

March 2020

# FEASIBILITY STUDY OF TOWN-OWNED LAND

Oak Bluffs, Massachusetts





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## Special Thanks To:

MassHousing and the Town of Oak Bluffs for partnering and providing the funding to support this important study. The Oak Bluffs Board of Selectman, Planning Board, Affordable Housing Committee, Water District, and Town Manager for your leadership and insights throughout the study. We would also like to thank all the interviewees who took the time to speak with us about the housing challenges and opportunities in Oak Bluffs and provided RKG with local data to assess financial feasibility for development on the Island.



## OAK BLUFFS HOUSING FEASIBILITY STUDY

## INTRODUCTION

Recognizing that the cost of housing in Oak Bluffs has rapidly outpaced what many year-round residents can afford, the Town applied for and received a grant from MassHousing to study the feasibility of building affordable housing on a roughly 8-acre parcel of town-owned land. Looking to build on the Town's 2017 Housing Production Plan, the grant request to MassHousing sought funding to hire a consultant to evaluate environmental and regulatory constraints, infrastructure needs, development scenarios, site plans, and a financial analysis to determine feasibility for housing on this site. Through the grant funding, the Town of Oak Bluffs hired RKG Associates, Inc. (RKG) and Weston and Sampson to complete the scope of work.

Over the course of the eighteen month process, the RKG Team worked closely with the Oak Bluffs Board of Selectmen, Planning Board, Affordable Housing Committee, and many others to develop concept plans for the site that would meet the Town's housing goals while respecting the environmental and infrastructure challenges faced by new development. Interviews with both on-island and off-island developers and site visits to other successful affordable housing projects on Martha's Vineyard helped craft several iterations of development scenarios and ideas for how to integrate road, water, and wastewater infrastructure for each scenario.

In addition to the completed Housing Production Plan, the Town also adopted a new Master Plan in August 2019 and provided valuable information and public feedback on affordable housing and suitable locations. This town-owned parcel of land was one of many parcels in the Master Plan comprising the "southern tier" along Edgartown-Vineyard Haven Road and studied as subarea in the document. The Master Plan points to a balance of growth and preservation, a mix of uses, careful consideration of public infrastructure investments, and environmental stewardship within the southern tier. Each of these elements was taken into consideration when evaluating the viability of housing on the town-owned site.

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### Identified Housing Need in Oak Bluffs

The 2017 Housing Production Plan (HPP) detailed the affordable housing needs in Oak Bluffs and several strategies the Town could employ to begin addressing those needs. Oak Bluffs has more than 4,000 housing units and half of these units are used by seasonal residents.<sup>1</sup> This greatly reduces the number of homes available to year-round residents, as well as employees who come to the Island to support the tourism, accommodation, retail, food service, and construction-based industries. According to the HPP, the income needed to afford a home priced at the town's median of \$644,500 is about \$170,000 per year. In 2016, the median household income in Oak Bluffs was

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<sup>1</sup> Town of Oak Bluffs Master Plan, 2019.

\$80,225 which is less than half of what is needed.<sup>2</sup> The affordability mismatch becomes even more pronounced for residents working in tourism and service sectors at an hourly wage far below what is needed to afford housing in Oak Bluffs.

The Housing Production Plan points to a significant need for affordable housing to support low and moderate income households which comprise about 40 percent of all year-round households in Oak Bluffs. Nearly half of those low and moderate income households are spending 50 percent or more of their household income on housing costs alone. These severely cost burdened households are finding it increasingly difficult to afford housing in Oak Bluffs, compounded by the fact that from 2010-2014 1,510 year-round homes were converted to seasonal homes further reducing the available stock for year-round residents.<sup>3</sup>

The primary housing needs identified in the 2017 HPP and reinforced in the Town's 2019 Master Plan point to:

- Housing for households earning at or below 50 percent of area median income (AMI);
- Year-round affordable homeownership units priced for households at or below 80 percent of AMI;
- Housing rehabilitation funding for owner-occupied households at or below 80 percent of AMI;
- Production of 68 or more units priced for low and/or moderate incomes over the next five years; and,
- Housing for seasonal employees.

This feasibility study for the town-owned parcel looks specifically at the ability of this site to accommodate affordable housing to make progress on the housing goals from the HPP and the Town's Master Plan.

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<sup>2</sup> Oak Bluffs Housing Production Plan, 2017.

<sup>3</sup> Oak Bluffs Housing Production Plan, 2017.



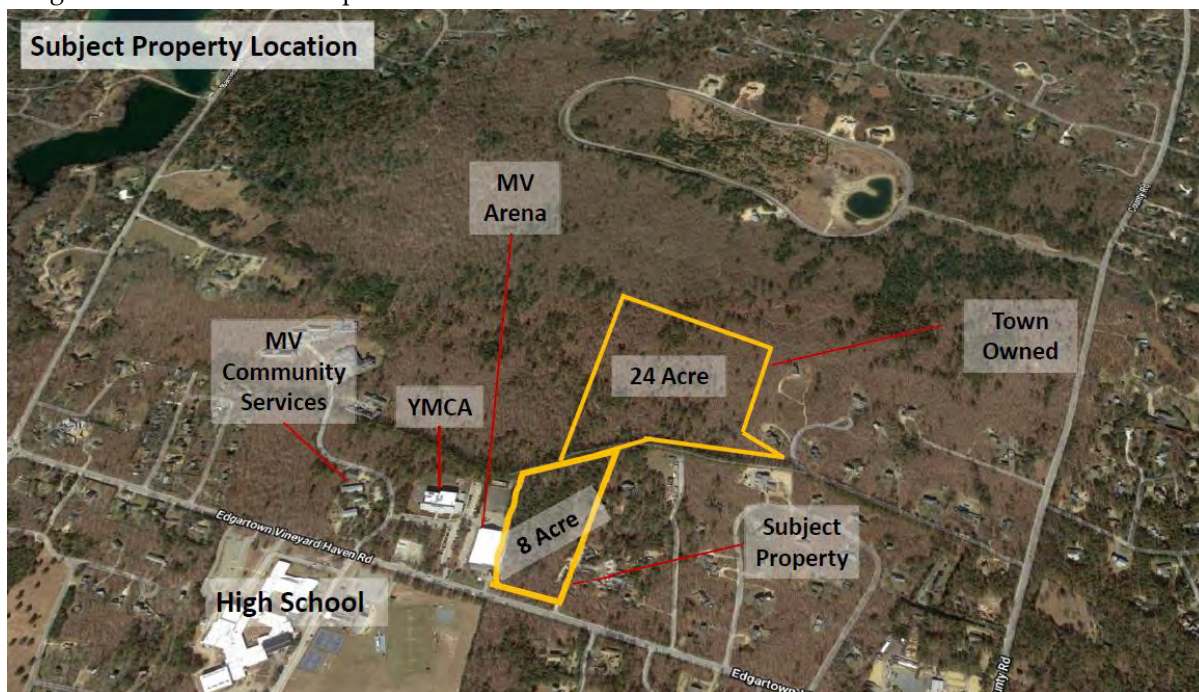
## OAK BLUFFS HOUSING FEASIBILITY STUDY

## PROJECT SITE

## Location and Site Characteristics

The town-owned parcel that was the subject of our analysis is a 7.8-acre site located on the north side of Edgartown-Vineyard Haven Road between Barnes Road to the east and County Road to the west. The parcel is rectangular in shape, and longer than it is wide. It is situated between the Martha's Vineyard Arena and YMCA to the east and some residential and light industrial uses to the west. Directly across Vineyard Haven Road to the south is the Martha's Vineyard Regional High School. Most notably, the subject parcel directly abuts a 23.7-acre parcel of land the Town is trying to acquire through a land swap with the Land Trust. While this study focused on the town-owned parcel, the site plans and analysis were undertaken in a way that would not prevent future development from occurring on the 23-acre parcel to the north.

Figure 1: Site Location Map

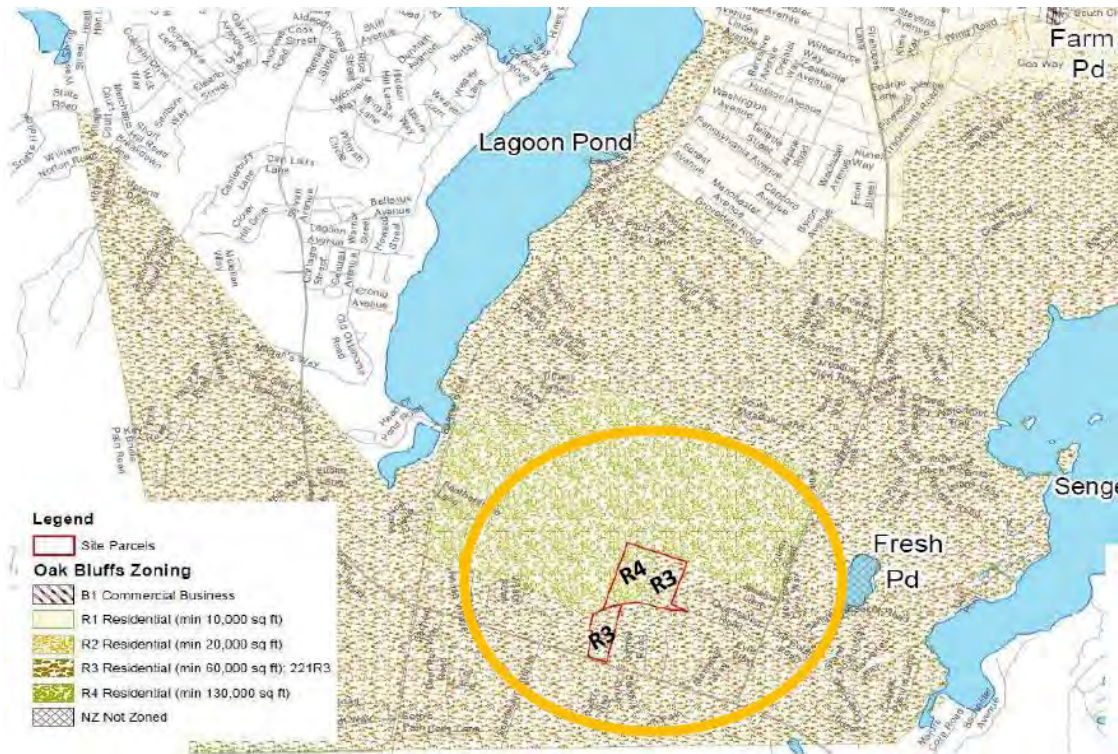


## Existing Zoning

The subject property is currently zoned R3 Residential. The only residential use allowed as-of-right in this zoning district is single-family housing. The minimum lot size in this district is 60,000 square feet or 1.4 acres with 50 foot minimum setbacks from the front, sides, and rear of the property. If more than one dwelling unit were to be constructed on the site, an additional 60,000 square feet per dwelling unit would be required. This limits the build-out on this site to four or five units under existing zoning. For a larger multi-family development to occur on this site, a

zoning change or overlay district would be required or the Town could pursue a 40B. Figure 2 shows the current zoning for subject property, the 24-acre parcel to the north, and surrounding parcels.

Figure 2: Existing Zoning Map



## Environmental and Infrastructure Challenges

For new housing to be built on the subject property, wastewater treatment and discharge must be accounted for, particularly given the capacity constraints of the Town's existing sewer lines and treatment plant. Given that wastewater treatment and discharge will need to be handled onsite, it was important to conduct some due diligence on the environmental, physical, and infrastructure constraints new development may face.

To that end, Weston & Sampson conducted a desktop GIS analysis of the subject property to determine the potential constraints to new development. The analysis considered:

- Surficial geological conditions
- Presence of protected or endangered species
- Historical/archeological land
- Nitrogen loading

- Proximity to groundwater sources
- Groundwater Contours
- Massachusetts Estuaries Project - Impaired watersheds
- Zone II (Wellhead Protection) areas
- Ground water flow paths and travel times.

### IDENTIFIED CHALLENGES

The desktop analysis of the subject parcel resulted in several identified challenges. The first is the potential presence of Priority Habitats of Rare Species where a majority of the parcel overlaps with this receptor. The next step in this process would be to file the project under the Natural Heritage and Endangered Species Program (NHESP) under the Massachusetts Endangered Species Act (MESA). Through that process a determination can be made about the presence and impact on any rare species and habitat.

