Continuous Monitoring and Adaptive Control
Retrofits for Water Quality

Addressing Indian River CCMP Action Plans
Fresh and Storm Water Discharges
Total Maximum Daily Loads (TMDLs)
Climate Change
Public Involvement and Education

Data and Information Management Strategy
Monitoring

Applicant Information

Virginia Barker, Director
Natural Resources Management Department
Viera Government Center
2725 Judge Fran Jamieson Way, Building A
Viera, FL 32940
321-633-2016
Virginia.Barker@brevardcounty.us
May 19, 2017

Frank Sakuma Jr.
Chief Operating Officer
Indian River Lagoon Council
1235 Main Street
Sebastian, FL 32958

Re: Letter of Commitment for the Proposal to Implement Continuous Monitoring and Adaptive Control (CMAC) Technology for Improved Water Quality in Brevard County

Dear Mr. Sakuma,

I am writing to express support and sponsorship on behalf of Brevard County’s ("County") proposal for Category 3: Science and Innovative Technology Projects under the FY 2017-2018 Indian River Lagoon National Estuary Program. We are submitting for consideration a plan to use Continuous Monitoring and Adaptive Control (CMAC) technology to enhance an existing stormwater pond located in Frontenac along Broadway Boulevard. The County has selected this project as a candidate for a pilot CMAC retrofit project because we believe in the opportunity the technology presents to measure and improve water quality not just at the proposed site, but also at a watershed scale.

The proposed CMAC technology delivers cleaner water and flood mitigation through forecast-based real-time flow control of distributed stormwater infrastructure. In partnering with OptiRTC, Inc. ("Opti") and Atkins to deliver CMAC and project reporting, respectively, the County is leveraging deep institutional expertise in stormwater management and proven ability to deliver cost-effective solutions. The proposal contains further details on applications of this technology, the expected outcomes, and deliverables.

We endorse the requested grant funds of $128,732 and are committed to the in-kind match amount of $52,742 for this project.

We are committed to implementing this project and are enthusiastic about our candidacy for funding from the Indian River Lagoon Council. We look forward to hearing from you on next steps.

For additional information and/or questions please contact Bach McClure, P.E., Lead Stormwater Engineer at (321) 633-2016.

Sincerely,

[Signature]
Virginia Barker, Director
Brevard County Natural Resources Management Department
EXECUTIVE SUMMARY

Project Title: Continuous Monitoring and Adaptive Control (CMAC) Retrofits for Water Quality in Brevard County
Project Applicant: Brevard County Natural Resources Management Department
Partners: OptiRTC; Atkins
Amount of Request: $128,732
Other Funding Sources and Amount of Total Match: In-kind match of $52,742 with OptiRTC, Atkins, and the County. Total match amount: $181,474

Brief Project Description:

- Project description narrative (limit 3 sentences): This project will leverage Continuous Monitoring and Adaptive Control (CMAC) technology to retrofit an existing stormwater pond in Brevard County (“County”). The CMAC retrofit of an existing stormwater pond will provide the County with a reliable and cost-effective means of achieving multiple environmental objectives, including improved water quality and flood mitigation. The overall goal of this proposed project is to evaluate a new technology that can further support restoration of the Indian River Lagoon by reducing impairments caused by stormwater runoff.
- Project Location (Latitude and Longitude): Lat. 28°27'36.01” N, Long. 80°45’48.85” W
- IRL Location Map; Project Boundary Map

- CCMP Action Plans addressed by project: Fresh and Storm Water Discharges; Total Maximum Daily Loads (TMDLs); Climate Change; Public Involvement and Education; Data and Information Management Strategy; Monitoring
- Project Outputs (Deliverables) and Outcomes: Deliverables include quarterly reports and a final report. Expected outcomes include demonstrated reliability of CMAC; improved water quality; greater understanding of effort required to deploy and maintain CMAC facilities; recommended methods to calculate water quality improvements with CMAC
- List of all CCMP Action Plans Addressed by Project: FSD-1; FSD-4; FSD-11; FSD-13; FSD-14 | TMDL-2; TMDL-3 | CC-2; CC-3 | PIE-1; PIE-2; PIE-3; PIE-4; PIE-5 | DIM-3 | MON-1; MON-3
Section 2: Project Specifics

