Exhibit EN-HLD-5

Visual Analysis

Vermont Yankee Cooling Tower Plume

February 18, 2003

Visual Analysis

Vermont Yankee Cooling Tower Plume

Prepared For: Entergy Nuclear Vermont Yankee, LLC
Governor Hunt Road
Vernon, Vermont

Prepared By: Dodson Associates, Ltd.
463 Main Street
Ashfield, Massachusetts

February 18, 2003

1. Executive Summary

Proposed operational changes to the Vermont Yankee Nuclear Power Plant will have little or no impact on the size and configuration of the plant's vapor plume. The visual impacts of these changes to the plume will usually be imperceptible and will therefore not offend the sensibilities of viewers. The average person, as well as most experts, will not be able to tell that these changes have taken place because in most cases the changes will be minimal to nonexistent. The only perceptible change will be the return to occasional operation of the cooling towers in the winter for the first time since 1978. This will result in occasional winter plumes which will present a minor change in the visual landscape when the cooling towers are in operation.

2. Introduction

Background: Entergy Nuclear Vermont Yankee LLC is proposing an upgrade of its generating facilities that could affect the dimensions and frequency of the plant's vapor plume. The vapor plume is a result of the cooling of water emanating from the plant as required by environmental regulations concerned with maintaining ambient water temperatures in the Connecticut River. The vapor plume has been a feature of the plant and the surrounding landscape since the plant's construction in 1972. Current plans for upgrading the plant will result in very minimal changes to the average size of the plume, though the plume may be extended into the winter months for the first time since 1978, resulting in the presence of a vapor plume less than 20% of the time during the winter.

Methodology: This visual study is based on data provided by the plant's engineering consultants, Stone & Webster. The data were developed by Stone & Webster to indicate the projected change in the vapor plume's height, width and length. The data calculated the most representative projected dimensions of the plume. The most representative plume dimensions were used for this study because they show the type of plume that will be most frequently seen by viewers. The largest plumes are infrequent and are typically created on very hazy or cloudy days and are therefore often obscured by poor visibility.

The Vermont Yankee Cooling Towers and 20 Meter High Vapor Plume

Using the Stone & Webster data, Dodson Associates developed a terrain model to calculate views of the plume from a number of locations in the region. The terrain model, produced in ArcView 3-D Analyst software, creates an accurate, 3-dimensional digital model of the landscape with existing and proposed plumes. The terrain model can also produce a series of maps of the region showing the plume viewshed - areas from which the plume can be seen from ground level locations.

TABLE 1

Vermont Yankee Power EPU
Cooling Tower Visible Plume Analysis Results
(Albany Meteorological Data)

Plume Parameters	Baseline		120% Load Current NPDES		120% Load Proposed NPDES	
	High Flow	Low Flow	High Flow	Low Flow	High Flow	Low Flow
Winter:						
length (m)	N/A	N/A	150	400	N/A	N/A
width (m)	N/A	N/A	20	60	N/A	N/A
height (m)	N/A	N/A	20	40	N/A	N/A
Spring:						
length (m)	300	400	300	400	300	400
width (m)	70	80	70	80	70	80
height (m)	60	80	80	90	50	80
Summer:						
length (m)	150	200	150	150	150	150
width (m)	30	50	40	40	30	40
height (m)	30	40	30	40	30	30
Fall:						
length (m)	300	400	300	400	300	400
width (m)	70	80	70	80	60	70
height (m)	60	90	80	90	50	80

N/A: Not applicable

Source: Stone & Webster

Photos of the plant were taken from a number of representative Vermont locations: close, medium and distant perspectives and from north, south and west of the plant. A photo from the Hinsdale, NH shoreline of the Connecticut River was also taken to represent water views of the plant. Digital terrain models of the points shown in the photographs allowed the existing and proposed plumes to be represented. Photo simulations of these terrain models were then created in PhotoShop digital photo processing software. These produced realistic before and after photos of the plume changes which can be used to gauge visual impacts and likely public reaction to the changed plume dimensions.

The Vermont Yankee Plant on an Overcast Day Viewing South. The Cooling Towers Are Creating a 20 Meter High Vapor Plume.

3. Plume Dimensions

Table 1 shows projected changes in plume dimensions calculated by Stone & Webster. The Stone & Webster plume data describe the vapor plume which emanates from two rows of cooling towers which are 56.5' in height at their highest dimension. In most cases, Stone & Webster calculates that there will be little change in the dimensions of the visible plume due to an upgrade in the cooling tower fans. According to Stone & Webster, the stronger fans cool the warm water more efficiently, resulting in less visible vapor per Btu of plant output. The major change in plume visibility occurs in the winter when the cooling towers will again be periodically operated under the proposed changes to the plant. The proposed winter plumes will be smaller and less frequent than the winter plumes produced by the plant from 1972 to 1978.

Meteorological data for the study were based on statistics from Albany, NY, the most similar nearby location with detailed meteorological records. Albany, like Vernon, is located in a river valley. Data from Hartford, CT were also considered but were not used because they produced smaller plume dimensions. Since fall and spring data are relatively similar, the visual study used winter, summer and spring/fall data as the basis for the simulations. The study also simulated sunny and cloudy weather for each of the seasons to show a range of visual weather conditions. Wind for the visual study is assumed to be the average velocity and direction for each season: NNW at 6 mph for winter, NNW at 5.5 mph for spring/fall and S at 5 mph for summer. These average wind velocities and directions were used to calculate the shape and orientation of the plumes in the simulations.

This study uses the most representative plume dimensions listed in Table 1 for summer, winter and spring/fall. The largest possible plumes have not been simulated since they usually occur relatively infrequently during very hazy or foggy atmospheric conditions when it would be difficult to see the entire plume and much of the surrounding

landscape. Plume dimensions for summer and spring/fall have been calculated by averaging the high air flow and low air flow dimensions calculated by Stone & Webster (see Table 1). Winter plume dimensions consist of the larger low flow dimensions only because winter plumes under high flow conditions are not anticipated. For purposes of this study, current NPDES regulations are assumed to be in effect.

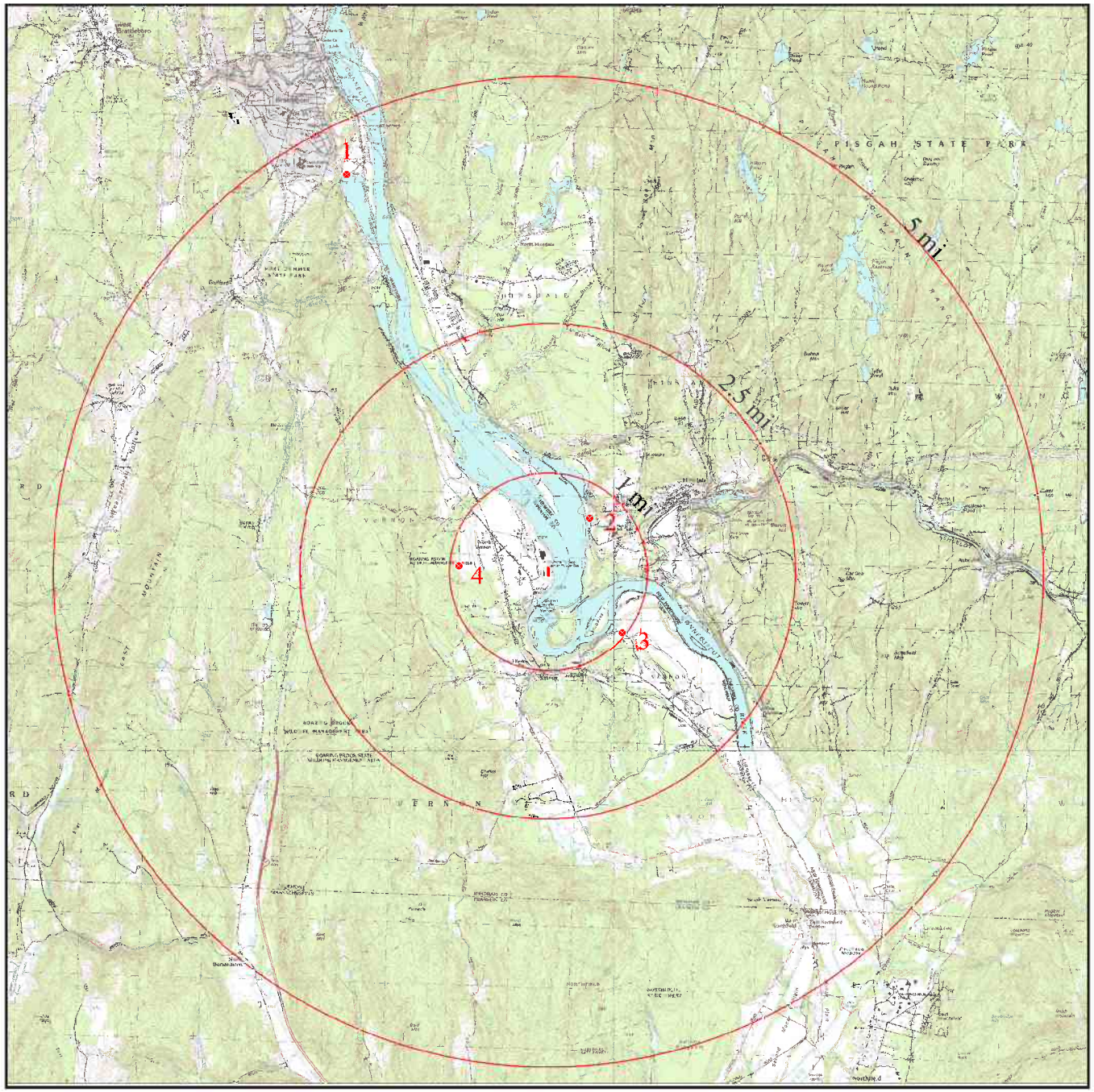
4. Viewsheds

To determine where the plumes would be visible from, Dodson Associates entered Stone & Webster's plume dimension data in a digital terrain model of the region using ArcMap 8.2 computer software. The model is based on US Geological Survey 7.5 minute quadrangle maps for the region. The model calculates the visibility of the vapor plume through an analysis of terrain. Two viewsheds were calculated: one for the existing plume and one for the proposed plume in each of three seasons: winter, summer and spring/fall. Spring and fall have been combined for this analysis because plume data for these two seasons is very similar. In most cases the proposed plume viewshed is similar or identical to the viewshed of the existing plume.

Three viewsheds are indicated by the red circles centered on the Vermont Yankee Plant. The foreground viewshed is located within 1 mile of the plant. The representative plume typically appears in the foreground of views in this area. The middleground viewshed is located from 1 to 2.5 miles of the plant. The representative plume typically appears in the middleground of views in this area. The background viewshed is located greater than 2.5 miles from the plant. The representative plume typically appears in the background of views in this area. The few areas with views of the plume located further than 5 miles from the plant will have very distant background views in which the plume appears as a small white object on the horizon.

Due to terrain, the plume is mainly visible to the north of the plant up to the southern portions of Brattleboro. To the south the plant is not as visible due to the nature of terrain in this area. To the east the state line forms the boundary of the study area along the western shores of

The Foreground Viewshed: Log Landing in North Vernon Viewing East Toward Vermont Yankee



Vermont Yankee Plume Visual Analysis

Base Map

February 18, 2003

0 mi. .5 mi. 1 mi. 2 mi.

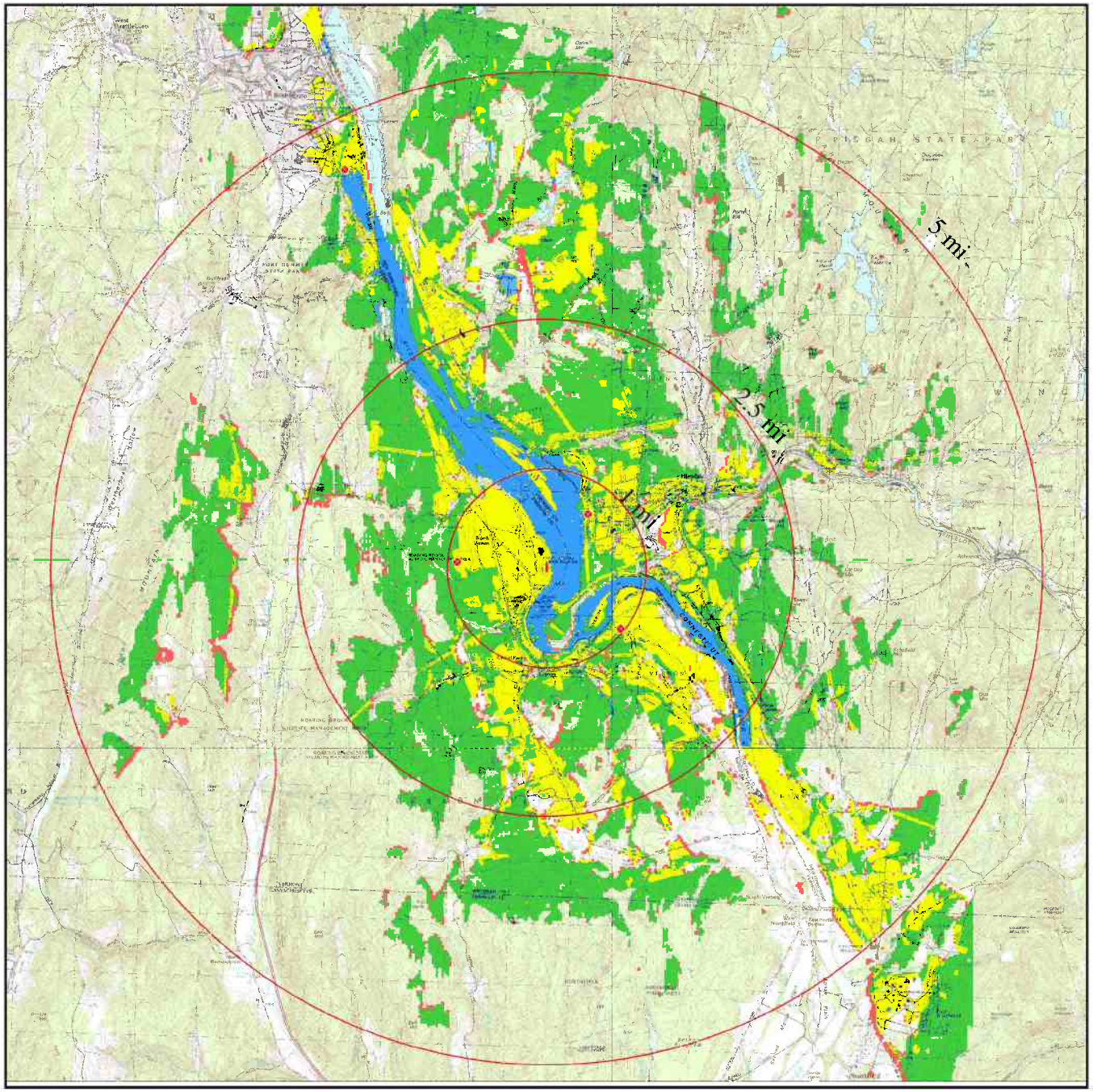
Key:

Cooling Towers

1 Photograph Location

Viewshed Zones:

Foreground Viewshed: < 1 Mile
Middleground Viewshed: 1-2.5 Miles
Background Viewshed: > 2.5



Vermont Yankee Plume Visual Analysis

Spring/Fall Viewshed

February 18, 2003

0 mi. .5 mi. 1 mi. 2 mi.

