

3.13 Electric and Magnetic Fields

This section assesses whether electric and magnetic fields (EMF) generated by light-rail transit (LRT) facilities, which uses an overhead electrical supply, would cause adverse effects. The information in this section is based on the Electromagnetic Fields Technical Report.

3.13.1 Changes or New Information Since 2013

The Columbia River Crossing (CRC) Final EIS and Record of Decision were completed in 2011, with design refinements addressed in subsequent NEPA reevaluations in 2012 and 2013. Since then, the following changes and new information have affected the potential impacts to EMF:

- Updates to methodology for evaluating EMF.
- Changes to the design of the CRC project’s LPA to develop a Modified LPA, including design options.

Based on the analysis in this section, the effects of the Modified LPA would be similar to those of the CRC LPA. The Modified LPA and the CRC LPA would both result in an increase in EMF exposure near the light-rail alignment, including at substations and within light-rail vehicles. Exposure levels in both cases would remain below applicable exposure guidelines. However, there would be changes between the CRC LPA and the Modified LPA in sensitive land uses exposed to EMF, as described in Table 3.13-1.

Table 3.13-1. Comparison of CRC LPA Effects and Modified LPA Effects from Electric and Magnetic Fields

Technical Considerations	CRC LPA Effects as Identified in the 2011 Final EIS	Modified LPA Effects as Identified in This Section	Explanation of Differences
Sensitive Land Uses	<ul style="list-style-type: none"> • Northernmost electrical substation would be located between 17th Street and McLoughlin Boulevard in Vancouver, land currently in residential use. The five residential parcels closest to the substation would be acquired. • New transit-oriented development activities and sensitive uses would be located a considerable distance from proposed substation locations. 	<ul style="list-style-type: none"> • Proposed Evergreen substation would be located approximately 100 feet south of a multifamily residential complex. EMF levels from the station would be below the public exposure guidelines. • The other three proposed substations are not near residential buildings or other EMF-sensitive land uses. 	Differences are due to the change in the LRT alignment in downtown Vancouver (shifted from downtown streets to along I-5) and the change in the northern LRT terminus.

CRC = Columbia River Crossing; EIS = Environmental Impact Statement; LPA = Locally Preferred Alternative; LRT = light-rail transit

3.13.2 Existing Conditions

Current Guidelines and Regulations

Federal regulations set limits for EMF exposure in the workplace and in public areas that apply to AM and FM radio, television, and wireless sources (47 Code of Federal Regulations 1.1307(b)). Schools, daycare facilities, hospitals, senior living facilities, research facilities, and universities are considered sensitive receptors to EMF. The FTA has adopted guidance on approaches to preventing and reducing community

1 environmental, health, and safety impacts from transit-generated EMF and electromagnetic radiation,
 2 including best management practices for light-rail systems.

3 The International Commission on Non-Ionizing Radiation Protection (ICNIRP), in association with the World
 4 Health Organization and the American Conference of Governmental Industrial Hygienists, has developed
 5 voluntary occupational guidelines for EMF exposure, shown in Table 3.13-2.

6 **Table 3.13-2. Exposure Guidelines for Power Frequency (60 Hz) Electromagnetic Fields**

Exposure at 60 Hz	Electrical Field (kV/m)	Magnetic Field (mG)
International Commission on Non-Ionizing Radiation Protection		
Occupational	8.3	10,000
General Public	4.2	2,000
American Conference of Governmental Industrial Hygienists		
Occupational Exposure Should Not Exceed this Level	25	10,000
Prudence Dictates Use of Protective Clothing Above this Level	15	-
Exposure of Workers with Cardiac Pacemakers Should Not Exceed this Level	1	1,000

7 Sources: ICNIRP 2010; ACGIH 2015
 8 Hz = hertz; kV/m = kilovolts per meter; mG = milligauss

Units for Electric and Magnetic Fields

Voltage is similar to “electrical pressure” in an electrical line. This pressure produces an electrical field that extends out from the line and is measured in volts per meter (V/m). Current, in an active electrical line, also produces a magnetic field around the line. Magnetic fields are measured in units of gauss (G). Since most magnetic fields are weak, these fields are typically measured in milligauss (mG or 1/1,000th of a gauss).