A. Project Goals and Objectives

In an effort to meet their Total Maximum Daily Load (TMDL) requirements, communities in Florida and specifically, those in the Indian River Lagoon, are seeking innovative and cost-effective ways to reach their pollutant load reduction goals while mitigating damaging flood events, such as the 2008 Tropical Storm Fay, which caused over $390M in damage in the region. Since the 1980s, the State of Florida has regulated stormwater discharges in an effort to prevent negative impacts to the environment. It is presumed that stormwater management systems built before the 2006 guidelines established in the Water Resource Implementation Rule under the State of Florida’s Administrative Code do not meet the minimum requirements of 80% reduction of the annual average load of pollutants that would cause or contribute to violations of the state water quality standards. This suggests that existing basins built prior to 2006 are well-suited candidates for retrofit and enhancements.

This project is focused on the implementation of Continuous Monitoring and Adaptive Control (CMAC) technology to retrofit an existing stormwater pond in Brevard County (“County”). CMAC is a reliable, secure, and cost-effective solution that will help accelerate the County’s path to achieving its environmental objectives. CMAC solutions integrate information directly from field deployed sensors with real-time weather forecast data to directly monitor performance and make automated and predictive control decisions to actively manage stormwater storage and flows. A typical CMAC system installation includes a water level sensor, actuated valve, and integrated, cloud-based software that provide dynamic control of stormwater storage and discharge of flows to meet each site’s objectives. Today’s sensor technology also allows for real-time Nitrate and TSS concentration monitoring, which is reliable enough to support calculations of observed pollutant mass load reductions.

The overall goal of this proposed project is to evaluate a new technology that can further support restoration of the Indian River Lagoon by reducing impairments caused by stormwater runoff. Specifically, project objectives and expected outcomes as documented in the final report will include the following:

1. Demonstrate Florida proof-of-concept for CMAC technology, including reliability of forecast-based controls
2. Measure and improve water quality by actively managing wet weather discharge as compared to a passive system
3. Understand the effort needed by the County to deploy and maintain CMAC facilities
4. Provide recommendations for methods to calculate water quality improvements with CMAC

B. Technical Merit/Justification

Background

The proposed CMAC retrofit is located at the Broadway Wet Pond in Brevard County (Lat. 28°27′36.01″N, Long. 80°45′48.85″W). See aerial image below.
The Broadway pond was built in 1998 and was sized to meet 80% of the water quality volume requirement. As shown in the photo above, the site also incurred significant damage during Fay in 2008. In addition to the capacity and water quality challenges, this site was selected as a primary candidate for the following reasons:

- Pond is owned and maintained by the County
- Close proximity and direct discharge to the Indian River Lagoon (0.12 miles)
- Easy access for County staff and maintenance personnel

The site has the following characteristics:

<table>
<thead>
<tr>
<th>Existing Conditions</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drainage Area</td>
<td>67.4 acres</td>
</tr>
<tr>
<td>Impervious Area</td>
<td>10.2 acres</td>
</tr>
<tr>
<td>Permanent Pool Volume</td>
<td>10.0 acre-ft.</td>
</tr>
<tr>
<td>Available CMAC Control Volume</td>
<td>7.3 acre-ft.</td>
</tr>
<tr>
<td>Estimated Nitrogen Load</td>
<td>290 lbs./yr.</td>
</tr>
</tbody>
</table>

In addition to Broadway, Brevard County and Opti have identified two other pond candidates if unforeseen circumstances arise during the design phase. These retrofits are relatively simple and can be installed in a week or two after the design and hardware procurement phase. Given the physical simplicity of the retrofit and backup sites, we are confident this project can be successfully executed (time and budget).

**Technical Justification**

Based on Harper and Herr, wet detention ponds in the St. Johns River Water Management District (SJRWMD) have a Total Nitrogen mean annual mass removal efficiency of 25%. It is our hypothesis that these removal efficiencies can be further improved with minimal BMP enhancements.
BMP Enhancement with CMAC: CMAC enables the stored volume in all ponds to be retained with an actively-controlled release valve to achieve water quality and flood protection improvements. The technique uses water level sensors, an actuated valve, and cloud-based software to make automated, real-time control decisions based on National Weather Service forecast data. Forecast integration allows for an adaptable permanent pool which can combine the existing permanent pool and some or all of the peak attenuation volume. The combined adaptable pool volume would act as the effective permanent pool.

