APPENDIX B: AIR QUALITY ANALYSIS

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AIR QUALITY ANALYSIS

An impact study was performed to assess air quality effects resulting from construction and operation of the Proposed Action, including stationary and mobile sources. This study provides findings on ambient air quality concentrations and compliance with the regulations and standards promulgated by the Clean Air Act (CAA) and amendments.

The U.S. Environmental Protection Agency (USEPA) defines ambient air in 40 Code of Federal Regulations (CFR) Part 50 as: "that portion of the atmosphere, external to buildings, to which the general public has access." In compliance with the 1970 CAA and the 1977 and 1990 CAA amendments, the USEPA has promulgated National Ambient Air Quality Standards (NAAQS). The NAAQS were enacted for the protection of the public health and welfare, allowing for an adequate margin of safety. To date, the USEPA has issued NAAQS for the following criteria pollutants: carbon monoxide (CO), sulfur dioxide (SO_2), particulate matter (particles with a diameter less than or equal to a nominal 10 micrometers [PM_{10}]) and particles with a diameter less than or equal to nominal 2.5 micrometers [$PM_{2.5}$]), ozone (O_3), nitrogen dioxide (NO_2), and lead (Pb).

Federal regulations designate Air-Quality Control Region (AQCRs) in violation of the NAAQS as nonattainment areas. According to the severity of the pollution problem, nonattainment areas can be categorized as marginal, moderate, serious, severe, or extreme. Severity categories have not been applied to $PM_{2.5}$ nonattainment areas.

An air quality applicability analysis was conducted to identify potential increases or decreases in criteria air pollutant emissions associated with the proposed water/wastewater utility privatization at Fort Belvoir, Virginia. The project would occur within a USEPA-designated marginal nonattainment zone for ozone and nonattainment for particulate matter (2.5 microns) and is subject to the federal conformity requirements. The purpose of this analysis is to apply the Federal General Conformity Rule established in 40 CFR Part 93 entitled *Determining Conformity of Federal Actions to State or Federal Implementation Plans* to the Proposed Action in order to determine any effect on air quality.

The federal conformity rules were established to ensure that federal activities do not hamper local efforts to control air pollution. In particular, Section 176(c) of the CAA prohibits federal agencies, departments or instrumentalities from engaging in, supporting, licensing, or approving any action, in an area that is in nonattainment of the NAAQS, which does not conform to an approved state or federal implementation plan. Therefore, the agency must determine whether or not the project would interfere with the clean air goals in the State Implementation Plan.

1.0 PROJECT DESCRIPTION

The Proposed Action is to implement a number of projects to upgrade the water and wastewater system infrastructure at Fort Belvoir, including replacement of water storage tanks (ISDC), replacement of force mains (R&R), annual maintenance of gravity sewer mains (general maintenance), reinstallation of aerial stream crossings with stream bank repair (ISDC), and implementation of additional R&R and FSDC projects identified in Fort Belvoir's 2012 Annual System Deficiency Corrections, Upgrades and Renewal & Replacement Plan (ASDC) for fiscal years (FY) 13 through 17 that are currently in the conceptual phase.

The projects would include demolition of four existing water storage tanks (one 300,000-gallon, two 500,000-gallon, and a 1-million gallon tank). These tanks would be replaced with three 1-million-gallon tanks with site clearing of approximately 10,000 square feet each. For the replacement of force mains, this

analysis assumes 4,500 linear feet of trenching. The trenches would be approximately 10 feet wide and between 4 and 10 feet deep. In the vicinity of sensitive areas, such as wetlands, the replacement of force mains would utilize horizontal directional drilling in place of trenching. To complete a conservative analysis, this applicability determination assumes that all areas would be trenched. This analysis includes the maximum amount of earth moving and construction equipment. For the locations where horizontal directional drilling is used, emissions would be expected to be similar or less than estimated in the analysis.

