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Yesler Terrace

Seattle, Washington

Final Report

Heliport Wind Assessment

RWDI # 1011844
October 13, 2010

SUBMITTED TO

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TABLE OF CONTENTS

Figures

1. INTRODUCTION

Rowan Williams Davies & Irwin Inc. (RWDI) was retained by Collins Woerman to undertake computer wind flow simulations that would allow for a comparison of wind flow patterns in the vicinity of the heliport for the proposed Yesler Terrace development in Seattle, Washington. The objective of this qualitative evaluation is to provide wind flows on and around the helipad with existing and proposed buildings in consideration of possible changes in existing wind conditions along the local approach path for helicopters. This qualitative comparison is based on:

- design drawings received July 22, 2010;
- our engineering judgement and knowledge of wind flows around buildings;
- our experience of wind tunnel modelling of various building projects; and,
- use of proprietary Computational Fluid Dynamics (CFD) software *Virtualwind* for visualizing wind flow patterns.

This assessment was conducted for the following three configurations:

Existing: the existing site and surroundings, without the proposed development;

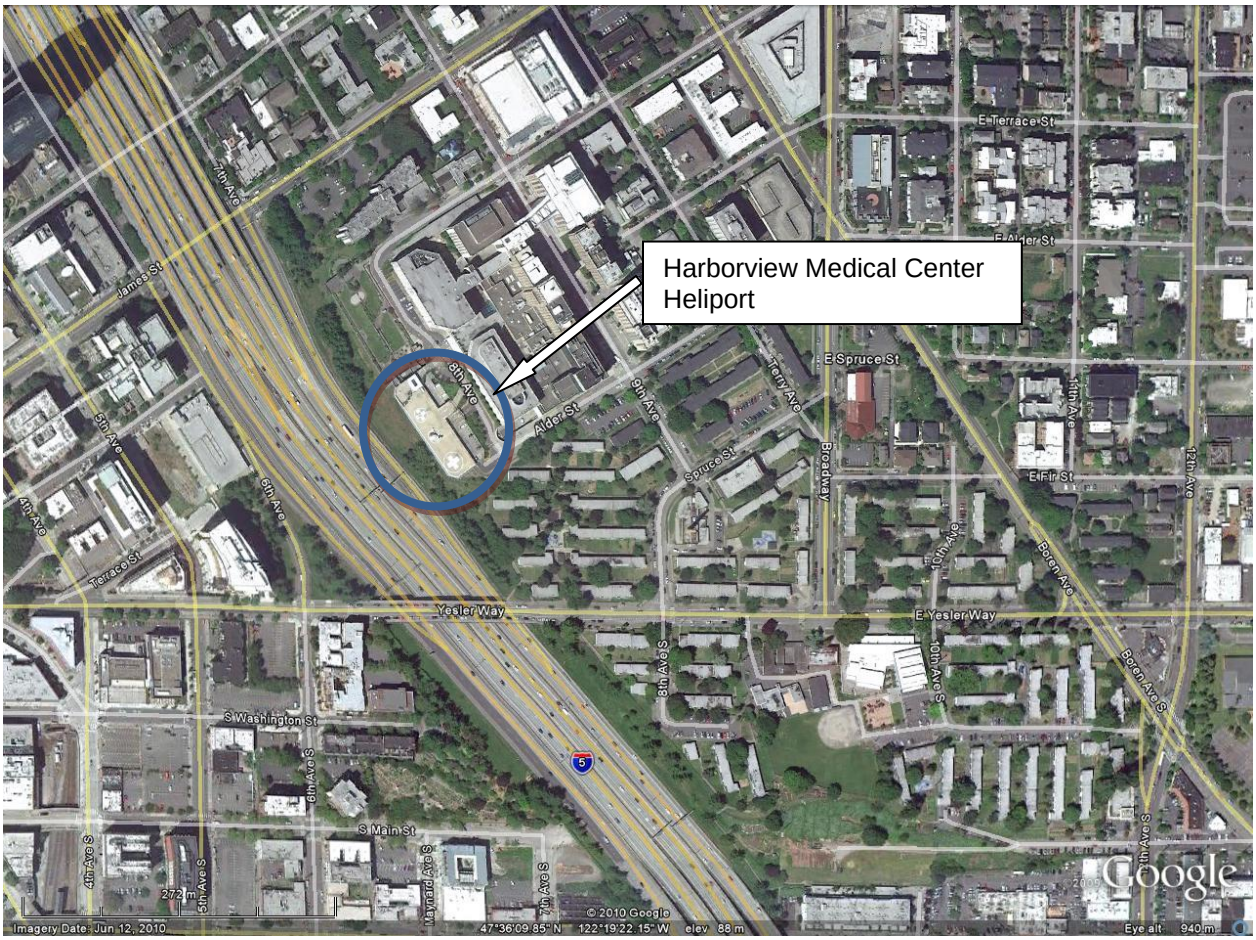
Proposed Option 1: the existing site and surroundings, with the proposed Yesler Terrace Option 1; and,

Proposed Option 2: the existing site and surroundings, with the proposed Yesler Terrace Option 2.

