

National Aeronautics and Space Administration



GODDARD SPACE FLIGHT CENTER

2021 Sustainability Report

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Greenbelt B37 Instrument Development Facility – 2021 Association of Builders & Contractors Excellence in Construction Award Winner



Kelly Busquets

Prepared By: Kelly M. Busquets
GSFC Sustainability Program Manager

Paul Bull

Reviewed By: Paul C. Bull
Division Chief, Facilities Management Division

David A. Reth

Approved By: David A. Reth
Director of Management Operations
Goddard Chief Sustainability Officer

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Executive Summary

Goddard's Mission and Sustainability

As a global leader in Earth Science, NASA's Goddard Space Flight Center (Goddard) has a unique understanding and obligation to lead the way in identifying and implementing operation strategies to ensure continued human progress, productivity, and prosperity while sustaining natural species and systems and reducing Goddard's impact to environmental, institutional, programmatic, and operational risks. In doing so, we continuously improve the resilience of Goddard's space and ground assets, mission operations, and equipment performance.

This document has been delayed for congressional approval of the new executive order that was not released until December 2021, so it reports the status of Goddard's sustainability program and outlines initiatives the Center has been pursuing to address the sustainability goals directed in the previous executive order, *Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis, EO 13990*, January 20, 2021, and the internal *NASA 2021 Sustainability Report and Implementation Plan*. The 2022 sustainability goals stated in this report are anticipated to change in accordance with the new EO *Catalyzing America's Clean Energy Economy Through Federal Sustainability*, signed Dec 8, 2021. Goddard's Sustainability Report and Implementation Plan (SRIP) will be updated once NASA has established new targets accordingly. This report reflects both FY20 and FY21 performance of Goddard's principal facilities at Greenbelt in Maryland (Greenbelt) and the Wallops Flight Facility in Virginia (Wallops). Goddard's sustainability policy is to execute the mission without compromising the planet's resources so that future generations can meet their needs.

Sustainability Process and Successes

Goddard's sustainability team focuses on reducing environmental impacts of NASA operations by conserving energy and water, using energy savings performance contracts, replacing old, less efficient buildings with new sustainable facilities and infrastructure, commissioning existing buildings, procuring and using greener products and materials, reducing greenhouse gas emissions from facility and fleet operations, electronic stewardship, reducing waste generation and disposal, stormwater management, and increasing pollinator habitat and carbon sequestration through establishment of native plantings and meadows. Goddard continues to reduce the footprint of its built assets through strategic demolition and consolidation efforts and removed 301,894 gross square feet (GSF) of inefficient space from its inventory from fiscal year FY17 - FY21, saving an estimated \$794,531 per year in operations and maintenance¹. The operation of new and existing sustainable buildings minimizes long-term infrastructure, energy, water, and maintenance costs. The Center's Energy Management Program (EMP) reduces risk to Goddard's mission by reducing our consumption of traditional energy resources and energy operating costs. The estimated annual energy savings from implementing performance contracts for FY20 was \$3.1M² and for FY21 was \$3.5M². Goddard completed 8 Existing Building Commissioning (EBCx) studies in FY18/19, 9 in FY19/20, 4 in FY20/21, and 16 more in FY21/22 to optimize building performance. Between FY15 - FY19, Goddard certified 7 facilities that meet the *Guiding Principles for Federal Leadership in High Performance and Sustainable Buildings* (GP), and in FY20 certified 4 more GP buildings. Goddard



anticipates certifying the new Instrument Development Facility (IDF) in FY22 for a total of 681,107 GSF, or 15.5% GSF of assets.

NASA's 10 Sustainability Goals (Details of the first eight goals are described in the following sections)

1. Reduce energy intensity
2. Use renewable energy
3. Use Performance Contracting
4. Increase sustainable buildings and infrastructure
5. Reduce water consumption
6. Reduce and divert waste from landfills
7. Reduce GHG emissions (fuel consumption) from fleet vehicles
8. Increase sustainable acquisition
9. Reduce GHG emissions from facility operations (tracked at HQ and addressed through energy reduction)
10. Continue electronic stewardship (tracked at HQ and addressed through sustainable acquisition and IT contracts)

Sustainability Priorities

Goddard's strategic priorities and objectives for FY22 are to advance efficiency in Center operations, meet or exceed sustainability goals and requirements driven by the NASA Sustainability Plan, and achieve cost savings by:

- Completing Preliminary Assessments (PA) and Investment Grade Audits (IGA) at Greenbelt and Wallops to identify and implement energy conservation measures (ECMs)
- Increasing sustainable facilities through Existing Building Commissioning (EBCx), which strives to bring existing buildings back to top energy-efficient performance
- Increasing sustainable infrastructure through the Envision sustainable infrastructure program.
- Reducing the Center's footprint by demolishing old, inefficient buildings and replacing them, where necessary, with sustainable, more energy-efficient buildings
- Increasing sustainable acquisition
- Continuing outreach campaigns to increase awareness that supports implementation of behavior energy-efficiency and sustainability initiatives
- Improving waste landfill disposal diversion and recycling rates
- Increasing low impact development through stormwater management and sustainable landscaping (filtration plantings, bio swales, stream restoration), to reduce impervious surfaces and improve stormwater quality
- Increasing pollinator habitat and carbon sequestration while reducing landscape maintenance costs through establishment of native plantings, meadows and reforestation

Implementation Summary: Facility Management

Facility Energy Efficiency



WFF E Buildings Dry Cooler



GB EBCx (ACS Refurbishment and Coil Restoration)

FY20 Energy Intensity Progress (Btu/GSF):

Reduced **34.2% (GB)**, **39.1% (WFF)** from the FY03 baseline
(Federal/Agency Goal: reduce 30% from baseline)

