REACHING STUDENTS IN THE CHESAPEAKE BAY REGION:

A Study on the Feasibility of Replicating Ocean Discovery Institute's Model

Final Report

April 30, 2015

By
Sarah Schoedinger, NOAA Office of Education
John Dillow, Orenda Associates
Shara Fisler, Ocean Discovery Institute
Lindsay Goodwin, Ocean Discovery Institute
Carla Pisbe, Ocean Discovery Institute
MacKenzie Sandy, Ocean Discovery Institute

Table of Contents

List of Figures

List of Tables

Abstract

"Reaching Students in the Chesapeake Bay Region" focuses on a planning effort to replicate Ocean Discovery Institute's successful program model, which cultivates a new generation of science and conservation leaders from populations that are traditionally under-represented in Science, Technology, Engineering and Mathematics (STEM) fields. In order to increase the impact of this model, Ocean Discovery Institute planned to expand operations locally in San Diego, California and nationally through replication in other urban watersheds. With support from NOAA's B-WET Program, Ocean Discovery Institute embarked on a study to investigate the feasibility of replication in the Chesapeake Bay's watershed. A team was assembled to pursue two lines of inquiry: (1) "Which replication strategy will be most successful?" and (2) "Which location, if any, would enable implementation of the model to succeed?" The team utilized instinct based on experience and data from multiple sources; including online demographic and organizational data, interviews, literature, and site visits; to make decisions throughout the study. With regard to replication strategy, the team concluded that a parent-affiliate structure would best support implementation of the model in San Diego and other urban underserved communities. This replication strategy required Ocean Discovery Institute to expand their program model to a more fully fleshed out business model that focuses on essential components that are required for success but allow for adaptation to local conditions. With regard to location, three urban areas were considered - Baltimore, Maryland; Washington, DC; and Hampton Roads, Virginia. Based on the similarity of community/student characteristics to the benchmark high school in San Diego; breadth of community-based, academic and STEM industry partners; funding capacity; and the degree of openness and interest demonstrated by all stakeholders in the region, the team selected the Booker T. Washington school-shed in Norfolk, Virginia as the best location for the first attempt at replication. A framework articulating specific objectives related to funding, development of organizational infrastructure, and program development will guide implementation from now through the start-up of operations in Norfolk. Securing funding will likely be the primary driver of the rate of implementation and, therefore, this should be an immediate priority. Ultimately, fidelity to the model is more important than meeting the estimated timeline. Success in San Diego, Norfolk, and any future sites, will depend upon this.

Executive Summary

Background on Project

This project, titled "Reaching Students in the Chesapeake Bay Region," focuses on a planning effort to replicate a successful model that recruits and retains underserved youth from urban communities in science, technology, engineering and mathematics (STEM). Currently, Ocean Discovery Institute provides tuition-free (but not commitment-free) programming to students within a single high-poverty, ethnically diverse community – City Heights in San Diego, California. This model engages students in rigorous educational, scientific research, and environmental stewardship experiences as they grow from curious youngsters to young adults who will make a difference as science and conservation leaders. Ocean Discovery Institute's model has demonstrated significant impacts on student achievement. Nine of the 13 elementary schools served by Ocean Discovery Institute have demonstrated increased scores on their state standardized tests during the course of their involvement with the program. Further, while nationally 1 in 10 low-income, first-generation college students earn a degree, 8 of 10 high school students in Ocean Discovery Institute's programs earn a bachelor's degree within 5 years. Sixty percent of those graduates have majored in science or conservation fields.

Figure 1. Third grade students begin on their path to science and conservation leadership, exploring their curiosities and gaining scientific understanding and skills as they perform a sea star dissection.

Figure 2. Locations in the continental United States where Ocean Discovery Institute may replicate. Black logos are locations that have not yet been investigated. Blue logo in CA represents the San Diego location.

Because of these achievements, Ocean Discovery Institute's model has received national recognition for its success in cultivating a new generation of leaders from populations that are traditionally under-represented in STEM fields and living in an urban, high-poverty community. Twelve years after our founding, Ocean Discovery Institute was awarded The White House's 2011 Presidential Award for Science, Mathematics, and Engineering Mentoring.

The planning to expand the impact of Ocean Discovery Institute's programs began in 2008. Back then the idea of increasing the scale of operations on both local and national levels began to take shape, all with the goal of reaching more underserved, urban youth. The strategy for local expansion has been focused on building the Living Lab, a place in the City Heights neighborhood where youth and their families from the community can learn about and participate in science and conservation activities. The strategy for national expansion focused on replication[1] of Ocean Discovery Institute's model in a number of US urban communities (Figure 2).

As part of a growing partnership with Ocean Discovery Institute, staff from the National Oceanic and Atmospheric Administration (NOAA) approached Ocean Discovery Institute's leadership to explore the possibility of replicating the model in the Chesapeake Bay region because Ocean Discovery Institute's model addresses NOAA's educational goals to improve environmental literacy and diversify the US workforce in fields related to NOAA's mission. Further, the model could fill an existing gap in STEM education and workforce development in urban centers throughout the region. With support from NOAA's B-WET Program in 2013, Ocean Discovery Institute embarked on a study to investigate feasibility of replicating their model in an urban center within the Chesapeake Bay's watershed. The three urban areas considered were Baltimore, Maryland; Washington, DC; and Hampton Roads, Virginia.

Methodology

To assess whether replication of the model was feasible in the Chesapeake Bay region, Ocean Discovery Institute assembled a team of staff members, consultants, and advisors who collectively pursued two lines of inquiry: (1) "Which replication strategy will be most successful?" and (2) "Which location, if any, would enable implementation of the model to succeed?" These two questions were investigated more or less simultaneously but relied on different methods and sources of data, including publicly available online data on demographics and organizations, stakeholder interviews, and site visits to the region. Additionally, the research was grounded by a review of the literature on replication of non-profit organizations, internal evaluation of Ocean Discovery Institute's model, and a review of case studies of non-profit educational or workforce development organizations that have successfully replicated in the United States. The team utilized these data, as well as their instincts based on experience, to make decisions throughout the study.

Findings Regarding Replication Strategy

At the outset of this study, the replication team assumed that the best strategy for replication in the Chesapeake Bay would be to find a local partner that would adopt and adapt Ocean Discovery Institute's model. However, nine months into the study, that assumption was proven wrong. This meant that the team's investigations with potential partners would focus on partners who might assist with programming but not full adoption of the model. The team had to shift the approach from adoption by a partner to setting up a whole new organization. Therefore, in order for replication to occur,

[1] For the purposes of this project, replication is "the transfer to a different location of test concept, a pilot project, a small enterprise, and so forth, in order to repeat success elsewhere", and is also sometimes referred to as "scale-out" (Creech 2008).

the organizational structure of Ocean Discovery Institute must transition to one with a parent organization and local affiliates (Figure 3). Once this occurs, the existing San Diego-based organization will become an affiliate, Norfolk may be established as the second affiliate, and other sites may follow. This shift in approach also meant that Ocean Discovery Institute needed to expand their program model to a more fully fleshed out business model that could guide work in San Diego but also development of new organizations in other geographical locations. The business model has been designed to maintain fidelity to aspects that are essential for reaching and sustaining success regardless of location. These essential components include: the organizational culture founded on the unshakeable belief in young people's ability to transform their lives; the systems that support operations; the cost structure and resources needed to sustain operations; and the programs that result in transformational impacts on the students and their community. But the model also requires adaptation to local conditions including the needs and assets of the community being served.

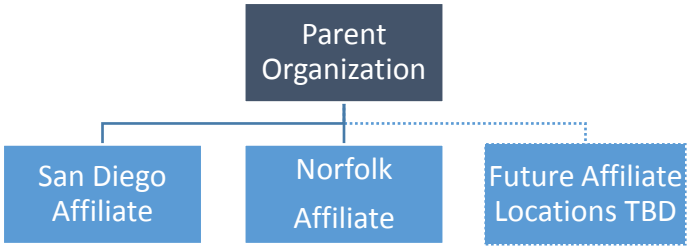


Figure 3. Recommended new structure of Ocean Discovery Institute that will support replication in new locations nationally and expansion within San Diego's City Heights community.

Findings Regarding Location for Replication

Baltimore, Washington, and Hampton Roads all have high-poverty communities that would benefit from Ocean Discovery Institute's model, but the degree of openness and interest uniquely demonstrated by potential partners in Hampton Roads led the team to narrow their investigation to that area.
To assess feasibility in this region, research focused on potential partners and sources of funding from Hampton Roads. The team concluded that Norfolk has the breadth of community-based, academic, and STEM industry partners with the capacity and interest to support Ocean Discovery Institute's model. The region also has the funding capacity to sustain operations of a Norfolk affiliate once it is established. It is projected that this affiliate can be self-sufficient from the initial implementation period onward, but this must be verified by the Norfolk board of directors once it is established. Further, the Norfolk Redevelopment and Housing Authority is one partner that will be critical during the early stages of replication because, as a community-based organization, they can be a champion, opening doors for Ocean Discovery Institute to a wide range of stakeholders in the area. These factors led the team to conclude that Norfolk would be the best location for the first attempt at replication.

Within Norfolk, the Booker T. Washington High School feeder pattern has been identified as the school-shed[2], which includes the housing projects of Young Terrace and Tidewater Gardens, managed by Norfolk Redevelopment and Housing Authority. Why the Booker T. Washington school-shed? The demographics of the student population were closest to the benchmark school-shed, Hoover High School in San Diego, with respect to racial diversity, the size of the student population, the percentage of students qualifying for Federal free or reduced lunch, the high school graduation rate, and the academic proficiency scores. In addition, input from the Deputy Superintendent of Norfolk Public Schools and representatives of the Norfolk Redevelopment and Housing Authority confirmed that the Booker T. Washington school-shed has the greatest need for Ocean Discovery Institute's model.

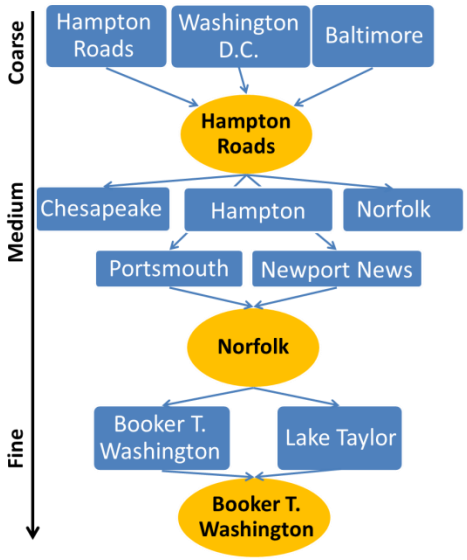


Figure 4. A schematic showing how the team's focus narrowed over the course of the feasibility study.

Conclusions

Replication in the Chesapeake Bay region is feasible, and Norfolk, Virginia and Booker T. Washington High School's school-shed are the best places to start. It is recommended that replication in this city and school-shed proceeds in accordance with Ocean Discovery Institute's Replication Strategy Matrix (Appendix I), which is a framework for implementation from now through early years of program implementation in Norfolk. This framework is divided into distinct phases of implementation containing groups of objectives (fundraising, organizational infrastructure, and program development) that must be met before the next phase begins. The
following considerations should guide how the objectives of Ocean Discovery Institute's replication strategy are implemented in the coming year:

1. The Replication Task Force of Ocean Discovery Institute's Board of Directors should remain in place to ensure that objectives are met before the next phase begins. The full Board should be kept informed of progress, particularly as each phase concludes.

2. Ocean Discovery Institute's relationship with NOAA (codified in a memorandum of understanding signed in January 2015) should be leveraged to ensure that NOAA's assets and capabilities are appropriately integrated as replication unfolds.

[2] A school-shed is defined as the area in which all of the young people "flow" into a single high school. It is how Ocean Discovery Institute defines the geographical extent of the community to be served by their model.

3. Additional advisors and consultants should be integrated as needed to provide expertise not present among staff and Replication Task Force to develop the parent organization's business model and the materials the parent organization will provide to the Norfolk affiliate.

4. A strong communications plan should be developed to ensure existing relationships with partners and potential partners in Norfolk continue to be fostered.

5. Norfolk relationships should be the primary mechanism for identifying potential board members.

6. Start-up funding must rely on national funders to support (1) Ocean Discovery San Diego growing to reach its entire school-shed, (2) the establishment of a parent organization, and (3) the establishment of the Norfolk affiliate so that it is ready to begin operations.

7. Securing funding for each phase will likely be the primary driver of the rate of implementation and, therefore, embarking upon the national funding strategy should be an immediate priority.

8. Ultimately, fidelity to the model is more important than meeting the estimated timeline. Success in San Diego, Norfolk, and any future sites, will depend upon this.

Reaching Students in the Chesapeake Bay Region – A Replication Project

Introduction

History of the Project

This project, titled "Reaching Students in the Chesapeake Bay Region," focuses on a planning effort to replicate a successful program that recruits and retains underserved youth from urban communities in science, technology, engineering and mathematics (STEM). Ocean Discovery Institute's model has received national recognition for its success in cultivating a new generation of leaders from populations that are traditionally under-represented in STEM fields and living in an urban, high-poverty community. With support from the National Oceanic and Atmospheric Administration (NOAA), Ocean Discovery Institute has been studying the feasibility of replicating their model of programs in an urban center within the Chesapeake Bay's watershed.

The planning to expand the impact of Ocean Discovery Institute's programs began in 2008. Back then the idea of increasing the scale of operations on both local and national levels began to take shape, all with the goal of reaching more underserved, urban youth. The strategy for local expansion has been focused on building the Living Lab[3], a place in the City Heights neighborhood of San Diego, California where youth from the community and their families can learn about and participate in science and conservation activities. This strategy is based on a thoughtful analysis by board members and staff examining the need within San Diego's City Heights neighborhood (with 20,000 underserved residents under the age of 18), the capacity of the organization to achieve desired outcomes with a much larger population of students, and the capacity of the San Diego area to provide the resources to do so.

Figure 5. Locations in the continental United States where Ocean Discovery Institute may replicate its model. Black logos are locations that have not yet been investigated.Blue logo in California represents the San Diego location.

[3] Ocean Discovery Institute will build a permanent facility in the heart of this community, allowing Ocean Discovery Institute to reach every child in the school-shed. This will be the Living Lab, a state-of-the-art facility that will enable 20,000 young people to be engaged annually, increase quality of programming, and set the expectations the young people deserve.

The strategy for national expansion focused on replication[4] of Ocean Discovery Institute's model in a number of US urban communities (Figure 5). Although both strategies were developed at the same time by the organization's board of directors and staff with input from local stakeholders, implementation initially focused on local scaling. Once expansion of the organization's capacity within San Diego was well underway, the organization was able to consider model replication in another region.

While continuing to refine its model, measure program impact, and make progress on building the Living Lab in City Heights, the organization's leadership met with the leadership of NOAA's Office of Education in February 2011 to discuss opportunities to expand collaborations between the two organizations. NOAA had recently created a 20-year strategic plan that outlined two main goals: (1) improving public environmental literacy and (2) creating a diverse workforce in scientific and engineering fields related to NOAA's mission. Thus, the educational goals of both Ocean Discovery Institute and NOAA were well aligned. Further, Ocean Discovery Institute already had ongoing, strong collaborations with NOAA's National Marine Fisheries Service that involved high school students in authentic scientific research, so it was logical to all parties to explore a deeper partnership. At that same time, Ocean Discovery Institute was in the midst of planning the design of the Living Lab in City Heights; NOAA's Office of Education assisted in recruiting scientists whose expertise was needed for the Living Lab design workshops in June and September of that year.

The Living Lab workshops provided participants from NOAA with a deeper understanding of, and appreciation for, Ocean Discovery Institute's impacts on urban and underserved youth. In September 2011, at the end of the second Living Lab workshop, representatives from NOAA's Office of Education, NOAA's Chesapeake Bay Office, and senior staff of Ocean Discovery Institute discussed the possibility of implementing Ocean Discovery's model of programs in Washington, DC or Baltimore, Maryland. At this same time Ocean Discovery had been notified that they would be given *a Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring* (which was officially awarded in December 2012). This award provided national recognition for the successes of Ocean Discovery's model in engaging and retaining underserved, urban youth in STEM fields. Since NOAA's Chesapeake Bay Office has a robust environmental education program and network of environmental education practitioners in Maryland, the District of Columbia and Virginia, Christos Michalopoulos and Sarah Schoedinger in NOAA's Office of Education reached out to their colleagues managing the Bay Watershed Education & Training (B-WET) Program for the Chesapeake Bay about replicating the Ocean Discovery model in their region. Everyone agreed it was worth exploring and in January 2012 NOAA convened a meeting of representatives of Ocean Discovery Institute, NOAA's Office of Education, NOAA' s Chesapeake Bay Office, and B-WET partners from Washington, DC and Baltimore. During that meeting, the B-WET partners and NOAA Chesapeake Bay staff identified gaps in current educational programming in the region that Ocean Discovery's model would be uniquely positioned to fill. These included the integration of STEM practices and content into environmental education programming, as well as the fact that Ocean Discovery Institute provides programming and opportunities to underserved, urban students over the course of their school careers.

[4] For the purposes of this project, replication is "the transfer to a different location of test concept, a pilot project, a small enterprise, and so forth, in order to repeat success elsewhere", and is also sometimes referred to as "scale-out" (Creech 2008).

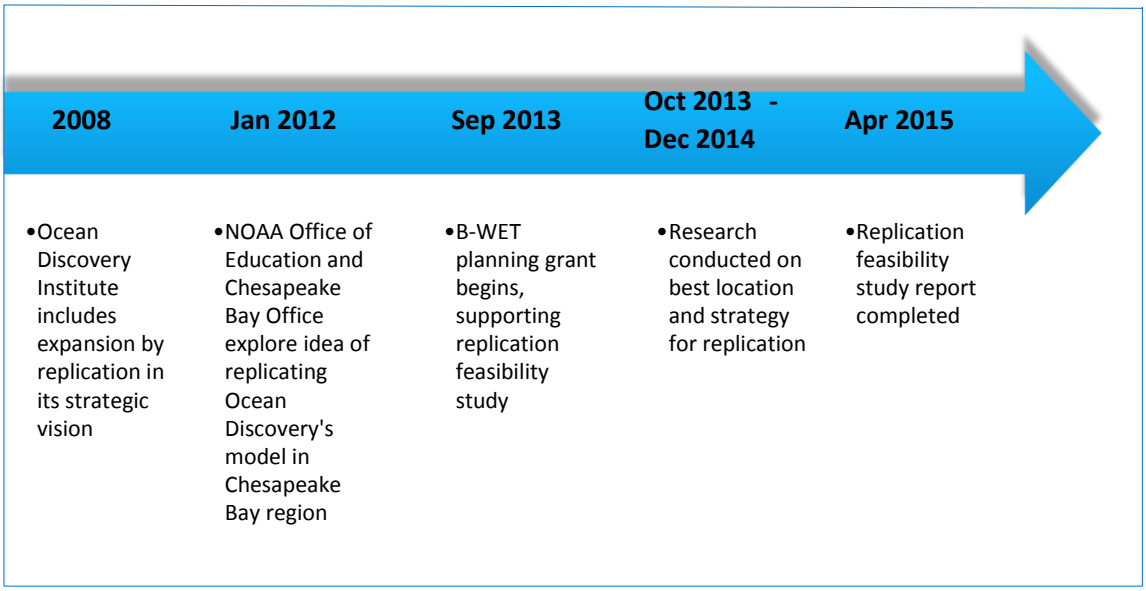


Figure 6. Timeline of major milestones leading to this feasibility study and report.

As a result of that meeting in January 2012, the staff managing the B-WET program for the Chesapeake Bay agreed to include replication as one of the priorities of their next funding opportunity in Fiscal Year 2013. In preparation for submitting a grant proposal to the Chesapeake B-WET Program, Ocean Discovery's Board of Directors assisted the staff in defining the criteria essential to the success of their model. These key characteristics (described on p.9) would guide the project's research phase, even as the strategy for replication shifted. In addition to these criteria, Ocean Discovery Institute staff and board members identified a range of potential approaches for replication (Figure 7).

Preliminary Success Criteria of the Ocean Discovery Institute Model

1. Singular vision that focuses the scope of work including: 100% focus on young people underrepresented in the sciences (low income, first-generation, people of color, and English second language learners) and a single-community focus.
2. Proximity to the ocean and the use of the ocean as a platform to teach Science, Technology, Engineering and Math (STEM).
3. Situated within a STEM and knowledge-based economy to provide mentors, internship and career opportunities, and funding.
4. Mechanism to maintain student continuity in an urban and densely populated community (e.g. through feeder school system, a "school-shed").
5. Strong relationships, built over time, with schools teachers and districts.
6. Incorporation of community-based and best practice approaches to develop and enhance programming and organizational systems.
7. Continual program enhancement process based on evaluation and outside resources.
8. Innovative and intentional planning for all program and organizational activities.
9. Strong and committed leadership with high accountability (including a mechanism to transition leadership to student leaders as they mature through the programs).
10. Powerful culture that is rooted in the belief of young peoples' abilities.
11. Ability to secure diverse, sustainable financial support. 12. Programming that is based in the following guiding principles:
    a. In order to build and sustain interest in the sciences, young people must be provided with early life experiences in the sciences and continue to be engaged in progressively rigorous experiences throughout their education.
    b. Discovery provides the spark that makes young people want to learn.
    c. The most potent and empowering education provides authentic experiences such as scientific research and actions that benefit the environment.
    d. The best strategies for teaching science and building an environmental ethic incorporate experience in nature.
    e. The most effective environments for learning draw upon students' assets, talents, and strengths.
    f. Educational initiatives must eliminate the unique barriers faced by urban, diverse young people as they study science and pursue higher education.

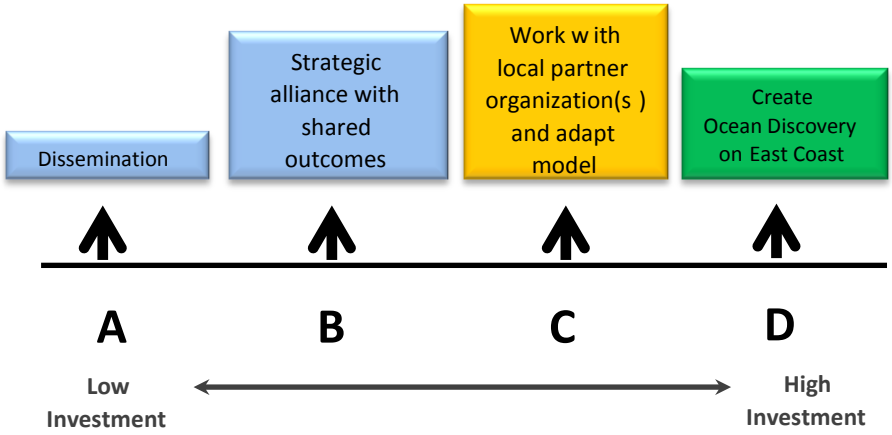


Figure 7. A range of options were considered for replication in the Chesapeake Bay region. Option C was the preferred option at the start of the feasibility study, but this would change to D during the course of the study.

Partnership with an existing organization initially appeared to be the best option because it would take fewer resources to move forward and would leverage local knowledge of community being served. Ocean Discovery Institute's leadership used the criteria to identify the partner organization and the location for replication that would be the focus of their application to the B-WET program. Based on those criteria, they proposed to replicate their program model in Washington, DC with Living Classrooms of the National Capitol Region as a major partner. Ocean Discovery Institute was successful in securing $375,000 over a 3-year period to support the feasibility study described in this report[5]. The project's proposed scope was scaled back and the work plan underwent initial revisions based on both a reduced budget, as well as comments from the reviewers of the grant application and the NOAA program officer managing the award process. These changes allowed the project team a more realistic timeframe for planning (i.e., this feasibility study) and pilot implementation. Even with those changes, the approved work plan was based on the assumption that Ocean Discovery Institute would be assisting another existent organization with adaptation of their program model in Washington, DC and that it would include pilot implementation by Year 3. Both these assumptions would be revised as the feasibility study began yielding findings.

During their first visit to Washington, DC after receiving the B-WET funding, Ocean Discovery Institute's project team realized they must expand their pool of potential partners in the region. There were several reasons for this. First, key personnel with whom the partnership strategy had been developed had recently departed Living Classrooms of the National Capital Region. Rather than forge ahead with Living Classrooms as their primary partner, the team decided to open the search for a local partner beyond Washington, DC. Second, the team was encouraged by their program officer not to limit their site investigations to Baltimore and Washington, DC, but to also include the Hampton Roads area. This ensured that the broader Chesapeake Bay region was considered.

Members of Ocean Discovery Institute's Board of Directors served on a task force to advise on replication strategies and implementation. Initially two interns were brought on board to assist with GIS analyses of

[5] Cooperative Agreement No. NA13NMF4570200.

key characteristics of the urban centers under consideration, and to investigate the literature on partnership models vis á vis replication. The latter was completed by a paid consultant as the team realized they needed someone with relevant experience who could work independently to produce the needed deliverables[6]. Lastly, the core replication team was complete when John Dillow, formerly of Living Classrooms of the National Capitol Region, was brought on as a consultant because of his extensive experience with non-profit replication, and Sarah Schoedinger agreed to serve the project advisor from NOAA. With the replication team and task force in place, the team gathered at Ocean Discovery Institute's offices in San Diego to map out processes and define metrics for the selection of a site and partnering organizations as well as refine the project's research targets.

In order to address the feasibility of replication in the Chesapeake Bay region, the project team used their model criteria (see box on p.9) to guide the development of quantitative and qualitative research methods in this feasibility study and these criteria were translated into Ocean Discovery Institute's Business Model. The Methods section of this report will go into greater detail about how the team gathered and analyzed data, as well as managed the project. The Findings and Discussion section summarizes key findings and lessons learned, and in the Conclusions and Recommendations section we will discuss the recommended course of action and identify milestones that will be important to maintaining forward progress.

[6] More on lessons learned about the use of unpaid interns are at the end of the Findings and Discussion section.

Who is Ocean Discovery Institute?

Founded in 1999, Ocean Discovery Institute is a non-profit organization that uses science to empower young people from urban and underserved communities to transform their lives, their community and our world as scientific and conservation leaders. They concentrate their efforts on connecting an entire community to science and conservation in one geographic area by focusing on the community's school-shed – an area in which all the young people of the community flow into one high school.

To date Ocean Discovery Institute's work has been conducted in the central San Diego neighborhood of City Heights. This community was chosen as the focus for these efforts because of the challenges it has and the opportunities that it provides. The community is densely populated with a low proportion of green space, much of which is in a degraded condition; 87% of students attending its high school are eligible for Federal free and reduced lunch programs and less than half graduate high school (Table 4). However, the community is young with 34% of the population is below the age of 18 (Table 6); is upwardly mobile, as many are recent immigrants who have come to the United States to make a better life; exhibits rich linguistic and cultural diversity (97% are people of color and over 30 languages[7] are spoken at the high school); can draw on San Diego's extensive STEM-related academic and business communities; and contains four canyons that connect it to the Pacific Ocean 11 miles away (Table 7).

Annually, Ocean Discovery Institute reaches 6,000 young people through tuition-free programs, and is growing to serve over 20,000 individuals in the San Diego region upon completion of the Living Lab. The organization is guided by the belief that young people have unlimited potential and want to make a difference and these young people will discover new ways to protect the ocean and nature, improve the health of their communities, and strengthen the quality of life in our world. Using their curiosity about the ocean to empower young people through education, scientific research, and conservation, Ocean Discovery Institute engages students early in their elementary school years and retains their involvement throughout high school, college, and beyond. The organization focuses on a single community to maximize the impact of its services on that community.

What is the model to be replicated and why does it work?

Core to the success of Ocean Discovery Institute's model is a pyramid approach to its programs, where the intensity of the experience increases with each level but fewer students are directly impacted. Curiosity, understanding and skills relevant to science, conservation, and leadership are gained at each level.

The base of the pyramid (Figure 8) represents the community initiatives. These programs engage young people, their families and neighbors within the school-shed through frequent and diverse opportunities that demonstrate how science and conservation are relevant to their daily lives and results in a stronger community. At the next level, the student initiatives engage students and teachers within their instructional settings to ensure that every student is engaged in hands-on science through direct instruction in the classroom and in field environments. Finally, at the highest level of the pyramid, Ocean Discovery Institute prepares scientific leaders by engaging approximately 100 middle school, high school,

[7] City Heights Partnership for Children. *City Heights Starting Point – Baseline Report*, .p.11

and college students in a series of rigorous, out-ofschool scientific experiences over multiple years. These experiences are combined with mentoring and support services to provide a pathway to science and conservation careers.

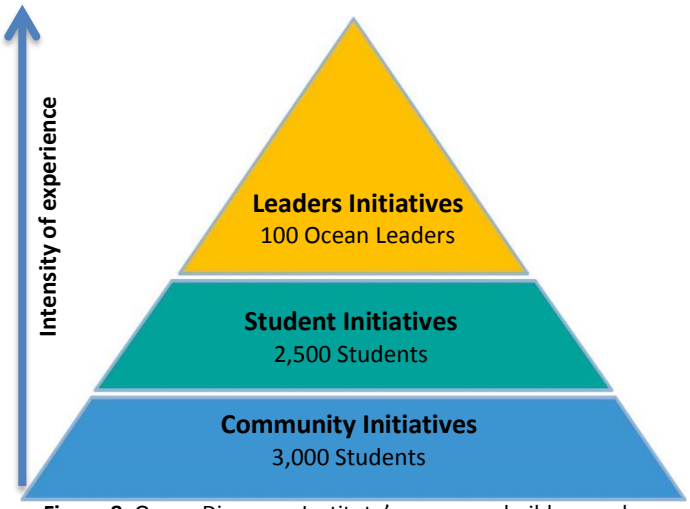


Figure 8. Ocean Discovery Institute's programs build on each other, providing opportunities to engage in scientific discovery and stewardship of the local watershed developing leadership skills and abilities.

Mentoring is an essential component of these initiatives. Scientists, engineers, and technology and conservation professionals from the local area and beyond serve as students' mentors; older students often serve as mentors to the younger ones from their community. By providing consistent academic and social supports to these youth once their curiosity is sparked, Ocean Discovery's programs are achieving significant results both with individuals and the community of City Heights.

What are the impacts of this model? While the staff and volunteers who work with these students day-to-day can provide qualitative evidence of the transformative impacts of Ocean Discovery Institute's programming, gains in scientific knowledge and attainment of bachelor's degrees in STEM and conservation majors have also been quantified. For example, 9 of the 13 elementary schools served by Ocean Discovery Institute have demonstrated increased scores on their state standardized tests during the course of their involvement with the program. In addition, when compared with other San Diego area schools with similar demographics, these schools, on average, score significantly higher in their state science tests[8]. At the high school level, 100% of the students, who participated in the Leaders Initiative, graduate high school, compared to 42% of their school peers. Of those Leaders who graduated high school, 80% enrolled in a four-year college or university, while only 39.5% of their school peers actually completed the coursework needed to apply to a four-year institution, and less than 12% enrolled[9]. While nationally 1 in 10 low-income, first-generation college students earn a degree, 8 of 10 students in Ocean Discovery Institute's Leaders Initiative earn a bachelor's degree within 5 years[10].

[8] Fifth grade California Science Standards Test scores were accessed using the San Diego Unified School District's Office of Accountability performance level reports by school. Comparison schools in San Diego with similar demographics and challenges to those partnered with Ocean Discovery Institute were selected for the analysis. These schools scores were then compared using a paired t-test. Ocean Discovery Institute's schools performed 13% higher on average when compared to similar schools (p=.004). Comparison data are from 2012 as the California Department of Education is no longer ranking similar schools in the same way it had previously.

[9] Data on course work completions by school are from the California Department of Education, Data Reporting Office for data compiled as of: 3/24/2014, http://data1.cde.ca.gov/dataquest/. Data on college enrollment refers to students enrolling in California state schools (California County Comparison - Fiscal, Economics, and Population – Graphs, available at http://www.cpec.ca.gov/FiscalData/CACountyEconGraph.ASP (last visited January 2015). While it is possible a few students are enrolling in four-year colleges outside of the state system, it is unlikely due to the high cost. The numbers are so small that they are assumed to be negligible in affecting the overall percentages.

[10] The Pell Institute, 2008. *Moving Beyond Access: College success for low-income, first-generation students.*

Finally, of the Leaders Initiative students who enrolled in a four-year college or university, 60% graduate with a major in a STEM or conservation field.

By providing rigorous educational, scientific research, and environmental stewardship experiences, Ocean Discovery Institute develops curiosity, scientific understanding and skills, and leadership abilities in underserved urban youth as they grow from early ages into early careers. This is achieved through providing continuous, tuition-free experiences across one entire school-shed.

The use of a watershed as both a real-world connection for the community they serve as well as a metaphor for student matriculation, enables transferability of the model to other urbanized communities in the United States as everyone lives in a watershed and each urban community has at least one school-shed. This study set out to discover if Ocean Discovery Institute's model could be replicated in any of the urban communities of the Chesapeake Bay and under what circumstances.

For decades, Swan Canyon – one of four major canyons that carve the urban neighborhood of City Heights – was a place of both environmental and societal degradation. Invasive plants choked the canyon habitats, which became a haven for drug dealing, illegal dumping transiency and a catch -all for the contents of polluted storm water runoff from the streets above.

Against this backdrop, Ocean Discovery Institute has made incredible strides to transform this landscape by engaging over 15,000 City Heights families, community members, and young people - like Sonya Vargas - to take action and improve the environment in their community.

Because of this, the canyon has been transformed, the community values and enjoys the watershed habitat, and young people like Sonya are on their way to become scientific leaders.

More than 5,000 native plants have been planted, invasive plants are gone, and 3,000 pounds of trash, that might have otherwise have wound up in San Diego Bay or the Pacific Ocean, have been removed.

What's more - in the process of leading her community to restore this habitat, Sonya worked alongside scientists, gained knowledge about restoration ecology, and learned how the world works and how she can make a difference. She has just graduated from UC Santa Barbara with a degree in biology and begun her career at a local environmental consulting firm.

"It is so inspiring to see Swan Canyon restored back to its natural beauty, but the best part about it is that through restoring these natural areas, we are abl e to simultaneously restore our communities," said Sonya.

Swan Canyon Entrance 2007

Swan Canyon Entrance 2014

Methods

Approach

Is it feasible to replicate Ocean Discovery Institute's model in the Chesapeake Bay region? This is the main question this study sought to address. This question was broken down into two sub-parts: (1) "Which replication strategy will be most successful?" and (2) "Which location, if any, would enable implementation of the model to succeed?" These two parts to the overall research question were investigated more or less simultaneously but relied on different methods and sources of data which will be described further in this section and Appendix A. The team utilized instinct based on experience and data to make decisions throughout the study.

The Project Team

Planning for replication in the Chesapeake Bay has relied on an array of stakeholders and staff for guidance. Various members from these groups provided input prior to the B-WET Program award as well as during this feasibility study phase of the project. This input has guided the core replication team throughout the project. The core team comprises:

- Shara Fisler, Ocean Discovery Institute's Executive Director and Founder. She provided strategic guidance with staff and board.
- Lindsay Goodwin, Ocean Discovery Institute's Associate Director, has been with the organization since 2001. She focused on developing and growing programs in San Diego and was responsible for development of key project deliverables for the study.
- Carla Pisbe, Ocean Discovery Institute's Replication Project Coordinator, began as student in 2004. She coordinated the project team and represented community and student instincts during the study.
- MacKenzie Sandy, Ocean Discovery Institute's Director of Philanthropy, has been with the organization since 2010, leading fundraising efforts and ensuring financial sustainability of the organization. She assisted with development of a plan to start and sustain replication in a new location.
- John Dillow, a consultant with Orenda Associates, has extensive experience with creating, acquiring, merging, and replicating non-profit organizations focused on environmental education and youth development in Baltimore and Washington, DC (among other locations). He assisted the team with on-the-ground research of potential partners, locations, and STEM and funding resources.
- Sarah Schoedinger, a senior program manager with NOAA's Office of Education, provided linkages to regional partners, ensured NOAA's resources in the region will be integrated into replication, and wrote this report.

Searching their local professional networks, Ocean Discovery Institute's leadership assembled a team of two interns one to assist with GIS mapping of census data in the regions being considered for replication and the other to conduct a literature review of replication strategies. Ultimately, they hired a

consultant to complete the work of the interns. Bemmy Mahammarov, a GIS specialist pursuing a PhD at University of California-Irvine, used GIS with publicly available data sources to assist the core team in identifying potential school-sheds in Baltimore, Washington, DC and the Hampton Roads[11] region. Her preliminary analyses were supplemented by additional research by the project team members and Sarvat Maharramli. Sarvat is an independent management consultant who was with AECOM for 5 years where he managed operations, finance, procurement, reporting, monitoring, evaluation and client relationships of a regional climate change adaptation project that covered 27 countries in Asia and the Pacific. Sarvat also completed a review of the literature regarding replication models of social and educational programs. In addition, he provided continual guidance during the development of this report.

Ocean Discovery Institute's Board of Directors established a task force composed of four members who have expertise in leadership development and culture management; communications; starting companies and bringing new products to market; and strategic planning for organizational development and funding. The members are:

- Kurt Gering (Board chair), Director of Talent Culture & Capability, San Diego International Airport;
- Scott Grimes, Program Officer, Endangered Habitats League; and
- John Johns, President, Providence Marketing Corporation;
- Benson Lam, Vice President of Strategies and Operations, Qualcomm Technologies, Inc.

Additionally, board member Ted Griswold, Partner with Procopio, Cory, Hargreaves & Savitch, LLP, provided legal expertise on the proposed organizational structure to support replication.

Finally, Ocean Discovery staff, students, and their parents were asked to provide input at key points in preparation for and during the feasibility study on replication. Of particular importance to this feasibility study, all these stakeholders assisted in the development of the
Ocean Discovery Institute Business Model, which defines the characteristics of the organization, of its operations, and of the community in which it works that together contribute to Ocean Discovery Institute's success.

[11] Hampton Roads is the name of a metropolitan area in Southeastern Virginia that includes the cities of Norfolk Chesapeake, Newport News, Hampton, Portsmouth, Suffolk, Poquoson, Virginia Beach and Williamsburg (http://visithampton.com/discover/trivia/ and http://en.wikipedia.org/wiki/Hampton_Roads.

Data Collection and Analysis

Which replication strategy will be most successful?

To answer the question of which replication strategy would be best for successful implementation of Ocean Discovery Institute's model, three methods were used:

1. Literature review on published studies of replication by social service organizations in the United States and the United Kingdom;
2. Research on thirteen active models by conducting interviews and/or reading case studies of educational or youth and workforce development organizations that had expanded operations through replication[12]; and
3. Internal evaluation by Ocean Discovery Institute staff and board members regarding their existing business model.

The information that was gleaned through this three-pronged approach (Figure 9) provided continual guidance as the team delved into the research on the best strategy for replication. The literature review and active model research identified successful models and lessons learned regarding expansion via replication. This research informed refinement of Ocean Discovery Institute's Business Model and recommendations for an organizational structure that can support replication long term and across multiple locations.

