Long List of Alternative Solutions and Pre-Screening

Alternative 1
Do Nothing

The Dufferin and West Don Sanitary Trunk Sewers would remain in place, and no improvements would be identified.

While the 'Do Nothing' alternative does not address the Problem and Opportunity Statement for the study, it is considered as a baseline for comparison of other alternatives and was carried forward throughout the study.

Alternative 2
Rehabilitation

The existing sections of the Dufferin Sanitary Trunk Sewer in need of repairs would be repaired in place. The following rehabilitation methods were reviewed:

- 2A – Dry Rehabilitation
  - Requires bypass pumping to divert flows during construction.
- 2B – Flow Controlled Rehabilitation
  - Requires measures restricting flows from entering pipe (upstream storage, weirs, etc.)
- 2C – Wet Rehabilitation
  - Work undertaken during live flow conditions

Rehabilitation technology alternatives were screened based on the advantages and limitations of each including: ease of construction, impact on capacity, durability and long term maintenance requirements, and site-specific conditions.

Alternative 3
Realignment

Various realignment options were considered (see separate drawings).

A number of construction technologies were reviewed, and the following were identified as feasible alternatives:

- Horizontal Directional Drilling (HDD)
- Microtunnelling (MT)
- Handtunnelling considered for tie-in connections only (HT)

Alternative realignments were screened based on their impacts to land use, staging area requirements, utility or other infrastructure conflicts, traffic impacts, and environmental impact including tree/vegetation removal requirements.

Construction technologies were considered for each realignment alternative, and assessed based on staging requirements and setbacks.

Longlist - Rehabilitation Technologies

A number of rehabilitation technologies were considered

Cured-in-Place Pipe (CIPP) DRY – existing pipe is lined with flexible tube filled with thermosetting resin. Tube is pulled through pipe, inflated, and heated to begin curing process.

Fold and Form – DRY – Thermoplastic liner is folded into a 'C' or 'H' shape, and inserted into the existing pipe. One end is plugged, and steam is injected under pressure to expand the liner to its original shape.

Centrifugally Cast Concrete Pipe (CCCP) – DRY – Cement motor lining is installed by spincasting onto the interior of a deteriorated pipe.

CIPP is the preferred rehabilitation method for this application.

Sliplining – WET OR DRY – Trenchless rehabilitation technology where a new pipe is inserted into the existing pipe by pulling, pushing, or carrying the new pipe into the existing pipe. The space between the two pipes is then grouted.

Polymer Based Coatings – DRY – application of polymer layer by spin-casting or manual spray using spray guns.

Steel Reinforced Polyethylene (SRP PE) – WET/CONTROLLED FLOW – steel-reinforced corrugated polyethylene strips with a smooth inner wall are spiral wound by machine into the existing pipe, and grouted in place.

Close-Fit Liner – WET/CONTROLLED FLOW – PVC liner assembled by a winding machine at the entry pit and is extended into the host pipe as the liner is built. Liner is locked, and winding machine is rotated in the opposite direction, expanding the liner to provide a 'close fit' with the inner wall of the pipe.

Longlist - Realignment Construction Technologies

A number of realignment construction technologies were considered

Pipe Jacking – All methods that use a jacking process to slide pipe segments through the ground, with new pipe segments added at the launch site.

Microtunnelling – Pipe jacking operation that uses a remotely-controlled microtunnel boring machine (MTBM). The MTBM is pushed into the earth by hydraulic jacks.

Hand Tunnelling (HT) – Tunnel is sequentially excavated and supported as the installation progresses forward.