In the absence of wind tunnel testing, this qualitative approach provides a screening-level estimation of wind flows. This method can be used for an initial qualitative estimate of wind flows at the planning stage and for an evaluation of different design options. The nature of our assessment was for comparative purposes of different design options.

2. SITE INFORMATION

Figures 1a and 1b show the 3-D rendered images of the Existing, Proposed Option 1, and Proposed Option 2 Configurations. These models were used in our computer simulations. The helipad, which is the focus of our wind flow comparison, is located to the southwest of the Harborview Medical Center in Seattle, Washington. The proposed Yesler Terrace development is located to the east and adjacent to the helipad on First Hill, bordered by Alder Street, Boren Avenue South, South Main Street and Interstate 5 Express. The proposed development consists of 23 buildings of varying footprints and heights ranging from 75 feet to 280 feet high.



Aerial View - Image Courtesy of GoogleEarth ™

3. METEOROLOGICAL DATA

Wind statistics at the Seattle Boeing Field between 1944 and 2006 and the Seattle-Tacoma International Airport between 1948 and 2008 were analyzed to determine the local wind directionality. Figures 2a and 2b graphically depicts the distributions of wind frequency and directionality and the southerly winds are prevalent for these two airports. The Virtualwind computer simulations focused on winds from the south to illustrate the nature of flows from this primary wind direction.

4. ASSESSMENT OF WIND CONDITIONS

4.1 General Background

Predicting wind speeds and occurrence frequencies is complicated, involving building geometry, orientation, position and height of surrounding buildings, upstream terrain and the local wind climate. Over the years, RWDI has conducted more than 1500 wind tunnel model studies on wind conditions around buildings, yielding a broad knowledge base. RWDI also has considerable experience in the application of computer modeling techniques (CFD) in the assessment of wind flows around buildings and structures.

To visualize the wind conditions around the proposed development, our proprietary program Virtualwind was used to simulate wind flows for wind approaching from the prevailing south direction. The results of these simulations are presented as contours of wind speed showing wind flow patterns (Figures 3 through 10) at various horizontal levels above and also a vertical slice through the helipad area. These figures represent the average wind speed for the selected direction and actual wind flows will fluctuate and approach from different directions. In these figures, a dark or light blue colour represents low wind speed areas; green indicates moderate wind speeds, and yellow and red regions are associated with high wind speeds, as indicated by the colour legend in the figures.

4.2 Wind Flow Results

Figures 3 through 10 show the simulated wind flows for the existing and proposed configurations. In these figures, multiple horizontal and vertical slices of mean wind velocity vectors were provided to depict the wind flow regions for different elevations along the helicopter flight path.

Based on the results of the simulations depicted in the figures, there is a minimal change in winds in the vicinity of the helipad by either of the two proposed development configurations when winds are from the prevailing southerly direction. Due to the height of the proposed development, which created a larger wake region than the existing, low buildings, some local change in wind flow patterns were noted, primarily to the north of the development and locally to the west.

Simulations were not conducted for other directions, such as the east, where the proximity of new tall buildings would more noticeably influence the local wind pattern in the study area, but significantly less frequently than the prevailing directions.

