ALTERNATIVE 4

BOG RENOVATION FOR CRANBERRY GROWING

Description of Alternative 4

This alternative involves the renovation of the 18-acre Irrigated Bog area to obtain higher cranberry yields. The current low cranberry yield – due to old vines, weeds, and adverse weather – has made farming the bog uneconomical, so the farmer declined to renew the lease.

Renovating a cranberry bog starts with removing the old vines, weeds, and surface organic material. Next, each of the fields is leveled, and the drainage ditches are cleared. Then, the irrigation system is updated, and the organic material is tested and adjusted for optimal growth. The renovation ends with the planting of new, high-yielding vines. If each step occurs on schedule, the renovation process can be completed in a year, but another three or four years are needed for the vines to mature and produce a crop. The cost of renovation ranges from $30,000 to $50,000 per acre depending on variables such as access to sand, machinery, and labor and unforeseen issues.

When deciding to renovate, considering whether the renovated bog would yield a profit is important. The economic analysis in Section 4: Cranberry Economics says that Carlisle's Cranberry Bog needs to get $30 per barrel or significantly increase the number of barrels produced per acre in order to turn a profit. Brian Wick of the Cape Cod Cranberry Association said, "There are some hard economic considerations, as the Return On Investment (ROI) can be 10 years or more and really will depend on the market price for the fruit among other factors." [1]

The cranberry industry has two levels of prices: the A Pool, which gets the top price from Ocean Spray, and the B Pool, which gets prices about half of the A Pool's prices. Some independent growers are in the next tier below the B Pool but get B Pool's prices. The Ocean Spray prices are elevated (from the sale of Ocean Spray products), whereas the B-pool prices and independent prices reflect wholesale prices.

Renovation Steps

In the first step, all the old vines and other plants are stripped off the bog surface using a bulldozer (**Figures 1 and 2**). Though unlikely, some of the old organic material could be screened, cleared of weeds and insects, and reused as organic liners. If the bog cannot support the machinery needed to level the bog, special machinery would be brought in, at additional cost.

Figure 1. Scraping the old bog **Figure 2. Leveling the new bog**

In the next step, the irrigation and drainage systems are examined and upgraded. This step includes clearing and shaping the ditches around each bog. The irrigation system could be upgraded to pop-up heads (**Figures 3 and 4**), which conserve water because there is no leaking due to the wear and tear of removing the sprinkler heads for the winter and then reinstalling them in the spring. This system can also be programmed to turn on automatically when the bog needs frost protection, which eliminates human error in predicting frosty nights, which freeze the buds and kill the crop.

Figure 3. Pop-up irrigation system **Figure 4. Close-up of pop-up head**

Then, the bog surface is leveled by laser to within two-inch tolerance, which conserves water when flooding for the harvest because extra water isn't needed to cover the high areas.

The next step is to add 6 to 8 inches of coarse sand for proper drainage and aeration so the cranberry vines can establish roots and grow. The irrigation system is placed during the laying of the sand, so it is not too far below the surface. Covering 18 acres of bog with a layer 6 to 8 inches thick requires about 1,000 truckloads of sand. **Figure 5**