All trenching associated with the additional ASDC projects would include approximately 31,000 linear feet of trenching of a similar size and depth of the force main trenches, although proposed pipe widths would vary by project as described in Chapter 2 of the environmental assessment (EA). A bridge and 100-foot-long access road are also included under ASDC projects. While the road could potentially be gravel, an asphalt road is assumed for a conservative analysis. For site clearing to the gravity sewer manholes, it is assumed that 200 feet along the 20-foot-wide right-of-way would be cleared. These estimates were multiplied by seven, which provides a conservative estimate for emissions from construction equipment.

For the stream crossings with associated stream repair, without specific design to include construction or clearing areas, this conformity determination assumed construction estimates for the maximum of 800 linear feet of stream bank at each site (400 linear feet per bank per site). These estimates were multiplied by nine, which provides a conservative estimate for emissions from construction equipment. The assumptions include 60 days for construction and 800 linear feet of stream repair/ground disturbance.

Construction is expected to occur over an 18- to 24-month period. For the purposes of this analysis, it was assumed that all construction would occur in one year. This ensures a conservative analysis.

2.0 METEOROLOGY/CLIMATE

Temperature is a parameter used in calculations of emissions for air quality applicability. Climate at Fort Belvoir can be characterized as a humid, continental climate with a mean high temperature of 88°F in July and a mean low temperature of 27 degrees Fahrenheit (°F) in January. The average temperature is 57.5°F. Summers are warm with periods of high humidity and winters are cold, with periods of snow cover. May is the month with most precipitation, averaging 3.82 inches (The Weather Channel undated)

3.0 CURRENT AMBIENT AIR QUALITY CONDITIONS

Fort Belvoir and Fairfax County are within the Washington, D.C., airshed, AQCR 47. AQCR 47 is in marginal nonattainment for the criteria pollutant ozone, under the 2008 8-hour ozone standard, and in nonattainment for $PM_{2.5}$. The airshed is in attainment for all other pollutants. While portions of AQCR 47 were in previous nonattainment for CO, Fairfax County is not included in that previous nonattainment area. On January 4, 2013, the District of Columbia, State of Maryland, and Commonwealth of Virginia requested that the USEPA redesignate AQCR 47 as in attainment for $PM_{2.5}$. The USEPA has not yet responded (MWCOG 2013).

AQCR 47 is also in the Ozone Transport Region. The Ozone Transport Region includes states in the northeast U.S. that must adhere to stricter conformity thresholds for nitrogen oxides (NO_x) and volatile organic compounds (VOCs), which are precursors for ozone.

The NAAQS for ozone and $PM_{2.5}$ are shown in Table B-1.

Table B-1: National Ambient Air Quality Standards for Ozone and $PM_{2.5}$

Pollutant	Federal Standard	Virginia Standard
$PM_{2.5}$ – 24-hour average	35 µg/m^3	35 µg/m^3
Ozone – 8-hour average	0.075 ppm	0.075 ppm

Sources: USEPA (2012a), Commonwealth of Virginia (2012)

Notes: µg/m3 – micrograms per cubic meter; ppm – parts per million

4.0 AIR QUALITY REGULATORY REQUIREMENTS: GENERAL CONFORMITY APPLICABILITY ANALYSIS

To regulate the emission levels resulting from a project, federal actions located in nonattainment areas are required to demonstrate compliance with the general conformity rule established in 40 CFR Part 93, *Determining Conformity of Federal Actions to State or Federal Implementation Pla*ns (the Rule). The project area is located within a nonattainment area; therefore, a General Conformity Rule applicability analysis is warranted.

Section 93.153 of the Rule sets applicability requirements for projects subject to the Rule through establishment of *de minimis* levels for annual criteria pollutant emissions. These *de minimis* levels are set according to criteria pollutant nonattainment area designations. For projects below the *de minimis* levels, a full conformity determination is not required. Those at or above the levels are required to perform a conformity determination as established in the Rule. The *de minimis* levels apply to emissions that can occur during the construction and operation phases of the action.

