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3. Scope of UP Express Electrification Project

As briefly described in Chapter 1, the purpose of the UP Express Electrification project is to convert the UP Express service that will operate between UP Express Union Station and UP Express Pearson Station (with stops at UP Express Bloor and UP Express Weston Stations) from diesel powered to electric powered trains.

The scope of the project includes three main components which are further elaborated on below:

- **Traction Power Supply** (subject to Class EA process being carried out by Hydro One, refer to *Hydro One Union Pearson Express Electrification Traction Power Substation Class Environmental Assessment - Draft Environmental Study Report* for detailed information related to the Traction Power supply components)
- **Traction Power Distribution** (subject to TPAP being carried out by Metrolinx)
- **Maintenance Facility for the electrified UP Express service** (subject to TPAP being carried out by Metrolinx)

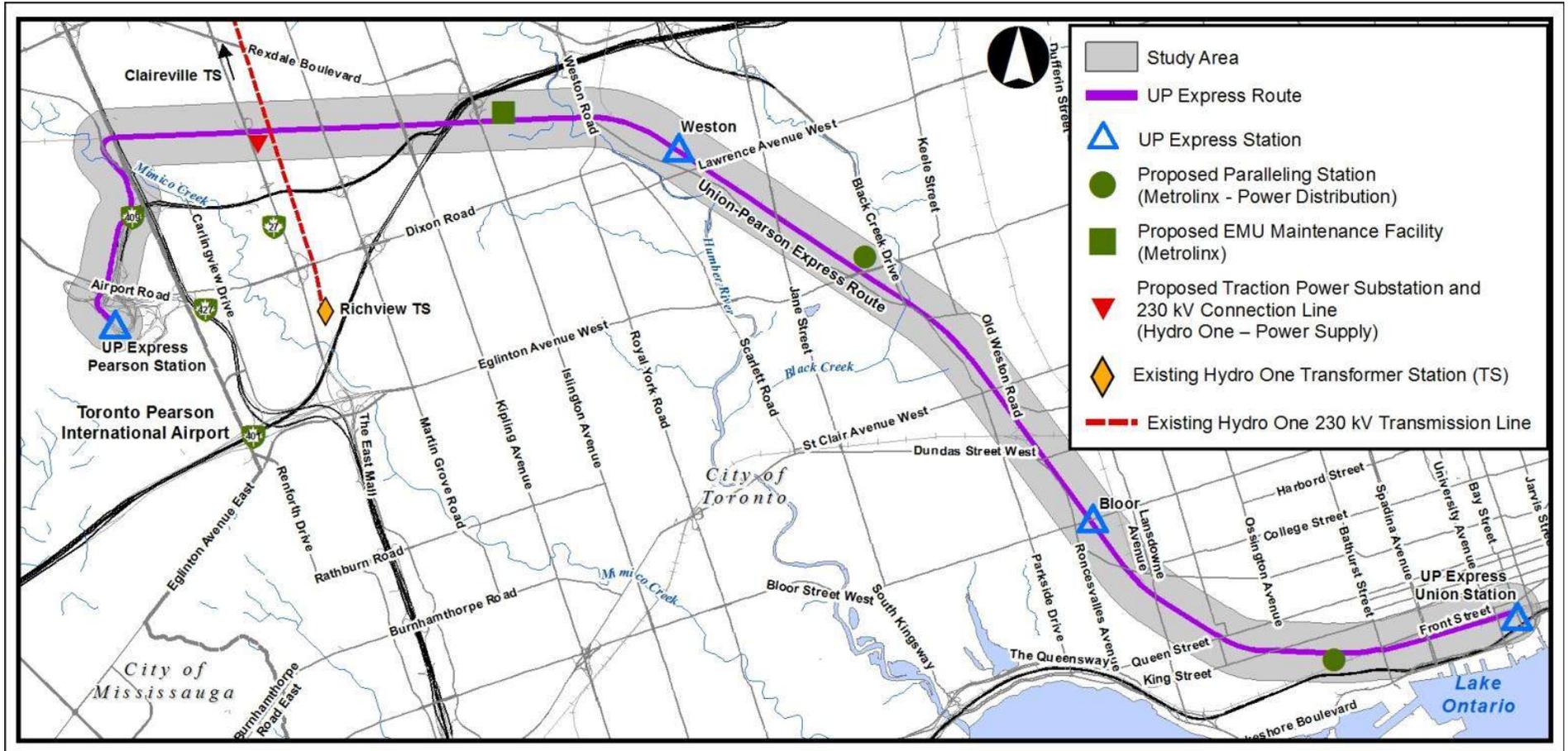
3.1 Study Area

Figure 3-1 illustrates the UP Express Electrification EA Study Area, which is described as follows:

- Proposed location for the new Traction Power Substation¹ (175 CityView Drive), which includes the location for the proposed gantries and 25 kV feeders (via underground duct banks) at this site;
- UP Express route beginning at the future UP Express Union Station, along the GO Union Station Rail Corridor (USRC), northwesterly along the GO Kitchener Rail Corridor to Highway 427, along the new airport spur (under construction) and into the future UP Express Pearson Station at Pearson International Airport;
- Preferred locations for traction power distribution facilities including two Paralleling Stations (and associated gantries/underground duct banks associated with 25 kV feeders); and
- Preferred location for the new EMU Maintenance Facility.

¹ Refer to the *Hydro One Union Pearson Express Electrification Traction Power Substation Class Environmental Assessment - Draft Environmental Study Report*.

FIGURE 3-1 UP EXPRESS ELECTRIFICATION STUDY AREA



3.2 Traction Power Supply (Hydro One)

Recognizing that a separate Class EA study is being undertaken by Hydro One to assess the traction power supply portion of the project, the following provides an overview of these particular components in order to provide context for how the electrified UP Express will be powered.

Metrolinx is proposing to electrify the UP Express service, which requires electrical power to be supplied from Ontario's electrical system through Hydro One's existing high voltage grid. As a result, Hydro One is carrying out the design and Class EA study under the Class EA for Minor Transmission Facilities Process for a new 230 kV line connection and a new Traction Power Substation (175 CityView Drive), which collectively form the power supply requirements of the undertaking.

3.2.1 230 kV connection

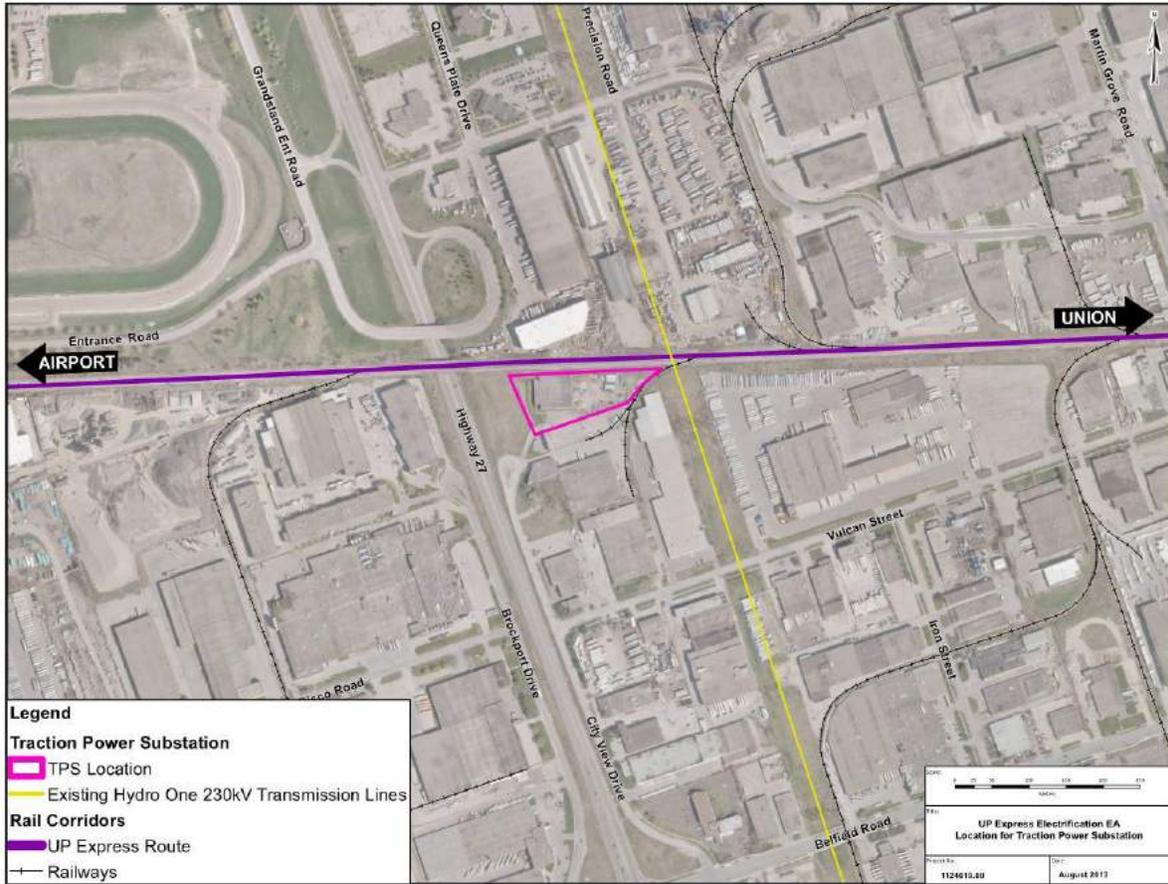
Electric power for UP Express will be provided by tapping 230 kV feeders from the 230 kV overhead transmission circuits emanating from the existing Hydro One Richview 230 kV substation. The new 230 kV transmission connection line taps will connect to a new Traction Power Substation (TPS) at 175 City View Drive (see **Figure 3-2**).