The internal evaluation consisted of a series of facilitated workshops that brought together Ocean Discovery Institute staff, board members, students and families, and external partners to identify the essential components of their model, i.e., the components that drive success and are non-negotiable requirements. This internal evaluation identified the initial model criteria that eventually evolved into a more fully-described business model and informed decisions about the proposed organizational structures to support replication. These criteria were also translated into quantitative and qualitative variables that assisted the team in answering the second part of the overall research question regarding which location that would be best for replication based on how well the locations fit Ocean Discovery Institute's model.

[12] Replication team members from Ocean Discovery Institute, reviewed case studies or conducted interviews with representatives of The Aravind Eye Hospital, AVID, Goodwill, Green Dot Public Schools, Harlem Children's Zone, Joblink, KaBOOM!, KIPP, Living Classrooms, Luna Dance Institute, Manchester Bidwell Corporation, Strive, and Year Up.

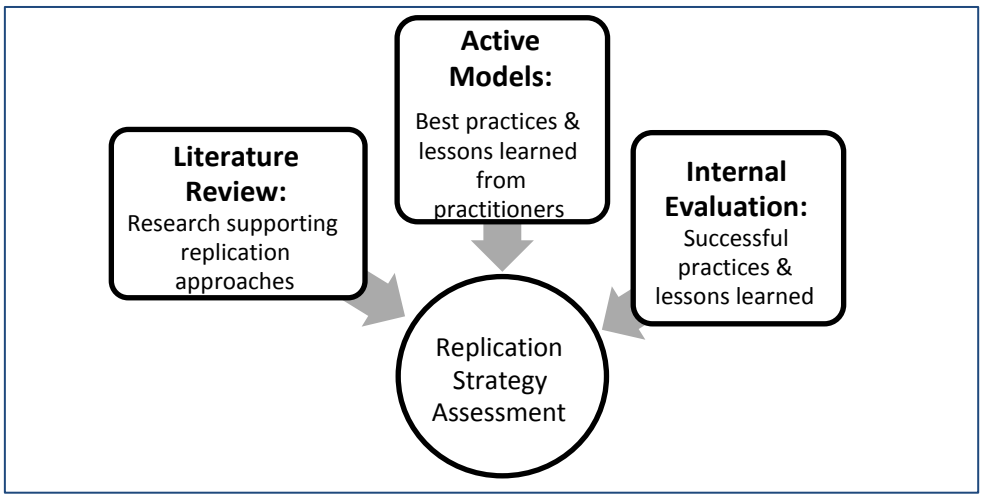


Figure 9. The team's approach to understanding which strategy for replication would be most successful in implementing Ocean Discovery's model comprised three methods which drew on native knowledge of the staff and board members, findings from published literature on replication by other nonprofits providing educational and/or social services, and interviews with practitioners whose programs had grown from local level to r egional/national level .

Which location, if any, would enable implementation of the model to succeed?

Although initial meetings with potential partners and NOAA staff in January 2012 indicated that Ocean Discovery Institute's model could fill a need, the question was still open regarding which location, if any, would be suitable for replication. This question was addressed through two additional lines of investigation: (1) an analysis of how well each metro area fits the model and (2) an analysis of the capacity of the region to financially support the model. The team used quantitative and qualitative approaches to inform these analyses.

(1) Analysis of How Well Each Metro Area Fits the Model

The locations' fit to the model was investigated using hard (essential) and soft (important but not essential) variables that were identified in the internal evaluation and then mapped to publicly available data sources (i.e., US Census data from 2010, state departments of education and local school districts' data from 2011-2012 academic year). These variables were reviewed at increasing levels of geographic granularity as the team's research proceeded (Figure 10). Hard variables were characteristics of the school or community deemed essential to successful replication (Table 1 and Table 2). Threshold values for a few of the hard variables were established to assist in the winnowing process. Soft variables are variables that were deemed important to determining place but not "deal-breakers" (Table 3). Hoover High School, the main high school serving City Heights, provided the benchmark for school and community variables that were researched.

Coarse level data were analyzed using GIS and Multi-dimensional Scaling (MDS)[13]. These data analyses assisted the team in focusing on neighborhoods and high schools within the metro areas of Baltimore; Washington, DC; and Hampton Roads. Census tract data were mapped using GIS to understand the communities within each urban area. Data from school districts were used to understand the student population characteristics. Where the numbers from the broader community did not match the data from the schools, the team flagged those areas for in-person visits to understand the discrepancy. MDS plots were made using school districtderived data on student populations. Coarse level data also quantified the presence of STEM industry as potential employers, as well as mentors from academia, industry and government agencies in the Chesapeake Bay region. Medium level analyses focused on school-sheds throughout the Hampton Roads region to determine the best fit to Ocean Discovery Institute's model. Fine level analyses determined the specific school-shed within Norfolk, VA that is the best fit to the model (Table 2 and Table 3).

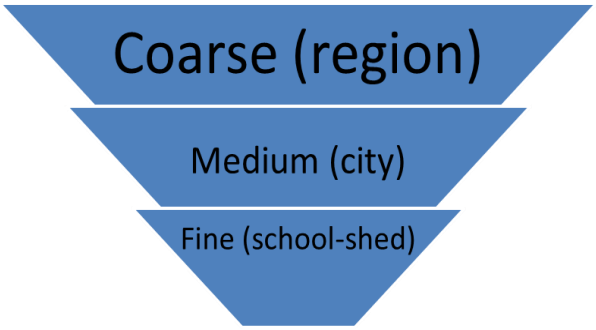


Figure 10. Levels of analyses on the possible location for replication in the Chesapeake Bay. The first level (coarse) assisted the team in confirming 3 urban areas each urban areas fit the model well enough to be considered. The next level of analyses led to determine the city and then the finest level led to the decision on

Table 1. Data on high school and community characteristics were collected from publicly available sources to assess whether any schools within Baltimore; Washington, DC; and Hampton Roads fit Ocean Discovery Institute's model well.

Coarse Level Characteristics	
High School Variables	**Community Variables**
% Students of Color	% People of Color
% Receiving Free or Reduced Federal Lunch	Median Income
% Black	% Black
% Latino	% Latino
% Asian	% Asian
% White	% White
Number Attending	Population Density
Graduation Rate	% Population below 18 years of age
Math Score (% at proficiency)	STEM Industry Presence
Reading Score (% at proficiency)	Driving distance to ocean (mi)
	Driving distance to watershed connection (mi)

[13] A full description of the GIS mapping and Multi-dimensional Scaling methods and preliminary results of coarse level analyses included in Appendix D.

Table 2. Hard variables on schools and community that were used for fine level assessments about location for replication, i.e., which school-shed best fits the Ocean Discovery Institute model.

Fine Level Hard Variables	Threshold Value for Hard Variable
Students are low income	Greater than 65% of students are low income (e.g. receive free & reduced lunch)
Students are ethnically diverse and underrepresented in STEM	Greater than 80% of population are students of color
Students are low science achieving	No threshold applied
Student graduation rates are low	No threshold applied
Student population is dense	No threshold applied
Students live within an urban, metropolitan center	No threshold applied
Students are retained through a feeder school system	No threshold applied
School has a culture rooted in the belief of young people's abilities	No threshold applied
Students are in close proximity to the ocean	No threshold applied
STEM jobs are available in the region	No threshold applied

Table 3. Soft variables were employed at the fine level to settle on a school-shed and community served by that school-shed. No threshold values were set for these variables because of their qualitative nature.

Fine Level Soft Variables (No Threshold Values for Soft Variables)
School has existing relationship with STEM industry. School has existing relationship with an institution of higher education. School has a superintendent who is interested and invested in our model. School has a focus and/or interest in science or STEM. School has accessible tracking and performance data. School has a reputation for strong and committed teachers. School has a commitment to NGSS. Community has potential to access a watershed habitat. Community has potential partners to implement pieces of the model. Community has investments such as funding, community development, etc. that can be leveraged. Community has a reputation for strong and committed leadership. Community has funders invested in improving the area. Community has a high numbers of recent immigrants and diverse languages spoken.

Initially these variables were to be used to determine both the place for replication and to identify the organization in the region to adopt Ocean Discovery Institute's model, but when it became clear the replication strategy had to change, the variables focused on people were now used to describe the culture of the location not to make a decision on a partner to adopt the model.

At each level of granularity in the analyses of which location best fits the model, qualitative data were collected through interviews by phone and in person during site visits to the region. These data informed the replication team's next steps by confirming or belying conclusions drawn from the quantitative data and introducing the team to potential partners in each region. Additionally, as the team progressed from coarse to medium to fine level analyses, we returned to the coarser level findings about each location to ensure that our collective instincts and the data were consistent with each other and confirm that we were still on the right path to finding a location for replication (Figure 11). If data and instinct were not convergent, the team delved deeper into the data to improve our understanding before making decisions to choose one path or the other.

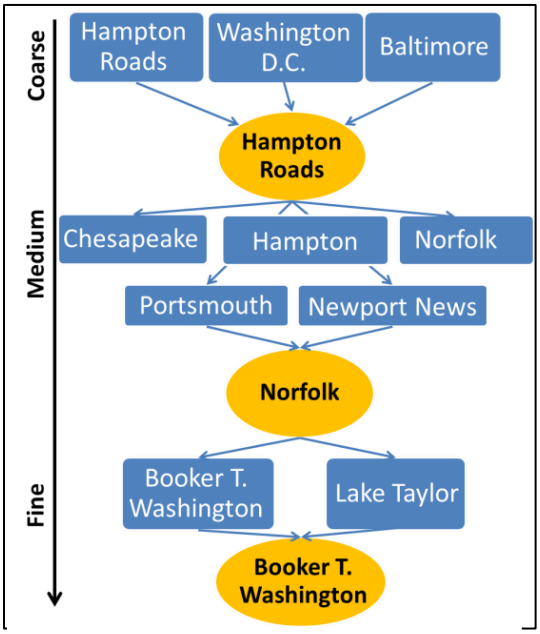


Figure 11. A schematic showing how team's focus shifted over the course of the feasibility study.

Finally, the team compiled data on organizations working in each of the communities that most closely resembled in the benchmark school-shed of City Heights. Personnel from those organizations were interviewed by phone or in person during site visits to the Chesapeake Bay region. These organizations fell into several categories: those serving the needs of community (community-based organizations); STEM-related businesses/industry (public and private sector); STEM education providers; and potential funders (foundations, corporations, and individuals). In some cases, these categories are not mutually exclusive (e.g., some private sector STEM-related corporations are also potential sources of funding for programs).

(2) Analysis of the Capacity of Region to Financially Support the Model

As the team's research progressed from coarse to medium level assessments, the approach to the replication strategy changed. With that change, the need to understand the capacity of the region to financially support and sustain Ocean Discovery Institute's model became a more critical component of the feasibility study. The consultant on the replication team, in conjunction with Ocean Discovery Institute's Director of Philanthropy, identified potential sources of funding from foundations, government agencies, and corporate and private philanthropy. These data were collected from publicly available sources online (e.g., annual reports and IRS 990 forms from non-profit foundations) as well as from interviews with leaders from the Hampton Roads Community Foundation, Hampton Roads Economic Alliance, and potential programmatic partners.

A mix of national funders and local sources were investigated. Each was assessed based on its "LIA" – Linkage, Interest, and Ability – and whether funds could be used to support local efforts, national efforts (in San Diego and Norfolk), start-up costs, sustaining costs, and any combination of the above. LIA is an Ocean Discovery Institute-developed system for ranking potential donor prospects. This system ensures

that Ocean Discovery Institute prioritizes the strongest prospects rather than expending valuable resources on all funding opportunities that present themselves. These three characteristics are defined as:

1) **Linkage** - whether or not Ocean Discovery Institute has an existing relationship that could result in an introduction to a prospect;
2) **Interest** - whether or not the prospect has interests aligned with Ocean Discovery Institute's mission; and
3) **Ability** - whether or not the prospect has the capacity to contribute financially.

Each characteristic is assessed and given a score of 1 to 3, with 1 being the weakest and 3 being the strongest. The scores are averaged and a final LIA score of 1 to 3 is assigned to all prospects.

Tools and Process for Communication and Documentation

The team also developed communication tools for reaching out to prospective partners in each city about the replication project. We developed a protocol for interviewing people in each region (including questions and process to be followed in each interview) to ensure we consistently gathered data on potential partners, locations, and strategies that would lead to successful replication (Appendix B). However, strict adherence was not required and we deviated from these protocols when circumstances required it. Additionally, the members of the core replication team provided project updates to potential partners and current stakeholders every few months.

Because of the geographical distribution of the core replication team (one member near Baltimore, one in Charlotte, and four in San Diego), the team set up an online space for sharing documents (BaseCamp) and maintaining a project calendar. Throughout the project, the core team held regular conference calls every four to six weeks with two- to three-person teams checking in with each other more frequently as needed. The project coordinator tracked the team's progress with a Gantt chart and prepared detailed agendas and briefing materials for each in-person meeting (i.e., site visits to Baltimore; Washington, DC; and Hampton Roads or planning meetings in San Diego). During site visits, the core team would conduct a daily debrief of the team's findings. These were semi-structured to ensure we addressed outstanding questions that the site visit was intended to answer, and that we defined and assigned next steps. Notes about the daily debriefs were collated with notes taken by individual members of team to summarize the findings of each site visit.

Results and Discussion

Which location, if any, would enable implementation of the model to succeed?

Coarse Level Assessment of How Well the Locations Fit Ocean Discovery Institute's Model and the Capacity of the Region to Support the Model

The original plan for replication assumed that Ocean Discovery Institute would share their program model with another organization already operating in the region and assist them with adapting the model. This organization would be chosen because it was working with underserved youth in one of the Chesapeake Bay's urban areas as well as its strong alignment with Ocean Discovery Institute's mission and culture. The initial proposal to NOAA identified Living Classrooms of the National Capitol Region as the implementing partner, and proposed Ward 7 or 8 in Washington, DC as the potential site for replication. However, with a the change in leadership at Living Classrooms of the National Capital Region early in the project, the replication team expanded the site options to include the metropolitan areas of Hampton Roads and Baltimore. Regardless, the assumption remained that the replication team would identify a lead organization to adopt the program model. Therefore data collection and analysis at the coarse level focused on confirming that (1) there was need for the model within the region and (2) there were communities and school-sheds that could serve as the focus for pilot implementation. Since the team relied on data gathering and instincts based on experience to guide its research, the findings below will reflect a blend of quantitative and qualitative data and instincts.

Finding #1: There is high need for Ocean Discovery Institute's model in the Chesapeake Bay region.

While not a shocking conclusion (given the feasibility study was funded based on preliminary analysis of the needs in the region), data on the "hard variables" for community and high school characteristics that fit Ocean Discovery Institute's model indicated there were high schools that may have school-sheds with similarity to the benchmark, Hoover High School. These data also showed how unique the Hoover High school-shed and City Heights community are in terms of density and diversity of the population. None of the areas in the Chesapeake Bay region examined by the team were as densely populated or as racially diverse as City Heights, although several high schools showed high percentages of students of color (Table 4).

The GIS mapping of community variables and a multi-dimensional scaling plot of school and community variables confirmed that there were pockets of need within each urban area in the region that were high enough to meet the threshold values for the hard variables of Ocean Discovery Institute's model with respect to percentage of students on Federal free/reduced lunch and percentage of students of color (Table 4 and Table 6).

Several Multi-dimensional Scaling (MDS) plots of hard variables for school and community characteristics were created to show the degree of similarity among a cluster of school-sheds so that the team could determine which merited further investigation with a site visit. The MDS plots generated from data on the few essential school characteristics (Students of Color and Percent of Population Receiving Federal Free and Reduced Lunch) showed that at least one high school in each urban area in the Chesapeake Bay was a highly similar to Hoover High School (Figure 12).

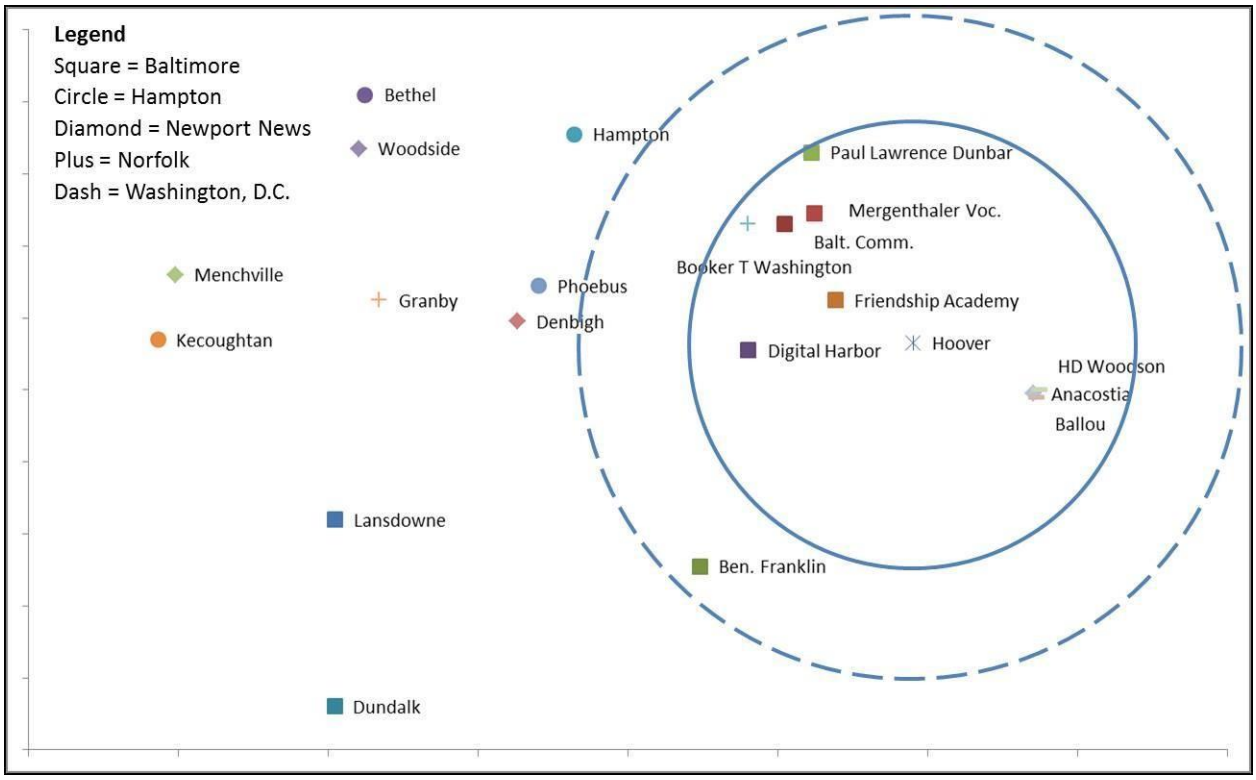


Figure 12. Coarse-level assessment: schools within the solid line are most similar to the current model in San Diego (Hoover High School). Schools within the dashed line have a degree of similarity and worth further investigation.

Table 4. Hard Variables – Data on School Characteristics for the purpose of comparing various school-sheds in Chesapeake Bay to the benchmark school-shed of Hoover High School (in red text). The schools initially considered are shown **in bold text**.

Location	High School Name	HS % Students of Color	HS % Receiving Federal Free or Reduced Lunch	HS % Black	HS % Latino	HS % Asian	HS % White	HS # Attend-ing	HS Gradu-ation Rate	HS Math Score (%)	HS Read-ing Score (%)
San Diego	Hoover	96	87	11	71	14	2	2,200	42	27	40
Baltimore	Achievement Academy	100	83	99	1	0	1	354	32	36	43
Baltimore	Antioch Diploma	99	80	98	1	0	1	395	27	27	31
Baltimore	Baltimore City College	88	59	85	2	1	10	1,289	92	88	95
Baltimore	**Baltimore Community**	**93**	**73**	**81**	**12**	**0**	**6**	**426**	**40**	**15**	**24**
Baltimore	Benjamin Franklin	69	85	58	10	1	31	380	71	66	47
Baltimore	**Digital Harbor**	**84**	**77**	**73**	**9**	**2**	**15**	**1,400**	**80**	**66**	**53**
Baltimore	Dundalk	38	68	26	10	2	58	1,317	73	81	78
Baltimore	**Friendship Academy**	**92**	**80**	**82**	**8**	**2**	**8**	**535**	**67**	**31**	**53**
Baltimore	Lansdowne	48	58	30	10	8	50	1,211	77	72	66
Baltimore	**Mergenthal-er Vocational**	**96**	**74**	**95**	**1**	**0**	**3**	**1692**	**82**	**65**	**67**
Baltimore	**Paul Lawrence Dunbar**	**99**	**71**	**97**	**1**	**1**	**1**	**907**	**91**	**83**	**87**
Hampton	Bethel	73	38	67	4	2	24	1,934	81	61	92
Hampton	Hampton	85	54	76	5	4	13	1,651	84	53	88
Hampton	Kecoughtan	47	37	40	5	2	49	1,772	81	65	91
Hampton	Phoebus	74	59	70	3	1	24	1,159	72	54	87
Newport News	Denbigh	71	60	53	13	5	27	1,285	75	44	87
Newport News	Menchville	51	35	42	6	3	47	1,708	79	67	91
Newport News	Woodside	70	40	54	12	4	29	2,046	89	64	95
Norfolk	**Booker T Washington**	**91**	**70**	**85**	**4**	**2**	**6**	**1,293**	**65**	**29**	**84**
Norfolk	Granby	63	50	53	7	3	30	1,949	69	65	94
D.C.	**Anacostia**	**99**	**99**	**99**	**0**	**0**	**0**	**751**	**40**	**12**	**17**
D.C.	**Ballou**	**99**	**99**	**98**	**1**	**0**	**0**	**678**	**50**	**23**	**20**
D.C.	**HD Woodson**	**100**	**99**	**100**	**0**	**0**	**0**	**762**	**53**	**16**	**22**

Table 5 shows the initial list of candidate high schools for Baltimore, Washington, DC, and Hampton Roads that resulted from the GIS and MDS analyses.

Table 5. Preliminary list of school-sheds based on GIS maps and MDS plot

Region	High School
Washington, DC	Anacostia
	Ballou
	H.D. Woodson
Baltimore	Baltimore Community
	Merganthaler Vocational
	Digital Harbor
	Friendship Academy
	Paul Lawrence Dunbar
Hampton Roads, VA	Booker T. Washington[14]

However, the MDS plots did not tell the full story and closer inspection of each datum for each school-shed's hard variables showed that Booker T. Washington High School in Norfolk was the closest fit to the model, e.g., there was greater racial diversity, its graduation rate was closer to Hoover's, and it was larger than some of the other schools in the region (Table 4).

In addition to reviewing the hard variables related to school characteristics, we also looked at those for community characteristics and found that these data yielded findings similar to the data on school characteristics (Table 6 and Table 7).

The differences noted between the data on the benchmark community and school characteristics, and those of Chesapeake Bay region warranted further investigation. Through site visits and interviews with local education providers the team gained a better understanding the physical placement of the school within each community and how the school-sheds actually work. What we learned from walking and driving around the communities that might be sites for replication in Baltimore; Washington, DC; and Hampton Roads was that each had communities that felt like City Heights (albeit with fewer people and a different landscape).
Additionally, conversations with local community-based organizations (e.g., Horton's Kids in

[14] Booker T. Washington High School was the only school-shed in Hampton Roads, VA that was included on our preliminary list because there were so many other schools in Baltimore and DC that were a closer fit to the model based on the hard variables, so the schools that were just outside a degree of separation from the MDS plot (figure 8) were not looked at seriously until we focused in on the Hampton Roads region and Norfolk specifically is our likely location for replication.

Washington, Choice Jobs in Baltimore, Norfolk Redevelopment and Housing Authority in Norfolk) confirmed that the need for Ocean Discovery Institute's model was high as students in the high-poverty areas of each city were completely disconnected from opportunities for STEM education and careers (see box below).

As we embarked on our journey to explore cities for potential replication in the Chesapeake Bay region, we never imagined finding such an expansive science wasteland among the region's high-poverty communities.

We were well familiar with the data on the lack of science and low science performance common in underserved communities, but it was very different to experience this first hand. We sat through multiple meetings with educators and community leaders and were reminded of the entrenched challenges these students face. In a meeting with an organization that has provided tutoring for over 15 years, not once have they seen a student bring in science homework. When asking a workforce development organization about their student's career interest they could not think of a single time when a student brought up a career in science.

Table 6. Hard Variables – Data on Community Characteristics for the purpose of comparing various school-sheds in Chesapeake Bay to the benchmark school-shed of Hoover High School (in red text). These data were culled from US Census data for the zip codes in which these high schools are based. The schools initially considered are shown **in bold text**.

Location	High School Name	% People of Color	Median Income	%Black	%Latino	%Asian	%White	Population Density	% Population below 18 years
San Diego	Hoover	97	23,963	16	56	25	17	33,310	34
Baltimore	Achievement Academy	99	30,161	95	3	1	16	7,441	28
Baltimore	Antioch Diploma	99	30,161	95	3	1	16	7,441	28
Baltimore	Baltimore City College	84	30,161	80	1	3	16	12,577	22
Baltimore	**Baltimore Community**	**29**	**30,161**	**8**	**18**	**3**	**81**	**2,597**	**4**
Baltimore	Benjamin Franklin	44	30,161	32	9	3	65	2,597	4
Baltimore	**Digital Harbor**	**17**	**151,260**	**8**	**3**	**6**	**93**	**19,230**	**4**
Baltimore	Dundalk	17	59,478	8	3	6	81	2,597	22
Baltimore	**Friendship Academy**	**12**	**104,433**	**8**	**3**	**1**	**93**	**7,441**	**4**
Baltimore	Lansdowne	44	30,161	32	9	3	81	7,441	22
Baltimore	**Mergenthaler Vocational**	**82**	**78,158**	**80**	**1**	**1**	**16**	**2,597**	**28**
Baltimore	**P.L. Dunbar**	**87**	**30,161**	**80**	**1**	**6**	**16**	**7,441**	**4**
Hampton	Bethel	53	65,064	45	3	5	34	5,193	22
Hampton	Hampton	72	38,417	64	3	5	19	5,193	22
Hampton	Kecoughtan	70	38,417	64	3	3	19	7,017	33
Hampton	Phoebus	97	38,417	83	13	1	9	5,193	33
Newport News	Denbigh	41	84,881	30	6	5	73	5,193	22
Newport News	Menchville	41	84,881	30	6	5	57	5,193	22
Newport News	Woodside	63	49,948	45	13	5	20	5,193	26
Norfolk	**Booker T Washington**	**85**	**23,796**	**83**	**1**	**1**	**9**	**7,017**	**33**
Norfolk	Granby	39	38,417	30	6	3	57	5,193	19
D.C.	**Anacostia**	**97**	**21,431**	**94**	**2**	**1**	**5**	**9,262**	**1**
D.C.	**Ballou**	**96**	**21,431**	**94**	**1**	**1**	**5**	**9,262**	**1**
D.C.	**HD Woodson**	**100**	**21,431**	**93**	**6**	**1**	**5**	**9,262**	**1**

Table 7. Hard Variables – Data on Community Characteristics for the purpose of comparing various school-sheds in Chesapeake Bay to the benchmark school-shed of Hoover High School (in red text). These data were culled from yellowpages.com (for STEM industry) and Google Earth (driving distances). The schools initially considered are shown **in bold text**.

Location	High School Name	STEM Industry	Driving distance to ocean (mi)	Driving distance to watershed connection (mi)
San Diego	Hoover	1,583	11	2
Baltimore	Achievement Academy	856	138	1
Baltimore	Antioch Diploma	856	138	1
Baltimore	Baltimore City College	856	138	1
Baltimore	**Baltimore Community**	**856**	**138**	**1**
Baltimore	Benjamin Franklin	856	138	1
Baltimore	**Digital Harbor**	**856**	**138**	**1**
Baltimore	Dundalk	856	138	1
Baltimore	**Friendship Academy**	**856**	**138**	**1**
Baltimore	Lansdowne	856	138	1
Baltimore	**Mergenthaler Vocational**	**856**	**138**	**1**
Baltimore	**P.L. Dunbar**	**856**	**138**	**1**
Hampton	Bethel	1,583	7	1
Hampton	Hampton	1,583	7	1
Hampton	Kecoughtan	1,583	7	1
Hampton	Phoebus	1,583	7	1
Newport News	Denbigh	1,583	7	1
Newport News	Menchville	1,583	7	1
Newport News	Woodside	1,583	7	1
Norfolk	**Booker T Washington**	**1,583**	**7**	**1**
Norfolk	Granby	1,583	7	1
D.C.	**Anacostia**	**1,530**	**180**	**0**
D.C.	**Ballou**	**1,530**	**180**	**0**
D.C.	**HD Woodson**	**1,583**	**180**	**0**

Finding #2: For Ocean Discovery Institute's model to succeed in a particular school-shed, the majority of the student population must come from the adjacent community and the schoolshed must be walkable, providing physical connections among the school campuses and the community they serve.

Schools in high-poverty communities will always have some attrition in their student population as parents often do what they can to get their kids into better performing schools. Conversely, dilution of the school-shed population is not seen as an issue because few parents opt to transfer their kids into schools that are under-performing (which is part of the characteristics needed for school-shed selection). During our early visits to the region, locals in the Chesapeake Bay region expressed concern that there were would be no well-defined school-sheds in any of the urban areas being considered for replication. But the replication team realized that even the benchmark school-shed of Hoover High School is not a perfectly defined school-shed wherein all students in the elementary schools matriculate into the school-shed's middle schools, and so on. What *is* important is that most of the students from the community flow through that community's school-shed. Equally important to successful implementation of Ocean Discovery Institute's model, is that the campuses in the school-shed must be walkable and have physical connections/corridors to the community they serve. These realizations were corroborated during the full site visit to the region in April 2014, where the team was able to visit the communities of many of the school-sheds under consideration for replication, and to meet with representatives of community-based organizations, STEM education providers, and potential funders that support environmental education.

At this stage of our research, all three urban centers (Baltimore, Washington, and the communities in Hampton Roads) were still viable options for replication in terms of the flow of students through the school-shed. As for walkability, several areas were identified as having disruptions in the physical connections throughout the community, which made them less attractive options (e.g., Baltimore's Cherry Hill neighborhood). However, too much was still unknown about the connectivity within each individual school-shed to make conclusions across all schools.

Finding #3: All urban school systems have their challenges, so that is not a reason to rule out a location. However, the degree of openness and interest offered by each region will be critical to progress. Where this is lacking, the model will not thrive.

During the April 2014 site visits to the Chesapeake Bay, the team interviewed program personnel and leadership of local non-profit education providers, community-based organizations, city agencies, and school systems. The team learned about the local politics of the public school systems in each region and the communities served by them, and was also able to sense the level of enthusiasm from these potential partners and stakeholders.

Each city's school system has its challenges (although the Hampton Roads region's schools were still unknown to us), but these challenges are typical of all urban school systems so this was not a separator among the three areas. However, the team was warned that communities in Baltimore and Washington are likely to be wary about yet another group coming into their neighborhoods, so getting community

buy-in would be a challenge. Additionally, the team sensed from the Baltimore-based organizations that high-need communities are burned-out from years of interventions to improve them, while the communities in Wards 7 and 8 in Washington are overwhelmed with need and by a large number of organizations working in the same space. However, the people we met from the organizations in Norfolk during this same trip were optimistic and enthusiastic about the potential role Ocean Discovery Institute's model might play in bringing STEM to underserved communities in the region. Despite the many challenges that face the communities in this region, this optimism for the possibility of improving these communities and the enthusiasm to collaborate were present in all future visits to Hampton Roads. For a first attempt at replicating Ocean Discovery Institute's model, the team felt that it would be better to choose a location where there were fewer barriers to collaboration, assuming the community fit the model in all other important aspects.

At this stage of our study, the team realized that a deeper dive was needed into the Hampton Roads communities to understand which city within Hampton Roads would best fit the criteria for successful implementation of the model and then re-consider the viability of Washington and Baltimore as a site for replication in light of what we learn about the Hampton Roads region.

Finding #4: Securing STEM opportunities for students would be challenging in Baltimore and Washington, DC.

Initial data collection on the number of science, engineering, and environmental employers in each region (Table 7; Appendix D: Tables 5, 8 and 11) showed that Baltimore does not have the depth of STEM industry[15] partners that Washington, DC or Hampton Roads has. This research also showed the Hampton Roads region has the same number of STEM employers (roughly 1580) as San Diego. During interviews, this finding was corroborated by local STEM providers. Further we learned that Washington, DC includes many federal agencies and universities that could provide STEM mentoring, but competition for those mentors is high among the organizations already serving underserved youth in the region. Therefore, in Baltimore and Washington, DC it may be difficult to develop the new relationships necessary to secure STEM opportunities for students, which is an essential component of Ocean Discovery Institute's model.

Finding #5: The donor base in Baltimore and Washington, DC has less capacity to financially support additional programs and infrastructure required by Ocean Discovery Institute's model.

During interviews with representatives of community-based organizations and STEM education providers serving communities in Baltimore and Washington, DC, the replication team learned that both cities have systemic challenges inhibiting funding capacity. The transience of the population inhabiting the Washington, DC metro area makes it hard to find a stable donor base.
Many prefer to give to organizations outside the area or are only donating during their time in Washington, DC which is often brief. In Baltimore, we were told the relationships between existing organizations and funders are fairly entrenched so newcomers would have a harder time finding

[15] STEM industry here includes not just corporations using science, technology, engineering, and math skills and knowledge, but also federal agencies and academic institutions.

funding. In addition, Baltimore and Washington, DC are saturated with non-profits and there is often high competition among them. While there was still much to learn about the true funding capacity of the Hampton Roads region at this stage of the study, the two interviews the team had with leadership from local education providers – Nauticus and Horizons Hampton Roads – left a positive, upbeat impression that Hampton Roads, and particularly Norfolk, would be fertile ground for replication. This was interesting coming from two local organizations that could have perceived Ocean Discovery Institute as a competitor to those same resources.

Finding #6: Our initial assumption, that adoption by an existing organization is the best strategy to replicate Ocean Discovery Institute's model, is wrong. The team had to shift the approach to replication from adoption to setting up a whole new organization in the new location.

When we set out to discover if it was feasible to replicate the success of Ocean Discovery Institute in the Chesapeake Bay region, several options were considered (Figure 7). Ocean Discovery Institute leadership chose to pursue finding a potential partner in the region who could adopt and adapt Ocean Discovery Institute's model.

During site visits in October 2013 and April 2014, the team met with representatives of several organizations in each region that could either serve as a partner to adopt the model or to provide other program support. These organizations included: Alice Ferguson Foundation, Groundwork Anacostia, Live It Learn It, Earth Force, and Living Classrooms of the National Capital Region in October 2013 and Chesapeake Bay Trust, Choice Jobs (Baltimore); Living Classrooms (Baltimore and National Capital Region); Maryland Sea Grant/IMET (Baltimore), Horton's Kids (DC), Alexandria Seaport Foundation (DC); Office of State Superintendent of Education (DC), Horizons Hampton Roads (Norfolk) and Nauticus (Norfolk) in April 2014.

None of the organizations were currently filling the gap that Ocean Discovery Institute could fill, i.e., their programming overlapped with pieces of the model, but not entirely. Yet, none were suitable partners to adopt the model. Any organization that has the organizational capacity to adopt the model and whose mission is aligned with Ocean Discovery Institute would not be interested in adopting the model because they are already successful in their own niche and know that deviation would likely result in decreased effectiveness within that niche. More importantly, the replication team realized that partnering with an organization that was searching for a successful program model to implement was actually riskier than we had assumed at the outset of this study because that organization may not have the capacity to support and sustain successful implementation.

This shift in approach meant that Ocean Discovery Institute needed to expand their program model to a more fully fleshed out Business Model that could guide work in San Diego but also development of new organizations in other geographical locations. They had to confirm that their existing staff and board members were supportive of continuing to pursue replication under these circumstances and with certain caveats. They had to confirm that their program officer at NOAA was supportive of revising the scope of work and budget. This was no minor issue as the re-scoping identified a new funding gap that would have

to be filled before pilot implementation (an original objective of the B-WET project) could occur. It also meant that understanding the funding capacity to support a whole new organization (not just a new line of business for an existing one) would be essential to any implementation occurring in the Chesapeake Bay or elsewhere. Finally, it meant that the team's investigations with potential partners would focus on partners in the Hampton Roads region who might assist with programming but not full adoption of the model.

~ End of Coarse Level Assessment ~

Which replication strategy will be most successful?

With the realization that replication through adoption of the model by an existing local organization would not succeed and, instead, would require the establishment of a new organization in the Chesapeake Bay area, the research on replication strategy became focused on the organizational structure this new approach would need.

The team investigated active models of nonprofit educational organizations that had successfully expanded their impact through replication using case studies (The Aravind Eye Hospital, Goodwill Industries, Green Dot Public Schools, Harlem Children's Zone, Joblink, KaBOOM!, KIPP, Luna Dance Institute, Manchester Bidwell Corporation, Strive, The Wooden Floor, and Year Up) or interviews with representatives of those organizations (AVID, KIPP Living Classrooms). Several factors were considered in choosing the active models:

- The organization has a focus on education;
- The organization has maintained a strong culture throughout their replication sites (e.g., KIPP) and have positive brand recognition that people associate with strong impacts (e.g., Year Up, AVID); and
- The organization is similar in size to Ocean Discovery Institute (e.g. the Wooden Floor).

These investigations along with the literature review (Appendix F) yielded four main findings:

1) Ocean Discovery Institute needs to be very clear on what is being replicated and what is important about how the model is implemented in a new location.
2) The local organization (i.e., the new location) will need some level of local autonomy; overly centralized decision-making and direction can harm rather than help with replication.
3) Strong and clear metrics to which all affiliate organizations can be held accountable are essential.
4) A funding model that sustains both local and national operations is required.

These findings led the organization's leadership to revisit the key criteria of their model that were developed through their initial internal evaluations of what makes Ocean Discovery Institute work and succeed (see "Success Criteria of the Ocean Discovery Institute Model" on p.9). Through additional iterations of internal evaluation with review and feedback by external partners, the key criteria were expanded to create a more complete articulation of the Ocean Discovery Institute

Business Model. This business model is summarized by the following statement, which includes the mission statement of the organization but goes on to explain the other elements of their model that make it unique and sustainable:

> "We empower young people, from strategically selected urban and underserved communities, to transform their lives, community, and world as science and conservation leaders. This is achieved by providing consistent and continuous, tuition-free science education across one school-shed at a time. This is made possible by an engaged community and a highly diversified network of donors and investors, many of whom provide significant unrestricted and recurring funding."

The Business Model is described through two metaphors. The first metaphor uses a sustainable ecosystem to show how student outcomes, community, programs, and contributions enable sustainability and high impacts (Figure 13). The second metaphor uses a frame to show where fidelity is crucial and where there may be adaptability based on location or time (Figure 14).

