Quarterly Progress Report:
Project Number and Title: 4-7, Integrated Green Infrastructure and Sustainable Transportation Planning
Research Area: Thrust Are 4
PI: *Christopher Hunter, University of Rhode Island*
Co-PI(s): *Farhad Atash, University of Rhode Island*
Reporting Period: October 1, 2019 – Dec 31, 2019
Submission Date: 2/27/2020

Overview: (Please answer each question individually)

We continued to examine the literature on Green Infrastructure Practices for potential impact on reduction of stormwater runoff trying to find quantifiable values:

- On community or site scale level
- On regional scale
    - With the intention of identifying concepts, principles, and benefits

We investigated issues dealing with Serviceability and

These activities will help us work toward a projection of how much potential there is for extending the life of the infrastructure.

We have been able to develop our initial literature review write-up, but certainly there is more to ascertain with trying to find quantifiable evidence of impacts when using green infrastructure.

We have begun to look into parameters that can be involved in modeling issues as we try to connect the ability to extend the serviceability life of the transportation infrastructure. Models were looked into that represented different portions of transportation infrastructure and reflected a reduction curve over time.

Table 1: Task Progress

Task Number	Start Date	End Date	% Complete
Task 1: Investigate Green Infrastructure (GI) practices at the community and site scale(concepts, principles and benefits)	7/1/2019	6/30/2020	50%
Task 2: Investigate GI practices at regional scale(concepts, principles, and benefits)	7/1/2019	6/30/2020	50%
Task 3: Identify specific set of infrastructure parameters to use for performance analysis and identify a modeling approach or apply asset management software to apply to strategies that align with GI best practices at different scales.	10/2019	6/30/2020	20%
Overall Project:	7/1/2019	6/30/2020	

Table 2: Budget Progress		
Project Budget	**Spend – Project to Date**	**% Project to Date***
108,000 (2yrs)	$16,000	15% spent

Include the date the budget is current to.

Describe any opportunities for training/professional development that have been provided…

Describe any activities involving the dissemination of research results (be sure to include outputs, outcomes, and the ways in which the outcomes/outputs have had an impact during the reporting period. Please use the tables below for any Publications and Presentations in addition to the description of any other technology transfer efforts that took place during the reporting period.)… Use the tables below to complete information about conferences, workshops, publications, etc. ***List all other outputs, outcomes, and impacts after the tables*** *(i.e. patent applications, technologies, techniques, licenses issued, and/or website addresses used to disseminate research findings).*

Table 3: Presentations at Conferences, Workshops, Seminars, and Other Events				
Title	**Event**	**Type**	**Location**	**Date(s)**
Integrated Green Infrastructure and Sustainable Transportation Planning	University of Rhode Island Annual Transportation Forum	Conference/Forum	Kingston, RI @ URI	10/25/2019

Table 4: Publications and Submitted Papers and Reports				
Type	**Title**	**Citation**	**Date**	**Status**
N/A				

Participants and Collaborators:

Use the table below to list all individuals who have worked on the project.

Table 5: Active Principal Investigators, faculty, administrators, and Management Team Members			
Individual Name	**Email Address**	**Department**	**Role in Research**
Christopher D. Hunter	cdhunter@uri.edu	Civil & Environmental Engineering	PI
Farhad Atash	fatash@uri.edu	Landscape Architecture	Co-PI

Use the table below to list all students who have participated in the project during the reporting. (This includes all paid, unpaid, intern, independent study, or any other student that participated in this project.)

Table 6: Student Participants during the reporting period				
Student Name	**Email Address**	**Class**	**Major**	**Role in research**
None during the time period.				

Use the table below to list any students who worked on this project and graduated during this reporting period.

Table 7: Student Graduates			
Student Name	**Role in Research**	**Degree**	**Graduation Date**
None.			

Use the table below to list organizations have been involved as partners on this project and their contribution to the project.

Table 8: Research Project Collaborators during the reporting period						
Organization	**Location**	**Contribution to the Project**				
		Financial Support	**In-Kind Support**	**Facilities**	**Collaborative Research**	**Personnel Exchanges**
None.						

List all other outputs, outcomes, and impacts here (i.e. patent applications, technologies, techniques, licenses issued, and/or website addresses used to disseminate research findings). Please be sure to provide detailed information about each item as with the tables above.

Have other collaborators or contacts been involved? If so, who and how? (This would include collaborations with others within the lead or partner universities; especially interdepartmental or interdisciplinary collaborations.)

Table 9: Other Collaborators			
Collaborator Name and Title	**Contact Information**	**Organization and Department**	**Contribution to Research**
Kate Wilson	kate.wilson@dot.ri.gov	RIDOT/Design	Technical Champion

Who is the Technical Champion for this project?
Name: Kate Wilson
Title: Principal Civil Engineer
Organization: Rhode Island Department of Transportation
Location (City & State): Providence, RI
Email Address:kate.wilson@dot.ri.gov

Changes:

We did not have a student working with us, but we have gotten access to a Ph.D. student, who has an environmental engineering background from his Masters Degree, and he is helping us move forward.

