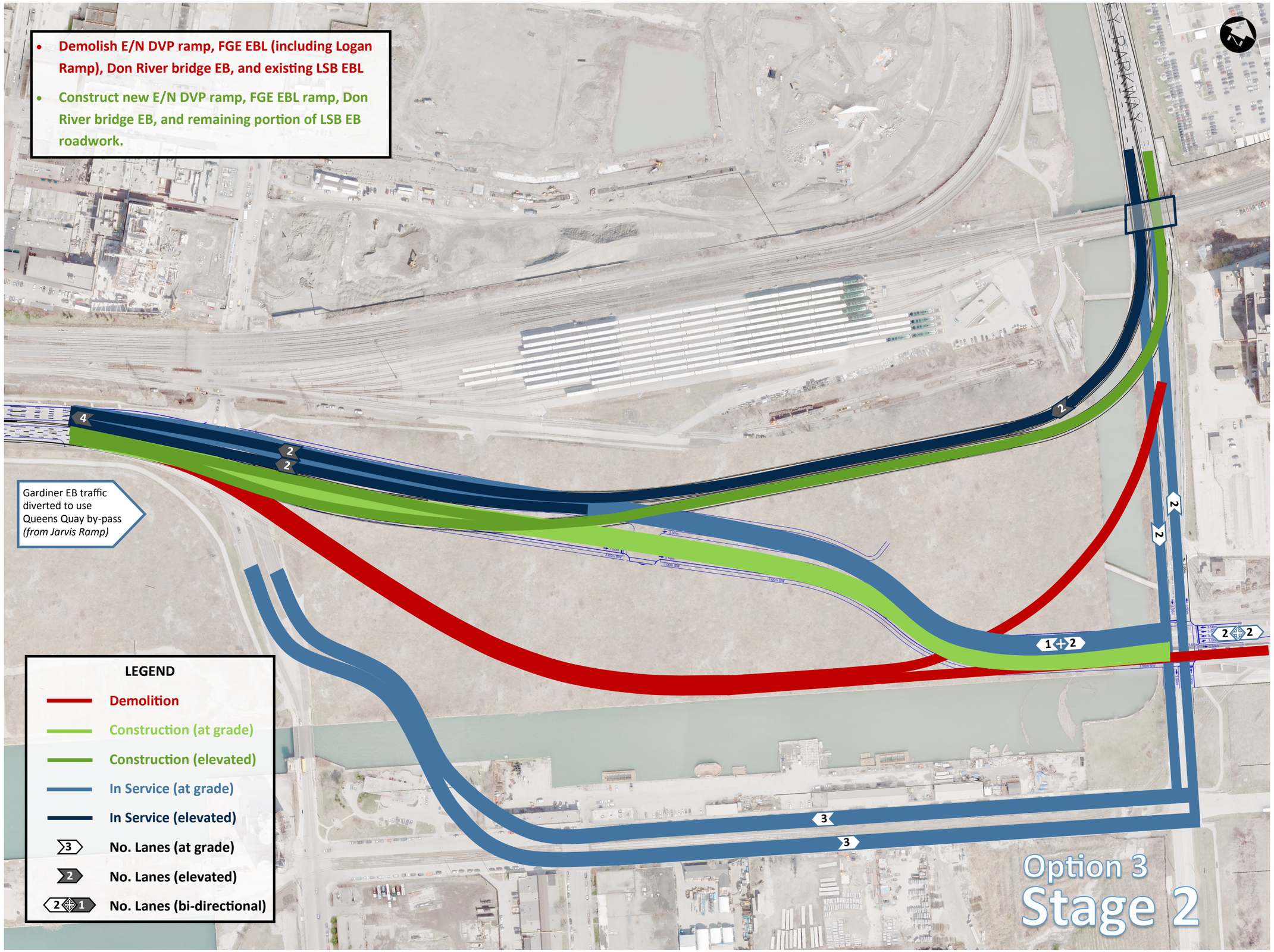
Re: PW11.1 - Appendix 3 - Part 8

- **Demolish S/W DVP ramp, FGE WBL (including Logan Ramp), Don River bridge WB, and existing LSB WBL**
- **Construct new S/W DVP ramp, FGE WBL ramp, Don River bridge WB, and remaining portion of LSB WB roadwork.**