In this ecosystem, the students are the trees that grow from seed, to seedling, to full-grown trees,representing an Ocean Discovery Institute student's growth into a leader in science, engineering, technology, or and conservation. These seedlings are nourished by and grounded in the soil, which is their diverse community that is supportive of its young people's aspirations. The sun's rays are the core program activities (previously described as a pyramid of initiatives for engaging students) that provide the energy for transformation of the students. Finally the clouds represent generating activities that ensure core programs are able remain tuition -free and be provided consistently and continuously. A diverse network of donors, investors and volunteers ensure there is adequate water needed to support the growth of the community's youth throughout their development and

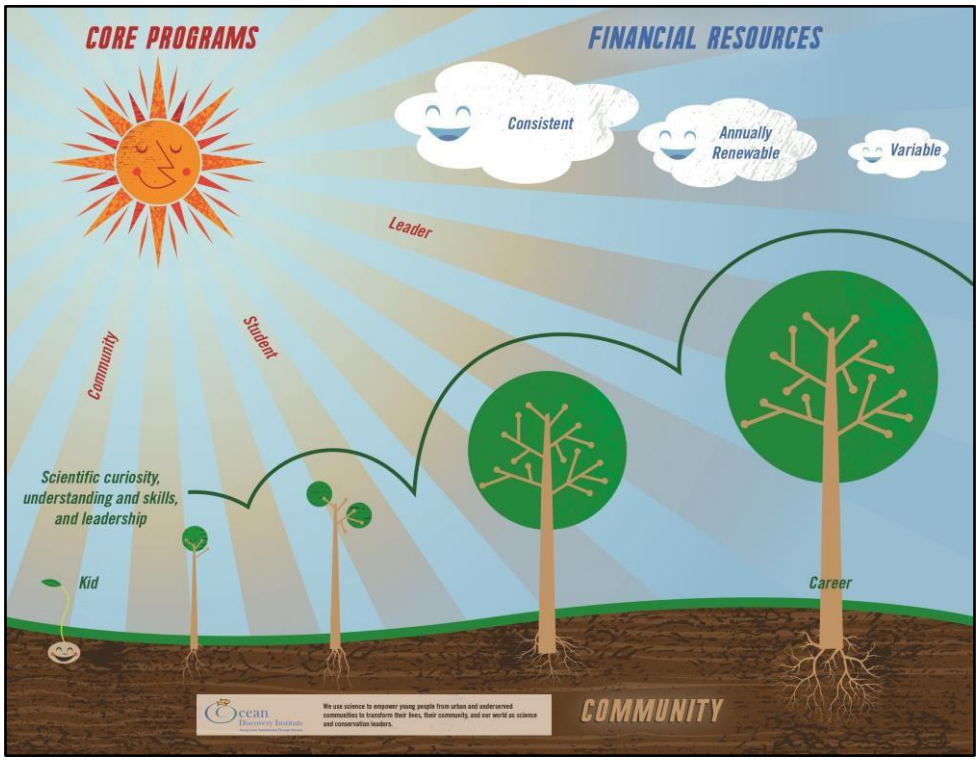


Figure 13. The Business Model uses the metaphor of a sustainable ecosystem to describe how Ocean Discovery Institute achieves its desired impacts.

the categories of funding (consistent, annually renewable, and variable). A greater proportion of the contributions are unrestricted and recurring on a consistent or annual basis to ensure sufficient reservoir and accurate forecasting. Just like an ecosystem, the model only works, i.e., the seeds mature into trees, when there is rich soil, sun, and adequate rain.

The second metaphor of the Business Model is the frame and the canvas. The frame represents the parts that must be consistent from location to location in order for the program to succeed. The frame consists of four important categories of operation: culture of organization, systems for operation, cost structure and resources, and programs and impact. The painting on the canvas will differ from site to site to reflect the community's demographics, needs, resources, the physical environment, as well as the maturity of the operations in each site will differ (Figure 14).

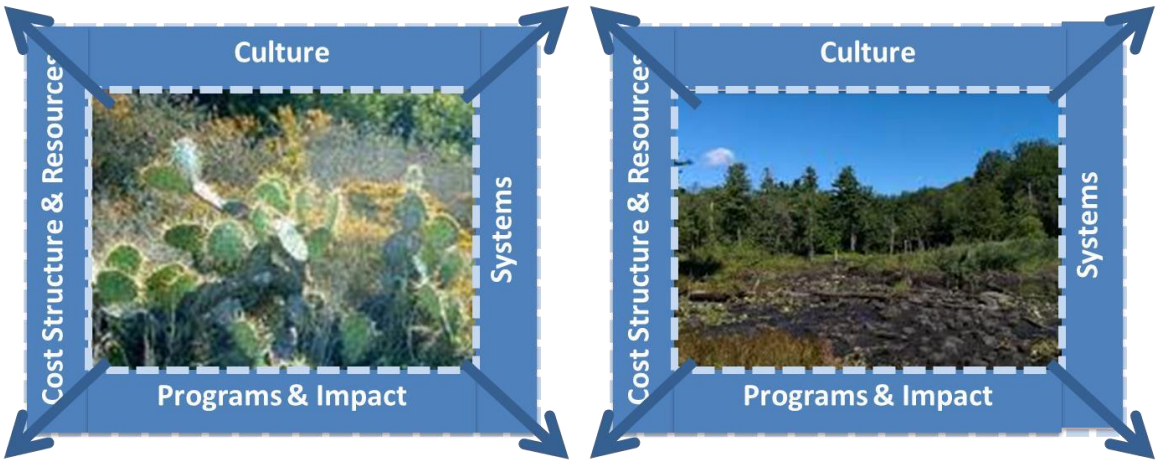


Figure 14. The arms of the frame describe the components of the organization and how it does its work that are critical to achieving its mission. The arrows and permeability of the frame represent the potential for evolution. The picture within the frame will look different in each location where the model is replicated, reflecting the actual and metaphorical ecosystem of each community.

The Business Model also includes details on how each arm of the frame is defined as well as considerations that will be important in shaping the final picture painted on the canvas. For example, one arm of the frame is Systems. This means that for the model to work, welldefined, measurable structure and processes must be in place; shared systems connect across departments and location to ensure efficient operations and allow the culture of the organization to thrive; and these systems enable staff and leadership to build institutional knowledge for all aspects of their Business Model. The picture on the canvas would reflect how shared systems actually work in each location and which tools are used to gather and organize data/information. Depending on where the organization is in its implementation of the Business Model, the picture inside the frame may be quite clear with many of the details painted in (e.g., San Diego today) or it may be somewhat fuzzy and indistinct (e.g., for the replication location in the Chesapeake Bay). The full description of the Business Model is provided in Appendix G.

The literature review (Appendix F) served several purposes throughout the course of our study. Initially it provided definition and categorization to different types of replication so that the team understood the theoretical framework for the other components of our study. More importantly, it confirmed many of the benefits of replication (e.g., opportunities for innovation and program development, strengthening

management of programs, diversifying financial resources, providing economies of scale, etc.) regardless of path to replication. Finally, as the idea of replication switched from one of partnership with another organization (i.e., having the replication happen by adoption/adaptation rather than by direct replication) the literature review in combination with the active models research provided helpful insights into how the future organization might be structured and related pros and cons to varying levels of control over local operations relative to the local circumstances (cultural, environmental, financial) in which replication will occur (Figure 15).

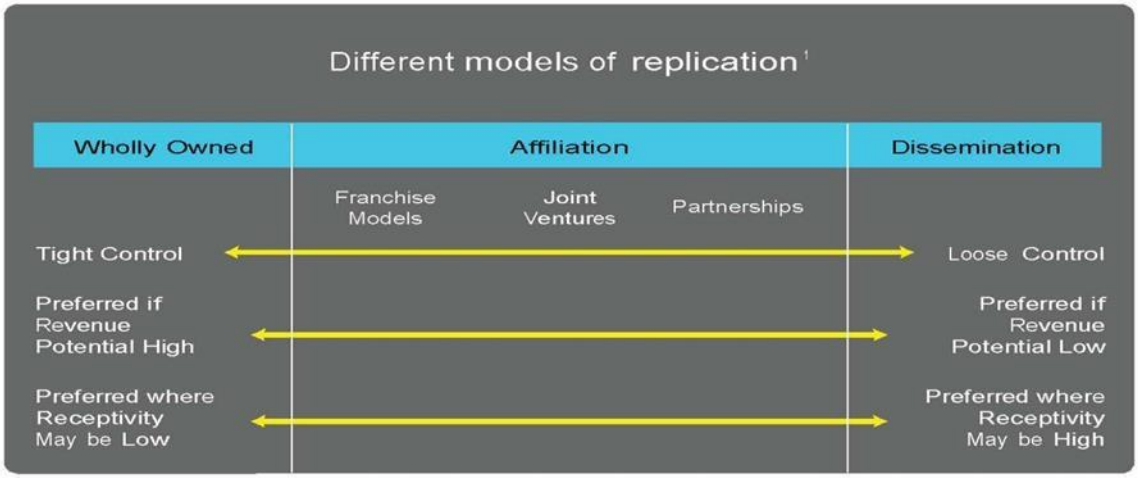


Figure 15. Different models of replication and related characteristics/factors to be considered in their employment. Source: Realizing the Potential for Social Replication. Research for Big Lottery Fund by the International Center for Social Franchising. Dan Berelowitz, Mark Richardson and Matt Towner. September 2013

With Ocean Discovery Institute's more fully defined Business Model, the pros and cons of each potential replication strategy was assessed to ensure funding opportunities are maximized while risk is minimized, fidelity to the business model and impacts is assured while local autonomy is maintained, and future replication locations could be supported. The best option for meeting those goals is a flexible franchise structure, where a new "parent" organization is established with local affiliates, one of which is the existing organization in San Diego (Figure 16).

With a franchise structure, the parent organization provides assistance, support, and services to the affiliate organizations while ensuring adherence to the standards and guidelines of the Business Model (i.e., the frame in Ocean Discovery's Business Model). Often these organizational structures rely on top-down management and communication with affiliates and can be inflexible. However, the replication team wants to develop a framework for operations within this structure that will allow for as much autonomy at the local level to be successful within the local context while adhering to Ocean Discovery's Business Model.

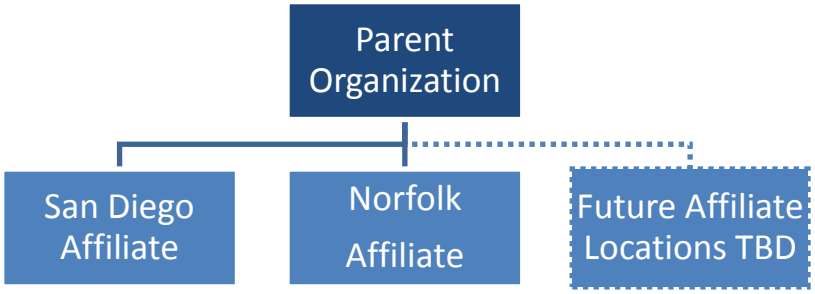


Figure 16. The recommended new structure of Ocean Discovery Institute that will support replication in new locations nationally and expansion within San Diego's City Heights community.

The exact relationship among the parent and affiliate organizations in relation to the implementation of the Ocean Discovery Institute Business Model will have to be worked out in the next phase of replication planning and is beyond the scope of this feasibility study and this report. Additionally, there will be a transition period during which Ocean Discovery Institute - San Diego will be serving as both parent and an affiliate before the parent organization is established and can support an affiliate in the Chesapeake Bay region and elsewhere in the United States.

The categories of activities that will need to be considered in terms of the allocation of decision-making authority, responsibility, and resources include:

- Governance (i.e., management of risk and decision-making authority for parent and affiliate)
- Organizational development (i.e., managing the organizational culture, responding to challenges and successes, managing the evolution of the business model)
- Sharing cost and resources (fundraising and internal financial controls)
- Monitoring and evaluation for quality assurance
- Measuring impacts and reporting
- Development and sharing of tools
- Mentoring and staff development (incl. training and sharing best practices)

Each of these activities will need to be looked at in terms of the roles of the parent and affiliate organizations at different phases of replication, from start-up to sustained operations. The team put some initial thought into how a few of the activities may play out and the roles of the parent and affiliate organizations as they evolve over different phases of replication, and were once again confronted with the complexity of the issues to be resolved. For instance, monitoring and evaluation to ensure adherence to the elements of the Business Model frame (culture, systems, cost and resources, programs and impacts) will initially be focused on the parent organization sharing the standards and assessment tools to ensure that there is fidelity to the business model, without sacrificing uniqueness of the local affiliate's community. As the organizations (affiliate and parent) mature, standards and performance measures may also evolve. How much of that evolution will be driven by the parent organization while allowing for lessons learned from the field (affiliates) to influence the business model and related standards will need to be considered more thoroughly. The allocation of responsibility for fundraising and resource sharing is another challenging area for investigating. For instance in the early

phases of replication, the parent would need to raise all the funds for itself (to provide services to the affiliates as they start-up and mature) and the affiliates would need to raise funds to support their local operations. Once established the affiliate organization would not only need to raise funds to support its sustained operations, but they may also need to pay a fee on a sliding scale that would increase as they mature to some fixed percentage. This fee would repay the parent organization for the investment of time, tools, professional development etc., that the parent would be providing to the affiliate organization to implement the Ocean Discovery Institute Business Model. The challenge will be figuring out what that percentage would be and ensuring that affiliates continue to see value in Ocean Discovery Institute's brand and the services. Additionally, there may be opportunities for the parent organization to secure funding for special initiatives that take place at the affiliate locations, but it is unclear at this point how this revenue sharing would function. These are just three examples of the issues related to roles, responsibility, and authority that will evolve as replication begins.

Medium Level Assessment of How Well the Locations Fit Ocean Discovery Institute's Model and the Capacity of the Region to Support the Model

Finding #7: As a region, Hampton Roads has the capacity to sustain an organization locally.

Using 990s, online information about foundations and local non-profit service organizations in the area, the consultant on the team identified a number of potential leads[16] to interview either to understand their likely interest in and ability to financially support replication of Ocean Discovery in Norfolk or to understand the capacity of the region to support non-profit organizations similar to Ocean Discovery in size, mission and operating costs. Once again, the optimism of people who were contacted in this component of the research was consistent with the team members' earlier experiences. The individuals interviewed were welcoming (even when this effort could have been seen as competition) and connected Ocean Discovery's Director of Philanthropy and the team's consultant to other individuals from the region who might be able to provide necessary insights.

We learned that geographical location of activities and resulting program impact within the Hampton Roads region determines the availability of support from some potential donors. For instance, some donors only support work conducted on the peninsula (region including Hampton) while others only focus on Portsmouth or Norfolk on the "south side". However, that nuance is not a driver for deciding where replication should occur within the region because the overall capacity of the region appears sufficient to start, as well as sustain, a new organization. It simply meant that additional information would have to be gathered to understand which potential donors had an interest in supporting replication for whichever city in the region was chosen.

[16] Foundations contacted included: Bank of America corporate foundation, Hampton Roads Community Foundation, Beazley Foundation, etc. Local non-profit organizations that provided insights into local fundraising capacity included Nauticus, Horizons Hampton Roads, Access College, Inc., etc. Additionally, the Hampton Roads Economic Alliance was helpful in understanding the local corporate culture regarding philanthropy.

It also became clear that expanding Ocean Discovery's reach beyond San Diego could provide access to new sources of funding from nationally focused philanthropic organizations and corporations with interests in both locations.

Finding #8: Different funding strategies will be needed for the start-up phase of replication compared with sustaining operations in Norfolk.

With guidance from its Board of Directors and staff, the replication team realized that replication under the new approach would require creation of a Start-up to Sustainability Plan. This plan is intended to enable the establishment of a new site in Hampton Roads without destabilizing funding and infrastructure in San Diego and create a template for additional replication. The capacity of funders in Norfolk to sustain a new organization should not be relied on for start-up of the new organization because the donor base in Norfolk is more likely interested in funding operations once they are up and running. Therefore, the strategy for garnering start-up funding will have to be sourced from nationally focused philanthropic organizations and corporations that may be interested in funding expansion of a successful model and/or have interests in supporting underserved communities in both San Diego and Norfolk.

Finding #9: Evidence of a STEM-based economy looks different in Norfolk than in San Diego

One of the key components of Ocean Discovery Institute's model is the presence of a vibrant STEM-based economy in the region in which the school-shed is located. This is important as a source of mentors and other volunteers as well as future employers. During early site visits to the region, team members met with representatives of Norfolk Redevelopment and Housing Authority, Hampton Roads Community Foundation, Hampton Roads Economic Alliance, Hampton University, Old Dominion University, and Access College, to understand the STEM industry and related resources in the region as well as the relationship among the cities that compose Hampton Roads.

Despite data on numbers and types of employers in Hampton Roads (Appendix E), the San Diego members of the replication team were not convinced there was adequate STEM industry in the area during their site visit, because they were looking for outward manifestations of wealth associated with STEM economy similar to that of San Diego. Meanwhile, the East Coast team members, who were more familiar with this region in Virginia, were convinced there would be plenty of opportunities for providing authentic STEM research experiences and career paths because of the presence of the US Navy (and related businesses), NASA, NOAA, several local universities, Norfolk Southern, and the port authority. But these opportunities would look different than those afforded the City Heights students because there was less of a focus on biotech and fisheries and more of a focus on physical oceanography, engineering, modeling, and simulation. During a later visit by the replication team, it became clear that the cultural evidence of a wealthy STEM-based economy is different in Hampton Roads than in San Diego.

That was a big part of the reason why the San Diego team members instincts conflicted with the quantitative data from online sources and qualitative data garnered through conversations with local professionals.

At this stage, the team was convinced that all the key criteria for success of the model (school and community characteristics, funding capacity, adequacy of the local STEM resources) could be met within Hampton Roads region. Further the team was leaning toward Norfolk, but wanted to be sure that other communities in the region were revisited in light of their community's demographics as well as the school-sheds comparison with Hoover High School in City Heights.

Finding #10: Census and school district data confirm that communities on the "south side" of Hampton Roads are the best fit to the model, but the school-shed is still an open question.

Early in the feasibility study, the school data collected for coarse level analysis indicated Booker T. Washington was a close fit to the benchmark school-shed for City Heights (Table 5), but at this stage of the study, the team had concerns about it being a magnet school with a focus on the visual and performing arts. At that same time we learned that the Lake Taylor school-shed was getting a new K-8 STEM learning facility and there was an existing Aquatic Center in Compostella, making that option attractive. Therefore we focused our final site visit to the region on really gaining a better understanding of the neighborhoods served by Norfolk Redevelopment and Housing Authority (NRHA) and their associated school-sheds. Before our trip, we gathered additional on-line data for all schools within five Hampton Roads communities (previously we had not included Portsmouth and Chesapeake). After running a Multi-dimensional Scaling plot on these schools (Figure 17), Booker T. Washington and Lake
Taylor High Schools demonstrated the best fit to model. Also during a previous visit the San
Diego members of the replication team walked the area around Booker T. Washington (Young Terrace) and realized it met the model. We used these findings, in addition to neighborhood information from NRHA to guide the next site visit. Additionally, the team decided to stay in Portsmouth (during previous visits we had stayed in Norfolk) so we could get a feel for that community as well.

Figure 17. Schools within the solid line are most similar to the current model in San Diego (Hoover).

When we walked through the project in Diggs Town, Norfolk we immediately felt a community that was similar to City Heights. This became clearer, during a cab ride from this project to the local high school. Our cab driver, Rochelle, an African American woman who grew up in this neighborhood stated that she "did her time" in Diggs Town. Rochelle described that in these school students aren't exposed to the possibility of college and careers in science and conservation. However, she dreamed of a better future for her and her daughters and moved out of the project. While she wished she knew of these opportunities earlier life, now 40 years old, she is paying her way through college driving taxi cabs and earning a degree information security technology.

Finding #11: Norfolk Redevelopment and Housing Authority will be a key partner regardless of the school-shed that is the final focus of replication.

At this stage of the feasibility study, the team was convinced that to replicate using the new approach (i.e., establishing Ocean Discovery Institute in Norfolk), close partnership with a community-based organization would be essential for success and indeed, next steps in setting up a new organization would be challenged without that connection to the community. During initial meetings with the personnel from the NRHA, who oversee their programs and coordination, the team learned that NRHA is keenly interested in integrating STEM activities into the out-of-school activities that are provided for kids within the properties they manage. They have repeatedly noted that there is a lack of STEM access in the communities served by NRHA, so the need is huge and they have continually showed an eagerness for Ocean Discovery Institute to come to town and get to work.

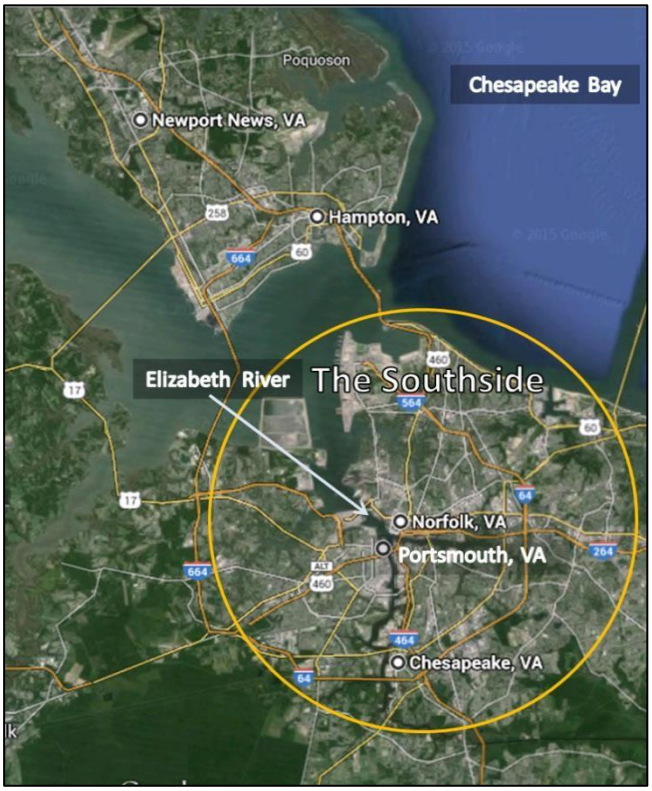


Figure 18. A Google Earth image of Hampton Roads. The "Southside" cities are circled in yellow (except Virginia Beach, which is outside the frame).

This was yet another sign that Norfolk is the right place and NRHA is a key ally to have on board, but the team needed to understand the details of the various housing projects and how they were connected the school-sheds under consideration. The team also wanted to figure out whether it would be best to remain focused on Norfolk or consider other "south side" communities in Portsmouth or Chesapeake (Figure 18).

Fine Level Assessment of How Well the Locations Fit Ocean Discovery Institute's Model and the Capacity of the Region to Support the Model

Finding #12: Norfolk is the place and Booker T. Washington is the school-shed.

Figure 19. Replication team with representatives of Norfolk Public Schools and Redevelopment and Housing.

Now that the team was honed in on Norfolk as the most likely place, they widened the consideration of Norfolk Public High Schools and mapped several options based on zip codes to figure out the potential school-shed pathways and size (Granby High School, Lake Taylor High School, Booker T. Washington High School). During the final site visit to the region, the team met with Norfolk Public Schools' Deputy Superintendent and the client services team from NRHA to get a better understanding of school-sheds and their linkages the communities managed by NRHA. These Authority. individuals strongly endorsed working with Booker T. Washington High School based on need. The fact that the high school has a focus on the arts was all the more reason they were interested in seeing STEM programming provided to the students in that school-shed. The Deputy Superintendent quickly arranged for team members to meet principals from the Booker T. Washington school-shed and the NRHA invited members of the replication team to attend the NRHA board meeting so they could meet representatives of the community while in town.

Figure 20. Replication team members with the principal of PB Young Elementary School.

The team met with the principal of one of the three elementary schools in the Booker T. Washington school-shed and saw the physical proximity of the elementary school to the community center managed by the NRHA (along with the housing for Young Terrace – one of the properties managed by NRHA) and heard first-hand about the need and opportunities at that school, further solidifying the conclusion that the need is high in the Booker T. Washington school-shed.

Additionally, the team visited the NRHA communities associated with Booker T. Washington High school-shed and Lake Taylor High school-sheds in order to get a sense of how close together communities are to their schools and their proximity to water. Both school-sheds have good proximity to green space and the water, but the Lake Taylor High school-shed is physically disconnected (i.e., the elementary and middle school are not located walking distance to the high school) therefore it is not as good a fit to the Ocean Discovery Institute Business Model.

By the end of the site visit the team was convinced that Norfolk (not Portsmouth, Hampton, or other cities in Hampton Roads) is best fit for replicating Ocean Discovery Institute's Model. Further, the team settled on Booker T. Washington High's school-shed as the place to replicate first (Appendix H).

Finding #13: Norfolk has ample STEM partners who can supply mentors, volunteers, and career opportunities for students

During the final site visit, the team met with numerous representatives of potential STEM partners from NOAA's Center for Operational Oceanographic Products and Services (CO-OPS), Portsmouth Naval Ship Yard, US Fleet Forces Command, Hampton Roads Sanitation District (HRSD), Nauticus, the Hampton Roads Naval Museum, Make a Difference 2020, and Cooperating Hampton Roads for Minorities in Engineering (CHROME). We discussed opportunities for partnership vis á vis mentoring, curriculum, field trips, internships, etc.

The meeting confirmed our earlier finding based on online research that there will be sufficient sources of volunteers and opportunities to support students' exploring interests in STEM as a course of study and career. The US Navy has a large presence and their representatives are enthusiastic about partnering but the size of the bureaucracy makes it difficult to leverage their resources, which is no different than in San Diego. It will take time to figure out the best way to leverage the Navy's STEM resources, but they are such a large presence in the region that it will be important to engage their folks early and often.

Other potential STEM partners in the region will be easier to engage but thought needs to be put on communications with these partners as the replication process unfolds and the project gets closer to implementation wherein these partners would be engaged.

Finding #14: Key partners for successful replication are present in Norfolk.

Based on guidance from the Ocean Discovery Institute's Board of Directors' Replication Task Force, the consultant on our team did due diligence on major organizations in the region that may become partners. The one partner that will be essential for replication to proceed in Norfolk is the Norfolk Redevelopment and Housing Authority (NRHA). The NRHA has been around a long time and it is a stable organization. It has a culture that supports collaboration and values the community's investment in their youth. This culture is pervasive among the staff and board members contributing to continuity of focus on those goals when turnover in personnel (inevitably) occurs. The literature on replication strategies emphasizes the importance of local leadership and committed and well-connected champions to success because these individuals understand the program being implemented and the local context of operations (Appendix F, pp. 16-17). The NRHA is a group of such individuals who are positioned to be major champions for Ocean Discovery Institute, opening doors in the region because they have connections with a wide range of stakeholders. During a recent teleconference with NRHA staff, the Client Services Director, Kim Thomas confirmed their interest in a partnership with Ocean Discovery Institute, saying: "Norfolk is failing its community and students, and when people have choices they have the opportunity to do something different in their future. This [partnership with Ocean Discovery Institute] is one of the greatest opportunities to come to Norfolk because the model works from the

inside out and not around the perimeter and this is exactly the type of work we want to do in our communities."

While partnerships with STEM industry will become important as implementation occurs, at this stage it is sufficient to have connected with many of them in the region and there will be no shortage of opportunities to deepen these relationships and develop others in the future.

Norfolk Public Schools has experienced a lot of turmoil recently (and we received indications that more is to come soon). However, this is not a deterrent for replicating in Norfolk because Ocean Discovery Institute's model is designed to work with the challenges and opportunities that are presented by the local school system at any time. The problems being experienced in the Norfolk Public School system currently are not atypical of many urban public school systems that are underperforming (including San Diego Unified School District).

To further solidify relationships, letters of support will be sought *after* the consideration of the recommendations of this report by the Ocean Discovery Institute Board in May 2015.

Finding #15: For replication to move forward, a business model for a new parent organization, including defining the relationship with affiliate organizations, will be needed. Then, strategic business plans for the parent and Norfolk affiliate will be needed to guide growth and development.

In order to develop these business plans, we needed to articulate the phasing of next steps with respect to establishing a new organizational structure, hiring personnel, figuring out programming, etc. Then costs were associated with each of these steps in each phase and those determined the total funding that would need to be raised before each phase can begin. These analyses are captured in the *Replication Strategy Matrix* (Appendix I) and *Replication Strategy Budget* (Appendix I), which not only identify steps that will be critical to moving forward, but also the cost basis and timing associated with each step along the way. This represents Ocean Discovery Institute's best thinking to date and is based on the following assumptions:

1. When seeking funding, contributions will be required to support three key outcomes: (1) expanding the San Diego affiliate's operations to the maximum capacity of the school-shed, (2) the establishment of a parent organization that will enable replication, and (3) the establishment of the first replicated affiliate in Norfolk.
2. Some costs incurred during the first replication (represented in Replication Strategy Matrix) will be one-time start-up costs that will support replication now and in future locations (e.g. establishment of the parent organization).
3. Substantial time and resources by Ocean Discovery Institute - San Diego will be needed to establish the parent organization and the first affiliate organization in Norfolk.
4. Movement beyond thresholds is reliant upon the objectives being met and therefore the project timeline may shift.

5. The parent organization will require approximately three full-time staff members and an annual operating budget of approximately $300,000.
6. The Norfolk affiliate will begin with an annual operating budget of approximately $575,000 (which will support core programs across the school-shed) and will grow modestly to a sustaining budget of approximately $850,000 (which will support all students within the school-shed from "seed to tree").
7. The Norfolk affiliate will receive funds from the parent in order to prepare for pilot implementation, but will not receive support once the pilot is underway.
8. Because the parent is not yet established, Ocean Discovery Institute - San Diego will have fundraising responsibilities for replication through establishment of the parent and Norfolk affiliate organizations in preparation for pilot implementation.

In total, success from today through a three-year pilot period is predicated upon Ocean Discovery Institute San Diego raising roughly $1.4 million, the parent raising roughly $1.25 million, and the Norfolk affiliate raising roughly $2.25 million.

Finding #16: The carrying capacity of Norfolk to sustain a new affiliate of Ocean Discovery Institute is $850,000 annually. This amount will enable the new affiliate to serve the entire Booker T. Washington High School school-shed after start-up is completed.

Our research indicates that the Norfolk affiliate has a carrying capacity to financially support an annual operating budget of $850,000. This figure was gleaned from data gathered on potential funders and similarly sized non-profit organizations operating in Norfolk (Finding #7). Using the numbers of students in the school-shed (Figure 21), cost per student in San Diego adjusted for Norfolk cost of living, and projected fundraising capacity as a guide, the team confirmed that a new entity operating in Norfolk could sustain operations at this level of income and reach the entire Booker T. Washington School-shed. It should be noted that $850,000 is the annual operating budget once the Norfolk Affiliate has completed pilot implementation in Year 3; the budget is estimated to be smaller during the start-up phase[17].

[17] By comparison, Ocean Discovery Institute's projected budget for operations once the Living Lab is open is $2.1 million.

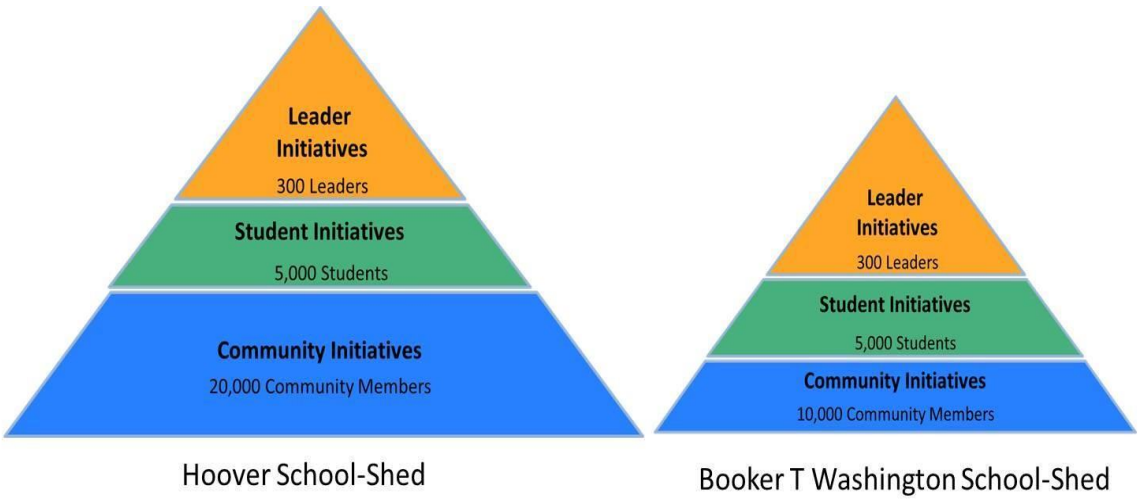


Figure 21. Comparison of two school-sheds. In the Hoover High school-shed, the community initiatives have the potential to reach more than just the population of school-shed because the elementary and middle schools feed into more than just Hoover High School. However, the Booker T. Washington High school-shed overlaps almost completely with its community, i.e., there are few students from the community surrounding Booker T. Washington that go to other school-sheds. Note these school-shed numbers are projections for operations at full capacity in San Diego and Norfolk.

Finding #17: Growth in Norfolk must be modest.

In preparation for this feasibility report, Ocean Discovery Institute developed an initial fundraising roadmap to be executed by the Norfolk affiliate during preparation for the pilot and pilot years 1 through 3. This roadmap is based on Ocean Discovery Institute's fundraising expertise and information learned about fundraising in Norfolk. It has been strategically developed with a goal of reaching the Norfolk community's carrying capacity through modest financial growth that builds towards sustainability.

It was determined that growth must be modest to ensure local staff and board are able to maintain culture throughout start-up, have sufficient time to learn, and develop programs in a way that respond to community needs rather than just funding opportunities.

In order to build toward financial sustainability, fundraising efforts will consist of a strategic composition of funding sources categorized as Consistent, Annually Renewable, or Variable (see Ocean Discovery Institute Business Model in Appendix G). These categories are defined as follows:

1) Consistent sources are regular recurring gifts that are typically unrestricted. Sustainability for consistent sources is reached when 40% of income is in this category.
2) Annually Renewable sources are highly anticipated based on a history of giving. Sustainability for annually renewable sources is reached when 35% of income is in this category.
3) Variable sources are competitive, less predictable, and higher risk sources of funding. Sustainability for variable sources is reached when 25% of income is in this category.

For activities occurring through pilot year 1 (see Replication Strategy Matrix in Appendix I), a gift composition table has been developed to demonstrate what is needed and what is known by the replication team (Table 8). It is important to note that while some prospects have been identified, there are significant numbers of prospects still needed to secure the requisite funding to begin to build operations in Norfolk, Virginia. These additional funding prospects would need to be identified by the Norfolk affiliate's Board of Directors.

Table 8. Funding strategy required for preparation of Pilot and Pilot Year 1 in Norfolk, Virginia. Gift table is broken down by type of funding source ("cloud"), amount of individual donations, number of donations and funding prospects identified.

Cloud	Level of Gift	# of Gifts to Secure	# of Prospects Needed	Prospects Identified	Total Amount
Variable	$150,000	2	5	1. HR Community Foundation 2. NOAA BWET	$300,000
Variable	$100,000	1	3	1. Brock Family 2. Batten Family	$100,000
Variable	$25,000	2	8	1. Beazley Foundation 2. Hansen Family Foundation 3. Mary Morton Parson Foundation 4. Palmer Foundation	$50,000
Variable	$10,000	4	15	1. BAE 2. Bank of America 3. Cox Charities 4. Dollar Tree 5. General Dynamics – NASSCO 6. Huntington Ingalls & Subsidiaries	$40,000
Variable	$5,000	1	5	TBD	$5,000
Variable	$1,000	5	10	TBD	$5,000
Consistent	$100,000	1 event	Multiple attendees	NA	$100,000
Consistent	$50,000	1 board "give"	Multiple Board Members	NA	$50,000
	Total				**$650,000**

Once the pilot phase begins, the strategy to reach sustainability relies on increasing the numbers of donors and the amount of gifts as well as moving away from reliance on Variable sources of funds toward more Consistent sources (Figure 22). It is important to note that by the end of the pilot, the organization will be securing $800,000 annually and we anticipate the carrying capacity of $850,000 to be reached shortly thereafter.

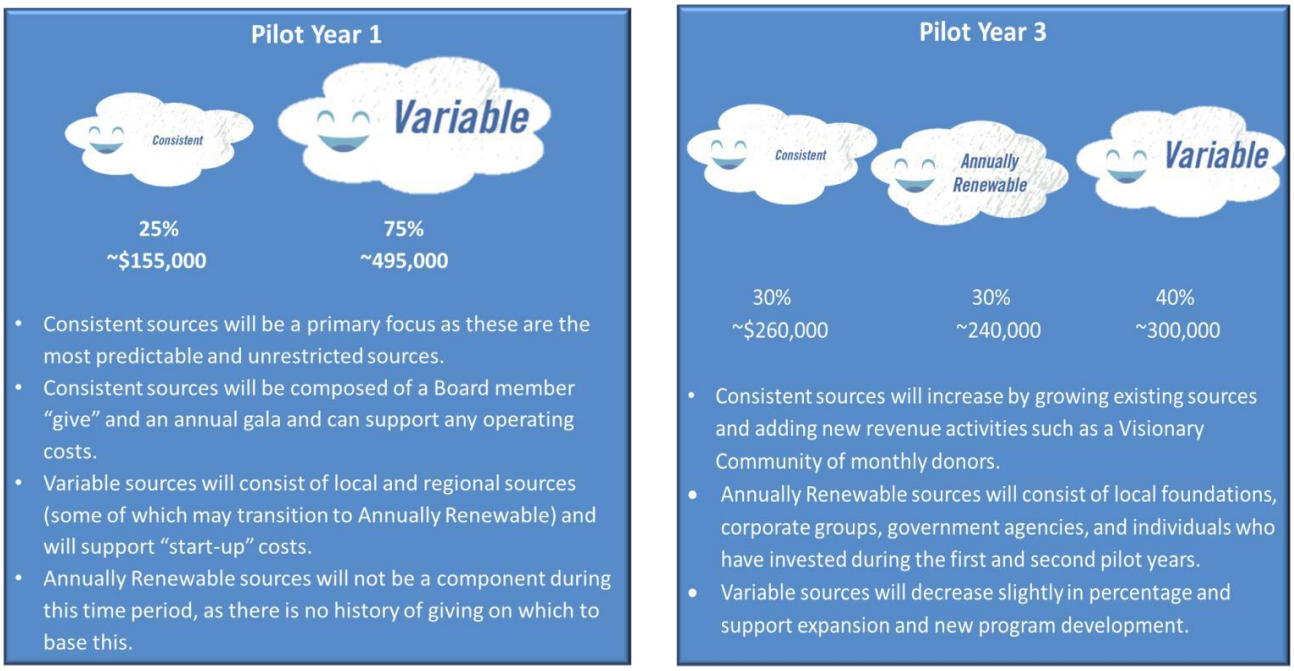


Figure 22. This figure summarizes the shift in funding strategy during the first three years of implementation of programs in Norfolk. The clouds represent the resources needed to grow and sustain operations in Norfolk.