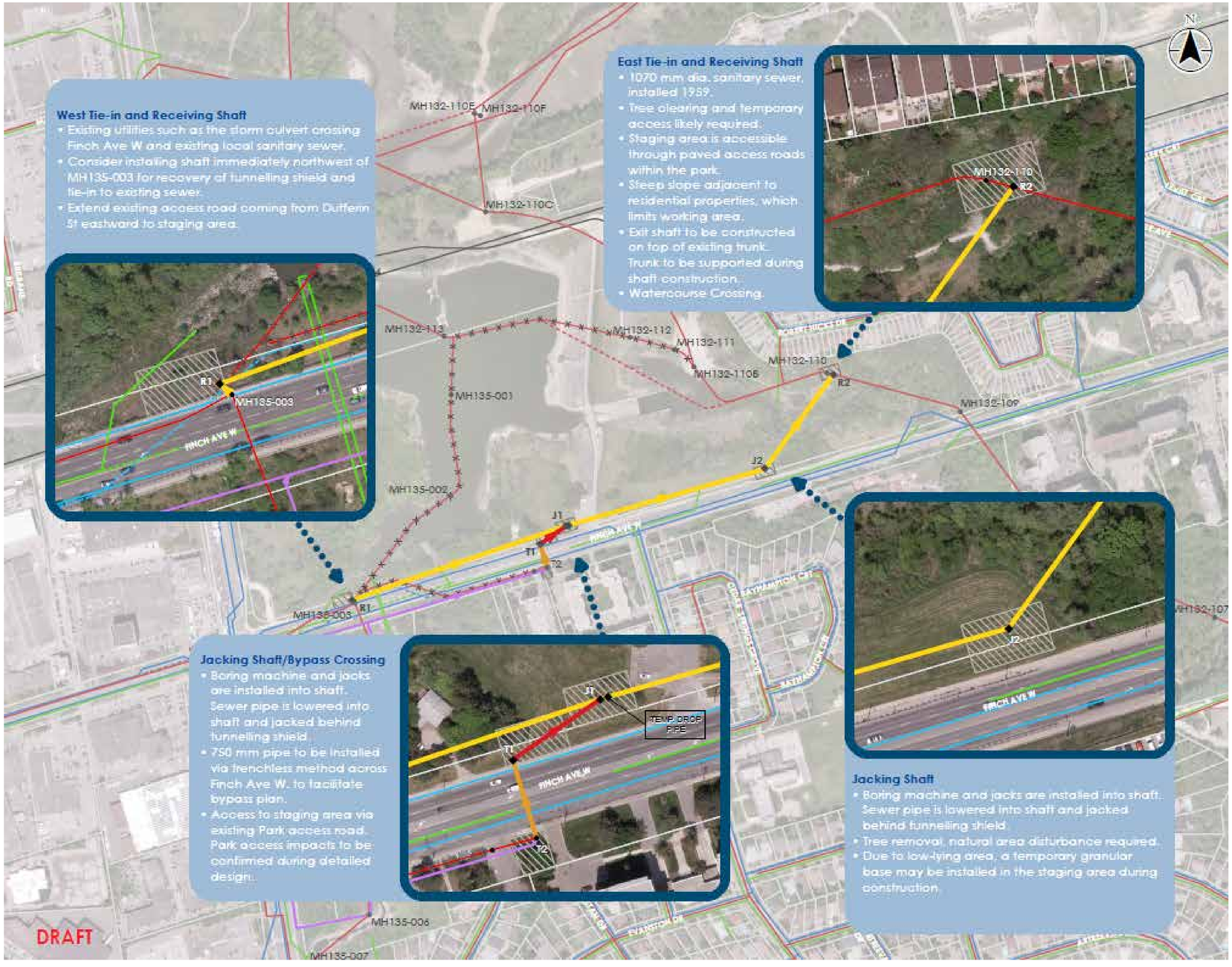
Microtunnelling and Horizontal Directional Drilling are recommended as the most preferred options based on the site conditions and overall environmental impact. Hand Tunnelling is considered for tie-in connections only.

Horizontal Directional Drilling (HDD) – Surfaced launched system often used for installation of pipes under rivers or other surface obstructions. A pilot tube is drilled, which determines the path of the installed pipe.