Reduced **2% (GB)**, but increased **7.6% (WFF)** from FY19
(Agency Goal: reduce 0.5% from FY19)

FY21 Energy Intensity Progress (Btu/GSF):

Reduced **38.34% (GB)**, **43.44% (WFF)** from the FY03 baseline
(Federal/Agency Goal: reduce 30% from baseline)

Reduced **4.11% (GB)**, but increased **1.69% (WFF)** from FY20
(Agency Goal: reduce 0.5% from FY20)

FY22 Energy Intensity Plan (TBD):

(Previous Goal reduce 0.5% in FY22 from FY21)

Implementation Status

Although Goddard’s EMP has successfully exceeded the 30% facility energy intensity reduction goal from the FY03 baseline, Goddard’s annual energy intensity increased slightly in both FY20 and FY21 from the previous year primarily due to COVID-19 safety protocols, which included turning air handling units on two hours before and after each workday to flush buildings out, and flushing water lines to prevent stagnation.



Goddard reduces energy consumption and costs through many methods. Core strategies include energy efficiency and renewable energy project implementation, sustainable building design, construction, and renovation, and employee training, outreach, and awareness through events such as Energy Awareness and Earth Day Activities and newsletters.

The EMP energy efficiency projects and initiatives in progress or completed in FY20/21 include the following:

- Greenbelt
 - o 14 Buildings EBCx (1, 3, 7, 10, 11, 13, 14, 15, 21, 28, 29, 30, 31, & 32) In progress: Projected energy reduction – 4.5%
 - o GSFC Main Gate Relocation Project LED Lighting Retrofits and HVAC system: In progress – potential energy reduction TBD.
 - o Energy Management Control System (EMCS) Upgrade Project: Near completion: Projected energy reduction – 3%
 - o 15-Building UESC Part I (16 ECMs): Awarded 12/2021: Projected energy reduction – 13%
- Wallops
 - o ESPC Phase 3A 4.3 MW Solar PV Project: Completed March 2020: Electricity generation – 13.8%/30% of main base load in FY20/FY21, however, not considered a savings until the ESPC is paid off
 - o HVAC Efficiency Project: In progress

Priority Strategies & Planned Actions

Goddard will continue to invest in life-cycle cost-effective energy efficiency projects using all available funding streams, including appropriated funds, financing, rebates, and Enhanced Use Lease (EUL) Agreements. For example, in FY18 NASA launched a cyclical Existing Building Commissioning Program using 35% of the Agency’s EUL net revenue (Congress provides NASA authority to lease non-excess but underutilized Agency assets to tenants, and to retain and utilize lease net revenue beyond expenses of hosting tenants; the authority returns 65% of net revenue to the Center that hosted the lease and provides 35% revenue to the Agency for use at any Center, the authorization expired in 12/31/2021 and a new authority is being sought).

Energy Performance Contracting

FY20/21 Performance Contracting Progress:

Established a new Utility Energy Service Contract (UESC) agreement with the utility provider and completed a Preliminary Assessment (PA) July 2021 at WFF. WFF is also doing Measurement & Verification (M&V) on an existing Energy Savings Performance Contract (ESPC) that will be paid off in 2030. At GB, a Combined Heat & Power (CHP) life cycle cost analysis PA and an Investment Grade



Audit (IGA) on 15 buildings was completed. The GB IGA was advanced to a UESC awarded on 12/30/2021.

Implementation Status

The EMP utilizes ESPCs and UESCs in concert with other mechanisms to improve system efficiencies and reduce utility expenditures in support of Goddard’s mission. Phase 1 and 2 of Wallops ESPC, awarded in 2010 and 2012 respectively, are valued at \$50.5M³ based on estimated life cycle cost savings. Additionally, a renewable energy, 4.3 MW photovoltaic (PV) system (Phase 3a), was added to the above ESPC in FY20. In 2017, Greenbelt implemented the directly funded UESC project under the GSA area-wide contract with the local utility provider PEPCO. The UESC program enabled GSFC to implement new chiller optimization software technology while earning rebate funds of \$937K⁴ that were reinvested in the current UESC project development process at the GB campus. On 12/30/2021, 15 buildings, 16 ECMs UESC project was awarded at the GB campus. The ECMs include implementing LED lights, chillers replacements, and monitoring-based commissioning. The UESC is projected to reduce the campus energy consumption by 13%.

Priority Strategies & Planned Actions

Wallops has established a new UESC arrangement with the local utility provider ANEC and conducted a base-wide facility PA to identify energy conservation measures (ECMs). Another Energy Service Company (ESCO) has also completed a PA at Wallops. The next step is for Goddard to determine the best value ECMs to move forward to the IGA phase of the UESC project development process.

Renewable Energy



Wallops Airfield Phase 3a Photo Voltaic Panels



Wallops F6 solar parking canopies and Airfield Phase 3a Photo Voltaic Panels

FY20 Renewable Energy Use Progress:

Roughly 10.7% (~13.8% of Main Base) of total electricity consumed by NASA at WFF was generated from the airfield solar farm in FY20 (~ 9 months)

(Federal/Agency Goal: 7.5% of total electricity used from a renewable source)



FY21 Renewable Energy Use Progress:

Roughly 20.6% (~27.5% of Main Base) of total electricity consumed by NASA at WFF was generated from the airfield solar farm in FY21

(Federal/Agency Goal: 7.5% of total electricity used from a renewable source)

FY22 Renewable Energy Plan (TBD):

Previous Goal 7.5% of total electricity used from a renewable source

Implementation Status

Goddard Campuses employ a diverse mix of renewable electric and thermal energy sources, including on-site geothermal heat pump systems, solar PV systems, landfill gas, and Renewable Energy Certificate (REC) purchases.

