Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army											Date: February 2018	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603728A *I Environmental Quality Technology Demonstrations*							
COST ($ in Millions)	**Prior Years**	**FY 2017**	**FY 2018**	**FY 2019 Base**	**FY 2019 OCO**	**FY 2019 Total**	**FY 2020**	**FY 2021**	**FY 2022**	**FY 2023**	**Cost To Complete**	**Total Cost**
Total Program Element	-	21.415	10.421	9.136	-	9.136	9.352	9.538	9.735	9.931	0.000	79.528
002: *Environmental Compliance Technology*	-	3.682	2.203	2.353	-	2.353	2.455	2.503	2.554	2.606	0.000	18.356
025: *Pollution Prevention Technology*	-	1.431	1.488	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	2.919
03E: *Environmental Restoration Technology*	-	6.302	6.730	6.783	-	6.783	6.897	7.035	7.181	7.325	0.000	48.253
03F: *Environmental Quality Tech Demonstrations (CA)*	-	10.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	10.000

A. Mission Description and Budget Item Justification

This Program Element (PE) matures and demonstrates technologies that assist the Army to reduce or eliminate environmental impacts both in the United States and abroad, and provide science and technology solutions to Army environmental challenges as a force multiplier in mission planning, material acquisition and soldier preparedness. Project 002 demonstrates tools and methods for compliance with environmental laws relevant to conservation of natural and cultural resources while providing a flexible realistic training environment for mission activities. The Army also requires the ability to assess, establish, upgrade, and secure infrastructure while in theatre to enable deployed force operations. This project matures and demonstrates tools for robotic and autonomous agile infrastructure modification and custom designed construction for expeditionary structures on demand. Project 025 demonstrates pollution prevention tools and methods to minimize the Army's use and generation of toxic chemicals and hazardous wastes. Project 03E focuses on technologies for advanced life cycle analysis, advanced sensing, and technologies to empower rapid fielding of next generation energetics, propellants and munitions.

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering Science and Technology priority focus areas and the Army Modernization Priorities for Air Missile Defense, Next Generation Combat Vehicle, and Network/C3I, and supports the Army Strategy for the Environment.

This PE is fully coordinated and complementary to PE 0602720A (Environmental Quality Technology).

Work in this PE is performed by the Army Engineer Research and Development Center, Vicksburg, MS, and the United States (U.S.) Army Research, Development, and Engineering Command, Aberdeen Proving Ground, MD.

Exhibit R-2, RDT&E Budget Item Justification: PB 2019 Army	Date: February 2018
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603728A *I Environmental Quality Technology Demonstrations*

B. Program Change Summary ($ in Millions)	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total
Previous President's Budget	11.137	10.421	10.624	-	10.624
Current President's Budget	21.415	10.421	9.136	-	9.136
Total Adjustments	10.278	0.000	-1.488	-	-1.488
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	10.000	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	0.468	-			
• SBIR/STTR Transfer	-0.187	-			
• Adjustments to Budget Years	-	-	-1.488	-	-1.488
• FFRDC	-0.003	-	-	-	-

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2017	FY 2018
Project: 03F: *Environmental Quality Tech Demonstrations (CA)*		
Congressional Add: *Program Increase*	10.000	-
Congressional Add Subtotals for Project: 03F	10.000	-
Congressional Add Totals for all Projects	10.000	-

Change Summary Explanation

FY17 Congressional increase in project 03F Environmental Quality Tech Demonstrations
Decrease in FY19 due to removal of pollution prevention task.

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army			Date: February 2018
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603728A / *Environmental Quality Technology Demonstrations*	Project (Number/Name) 002 / *Environmental Compliance Technology*	

COST ($ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
002: *Environmental Compliance Technology*	-	3.682	2.203	2.353	-	2.353	2.455	2.503	2.554	2.606	0.000	18.356

