration of water flows in the immediate area of the site, visual impacts during construction may include views of increased turbidity in streams or wetland areas. It is possible that users of the southern portion of the FCRA near the northern FCTC installation boundary may notice water flows occurring where there previously were none in addition to heavier or lighter water flows or levels in some locations compared to observations of these attributes before construction. Water flow in this area is from FCTC toward FCRA. More detailed information about water flows and construction impacts to water resources is available in Section 3.3.14.

Views of water features are highly important to recreation area users when they describe aspects of a scenic view or landscape. Users of FCRA observing changes that are perceived to degrade the environment of the recreation area would likely be concerned about these changes. Diligent implementation of BMPs and the water pollution prevention measures that would be required as part of the site's SWPPP, Soil Erosion and Sedimentation Control Plan, and SPCC Plan would minimize any onsite and especially offsite visual changes to views incorporating water features.

Baseline Construction - Overall Visual Impact Summary

Minor to moderate public (offsite) visual impacts would consist mainly of views of utility infrastructure and increased traffic on area roads. There would be a slight potential for heavily screened glimpses of structure construction. Higher levels of traffic on east and south FCTC perimeter roads would be visually obvious to the public. There is a minor potential for visible changes to water views offsite in areas such as FCRA. Overall, there would be moderate onsite impacts from forest removal and clearing, and the potential for fugitive dust.

Nighttime impacts would be minor because construction would mainly be performed during the daytime. Because of the greater cut and fill volumes required compared to those at Site 1, there would likely be longer daily work schedules at FCTC Site 2, with corresponding greater periods of construction lighting extending into the dark portions of the morning and evening. There would also be a greater potential for skyglow and visibility of heavily screened lighting impact during the winter season when lighting is needed at the start and end of each day of construction work.

3.3.16.4.1.2 Mitigation

3.3.16.4.1.2.1 FCTC Site 1

The following impact minimization and mitigation measures may be implemented to reduce visual impacts from construction activities in the CIS footprint.

The size of the CIS footprint has been compacted as much as possible while still meeting military-specified clearances and distances for each type of building that is part of the potential CIS. CIS facility buildings would be designed to use materials and colors that avoid high visual contrast with the existing surroundings to the extent feasible.

Existing facilities would be used to the maximum extent feasible so that additional structures and linear corridors may not need to be constructed. The portion of FCTC that would potentially be used for the CIS footprint does not have existing facilities; however, there are certain buildings and infrastructure items stored at the W.K. Kellogg ANGB (east-northeast of FCTC across Skyline Drive) that may be used to partially accommodate potential CIS needs.

Potential CIS preconstruction activities would include tree and brush clearing on the site, dewatering, grading, road building, and upgrading of existing utilities. Distance between the CIS footprint and the installation boundary is about 175 feet at the closest point of the CIS footprint. Preservation of the entire buffer of existing forest between these two boundaries would minimize the visual impacts from public and nearby residential viewpoints. Consideration would be given to further limiting the removal of trees and other vegetation during construction, if practicable, to minimize visual impacts.

Dust control measures, potentially including water spray onto construction roads and gravel surfacing on bare, heavily trafficked areas, would be used to control visible dust from construction areas in the CIS footprint. Erosion control and storm water BMPs would also be implemented during construction. Refer to Sections 3.3.9 Land Use and 3.3.14 Water Resources for further information about dust and erosion control measures to be used.

Disturbed areas within utility ROWs would be reseeded with grass, but large bushes and trees would be prevented from growing in these areas as part of routine maintenance activities. Permanently cleared ROWs on such corridors would be visible wherever a line of sight between the observer and ROW in question occurs (mainly road and wetland crossings).

Light trespass and skyglow impacts would be reduced through the use of fully recessed light fixtures and structures that are approved by the International Dark Sky Association throughout the CIS footprint. This measure would reduce the lighting impacts on nearby areas more heavily visited by the public during weekends and in evenings during the summer, such as FCRA north of the west side of FCTC. Nighttime construction work would be part of the construction. While there is no true mitigation measure for skyglow that would be created by night lighting, especially in cloudy conditions, impact minimization measures would be taken to reduce this impact. Temporary construction lights would be directed downward, would be the minimum size and number needed to do the work, and would only be used onsite for the amount of time they are needed.