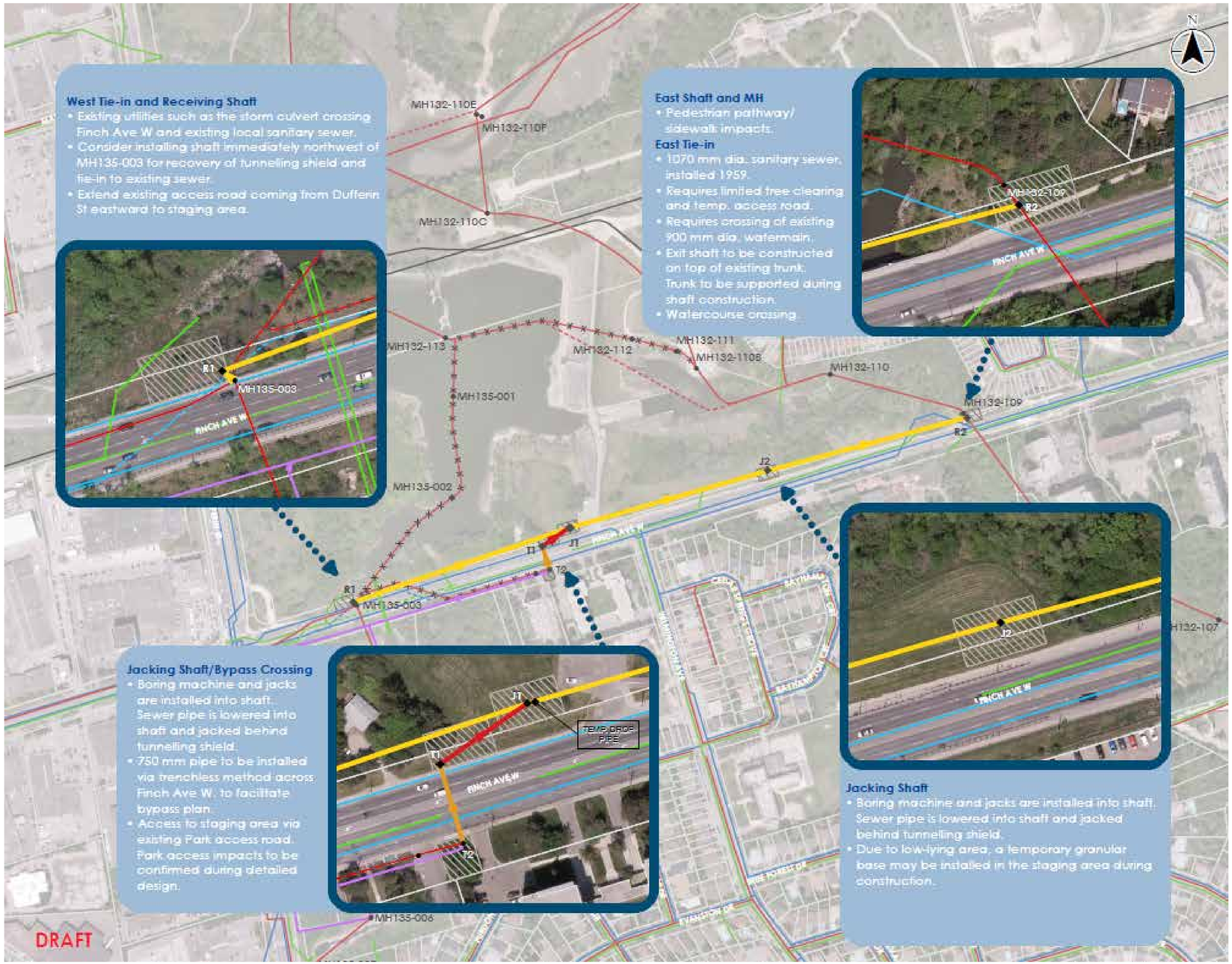
Auger Boring/Pilot Tube Guided Auger Boring – Casing pipe is jacked through the earth while simultaneously removing the soil using a flight of augers positions within the casing pipe.