A. Mission Description and Budget Item Justification

This Project matures and demonstrates technologies transitioned from Program Element (PE) 0602720A (Environmental Quality Technology), Projects 048 and 896, and PE 0602784 (Military Engineering), Projects T41 and T45. This project assists Army installations and operations in achieving environmental compliance. Army facilities are subject to fines and facility shutdowns for violations of federal, state, and local environmental regulations. Efforts under this Project enable the Army to reduce environmental constraints at installations while complying with the myriad of federal, state, local, and host country environmental regulations and policy. In addition, this project matures capabilities to assess, establish, upgrade, and construct infrastructure to project power and enable deployed force operations. Current and planned efforts enable the Army to perform additive and advanced manufacturing for deployed force infrastructure, support robotic and autonomous engineering during combat operations, and ensure infrastructure resiliency. Technologies demonstrated aim to reduce the cost of resolving compliance issues for the Army, sustain the viability of testing and training ranges, protect critical resources, and expand capacity to perform construction and supporting tasks in high risk/threat and dynamic environments.

Work in this Project supports the Army Science and Technology Military Engineering and Environmental Technology, Simulation and Computing Portfolio.

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering Science and Technology priority focus areas, supports the Army Strategy for the Environment, and supports the Army Modernization Priority for Next Generation Combat Vehicle, Air Missile Defense and Network/C3I.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
Title: Sustainable Ranges and Lands	1.059	1.106	-
Description: This effort provides ecosystem vulnerability assessment and ecosystem analysis, monitoring, modeling, and mitigation technologies to support sustainable, unconstrained, realistic access and use of the Army's ranges and lands. This effort demonstrates environmentally safe and cost effective technologies to manage and reduce the increase in noise and pollution concerns associated with training ranges.			
FY 2018 Plans: Integrate and mature methodologies for high-resolution permafrost/ground-ice mapping for improved risk characterization. Extended permafrost heat transfer models to account for near surface ground heterogeneity and provide a real-time feedback system for early warning of ground stability, including permafrost change development, for existing infrastructure.			
FY 2018 to FY 2019 Increase/Decrease Statement: Effort ends FY18.			
Title: Infrastructure for Combat Operations (Previous Titled: Adaptive & Resilient Installations)	2.623	1.097	-

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603728A / *Environmental Quality Technology Demonstrations*	**Project (Number/Name)** 002 / *Environmental Compliance Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
Description: The Army requires the ability to assess, establish, upgrade, and secure infrastructure while in theatre to enable deployed force operations. This effort matures and demonstrates tools for the assessment of physical and ecological impacts on operations, agile infrastructure modification, and custom?designed construction for expeditionary structures on?demand. ***FY 2018 Plans:*** Mature and validate representative hardware and software to assess the relative risk associated with autonomous construction activities, and the degree to which risk may be mitigated through the employment of innovative robotic construction methods. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** Effort ends FY18.			
Title: Robotics for Engineer Operations ***Description:*** Mature and demonstrate robotic and autonomous technologies for Engineer operations supporting mobility, countermobility, and advanced construction methods for deployed operations. ***FY 2019 Plans:*** Will mature risk mitigation frameworks associated with contingency autonomous construction methods and activities. Mature algorithms and decision making software for control processes (bandwidth needs, response time lag, and override response times) developed to facilitate autonomous methods necessary for expedient point of need construction. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** Initiate effort in FY19.	-	-	2.353
Accomplishments/Planned Programs Subtotals	3.682	2.203	2.353

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army			Date: February 2018
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603728A / *Environmental Quality Technology Demonstrations*	Project (Number/Name) 025 / *Pollution Prevention Technology*	

COST ($ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
025: *Pollution Prevention Technology*	-	1.431	1.488	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	2.919

A. Mission Description and Budget Item Justification

This Project matures and demonstrates pollution prevention advanced technologies required for sustainable operation of Army weapon systems, to include compliance with regulations mandated by federal, state, and local environmental and health laws. Technology thrusts under this Project include demonstration of advanced technologies to enable sustainment of propellant, explosive, and pyrotechnic production and maintenance facilities and training ranges through elimination or significant reduction of environmental impacts. These technologies will ensure that advanced energetic materials required for the future force's high performance munitions are developed that meet weapons lethality and survivability goals and that are compliant with environmental and health laws. Technology thrusts also include demonstration of more sustainable technologies for surface finishing processes, paints and coatings, cleaning solvents, refrigerants, and fire suppressants.

