EVERGLADES NATIONAL PARK
UNITED STATES OF AMERICA (N76)

STATE PARTY REPORT

ON THE STATE OF CONSERVATION OF

EVERGLADES NATIONAL PARK

January 2019

1. Executive Summary

In 1993, Everglades National Park was added to the list of World Heritage Sites in Danger, based on four key threats to its Outstanding Universal Value (OUV): alterations of the hydrologic regime, adjacent urban and agricultural growth, increased nutrient pollution, and impacts to the protection and management of Florida Bay. In 2018, record numbers of wading bird nests "supercolonies" formed in the southern mangroves of the Park for the first time in eight decades. The same year, water quality entering the upstream Everglades reached its highest performance level, through a combination of agricultural source controls and expanded stormwater treatment. During the last three years, Northeast Shark River Slough (SRS) and Taylor Slough experienced some of their highest water deliveries on record. These three changes represent major milestones, and combined indicate that Everglades water flow and water quality improvements are progressing, and that the ecosystem is positively responding.

In 2006, a series of corrective measures were developed to assess progress toward restoration of the site's OUV. Six years later, a suite of hydrological and ecological indicators of integrity were added. The focus of these site-specific conservation efforts include: re-establishing adequate flows of clean water into the Northeast SRS basin, reducing groundwater seepage losses into the adjacent eastern developed areas, and redirecting these flows through SRS and Taylor Slough to provide needed freshwater flows to Florida Bay. Full implementation of three key foundation projects formed the original basis of the 2006 corrective measures: the Modified Water Deliveries (MWD) and Canal-111 South Dade (C-111) projects directly adjacent to the site, and water quality improvements under the State of Florida's Everglades Construction Project (ECP) in the upstream watershed. By 2018, construction on all of these projects was complete, and we have been progressively receiving water flow and water quality benefits. These combined projects will help to restore more natural marsh water depths and flooding durations, stabilize estuarine salinities, and advance the recovery of healthy native plant and animal populations.

The Florida Bay ecosystem had been slowly recovering following the seagrass die-off and algal blooms of 2015–2016. In September 2017, Florida Bay was impacted by Hurricane Irma. The storm produced significant wind and storm surge damage to large swaths of mangrove forests and seagrass communities. Since 2018, we have been observing substantial recovery, indicating that these ecosystems are rather resilient to natural disturbances. Unusually wet conditions during the 2017 and 2018 reporting period provided an unplanned "test" of the new Modified Water Deliveries and C-111 project infrastructure. While Northeast SRS and Taylor Slough wetlands experienced record high water levels, and Florida Bay salinities were reduced, concerns over Tamiami Trail roadway instability and eastern flood protection required Northeast SRS inflows to be periodically terminated. This illustrates that addition infrastructure improvements are needed.

In 2016, the Tamiami Trail Next Steps (TTNS) project began construction on additional bridges and roadway raising, further removing this sheetflow impediment, and the State's Restoration Strategies project expanded upstream water quality treatment. In 2016 and 2018, the Central Everglades Planning Project (CEPP) and the Everglades Agricultural Area (EAA) Reservoir were authorized by Congress. Completion of these four next generation projects over the coming years is critical for our continuing progress in achieving the site's Desired State of Conservation.

World Heritage Committee Decision 42 COM 7A.42
Forty-Second Session (Manama, Bahrain, 2018)

Everglades National Park (United States of America) (N76)

Decision: 42 COM 7A.42

The World Heritage Committee,

1. Having examined Document WHC/18/42.COM/7A,

2. Recalling Decision **41 COM 7A.1**, adopted at its 41st session (Krakow, 2017),

3. Recalls its request to the State Party to submit to the World Heritage Centre, by **1 February 2019**, an updated report on the state of conservation of the property and the implementation of the adopted corrective measures, for examination by the World Heritage Committee at its 43rd session in 2019;

4. **Decides to retain Everglades National Park (United States of America) on the List of World Heritage in Danger.**

2. Response to the Decisions of the World Heritage Committee

Everglades National Park (ENP) was established in 1947 with a mission unique within the National Park Service (NPS). In contrast to earlier parks in the western United States featuring dramatic landscapes, this park was set aside to protect the abundant and diverse biological resources of its vast subtropical wetlands and coastal/marine ecosystems. Achieving this mission has proven challenging in light of the extensive human modifications to south Florida, resulting primarily from alterations in hydrology and land use. The Park is located at the southernmost end of the highly modified greater Everglades ecosystem that originates in the Kissimmee River headwaters near Orlando, Florida. The flow of water in this once continuous watershed was altered by the construction of canals and levees beginning in the 1880's. The initial private and State of Florida drainage efforts were expanded by the Army Corps of Engineers, creating the Central and Southern Florida (C&SF) Flood Control Project, which was authorized by the U.S. Congress in 1948. The primary result has been unnaturally large discharges from Lake Okeechobee to the Caloosahatchee and St. Lucie estuaries, and limited flows southward into the Everglades and southern estuaries. The C&SF Project created a series of five Water Conservation Areas (WCAs) upstream of the Park, which act as shallow reservoirs to retain wet season rainfall and provide dry season water deliveries. These WCAs have further altered the volume, distribution, and timing of water deliveries to the Park.

These long-term changes in the upstream watershed have had tremendous implications within ENP: Northeast Shark River Slough (NESRS) and Taylor Slough are persistently too dry; Western Shark River Slough (WSRS) is frequently too wet; and the West Coast estuaries and Florida Bay are generally starved for freshwater and suffer from high salinity levels. This has promoted mangrove encroachment into the adjacent freshwater wetlands. The altered wetland and estuarine functions have profoundly affected both the habitats and the fish and wildlife that depend on them. In recognition of these threats, and at the request of the U.S. Government, ENP was inscribed on the list of World Heritage Sites in Danger in 1993. Four major threats have negatively affected the Park for many decades, and were highlighted at the time of the World Heritage listing.

Threat 1. Alterations of the hydrologic regime have resulted in changes in the volume, distribution, and timing of water flows to the Park.

> **Response:** Construction is now complete on the Modified Water Deliveries (MWD) and Canal-111 South Dade (C-111) foundation projects, and we are currently receiving increased water volumes and flow distribution benefits within Northeast SRS and Taylor Slough. Upcoming next generation restoration projects such as the Western Everglades Restoration Project (WERP), Central Everglades (CEPP), and the Everglades Agricultural Area Reservoir (EAAR) all show promise for improving water flow into the Park. While these projects may take up to a decade or more to be fully realized, they indicate that the State and Federal governments are committed to additional projects, which focus on reducing the adverse impacts of upstream water management on the Park.

Threat 2. Adjacent urban and agricultural growth has resulted in flood protection improvements, which can drain the park's eastern wetlands. These areas are also locations where invasive exotic species enter the Park from man-made environments.

Response: In 2012, a 5-mile long partially penetrating seepage barrier was constructed along the Park's northeastern boundary by a local rock-mining company. This was built to mitigate for increased seepage linked to their adjacent activities. By the end of 2018, a combination of seepage collection canals and water detention areas were completed along a 20-mile stretch from the 8.5 Square Mile Area down to the Frog Pond. This water management system was designed to create a hydraulic ridge between the higher water levels in the Everglades and the lower water levels in the eastern developed areas. While this system relies on pumping excess water when it's available, if can offset some of the impacts of flood protection operations along the eastern urban/agricultural areas, thereby retaining more surface water in the wetlands of the Park.

Threat 3. Increased nutrient pollution has resulted from the transport of agricultural and urban runoff into the Park, causing alterations in native flora and fauna.

Response: The State of Florida's Everglades Construction Project (ECP) was fully operational in 2012, and has substantially improved water quality throughout much of the Everglades marsh. Upcoming projects such as the Western Everglades Restoration Project, Central Everglades, and the Everglades Agricultural Area Reservoir all include additional planned water quality treatment features, and show promise for further improving water quality in the Park.

Threat 4. Impacts to the protection and management of Florida Bay have resulted from reduced or re-directed freshwater inflows, and increased nutrient loadings.

Response: Implementation of the MWD and C-111 projects has resulted in more water being retained in Northeast SRS and Taylor Slough, and directs this water into Florida Bay. By 2018, two new pump stations were added adjacent to the Taylor Slough headwaters, strategically located to reduce Park seepage losses and increase water flow into Florida Bay. As more of the upstream restoration projects come online, larger volumes of clean water can be delivered through the Park wetlands and into Florida Bay.

In spite of the long history of alterations to the Everglades watershed, the natural resources protected by Everglades National Park provide key ecosystem services to the regional human population. These services include water storage and treatment, recharge of the surficial aquifer, buffering against the impacts of tropical storms and hurricanes, as well as economic benefits associated with tourism, including recreational and commercial fishing. In 2011, ENP-related tourism generated 146.8 M USD in economic benefit locally, and provided 2,408 jobs. Benefits to the wider, world community include: 1) the protection and preservation of a unique mix of temperate and subtropical habitats and species, 2) the maintenance of a refuge for rare, threatened, and endangered species, and 3) climate modification benefits from carbon sequestration within the freshwater wetlands, mangrove forests, and seagrasses along the Gulf Coast and within Florida Bay.

This report, prepared in 2019 for examination by the World Heritage Committee at its 43rd session, is the fourth biennial report to be submitted by the NPS, and includes the full agreed upon physical and ecological indicators of integrity. This report follows the recommended format of the World Heritage Committee and responds to the recent decisions of the Committee. It provides updated

information on progress toward implementing the corrective measures and describes recently detected changes in the status of the indicators of integrity. The information presented is intended to assist in decision-making for the state of conservation of this site, which is on the List of World Heritage Sites in Danger. The report will also gauge the overall response of Park ecosystems to factors such as changes in water management, climatic change, invasive exotic species, and implementation of Everglades Restoration projects.

The current reporting period (2017–2018), shows continuing progress in the initial foundation projects, but also included unusual weather conditions associated with three consecutive years of above average hurricane intensity. High rainfall in September 2017, associated with Hurricane Irma, led to period of record water levels within the park and adjacent areas. In 2018, similar high rainfall events in May 2018 (Tropical Storm Alberto) and September 2018 (Tropical Storm Gordon) made 2018 one of the wettest years on record throughout south Florida. In spite of this, a 2017 dry season drought exacerbated the long-term water deficit stresses on Florida Bay leading to hypersaline conditions that had negative ecological consequences.

Construction of the MWD and C-111 foundation projects was complete in 2018. This provided the capacity for additional water flows into the Northeast SRS and Taylor Slough regions of the Park. These two locations have not seen these types of high water conditions in decades. Though unplanned and uncontrolled, these unusual wet and dry weather events give us insight into how the ecosystem may respond to future flow restoration conditions and increased water storage. There are some notable outcomes that confirm that Everglades restoration efforts are on track:

- There have been no large-scale, damaging fires within Everglades National Park in over a decade,
- In spite of seagrass die-offs and hurricanes, Florida Bay continues to support healthy sportfish populations and a world-class recreational fishery,
- Hurricane Irma's record rainfall did not cause extreme or prolonged flooding in adjacent agricultural and urban areas, nor did it result in nutrient enriched or contaminated water entering into the Park,
- With 3.3-miles of Tamiami Trail bridging, and the MWD and C-111 project infrastructure now complete, we at the cusp of realizing significant improvements in water deliveries to Northeast SRS and Taylor Slough.

2a. Progress in Implementing the 2006 Corrective Measures

Substantial progress has been made since the 2017 SOC report, in implementing the majority of the corrective measures developed in 2006. In 1994, three water management foundation projects were proposed to address the threats to Everglades National Park, identified at the time the site was added to the list of World Heritage Sites in Danger. Today, all three of these initial water flow and water quality restoration projects have been constructed, and their full operational benefits should be in place by approximately June 2020. Early results from the post construction period indicates that flows into Northeast SRS and Taylor Slough are trending upward, while constraints associated with Tamiami Trail and eastern flood protection still need to be resolved. Water quality has improved substantially throughout much of the Everglades marsh, but we still need to resolved SRS water quality exceedances, particularly as we transition quickly, following

marsh dry downs. These findings support the judgement that completion of these initial foundation projects was not sufficient to deliver the required volumes of clean water needed to achieve our Desired State of Conservation. Fortunately, a series of four next generation restoration projects have been authorized, and are moving forward, to address these performance deficits. The status of each of the 2006 corrective measures is described below, relative to the originally identified threats.

Threat 1 - Alterations of the Natural Hydrologic Regime

Corrective Measure (CM) 1 focuses on re-establishing water flows into the Northeast Shark River Slough (SRS) watershed of Everglades National Park. This action requires bringing all of the privately owned lands in the East Everglades Expansion Area into public ownership (CM 1A), and providing flood protection to any remaining developed areas (CMs 1A/B). Reestablishing more natural water flows into Northeast SRS also requires the removal of barriers to natural sheetflow (both within the upstream Water Conservation Areas and along Tamiami Trail) to reestablish more natural marsh connectivity (CM 1C). All of these actions will support our efforts to increase water flows back into the historic sloughs and marl prairies, and to restore more natural water depths and flooding durations within the eastern watersheds of the park.

Corrective Measure 1A addresses the U.S. Congressional requirement to complete acquisition of approximately 44,000 hectares (109,000 acres) of privately owned land in the East Everglades, and flood protecting the remaining developed sites, as a prerequisite to restoring water flows into Northeast SRS.

Status – East Everglades Land Acquisition - Completed: As of July 2016, all 44,000 hectares of the East Everglades were acquired and placed into public ownership. A required land exchange with the Florida Power and Light Company (relocating a planned utility corridor) was completed, including transfer of title. The three commercial airboat operations and two radio tower sites along Tamiami Trail were also brought into federal ownership.

Status – Flood Protection for Commercial Sites - Underway: Protecting the remaining five developed sites along Tamiami Trail from flooding is required before we can significantly increase water flows into Northeast SRS. Flood protection plans for these sites are currently being implemented (through a combination of government and private actions). These flood protection cures will enable continued business services at the commercial airboat and radio tower sites, as restoration moves forward. The flood protection features will be in place to allow the Modified Water Deliveries and C-111 projects to be fully operational by June 2020.

Corrective Measure 1B recognized the need to complete flood mitigation features in the 8.5 Square Mile Area and to develop a new water control plan, prior to implementing the MWD project full flow benefits.