Key:

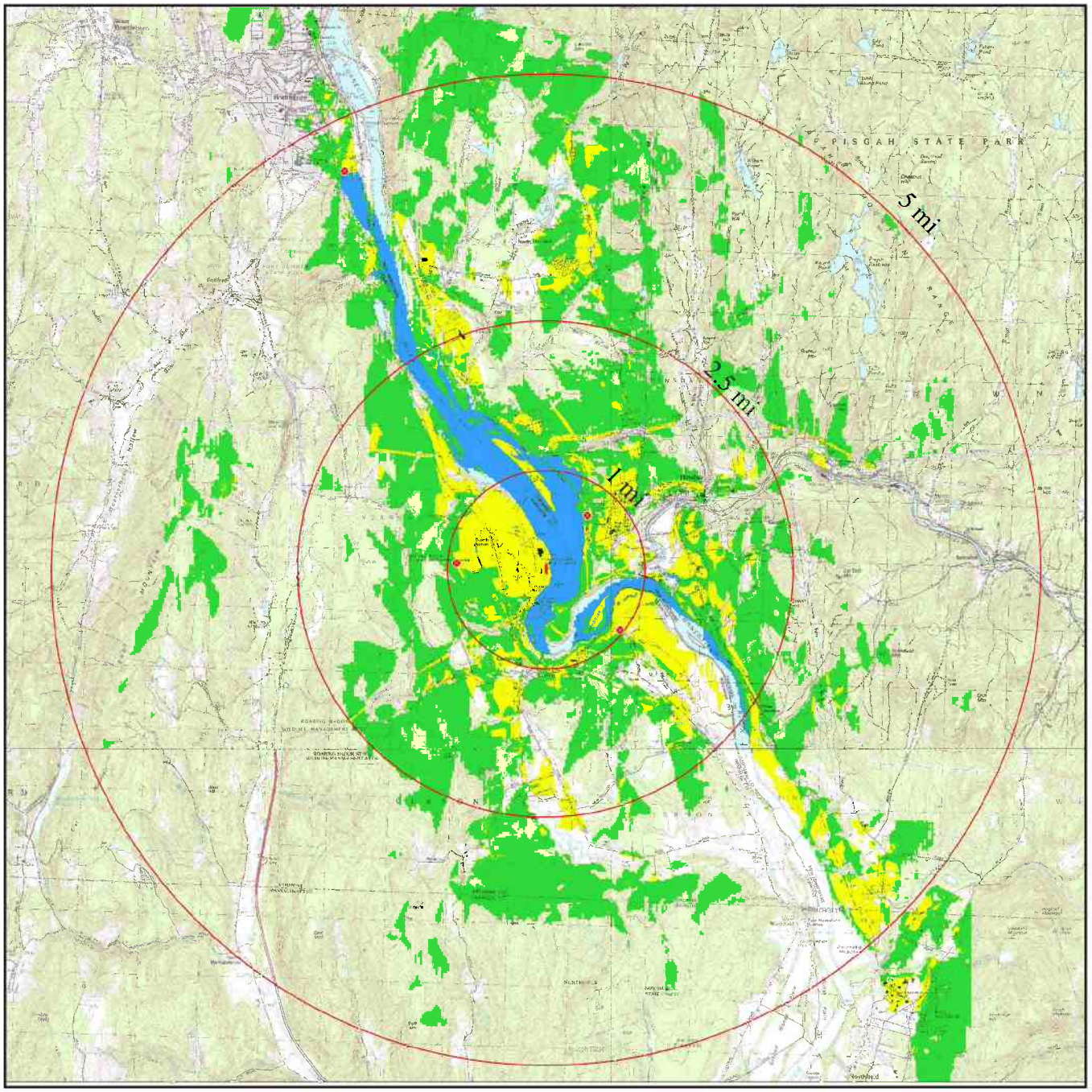
- Cooling Towers
- Photograph Location

Existing Viewshed:

- Viewshed Forested
- Viewshed Open
- Viewshed Water

120% Load:

- Viewshed



Vermont Yankee Plume Visual Analysis

Summer Viewshed

February 18, 2003

0 mi. .5 mi. 1 mi. 2 mi.

Key:

Cooling Towers

Photograph Location

Existing Viewshed:

Viewshed Forested (Very Few Views)

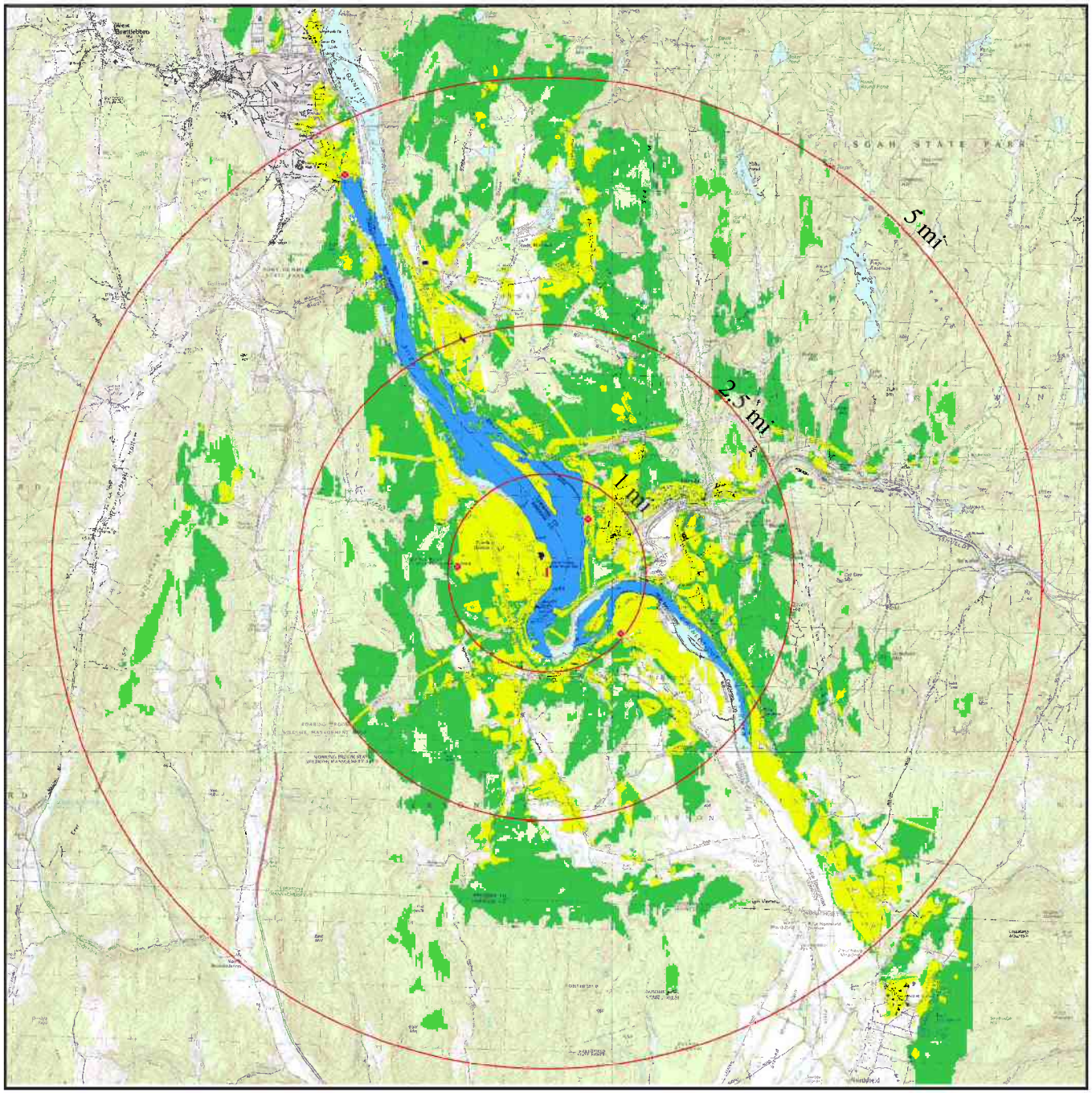
Viewshed Open

Viewshed Water

120% Load: No Difference

Viewshed Zones:

Foreground Viewshed: < 1 Mile
Middleground Viewshed: 1-2.5 Miles
Background Viewshed: > 2.5



Vermont Yankee Plume Visual Analysis

Winter Viewshed

February 18, 2003

0 mi. .5 mi. 1 mi. 2 mi.

Key:

- Cooling Towers
- Photograph Location

Existing Viewshed:No Plume

120% Load:

- Viewshed Forested
- Viewshed Open
- Viewshed Water

Viewshed Zones:

Foreground Viewshed: < 1 Mile
Middleground Viewshed: 1-2.5 Miles
Background Viewshed: > 2.5

the Connecticut River. To the west, the steep hills limit the visibility of the plume to the edges of the Connecticut Valley. Public roads providing views of the plume include portions of Route 142, Governor Hunt Road, Tyler Hill Road, Bemis Road, West Road, Pond Road, Stebbins Road and Blodgett Road. In addition to these roads, the viewshed includes farms, residences, a lumber yard, highway commercial businesses and a number of historic structures including the Governor Hunt Mansion which serves as the visitor center for the nuclear plant.

Most viewers will see the plume while driving on Route 142 in Vernon or Brattleboro. A one-mile section of Route 142 in Vernon northwest of the plant provides the clearest views, especially for southbound travelers. The plume is somewhat screened for northbound travelers. These full views will last from 1 to 1.5 minutes for typical travelers. Route 142 in Brattleboro provides intermittent views of the plume from a distance of 4 to 5 miles. At this distance the plume is a relatively small part of the landscape. Local roads in Vernon, including Tyler Hill, Bemis, Stebbins, Governor Hunt, Blodgett, West and Pond Road provide intermittent views of the plume depending on the season. Summer vegetation will tend to obscure many of these views since they are often screened by trees. Some utility corridors and hiking trails in the surrounding hills also provide distant views of the plume.

Two types of vegetation were used for this study: forests and open lands. Forests are defined by USGS as vegetation capable of hiding a person. This derives from the military uses of USGS maps. This classification system works well for visual analysis purposes since vegetation capable of hiding a person will also block that person's view of the surrounding landscape. Visibility in forested areas depends on the season, the density of vegetation, the type of vegetation (deciduous vs. evergreen), the slope (steep vs. flat) and the presence of nearby open areas. Open lands such as fields, meadows, lawns, low shrublands and unvegetated areas such as roads and parking lots provide generally unobstructed views of the surrounding landscape.

Most areas in the viewsheds are heavily forested hillsides where visibility is limited by trees and where few people live or visit. Some trails and gravel roads traverse these areas. The most visible and frequently traveled or inhabited areas are located in farmland and residential areas west and northwest of the plant. Route 142 traverses this area and has clear views of the plumes for about a mile. Local neighborhoods in Vernon to the south and west of the plant also have views of the plume, partially blocked in the summer by vegetation. Short stretches of Route 142 in Brattleboro and small areas along the river in the town center also have distant views of the plume as shown in the photo simulations.

6. Photographs

Digital color photographs were taken in early January, 2003 of various locations throughout the estimated viewshed of proposed plumes. The photos were taken in the late morning and early afternoon of a clear, sunny day with scattered clouds. A Canon Digital EOS D30 camera with a 35-80 mm zoom lens was used. The lens was kept in the range of 50mm to produce images as close as possible to those seen by the human eye. The digital camera was set on a large format (high resolution) image storage setting. Some of the photos were taken as a sequence of panoramas to portray the full width perceived by the human eye. Four photos were chosen to represent changes to the plume. The photos were selected to represent a range of viewing distances, directions, locations and contexts. The location and direction of the four photographs selected for use in this study are indicated on the location map. Photographs were taken at eye level from publicly accessible roads and trails. One close-up (3/4 mile) , two medium range (1 mile) and one distant photo (4.8 miles) were included. The selected photographs are panoramas created by joining two to three individual photos taken in a sequence. This recreates the wide cone of vision experienced in the field by the human eye.

View #1: Looking South from Route 142 in Southern Brattleboro - 4.8 Miles Distance

View #2: Looking West from the Hinsdale, NH Shore of the Connecticut River - 3/4 Mile Distance

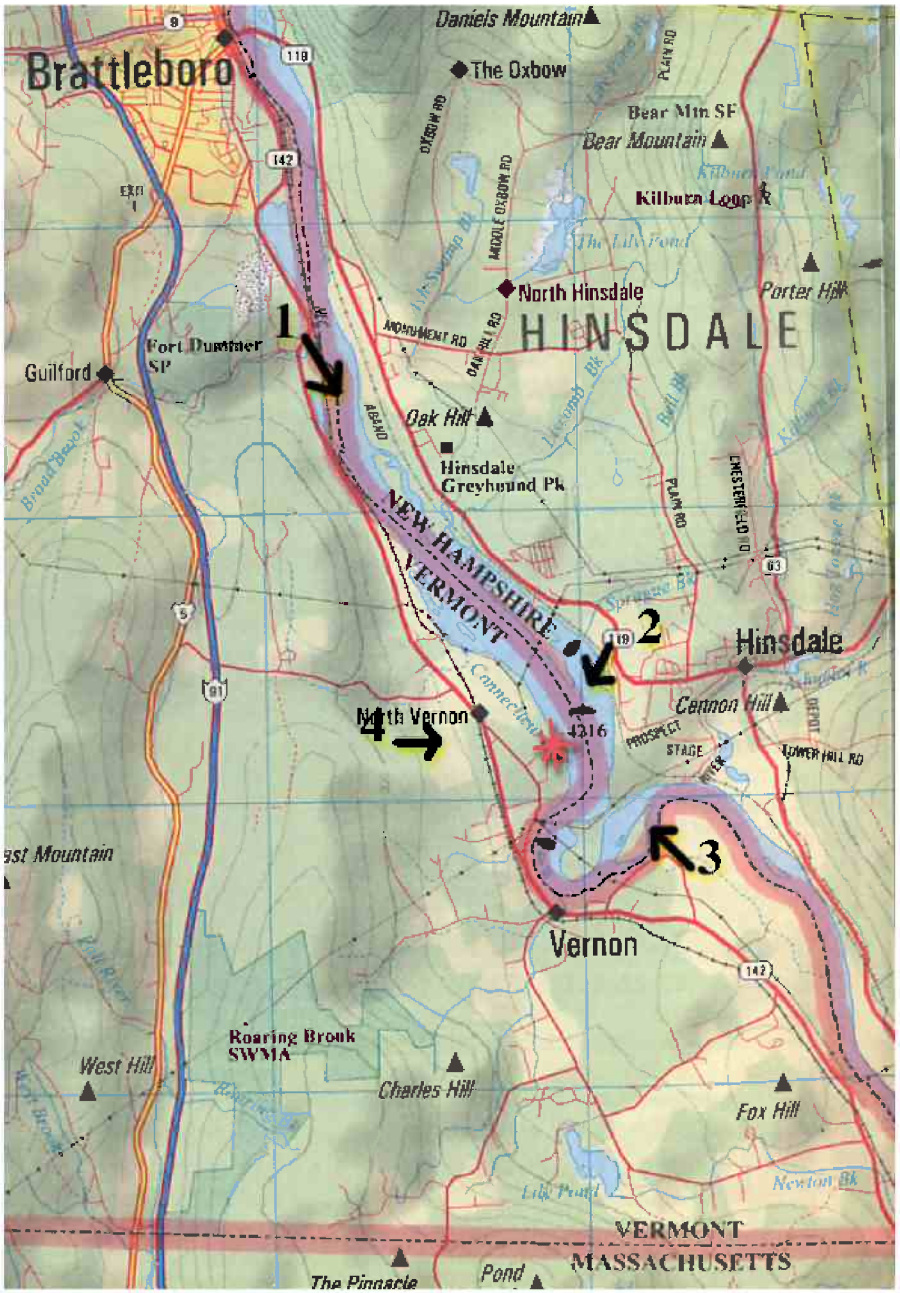
View #3: Looking North from Stebbins Road in Vernon - 1 Mile Distance

View #4: Looking East Toward North Vernon and the Plant from a Trail - 1 Mile Distance

6. Terrain Models

A total of 24 terrain models have been created showing views of existing and proposed plumes from four locations in the winter, summer and spring/fall. To construct accurate views of existing and proposed plumes, a digital terrain model of the plume viewshed was constructed using ArcView 3.2 3-D Analyst software. The model allows views to be constructed from any location in the viewshed, accurately showing the location, size and shape of the plumes. The existing power plant buildings, including the cooling towers, main building and stack were also entered into the model. Other features such as water bodies, buildings and roads were included in the model. The model did not include vegetation which was added as a factor in the photo simulation stage of the project.

Photographs showing the plume area from close, medium and distant locations to the south, north, east and west of the plant were taken around noon on a clear, sunny day in early January, 2003. Terrain model views were then constructed in the computer to represent the same views as shown in the photographs. This was done by constructing the terrain models from the same locations and viewing angles as the photos. The terrain models then calculated the exact height, width and length of the plume for winter, summer and spring/fall for each of the four views based on Stone & Webster's data. The accurate perspective views created by the terrain model served as the basis for the photo simulations of existing and proposed plumes to be described in later chapters. The terrain models provide a highly accurate but geometric representation of the plumes. The plumes were represented as simple rectangular shapes based on the dimensional data for each season provided by Stone & Webster. The photo simulations took this accurate representation and added detail, color, texture and seasonal factors to create a realistic and accurate simulation of future plume visual characteristics.