Fort Belvoir has completed a General Conformity Rule applicability analysis in order to analyze any impact to air quality. For ozone, emissions have been estimated for the ozone precursor pollutants NO_x and VOCs. Annual emissions for these compounds were estimated for each of the construction projects to determine if they would be below or above the *de minimis* levels established in the Rule. The *de minimis* threshold for moderate ozone nonattainment areas in the Ozone Transport Region is 100 tons per year for NO_x and 50 tons per year for VOCs.

On July 11, 2006 USEPA established *de minimis* levels for $PM_{2.5}$. The final rule established 100 tons per year as the *de minimis* emission level under nonattainment for directly emitted $PM_{2.5}$ and each of the precursors that form it (SO_2, NO_x, VOC, and ammonia). This 100 tons per year threshold applies separately to each precursor. This means that if an action's direct or indirect emissions of $PM_{2.5}$, SO_2, NO_x, VOC, or ammonia exceed 100 tons per year, a General Conformity determination would be required. Under the current USEPA policy for addressing $PM_{2.5}$ precursors, only $PM_{2.5,}$ NO_x, and SO_2 must be evaluated in all regions. States are not required to evaluate VOCs or ammonia unless the State or USEPA make a technical demonstration that those particular emissions from sources within the State significantly contribute to $PM_{2.5}$ concentrations in a given nonattainment area (USEPA 2007). Neither USEPA nor Virginia has found $PM_{2.5}$ problems in AQCR 47 to be caused by VOCs, or ammonia. Ammonia is not further addressed by the EA NO_x is addressed as a $PM_{2.5}$ and ozone precursor and VOCs are addressed as an ozone precursor.

Sources of NO_x, VOCs, $PM_{2.5}$, and SO_2 associated with the proposed project would include emissions from construction and demolition equipment, construction worker vehicles, and fugitive dust ($PM_{2.5}$).

There would be no long-term operational emissions associated with any of the water/wastewater utility privatization projects.

In addition to the evaluation of air emissions against *de minimis* levels, emissions are also evaluated for regional significance. A federal action that does not exceed the threshold emission rates of criteria pollutants may still be subject to a general conformity determination if the direct and indirect emissions from the action exceed ten-percent of the total emissions inventory for a particular criteria pollutant in a nonattainment area. If the emissions exceed this ten-percent threshold, the federal action is considered to be a "regionally significant" activity, and thus, the general conformity rules apply.

5.0 CONFORMITY APPLICABILITY ANALYSIS

This project construction-related General Conformity analysis was performed for the Proposed Action at Fort Belvoir. This conformity analysis and air emissions evaluation will follow the criteria regulated in *40 CFR Parts 51, and 93, Determining Conformity of General Federal Actions to State or Federal Implementation Plans; Final Rule* (November 30, 1993). The emissions evaluation will also follow all NEPA-related criteria regulated in *40 CFR Part 6*.

5.1 Construction Phase Emissions

Construction emissions would result from the operation of heavy equipment from trenching, demolition, and construction, as well as construction worker commuting vehicles. The project would utilize a mix of heavy equipment for construction, mainly associated with site preparation and clearing, trenching and demolition.

5.1.1 Emissions from Heavy Equipment

Annual emissions were calculated for various types of diesel construction vehicles using model emission rate input for the year 2014 in USEPA's *Nonroad 2005 Emission Inventory Model: Diesel Construction Equipment, Fairfax County, Virginia* (USEPA 2005). Truck emission levels were calculated using USEPA's *MOBILE6* model for conditions in July 2014 (USEPA 2006). The total annual emissions in tons per year were determined for each vehicle type based on the number of operating hours per year per vehicle type.

Emissions factors used for construction vehicles are shown in Table B-2.