We are looking into issues with drainage as well as the overall green infrastructure to see if that will give us another way to look at the problem. Whatever the drainage or runoff issue is, it has an impact on the infrastructure in its environment.

Planned Activities:

The future activities are involved in integrating how we can best use the student to provide the linkages between an estimated impact of green infrastructure on transportation infrastructure. We have been in contact with the Aquidneck Island Planning Commission and their attempts to transform there West Side of the Island to deal with resiliency.

Quarterly Progress Report:
Project Number and Title: 4-7, Integrated Green Infrastructure and Sustainable Transportation Planning
Research Area: Thrust Area 4
PI: *Christopher Hunter, University of Rhode Island*
Co-PI(s): *Farhad Atash, University of Rhode Island*
Reporting Period: January 1, 2020 – March 31, 2020
Submission Date: 3/31/2020

Overview:

We continued to examine the literature on Green Infrastructure Practices for potential impact on reduction of stormwater runoff trying to find quantifiable values:

- On community or site scale level
- On regional scale
    - With the intention of identifying concepts, principles, and benefits

These activities will help us work toward a projection of how much potential there is for extending the life of the infrastructure.

We have been able to develop our initial literature review write-up, but certainly there is more to ascertain with trying to find quantifiable evidence of impacts when using green infrastructure.

We have begun to look into parameters that can be involved in modeling issues as we try to connect the ability to extend the serviceability life of the transportation infrastructure. Hazard-based models were looked into that could help represent reduced serviceability of transportation infrastructure.

Table 1: Task Progress

Task Number	Start Date	End Date	% Complete
Task 1:Investigate Green Infrastructure (GI) practices at the community and site scale(concepts, principles and benefits)	7/1/2019	6/30/2020	60%
Task 2:Investigate GI practices at regional scale(concepts, principles, and benefits)	7/1/2019	6/30/2020	60%
Task 3: Identify specific set of infrastructure parameters to use for performance analysis and identify a modeling approach or apply asset management software to apply to strategies that align with GI best practices at different scales.	10/2019	6/30/2020	25%
Overall Project:	7/1/2019	6/30/2020	

Table 2: Budget Progress

Project Budget	Spend – Project to Date	% Project to Date*
108,000 (2yrs)	$16,000	15% spent

Include the date the budget is current to.

Describe any opportunities for training/professional development that have been provided…

Describe any activities involving the dissemination of research results (be sure to include outputs, outcomes, and the ways in which the outcomes/outputs have had an impact during the reporting period. Please use the tables below for any Publications and Presentations in addition to the description of any other technology transfer efforts that took place during the reporting period.)… Use the tables below to complete information about conferences, workshops,

publications, etc. ***List all other outputs, outcomes, and impacts after the tables*** *(i.e. patent applications, technologies, techniques, licenses issued, and/or website addresses used to disseminate research findings).*

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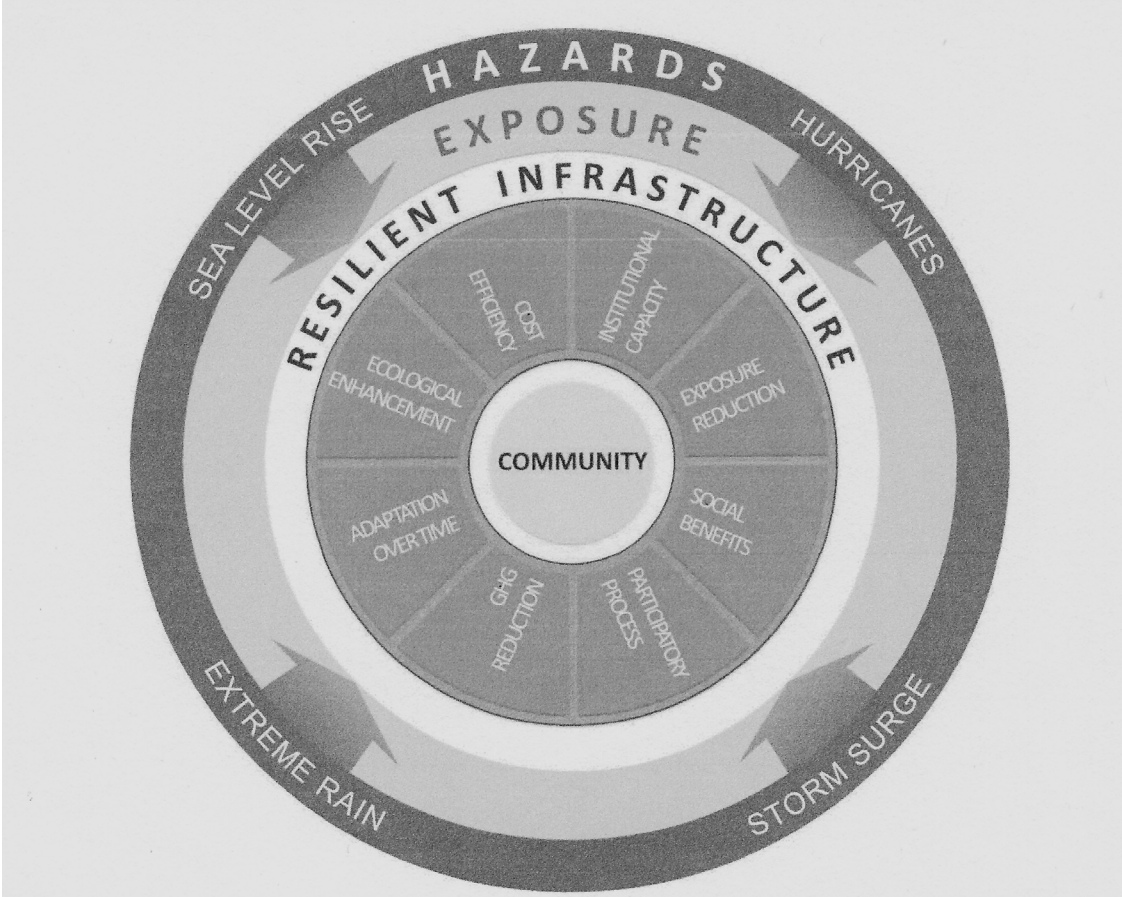