Map Showing the Location of the 4 Site Photographs

View #1: Photo Panorama Looking South toward the Vermont Yankee Plant from Route 142 in South Brattleboro

Terrain Model of View #1 Constructed in the Computer from Topographic Data

View #1: Spring/Fall Existing

View #1: Spring/Fall Proposed

View # 1: Summer Existing

View #1: Summer Proposed

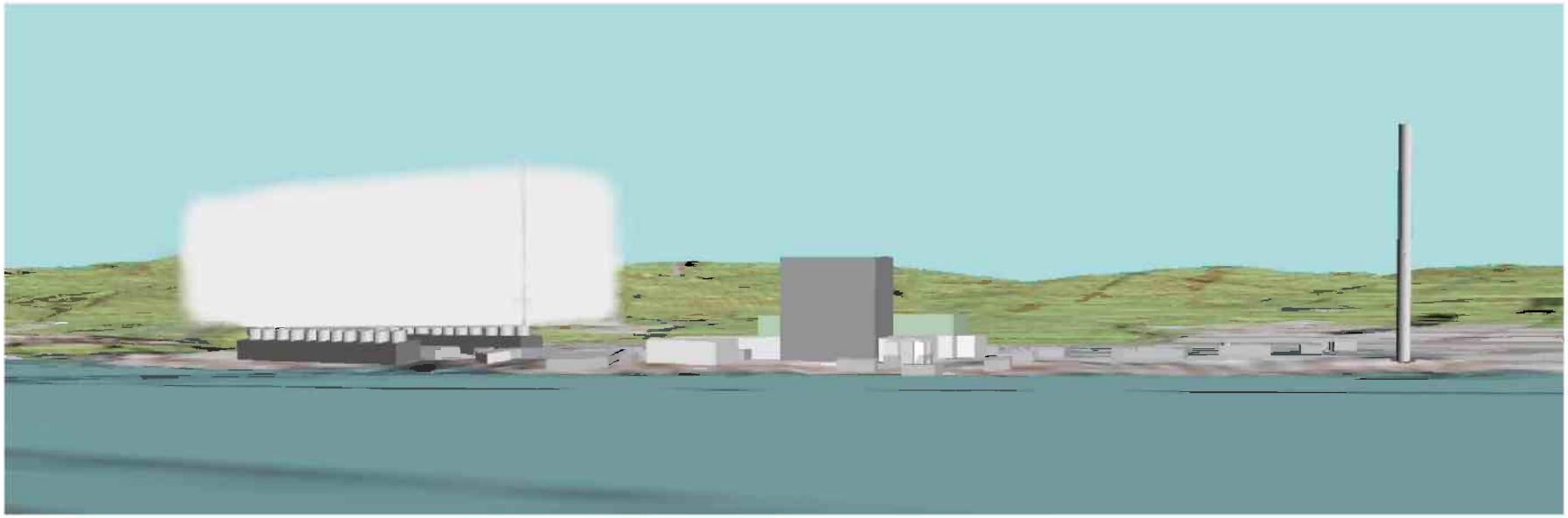
View #1: Winter Existing (No Plume since 1978)

View #1: Winter Proposed

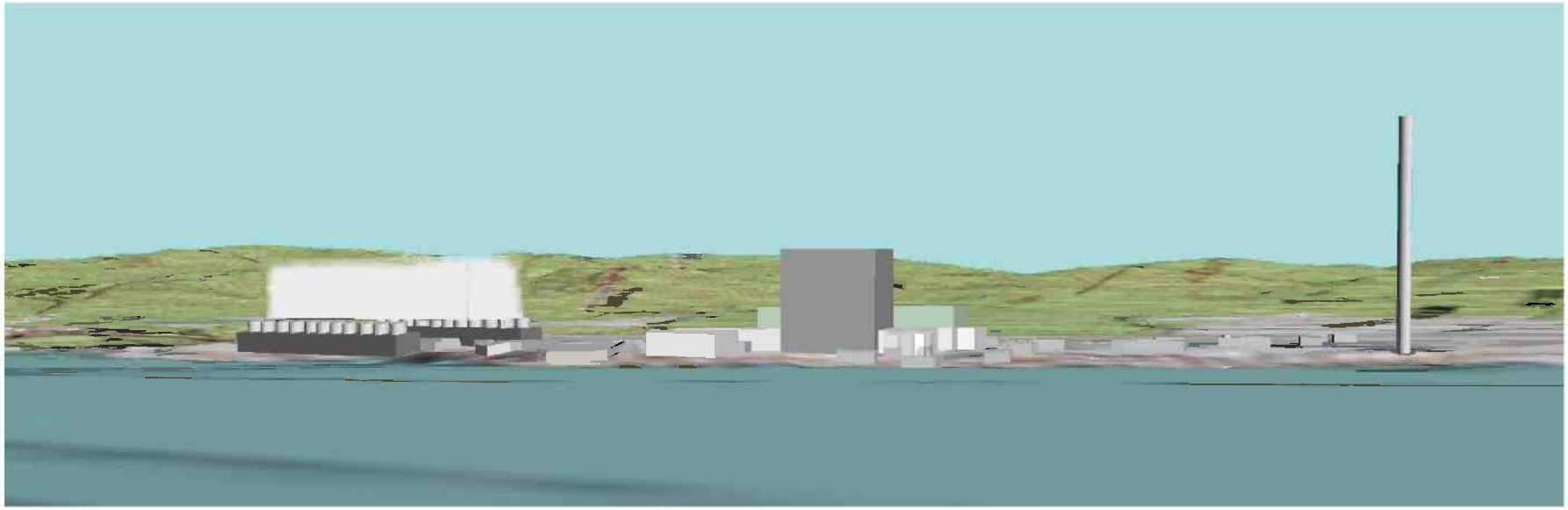
View #2: Photo Panorama Looking West toward the Vermont Yankee Plant from the Hinsdale, NH Shore of the Connecticut River

Terrain Model of View #2 Constructed in the Computer from Topographic Data and Building Plans

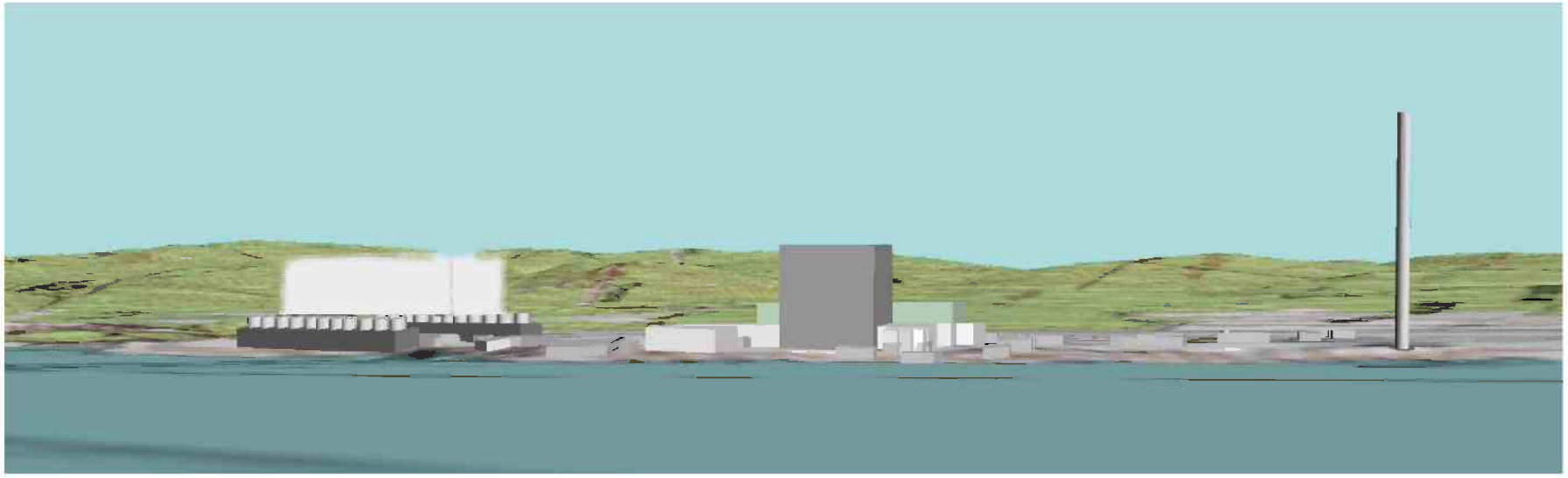
View #2: Spring/Fall Existing



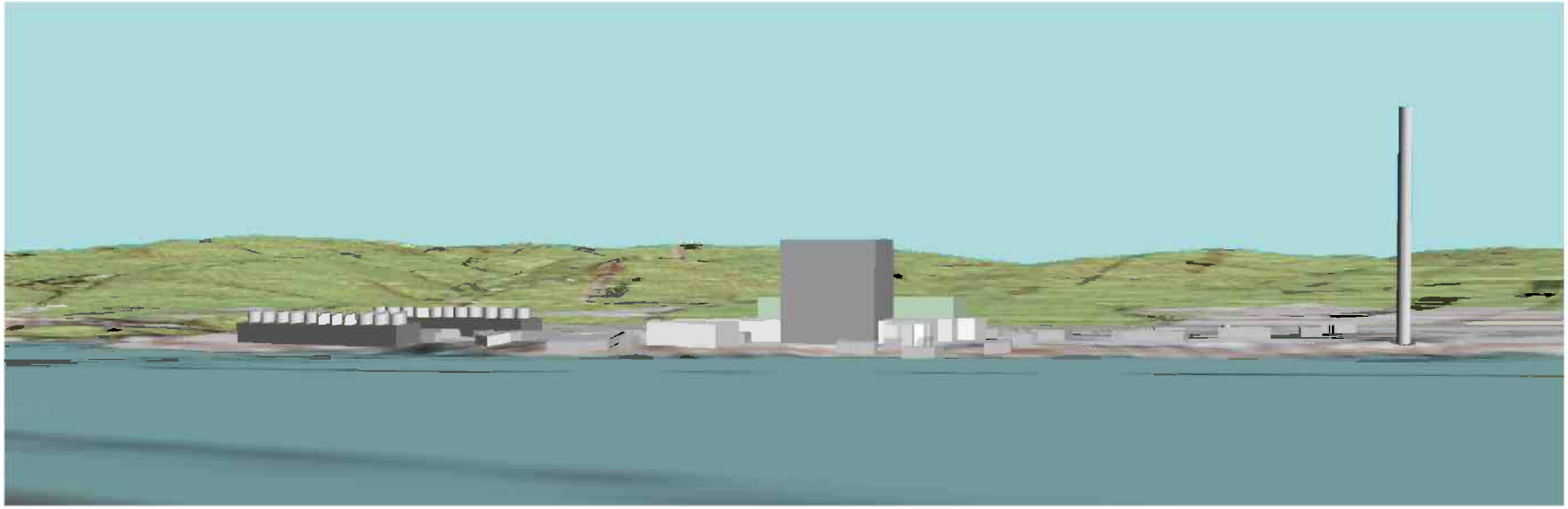
View #2: Spring/Fall Proposed



View #2: Summer Existing



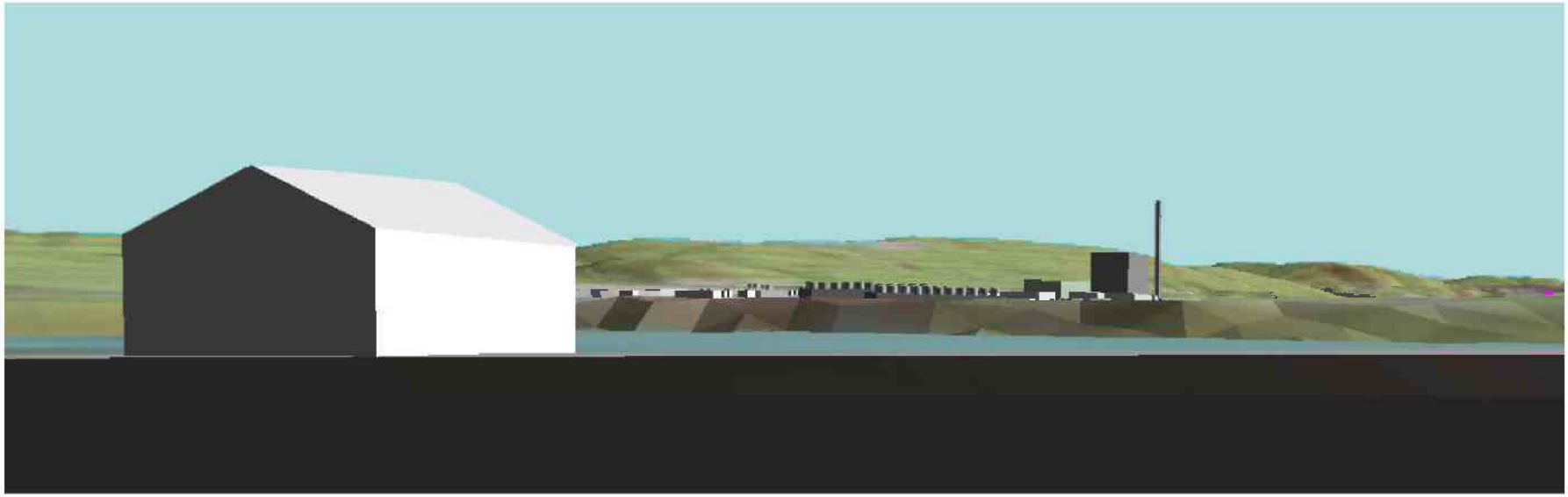
View #2: Summer Proposed



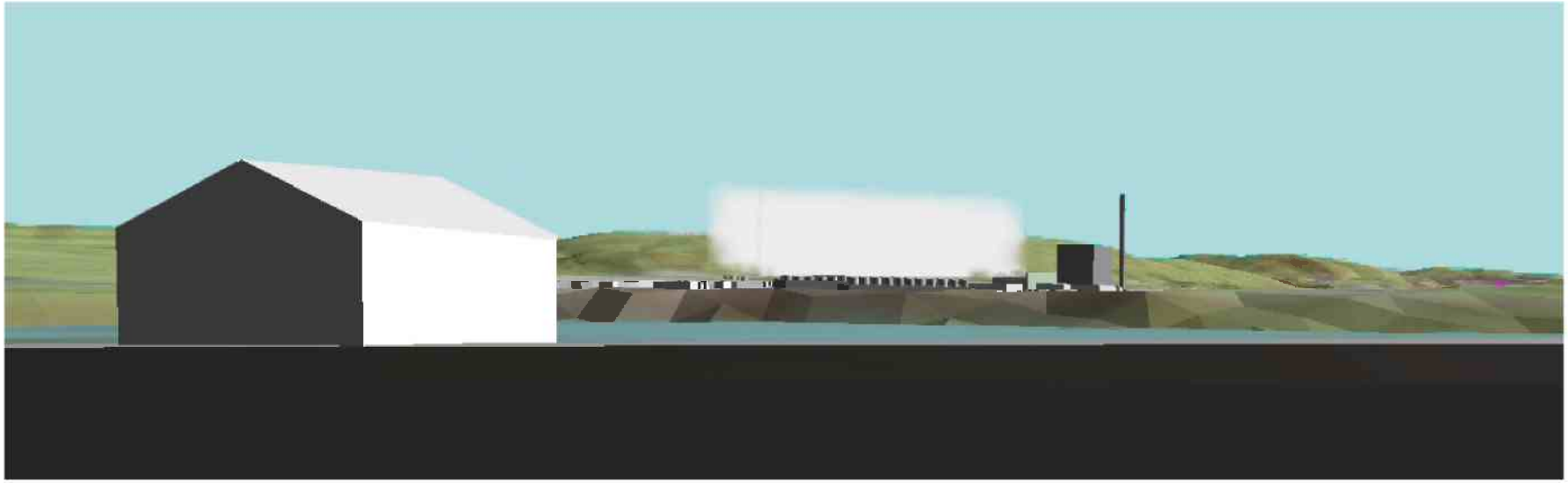
View #2: Winter Existing (No Plume Since 1978)

View #2: Winter Proposed

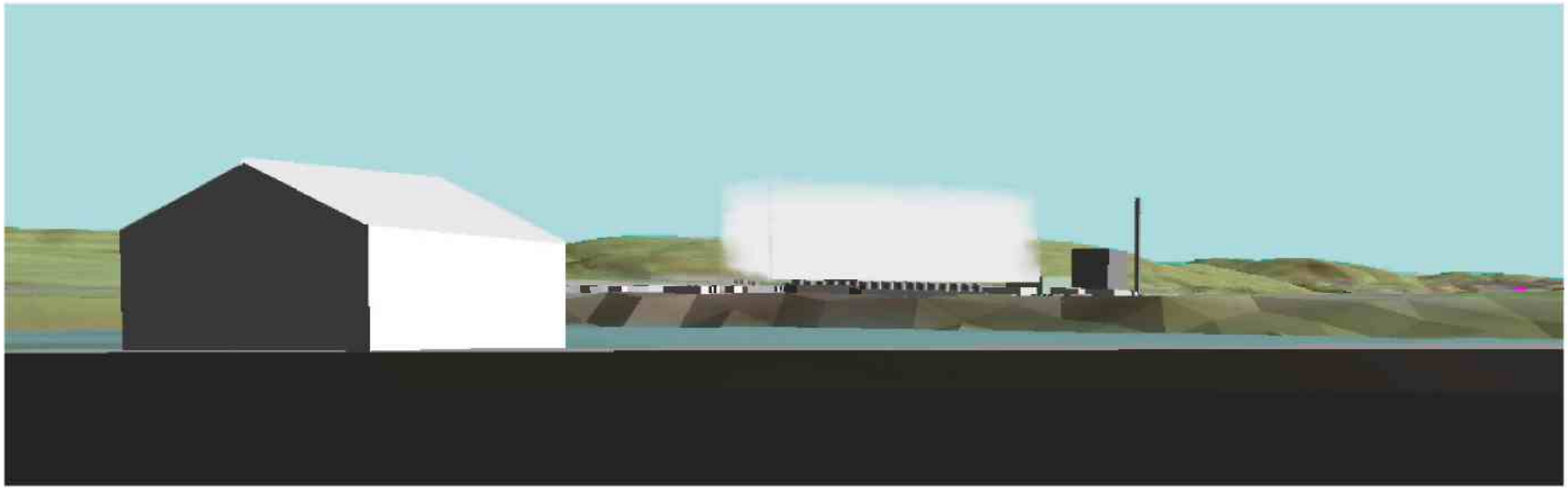
View #3: Photo Panorama Looking North toward the Vermont Yankee Plant from Stebbins Road in Vernon Center.