LEGEND

- Demolition
- Construction (at grade)
- Construction (elevated)
- In Service (at grade)
- In Service (elevated)
- No. Lanes (at grade)
- No. Lanes (elevated)
- No. Lanes (bi-directional)

Option 3
Stage 1


Demolish E/N DVP ramp, FGE EBL (including Logan Ramp), Don River bridge EB, and existing LSB EBL
Construct new E/N DVP ramp, FGE EBL ramp, Don River bridge EB, and remaining portion of LSB EB roadwork.
DON VALLEY PARKWAY
Gardiner EB traffic diverted to use Queens Quay by-pass (from Jarvis Ramp)
LEGEND
Demolition
Construction (at grade)
Construction (elevated)
In Service (at grade)
In Service (elevated)
No. Lanes (at grade)
No. Lanes (elevated)
No. Lanes (bi-directional)
Option 3
Stage 2

- Remove temporary crossing at Keating Channel
- Open all structures and roadways

LEGEND

- Demolition
- Construction (at grade)
- Construction (elevated)
- In Service (at grade)
- In Service (elevated)
- No. Lanes (at grade)
- No. Lanes (elevated)
- No. Lanes (bi-directional)

Option 3
Final

APPENDIX D

INFRASTRUCTURE COSTING ASSUMPTIONS

Capital Cost and NPV Estimate Approach

The estimate of probable costs that was completed for the evaluation of alternative solutions involved the determination of comparative capital, operations and maintenance costs of each of the three Hybrid Alternatives (Options 1, 2A and 3) over a 100-year period starting in 2013. This approach adopted conventional Life Cycle Cost Analysis methodology but used a more lengthy evaluation period of 100 years to allow the exercise to be performed and presented in line with the City's original method of evaluation of its Maintain Scheme of re-decking the F.G. Gardiner Elevated Expressway from Yonge Street to Cherry Street.

This method of evaluating the costs and life cycle costs of alternatives for the Gardiner Reconfiguration is kept consistent throughout the entire Environmental Assessment work.

Capital Cost Estimate

Capital costs in the estimates were defined as the major capital expenditures necessary for either new bridge or road construction or for bridge deck replacement. These included cost determination for the following Major Costs Items:

1. Roadworks
    - Lakeshore Boulevard
    - On-grade portion of the Gardiner
    - Other Roadworks, Signals and Intersections
2. Structures
    - Bridge and Ramp Demolition
    - Bridge Deck Replacement of the Gardiner
    - Other Bridges (e.g. Don River Crossings, Transition between existing and new bridges)
    - New Ramp Bridges
    - Overpass Bridge (e.g. Metrolinx Bridge)
3. Utility Relocations
4. Traffic Maintenance During Construction
    - Major Detours, Temporary Roadworks and Outside corridor works
5. Landscaping and Urban Design
    - Type 1: Hardscape w/ Planting Area (Urban, street trees in paving, structural soil)
    - Type 2: Hardscape w/ Planting Areas & Special Amenities (skate park, court sports, 1/3 planting)
    - Type 3: Hardscape w/ Planting Areas (Paving, Gardens, Street trees, 1/3 Planting)
    - Type 4: Softscape (Primarily groundcover Planting, trees, Paths, 2/3 planting)
    - Vegetative green screening of railway retaining wall (non-structural)
6. Contaminated Material Disposal
    - Contaminated soil disposal for trench excavation along new Lake Shore for sewer works and new footing construction.