3.3.16.4.1.2.2 FCTC Site 2

Impact minimization and mitigation measures implemented at FCTC Site 2 would be the same as those presented for FCTC Site 1.

3.3.16.4.2 Construction - Expedited Schedule

3.3.16.4.2.1 Environmental Consequences

3.3.16.4.2.1.1 FCTC Site 1

Visual impacts would be very similar during the expedited schedule and the baseline schedule; the clear difference would be the earlier timeframe when the visual impacts would begin to occur with regard to the construction schedule, the greater intensity of the impacts, and the increase in the number of overlapping impacts with many activities occurring concurrently during the expedited schedule work. Construction temporary lighting would be installed sooner than in the baseline and more lights would be used at the same time to accomplish more of the work more quickly.

Overall offsite visual impacts would be moderate for the expedited schedule. Some additions would occur for the expedited schedule as compared to the baseline schedule with heavier and more time-concentrated activities during the expedited schedule and skyglow visible in the area. Based on the expedited schedule, there is a strong likelihood that the residential area east of FCTC would have noticeable views of heavy truck traffic along the FCTC east perimeter road. The 24-hour per day, 7-day per week work schedule would result in almost constant day and night large truck traffic enroute to the FCTC entrance and traveling toward the CIS footprint along the FCTC perimeter road, which is visible to the residential area and I-94. At night, vehicle headlights and possibly a minor filtered view of construction lighting would be visible to these residences at almost all times during the nighttime work, especially during the shorter daylight seasons (late fall, winter, and early spring). On cloudy nights, there would be a moderate amount of skyglow present over the FCTC area from construction lighting, as viewed from this residential area and from I-94 east and south of FCTC.

Construction visual impacts would be moderate and very similar for the baseline schedule and the expedited schedule whether they occur at FCTC Site 1 or FCTC Site 2 because of the similar levels of forest screening for both CIS footprints and the likelihood that views of increased traffic, minor amounts of additional skyglow, and potential filtered views of some construction lighting would be the noticeable impacts at either location. Construction traffic on the east FCTC perimeter road would be clearly visible to residents east of FCTC and drivers on I-94 south of FCTC.

3.3.16.4.2.1.2 FCTC Site 2

The expedited schedule construction impacts to visual resources would be essentially the same at FCTC Site 2 as described for FCTC Site 1.

3.3.16.4.2.2 Mitigation

3.3.16.4.2.2.1 FCTC Site 1

Mitigation measures for visual impacts during the expedited construction schedule would be the same as those for the baseline schedule.

Mitigation measures for the expedited schedule construction visual impacts would be the same whether at FCTC Site 1 or FCTC Site 2. The most noticeable visual impact from construction at FCTC Site 1 or FCTC Site 2, because of the forest screening from the surrounding area, would be visible skyglow, especially on cloudy nights. Because this impact would not be mitigable beyond BMPs, such as using fully recessed International Dark Sky Association approved lighting fixtures, no mitigation would be implemented.

3.3.16.4.2.2.2 FCTC Site 2

Impact minimization and mitigation measures implemented at FCTC Site 2 would be essentially the same as described for FCTC Site 1.

3.3.16.4.3 Operation

3.3.16.4.3.1 Environmental Consequences

3.3.16.4.3.1.1 FCTC Site 1

After construction activities are complete, visual impacts would remain at a relatively constant level for the remainder of the life of the potential CIS for all observers.

Outside the FCTC installation, it is very unlikely that there would be any direct view of the potential CIS because of screening by forested areas; however, minor amounts of light or glow from lighting may be visible from mission support areas that are close to the highway, especially in winter. This indirect impact would be so minimal that the public would either not notice it or would quickly become accustomed to it. Increased levels of traffic would be an expected part of the view, although visible traffic would be noticeably less than its level would have been during construction. Impacts to views from other public areas would be minor, largely because of the high degree of visual screening between the potential CIS and public views.

Figure 3.3.16-15 shows a simulated view of the potential CIS at FCTC Site 1 during operation from inside the FCTC installation.

Lighting. Lighting from FCTC Site 1 would not be expected to be visible to the public outside the installation; however, it would be visible to the potential CIS and FCTC personnel during operation, as shown on Figure 3.3.16-15. An example of the appearance of existing skyglow as seen from FCTC that is similar to what may be created from the potential CIS lighting during operation is shown on Figure 3.3.16-16. Overall, lighting impacts from potential CIS deployment at FCTC Site 1 would be minor and confined to the FCTC installation with the exception of minor levels of skyglow that would be visible to residents in the area on cloudy nights.