Terrain Model of View #3 Constructed in the Computer from Topographic Data and Building Plans

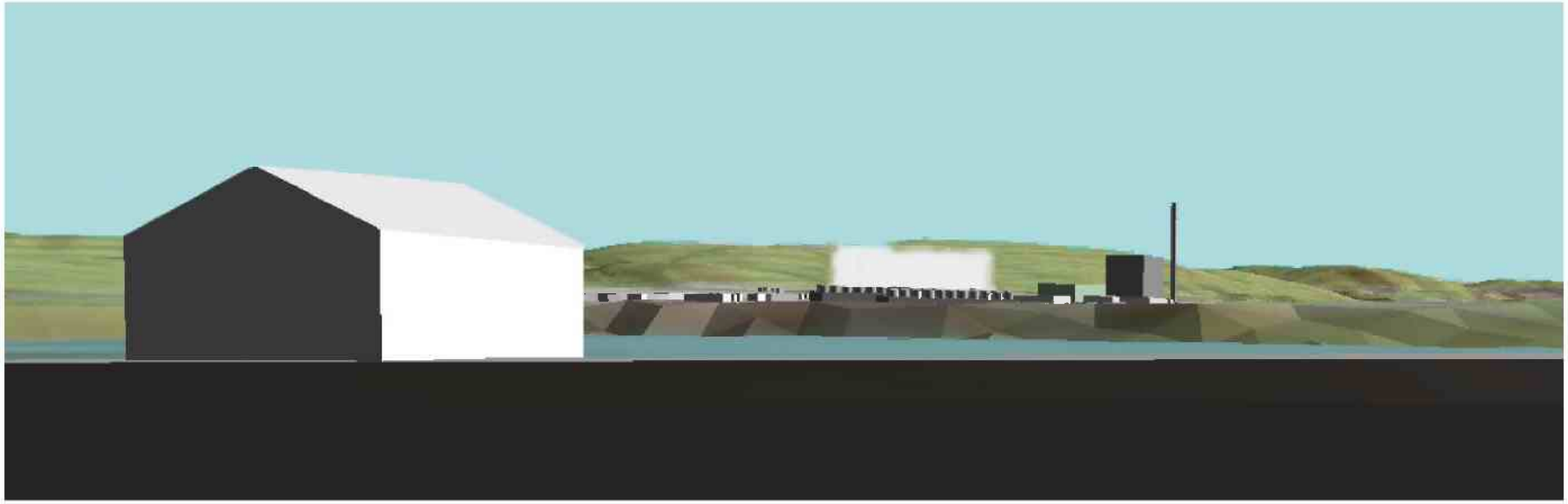


View #3: Spring/Fall Existing

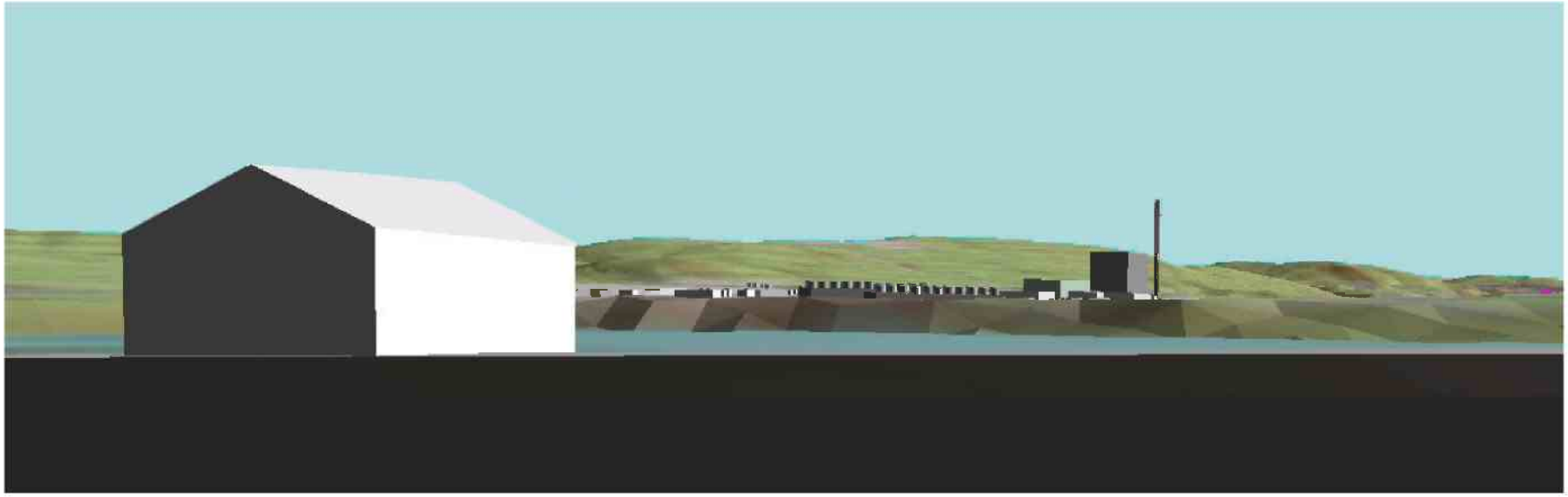


View #3: Spring/Fall Proposed

View #3: Summer Existing



View #3: Summer Proposed



View #3: Winter Existing (No Plume Since 1978)

View #3: Winter Proposed

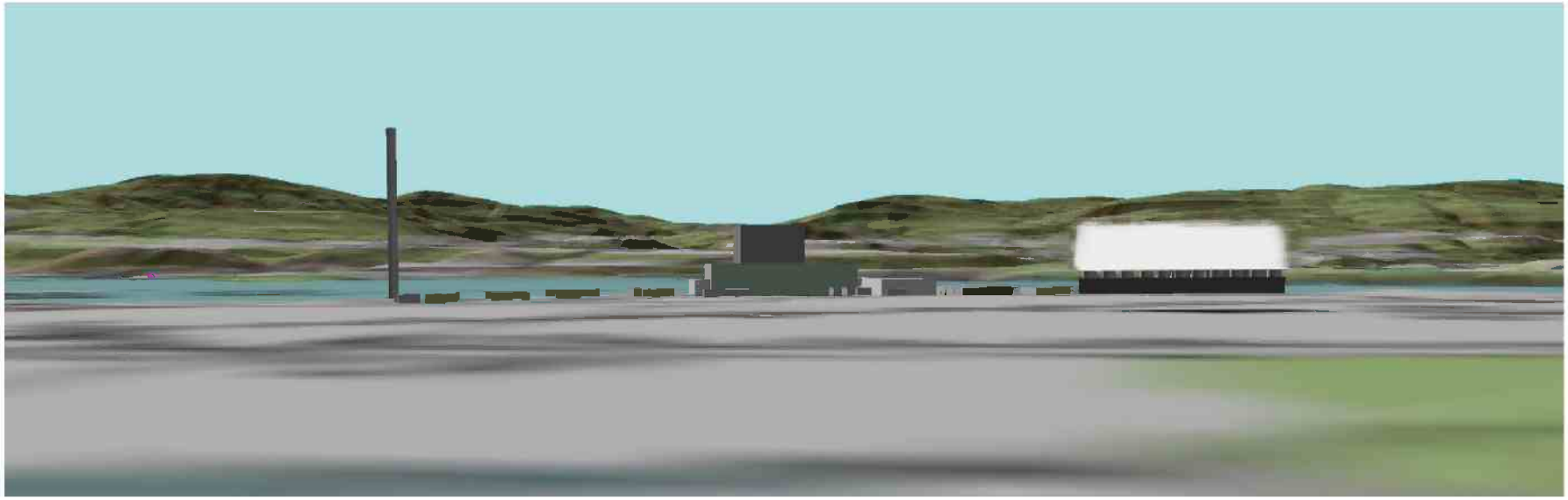
View #4: Photo Panorama Looking East Toward North Vernon and the Vermont Yankee Plant

Terrain Model of View #4 Constructed in the Computer from Topographic Data

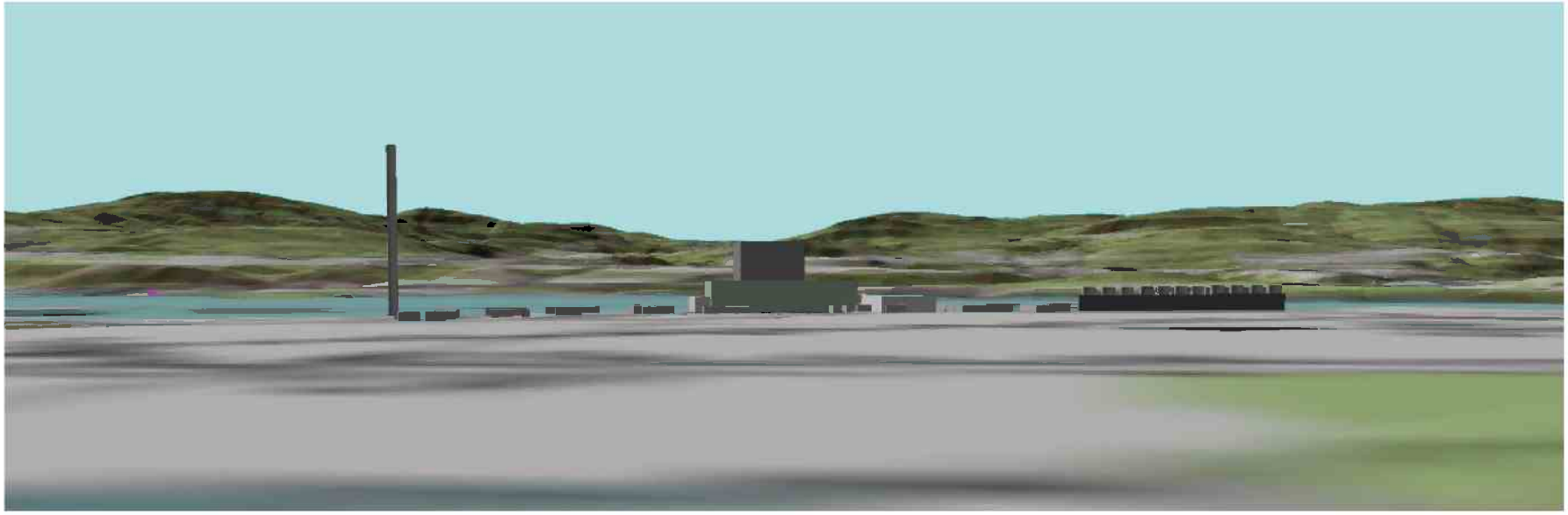
View #4: Spring/Fall Existing

View #4: Spring/Fall Proposed

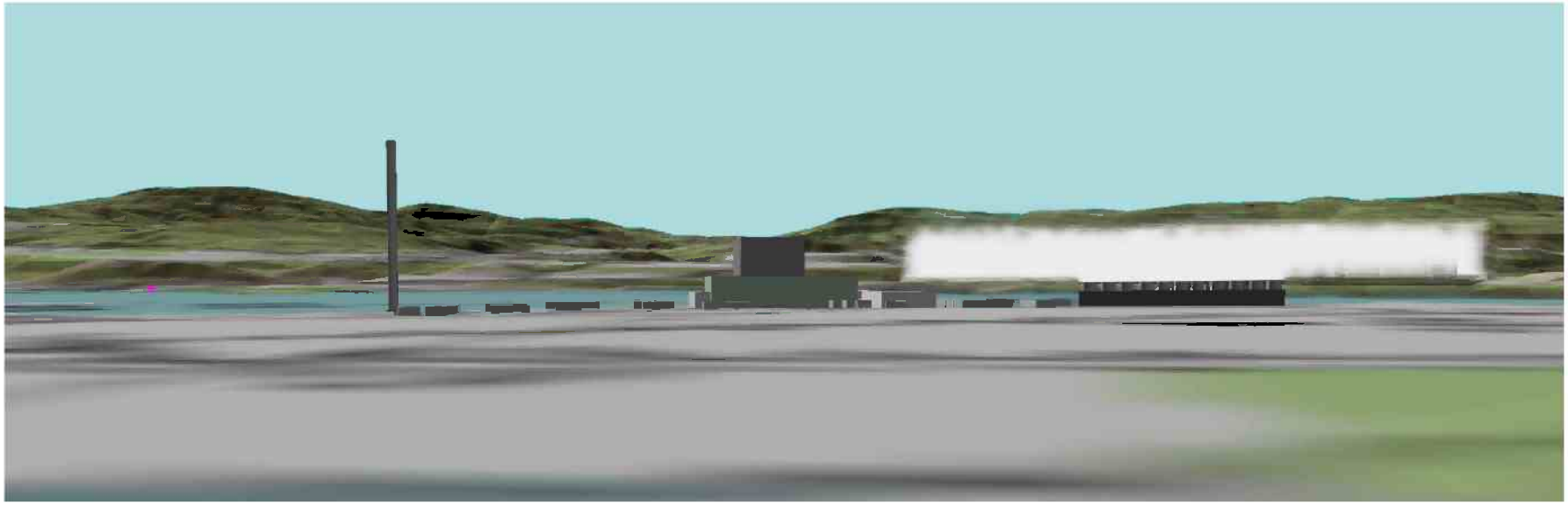
View #4: Summer Existing



View #4: Summer Proposed



View #4: Winter Existing (No Plume Since 1978)



View #4: Winter Proposed

7. Photo Simulations

Simulations of the existing and proposed plumes were created using the photographs taken from the four selected sites. To create an accurate simulation of the plumes, terrain model views were constructed from each of the sites showing the existing and proposed plumes during the winter, summer and spring/fall. The terrain model views were then superimposed on the photographs, showing exactly where plumes would appear in each view. Using PhotoShop 5.5 software, existing and proposed plumes were then inserted into the photographs at the exact locations specified by the terrain model. Because plume dimensions vary according to seasonal and atmospheric conditions, simulations of existing and proposed plumes were created for both clear and cloudy days in the winter, summer and spring/fall. Spring and fall were combined because projected plume dimensions are very similar for both of these seasons. The following chart describes the various factors used in creating the photo simulations:

Plume Type	Existing
	Proposed
Atmospheric Conditions:	Clear, sunny sky
	Cloudy, overcast sky
Season:	Winter
	Summer
	Spring/Fall

The time of day shown in the photographs is noon for winter, 2 PM for spring/fall and 4 PM for summer. The winter photographs were modified using PhotoShop to show clear as well as cloudy atmospheric conditions. Summer and spring/fall features were added to the winter photographs to show foliage, water and the brighter light typical of these seasons. The average wind speed and direction for each season were factored into the simulations. Plumes were simulated to show the effects of a 6 mph north-northwest wind for winter, a 5.5 mph north-northwest wind for spring/fall and a 5 mph south wind for summer simulations. These winds are incorporated in Stone & Webster's plume data as shown in Table 1.

Cloudy and clear skies create differing optical and perceptual conditions for viewing of the plume. Clear skies accentuate the contrast between the light tones of the plume and the darker tones of the blue sky. Direct sunlight brightens the plume and creates contrasting highlights and shadows in its form. The darker blue skies of the zenith create strong contrasts when the plume is seen at a close distance and is relatively high in the sky. The lighter tones of blue sky nearer the horizon reduce the visual contrast of the plume for more distant viewing perspectives. Overcast skies tend to reduce the visibility of the plume by reducing the brightness of the plume itself and by reducing the contrast between the plume and the overcast sky. The tones of the plume and the clouds tend to be closer, reducing contrast and visibility. Seasonal and meteorological variability will modify the visibility of the plumes. Dark clouds will increase plume visibility and lighter clouds will tend to reduce it. Haze in the atmosphere will also reduce plume visibility while dry, clear weather will tend to increase it. The photo simulations have taken these variations into account to the extent possible given the potentially wide range of variations possible on the site. Clear skies were present in the original photographs. Cloudy skies were simulated by inserting a dense cloud cover, by reducing the light intensity of the image and by eliminating direct light and shadows in the landscape.