For utility costs, an inventory of the buried utilities under the existing Gardiner Expressway was developed and costed for complete removal and relocation. 15% of this cost was assigned to each of the three Hybrid Alternatives. A detailed inventory of the existing utilities in the Lake Shore Boulevard corridor was prepared from available Digital Map Owners Group (DMOG) composite underground utility maps mapping. This inventory was provided to the affected utility companies for the costing exercise. Of note is that the majority of the lands through which the Hybrid options are located are outside of the Gardiner/Lake Shore Boulevard corridor and has minimal underground utilities

Any costs associated with relocating existing utilities from the old Lake Shore Boulevard corridor to the new one through the Keating Precinct area were not included in establishing utility costs for the Hybrid Alternatives. Municipal servicing and utility work requirements and issues in this area were assessed as part of the *Keating Channel Precinct Plan (May 2010)* that concluded the following relative to municipal servicing infrastructure:

- The current potable water infrastructure in the Keating Channel Precinct is very limited and over 80 years old, nearing the end of its lifespan. It needs to be replaced to adequately prepare for new development in this Precinct and the rest of the Lower Don Lands
- The sewers in this area were part of the East Harbour Development, and were constructed and installed in the late 1920's and early 1930's. Like the water infrastructure, the wastewater infrastructure is nearing the end of its lifespan. In addition to the age of the infrastructure, the configuration of the existing system is not conducive to supporting the proposed development
- The majority of storm outlets are found along the Keating Channel. They serve the study area north of the Keating Channel. Most of the active storm system was constructed in the late 1920s and 1930s as a part of the Eastern Harbour Development, with the most recent storm sewers constructed in the late 1940s.
- Much of the servicing infrastructure is old and needs replacing and is not functioning in a manner that is considered sustainable

Utility/servicing, relocation and de-commissioning issues and costs associated with existing utilities in the bypassed portion of Lake Shore Boulevard were considered to be part of the cost of development of the Keating Precinct lands and as a separate initiative to this EA.

For traffic maintenance during construction costs, these were determined as a percentage allowance of 5 % of the total Major Cost Items 1, 2, and 3 as mentioned above.

Contaminated material disposal costs were established by estimating the volume of contaminated soil that may be encountered with disposal to an appropriate MOE licensed site using unit rates from recent project experience. The estimation of the required volume of contaminated soil removal and disposal along the project limits was based on a 4 m wide excavation into native soils along the new Lake Shore Boulevard footprint between Cherry Street and Don Roadway to a depth of 2 m and an additional allowance for the construction of new footings for the new bridge and ramp structures. Of note is that the future grade of Lake Shore Boulevard in this area will be entirely in fill. Similar to the issue utility

relocation associated with the bypassed Lake Shore Boulevard corridor, any de-commissioning costs related to the disposal of contaminated materials in the old road corridor were considered to be part of the development of the Keating Precinct lands and were not part of this EA.

Totals for the Major Cost Items outlined above were developed and, in addition to the above-mentioned allowances already made, the following percentages were added to determine the total capital costs for each Hybrid alternative:

- Engineering and design costs – 10% for the new works east of Cherry Street added under the Hybrid Concepts.
- Contingencies – 15% for the new work east of Cherry Street added under the Hybrid Concepts.
- An additional 20% cost allowance was applied for the total capital, operations and maintenance costs

Quantities for costing (e.g. deck areas, LSB lanes) were taken from concept plans for each of the alternatives. Unit costs were applied to these quantities to determine the capital cost. The unit costs were estimated based on the following principles:

- The major reference for prices was the *Ontario Ministry of Transportation (MTO)'s Parametric Estimating Guide (PEG), 2011*.
- For items not directly related to the MTO PEG (e.g. bridge demolition, and bent relocation) the work was quantified and priced according to *MTO's Highway Costing (HiCo) 2013* data base with adjustment based on similar and local project experience.
- Other items that were not covered or not directly related to PEG or HiCo were estimated based on recent, similar project experience. These include the following:
    - Demolition;
    - Intersection costs (drainage, curb, pavement marking etc.); and
    - Landscaping and urban design

Although the majority of unit prices were based on the MTO PEG, price adjustments were made. Prices from recent City of Toronto projects (e.g. bridge removal, and deck replacement) were reviewed and some of the unit prices were adjusted to account for complexity of the Gardiner project, the increased durability required to provide for the extended service life of 100 years, use of advanced construction materials and the work in downtown core. Unit prices used in the analysis were corrected to 2013 year values. Additional adjustments were made as follows;

- Available MTO PEG 2011 prices were updated with inflation rate of 5% per year for two years in order to represent 2013 prices.
- In agreement with Delcan's 2014 peer review report, a complexity factor of 2.6 was applied for the new bridge construction item – New Bridge Gardiner and Ramp. This was to account for the difficult urban city construction environment for bridge work. This factor was not considered applicable to demolition, road, signal, and other structural items.