Direct Pipe – Hybrid of HDD and MT – MT machine is mounted in front of a steel pipe that is first welded on the surface. A pipe thruster clamps to the outside of the pipeline and pushes the pipe column as well as the MT machine into the ground. The face of the tunnel is excavated by the MT machine.

North Area: Alternative 3b - Microtunnelling



North Area: Alternative 3d - Microtunnelling



Legend

- Selected Existing Sanitary Manhole
- Sanitary Sewer - Active
- Sanitary Sewer - Abandoned
- Storm Sewer - Active
- Storm Sewer - Abandoned
- Watermain - Active
- Watermain - Abandoned
- Oil Pipeline

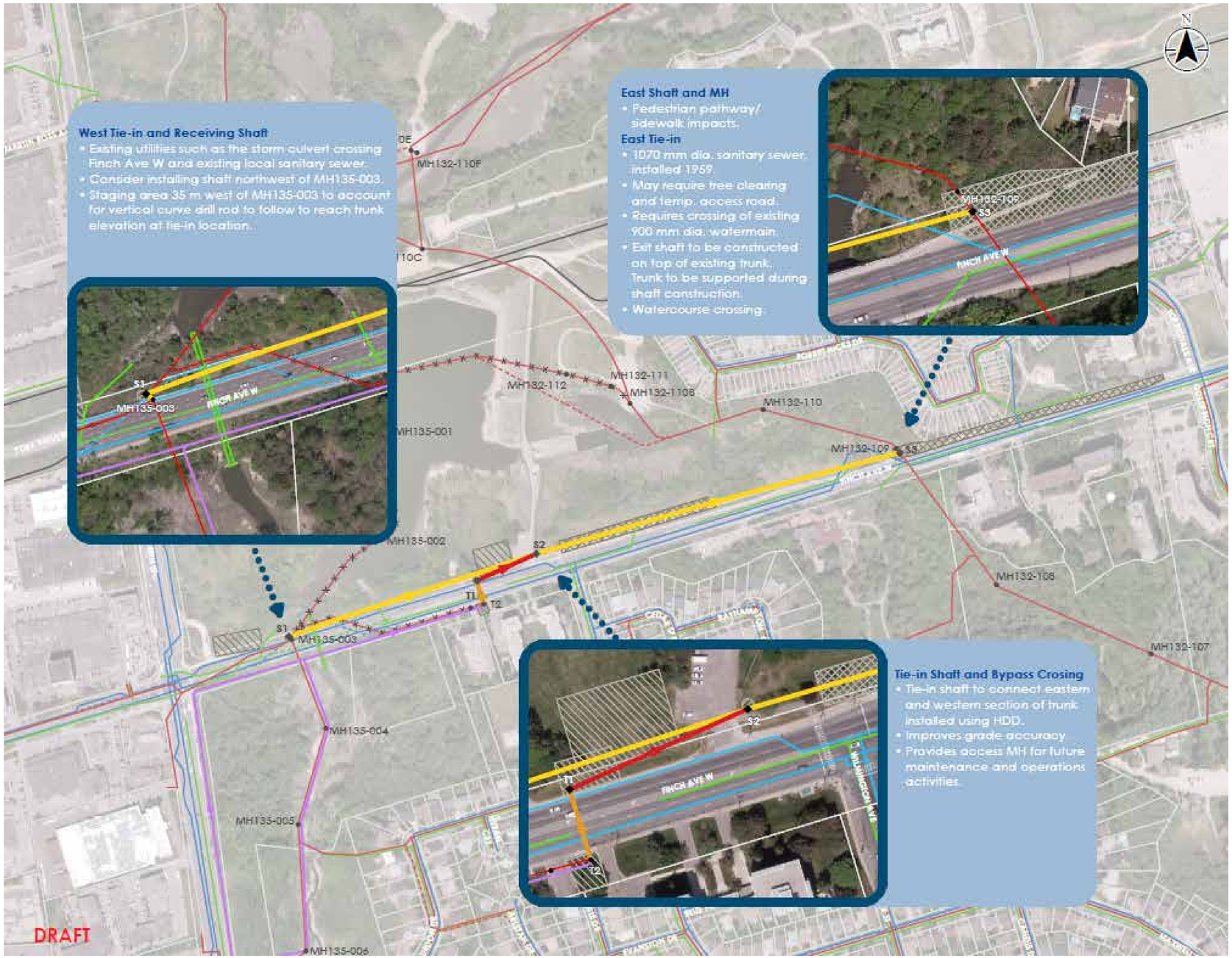
Proposed Sanitary Sewer Works

- New Sanitary Manhole
- Temporary Forcemain
- Reconstruction - Microtunnelling (1050 mm)
- Reconstruction - Trenchless Crossing Method (750 mm)
- Reconstruction - Open Cut (750 mm)
- x x Abandon