Proposed Calculation Method and Analysis for CMAC: The proposed crediting strategy is based on the “Evaluation of Current Stormwater Design Criteria within the State of Florida” by Dr. Harvey Harper and Dr. David Baker of Environmental Research and Design, Inc. Harper and Baker suggest that the phosphorus and nitrogen removal efficiency of wet detention ponds are a function of detention time.

We propose that BMPs enhanced with CMAC can use a slightly revised detention time equation to account for the benefits of actively controlling available flood storage volume above the permanent pool. The full adaptive permanent pool is equal to the existing permanent pool plus the actively controlled volume. Recognizing that drawing down the actively controlled portion of the full adaptive permanent pool may reduce the effective detention time of the facility, the proposed detention time equation is as follows:

\[ Detention\ time, td \ (\text{days}) = \frac{PPV + aACV}{RO} \times \frac{365\ \text{days}}{\text{year}} \]  

(Equation 4)

\[ PPV = \text{existing permanent pool volume (ac-ft.)} \]

\[ ACV = \text{actively controlled volume above existing permanent pool (ac-ft.)} \]

\[ \alpha = \text{multiplier to account for effects of drawdown on detention time, 0.79} \]

The multiplier, \( \alpha \), has been calculated based on the results of long-term simulation modeling of forecast-based control. The model uses 50 years of rainfall records from Florida to simulate runoff into and discharge from a stormwater basin. The average value of the multiplier, \( \alpha \), is 0.79. This value can be used along with the existing permanent pool, and the new actively controlled volume, to compute the detention time of ponds retrofit with CMAC. Based on this proposed calculation, we expect the following estimated results:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing TN Removal Efficiency</td>
<td>25%</td>
</tr>
<tr>
<td>CMAC TN Removal Efficiency</td>
<td>42%</td>
</tr>
<tr>
<td>Incremental TN Removal</td>
<td>48 lbs./yr.</td>
</tr>
</tbody>
</table>

A similar study, quantifying the water quality improvement of BMP Enhancement with CMAC in the Chesapeake Bay has produced the following results by storm size:

<table>
<thead>
<tr>
<th>Storm Size (in)</th>
<th>Nitrogen Percent Removal</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.30</td>
<td>28%</td>
</tr>
<tr>
<td>0.32</td>
<td>42%</td>
</tr>
<tr>
<td>0.52</td>
<td>48%</td>
</tr>
<tr>
<td>0.79</td>
<td>68%</td>
</tr>
<tr>
<td>1.32</td>
<td>47%</td>
</tr>
</tbody>
</table>
C. Benefit(s) to the IRL
The IRL will experience a direct water quality benefit by more effectively controlling wet weather flows as suggested above. In addition to the water quality benefit, there is 7.3 ac-ft. of controllable volume for more effective flood control. Using a facility’s available storage volume during the peak of the storm is critical and can only truly be achieved with dynamic forecast based controls such as CMAC. This system provides multiple redundancies for failure including existing structural overflows. Given that CMAC is configurable to changes in the watershed and uses the forecast, it is truly a resilient and adaptive system.

D. Local commitment
This project will support the goals of Brevard County’s Save Our Indian River Lagoon Project Plan, which was established as a means for the County to meet its updated TMDL targets. Upon successful implementation of this pilot project, the County may seek additional opportunities to leverage CMAC in order to accelerate its efforts to achieve water quality credits.