Cultural and Historic Sites. Territorial Road along its 5 mile length spanning the FCTC installation has been determined eligible for NRHP listing, with the largely intact visual character of the road compared with historic conditions a contributing factor in the determination of NRHP eligibility. The portion of Territorial Road nearest to FCTC Site 1 is more than 0.5 mile north. Because of the substantial forest cover throughout this area (between the FCTC Site 1 footprint and Territorial Road) and the distance between the FCTC Site 1 footprint and Territorial Road, views of the potential CIS from Territorial Road would not occur.

The potential CIS would not be visible from any of the NRHP-listed or eligible sites in the vicinity of the FCTC installation. The general forest cover in the area that would serve to screen views, as well as the topography and the distance to the listed properties, preclude the possibility of the views from these properties being impacted by operation of the potential CIS. Because of the distance and topography between the NRHP-listed properties and the potential CIS and because of the minimal lighting levels that would be used, it is also unlikely that skyglow or other night lighting during the operation of the potential CIS would be visible from cultural or historic sites outside FCTC. Visual impacts to cultural and historic sites would, therefore, be minor.

Operation – Visual Impact Summary

Negligible to minor aesthetic impacts would occur during operation. The visual impacts from operation and facility lighting would be negligible, with minor skyglow effects being the main expected impact.

3.3.16.4.3.1.2 FCTC Site 2

After construction activities are complete, visual impacts would remain at a relatively constant level for the remainder of the life of the CIS for all observers.

Outside the FCTC installation, it is very unlikely that there would be any direct view of the potential CIS because of screening by forested areas; however, minor amounts of light or glow from lighting may be visible from mission support areas that are close to the highway and potentially from FCRA, especially in winter. This indirect impact would be so minimal that the public would either not notice it or would quickly become accustomed to it. Increased levels of traffic would be an expected part of the view, although visible traffic would be noticeably less than its level would have been during construction. Impacts to views from other public areas would be minor largely because of the high degree of visual screening between the potential CIS and public views.

Lighting. A primary issue pertaining to visual impacts from FCTC Site 2 during operation is the potential for lighting-related impacts, especially where these impacts may affect users of FCRA. The FCRA is approximately 1,000 feet north of the most northerly points of FCTC Site 2 that would be cleared. The 1,000 foot span between the closest boundaries of FCRA and FCTC Site 2 is occupied by dense stands of mature forest and one large pond across the area of FCTC Site 2. Because of the distance and intervening heavy forest vegetation, there would not be direct views of the CIS facility lighting, especially during the summer. Similarly, there is not likely to be a view during the winter with no leaves on the trees; however, there is a slightly greater possibility that some light or glow from the CIS may be perceptible at ground level.

On cloudy nights, observers at FCRA would likely be able to see a soft skyglow in the sky overhead that would be minimally perceptible in contrast to the surrounding mostly dark sky.

However, in this situation, there would also be skyglow present from existing lighting and other development along I-94 such that an observer likely would not be able to pinpoint the source of the skyglow to a particular contributing feature such as the potential CIS facilities when looking south from the FCRA.

The degree of impact to individual recreationists using the FCRA would be highly dependent on the activities important to each user or group, especially considering nighttime activities such as stargazing. Unless recreationists had come to use FCRA with the specific intent of looking at the night sky, it is unlikely that the minor amount of skyglow would be noticed by these overnight users. Activities focusing on the night sky typically require a clear sky, when skyglow would be more minimally perceptible compared to what it would be on a cloudy night. Although skyglow would be visible, it would not be great enough to detract from the typical nighttime activities associated with outdoor tent or cabin camping or other recreational experience for the majority of users of FCRA.

The observed skyglow in the FCTC area shown on Figure 3.3.16-16 for FCTC Site 1 would also be representative of the expected appearance of skyglow from FCTC Site 2.

Cultural Resources. Because of the substantial forest cover throughout this area (outside of the CIS footprint) and the distance between the CIS footprint and Territorial Road, views of the CIS from Territorial Road would not occur. Evaluation of the cultural significance of Territorial Road resulted in a recommendation that the views and topography in the area of the road be maintained in their present state, which was found not to have changed substantially from what it would have been historically. Because there is a 1,000 foot band of dense forest between Territorial Road and the FCTC Site 2 cleared area boundary, the historical visual character of Territorial Road would remain intact during operation of the potential CIS.