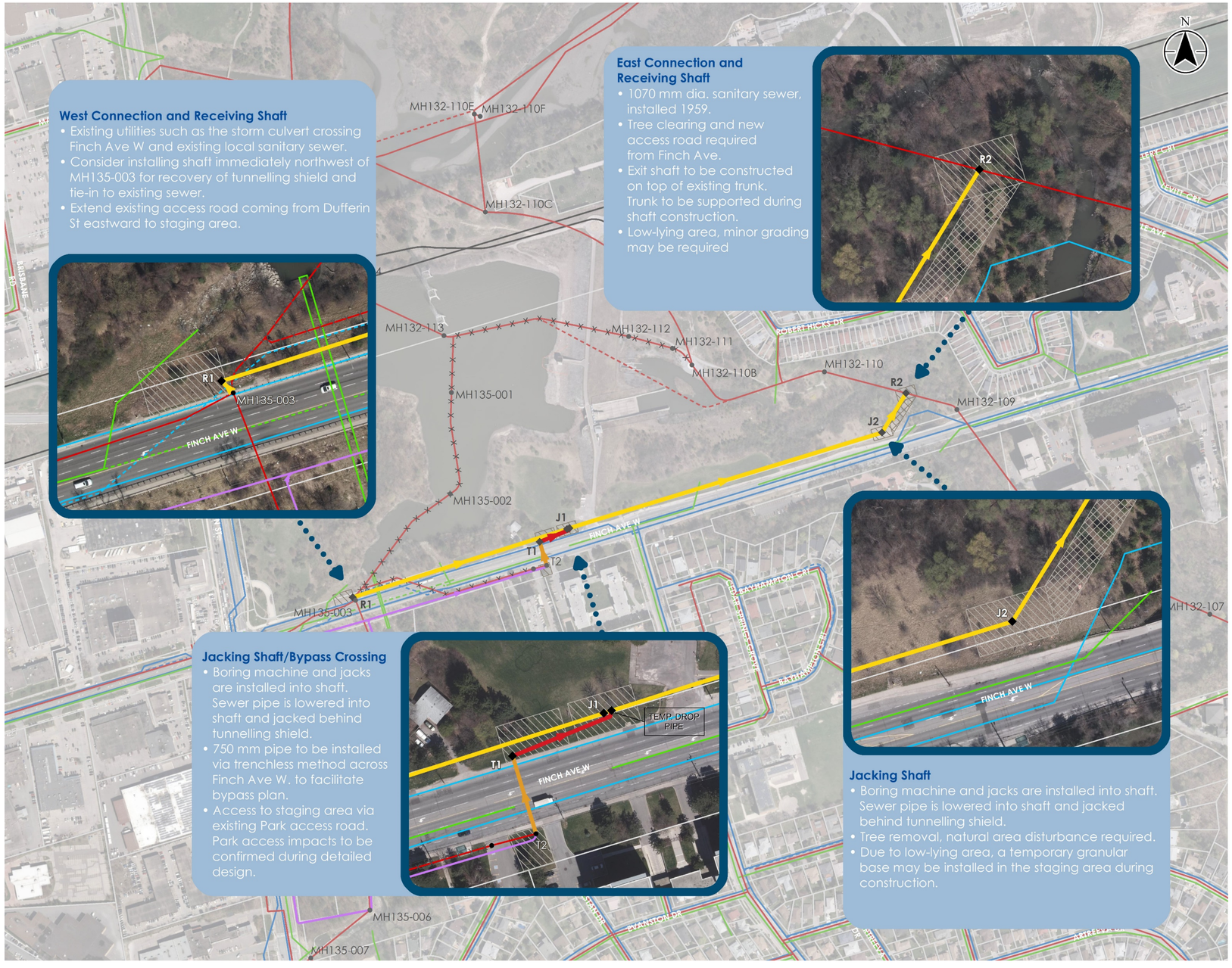
Construction Details

- Staging Area

North Area: Alternative 3d - HDD



North Area Recommended Alternative 3f Microtunnelling



Legend

- Selected Existing Sanitary Manhole
- Sanitary Sewer - Active
- Sanitary Sewer - Abandoned
- Storm Sewer - Active
- Storm Sewer - Abandoned
- Culvert
- Watermain - Active
- Watermain - Abandoned
- Oil Pipeline