E. Project Readiness
Upon award, we are capable of initiating the project with the following expected timeline after a notice to proceed:

<table>
<thead>
<tr>
<th>Task</th>
<th>Proposed Completion Date From Notice to Proceed (NTP)</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design</td>
<td>16 weeks</td>
<td>OptiRTC</td>
</tr>
<tr>
<td>Installation and Deployment</td>
<td>32 weeks</td>
<td>Brevard County</td>
</tr>
<tr>
<td>Maintenance (1 year)</td>
<td>84 weeks</td>
<td>Brevard County</td>
</tr>
<tr>
<td>CMAC Operations (1 year)</td>
<td>84 weeks</td>
<td>OptiRTC</td>
</tr>
<tr>
<td>Final Report</td>
<td>92 weeks</td>
<td>Atkins</td>
</tr>
</tbody>
</table>

Permitting activities shall follow local requirements. CMAC retrofits make use of existing pond storage and convert it to water quality volume, and do not typically require significant excavation or regrading. The land disturbance is limited to trenching conduit runs and pouring a small footer for a support pole. The typical total land disturbance is 500 to 1,000 square feet, which is much less than typical Erosion and Sediment Control Permit thresholds.

F. Project Monitoring/Evaluation and Maintenance Plans
This project will rely heavily on real-time data collection through Opti’s continuous monitoring platform. Stakeholders will have data access in real-time through Opti’s web-based dashboard portal. The system will be run in passive and active modes for comparisons. Threshold alerts will also be provided for targeted maintenance activities. The County will also provide dry and wet weather sampling as calibration during the wet and dry season. The following data streams will be made available in real-time and for project reporting purposes: Level; Flow; Nitrate Concentration; TSS Concentration; Rainfall; Forecast and expected runoff volume.

G. Citizen/Volunteer Engagement and Outreach Components
This project presents several unique opportunities for Brevard County to engage its citizens and community. The County can leverage CMAC to enhance existing education and outreach programs, which include environmental events, homeowner associations presentations, and “Protecting Our Water Resources” presentations at community schools. Through the use of Opti’s public API, the County can also develop innovative ways of displaying how its...
stormwater facilities are performing in real-time and measure its outreach efforts. The real-time data available through the CMAC system provides project stakeholders (i.e. the community, Brevard County, engineers, and regulators) an opportunity to inspect and realize system performance over time. The ability to have insight into real-time site conditions and pond performance will also play a critical role in communicating the benefits of implementing CMAC technology and provide extended opportunities to display its impact.

With proven deployments at elementary schools and universities across the U.S., CMAC provides teachers with a multitude of ways of engaging and educating students on the importance of water resources, including as a tool to collect and analyze performance metrics such as total captured stormwater runoff that provide interactive lessons for visuals and graphs, water resources and hydrology, quantitative learning and statistics, and technology (connected sensors to the environment).

H. Experience and Past Performance
To date, CMAC technology has achieved water quality, flood control, hydromodification, and water reuse objectives at over 130 sites across 21 US states. Please see below for a few project examples:

1. **City of Ormond Beach, FL**
   - Opti’s project with the City of Ormond Beach (in Volusia County, FL) is a component of the City's overall Laurel Creek Pump Station Additions and Improvements Project. The project site is focused on the Laurel Creek Pumps, which controls lake levels for a 75-acre system that consists of five interconnected lakes within the Laurel Creek Drainage Basin Area.
   - The City implemented CMAC technology in order to further minimize the risk of flooding with forecast-based control and to fully take advantage of the storage potential associated with the five interconnected lakes.

2. **Anacostia River Watershed Smart Integrated Stormwater Management Study**
   - Funded by the National Fish and Wildlife Foundation (NFWF) and through a grant administered by the Metropolitan Washington Council of Governments (MWCOG) for $300,000, this project is a multi-jurisdictional collaboration between the District of Columbia, Prince George’s, and Montgomery Counties.
   - CMAC is installed on 1 Wet Pond, 1 Dry Pond, and 1 Bio-swale across 500 impervious acres, with the technology controlling 180 impervious acres.

3. **Philadelphia Water Department Private Retrofit Program**
   - The City of Philadelphia’s Green City, Clean Waters program was implemented as a means to reduce CSOs. The City, through the Philadelphia Water Department (PWD) and Philadelphia Industrial Development Corporation (PIDC), has created the Stormwater Management Incentives Program (SMIP) and the Greened Acre Retrofit Program (GARP) to reduce the price for qualified non-residential PWD customers and contractors to design and install stormwater best management practices.
   - As part of this program, CMAC was implemented on a private site and used to retrofit an underperforming retention pond. During the first 90 days of operation, the CMAC system exceeded PWD’s criteria for wet weather site discharge by completely avoiding wet weather outflow for nearly all rain events. In total, during a period with approximately 1.01 million gallons of runoff generated from 14 storm events, the system prevented 0.97 million gallons of water from entering the combined sewer during wet weather.