Status – Flood Mitigation in the 8.5 Square Mile Area - Completed: Construction of the originally planned flood mitigation features that protect the 8.5 Square Mile Area were initially completed in 2012, and an additional seepage collection canal and water control structure were completed in 2018. The features in the 8.5 Square Mile Area not only provide flood mitigation to the agricultural and residential lands, but also are part of the seepage management system

along the eastern border of the park. This project is also linked to Corrective Measure 4A, since the C-111 North Detention Area receives stormwater runoff from the 8.5 SMA flood mitigation system (via the S-357 pump station). Monitoring of these features to determine their year-round benefits is underway. Full operation of this system is linked to the completion of the Combined Operational Plan, expected in June 2020.

Status – Development of MWD Water Control Plan - Underway: Corrective Measure 1B also recognized the need to develop a new water control plan that will improve rainfall-based water deliveries and promote increased sheetflow to ENP, while maintaining flood control and water supply requirements. This water control plan has been addressed through a combination of incremental field testing of the evolving water management infrastructure, and the development of a final Combined Operational Plan (COP) that will control the operations of the combined Modified Water Deliveries and C-111 project infrastructure. During the current reporting period (2017–2018), we completed the first incremental field test (increments 1.1-1.2), and in September 2018 we initiated increment 2 operations. Under this 2nd increment, we further relaxed the operational constraints and raised the L-29 canal stage by up to one foot, allowing us to increase water flows into Northeast Shark River Slough. The final COP will build on the lessons learned during the incremental field tests. The next report will document the level of restoration that can be achieved, following completion of the full suite of MWD and C-111 project components.

Corrective Measure 1C recognizes the benefits of removing barriers to enhance sheetflow and marsh connectivity between ENP and the upstream Everglades. These barriers included the canals and levees within Water Conservation Area 3 (WCA 3) upstream of the park, as well as the barrier created by the eastern Tamiami Trail roadway. When the corrective measures were developed in 2006, both the MWD project and the regional-scale Comprehensive Everglades Restoration Plan (CERP) contemplated improving water conveyance, sheetflow, and marsh connectivity between WCA3A, WCA3B, and Northeast SRS. The MWD project would accomplish this by constructing water conveyance structures in the levees between WCA-3A/3B and Northeast SRS, and adding structures/plugs in the L-67A canal to promote sheetflow. CERP contemplated going further, by degrading large portions of these levees and backfilling segments of their associated canals.

Status – MWD/TTNS/CERP Project Sheetflow and Marsh Connectivity - Limited Progress: The MWD project was formally closed out without constructing the planned water conveyance and sheetflow improvements in the upstream WCAs, due to cost concerns and Tamiami Trail design limitations. Several of these features have been carried over into the CEPP design. In addition, a pilot project (referred to as the Decompartmentalization Physical Model) constructed a new water control structure to move water across the levee between WCA-3A and WCA-3B, while testing options for degrading a downstream levee, and backfilling its associated canal.

The Tamiami Trail Next Steps (TTNS) project began construction in 2016 and was substantially completed in Feb. 2019. The Phase 1 included construction of 2.3-miles of additional bridging to further promote sheetflow. Planning for the TTNS phase 2 project began in 2018, and will include raising/reconstructing the remaining 6.5-miles of un-bridged roadway. The NPS applied for a Federal Highway Administration grant in Dec. 2018 to cover

this work, along with matching State of Florida funding. If approved, phase 2 planning would be completed in 2019-2020 and construction would be complete in late 2022. This action would remove the roadway as a flow constraint, meeting the full CERP conveyance requirements.

The planned southern CEPP components include three additional water conveyance structures in the levee between WCA-3A and WCA-3B, and expansion of the DPM levee removal and backfilling within WCA-3B. While the CEPP Project was authorized by Congress in 2016, detailed planning and construction has been delayed due to limited Federal appropriations. These CEPP southern components are expected to be completed by 2030. While some of the MWD and CERP proposed features, such as plugs and/or backfilling in an internal canal within WCA-3A (the L-67 canal) are not included, these features may be reevaluated in a future phase of the CERP Decompartmentalization and Sheetflow Enhancement project. The loss of this canal plugging reduces sheetflow enhancement benefits, and may have water quality implications for the park.

Threat 2 – Adjacent Urban and Agricultural Growth

Past actions to improve flood protection in adjacent urban and agricultural areas have reduced water levels within ENP wetlands and freshwater flows to Florida Bay, due to increased eastward groundwater seepage. This problem could be compounded as Everglades restoration progressively increases water flows into the park. Corrective measure 2 addresses these ENP groundwater losses, through the development of seepage management systems. First federal lands within ENP needed to be exchanged with lands owned by the State of Florida (CM 2A), to support construction of the C-111 project water detention areas and pump stations (CM 2C). Completion of the MWD and C-111 Combined Operational Plan (COP) will formalize the water management operations, and will optimize the return of groundwater seepage back to the park (CM 2B). Reducing seepage losses also helps to reestablish flows into the historic sloughs, thereby restoring water depths and flooding durations within the park.

Corrective Measure 2A recognizes that completion of a land exchange between the South Florida Water Management District (SFWMD) and NPS is required to construct the C-111 South Detention Areas (SDA).

Status – C-111 Land Exchange – Completed: The land exchange between the NPS and the SFWMD was approved by Congress, and no additional real estate within ENP was required for completion of the C-111 SDAs.

Corrective Measure 2**B** recognized the need to develop a new water control plan that will improve rainfall-based water deliveries and promote increased sheetflow to ENP, while maintaining flood control and water supply requirements (see also CM 1B).

Status – Development of C-111 Water Control Plan - Underway: This water control plan has been addressed through a combination of incremental field testing of the evolving water management infrastructure, and the development of the COP that will control the operations of the combined Modified Water Deliveries and C-111 project infrastructure. The COP is expected to be complete in June 2020, and will build on the lessons learned during the

incremental field tests. The next SOC report will document the level of restoration that can be achieved, following completion of the full suite of MWD and C111 project components.

Corrective Measure 2C requires completion of construction of the C-111 detention-area features from the 8.5 Square Mile Area south to the area known as the Frog Pond. These features include northern and southern components. The detention areas reduce seepage losses along the portions of the eastern ENP boundary.

Status – Construction of the C-111 Detention Areas – Completed: The S-332B/C/D pump stations land the C-111 South Detention Area (SDA) was operational by 2009. Construction of the C-111 Northern Detention Area was not completed until early 2017. The northern detention area now receives runoff from the 8.5 SMA via the S-357 pump station. These detention areas have been shown to maintain higher water levels in upper Taylor Slough, but they are not very efficient (with 70-80% of the pumped water quickly returning back to the eastern canals via groundwater seepage). In response, the Army Corps recently completed a new internal levee system to hold the pumped water along the western edge of the detention areas.

Threat 3 - Increased Nutrient Pollution from Upstream Agricultural Areas

Water entering the park must be low in nutrients, with concentrations of phosphorus in surface water <10 parts per billion (ppb), as established by State of Florida and Federal water quality standards. Total phosphorus (TP) concentrations above this level led to imbalances in native flora and fauna. Corrective Measure 3 focuses on improving water quality upstream of the Water Conservation Areas and ENP, by implementing agricultural best management practices (BMPs), and constructing man-made stormwater treatment areas (CM 3A). Reducing ENP inflow nutrient concentrations and redistributing phosphorus loadings by enhancing sheetflow, will contribute to healthier freshwater Everglades wetlands, as well as a healthier estuary in Florida Bay.

Corrective Measure 3A focuses on implementing upstream water quality source controls such as BMPs, and construction of engineered wetlands or stormwater treatment areas (STAs) to achieve the long-term TP limits for water flowing into Shark River Slough and the Taylor Slough/Coastal Basins.

Status – Implementation of Agricultural BMPs and STAs – Completed: The State of Florida passed the Everglades Forever Act in 1994, mandating the implementation of Everglades Agricultural Area BMPs and requiring the construction of 45,000 acres of STAs, as part of the Everglades Construction Project (ECP). The ECP was completed by 2006, and the DOI and the State worked together to expand the STAs by an additional 12,000 acres in 2012. In addition, the agricultural BMPs were designed to achieve a 25% reduction to total phosphorus (TP) loads entering the Everglades, but they have performed better than expected, achieving a 57% TP load reduction.

Status – Implementation of Longer-Term Water Quality Projects – Significant Progress: In 2010 the U.S. Environmental Protection Agency (EPA) determined that additional actions were needed to achieve the States' Everglades water quality standards, beyond the Everglades Construction Project. The EPA's amended determination required establishment of a new water quality based effluent limit (WQBEL) for STA outflows. The State developed the Restoration

Strategies project, which further expanded the STAs within the EAA, and included construction of new flow equalization basins (FEBs) to regulate the rate of water inflows to the STAs. The full Restoration Strategies project is scheduled to be complete in 2025, and is expected to achieve the WQBEL requirements by approximately 2029. Fortunately, the first new Flow Equalization Basin (referred to as A-1) was constructed in the central EAA flow path in 2015, and represents the water quality feature that most directly affects water quality entering the park. In 2018, a very wet year, the combination of the A-1 FEB and its associated STA produced an annual average outflow TP concentration of approximately 11 ppb, achieving the WQBEL.

In order for Central Everglades project to redirect new water flows from Lake Okeechobee southward into the Everglades, an additional 14,000-acre FEB (A-2) was originally planned to provide the required water quality treatment. In 2017, the State of Florida recommended that this shallow FEB be replaced with the 10,000-acre Everglades Agricultural Area deep water reservoir, and a 6,500-acre STA. The new EAA storage reservoir will help retain wet season flows currently being discharged into the northern estuaries, and pass these flows southward when treatment capacity is available. The additional flows from Lake Okeechobee (essentially a new water source) and the existing EAA runoff will need to meet the State's water quality standard (WQBEL) before these flows are discharged into the Everglades, including the Park. Finally, a new Western Everglades Restoration Project (WERP) was initiated after 2015, which focuses on addressing water flow and water quality improvements in predominately agricultural lands to the west of the Everglades Agricultural Area. This project is still in the planning phase, but is expected to improve water deliveries to the Miccosukee Reservation and WCA-3A, prior to the water entering into western SRS.

Threat 4 - Impacts to the Protection and Management of Florida Bay

Decades of drainage and upstream water diversions have decreased the volume, and altered the timing and distribution of freshwater flows into Florida Bay. Salinities in the nearshore areas of Florida Bay have also risen in response to sea level rise. Increased freshwater flows would help to maintain longer hydroperiods in the coastal freshwater wetlands, reducing soil oxidation and slowing down the impacts of saltwater intrusion. Corrective measure 4 therefore focuses on increasing water deliveries through Taylor Slough and the ENP Eastern Panhandle, and reducing groundwater seepage losses from the coastal wetlands (CMs 4A/B). These actions will reduce salinity fluctuations in the nearshore and open water areas of Florida Bay, which will promote healthier and more diverse seagrass communities, as well as increase fish and invertebrates that support coastal wading bird communities. Our longer-term Everglades restoration efforts, such as the Central Everglades and EAA Reservoir projects focus on recreating the original/pre-drainage water flow connection between Lake Okeechobee and the Everglades.

Corrective Measure 4A calls for completion of construction of the C-111 Detention Areas from the 8.5 Square Mile Area to the Frog Pond. Implementing a new rainfall-based water delivery formula, as part of the MWD and C-111 Combined Operational Plan, will also reduce the likelihood of nutrient enrichment via pumping water from the C-111 canal system back into the ENP marshes and Florida Bay.

Status – C-111 Project Construction – Completed: The S-332B/C/D pump stations and the C-111 South Detention Area (SDA) were operational by 2009. Construction of the C-111 Northern Detention Area was completed in early 2017. The northern detention area now receives runoff from the 8.5 SMA via the S-357 pump station. These detention areas have been shown to maintain higher water levels in upper Taylor Slough, but they are not very efficient (with approx. 80% of the pumped water quickly returning back to the eastern canals via groundwater seepage). In response, the Army Corps recently completed a new internal levee system to hold the pumped water closer to the western edge of the detention areas. The benefits of this fully completed water management system will be described in the next SOC report.

Status - New Operational Plan – Underway: Development of a new rainfall-based water delivery formula is being addressed through a combination of incremental field testing of the evolving water management infrastructure, and the development of a final Combined Operational Plan (COP) that will control the operations of the combined Modified Water Deliveries and C-111 project infrastructure. The COP is expected to be complete in June 2020, and will build on the lessons learned during the incremental field tests. The next SOC report will document the level of restoration that can be achieved, following completion of the full suite of MWD and C-111 project components.

Corrective Measure 4B calls for completion of the C-111 Spreader Canal project, and development of a revised water control plan to include rainfall-driven operations. These new features would reduce seepage losses from ENP, and direct flows toward Florida Bay.

Status – C-111 Western Spreader Canal Construction – Completed: The SFWMD completed construction of the C-111 Western Spreader Canal project in 2012, and efforts to evaluate the operational benefits and impacts of this project are ongoing. The Eastern phase of the C-111 Spreader Canal project has not yet moved forward, but the project is scheduled to begin planning in 2023.

Status - New Operational Plan – Underway: The final operations for these features have been incorporated into the Combined Operational Plan for the MWD and C-111 projects. In the last year, two additional pumps were added at the S-199 and S-200 pump stations, and the overall pumping scheme has been increased as part of the most recent incremental field tests. Preliminary information suggests that the more aggressive pumping does help to retain water in upper Taylor Slough, but it is unclear if these benefits extend southward into Florida Bay. The eastern areas of Florida Bay appear to be responding positively to the increased C-111 westward pumping, while these benefits for the critical areas in central Florida Bay have not yet been observed.

2b. Is the Timeframe for Implementing the Corrective Measures Suitable?

The 2015 SOC report acknowledged that we face a significant challenge in implementing the corrective measures, while assuring that the objectives for restoration are not lost during the extended planning, authorization, and funding process. The original 2006 corrective measures were linked to three water management projects: the Modified Water Deliveries, Canal-111, and Everglades Construction Project, which were all authorized by 1994. This date corresponds with

the timeframe when the site was placed on the list of World Heritage Sites in Danger. As of 2019, all three of these initial restoration projects have been constructed and are now operational, while the final combined operational plan for the MWD and C-111 projects has been delayed until June 2020.