Table B-2: Emissions Factors for Construction Vehicles

Construction Vehicle Type	Emissions Factors (pounds per hour)			
	NO_x	VOC	$PM_{2.5}$	SO_2
Front end loader	3.402	0.204	0.194	0.496
Excavator	2.763	0.204	0.149	0.529
Dozer	2.714	0.199	0.180	0.496
Pneumatic tire roller	0.927	0.099	0.090	0.156
Steel wheel roller	0.927	0.099	0.090	0.156
Asphalt paver	1.284	0.100	0.082	0.215

Construction Vehicle Type	Emissions Factors (pounds per hour)			
	NO_x	VOC	$PM_{2.5}$	SO_2
Vibratory roller	1.466	0.116	0.105	0.240
Grader	1.513	0.121	0.107	0.265
Concrete pumper truck	2.941	0.237	0.101	0.331
Concrete truck	2.941	0.237	0.101	0.331
Crane	1.156	0.116	0.099	0.182
Water tanker [a]	9.984	0.242	0.242	0.0132
Dump truck [a]	9.984	0.242	0.324	0.0132
Delivery truck (heavy) [a]	6.488	0.713	0.453	0.0056
Air compressor	0.558	0.049	0.051	0.093

[a] Units are in grams/mile.

Calculations for Construction Emissions

Using the emissions factors in Table B-2, construction emissions were calculated for the proposed construction at Fort Belvoir. Using the assumptions described above, the emissions in tons of NO_x, VOC, $PM_{2.5}$, and SO_2 for construction equipment emissions were calculated for each vehicle type using the appropriate equations displayed in Table B-3.

Table B-3: Equations for Construction Emissions Calculations

Emission Source	Equation	Sample Calculation
Heavy equipment emissions, hourly on-site activities	(# of vehicle type) (Emission factor) (Total # of days in operation) (hours/day) (1 ton/2000 lbs) = tons of air emissions	(1 front end loader) (1.513 lbs/hr) (292 days in operation) (8 hours/day) (1 ton/2000 lbs) = **0.3978 tons of NO_x of equipment emissions**
Construction truck emissions with vehicle-miles	(# vehicle type) (Emission factor) (Total # of miles traveled during a specific construction activity) (miles/day)(1 ton/2000 lbs) = tons of air emissions	(1 dump truck) (9.984 grams/mile) (10,850 miles total during construction)(1 lb/453.59 grams) (1 ton/2000 lb) = **0.107 tons NO_x of vehicle emissions**
Construction crew, commuting	(# of vehicles) (#miles/day) (#days) (emissions factor grams/mile) (1 lb/453.59 grams) (1 ton/2000 lb) = tons of vehicle emissions	(40 vehicles) (40 miles/day) (240 days) (0.76 grams/mile/vehicle) (1 lb/453.59 grams) (1 ton/2000 lb) = **0.32 tons NO_x of vehicle emissions**

Surface Disturbance (Fugitive $PM_{2.5}$)

The quantity of dust emissions of $PM_{2.5}$ from construction operations is assumed proportional to the days of construction activity on unpaved surfaces. The following sources for emission factors, with a capture fraction of 50 percent and silt and moisture contents of 20 percent, were used in $PM_{2.5}$ emission calculations for fugitive emissions (AP-42 Section 13.2; USEPA 2011).

- The unpaved road equation 13.2.2.1 equation 1a (AP-42 Chapter 13.2.2) is used to estimate fugitive emissions for the concrete pumper truck, concrete truck, crane, dump truck, and delivery truck. Mileage on unpaved surface for each day of operation by vehicle type is estimated, and then multiplied by the number of construction days.
- Front end loader and backhoe emissions combine unpaved road travel from equation 13.2.2.1 equation 1a and the dumping equation from AP-42 Chapter 11, Chapter 11.9-4.
- Dozer and vibratory roller emissions are based on the dozer equation from AP-42 Chapter 11, Table 11.9-1.
- Grader emissions are based on the grader equation from AP-42 Chapter 11, Table 11.9-1.

Resultant emission rates in lb/day are presented in Table B-4 and resultant tons of $PM_{2.5}$ emissions are provided in Table B-5.