I. **Special Requirements – TMDLs; Climate Change; Under-represented Communities.**
Through the use of CMAC, this project will provide a cost-effective means to accelerate the enhancement and conversion of the Broadway, allowing it to receive water quality credits. CMAC enhances and improves stormwater outcomes in several ways, including:
1. Dramatically improving runoff water quality by increasing residence time and/or improving unit process effectiveness (e.g., settling, denitrification).
2. Restoring pre-development hydrology and base flows by actively modulating release rates based on forecast information.
3. Reduce the frequency of flooding events.
4. Being adaptable to future climatic conditions or changes in site characteristics by reconfiguring the software. For example, in response to Hurricane Sandy, CMAC has been adopted by the New York City Economic Development Corporation through its $30 million RISE:NYC program to better prepare for the impacts of climate change.

Section 3: Project Funding
A. Partnership and Cost Sharing

$[128,732] Requested Grant Funds  $[0.00] Match Funds
$[52,742] Value of In-kind Match (volunteer labor time is $22.14/hr.)
Value of In-Kind Match as percentage of Total Project Costs = [29]%

B. Project Budget including in-kind and cash match amounts and source of all funds:

<table>
<thead>
<tr>
<th>Task #</th>
<th>Description</th>
<th>IRL Funding</th>
<th>Cost Share Funding</th>
<th>Total Price</th>
<th>Cost Share Funding Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Design Total</td>
<td>$30,000</td>
<td>$40,000</td>
<td>$70,000</td>
<td>In-kind (OptRTC)</td>
</tr>
<tr>
<td>2</td>
<td>Permitting Total</td>
<td></td>
<td></td>
<td>$0</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Installation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.1</td>
<td>CMAC Hardware Procurement</td>
<td>$53,801</td>
<td>$0</td>
<td>$53,801</td>
<td>In-kind and/or stormwater utility funds</td>
</tr>
<tr>
<td>3.2</td>
<td>Installation Services</td>
<td>$7,500</td>
<td>$10,000</td>
<td>$17,500</td>
<td>(Brevard County)</td>
</tr>
<tr>
<td>3.3</td>
<td>Site Commissioning</td>
<td>$5,000</td>
<td>$0</td>
<td>$5,000</td>
<td></td>
</tr>
<tr>
<td>3.3</td>
<td>Installation Total</td>
<td>$66,301</td>
<td>$10,000</td>
<td>$76,301</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Annual Services</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.1</td>
<td>Continuous Monitoring and Adaptive Control</td>
<td>$5,000</td>
<td>$0</td>
<td>$5,000</td>
<td></td>
</tr>
<tr>
<td>4.2</td>
<td>Maintenance Hardware</td>
<td>$2,500</td>
<td>$0</td>
<td>$2,500</td>
<td></td>
</tr>
<tr>
<td>4.2</td>
<td>Annual Services Total</td>
<td>$7,500</td>
<td>$0</td>
<td>$7,500</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Final Report</td>
<td>$24,931</td>
<td>$2,742</td>
<td>$27,673</td>
<td>In-kind (Atkins)</td>
</tr>
<tr>
<td>6</td>
<td>Grand Total</td>
<td>$128,732</td>
<td>$52,742</td>
<td>$181,474</td>
<td></td>
</tr>
</tbody>
</table>
Statement of Work

Project Name: Continuous Monitoring and Adaptive Control (CMAC) Retrofits for Water Quality in Brevard County

I. Introduction/Background

In an effort to meet their Total Maximum Daily Load (TMDL) requirements, communities in Florida and specifically, those in the Indian River Lagoon, are seeking innovative and cost-effective ways to reach their pollutant load reduction goals while mitigating damaging flood events, such as the 2008 Tropical Storm Fay, which caused over $390M in damage in the region. Since the 1980s, the State of Florida has regulated stormwater discharges in an effort to prevent negative impacts to the environment. It is presumed that stormwater management systems built before the 2006 guidelines established in the Water Resource Implementation Rule under the State of Florida’s Administrative Code do not meet the minimum requirements of 80% reduction of the annual average load of pollutants that would cause or contribute to violations of the state water quality standards. This suggests that existing basins built prior to 2006 are well-suited candidates for retrofit and enhancements.