Electrical systems can be either direct current (DC) or alternating current (AC). The electricity in wall sockets and power lines is alternating current. Direct current powers the MAX light-rail system in Portland. The frequency of alternating current is measured in hertz (Hz).

9 **EMF Generation and the Existing** 10 **TriMet Light-Rail System**

11 The main sources of EMF associated with
 12 LRT are the traction power system elements
 13 for the TriMet MAX LRT system. Table 3.13-3
 14 shows the strength of the magnetic field at
 15 distances of 30, 65, and 100 feet from the
 16 light-rail tracks. As shown in Table 3.13-3,
 17 the magnetic field strength weakens rapidly
 18 as distance from the tracks increases. The
 19 highest measured value (167 milligauss
 20 [mG]) is well below the ICNIRP standard of
 21 2,000 mG for public exposure to magnetic
 22 fields.

23 **Table 3.13-3. Magnetic Field Strength at Distance from TriMet’s Light-Rail Tracks (mG)**

Direction	30 Feet	65 Feet	100 Feet
Horizontal	167.0	44.6	13.3
Vertical	17.8	8.2	3.4

24 Source: Edelson and Holmstrom 1998
 25 mG = milligauss.

1 Direct current magnetic fields measured in 2008 at TriMet’s light-rail substations ranged from 107 to 601 mG
2 at the perimeter of the buildings and from 47 to 551 mG at light-rail stations. Magnetic field measurements
3 taken inside light-rail cars fluctuated between approximately 0.38 and 8.13 mG at approximately seat height,
4 indicating that EMF emissions are extremely low within the light-rail vehicles used in the existing light-rail
5 system. All the field intensities measured in TriMet’s system are below the public exposure guidelines.

6 3.13.3 Long-Term Benefits and Effects

7 **No-Build Alternative**

8 Existing EMF levels in the study area are a function of global background magnetic fields and EMF generated
9 by nearby sources (e.g., utility power cables, office equipment, internal building wiring, and any other
10 electrical apparatus). EMF levels fluctuate over time, depending on the operation of these nearby sources.
11 Under the No-Build Alternative, there would be no change in existing EMF levels.

12 **Modified LPA**

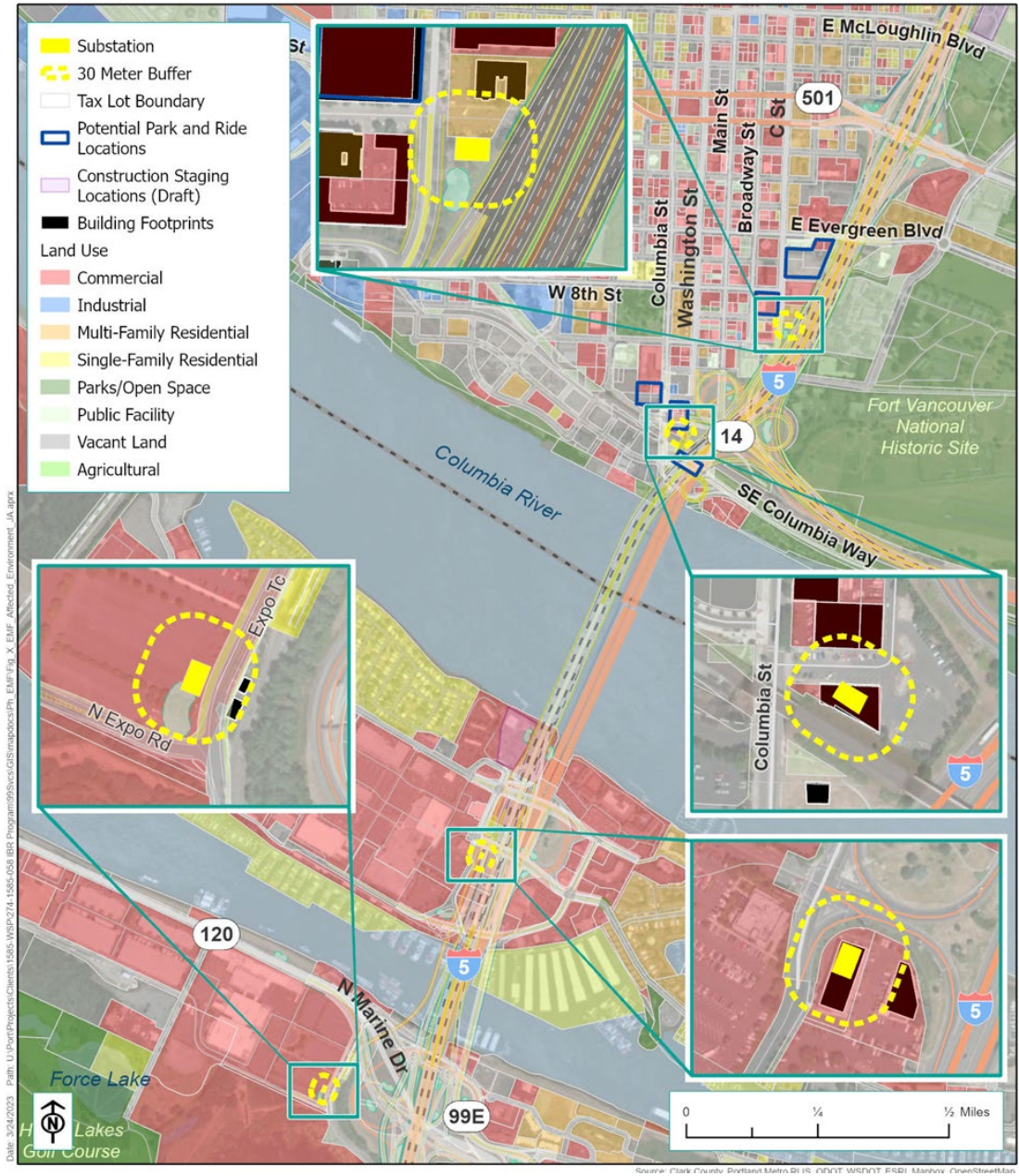
13 There would be no changes to existing EMF sources or levels related to the highway components of the
14 Modified LPA, including the one or two auxiliary lane options, the option with or without the C Street ramps,
15 or the option to shift the I-5 mainline to the west.