Figure 3. Adaptive Gradients as dimensions of holistic project assessment. Resilient infrastructure protects coastal communities from current and future hazards by reducing exposure while achieving multiple goals. Emerging practices focus on hybrid projects, which may include green (ecosystem based), grey (traditional built infrastructure), and non-structural (zoning, building codes, governance) components. The Adaptive Gradients, shown as the inner wheel, summarize the various dimensions of project success. Outcomes can be measured by contributions to exposure reduction, institutional capacity, cost efficiency, ecological enhancement, adaptation over time, greenhouse gas reduction, participatory process, and social benefits. Investing in the expansion of coastal defenses and incentivizing collaboration between integrated spheres of influence results in better buffering of the community from hazards and uplift to other goals. Evaluation across all these measures will encourage adoption of more complete and community-appropriate resiliency interventions, both currently and as climate changes over time.

Participants and Collaborators:

Use the table below to list all individuals who have worked on the project.

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Table 6: Student Participants during the reporting period				
Student Name	**Email Address**	**Class**	**Major**	**Role in research**
Mohammed Alotaibi		Graduate student, 1st Yr. Ph.D. student	Civil Engineering	Assisting in identifying green infrastructure deployment and investigating potential modeling

Use the table below to list any students who worked on this project and graduated during this reporting period.

Table 7: Student Graduates			
Student Name	**Role in Research**	**Degree**	**Graduation Date**
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Have other collaborators or contacts been involved? If so, who and how? (This would include collaborations with others within the lead or partner universities; especially interdepartmental or interdisciplinary collaborations.)

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Kate Wilson	kate.wilson@dot.ri.gov	RIDOT/Design	Technical Champion

Who is the Technical Champion for this project?
Name: Kate Wilson
Title: Principal Civil Engineer
Organization: Rhode Island Department of Transportation
Location (City & State): Providence, RI
Email Address:kate.wilson@dot.ri.gov

Changes:

This quarter, we gained access to a Ph.D. student, Mohammed Alotaibi, who has an environmental engineering background from his Masters Degree, and he was helping us move forward. He helped with our presentation at the Thrust Area 4 presentation, but was withdrawn from the university shortly after that.

We are currently looking into the possibility of working with another existing graduate student who may be able to assist us through the summer and the possibility of bringing on a new graduate or undergraduate student full-time over the summer to help us complete our tasks. They would be able to work with us through remote contact and weekly tasks.

We are looking into issues with drainage as well as the overall green infrastructure to see if that will give us another way to look at the problem. Whatever the drainage or runoff issue is, it has an impact on the infrastructure in its environment. Also, we have run across a potential assessment tool that may give us some further look into the overall transportation planning and green infrastructure process.

Planned Activities:

The future activities are involved in integrating how we can best use the student to provide the linkages between an estimated impacts of green infrastructure on transportation infrastructure. We have been in contact with the Aquidneck Island Planning Commission and their attempts to transform there West Side of the Island to deal with resiliency. We are now looking into a concept called the Adaptive Gradients Framework from research associated with Coastal Resiliency, where we may be able to tie efforts into the West Side Aquidneck Island project.

We obviously still have more work to do with the stated Tasks, but these activities are believed to help us pull the ideas together.

The figure that is embedded with Figure 3 on Adaptive Gradients comes from the following journal article.

Hamin, Elizabeth, A. Yaser, M. Dilthy, et al. Pathways to Coastal Resiliency: The Adaptive Gradients Framework. Sustainability. July 26, 2018, Volume 10, 2629. (www.mdpi.com/journal/sustainability)