What we have determined over this long period of implementation is that completion of these foundation projects was not sufficient to deliver the volumes of clean water to achieve our Desired State of Conservation. This is due to a combination of: (1) lost benefits resulting from design, cost, and/or operational changes required to balance ecosystem restoration, water supply, and flood control goals, (2) the continued deterioration of the overall Everglades ecosystem, and (3) our evolving understanding of the specific water flow and water quality targets needed to achieve our long-term restoration goals. In response to these restoration performance shortfalls, the 2015 SOC report added additional larger-scale water management projects, to our descriptions of the corrective measures needed to achieve the Desired State of Conservation. These include the State of Florida's Restoration Strategies project to further improve water quality, and the Central Everglades/EAA Reservoir project will redirect Lake Okeechobee discharges southward, back into the Everglades. While both of these projects are progressing, their full benefits are not expected to be realized before approximately 2030. The most recent project that will further improve water quality entering WCA-3A and ultimately the Park is the Western Everglades Restoration Project that is still in the planning phase.

The National Park Service will continue to track our progress in achieving the corrective measures and indicators of integrity that define the Desired State of Conservation for Everglades National Park. At the same time, the status and trends for a larger set of system-wide ecological indicators are also being evaluated for the entire south Florida ecosystem in the Department of Interior's Strategy and Biennial Reports to Congress, which focus on broader Everglades restoration progress. This report is produced by the South Florida Ecosystem Restoration Working Group and Science Coordination Group, for dissemination by the South Florida Ecosystem Restoration Task Force, (http://evergladesrestoration.gov/content/Strategic_Plan_Biennial_Report.html). The National Park Service's World Heritage State of Conservation report therefore serves as a subset of these system-wide indicators, (https://www.nps.gov/ever/learn/nature/worldheritage.htm).

The NPS and the Department of the Interior have actively participated in local and regional restoration planning and environmental evaluation efforts for decades. We specifically use our ongoing State of Conservation assessments to shape our restoration recommendations, to more directly address these park-specific threats. The shorter-term, and more localized MWD and C-111 projects, as well as the regional-scale and longer-term CEPP/EAA Reservoir and Restoration Strategies projects form a continuum of important corrective measures that will move the park resources toward the Desired State of Conservation.

2c. Progress Achieved Toward the Desired State of Conservation for the Removal of the Property from the List of World Heritage Sites in Danger

The prior sections of this report have described the progress and challenges in implementing the correctives measures over the last two decades (e.g., implementation of the Modified Water Deliveries, C-111, and Everglades Construction Projects). As we have stated, completion of these water management and water quality treatment projects alone, is not sufficient to deliver the volumes of clean water into Northeast SRS and reduce groundwater seepage losses to achieve our Desired State of Conservation. The sections below describe the status and trends of the hydrological, water quality, and ecological indicators of integrity, for the current reporting period. The detailed tables describe the specific targets, and compare these metrics for the 2017-2018 reporting period versus the 2011-2012 reporting period (included was the 2013 SOC report).

Hydrological and Water Quality Indicators of Integrity

The current reporting period included unusual weather conditions associated with three consecutive years of above average hurricane intensity, as well as a major El Nino event in the spring of 2016. High rainfall in September 2017 (Hurricane Irma) led to period of record water levels within the park and adjacent areas. In 2018, similar high rainfall events in May 2018 (Tropical Storm Alberto) and September 2018 (Tropical Storm Gordon), made 2018 one of the highest water flow years on record throughout south Florida.

Hydrologic Indicators - Northeast SRS Inflows and Water Levels: Water flows from the upstream Water Conservation Areas into Shark River Slough in water year 2018 (WY18) reached over 1.6 million acre-feet, the highest annual total inflow volume in 23 years. In spite of this, the annual total inflow into Northeast SRS reached approximately 300 thousand acre-feet in WY18. The Northeast SRS inflows were below the established average annual inflow target of 550 thousand ac-ft in WY17 and WY18, and less than 20% of the total SRS inflows passed into Northeast SRS, versus the established target of 55%. Peak wet season water levels in Northeast SRS during WY17 and WY18 were some of the highest since the 1980s, even though Northeast SRS inflows had to be terminated due to water management constraints in both the L-29 canal and the 8.5 SMA. Reduced wet season inflows to Northeast SRS inflows allowed marsh water levels to recede quickly. As a result of this operational constraint, the average annual water level at the NE2 gage remained below the dry year target of 7.5 feet in both WY17 and WY18 (see Table 2 for the status and trend details on the hydrologic metrics).

Water Quality Indicators – Total Phosphorus in Surface Waters and Periphyton: Phosphorus is the limiting nutrient in the Everglades, and total phosphorus (TP) concentrations in surface water and plant tissue are good indicators for water quality conditions. The established water quality metric for the site include TP at the ENP inflow structures and TP in the downstream marsh surface water. In addition, TP concentrations in periphyton tissue and periphyton biomass were both measured in the downstream marsh.

For the ENP inflow structures, the water quality goal is to be in compliance with all State of Florida and Federal standards for total phosphorus. High rainfall in September 2017 (resulting from

Hurricane Irma) caused marsh water levels to rise rapidly throughout the Everglades, re-suspending nutrients and sediments, and transferring them into the canal system. A rapid spike in TP inflow concentrations from this unusual event contributed to an exceedance of the TP limit for Shark River Slough in WY17. Similar high rainfall and rapid marsh water level increases occurred in WY18, but did not cause a TP exceedance. Phosphorus concentrations across all marsh stations in our water quality monitoring network indicated the TP levels were below the established limits, and an improving trend in TP continued during WY17 and WY18. Addressing the causes and possible remedies for the spikes at ENP inflow structures is a task for an interagency team of water quality and hydrologic experts in 2019 (see Table 2 for the status and trend details on the water quality metrics).

Periphyton is an algal/diatom community that represents a large portion of Everglades' net primary productivity, and responds quickly to changes in environmental conditions at both small and large spatial scales. Small increases in phosphorus concentrations can decrease periphyton biomass, shift periphyton community structure, and adversely impact higher trophic levels. The WY17 and WY18, measurements of periphyton tissue TP and periphyton biomass at all of the measurement sites in SRS and Taylor Slough met the established criteria for un-impacted marshes (see Table 2 for the status and trend details for the water quality metrics). A trend of slight decreases in periphyton biomass was observed in Northeast SRS during WY17 and WY18, but no trend was detected in Taylor Slough. Future monitoring will determine if there is any cause for concern.

Ecological Indicators in Freshwater Environments

The status of the ecological indicators of integrity in the freshwater marshes are a good reflection of both the overall health of the park ecosystems, and the progress in achieving the corrective measures. We focus on freshwater fish and aquatic invertebrates, wading birds, and the American alligator, which are all a good indicators of our progress in restoring water flows and marsh water depths.

Freshwater Fauna Indicator – Abundance of Fish and Aquatic Invertebrates: Fish and aquatic invertebrate assemblages play an important role in Everglades food webs. The factors that influence the abundance of fish and aquatic invertebrate populations tend to cascade up the food web, and influence species such as alligators and wading birds. The Desired State of Conservation is to maximize densities of small-sized freshwater fishes and aquatic invertebrates in a manner consistent with their expected responses in the pre-drainage Everglades ecosystem. Freshwater fish and aquatic invertebrate metrics are reported for Shark River Slough (SRS) and Taylor Slough separately. The overall metric for freshwater fish and large aquatic invertebrates in each slough is based upon an average of the assessments for all of the monitoring sites (see Table 2 for the status and trend details on the aquatic fauna metrics).

In SRS, fish and aquatic invertebrate abundance was lower than expected, given the above average rainfall in 2017-2018. Total fish abundance, and abundance of more drought intolerant species were below the established targets, while more drought tolerant species were present at a majority of sites. Our analyses also suggest that lower total native fish abundance corresponded with a higher abundance of non-native fishes (particularly African Jewelfish). This condition warrants significant concern. The overall trend in fish and aquatic invertebrate abundance was consistent

with the 2013 assessment. This suggests that aquatic fauna in SRS have not yet improved in response to the initial MWD and C-111 project implementation.

In Taylor Slough, a similar pattern existed in 2017–2018, with lower fish abundance than expected and more drought tolerant species than expected. Compared to the 2013 assessment, we observed a declining trend in native fish and aquatic invertebrates. This warrants significant concern. Increased pumping of water into the C-111 detention areas has not been in-place long enough to observe improvements in Taylor Slough aquatic fauna. If we can increase the depth and duration of marsh flooding, we would expect to see increased freshwater faunal assemblages and more native species. Understating the role of this localized water pumping on non-native fish populations and the influence of non-native fishes on total fish abundance, and the broader aquatic food web will require additional evaluation.

Freshwater Fauna Indicator – Wading Bird Nesting Success, Location, and Timing: The great abundance and diversity of wading birds (particularly herons, egrets, ibises, and storks) is a defining characteristic of the Everglades, and a significant reason for the creation of ENP. Since wading birds are easy to monitor across the landscape and their habitat requirements and historical nesting patterns are well known, they are excellent indicators of environmental conditions. Successful wading bird breeding requires abundant aquatic prey, and predictable water depths and recession rates for foraging. In the pre-drainage Everglades, nesting colonies regularly formed at the marsh/mangrove ecotone within ENP. Large "supercolonies" were observed during peaks in prey-base availability, following years with high wet-season water levels and stable dry-season recessions. By contrast, in the post-drainage Everglades, wading bird numbers have been reduced by 70–90%, and the major nesting areas have shifted northward into the Water Conservation Areas. Since water levels in the impounded WCAs tend to recede more slowly, these areas have recently seen increased nesting success. The slower recessions in the WCAs have triggered a number of wading bird species (such as the endangered wood stork) to shift the timing of their nesting later into the dry season. When fledglings emerge near the end of the dry season, they can experience more nesting failures during very wet years as water levels rise rapidly, dispersing their prey base. The wading bird metrics are therefore tied to nesting abundance, location, and timing (see Table 2 for the status and trend details on the wading bird metrics).

After sharp ecosystem-wide declines in wading bird nesting from the 1930s through the mid-1980s, wading bird nesting has been slowly increasing in the WCAs and the park. In 2018, following back-to-back high rainfall years, the water depth and prey conditions along the marsh/mangrove ecotone of ENP appeared optimal. In response, supercolonies returned to ENP, with nesting numbers and fledgling success that has not been observed in 50 years. Under these optimal conditions, we exceeded our metrics for wading bird nesting and fledgling survival. While there was a larger percentage of the total wading bird nesting effort return to the ENP marsh/mangrove ecotone, we remained below the 70% goal. The timing of Wood Stork nesting has moved earlier into the dry season (Jan. vs Feb.-Mar.) but still is later than the pre-drainage observations of Nov.-Dec. that assure higher rates of fledging survival. Finally, the interval between successful White Ibis nesting years has been decreasing, but is still below the metric of 1-2 years. Our next SOC report will help us determine if the recent positive trends in wading birds nesting will continue, following completion of our initial phase of restoration projects.

Freshwater Fauna Indicator – American Alligator Abundance, Nesting Success, Location, and Size Class: The American alligator is a keystone species and an important indicator of Everglades ecosystem health because they are highly responsive to hydrologic changes. Alligators were abundant throughout the pre-drainage Everglades, but the highest densities were in the marl prairies and along the marsh/mangrove ecotone within ENP. Alligators are much less common in these areas today because of reduced water depths and hydroperiods in the marl prairies, and reduced freshwater flows and elevated salinities in the southern coastal marshes. The American alligator metrics focus on nesting effort and success, nest density and distribution, and population demographics (size class). Since the American alligator responds quickly to changing hydrologic conditions, annual assessments of nesting effort/success fluctuate substantially from year to year, and are best evaluated over longer periods.

American alligator nesting effort in the park has increased significantly since 1985, but has remained below our target. Recent trends have shown more stability during poor to moderate conditions, and record high numbers during favorable conditions. Two of the five highest nesting effort years (2014, 2015) were followed by moderate (2016) and extremely low (2017) effort years. Nesting success has continued to be highly erratic due to both extreme natural rainfall variability, and managed hydrologic fluctuations. Surveys in 2017–2018 indicate that American alligator abundance remains relatively low, with reduced alligator numbers in all size classes within ENP. While alligator numbers remain low, nest density has increased and nests have been better distributed in recent years (2014–18). While nesting effort and nest densities have increased, we are below all of the established metrics for the American alligator within ENP (see Table 2 for the status and trend details on the American alligator metrics).

Ecological Indicators in Coastal/Estuarine Environments

The status of the coastal and estuarine integrity indicators are linked to the corrective measures via their influence on the volume, distribution, and timing of freshwater flows, which impact downstream salinities. Both mean salinities and the range of variations are drivers of seagrass abundance and diversity. Periods of high salinity, coupled with warm and calm weather, can lower dissolved oxygen levels. This has triggered widespread seagrass die-offs in Florida Bay, releasing nutrients that can cause algal blooms and further reducing light penetration. These water column and benthic community changes, in turn, control the growth, survival, and abundance of estuarine fish and invertebrates, coastal bird populations, and keystone species such as the American crocodile.

Salinity Indicator – Desired Range and Frequency of Extremes: Salinity is the primary parameter controlling the major ecological processes in coastal and estuarine ecosystems, influencing the distribution of aquatic plants and animals, overall biological productivity, and nutrient cycling. In the pre-drainage Everglades, freshwater inflows were more persistent, both from a seasonal and annual perspective. This created lower salinity conditions throughout much of the year, over large areas along the park's coastline (from the Gulf of Mexico and throughout much of Florida Bay). In the post-drainage Everglades, most of the historic freshwater flows have been diverted to the northern estuaries, or to meet urban and agricultural water supply needs. Consequently, the southern coastal ecosystems receive less freshwater, and salinities routinely reach and exceed oceanic conditions (35 parts per thousand). Three metrics are used to track the influence of hydrologic restoration activities on salinities in Florida Bay: the amount of time each

year that salinities are in the desired range, the difference between observed salinities and the desired low-salinity targets, and the frequency of extreme high-salinity events. All of these targets are based on predicted pre-drainage conditions, derived from a combination of paleo-ecological studies and model simulations.