Because the plume does not currently operate in the winter, no plume was available to photograph for this project. Simulated plumes were based on images of the actual Vernon nuclear plant plume photographed in the past. These past photographs were taken in the summer, spring and fall months. Winter plumes were simulated by increasing the density and reflectivity of the spring and fall plumes.

View #1: Spring/Fall Clear - Existing

View #1: Spring/Fall Clear - Proposed

View #1: Spring/Fall Cloudy - Existing

View #1: Spring/Fall Cloudy - Proposed

View #1: Summer Clear - Existing

View #1: Summer Clear - Proposed

View #1: Summer Cloudy - Existing

View #1: Summer Cloudy - Proposed

View #1: Winter Clear - Existing

View #1: Winter Clear - Proposed

View #1: Winter Cloudy - Existing

View #1: Winter Cloudy - Proposed

View #2: Spring/Fall Clear - Existing

View #2: Spring/Fall Clear - Proposed

View #2: Spring/Fall Cloudy - Existing

View #2: Spring/Fall Cloudy - Proposed

View #2: Summer Clear - Existing

View #2: Summer Clear - Proposed

View #2: Summer Cloudy - Existing

View #2: Summer Cloudy - Proposed

View #2: Winter Clear - Existing (No Plume Since 1978)

View #2: Winter Clear - Proposed

View #2: Winter Cloudy - Existing (No Plume Since 1978)

View #2: Winter Cloudy - Proposed

View #3: Spring/Fall Clear - Existing

View #3: Spring/Fall Clear - Proposed

View #3: Spring/Fall Cloudy - Existing

View #3: Spring/Fall Cloudy - Proposed

View #3: Summer Clear - Existing

View #3: Summer Clear - Proposed

View #3: Summer Cloudy - Existing

View #3: Summer Cloudy - Proposed

View #3: Winter Clear - Existing (No Plume Since 1978)

View #3: Winter Clear - Proposed

View #3: Winter Cloudy - Existing (No Plume Since 1978)

View #3: Winter Cloudy - Proposed

View #4: Spring/Fall Clear - Existing

View #4: Spring/Fall Clear - Proposed

View #4: Spring/Fall Cloudy - Existing

View #4: Spring/Fall Cloudy - Proposed

View #4: Summer Clear - Existing

View #4: Summer Clear - Proposed

View #4: Summer Cloudy - Existing

View #4: Summer Cloudy - Proposed

View #4: Winter Clear - Existing (No Plume Since 1978)

View #4: Winter Clear - Proposed

View #4: Winter Cloudy - Existing (No Plume Since 1978)

View #4: Winter Cloudy - Proposed

8. Discussion of Visual Impacts

Summary: Because the differences in plume dimensions and frequency of operation between existing and proposed plumes are negligible to non-existent in the spring, summer and fall, there will be no perceptible visual change to the plume during these seasons. The primary visual change resulting from the proposed operational modifications will be the return of a winter plume on a periodic basis for the first time since 1978.

Summer: In the summer there will be no change in the dimensions or the frequency of the vapor plume, resulting in no visual changes. This has been made possible by the installation of larger fans in the cooling towers. Even though more vapor will be produced by the proposed higher plant operating levels, the more powerful fans dissipate the vapor more efficiently, resulting in no change in plume dimensions from current operating conditions. The viewshed area for the simulated summer plume is identical to the viewshed area for existing summer plumes.

Spring/Fall: Visual simulations of the plume for spring and fall have been combined because projected plume dimensions for each of these seasons are virtually identical. Spring and fall plume widths and lengths will remain the same as existing widths and lengths. Spring and fall plume heights will increase by an average of 16% from existing conditions. These changes have been incorporated in the terrain models and the photo simulations. The increases in plume height for spring and fall are perceptible when directly compared with a similar image of existing plumes. The proposed 16% increase in spring/fall plume height will not be readily perceptible in the field without comparison to existing plumes. For example, the photo simulations of existing and proposed plumes can be distinguished from each other when held next to each other. But it is difficult to identify them when they are viewed one by one.

The viewshed map for spring/fall shows that the slightly higher plume will be visible from a slightly larger viewing area. Most of the increased viewing area occurs in the surrounding wooded hills which have limited visibility of the plant and relatively few viewers. A 16% increase in plume height will also allow the plume to appear slightly more prominently in areas with existing views of the plume such as along Route 142 and some of the local roads in Vernon. This is a relatively minor visual change.

Winter: The cooling towers have not been not operated in the winter since 1978. The proposed restoration of winter cooling tower operation will result in a change in the winter visual landscape of recent years as shown in the attached photo simulations. The projected average winter plume sizes are similar to plumes in the warmer months but will only be visible less than 20% of the time. Because of winter atmospheric conditions, they will tend to be denser and whiter than warm season plumes.

While the appearance of a vapor plume in the winter will represent a change in the visual landscape of the past several decades, it will not be a major change due to the fact that plumes are visible at the plant during all the other seasons of the year and that winter plumes existed until 1978. Winter in New England is also a time when vapor and steam plumes are typically seen from homes, schools, offices, factories and other heated structures. The temperatures and dry air of winter tend to accentuate plume formation from a variety of sources. The proposed Vermont Yankee plume will be a part of this winter vapor plume effect.

The viewshed of the winter plume is similar to viewsheds in the other seasons. Since no plume currently exists in the winter, the existing viewshed consists of views of the plant structures.

9. Quechee Analysis

The Environmental Board provided guidance to determine the aesthetics of a project under Act 250 in the Quechee Lakes case. As a result of that case, the aesthetics of a project are evaluated under a two-stage test: first, is there an adverse aesthetic impact and, if so, is it undue?

Quechee Analysis - Part I: Is there an adverse aesthetic impact? As part of this analysis, it must be determined whether or not the project will be in "harmony" with its surroundings and will "fit" in the context within which it will be located. The findings for the first stage are presented in accordance with of the Environmental Board's guide questions:

Question #1: a) What is the nature of the project's surroundings? b) Is the project to be located in an urban, suburban, village, rural or recreational resort area? c) What land uses presently exist? d) What is the topography like? e) What structures exist in the area? f) What vegetation is present? g) Does the area have particular scenic values?

Answer #1: a) The project is immediately surrounded by a nuclear power plant, parking lots and administrative buildings on the banks of the Connecticut River. Beyond the plant, the area is surrounded by evergreen forests, houses, a state highway, the Vernon Dam and electric generating plant, farmland and forested hills.

b) The project will be located in the Vermont Yankee nuclear power plant, an industrial area. The surrounding context for the plant is rural farmland and a small village.

c) Current land uses include the Vermont Yankee nuclear power plant and the Vernon Dam (industrial), forests, residential hamlet, highway commercial and farmland. The Vermont Yankee plant has been in operation since 1972. The cooling towers operated year-round from 1972 to 1978. Since 1978 the cooling towers have only operated in the spring, summer and fall.

d) The topography consists of several relatively flat river terraces separated by gradual slopes. The plant is located on a lower terrace next to the river. Hills rise from the flat valley floor approximately

Typical Vernon Landscape. The Vermont Yankee Plant is Hidden in the Woods to the Left. When Operating, the Plume Will Be Partially Visible Behind the Large Trees.

1/2 mile to the west.

e) The area includes the nuclear power plant, cooling towers, administrative buildings, communications towers, a concrete stack, parking lots, the Vernon Dam and substation, electric transmission lines. Beyond the plant structures include historic and recent housing in a small village, farm buildings, small highway commercial buildings, utility lines and a railroad line.

f) Vegetation includes lawns, pine forests, farm fields, riparian vegetation along the Connecticut River, residential landscapes and mixed deciduous/evergreen forests on the hillsides.

g) The immediate area of the nuclear plant is an industrial site and is not scenic. The surrounding context of the plant including the river, farmland, forested hills and historic villages is scenic. Because it is located on a low river bench, the nuclear plant is relatively unobtrusive in the landscape, especially as seen from the south. This allows the surrounding landscape to remain scenic in spite of the presence of a large industrial facility.

Question #2: a) Is the project's design compatible with its surroundings? b) Is the architectural style of the buildings compatible with other buildings in the area? c) Is the scale of the project appropriate to its surroundings? d) Is the mass of structures proposed for the site consistent with land use and density patterns in the vicinity?

Answer #2: a) The proposed plumes are very similar in size to the existing plumes and will therefore be compatible with their industrial surroundings. Winter plumes will be new but will be consistent with an industrial facility located in a rural setting.

b) No buildings are proposed. The vapor plume will be very similar to existing vapor plumes that have been present on the site since 1972.

Pond Road Viewing North. The Plant is Located Behind the Hill to the Right

c) The scale of the proposed vapor plume is very similar or identical to the existing plumes. Proposed winter plumes are smaller and less frequent than those in existence from 1972 to 1978.

d) No structures are proposed. The mass of the proposed vapor plume is very similar to existing plumes. Proposed winter plumes are smaller and less frequent than those in existence from 1972 to 1978.

Question #3: Are the colors and materials selected for the project suitable for the context within which the project will be located?

Answer #3: The proposed plumes will be identical in color and density to the existing plumes. They will not feel offensive or out of place because they are a continuation of a common visual phenomenon that has existed in the landscape during the warmer months since 1972. Vapor plumes are also a very common visual element of the Connecticut Valley in winter, emanating from mills and other facilities

along many areas of the river in Vermont and New Hampshire. These vapor plumes have been a factor in the traditional Connecticut Valley visual landscape since the beginning of the industrial revolution.

Question #4: Where can the project be seen from? b) Will the project be in the viewer's foreground, middleground and background? c) Is the viewer likely to be stationary so that the view is of long duration, or will the viewer be moving quickly by the site so that the length of view is short?

Answer #4: a) Please see the attached viewshed maps which precisely define the visibility of the existing and proposed plumes.

b) Most viewers see the plumes while driving along a mile-long stretch of Route 142 in Vernon. Distant views are also visible along portions of Route 142 in Brattleboro Some views are also available to smaller numbers of people along town roads in Vernon. The existing and proposed plumes are primarily in the viewers' middleground in Vernon and background in Brattleboro.

c) Most viewers of the existing and proposed plumes are travelling north or south on Route 142 in Vernon or Brattleboro. The duration of views in Brattleboro averages several seconds and the plumes are small in relation to the surrounding landscape. The duration of views for southbound travelers on 142 in Vernon is around one minute assuming normal travel speeds. Northbound travelers have a less clear view of the plumes and will see them for 20 to 30 seconds assuming normal travel speeds. Travelers on local roads are less numerous and generally have more obstructed views of the plumes. Local residents and visitors can see the plumes from certain locations for longer amounts of time (see Viewshed Map). Viewers from fixed locations are much less numerous than travelers on local and state roads.

Question #5: a) What is the project's impact on open space in the area? b) Will it maintain existing open areas or will it contribute to the loss of open space?

Answer #5: a) The project will have no impact on open space in the area. It involves minimal changes to the vapor plume at the Vermont Yankee plant.

b) The project will not affect existing open areas one way or another and it will not contribute to the loss of open space.

Conclusion: There is no adverse impact because the project proposes little to no visual change to an industrial use which has existed on the site since 1972. Even if the impact were deemed adverse, it should not be considered undue, as explained below.

Quechee Analysis - Part II: The next step is to determine if the projects impact is undue. An impact is undue if a positive conclusion is made with regard to any one of three areas: 1) community standards, 2) offense to aesthetic sensibilities and 3) mitigative steps. The following are guiding questions from the Environmental Board and the proponents' answers to these questions.

Question #1: Does the project violate a clear, written community standard intended to preserve the aesthetics or scenic, natural beauty of the area? Such standards may, for example, be set forth in the local or regional plan, or be adopted in the creation of a historic design district, or be incorporated into a municipal or state scenic road designation. If the Board or Commissions find that such standards do exist, and the project as designed would violate these standards, the adverse impact would be undue.

Answer #1: The Vernon Town Plan and the Windham Regional Plan outline standards and policies for scenic areas. The proposed project respects these standards and policies (see discussion below). There are no known historic design districts or scenic roads in the viewshed area. The Town of Vernon recently voted to endorse the

proposed project.

Question #2: Does the project offend the sensibilities of the average person? The Vermont Legislature has directed the Commissions and the Environmental Boards, composed of lay people from many different communities in Vermont, to determine what is acceptable in terms of new developments' impact on aesthetics and scenic and natural beauty. If the sensibilities of these commission and board members are collectively offended by a project, its impact under Criterion 8 is undue. It is not enough that commission and board members might prefer to see a different design or style of building or that they might prefer a different type of land use, but that the project, when viewed as a whole, is offensive or shocking, because it is out of character with its surroundings, or significantly diminishes the scenic qualities of the area.

Answer #2: The project does not offend the sensibilities of the average person because little or no visual change will result from the proposed improvements to the power plant. As shown in the attached photo simulations, the proposed changes to the vapor plume are so small as to be imperceptible in the spring, summer and fall seasons. These very small to nonexistent changes cannot offend the sensibilities of the average person because they literally cannot be seen.

Proposed operation of the cooling towers less than 20% of the time in the winter will result in a minor visual change in the winter months. Restoration of winter operation of the cooling towers will not offend the sensibilities of the average person because vapor plumes have been present in Vernon since 1972 in the spring, summer and fall. An occasional winter vapor plume will not appear out of place or unusual because plumes are an accepted part of the landscape in Vernon and Brattleboro during most times of the year. Many other buildings, factories and plants emit vapor plumes in the winter along the Connecticut River and have done so since the beginning of the industrial revolution. Vapor plumes are an accepted part of the cultural and historic landscape of the region. Because the plumes consist of vapor and not polluting smoke, they are accepted as a benign element of the winter landscape. The projected dimensions of the average Vermont Yankee winter vapor plume: 40 meters high, 60 meters wide and 400 meters long compares with the dimensions of plumes in other seasons and does not represent a significant increase in plume size or appearance. It will not be offensive or shocking to the average viewer because it was visible from 1972 to 1978 and already is an accepted visual element in the landscape.

West Road Looking Northeast. The Vermont Yankee Plant is Located Below the Right Horizon. No Plumes Will Be Visible From This Location.

Route 142 Looking South Toward the Vermont Yankee Plant

Question #3: Has the applicant failed to take generally available mitigating steps which a reasonable person would take to improve the harmony of the proposed project with its surroundings? Such steps may include selection of less obtrusive colors and building materials, implementation or landscaping plans, selection of a less obtrusive building site within a project area or reduction of the mass or density of the project.

Answer #3: Vermont Yankee is proposing to replace the existing fans in the cooling towers with larger fans. This will allow the vapor plume dimensions to remain essentially the same in spite of a significant increase in cooling demand under the proposed alterations to the plant. This represents a significant mitigating step that avoids the creation of larger plumes due to greater cooling demands. Vermont Yankee may also seek to modify its NPDES permit winter thermal discharge limitations which would obviate the need to run the cooling towers in the winter.

Conclusion: The proposed visual changes are neither adverse nor undue. They continue relatively unchanged a visual element that has been part of the area's landscape since 1972. Vapor plumes have been a part of Vermont's landscape for over 100 years and are an accepted part of Vernon's landscape.

10. Compliance with Local Plans & Policies

The Select Board and Planning Commission of the Town of Vernon recently voted to support Entergy Vermont Yankee's Extended Power Uprate (EPU) application. The proposed changes to the vapor plume are therefore consistent with and supported by town policies. The changes to the plume are also consistent with the town plan as described below:

Vernon Town Plan (2002)

The Town of Vernon's recently revised Town Plan (2002) states that:

> *"Vernon enjoys a wide variety of scenic resources, many of which are typical of Vermont settlements. These resources are a significant factor in the quality of life experienced in Vernon. Many of these resources, however, are highly sensitive and may adversely impacted through careless development."*

The town plan does not specifically describe or identify scenic resources beyond this general description. The plan lists the following policy for scenic areas within the town:

> *"Recognizing the value of scenic resources, it is the policy of the Town of Vernon to encourage land uses that will help to protect river corridors, scenic highways and roads, scenic views and other scenic*

resources."

Since the Town Plan does not specifically describe the characteristics and location of scenic areas, it is not possible to determine to what extent the plume viewsheds affect scenic resources as defined by the town. But because the plume viewsheds affect significant areas of the town, including river corridors, scenic highways and scenic views, it can be assumed that some scenic resources are located within sight of the plumes.