Finding #18: Funding from nationally-focused philanthropic organizations will be required for the start-up phase of replication.

In order to replicate, we identified that success will require approximately $2 million to be raised from the nationally-focused philanthropic community over a period of four to five years. This will support expansion of operations to serve the full school-shed in San Diego so that the initial model is complete, the establishment of a parent organization that will enable replication in Norfolk and elsewhere, and the establishment of the first replicated affiliate in Norfolk, as detailed in the Replication Strategy Matrix (Appendix I).

In order to reach success, it is imperative that we engage the national philanthropic community because: (1) These organizations have the greatest interest in supporting projects that will provide benefit on a national scale, (2) They have the capacity to make the large investments necessary to take great strides forward in a short period of time, (3) this strategy will ensure we do not draw on existing resources of support for San Diego's operations, and (4) it is unlikely that funding prospects in Norfolk will be willing to pay for the parent organization to be developed and may be reticent to fully fund a Norfolk affiliate in advance of operations. Ocean Discovery Institute - San Diego will be initiating this national fundraising effort and the parent organization will be completing it.

To achieve $2 million we believe we need at least ten prospects to achieve two to three major gifts. Initial research into the national philanthropic landscape resulted in the identification of seventeen funding

prospects. Of those prospects, further research resulted in a narrowed list of twelve prospects for support of our expansion efforts. It is important to note that the list of prospects listed in Table 9 below, was developed using Ocean Discovery Institute's LIA prospecting strategy as defined in the "Methods" section of this report.

Table 9. National funding prospects to be pursued to enable expansion in San Diego, establishment of a new parent organization and development of new affiliates. LinkageInterest-Ability scores range from 1 to 3 with 3 being the strongest rating for each characteristic.

National Funding Source	Range of Giving	LIA Score
Atlantic Philanthropies	$100,000 - $1,000,000	2
Annie E Casey Foundation	$100,000 - $200,000	2
Bill & Melinda Gates Foundation	$500,000 - $3,000,000	3
Edna McConnell Clark	$1,000,000 - $2,000,000	3
Ford Foundation	$100,000 - $550,000	2
Jack Kent Cooke Foundation	$50,000 - $500,000	2
John D & Catherine T MacArthur Foundation	$100,000 - $600,000	2
John and James L. Knight Foundation	$100,000 - $1,000,000	2
Kapor Center for Social Impact	$50,000 - $250,000	2
Nathan Cummings Foundation	$50,000 - $600,000	2
Open Society Foundations	$100,000 - $500,000	2
The David & Lucile Packard Foundation	$200,000 - $750,000	2

Moving forward, we will transition from the prospect identification phase to the initial cultivation of these national funding prospects. Initial cultivation will consist of initiating contact through introductions made by existing supporters and submitting applications to those foundations that accept them.

---End of Fine Level Assessment---

The following summarize a handful of lessons learned in the process of conducting this feasibility study. While they do not directly address the main research question or the specific lines of inquiry identified at the start of our research, they are of note.

1. The relationship with NOAA being that of both the funder and an invested partner ensured the feasibility assessment could evolve as needed to ensure the success of the ultimate goal. Having NOAA's commitment to the larger goal of replication and a clear understanding of the inherent challenges that this feasibility study entailed meant that the federal program officer and the project liaison were willing to work with the recipient so that the work plan deliverables and timeline could be revised to meet the project goal and agency's mission. Additionally, beyond the funding, the resources and expertise of the agency (i.e., Sarah Schoedinger's authorship of this report) were pivotal to the overall accomplishments of the project.

2. While substantial investments are needed to get the initial second site up and running, as well as establish the parent organization, it is anticipated that costs for establishing additional sites will be lower.

3. The investments made in this process demonstrate value not just for the ultimate outcome of replication, but also for operations at Ocean Discovery Institute San Diego. For example, the need to clearly define the Ocean Discovery Institute Business Model, is already driving different strategies and decision making to better achieve sustainability and student success.

4. It is essential to identify the time and expertise outside of the bailiwick of existing staff that will be needed to ensure project success. Non-profit organizations often operate with very minimal resources. Consequently, their staff members do not always acknowledge what is required to achieve success and, instead, attempt to get the job done with the fewest resources possible. However, such efforts to save funds, may end up costing the organization in staff time and delays in the project. In this project, Ocean Discovery Institute leadership searched their local professional networks to identify unpaid interns who could help with specific aspects of the research (discussed in Methods). Given the complexity and dynamic nature of this study, hiring a paid consultant with the requisite experience and expertise was more efficient because less staff time was needed to guide them toward the desired output and the project was able to evolve as needed.

Conclusions and Recommendations

> Plans are nothing.
>
> Planning is everything.
>
> ~Dwight D. Eisenhower

The feasibility study asked: (1) "Which replication strategy will be most Plans are nothing. successful?" and (2) "Which location, if any, would enable implementation of the model to succeed?" Our conclusions are as follows:

With respect to strategy:

1. The clearly defined Ocean Discovery Institute Business Model will allow replication to occur.
2. In order for replication to occur, the organizational structure of Ocean Discovery Institute must transition to one with a parent organization and local affiliates. Once this occurs, the existing San Diego-based organization will become an affiliate, Norfolk may be established as the second affiliate, and other sites may follow.

With respect to location:

1. Replication is feasible in Norfolk and elsewhere in the United States, assuming certain conditions are met.
2. In the Chesapeake Bay region, Norfolk, Virginia is the location that best fits the Business Model.
    a. The Booker T. Washington High School feeder pattern has been identified as the school-shed, which includes the housing projects of Young Terrace and Tidewater Gardens.
    b. The community, academic, STEM industry, and funding partners have the capacity and interest to support this model. The Norfolk Redevelopment and Housing Authority has been identified as one of the key partners.
    c. The region has the funding capacity to sustain operations of a Norfolk affiliate once it is established. It is projected that this affiliate can be self-sufficient during the pilot years, but this must be verified by the Norfolk Board of Directors once in place.

An entire community transformed through science...

When Ocean Discovery begins programs in the Booker T. Washington school-shed, the community will be taking their first step towards this vision.

Imagine…

Every third grader dissecting a sea star in their classroom.

The third graders traveling to the coast alongside scientists to explore these animals in their natural habitat.

Their teachers ready to foster their enthusiasm and answer their many questions.

Photo Credit: Ocean Discovery Institute

Imagine…

Hundreds of people from the community coming together to transform neglected land into a vibrant environment.

Families gathered on a Saturday at the community center to build remotely operated vehicles with the help of naval engineers.

Photo Credit: Ocean Discovery Institute

Imagine…

Kids with a lot of potential but a long way to go, selected to embark on a journey that begins with an intensive summer of ocean discovery and builds a pathway to college and careers.

Photo Credit: Ocean Discovery Institu te

Imagine…

A community of parents, teachers, and kids ready to seize opportunity. A committed group of supporters who ensure all of these opportunities are provided tuition-free.

Photo Credit: Ocean Discovery Institute

Recommendations

The primary recommendation is to move forward via the plan outlined in the report (summarized in the Replication Strategy Gantt Chart, Appendix I). Objectives outlined in the Replication Strategy Matrix have to be met in order to progress beyond each threshold. The following considerations should guide how the objectives of Ocean Discovery Institute's replication strategy are enacted in the coming year.

1. The Replication Task Force of Ocean Discovery Institute's Board of Directors should remain in place to ensure that thresholds are not crossed without measurable objectives being met. The full board should be kept informed of progress, particularly as each threshold is crossed.

   Leverage relationship with NOAA (codified in a memorandum of understanding signed in January 2015) to ensure that NOAA's assets and capabilities are appropriately integrated as replication unfolds.
2. Additional advisors (e.g., leaders from local organizations that have already replicated successfully) should be integrated as needed to provide expertise not present among staff and Replication Task Force.
3. A consultant must be identified to lead the development of the Parent Business Model to ensure sufficient capacity, time, and expertise are available.
4. When parent materials are developed, outside advisors should be drawn upon to ensure that these are highly transferable.
5. A strong communications plan should be developed to ensure existing relationships with partners and potential partners in Norfolk continue to be fostered.
6. Norfolk relationships should be the primary mechanism for identifying potential board members.
7. Start-up funding must rely on national funders to support Ocean Discovery Institute - San Diego growing to reach its entire school-shed, the establishment of a parent organization, and the establishment of the Norfolk affiliate so that it is ready to begin operations.
8. Securing funding for each threshold will likely be the primary driver of the rate of implementation, and, therefore, embarking upon the national funding strategy should be an immediate priority.
9. Ultimately, fidelity to the model is more important than meeting the estimated timeline. Success in San Diego, Norfolk, and any future sites, will depend upon this.

Literature Cited [18]

Creech, H. 2008. *Scale Up and Replication for social and environmental enterprises.* The SEED Initiative

City Heights Partnership for Children, 2014. *City Heights Starting Point – Baseline Report*. http://issuu.com/uw_sandiego/docs/city_heights_baseline_report_digita

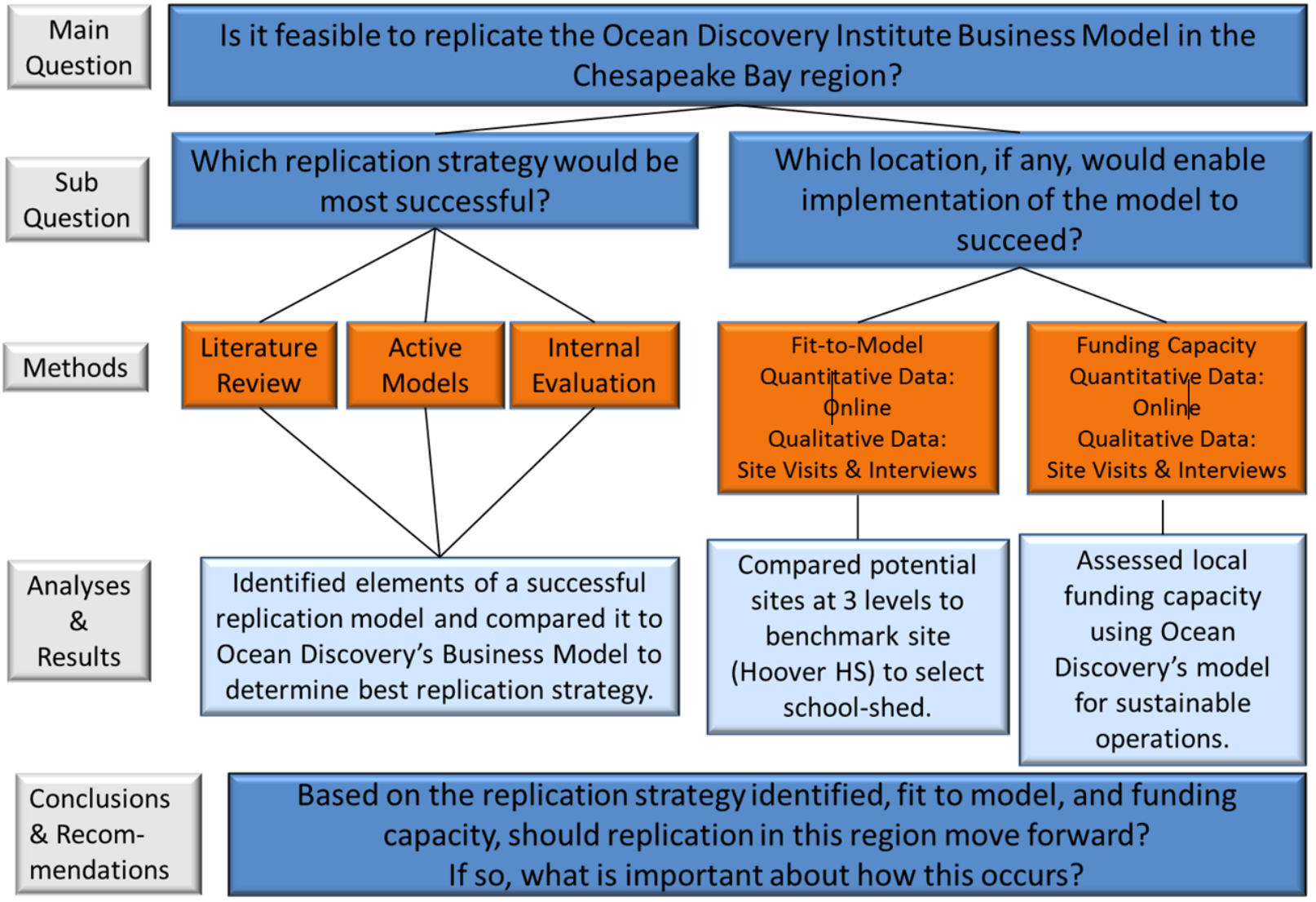
The Pell Institute, 2008. *Moving Beyond Access: College success for low-income, first-generation students.* http://www.pellinstitute.org/downloads/publicationsMoving_Beyond_Access_2008.pdf

Appendices

A. Feasibility Study's Design
B. List of Questions Asked During Site Visits
C. Coarse, Medium and Fine Level Data on Schools and Community
D. Replication of Ocean Discovery Institute Model: Coarse Level Site Assessment
E. STEM Industry Research for the Hampton Roads Region of Virginia: Chesapeake, Hampton, Newport News, Norfolk, and Portsmouth
F. "Replication of Ocean Discovery Institute: An Urban STEM Model that Will Empower Decision Makers and Leadership for the Chesapeake Bay Region": Replication Strategy Assessment: Literature Review
G. Detailed version of the Ocean Discovery Institute Business Model
H. Norfolk Public Schools – relevant school-shed feeder pattern
I. Replication Strategy Gantt Chart, Matrix, and Budget

[18] Literature cited in any appendix is not listed here unless it was directly cited in the report text. The literature review contains an extensive list of citations. See Appendix F for more details.

Appendix A: Replication Study Design



Appendix B

Site Visit Questions for Coarse Level Assessment

Goal: Guide coarse-level decisions regarding location.

Sub-Goals:

1. Gain an understanding of community character and readiness from those with on-theground experience.
2. Gain a broad perspective of the key leaders in the community and potential partners.

Questions to Address Goals:

1. How would you describe the strengths and challenges of *community+?
2. What inspires you about working in this community?
3. What is the single most exciting thing happening in this community to educate young people?
4. Do you see a gap in STEM education in this community? If yes, what do you think are the drivers for this?
5. What considerations do you think are critical when thinking about working in this community?
6. Which neighborhood(s) within this community is the highest need and/or best match and why?
7. Is there a viable school-shed (i.e, is the flow of students from one level to the next relatively intact and there is a high degree of "walkability" among campuses)?
8. What STEM, environmental, and non-STEM organizations stand out among others in terms of positive impacts, leadership, focus, and/or culture? Who are they and why?
9. Are there any other key leaders that haven't been mentioned so far (elected officials, community leaders, etc.) with whom you think we should be connecting? Why?
10. *(For funding entities only)* As an entity that invests in *areas of interest+,
    A. What do you think are the strengths in the region that this project could leverage?
    B. What are the gaps that this project could fulfill?
    C. What considerations do you think are critical when thinking about raising funds to sustain an organization in this community?
11. *Other questions directly related to the coarse-level data on school and community variables that were specific to each region visited.+

Appendix C: Data on Schools and Communities for Coarse-level Assessment

Location	High School Name	HS % Students of Color	HS % Receiving Free Reduced Federal Lunch	HS % Black	HS % Latino	HS % Asian	HS % White	HS # Attending	HS Grad. Rate	HS Math Score (%)	HS Reading Score (%)
San Diego	**Hoover**	96	87	11	71	14	2	2,200	42	27	40
Baltimore	Achievement Academy	100	83	99	1	0	1	354	32	36	43
Baltimore	Antioch Diploma	99	80	98	1	0	1	395	27	27	31
Baltimore	Baltimore City College	88	59	85	2	1	10	1,289	92	88	95
Baltimore	Baltimore Community	93	73	81	12	0	6	426	40	15	24
Baltimore	Benjamin Franklin	69	85	58	10	1	31	380	71	66	47
Baltimore	Digital Harbor	84	77	73	9	2	15	1,400	80	66	53
Baltimore	Dundalk	38	68	26	10	2	58	1,317	73	81	78
Baltimore	Friendship Academy	92	80	82	8	2	8	535	67	31	53
Baltimore	Lansdowne	48	58	30	10	8	50	1,211	77	72	66
Baltimore	Mergenthaler Vocational	96	74	95	1	0	3	1692	82	65	67
Baltimore	Paul Lawrence Dunbar	99	71	97	1	1	1	907	91	83	87
Hampton	Bethel	73	38	67	4	2	24	1,934	81	61	92
Hampton	Hampton	85	54	76	5	4	13	1,651	84	53	88
Hampton	Kecoughtan	47	37	40	5	2	49	1,772	81	65	91
Hampton	Phoebus	74	59	70	3	1	24	1,159	72	54	87
Newport News	Denbigh	71	60	53	13	5	27	1,285	75	44	87

Location	High School Name	HS % Students of Color	HS % Receiving Free Reduced Federal Lunch	HS % Black	HS % Latino	HS % Asian	HS % White	HS # Attending	HS Grad. Rate	HS Math Score (%)	HS Reading Score (%)
Newport News	Menchville	51	35	42	6	3	47	1,708	79	67	91
Newport News	Woodside	70	40	54	12	4	29	2,046	89	64	95
Norfolk	Booker T Washington	91	70	85	4	2	6	1,293	65	29	84
Norfolk	Granby	63	50	53	7	3	30	1,949	69	65	94
Washingto n D.C.	Anacostia	99	99	99	0	0	0	751	40	12	17
Washingto n D.C.	Ballou	99	99	98	1	0	0	678	50	23	20
Washingto n D.C.	HD Woodson	100	99	100	0	0	0	762	53	16	22

Appendix C: Data on Schools and Communities for Coarse-level Assessment

Location	High School Name	Community % People of Color	Community Median Income	Community %Black	Community %Latino	Community %Asian	Community %White	Pop Density	Community %Pop below 18 years of age	Community STEM Industry	Community Driving distance to ocean (mi)	Community Driving distance to watershed connection (mi)
San Diego	**Hoover**	97	23,963	16	56	25	17	33,310	34	1,583	11	2
Baltimore	Achievement Academy	99	30,161	95	3	1	16	7,441	28	856	138	1
Baltimore	Antioch Diploma	99	30,161	95	3	1	16	7,441	28	856	138	1
Baltimore	Baltimore City College	84	30,161	80	1	3	16	12,577	22	856	138	1
Baltimore	Baltimore Community	29	30,161	8	18	3	81	2,597	4	856	138	1
Baltimore	Benjamin Franklin	44	30,161	32	9	3	65	2,597	4	856	138	1
Baltimore	Digital Harbor	17	151,260	8	3	6	93	19,230	4	856	138	1
Baltimore	Dundalk	17	59,478	8	3	6	81	2,597	22	856	138	1
Baltimore	Friendship Academy	12	104,433	8	3	1	93	7,441	4	856	138	1
Baltimore	Lansdowne	44	30,161	32	9	3	81	7,441	22	856	138	1
Baltimore	Mergenthaler Vocational	82	78,158	80	1	1	16	2,597	28	856	138	1
Baltimore	Paul Lawrence Dunbar	87	30,161	80	1	6	16	7,441	4	856	138	1
Hampton	Bethel	53	65,064	45	3	5	34	5,193	22	1,583	7	1
Hampton	Hampton	72	38,417	64	3	5	19	5,193	22	1,583	7	1
Hampton	Kecoughtan	70	38,417	64	3	3	19	7,017	33	1,583	7	1
Hampton	Phoebus	97	38,417	83	13	1	9	5,193	33	1,583	7	1
Newport News	Denbigh	41	84,881	30	6	5	73	5,193	22	1,583	7	1

Location	High School Name	Community % People of Color	Community Median Income	Community %Black	Community %Latino	Community %Asian	Community %White	Pop Density	Community %Pop below 18 years of age	Community STEM Industry	Community Driving distance to ocean (mi)	Community Driving distance to watershed connection (mi)
Newport News	Menchville	41	84,881	30	6	5	57	5,193	22	1,583	7	1
Newport News	Woodside	63	49,948	45	13	5	20	5,193	26	1,583	7	1
Norfolk	Booker T Washington	85	23,796	83	1	1	9	7,017	33	1,583	7	1
Norfolk	Granby	39	38,417	30	6	3	57	5,193	19	1,583	7	1
Washington D.C.	Anacostia	97	21,431	94	2	1	5	9,262	1	1,530	180	0
Washington D.C.	Ballou	96	21,431	94	1	1	5	9,262	1	1,530	180	0
Washington D.C.	HD Woodson	100	21,431	93	6	1	5	9,262	1	1,583	180	0

Appendix C: Data on Two School-sheds in Norfolk, VA for Fine-level Assessment

Location	High School Name	HS % Receiving Free Reduced Federal Lunch	HS % Black	HS % Latino	HS % Asian	HS % White	HS % Students of Color	HS # Attending	HS Grad Rate	HS Math Score (%)	HS Reading Score (%)	Science Achievement
Portsmouth	Churchland HS	43	63.17	3.38	0.86	27.79	67.41	1390	88	76	88	81
Portsmouth	I.C. Norcom HS	66	92.37	1.34	0	2.52	93.71	1192	72	52	80	66
Portsmouth	Woodrow Wilson HS	60	60.87	3.13	1.24	29.24	65.24	1375	65	74	81	78
Chesapeake	Deep Creek HS	39	45.30	5.83	1.97	40.5	53.10	1373	79	84	88	85
Chesapeake	Grassfield HS	10	20.25	6.19	2.46	63.22	28.90	2069	94	92	97	96
Chesapeake	Great Bridge HS	14	20.20	5.82	1.83	64.64	27.85	1530	91	85	89	88
Chesapeake	Hickory HS	6	5.72	4.84	2.2	81.75	12.76	1819	94	88	96	97
Chesapeake	Indian River HS	35	45.91	7.26	2.75	35.59	55.92	1638	79	73	90	82
Chesapeake	Oscar Smith HS	50	51.66	7.22	3.77	28.79	62.65	2174	75	72	80	76
Chesapeake	Western Branch HS	23	37.68	3.78	2.84	48.7	44.30	2115	86	82	91	89
Hampton	Bethel HS	38	67	4	2	24	73.00	1,934	81	61	92	81
Hampton	Hampton HS	54	76	5	4	13	85.00	1,651	84	53	88	70
Hampton	Kecoughtan HS	37	40	5	2	49	47.00	1,772	81	65	91	88
Hampton	Phoebus HS	59	70	3	1	24	74.00	1,159	72	54	87	73
Newport News	Denbigh HS	60	53	13	5	27	71.00	1,285	75	44	87	64
Newport News	Menchville HS	35	42	6	3	47	51.00	1,708	79	67	91	84
Newport News	Woodside HS	40	54	12	4	29	70.00	2,046	89	64	95	83
Norfolk	Booker T Washington HS	70	85	4	2	6	91.00	1,293	65	29	84	58
Norfolk	Granby HS	50	53	7	3	30	63.00	1,949	69	65	94	79
Newport News	Heritage HS	23	85.15	4.1	0.15	8.74	89.40	1132	81	46	81	65
Newport News	Warwick HS	54	46.99	13.35	3.9	32.52	64.24	1532	83	62	83	66
Norfolk	Lake Taylor HS	68	71.46	6.4	2.61	13.75	80.47	1282	84	84	84	65
Norfolk	Matthew Fontane Muary HS	n/a	52.18	4.76	1.93	34.43	58.87	1632	76	77	85	81
Norfolk	Norview HS	56	58.49	6.7	3.18	24.13	68.37	1793	86	86	86	76

Hard Variable	Students are low income	Students are ethnically diverse/underrepresented	Students are low science achieving	Student graduation rates are low	Student population is dense	Students live within an urban, metropolitan center	Students are retained through a feeder school system	School has a culture rooted in the belief of young peoples abilities	Students are in close proximity to the ocean	STEM jobs are available in the region	STEM jobs are available in the region
Threshold	Greater than 65% of students are low income (e.g. receive free & reduced lunch)	Greater than 80% of population are students of color	Greater than 50% of students perform below average on science test scores	Less than 80% of students graduate in 4 years	Number of students at high school indicating 5,000 population under 18	Yes or No	More than 80% of students are retained through school feeder system	Yes or No	Distance to VA Beach, Within 30 miles of the ocean	# of people in community/total # ads for job openings	% share of ads requiring STEM skills and at least a bachelors degree
Booker T. Washington	70	94	47	87	1,492	Yes	Yes	Yes at elementary	19	Yes	Yes
Lake Taylor	68	86	25	91	1,566	Yes	Yes	NDF	16	Yes	Yes

Appendix C: Data on Two School-sheds in Norfolk, VA for Fine-level Assessment

Soft Variable	School has existing relation-ship with STEM industry	School has exisiting relationship with Inst. of Higher Ed	School has a superinten-dent that is interested and invested in our model	School has a focus and interest in science or STEM	School has accesible tracking and performance data	School has a reputation for strong and commited teachers	School has a commit-ment to NGSS	Commun-ity has potential to access a watershed habitat.	Community has potential partners to implement pieces of the model	Community has investments that can be leveraged	Community has a reputation for strong and committed leadership	Community has funders invested in imprvoing the area	Community has a high numbers of recent immigrants and diverse languages spoken
Threshold	No threshold. Describe.	No threshold. Describe.	No threshold. Describe.	No threshold. Describe.	No threshold. Describe.	No threshold. Describe.	No threshold. Describe.	No threshold. Describe.	No threshold. Describe.	No threshold. Describe.	No threshold. Describe.	No threshold. Describe.	No threshold. Describe.
Booker T. Washington	Some	Yes	Yes prefers BTW	Yes interest	YES	NDF	NDF	Yes, lake near Tidewater Gardens?	YES	Yes, United for Children elementary, MAD 2020	Yes, NRHA	Yes, United Way & Brock	No
Lake Taylor	Some	YES	Yes	Yes interest, k-8 stem school	YES	NDF	NDF	YES (Oakleaf)	YES	Yes, CHROME at middle school, MAD 2020	Yes, NRHA	Not specific	No

Other	
Booker T. Washington High School	NRHA and NPS advocate
Lake Taylor High School	Southside disconnected from remainder of school-shed capping the shed at stream.

Appendix D

Replication of Ocean Discovery Institute's Model: Coarse Level Site Assessment

By Bemmy Maharramov

Introduction

Effective replication of successful community-based initiatives remains a challenge across disciplines. For the purposes of this report, replication is defined as, "*the transfer to a different location of test concept, a pilot project, a small enterprise, and so forth, in order to repeat success elsewhere*", and is also sometimes referred to as "scale-out" (Creech 2008). Replication is a challenge for a host of reasons, including lack of robust monitoring and evaluation frameworks, timelines that do not align with the amount of time it realistically takes for implementation in a community, lack of funding and political will required for sustainability, and inadequate understanding of the context and needs of a new location (Summerville and Raley 2009). At the same time, replication across scales and locations is a powerful tool in leveraging models and approaches that have been found to work, as well as sharing lessons learned and knowledge.

This project focuses on the replication effort of a successful non-profit, Ocean Discovery Institute, and in particular the site assessment to select the location and potential partners to support the model in the Chesapeake Bay region in a project entitled, "*Reaching Students in the Chesapeake Bay Region*". A mixed methods approach will be used throughout the site assessment, including analysis of publicly available on-line data, literature review, field data collection, surveys, and interviews as well as the use of Geographic Information Systems (GIS).

Background

San Diego-based non-profit, Ocean Discovery Institute (henceforth called "Ocean Discovery"), uses ocean science to empower young people from underserved urban communities to transform their lives, their community, and the world as scientific and environmental leaders. By providing programs and services that develop the knowledge and skills necessary to become tomorrow's decision makers and work force, Ocean Discovery ensures young people understand how the world works and how they can make a difference. In 2011, Ocean Discovery was awarded the *Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring*, the highest honor bestowed by the U.S. government for efforts that advance these fields.

Ocean Discovery's model integrates education, scientific research, and environmental stewardship (Figure 1) and focuses its efforts in a single geographic area. An innovation of the Ocean Discovery model is their integrative focus on a selected geographic area, utilizing a unique three-tiered pyramid model for focused engagement at the community, school, and individual scales (Figure 2). The model is focused on a single "school-shed", where the majority of students flow from the elementary to middle to high school, to order to realize transformative impacts over time.

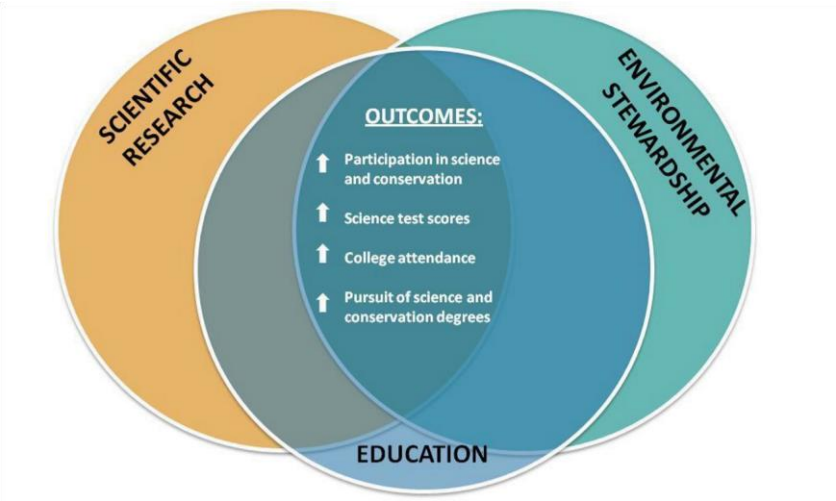


Figure 1: Ocean Discovery's three major spheres of focus: education, environmental stewardship and scientific research

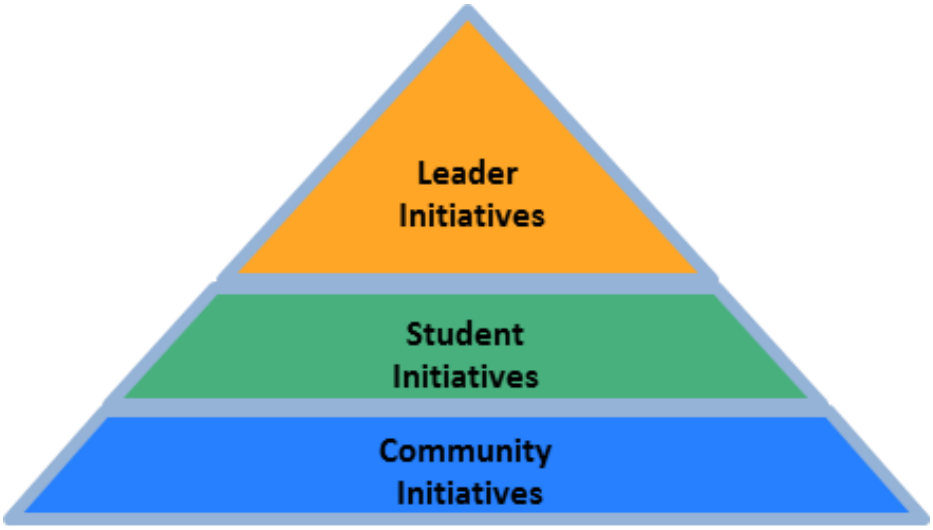


Figure 2: Ocean Discovery's three-tiered pyramid approach for engagement, from the community to individual level in the school-shed

Ocean Discovery has applied this model with great success in the community of City Heights in San Diego. While this community boasts significant cultural and linguistic richness, it also has great need, with environmental, social, and educational challenges closely intertwined. One of the most diverse neighborhoods in the nation, City Heights is a densely urbanized community that exhibits the highest poverty in the region.

The following model criteria have been critical elements to Ocean Discovery's success.

1. Singular vision that focuses the scope of work including: 100% focus on young people underrepresented in the sciences (low income, first-generation, people of color, and English second language learners) and a single community focus.

2. Proximity to the ocean and the use of the ocean as a platform to teach Science, Technology, Engineering and Math (STEM).
3. Situated within a STEM and knowledge-based economy to provide mentors, internship and career opportunities, and funding.
4. Mechanism to maintain student continuity in an urban and densely populated community (e.g. through feeder school system, a "school-shed").
5. Strong relationships with schools teachers and districts.
6. Incorporation of community-based and best practice approaches to develop and enhance programming and organizational systems.
7. Continual program enhancement process based on evaluation and outside resources.
8. Innovative and intentional planning for all program and organizational activities.
9. Strong and committed leadership with high accountability (including a mechanism to transition leadership to student leaders as they mature through the programs).
10. Powerful culture that is rooted in the belief of young peoples' abilities.
11. Ability to secure diverse, sustainable financial support.
12. Programming that is based in the following guiding principles:
    a. In order to build and sustain interest in the sciences, young people must be provided with early life experiences in the sciences and continue to be engaged in progressively rigorous experiences throughout their education.
    b. Discovery provides the spark that makes young people want to learn.
    c. The most potent and empowering education provides authentic experiences such as scientific research and actions that benefit the environment.
    d. The best strategies for teaching science and building an environmental ethic incorporate experience in nature.
    e. The most effective environments for learning draw upon students' assets, talents, and strengths.
    f. Educational initiatives must eliminate the unique barriers faced by urban, diverse young people as they study science and pursue higher education.

As the model criteria reflect, building leadership requires mentoring between peers as well as between working professionals and young people.

NOAA's Office of Education and Ocean Discovery have a history of partnership with the goal of increasing the impact of the organization and extending the reach of NOAA's mission. In January 2012, NOAA's Office of Education and NOAA's Chesapeake Bay Office gathered a group of leaders that represent some of the most impactful education, environmental, and career-development organizations in the region, to explore extending the reach of Ocean Discovery to the Chesapeake Bay region. The group determined that this model (particularly the focus on a single community, the provision of progressive opportunities, and the robust leadership initiative that supports students on their pathway to science careers) would be desired, beneficial, and fill an existing need.

In September 2013, Ocean Discovery Institute was awarded B-WET Urban STEM Model funding in order to explore replication of the model in the Chesapeake Bay Area.

The overall objective of this report is to provide data-driven site assessment analysis that will inform a larger feasibility study (which includes assessments of site, funding capacity, and replication structure) of replication of Ocean Discovery's model in the Chesapeake Bay area. In particular, this report will use application of GIS research and planning skills in conducting the site assessment to recommend candidate locations, if any, to replicate Ocean Discovery's model in the Chesapeake Bay region.

Methods

Through a three-tiered research process (Figure 3), data on potential candidate locations and partners will be mapped and assessed in increasing detail to narrow the pool of potential locations and partners. The coarse level research will be investigated through publicly and readily available data and focus on narrowing potential sites. At the conclusion of the coarse level, discrete neighborhoods will be identified. At the medium level, some data will require interviews, site visits or other strategies to further narrow potential candidate locations and partners to 2-3 sites to continue onto the fine level assessment. During the fine level assessment, interviews with people will be conducted to finalize selection of the partners and location to move forward with the replication pilot in the Chesapeake Bay.

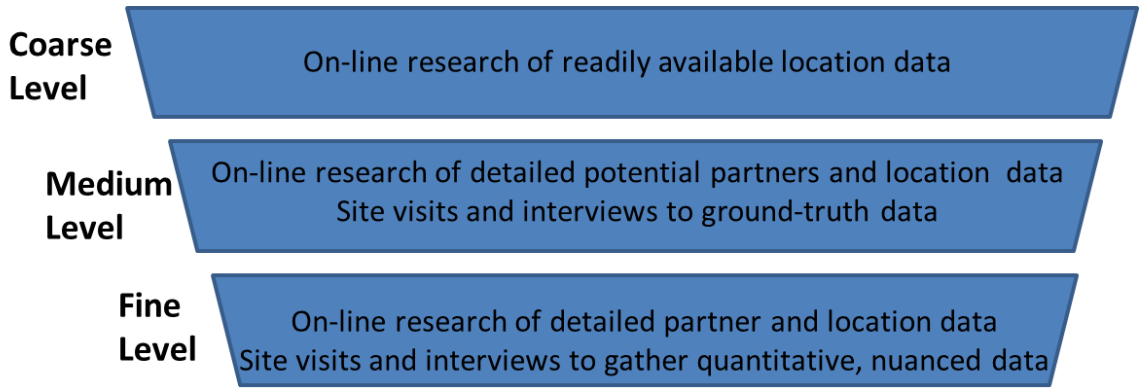


Figure 3: Three-tiered site assessment research process

In order to identify and narrow potential locations, a mixed-methods site assessment approach was used, including mapping, surveys, and site visits, utilizing both quantitative and qualitative data analysis. Variables were identified that link to each of Ocean Discovery's model criteria, and enable comparison between potential sites and the current City Heights, San Diego location. Data will be "ground-truthed" through on-site visits. Decisions will be made based on: Data-driven recommendations (provided in this report)

- Instinct and on-the-ground experience from site visits
- Interplay between location, potential partners, and replication strategy

Below describes the methods of this coarse level site assessment.

Variables were identified and mapped per each of the identified geographic focus areas, and compared to the home site, City Heights in San Diego, which were also similarly mapped. The seven identified geographic focus areas for the project are: Ward 7 - Washington, DC, Ward 8 – Washington, DC, Southeast Baltimore, Southwest Baltimore, Newport News, VA, Norfolk, VA, and Hampton Roads, VA. These target geographies were chosen as a result of an initial October 2013 field visit; advising from NOAA personnel; and input from local experts with knowledge of the region's challenges, assets, socioeconomic situation, and demographics. Based on this, four geographic areas were mapped, from which eight maps for analysis were developed. The four
mapping areas were: City Heights, San Diego, Washington, DC, Baltimore, and the Hampton/Newport News/Norfolk region of Virginia.

The coarse level analysis focused largely identifying locations with similar characteristics to the benchmark location, City Heights, San Diego. The variables for the coarse level analysis fall into one of the following major categories: demographics, distance to ecosystems, capacity and resources and academic achievement. The demographics and academic achievement variables were linked to model criteria one, "singular vision that limits scope of work including 100% focus on young people underrepresented in the sciences and a single community focus". The variable focused on distance to ecosystems was linked to model criteria two, "proximity to the ocean and the use of the ocean as a platform to teach STEM". And the capacity and resources variable was linked to model criteria three, "situated within a STEM and knowledge-based economy to provide mentors, internship and career opportunities and funding".

The variables that were mapped using ArcGIS software were population density, median income, percent of the population below age 18, ethnic diversity, high school location, and high school graduation rate, high school math achievement, high school reading achievement and high school science achievement.[1]

The US Census 2010 Tiger/Line shape files were used for the county (San Diego, Washington, DC, Baltimore County) and city (Baltimore City, Hampton, Newport News and Norfolk) tracts, road and water data layers. The 2010 American Community Survey (ACS) was used for all of the demographic data layers for all of the counties (San Diego, Washington, DC, Baltimore County) and cities (Baltimore City, Hampton, Newport News and Norfolk). In particular datasets S1701, S1903 and DP05 were used to obtain the following information at the tract level per city or county: total population, percent of the population below the age of 18, median income, and percent Black, percent Hispanic or Latino, percent Asian and percent White. From these datasets, original data layers were created, such as population density (total population was divided by square miles of land, after being converted from square meters to miles) and percent of population below age 18 (total population below age 18 was divided by the total population).