During the 2017–2018 reporting period, the Everglades experienced multiple hurricane events, which led to wide fluctuations in Florida Bay salinities. The spring 2016 El Nino event lowered salinities across portions of Florida Bay, while rainfall and freshwater inflows declined in late 2016 and early 2017. By August 2017, salinities in central Florida Bay exceeded 40 parts per thousand (ppt), saltier than ocean water. On September 10th 2017, Hurricane Irma made landfall in the Florida Keys, and followed a path across western Florida Bay, and through the Gulf Coast estuaries. High rainfall was recorded over the next week across the Florida Peninsula, which steadily increased flows into Shark River Slough. The combination of local rainfall and persistent regional inflows drove salinities into the 20-25 ppt range over much of Florida Bay, well into the 2017 dry season. Florida Bay salinities steadily increased in early 2018, until Tropical Storm Alberto hit the region in May 2018, followed by Tropical Storm Gordon in September 2018.

Following the 2015 drought, Florida Bay salinity scores generally improved for both the wet and dry seasons over the next 5–6 years, compared to the previous 5 year period. While Florida Bay experienced multiple periods of above average rainfall and freshwater inflows, during 2017–2018 salinities were routinely above the target (interquartile) range for desired conditions. In spite of the 2017–2018 tropical events, Florida Bay salinities exceeded the 90th percentile of the desired targets, and showed no overall improving trend. Florida Bay continues to suffer from a lack of freshwater flow from Taylor Slough, Shark River Slough, and numerous creeks and rivers. Until the full suite of flow restoration projects are implemented, hypersaline conditions will continue to dominate the Florida Bay landscape (see Table 2 for the status and trend details on the salinity metrics).

Seagrass Indicators – Spatial Extent, Abundance, and Species Dominance: The seagrass indicators are created from a set of metrics including spatial extent, abundance, species dominance, and presence of target species, which are monitored throughout Florida Bay. The abundance index combines these metrics and reflects the status and health of the seagrass community as a whole, emphasizing overall abundance and spatial extent of seagrasses in Florida Bay. For the abundance index, the Desired State of Conservation is a sustained submersed aquatic vegetation (SAV) community (high abundance and spatial extent) in the Florida Bay ecosystem. The species index combines SAV species diversity and the frequency of occurrence of desired (non-dominant) species that are expected to increase with higher freshwater flow to Florida bay *(Halodule, Ruppia).* For the species index, the desired State of Conservation is a long-term positive trend in the SAV community and more stable SAV habitat in the Florida Bay ecosystem. A positive trend would signify that higher freshwater flows into Florida Bay are leading to increased seagrass diversity and improved habitat quality. These two indicator targets vary spatially due to the complexities of the bay bottom and associated factors (e.g., Florida Bay morphology consists of deeper basins separated by isolated by mud banks).

Seagrass abundance and species diversity in Florida Bay varies considerably by location. The highest and most consistent abundance and species diversity has been in the Northeastern zone,

where freshwater inflows are presumably higher due to the proximity of the lower C-111 canal system. Species diversity in this zone dropped in 2016, likely in response to droughts and hurricane disturbance. The Western Zone of the Bay has had moderate seagrass abundance with a decline after the 2015 die-off, but species diversity has remained high. The Coastal Transition Zone has had moderate seagrass abundance and species diversity, with some declines after the 2015 die-off. The Central Zone of the Bay has seen a significant reduction in seagrass abundance and species diversity post 2015, with little recovery since the 2017 hurricane. Finally, the Southern Zone has shown a long term trend of low seagrass abundance and moderate species density, since approx. 2011 (see Table 2 for the status and trend details of the seagrass metrics).

Algal Blooms in Florida Bay – Chlorophyll-a Concentrations and Spatial Extent: Florida Bay has a history of highly variable water quality conditions, with algal bloom episodes that can last from weeks to even years. Blooms sustained for more than several months can be damaging to seagrass habitat and fauna, especially sponges. This indicator serves as an alert that harmful water quality conditions are present in the Bay. This marker for water quality degradation in Florida Bay was triggered by the seagrass die-off event in 2015, and then again following Hurricane Irma in 2017. This combination of events has spurred the occurrence of record-high chlorophyll *a* concentrations in much of the Bay.

During the current reporting period, chlorophyll-concentrations increased in all five zones of Florida Bay. The areas most impacted extended in a swath from the Northern Coastal Transition Zone into the Central Zone, where concentrations were more than 10 times greater than the threshold thought to cause harm to Bay. The Northeastern Zone, where algal blooms have been relatively rare, displayed poor water quality conditions in 2017-2018, following Hurricane Irma. Finally, the Western and Southern Zones showed trends dropping from good to fair in response to these disturbance events (see Table 2 for the status and trend details on the algal bloom metrics).

Estuarine Fauna – Sport Fish Abundance: The abundance and availability of the four native sport fish species (snook, red drum, spotted seatrout, and gray snapper) were chosen as indicators of the condition of the coastal and estuarine faunal communities because each of these species relies on this region throughout its life cycle. Sport fish abundance is known to fluctuate in response to salinity and other environmental conditions, but these relationships have yet to be fully quantified. Sport fish abundance is monitored by the NPS using a fishing-dependent metric called "catch per unit effort" (CPUE), which tracks the catch success of anglers who are targeting a particular species. Unlike our other ecological indicators that have targets that are linked to a pre-drainage or historic range of conditions, the Desired State of Conservation for the sport fish species is to achieve a stable to increasing trend in CPUE, which generally translates to sustainable recreational use. Over time, we may refine this target with respect to the linkages with restoration of freshwater flows, stabilization of salinity, or other environmental parameters, as more information becomes available. In the past, pink shrimp density was also included, which is known to closely track salinity variations and upstream water management. This indicator has not been routinely sampled since 2012, and is therefore not included in this assessment.

Snook CPUE dropped in 2010 in response to a winter freeze, but has been stable or increasing each year up to 2015, our last major seagrass die-off event, which also triggered an algal bloom. Snook CPUE has since been slowly increasing. After a 5-year low in 2016, red drum CPUE has been

stable. Spotted seatrout CPUE has increased steadily since 2015, and is near its peak level over the last 12 years. Gray snapper CPUE was stable from 2006 to 2015, and has increased since 2016, reaching a 38-year high. Three of the four sport fish indicator species have shown a positive trend during this reporting cycle, suggesting that sport fish have been recovering since our recent natural disturbances, and that recreational fishing is currently at sustainable levels (see Table 2 for the status and trend details on the sport fish metrics).

Estuarine Fauna - American Crocodile Abundance, Nesting Effort, and Juvenile Survival: The American crocodile is a good coastal ecosystem indicator, since the species' lifecycle is responsive to changing patterns of freshwater flow and salinity. American crocodiles were federally listed as "endangered" in 1975, due to extensive habitat degradation (including nesting sites) and over-hunting. Crocodiles have been slowly recovering in the park and the wider Everglades. There are now more crocodiles, nesting in more places, than in the prior 35 years, leading to their reclassification as "threatened" in 2007.

The most important metrics related to hydrologic restoration include the total crocodile population numbers, nest distribution, nesting effort, and growth/survival from hatching to late juvenile stages. Crocodiles nest in the late dry season primarily in elevated, sandy areas along ENP mangrove shorelines. Upstream water management practices have reduced freshwater inflows to the coastal areas along Florida Bay. In response, hatchlings have to migrate inland from their nesting sites to nursery areas, since they cannot tolerate high salinity for extended periods. Effects of unnatural freshwater flows include: longer hatchling migration to suitable nursery habitat, reduced use of nest sites further from mainland freshwater sources, and impacts to growth, survival, and dispersal of juvenile crocodiles.

The American crocodile has been studied within the Park since 1978, and the above set of metrics is used to infer trends in crocodile abundance. American crocodile abundance has been increasing within the Park, and this trend continued during 2017–2018. Nesting effort has increased throughout ENP, particularly in the Flamingo/Cape Sable region, where the NPS has been plugging historic drainage canals, which allowed brackish water to penetrate into the interior wetlands. Nesting continues to increase in Northeast Florida Bay but at a much slower rate. Nesting success is typically high in ENP with few total failures. Crocodiles are starting to use new or previously unknown nesting areas in recent years. Crocodile hatchling growth rates (which increase the odds of juvenile survival) were variable but high in most regions. Recent improved estimates of survival using enhanced modeling techniques demonstrate first and second year survival within ENP is more than five times higher than previously thought, and are demonstrably higher than adjacent nursery areas. Increased population growth, nesting success, and juvenile survival is expected, once upstream hydrologic restoration projects are completed and more natural freshwater flows are restored (see Table 2 for the status and trend details on the American crocodile metrics).

Estuarine Fauna – Roseate Spoonbill Abundance, Nesting Effort, and Juvenile Survival: Roseate spoonbills are a good indicator, since they nest in and around Florida Bay and forage in adjacent coastal wetlands. Spoonbills have been studied in the Park since the 1930's, and were almost extirpated in Florida due to plume hunting and habitat degradation. By 1935, the only known nesting colony in the state consisted of about 15 pairs on Bottle Key in Florida Bay. The establishment of the Park led to increased protection, and spoonbill abundance steadily increased

until the 1980s, when changes in water management began to impact spoonbill nesting by diminishing, redirecting, and disrupting the timing of freshwater inflows, which reduced the availability of prey. In 2010, the state of Florida reclassified the roseate spoonbill from a “Species of Special Concern” to "Threatened" because of the bird's small population and restricted range. While spoonbill numbers and nesting locations are on the rise statewide, spoonbill nesting in the Park has not recovered since the 1980’s.

The most important spoonbill metrics include the total number of nesting pairs in Florida Bay, the return of spoonbill nests to historically important sites, and spoonbill chick production. These behavioral responses can result in substantial annual variations in these indicator values, and trends are best evaluated over long periods. Breeding populations (reported as nesting pairs) sharply declined after the mid 1980’s, and the number of nesting pairs for the 2014-2018 reporting period remained below the pre-1984 target. One historical colony in Northeast Florida Bay has become active, but overall nest numbers are below the targets in both eastern and western Florida Bay. Spoonbill chick production has generally been low since the 1980’s, but there was a slight positive trend since 2015 in both eastern and western Florida Bay (see Table 2 for the status and trend details on the Roseate spoonbill metrics).

3. Other Current Conservation Issues Identified by the State Parties which may Impact on the Property’s Outstanding Universal Value

Exotic Invasive Species

In 2015, the South Florida Ecosystem Restoration Task Force developed an Invasive Exotic Species Action Framework (http://evergladesrestoration.gov/content/ies/). This framework is helping to align and prioritize the work of the various government entities (Federal, State and Local) in the fight against invasive species in the south Florida ecosystem, including the Park. In addition, the Task Force effort has brought the situation of invasive species in the south Florida ecosystem to a higher level of awareness at the national level. The U.S. National Invasive Species Council (NISC) Secretariat has produced a documentary on invasive species entitled, *Protecting What Matters* that includes information on south Florida invasive species. All of these efforts are positive progress toward addressing the issue of invasive species within the World Heritage property.

Nevertheless, additional resources and long-term steady attention will be needed to turn the tide on invasive exotic species within the site. Current data indicate that many additional exotic species are present in the urban and agricultural areas outside the boundaries of the site, though not yet found inside the boundaries. Thus we expect to be working on this threat to the Outstanding Universal Values for many years to come. The NPS places the highest management priority on exotic species that cause the greatest ecological harm to native plant and animal communities. The Park is working to maintain and expand existing successful exotics control and maintenance programs, but the scale of the problem, and limited resources have prevented establishment of control programs exotic fish and some wildlife species. The Park is focused on tracking existing and new invasions, investing in research, applying early detection and rapid response, and working with our partners and the public on education, outreach, and controlling exotic species introductions. We are still in the early stage of establishing formal corrective measures and quantitative targets, with respect to

exotic species. This section of the report builds on the 2013 World Heritage report, in the assessment of indicator metrics and preliminary statements of desired conditions.

Exotic Invasive Plants – Relative Abundance or Percentage of Native to Exotic Species: Approximately 1,000 known plant species occur in the Park, and approximately 250 are considered exotic (i.e., non-native). The highest management priority is given to the four exotic plant species that are the most invasive, and cause the greatest ecological harm: melaleuca, Australian pine, Old World climbing fern, and Brazilian pepper. The percent cover of these key invasive plant species over the entire park was digitally mapped during low elevation overflights in 2013. Supplemental mapping of melaleuca and Australian pine has been done in key treatment locations, while the status of Brazilian pepper and Old World climbing fern has not been systematically updated since 2013, due to limited resources. The percent cover of other invasive plant species are not estimated by aerial surveys, because these species inhabit the understory or have localized distributions, making it difficult to confidently estimate changes in percent cover for these taxa.

The desired state for these four key exotic plants and their management approaches are species-dependent. Their current status reflects available funding for control, current treatment technologies, and the biology, distribution, and accessibility of the particular exotic plant species. For melaleuca and Australian pine, the target is less than 1% cover per km^2 in the current or historical areas containing these species and preventing expansion into new areas. The target for Old World climbing fern and Brazilian pepper is less than 5% cover per km^2 in areas currently containing these species and preventing expansion into new areas. The target for all other exotic plant species is less than 1% cover per species per km^2 in areas currently containing these species, and preventing expansion into new areas. Our Desired State of Conservation also includes expanded monitoring and control of newly detected species.

Melaleuca receives the most management attention of any exotic plant in the Park via direct application of chemical and biological control agents. While we have not achieved the < 1% cover target, the total km^2 of melaleuca infestation has decreased over the last 10 years. Australian pine is second in terms of management attention, and chemical control is effective, but no effective bio-control exists. While we have not achieved the < 1% cover target, the total km^2 of Australian pine infestation has decreased in recent years. Management of Old World climbing fern is frequently limited by its remoteness. Chemical, biocontrol, and prescribed fire have been effectively applied in areas of dense infestations. We have not achieved the < 5% cover target, and the total km^2 of Old World Climbing Fern infestations has increased in recent years, due to expansion into previously undetected areas. Management of Brazilian pepper is generally limited to areas near man-made disturbances (roadsides, former farmlands, etc.), because no effective chemical or bio-control options exist, and mechanical control is expensive. We have not achieved the < 5% cover target, and the total km^2 of Brazilian pepper infestation has increased in recent years, due to expansion, particularly in coastal marshes near the mangrove ecotone. Management of other invasive exotic plants is limited to areas of high concern (visitor use areas, T&E species habitats. The effectiveness of chemical and biocontrol approaches differs by species. We have not achieved the < 1% cover target, and the total km^2 of these other exotic plant species infestations has increased in recent years (see Table 2 for the status and trend details on the exotic plant metrics).