Because vapor plumes from the Vermont Yankee plant have been visible in the Vernon landscape for over 30 years and because no significant change in plume dimension is anticipated as a result of the proposed changes to the plant, no impact to the Town Plan scenic policy is projected. River corridors, scenic highways and roads, scenic views and other scenic resources will not be affected by the proposed changes because the plume dimensions and frequency of operation will not change significantly from present conditions. The one change involving winter operation of the plume will affect winter views from scenic areas. The winter plumes will not feel offensive or out of place because they existed until 1978 and are a continuation of a common visual phenomenon that has existed in the landscape during the warmer months since 1972. Vapor plumes are also a very common visual element of the Connecticut Valley in winter, emanating from mills and other facilities along many areas of the river in Vermont and New Hampshire. These vapor plumes have been a factor in the traditional Connecticut Valley visual landscape since the beginning of the industrial revolution.

Windham Regional Plan: The Windham Regional Plan was produced by the Windham Regional Commission in 1997. Its chapter on Natural Resources includes a section on scenic resources. The Regional Plan states:

"One of the region's most valuable resources is the exceptional scenic quality of its landscapes. These scenic resources provide a unique visual experience for residents and attract a significant tourist population, important to the regional economy. As the region grows its highly valued scenery will continue to evolve. Through good planning and design these changes can occur without adversely affecting the scenic value of the landscape. Mountain landscapes, farm landscapes, ridge lines, the night sky and prominent nighttime landscape, shorelines and scenic views and corridors are highly vulnerable to development. .....Light pollution or "sky glow" is a cumulative and increasing problem, especially near the urban clusters along the region's eastern border and near major resort development centers....."

View North on Route 142 Near Stebbins Road. The Plume Is Behind the Trees

The Regional Plan lists a number of policies designed to protect scenic resources:

1. *Give special consideration to high quality scenic landscapes and scenic corridors.*

2. *Foster greater appreciation of scenic resources as a significant environmental and economic resource.*

3. *Improve sites which diminish a scenic view, particularly along state and federal highways and within scenic corridors.*

4. *Encourage scenic easements and implement appraisal practices that encourage the donation of scenic easements to public and private natural resource/conservation agencies and organizations.*

5. *Encourage the scale, siting, design and management of new development to be in keeping with the landscape and to enhance it.*

6. *Encourage incentives for not developing scenic lands that may otherwise be suitable for development.*

7. *Minimize visual impacts of communication towers and other high-elevation or ridgeline structures through co-location, design, siting and color choice. Design and site communication and other high elevation towers so that they do not require night-time illumination.*

8. *Illuminate structures and exterior areas only at levels necessary to ensure safety and security of persons and property.*

Looking South from the Route 119 Bridge in Brattleboro.

9. *Arrange all exterior lighting so that the light source (lamp) is not directly visible from public roads, adjacent residences or distant vantage points. Shield exterior lighting so that the source light does not project above the lamp.*

10. *Discourage exterior area illumination of regionally prominent features and landscapes. Ensure that any such illumination will not significantly reduce the natural appearance of the nighttime landscape, will not be obtrusive in the viewshed, and will not distract unduly from the night-time horizon or night sky.*

11. *Encourage careful planning of new or improved roads to maintain or enhance scenic resources.*

In addition to these policies, the Windham Regional Commission proposes the following programs or actions to protect scenic re-

sources:

1. *Work with towns to identify locally and regionally significant scenic resources; evaluate and rank identified scenic resources based on their need for immediate protection, and develop methods for protection of these resources.*
2. *Coordinate with state, towns and private development along Interstate 91 and recommend future needs for landscaping in developed areas and at interchanges and for tree cutting to enhance certain views of the Connecticut River area.*

Because vapor plumes from the Vermont Yankee plant have been visible in the Vernon landscape for over 30 years and because no significant change in plume dimension is anticipated as a result of the proposed changes to the plant, no impact to the Windham Regional Plan scenic policy is projected. River corridors, scenic highways and roads, scenic views and other scenic resources will not be affected by the proposed changes because the plume dimensions and frequency of operation will not change significantly from present conditions. No direct illumination of the plume is proposed so light pollution from the plume will not be significant. Under certain atmospheric conditions, ambient light from the plant will reflect off the base of the plume as it has done for many years.

Restoration of winter operation of the plume will affect winter views from scenic areas. These proposed winter plumes will be smaller and less frequent than those seen from 1972 to 1978 and will be similar to the plumes visible in the other three seasons. The winter plumes will not feel offensive or out of place because they are a continuation of a common visual phenomenon that has existed in the landscape for many years.

11. Conclusion

This report has shown that the proposed operational changes to the Vermont Yankee Nuclear Power Plant will have little or no impact on the size, configuration and frequency of operation of the plant's vapor plume. The estimates of proposed plume dimensions, the terrain models showing computer-generated views and the photo simulations accurately show the minimal nature of the visual changes. The viewshed maps demonstrate that the extent of visibility of the plumes will not change significantly from current levels of operation. The visual impacts of these minor changes will usually be imperceptible and will therefore not offend the sensibilities of the average person. The only perceptible change will be the return of the operation of the cooling towers in the winter, a time when the towers have not been operated since 1978. This will result in winter plumes less than 20% of the time which will create a minor change in the visual landscape. The sum total of these changes is insignificant from an aesthetic standpoint.

The Vernon Dam and the Vermont Yankee Plant Viewed from Vernon Center

Visual Analysis : Addendum to Feb. 18, 2003

Vermont Yankee Cooling Tower Plume - 125 hp Fans

June 16, 2003

Visual Analysis : Addendum to Feb. 18, 2003
Vermont Yankee Cooling Tower Plume - 125 hp Fans

Prepared For: Entergy Nuclear Vermont Yankee, LLC
Governor Hunt Road
Vernon, Vermont

Prepared By: Dodson Associates, Ltd.
463 Main Street
Ashfield, Massachusetts

June 16, 2003

Summary

This report supplements the *Vermont Yankee Cooling Tower Plume Visual Analysis* (EN-HLD-2) dated February 18, 2003 which analyzed the visual impacts of larger vapor plumes at the Entergy/Vermont Yankee plant associated with the proposed 120% power uprate. This report analyzes the visual impacts of using the existing125 hp fans in the cooling towers for the 120% power uprate instead of the new 200 hp fans that served as the basis of analysis in the February 18, 2003 report.

The existing 125 hp fans usually produce slightly larger vapor plumes than the proposed 200 hp fans due to their lower air flows. For the proposed 120% power uprate the plumes associated with the 125 hp fans are typically about 20% larger than plumes associated with the 200 hp fans, though in one case – winter - they are slightly smaller. Dodson Associates has used the same visual analysis methodology used in the February 18, 2003 report to simulate the visual impacts of these larger plumes. Computer-generated terrain model views were first created showing the 125 hp plumes from four representative sites near the plant. More realistic photo simulations were then created using the terrain models as a basis to depict the accurate dimensions and appearance of the proposed plumes. Plume viewsheds were not created for this study.

For a description of the analysis methodology, information on and simulations of existing conditions at the plant, location of viewpoints and for terrain models and simulations of the visual impacts of the plumes with 200 hp fans, please see the February 18, 2003 report. This study simulates plumes visible from each of the four viewing sites for spring/fall, summer and winter. Summer and winter plumes for site #1 have not been shown because they are not visible from this location.

According to the standards of the Queechee Analysis, the increased size of the vapor plume resulting from the use of 125 hp fans instead of 200 hp fans will cause an adverse aesthetic impact but this impact will not be undue because similar plumes have been a frequent presence in the landscape since 1972, because the site has been an industrial facility since 1972, because industrial plumes are a common feature of the Connecticut River Valley, because the changes to the plumes do not violate a clear community standard and because the plumes do not violate the sensibilities of the average person.

TABLE 2-3
Results from Albany Meteorological Data
(200 HP Fans)

Plume Parameters	Baseline		120% Load Current NPDES				120% Load Proposed NPDES Summer Limit[1]	
			Summer Limit[1]		Winter Limit[1]			
	High Flow	Low Flow	High Flow	Low Flow	High Flow[2]	Low Flow[2]	High Flow	Low Flow
Winter:								
length (m)	N/A	N/A	N/A	N/A	150	400	N/A	N/A
width (m)	N/A	N/A	N/A	N/A	20	60	N/A	N/A
height (m)	N/A	N/A	N/A	N/A	20	40	N/A	N/A
Spring:								
length (m)	300	400	300	400	N/A[3]	N/A[3]	300	400
width (m)	70	80	70	80	N/A[3]	N/A[3]	70	80
height (m)	60	80	80	90	N/A[3]	N/A[3]	50	80
Summer:								
length (m)	150	200	150	150	N/A	N/A	150	150
width (m)	30	50	40	40	N/A	N/A	30	40
height (m)	30	40	30	40	N/A	N/A	30	30
Fall:								
length (m)	300	400	300	400	N/A[3]	N/A[3]	300	400
width (m)	70	80	70	80	N/A[3]	N/A[3]	60	70
height (m)	60	90	80	90	N/A[3]	N/A[3]	50	80

TABLE 2-4
Results from Albany Meteorological Data
(125 hp fans)

Plume Parameters	Baseline		120% Load Current NPDES				120% Load Proposed NPDES Summer Limit[1]	
			Summer Limit[1]		Winter Limit[1]			
	High Flow	Low Flow	High Flow	Low Flow	High Flow[2]	Low Flow[2]	High Flow	Low Flow
Winter:								
length (m)	N/A	N/A	N/A	N/A	150	400	N/A	N/A
width (m)	N/A	N/A	N/A	N/A	20	60	N/A	N/A
height (m)	N/A	N/A	N/A	N/A	20	30	N/A	N/A
Spring:								
length (m)	300	400	400	500	N/A[3]	N/A[3]	400	500
width (m)	70	80	90	90	N/A[3]	N/A[3]	80	90
height (m)	60	80	90	100	N/A[3]	N/A[3]	90	100
Summer:								
length (m)	150	200	200	200	N/A	N/A	200	200
width (m)	30	50	40	50	N/A	N/A	40	50
height (m)	30	40	30	50	N/A	N/A	30	50
Fall:								
length (m)	300	400	400	500	N/A[3]	N/A[3]	400	500
width (m)	70	80	90	90	N/A[3]	N/A[3]	80	90
height (m)	60	90	100	110	N/A[3]	N/A[3]	90	100

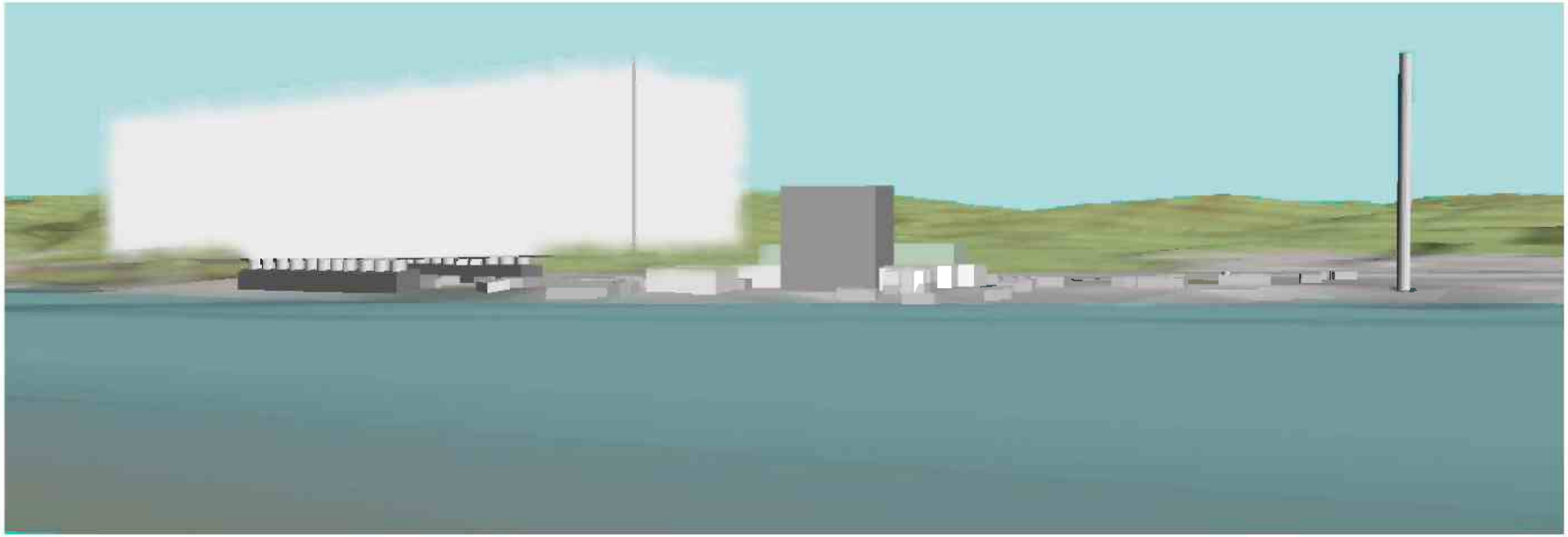
N/A: Not applicable

1. Summer and Winter Limits refer to the NPDES permit limits for summer and winter.
2. Winter High Flow corresponds to all fans operating while Low Flow represents fewer fans operating. The High Flow winter plume data are provided to bound the analysis but the Low Flow case is the predominant operating mode.
3. Spring and fall plume dimensions are not calculated for Winter Limit heat rejection rates as they are smaller than the Summer Limit plume dimensions.