- All deck replacement unit costs were adjusted to be consistent with the City's original Gardiner Rehabilitation Life Cycle Analysis.

Life Cycle Costs and Operations and Maintenance Considerations

A life cycle cost analysis was conducted for the alternatives for a 100-year cycle starting in 2013. The City previously conducted a Life Cycle Cost Analysis (LCCA) for maintaining the entire elevated section of the Gardiner. The same approach was adopted here for the Hybrid Alternatives. The capital costs and costs associated with projected remedial treatment occurrences were assigned throughout the 100 year time line using year 2013 construction unit rates without adjustment for inflation. The maintenance methodology followed the City of Toronto's model proposed for Major and Minor Arterial Roads. A 4% discount rate was applied to convert all costs to 2013 present value and summed together to arrive at the total LCCA cost for each individual alternative. The following are some key comments and assumptions related to this analysis:

- All capital cost work items carried forward from the original Maintain (west of Cherry Street) were be used in accordance with the original "Maintain Alternative" time line.
- The majority of the capital costs for new bridge works (demolition of Logan Ramp and construction of new ramp structures in the vicinity of Cherry Street) would start in 2020 and be carried out over a period of 4 years, followed by designated and specific life-cycle repairs required over the 100 years period of evaluation.
- The new structures supporting the new ramps and new road works would follow a similar model once their remaining life-spans expired. All new bridges would be designed for 75 years life according the CHBDC except otherwise noted.
- Operations and maintenance (O&M) costs include allowances for the following:
    - Structural work
        - Superstructure Repairs - overlay, waterproof and pave (OWP);
        - Superstructure Repairs - patch, waterproof and pave (PWP);
        - Bent Repairs; and
        - Steel Painting.
    - Road work
        - Road Resurfacing;
        - Road Reconstruction; and
        - Intersection Signal Replacement.
- O&M unit costs were based on ongoing and recent City costs for these types of remediation works.
- It was assumed that the new decks will have a life span of 100 years, having been replaced with reinforcing materials inert to chlorides such as Stainless Steel and/or Glass Fibre Reinforced Polymer (GFRP) in conjunction with high performance concrete, waterproofing membrane and asphalt protection layer.

- To systemically evaluate the costs, the section of the Gardiner Expressway east of Yonge Street was divided into twelve (12) zones based on similar condition, and approximate dates of construction or rehabilitation for the existing deck. The capital and O&M costs for these zones were developed for each of the alternatives:

  - Zone 1: Jarvis Street to Small Street
  - Zone 2: Small Street to Cherry Street
  - Zone 3: Cherry Street to Don River (Existing structures to be maintained)
  - Zone 3a: Cherry Street to Don River (New Structures under Hybrid Scheme)
  - Zone 4: Gardiner to LSB Ramps at east
  - Zone 5: Jarvis on-ramp
  - Zone 6: Sherbourne off-ramp
  - Zone 7: Gardiner off ramp to DVP
  - Zone 8: DVP on-ramp to Gardiner
  - Zone 9: Yonge Street to west of Jarvis Street
  - Zone 10: West of Jarvis Street to Jarvis Street
  - Zone 0: LSB Bridge over the Don River

Life cycle costs have been summarized in two ways:

- All 2013 capital and maintenance costs were assigned over the 2013 – 2113 timeline at the appropriate years and discounted to a 2013 net present worth.
- The initial construction capital costs (essentially in the period of 2020 to 2028) were classified as 2013 capital costs and the remaining costs in the 100 year period were discounted to 2013 and added to the 2013 capital costs.

The above costing methodology was peer reviewed by an independent consultant and has been adjusted based on comments and suggestions that were received. Property costs are not included in the capital cost estimates.