A high school layer was created by geocoding each high school per target geographic region. In addition, each high school data point contains within its attribute table data on academic achievement

(2011/2012 graduation rate, math achievement, reading achievement and science achievement[2]) and student demographics (number of students, % students of color, % receiving free or reduced federal lunch, and % Black, Latino, Asian or White). The high school information was obtained from each of the California, Baltimore, Virginia and Washington, DC's Department of Education websites (referred to as the Office of the State Superintendent of Education in the case of Washington, DC).

In order to depict as many layers as possible in a meaningful way and limit the number of maps produced (8), two maps with multiple layers were produced per region. The first map produced per each of the four mapped areas depicts race and ethnicity with four corresponding layers (% Black, Hispanic/Latino, Asian and White). The darker the tract indicates an aggregately higher percent of % Black, Hispanic/Latino and Asian in that particular location. The second map produced per each of the four mapped areas depicts socioeconomic status, population density and age demographics with three corresponding layers (median income, people per square mile and percent of the age structure 18 and below). The darker the tract indicates aggregately a lower income, higher population density and higher percent below the age of 18.

In order to gain an approximation of STEM resources and capacities across each region, online search was conducted on yellowpages.com using the search terms "Science", "Engineering" and "Environment" per region (San Diego, Washington, DC, Baltimore, Hampton, Newport News and Norfolk) and aggregating the three neighboring Virginia cities. It should be noted there is likely redundancy of organizations across these search terms (i.e. a company that comes up under both a "science" and "engineering" search); however, nonetheless this gives an approximation of the presence of these entities per region.

Analysis by Geographic Region

In order to compare coarsely across geographic regions, the maps were analyzed in terms of the variables mapped by category (race and ethnicity and population demographics and income). The census tracts of each geocoded high school was assessed and compared to the benchmark site of City Heights and the location metric criteria. To facilitate a more granular analysis of the variables, a matrix was created to examine the breakdown of race and ethnicity, income, population demographics and school academic achievement and demographics per high school, and also compare for similarity against the control site and location metric criteria.

Across Geographic Region

As referred to above, a matrix was produced to provide a tool to compare the results across communities. On one axis of this matrix was a list of the high schools examined in the coarse level analysis, and on the other axis was a list of the variables. These variables were: tract level variables (population density, % population below 18, median income, % Black, % Latino, % Asian, % White); high school specific variables (% HS students of color, % HS receiving free reduced federal lunch, % HS Black, % HS Latino, % HS Asian, % HS White, HS graduation rate, HS math score, and % HS reading score), estimated STEM capacity/resources, and driving distance to ecosystems (Chesapeake/ocean).

In order to assess the level of similarity/dissimilarity of each high school to the control site of Hoover High School in City Heights, San Diego, the data were visualized using multidimensional scaling (MDS). In the MDS plot, a point in multidimensional space represents each school, and the schools are arranged within the space so that the distance between schools (points on the plot) represents the relative level of similarity. In other words, points that are closer together represent schools that are similar, and points that are farther apart represent schools that are dissimilar. In cases where values were a range (e.g., median income), the midpoint within the range was selected for comparison for use in the MDS plot.

Developing recommendations

Considering the coarse level data analysis both by and across geographic areas, initial recommendations were developed regarding which high schools (and their surrounding communities) to focus on for consideration and special focus during the site visits. In addition, specific questions and variables to ground-truth were identified to facilitate a bridge between the coarse and medium level analysis.

Results

By Geographic Area

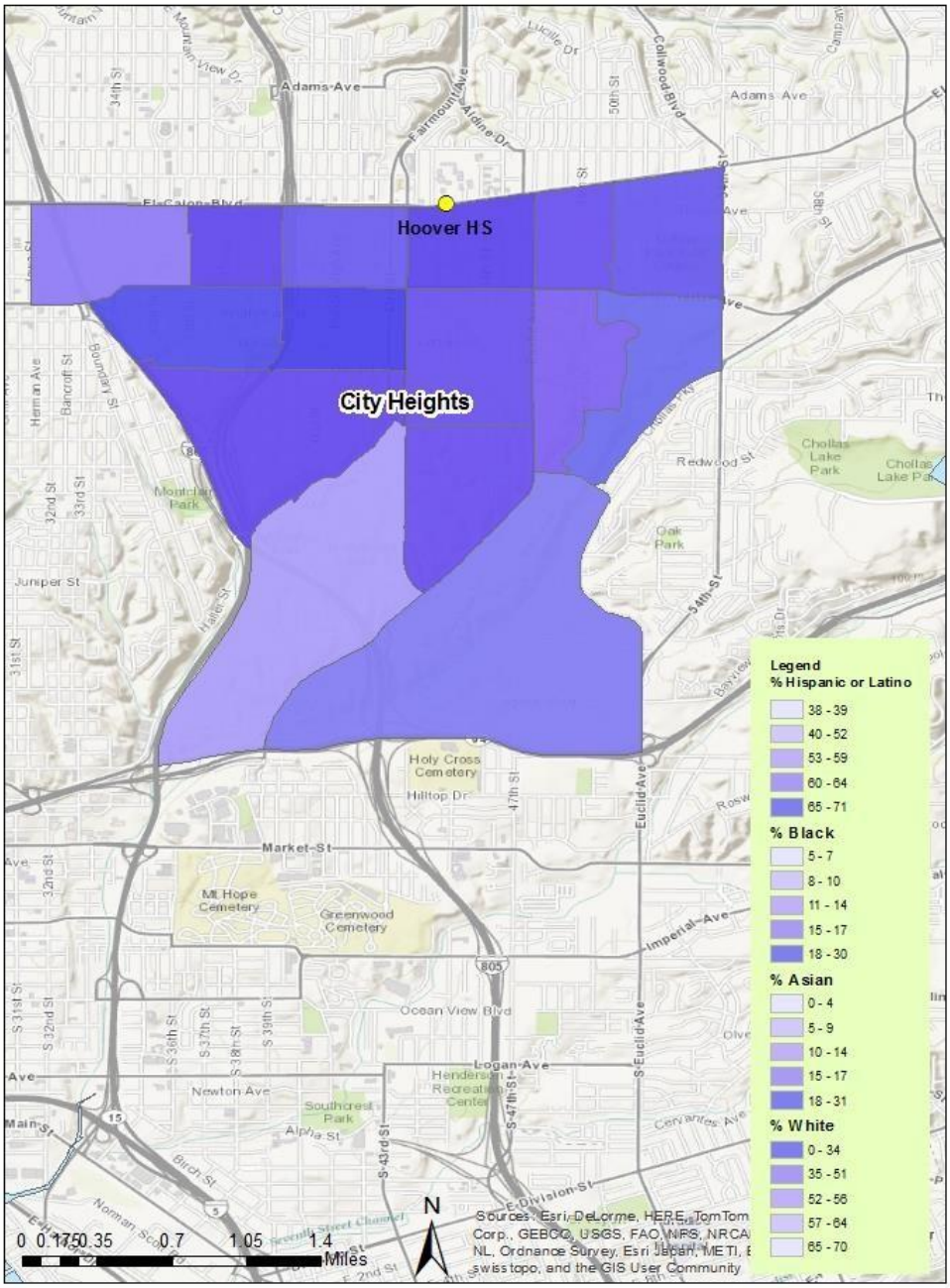
GIS Mapping

San Diego, CA: City Heights (Benchmark site)

The first maps are of the benchmark site, the City Heights neighborhood of San Diego, CA (Map 1 and 2). There is one high school in City Heights, Hoover High School. Since this map is at the community scale of City Heights, this represents the school-shed for the high school, or the area upon which the high school draws the majority of its students. Table 1 provides information about the academic achievement of this high school. Map 1 illustrates that the location of this high school is within an area with a high minority and traditionally underserved population. Map 2 depicts that the high school is in the census tract with high population density, low median income and high percent population under the age of 18.

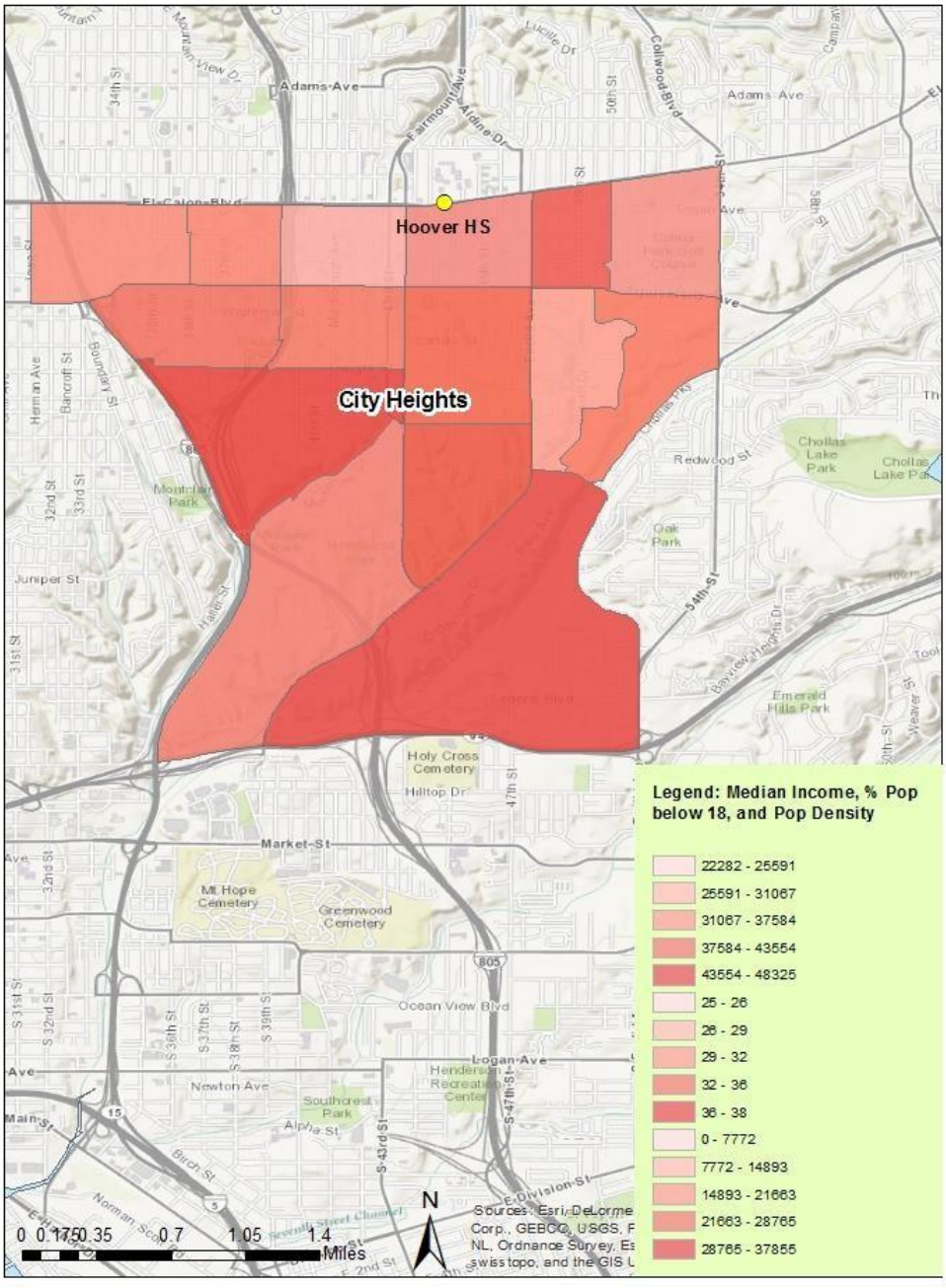
In terms of STEM capacity and resources in the larger San Diego region, there are 1583 estimated science, engineering or environmental related entities (Table 2). In addition, the high school is very close to both the watershed connection (1.8 miles) as well as driving distance to the ocean (11 miles) (Table 3).

Coarse Analysis: City Heights, San Diego



Map 1: Ethnic and Racial Diversity in City Heights, San Diego (note: % White scale is reversed)

Coarse Analysis: City Heights, San Diego



Map 2: Income and Population, City Heights, CA (note: income scale is reversed)

Table 1: High School Academic Achievement for City Heights, CA (2011-2012)

HIGH SCHOOL	CITY	STATE	GRADUATION RATE (over 4 years)	MATH (out of 1,000)	READING(out of 1,000)
Hoover High School	San Diego	CA	42%	268	404.4

Table 2: Estimation of STEM Capacity and Resources

STEM REGIONAL ESTIMATIONS*	SCIENCE	ENGINEERING	ENVIRONMENTAL	TOTAL
San Diego	365	971	247	1583

Table 3: Driving Distance from Hoover High School (San Diego, CA)

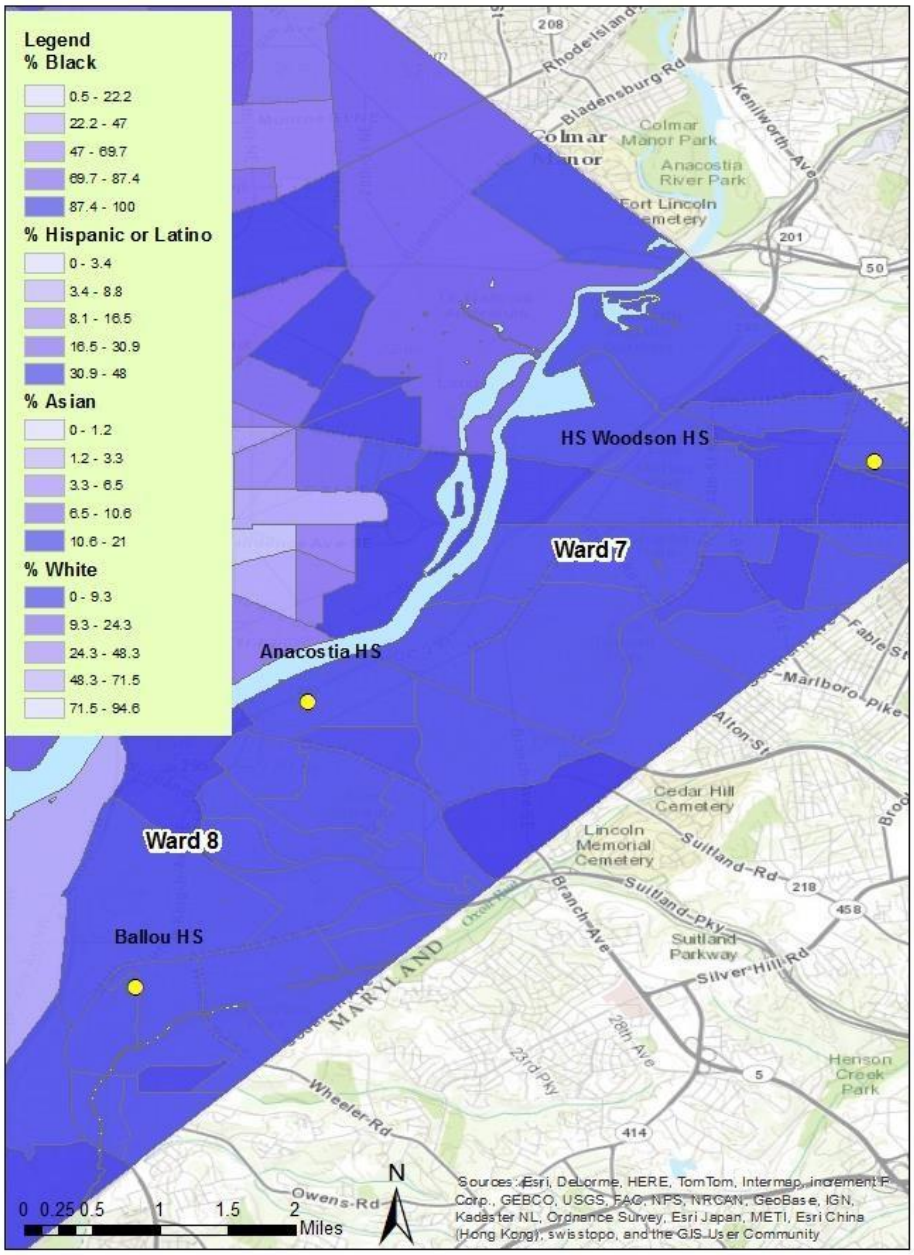
HIGH SCHOOL	DRIVING DISTANCE TO WATERSHED CONNECTION	DRIVING DISTANCE TO OCEAN CONNECTION
Hoover High School	1.8 miles (Swan Canyon)	11 miles (Mission Beach)

Washington, DC: Wards 7 and 8

For Wards 7 and 8 in Washington, DC, Map 3 illustrates that all three high schools in those wards are in an area of Washington DC with a high percent of people of color and traditionally underserved populations. In addition, Map 4 reveals similar low median income and highdensity population patterns across the two Wards. All three high schools have low academic performance and graduation rates, with Anacostia High School having the lowest graduation rate and math and reading scores (Table 4).

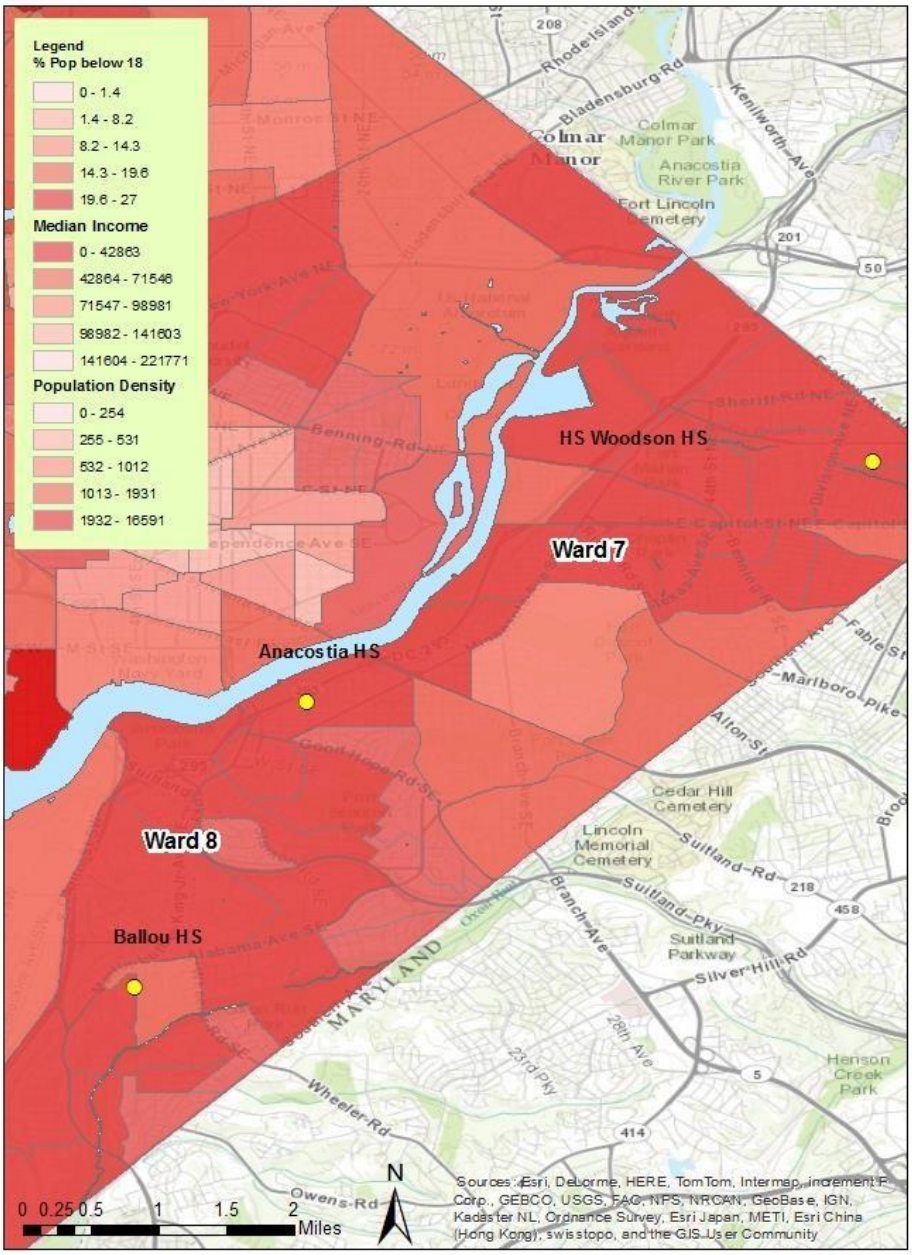
In terms of the STEM capacity and resources in Washington, DC there are 1530 estimated science, engineering, or environmental related entities, noting that there is also an abundance of STEM capacity and resources located in neighboring Northern Virginia and Maryland (Table 5). In addition, the most centrally located high school, Anacostia High School, is less than one mile from a watershed connection via the Anacostia River and 180 miles driving distance to the nearest ocean beach location.

Coarse Analysis: Washington, DC Wards 7 and 8



Map 3: Ethnic and Racial Diversity, Washington, DC (note: % White scale is reversed)

Coarse Analysis: Washington, DC Wards 7 and 8



Map 4: Income and Population, Washington, DC (note: income scale is reversed)

Table 4: High School Academic Achievement for Washington, DC Wards 7 and 8 (2012 – 2012)

HIGH SCHOOL	WARD	STATE	GRADUATION RATE (over 4 years)	MATH (out of 100, % proficient)	READING (out of 100, % proficient)
Anacostia High School	8	Washington, D.C.	40	12	17
Ballou High School	8	Washington, D.C.	50	23	20
H.D. Woodson High School	7	Washington, D.C.	53	16	22

Table 5: Estimation of STEM Capacity and Resources

STEM REGIONAL ESTIMATIONS*	SCIENCE	ENGINEERING	ENVIRONMENTAL	TOTAL
Washington, DC	462	855	213	1530

Table 6: Driving Distance fro Centrally Located High School in Washington, DC

HIGH SCHOOL	DRIVING DISTANCE TO WATERSHED CONNECTION	DRIVING DISTANCE TO OCEAN CONNECTION
Anacostia High School	.03 miles	180 miles

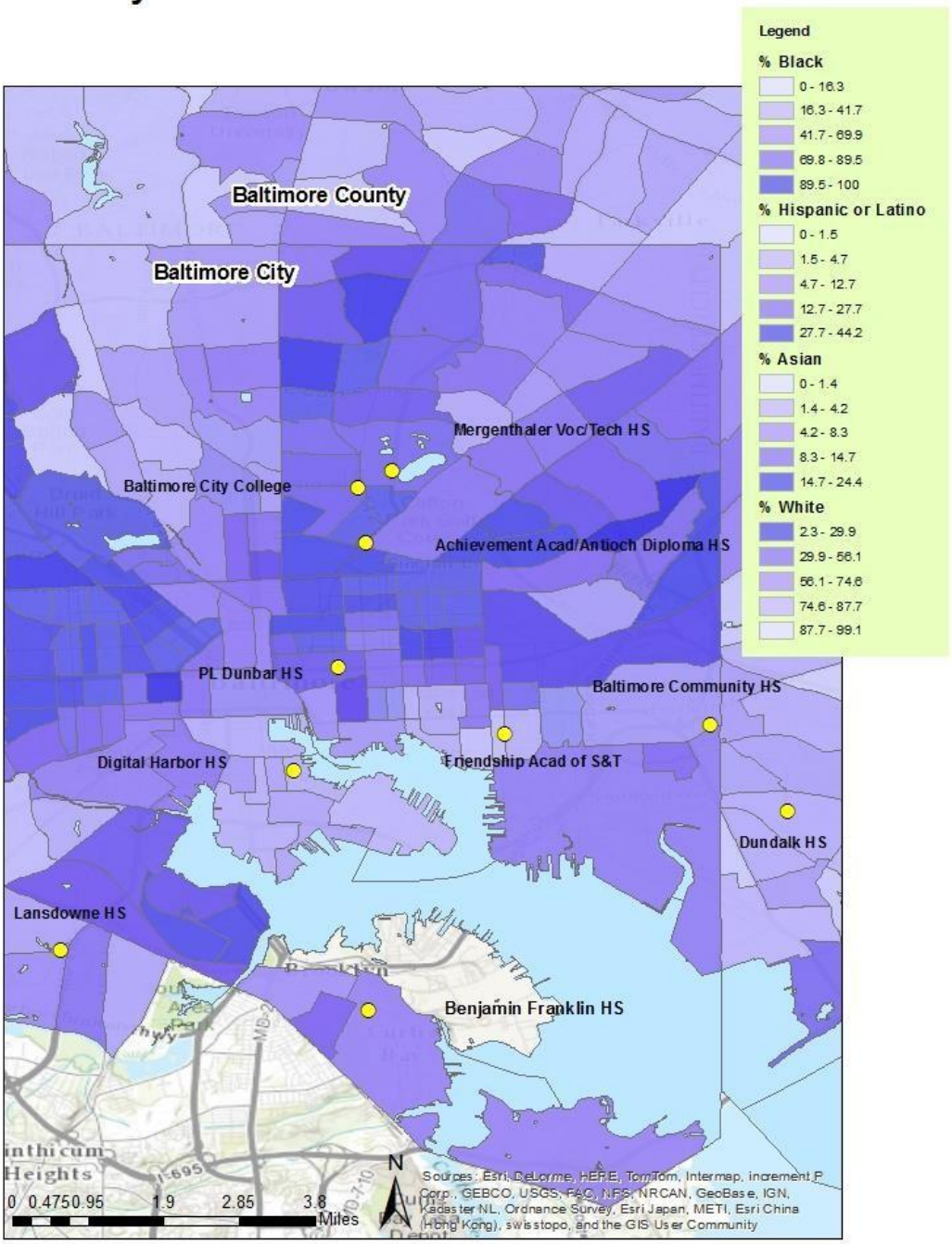
Baltimore, MD: Southwest and Southwest

For Southeast and Southwest Baltimore, Map 5 reveals that the high schools with the highest percentage of minority and traditionally underserved populations are Achievement Academy/Antioch Diploma High Schools, followed by Baltimore City College and Paul Lawrence Dunbar High Schools. The map also shows that neighboring US census tracts have very high percentages of minority and traditionally underrepresented populations, which would be a part of the school-sheds of these high schools. A similar pattern exists for income, population density and percent of the population below the age of 18 (Map 6).

In terms of high school performance, Baltimore City College has the highest academic achievement, followed by the Paul Lawrence Dunbar High School (Table 7). Achievement Academy, Antioch Diploma, Baltimore Community High School and Friendship Academy are performing the poorest. It should be noted that Achievement Academy and Antioch Diploma high schools are housed in the same building and are both “second chance institutions”.

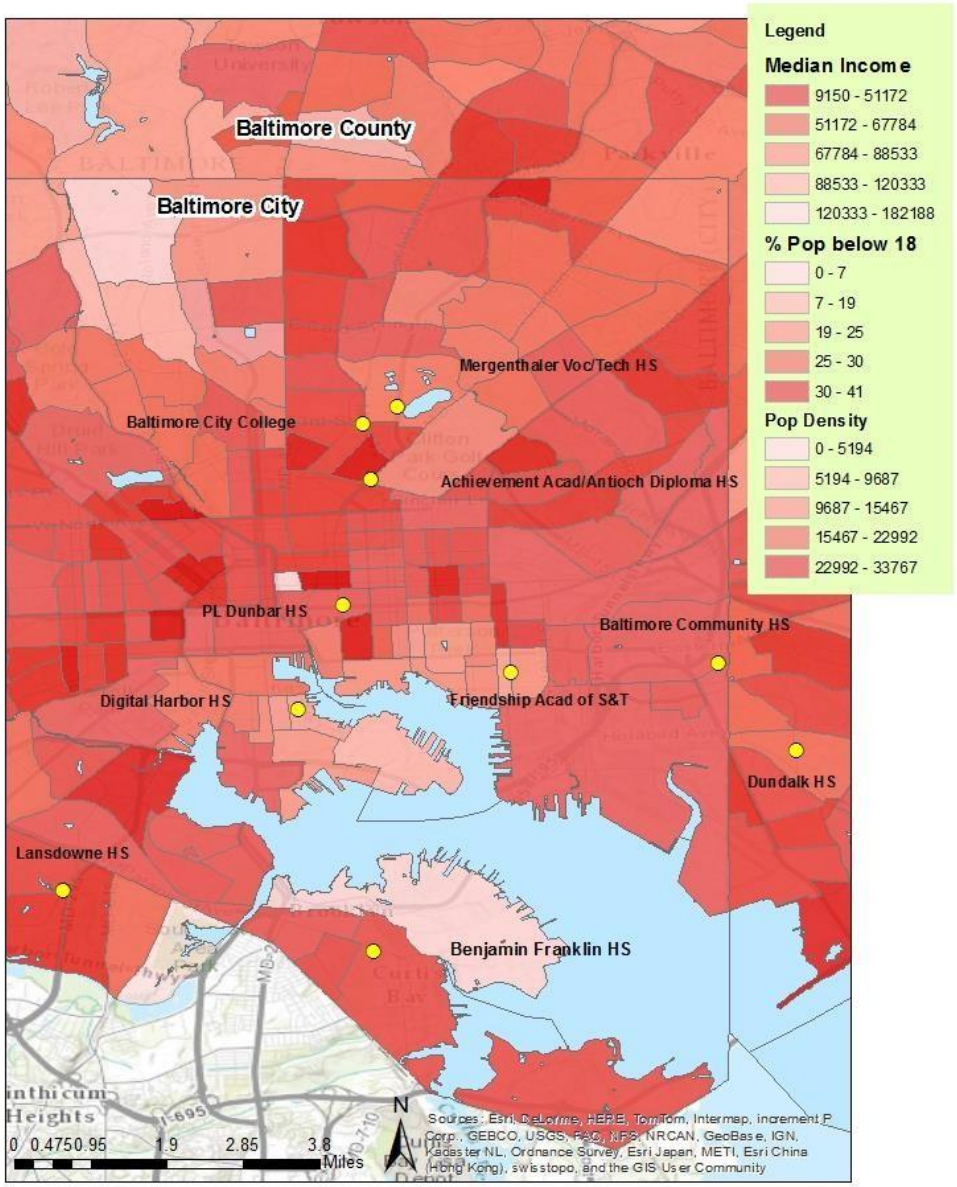
In terms of the STEM capacity and resources in Baltimore there are 856 estimated science, engineering or environmental related entities (Table 8). In addition, the most centrally located high school is less than one mile from the nearest watershed connection via the harbor and 138 miles driving distance to the nearest ocean beach.

Coarse Analysis: Southeast and Southwest Baltimore



Map 5: Ethnic and Racial Diversity, Southeast and Southwest Baltimore (note: % White scale is reversed)

Coarse Analysis: Southeast and Southwest Baltimore



Map 6: Income and Population, Southeast and Southwest Baltimore (note: income scale is reversed)

Table 7: High School Academic Achievement for Southeast and Southwest Baltimore (20112012)

HIGH SCHOOL	REGION	SCHOOLDISTRICT	GRADUATION RATE (over 4 years)	MATH (out of 100, % passed)	READING (out of 100, % passed)
Achievement Academy at Harbor City High School	Southeast	Baltimore City Public Schools	32.16	36.2	43.4
Baltimore Antioch Diploma Plus High School	Southeast	Baltimore City Public Schools	26.71	27.1	31.3
Baltimore City College	Southeast	Baltimore City Public Schools	92.04	87.5	95
Baltimore Community High School	Southeast	Baltimore City Public Schools	39.42	14.6	23.6
Benjamin Franklin High School at Masonville Cove	Southwest	Baltimore City Public Schools	71.26	66.2	47.1
Digital Harbor High School	Southwest	Baltimore City Public Schools	79.32	66.1	52.5
Dundalk High School	Southeast	Baltimore County Public Schools	73.48	80.7	77.6
Friendship Academy of Science and Technology	Southeast	Baltimore City Public Schools	67.07	30.8	53.4
Lansdowne High School	Southwest	Baltimore County Public Schools	77.03	72	66
Mergenthaler Vocational-Technical High School	Southeast	Baltimore City Public Schools	82.23	64.8	66.6
Paul Lawrence Dunbar High School	Southeast	Baltimore City Public Schools	91.27	83.3	86.6

Table 8: Estimation of STEM Capacity and Resources

STEM REGIONAL ESTIMATIONS*	SCIENCE	ENGINEERING	ENVIRONMENTAL	TOTAL
Baltimore	178	519	159	856

Table 9: Driving Distance from Centrally Located High School, Baltimore, MD

HIGH SCHOOL	DRIVING DISTANCE TO WATERSHED CONNECTION	DRIVING DISTANCE TO OCEAN CONNECTION
P.L. Dunbar	0.88 miles	138 miles

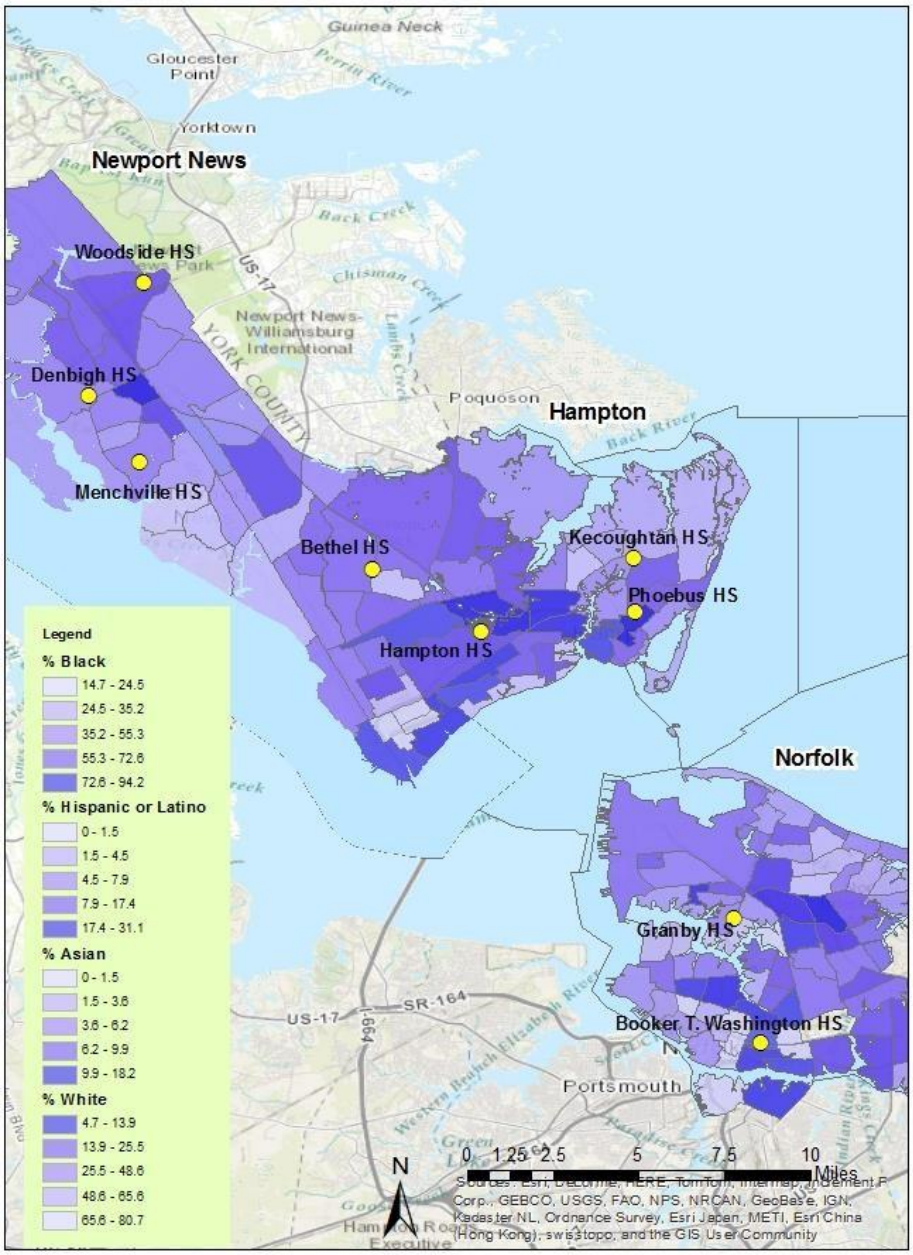
Hampton/Newport News/Norfolk, Virginia

For the geographic focus areas in Virginia (Hampton Roads, Newport News and Norfolk), the high schools in the US census tracts with the highest percent of minority and traditionally underserved populations are Woodside High School in Newport News; Phoebus and Hampton High Schools in Hampton Roads; and Booker T. Washington High School in Norfolk (Map 7). In terms of income, population density and percent of the population below the age of 18, Phoebus High School in Hampton Roads stands out the most in this regard, followed again by Hampton High School, Booker T. Washington High School and Woodside High School (Map 8). However, given these high schools draw from the larger school shed, it is useful to note the demographics of the surrounding census tracts as well.

For academic achievement, the highest performing high school is Woodside High School in Newport News, followed by Hampton, Kecoughtan and Bethel High Schools in Hampton Roads (Table 10). The lowest performing high schools are Booker T. Washington High School in Norfolk and Phoebus High School in Hampton.