View #1: Spring/Fall Existing

View #1: Spring/Fall 120% Load, 125 Fans

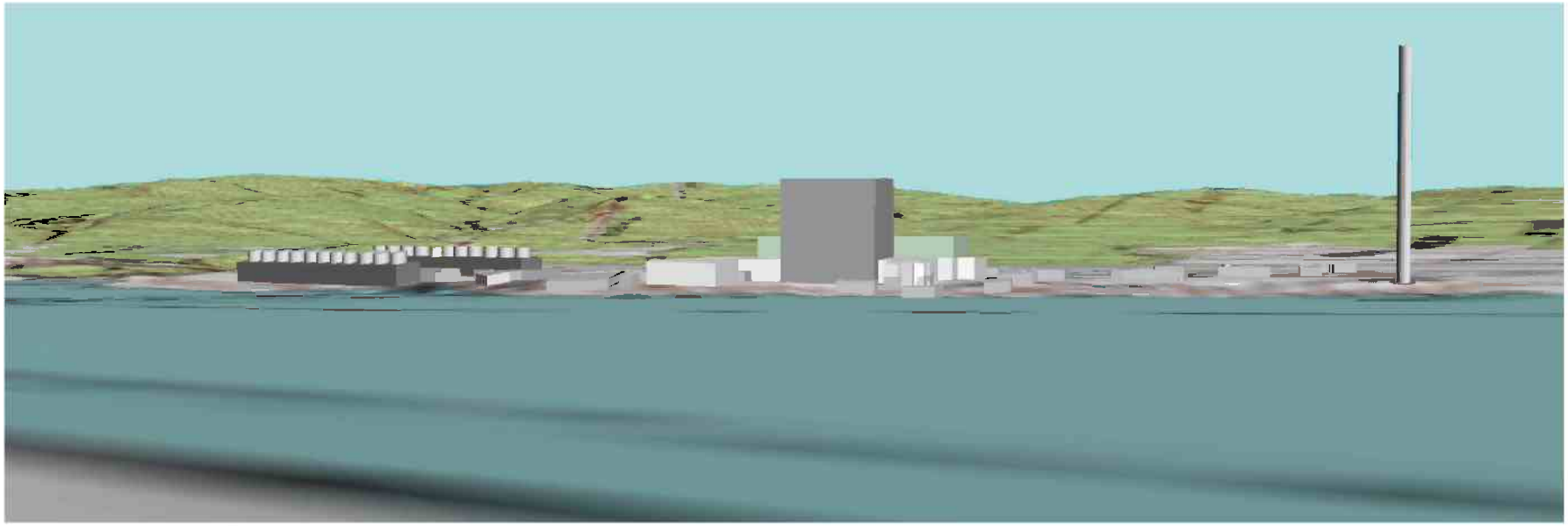
View #2: Spring/Fall Existing



View #2: Spring/Fall 120% Load, 125 Fans

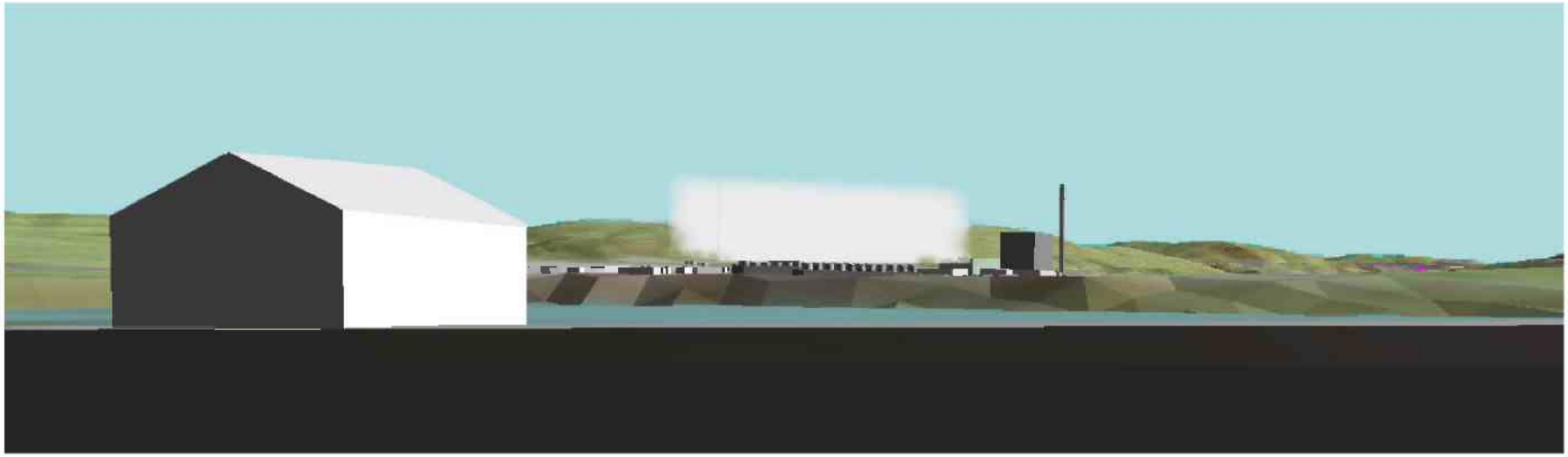
View #2: Summer Existing

View #2: Summer 120% Load, 125 Fans

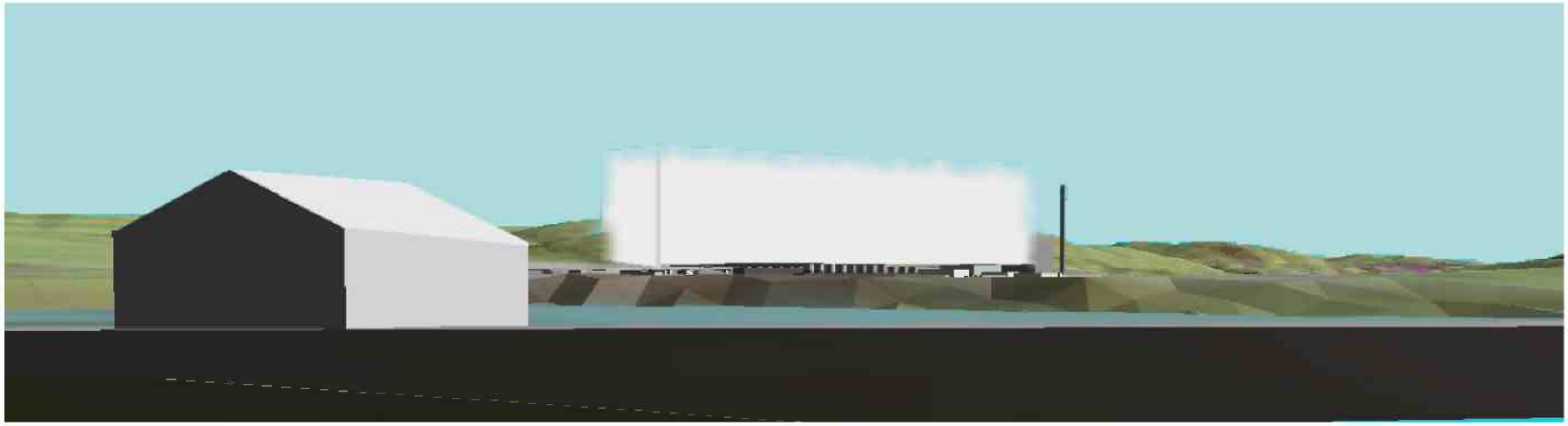


View #2: Winter Existing

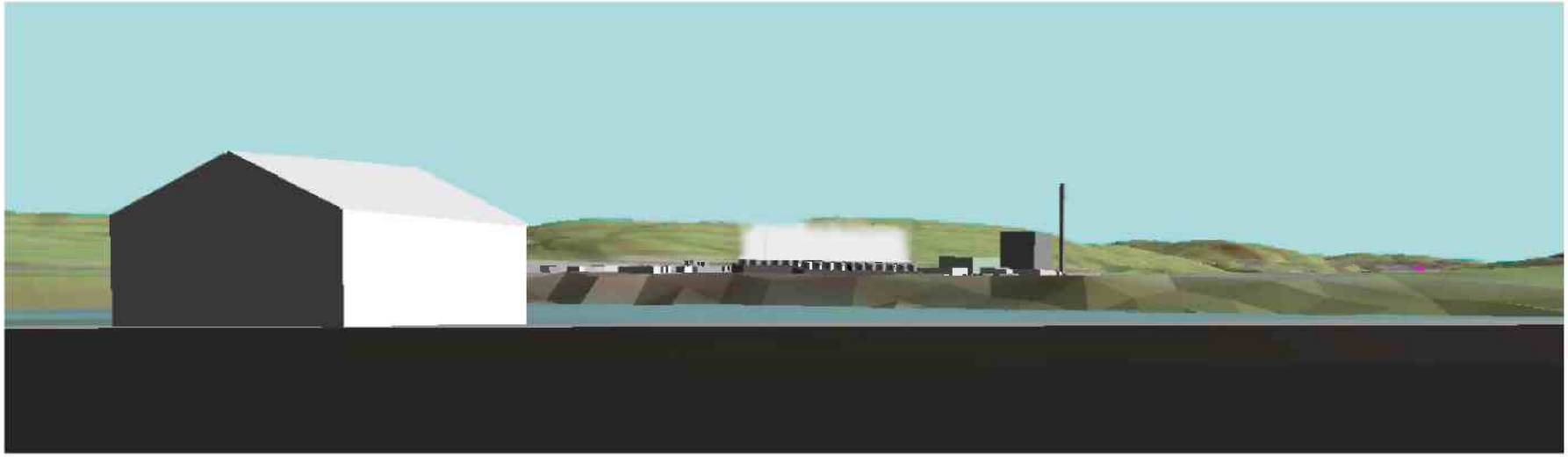
View #2: Winter 120% Load, 125 Fans



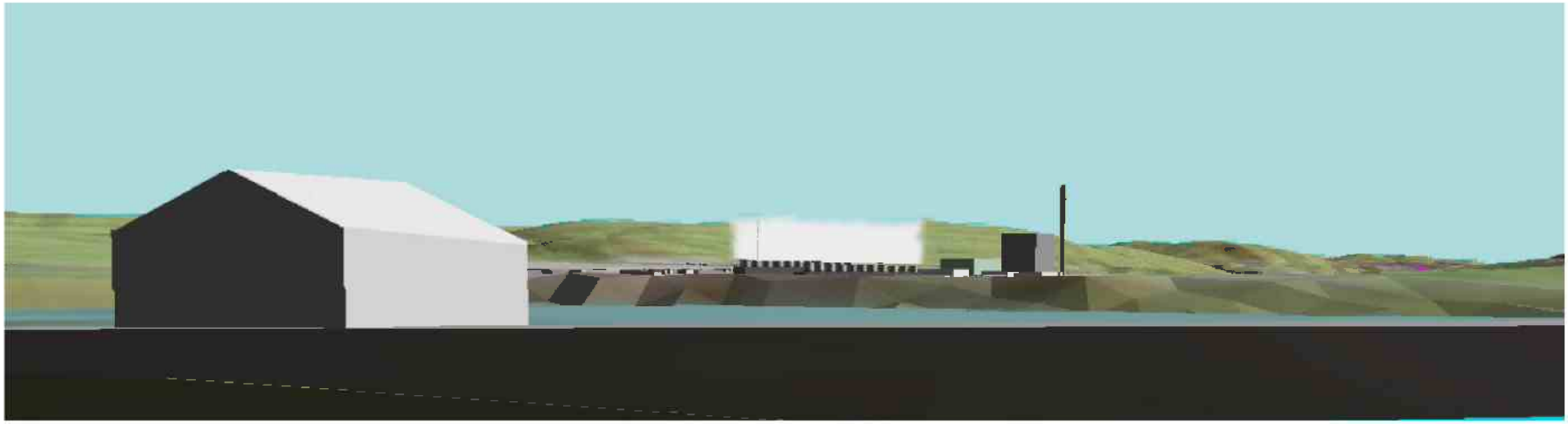
View #3: Spring/Fall Existing



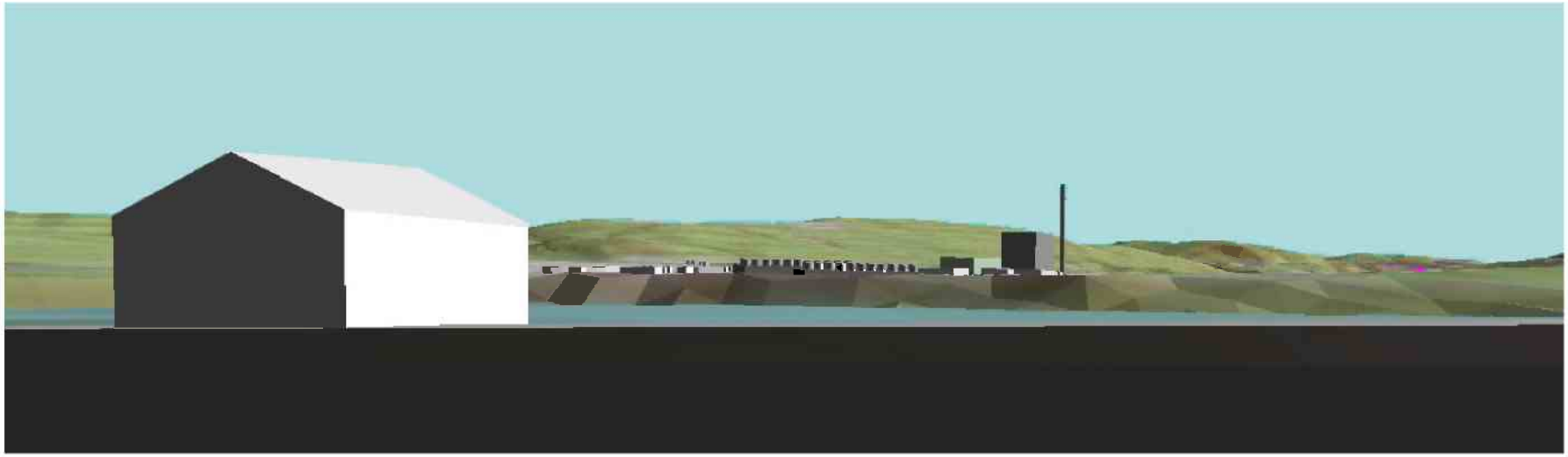
View #3: Spring/Fall 120% Load, 125 Fans