Secondly, Weston & Sampson evaluated the fate and transport of a proposed groundwater discharge of treated effluent on the subject parcel. It was determined that a majority of the subject parcel was located upgradient and within the Zone II wellhead protection area of the Farm Neck Wellfield, owned and operated by the Oak Bluffs Water District. The impact of a proposed groundwater discharge and subsequent treated effluent travel times from these areas of the subject property to the Farm Neck Wellfield was evaluated based on groundwater time of travel calculations. It was determined that the flow of treated effluent to the Farm Neck Wellfield where the fate of wastewater will ultimately flow, showed a travel time of greater than 20 years which is far longer than travel time established for regulatory concerns (e.g. 2-years travel time or less). However, since overall discharge is expected to be greater than 10,000 gallons per day (gpd) into a nitrogen sensitive area, therefore an Environmental Notification Form (ENF) will be required. A second option would be to distribute wastewater amongst the three areas of the subject parcel that do not overlap with the Farm Neck Wellfield Zone II. These areas discharge into groundwaters which eventually recharge the Lagoon and Sengekontacket Ponds, both of which are considered Nitrogen sensitive, and therefore would require mitigation efforts. It should be noted that if the Town elects to construct a wastewater treatment and disposal system under 10,000 gallons per day, then Massachusetts Title 5 requirements would need to be met. The Town could build a system capable of treating flow for up to 90 bedrooms under Title 5.

A note worth mentioning is the analysis described above originally factored in travel times to existing public water supply wells, but discussions with the Oak Bluffs Water District personnel uncovered a desire to place a new wellhead on a parcel to the west of County Road north of the subject parcel. Weston & Sampson re-ran the travel time model to gauge potential impact on the proposed wellhead and found at the shortest distance from the subject parcel, the travel time was longer than the two-year minimum. At the furthest distance, the travel time is expected to be almost fourteen years. While the Town and water district are still in discussions regarding the proposed wellhead site, preliminary modeling indicates little risk for public drinking water



supply from discharge on the subject property. In the Appendix to this report, we have included the full analysis from Weston & Sampson.

## OAK BLUFFS HOUSING FEASIBILITY STUDY

## DEVELOPMENT SCENARIOS

RKG examined three scenarios to test the financial feasibility of developing the town-owned property in Oak Bluffs. The analysis presents the relative impact on financing based on changes to the development program. The scenarios were chosen in consult with the Town and represent programs grounded in market realities and having the potential of being undertaken. Under the existing zoning, which includes building setbacks and density limitations, only eight units could be developed by-right. The tested scenarios assume that the development would be permitted through another mechanism such as an overlay district/40R, or Massachusetts Chapter 40B Comprehensive Permit. The Comprehensive Permit allows a developer to supersede local zoning if the Massachusetts Department of Housing and Community Development (DHCD) determines the town does not have an enough affordable housing units on its Subsidized Housing Inventory, and the town is not protected under the Safe Harbor provision. Under a Comprehensive Permit, the developer would be required to reserve at least 20 percent of the total number of units as affordable.

RKG presented several hypothetical development scenarios to the Town for feedback, which were then narrowed to three representing options for both short- and longer-term development time horizons. The Town's preferred scenario envisions a two phase process whereby a 15-unit development utilizing a Title 5 wastewater system is constructed, after which an additional 45 units are built by transitioning wastewater treatment to an on-site package plant. The phased scenario could allow the Town to realize development on a shorter timeframe but could be more complicated with the transition from a Title 5 system to a package plant.

A second scenario is also offered that includes a 60-unit build-out utilizing a package treatment plant for wastewater. This does not include a phased approach, but instead frontloads the roadways and wastewater infrastructure to allow development to occur in a single phase. The third scenario presents a hypothetical maximum development on the combined 8-acre and 24-acre parcels, which could result in upwards of 260 units for which RKG assumed a minimum of 20 percent to be affordable.

Tested Scenarios	Land Area	Number of Units	Affordability	Wastewater System
60-Unit Phased Development	8 Acres	15 (Phase One) 45 (Phase Two)	100%	Title 5 (Phase One) Higher Level of Treatment (Phase Two)
60-Unit Development	8 Acres	60	100%	Higher Level of Treatment
Hypothetical Maximum	32 Acres	260	80/20 Market/Aff.	Full Treatment Plant

One key difference in terms of development costs between the scenarios are wastewater treatment systems. As the development scenarios become larger, different types of wastewater treatment systems are needed to ensure the development remains in compliance with environmental regulations. The different wastewater treatment systems have a multitude of requirements regarding land area, treatment levels, and discharge which ultimately impact cost.

The financial feasibility analysis calculates the basic go/ no-go decision a developer must make about a potential project. The decision to pursue a project comes down to overall financial return and risk exposure. If there is confidence that the desired returns will be reached, then the project will be pursued, otherwise the project will not be undertaken. Industry standard financial viability metrics include the Internal Rate of Return (IRR) and Net Present Value (NPV). While these are important metrics, they are not the sole arbitrators of financial viability, as project risk assessment and developer track record are also important factors.

The IRR and NPV when examined together, offer significant insight to both a lender and developer. The IRR is the calculated annual return on investment, taking into consideration net operating income, investment holding period, and sales value. The NPV is the present value of all future cash flows (both revenues and expenditures) for the project based on an expected return rate (discount rate) and over the course of the determined holding period. Based on the size of the initial upfront capital investment in a project, small percentage changes in the IRR can have dramatic effects on the net present value. The decision factor for not pursuing a project is if the IRR does not meet the required rate of return, or if the NPV is below zero. It is possible that a project results in a positive NPV and a lower than desired IRR. In cases such as this, the decision process becomes more nuanced as the developer would have to get comfortable with realizing a lower return.

Within the real estate development industry, the standard IRR return for a new construction rental project is 10 percent and RKG used this value as the benchmark to determine financial feasibility. As part of the modeling process, RKG examined the dollar value of equity, debt, and financial subsidies (gap funding) needed to make a scenario viable. For each scenario, RKG assumed that developers would contribute 25 percent of the development cost in the form of equity, and that the remaining 75 percent would be a combination of debt and financial subsidies.

This analysis is not without limitations and is based upon assumptions which were collected through developer interviews, market research, and professional judgement. The analysis does not test every variable or possibility, but rather it can be used as a tool to help inform the decision-making process and understand the advantages and disadvantages of the development scenarios presented.

## 60 Affordable Units - Phased Development Scenario

### SCENARIO DESCRIPTION

The development program envisions a total of 60 units of affordable housing built in two phases over a five year period. Under the first phase, 15 affordable units would be built requiring a less intensive investment in roadway and wastewater infrastructure. While in the second phase, 45 affordable units would be constructed at a higher level of density which would require upgrading the entire parcel's wastewater infrastructure. The second phase of this project is an option rather than a mandate and is based entirely on market conditions and ability to finance the additional infrastructure.

Development Program	
<b>Residential Units</b>	60
<b>Affordability</b>	100% Affordable
<b>Total Development Cost</b>	\$26,710,000
<b>Wastewater Solution</b>	Title 5 & Higher Level of Treatment
<b>Infrastructure Cost (Wastewater)</b>	\$3,750,000
<b>Timeframe</b>	5 Years

A two-tiered approach towards wastewater treatment is used under this scenario. Under Phase One, a standard Title 5 system would be used to accommodate the first 15 affordable units. The cost of this system is roughly \$750,000 with the benefit being that after the one-time expense is incurred the need for ongoing maintenance and management tends to be minimal. The drawback of having this system in place is that any additional expansion

would be costly. If the Town were to undertake Phase Two of the development program, then a higher level of wastewater treatment would be required. The cost of an advanced treatment system is roughly \$3,000,000 and requires a significant investment in the form of time and money to navigate the design, review, and permitting process. At a minimum, it could take three years to permit and build the infrastructure and additional housing units. It is estimated that it would take approximately five years to complete the project in full.

Figure 3. Example Phase One Typology

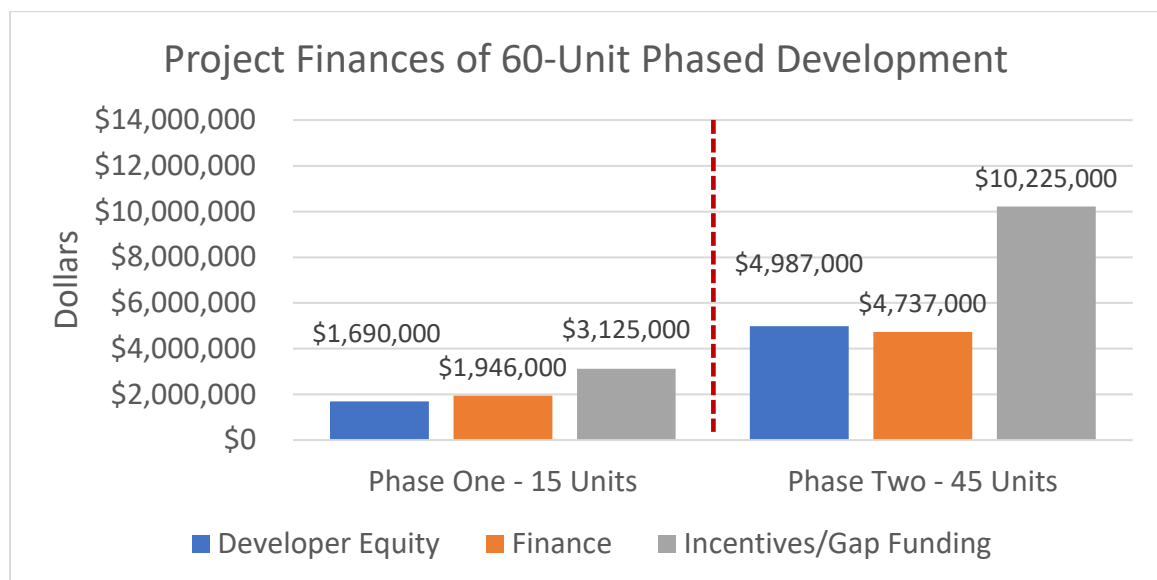




### PROJECT FINANCES

Since the project would be strictly 100 percent affordable, a traditional real estate finance capital stack of 25 percent equity and 75 percent debt will not work. As such, a significant financial subsidy would be required. Based on RKG's financial analysis a subsidy of 50 percent of the total development cost, or \$13,350,000 would be needed to make the project financially viable. The graphic below presents the component parts of the project finances, with developer's equity accounting for \$6,683,000 (25 percent) and debt financing accounting for \$6,677,000 (25 percent) of total costs.

Figure 4. Example Phase Two Typology



Without incentives/gap funding the project would not be financially feasible because the developer would not be able to achieve their expected return on investment. The financial feasibility challenges are two-fold. The first is rental revenues from the affordable units are not high enough to cover the costs of constructing the entire project. Secondly, having to construct a two-phase wastewater treatment option is very costly and effectively means building two different systems at different phases of the project. Under Phase One a subsidy amount of \$3,125,000 is needed, while under Phase Two a subsidy of \$10,225,000 is needed.

### POTENTIAL SITE LAYOUT

Under Phase One, a 15-unit semi-attached development would be built on the southwest portion of the 8-acre parcel. These units would be serviced by a road and have parking located in front. Under Phase Two, the road would be extended northwards, and a 45-unit mid-rise (3-4 story) building would be constructed. This development would have parking located in the rear. Figure 5 illustrates a potential layout. As part of Phase Two, a higher level wastewater treatment plant would be sited in the southeast corner and service the entire site. The original Title 5 system would be decommissioned, and the existing 15 units would be connected to the new wastewater system.

Due to the small number of units constructed during the initial phase, minimal impacts are expected regarding traffic. However, if Phase Two were to be completed then traffic impacts would need to be considered.

### ADVANTAGES

From the perspective of creating affordable housing, the initial 15-unit development offers the Town a relatively quick and lower cost option of producing units. The Title 5 system that would service the development is the least expensive option with regards to wastewater infrastructure, and the easiest to permit. There is the potential for Phase One to be permitted and completed within two years. The speed in which this project could be constructed could help address some of the identified housing needs in Oak Bluffs. If market conditions remained favorable, the implementation of Phase Two would result in the project being transformative from the standpoint of addressing the housing waitlist challenges in Oak Bluffs.