The potential CIS would not be visible from any of the NRHP-listed or eligible sites in the vicinity of the FCTC installation. The general forest cover in the area that serves to screen views, as well as the topography and the distance to the listed properties, preclude the possibility of the views from these properties being impacted by operation of the potential CIS. Because of the distance and topography between the NRHP-listed properties and the potential CIS and because of the minimal lighting levels expected to be used, it is also unlikely that skyglow or other night lighting during operation of the potential CIS at FCTC Site 2 would be visible from cultural or historic sites. Visual impacts to cultural and historic sites would, therefore, be minor.

<u>Operation – Visual Impact Summary</u>

Negligible to minor aesthetic impacts would occur during operation. The visual impacts from operation and facility lighting would be negligible, with minor skyglow effects being the main expected impact, especially because of the proximity of FCTC Site 2 to FCRA.

3.3.16.4.3.2 Mitigation

3.3.16.4.3.2.1 FCTC Site 1

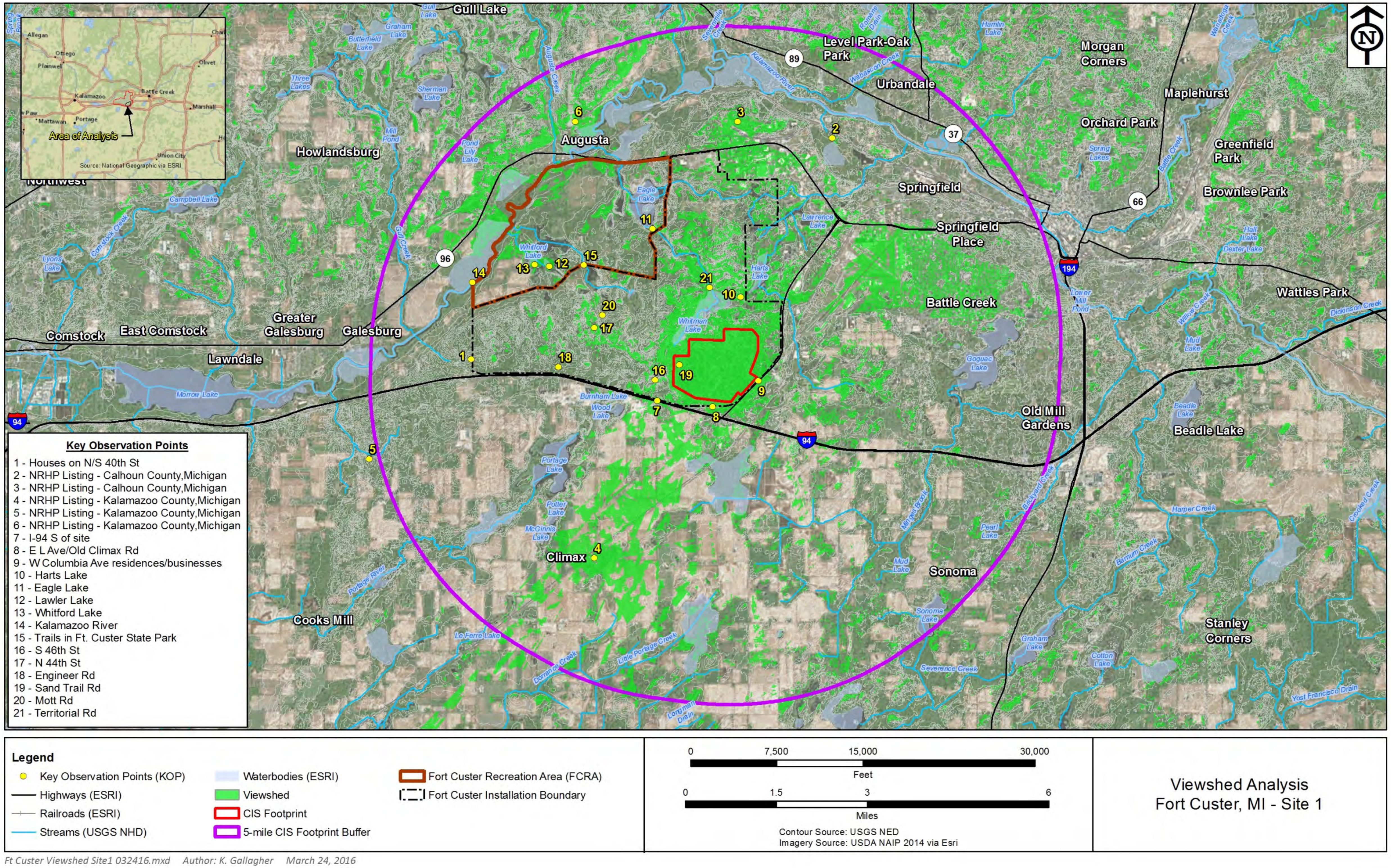
Mitigation for visual impacts during operation would be similar to the mitigation during construction in a general sense, and would include implementation of measures such as dust control if needed, although traffic and activity would be potentially creating dust at a much lower level during operation because roads and other surfaces would likely be covered by additional gravel layers and would have already been upgraded for use during potential CIS operation. It is unlikely that any nearby residents would have views of the potential CIS during operation except in the event that they may be able to distinguish some structures or cleared area through the forested buffer near the southeast corner of the CIS footprint. MDA does not currently plan to provide additional vegetative screening or include other mitigation measures to reduce visual impacts from this location because the view would be heavily screened, and likely obscured, for most drivers passing the site at the speeds that vehicles maintain on this part of I-94. Individual residences would not experience views of the potential CIS from their locations because of the forest buffer to be maintained around the potential CIS.