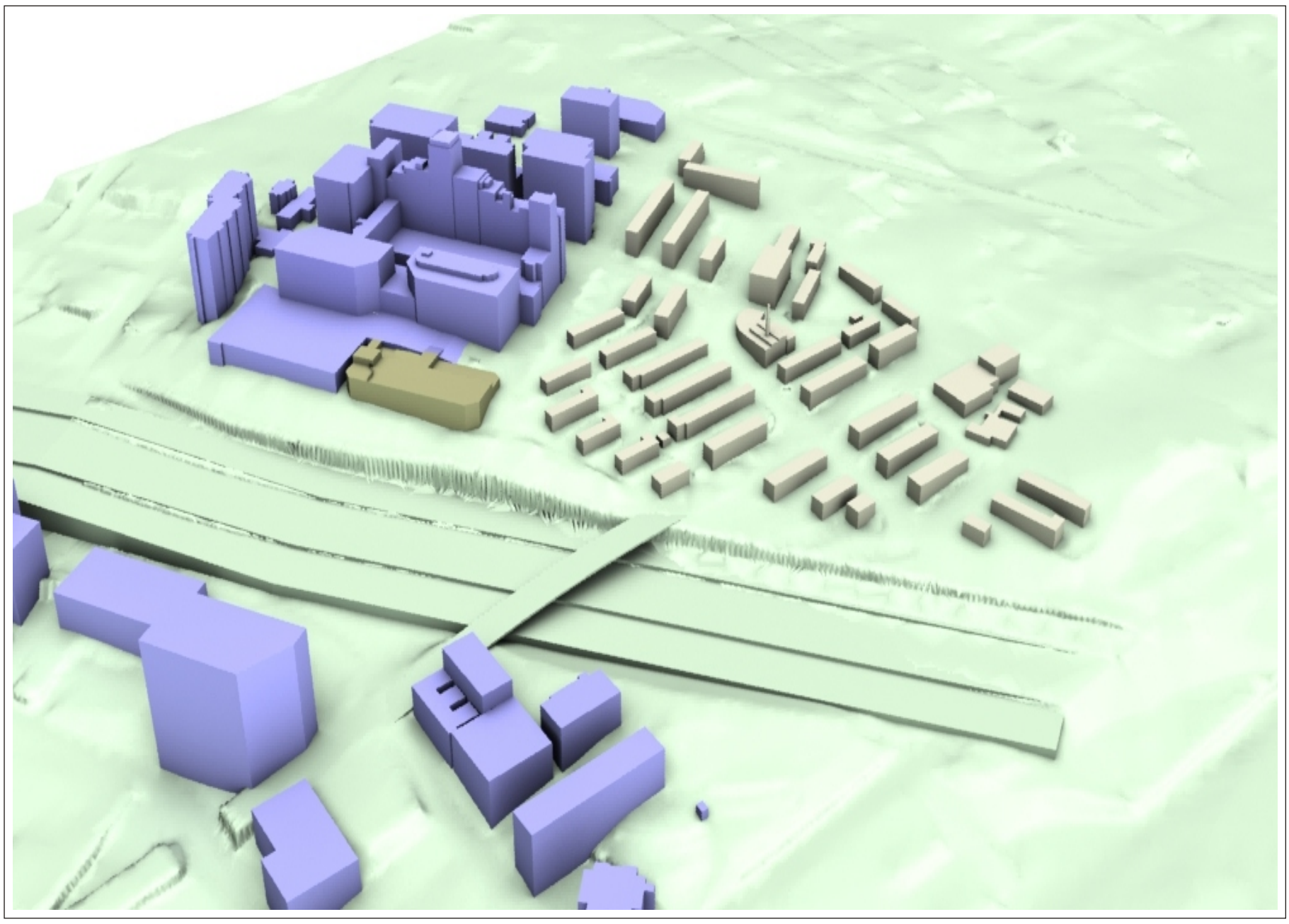
Due to the shape of the proposed building farthest to the northwest, which is adjacent to the helipad and well exposed to the prevailing southerly winds, the Proposed Option 1 configuration appears to have less affect on wind flows near the helipad when compared to those for Proposed Option 2 (see Figures 6 through 10).