The size and phasing of this project has the potential to encourage an on-island developer to undertake this development. The benefit of working with a local builder is that they understand the needs of islanders and are familiar with the Town's regulatory framework. Additionally, a local building is a community stakeholder and would source some of their materials and labor locally, thereby contributing to the local economy.

Figure 5. Town Preferred– 60 Unit



### DISADVANTAGES

This scenario is not without challenges. If both phases of the project were undertaken, the developer would incur additional infrastructure costs which affect feasibility, given that the Title 5 system could not support the full 60-unit build-out. The upgrades needed for wastewater and roadways is both expensive and time consuming.

If the project were to continue to Phase Two, the complexity, financial commitment, and size of this project might be too large for an on-island developer. A local developer may not be able to bring together the finances to oversee the enhanced wastewater component and expanded timeline. Permitting and constructing the wastewater infrastructure would take at least 3 years, and entail an environmental analysis, soil testing, system design, and a ground water discharge permit from the state, a process that comes with considerable costs.

## 60 Affordable Units - Not Phased

### SCENARIO DESCRIPTION

This scenario proposes 60 units of affordable housing built over a three year period and utilizes an enhanced wastewater treatment system (package plant). This scenario operates under a more aggressive timeline than the 60-unit phased scenario and has the intention of maximizing the number of affordable units at one time.

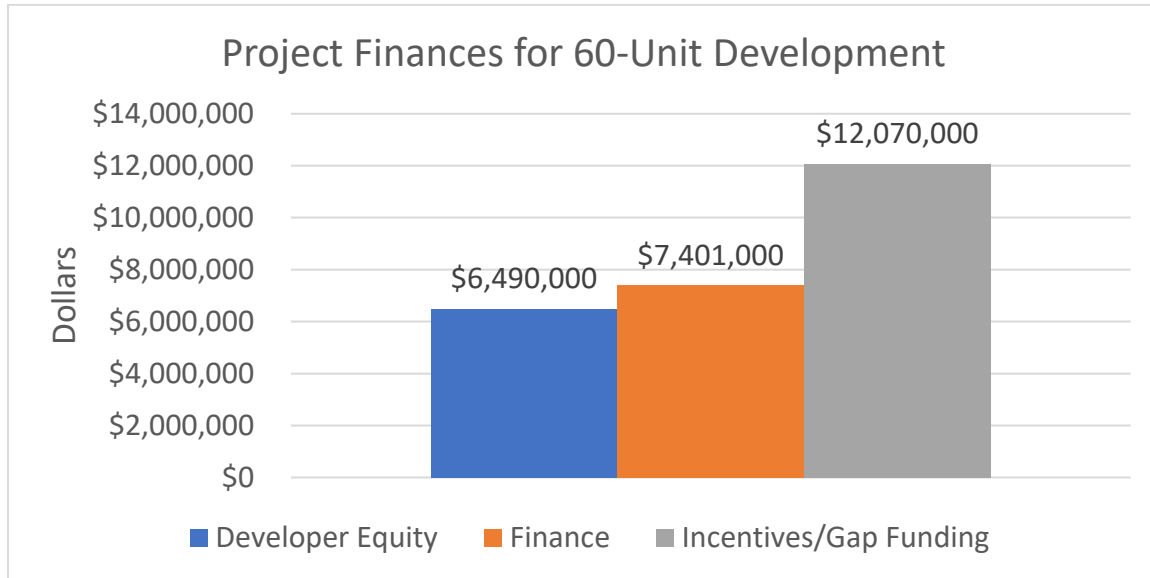
Development Program	
<b>Residential Units</b>	60
<b>Affordability</b>	100% Affordable
<b>Total Development Cost</b>	\$25,961,000
<b>Wastewater Solution</b>	Higher Level of Treatment
<b>Infrastructure Cost (Wastewater)</b>	\$3,000,000
<b>Timeframe</b>	3 Years

From the outset, this scenario intends to treat a higher volume of wastewater and to a higher level. The strategy results in higher numbers of developable units, and a more streamlined development process. The cost of an advanced treatment system is roughly \$3,000,000 and compares favorably to the 60-unit phase scenario which has a combined infrastructure cost of \$3,750,000. Even with the lower price point, the project still requires an investment in the form of time and money on the part of the developer to navigate the design, review, and permitting process. At a minimum it could take three years to permit and build the infrastructure and housing; however, this is still a shorter timeframe than the 60-unit phased scenario.

### PROJECT FINANCES

The total development cost for this project, which includes the cost of infrastructure, is approximately \$25,961,000. Based on RKG's financial analysis a subsidy of 47 percent of the total development cost, or \$12,070,000 would be required to make the project financially viable. The graphic below presents the component parts of the project finances, with developer's equity

accounting for \$6,490,000 (25 percent) and debt financing accounting for \$7,401,000 (29 percent) of total costs.



Under this scenario a large financial subsidy is required because all the units are designated as affordable, which means that rents are deed restricted and average to 65 percent of area median income. The upfront cost for wastewater infrastructure also impacts finances because the property cashflow may not be enough to generate an expected return of 10 percent.



### POTENTIAL SITE LAYOUT

This development scenario includes two 30-unit buildings serviced by a wastewater treatment facility. Figure 6 illustrates a conceptual layout. Parking for each of the buildings would be in the rear next to an open space. The development would be mid-rise (three stories) and of greater density than what is typically found in Oak Bluffs. Under this scenario, residential development would be maximized while not precluding the potential development of the rear 24-acre parcel. An access road on the eastern portion of the site would link the front and rear parcels. The layout attempts to minimize the impact to abutters but ensuring the maximum amount of tree cover to visually buffer the development.

### ADVANTAGES

The affordable units created under this scenario would address much of the identified housing need in Oak Bluffs. A total of 60 affordable units would be available to low-income households living year-round in Oak Bluffs. The project would be completed in one phase and within three years, which is cheaper than undertaking the two phase strategy described in the previous scenario. The more aggressive approach incentivizes the developer to complete the project quickly so that they can begin receiving a stabilized cashflow.

The rental product created in this scenario would be unlike what currently exists in the marketplace. The existing rental housing stock in Oak Bluffs tends to be single-family homes or condominiums. The units created under this scenario would be higher density and mid-rise, a typology not typically seen on Martha's Vineyard. Additionally, the layout allows for the preservation of open space and the creation of outdoor community space.

Figure 6. 60-Unit Development

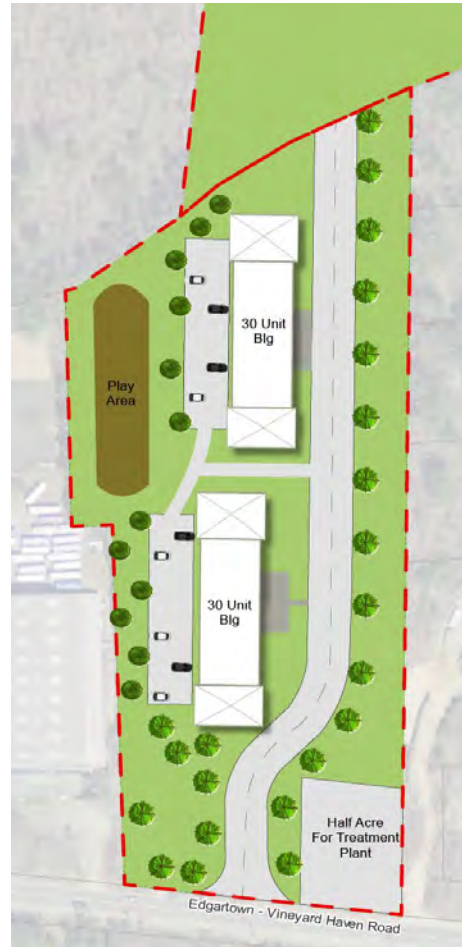


Figure 7. Example Development Typology



By concentrating development on the 8-acre site, the 24-acre parcel directly behind the site can be reserved for future use.

To offset the financial gap which exists, the developer could consider a combination of local, state, and federal funding sources. The size of the project, coupled with its affordability component, could make it highly competitive for grants and tax credits at the state and federal levels. Agencies look to fund projects which have the potential to be transformative. Given the lack of large scale affordable housing developments on Martha's Vineyard, this project has a reasonable chance of securing funding.

### DISADVANTAGES

The cost of building a wastewater treatment facility while maintaining 100 percent of the units as affordable does result in the project being financially infeasible without significant incentives/subsidies. The revenue generated from the affordable units is not enough to cover both the upfront infrastructure and on-going operational costs. A development of this size would require both on-site property management and maintenance which ultimately decreases the available cash flow and affects return on investment.

The complexity, financial commitment, and size of this project would likely require an off-island developer to pursue the project. Local builders may not have the resources available to undertake a project of this size and scale. Permitting and constructing the wastewater infrastructure could take at least 3 years, and entail an environmental analysis, soil testing, design, and obtaining a ground water discharge permit from the state.

## Maximum Development- 260 Units

### SCENARIO DESCRIPTION

This scenario assumes the maximum development potential on the site by combining both the 8- and 24-acre parcels. The result is a 260-unit development that is of a scale and intensity not seen anywhere in Oak Bluffs. Given its size, the project would be completed in four phases over a ten year period. While hypothetical in nature, if built the development would have a substantial impact in addressing the demand for affordable housing in Oak Bluffs. The scenario assumes a developer would reserve at least 20 percent, or 52 units as affordable, while the remainder would be market rate units. If more subsidies were obtained, greater numbers of affordable units could be created.

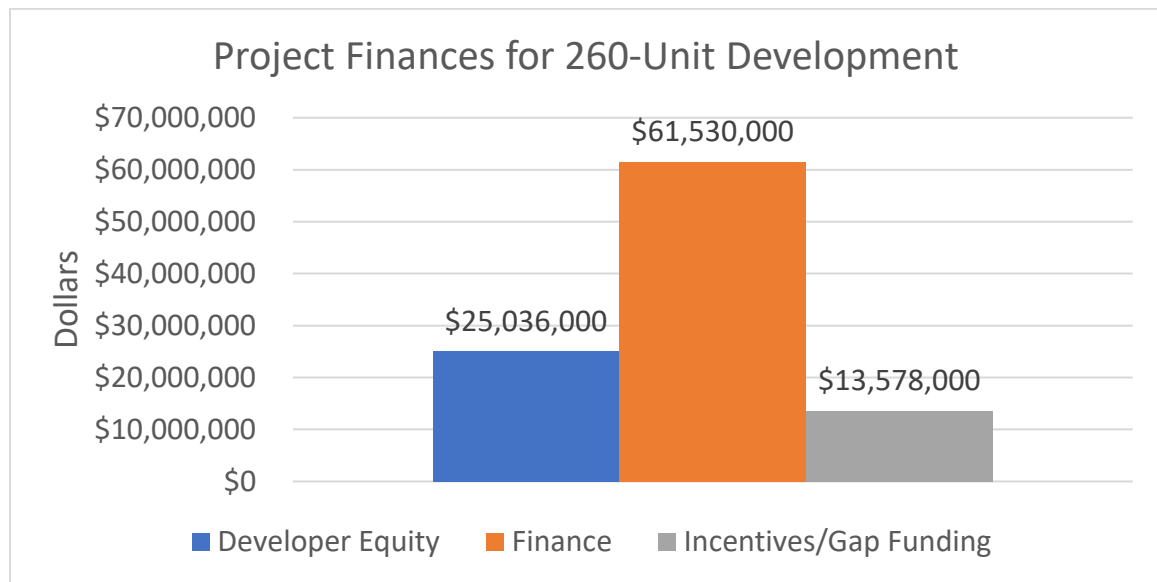
The size of this development scenario requires the use of a full-size wastewater package treatment plant. The cost of this system is roughly \$4,500,000 and requires a significant investment on the

Development Program	
<b>Residential Units</b>	260
<b>Affordability</b>	80/20 Market/Affordable
<b>Total Development Cost</b>	\$100,144,000
<b>Wastewater Solution</b>	Full Treatment Plant
<b>Infrastructure Cost (Wastewater)</b>	\$4,500,000
<b>Timeframe</b>	10 Years

part of the developer in both time and money. At a minimum, it could take four years to permit and build the treatment plant. Given the timeframe, there are more financial risks with this project, including changing market conditions.