The CIS lighting plan would also seek to minimize aesthetic impacts and consider effects on night sky views, with an emphasis on using International Dark Sky Association approved lighting fixtures throughout the footprint. Skyglow from operation of the potential CIS would be visible in the area surrounding the FCTC installation; however, the forest buffer around the potential CIS would reduce this effect except on cloudy nights, when it would be more noticeable as a slightly lighter area above the potential CIS because of the light reflection off the clouds and back down toward viewers on the ground. Skyglow effects would be minimized during operation through use of fully recessed light fixtures that direct all light downward so that there is no glare from direct observation of the lights and very little light travels outside the area being lit or upward toward the sky.

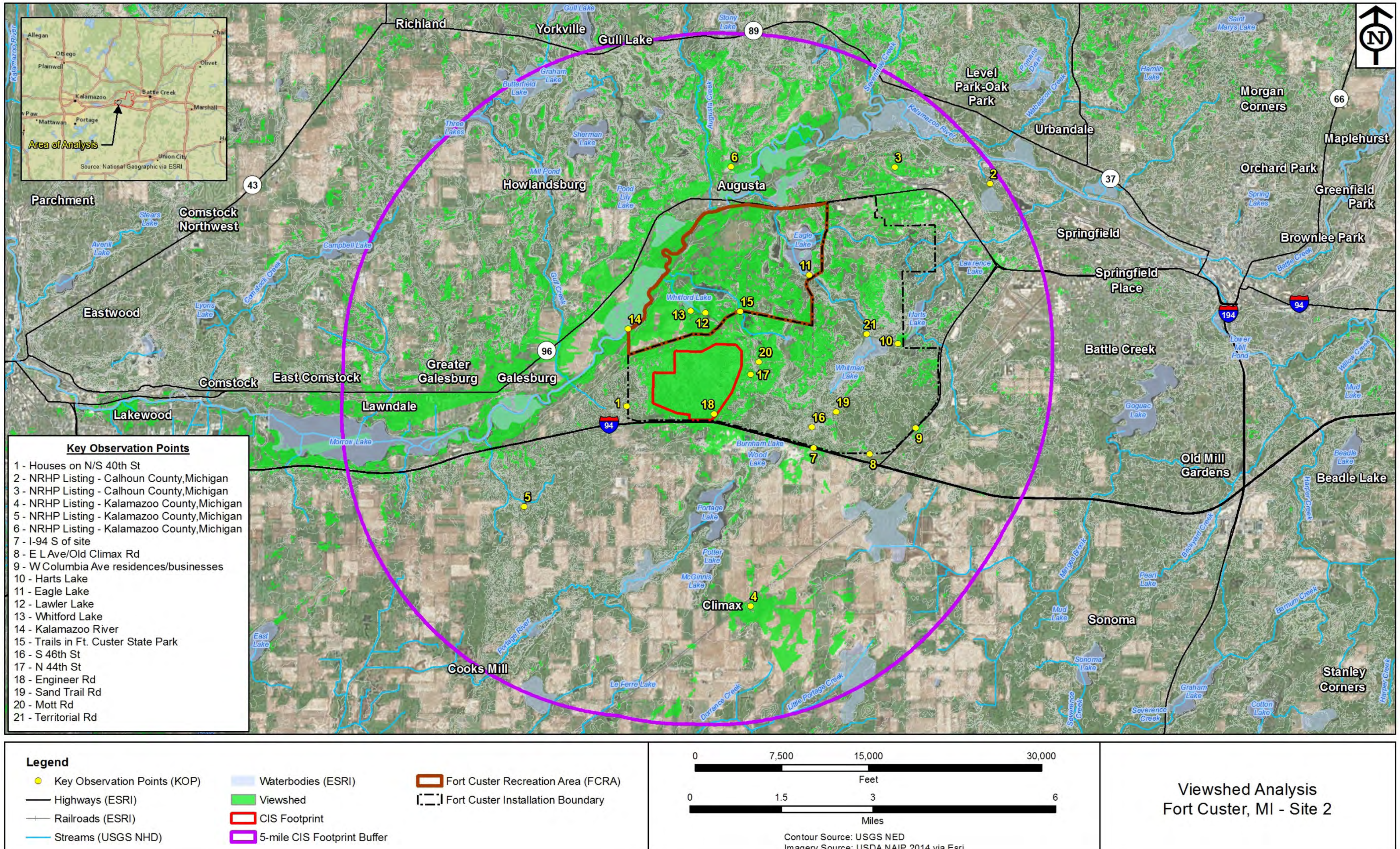
3.3.16.4.3.2.2 FCTC Site 2

Operational mitigation measures for visual impacts for FCTC Site 2 would be the same as those described for FCTC Site 1.