5. SUMMARY

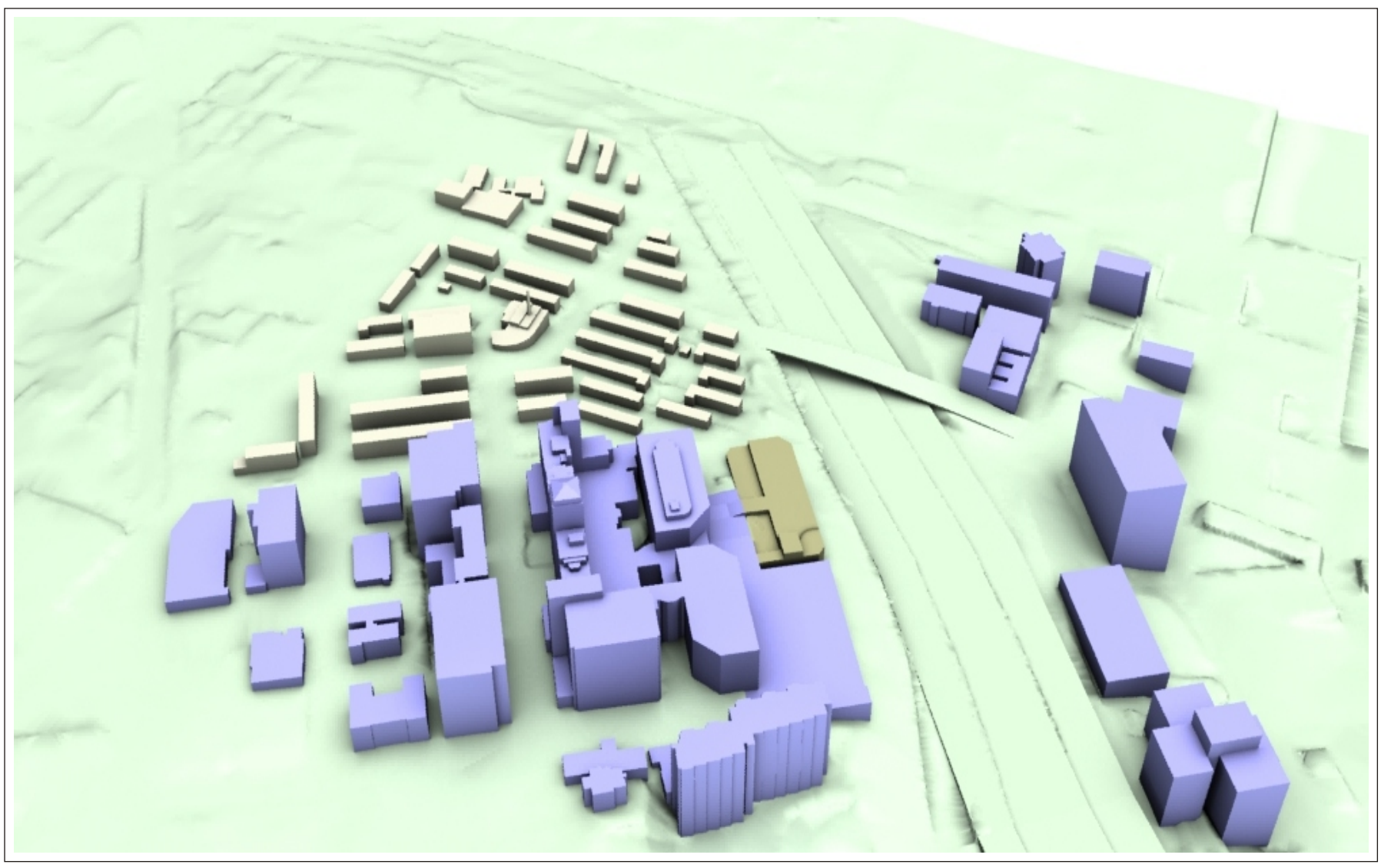
Generally, the proposed Yesler Terrace development had minimal influence on the existing wind speeds in the vicinity of the helipad and local approach path when winds are from the prevailing southerly direction. In our opinion, Proposed Option 1 had the least change in velocity, when compared to Option 2, due to building shape. There is the potential for changes in wind flows on/near the helipad or along the proposed flight path due to the increased height of the proposed development.

6. APPLICABILITY OF RESULTS

The assessment and recommendations presented in this report are based on the proposed geometry and design drawings provided to RWDI. The interpretation of wind flows determined by this wind assessment is applicable to the particular building configurations examined and the existing and proposed surroundings identified to RWDI. In the event of any significant changes to the design, construction or operation of the building or addition to the surroundings in the future, RWDI could provide an assessment of their impact on the design considered in this report. It is the responsibility of others to contact RWDI to initiate this process.