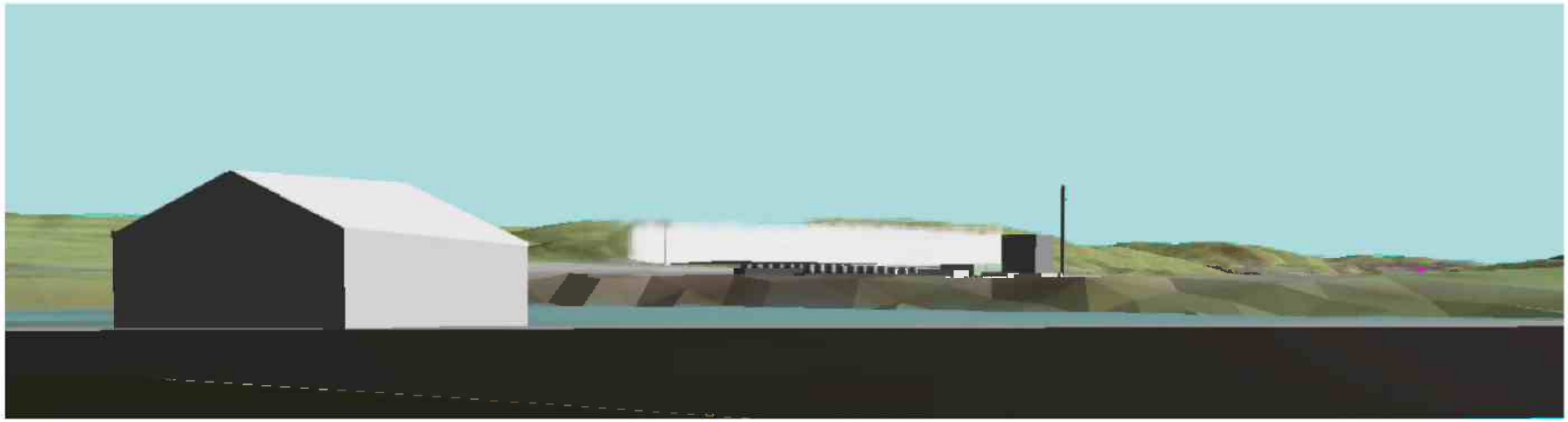
View #3: Summer Existing



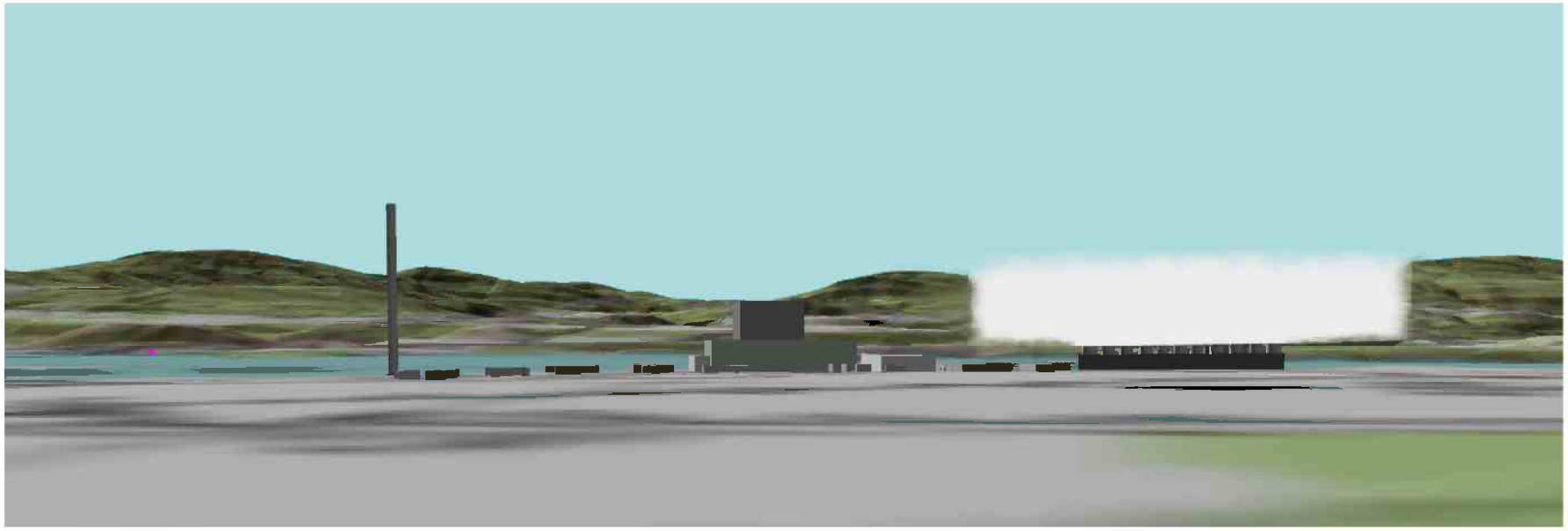
View #3: Summer 120% Load, 125 Fans



View #3: Winter Existing

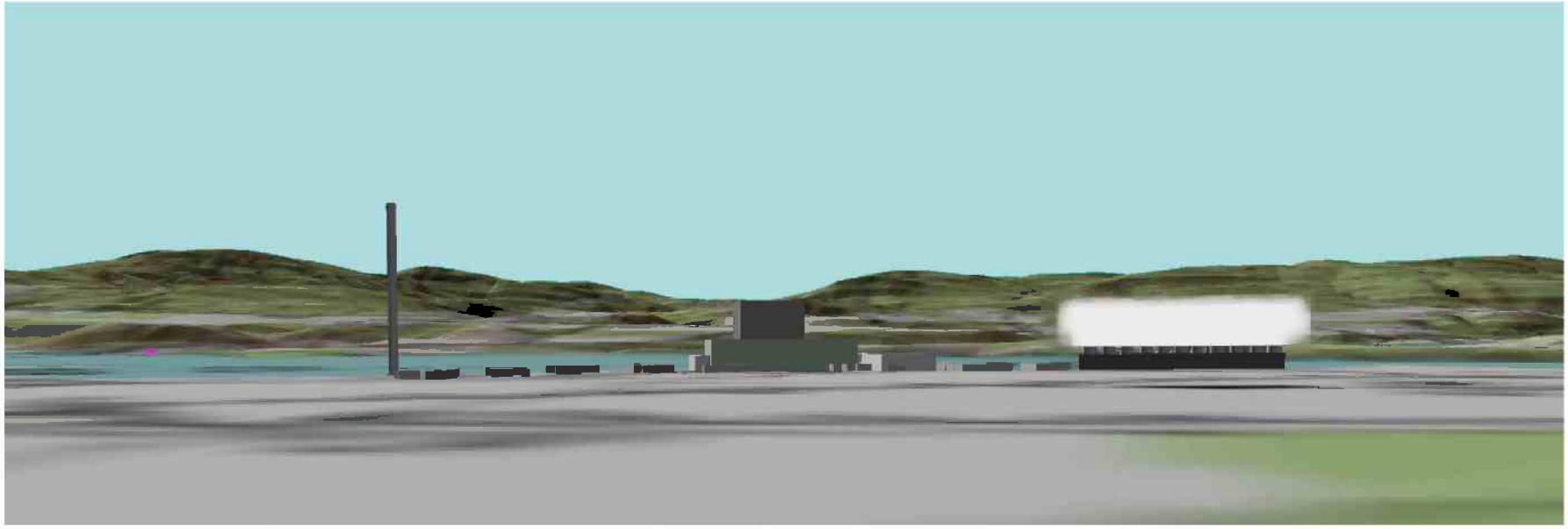


View #3: Winter 120% Load, 125 Fans

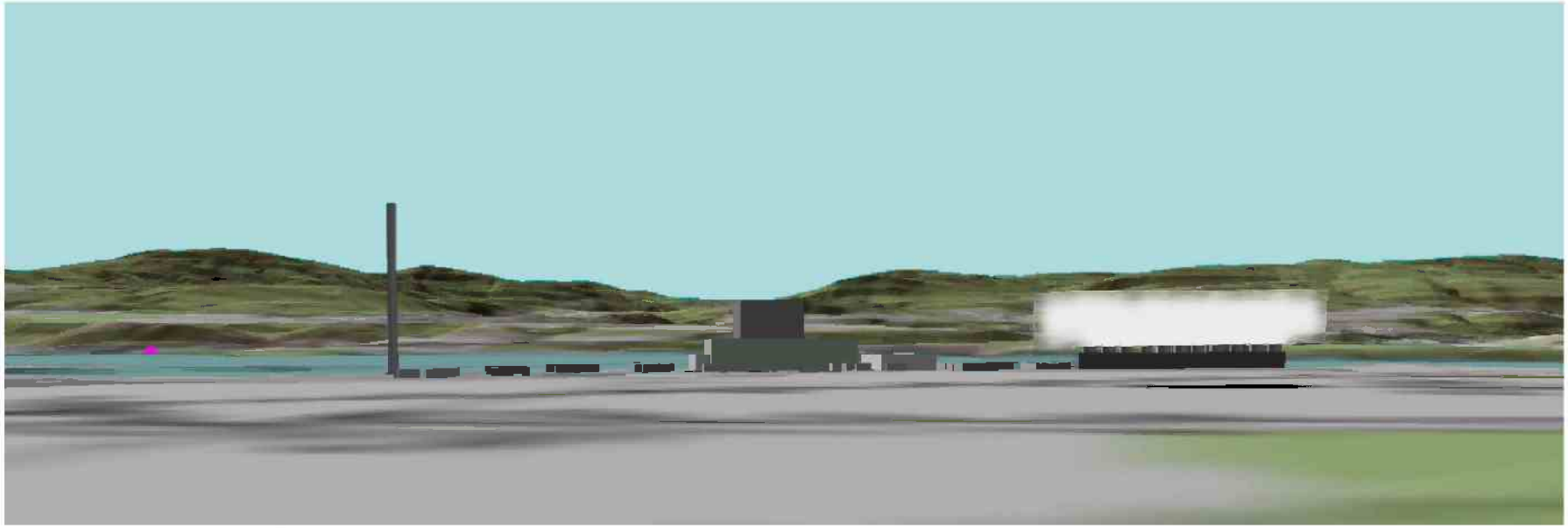


View #4: Spring/Fall Existing

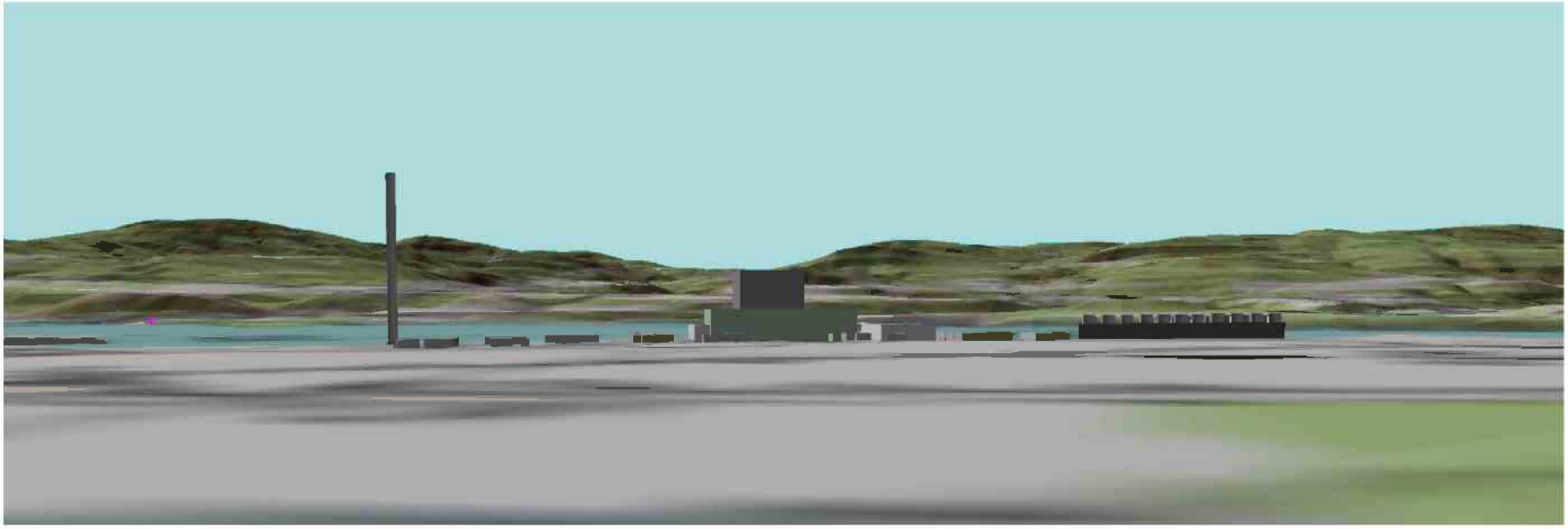
View #4: Spring/Fall 120% Load, 125 Fans



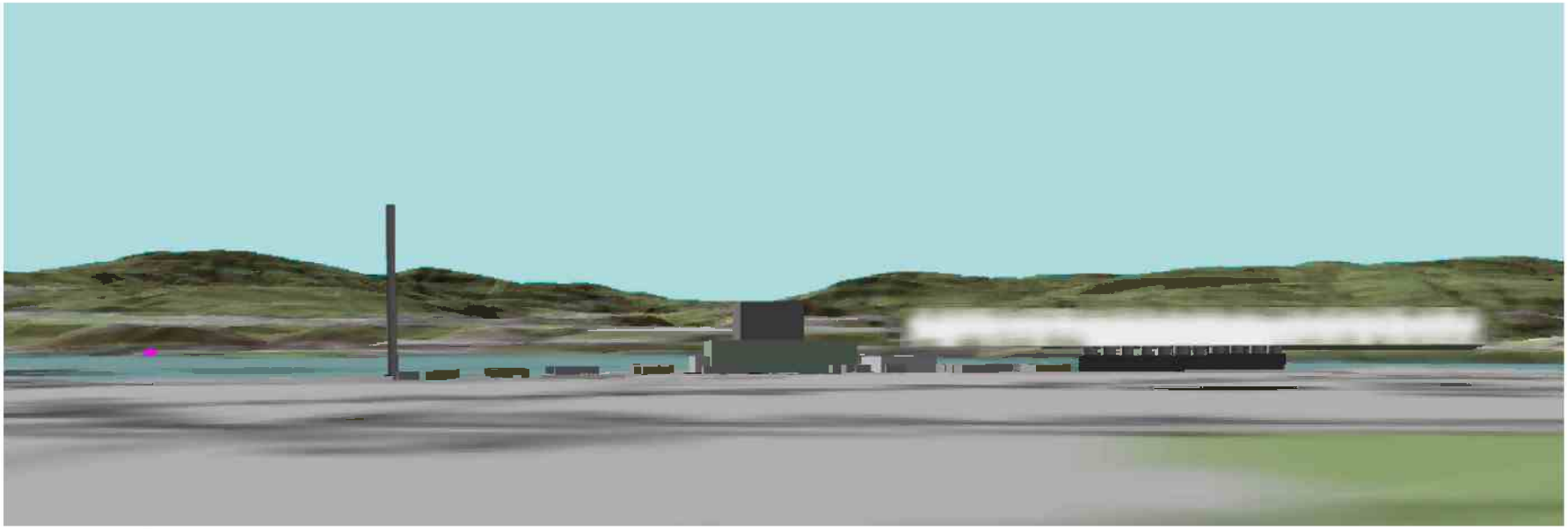
View #4: Summer Existing



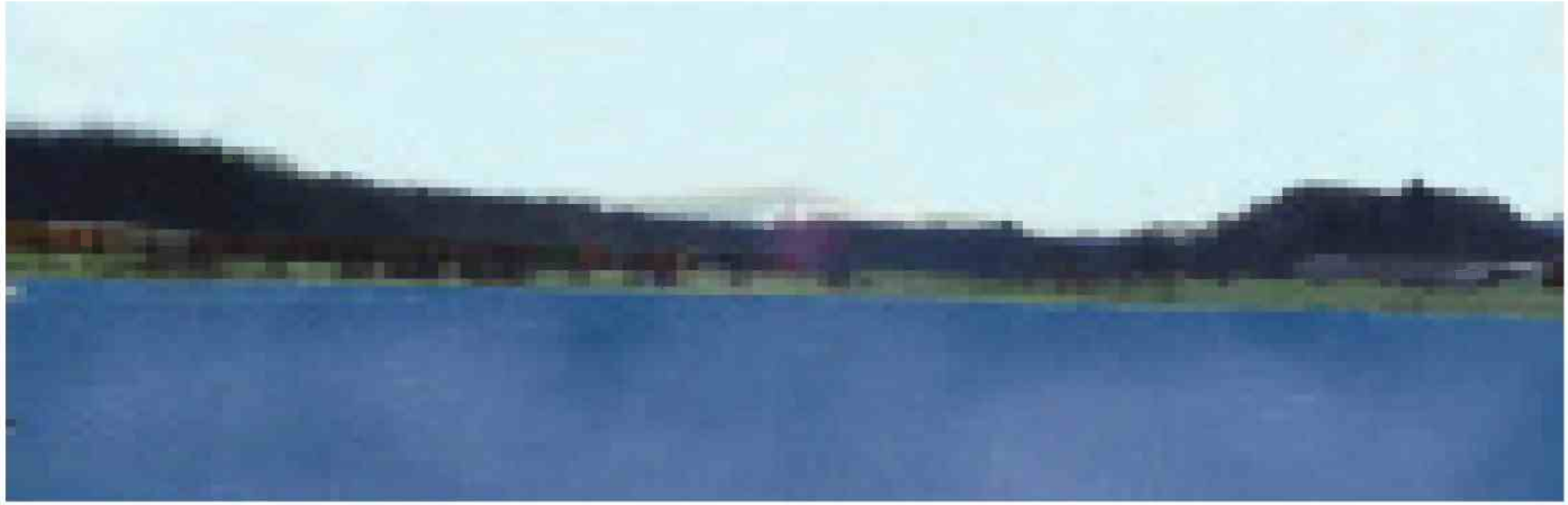
View #4: Summer 120% Load, 125 Fans



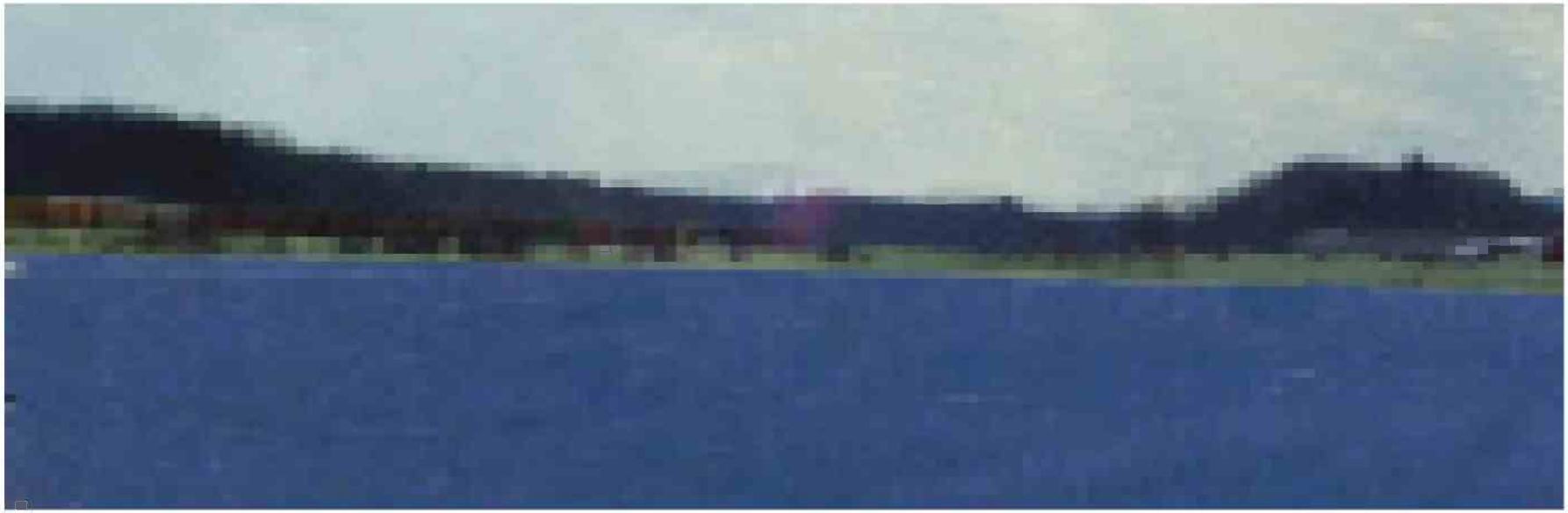
View #4: Winter Existing



View #4: Winter 120% Load, 125 Fans



View #1: 120% Load, Spring/Fall Clear, 125 Fans



View #1: 120% Load, Spring/Fall Cloudy, 125 hp Fans

View #2: 120% Load, Spring/Fall Clear, 125 hp Fans

View #2: 120% Load, Spring/Fall Cloudy, 125 hp Fans

View #2: 120% Load, Summer Clear, 125 hp Fans

View #2: 120% Load, Summer Cloudy, 125 hp Fans

View #2: 120% Load, Winter Clear, 125 hp Fans

View #2: 120% Load, Winter Cloudy, 125 hp Fans

View #3: 120% Load, Spring/Fall Clear, 125 hp Fans

View #3: 120% Load, Spring/Fall Cloudy, 125 hp Fans

View #3: 120% Load, Summer Clear, 125 hp Fans

View #3: 120% Load, Summer Cloudy, 125 hp Fans

View #3: 120% Load, Winter Clear, 125 hp Fans

View #3: 120% Load, Winter Cloudy, 125 hp Fans

View #4: 120% Load, Spring/Fall Clear, 125 hp Fans

View #4: 120% Load, Spring/Fall Cloudy, 125 hp Fans

View #4: 120% Load, Summer Clear, 125 hp Fans

View #4: 120% Load, Summer Cloudy, 125 hp Fans

View #4: 120% Load, Winter Clear, 125 hp Fans

View #4: 120% Load, Winter Cloudy, 125 hp Fans