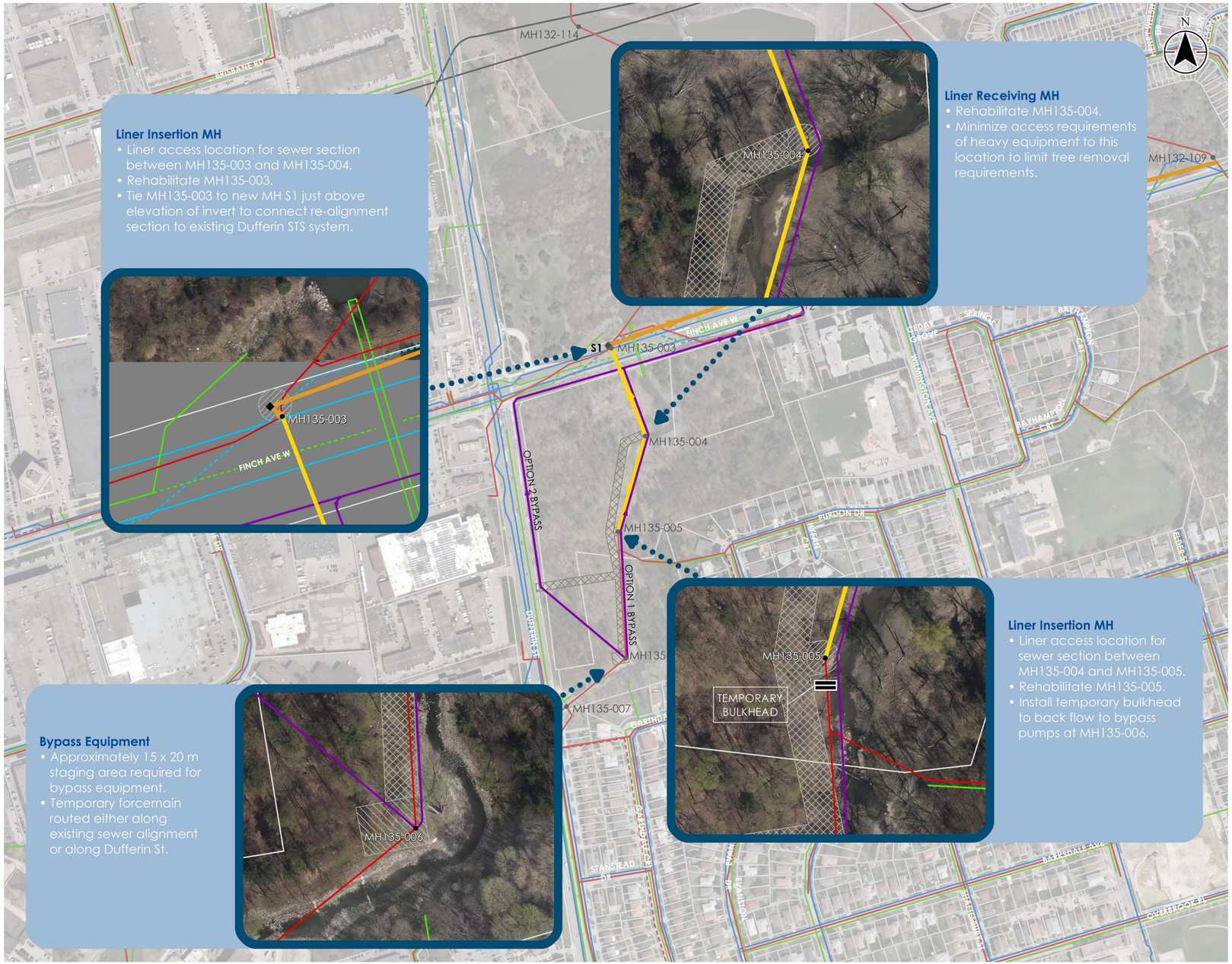
Proposed Sanitary Sewer Works

- New Sanitary Manhole
- Temporary Forcemain
- Reconstruction - Microtunnelling (1050 mm)
- Reconstruction - Trenchless Crossing Method (750 mm)
- Reconstruction - Open Cut (750 mm)
- x x Abandon

Construction Details

- Staging Area
- Access Path for Long-term Operation and Maintenance

South Area Recommended Alternative 2A Rehabilitate Dry



Legend

- Selected Existing Sanitary Manhole
- Sanitary Sewer - Active
- Sanitary Sewer - Abandoned
- Storm Sewer - Active
- Storm Sewer - Abandoned
- Watermain - Active
- Watermain - Abandoned
- Oil Pipeline

Proposed Sanitary Sewer Works

- New Sanitary Manhole

Proposed Sanitary Sewer Works

- Temporary Forcemain
- Rehabilitation
- New Trunk (North Area)

Construction Details

- Insertion Shaft
- Staging Area
- Access Path for Long-term Operation and Maintenance

Rehabilitation Alternatives:
Alternative 2a Cast-In-Place Pipe
Alternative 2b Steel Reinforced Pipe PE

Technical Studies Being Undertaken

Geotechnical Considerations

- A Geotechnical Investigation was recently completed north of the site for a related sewer project by SPL Consultants Ltd. in 2013.
  - A total of eight (8) boreholes were drilled and were used to determine the soil stratigraphy.
  - The Groundwater table was 2.3 meters below grade, but fluctuates with the operation of the dam.