In FY20, the following renewable energy projects were completed:

Wallops ESPC: (4.3 MW Phase 3a) Photovoltaic (PV)

- On-site solar energy self-generation for double renewable energy credits
- Makes use of unbuildable space next to airfield
- Meets Wallops renewable electricity goal
- Meets ~83%⁵ of Wallops peak load
- Eliminates greenhouse gas (GHG) emissions and reduces WFF carbon footprint

Wallops HVAC Efficiency Project (Geothermal Wells)

- Installed geothermal wellfield with 42 wells and a 77 Ton Multistack combination Chiller/Boiler in U-25 & U-30
- Installation complete. Awaiting Testing and Balancing and Commissioning to close the project

Priority Strategies & Planned Actions

Beginning in FY20, NASA centralized REC purchases at the agency level to reduce costs and gain administrative efficiencies for the Agency.

FY22 Federal Energy Management Program (FEMP) Energy Storage Initiative:

- WFF was selected to participate in a FEMP study intended to help agencies identify opportunities for onsite battery storage and provide technical and procurement assistance to accelerate deployment. WFF is working with FEMP to assess the feasibility of adding a Battery Energy Storage System to the Main Base Campus.

High Performance Sustainable Buildings and Infrastructure



Greenbelt B37 Instrument Development Facility – 2021 Association of Builders & Contractors Excellence in Construction Award Winner

FY20/21 Sustainable Buildings Progress:

Added **4 buildings** that meet GP at WFF – **16% GSF and 17%** of Goddard buildings meet Guiding Principles

(Agency FY20 Goal: 24.8% GSF and 20.6% of the number of buildings meet GP)

(Agency FY21 Goal: 26.0% GSF and 21.2% of the number of buildings meet GP)

FY22 Sustainable Buildings Plan (TBD):

Previous Goal 27.8% (GSF) or 23.6% (bldgs.) meet GP

Implementation Status

Between FY10 - FY18, Goddard constructed 3 new sustainable facilities (B36, E110, and V27), and renovated/improved 4 existing buildings (B26, B34, B35, E109), to meet the Silver or Gold certification level for Leadership in Energy and Environmental Design (LEED). Buildings E109, E110 and V27 also

meet the Federal Guiding Principles (GP) for sustainable buildings. Sustainable building elements include use of sustainable sites, energy and water efficient equipment and fixtures, green roofs, reserved parking for alternative fuel, energy efficient and van pool vehicles, recycling areas on each floor, water efficient landscaping, bio retention basins and Filtera boxes, innovative sustainable design, indoor air quality, construction with recycled content and regionally sourced materials.

Between FY18 and FY19, Goddard completed 17 Existing Building Commissioning (EBCx) studies on Greenbelt Buildings 1, 3, 8, 10, 11, 13, 14, 21, 28, 29, 30, 31, 32, and Wallops Buildings E100, F5, F6, and J20, as the first step towards meeting the Guiding Principles, to bring the facilities back to top performance, and making them more efficient and sustainable.

In FY19, in coordination with HQ NASA, Goddard completed a Post Occupancy Evaluation (POE) on B36 at Greenbelt to further the Agency’s knowledge on the impact of LEED certified sustainability investments.

In FY19 and FY20, after completing additional requirements, the 4 LEED certified buildings at Greenbelt (B26, B34, B35, B36), were confirmed to meet the Guiding Principles, and 4 buildings at Wallops (F5, F6, E100 and J20) were commissioned and GP certified, bringing the number of the Center’s sustainable buildings that meet the Guiding Principles up to **17%** for a total of **620,534 GSF**.



Building F-5 Dormitory – GP Certified



Building F-6 WFF Headquarters – GP Certified



Building E-100 Auditorium – GP Certified



Building J-20 Visitor Center – GP Certified

Priority Strategies & Planned Actions

At Greenbelt, a state-of-the-art facility for development of instruments and new technology for space flight mass spectroscopic instruments was constructed and is in the process of being LEED certified. When certified, it will provide Goddard with an additional 54,000 square feet of sustainable LEED certified buildings that meet the Guiding Principles. At that point, **15.5% GSF (681,107 GSF)** or **18.8%** of Goddard’s buildings will meet the Guiding Principles, moving the Center closer towards meeting the Agency’s 26.8%/22.6% sustainability goal.

Additionally, the remaining 13 Greenbelt buildings with completed EBCx studies (1, 3, 8, 10, 11, 13, 14, 21, 28, 29, 30, 31, and 32), will be repaired, upgraded and commissioned, moving them towards meeting the Guiding Principles for sustainable buildings. After completing the needed repairs and upgrades for buildings 3, 14, 28, and 32, the Center is estimated to realize an annual energy cost savings of **\$395K**.

Water Conservation

FY20 Water Intensity Progress (Gal/GSF):

Achieved **48.1% (GB)** reduction, but decreased only **6.1% (WFF)** from the FY07 baseline (Federal/Agency Goal: reduce 20% from baseline)

Achieved: **0.2% (GB)** annual reduction but increased **4% (WFF)** from FY19 (Agency Goal: reduce 0.5% from FY19)

FY21 Water Intensity Progress (Gal/GSF):

Achieved **52.75% (GB)** reduction, but decreased only **1.12% (WFF)** from the FY07 baseline (Federal/Agency Goal: reduce 20% from baseline)

Achieved: **4.66% (GB)** annual reduction but increased **4.98% (WFF)** from FY20 (Agency Goal: reduce 0.5% from FY20)



FY22 Water Intensity Plan:

Previous Goal 0.5% reduction in FY22 from FY21

Implementation Status

Goddard reduces potable water consumption and costs through all available methods. Core strategies include upgrading major water infrastructure and repairing/replacing aging distribution systems, retrofitting bathroom fixtures, installing water meters, using native water efficient plants and eliminating use of landscape irrigation systems. The ongoing Greenbelt FY20 water leak study is anticipated to identify an estimated \$2K in annual cost savings⁶. Decentralizing the Wallops steam distribution system in 2012 helped to reduce the facility's water consumption by over 28% from the FY07 baseline.