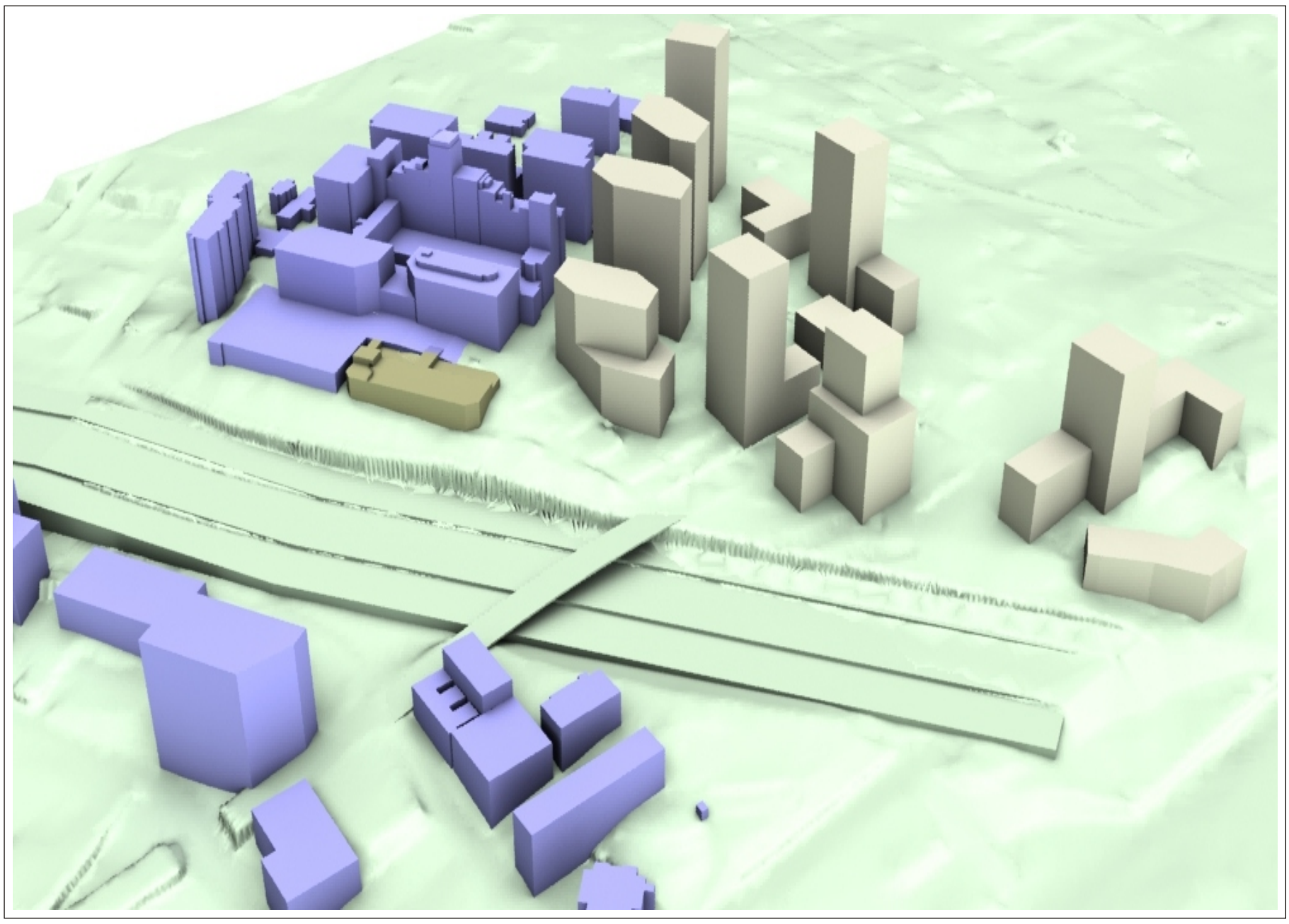


Southwest View

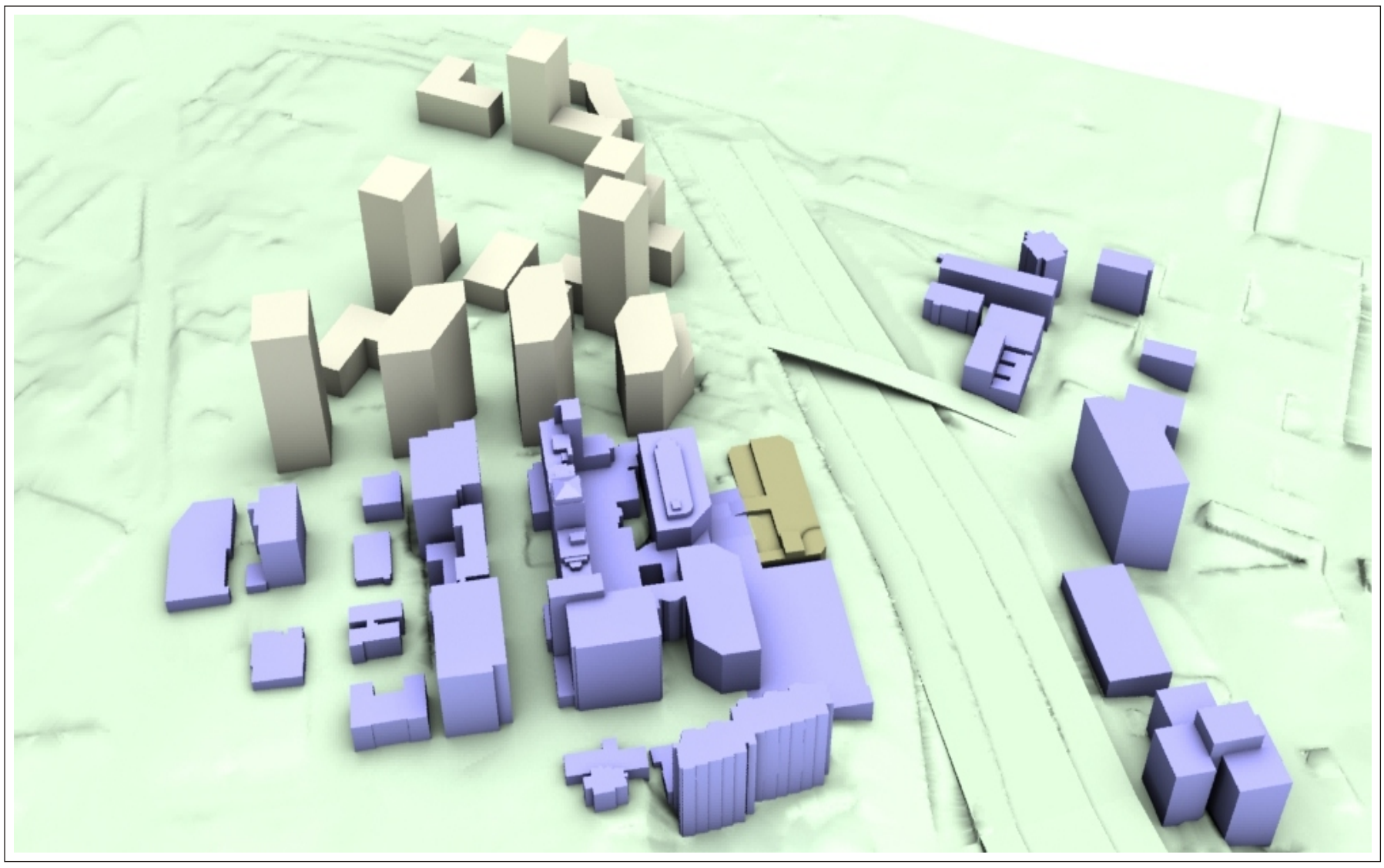


Northeast View

Wind Simulation Model **Configuration - Existing** Yesler Tarrace - Seattle, Washington	Project #1011844	Figure: 1a Produced by: EJS Date Revised: August 5, 2010	RWDI