Exotic Invasive Fish and Wildlife – Relative Abundance or Percentage of Native to Exotic Species: Invasive fish and wildlife continue to present significant challenges in the Park, and preventing the arrival and establishment of new species remains the preferred course of action. Most of these species arrive in the Park from the upstream canal system, or from adjacent developed areas, and new regulatory actions to limit introductions are not expected in the near future. The Park's control efforts focus on addressing new threats as they emerge, and long-term management of well-established species.

The management metrics for invasive fish are linked to reducing the rate of new introductions and maintaining a low relative abundance (less than 2%) vs native species. No new introductions of exotic freshwater fishes have been observed in the Park since 2010, but surveys in the adjacent canal systems detected three exotic fishes (either from the aquarium trade or stocked by the SFWMD for aquatic vegetation control). In addition, several other recently observed exotic fishes in the broader south Florida canal system have establish populations, and could pose a risk of spreading into the Park. The relative abundance of exotic freshwater fishes during this reporting period increased above the 2% threshold at all monitoring sites. In Shark River and Taylor Sloughs, relative abundance of exotic fishes was 3.8% and 2.4%, respectively. In the ENP-wide monitoring sites, relative abundance of exotic fishes was 48% during the reporting period. The drought tolerant African jewelfish continues to be the most abundant exotic fish observed in park-wide monitoring at 43% of all catches and 89% of all exotic fishes, with patterns of increasing abundance in both shorter hydroperiod marshes and slough habitats.

The management metrics for herpetofauna include minimizing or eliminating new introductions, and containing and decreasing known exotic species within the Park. Recent studies suggest that all previously documented exotic reptile and amphibian species continue to persist across their formerly known range in and around the Park. Limited monitoring surveys during 2014–2018 suggest range expansion is occurring for the Burmese python and the Argentine tegu within South Florida. Burmese pythons have been established in the Park for multiple decades. Burmese pythons were captured in substantial numbers during the reporting period, but there is little optimism to expect widespread control in the near future. The Argentine tegu established a large population relatively recently just east of the Park. We have an aggressive containment program, and continue to capture increasing numbers, but they still present a significant threat for incursion. The North African python has been observed outside the Park in recent years. Increased monitoring has produced limited actionable information to determine if containment or eradication is possible. Additional exotic herpetofauna species have expanded their range in recent years (such as the African redhead agama, and veiled chameleon). These species also present potential threats of incursion into the Park.

The Indo-Pacific lionfish was first reported inside the Park in 2010. This is the only notable invasive marine species in and around the Park. Our management metric is to minimize the number and reduce the spatial distribution of lionfish. The density of lionfish in the Park is low, with a total of 40 lionfish sightings reported in the Park since 2010. Our partner agencies have documented a rapid increase in lionfish numbers on reef habitats in adjacent coastal waters. The only Park habitats where lionfish have been captured thus far include hard bottom environments or man-made structures. Lionfish are known to occupy a wide range of other habitats including coral reefs, seagrass beds, mangroves, and estuaries, so they could potentially invade any habitat within Florida

Bay. Because seagrass beds and mangrove areas are important nursery areas for juvenile fish and invertebrates, the potential impact of lionfish in the Park is a serious concern. We initiated our first lionfish survey in 2013, and the rate of lionfish observations has not increased. Limited data suggest occupancy rates and densities of lionfish in Florida Bay are low and there is currently little impact to native fish and invertebrate species compared to adjacent shallow-reef and deeper-water habitats in the Atlantic and Gulf of Mexico. The potential for invasion by this species is still high, due to high densities and expanding populations in adjacent waters (see Table 2 for the status and trend details on the exotic herpetofauna and fish metrics).

Climate Change

Everglades National Park is considered to be highly vulnerable to the impacts of climate change, particularly sea-level rise. An NPS general discussion of the impacts to Everglades National Park is available at (https://www.nps.gov/subjects/climatechange/sciencevideos.htm). The NPS has been documenting the impacts of sea-level rise across the Service for a number of years, and sea-level rise and 2050/2100 projections under various emissions scenarios are available on the NPS interactive viewer (https://maps.nps.gov/slr/). The NPS developed research, adaptation, and mitigation guidance, (https://www.nps.gov/subjects/climatechange/sealevelchange.htm). For Everglades National Park, our 2015 General Management Plan (GMP) outlines a series of recommended responses including: (1) expanded research to identify specific natural and cultural resources at risk from climate change, (2) new or ongoing partnerships with management entities to maintain regional habitat connectivity, (3) restoration of key ecosystem features to increase ecosystem resilience, and (4) minimization of the impacts of other stressors on park resources. These are all important aspects of the overall ENP strategy to address climate change and sea-level rise impacts to park natural and cultural resources.

The Park has several cooperative research and monitoring studies on climate change, to assess the potential impact of sea-level rise on the ecotone between the marine and freshwater landscapes. A good example is studies of the loss of organic peat soils as a result of saltwater intrusion, which impacts freshwater marsh plants via increased pore water salinities. This information is critical to defining water management actions to increase ENP freshwater inflows to mitigate against sea-level rise. ENP also continues to work on internal projects to reduce the impact of man-made features near the coast, such as drainage canals. The park recently completed an Environmental Assessment to examine the potential for a second phase of canal plug and repairs to multiple historic canals on Cape Sable, in the southwestern corner of the park. The park is also undertaking comprehensive climate-change planning now that the GMP is approved. Wayside exhibits are being developed to illustrate the risk sea-level rise poses to park resources and to open a conversation with visitors regarding climate change.

Oil and Gas Exploration/Extraction

The WH Committee previously asked about potential impacts of proposed expansion of oil and gas extraction within the Everglades. These activities have previously been limited to the Big Cypress Watershed including within the Big Cypress National Preserve (BCNP), or to the west of ENP's major drainage basins. In 2015, a major land development company applied for a permit to drill exploratory wells on five acres of a 20,000 acre tract they own within the Water Conservation Areas, upstream of the park. The Florida Department of Environmental Protection (FDEP) previously denied the permit, since the area was considered environmentally sensitive. After a

multi-year legal challenge, a Florida administrative court ruled in the companies favor in 2017, and the FDEP appealed that decision. In early 2019, a Florida appeals court overruled the FDEP decision, and granted the land development company authority to conduct exploratory drilling. While the path forward is unclear, this would be the first new oil or gas permit issued in the Everglades by FDEP in the last 50 years. The implications of this planned activity on the park are unknown, but the NPS has previously raised concerns over localized adverse impacts within the BCNP.

4. Summary of New Developments that may affect the OUVs

As explained previously, completion of three new projects: (1) the Tamiami Trail Next Steps roadway improvements, (2) the Central Everglades Project, which now includes the EAA Reservoir south of Lake Okeechobee, and (3) the expanded water quality treatment features included in the Restoration Strategies Project will be needed to achieve the water flow and water quality conditions envisioned in the indicators of integrity. Both the Central Everglades and Restoration Strategies projects are expected to reach key construction milestones around by 2025-2026. While full construction of these regional-scale projects was originally expected to be a decade away. The good news is that the water flow and water quality benefits from these upcoming projects are projected to fully achieve our desired state of conservation.

A key change in water availability in the greater Everglades watershed occurred in 2008, when safety concerns with the Herbert Hoover Dike (HHD) around Lake Okeechobee prompted the Army Corps to lower the Lake regulation schedule, via increased discharges to the northern estuaries. That same year the Army Corps began work on a $1.7 billion HHD rehabilitation project. To date, numerous improvements have been made to the dike and associated water control structures, at a cost of $1 billion, with an originally planned completion by 2025. During the wet seasons of 2017–2018, the public was shocked by the environmental and economic impacts caused by high Lake Okeechobee regulatory releases and associated harmful algal blooms in the Lake and northern estuaries. These concerns prompted the federal and state governments to dedicate $730 million in supplemental funding, to increase the pace of the HHD repairs, and commit to developing a new Lake regulation schedule by 2022. This acceleration in Lake Okeechobee projects, has put added pressure on completing the Central Everglades/EAA Reservoir projects, and other CERP features needed to move clean water southward back into the Everglades.

Another new development occurred within the State of Florida appropriations, suggesting that they will be greatly accelerating their Everglades restoration funding. In early 2019, the new Florida Governor announced a $625 million fiscal year 2019 commitment to advance a number of key water resources projects (including $360 million toward Everglades water storage reservoirs, $150 million for targeted water quality projects, and $25 million to address harmful algal blooms in the northern estuaries). This is the first year of a four-year $2.5 billion commitment of state appropriations. This marks the start of a growing Federal and State of Florida pledge to advance Everglades restoration, with a focus on sending more clean water south from Lake Okeechobee into the southern Everglades and Florida Bay.

The completion of these original Everglades foundation projects, and the signs of a likely acceleration of key next generation restoration projects, suggests that we are on the verge of seeing major hydrological, water quality, and ecological improvements throughout the watershed, and specifically at this site. This bodes well for our ability to recover and maintain the site's Outstanding Universal Value.

Public Access to the State of Conservation Report

We approve public access to the entirety of this report on the World Heritage Centre's State of Conservation Information System.

(Signature of the Authority)

Pedro M. Ramos
Superintendent
Everglades and Dry Tortugas National Parks

Table 1. Everglades National Park – History and Status of Corrective Measures, February 2019.

Corrective Measure (Established 2006)	Status of Corrective Measure 2013	Status of Corrective Measure 2019
Threats 1 and 2: Alterations to the Natural Hydrologic Regime, and Adjacent Urban and Agricultural Growth.		
Park Need: Public ownership of lands in the East Everglades is a prerequisite to re-establishing water flows in Northeast Shark River Slough.		
1A: Complete East Everglades Expansion Area land acquisition (approximately 44,000 hectares (ha)). Note in 2016: Acquisition of private parcels and protection of developed sites from flooding are both required in order for this corrective measure to result in the ability to increase flows significantly to NESRS.	1A: Land acquisition is 99% complete though six of the largest parcels remain in private ownership, totaling 300 ha. Funds for acquisition remain in the NPS budget. An NPS decision on the pathway for acquisition of five of the six parcels is expected in 2013. NPS is preparing an Environmental Impact Statement for acquisition of the sixth and largest parcel (a utility corridor of approximately 134 ha). Estimated completion date is spring 2014.	1A: All 44,000 hectares of the East Everglades (8,000+ privately owned parcels of land) were acquired by 2016. The land exchange with Florida Power and Light Company (the utility corridor) is complete, including transfer of title. The three commercial airboat operations and two radio tower sites along Tamiami Trail were also brought into federal ownership. Limited incremental field testing of water flow improvements in Northeast Shark River Slough began in April 2015. Flood protection plans are current being implemented through a combination of NPS and private actions. These flood protection cures will enable continued business services at these sites, as restoration moves forward. Specifically flood protection features that would allow the Modified Water Deliveries and C-111 projects to be fully operational, are expected to be in place by late 2019 or early 2020.

Park Need: The inhabited area adjacent to the park, called the 8.5 Square Mile Area, must be protected from flooding in order to allow water flows into NESRS.		
1B: Complete flood mitigation features in the 8.5 Square Mile Area.	1B: Construction of the flood mitigation features for the 8.5 Square Mile Area was completed in 2009. Monitoring data indicated that additional work was needed to achieve flood protection goals. A "connector canal" modification was designed in 2012 and construction will be completed in 2013. Completion of this project will remove one of the main barriers to increasing water levels in the L–29 canal.	1B: Construction of the flood mitigation features that protect the 8.5 Square Mile Area were completed in late 2018. Monitoring of these features to determine their year-round benefits is underway. Full operation of this system is linked to the completion of the Combined Water Operations Plan, expected in June 2020. Note that this project is linked to Corrective Measure 2C: protection of the 8.5 Square Mile Area not only provides flood mitigation to residents, but also provides one of the numerous elements of seepage control along the eastern border of the park. Note that this project is also linked to Corrective Measure 4A: Full implementation of the 8.5 Square Mile Area flood mitigation system, which depends on completion of the C-111 North Detention Area (NDA) and C-111 South Detention Area (SDA), since the C-111 project receives stormwater runoff from the 8.5 SMA flood mitigation system. Construction on the C-111 North Detention Area was completed in early 2018, but flows were limited during 2018 by ongoing construction of internal levees in the C-111 South Detention Area (SDA). This work is now complete, so the C-111 South Dade project infrastructure is now fully in-place.