### PROJECT FINANCES

Even with market-rate units accounting for 80 percent of the total, this project is financially feasible only with subsidy. Based on RKG's financial analysis, a subsidy of 14 percent of the total development cost, or \$13,578,000, would be needed to make the project viable. The graphic below presents the component parts of the project finances, with developers' equity accounting for \$25,036,000 (25 percent) and debt financing accounting for \$61,530,000 (61 percent) of total costs.



This scenario requires less financial subsidy as a percentage of total development costs than the other two scenarios because the project relies heavily on market rate units to cover the affordable unit value gap differential.

### POTENTIAL SITE LAYOUT

This scenario could result in 60 townhouse style units and four 50-unit multi-family buildings, all of which would be serviced by a wastewater treatment facility. Affordable units would be mixed throughout the site. A development of this size and scale is not common to the Island and would result in a significant boost for local housing production. Figure 8 illustrates a conceptual layout for the site. The 8-acre portion of the site would consist of townhomes on either side of the street, while the rear portion would contain the mid-rise buildings. The larger buildings would be 4-5 stories in height with parking located in the rear, while each townhome would have parking located in an attached garage or driveway. To access the site, a single road would cut through the 8-acre site and then loop around to connect the mid-rise buildings. Given the size and scale of this development, traffic and access are likely to be impacted and the site may require some form of signalization.

Figure 8. 260-Unit Scenario



### ADVANTAGES

The affordable units created under this scenario would address much of the identified housing needs in Oak Bluffs. A total of 52 affordable units would be available to low-income households. Additionally, the project would provide market rate units which could be used to address other year-round housing needs. The market-rate units would radically increase the housing supply in Oak Bluffs and has the potential to help year-round residents secure housing. The phasing of the project over ten years would allow enough time for the market to absorb new units and allow for evaluation between phases.

Figure 9. Example Development Typology



The rental product created in this scenario would be unlike what currently exists in the marketplace. Oak Bluffs' existing rental stock tends to be either single-family homes or



condominiums. The units created under this scenario would be higher density and mid-rise, a typology not typically seen on Martha's Vineyard.

Another notable benefit to this project is that it would be highly competitive for state grants and federal tax credits. The size and potential for housing production impact would likely be viewed favorably by funding agencies. Additionally, this project has the potential to be a model for other seasonal communities with a high cost of year-round housing.

#### DISADVANTAGES

Based on the above analysis, without large financial incentives/subsidies the project is infeasible. This stems from both the cost of building a wastewater treatment facility and the affordability component of the development. By assuming 20 percent of the units are affordable and are on average available to households at 65 percent of AMI, the revenues generated from those units would not cover the costs without significant subsidies. From an operations standpoint, the project would incur costs such as on-site property management and maintenance and require a contract to operate the wastewater facility. These operational expenses would further minimize the cash flow from the property.

The primary drawback to this scenario is the timeframe for completing the project. Over the course of ten years, Oak Bluffs may experience varying real estate markets. Just building the infrastructure could take at least 4 years and impacts the financial return on investment. Additionally, from a market perspective Oak Bluffs may not be able to absorb such a large project over the course of ten years, therefore would result in a high level of risk. A project of this size and scale is also likely to face significant community opposition and may not be politically feasible, regardless of financial viability.

## OAK BLUFFS HOUSING FEASIBILITY STUDY

## RECOMMENDATIONS

To address some of these issues, RKG compiled a set of recommendations informed by the financial analyses, and interviews and focus groups. The recommendations presented are targeted toward addressing the identified gaps and barriers in the current housing market and have been organized by short-, mid-, and long-term timeframes. Within each timeframe category, the strategies are ordered in a logical progression to provide a linear set of accomplishments that build upon each other to provide for the greatest chances of success.

- Advance due diligence on the property to further explore feasibility of wastewater options.
- Continue dialogue with Water District around discharge and well head concerns.
- Develop community process for gaining support for this potential development project. This could also include a process for determining support for uses on the 24-acre parcel.
- Seek assistance from Martha's Vineyard Commission and/or MassHousing to pursue an RFI/RFP process for the property.
- Explore potential funding sources for gap financing an infrastructure components of the project.

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### Due Diligence

This study included a preliminary desktop-level analysis of soil conditions, habitat and species identification, historic/archeological resources, and groundwater sources. In order to identify or further clarify these or other outstanding issues, the Town should undertake a more site-specific due diligence effort prior to issuing any RFQ/RFP for the land. Further exploration should be conducted, but not limited to, the following areas:

- Soil Test Pitting and Percolation Testing
- Wetland Mapping/Flagging

Additionally, it will be critical that the Town engage the local water district relative to their concerns with potential development scenarios and potential impacts to existing and proposed water infrastructure. The Town should also initiate discussions with the Wastewater Treatment Facility for the Town to determine if capacity is available to serve any potential development scenarios considered for this housing project. Weston & Sampson was initially advised that capacity was not available to connect the proposed housing project, but recent discussions at the February 2020 meeting indicated capacity "may" now be available. It is assumed that connecting to the WWTF for treatment and disposal would be the most cost effective solution for the proposed project but would be subject to negotiations.

Advancing these due diligence and coordination efforts will provide additional information the Town can use in crafting the RFQ/RFP and provide this information to potential respondents. This will allow respondents to consider any identified constraints in their proposals for site development. The results of the additional analysis and coordination could result in changes to the development scenarios, particularly if soil condition assumptions change groundwater flows or penetration rates. Coordination efforts with the water district will be a significant driver in establishing the method and discharge capacity of wastewater treatment and disposal systems

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## RFI/RFP Process

For the selling or leasing of municipally-owned property, the two-step RFI/RFP process has become the most popular developer solicitation process among both the public and private sectors. The advantage to the two-step process is that the RFI can be issued to a wide range and spectrum of developers that encompass the local, regional, and national community as well as developers with extensive experience in a specific development program. Our recommended steps for a successful RFI/RFP process include:

### **Developing a Draft RFI**

Develop a draft RFI document in conjunction with the necessary market support items to be included with the RFI. The draft RFI should include an overview of the preferred development plan, the Town's goals for the site, a description of financial requirements for Proposers, and the format of submittals. In addition, the RFI should include a timeline for the submittal, an overview of the scoring/review process for submittals and the requirements for submitting questions.

### **Designing a Marketing Plan for RFI**

Develop a strategic marketing and promotional plan for the RFI. The marketing plan should focus on print media, electronic media, and cooperative agreements with select trade associations. RKG recommends making the RFI package available from several avenues, including direct download from the Town's website. Print media should be considered, though the cost for advertising could be significant, the ability to reach a wider and perhaps more qualified audience needs to be balanced against the cost. Some trade associations, such as the Urban Land Institute or the International Economic Development Council may be well positioned to attract developers with the capabilities to develop the property. The Town could also consider advertisement through Commbuys.

### **Developing Evaluation Standards**

Develop the standards and procedures by which submittals from development teams will be evaluated. There should be two sets of evaluation standards – threshold standards and competitive standards. Threshold standards will be those items which must be met in order for a submittal to be evaluated. For example, this could include a minimum number of years of experience, documentation of minimum financial capabilities, completion of all required forms or other requirements considered critical to the review. For those submittals which meet threshold

requirements, additional standards should be developed and utilized to determine whether and to what extent each submittal meets the goals for the project, and how each provides best value. These could include a review of risk factors, willingness to follow the preferred program, proposed funding strategy, and the level and relevancy of the development team's experience.

### **Developing Training Materials for Evaluators**

Develop training materials for the Evaluation Team. These materials should focus on how to objectively evaluate proposals using the evaluation standards developed in the previous task. These materials should include a description of the proposed standards, the scoring/ratings system, a review of threshold standards versus competitive standards and a discussion of key proposal evaluation measures.

### **Finalizing RFI Evaluation Standards, Training Materials, and Schedule**

Once the selection team has reviewed the evaluation standards and training materials, both sets of materials need to be finalized for use in the next phase of the project. The selection team should also finalize a schedule for the evaluation of submittals. All dates established will be stated in terms of "after the submittal deadline". This will allow the evaluation schedule to be implemented even if the submittal date is changed for any reason.

The next step in the process should be to issue the RFI and to conduct a site tour and pre-bid meeting. Concurrently, training of the evaluation panel should be conducted. There should be a concerted effort to respond quickly to questions in a consistent manner as they are submitted as part of the RFI.

### **Conducting a Pre-Bid Meeting and Site Tour**

Conduct a pre-bid meeting and site tour. The Town should anticipate holding the pre-bid meeting on-site; however, an alternate location may be utilized for the pre-bid meeting at the Town's discretion.

### **Responding to Questions Resulting from RFI and Pre-Bid Meeting**

Potential respondents to the RFI will have the opportunity to submit written questions in advance of the site tour. RKG Associates will prepare answers for review by County staff, and manage the distribution of questions and answers once answers are reviewed and approved by the County. For those questions submitted in advance of the pre-bid meeting, a written summary of questions and answers will be made available during the pre-bid meeting, at the County's discretion, and subject to approval. Subsequent to the pre-bid meeting and tour, potential respondents will again have an opportunity to submit questions in writing. RKG will develop responses for review and approval by County staff, and support dissemination of this information as part of the RFI process.

### **Preparing Summary Memo Regarding Responsiveness of Proposers**

RKG Associates will prepare a summary memorandum which evaluates whether and to what extent each submittal meets the specific requirements of the RFI. This memorandum will provide



a summary of how each submittal meets the threshold requirements for the RFI. For those submittals which do not meet the threshold requirements (and are therefore non-responsive), RKG will work with County staff to develop a notification letter for these proposers, to provide them with specific reasons as to why their proposal is considered non-responsive.

### **Preparing Comprehensive Independent Evaluation**

RKG Associates will prepare a comprehensive independent evaluation of the proposals received by the County. The evaluation shall be conducted using the approved evaluation standards for evaluation of the proposals. The comprehensive independent evaluation will review each proposal's compliance with the requirements of the RFI (threshold requirements) as well as specific performance against the evaluation criteria.

### **Evaluation Meetings**

RKG will participate in meetings with the Evaluation Team for the purposes of reviewing proposals received. These meetings will occur within thirty (30) days after the submittal deadline, based on an agreed-upon schedule developed jointly by the RKG and the Client. As necessary, the meetings may include developer interviews for the highest ranking proposals.

### **Preparing Final Recommendations**

Within one week after the final meeting of the Evaluation Team, RKG Associates will prepare a summary report which documents the activities and actions of the Evaluation Team. Based on the results of the Evaluation Team meetings, the report will include specific recommendations for the County, including the justification and reasoning used by the Evaluation Team in reaching its decision.

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## **Potential Funding/Financing Sources**

Based on RKG's financial feasibility modeling for each development scenario, it is highly likely that subsidies or incentives will be needed to move development forward. Listed below are several funding sources the Town and/or future developer could consider to help with covering some or all of the financing gaps.

### **DEVELOPMENT FUNDING/FINANCING**

Funding that could help cover financing gaps directly related to the development itself include, but are not limited to:

- **Low Income Housing Tax Credits (LIHTC)** – The LIHTC program is one of the most critical state and federal resources available to support the development and rehabilitation of affordable housing. Units funded by LIHTC must be affordable to people earning no more than 60 percent of AMI, and units must be maintained as affordable for a minimum of 30 years. Developers compete for state tax credits based on the merits of their project and alignment with the state's allocation plan.

- **Community Preservation Act (CPA)** – CPA funding is available, not only in Oak Bluffs, but to many communities across the Island. These funds are derived from a surcharge on property tax bills that is dedicated to affordable housing, open space and recreation, and historic preservation. The Town could consider dedicating a portion of their funds to this project, or even pooling funds with other communities in exchange for providing affordable units to their residents.
- **Oak Bluffs Affordable Housing Trust Fund** – The Town also has funding through it's affordable housing trust that could be used to help offset development costs at this site. Funding could be used to help subsidize the costs of affordable units or even create more deeply subsidized units.
- **Other Financing Options for Developers** – State agencies such as Mass Housing Partnership (MHP), MassDevelopment, and MassHousing offer permanent financing options for affordable and mixed-income developments. From loans to bond financing, each agency has a unique package of financing options geared toward residential development. MassDevelopment also offers infrastructure financing and pre-development assistance along with traditional bond and loan financing mechanisms.