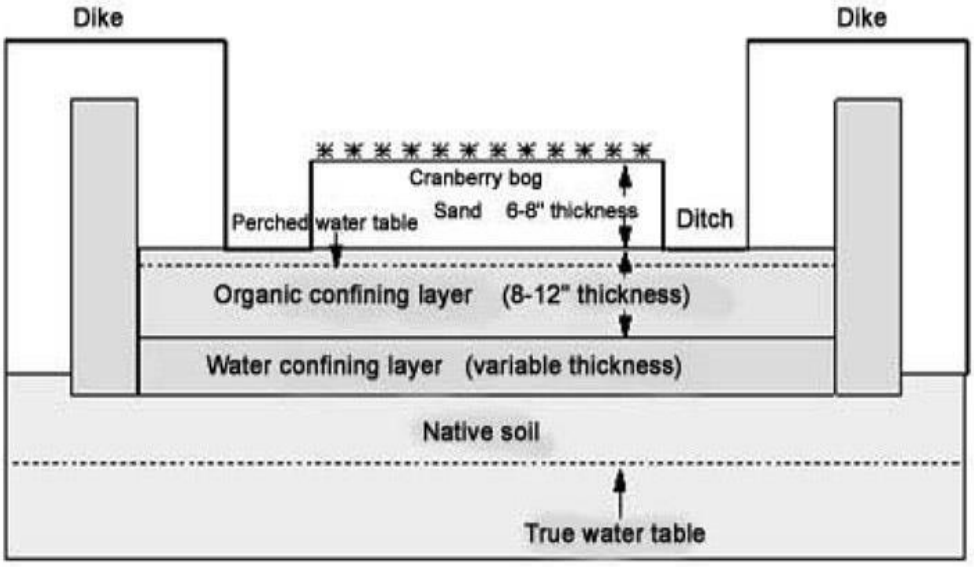

Figure 5. Cross-section showing construction of cranberry bog with location of organic and water confining layers in system using perched water table design.

shows a cross section of an ideal cranberry bog. The Carlisle Cranberry Bog's layers are probably different because of the bog's age. A study of its exact makeup would help in knowing what renovation involves.

In the last step, new vines are planted. The minimum recommended planting density is 1 plant per square foot or 43,560 plants per acre. Two options are available for new cranberry plants. One option is vine cuttings from specific species. The cuttings are laid on the sand and lightly harrowed into the sand to encourage the vines to take root (**Figure 6**). These cuttings are called stolon bundles and can cost $3,000 to $5,000 per acre depending upon the type of vine.

Figure 6. Cranberry vines being spread

The other option is plugs, which are cranberry vines that already have a small root system and must be individually planted (**Figure 7**). The plugs have a much higher success rate, because they already have a root system, but they are much more expensive: from $9,000 to $11,000 per acre. Although the vines themselves are cheaper, they often leave bare spots, so more vines have to be used.

Figure 7. New cranberry plugs

A list of advantages of plugs follows (taken from Evergreen Nursery[2]).

- Starting with pure plug material guarantees pure beds. Over time, cranberry beds will have volunteer seedlings. Volunteer seedlings are seedlings that grow off the original vine plug. Beds pruned for propagation will contain these volunteers and potentially result in lower-yielding new beds.
- Plugs and rooted cuttings establish quickly in beds.
- Plugs give a greater uniformity in beds than vine cuttings give, so no space is wasted, and no bare spots need replanting.
- Planting dates are flexible: Plant from spring to fall.
- Beds establish more quickly than do spreading vines.
- Uniform density and earlier fruit production make plugs the more economical way to establish beds.
- Planting plugs uses less than 10% of the material typically used for vine cuttings per acre.
- Plugs establish new varieties faster than vine cuttings.
- If you have a specific variety, only a fraction of the material is needed to increase acreage over the material needed with spreading vines
- Plugs are a great way to fill in bare spots.
- DNA-tested plugs establish true-to-type beds, a resource for future plantings.

The type of cranberry to plant is very important in determining the success and the return on investment of the cranberry bog. Currently, the bog is a mix of Howes, Early Black, and Stevens varieties. The Howes and Early Black are two of the earliest varieties of cranberry. The Stevens variety was the first hybrid created by the United States Department of Agriculture (USDA). The yield of these three varieties under optimal

conditions is around 300 barrels per acre. Rutgers University and the University of Wisconsin are breeding hybrids today that can produce 500 up to 900 barrels per acre. A high-producing vine could offset low per-barrel prices to help the bog attain a profit. **Table 1** shows some of the newest cranberry vines available. One added cost with these new hybrids is that royalties (for the patent holder) are sometimes added to the purchase price.

Once chosen, the cuttings or plugs are planted, which requires a fair amount of labor and some special machinery. Cuttings are the simplest to plant because they are just spread on the surface by hand or in rows and then spread using a hay tedder. Then the cuttings are lightly pushed into the sand using a harrow. For plugs there are several types of transplanting machines, and the labor is more intensive. A multi-row furrow maker is the simplest transplanter (**Figure 8**). Workers follow behind to drop plants into the furrow and then hand plant them. This method requires about 25 people to plant 1 acre per day, or 200 hours of labor per acre.