Corrective Measure (Established 2006)	Status of Corrective Measure 2013	Status of Corrective Measure 2018
Park Need: A water control plan defining water operations that will improve rainfall-based water deliveries and promote increased sheetflow to ENP, while maintaining flood control and water supply requirements, is necessary.		
1B: Complete the Combined Operations Plan (COP) for the Modified Water Deliveries (MWD) and C-111 South Dade Projects. This Corrective Measure is the same as Corrective Measure 2B.	1B: Everglades Restoration Transition Plan (ERTP) operations have been implemented. A water operations field test is being designed and agreed upon between the U.S. Government and the State of Florida that should address water quality concerns associated with increases in flow to NESRS. This field test is expected in early 2013 and will last for 2 years. The COP and the COP plans have been eliminated from the MWD project, and future water control plans will be developed at the conclusion of the field test. Changes to water operations are likely to move forward very slowly and in small increments. Substantial change will occur only when raising and bridging the Tamiami Trail is complete as envisioned in the Central Everglades Planning Project (CEPP—a new element of the CERP) and the Tamiami Trail Next Steps (TTNS) project. Timeline for completion of these projects is >10 years from now.	1B: During the current reporting period (2017—2018), we completed the first incremental field test (increment 1.1-1.2), and in September 2018 we initiated increment 2 operations. Under this 2nd increment, we further relaxed the operational constraints and raised the L-29 canal stage by up to one foot, allowing us to increase water flows into Northeast Shark River Slough. The final Combined Operational Plan (COP) will build on the lessons learned during the incremental field tests. The next report will document the level of restoration that can be achieved, following completion of the full suite of MWD and C111 project components. The current reporting period (2017—2018), included unusual weather conditions associated with three consecutive years of above average hurricane intensity. High rainfall in September 2017, associated with Hurricane Irma, lead to period of record water levels within the park and adjacent areas. In 2018, similar high rainfall events in May (Tropical Storm Alberto) and September (Tropical Storm Gordon), made 2018 one of the wettest years on record throughout south Florida. These wet conditions lead to another round of emergency deviations in ENP water operations, further testing the performance of the evolving MWD and C-111 infrastructure. The unusually wet conditions in 2017—2018 sparked a State of Florida effort to enhance flood protection in the agricultural areas east of the park, via addition pumping and reduced canal operational levels. Analysis of the impacts of these operations is underway, and will inform the final design of the COP. One lesson learned is that the eastern flood protection and seepage management infrastructure is not as effective as originally expected, so inflows to Northeast SRS had to be reduced during these high water periods (see CM 2C below). Unless this issue is addressed, the restoration benefits of the MWD and C-111 projects may be limited during wet periods. So far, our assessment remains the same as in 2017: limitations in the water management infrastructure associated with the MWD and C-111 projects will move restoration forward slowly and in small increments. Flows under the eastern Tamiami Trail roadway will be constrained until the Phase 2 roadway reconstruction/raising is complete. Full achievement of the Everglades National Park water flow and distribution targets for the Desired State of Conservation won't occur until the CEPP and EAA reservoir projects are complete in about a decade.

Corrective Measure (Established 2006)	Status of Corrective Measure 2013	Status of Corrective Measure 2018
Park Need: Removal of barriers to water flow within Water Conservation Area 3 (WCA 3) upstream of the park is needed to enhance sheetflow and marsh connectivity into NESRS.		
1C: Construct water conveyance structures on the L–67A, L–67C, and L–29 canals and levees. In 2006, both the MWD project, and the CERP WCA 3 Decompartmentalization and Sheetflow Enhancement Project (Decomp) included planned actions to degrade levees and fill canals within WCA 3, north of the park.	1C: The Decomp. physical model along the L–67 levees and canals is under construction. Construction components are expected to be complete in early 2013, and data will be collected during 2013 and 2014. The test is scheduled to conclude in 2014. Phase 1 of the Decomp project is incorporated into the CEPP, which is also examining changes to the L–67 levees and canals. The scope of alternatives ranges from small to large modifications to the L–67 structures. Schedule for completion of conceptual planning for CEPP is the end of 2013. The CEPP project then moves forward to Congress for authorization and funding. Timeline for completion of this project is >10 years from now. The CEPP plan to move water from WCA 3 to NESRS is needed in the same timeframe as required by the TTNS project.	1C: The Decomp. physical model construction has been complete for several years, adding a new water control structure in the L-67A levee (S-152) to move water between WCA-3A and WCA-3B, and L-67C levee degradation (complete vs partial backfilling of the adjacent L-67C canal). The new WCA-3A/B water flow connection and degrading the L-67C levee and backfilling the canal have enhanced sheetflow and marsh connectivity. While the CEPP Project was authorized by Congress in 2016, detailed planning and construction has been delayed due to limited Federal appropriations. The planned southern CEPP features includes three additional water conveyance structures in the L-67A, and full removal of portions of the L-67C and L-29 levees, which will significantly enhance sheetflow and marsh connectivity. Both the MWD and original CERP design included plugging or backfilling portions of the L-67A canal to enhance sheetflow from WCA-3A into SRS. These features are not included in CEPP, but may be evaluated in a future Phase 2 of the Decomp. and Sheetflow project.
Park Need: Removal of barriers to water flow along the Tamiami Trail is needed to enhance sheetflow and marsh connectivity into NESRS. Both bridges and modifications to the roadway are needed in order to raise water levels in the park while avoiding water damage to the road itself.		
1C: Tamiami Trail bridging and roadway modifications.	1C: The 2008 Tamiami Trail 1-mile bridge and limited road-raising project will provide modest flow increases into NESRS and is now scheduled for completion in spring of 2014. An NPS project to design and construct 2.6 miles of additional bridging is underway as of October 2012. Planning and final design should be complete by June 2014 and, depending on the availability of funding, a design and build contract should be awarded by the end of 2014, with construction completed by 2018. Raising the remainder of the Tamiami Trail roadway is still required in order to restore more-natural water levels to NESRS without compromising the roadway. The funding and timing of this work is unknown at this time.	1C: The 2008 Tamiami Trail 1-mile bridge and limited roadway reconstruction/raising was completed in 2014, and is providing modest flow improvements in NESRS. These MWD features allowed for limited additional flow during the 2017-2018 incremental field tests. The Tamiami Trail Next Steps (TTNS) Phase 1 project completed 2.3-miles of additional bridging in late 2018, but the old roadway under the bridges will not be fully removed until April 2019. Once this work is complete we will see improved sheetflow, and additional inflows into NESRS, up to the limits of the MWD L-29 canal constraint of 8.5 feet. In October 2018, the Florida Governor committed $44.5 million to raise and reconstruct the remaining Tamiami Trail roadway, and the Federal Highway Administration is currently reviewing a $62 million NPS grant application to provide the remaining funding. If approved, design and permitting with occur in 2019-2020, and construction could be complete by 2022. The combination of the CEPP and TTNS projects will further enhance sheetflow and marsh connectivity by removing a 2.3-mile section of the L-29 Levee coinciding with the TTNS Phase 1 bridging. This will also allow us to raise the L-29 canal up to 9.7 feet, further increasing NESRS inflows. The current timeline for removal of the L-29 Levee, as well as associated upstream CEPP water conveyance features is 2030.

Park Need: Water in NESRS and Taylor Slough needs to be retained inside the park via seepage management features. This water should flow down the historic sloughs, increasing water depths and hydroperiods in the park. Currently, lowered water levels in urban and agricultural areas east of the park draw large amounts of water out of the park via seepage.		
2A: Complete C-111 land exchange between the South Florida Water Management District (SFWMD) and NPS. This is required to construct the C-111 detention areas.	2A: The land exchange is complete and no additional real estate is required for completion of the C-111 detention area projects.	2A: The land exchange is complete and no additional real estate is required for completion of the C-111 detention area projects.
2B: See 1B.		
2C: Complete the construction of C-111 detention-area features from the 8.5 Square Mile Area south to the area known as the Frog Pond. These features include northern and southern components. The detention areas reduce seepage losses along the portions of the eastern ENP boundary. An existing pump station (S–356), constructed by the MWD project, and is available for use to help retain water in NESRS. CERP included an ENP Seepage Management project that would add additional S–356 pump stations as well as a subsurface seepage barrier by 2015.	2C: Operation of the C-111 southern detention-area components and their effects on park ecology are being assessed. Construction of the C-111 northern detention area is still delayed, scheduled for completion in 2017. The water operations field test described in 1B should address water quality concerns associated with increases in flow to NESRS. This test is expected in early 2013 and will last for 2 years. Construction of the rock-mining shallow seepage barrier pilot (2 miles) was completed in spring of 2012. The feature is being monitored for effectiveness, and depending on results, may lead to an additional 3–5 miles of shallow seepage barrier in the near future. Additional seepage management to restore water levels in NESRS while maintaining flood protection is envisioned in the CEPP and would follow the schedule of design and implementation for that project.	2C: The S-332B/C/D pump stations and the C-111 South Detention Area (SDA) were operational by 2009. Construction of the C-111 Northern Detention Area was not completed until early 2017. The northern detention area now receives runoff from the 8.5 SMA via the S-357 pump station. These detention areas have been shown to maintain higher water levels in upper Taylor Slough, but they are not very efficient (with approx. 80% of the pumped water quickly returning back to the eastern canals via groundwater seepage). In response, the Army Corps recently completed a new internal levee system to hold the pumped water closer to the western edge of the detention areas. The rock mining industry added three additional miles to their shallow seepage barrier along the upper L-31N levee in 2013 (total of 5 miles), to mitigate for groundwater losses from Northeast SRS. Recent analyses indicate that this barrier is effective in blocking shallow groundwater flows, in combination with other features such as the detention areas. Seepage control and groundwater retention within the park must be managed to allow deeper groundwater flows to the east to be maintained, for both public water supply and beneficial freshwater flows to Biscayne Bay. The record rainfall experienced in 2017-2018 required emergency modifications to the ENP water operations, testing the seepage management infrastructure that has been put in place over the last decade. Our analyses indicate that the detention areas and seepage management barrier are not as effective as originally expected. Unless this issue is addressed, restoration project benefits may be reduced.

Threat 3: Increased Nutrient Pollution from Upstream Agricultural Areas.		
Corrective Measure (Established 2006)	Status of Corrective Measure 2013	Status of Corrective Measure 2018
Park Need: Water entering the park must be low in nutrients, with concentrations of phosphorus in surface water <10 parts per billion (ppb), as established by the State of Florida. Total phosphorus (TP) concentrations above this level lead to imbalances in flora and fauna. Water needs to be cleaned upstream of the park, via improvement of agricultural practices and treatment by stormwater treatment areas (STAs). Reduction of nutrient concentrations and redistribution of phosphorus loading by sheetflow will contribute to healthier freshwater Everglades wetlands, as well as a healthier estuary in Florida Bay.		
3A: Implement upstream water quality source controls or Best Management Practices (BMPs) and construct engineered wetlands or STAs to achieve the long-term TP limits for water flowing into Shark River Slough and the Taylor Slough/Coastal Basins. In 2008, a Federal Court found that delay in achieving the State of Florida Phosphorus Threshold Rule (<0.01 mg per liter for the Everglades) was a violation of the Clean Water Act. The US District Court (2010) directed the U.S. Environmental Protection Agency (EPA) to develop a plan for compliance for runoff from the Everglades Agricultural Area (EAA). The EPA (2010) issued an Amended Determination identifying a protective discharge limit for phosphorus from the STAs and a comprehensive set of actions to meet this limit.	In June 2012, the State of Florida and the EPA reached a consensus on additional remedies needed for improving water quality in America's Everglades—Restoration Strategies (RS). Included in the RS are a Water-Quality-Based Effluent Limit for STA discharges, to be enforced by permits that, if achieved, will ensure that park waters meet the 10 parts per billion (ppb) target; the construction of six projects by the South Florida Water Management District (SFWMD) that will create more than 6,500 acres of new STAs and 116,000 acre-ft of additional water storage in Flow Equalization Basins (FEBs); and development of science plan to ensure continued research and monitoring of water quality treatment technologies. The FEBs are upstream water storage features intended to provide a more steady flow of water to the STAs downstream, helping to maintain desired water levels and flows needed to achieve optimal water quality treatment performance. It is possible that the FEBs also will have some TP removal ability within their footprints. In order for CEPP to be implemented, an additional FEB (A-2) upstream of the park is needed to ensure that additional future inflows to the park meet the water quality targets.	The State's Restoration Strategies project is scheduled to be fully constructed by 2025, and several project components in the central flow path were completed by 2015. These flow path components serve as the key water quality features that most directly affecting park water quality A 16,000 acre Flow Equalization Basin (referred to as A-1FEB), was constructed in 2015. In 2018, the combination of the A-1 FEB and its associated STA 3/4 produced, an annual average outflow TP concentration of approximately 11 ppb. In order for CEPP to redirect water flows from Lake Okeechobee southward into the Everglades, an additional 14,000-acre FEB (A-2) was originally proposed to provide the additional water quality treatment. In 2017 the State of Florida recommended that this shallow FEB to be replaced with a 10,000-acre Everglades Agricultural Area deep reservoir, and a 6,500-acre STA. The new EAA storage reservoir will retain wet season flows that currently being discharged into the northern estuaries. The additional flows from Lake Okeechobee (new source) and existing EAA runoff will need meet the water quality standards before these flows are discharged into the Everglades, including the park.

Threat 4: Impacts to the Protection and Management of Florida Bay (Reduced Freshwater Inflows and Increased Nutrient Loadings).		
Corrective Measure (Established 2006)	Status of Corrective Measure 2013	Status of Corrective Measure 2018
Park Need: Increasing natural freshwater flows from NESRS and Taylor Slough into the downstream estuaries will contribute to healthier and more diverse seagrass communities and increase fish and invertebrate productivity in Florida Bay.		
4A: Complete construction of the C-111 Detention Area features from the 8.5 Square Mile Area to the Frog Pond and implement CSOP operations. Implementing rainfall-driven pumping operations based on marsh water levels as envisioned in CSOP will reduce the likelihood of pumping nutrient enriched groundwater into ENP marshes.	4A: The C-111 North Detention area is still not complete; it is scheduled for completion in 2017. The CSOP and the COP plans have been eliminated from the MWD project, and future water control plans will be developed at the conclusion of the water operations field test described in 1B. Changes to water operations are likely to move forward very slowly and in small increments, with substantial change occurring only when raising and bridging the Tamiami Trail is complete as envisioned in the CEPP and TTNS projects (more than a decade). Rainfall-based pumping operations will be encouraged in the water control plan for ENP.	4A: The C-111 North Detention Area (NDA) was completed in 2017, forming a continuous water management system along the ENP boundary, from the 8.5 SMA to the Frog Pond. This flood protection and seepage management infrastructure has not been as effective as originally expected, so inflows into Northeast SRS had to be reduced during high water periods (see CM 2C). In response, the State of Florida increased pumping into the detention areas via lowering C-111 canal stages, and the Army Corps constructed a new internal levee system (within the North and South Detention Areas) to hold the pumped water closer to the western edge of the detention areas. We will describe the effectiveness of these recent improvements in the next SOC report. Water deliveries into Northeast SRS and Taylor Slough were progressively increased via the incremental field tests, and we are well into development of the final Combined Operational Plan (COP) for the MWD and C-111 South Dade projects (see CM 1B). In spite of these higher inflows and periods of record rainfall in the 2017-2018 reporting period, Florida Bay continued to experience problems with seagrass die-off and persistent algal blooms. The COP modeling and environmental assessments are informing us on the potential benefits that these early restoration projects can have on improving the volume, distribution, and timing of freshwater flows into Florida Bay. The Northeast SRS inflow limitations and seepage management issues will need to be addressed, as we increase water flows via the CEPP and EAA reservoir projects, which are needed to fully achieve the Desired State of Conservation in Florida Bay.
4B: Complete the C-111 Spreader Canal and revised water management operations to include rainfall-driven operations.	4B: Phase 1 Western Project of the C-111 Spreader Canal project was completed in spring of 2012 and began operating in June 2012. The effects of this project on adjacent park wetlands and on Florida Bay are being monitored and will be evaluated after 3 years of monitoring (2015). Initial signals are positive. Rainfall-driven operational controls have not yet been implemented but will be incorporated into future water control plans. The remaining phases of the C-111 Spreader Canal project are not currently scheduled.	4B: The SFWMD is still evaluating the operational benefits and impacts of the C-111 Western Spreader Canal Project. In the last year, two additional pumps were added at the S-199 and S-200 pump stations, and the overall pumping scheme has been increased as part of the most recent incremental field tests. Preliminary information suggests that the more aggressive pumping does help to retain water in upper Taylor Slough, but it is unclear if these benefits extend southward into Florida Bay. The eastern areas of Florida Bay may be responding positively to the increased C-111 westward pumping, while the critical areas in central Florida Bay do not appear to be benefiting from these efforts. The Eastern phase of the C-111 Spreader Canal project has not moved forward, but the Army Corps is scheduled to begin planning in 2023.