## INFRASTRUCTURE FUNDING

Each of the development scenarios presented in this report will require some substantial investment in roadway and wastewater infrastructure. Fortunately, Massachusetts has some grant and loan programs available to municipalities and developers which include, but are not limited to:

- **MassWorks Grant** – These highly competitive grants are awarded by the Commonwealth through the Executive Office of Housing and Economic Development (EOHED) annually but are subject to appropriations and change in administration. These grants are aimed at filling infrastructure financing gaps or to provide a catalyst to sites that are ready for development. The Baker Administration has a specific focus on housing projects across the Commonwealth right now, and this site could be a prime candidate for a future MassWorks grant.
- **Massachusetts Housing Choice Grant** – These grants are available to Housing Choice Communities (Oak Bluffs is not yet one) to fund infrastructure projects such as roadway, utility, or wastewater improvements. Within the grant program, there is a set aside for Small Town Housing Choice communities which are towns with less than 7,000 residents.
- **Massachusetts State Revolving Fund (SRF)** – Offers affordable loan options to cities and towns to improve water infrastructure and wastewater treatment and collection systems. The program provides a low interest (2%) loan to fund projects. One challenge with this source is the project proponent must be a municipality. If the Town of Oak Bluffs was not

planning to undertake the wastewater plant work themselves, this program may not be applicable.

- **Water Infrastructure Finance and Innovation Act (WIFIA)** – Federal assistance program that provides loans for wastewater infrastructure and other water infrastructure programs. There is a set aside for Small Communities (<25,000 in population) and projects over \$5,000,000. There is a high application fee (\$25,000 for Small Communities), and the program may only cover a portion of the costs.

## FUTURE PLANNING

If the Town chooses to limit near-term development to the 8-acre parcel of land, there may still be a need for additional planning in the future to determine a use for the 24-acre parcel. There are resources available to assist the Town with future site planning efforts that include, but are not limited to:

- **MassDevelopment Site Readiness & Technical Assistance Programs** – MassDevelopment offers funding through two annual grant programs. The Site Readiness program aims to increase the Commonwealth’s inventory of development-ready sites through site planning, market feasibility, and environmental due diligence efforts. The Technical Assistance program is geared more toward visioning, planning, and strategy to determine the future use of a site and gain resident and political buy-in.
- **MassHousing Planning for Housing Production** – This program helps municipalities identify a key barrier or issue standing in the way of housing production and provide funds to solve those key challenges. The grants seek to advance affordable and mixed-income housing growth in municipalities that fall below 13% on the state’s Subsidized Housing Inventory (SHI).
- **District Local Technical Assistance (DLTA)** - This funding is available through the Martha’s Vineyard Commission and can applied for and used to conduct a wide range of studies.

OAK BLUFFS HOUSING FEASIBILITY STUDY

# APPENDIX

# MEMORANDUM

**TO:** Kent Nichols, Corey Repucci  
**FROM:** Jill Getchell, Kevin MacKinnon  
**DATE:** June 18, 2019  
**SUBJECT:** Oak Bluffs Site Feasibility Study

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## Introduction

Pursuant of RKG Associates, Inc. (RKG) request, Weston & Sampson has evaluated the subject parcels located in Oak Bluffs, Massachusetts and identified potential environmental, physical and infrastructure constraints related to the parcel(s) ability to assimilate wastewater. Weston & Sampson's preliminary assessment is discussed below. Please find attached the figures that are associated with the outlined assessment.

## Tasks Performed

The subject Parcels located in Oak Bluffs are shown in Figure 1. The larger parcel is approximately 23.67 acres and the smaller parcel is approximately 7.83 acres, totaling 31.50 acres in property. The parcels are bound between two large ponds, Lagoon Pond northwest of the parcels and Sengekontacket Pond east of the parcels.

The site parcels are located within an outwash plain where the surficial geology can be described as coarse glacial stratified deposits, bedded sands and gravels (Figure 2). Both parcels are shown to be within the delineated Zone II of the Farm Neck Road Wellfield (Figure 3) that serves the Oak Bluffs Water District. There are three areas within the parcels that do not overlap with the Zone II that have been labeled A, B and C (Figure 4). Table 1 below summarizes the maximum allowable discharge to areas A, B and C (considering the setbacks from property boundaries) assuming a loading rate of 3 gpd/ ft<sup>2</sup> (Guidelines for the Design, Construction, Operation, and Maintenance of Small Wastewater Treatment Facilities with Land Disposal, July 2018).



Table 1: Non-Zone II Areas

	Area (ft <sup>2</sup> )	Maximum Calculated Wastewater Discharge (gpd)
Area A	29,374	88,122
Area B	52,506	157,518
Area C	7,205	21,615

Groundwater elevation contours were used from Whitman and Howard (1994) to evaluate the fate and transport of wastewater discharged within the subject parcels (Figure 3). Generally, groundwater flows from southwest to northeast, meaning from West Tisbury to either Tisbury, Oak Bluffs or Edgartown with a hydraulic gradient of approximately 0.001. According to Martha's Vineyard Source Water Protection Project (2003), the upper aquifer in this area is approximately 70 feet thick with an estimated transmissivity of 200,000 gpd/ft (approximately 26,736 ft<sup>2</sup>/day). There is a secondary aquifer below the primary aquifer that is estimated to be between 90 and 160 feet below sea level. The two aquifers are separated by a silty sand layer that is about 20 feet thick.

Using this data, multiple particles were placed strategically around the subject parcel(s) and tracked downgradient to represent the fate of proposed wastewater discharge areas (Figure 4). If any particle fell within the Farm Neck Road Wellfield Zone II, groundwater was assumed to flow towards and be pumped by, the wellfield. Otherwise, groundwater is expected to flow west towards Lagoon Pond or east towards Sengekontacket Pond. Travel times have been calculated for particles that lie within the Zone II. These calculations were estimated using Darcy's law.

$$q = \frac{(T/b)i}{n_e}$$

where,

- $q$  = Darcy Velocity (ft/day)
- $T$  = Transmissivity (ft<sup>2</sup>/day)
- $b$  = Aquifer Thickness (ft)
- $i$  = Hydraulic Gradient (ft/ft)
- $n_e$  = Effective Porosity= assumed value of 0.28

The velocity of groundwater was estimated to be 1.36 ft/day. In order to estimate the travel time of groundwater to the Farm Neck Wellfield, distance from the particle to the wellfield was divided by 1.36 ft/day. Overall, the average travel time was approximately 8,000 days (22 years).

Table 2: Particle Tracking

Particle Track	Distance from Farm Neck Road Wellfield (ft)	Time of Travel to Farm Neck Road Wellfield (days)
P-1	10,965	8,038
P-2	Flow Path Shown	–
P-3	10,369	7,601
P-4	11,859	8,694
P-5	Flow Path Shown	–
P-6	9,204	6,747
P-7	Flow Path Shown	–
P-8	10,728	7,865
P-9	10,527	7,717
P-10	Flow Path Shown	–

After identifying the closest pond systems to the parcels, relevant Massachusetts Estuaries Project (MEP) Reports and local Board of Health Regulations associated with Nitrogen Loading Thresholds and limitations were reviewed. MEP reports are available for the Lagoon Pond System and Sengekontacket Pond System regarding Nitrogen Loading Thresholds. Watershed and sub-watershed have been delineated for the Lagoon Pond System and Sengekontacket Pond System (Figure 5)

The Board of Health Regulations, Section 210- Fertilizer Regulations states that the Massachusetts Department of Environmental Protection has established a maximum pollutant load a receiving area can accept and still meet water quality standards at Oak Bluffs Great Pond, Farm Pond, Lagoon Pond, Sengekontacket Pond and Tisbury Great Pond. This maximum amount is known as TMDL (Total Maximum Daily Load). TMDL and present nitrogen load values are included in Table 3.

Table 3: Nitrogen Loading Summary

System	Present Total Watershed load (lb N/year)	TMDL (lb N/year)	Allowable Load (lb N/year)
Sengekontacket Pond Estuarine System	30,241	36,944	6,703
Lagoon Pond Estuarine System	37,660	45,240	7,580
Note that present loads and TMDLs were extracted from System Total Maximum Daily Loads for Total Nitrogen Reports (2015) prepared by the Commonwealth of Massachusetts.			

To evaluate potential Massachusetts Environmental Policy Act (MEPA) Thresholds, possible triggers such as historical/archaeological land, Area of Critical Environmental Concern, and State Listed Species were identified in the vicinity of the site parcels. As shown in Figure 6, the only potential trigger is NHESP

Priority Habitats of Rare Species. A majority of the parcels overlap this receptor. Therefore, to identify rare species the project will have to be filed under the Natural Heritage and Endangered Species Program (NHESP) under Massachusetts Endangered Species Act (MESA).

The area that is encompassed within the site parcels is classified as R3 Residential, minimum of 60,000 square feet, and R4 Residential, minimum 130,000 square feet (Figure 7). This information is based on Oak Bluffs Zoning Bylaws. The overlay zoning within the site parcels is classified as southern woodlands district, water protection overlay district (due to the Zone II) and wireless communication district (Figure 8).

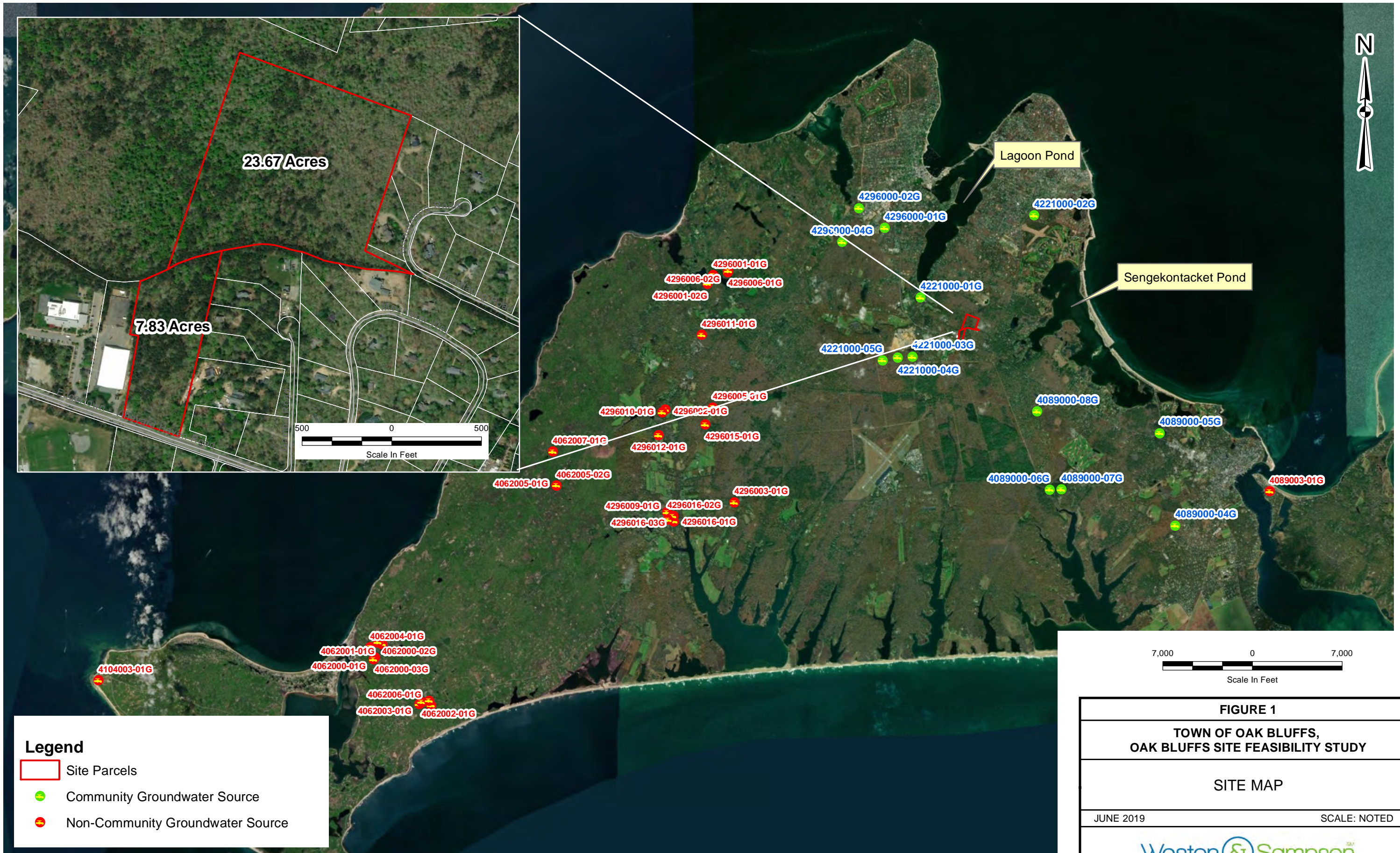
An estimated nitrogen load that would be discharged to the subject parcels was estimated assuming a nitrogen concentration of 10 mg/l. Using the parcel(s) area (31.5 Ac) combined with the Title 5 regulations (440 gpd/Ac), the development could produce a potential wastewater discharge of 13,877 gpd with a corresponding nitrogen load of 423 lb N/yr. Each area delineated on Figure 4 outside of the Zone II would be sufficient in size to support 13,877 gpd. Although, the corresponding nitrogen load exceeds the sum of the allowable loads, meaning some type of mitigation efforts would be necessary.