This project is focused on the implementation of Continuous Monitoring and Adaptive Control (CMAC) technology at a stormwater pond in Brevard County. CMAC represents a cost-effective and secure means of accelerating the enhancement and conversion of existing stormwater facilities and construction of new facilities to significantly improve water quality and mitigate flooding.

II. Objective

Project objectives are to:

- Demonstrate Florida proof-of-concept for CMAC technology, including reliability of forecast-based controls
- Measure and improve water quality by actively managing wet weather discharge as compared to a passive system
- Understand the effort needed by the County to deploy and maintain CMAC facilities
- Provide recommendations for methods to calculate water quality improvements with CMAC

III. Location of Project (narrative and project location map)

The proposed CMAC retrofit is located at the Broadway Wet Pond in Brevard County (Lat. 28°27’36.01” N, Long. 80°45’48.85” W). See aerial image below:
The Broadway pond was built in 1998 and sized to meet 80% of the water quality volume requirement. The site also incurred significant damage during Fay in 2008. In addition to the capacity and water quality challenges, this site was selected as a primary candidate for the following reasons:

- Pond is owned and maintained by the County
- Close proximity and direct discharge to the Indian River Lagoon (0.12 miles)
- Easy access for County staff and maintenance personnel

The site has the following characteristics:

<table>
<thead>
<tr>
<th>Existing Conditions</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drainage Area</td>
<td>67.4 acres</td>
</tr>
<tr>
<td>Impervious Area</td>
<td>10.2 acres</td>
</tr>
<tr>
<td>Permanent Pool Volume</td>
<td>10.0 acre-ft.</td>
</tr>
<tr>
<td>Available CMAC Control Volume</td>
<td>7.3 acre-ft.</td>
</tr>
<tr>
<td>Estimated Nitrogen Load</td>
<td>290 lbs./yr.</td>
</tr>
</tbody>
</table>

In addition to Broadway, Brevard County and Opti have identified two other pond candidates if unforeseen circumstances arise during the design phase. These retrofits are relatively simple and can be installed in a week or two after the design and hardware procurement phase. Given the physical simplicity of the retrofit and backup sites, we are confident this project can be successfully executed (time and budget).

IV. Scope of Work

1. Design

   * **Modeling and Calculations**

   - A CMAC retrofit requires simple routing and drawdown calculations to design and ensure safe, optimized performance. Excavation and regrading are not required, allowing as-built grading plans,
verified with spot surveys, to be used as input data. The following calculations will be performed for each CMAC retrofit:

- Maximum drawdown time of the controllable volume (i.e. the volume between the valve invert elevation and the riser top elevation)
- Peak flow and water surface elevation for a range of design storms to ensure safe operation of the system during flood events.

**Design Plans and Specifications**

Opti will provide a conceptual design for selected projects, including the following components:

- Project Overview
- Scope of Work for Installation of Hardware
- Existing Conditions
- Proposed Conditions
  - Locations of major hardware components
  - Location of conduit runs for major hardware components
  - Standard installation details of hardware procured by Opti
  - Electrical connection schedule
- Hardware Specifications and Procurement List

**Software Configuration**

Control logic exists both locally on the Opti Control Panel and in the cloud as part of the CMAC solution. Both will be configured to achieve the control objectives. During software configuration, Opti defines control configuration settings and simulates the expected behavior before deploying the software and enabling it to control the actuated valve.

Based on the simulation results, Opti will deploy the site-specific software configuration, enabling automatic software control and remote manual control of the actuated valve. This is done in coordination with Site Commissioning, which is a separate task performed to verify installation and measurements.

Once the system has passed all of the checks for commissioning, it will be ready to operate and users can be invited to view the Opti Portal Dashboard.

