BEFORE THE STATE OF WASHINGTON
ENERGY FACILITY SITE EVALUATION COUNCIL

IN RE APPLICATION NO. 99-1

SUMAS ENERGY 2 GENERATION FACILITY

EXHIBIT _____(DC-RT)

APPLICANT'S PREFILED REBUTTAL TESTIMONY

WITNESS : DAVID CARLTON

Q. Please introduce yourself to the Council.

A. My name is David Carlton. I am an Associate with Tetra Tech/KCM, Inc. Tetra Tech/KCM is a consulting engineering company specializing in work for municipal clients. I have been an engineer with Tetra Tech/KCM since 1991. Prior to that, I was with Montgomery/Watson Engineers, King County Surface Water Management, and the Floodplain/Shoreland Management Section of the Wisconsin Department of Natural Resources. In these positions, I worked extensively with communities developing floodplain models, maps and management plans. My experience and education are fully described in my resume provided as Exhibit ___ (DC-1).

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Q. What testimony are you responding to?

A. I have been asked to respond to the potential flood impact testimony by Paula Cooper.

Q. Did anyone assist your preparation of this testimony?

A. Yes. In preparing this testimony, I consulted with my colleagues Greg Gaasland and Anthony Melone. Mr. Gaasland performed the modeling completed by Tetra Tech/KCM for the City of Sumas that has been addressed by Ms. Cooper. Mr. Gassland's resume is provided as Exhibit __ (DC-2). Mr. Melone was the project manager for the project and oversaw all of the work. Mr. Melone's resume is provided as Exhibit ___ (DC-3).

Q. Please describe the flood modeling work Tetra Tech/KCM has done in the Sumas region.

A. In 1993, Tetra Tech/KCM was retained by Whatcom County to assist them with developing a Comprehensive Flood Hazard Management Plan for the lower Nooksack River. As part of that project we developed both one-dimensional and two-dimensional steady-state models of the river from Deming to Puget Sound. That project was completed in 1996. During 1996 we were hired by the City of Sumas to develop a two-dimensional steady-state flood model for the City. The purpose of the model was to predict the areal extent, depth and velocity of water throughout the City during a 100-year flood event. That project was completed in 1997.

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Q. In her testimony, Ms. Cooper addresses modeling done by Tetra Tech/KCM for the City of Sumas that is part of SE2's Application and the DEIS. Please briefly describe this modeling.

A. In 1996 the City of Sumas retained Tetra Tech/KCM to perform hydraulic modeling as part of the City's floodplain management planning project. The modeling was conducted for existing conditions in the City and for a 100-year flood event. The 100-year flood analysis included assessment of the effect of filling the entire industrial-zoned area of the City of Sumas. Flood flows were analyzed using a Finite Element Surface Water Modeling System (FESWMS) for two-dimensional flow in a horizontal plane, a two-dimensional steady-state modeling system. Two flood events were analyzed in this project. They were the November 10, 1990 flood in the area (approximately a 50-year flood) and the 100-year flood (according to the Federal Emergency Management Agency (FEMA), Flood Insurance Study, City of Sumas, Washington, November 15, 1984). A separate one-dimensional unsteady flow model (FEQ), developed for the City by another firm, estimated the peak flow rate reaching Sumas during the 1990 flood. The peak flow rate from this study was used to calibrate our two-dimensional model.

The modeling done for the City meets federal, state and local standards for floodplain modeling. Moreover, the modeling is exceptional in a number of respects. First, the model used was a two-dimensional model. Two-dimensional modeling was quite new at the time and is still not commonly used for floodplain analysis. Even today, most flood modeling, probably in the range of 95%, is completed using a one-dimensional steady-state model. The completion of a one-dimensional steady-state model for a

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river system is considered adequate by FEMA for communities to qualify for flood insurance. Since their development, however, two-dimensional models have been recognized as providing more precise results where terrain and flow patterns are highly variable, as near the City of Sumas. The two-dimensional modeling performed for the City is therefore more precise than usual flood modeling. Second, the data from the one-dimensional unsteady modeling (FEQ) provided exceptionally good flood flow data that was used to calibrate our two-dimensional modeling for the City. Third, a wealth of data in the form of high water marks was collected following the 1990 flood. The unusual abundance and precision of this data resulted in a calibrated model that presents a very accurate picture of flood characteristics in the Sumas area.

Q. Ms. Cooper testifies that Tetra Tech/KCM's modeling of the impacts of filling industrial areas in the City of Sumas includes the proposed SE2 site. Can this modeling therefore be used to estimate flood impacts from filling only the proposed SE2 site?

A. Yes. The flood modeling for filling the entire industrial region shows the effect of filling a larger area than just the SE2 site. Filling a smaller area would result in relatively smaller flood areas, elevations and velocities. The entire industrial zone analyzed in Tetra Tech/KCM's 1997 flood modeling was much larger than the 20 acres of fill for the SE2 development.

Q. In her testimony, Ms. Cooper states "an analysis with an unsteady flow model would allow us to evaluate whether or not other floodplain properties are

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adversely affected." What would unsteady modeling show that steady modeling does not?

A. Steady modeling is based on peak flood flow rates and can show what areas will be under water during a flood event, the depth of the water during a flood event, and the velocity of the water. Unsteady modeling includes variations in flood flow rates and, therefore, in addition to flood area, depth and velocities, it can show changes in flood flow rates.

Q. Is unsteady modeling typically used to evaluate flood impacts and hazards?

A. No. I would estimate that 90% of flood modeling today uses steady models. Unsteady flood modeling emerged 10 to 12 years ago, but it is complex to apply, and, as a result, time-consuming and sometimes expensive. Flood modelers inexperienced with unsteady models may have difficulty properly applying them. Consequently, their use as of yet is relatively rare. As I mentioned earlier, FEMA only requires steady-state models.

END OF REBUTTAL TESTIMONY

I declare under penalty of perjury that the foregoing testimony is true and correct to the best of my knowledge.

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David K. Carlton

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