Goddard is facing increasing challenges to reduce year-over-year water consumption and costs. Because Goddard does not exclude any facilities from the water intensity metric, mission activities and facility operations impact performance. For example, during each orbital launch at Wallops, over 230,000 gallons of water are used for flame suppression. At both campuses, large amounts of potable water are used to meet drinking water quality standards that require periodic flushing. Most water projects, whether storage tank maintenance, line replacement, or fire hydrant testing, require flushing. In FY17, Wallops increased water consumption by 23% due primarily to the airfield runway and pavement repair project. This year, for dust suppression, Wallops used about 15,000 gal/day, 7 days a week, for 3 months for the beach replenishment project. Beach replenishment is required about every 5 years depending on the erosion severity from annual storms. A non-potable water alternative could save the facility approximately 1,260,000 gallons used for each beach replenishment project.

Priority Strategies & Planned Actions

Goddard will continue to assess our water distribution systems, conduct leak detection audits, repair/replace components as appropriate, identify water conservation measures through energy assessments, and add water meters. For industrial water uses, Goddard will evaluate options to use non-potable water sources for activities such as fire hydrant flushing and orbital launch flame suppression at Wallops. Alternatives to potable water resources will also be addressed for construction projects.

Waste Management and Diversion



Greenbelt B26 Recycling Area and B36 Recycling Pull-Out Drawers

FY20 Non-hazardous Waste Diversion Progress⁷:

Diverted **99.1%** of Construction & Demolition (C&D) debris and **26.1%** of non-C&D waste from landfill disposal and reduced total solid waste **41%** from FY19.

(Agency Goal: Divert 50% of C&D debris and 50% of non-C&D waste from landfill disposal and reduce total solid waste by 1%)

FY21 Non-Hazardous Waste Diversion Progress⁷:

Diverted **100%** of Construction & Demolition (C&D) debris from landfill disposal. (This data may be high because only diverted C&D was reported - no C&D was reported sent to the landfill for any construction projects which is unlikely.)

Diverted **31.5%** of non-C&D waste from landfill disposal.

Reduced total solid waste from FY20 **19.9% (GB)**, but increased **66% (WFF)**.

(Agency Goal: 1% reduction in solid waste generated from FY20)

Divert 50% non-hazardous solid waste and <50% non-hazardous solid waste sent to treatment or disposal facilities)

FY22 Non-Hazardous Waste Diversion Plan (TBD):

Previous Goal 1% reduction in solid waste generated from FY21

Divert 50% non-hazardous solid waste and <50% non-hazardous solid waste sent to treatment or disposal facilities

Implementation Status

Goddard carefully manages and monitors construction projects and continues to exceed the Agency’s waste diversion goals for Construction & Demolition debris. Goddard reaches out to employees through newsletters, signage, a recycling website, and environmental events such as America Recycle and Earth

Day to provide pollution prevention awareness, but faced challenges with recycling contracts, which caused our non-C&D solid waste diversion rates to fall below 50% due to low tolerance of contaminated recycling materials. Goddard established a waste management tiger team, reviewed our recycling processes, established new contracts, and also considered alternative waste disposal options such as waste to energy (incineration) or energy recovery, to improve solid waste diversion rates.



Greenbelt B33 Water Bottle Fill Station reduces waste of single use plastic water bottles

Priority Strategies & Planned Actions

Goddard will continue to provide outreach activities to increase employee participation in our pollution prevention efforts. Greenbelt initiated a contract with a new vendor for the collection of solid waste and recycling and continues to evaluate if single stream recycling is the best process for the facility. Wallops will research better ways to track the amount of materials recycled.

Implementation Summary: Fleet Management

Transportation/Fleet Management



Greenbelt B26 Management Operations Building electric cart parking and bike sharing program bicycles

FY20 Fleet and Mobility Progress⁸:

Reduced consumption of unleaded/diesel/E85 by **29%** and Bio Diesel at GB by **54%** in FY20 compared to FY19.

(Agency Goal: Reduce fuel 10% and increase alt. fuel 0% in FY20 compared to FY19)

FY21 Fleet and Mobility Progress⁸:

Reduced consumption of unleaded/diesel/E85 by **2.87%** and Bio Diesel at GB by **92%** in FY21 compared to FY20.

(Agency Goal: Reduce fuel 10% in FY21 compared to FY20)

FY22 Fleet and Mobility Plan (TBD):

Previous Goal: 0% petroleum reduction in fleet consumption compared to FY21

Implementation Status

Goddard has reduced Scope 3 indirect and per-mile GHG emissions by **95.7%**⁹ since the 2008 baseline, representing a significant reduction in fleet vehicle petroleum use. The Center has aggressively executed its Fleet Management Plan to optimize and right size the fleet to match program needs and mission requirements. This includes replacing standard fuel vehicles with alternative fuel vehicles (AFV), low GHG emitting and zero emission vehicles (i.e., electric carts) during end-of-life cycle replacements. The Vehicle Utilization Review Board (VURB) reviews and evaluates vehicle requirements for both existing and new requests, and the Fleet Information Management System (FIMS) is used to improve data and cost information of the fleet.



The Center uses compressed natural gas (CNG)/85, a compressed natural gas alternative that produces less GHG emissions than gasoline and diesel fuels. Goddard reduces vehicle use on Center through bike sharing programs, shuttles, interconnected pedestrian friendly campuses, installed 13 Level 1 electric vehicle (EV) charging posts (Level 1 charging stations are 120-volt outlets that provide 2-5 miles of range per charging hour), at Greenbelt (B4, B24, B26, B31) and promotes video teleconferencing and carpooling between campuses. FY20/21 pandemic protocol required telework for all but on-site essential activities, and initially eliminated all business travel.