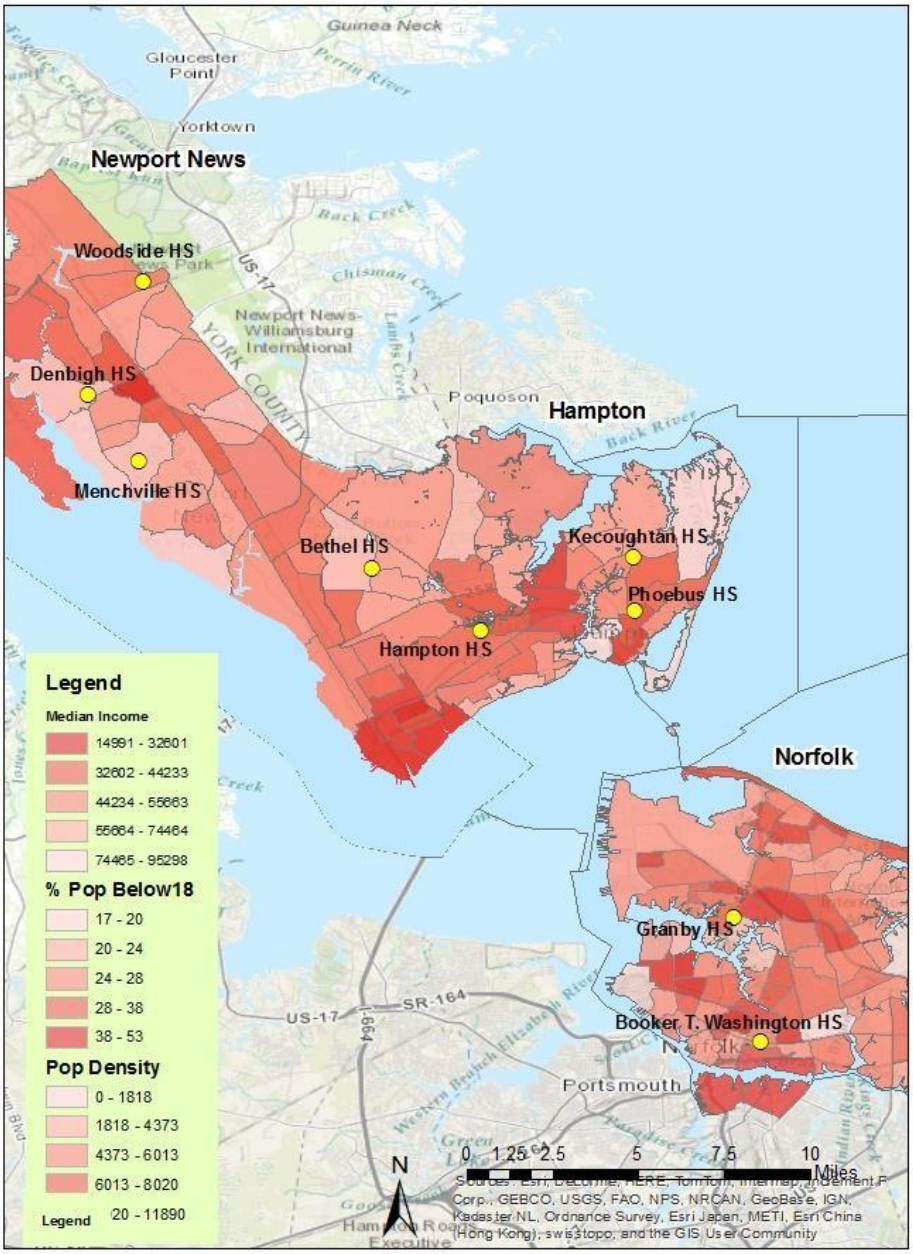
For STEM capacity and resources, in the Hampton/Newport News/Hampton areas there are aggregately 1583 estimated science, engineering or environmental related entities, or 459, 458 and 666 respectively (Table 11). In addition, the centrally located high school, Hampton High School, is less than one mile from the nearest watershed connection and approximately 7 miles to the nearest ocean beach location.

Coarse Analysis: Hampton, Newport News and Norfolk, Virginia



Map 7: Ethnic and Racial Diversity, Hampton, Newport New and Norfolk, VA (note: % White scale is reversed)

Coarse Analysis: Hampton, Newport News and Norfolk, Virginia



Map 8: Income and Population, Hampton, Newport News and Norfolk, VA (note: income scale is reversed)

Table 10: High School Academic Achievement for Hampton, Newport News and Norfolk, VA (2011 – 2012)

HIGH SCHOOL		REGION	SCHOOL DISTRICT	GRADRATION RATE (over 4 years)	MATH (out of 100, % proficient)	READING (out of 100, % proficient)
Bethel High School		Hampton Roads	Hampton City Schools	81	61	92
Booker T Washington High School		Norfolk	Norfolk Public Schools	65	29	84
Denbigh High School		Newport News	Newport News Public Schools	75	44	87
Granby High School		Norfolk	Norfolk Public Schools	69	65	94
Hampton High School		Hampton Roads	Hampton City Schools	84	53	88
Kecoughtan High School		Hampton Roads	Hampton City Schools	81	65	91
Menchville High School		Newport News	Newport News Public Schools	79	67	91
Phoebus High School		Hampton Roads	Hampton City Schools	72	54	87
Woodside High School		Newport News	Newport News Public Schools	89	64	95

Table 11: Estimation of STEM Capacity and Resources

STEM REGIONAL ESTIMATIONS*	SCIENCE	ENGINEERNG	ENVIRONMENTAL	TOTAL
Hampton	113	246	100	459
Norfolk	112	435	119	666
Newport News	110	239	109	458
VA Total	335	920	328	1583

Table 12: Driving Distance fr om Centrally Located Hi gh School, VA Region

HIGHSCHOOL	DRIVING DISTANCE TO WATERSHED CONNECTION	DRIVING DISTANCE TO OCEAN CONNECTION
Hampton HS	0.5 miles	6.7 miles

Across Geographic Areas

Matrix

The matrix (Table 13) shows in more detail the breakdown of the variables per each US census tract that a high school is located in (community data) and variables of the student population per high school (high School data). It is important to note that in cases where values were a range (e.g., median income), the median within the range was selected for comparison use in the matrix.

In terms of diversity, US census tract data demonstrate that Ocean Discovery's City Heights community is the most diverse, with more distributive representation of all measured ethnic/racial groups (17% White, 25% Asian, 56% Latino and 16% Black). In contrast, in Washington, DC the populations are mostly Black (94%). In Baltimore, some areas are largely White and some are largely Black, with small amounts of Latino and Asian populations. For example, Baltimore City College, Mergenthaler, and Paul Lawrence Dunbar high schools are in areas with a population that is largely Black (80%), while Digital Harbor and Friendship Academy are in areas with a population that is largely White (93%). The Virginia cities exhibit a similar pattern as Baltimore. Phoebus and Booker T. Washington high schools are in areas that are largely Black, while Denbigh high school is in an area largely White.

In addition to looking at demographics per US census tract, an initial examination of demographics of the student population attending each high school indicate that the benchmark site, Hoover High School is 96% students of color, of which it is 71% Latino. In the Washington, DC high schools, all three were 99-100% students of color, with 98-100% Black. In Baltimore, the schools ranged from 38-100% students of color (the former Dundalk and the latter Achievement Academy), with Blacks being the highest representation. Some US census tracts that are largely White have high school student populations that are largely students of color. For example, Digital Harbor and Friendship Academy are 84% and 92% students of color respectively, but there US census tracts are majority White. In Virginia, the range was between 47-91% students of color (the former being Kecoughtan and the latter being Booker T. Washington), with Blacks being the highest representation. The matrix table can be referred to for more specific details per high school.

In terms of the community's population density, percent under the age of 18, and median income, City Heights is in an area of very high density and percent of the population below the age of 18 relative to the East coast regions. The median income is comparable to some of the East coast geographic regions, in particular Washington, DC and some parts of Baltimore. In Washington, DC there is consistently low income across the high schools ($21,431 median annual income), low percent population below the age of 18 (1%), and a similarly higher population density (9,262 people per square mile).

In terms of the socioeconomic status of students in the high school, the percent of students receiving free or reduced lunch were significant across all geographic locations, with 87% of Hoover High School

students receiving free or reduced lunch. In Washington DC, 99% of all students received free or reduced lunch. In Baltimore the number was also very high, ranging from 58-85%, the former being Lansdowne and the latter being Benjamin Franklin. In Virginia, the number of students receiving free or reduced lunch ranged from 35-70%, the former being Menchville and the latter being Booker T. Washington.

In Baltimore and the Virginia communities there is more variation across the high school locations. In Baltimore, the high schools in the areas with the lowest income in the US census tracts were Achievement Academy/Antioch Diploma, Baltimore City College, Baltimore Community College, Benjamin Franklin, Lansdowne and Paul Lawrence Dunbar. The areas with the highest population density were Digital Harbor and Baltimore City College (19,230 and 12,577 people per square mile, respectively). The areas with the highest percent population below the age of 18 were Achievement Academy/Antioch Diploma and Mergenthaler high schools (28%). In the Virginia communities, the high school in the area with the lowest income was Booker T. Washington in Norfolk ($23,796 median annual income). The high schools in the areas with the highest population density were Kecoughtan and Booker T. Washington (7,017 people per square mile), and the high schools in the areas with the highest percent population below the age of 18 were Phoebus and Booker T. Washington (33%).

Table 13. US Census Tract Data on Community Populations in which High Schools are located (Comm.) and High School Data on Student Populations (HS) by High School

Location	High School Name	*Comm. %People of Color	*Comm. Median Income ($)	*Comm. %Black	*Comm. %Latino	*Comm. %Asian	*Comm. %White	*Comm. Pop Density	*Comm. %Pop below 18 years of age	Comm. STEM industry	Comm. Driving Distance to Ocean (mi)	Comm. Driving Distance to Watershed Connection (mi)
San Diego	**Hoover**	97	23,963	16	56	25	17	33,310	34	1,583	11	2
Baltimore	Achievement Academy	99	30,161	95	3	1	16	7,441	28	856	138	1
Baltimore	Antioch Diploma	99	30,161	95	3	1	16	7,441	28	856	138	1
Baltimore	Baltimore City College	84	30,161	80	1	3	16	12,577	22	856	138	1
Baltimore	Baltimore Community	29	30,161	8	18	3	81	2,597	4	856	138	1
Baltimore	Benjamin Franklin	44	30,161	32	9	3	65	2,597	4	856	138	1
Baltimore	Digital Harbor	17	151,260	8	3	6	93	19,230	4	856	138	1
Baltimore	Dundalk	17	59,478	8	3	6	81	2,597	22	856	138	1
Baltimore	Friendship Academy	12	104,433	8	3	1	93	7,441	4	856	138	1
Baltimore	Lansdowne	44	30,161	32	9	3	81	7,441	22	856	138	1
Baltimore	Mergenthaler Vocational	82	78,158	80	1	1	16	2,597	28	856	138	1
Baltimore	Paul Lawrence Dunbar	87	30,161	80	1	6	16	7,441	4	856	138	1
Hampton	Bethel	53	65,064	45	3	5	34	5,193	22	1,583	7	1
Hampton	Hampton	72	38,417	64	3	5	19	5,193	22	1,583	7	1
Hampton	Kecoughtan	70	38,417	64	3	3	19	7,017	33	1,583	7	1
Hampton	Phoebus	97	38,417	83	13	1	9	5,193	33	1,583	7	1

Location	High School Name	*Comm. %People of Color	*Comm. Median Income ($)	*Comm. %Black	*Comm. %Latino	*Comm. %Asian	*Comm. %White	*Comm. Pop Density	*Comm. %Pop below 18 years of age	Comm. STEM Industry	Comm. Driving Distance to Ocean (mi)	Comm. Driving Distance to Watershed Connection (mi)
Newport News	Denbigh	41	84,881	30	6	5	73	5,193	22	1,583	7	1
Newport News	Menchville	41	84,881	30	6	5	57	5,193	22	1,583	7	1
Newport News	Woodside	63	49,948	45	13	5	20	5,193	26	1,583	7	1
Norfolk	Booker T Washington	85	23,796	83	1	1	9	7,017	33	1,583	7	1
Norfolk	Granby	39	38,417	30	6	3	57	5,193	19	1,583	7	1
Washington D.C.	Anacostia	97	21,431	94	2	1	5	9,262	1	1,530	180	0
Washington D.C.	Ballou	96	21,431	94	1	1	5	9,262	1	1,530	180	0
Washington D.C.	HD Woodson	100	21,431	93	6	1	5	9,262	1	1,583	180	0

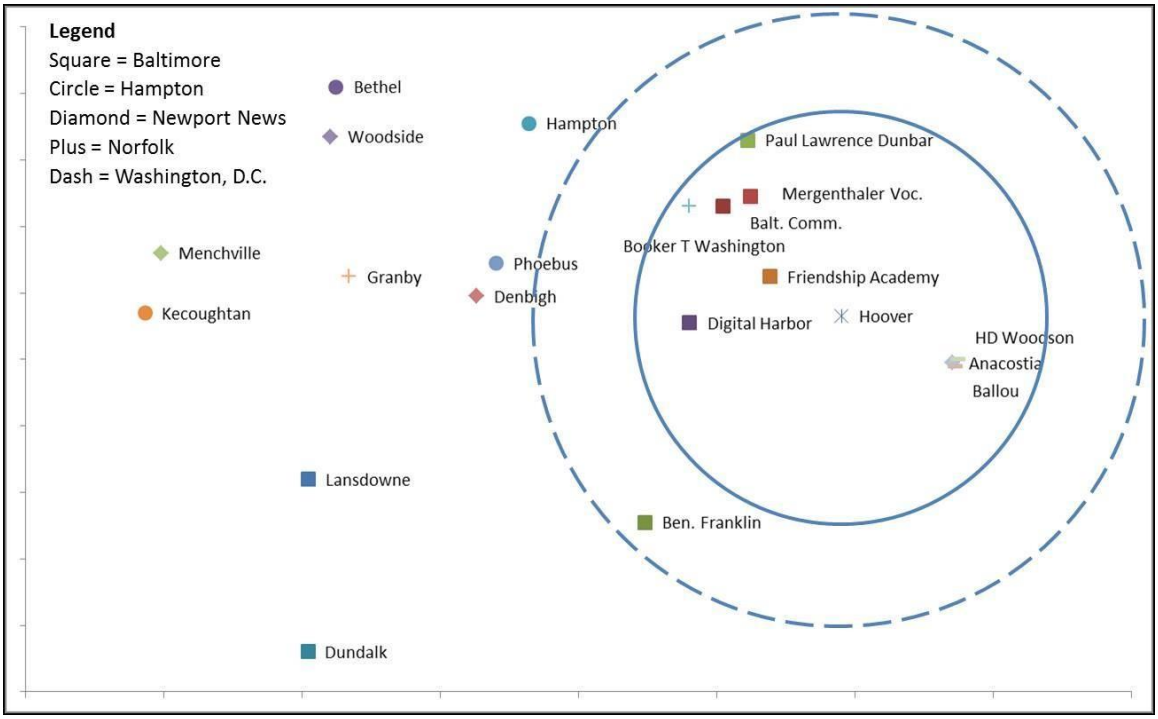
*Median value

Location	High School Name	HS %Students of Color	HS %Receiving Free Reduced Federal Lunch	HS %Black	HS %Latino	HS %Asian	HS %White	HS # Attending	HS Grad. Rate	HS %Math Score	HS %Reading Score
San Diego	**Hoover**	96	87	11	71	14	2	2,200	42	27	40
Baltimore	Achievement Academy	100	83	99	1	0	1	354	32	36	43
Baltimore	Antioch Diploma	99	80	98	1	0	1	395	27	27	31
Baltimore	Baltimore City College	88	59	85	2	1	10	1,289	92	88	95
Baltimore	Baltimore Community	93	73	81	12	0	6	426	40	15	24
Baltimore	Benjamin Franklin	69	85	58	10	1	31	380	71	66	47
Baltimore	Digital Harbor	84	77	73	9	2	15	1,400	80	66	53
Baltimore	Dundalk	38	68	26	10	2	58	1,317	73	81	78
Baltimore	Friendship Academy	92	80	82	8	2	8	535	67	31	53
Baltimore	Lansdowne	48	58	30	10	8	50	1,211	77	72	66
Baltimore	Mergenthaler Vocational	96	74	95	1	0	3	1692	82	65	67
Baltimore	Paul Lawrence Dunbar	99	71	97	1	1	1	907	91	83	87
Hampton	Bethel	73	38	67	4	2	24	1,934	81	61	92
Hampton	Hampton	85	54	76	5	4	13	1,651	84	53	88
Hampton	Kecoughtan	47	37	40	5	2	49	1,772	81	65	91

Location	High School Name	HS %Students of Color	HS %Receiving Free Reduced Federal Lunch	HS %Black	HS %Latino	HS %Asian	HS %White	HS # Attending	HS Grad. Rate	HS %Math Score	HS %Reading Score
Hampton	Phoebus	74	59	70	3	1	24	1,159	72	54	87
Newport News	Denbigh	71	60	53	13	5	27	1,285	75	44	87
Newport News	Menchville	51	35	42	6	3	47	1,708	79	67	91
Newport News	Woodside	70	40	54	12	4	29	2,046	89	64	95
Norfolk	Booker T Washington	91	70	85	4	2	6	1,293	65	29	84
Norfolk	Granby	63	50	53	7	3	30	1,949	69	65	94
Washingto n D.C.	Anacostia	99	99	99	0	0	0	751	40	12	17
Washingto n D.C.	Ballou	99	99	98	1	0	0	678	50	23	20
Washingto n D.C.	HD Woodson	100	99	100	0	0	0	762	53	16	22

Multidimensional scaling (MDS) was applied to the variables in the matrix to visualize these data and demonstrate the relative differences between each school. In the MDS plot (Figure 4), each point represents a different school and distance (regardless of direction) represents the degree of similarity/difference between schools. The points that fall onto one another are highly similar (e.g., Anacostia, Ballou. HD Woodson). The MDS plots generated from data on the few essential school characteristics (Students of Color and Percent of Population on Federal Free and Reduced Lunch) showed that at least one high school in each potential geographic region was a highly similar to Hoover High School (Figure 4). Two areas were defined within the MDS plot, those schools that are most similar to Hoover High School (within the solid line in
Figure 4) and those that have a high degree of similarity and may be worth further investigation (within the dashed line in Figure 4). It should be noted that Achievement Academy, Antioch Diploma, and Baltimore City College high schools were removed from the candidate locations for the MDS as they are "second chance" schools and do not align with Ocean Discovery's model.

Figure 4: MDS plot of relative differences between schools using students of color and %free and reduced lunch



Discussion

Across Geographic Areas

Based on a review of these results from the coarse level analysis, it is shown that all three of the potential geographic regions (Washington, DC, Baltimore and the Hampton/Newport News/Norfolk region of Virginia) are characterized by areas with high concentrations of minority and traditionally underserved populations, low median income and high population densities.

Results of the MDS plot (Figure 4) reveal schools that are most similar to the benchmark Hoover High School, where the model is currently being implemented. The three high schools in Washington, DC are all most similar to Hoover and are strong candidates for further consideration. The overall pattern of schools shows that the cluster of schools shown in Figure 1 that are within the dashed line have a student population that is both similar to one another and the model, which suggests that they may be good candidates both for best supporting the pilot of model and providing insights that would be relevant for future replication efforts at additional sites. Schools outside of the dashed line were eliminated from consideration.

Mapping results demonstrate regional patterns where Washington, DC and Baltimore are characterized by large swaths of area with similar demographics, in contrast to the more patchy demographic landscape of the Virginia region.

The high schools in Wards 7 and 8 in Washington, DC all have low academic achievement. In contrast, there is more diversity in performance across the high schools examined in Baltimore and Virginia, some performing well and some performing poorly. Evaluating just by demographics alone is not sufficient as some very high performing public schools are located in census tracts with low income and traditionally underserved populations. This may be an indicator of alternative public education structures, like magnet or charter schools. In addition, some of this may also be a reflection of the different scales of the three geographic areas studied for this coarse analysis – DC wards, two large sections of Baltimore, and three cities in Virginia.

In terms of location to the Chesapeake Bay and ocean ecosystems, the Virginia geographic region is the closest to both the Chesapeake Bay ecosystem and the Atlantic Ocean. Baltimore is in close proximity to the Chesapeake Bay ecosystem, by not as close to the Atlantic Ocean. And the Washington, DC region is the least close to the Chesapeake Bay and ocean ecosystems.

All geographies were rich in STEM capacity and resources, with San Diego in the lead, followed by Washington, DC, Baltimore and the Virginia cities. However, if the Virginia cities are aggregated, as they are situated next to each other, then Virginia and San Diego have the same amount of estimated STEM capacity and resources. The STEM resources and capacity for Washington, DC is likely more than its estimated number given the high amount of public and private sector knowledge capital in close proximity (neighboring Virginia and Maryland).

By Geographic Area

For Washington, DC, the difference between academic performance and demographics between the high schools in Wards 7 and 8 is marginal. Both the maps and the matrix demonstrate the similarity across the Wards. In this case, more information is needed at the medium level to determine which Ward, if any, to focus on.

In Baltimore, high students of color and low-income populations characterize many areas of the city. Some high schools are performing very well in areas of low income and high traditionally underserved populations, while other high schools are performing poorly in similar neighborhoods. For example, Baltimore City College and Paul Lawrence Dunbar High Schools are both high academic achievement high schools. This indicates that there may be magnet or charter schools in Baltimore drawing from various neighborhoods, which is an element to consider when interpreting these maps. Based on U.S. census tract demographic characteristics, and high school specific demographics, the communities that could be examined more at the medium level are those surrounding Benjamin Franklin and Lansdowne high schools.

For Virginia, the data and maps indicate that there are pockets of areas that exhibit low academic achievement, low income as well as high population density. Similar to Baltimore, evaluating demographics alone is not sufficient as there are very achieving public schools in areas of low income and traditionally underserved populations, such as Woodside, Hampton, Kecoughtan, and Bethel High Schools. There are two areas that stand out in particular in terms of poor academic achievement, high minority and traditionally underserved populations and low income. These are the Hampton Roads area surrounding Phoebus High School, as well as the area surrounding Booker T. Washington High School in Norfolk.

Recommendations

Considering the results both by and across geographic areas, initial recommendations regarding which high schools (and their surrounding communities) can be proposed for consideration and special focus during the site visits and consideration in the medium level of analysis (Table 14).

Table 14: Preliminary List of Communities for Consideration at the Medium Level

REGION	HIGH SCHOOL &SURROUNDING COMMUNITY
Washington, DC	Anacostia
	Ballou
	H.D. Woodson
Baltimore	Baltimore Community
	Merganthaler Vocational
	Digital Harbor
	Friendship Academy
	Paul Lawrence Dunbar
Norfolk, VA	Booker T. Washington

During the site visit to ground-truth these data-driven recommendations and leverage the experience-based instincts of the Ocean Discovery staff, it will be important for Ocean Discovery to (1) understand the community character and readiness from those with on-theground experiences in locations of interest and (2) gain a broad perspective of key leaders in the community and potential partners. In addition, specific questions should be investigated in each geographic area based on the results of the coarse level data analysis. For Baltimore, this includes understanding circumstances where school demographic data did not align with community demographic data and understanding the presence/absence of a viable schoolshed. For Washington, DC, this includes questions related to density of young people and community readiness. For Hampton/Newport News/Norfolk, this includes understanding the makeup of the STEM industries and resources in the area.

Conclusion

Ocean Discovery Institute's, "*Reaching Students in the Chesapeake Bay Project*" in has the great potential to inform how to rigorously replicate a successful model in the education and environmental/conservation sector. This project demonstrates the utility of using a mixedmethods approach to site assessment. In addition, the three-tiered (coarse-medium-fine) Site assessment process will also help inform and guide the organization's development of their larger national level strategy for replication. This provides a learning tool for Ocean Discovery, as well as for other education and environmental related programs across the country and beyond.

Literature Cited

Creech, Heather. (2008). Scale up and replication for social and environmental enterprises. International Institute for Sustainable Development. Retrieved from: http://www.iisd.org/pdf/2008/seed_scale_enterprises.pdf.

Summerville, G. and B. Raley. (2009). Laying a Solid Foundation Strategies for effective program replication. Public/Private Ventures. Retrieved from: http://ppv.issuelab.org/resource/laying_a_solid_foundation_strategies_for_effective_program_replication.

Appendix E

STEM Industry Research for the Hampton Roads Region of Virginia: Chesapeake, Hampton, Newport News, Norfolk, and Portsmouth

By Bemmy Maharramov

Introduction

In terms of the presence of Science, Technology, Engineering and Math (STEM) industry, the Hampton Roads region of Virginia has a lot of complementarity and parallels to Ocean Discovery Institute's home office site of San Diego, California. For one, there is a strong military and defense presence; Navy, Marines, and Coastguard; in both regions. Both San Diego and Virginia's Hampton Roads region have important and strategic ports with the shipping industry playing a key functional and employment role. Another feature of both regions is the strong presence of an engineering sector, in part providing a strong supportive role of the government and stimulating further private sector growth. In addition, both regions are in close proximity to the ocean and coastal ecosystems, which serves as the basis for Ocean Discovery Institute's model of utilizing the ocean as a platform for education, science research, and environmental stewardship.

Relative to other states and from a business perspective, Virginia is one of the leaders and in 2013 Forbes named Virginia the "Top State for Business". In order to get an overall understanding of the economic development in the region, and evaluate this in terms of STEM, the Hampton Roads Economic Development Alliance (HREDA, 2014) was utilized for the data and analysis described below.

Highlighted Features of the region: Port of Virginia, Military and Manufacturing

- **Port of Virginia:** fastest growing port on the East Coast
- **Military**: 100,000 activity duty military personnel from all branches of the army, with over 6,000 who exit the service every year and establish homes in the region
- **Manufacturing**: In the past decade, over 43 manufacturing companies have established operations in the region, creating 2,800 new jobs and investing $900 million

*Source: HREDA

Overview of top industries and employers in the region

By industry, the top industries in the Hampton Roads region (which encompasses Chesapeake, Hampton, Newport News, Norfolk, and Portsmouth) are: trade, transportation, and utilities; professional and business services; and government. The prominent industries in the region have strong STEM components, ranging from engineering to shipping (building and repair) to healthcare. The largest employers in the region, including the Department of Defense, SeaWorld, and various healthcare centers, all place high importance on STEM values and competencies. Table 1 and 2 below illustrate the

specific employers that are the largest in the region as well as the employment by industry, with the top three sectors in Table 2 highlighted in blue.

Table 1: Largest Employers, Hampton Roads Region

Largest Employers
US Department of Defense
Huntington Ingalls Industries/ Newport News Shipbuilding
Sentara Healthcare
Riverside Health System
SeaWorld Parks & Entertainment
Smithfield Foods, Inc.
Dominion Virginia Power
Chesapeake Regional Medical Center

*Source: Hoovers, HREDA

Table 2: Employment by Industry, Hampton Roads Region

Employment by Industry		
Industry	**# Emps**	**% Emps**
Natural Resources and Mining	1,080	0.10%
Trade, Transportation, and Utilities	126,934	17.60%
Construction	33,616	4.70%
Manufacturing	54,869	7.60%
Information	11,339	1.60%
Finance and Insurance	21,480	3.00%
Professional and Business Services	108,886	15.10%

Educational and Health Services	97,083	13.40%
Leisure and Hospitality	84,148	11.70%
Other Services	22,538	3.10%
Government	159,966	22.20%

*Source: Virginia Employment Commission, 4th Quarter 2012

Following is a breakdown of employment and industry per city within Hampton Roads. Particular focus is paid per city to employers and industries with strong STEM implications. All the cities below are strong in terms of STEM and should be assessed in more detail. One city that stood out in particular is Hampton, Virginia. This is due to the presence of a university, highly focused STEM private companies, and national level aerospace and atmospheric research entities.

Chesapeake

In Chesapeake, the largest industry mirrors the larger region: trade, transportation, and utilities; professional and business services; followed by government. From a STEM perspective, healthcare and the leisure and hospitality sectors are also important employers. For example, LTD Management is a major employer in the region, which is a hotel development and management company. This potentially indicates an opportunity to link the ecological charisma of the area to sustainable tourism, eco-tourism, and overall environmental stewardship.

Table 3: Largest Employers, Chesapeake

Largest Employers
Chesapeake Reg Medical Center
Cox Communications
HSBC North America
LTD Management CO., L.L.C.
QVC Chesapeake, Inc.

*Source: Hoovers, HREDA

Table 4: Employment by Industry, Chesapeake

Employment by Industry		
Industry	**# Emps**	**% Emps**
Natural Resources and Mining	236	0.20%
Trade, Transportation, and Utilities	22,706	23.50%
Construction	7,763	8.00%
Manufacturing	4,650	4.80%
Information	2,208	2.30%
Finance and Insurance	2,602	2.70%
Professional and Business Services	19,347	20.00%
Educational and Health Services	7,388	7.60%
Leisure and Hospitality	9,757	10.10%
Other Services	3,751	3.90%
Government	16,373	16.90%

*Source: Virginia Employment Commission, 4th Quarter 2012

Hampton

Some of the largest employers in Hampton have a strong STEM focus, such as Hampton University, a historically black university with many STEM related degrees, including a Master in Environmental Science, Bachelor in Marine and Environmental Science, an Engineering and Technology School, and more. Also, Science Systems and Applications, whose company headline is "*Science and Technology with Passion*", is a very strong STEM related company in the city. All of the major employers in Hampton are science or engineering related in some way. In addition, not noted in the table below, is the presence of the National Institute of Aerospace and the NASA Langley Research Center, which engage in aerospace and atmospheric science.

Table 6: Largest Employers, Hampton

Largest Employers
Alcoa Howmet
Hampton University

Jacobs Technology
Measurement Specialties
Science Systems and Applications

*Sources: Hoovers, HREDA

Table 7: Employment by Industry, Hampton

Employment by Industry		
Industry	**# Emps**	**% Emps**
Natural Resources and Mining	8	0.70%
Trade, Transportation, and Utilities	8,783	15.90%
Construction	2,040	3.70%
Manufacturing	2,240	4.00%
Information	1,362	2.50%
Finance and Insurance	796	1.40%
Professional and Business Services	8,720	15.70%
Educational and Health Services	8,411	15.20%
Leisure and Hospitality	5,937	10.70%
Other Services	1,262	2.30%
Government	15,816	28.60%

*Source: Virginia Employment Commission, 4th Quarter 2012

Newport News

In Newport News, Canon is one of the largest employers in the region and already has existing community partnerships in the environmental and educational arena, such as with the Chesapeake Bay Foundation. In addition, industrial, healthcare, and government are a major presence in the city, including a strong focus on shipbuilding in the city that has strong STEM connections.

Table 8: Largest Employers, Newport News

Largest Employers
Canon Virginia, Inc.
Ferguson Enterprises, Inc.
Huntington Ingalls Industries/Newport News Shipbuilding
Riverside Health Systems
U.S. Department of Defense

*Sources: Virginia Employment Commission, 4th Quarter 2012, HREDA

Table 9: Employment by Industry, Newport News

Employment by Industry		
Industry	**# Emps**	**% Emps**
Natural Resources and Mining	14	0.00%
Trade, Transportation, and Utilities	12,940	18.00%
Construction	2,826	3.90%
Manufacturing**	0	0.00%
Information	1,074	1.50%
Finance and Insurance	1,551	2.20%
Professional and Business Services	13,083	18.20%
Educational and Health Services	12,122	16.90%
Leisure and Hospitality	7,350	10.30%
Other Services	2,355	3.30%
Government	18,385	25.60%

*Source: Virginia Employment Commission, 4th Quarter 2012 Asterisk (**) indicates non-disclosable data

Norfolk

Industry associated with shipping is also strong in Norfolk, as well as business-related services (Dominion Enterprises, Bank of America, etc.), and a significant healthcare industry. Government; followed by education and healthcare services; and trade, transportation, and utilities are the dominant industries by employment in the city. The state's only freestanding children's hospital, Children's Hospital of the King's Daughters, is located here.

Table 10: Largest Employers, Norfolk

Largest Employers
BAE Systems Norfolk Ship Repair
Bank of America
Children's Hospital of the King's Daughters
Dominion Enterprises
Sentara Healthcare

*Sources: Hoovers, HREDA

Table 11: Employment by Industry, Norfolk

Employment by Industry		
Industry	**# Emps**	**% Emps**
Natural Resources and Mining	12	0.00%
Trade, Transportation, and Utilities	23,369	16.90%
Construction	3,915	2.80%
Manufacturing	6,489	4.70%
Information	2,687	1.90%
Finance and Insurance	5,346	3.90%
Professional and Business Services	18,934	13.70%

Educational and Health Services	25,193	18.20%
Leisure and Hospitality	11,833	8.60%
Other Services	3,876	2.80%
Government	36,531	26.40%

*Source: Virginia Employment Commission, 4th Quarter 2012

Portsmouth

The government and healthcare sectors are the most prominent industries and employers in Portsmouth. There are two substantial healthcare facilities, including the Naval Medical Center. The Coast Guard has a base in the city, which has strong connections to STEM. In addition, the industrial landscape is also characterized by the shipping industry, such as General Dynamics/Earl Industries.

Table 12: Largest Employers, Portsmouth

Largest Employers
Bon Secours/ Maryview Hospital
CDI Marine
General Dynamics/ Earl Industries
Naval Medical Center
U.S. Coast Guard

*Sources: Virginia Employment Commission, 4th Quarter 2012, and HREDA

Table 13: Employment by Industry, Portsmouth

Employment by Industry		
Industry	**# Emps**	**% Emps**
Natural Resources and Mining	0	0.00%
Trade, Transportation, and Utilities	5,343	12.00%
Construction	2,072	4.70%
Manufacturing	1,771	4.00%

Information	341	0.80%
Finance and Insurance	521	1.20%
Professional and Business Services	4,396	9.90%
Educational and Health Services	6,509	14.70%
Leisure and Hospitality	2,296	5.20%
Other Services	1,738	3.90%
Government	19,413	43.70%

*Source: Virginia Employment Commission, 4th Quarter 2012

List of STEM industries in Hampton Roads

Advanced Engineering Consultants
249 Central Park Ave. #330
Va. Beach, VA 23462 Web Site:
www.aecmep.com Category:
Consultants-Government Contractors

ATC Associates, Inc. 211
Expressway Ct.
Va. Beach, VA 23462
Web Site: www.atcassociates.com Category:
Engineering-Environmental

Baldwin & Gregg, Ltd.
300 E Main St. #370
Norfolk, VA 23510-1769
Web Site: www.baldwinandgregg.com Category:
Engineering-Surveying

C. Allan Bamforth, Jr., Engineer-Surveyor, Ltd.
2207 Hampton Blvd.
Norfolk, VA 23517-1507 Web
Site: www.bamforth.com
Category:
Engineering-Civil

BBG Incorporated 1708
South Park Ct.
Chesapeake, VA 23320-8910 Web
Site: www.bbginc.com Category:
Engineering-Electronic

DDL OMNI Engineering LLC
440 Viking Dr. #150
Va. Beach, VA 23456 Web Site:
www.ddlomni.com Category:
Technical Services

Draper Aden Associates
703 Thimble Shoals Blvd
Suite C2
Newport News, VA 23606-4500 Web
Site: www.daa.com Category:
Engineering Consultants

Engineering Services, Inc.
3351 Stoneshore Rd. Va.
Beach, VA 23452-4865
Category:
Engineering-Civil

Hughes Security Engineering, LLC 4056
Dunbarton Cir.
Williamsburg, VA 23188
Web Site: www.hughessecurityengineering.com
Category:
Security Services

JES
569 Central Dr. #200 Va. Beach,
VA 23454 Web Site:
www.jeswork.com Category:
Engineering-Structural

Bondurant Associates
444 Crawford St. #300
Portsmouth, VA 23704-3843
Web Site: http://bondurant.org/website/ Category:
Engineering-Structural

Johnson, Mirmiran & Thompson
272 Bendix Rd. #260
Va. Beach, VA 23452 Web
Site: www.jmt.com
Category:
Engineering

Kimley-Horn & Assoc., Inc.
4500 Main St. #500
Va. Beach, VA 23462
Web Site: www.kimley-horn.com Category:
Engineering Consultants

McCallum Testing Laboratories, Inc.
P.O. Box 13337
Chesapeake, VA 23325
Web Site: mccallumtesting.thebluebook.com/
Category:
Engineering-Geotechnical

McPherson Design Group, pc
6371 Center Dr. #100
Norfolk, VA 23502
Web Site: www.mcphersondesigngroup.com
Category:
Engineering-Structural

Parsons Brinckerhoff
277 Bendix Road, Suite 300
Va. Beach, VA 23452 Web
Site: www.pbworld.com
Category:
Engineering Consultants

Pro-Concepts, LL
580 Lynnhaven Pkwy. #202
Va. Beach, VA 23452-7333
Web Site: www.proconceptsllc.com Category:
Information Technology

Reed Integration, Inc.
7007 Harbour View Blvd. #117
Suffolk, VA 23435
Web Site: www.reedintegration.com Category:
Engineering & Management Services

Reynolds, Smith, and Hills, Inc
109 East Main St., Suite 650 Norfolk,
VA 23510
Web Site: www.hsandh.com Category:
Engineering Consultants

SAIC Science Applications International VA Beach
2829 Guardian Lane
Va. Beach, VA 23452
Web Site: www.saic.com
Category:
Engineering & Technical Services

Skanska USA Civil Southeast
295 Bendix Rd. # 400
Va. Beach, VA 23452-1295
Web Site: www.usacivil.skanska.com Category:
Engineering-Civil

Sonalysts, Inc.
5101 Cleveland St. #301
Va. Beach, VA 23462
Web Site: www.sonalysts.com Category:
Engineering & Technical Services

STAR/System Technologies Advanced Research
448 Viking Dr. #350
Va. Beach, VA 23452
Web Site: www.starssite.com Category:
Computer Software Engineering
Computer Software & Services

T-Solutions, Inc.
112 Bruton Ct.
Chesapeake, VA 23322
Web Site: http://www.tsoln-inc.com/ Category:
Engineering

A. Morton Thomas & Associates, Inc
1530 Breezeport Way #300
Suffolk, VA 23435
Web Site: www.amtengineering.com
Category:
Engineering Consultants
UrsaNav, Inc.
616 Innovation Dr.
Chesapeake, VA 23320
Web Site: www.ursanav.com
Category:
Engineering
Vansant & Gusler, Inc.
6330 Newtown Rd. #400
Norfolk, VA 23502-4890
Web Site: www.vansantgusler.com
Category:
Engineering Consultants
Virginia Aquarium & Marine Science Center
717 General Booth Blvd.
Va. Beach, VA 23451-4811
Web Site: www.VirginiaAquarium.com
Category:
Museums
Woolpert, Inc.
676 Independence Pkwy. #100
Chesapeake, VA 23320
Web Site: www.woolpert.com
Category:
Engineering
XDIN, Inc.
308 35th St. #201
Va. Beach, VA 23451
Web Site: www.xdin.com/usa
Category:
Engineering Consultants

*Source: Hampton Roads Chamber of Commerce

Sources of Data:

Hampton Roads Economic Development Alliance: http://hreda.com/
Hoovers: http://www.hoovers.com/
Virginia Employment Commission, 4th Quarter 2012: http://www.vec.virginia.gov/
Hampton Roads Chamber of Commerce: http://www.hamptonroadschamber.com/

Appendix F

“Replication of Ocean Discovery Institute: An Urban STEM Model that Will Empower Decision Makers and Leadership for the Chesapeake Bay Region”

Replication Strategy Assessment:

Literature Review

By Sarvat Maharramli

A. Methodology

This literature review highlights key available resources for the replication of social and educational programs, especially focusing on key trends, lessons learned, and good practices of organizations of similar size with the Ocean Discovery Institute. The reviewed literature includes a wide range of resources including, academic articles, books, white papers, case studies, essays, magazine articles, workshop presentation materials, toolkits, guidebooks and manuals for organizations to replicate their programs. Although the majority of the literature on this topic covers experiences of similar non-profit organizations, educational institutions and funding institutions in the U.S., selected relevant examples from other countries, including UK, Canada and other European countries have been also reviewed and cited. The authors mainly used open-source Internet and certain online libraries to collect and analyze existing literature under search terms of "replication", "scaling up", "social innovation", "expansion of NGOs" and other relevant concepts. Although precise definitions of these concepts are arguably different (which will be discussed under the *Results Section* of the literature review); methods, strategies and approaches used under these concepts provide valuable information that Ocean Discovery can utilize for the development of a sustainable replication strategy of its program in new regions.