The primary way that users interact with Opti’s software and an actively controlled site is through the Opti Portal Dashboard. Opti will configure the real-time display information and graphs on the dashboard, and set up user accounts for all stakeholders. Stakeholders can have either View Only or Control permissions, as appropriate. The Dashboard includes the following information:

- System Control Pod, providing remote control of the operation mode and valve state
- System Status Pod, providing information about the current and recent cell data connectivity and operation mode
- Storm Status Pod, providing information about upcoming precipitation events
• Forecast graph looking forward 48 hours
• Time series, updating in real-time, for:
  ■ Current water level and relevant thresholds
  ■ Current stored volume and relevant thresholds
  ■ Target flow rates and valve states

2. Permitting
Permitting activities shall follow local requirements. CMAC retrofits make use of existing pond storage and convert it to water quality volume, and do not typically require significant excavation or regrading. The land disturbance is limited to trenching conduit runs and pouring a small footer for a support pole. The typical total land disturbance is 500 to 1,000 square feet, which is much less than typical Erosion and Sediment Control Permit thresholds. Prior to proceeding with the CMAC project, the County shall notify Opti of other expected permitting requirements not included in this scope of work.

3. Installation

**CMAC Hardware Procurement**
- One (1) pre-configured Opti Control Panel, which includes all components necessary to remotely control stormwater facilities using Opti’s CMAC technology. The Opti Control Panel communicates over cellular networks, and is outdoor-rated.
- One (1) - Solar Power Kit
- One (1) - Actuated Valve
- One (1) - Water Level Sensor
- One (1) - Nitrate Sensor
- One (1) – TSS Sensor
- One (1) - Tipping bucket rain gauge

**Installation Services**
Opti and Brevard County will work together to complete the retrofit installations. CMAC retrofits can typically be completed within one week with hand tools. When site conditions permit, a mini-excavator may be used to dig the conduit trenches. All materials needed to complete the installation will be procured by Opti and Brevard County.

The following steps summarize a CMAC retrofit and are representative of what will be required for each of the stormwater pond retrofit sites included in this proposal. Sites may require varying levels of debris removal and outlet structure upgrades. On-site steps to complete CMAC retrofits include the following:
● Mobilization
● Site preparation - debris clearing, sediment and erosion controls
● Support pole installation; Opti control panel and solar power kit mounting
● Outlet structure modification (core orifice as needed)
  a) Install valve and actuator in outlet structure
  b) Install pressure transducer and stilling well within pond basin
  c) Supply and install trash rack upstream of valve, as needed
● Electrical
  a) Supply conduit and associated electrical components
  b) Trench conduit runs from Opti control panel to outlet structure and from outlet structure to pressure transducer location
  c) Pull cables through conduit runs and fill/patch trenches
  d) Terminate signal and power cables at Opti control panel and seal all connections
● Seed and mulch disturbed area

4. Site Commissioning and Quality Assurance Check
Once installation is complete, Opti will provide on-site commissioning. Site commissioning includes inspection of the installation, calibration of the system, and onsite system testing. Commissioning follows these steps:

● Inspect installation of all site hardware: actuated valve, water level sensor, Opti control panel, power system, conduit sealing, and mounting
● Calibration of system equipment: water level sensor and valve actuator
● Testing of system equipment: local and remote valve actuation, accurate water level sensing
● Testing of web dashboard functionality
● Post-commissioning documentation
  ■ Commissioning Report
  ■ Operations and Maintenance Manual

5. Annual Services
Continuous Monitoring and Adaptive Control (CMAC)
Following the commissioning, Opti will begin the system optimization period, which is an opportunity to observe the watershed response, behavior of the stormwater pond, and the potential control decisions. The optimization period plan will be discussed with the County during the system launch meeting. Opti will provide the County with a one (1) year license for CMAC services including: 24/7 always ON system-wide monitoring and control, expert engineering support, real-time dashboard access, and manual control capabilities.
Maintenance

Brevard County will continue to be responsible for structural and aesthetic maintenance of the Broadway Pond. In addition to traditional maintenance activities listed above, Broadway will also be responsible for the following associated control hardware at their respective inspection schedules:

<table>
<thead>
<tr>
<th>Hardware Component</th>
<th>Frequency and task</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opti Control Panel</td>
<td>Spring and fall inspection</td>
</tr>
<tr>
<td>Water Level Sensor</td>
<td>Spring and fall inspection and cleaning</td>
</tr>
<tr>
<td>Actuated Valve</td>
<td>Spring and fall, testing, and cleaning</td>
</tr>
</tbody>
</table>

Unscheduled maintenance may be required on occasion. Troubleshooting and unscheduled maintenance needs can be facilitated by system alarms, the Opti dashboard portal, and Opti engineering support.
V. **Task Identification**

The County shall complete the following tasks:

1. **Quarterly Progress Reports.** Quarterly progress reports will be submitted starting after the first quarter following contract execution and continuing to project completion. The reports will contain a description of activities that occurred during that quarter and a summary of activities that occurred during that quarter and a summary of activities expected to occur the next quarter. Analyses, completed during the quarter, will be included in the report and delivered electronically to the Council office.

2. **Project Administration and Final Report.** After the completion of 100 percent of the project, a draft Project Final Report will be submitted for review; comments received from the reviewer will be addressed to create a Project Final Report. The report, including all collected data, will be delivered electronically to the Council office. The report will include the following topics and analyses:
   
   I. Discussion of the project background, objectives, and approach
   
   II. Description of the basin contributing to the detention pond, including an estimate of the average annual total nitrogen (TN) loading into the pond using the methodology from Harper, 2007.
   
   III. Calculation of expected TN removal based on theoretical residence time using the methodology from Harper, 2007
   
   IV. Using monitoring data from the CMAC installation,
      
      a) Calculation of the actual average residence time and TN removal under passive control
      
      b) Calculation of the actual average residence time and TN removal under active control
c) Calculation of annualized additional residence time and nitrogen removal using the CMAC control system

d) Calculation of annualized pollutant removal based on real-time nitrate sensor

VI. Deliverables and Time Frames

<table>
<thead>
<tr>
<th>Deliverable</th>
<th>Time Frame</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quarterly Reports</td>
<td>Quarterly until project has been in operation for 1-year</td>
</tr>
<tr>
<td>Final Report</td>
<td>Estimated: 92 weeks after NTP or sooner</td>
</tr>
</tbody>
</table>

VII. Budget

<table>
<thead>
<tr>
<th>Task #</th>
<th>Description</th>
<th>IRL Funding</th>
<th>Cost Share Funding</th>
<th>Total Price</th>
<th>Cost Share Funding Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Design Total</td>
<td>$30,000</td>
<td>$40,000</td>
<td>$70,000</td>
<td>in-kind (OptRTC)</td>
</tr>
<tr>
<td>2</td>
<td>Permitting Total</td>
<td>$0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Installation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.1</td>
<td>CMAC Hardware Procurement</td>
<td>$53,801</td>
<td>$0</td>
<td>$53,801</td>
<td>in-kind and/or stormwater utility funds (Brevard County)</td>
</tr>
<tr>
<td>3.2</td>
<td>Installation Services</td>
<td>$7,500</td>
<td>$10,000</td>
<td>$17,500</td>
<td></td>
</tr>
<tr>
<td>3.3</td>
<td>Site Commissioning</td>
<td>$5,000</td>
<td>$0</td>
<td>$5,000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Installation Total</td>
<td>$66,301</td>
<td>$10,000</td>
<td>$76,301</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Annual Services</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.1</td>
<td>Continuous Monitoring and Adaptive Control</td>
<td>$5,000</td>
<td>$0</td>
<td>$5,000</td>
<td>in-kind (Atkins)</td>
</tr>
<tr>
<td>4.2</td>
<td>Maintenance Hardware</td>
<td>$2,500</td>
<td>$0</td>
<td>$2,500</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Annual Services Total</td>
<td>$7,500</td>
<td>$0</td>
<td>$7,500</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Final Report</td>
<td>$24,931</td>
<td>$2,742</td>
<td>$27,673</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Grand Total</td>
<td>$128,732</td>
<td>$52,742</td>
<td>$181,474</td>
<td></td>
</tr>
</tbody>
</table>