Figure 8. Multi-row furrow maker

A custom-built, semi-automated planter does 9 rows per pass (**Figure 9**). Each row has a planting shoe and packer wheels, with one worker per row to place the plant within the shoe. This method can plant 1.5 acres per day, using about 55 hours of labor per acre. It can be used with rooted cuttings raised in either cells or open trays. Commercially built transplanters are widely used in the vegetable industry, have the lowest labor cost (about 40 hours of labor per acre), but require the use of rooted cuttings raised in cells.[4]

After the vines or plugs are planted, the plants need special attention. The young plants need fertilizer and watering twice a day to encourage growth. After the first month, some herbicides should be spread to avoid other plants from growing and crowding out the

Table 1. Examples of New Cranberry Vines

Name	Firmness[a]	Optimal Harvest Time[a]	Average Weight (grams)	Berry Yield (barrels/acre)	Yield Source Data	Characteristics
Stevens	730	10/6-10/20	2.05	370	10 Year Average	Consistent yield, easily managed, industry standard, plagued with low-color fruit
GH1	730	10/1-10/15	1.92	380	10 Year Average	Consistent long-term yield, uniform color, winter hearty
BG	710	10/6-10/20	2.11	530	30 Acres in 2015	Consistent long-term high yield, uniform color, good rebud
Pilgrim King	730	10/1-10/15	2.68	616	Plot in 2014 & 2015	Extremely large fruit, uniform color, high yield
Valley 95	680	9/22-10/6	1.94	657	Plot in 2014 & 2015	Early selection for high yield and and high color
Valley 104	760	9/25-10/12	1.79	750	Plot in 2014 & 2015	High yield and early color
Valley 114	735	9/20-10/6	2.06	632	Plot in 2014 & 2015	High yield and early color
Valley King	760	9/20-10/6	2.68	747	Plot in 2014 & 2015	High yield, very large fruit
Midnight 8	660	9/1-9/20	1.61	570	2 Acres in 2014 & ’15	High yield, very early color, excellent rebud
Midnight 9	710	9/15-10/1	1.60	570	Plot in 2015	High yield, excellent rebud
Crimson King	750	9/15-10/1	2.43	900	Plot in 2014	Highest yielding, high color throughout canopy, newest variety being expanded
Granite Red	830	10/1-10/15	2.42	438	Plot in 2014 & 2015	Extremely firm fruit, excellent fresh fruit, keeping quality, large fruit with uniform color

[a]Data Source: Ocean Spray Tests. All other data is collected at Valley Corporation. Newer varieties have a greater chance of fluctuating data.

Figure 9. Semi-automated transplanter

young plants or stealing nutrients. An Integrated Pest Management (IPM) program helps handle the insects and weeds that are a threat to the young cranberry plants. Light layers of sand are spread at the end of each season to anchor vine runners and encourage upright growth. This level of care continues until the vines start producing cranberries.

Considerations for Organic Cranberry Farming

This Alternative assumes that the renovation of Carlisle's cranberry bogs would lead to a greatly improved bog that would be managed and harvested in the traditional methods for wet-harvested cranberries. Thus, "organic" procedures would not be used, and the wet-harvested berries would be sold, as in the past, to a processing company for conversion into juice or canned products. However, this assumption (used in this report) would not prevent any future cranberry farmer from assigning all or a portion of the bog acreage to organic cranberry farming. In this case, the cranberries would be harvested and sold dry. In fact, the Town would certainly welcome such an event. We have chosen not to make organic cranberry farming the focus of this alternative for various reasons, including the following.

- Organic cranberry farming and marketing is a small, specialized market. Special knowledge, skills, and dedication are needed by the farmer.
- To be profitable, any organic cranberry farmer in Carlisle would likely have to direct market the produce to retail outlets in the area. The marketing and distributions adds significantly to the farmer's burden, especially to the time commitment.
- A number of traditional cranberry growers have recently switched to organic cranberry farming, presumably due to adverse economic conditions. In addition,

organically grown cranberries all hit the market around October unless they are frozen for later sale. These factors lead to an oversupply of the product each fall which, in turn, puts a downward pressure on prices.

- The growing of cranberries organically is very labor intensive in part because, in the absence of herbicides, weeding must be done by hand. Finding the labor at a reasonable price to do the weeding would be problematic.
- Given the significant labor requirements, organic cranberry farming is more commonly appropriate for relatively small bogs (e.g., less than 10 acres).
- Given the historic use of pesticides and herbicides at Carlisle's bog, it could take a few years to achieve "organic" status.