Priority Strategies & Planned Actions

Because the Center has already optimized its Fleet Management Plan, we do not expect to see significant reduction in future fleet fuel use until petroleum based vehicles are replaced by electric vehicles. Goddard will continue to evaluate options to reduce our carbon footprint and Scope 3 GHG emissions. In FY22, Goddard plans to install 8 Level 2 EV charging stations (Level 2 charging stations are 240 volt charging stations that provide 10-20 miles of range per charging hour and can collect EV charging data). Goddard anticipates acquiring a few electric vehicles (trucks and passenger sedans) this year. Along with the installation of EV charging stations for government vehicles, Goddard will work with HQ to draft an EV charging policy to allow employees and possibly visitors to charge their personal electric vehicles on a reimbursable basis, to promote the use of more electric vehicles on Center, further supporting Goddard's sustainability goals. Return to work protocols will continue to allow telework and minimize business travel to essential travel.

Implementation Summary: Cross-Cutting Operations

Sustainable Acquisition/Procurement

FY20 Sustainable Acquisition Progress:

82.2%¹⁰ of items purchased with recycled or bio-based content

36% of contract actions and **51%** of obligations have environmental requirements¹¹.

(Agency goal: 17% of contract actions or 19% obligations have statutory environmental requirements)

FY21 Sustainable Acquisition Progress:

94.4%¹⁰ of items purchased with recycled or bio-based content

36% of contract actions and **48%** of obligations have environmental requirements¹¹.

(Agency goal: 21% of contract actions or 21% obligations have statutory environmental requirements)



FY22 Plan (TBD):

Previous Goal: 22% of contract actions or 22% obligations have statutory environmental requirements

Implementation Status

Goddard relies on the HQ NASA Principal Center for Recycling and Sustainable Acquisition (RSA) for technical resources and program support, including training sessions for contracting, environmental and sustainability personnel, and periodic reviews to evaluate sustainable acquisition contracts. Goddard requires the use of sustainable or energy efficient products such as Energy Star appliances, Water Sense certified fixtures, Electronic Product Environmental Assessment Tool (EPEAT) Gold-registered computer equipment, LED lighting, regional materials, certified woods, less toxic, bio based and recycled content products, low emission adhesives, paints, and flooring in all procurement actions, new construction projects, major renovations, facility repair and maintenance operations and custodial services whenever economically feasible.

Priority Strategies & Planned Actions

Goddard will continue to identify and explore new opportunities to increase the use of sustainable products. Wallops will re-establish use of disposable utensils and plates made from bio based and/or recycled content materials to decrease use of Styrofoam and plastics in the cafeteria. Wallops also plans to review contracts to better identify use of environmental requirements.

Other Sustainability Highlights

Notable Projects and Initiatives

In addition to the priorities described above that address NASA’s sustainability goals, Goddard has also initiated the following projects, programs, and initiatives:

Envision – Wallops Island Causeway Bridge Replacement Project

Over the last two years, WFF has evaluated the Envision infrastructure rating program developed by the Institute for Sustainable Infrastructure (ISI) in association with the American Society of Civil Engineers (ASCE). The Envision rating program evaluates the sustainability of infrastructure projects similar to the LEED rating system for buildings, and addresses sustainability issues such as environmental, natural resources, climate resilience, community, quality of life, and long-term operation and maintenance impacts.

Wallops first tested the system by conducting in-house self-assessments on the completed Airfield Solar project, and the in-progress Airfield Apron Repair project with favorable results. With HQ concurrence,

Wallops has now registered the Causeway Bridge Replacement project as NASA’s first Envision project to be rated by the ISI’s sustainable infrastructure system. With approximately 68% of NASA’s construction budget used for infrastructure, NASA recognizes the importance of improving the sustainability of infrastructure projects and has added the Envision rating system in both the 2021 NASA Sustainability Plan and the draft NPR 8820.2H update.

Wallops’ current Envision self-assessment at 30% project design indicates a rating of 11%. Wallops anticipates a guaranteed rating of 21% by the 90% design with the possibility of obtaining a maximum rating of 46% by the end of construction. A 30% rating is needed to obtain a Silver level certification. See table below:

VERIFICATION AWARD LEVELS

To receive recognition, projects must achieve a minimum percentage of the total applicable Envision points. Projects can be recognized at four award levels:

- **Verified:** 20%
- **Silver:** 30%
- **Gold:** 40%
- **Platinum:** 50%



Wallops Island Causeway Bridge Replacement Envision Project

Greenbelt Stormwater Management

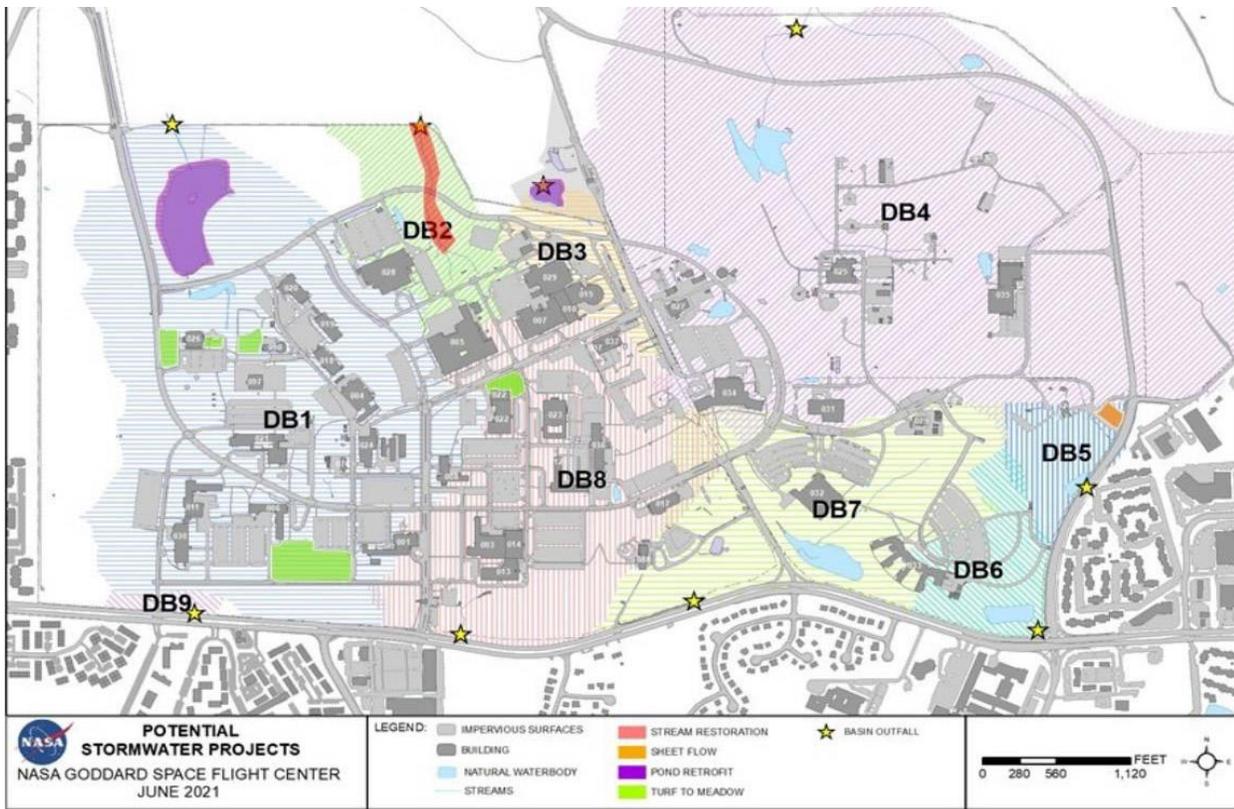
The Maryland Department of the Environment (MDE) issued a revised National Pollutant Discharge Elimination System (NPDES) Phase II Municipal Storm Sewer System (MS4) permit to Greenbelt on October 9, 2018. The new permit requires 20% of the impervious area at Greenbelt receiving minimal or no stormwater management treatment to be removed or treated through best management practices by 2025. The permit applies to the total area of untreated impervious surface area that existed prior to the baseline year of 2006.

Greenbelt completed a study in 2014 (revised in 2019) to determine the baseline impervious surface and restoration opportunities to achieve the 20% goal. Approximately 31 acres of impervious surface will need to be restored by 2025. In 2019, MDE approved Greenbelt's Impervious Area Restoration Work Plan. The Plan outlines projects and methods Greenbelt intends to pursue to meet the permit goal, such as redevelopment projects incorporating low impact development designs (e.g., bioretention basins) and building deconstruction. Other projects, such as stream restoration, are contingent upon funding.

Goddard added the stormwater restoration priorities to the Goddard Master Plan that was finalized this year. After 2025, Greenbelt will continue to manage stormwater impacts from future development through low impact development and environmental site design.

Potential stormwater projects at Greenbelt to meet the NPDES MS4 permit 20 percent restoration requirements required by 2025 include:

- Cobe Road headwall repair, slope stabilization, and stream restoration
- Restore approximately 500 linear feet of stream from Cobe Road to the perimeter of Greenbelt property (red zone in the adjacent map)
- Maintain and restore stormwater management structures (e.g., ponds) to meet approved design and as-built criteria. (purple zones in adjacent map)
- Evaluate existing ponds for retrofits to achieve additional water quality (purple zones in adjacent map).
- Meadow plantings to replace turf grass
- Underground Sand Filters
- Sheet flow to Buffer Area (disconnect from storm sewer system to drain to natural areas)
- Tree Stormwater Filter Boxes



The map shows the drainage basins (DB) and proposed restoration projects identified in the Stormwater Restoration Plan for the Greenbelt campus to meet the MS4 permit requirements and Goddard sustainability goals.

Wallops Stormwater Management and Erosion Protection

WFF developed a list of desired projects for the Goddard Master Plan, with initial emphasis on stormwater infrastructure studies and subsequent structural improvements to address immediate and long term needs to minimize adverse impacts, including those from flooding and shoreline erosion. The stormwater studies will help identify structural and procedural changes to improve stormwater quality and reduce runoff from existing facilities, parking lots, airfield runways and industrial areas. The studies will also identify resource protection strategies and features to protect waterways. The LEED and Envision certification programs will also ensure that future individual projects address stormwater impacts on a project-by-project basis, by including features such as Low Impact Design, Filtera Boxes, retention basins and vegetative buffers. Wallops is also evaluating the use of meadow areas as a future BMP because they reduce mowing, increase infiltration, reduce evapotranspiration, reduce water movement and benefit pollinators, which is another federal goal.