Work in this Project supports the Army Science and Technology Environment and Terrain Portfolio.

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering Science and Technology priority focus areas and the Army Modernization Strategy and supports the Army Strategy for the Environment.

The Project is fully coordinated and complementary to Program Element (PE) 0602720A, Project 895. This Project transitions technologies developed under that PE.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
Title: Pollution Prevention Technology	1.431	1.488	-
Description: This effort demonstrates pollution prevention advanced technologies required to sustain operation of Army weapons systems to comply with state, federal, and local environmental and health laws and regulations. ***FY 2018 Plans:*** Mature and characterize nanoporous silicon-based energetic materials as potential alternatives to lead-based primary explosives; demonstrate the use of Chemical Agent Resistant Coating formulations that replace hazardous isocyanate compounds with polysiloxane-based resins; demonstrate alternative refrigerants with low global warming potential in military environmental control unit applications. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** Effort ended in FY18.			
Accomplishments/Planned Programs Subtotals	1.431	1.488	-

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603728A / *Environmental Quality Technology Demonstrations*	**Project (Number/Name)** 025 / *Pollution Prevention Technology*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army			Date: February 2018
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603728A / *Environmental Quality Technology Demonstrations*	Project (Number/Name) 03E / *Environmental Restoration Technology*	

COST ($ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
03E: *Environmental Restoration Technology*	-	6.302	6.730	6.783	-	6.783	6.897	7.035	7.181	7.325	0.000	48.253

A. Mission Description and Budget Item Justification

This Project matures and demonstrates technologies transitioned from Program Element (PE) 0602720A (Environmental Quality Technology), Projects 835 and 896 by addressing the management and mitigation of materials and chemicals with focus on impacts of new materiel that will enter the Army inventory within the next decade and beyond; shape and protect Army investments in next generation fires by delivering proactive scientifically sound risk and environmental impact management strategies; environmental factors in mission planning activities impacting the battlefield landscape of future threats; and opportunities and impacts to mission success in sparse data environments, enabling mission planners to identify the industrial/commercial resources used as components of weapons development. Technologies matured within this Project inform the Army of potential environmental threats, opportunities and impact to mission; to understand the environmental threat in urban and industrial contested environments; and rapidly sense and assess the presence and extent of dangerous compounds in battlefield environments. A key aspect of this work is the enhancement of risk assessment and life cycle analysis techniques that can more accurately predict and identify the environmental liabilities associated with fielding new systems and technologies. Efforts also identify ways to economically comply with myriad federal, state, and host country regulations dealing with contaminated soil and water. This Project includes pilot scale field studies to demonstrate technological feasibility and optimize performance and productivity of the risk mitigation techniques.

Work in this Project supports the Army Science and Technology Military Engineering and Environmental Technology, Simulation and Computing Portfolio.

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering Science and Technology priority focus areas and the Army Modernization Priority for Network/C3I, Air Missile Defense, and Long Range Precision Fires, and supports the Army Strategy for the Environment.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
Title: Hazard Assessment for Military Materials	2.400	1.398	0.278
Description: This effort demonstrates tools to assess hazard and risk of Army-unique chemicals and materials. The tools provide for rapid environmental baseline survey reporting and screening assessments of existing and future militarily relevant compounds and allow for improved predictive risk assessment and provide environmental life cycle assessment capability.			
FY 2018 Plans: Demonstrate a novel passive chemical sensor to detect multiple contaminants (copper, arsenic, and nitrate) in water to provide sensing devices that are rapid, robust, and cost-efficient for real time water quality monitoring.			
FY 2019 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603728A / *Environmental Quality Technology Demonstrations*	**Project (Number/Name)** 03E / *Environmental Restoration Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
Will characterize environmental fate, degradation and transport of obscurants and tone-down materials in different environments ranging from open lands to dense urban areas. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** Program reduction to support priority objectives.			
Title: Technologies for Sustainable and Green Operations and Acquisition ***Description:*** This effort exploits and matures technologies to control contaminant transport in environmental media on Army lands and mission spaces as well as assesses and demonstrates novel detection, remediation, and mitigation capabilities for existing and emerging contaminants. ***FY 2018 Plans:*** Demonstrate an operational field effluent treatment system that will minimize water demand, decontaminated waste, and reduce logistic demands. Validate computationally developed environmentally relevant physical and chemical properties of emerging and traditional munitions compounds essential to predict their fate and transport in natural water. Validate an artificial intelligence model that will predict adverse outcomes based on chemical-biological interactions for assessment of military compounds. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** Effort ends in FY18.	1.095	3.331	-
Title: Risk Prediction and Decision Technologies ***Description:*** This effort matures and provides integrated science and technology solutions to Army environmental challenges with a focus on predicting the environmental attributes of emerging chemicals and materials, predictions that inform acquisition lifecycle models in order to minimize impacts to the mission and to the Soldier. ***FY 2018 Plans:*** Validate an environmental lifecycle forecasting tool designed to provide quantitative environmental impact assessment for emerging materials and technologies. Mature qualitative and quantitative methods for assessing synthetic biology environmental impacts of military relevance. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** Effort ends in FY18.	2.807	2.001	-
Title: Rapid Risk Analysis of Fires	-	-	2.874