3.2.2 Traction Power Substation

The electrified UP Express will be a 2 x 25 kV ac autotransformer fed electrification system which will be connected directly to a high voltage system. The proposed Traction Power Substation (TPS) will transform the utility supply voltage of 230 kV to 2x25 kV (UP Express Union Station to Highway 427), and 1x25 kV (Highway 427 to UP Express Pearson Station) along the Overhead Contact System (OCS) for distribution to the electric trains along the rail corridor. The TPS will contain two main transformers of 30 million volt-amperes (MVA) capacity each.

For further detail, refer to *Hydro One Union Pearson Express Electrification Traction Power Substation Class Environmental Assessment - Draft Environmental Study Report*.

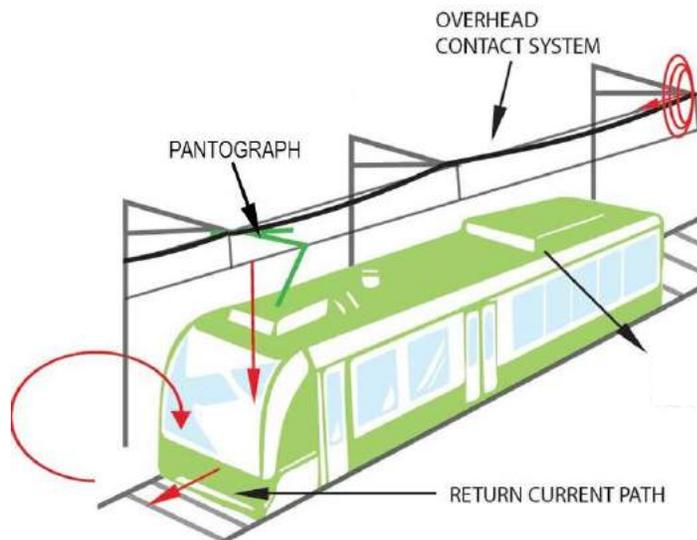
FIGURE 3-2 LOCATION OF TRACTION POWER SUBSTATION



3.3 Traction Power Distribution

The power supplied by the City View Drive traction power substation will be distributed through the UP Express corridor via the power distribution system which will be comprised of an Overhead Contact System, gantries, 25 kV feeders (underground), and two Paralleling Stations. The trains will collect their propulsion power from the OCS by means of pantographs mounted on top of the trains (see **Figure 3-3**), and will return the current (i.e., power) back to the traction power substation via their wheels through the traction power return system.