Table 2. Everglades National Park – Status of the Indicators of Integrity, February 2019.

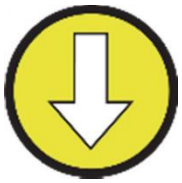
Indicator 1. Water Volume and Flow Distribution

Water Volume and Flow Distribution				
Criteria	Desired State of Conservation	Condition & Trend Assessed for the 2013 Report	Condition & Trend Assessed for the 2019 Report	Rationale
Magnitude and direction of sheetflow	On an average annual basis, 55% of flows should come through NESRS and 45% through WSS.			A large disparity continues to exist in the distribution of inflows between Western SRS and Northeast SRS. Over the two year reporting period (WY17–WY18) less than 20% of the total Shark River Slough inflows were delivered into Northeast SRS, vs > 80% into Western SRS. This distribution was consistent over both wet and drier years.
Average annual water volume into NESRS	On average, a total annual volume of water should be delivered to NESRS of 550 thousand acre-feet (acre-ft) with a range of 200 to 900 thousand acre-ft during years of below- and above-average rainfall, respectively.			Over the period from 1980 to 2018 (38 years), this annual target flow was met only one time. During the two year reporting period (WY17–WY18), annual flows ranged between 100 and 300 thousand ac-ft, well under the target. In WY18, the second wettest year since 1980, Northeast SRS inflows reached approx. 300 thousand ac-ft, versus the total SRS inflow of over 1.6 million ac-ft.

Indicator 2. Water Level Patterns in Northeast SRS

Water Level Patterns				
Criteria	Desired State of Conservation	Condition & Trend Assessed for the 2013 Report	Condition & Trend Assessed for the 2019 Report	Rationale
Water pattern and water levels (timing and spatial distribution of surface- water depth hydropattern)	The target is to achieve annual average water levels (stage) in NESRS of approximately 8.0 feet (ft) National Geodetic Vertical Datum of 1929 (NGVD) during years of average annual rainfall. During years of below- and above-average annual rainfall, the average water level in NESRS should be 7.5 and 8.8 ft., respectively.			Northeast SRS water levels have remained consistently lower than these average annual targets. Since 1980, the average annual water level at the NE2 gage never exceeded the minimum target of 7.5 feet (NGVD). In WY18, the second highest SRS inflow year since 1980, the average annual water level at the NE2 gage was approx. 7.0 feet (NGVD).

Indicator 3. Water Quality – Inflows and Marsh Total Phosphorus

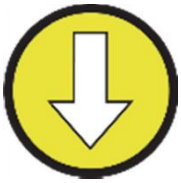
Water Quality: Total Phosphorus and Periphyton				
Criteria	Desired State of Conservation	Condition & Trend Assessed for the 2013 Report	Condition & Trend Assessed for the 2019 Report	Rationale
TOTAL PHOSPHORUS				
Shark River Slough inflow phosphorus concentration	Inflow phosphorus concentrations to Shark River Slough below the target.			Inflow phosphorus concentration was below the long-term limit and the target during WY2013. Since WY2013, concentrations have been below the limit except in WY2014 and WY2017.
Shark River Slough interior marsh phosphorus concentration	Interior marsh phosphorus concentrations in Shark River Slough below the target.			Across interior marsh stations, phosphorus concentration is below the target and downward trends at most stations are apparent.
Taylor Slough and Coastal Basins inflow phosphorus concentration	Inflow phosphorus concentrations to Taylor Slough and Coastal Basins below the target.			Inflow phosphorus concentration has been below the long-term limit and the phosphorus target was met since WY2014.
Taylor Slough and Coastal Basins interior marsh phosphorus concentration	Interior marsh phosphorus concentrations in Taylor Slough and Coastal Basins below the target.			Interior marsh phosphorus concentrations are below the target and concentrations have been fairly stable since May 2002.

Indicator 3. Water Quality – Periphyton Total Phosphorus

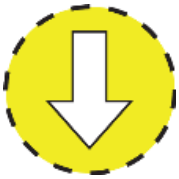
Water Quality: Total Phosphorus and Periphyton				
Criteria	Desired State of Conservation	Condition & Trend Assessed for the 2013 Report	Condition & Trend Assessed for the 2019 Report	Rationale
PERIPHYTON				
Shark River Slough periphyton tissue phosphorus content	25% or less of Shark River Slough stations are coded yellow or red.			Since WY2013, 83 to 88% of monitored stations in Shark River Slough were coded green for periphyton tissue phosphorus content, meeting the desired state.
Shark River Slough periphyton biomass	25% or less of Shark River Slough stations are coded yellow or red.			WY2016 and WY2017 had the greatest frequency of stations coded yellow and red since WY2009, with only 49 and 54%, respectively, of the stations coded green for periphyton biomass, failing to meet the desired state.
Taylor Slough periphyton tissue phosphorus content	25% or less of Taylor Slough stations are coded yellow or red.			Since WY2014, stations in Taylor Slough have been coded green at 75% of the stations or more for periphyton tissue phosphorus content meeting the desired state.
Taylor Slough periphyton biomass	25% or less of Taylor Slough stations are coded yellow or red.			In WY2016, the lowest frequency of stations being coded green for periphyton biomass (13%) since WY2006 was observed. These stations recovered in WY2017, with 100% of the stations being coded green. The rest of the years since WY2014 have stations

				coded green with a frequency from 88 to 100%, meeting the desired state.

Indicator 4. Freshwater Fish and Aquatic Invertebrates

Fish and Wildlife: Freshwater Fauna				
Criteria	Desired State of Conservation	Condition & Trend Assessed for the 2013 Report	Condition & Trend Assessed for the 2019 Report	Rationale
Shark River Slough overall	Abundance is maximized in a manner that reflects pre-drainage conditions.			Fewer fish were present than expected based on rainfall conditions, and drought intolerant species were abundant. However relatively abundant non-native species may also be reducing small fish influencing model results. The end result is a similar condition to the 2013 report, and the trend is stable from the previous evaluation.
Taylor Slough overall	Abundance is maximized in a manner that reflects pre-drainage conditions			Fewer fish were present than expected based on rainfall conditions and drought-tolerant species were abundant. This represents a decline in condition from the previous assessment.

Indicator 5. American Alligator

American Alligator				
Criteria	Desired State of Conservation	Condition & Trend assessed for the 2013 Report	Condition & Trend Assessed for the 2019 Report	Rationale
Positive trend in nesting effort	Increasing trend in nesting effort throughout all freshwater marshes, particularly peripheral marshes historically believed to support the majority of nesting effort. The target is nesting effort consistent with a restored Everglades ecosystem.			Nesting effort has increased significantly since 1985; recent trends show more stability during poor to moderate conditions and record numbers during favorable conditions. Nesting efforts in 2014–2017 show an overall decreasing short term trend. Two of the five highest nesting effort years (2014, 2015) in the 33 year dataset have occurred since 2013 but were followed by two moderate (2016) and extremely low (2017) effort years.
Positive trend in nest success	Increasing trend in nest success and reduced failure due to flooding of egg cavity. The target is nest success levels consistent with a restored Everglades ecosystem.			Nest success in recent years continues to be highly erratic due both to extreme natural and managed seasonal hydrologic fluctuation.

Positive trend in nest Density/ distribution	Increasing trend in density of nests across hydrologic basins, particularly within shorter hydro period peripheral marshes. The target is nest density and distribution consistent with a restored Everglades ecosystem.			Nest density and distribution throughout freshwater hydrologic basins of ENP have demonstrated an increasing trend in recent years (2014–8) distribution across basins was consistent with recent stable trend when taking into account variability related to differing environmental conditions among years.

Indicator 5. American Alligator

American Alligator				
Criteria	Desired State of Conservation	Condition & Trend assessed for the 2013 Report	Condition & Trend Assessed for the 2019 Report	Rationale
Positive trend in alligator abundance	Increasing trend in abundance for all size classes of alligators within freshwater wetlands. The target is an abundance of alligators consistent with a restored Everglades ecosystem.			Results of spotlight surveys indicate reduced abundance estimates in all size classes within ENP. Recent surveys indicate continued relatively low abundance. Surveys in limited areas may not represent system-wide conditions. Survey efforts were expanded in 2017 to provide more comprehensive assessment of this metric in the next reporting period.

Indicator 6. Everglades Wading Birds

Everglades Wading Birds				
Criteria	Desired State of Conservation	Condition & Trend Assessed for the 2013 Report	Condition & Trend Assessed for the 2019 Report	Rationale
Total number of pairs of nesting birds in south Florida	Maintain or increase current total numbers of nesting birds in ENP mainland colonies to a level consistent with a restored Everglades ecosystem.			Absolute size of breeding populations of ibises, storks, and other long-legged wading birds declined sharply from the 1930s to the 1970s. Numbers nesting in the park have since been trending upward. Although the 2018 nesting season was exceptionally high year to year variability is still expected in future years.
Month of wood stork nest initiation	Month of wood stork nest initiation should be November or December.			Storks nested earlier (Jan. as compared to Feb.-Mar.) in 2017 and 2018, but the overall trend continues to remain below the target of November or December nest initiation.
Proportion of nests located in ENP headwaters	At least 70% of all wading bird nests should be located in the headwaters ecotone of the mangrove estuary of Florida Bay and the Gulf of Mexico (ENP).			Indicator continues to move in a positive direction, but remains distant from the 70% target.
Mean interval between exceptional white ibis (*Eudocimus albus*) nesting years	Mean interval between exceptional white Ibis nesting years (≥13,000 nesting pairs) should be 1–2 years.			The trend is positive and consistent in recent years. This interval now consistently exceeds the target for restoration and has shown dramatic improvement in the last decade.

Indicator 6. Everglades Wading Birds

Everglades Wading Birds				
Criteria	Desired State of Conservation	Condition & Trend Assessed for the 2013 Report	Condition & Trend Assessed for the 2019 Report	Rationale
Ratio of wood stork and white ibis nests to great egret nests	Ratio of the combination of wood stork and white ibis nests to great egret nests should be 32:1, which is characteristic of the community composition of pre-drainage conditions.			Current ratio for the 2018 season (6:1) is up slightly from previous years but still well below the 32:1 ratio that is considered to be representative of healthy foraging and nesting conditions.

Indicator 7. Florida Bay Salinity

Salinity Patterns in Florida Bay				
Criteria	Desired State of Conservation	Condition & Trend Assessed for the 2013 Report	Condition & Trend Assessed for the 2019 Report	Rationale
Amount of time during the year that salinity is in the desired range	Salinity is within the interquartile range of the desired pre-drainage conditions 50% of the time.			Salinity conditions overlap with desired conditions only during 2 months at the end of the dry season. Conditions are variable but exhibit no year-to-year trend.
Difference between observed mean salinities and desired mean salinities	The mean salinity is within the variability of the mean salinity of desired pre- drainage conditions.			The mean salinity is above desired mean salinity throughout the year. The degree of difference over the period of record (POR) is variable but largely driven by precipitation and shows no year-to-year trend.
Occurrence of extreme high-salinity events	Salinity does not exceed the 90th percentile defined by the desired conditions more frequently than 10% of the time.			Salinity exceeds the 90th percentile of the desired conditions more frequently than desired and, while variable, shows no year-to- year trend.

Indicator 8. Florida Bay Algal Blooms (Chlorophyll- a Concentration)

Algal Blooms in Florida Bay: Chlorophyll *a* Concentration				
Criteria	Desired State of Conservation	Condition & Trend Assessed for the 2013 Report	Condition & Trend Assessed for the 2019 Report	Rationale
Northeastern Florida Bay chlorophyll *a* concentration	Annual median concentrations below 1 ppb.			Algal bloom conditions improved after poor to fair conditions in 2013–2014. However, following the disturbance of Hurricane Irma in 2017, relatively strong and widespread blooms occurred.
Central Florida Bay chlorophyll *a* concentration	Annual median concentrations below 3 ppb.			Conditions had been good since 2008, but degraded broadly following the seagrass die-off in this region in 2015. Extremely high chlorophyll *a* concentrations were measured following Hurricane Irma.
Southern Florida Bay chlorophyll *a* concentration	Annual median concentrations below 1 ppb.			Algal bloom conditions were good from water years 2011-2014, but subsequently decreased to fair. Recent decreases likely was driven by seagrass die-off and Hurricane Irma.
Western Florida Bay chlorophyll *a* concentration	Annual median concentrations below 3 ppb.			Western Florida Bay had good water quality conditions for the decade prior to the 2015 seagrass die-off event. Subsequent water quality degradation likely was driven by the die-off and Hurricane Irma.