- A Geotechnical Investigation will be completed within the project area as part of the Preliminary Design Phase to confirm subsurface conditions.

Hydrogeological Assumptions

- A Hydrogeological Assessment was recently completed north of the site for a related sewer project by Genivar Inc. in 2013.
  - The maximum daily dewatering rates were expected to range between 730,000 and 1,245,000 L/day, and the construction was expected to be completed within 6 months.
- A Hydrogeological Assessment will be completed within the project area as part of the Preliminary Design Phase to confirm subsurface conditions.

Sewer and MH Inspections

- A Condition Assessment was completed by Andrews infrastructure in 2010 and 2011. The condition assessment revealed that three sections of the West Don Sanitary Trunk Sewer were experiencing advanced structural deterioration, and that overall the West Don Sanitary Trunk Sewer was hydraulically overloaded.
- Additional camera inspections were undertaken by Capital Sewer Services Inc. as part of this study. The investigation identified additional structural degradation, and infiltration of groundwater. The investigation also identified the need for MH rehabilitation within the South Area.

Flow Monitoring

- Flow monitoring data is available at MH 135-005 and MH 132-009 which were installed in 2009.
- One additional flow monitor was installed in the local sewer upstream of MH 135-003 to provide additional information.
- Two (2) rain gauges are used to assess the flow monitoring data.