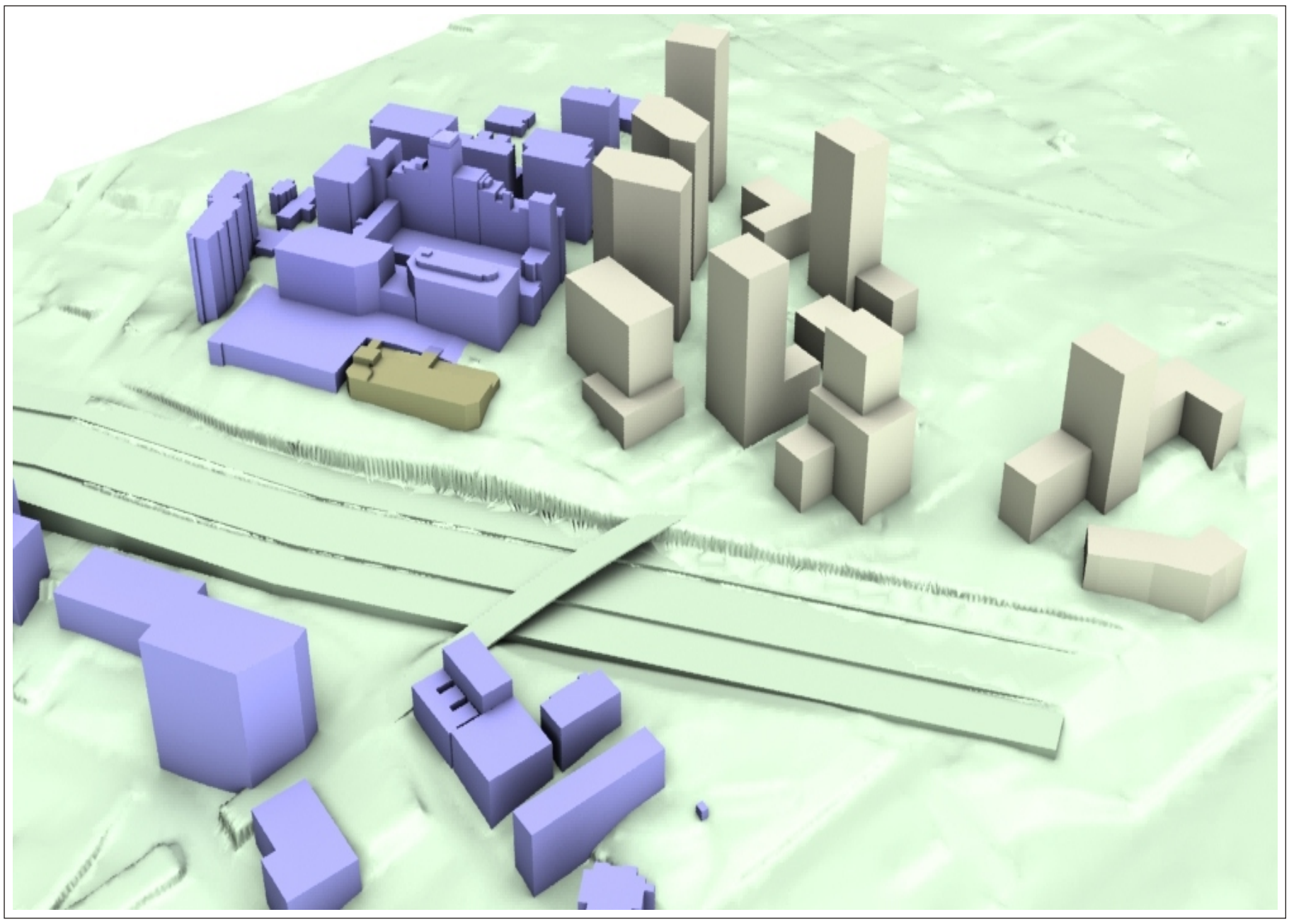


Southwest View

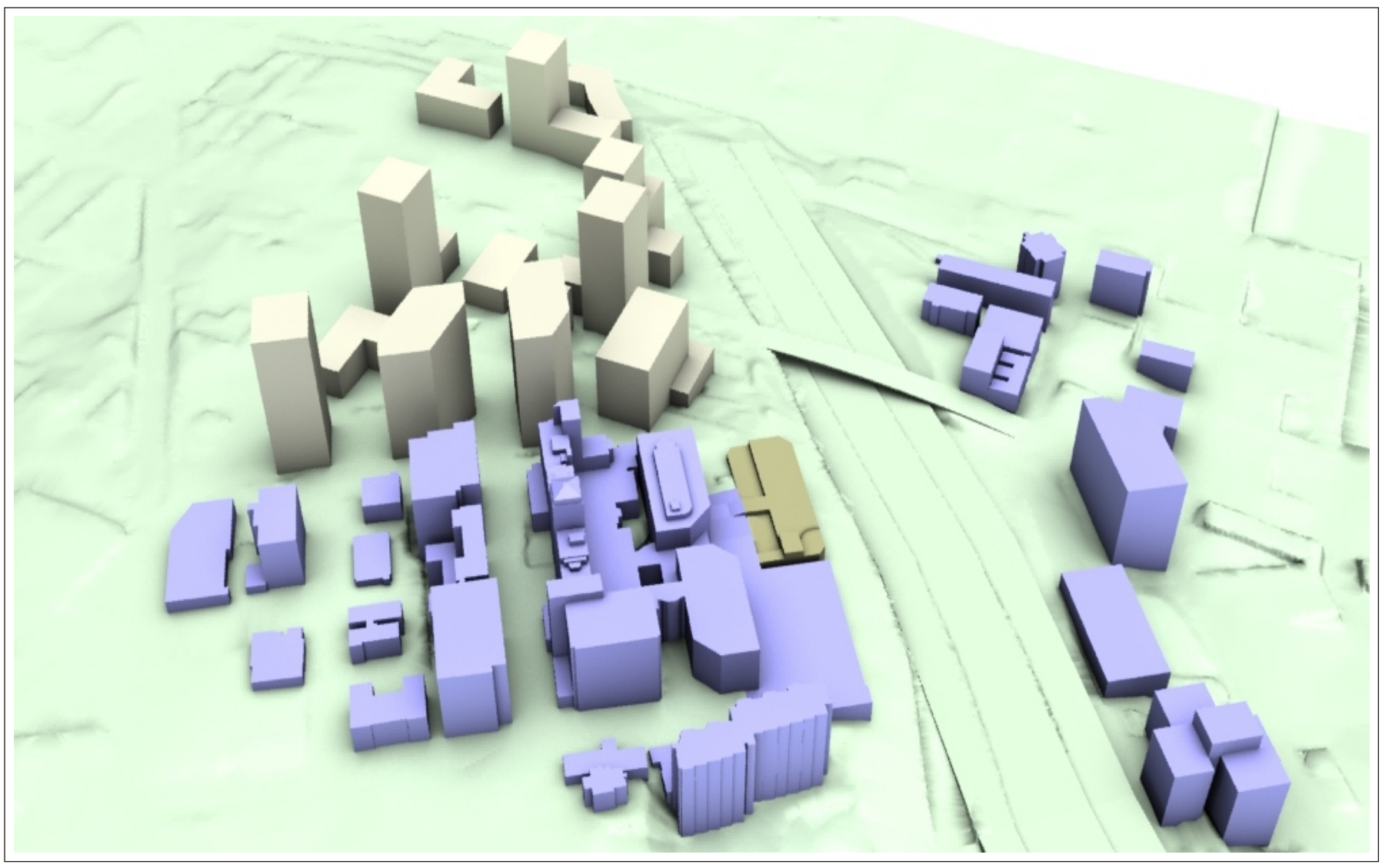


Northeast View

Wind Simulation Model **Configuration - Proposed 1** Yesler Tarrace - Seattle, Washington	Project #1011844	Figure: 1b Produced by: EJS Date Revised: August 5, 2010	RWDI



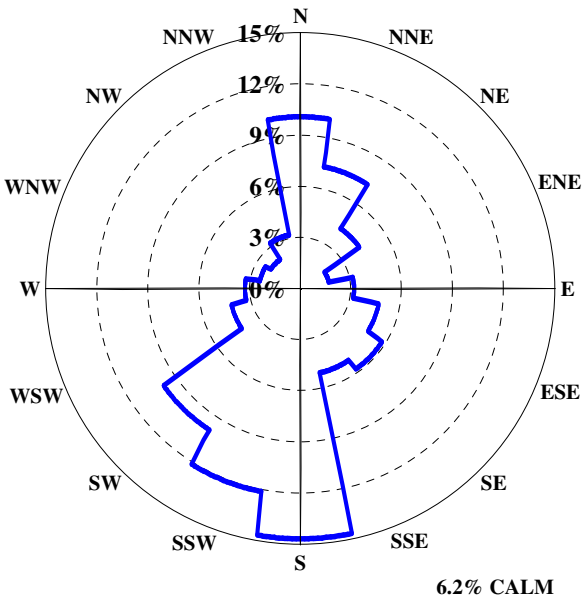
Southwest View



Northeast View

Wind Simulation Model **Configuration - Proposed 2**		Figure:	1c
		Produced by:	EJS
Yesler Tarrace - Seattle, Washington	Project #1011844	Date Revised:	August 5, 2010

RWDI

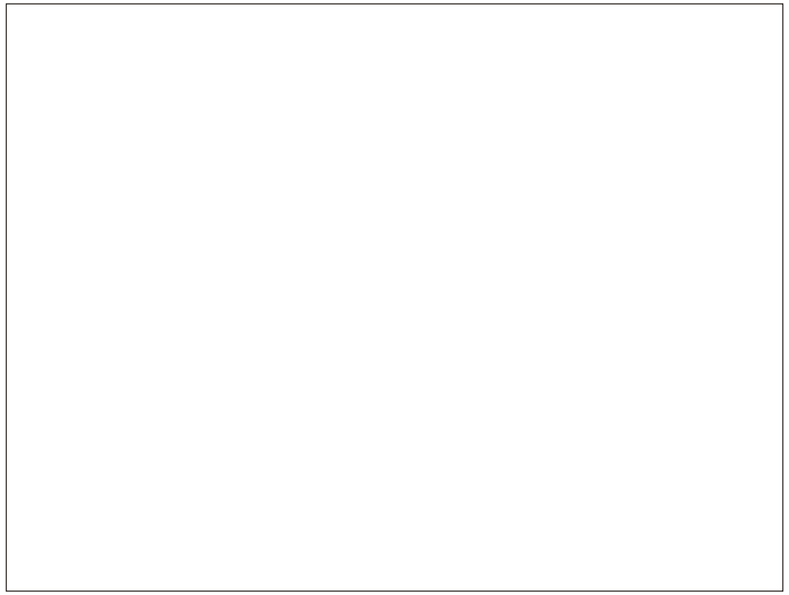


ALL ANNUAL WINDS

Directional Distribution (%) of Winds (Blowing From) **Station: Seattle-Tacoma International Airport, WA (1948 - 2008)** Yesler Terrace - Seattle, Washington Project #: 1011844	Figure: **2a** Date: August 6, 2010	RWDI

Existing

Proposed Option 1



Proposed Option 2

Wind Simulation Result - Vectors at 235' Above Helipad
Winds from the South

Yesler Tarrace - Seattle, Washington

Project #1011844

Drawn by: EJS

Figure: 10

Scale: N.T.S

Date Revised: August 6, 2010

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