FIGURE 3-3 PANTOGRAPH ON ELECTRIC TRAIN



Therefore, the traction power distribution components can be summarized as follows:

- Overhead Contact System
- Catenary Feeding Gantries
 - 25 kV feeders (underground)
- Two Paralleling Stations

3.3.1 Overhead Contact System (OCS)

Generally speaking, the OCS is used to transmit electrical energy to trains at a distance from the energy supply point. The OCS is a fundamental component of the overall traction power distribution system for the electrified UP Express service. The OCS consists of a wiring system (i.e., messenger wire and contact wire) that provides efficient transfer of power to the pantograph mounted on the roof of the train, and then to the electric drive motors. The OCS wiring system will be suspended from a number of support structures (i.e., portals and cantilevers) placed along the UP Express route (rail corridor). **Figure 3-4** illustrates a typical OCS including portal structures.

FIGURE 3-4 TYPICAL OCS



Location: Rugby Station - west coast main line (UK)

3.3.2 Gantries and 25 kV Feeders

In order to convey electrical power to the OCS, 25 kV power supply feeders need to be routed at three locations: from the traction power substation to the OCS along the rail corridor, and from the two paralleling stations to the OCS along the rail corridor. At these three locations, the 25 kV feeders will be installed in underground duct banks where they will connect to the main and strain gantries (one on either side of the railway) situated in the vicinity of both Paralleling Stations and the Traction Power Substation (Hydro One). From the gantry locations, the feeders then connect to the OCS. **Figure 3-5** illustrates typical gantries.

FIGURE 3-5 TYPICAL GANTRIES



3.3.3 Paralleling Stations

Paralleling stations contain autotransformers which are required as a part of the 2 x 25 kV system in order to boost the OCS voltage at certain points along the UP Express route and to reduce the running rail return current. The function of the autotransformers is to step down the 50 kV nominal voltage between the OCS and negative feeder, to the 25 kV level between catenary and running rails. The paralleling station facilities also contain associated switchgear and disconnect switches. **Figure 3-6** illustrates a typical paralleling station.