Project List (WFF Main Base Projects)

- Minor renovation and updating of stormwater system (recurring, every 5 years)



- Conduct long term maintenance inspections of stormwater BMPs Renovate drop inlets, filtration/collection devices, outfalls and water quality sampling access points
- Perform maintenance on stormwater BMPs
- Install oil/water separator on outfall 03 for airfield

Project List (WFF Island Projects)

Stormwater Study

- Conduct full stormwater system inspection and survey and mapping
- Calculate stormwater treatment capacities of existing structures
- Evaluate recent development for system tie in to reduce maintenance requirements
- Develop long-term stormwater plan for system expansion for tie in and future land development
- Develop and prioritize stormwater maintenance and repair list

Wetlands Planning and Development

- Update current wetlands mapping and planning and integrate with stormwater planning
- Evaluate and develop strategies for the control of invasive wetland species, specifically Phragmites spp.
- Evaluate additional land use options for managed wetlands, such as wetland banks and photovoltaic system development
- Stormwater system renovation

Stormwater System Renovation

- Develop system design and renovation plans, including wetland development
- Repair and clean stormwater systems to restore function, including renovate drop inlets, filtration/collection devices, outfalls and water quality sampling access points
- Expand existing system to allow for new development and reduce flooding in problematic areas
- Implement wetland construction and modification plans
- Stormwater system renovation

Sanitary Sewer Leak Study

- Inspect and evaluate sanitary sewer manhole lids, including smoke and dye tests and CCTV inspections
- Develop repair design of SS

Sanitary Sewer Renovation to Reduce Stormwater Inflow into Sanitary Sewer

- Based on leak study, repair, re-frame and elevate manhole lids and line manholes, pipes and pump stations
- Install, where appropriate, stormwater conveyance to divert stormwater away from sanitary

Road Repairs to Reduce Road Flooding

- Install stormwater conveyance structures to facilitate East to West movement of stormwater
- Raise road where appropriate to eliminate road flooding

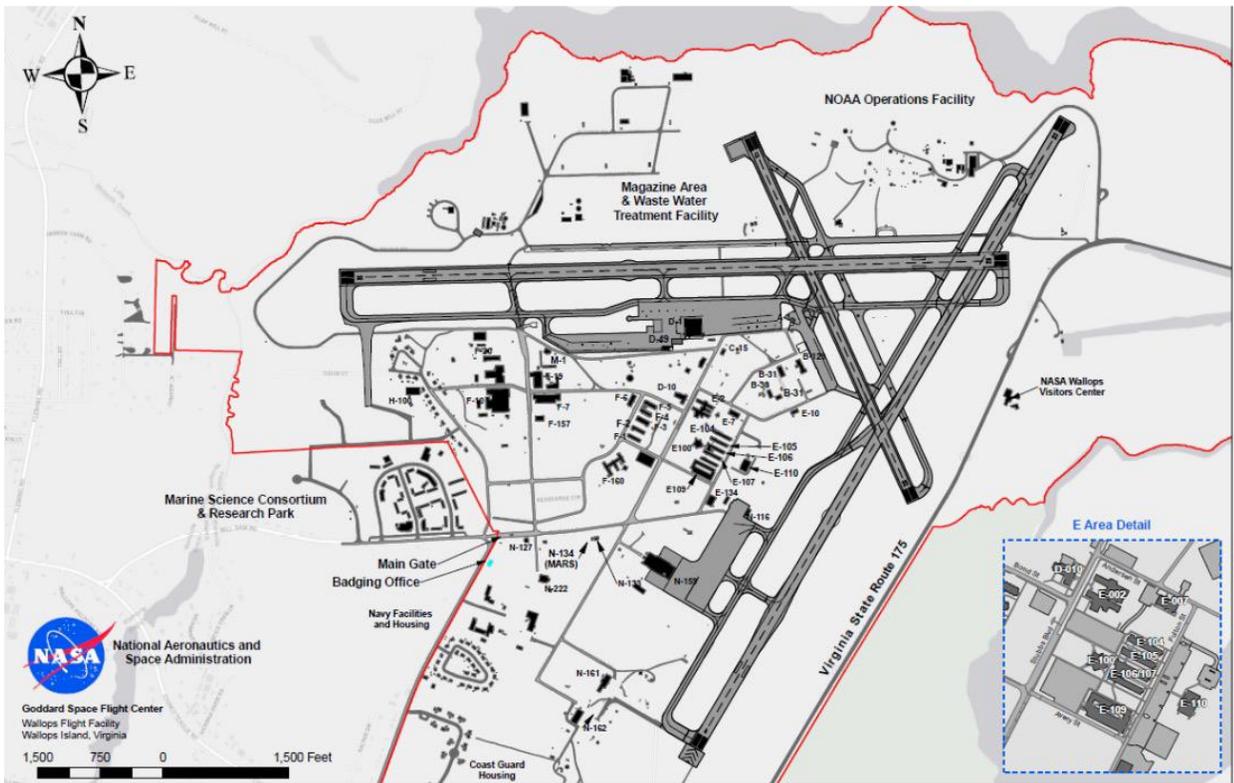
Shoreline Erosion Protection

- Evaluate alternative methods for breakwater development
- Establish breakwaters

Minor renovation and updating of stormwater system (recurring, every 5 years)

- Conduct long term maintenance inspections of stormwater BMPs
- Renovate drop inlets, filtration/collection devices, outfalls and water quality sampling access points
- Perform maintenance on stormwater BMPs

The current baseline non-permeable surfaces and the future 2037 non-permeable surfaces showing the planned new construction and demolition are shown on the maps below for comparison. Non-permeable surfaces include buildings, roads, sidewalks, paved parking areas, and launch pads.