Figure 3.3.16-1 Preliminary Viewshed Map – FCTC Site 1



3.3.16-2 Preliminary Viewshed Map – FCTC Site 2



Ft Custer Viewshed Site2 032416.mxd Author: K. Gallagher March 24, 2016

Figure 3.3.16-3 Photo Locations – FCTC Sites

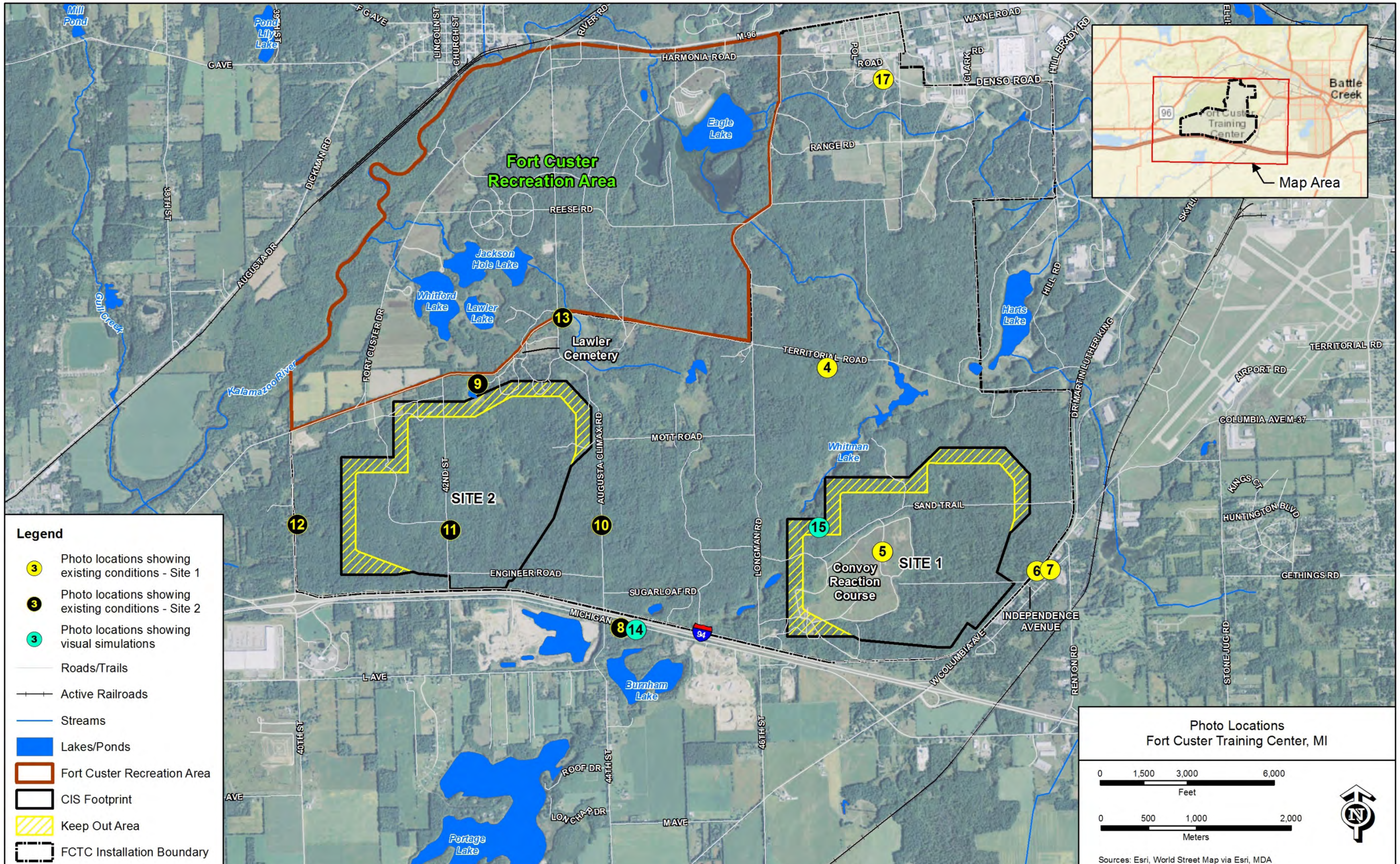


Figure 3.3.16-4 Representative View of Territorial Road – FCTC Site 1

Photo description: Typical view FCTC interior, east side, along Territorial Road near FCTC Site 1, showing appearance of Territorial Road and forest density.

Figure 3.3.16-5 View of Convoy Reaction Course – FCTC Site 1

Photo description: View over interior convoy reaction course, looking west, showing open area within FCTC Site 1.

Figure 3.3.16-6 Daytime View toward FCTC Installation Boundary from East Side

Photo description: Daytime public view, I-94 and Independence Avenue residential area showing perimeter tree screening.

Figure 3.3.16-7 Nighttime View toward FCTC Installation Boundary from East Side

Photo description: Nighttime public view, I-94 and Independence Avenue residential area showing existing streetlight.

Figure 3.3.16-8 Representative View of FCTC Installation Boundary near FCTC Site 1

Photo description: Daytime public view, from south across I-94 near industrial/residential area, showing view blocked by forest.

Figure3.3.16-9 Representative Interior View of Territorial Road near FCTC Site 2

Photo description:Typical appearance of Territorial Road and surrounding forest.vegetation near FCTC Site 2.

Figure 3.3.16-10 Representative Interior View – 44th Street – FCTC Site 2

Photo description: Typical view FCTC interior along 44th Street, looking south showing forest and longitudinal view.

Figure 3.3.16-11 Representative Interior View – 42nd Street – FCTC Site 2

Photo description: View of FCTC interior along 42nd Street showing undulating topography (looking north).

Figure 3.3.16-12 Representative Public View – FCTC Boundary near FCTC Site 2

Photo description: From west side residential area along 40th Street.

Figure 3.3.16-13 Representative Public View from Fort Custer Recreation Area

Photo description: View from south end of Augusta-Climax Road in Fort Custer Recreation Area Looking south toward FCTC installation boundary.