16 The light-rail trains would be powered by electricity, creating EMF fluctuations each time a train passes by. In
17 the study area overall, EMF levels under the Modified LPA would be similar to those under the No-Build
18 Alternative. Within and near the light-rail right of way, near substations, and within the light-rail vehicles, EMF
19 emissions would increase slightly compared to the No-Build Alternative but would remain well below
20 exposure guidelines. The Modified LPA with the single-level fixed-span bridge configuration, including the
21 single-level movable-span option, would shift the LRT alignment across the Columbia River slightly west of
22 the double-deck fixed-span bridge configuration but EMF levels would remain well below exposure guidelines.

23 Figure 3.13-1 illustrates the locations of the light-rail substations proposed under the Modified LPA and the
24 adjacent land uses. The proposed Evergreen substation would be located approximately 100 feet south of a
25 multifamily residential complex in downtown Vancouver. Based on measurements taken at similar traction
26 power substations, EMF levels from the Evergreen substation would be below the general public exposure
27 guidelines shown in Table 3.13-1. The other three proposed substations are not near residential buildings or
28 other EMF-sensitive land uses.

29 The Modified LPA would produce EMF from LRT, which is powered by electricity. However, the EMF intensities
30 would be below exposure guidelines for risks to human health.

1 Figure 3.13-1. Modified LPA Proposed Light-Rail Substations and Existing Land Uses



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3 3.13.4 Temporary Effects

4 Construction of the Modified LPA would require electrical power for certain activities but is not expected to
5 result in appreciable changes to EMF levels in the study area.

6 3.13.5 Indirect Effects

7 After decades of study and human exposure a direct link between EMF levels and adverse health impacts has
8 not been firmly established. Consequently, no indirect effects from EMF are anticipated from the Modified LPA
9 or the No-Build Alternative.

1 **3.13.6 Potential Avoidance, Minimization, and Mitigation Measures**

- 2 The levels of EMF anticipated to result from the Modified LPA are less than the exposure standards for both
3 the workplace and the public; therefore, mitigation would not be necessary. The IBR Program would follow
4 FTA guidance on best management practices for avoiding and minimizing EMF levels from light-rail systems.