### Conclusions

Based on the review of the initial investigation, there are two potential methods to discharge wastewater on site:

- a. Discharge into Zone II where the fate of the wastewater will ultimately flow towards the Farm Neck Wellfield with a travel time of 20 years following zoning guidelines. Discharge is expected to be greater than 10,000 gpd into a nitrogen sensitive area, therefore an ENF will be required.
- b. Distribute wastewater discharge amongst the three zones located outside of the Zone II, which will eventually drain into Lagoon and Sengekontacket Pond, where mitigation efforts will be necessary.





**FIGURE 1**

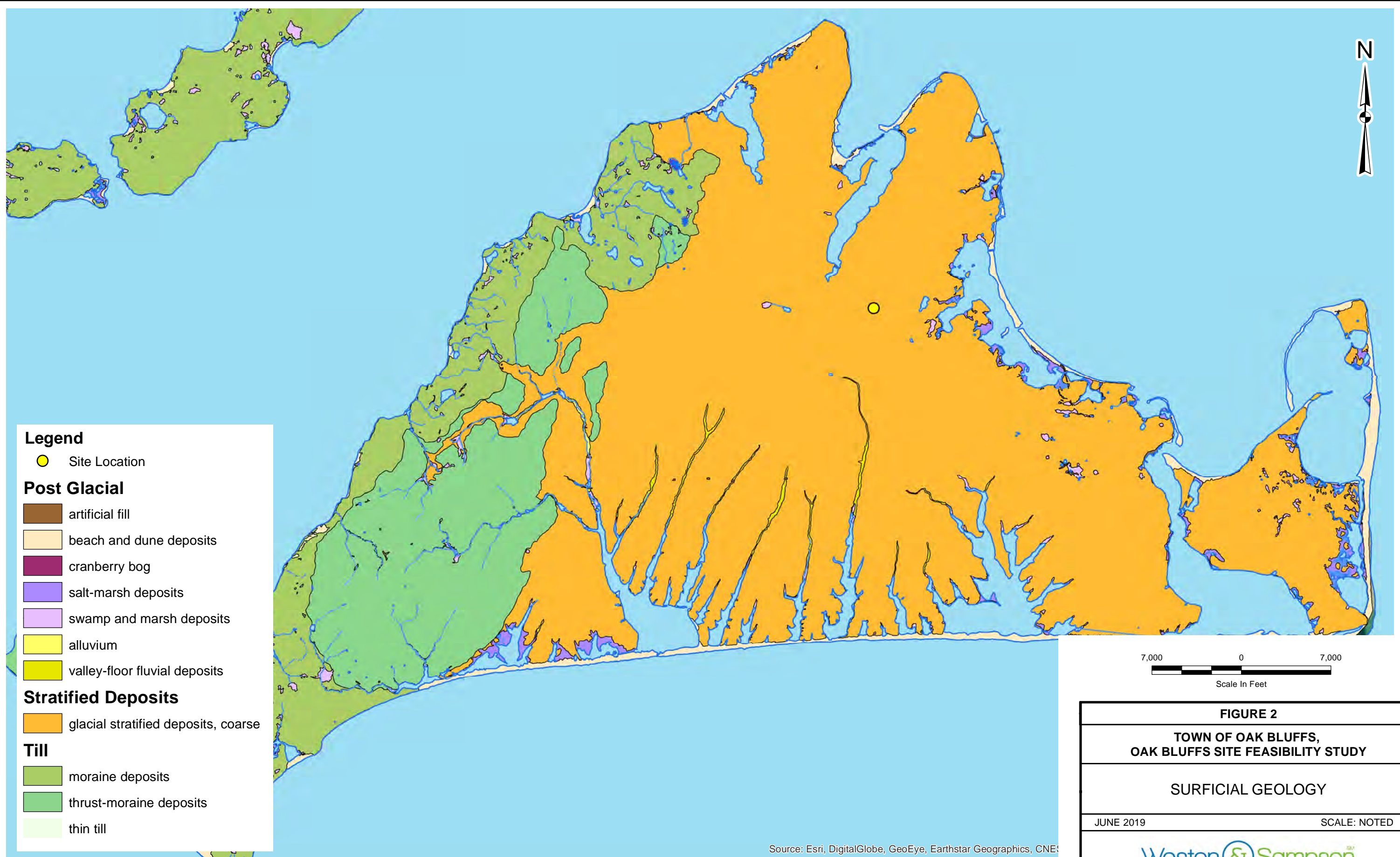
**TOWN OF OAK BLUFFS,  
OAK BLUFFS SITE FEASIBILITY STUDY**

**SITE MAP**

JUNE 2019 SCALE: NOTED

Weston & Sampson





**FIGURE 2**

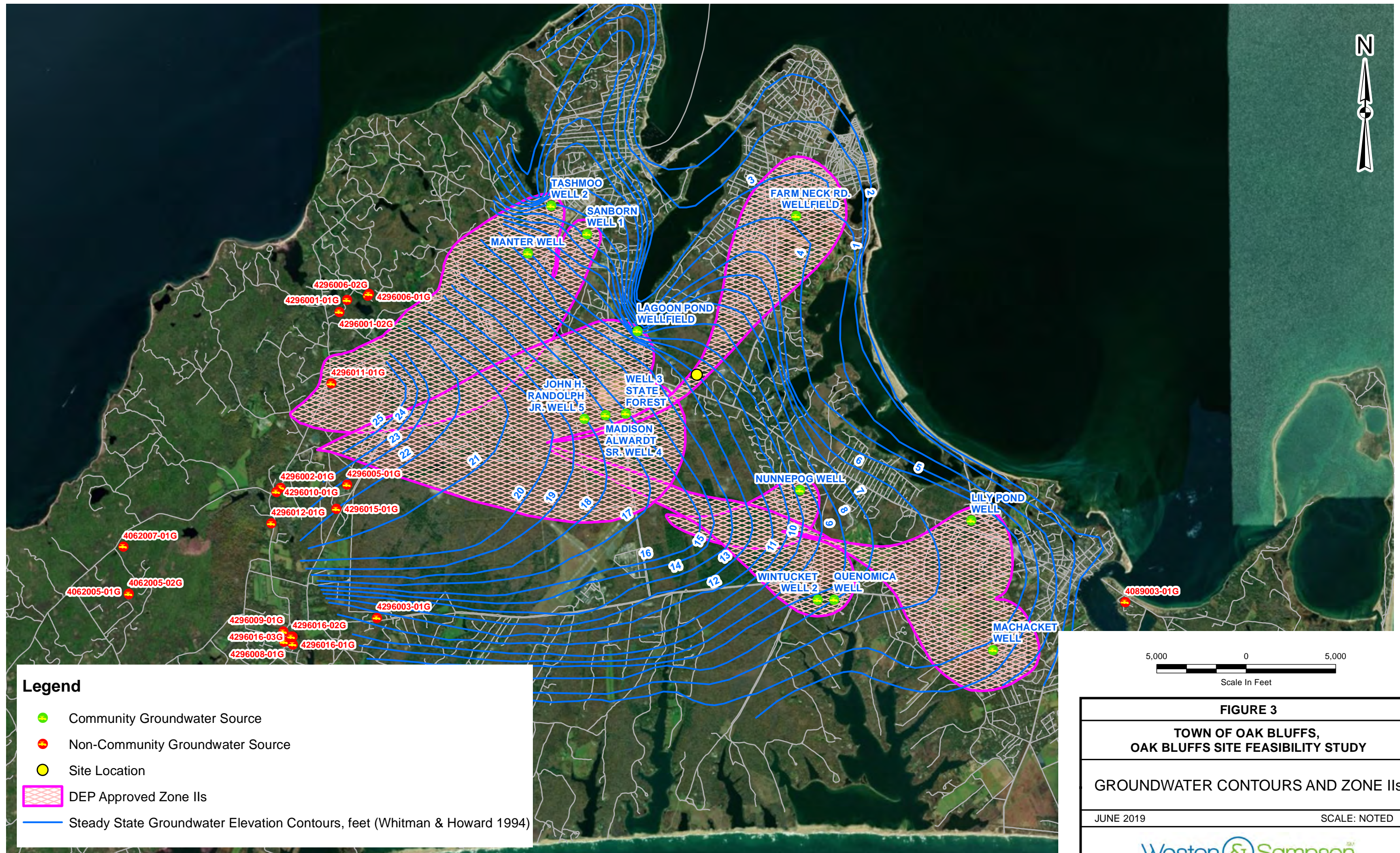
**TOWN OF OAK BLUFFS,  
OAK BLUFFS SITE FEASIBILITY STUDY**

**SURFICIAL GEOLOGY**

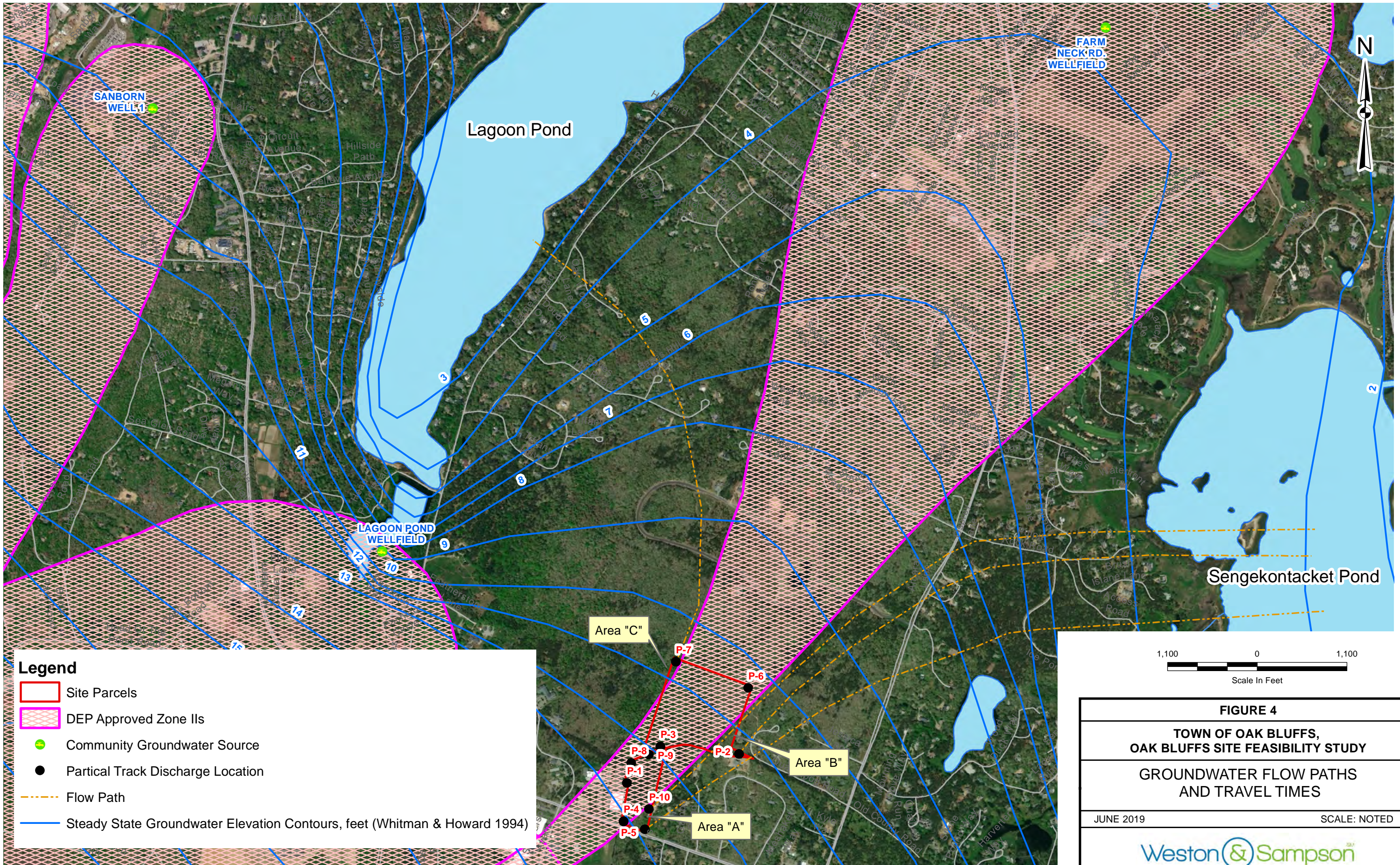
JUNE 2019 SCALE: NOTED

Weston & Sampson

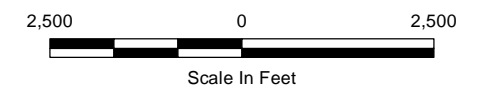
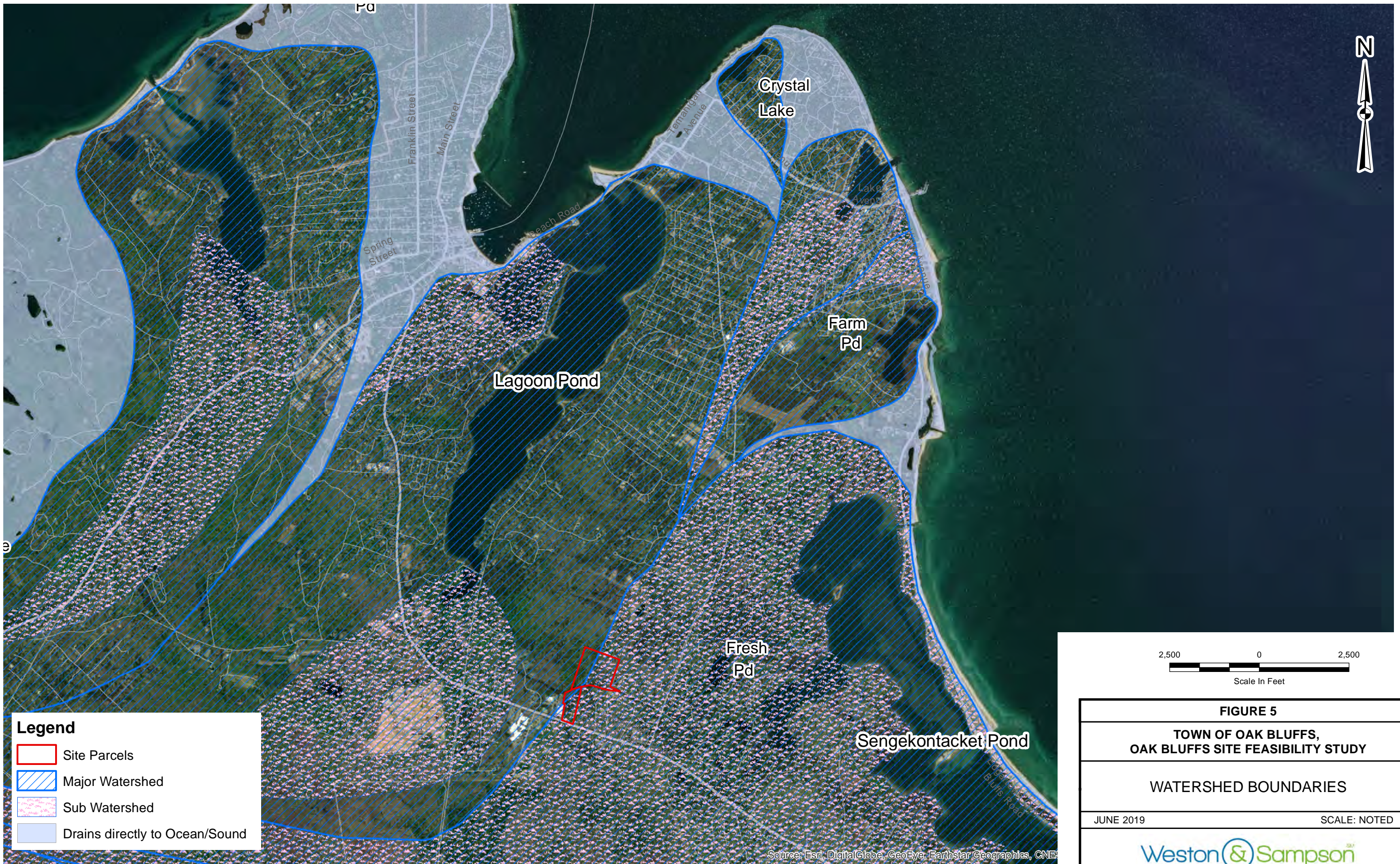






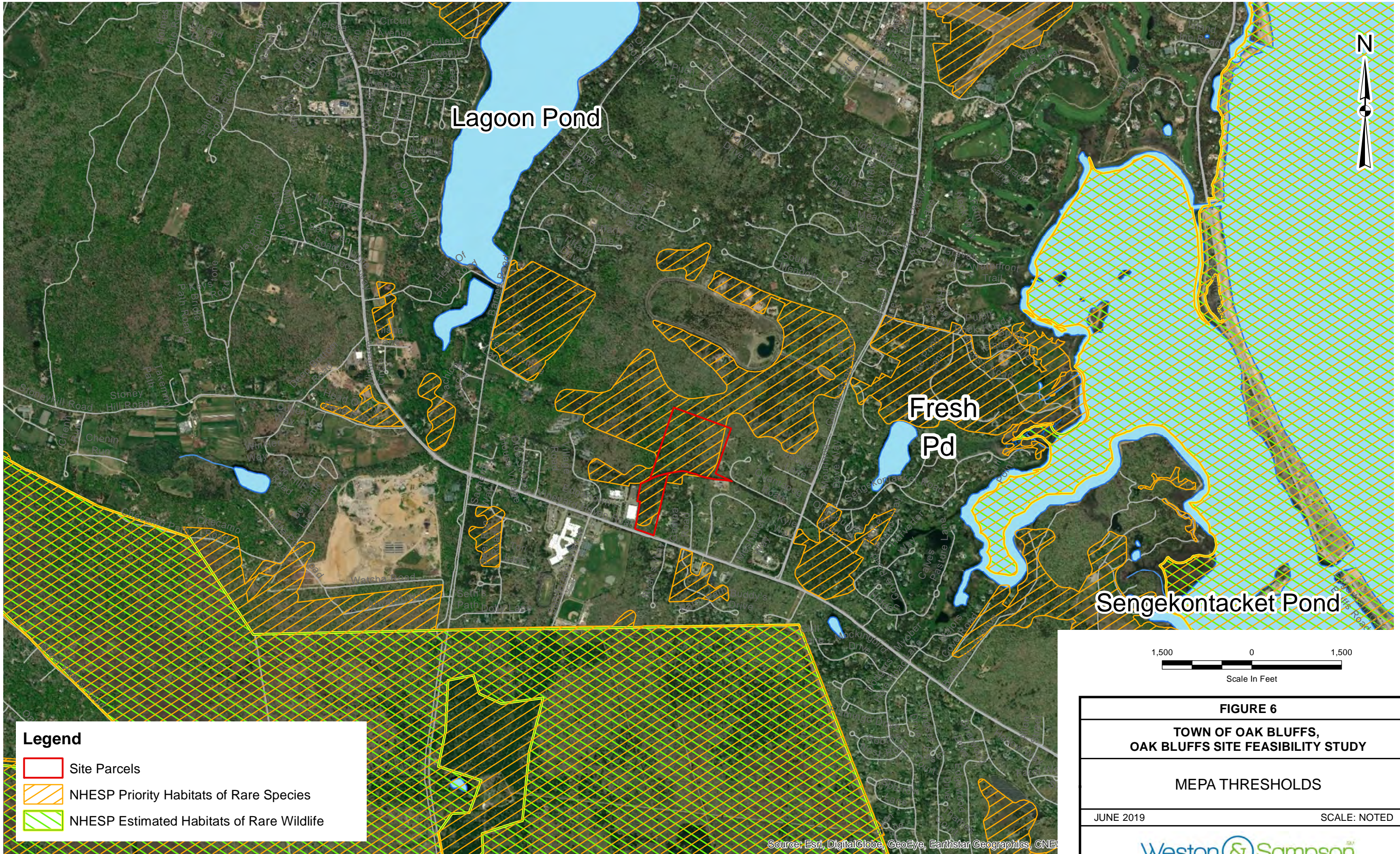






<b>FIGURE 5</b>	
<b>TOWN OF OAK BLUFFS, OAK BLUFFS SITE FEASIBILITY STUDY</b>	
<b>WATERSHED BOUNDARIES</b>	
JUNE 2019	SCALE: NOTED