Figure 3.3.16-14 Simulated Public View of Construction Traffic on FCTC Perimeter Road from I-94

Figure 3.3.16-15 Simulated View of FCTC Site 1 Continental United States Interceptor Site Facilities from FCTC Interior

Photo description: Daytime view, looking north-northeast**.**

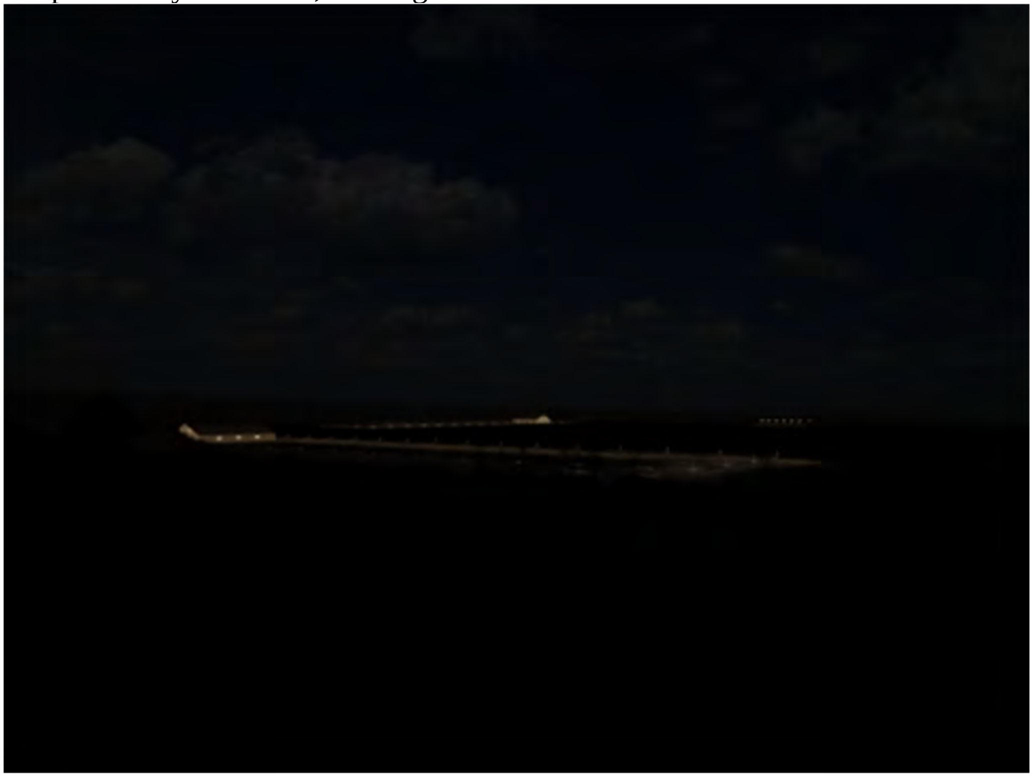


Photo description: Nighttime view, looking north-northeast

Figure 3.3.16-16 Existing Nighttime View of Distant Skyglow and FCTC Interior

Photo description: Building light and streetlight south of barracks.

3.3.17 Cumulative Impacts – FCTC Sites

Cumulative impacts are defined as the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions (40 CFR Part 1508.7). Cumulative impacts can result from individually minor but collectively substantial actions taking place over a period of time.

Several steps are involved in determining cumulative impacts. First, the significant cumulative effects issues associated with the potential action must be identified and the assessment goals defined. Second, the geographic scope or boundaries must be established; this is often referred to as the "project impact zone." Third, the timeframe for the analysis must be determined taking into consideration the timeframe of the project-specific analysis. Lastly, other actions affecting the resources, ecosystems, and human communities of concern should be identified (CEQ, 1997).

In order to evaluate cumulative impacts due to the potential CIS, FCTC personnel, the City of Battle Creek, and Battle Creek Unlimited were contacted to identify projects within or near FCTC which may be impacting or providing contributing impacts to resources within the same geographic area, spatial timeframes, and duration as the CIS (CEQ, 1997). Specific criteria considered for identifying applicable projects included the following:

- Geographic boundaries – the project must occur within the same site boundaries (installation), community, and/or region as the potential CIS.
- Timeframe – the project must be ongoing or occur within the same timeframe as the anticipated CIS project construction.
- Impacts to resources – the project must impact the same resources as evaluated in this EIS (e.g. air quality, biological resources, etc.).

In addition, the Michigan State Transportation Implementation Plan 2014 - 2017 Project List was reviewed to identify MDOT projects within the geographic region of the CIS (MDOT, 2016). Based on the criteria outlined above, and responses from the agencies/groups contacted, there were no past, present, or foreseeable future projects were identified within the installation, community, or region which could result in cumulative impacts on the resources evaluated in this EIS (FCTC, 2015b; City of Battle Creek, 2016; BCU, 2016; BVSPC, 2016c; MDOT, 2016).

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