Other Considerations

A consideration and cost for renovation are dealing with the beavers and muskrats. The beavers and muskrats build dams and damage dikes, which impede the water flow and make it difficult to control the water at the bog. There are two options for beaver and muskrat control. One is to use beaver deceivers at each dam. These devices are expensive and have limited success. The other is to trap the beavers. Beaver and muskrat trapping costs are per animal trapped, and trapping is allowed from November 1st through April 15th of the next year. See Section 5(c): Beaver and Muskrat Control for further information.

Another consideration is dealing with the specialized machinery needed to grow and harvest the cranberries. In the past, Mark Duffy rented equipment from a company that in 2016 sold its equipment and went out of business. To continue harvesting cranberries, a farmer would have to find another place to rent machinery or buy it outright.

Renovation Costs

Section 4: Cranberry Economics provides a detailed description of the range of costs involved in cranberry-bog renovation and a general discussion of the historic and current economics of cranberry production. The economic analysis for Carlisle's Irrigated Bog estimates that renovation would cost $33,000 per acre or $660,000 to renovate the whole 20 acres. In addition, a subsidy of $30,000 per year is due to the farmer to nurture and care for the plants until they become productive. The total investment by the Town would then be approximately $800,000.

Currently the Cranberry Bog produces about 100 barrels per acre, but, with independent prices at $10 to $15 per barrel and costs at $15 to $20 per barrel, the bog loses $5 per barrel (or $500 per acre, or $10,000 overall), so cranberry production is economically unfeasible. With annual operating costs of up to $66,000 and prices for independent growers in the $15 to $20 per barrel range, then the Cranberry Bog would need to increase production to around 350 barrels per acre (a 3.5-fold increase) in order to make a small profit. This increased production is possible with the new, high-yielding vines that are listed in Table 1.

Fortunately, there are some grants, both state and federal, that can help with the renovation costs. MassDevelopment offers a guaranteed loan program that partners with banks and guarantees up to $500,000 per farm, up to 50 percent of the outstanding principal. A recent report from the Massachusetts Cranberry Revitalization Task Force highlighted the need for this program, which would help the cranberry industry by financing cranberry bog upgrades, including leveling, improving irrigation systems, and planting hybrid vines to produce a larger cranberry for juice and dried cranberries. Federal programs (USDA-Natural Resources Conservation Services cost-share programs for some aspects of renovation) and state programs (Department of Agriculture, Agricultural Environmental Enhancement Program) also cover some potential costs. These programs are directed at farmer-owned bogs rather than town-owned bogs, but maybe exceptions can be made because the state is interested in cranberry-bog renovation.

Summary Evaluation

Relative to the general evaluation criteria listed in Section 3 of the Main Report and other considerations, the following pros and cons of this alternative follow.

<u>Pro</u>

- Cranberry farming, which has been ongoing for over 110 years, would continue. The cultural heritage would not be lost.
- Public use of the dike trails would continue with some initial disruptions.
- Renovation would improve the bog overall and maintain the paths and vistas.
- Renovation would preserve 100% of the registered water rights.
- Renovation would allow the bog to keep special agricultural exemptions from the Wetlands Protection Act regulations.
- Renovation would preserve the last remaining cranberry bogs in Middlesex County.

<u>Con</u>

- Renovation has high capital costs.
- Renovation requires 3 to 5 years to achieve a producing cranberry bog. A subsidy to the farmer would likely be needed during this period.
- Constant maintenance is needed to deal with beavers and muskrats.
- High increase in traffic on Curve Street during the renovation.
- The return on investment is long, which means the profit won't make up for the amount spent on renovation for many years.
- Cranberry farming (any kind of farming) is risky. Profits are not guaranteed.
- Finding an interested and qualified cranberry farmer to manage the cranberry-growing operation may be difficult.

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2. Cranberry Plugs; http://www.evergreennurseryco.com/cranberries.php; Evergreen Nursery Company; September 2016.

3. Table 1 source: http://www.cranberryvine.com/cranberry-varieties. Table 1 reproduced with permission from Valley Corporation, Tomah, WI.

4. Planters; http://www.integritypropagation.com/planting_planters.html; Integrity Propagation LLC, 2010. September 2016.

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