

**Technical Review Memorandum**  
**Regarding the**  
**Power Engineers**  
**230 kV Eastside Line Project**  
**EMF Calculations and Report – Revision 2**

Prepared for

Environmental Science Associates  
5309 Shilshole Avenue NW, Suite 200  
Seattle, Washington 98107

Prepared by

Enertech Consultants  
494 Salmar Avenue, Suite 200  
Campbell, California 95008

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Prepared by  
Enertech Consultants  
Campbell, California

## **INTRODUCTION**

Power Engineers (PE) was retained by Puget Sound Energy to perform an electric and magnetic field evaluation of the various power line configurations associated with the Energize Eastside Project. The result of this effort was a report dated December 13, 2016 and entitled “230 kV Eastside Line Project – EMF Calculations and Report – Revision 1”. Enertech Consultants was retained by Environmental Science Associates (ESA) to review the Revision 1 report which was prepared by Power Engineers, which resulted in Enertech’s Technical Review Memorandum dated January 13, 2017.

Subsequently, Power Engineers revised their report and issued a Revision 2 report on March 7, 2017. Enertech reviewed this second revision of the report, and the results of this second technical review are presented in this memorandum.

## **OVERALL REVIEW**

Enertech performed an overall review of PE Revision 2 report to determine how the report addressed the review comments presented in Enertech’s Revision 1 Technical Review memorandum. Most of Enertech’s review comments have been incorporated into this second revision, and the revised report is much easier and straightforward to read. The Revision 2 report also includes a new calculation location (O-1).

Enertech compared the calculated magnetic field tabular data and graphs in the Revision 2 report with the previous Revision 1 report. Except for corrected values noted in the first review memo, calculation results were generally consistent with the Rev 1 report to the extent that direct comparisons were possible. For the existing line configuration, loading cases were updated to include four load conditions (summer average, summer peak, winter average, and winter peak) whereas in Revision 1 there was only an average and peak load provided. Calculation results were also updated to include 2027-28 load conditions which were not presented in the Revision 1 report. Enertech was unable to validate these new calculation results or review the Appendix A – Analysis Data due to budget constraints. However, graphs and tabular data were all consistent with respect to each other, and with the tables of summary results (except for Table 3 noted within this memo).

In the Executive Summary (Section 1.0) and referenced in related sections (4.1 and 4.2), the ICNIRP standard is stated as having “...recommended limit for the general public at the edge of Right-of Way (ROW)...”. However, the ICNIRP standard presents reference levels for general public exposure, and the standard does not restrict it to the edge of a transmission line right-of-way. In some cases, a transmission line right-of-way may be restricted from access by the general public, but this is not always the case (especially in urban areas such as the greater downtown Seattle area). Therefore the public could be potentially exposed to the maximum field levels within the right-of-way.

In the Executive Summary (Section 1.0), the report states that “Percentage differences between calculated EMF values and industry guidelines are based on the IEEE guidelines for the maximum values and ICNIRP guidelines for the ROW values.” However, all percentage differences shown in the calculation tables are comparisons with ICNIRP values only. Using the ICNIRP guideline is not only a conservative approach but also a consistent approach for evaluating the calculation results. Therefore the statement regarding the IEEE standard for comparisons should be removed or clarified. Also, the maximum value should be defined as the maximum calculated value within the right-of-way.

In Table 2 (Summary of Magnetic Field (2027-28 Results), the existing calculated values for the Bellevue South: Oak1 maximum and edge of ROW are omitted. These values should be included in the table for completeness.

In Table 3 (Summary of Magnetic Field Results), the Bellevue Central By-Pass segment is omitted because it is not an existing corridor, but it is the only segment not presented in the table. It may be helpful to include this segment as well and not just include only existing corridor segments. Also, for the Bellevue South segment, calculated values are shown for the OAK2 segment but the OAK1 segment has higher calculated values for the 2017/18 and 2027/28 Upgraded Configuration.

In the sections related to the presentation of electric and magnetic field calculation results, many of the tables show changes with respect to the results as maximum and as a edge of ROW values. For example, Table 11 shows that the maximum value for all segments increase with upgraded configuration, but decrease at the edge of ROW. However, no explanation is given to explain why this change in field level occurs. In each of these sections, only the tables of calculation results are presented with no explanation as to why changes occur.

Tables related to the presentation of magnetic field calculation results are inconsistent with respect to the existing configuration for 2017/18 loading conditions. Tables 12, 13, 17, 18, 22, 23, 27, 28, 52, 53, 57, and 58 do not present these calculation results. However, Tables 32, 33, 37, 38, 42, 43, 47, and 48 do present these results. It would be prudent to have all tables present magnetic field calculation results for the existing configuration for 2017/18 loading.

Tables related to the presentation of magnetic field calculation results are inconsistent with respect to certain locations within segments (i.e. magnetic field calculation results are shown for certain locations but not others within the table). Starting with Tables 34 and 35, there are no calculation results shown for the existing line configuration for the 2027-28 loading condition. Tables 37 and 38 have some calculation results for the existing line configuration but omit location O-1, J-1, J-2, and J-3 results. Tables 39 and 40 have some calculation results for the existing line configuration but omit results for locations G2-1 through K-4. Similar inconsistencies occur in Tables 42, 43, 47, 48, 49, and 50.

In the Conclusion section (Section 11.0), the report states that “Although the maximum electric field within the ROW increases by nearly 30 percent when compared to the existing line configuration,...” The percent change ranges from a decrease of about 6.6% (Renton segment) to an increase of about 254% (Oak1 segment), with the Bellevue Central Bypass creating new electric fields where none previously existed (reference Table 1). Therefore, the referenced 30% seems arbitrary since it only relates to the Oak2 and Willow2 locations within the Bellevue South segment.

In the Conclusion section (Section 11.0), the report states that “...electric field values at the edge of ROW are considerably smaller for segments not part of Oak1 or Oak2 route alternatives. Oak1 and Oak2 routes, on the other hand, show increased calculated electric field for both maximum and edge of ROW values” The Willow2 location should also be included with the Oak1 and Oak2 locations according to the results shown in Table 1.

In the Conclusion section (Section 11.0), the second and third paragraphs report magnetic field reductions or increases for selected locations and for specific loading conditions. These results seem to be presented as examples of the magnetic field change but are very selective. Since this is a conclusions section, it may be better to provide an overall synopsis of the entire project rather than selecting a few specific locations/load conditions to report calculation results and omitting others.