Indicator 9. Florida Bay Seagrasses

Seagrasses in Florida Bay				
Criteria	Desired State of Conservation	Condition & Trend Assessed for the 2015 Report	Condition & Trend Assessed for the 2019 Report	Rationale
NORTHEASTERN ZONE				
Seagrass Abundance	Abundance of seagrass consistent with restored habitat in the Everglades ecosystem.			Seagrass abundance index has remained favorable since 2008, with no indication of seagrass die-off over the past 3 years, as in more westerly Florida Bay areas.
Seagrass Species	Seagrass species diversity, promoting sustainable habitat that is consistent with a restored Everglades ecosystem.			Seagrass species index degraded after May 2016 (in WY2017 and WY2018), potentially associated with hurricane disturbance and subsequent algal blooms.
NORTHERN COASTAL TRANSITION ZONE				
Seagrass Abundance	Abundance of seagrass consistent with restored habitat in the Everglades ecosystem.			Seagrass Abundance Index has remained fair since 2008, with no indication of recovery since density levels fell in 2006.
Seagrass Species	Seagrass species diversity, promoting sustainable habitat that is consistent with a restored Everglades ecosystem.			Species diversity Index improved from 2013 to 2014 with expansion of *Ruppia*, but fell to a fair condition in 2015.

Indicator 9. Florida Bay Seagrasses

Seagrasses in Florida Bay				
Criteria	Desired State of Conservation	Condition & Trend Assessed for the 2015 Report	Condition & Trend Assessed for the 2019 Report	Rationale
CENTRAL ZONE				
Seagrass Abundance	Abundance of seagrass consistent with restored habitat in the Everglades ecosystem.			Seagrass abundance continued to be fair for 2013–2016, but with the die-off event that started in calendar year 2015 had a poor index score by water year 2017. The die-off was associated a record-breaking, high salinity event. Some of the worst die-off areas were in shallow areas that are not part of the long-term monitoring network.
Seagrass Species	Seagrass species diversity, promoting sustainable habitat that is consistent with a restored Everglades ecosystem.			Inter-annual variation in species diversity reflects species fluctuations associated *Thalassia* die-off and *Halodule* expansion after the die-off event.
SOUTHERN ZONE				
Seagrass Abundance	Abundance of seagrass consistent with restored habitat in the Everglades ecosystem.			The seagrass abundance has continues to be poor in the region since 2011
Seagrass Species	Seagrass species diversity, promoting sustainable habitat that is consistent with a restored Everglades ecosystem.			Species composition and diversity continued to be fair, with target species being rare.

Indicator 9. Florida Bay Seagrasses

Seagrasses in Florida Bay				
Criteria	Desired State of Conservation	Condition & Trend Assessed for the 2015 Report	Condition & Trend Assessed for the 2019 Report	Rationale
WESTERN ZONE				
Seagrass Abundance	Abundance of seagrass consistent with restored habitat in the Everglades ecosystem.			Abundance in the western zone overall remained fair, but the 2015 die-off event strongly impacted some western basins and banks.
Seagrass Species	Seagrass species diversity, promoting sustainable habitat that is consistent with a restored Everglades ecosystem.			Species index scores remained good because the target species remained common.

Indicator 10. Estuarine Fish (Sport Fish)

Estuarine Fish (sport fish) and Invertebrates				
Criteria	Desired State of Conservation	Condition & Trend Assessed for the 2015 Report	Condition & Trend Assessed for the 2019 Report	Rationale
Trend in snook (*Centropomus undecimalis*) catch-per-unit effort (CPUE)	The target is the CPUE levels during 2007– 2009, or at least a stable CPUE trend, indicating sustainable recreational use and environmental conditions.			Snook CPUE has increased substantially since 2014. CPUE in 2017 was equivalent to 2008 levels. The CPUE indicates recovery of the Snook population since the 2010 winter freeze.
Trend in red drum (*Sciaenops ocellata*) CPUE	The target is a stable to increasing trend in CPUE, indicating sustainable recreational use and environmental conditions.			Red drum CPUE peaked in 2011 in the year after the winter freeze of 2010. Red drum steadily declined from 2011 reaching a 5-year low in 2016. Levels of CPUE have been stable over the past three years, and equal to those seen in 2006.
Trend in spotted seatrout (*Cynoscion nebulosus*) CPUE	The target is a stable to increasing trend in CPUE, indicating sustainable recreational use and environmental conditions.			Spotted seatrout CPUE has increased steadily since 2015. Current levels are equal to 2006, and are on the high side of relatively stable CPUE over the last 12 years.
Trend in gray snapper (*Lutjanus griseus*) CPUE	The target is a stable to increasing trend in CPUE, indicating sustainable recreational use and environmental conditions.			Gray Snapper CPUE was stable from 2006 to 2015 and steadily increased from 2015 to 2017 reaching a 38-year high.

Indicator 11. American Crocodile

American Crocodile				
Criteria	Desired State of Conservation	Condition & Trend Assessed for the 2013 Report	Condition & Trend Assessed for the 2019 Report	Rationale
Trend in total population	Population is nearing pre-drainage estimates consistent with a restored Everglades ecosystem. Occupation throughout historic range.			Total population is inferred from the other metrics monitored. From 2014 to 2018, nesting has increased throughout ENP.
Trend in reproduction	Increasing trend present in nesting effort, distribution, and success in ENP, including historical nesting sites in northeastern Florida Bay. Increasing trend present in growth and survival of juvenile crocodiles, consistent with a restored Everglades ecosystem.			Reproductive effort within ENP has exhibited an increasing trend and is the best indicator of continued species recovery. Nesting effort peaked in 2008, declined in 2009–10, and has slowly rebounded from 2011 to 2018. Nest success is typically high in ENP with few total failures. Consistent use of new and previously unknown nesting areas has been documented in recent years.
Trend in hatchling-juvenile growth and survival	Reduced salinity regimes occur, encouraging rapid hatchling growth rates (approaching mass ≥200 g 3–4 months post-hatching) and allowing juveniles to more rapidly reach total length ≥75 cm.			Survival is directly linked to increased hatchling-juvenile growth rates, which increase with lower salinities. New long-term analysis of hatchling growth and survival within ENP shows the highest rates observed in Florida. This survival rate is approximately 5 times greater than previously found.

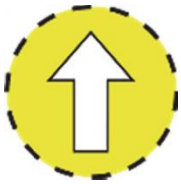
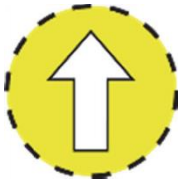
Indicator 12. Roseate Spoonbill

Roseate Spoonbill				
Criteria	Desired State of Conservation	Condition & Trend Assessed for the 2013 Report	Condition & Trend Assessed for the 2019 Report	Rationale
Total number of pairs of nesting roseate spoonbills in Florida Bay	Increase and maintain the number of spoonbill nests in Florida Bay to those consistent with peak (pre–1984) number.			Breeding populations of roseate spoonbills in Florida Bay have decreased sharply since the 1980s and continue to remain well below the minimum target for the current reporting period (2014–2018).
Presence of roseate spoonbills in historical nesting sites in northeast Florida Bay (NEFB)	Increase the number of spoonbill nests at historical colony sites in NEFB.			Even though a historical colony in NEFL has become active again in recent years, overall nest numbers are still well below the target for the current reporting period (2014–2018). Note the correction made to the 2013 report arrow. It was mistakenly put as a "stable arrow" but should have reported as a "down" arrow.
Presence of roseate spoonbills in historical nesting sites in northwest Florida Bay (NWFB)	Increase the number of spoonbills nests at historical colony sites in NWFB.			The trend for this reporting period (2014–2018) is now uncertain, and nest numbers continue to remain below target.

Indicator 12. Roseate Spoonbill

Roseate Spoonbill				
Criteria	Desired State of Conservation	Condition & Trend Assessed for the 2013 Report	Condition & Trend Assessed for the 2019 Report	Rationale
Roseate spoonbill chick production in NEFB	Increase the number of chicks fledged per nest attempt at historical colony sites in NEFB.			There was a slight decline over from the 2014 to 2015 season. A slight uptick in chick production has occurred over the last 3 nesting seasons (2015–2016, 2016–2017, and 2017–2018). The overall trend remains positive, but below the target.
Roseate spoonbill chick production in NWFB	Increase the number of chicks fledged per nest attempt at historical colony sites in NWFB.			Delay in restoration of foraging grounds and predation by crows have had a negative impact on NWFB colonies in the 2014–2015 season. While the long term trend is still uncertain, chick production over the last 3 seasons (2015–2016, 2016–2017, and 2017–2018) has moved above target.

Indicator 13. Invasive Exotic Plants

Invasive Plants				
Criteria	Desired State of Conservation	Condition & Trend Assessed for the 2013 Report	Condition & Trend Assessed for the 2019 Report	Rationale
Percent cover of melaleuca *(Melaleuca quinquenervia*)	Less than 1% cover per km^2 present in currently infested areas and area of infestation is not expanding.			Most park invasive plant management effort is directed at this species. Chemical and biocontrol agents are effective. Number of infested acres has decreased during the past 10 years.
Percent cover of Australian pine (Casuarina equisetifolia)	Less than 1% cover per km2 present in currently infested areas and area of infestation is not expanding.			Casuarina is second in terms of the amount of effort dedicated to management. Chemical control is effective, but access to some remote infestations is difficult. No effective biocontrol exists. Number of infested acres is decreasing.
Percent cover of Old World climbing fern (Lygodium microphyllum)	Less than 5% cover per km2 present in currently infested areas and area of infestation is not expanding.			Management activity is limited by remoteness but is effective on dense infestations. Biocontrols and prescribed fire have been applied in some areas as means of control. The change in condition and trend in this 2019 report is due to reports of Lygodium in areas it was previously not detected.

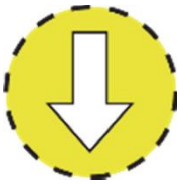
Indicator 13. Invasive Exotic Plants

Invasive Plants				
Criteria	Desired State of Conservation	Condition & Trend Assessed for the 2013 Report	Condition & Trend Assessed for the 2019 Report	Rationale
Percent cover of additional collective exotic plant species	Less than 1% cover per km^2 present in currently infested areas and area of infestation is not expanding.			Management efforts for these species are currently limited to areas of high concern such as those with high visitor use or areas with threatened and endangered species that may be impacted by the presence of exotic plants. Chemical controls and effective biocontrols differ by species. The overall area affected by the combination of these plants is increasing.
Percent cover of Brazilian pepper (Schinus terebinthifolius)	Less than 5% cover per km2 present in currently infested areas and area of infestation is not expanding.			Management of this species is limited to specific areas of high priority. No effective control currently exists for use in remote areas. No effective biocontrol exists. Overall, the area of infestation is increasing.

Indicator 14. Invasive Exotic Fish

Invasive Fish and Wildlife (Freshwater and Marine)				
Criteria	Desired State of Conservation	Condition & Trend Assessed for the 2013 Report	Condition & Trend Assessed for the 2019 Report	Rationale
A. FRESHWATER FISH				
Rate of new introductions of exotic fish	Rate of new introductions of exotic fishes is decreasing over time.			No new introductions of exotic freshwater fish have occurred in ENP since 2010, suggesting the rate of introductions may be decreasing from that observed in the previous decade. Nonetheless, new records of other exotic fishes occupying canals adjacent to ENP suggest an increased risk of new introductions.
Relative abundance of exotic fishes in Shark River Slough	Freshwater fish assemblage is dominated by native species and contains less than a 2% relative abundance of exotic individuals.			Exotic species are present and relative abundance increased above the 2% threshold at monitored sites.
Relative abundance of exotic fishes in Taylor Slough	Freshwater fish assemblage is dominated by native species and contains less than a 2% relative abundance of exotic individuals.			Exotic species are present and relative abundance increased above the 2% threshold at monitored sites.
Relative abundance of exotic fishes in ENP-wide annual sample	Freshwater fish assemblage is dominated by native species and contains less than a 2% relative abundance of exotic individuals.			The relative abundance of exotic fishes far exceeded the 2% threshold at monitored sites.

Indicator 14. Invasive Exotic Herpetofauna

Invasive Fish and Wildlife (Freshwater and Marine)				
Criteria	Desired State of Conservation	Condition & Trend Assessed for the 2013 Report	Condition & Trend Assessed for the 2019 Report	Rationale
B. HERPETOFAUNA				
Rate of new herpetofaunal introductions in and around ENP	Minimize and eliminate new invasive herpetofaunal introductions to ENP.			Several new species have expanded their range in South Florida in recent years. There is presently little prospect for comprehensive preventative regulation.
Containment and control of established populations: Burmese python	Burmese python population in the park is contained and decreasing.			Available evidence suggests Burmese pythons occupy an increasingly larger range over which they are having a significant impact. There remains little optimism for widespread control in the near future.
Response efforts to known invasives adjacent to ENP: Northern African python	Known invasives adjacent to ENP are eliminated prior to establishment in the park.			Credible observations of Northern African pythons have been scant in recent years. Though monitoring efforts increased, there is little evidence to infer whether the population can be eradicated or even contained.
Response to recent introductions to the park: Argentine tegu	Recent introductions to the park are effectively addressed and populations of incipient invasives are eliminated.			Though containment efforts increased during the reporting period, the geographic extent of the population continued to expand towards the park. Funding constraints

				threaten the continuity of trapping and monitoring efforts.

Indicator 14. Invasive Exotic Marine Fish

Invasive Fish and Wildlife (Freshwater and Marine)				
Criteria	Desired State of Conservation	Condition & Trend Assessed for the 2013 Report	Condition & Trend Assessed for the 2019 Report	Rationale
C. MARINE SPECIES				
Lionfish density	Minimize the number of lionfish in Florida Bay			Density of lionfish is low in ENP compared to surrounding habitat types (complex reef and deeper waters). However, individuals continued to be observed in ENP during the reporting period.
Biomass of prey species	Minimize the impact from lionfish on post-settlement and juvenile native fish and invertebrate populations			ENP marine and estuarine waters are important nursery areas for many fish and invertebrate species. The impact on prey species by increasing lionfish density or distribution is potentially large, but current estimates of lionfish density and distribution are not expected to significantly affect biomass of prey species.

Distribution of lionfish	Minimize the spatial distribution of lionfish			Limited data suggest the distribution of lionfish has not increased within ENP boundaries, perhaps because available ENP habitats are not as suitable as those found in adjacent waters. Nonetheless, lionfish are able to occupy any habitat type within marine waters of ENP.