The structure of the literature review is based on the discussion of key questions that the Assessment is aiming to answer, specifically around the definition, rationale, strategies and approaches to sustainable replication, with a special emphasis on the success factors discussed by different practitioners and academicians. The literature review also identifies key questions that should be answered as a part of the replication process. These questions were derived through different assessment methods, namely, interviews with the Ocean Discovery staff members and representatives of similar organizations that initiated successful national replication and expansion of their programs.

B. Results

For the purpose of this assignment, the key findings from the literature are structured under three key categories:

1. *Definition and rationale for replication*: this section clarifies the definition of the replication, key concepts and discusses different authors' views on key drivers of replication.

2. <u>*Strategies, approaches and methods of replication*</u>: this section outlines key strategies, approaches, paths and methods of replication discussed by different academicians and practitioners.
3. <u>*Key success factors for the sustainable replication*</u>: this section looks into various success factors, lessons learned and best practices proposed for sustainable program replications.

1. Definition and Rationale for Replication

<u>Definition:</u> Clarification of the definition of the "replication" and its difference from similar concepts such as "expansion", "scaling up" is an important distinction widely discussed in the literature. The following key characteristics have been emphasized by different authors in discussing the definition of replication (Fleischer, *et al*. 2008; Creech 2008; RPS, 1994; Jowet and Dyer 2012; Dees and Anderson, 2003):

- Piloting, implementing successful and tested programs, concepts, ideas, innovation in different locations;
- Reaching larger groups of beneficiaries and achieving greater impact;
- Remaining sensitive to local context;
- Adapting to new regions and communities

Replications and Program Strategies (RPS, 1994) identifies replication as "*the process of moving a tested prototype program to additional sites in keeping with the hard (invariable) and soft (variable) aspects of that particular program's components while remaining sensitive to the local context of each additional site*" (RPS, 1994, p.1). Hard or invariable features are characteristics of the original model considered essential for replication, whereas soft/variable features do not have to be a part of the replication process and can be dropped depending on the new replication sites (RSP, 1994, Lowet and Dyer 2012,). It is also noteworthy to mention that replication does not mean "copying" or "duplicating" any concept without taking into consideration the local context (Fleisch *et al.* 2008; Jowet and Dyer 2012; RPS, 1994). Bradach (2003) calls the replication "a process of planned evolution" for an organization.

It is also important to differentiate between "replication" and "scaling", as replication is considered just one way of scaling programs (Creech 2008; Grantmakers for Effective Organizations. 2011). According to Hartmann and Linn, scaling is something different - "expanding, adapting and sustaining successful policies, programs or projects in different places and over time to reach a greater number of people" (Hartmann and Linn, 2008, p.7). Although several authors present "replication" as one of the mechanisms of the "scaling", there is not sufficient discussion in the literature on how it differs from other mechanisms and many academicians and practitioners interchangeably use these terms.

2. Rationale for replication

One of the key questions discussed in the literature is the rationale underlying why an organizations needs/wants to replicate its program. Different authors extensively discuss the (1) driving forces; (2) preconditions; and (3) benefits of the replications on social and educational sectors. Organizations need to analyze these aspects of the rationale for replication and include those factors into their replication strategy.

Driving forces: Key driving forces of the replication can be divided into two categories: internal and external factors. Internal factors include ideas, vision, strategic approach and leadership of an organization (Hartmann and Linn, 2008) to expand its social impact and reach larger beneficiaries. External factors include new opportunities, resources (Bridgespan Group, 2005) and demand (Bradach 2003) that organizations are trying to capture. A study conducted among 20 youth-serving organizations by Bridgespan Group (2005) discovered that expansion and replication was "more often a response to opportunity than the result of strategic choices". In terms of demand, an organization should conduct extensive research (survey, field visits, etc.) to identify demand for the proposed program. For example, to identify demands in the potential target regions, the STRIVE program reviewed statistics from the 50 largest cities across the United States before initiating its expansion program (Bradach 2003).

Preconditions: Identifying and establishing preconditions for replication is an important factor for initiating any replication. The program needs to meet several key preconditions in order to be replicated

in a new community. First of all, it needs to address priority social and public needs or problems (Summerville and Raley 2009; Racine 2004). Secondly, the program should have a strong theory of change and clear, effective and replicable elements (Bradach 2003; Summerville and Raley 2009). As Bradach (2003) indicates, replicating the entire organization and its culture might be complex and unrealistic; thus, it is imperative to understand replicable core elements of the program. Racine (2008) proposes responding to the following four dimensions of the replication: *"(1) What the program tries to achieve (product); (2) How it tries to achieve (production process); (3) How the product will be shaped by the reactions of the market; and (4) How the process will be shared by the reaction of the market when the program is disseminated*." The final precondition for the program replication is the institutional readiness, which requires an organization to have the necessary systems and procedures in place to initiate, measure, and achieve positive results within the realistic timeframe (Dees, *et al.* 2002; Racine 2004; Bradach 2003; Bridgespan Group 2005). According to Bradach (2003), organizations should answer to the following three questions before moving forward with the replication of their program: *"(1) where and how to grow; (2) what kind of network to build and*
(3) what the role of the "center" needs to be."

Benefits: Replicating a tested and successful social program in new communities has social, economic, financial and programmatic benefits to both the (1) replicating organizations and (2) new communities and partner organizations in those communities. Key benefits of replication to the replicating organizations can be described as follows:

- Programmatic and political benefits: National recognition, dissemination of values, vision and organizational culture and reaching new beneficiaries are high level benefits discussed by different authors (Steele *et al*., 2008; Creech, 2008; Fleisch 2008). In addition, the replication process creates opportunities for innovation, mutual learning and program development through testing a program in a new environment and context (Berelowitz *et al.* 2013; Oudenhoven and Wazir 1998).
- Organizational benefits: Properly designed and implemented replication program (1) strengthens program management, especially data collection and measurements systems of an organization; and (2) improves skills and knowledge of the existing staff members and attracts new workforce (Berelowitz *et al*. 2013).

- Economic and financial benefits: Diversification of financial resources and availability of alternative donors in new communities (Fleisch 2008; Jowet 2010; Oudenhoven and Wazir 1998). In addition, by establishing new replication sites and standardized systems and services, organizations benefit from the economies of scales (Berelowitz *et al*. 2013).

Benefits of replication to a new community, including local organizations/partners vary depending on the path of the replications (wholly-owned branch office, franchise, partnership or dissemination) selected by the replicating organization in introducing a new program. However, there are a few benefits that are applicable to all replication pathways. First of all, the community will benefit from the resolution of societal problems applying the tested successful models without high risks and costs (Fleisch *et al*. 2008). In terms of the local partner organizations, the local replicators benefits from (1) access to the tested model, experienced staff, templates and examples of the successful program materials and resources (Winter and Szulanski 2001); (2) low start-up costs and support in diversifying funding sources (Fleisch 2008; Jowet 2010; Oudenhoven and Wazir 1998; Berelowitz *et al.* 2013); and (3) access to the larger network of organizations involved in the replication process (Bradach 2003).

3. Replication Strategies, Models, Approaches and Phases

Replication Strategies and Models: The contemporary literature on replication models and strategies provide a series of categorizations on replication models and strategies. Review of these strategies and models revealed that some of these categorizations are repetitive and there is some inconsistency among academicians and practitioners about the categorization of replication models. Thus, this paper focuses on key categorizations and models that can provide value to Ocean Discovery in designing its replication strategies.

The first categorization of the replication strategies are four paths presented by RPS (1994, p.4) and further developed and discussed by other academicians and practitioners (RPS, 1994; Oudenhoven and Wazir, 1998; Jowett and Dyer, 2012; Hartman and Linn, 2008; Zhonghua, 2008; Fleisch *et al*., 2008). These replication paths are (1) *Mandated, (2) Franchise, (3) Staged and (4) Concept.* RPS' categorization was further developed/interpreted by different authors who presented either new paths,

such as Spontaneous or Endogenous (Oudenhoven and Wazir 1998) or combined them under a hybrid model, such as Network Replication (Jowett and Dyer, 2012). One of the hybrid models proposed by Jowett and Dyer (2012) is called the "network" model, which argues that replication can be done by any organization using the core requirements of the original model. In a network model, organizations agree to join a network of organizations for mutual learning and sharing experience. Supporters of this model argue that by networking, organizations can reduce risks and costs, but at the same time, can adapt to local context. The table below shows key characteristics of four path/strategies discussed by different authors (RSP 1994; Jowet and Dyer 2012; Fleisch *et al*. 2008; Oudenhoven and Wazir 1998; Alhert *et al*. 2008).

Path	**Key Characteristics**
Mandated	• More top-down approach; Politically supported by government; • Obligatory in some cases; • Easy financing since the government supports the replication strategy
Franchise	• Based on the franchise approach used in the private sector; • Continuous assistance, support and services to each franchisee; • Adherence to certain standards and maintenance the initiative's integrity • Mainly one-way communication from the main organization to franchisees; • Less flexible and weak adaptation to local contexts • Easy to manage and evaluate • Faster and more cost effective due to the economies of scale

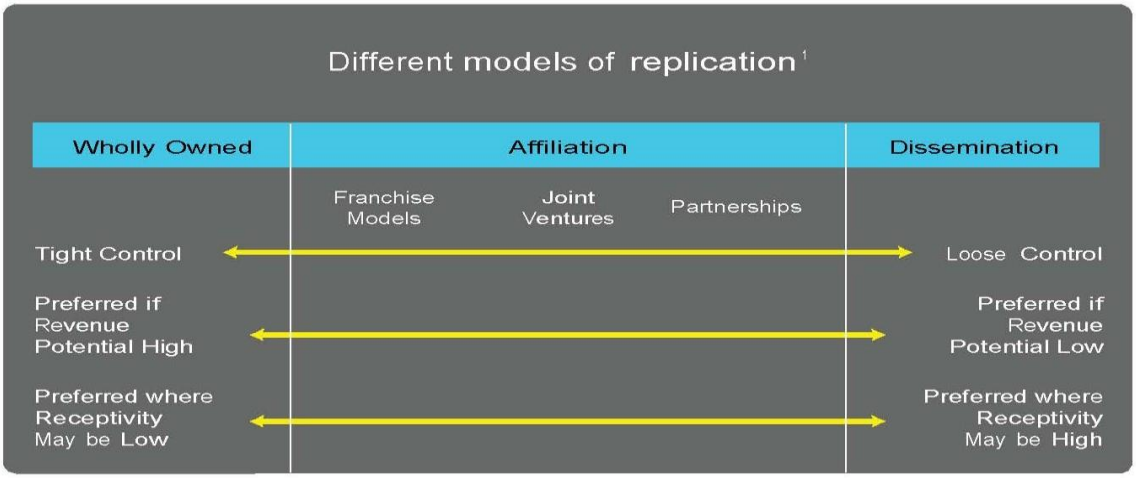
Staged	• Carried out by initiating organization • The model has three stages: (1) pilot stage to determine viability, (2) demonstration stage for rigorous testing, monitoring and evaluations and (3) the implementation stage for roll-out • Time consuming, slowly and costly; but less risky • Human factor and understanding of local context are important factors
Concept	• Can be carried out by any organization using the general concept/idea • Promotes local ownership and adaptation with bottom-up approach • Flexible and Demand-driven • Consistence between old and new sites are not required • Low risk and financial costs to the initiating organization • Strict adherence to the model of the prototype is not required

Oudenhoven and Wazer (1998) divide these four paths into two approaches: universalist path (Mandated, Staged, and Franchised) and contextual (Concept and Spontaneous) path.

According to the authors, supporters of the former approach argue that universal principles can be applied to a wide range of situations; whereas, the latter approach concentrates on the local situation and practice in implementing replication programs (Oudenhover and Wazer, 1998).

The second categorization of the replication strategies is proposed by Clark, *et al.* (2012) who divide replication strategies into two large categories: "*strategies that involve **geographic replication** (for example, opening up new branches in order to implement a program model for new sets of beneficiaries) vs. **non-replication options** (affiliating with new partners, disseminating ideas about change models directly or indirectly, working to change policy environments, and other strategies to create thought change or promote a social movement, etc.)".*

The third and most recent categorization of the replication strategies and models is proposed by Berelowitz *et al.* (2013) as a result of the study conducted among 123 social organizations in the UK. Berelowitz reviews other key models and propose three models of the replication based on these criteria: *level of control by a replicating organization; level of receptivity in a community and revenue potential in a replication site.*

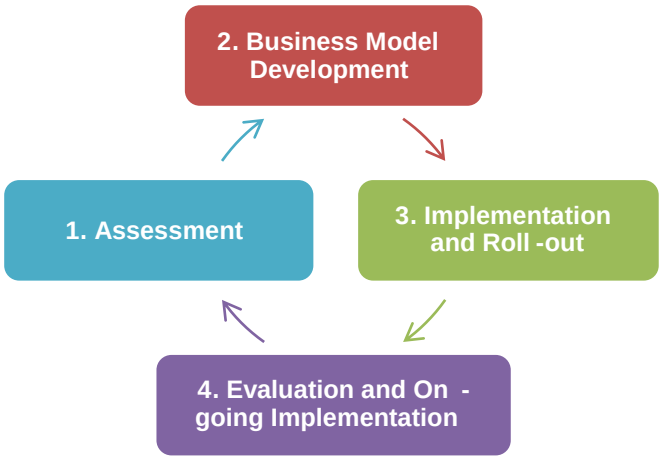


Source: *Realizing the Potential for Social Replication. Research for Big Lottery Fund by the International Center for Social Franchising.* Dan Berelowitz, Mark Richardson and Matt Towner. September 2013.

In "wholly owned" or "branch" structure, an organization creates, owns and operates a new replication entity itself without any local organizations' involvement. In the "joint venture" model, an organization creates a replication entity with another organization to share the risks, benefits and costs. In the "partnership" model, an organization signs a "loose agreement" with a different organization in the region to deliver its services in a new site through a partner. Finally, in the "social franchise" model, a central organization (franchisor) allows a local organization (franchisee) to deliver its proven model under a license (Berelowitz, 2013; Jowett and Dyer 2012). The franchisor provides continuous support and services to a local organization, while a franchisee organization maintains established standards and pays a certain fee under a contract/licensing agreement. According to the results of a survey conducted by Berelowitz *et al.* (2013) among 123 social organizations in UK, the three top replication models in the UK were "Wholly Owned" (35%); "Social Franchise" (25%) or "Partnerships" (22%). The branch structure is especially preferred when the success of the replication requires tight control over the program replication and transfer of strong culture and invariable elements to new sites, where the receptivity is low in communities (Berelowitz *et al.* 2013; Dees *et al.* 2002). Some authors also believe that the management is easier under this strategy (Campbell *et al.* 2006). Key challenges of this approach are (1) difficulties in attracting local funding; (2) high start-up and management cost; and (3) weak local ownership and support (Campbell *et al.* 2008; Oudenhoven and Wazir 1998). For example, City Year organization uses a very tight policy on establishing replication sites: all sites are parts of the national

organizations; local employees are hired by City Year directly; regular trainings, field visits and standardized trainings are organized for all sites (Bradach 2003; Dees *et al.* 2002).

Approaches and Phases of Program Replications: Organizations use different approaches and processes to initiate the replication of their programs depending on the motivation; local context, strategies and preconditions existing within the organization and/or new sites. The majority of these approaches fit into the circular process of the four steps discussed by different academicians (Clark *et al.* 2012; Berelowitz *et al.* 2013):



*Phase One -Assessment: O*rganizations define the business module, its essential elements and social impact; reviews institutional readiness (including administrative, human and organizational systems); identifies potential pilot sites for replication; and determines the replication strategy/models (Berelowitz *et al.* 2013; Clark *et al.* 2012; MSI 2012). Summerville and Relay call it the "determination of the desirability and feasibility of the replication" (Summerville and Relay 2009).

Phase Two-Business Model Development: Organizations prepare a business strategy and funding proposals; creates legal documents and other administrative and operations systems for the replication (including branding); identifies internal team and local champions for the implementation of the replication and finalizes site selection process (Clark *et al.* 2012; Berelowitz *et al.* 2013; MSI 2012).

*Phase three-Implementation: O*rganizations pilot replication in 3-6 varied locations; establish local presence; conduct initial and on-going trainings for the local staff; and monitor the implementation and

collects data; and provide necessary administrative and leadership support from the home organizations (Clark *et al.* 2012; Berelowitz *et al.* 2013; MSI 2012).

Phase Four: Evaluation and On-going Implementation: Organizations collect data and evaluate the pilot replications; provide feedback to the replication team; incorporate new ideas and evaluation results to the replication sites; initiate the roll-out to new sites if necessary (Clark *et al.* 2012; Berelowitz *et al.* 2013;

Different authors and development institutions (non-profits and consulting firms) propose more detailed processes and steps for the replication and/or scaling a social program that can be useful when an organization plan its replication strategy. One of these approaches is developed by the Management Systems International (MSI, 2012), which proposed three steps and ten tasks for effective replication.

Step One: Developing a Scaling Up Plan	**Step Two: Establish the Pre-Conditions for Scaling Up**	**Step Three: Implement the Scaling Up process**
Task 1: Creating a Vision Task 2: Assess Scalability Task 3: Fill Information Gaps Task 4: Prepare a Scaling Up Plan	Task 5: Legitimize Change Task 6: Build a Constituency Task 7: Realign and Mobilize Resources	Task 8: Modify Organizational Structures Task 9: Coordinate Action Task 10: Track Performance and Maintain Momentum

Source: Management Systems International. 2012. *Scaling Up – From Vision to Large-Scale Change. A management framework for practitioner.* Second Edition, 2012

4. Success Factors for the Replication

Success of a program replication depends on different factors starting from the design and validation of the business model to the proper site selection. Different authors focus on different aspects of the replication process to ensure its successes. Dee *et al.* (2002) argues that an organization should work on five "R's" to successfully replicate its program: *Readiness, Resources, Receptivity, Risk and Return*. This

part of the paper summarizes discussions on good practices utilized by different organizations for the replication and/or scaling of their programs.

a. *Validated Business Model and Institutional Readiness of the Home Organization.* An organization needs to clearly define core elements of the program to be replicated, understand the difference between variable and invariable elements of the program and ensure that the proposed model will still produce a successful program in the new site (Bradach 2003; Summerville and Raley 2009). In addition to the validated business model, an organization should ensure that all administrative, legal and operational systems and procedures are in place before initiating the replication (Racine 2004; Dees

et al. 2002; Bridgespan Group 2005). Based on the defined business model and institutional readiness, an organization should identify the best replication models and strategy that will yield a successful replication in new sites.

b. *Home Organization's Role and Responsibilities:* This topic extensively discussed in the literature, especially for the "branch", "wholly-owned", "social franchise" models of the replication. The Home Organization's (HO) responsibilities include:

I. *Back-office support and management:* including advice on management and government and other operational issues (Campbell *et al.* 2008; Detgen and Alfred 2011). Summerville and Raley (2009) believe that an organization needs at least three full-time employees to successfully implementation a replication program. These positions are *"(1) an expert who is dedicated to beginning partnership and positioning the program; (2) a staff person assigned to training and technical assistance; and (3) a data analyst who helps program collect and interpret data."*

II. *Fundraising*: raising funds for local activities, providing initial seed funding; identifying an efficient way for the flow of funds between the home organization and new sites (Campbell *et al.* 2008). A study conducted by Berelowitz *et al.* (2013) using data from 63 organizations reported that 50% of organizations considered access to finance as an issue for replicating their program.

III. *Technical and program support:* developing and providing program materials, including manuals and case studies; ensuring the proper data collection, monitoring and evaluation (Curtis 2001).

IV. *Staff Development*: Identifying, hiring and training new staff members; introducing mentorship program between the staff members of the home organization and new sites/branch or local partners (Summerville and Raley 2009; Curtis 2001).

V. *Leadership Support and Commitment:* HO's leadership, including Board should allocate sufficient time and resources to demonstrate leadership support for the program replication, especially during the initial stage of the new site selection and launch (Yoder and James, 2006; Summerville and Raley 2009; Berelowitz *et al.* 2013). Thus, it is important to engage and educate the leadership, especially the Board about its role and responsibilities from the outset. As Campbell *et al.* (2008) argues "*the demand for resources and leadership attention associated with getting new sites up and running smoothly can put extraordinary pressure on the existing organization and threaten quality at the home site*." Experience of several organizations indicates that founding leaders and staff members might have difficulties leading the transition and expansion of an organization (Berelowitz *et al.* 2013; Racine 2003). The role of board and leadership in replication process and the impact of the replication to the quality of the programs in original sites need further research to provide sufficient data about the (1) new and changing role of leadership, especially in relation to the new "branches" and "communities" and (2) quality of the program in the original sites.

c. *Flexibility and Adaptability of the Replication Model:* It is important to understand that the HO might need to modify its replication model to accommodate the local reality and meet the needs of the local communities and/or partners (Detgen and Alfred 2001; Racine 2004). Being too rigid with the selection criteria and trying to completely copy the home organization model can potentially create damage the replication process. If this flexibility and modifications do not jeopardize the integrity and invariable/hard elements of the program, home organization should demonstrate flexibility in the replication model (RPS 1994). This need for flexibility is widely

discussed in the literature under two concepts: *replication vs. adaptation duality* (Racine 2003) and *exploration vs. exploitation dilemma* (March 1991; Winter and Szulanski 2001). Racine (2001) argues that building balance of "local adaptation with the presentation of key standards and essence of the proposed program" is crucial for any replication program. Explorationexploitation dilemma (March 1991 cited in the Winter and Szulanski 2001) examines the balance between the advantages of "precision" and "learning and adaptation".

d. <u>*Fundraising*</u>: Establishing reliable financial sources for the replication activities, including local funding and securing adequate funding over sufficient time (ideally a minimum of 36 months) are key factors under this category (Bradach 2003; Curtis 2001). One of the key success factors for the "After School Matters" program was its strategy to diversify the funding sources to avoid program's dependence from the government funds (Bridgespan Corporation 2005). In working on the fundraising strategies for replication sites, it is important to understand that some funding institutions prefer not to finance non-programmatic expenses of the home organizations (Bradach 2003).

e. *Data Tracking, Quality Control and Evaluation:* Introducing a system to collect performance data from the early stage; allocating sufficient human resources for the quality assurance, data collection and monitoring work; instituting a site monitoring tools; evaluating the replication program at the pilot sites can increase credibility of the replication program in leveraging new resources and further expansion nationally (Bridgespan Group, 2005; Curtis 2001; Campbell *et al.*2008).

f. *Communication Strategies and Network:* Establishing effective communication strategies and network among the HO and new sites for mutual learning, support and capacity building is important for the success of the replication program at the early stage (Summerville and Raley 2009). The role of effective communication between the home organization and stakeholders in new sites and networking among replication sites requires further research to understand effective communication tools for successful replication

g. *Site Selection:* Selecting the right sites and regions for the program replication is the key for the success of the replication. This section of the paper focuses on literature related to three interrelated components of the site selection process, which can also impact the business model, fundraising strategy and general home organization's role in the process. It is essential to establish comprehensive and effective selection criteria for the identification of a location and avoid choosing purely on the basis of (1) analysis; or (2) donor direction; or (3) requests of other organizations in the sites (Campbell *et al.* 2008). In addition, the HO should ensure that there is a certain level of receptivity in the local community. Understanding cultural diversity and local needs of the community will positively contribute to the receptivity of the community (Oudenhoven and Wazir 1998). Dees *et al.* (2002) emphasizes three important elements for the receptivity of the local community:

> *"demand – willingness of key stakeholders to invest in bringing an innovation to their communities; comparability - degree to which target communities offer operating conditions similar to those that contributed to success in the original community; and openness - willingness of individuals and institutions in the target communities to accept people and ideas from the outside."*

I. *Geographic Location*. Selecting a geographic location for the replication requires in-depth analysis of the demographics, school system and local governance structure to ensure that the new region has similar physical and social environment with the original site. However, the HO should be careful not to be too rigid about these criteria as this can results in excluding some potentially successful locations (Campbell *et al.* 2008).

II. *Local Leaders and Champions*: The literature on the replication strategies emphasizes local leadership and identification of a committed and wellconnected champion who understands the program and local context as one of the most important factor the success of the replication in new sites

(Summerville and Raley 2008; Campbell *et al.* 2009; Curtis 2001; Bridgespan Group 2004; Bradach 2003). Some non-profit organizations that successfully replicated their program (Citizens Schools Program) placed leadership as the number one criteria for expansion (Bridgespan Group 2004). These organizations would not open a new site (Youth Villages programs) if they could not find an experienced leader who worked in one of existing projects/programs of the organization (Campbell *et al.* 2008). Other good practices used by different organizations (Manchester Bidwell Corporation, Boys Town, etc.) included (1) bringing the leaders from new sites to the HO to spend quality time with the experienced staff members and understand the organizational culture (Bridgespan Group 2004) and (2) empowering staff members and leadership with systematic and on-going training programs and technical assistance (Summerville and Raley 1998; Bradach 2003; Curtis 2001; Oudenhoven and Wazir 1998).

III. *Local Partner Organizations:* Organizations might take different approaches to local partnership depending on replication model/strategy (branch office, social franchise, partnership, concept, dissemination, etc.) they are planning to pursue in new sites. Identifying local community organizations and/or networks that can support the replication process with resources, technical advice and information can play a central role in facilitating the replication work (Bradach 2003; Bridgespan Group 2005; Summerville and Raley 1998). For example, Citizens School and Jumpstart used existing networks (YMCA and university presidents respectively) to quickly reach a larger group of beneficiaries (Bradach 2003). This kinds of collaborative work can also lower the cost of replication (Clark *et al.* 2012). However, finding a right local partner with similar visions and commitment to work on replication in the community is considered a challenge by many organizations (Berelowitz *et al.* 2013; Summerville and Raley 1998). It is also crucial to clarify the decision-making related role and responsibilities of a home organization and new sites (Campbell *et al.* 2008) to avoid any potential conflict during the implementation of the program. A study of 20 youth-serving organizations by Bridgespan Group (2005) discovered that "finding the right balance between local autonomy and central control was a recurring challenge"

for many replicating organizations. In addition to local partner organizations, successful partnership with local schools, parents, and local government institutions is considered an important factor for the success of the replication program (Oudenhoven and Wazir 1998). However, the current literature on youth-serving educational programs is lacking data on parents and local governments' engagement and attitude to the new programs and replicating organizations in their communities. Better understanding the ways and roles local governments and parents can be engaged into the process as key stakeholders and as a supportive role might help to build better local ownership for the replication program in a new site.

Bibliography

1. *Racine D. 1998. Replicating Programs in Social Markets. Replication and Program Strategies, Inc.*
2. *Jowett A. and Dyer C. 2012. Scaling-up successfully: Pathways to replication for educational NGOs. International Journal of Educational Development. 2012 Elsevier Ltd.*
3. *Nine steps for developing a scaling-up strategy. World Health Organization. ExpandNet. 2010.*
4. *Summerville G. and Raley B.. 2009. Laying a Solid Foundation. Strategies for Effective Program Replication. Public/Private Ventures 2009.*
5. *Fleisch H., Ahlert D., Ahlert M., Hai Van Doung Dinh, Heußler T. , Kilee L., Meuter J. 2008. Social Franchising: a way of systematic replication to increase social impact, Berlin: Bundesverband Deuscher Stiftung*
6. *Jowett A. 2010. Paths to Scaling-up through Replication: An Educational Perspective. POLIS Journal Vol.4, Winter 2010*
7. *Hartmann A. and Linn J.F. 2008. Scaling Up: A framework and lessons for development effectiveness from literature and practice.; Wolfensohn Center for Development; Working Paper 5/October 2008*

8. *Oudenhoven N. and Wazir R. 1998.Replicating Social Programmes Approaches, Strategies and Conceptual Issues. 1998. UNESCO Discussion Paper Series – No.18 (Management of Social Transformations).*
9. *Bridgespan Group. 2005. After School Matters: Managing local rapid expansion as a young organization.*
10. *Bridgespan Group. 2005. The Steppingstone Foundation: Expanding to new geographies while maintaining high-quality results.*
11. *Bridgespan Group. 2004. Citizens School. Creating a strong program locally as a basis for national expansion.*
12. *Edwards M. and Hulm D.. 1992. Scaling up NGO impact on development: learning from experience.*
13. *Bradach J. 2003. Going to Scale: the challenge of replicating social programs... Stanford Social Innovation Review, Spring 2003*
14. *Management Systems International. 2012. Scaling Up – From Vision to Large-Scale Change. A management framework for practitioner. Management Systems International. Second Edition, 2012*
15. *Grantmakers for Effective Organizations. 2011. Scaling What Works. What do we mean by scaling? Briefing Paper 1.*
16. *Curtis L. 2001. Lessons from the Street: Capacity Building and Replication. Journal of Nonprofit Management. Volume 5. Number 1. Summer 2001.*
17. *Creech H. 2008. Scale Up and Replication for social and environmental enterprises. The SEED Initiative.*
18. *Berelowitz D., Richardson M. and Towner M. 2013. Realizing the Potential for Social Replication. Research for Big Lottery Fund by the International Center for Social Franchising. September 2013.*
19. *Davies A. & Simon J. 2013. How to grow social innovation: A review and critique of scaling and diffusion for understanding the growth of social innovation. Paper prepared for the 5th International Social Innovation Research Conference, 2-4 September 2013, Oxford, The Young Foundation.*

20. *Racine D. 2003. Dissolving Dualities: The case of commonsense replication. Nonprofit and Voluntary Sector Quarterly 2003 32: 307*
21. *Sidney G. Winter, Gabriel Szulanski. 2001. Replication as Strategy. Organization Science 12(6):730-743.*
22. *Clark C.H. Massarskly C.W. Raben T. S. Worsham E. 2012. Scaling Social Impact. A literature toolkit for funders.* Growth Philanthropy Network and Duke University
23. *Dees G., Anderson B. and Wei-Shillern J. 2002. Pathways to Social Impact: Strategies for Scaling Out Success Social Innovations. CASE, Duke University August 2002.*
24. *Racine D. 2000. Investing in What Works. Replication and Program Strategies. November 2000.*
25. *Racine D. 2004. Capturing the Essential Elements. Public/Private Ventures.*
26. *Detgen A. Alfred C. 2011. Replication of a career academy model: the Georgia Central Educational Center and four replication sites. Amy Detgen and Corinne Alfred. Institute of Educational Sciences.*

Ocean Discovery Institute

Young Lives Transformed Through Science

Business Model

Business Model Outline

Who We Are: Mission & Vision

What We do: Business Model

1. Business Model Statement
2. Sustainable Ecosystem
3. Sustainability in San Diego

How We Do It: Frame & Canvas

Growing the Model: Replication

1. Replication Strategy
2. Legal structure

Mission & Vision

Ocean Discovery Institute uses science to engage young people from underserved urban communities and empowers them to transform their lives, their community, and ultimately our world as scientific and environmental leaders.

3

Business Model Outline

Who We Are: Mission & Vision

What We do: Business Model

1. Business Model Statement
2. Sustainable Ecosystem
3. Sustainability in San Diego

How We Do It: Frame & Canvas

Growing the Model: Replication

1. Replication Strategy
2. Legal structure

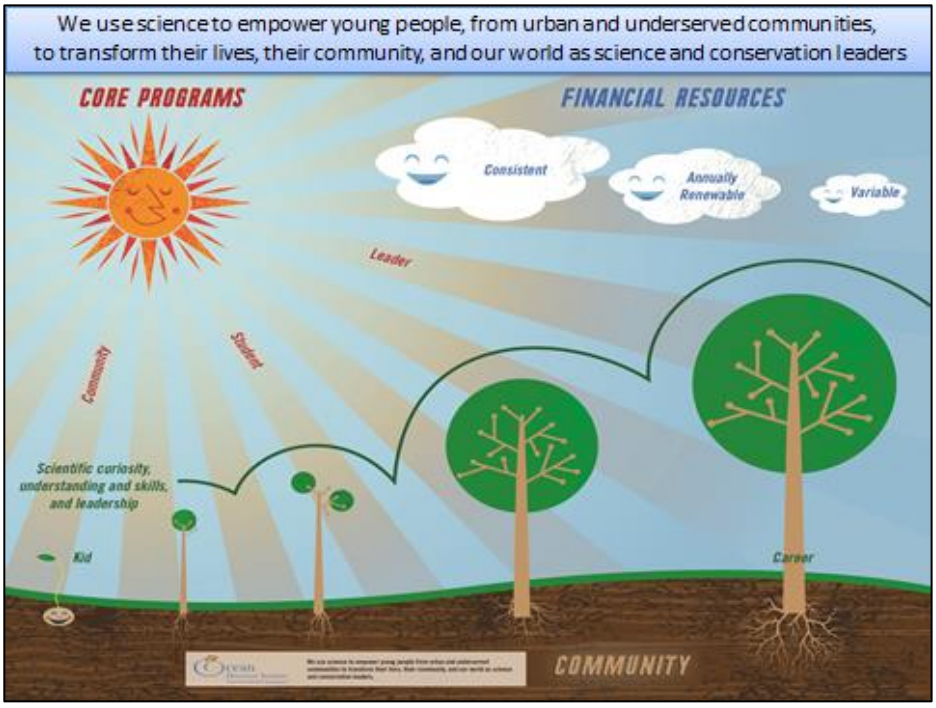
4

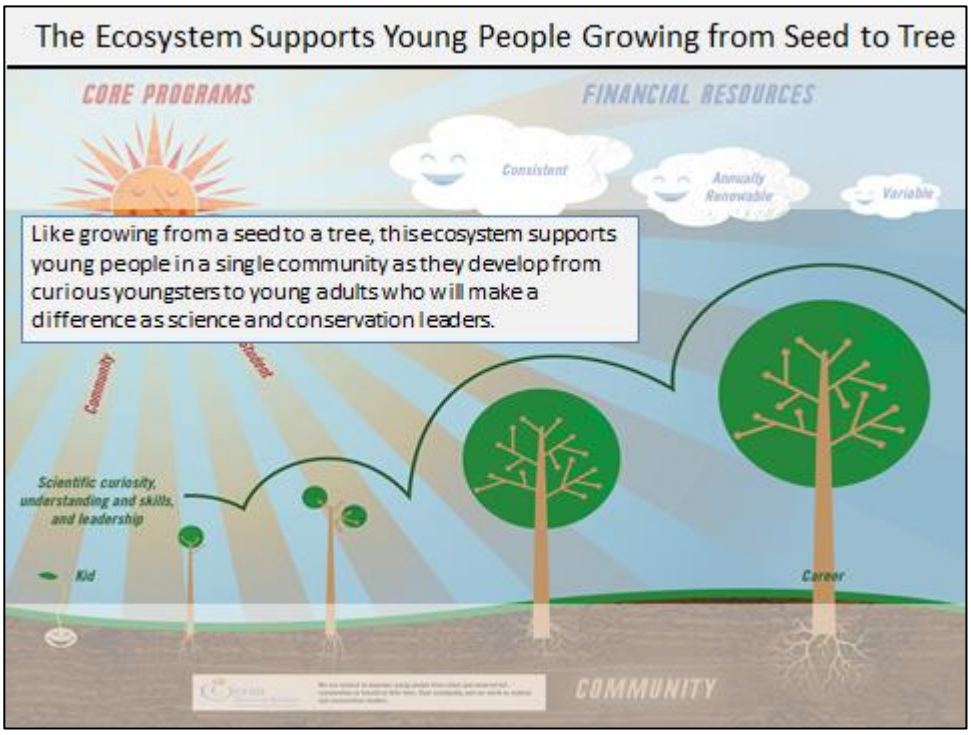
Business Model:
Business Model Statement

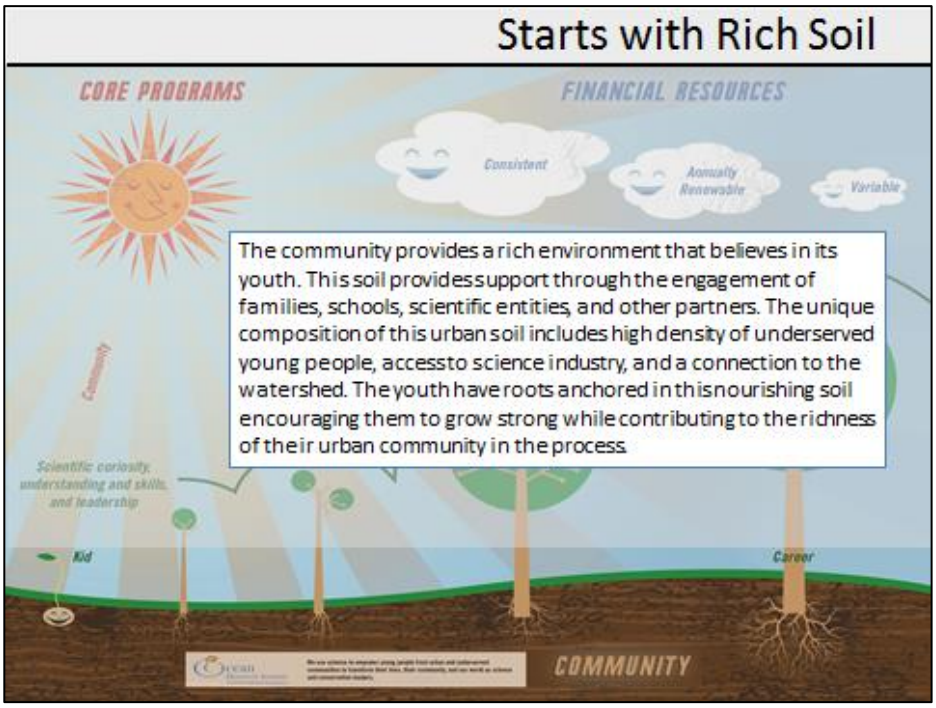
We empower young people, from strategically selected underserved urban communities, to transform their lives, community, and world as science and conservation leaders. This is achieved through providing consistent and continuous, tuitionfree science education across one school-shed at a time. This is made possible by an engaged community and a highly diversified network of donors and investors, many of whom provide significant unrestricted and recurring funding.*

Figure: The figure on the next slide demonstrates this business model as a "sustainable ecosystem" where resources are sufficient to support growth and evolution.