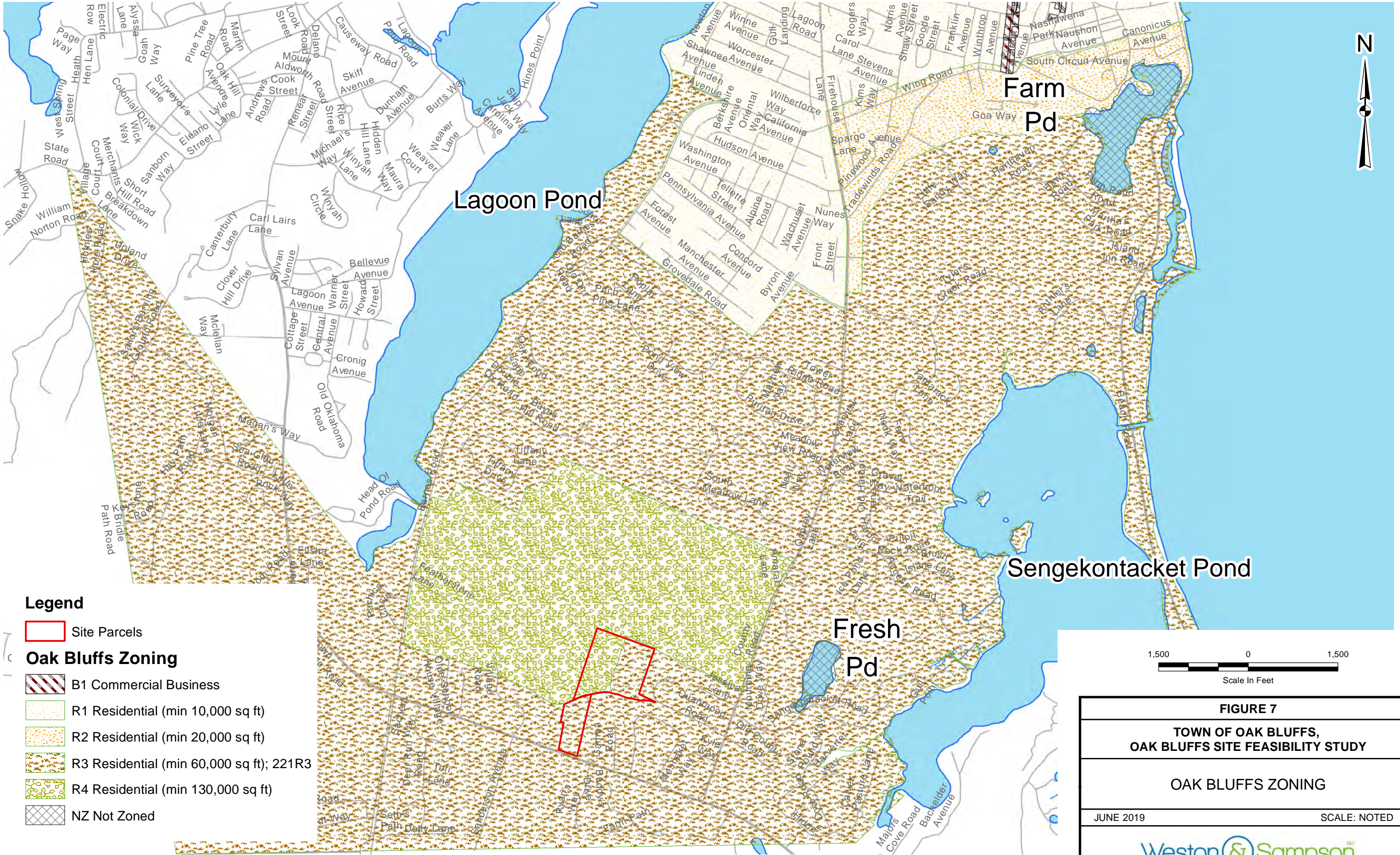




Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES

<b>FIGURE 6</b>	
<b>TOWN OF OAK BLUFFS, OAK BLUFFS SITE FEASIBILITY STUDY</b>	
<b>MEPA THRESHOLDS</b>	
JUNE 2019	SCALE: NOTED





**FIGURE 7**

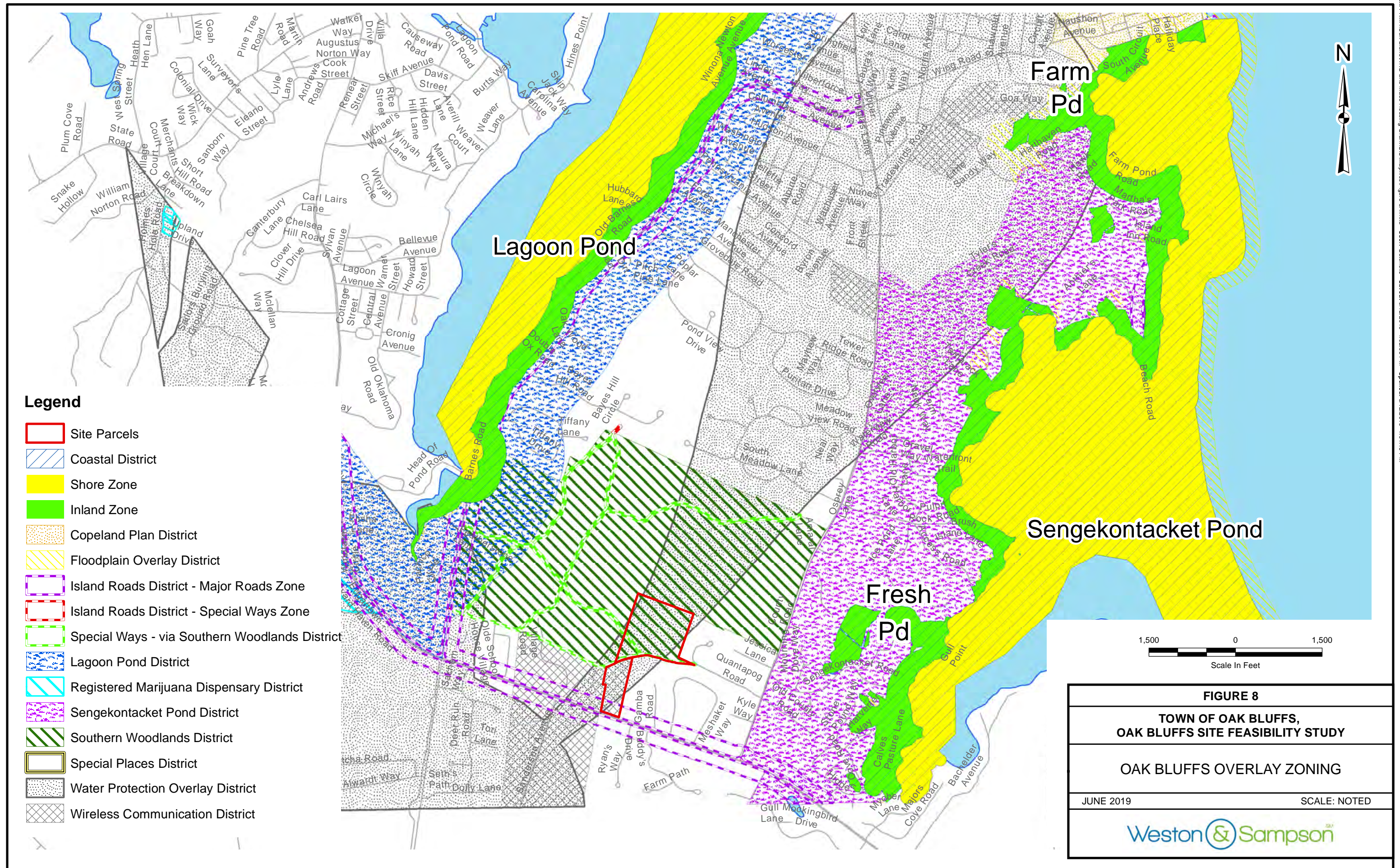
**TOWN OF OAK BLUFFS,  
OAK BLUFFS SITE FEASIBILITY STUDY**

**OAK BLUFFS ZONING**

JUNE 2019 SCALE: NOTED

Weston & Sampson







# MEMORANDUM

**TO:** Kent Nichols, Corey Repucci  
**FROM:** Jill Getchell, Kevin MacKinnon  
**DATE:** August 29, 2019  
**SUBJECT:** Oak Bluffs Site Feasibility Study- County Road Wellsite Follow up

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Pursuant of RKG Associates, Inc. (RKG) request, Weston & Sampson had evaluated the subject parcels located in Oak Bluffs, Massachusetts and identified potential environmental, physical and infrastructure constraints related to the parcel(s) ability to assimilate wastewater. Weston & Sampson's preliminary assessment was outlined in the memo dated June 18, 2019. The town of Oak Bluffs is considering adding a new source to their system, the County Road Well. This new proposed source was unknown at the time of that memo, therefore the preliminary assessment did not incorporate the proposed County Road Wellsite into the time of travel calculations. This memo discusses the estimated travel times determined from the proposed wastewater discharge parcels (subject parcels) to the proposed wellsite.

The subject parcels and proposed County Road Wellsite are shown in Figure 1. Initially, multiple particles were placed strategically around the subject parcel(s) and tracked downgradient to represent the fate of proposed wastewater discharge areas. If any particle fell within the Farm Neck Road Wellfield Zone II, groundwater was assumed to flow towards and be pumped by, the wellfield. Otherwise, groundwater was expected to flow perpendicular to groundwater head contours west towards Lagoon Pond or east towards Sengekontacket Pond.

With the addition of a new source, updated travel times need to be calculated based on the conceptual Zone II of the County Road Well. The conceptual Zone II is expected to capture the entirety of both parcels. Therefore, the fate of proposed wastewater discharge is expected to flow towards the Farm Neck Road Wellfield or proposed County Road Well.

Travel times have been calculated for particles that lie within the Zone II. These calculations were estimated using Darcy's law.

$$q = \frac{(T/b)^i}{n_e}$$

where,

- $q$  = Darcy Velocity (ft/day)
- $T$  = Transmissivity (ft<sup>2</sup>/day)
- $b$  = Aquifer Thickness (ft)
- $i$  = Hydraulic Gradient (ft/ft)
- $n_e$  = Effective Porosity= assumed value of 0.28

Groundwater elevation contours were used from Whitman and Howard (1994) to evaluate the fate and transport of wastewater discharged within the subject parcels (Figure 1). According to Martha's Vineyard Source Water Protection Project (2003), the upper aquifer in this area is approximately 70 feet thick with an estimated transmissivity of 200,000 gpd/ft (approximately 26,736 ft<sup>2</sup>/day) and Storativity coefficient of 0.02.

Instead of assuming a hydraulic gradient to calculate travel times, discrete hydraulic gradients were calculated for distances from the wellsite at 1 to 10 feet, 10 feet to 100 feet, 100 feet to 1,000 feet, 1,000 feet to 1,400 feet, 1,400 feet to 2,000 feet, 2,000 feet to 3,000 feet, 3,000 feet to 3,500 feet and 3,500 to 4,000 ft. The hydraulic gradient can be calculated by dividing the head difference of two locations within the same aquifer for each of these segments by the distance between the two locations. Head was calculated using static groundwater elevations and subtracting the drawdown expected at a specified distance (pumping groundwater elevation) assuming the proposed County Road wellsite would be pumping at a rate of 700 gallons per minute (gpm). Drawdown was calculated using the Theis equation.

$$s = \frac{Q}{4\pi T} W(u)$$

$$W(u) = \ln\left(\frac{1}{u}\right) - 0.5722$$

$$u = \frac{r^2 S}{4Tt}$$

where,

- $s$  = Drawdown (ft)
- $Q$  = Pumping Rate (gpm)
- $W(u)$  = Well Function
- $r$  = Radial Distance from pumping well (ft).
- $S$  = Storativity
- $t$  = Elapsed time since start of pumping (minutes)= 180 days

The velocity of groundwater was estimated for each segment using the corresponding hydraulic gradients. In order to estimate the travel time of groundwater, the distance to the proposed wellsite was divided by Darcy's velocity. The closest and furthest distance the parcels are to the proposed wellsite are 1,400 feet and 3,500 feet, respectively as shown on Figure 1. Note multiple distances were evaluated

to refine the hydraulic gradients and to calculate more accurate travel times. The travel times are summarized in Table 1 below.

*Table 1: Travel Times to Proposed County Road Wellsite*

Distance from Proposed County Road Wellsite (ft)	Pumping Water Elevation (ft)	$\Delta h$ , Change in Head (ft)	$\Delta l$ , Change in Distance (ft)	Hydraulic Gradient (ft/ft)	Darcy Velocity (ft/day)	Travel Time to Proposed Well Site (days)	Cumulative Travel Time (days)	Cumulative Travel Time (years)
1	0.92	—	—	—	—	—	—	—
10	2.78	9	1.86	0.207	281.91	0.04	0	0.0
100	4.73	90	1.95	0.022	29.56	3.38	3	0.0
1000	7.58	900	2.85	0.003	4.32	231.50	235	0.6
1400	8.15	400	0.57	0.001	1.94	720.23	955	2.6
2000	9.43	600	1.28	0.002	2.91	687.27	1642	4.5
3000	10.86	1000	1.43	0.001	1.95	1537.95	3180	8.7
3500	11.58	500	0.72	0.001	1.96	1781.82	4962	13.6
4000	12.09	500	0.51	0.001	1.39	2874.87	7837	21.5

At the shortest distance (1,400 ft) from the subject parcels to the new water supply well, the travel time is more than 2 years (2.6 years) based on the assumptions stated earlier. At the furthest distance, the travel time is expected to be almost 14 years.

The results of the memo are based on information compiled from a number of sources (cited above), using standard methodologies for evaluation of groundwater and nutrient time of travel. No hydrogeologic parameters were field measured or confirmed by Weston & Sampson. Should additional hydrogeologic data become available from the water department (pumping test data, Zone II reports, new source approval permit applications), a supplemental analysis should be conducted to verify our findings herein.

The results of our analysis suggest that the travel time from the proposed development parcel(s) is greater than 2-years. Travel times greater than 400 feet (Zone I radius) typically provide protection for a public drinking water supply well from viruses and pathogens. Travel times in excess of two years allow for more relaxed permitted effluent limits and can decrease the cost of wastewater treatment.