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603728A / *Environmental Quality Technology Demonstrations*	**Project (Number/Name)** 03E / *Environmental Restoration Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
Description: This effort is focused on health implications of new, to-be fielded munitions and investigates the overall life cycle of the materials to shape and protect Army investments in next generation fires supporting Army Modernization Priority Long Range Precision Fires. ***FY 2019 Plans:*** Demonstrate proactive environment, safety, and occupational health risk assessment tools to ensure rapid fielding of energetics, propellants, and munitions. Validate models to predict chemical impacts on select species using embryo gene expression, and demonstrate new computational technologies with high potential for meeting the Army?s needs to predict the toxicity of new and novel chemical agents used in munitions, smoke screens, and energetics. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** New start effort for FY19.			
Title: Understanding the Environment as a Threat ***Description:*** This effort provides environmental conditions and hazards in contested environments to enable operational planning and decisions to understand environmental threats from informed modeling and simulation supporting Modernization Priority Network/C3I Mission Planning Applications. ***FY 2019 Plans:*** Will demonstrate predictive tools to inform engineer reconnaissance and provide environmental situational awareness for mission planning. Demonstrate in silico prediction of physical, chemical and biological properties of insensitive munitions compounds and their transformation products in the natural water, arid and semi-arid environments, and mature models capable of predicting chemical behavior in complex environments to support scientifically defensible knowledge, tools, and guidance. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** New start effort in FY19.	-	-	1.938
Title: Chemical Sensing in Contested Environments ***Description:*** This effort provides robust tools for environmental reconnaissance missions and environmental sensing technologies for mission readiness. Supports Modernization Priority C3I Persistent Surveillance. Enhanced situational understanding reduces surprise, and can prevent detection, acquisition and engagement. ***FY 2019 Plans:*** Will demonstrate advanced environmental sensor technologies to enable rapid collection and data analysis of environmental information. Will demonstrate printed, functionalized carbon nano-tube sensor elements to promote properties critical for sensing	-	-	1.693

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army		Date: February 2018
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603728A / *Environmental Quality Technology Demonstrations*	**Project (Number/Name)** 03E / *Environmental Restoration Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018	FY 2019
contaminants of interest (e.g., copper, arsenic, and nitrites), and demonstrate/validate experimental protocols for improved selectivity for passive samplers. ***FY 2018 to FY 2019 Increase/Decrease Statement:*** New start effort for FY19.			
Accomplishments/Planned Programs Subtotals	6.302	6.730	6.783

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2019 Army			Date: February 2018
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603728A / *Environmental Quality Technology Demonstrations*	Project (Number/Name) 03F / *Environmental Quality Tech Demonstrations (CA)*	

COST ($ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
03F: *Environmental Quality Tech Demonstrations (CA)*	-	10.000	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	10.000

Note

Congressional increase for Program increase

A. Mission Description and Budget Item Justification

This is a Congressional Interest Item.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2017	FY 2018
Congressional Add: Program Increase	10.000	-
FY 2017 Accomplishments: N/A		
Congressional Adds Subtotals	10.000	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A