Main Base Current Non-Permeable Features - 352.42 acres



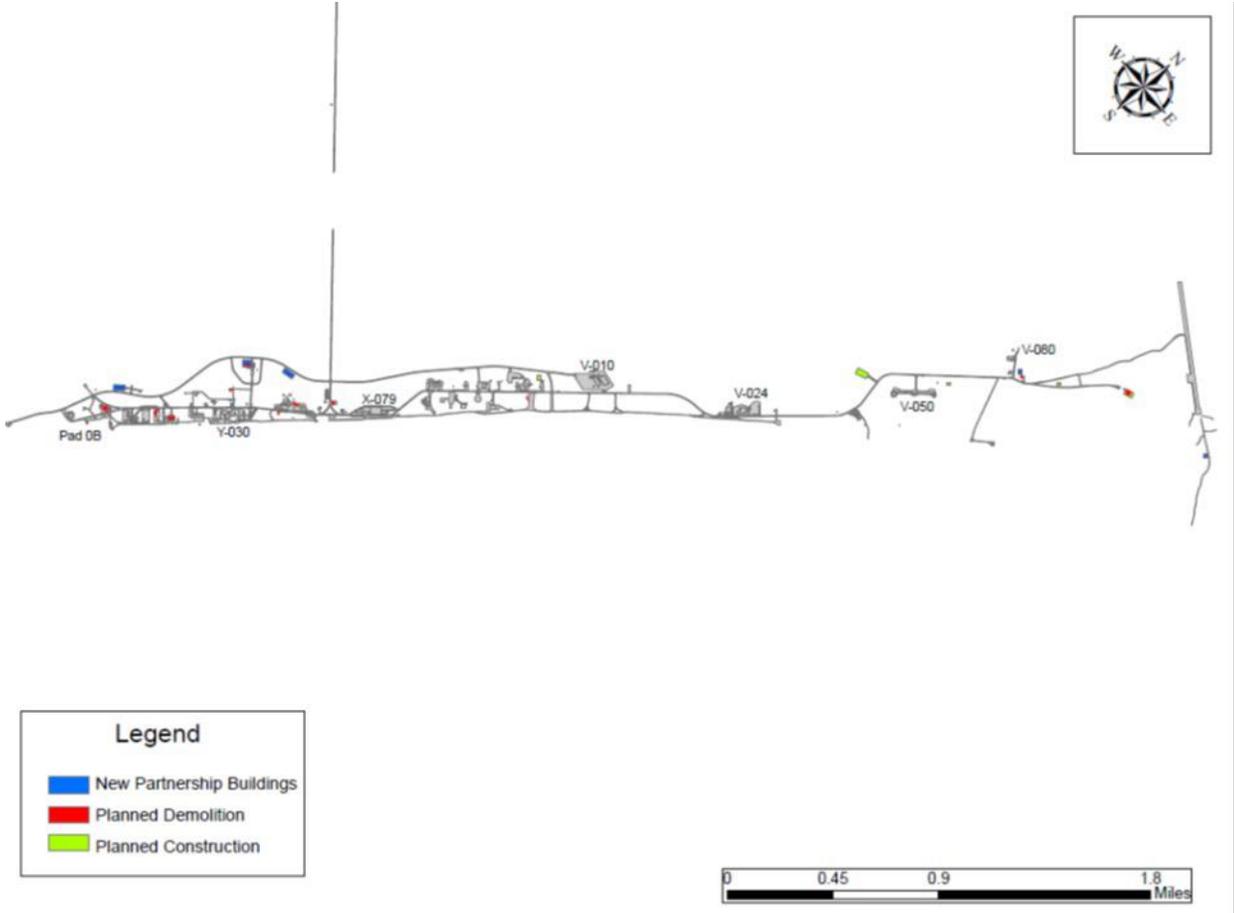
**Main Base 2037 Projected Non-Permeable Features – 357.49 acres
(9.01 construction – 3.94 demo)**



Mainland (10.88) and Island (81.26) Current Non-Permeable Features – 92.14 acres



**Mainland 2037 Projected Non-permeable Features – 11.63 acres
(0.75 construction)**



**Island 2037 Projected Non-permeable Features – 84.88 acres
(4.43 acres construction – 0.81 acres demo)**

EV Charging Station Research Project

Goddard conducted an employee survey and researched the type and number of electric vehicles that employees would use to commute to work to determine the potential environmental benefits (reduced fuel use and per-mile GHG emissions) of electric vehicle charging stations made available for government, employee and visitor use on a reimbursable basis. Results indicated a moderate reduction in GHG emissions. The data will inform a new Goddard EV Charging Policy, and once we receive Agency approval, will promote the use of more electric vehicles on campus, to further support the Center’s sustainability goals.



Notes

1. FY17-FY21 Real Property Demolition Report pulled from the Real Property Management System in Dec 2021 by Denise Harrington. Estimated O&M savings derived from the most recent O&M data reported in the Annual HQ Real Property Data call (in some cases \$0 if the building was abandoned) and does not include the new cost of O&M for any buildings that we replaced.
2. FY20/21 NETS reports estimated performance contracting savings for Goddard is \$3.1M/\$3.48M (Greenbelt + Wallops)
3. NETS 2010 and 2012 ESPC data
4. \$937,156 rebate amount reported by Goddard Energy Manager Evelyn Baskin
5. 83% of peak load as reported by Wallops energy manager Ed Baca - Found max power provided by PV each month and found the power demand on the grid at the same time and calculated the percentage of PV power over the total demand of the base (PV Power + Grid Demand). Next calculated the average of the monthly percentage. Data is for FY21
6. \$2K estimated water savings from 2020 leak study reported in NETS
7. Data derived from NASA Environmental Tracking System (NETS) reports using weighted facility area average for Greenbelt (82%) and Wallops (18%) to determine the combined Goddard rates
8. Rob DiPalo, Carlos Smith and Gene Merrit from Code 270 provided vehicle fuel consumption data.
9. 2020 Scope 3 GHG reduction from baseline provided by HQ (Erick Tucker/Leidos) Goddard = GB [(-94.8%)(82%)] + WFF [(-99.6%)(.18%)] = -95.7%
10. Data derived from NASA Environmental Tracking System (NETS) reports using weighted facility area average for Greenbelt (82%) and Wallops (18%) to determine the combined Goddard rates
11. FY20 and FY21 FPDS report – Therese Patterson