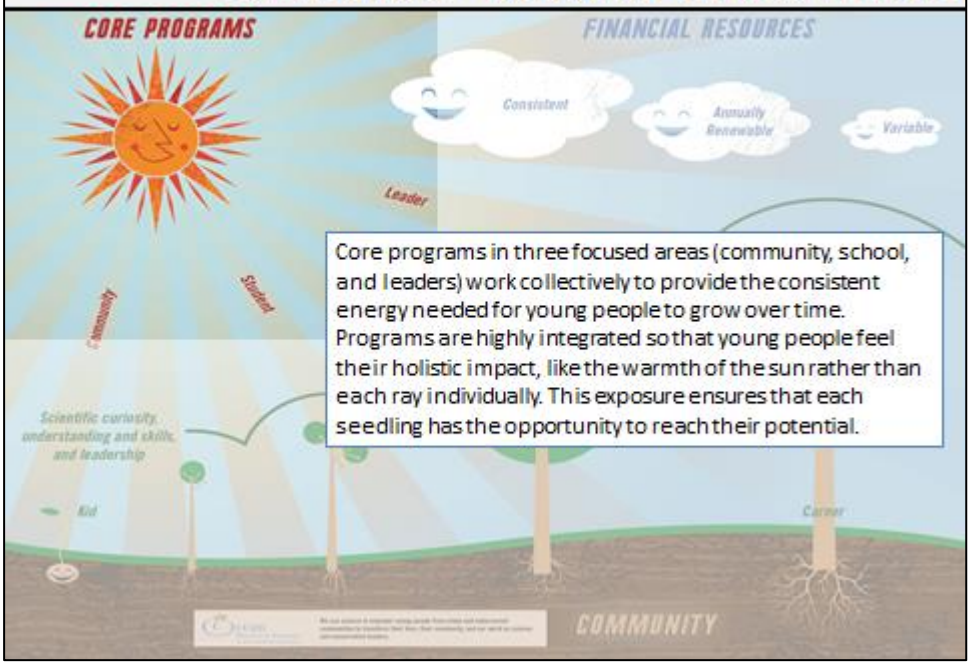
**A school-shed is defined as the area in which all of the young people "flow" into a single high school.*




The Ecosystem Supports Young People Growing from Seed to Tree
CORE PROGRAMS
FINANCIAL RESOURCES
Consistent
Annually Renewable
Variable
Like growing from a seed to a tree, this ecosystem supports young people in a single community as they develop from curious youngsters to young adults who will make a difference as science and conservation leaders.
Community
Student
Scientific curiosity, understanding and skills, and leadership
Kid
Career
COMMUNITY

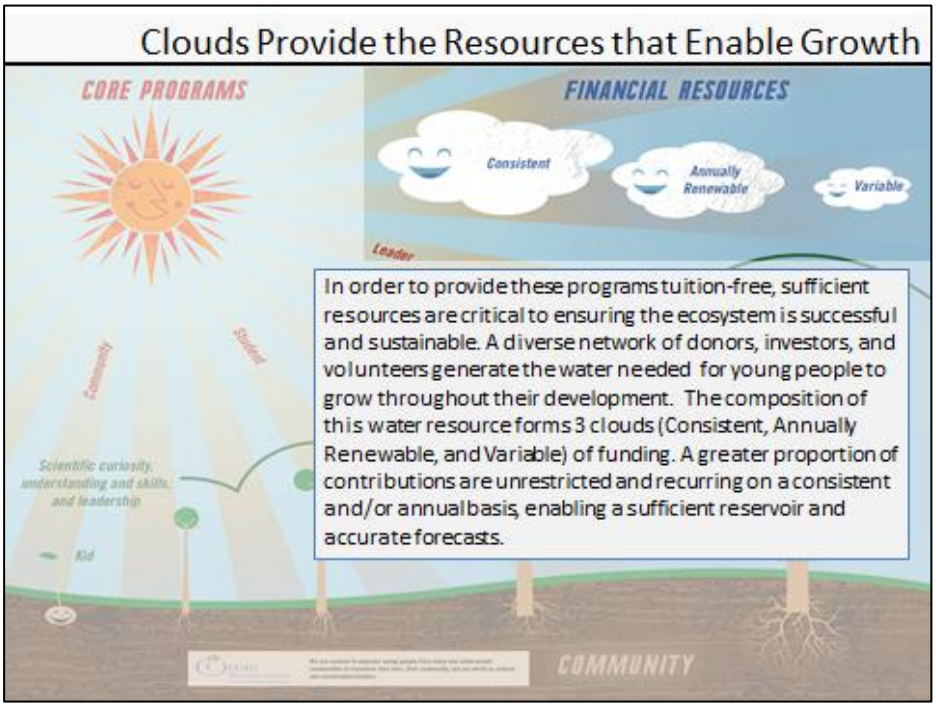

Starts with Rich Soil
CORE PROGRAMS
FINANCIAL RESOURCES
Consistent
Annually Renewable
Variable
The community provides a rich environment that believes in its youth. This soil provides support through the engagement of families, schools, scientific entities, and other partners. The unique composition of this urban soil includes high density of underserved young people, access to science industry, and a connection to the watershed. The youth have roots anchored in this nourishing soil encouraging them to grow strong while contributing to the richness of their urban community in the process.
Community
Scientific curiosity, understanding and skills, and leadership
Kid
Career
COMMUNITY

Sun Provides Energy for Transformation



Core programs in three focused areas (community, school, and leaders) work collectively to provide the consistent energy needed for young people to grow over time. Programs are highly integrated so that young people feel their holistic impact, like the warmth of the sun rather than each ray individually. This exposure ensures that each seedling has the opportunity to reach their potential.

Clouds Provide the Resources that Enable Growth



In order to provide these programs tuition-free, sufficient resources are critical to ensuring the ecosystem is successful and sustainable. A diverse network of donors, investors, and volunteers generate the water needed for young people to grow throughout their development. The composition of this water resource forms 3 clouds (Consistent, Annually Renewable, and Variable) of funding. A greater proportion of contributions are unrestricted and recurring on a consistent and/or annual basis, enabling a sufficient reservoir and accurate forecasts.

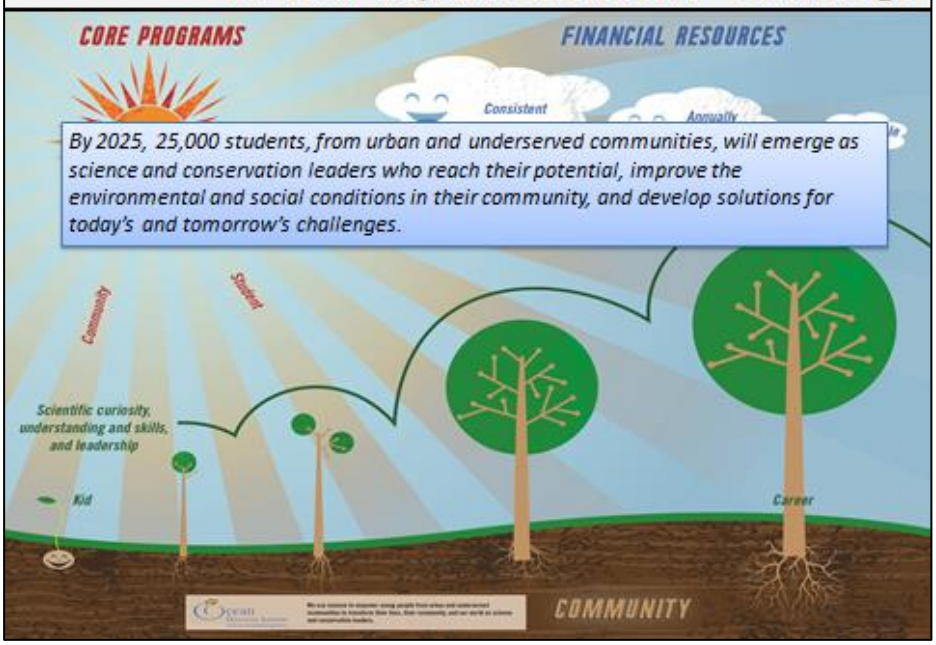
Business Model:
Building sustainability in San Diego

In order to build toward a sustainable ecosystem, 10-year goals for program impact and financial sustainability have been established to ensure balance in the system. These goals are consistent across locations; however, the numbers vary to reflect each locale's carrying capacity.

These goals are defined on the following slides.

12

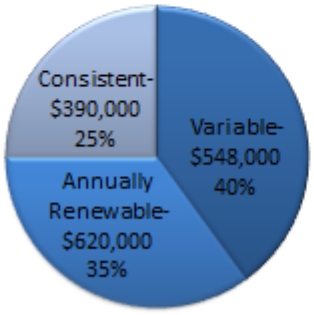
10-Year Impact Statement – San Diego



10-Year Financial Sustainability Statement
San Diego

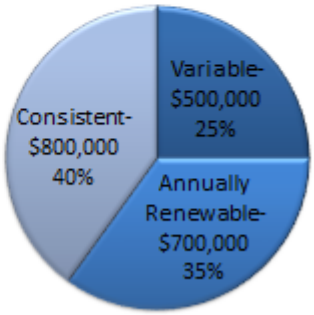
By 2025, Ocean Discovery Institute will annually secure $2 million in operating support with 40% of income generated from "Consistent" sources, 35% from "Annually Renewable" sources, and 25% from "Variable" sources. This strategic composition of funding will ensure sustainability as it emphasizes lower risk, and typically unrestricted sources of funding.

2014



$1.5 Million Budget

2025



$2 Million Budget

14

Business Model Outline

Who We Are: Mission & Vision

What We do: Business Model

1. Business Model Statement
2. Sustainable Ecosystem
3. Sustainability in San Diego

How We Do It: Frame & Canvas

Growing the Model: Replication

1. Replication Strategy
2. Legal structure

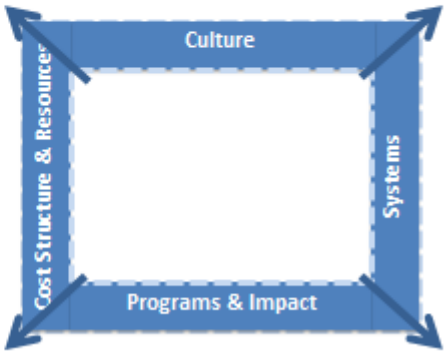
15

Frame & canvas

Ocean Discovery Institute has a signature style. As soon as you walk in the door or you meet a student, the mark of Ocean Discovery Institute is present and people are drawn to it. The organization and its students have achieved results based on "who it is" (its culture and systems), not just "what it does" (its business model).

In order to capture this *essence* of Ocean Discovery Institute, we use a "frame and canvas" structure. The frame provides structure and guidance in critical areas of culture, systems, cost structure and resources, and programs and impacts; while the canvas promotes adaptation and evolution.

We believe that this structure enables others to create the "who it is" somewhere else and ensures that the model is relevant over time.



16

Frame & canvas

Over time local environmental conditions may change and the model may exist in different environments. These changes in conditions requires the structure of the frame to evolve, which is represented by the arrows on the frame. In addition, the canvas is designed to foster innovation and adaptability across time and locations. Thus, the picture may look different; however, there is a standard of operation that identifies the organization(s) as Ocean Discovery Institute. In addition, the frame provides a mechanism to measure organizational success, ensuring the integrity of the model is upheld along with the uniqueness and quality of programs and impacts.

17

Frame & Canvas

Culture

- Frame
  - The foundation of our culture is an unshakable belief in young peoples' ability to transform their lives.
  - Learning, diversity, stewardship, leadership, and passion are the values which shape our actions. (See Slide 20 for definitions of each organizational value.)
  - We are rooted in the community we serve.
  - We actively manage our culture.
  - Innovation is driven by both data and instinct.
- Canvas
  - How the frame is implemented and what supports the frame, e.g.,
    - How the organization chart and roles are structured.
    - What the leadership culture is and how it stays present.
  - Considerations
    - Pace of growth should enable cultural evolution, learning along the way, and dynamic decision making.
    - Staffing plans provide sufficient time for planning, implementation, and enhancement of programs and operations.
    - Leverage creative staffing approaches (e.g., Ameri-Corps) and volunteers (e.g., cooperative structure).

18

Our values

1. **Learning**: We believe that education and discovery are remarkable opportunities and that every person has the potential to improve their future and that of our world through the acquisition of knowledge and new ideas. True learning requires courage to face the unknown, belief in one's own ability, and strategic use of resources.
2. **Diversity**: We believe that diversity results in the most productive, sustainable, and resilient communities. Rich interactions between those with diverse perspectives result in the evolution of thought and innovation.
3. **Stewardship**: We believe that as stewards we have the responsibility to use our resources wisely. Whether we are working in the natural environment or with our donors' capital, our commitment is to find the most sustainable use of those resources in order to have the greatest impact.
4. **Leadership**: We believe that all individuals have the capacity to lead with conviction and integrity. We improve our world by instilling leadership principles that include "walking the talk", challenging the process, empowering and encouraging others, and inspiring a shared vision.
5. **Passion**: We believe that passion elicits the persistence necessary for discovery and accomplishment. By engaging in all action with curiosity and commitment, we can ignite a passion in each person that collectively will benefit our world.

19

Frame & Canvas

Systems

- Frame
  - Well-defined, measurable structures and processes are in place.
  - Shared systems that connect across departments and locations allow us to operate efficiently.
  - Systems provide the framework that allow our culture to thrive.
  - We build institutional knowledge around how we develop, implement, and enhance each arm of the frame.
- Canvas
  - How the frame is implemented and what supports the frame, e.g.,
    - How shared systems work.
    - What tools are used to gather and organize data.
  - Considerations
    - Build from existing systems provided by the parent organization.
    - Prioritize systems that empower more people to do more.
    - Foster simplicity and repetition.

20

Frame & Canvas

Cost Structure & Resources

- Frame
  - Our programs are provided tuition-free but not commitment-free.
  - Our results demonstrate a high return on investment.
  - We maintain long-term symbiotic partnerships with community, public schools, STEM industry, government, academia, and funders to increase impact and sustainability.
  - The integration of dedicated volunteers with significant, relevant expertise is core to achieving success.
  - We have a highly diversified portfolio of supporters maintained through shared beliefs and values.
  - All stakeholders (e.g., staff, Board, students, partners, volunteers) contribute to our financial strength.
- Canvas
  - How the frame is implemented and what supports the frame, e.g.,
    - How staff and board are integrated in fundraising activities.
    - How the funding sources are apportioned between type (government, foundations, corporate, individuals).
  - Considerations
    - Maximize return on investment.
    - Begin with programs that demonstrate impact quickly impact and low start-up cost.
    - Prioritize programs that are associated with specific financial opportunities.
    - Leverage the work of partners.

21

Frame & Canvas

Impacts & Programs

- Frame
  - Our mission is to empower urban and underserved young people to transform their lives, their community, and ultimately our world.
    - We achieve our mission when we demonstrate results that show how participants fulfill their potential, improve the social and environmental conditions in their community, and develop solutions for today's and tomorrow's challenges.
    - To generate transformative results, we provide opportunities to young people from "seed to tree" that progressively generate curiosity, build scientific understanding and skills, and prepare leaders.
    - To achieve these results, we integrate education, scientific research, and environmental stewardship experiences through "Our Model".
    - Experiences are provided by implementing initiatives through a "Pyramid Approach" that ensures every child in the school-shed has access to opportunity.
    - Our programs are designed using a shared education foundation that defines how to engage this audience, what content is essential, and how to generate the spark that makes them want to learn.

Our Model

Our Pyramid Approach

22

Frame & Canvas

Impacts & Program

- Canvas
  - How the frame is implemented and what supports the frame, e.g.,
    - What the scale of the reach is (numbers of youth served and size of community) and cultural demographic of those engaged.
    - Which programs are offered and the emphasis of the supporting curriculum.
  - Considerations
    - Begin with programs that are offered across the entire school-shed, demonstrate impact, and build brand.
    - Design programs to fill gaps identified in the community.
    - Begin with all levels of initiatives to ensure all young people in the school-shed have the opportunity to participate, free choice opportunities exist, and key stakeholder relationships are developed over time.
    - Begin with large-scale community event that engages key leaders, builds relationships with critical stakeholders, demonstrates the ability to deliver on promise, and enables shared success among all participants.
    - Ensure the pilot phase demonstrates the "once in a lifetime" experience that the Leaders Initiative can provide.
    - Build depth of programming and numbers of participants over time.

23

Frame & Canvas

To reach our entire school-shed, Ocean Discovery Institute offers opportunities for participation at three levels:

1. Community Initiatives engage young people, their families, and neighbors within the school-shed to ensure everyone sees science and conservation as relevant to their lives.
   This is accomplished through:
   - Frequent and diverse opportunities provided through standardized programs and self-guided experiences that distinctly connect to the priorities of the community (e.g., family & fun, health & safety, education & economic opportunity)
   - Events that build community and demonstrate collective impact

2. Student Initiatives engage students and their teachers within their instructional settings to ensure every student is engaged in hands-on science.
   This is accomplished through:
   - Direct instruction in classroom and field environments
   - Teacher professional development

3. Leaders Initiatives engage young people along a pathway to college and career to ensure students, who want to become science and conservation leaders, are provided the tools to get there.
   This is accomplished through:
   - Rigorous opportunities that engage students over multiple years and integrate research, mentoring, and robust support services
   - Rigorous opportunities that engage students at multiple levels through their participation in mentoring others, internships, and fellowships

24

Guiding Principles:
Using the ocean to engage, educate, and inspire

ENGAGE:

- Participation in authentic activities, including scientific research and actions that benefit the environment, empower young people.
- Early and ongoing experiences in science are critical to generate curiosity, build literacy, and prepare leaders.
- Mentoring among peers and from professionals enables young people to envision their pathway to college and careers.
- Using relevant curriculum builds understanding that young people's can apply in their daily lives and transfer globally.
- Learning experiences in nature build an environmental ethic and understanding of science.
- Robust experiences with increasing levels of student responsibility ensure young people continuously gain skills, knowledge, and self-efficacy.
- Drawing upon students' assets and strengths builds confidence, creating an effective science learning environment.
- Addressing barriers faced by young people, from urban and diverse backgrounds, is necessary for their continued pursuit of science and higher education.

EDUCATE:

- All principles of science, technology, engineering, math, and conservation can be taught through the ocean as a natural platform.

INSPIRE:

- Discovery provides the spark that makes young people want to learn.
- A coaching approach empowers young people to understand their choices, make decisions, and take actions to reach their full potential.

25

Business Model Outline

Who We Are: Mission & Vision

What We do: Business Model

1. Business Model Statement
2. Sustainable Ecosystem
3. Sustainability in San Diego

How We Do It: Frame & Canvas

Growing the Model: Replication

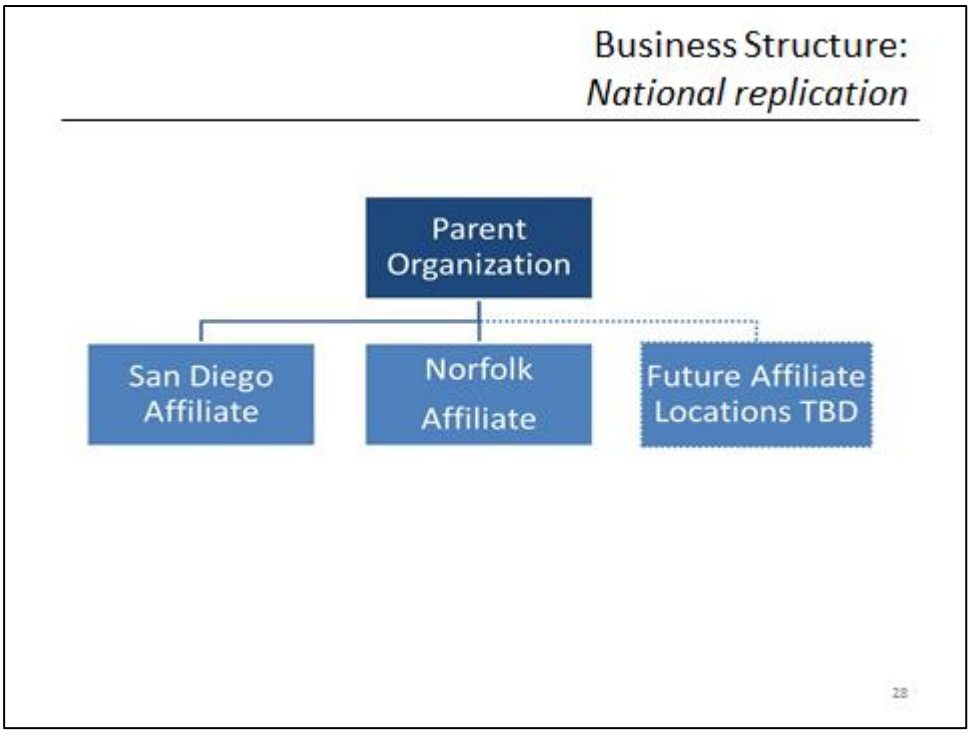
1. Replication Strategy
2. Legal structure

26

Business Structure: *National replication*

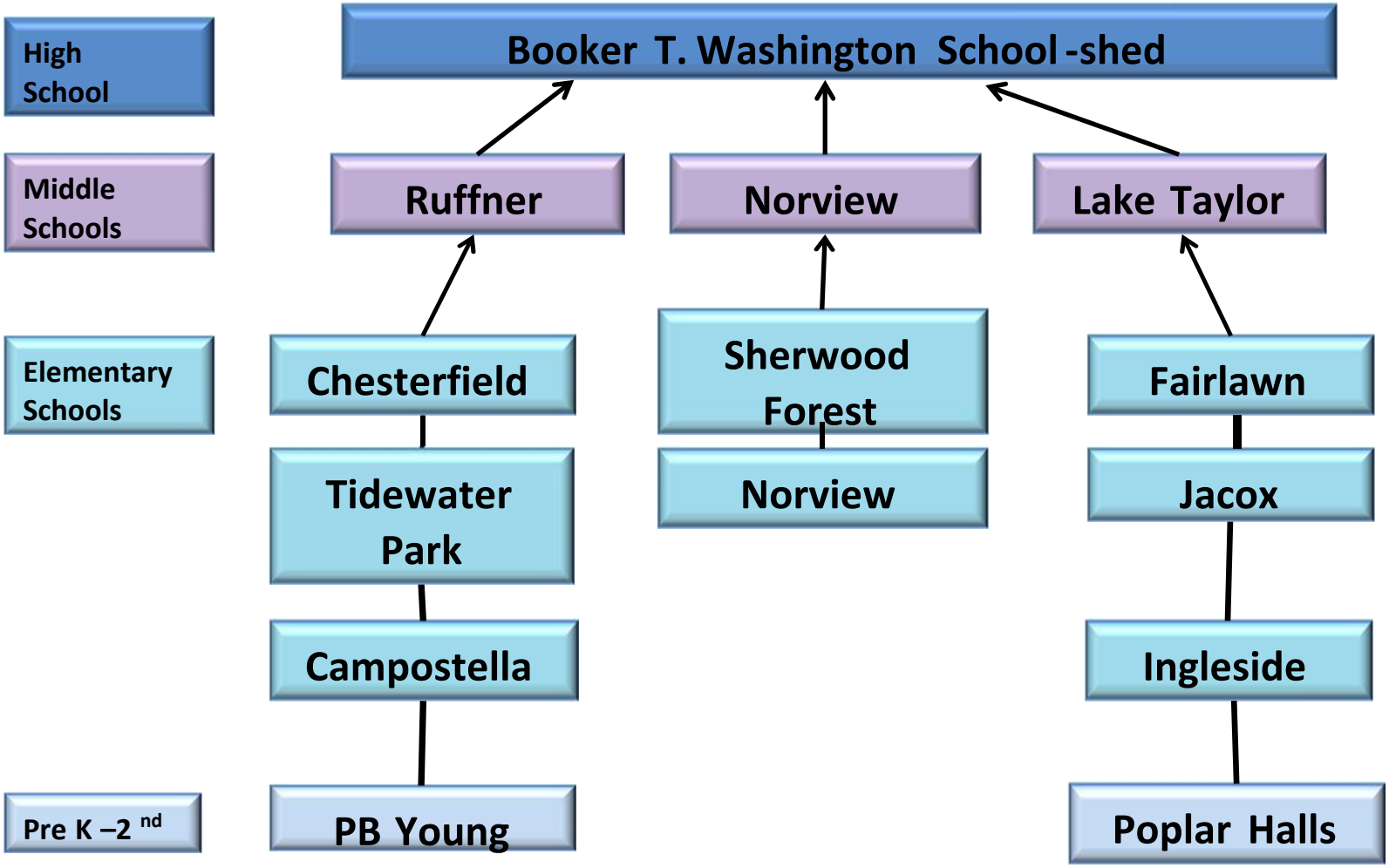
As Ocean Discovery grows, we are looking to continue to adapt to our surroundings in our origin site of City Heights and replication in new locales across the country.

27


Business Structure:
National replication
Parent Organization
San Diego Affiliate
Norfolk Affiliate
Future Affiliate Locations TBD
28

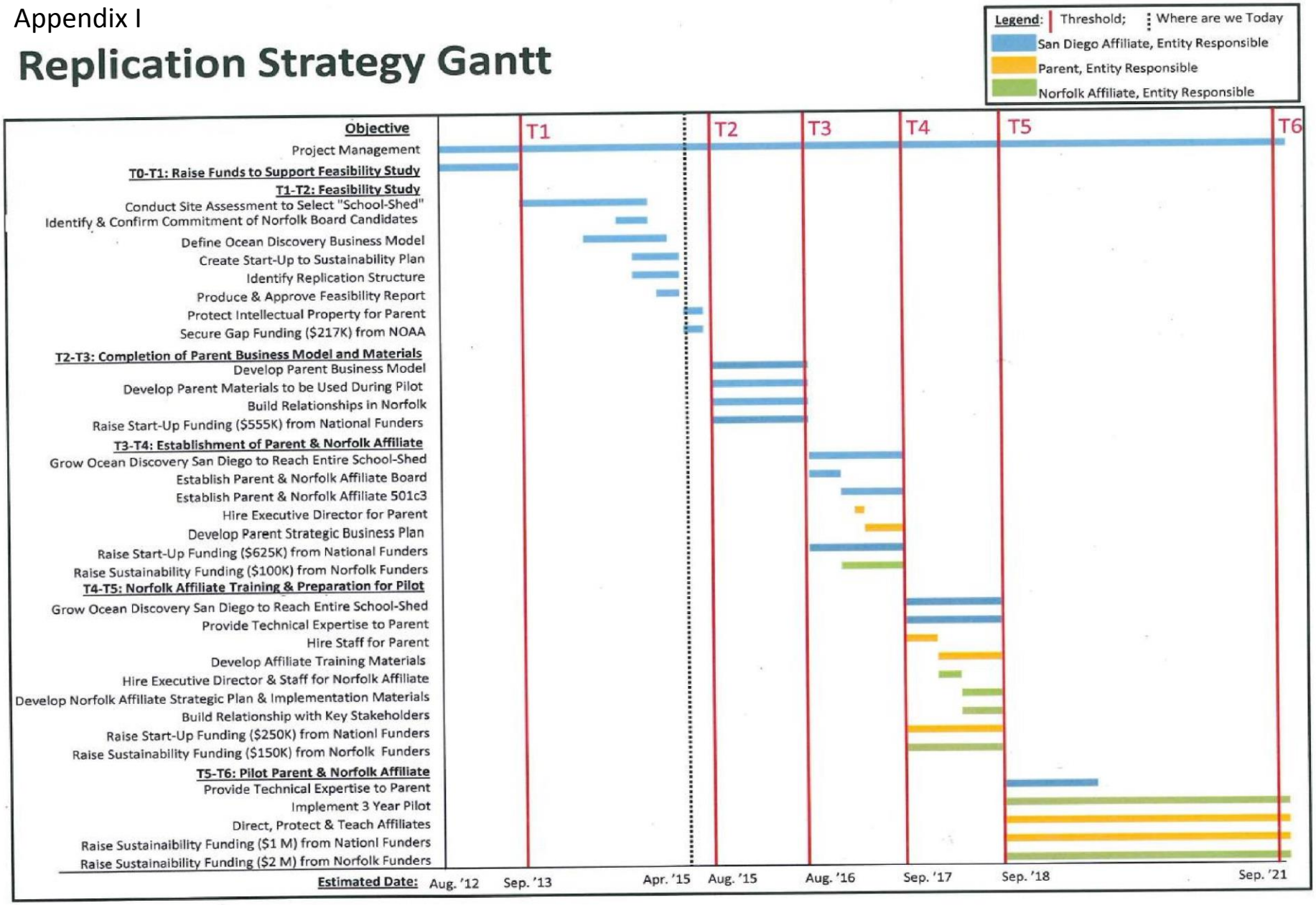
Appendix H: School-shed Feeder Pattern for Booker T. Washington High School

Primary Feeders



Appendix I

Replication Strategy Gantt



Replication Strategy Matrix

#	Objective	Entity Responsible	Estimated Duration	Expense by Objective***	Total Expenses by Entity***	Total Development by SD/Parent	Balance (to be Used in Next Threshold by SD/Parent)	Total Development By Affiliate	Balance (to be Used in Next Threshold by Affiliate)	Cost Basis	Estimated Total Duration	Estimated Start Date	Threshold (T)
1	Raise Funds to Support Feasibility & Fundraising through T3	Ocean Discovery SD** Parent*	1-2 years	Complete		$375,000	$375,000	NA	NA	-Replication in partnership with existing organization	0.5 years	Nov-12	T1
2	Conduct Site Assessment	Ocean Discovery SD** Parent*	1.5 years	Complete	($311,000)	$217,000	$281,000	NA	NA	- Consultant - In-kind NOAA detail for 3 months - Ocean Discovery staff time - Travel	2 years	Sep-13	
3	Identify and Confirm Commitment of Affiliate Board Candidates*	Ocean Discovery SD** Parent*	3 months	Complete									
4	Develop Affiliate Budget and Funding Plan	Ocean Discovery SD** Parent*	1 year	Complete									
5	Secure Key Partner Letters of Support	Ocean Discovery SD** Parent*	3 months	Complete									
6	Produce & Approve Feasibility Study	Ocean Discovery SD** Parent*	3 months	In Progress									
7	Raise Start-Up Funds from National Funders ($217K from NOAA)**	Ocean Discovery SD	6 months	In Progress									
8	Set up IP Protections for Parent**	Ocean Discovery SD	3 months	($11,000)									T2
9	Develop Parent Business Model**	Ocean Discovery SD	1 year	($206,000)	($336,000)	$555,000	$500,000	NA	NA	- Ocean Discovery staff time ($195K) and fringe ($15K) (Shara 25%, Lindsay 40%, Carla 50%, MK 15%, Managers and Coordinator 15%, Full-time Admin support) - Other costs (15%) ($30K) - Consultant for business model development ($10-20K) - Travel ($25K) (San Diego stakeholders to Norfolk and/or travel for Norfolk Board candidates to visit San Diego)	1-2 years	Sep-15	
10	Build Partnerships and Community Relationships in Norfolk**	Ocean Discovery SD	1-2 years										
11	Develop Parent Products to be Used for Local Implementation**	Ocean Discovery SD** Parent*	1 year	($75,000)									
12	Raise Start-Up Funding from National Funders ($555K)	Ocean Discovery SD** Parent*	1-2 years	($55,000)									T3
13	Grow Ocean Discovery San Diego to Reach Entire School-Shed**	Ocean Discovery SD**	1 year	($200,000)	($200,000)	$625,000	$750,000			**Ocean Discovery SD:** -Consultant for parent and affiliate establishment - Consultant for national fundraising - Ocean Discovery staff time to establish parent, raise national funds, and scale operations at the model San Diego location - Travel for San Diego Staff to Norfolk - Raising $125K to subsidize Affiliate work in T5 **Parent:** - 1 Full time staff (Executive Director) - Operational costs -Travel	1 year	Sep-16	
14	Establish Parent Board**	Ocean Discovery SD** Parent*	9 months	($150,000)	($150,000)								
15	Establish Affiliate Board	Ocean Discovery SD** Parent*	9 months										
16	Establish Parent 501c3**	Ocean Discovery SD**	3 months										
17	Establish Affiliate 501c3	Ocean Discovery SD** Parent*	3 months										
18	Hire Executive Director for Parent**	Ocean Discovery SD	3 months										
19	Raise National Start-Up Funds ($625K)	Ocean Discovery SD** Parent*	1 year										
20	Develop Parent Strategic Business Plan	Parent	6 months	($150,000)	($150,000)								
21	Raise Local Sustainability Funds from Norfolk Funders ($100K)	Affiliate	6 months	Volunteer Time	$0			$100,000	$225,000				T4
22	Grow Ocean Discovery San Diego to Reach Entire School-Shed**	Ocean Discovery SD**	1 year	($200,000)	($200,000)								
23	Continue Parent Operations	Parent	1 year										

Replication Strategy Matrix

#	Objective	Entity Responsible	Estimated Duration	Expense by Objective***	Total Expenses by Entity***	Total Development by SD/Parent	Balance (to be Used in Next Threshold by SD/Parent)	Total Development By Affiliate	Balance (to be Used in Next Threshold by Affiliate)	Cost Basis	Estimated Total Duration	Estimated Start Date	Threshold (T)
24	Hire Parent Staff	Parent	3 months	($300,000)	($400,000)	$250,000	$400,000			**Ocean Discovery SD:** - Ocean Discovery SD staff time to scale operations at the model San Diego location **Parent:** - 3 Full time staff - Ocean Discovery SD staff time to advise on Parent operations - Travel - Operational costs **Affiliate:** - 3 full time staff (Directors, Programs, Fundraising) - Operational costs	1 year	Sep-17	
25	Develop Affiliate Training Materials	Parent	1 year										
26	Raise Additional Funds from National Funders ($250K)	Parent	1 year										
27	Hire Executive Director	Parent & Affiliate	3 months										
28	Provide Technical Expertise to Parent	Ocean Discovery SD**	1 year	($100,000)									
29	Build Relationships with Key Stakeholders (Parent and Affiliate)	Parent & Affiliate	1 year	($225,000)	($225,000)			$150,000	$150,000				
30	Hire Staff for Affiliate	Affiliate	3 months										
31	Develop Affiliate Strategic Business Plan	Affiliate	1 year										
32	Raise Local Sustainability Funds from Norfolk Funders ($150K)	Affiliate	1 year										
33	Develop Affiliate Implementation Materials	Affiliate	1 year										T5
34	Direct, Protect, and Teach Affiliate	Parent	1 year	($300,000)	($400,000)	$300,000	$300,000			- 3 Full time staff - Operational costs - Travel - Ocean Discovery SD staff time to advise on Parent operations			
35	Raise National Funds for Parent Operations ($300K)	Parent	1 year										
36	Provide Technical Expertise to Parent	Ocean Discovery SD**	1 year	($100,000)									
37	Pilot Year 1	Affiliate	1 year	($575,000)	($575,000)			$500,000	$75,000	-$150,000 raised by Affiliate is expended exclusively by Affiliate - Additional Staff (coordinators, AmeriCorps, etc.), - Supplies for implementation - Operating to support: 1 Watershed Avengers large event plus smaller event, 3rd grade, Sea Semester - No fee to Parent during pilot			
38	Raise Local Sustainability Funds for Affiliate Operations and 15% of Following Year ($500K)	Affiliate	1 year										
39	Direct, Protect, and Teach Affiliate	Parent	1 year	($300,000)	($300,000)	$350,000	$350,000			- 3 Full time staff - Operational costs - Travel			
40	Raise National Funds for Parent Operations ($350K)	Parent	1 year										
41	Pilot Year 2		1 year										

Replication Strategy Matrix

#	Objective	Entity Responsible	Estimated Duration	Expense by Objective***	Total Expenses by Entity***	Total Development by SD/Parent	Balance (to be Used in Next Threshold by SD/Parent)	Total Development By Affiliate	Balance (to be Used in Next Threshold by Affiliate)	Cost Basis	Estimated Total Duration	Estimated Start Date	Threshold (T)
42	Raise Local Sustainability Funds for Affiliate Operations and 15% of following year ($700K)	Affiliate	1 year	($600,000)	($600,000)			$700,000	$175,000	- Slight increase in staff (e.g. volunteer coordinator, Finance Administration Manager, and development assistance) - Increase in programming provided - Instructional supplies and equipment - General operations - No fee to Parent during pilot	3 years	Sep-18	
43	Direct, Protect, and Teach Affiliate	Parent	1 year	($300,000)	($300,000)	$350,000	$400,000			- 3 Full time staff - Operational costs - Travel			
44	Raise National Funds for Parent Operations ($350K)	Parent	1 year										
45	Pilot Year 3	Affiliate	1 year										
46	Raise Local Sustainability Funds for Affiliate Operations and 15% of Following Year ($800K)	Affiliate	1 year	($700,000)	($700,000)			$800,000	$275,000	-Slight increase in staff (e.g. volunteer coordinator, Finance Administration Manager, and development assistance, and) to - Increase in programming provided , - Instructional supplies and equipment - General operations - No fee to Parent during pilot			
47	Affiliate Demonstrates Compliance and Success with Model	Affiliate											T6
48	* For Future, ** One Time Only, ***Financial projections are for this time only including one time and learning curve expenses												

Replication Strategy Budget

		Ocean Discovery SD	Parent	Affiliate
T0 - T1 (11/2012-8/2013)				
	Total Development	$375,000	-	-
	Total Expenses	$0	-	-
	Net Income	**$375,000**	**$0**	**$0**
T1 - T2, Estimated Start Date (9/2013-8/2015)				
	T1 Balance	$375,000	-	-
	Total Development	$217,000	-	-
	Total Expenses	($311,000)	-	-
	Net Income	**$281,000**	**$0**	**$0**
T2 - T3, Estimated Dates (9/2015-8/2016)				
	T2 Balance	$281,000	-	-
	Total Development	$555,000	-	-
	Total Expenses	($336,000)	-	-
	Net Income	**$500,000**	**$0**	**$0**
T3 - T4, Estimated Dates (9/2016-8/2017)				
	T3 Balance	$500,000	-	-
	Total Development	$625,000	-	$100,000
	Total Expenses	($350,000)	($150,000)	-
	FundsTransferred	($575,000)	$450,000	$125,000
	Net Income	**$200,000**	**$300,000**	**$225,000**
T4 - T5, Estimated Dates (9/2017-8/2018)				
	T4 Balance	$200,000	$300,000	$225,000
	Total Development	-	$250,000	$150,000
	Total Expenses	($200,000)	($400,000)	($225,000)
	Net Income	**$0**	**$150,000**	**$150,000**
T5 - T6 Pilot Year 1, Estimated Dates (9/2018-8/2019)				
	T5 Balance	-	$150,000	$150,000
	Total Development	-	$300,000	$500,000
	Total Expenses	-	($400,000)	($575,000)
	Net Income	**$0**	**$50,000**	**$75,000**
T5 - T6 Pilot Year 2, Estimated Dates (9/2019-8/2020)				
	T6 Y1 Balance	-	$50,000	$75,000
	Total Development	-	$350,000	$700,000
	Total Expenses	-	($300,000)	($600,000)
	Net Income	**$0**	**$100,000**	**$175,000**
T5 - T6 Pilot Year 3, Estimated Dates (9/2020-8/2021)				
	T6 Y2 Balance	-	$100,000	$175,000
	Total Development	-	$350,000	$800,000
	Total Expenses	-	($300,000)	($700,000)
	Net Income	**$0**	**$150,000**	**$275,000**
	Total Project Development	**$1,772,000**	**$1,250,000**	**$2,250,000**
	Total Project Expenses	**($1,772,000)**	**($1,100,000)**	**($1,975,000)**
	Total Net Income	**$0**	**$150,000**	**$275,000**

“REACHING STUDENTS IN THE CHESAPEAKE BAY REGION:
A Study on the Feasibility of Replicating Ocean Discovery Institute’s Model”
report completed in partnership between the NOAA Chesapeake Bay Watershed Education and Training Program and Ocean Discovery Institute.

End