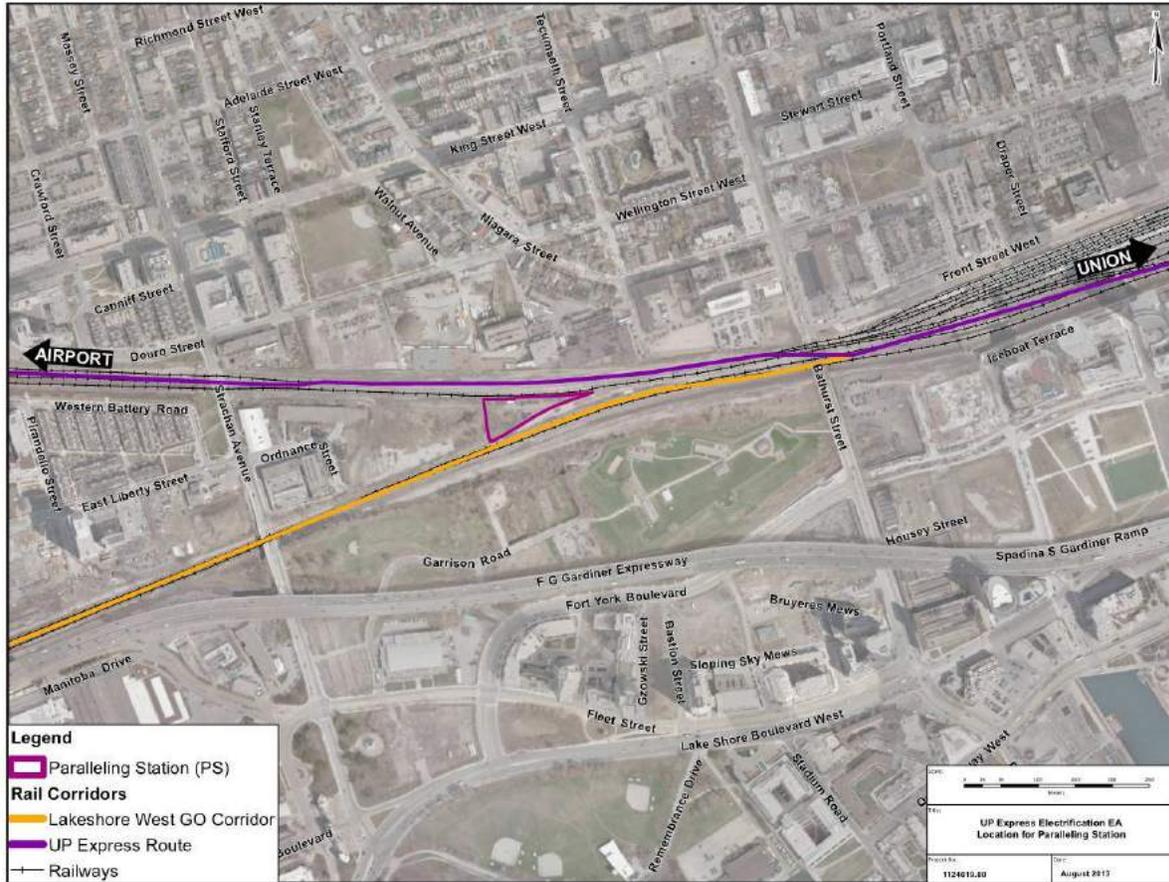
FIGURE 3-6 TYPICAL PARALLELING STATION



To ensure maximum reliability of the system, paralleling stations need to be located at regular intervals along the electrified route, approximately every 8 -12 km. There are two paralleling stations required as part of the electrified UP Express system: one at Ordnaunce Road, and one at 3500 Eglinton Avenue West (see **Figures 3-7** and **3-8** respectively). Further detail related to the process followed for identifying the preferred Paralleling Station locations is contained in Chapter 2.

With respect to the 3500 Eglinton Avenue West location, this is also the proposed location for the planned Metrolinx Eglinton Crosstown Maintenance and Storage Facility. Accordingly, coordination between the UP Express Electrification EA team and the Eglinton Crosstown project team was undertaken as part of the TPAP to ensure that the paralleling station facility could be accommodated on the Eglinton Avenue West site. It was subsequently confirmed that the paralleling station can be incorporated within the Eglinton Avenue West site (as shown on **Figure 3-8**).

FIGURE 3-7 PARALLELING STATION - ORDNANCE STREET



3.3.4 Ancillary Components

There are a number of ancillary works associated with the traction power distribution system that will also be implemented as part of electrifying UP Express. These particular components include but are not limited to: grounding and bonding system, bridge protection measures, etc. and are summarized in detail in Chapter 5:

3.4 Maintenance Requirements

3.4.1 Traction Power Distribution System Maintenance

New maintenance requirements will be introduced as part of implementing UP Express electrification. In terms of the traction power distribution system, the following equipment will need to be maintained: OCS, autotransformers, indoor and outdoor type switchgear, disconnect switches, System Control and Data Acquisition (SCADA) interface equipment, cables and wires, ground grids / mats, etc. These maintenance requirements are further detailed in Chapter 5.

3.4.2 Electric Train Maintenance

Regular maintenance will need to be carried out on the new electric trains (EMUs) that will operate along the electrified UP Express route. This includes preventative maintenance (e.g., replacing brake pads, measuring wheels, inspection of running gear, etc.), heavy maintenance (e.g., replacement of transformers and ac propulsion systems, etc.) and service maintenance (e.g., general cleaning, toilet dumping, refill potable water, etc.).

Maintenance of the UP Express trains will require a maintenance facility that can accommodate a small fleet of electric trains and operate within limited daily maintenance windows. An assessment of potential maintenance facility options was carried out as part of the TPAP, which is described in detail in Chapter 5. The preferred option identified was implementation of a new maintenance shop and storage yard at 50 Resources Road to service the dedicated fleet of electric UP Express EMU vehicles (see **Figure 3-9**).

FIGURE 3-9 EMU MAINTENANCE FACILITY AT 50 RESOURCES ROAD