Table B-4: Fugitive $PM_{2.5}$ Emission Factors for Construction Vehicles

Equipment/Vehicle Type	Fugitive $PM_{2.5}$ (lb/day)	Equipment/Vehicle Type	Fugitive $PM_{2.5}$ (lb/day)
Front end loader	2.26	Concrete pumper truck	0.16
Dozer	0.73	Concrete truck	0.28
Vibratory roller	0.73	Dump truck	0.19
Grader	0.02	Delivery truck (heavy)	0.12
Excavator	0.20	Crane	0.21

Proposed Action Alternative

Equipment requirements were estimated for the construction and demolition activities associated with site preparation for the water storage towers, gravity sewer, stream crossings and trenching. Table B-5 provides the equipment assumptions and resultant total equipment emissions for the Proposed Action Alternative.

Dump truck calculations are performed based on the estimated number of total miles needed throughout that year, with a round trip haul of 16 miles. This estimation assumes a 16 ton capacity dump truck. Under total days of operation in the tables, dump trucks will instead display the total annual miles estimated.

Table B-5: Total Equipment Emissions For Construction

Construction Vehicle Type	Total Vehicle Days of Operation	Annual Emissions (tons per year)				
		NO_x	VOC	$PM_{2.5}$	Fugitive $PM_{2.5}$	SO_2
Front end loader	292	3.978	0.239	0.206	0.657	0.580
Excavator	336	3.922	0.304	0.245	0.000	0.290
Dozer	5	0.057	0.004	0.003	0.005	0.421
Pneumatic tire roller	1	0.004	0.000	0.000	0.000	0.001
Steel wheel roller	2	0.007	0.001	0.001	0.000	0.001
Asphalt paver	1	0.005	0.000	0.000	0.000	0.001
Vibratory roller	194	0.673	0.053	0.043	0.086	0.110
Grader	4	0.026	0.002	0.002	0.000	0.005
Concrete pumper truck	1	0.012	0.001	0.001	0.001	0.001
Concrete truck	1	0.012	0.001	0.001	0.001	0.001
Crane	260	1.201	0.109	0.089	0.129	0.499
Water tanker [a]	1	0.000	0.000	0.000	0.007	0.000
Dump truck [a]	14,900	0.145	0.013	0.003	1.339	0.000
Delivery truck (heavy) [a]	30	0.000	0.000	0.000	0.112	0.000
Air compressor	90	0.201	0.018	0.018	0.000	0.033
Total Emissions		**10.243**	**0.746**	**0.613**	**2.336**	**1.943**

[a] Units are in total miles.

5.1.2 Emissions from Construction Crew Workers

Emissions from construction personnel traffic were calculated using the USEPA's *MOBILE6.* It is assumed that the construction crew would consist of an average of 40 workers per day for 240 days. For a conservative analysis, it was assumed each person would drive to the site and that the average number of workers would drive approximately 40 miles each day. Based on *MOBILE6*, the emission factor for NO_x is 0.760 grams/mile/vehicle, VOC is 1.299 grams/mile/vehicle, $PM_{2.5}$ is 0.011 grams/mile/vehicle, and SO_2 is .0068 grams/mile/vehicle for the average fleet in Fairfax County, Virginia. Resultant total emissions associated with the commuter vehicles from the construction crew, using the commuter equation in Table B-3, are approximately:

- 0.322 tons of NO_x
- 0.550 tons of VOC

- 0.005 tons of $PM_{2.5}$
- 0.003 tons of SO_2

5.1.3 Emissions from Painting

For painting the water storage tanks, it was assumed that alkyd paint would be used with a VOC content of three pounds per gallon and one gallon of paint covers approximately 200 square feet. Three coats of paint would be applied (one interior and two exterior) to approximately 150,000 square feet of surface, approximately 50,0000 square feet per water storage tank.

Given these assumptions, approximate VOC emissions for painting the water tanks would be 3.375 tons VOC.

5.1.4 Summary of Construction Emissions

After emissions analysis was performed for all aspects of construction, the totals were added to determine the combined annual construction emissions. Table B-6 summarizes the results.

Table B-6: Emissions from Construction and Demolition

Construction Activity	Total Annual Emissions (tons per year)			
	NO_x	VOC	$PM_{2.5}$	SO_2
Use of heavy equipment	10.243	0.746	0.613	1.943
Fugitive emissions			2.336	
Construction crew, commuting	0.322	0.550	0.005	0.003
Painting		3.375		
Total Emissions from Construction and Demolition	**10.565**	**4.670**	**2.954**	**1.946**

5.2 Regional Significance

Air emissions were also evaluated to determine regional significance. The *Draft Washington, DC-MD-VA Region 1997 $PM_{2.5}$ Maintenance Plan* (MWCOG 2013) and the *Plan to Improve Air Quality in the Washington, DC-MD-VA Region: State Implementation Plan for 8-Hour Ozone* (MWCOG 2007) set forth daily target levels for nonattainment pollutants within the Washington Metropolitan nonattainment region. Annual and daily emission inventories for each of the pollutants are available in Table B-7.

The draft maintenance plan for $PM_{2.5}$ provides emission inventories for on-road (mobile) sources of pollution only. For point and non-road sources, the plan relies on the non-road diesel emission reduction program and point source Federal regulations to reduce future emissions from these sources.

Table B-7: State Implementation Plan Emission Inventories

Source of Emissions	$PM_{2.5}$ 2017 Emission Inventory (tons per year)			Ozone 2009 Emission Inventory (tons per day)	
	$PM_{2.5}$	NOx	SO_2	NO_x	VOCs
Point	NA	NA	NA	113	14
Area	NA	NA	NA	27	179
Non-road	NA	NA	NA	75	88
On-road	1,350	27,400	531	146	66

Emissions resulting from the construction of the Proposed Action do not exceed ten percent of the emission inventories. Impacts to air quality would not be regionally significant.

6.0 CONCLUSION

Emissions from the Proposed Action would be below *de minimis* thresholds. As the annual emissions are well below *de minimis* levels and are not regionally significant, a full conformity determination is not required. A draft Record of Non-Applicability (RONA) can be found in Attachment One.

7.0 REFERENCES

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ATTACHMENT ONE: RECORD OF NON-APPLICABILITY

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GENERAL CONFORMITY – RECORD OF NON-APPLICABILITY

Project/Action
Name: Environmental Assessment for Water/Wastewater Utility Upgrade at Fort Belvoir Project/Action

Begin Date: July 2013
End Date: December 2014

General Conformity under the Clean Air Act, Section 176 has been evaluated for the project described above according to the requirements of 40 CFR 93, Subpart B. The General Conformity Rule applies to federal actions occurring in regions designated as being in non-attainment for the National Ambient Air Quality Standards (NAAQS) or attainment areas subject to maintenance plans (maintenance areas). Threshold *(de minimis)* rates of emissions have been established for federal actions with the potential to have significant air quality impacts. If a project/action located in an area designated as non-attainment exceeds these *de mimimis* levels, a general conformity analysis is required. Fort Belvoir is in Fairfax County which is in marginal nonattainment for ozone and in nonattainment for particulate matter with diameter less than or equal to 2.5 micrometers ($PM_{2.5}$). Thus the thresholds for ozone precursor pollutants nitrogen oxides (NO_x) and volatile organic compounds (VOCs), for $PM_{2.5}$, and the $PM_{2.5}$ precursor pollutant sulfur dioxide (SO_2) apply.

A General Conformity Analysis of this project/action is not required because total maximum annual direct and indirect emissions from this project/action have been estimated at:

> NO_X: 10.565 tons per year, VOCs: 4.670 tons per year, $PM_{2.5}$: 2.954 tons per year, and SO_2: 1.946 tons per year

These are below the *de minimis* levels established in 40 CFR 93.153 (b) of:

> NO_x, $PM_{2.5}$, SO_2: 100 tons per year; VOC: 50 tons per year.

Fairfax County is in attainment for all other criteria pollutants including sulfur dioxide, nitrogen dioxide, carbon monoxide, particulate matter (PM_{10}) and lead and therefore, these pollutants are not subject to conformity review.

Supporting documentation and emissions estimates can be found in Section 3.6 and Appendix B of the Environmental Assessment.

Gregory D. Gadson
Colonel, US Army
Garrison Commander

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