
To: York Region Rapid Transit Corporation Board of Directors

From: Mary-Frances Turner, President

Subject: Yonge Subway Extension Conceptual Design
– Final Report

Ref: YORK-#4046262

Recommendations

It is recommended that:

1. The Board endorse the findings of the Yonge Subway Extension (YSE) Conceptual Design Final Report.
2. The Board receive the comments submitted on the Draft Final Report from the stakeholder municipalities and agencies including Vaughan, Richmond Hill and Markham staff.
3. The Board authorize staff to complete the Transit Project Assessment Process (TPAP) for the train storage facility within the remaining funds in the approved Conceptual Design Study budget.

Purpose

The purpose of this report is to:

- Provide the Board with the final report for the Yonge Subway Extension (YSE) Conceptual Design Study.
- Seek approval to continue work on critical elements of the YSE, specifically the Transit Project Assessment Process (TPAP) for the train storage facility, within the already approved Conceptual Design Study budget.

Background

In September of 2009, York Regional Council authorized \$4.31 million to be allocated to the Yonge Subway Extension conceptual design assignment

- The total budget for the YSE Conceptual Design Study, which is jointly funded by the City of Toronto, is \$5.75 million.
- The City of Toronto is responsible for 25% of the budget based on the approximate length of the extension located within the City's municipal boundary.
- The study was jointly managed by YRRTC and TTC.

The Draft Final Report was presented to the YRRTC Board in September 2011

- The results of the YSE Conceptual Design Study were presented at the September 8, 2011 meeting of the YRRTC Board.
- Since that time modifications have been made to the Draft Final report and it has been circulated for comments.

The YSE Conceptual Design Study Draft Final Report was circulated for review and comment to staff at Vaughan, Richmond Hill and Markham on December 1st, 2011

- Individual meetings with staff from all three Municipalities have taken place.
- Comments were received from the Town of Markham in January, 2012 and from the Town of Richmond Hill and City of Vaughan in March, 2012.

A copy of the Conceptual Design Study Executive Summary has been attached to this report.

Analysis

Refinements have been made to the Yonge Subway Extension TPAP design based on additional technical analysis and investigations

- The number of bus bays at Steeles Station has been reduced by relocating some YRT services to Clark Station.

- As a result, a bus loop at Clark Station has been added and the bus portal on Yonge Street north of Steeles Station has been deleted.
- A train storage facility north of Richmond Hill Centre has been added to satisfy recommendations of the TTC Subway Rail Yard Needs Study.
- Royal Orchard Station has been removed from the YSE project based on low ridership and development potential.

Analysis of ridership projections and development opportunities confirm the removal of Royal Orchard Station from the YSE project

- Future redevelopment potential in the area of the proposed station is limited by the Vaughan Thornhill Heritage Conservation District as well as established high and low density property fabrics in Markham.
- Limited redevelopment and land growth opportunities result in projected subway ridership volumes too low to justify the cost of building a subway station.
- The cost to rough-in a subway station is approximately 70-80% of building a fully functional subway station.
- 2031 ridership projections for Royal Orchard station are approximately 66% of current Bessarion Station ridership which is the lowest in the TTC subway system; high density development in the vicinity of Bessarion Station will increase ridership in the coming years, whereas Royal Orchard population density is not expected to change significantly.
- After the subway is built, convenient local bus service will still be provided on Yonge Street to allow riders to connect from the Royal Orchard area to one of the subway stations.

Comments received from the stakeholder municipalities will be addressed during the next phase of design. A summary of the issues and initial responses are summarized below

- Ensure consistency between the population and employment forecasts used in the study and those developed by the stakeholder Municipality.
- Review the rationale and justification for the removal of Royal Orchard station from the project.
- Review the consistency of the planned project with local Council resolutions.

- Review issues and studies necessary for the planned storage facility which is necessary for the extension.
- Review various technical issues associated with utilities, drainage, dewatering, stormwater management, traffic management, coordination with development, etc.
- Review issues associated with the proposed commuter parking lot at Langstaff Station.
- Consider development and transportation pressures when establishing the location for the PPUDO at Richmond Hill Centre Station.
- Review pedestrian access to YSE facilities and the depth of the stations.
- Ensure municipality involvement in issues related to architecture, urban design, sustainability, streetscaping and property.
- Outline the process and opportunity for future stakeholder involvement in the design process.
- A copy of all comments received, responses, and action items have been included as an appendix in the Final YSE Conceptual Design Study Report.

Presentations to local Municipalities will share the findings of the Final YSE Conceptual Design Study

- Presentations to local Municipalities will be arranged to highlight the final YSE Conceptual Design Report study results.

Sufficient budget remains to secure TPAP approval of a Train Storage Facility for the Yonge Subway Extension

- The TTC Subway Rail Yard Needs Study, endorsed by the YRRTC Board in May of 2010, identified that the extension of the Yonge line to Richmond Hill requires storage of 14 subway trains in the vicinity of Richmond Hill Centre.
- To secure approval and protect property for the storage facility, it is necessary to complete the Transit Project Assessment Process.
- The Conceptual Design Report laid the groundwork for the TPAP by documenting and analyzing technical requirements for the train storage facility.

- The TPAP will be completed within the already approved YSE Conceptual Design Study budget, of which approximately \$1.5 million remains.
- Richmond Hill staff support the decision to complete the TPAP for the storage facility.

Completing the TPAP for the Train Storage Facility will secure approval of remaining YSE components and prepare the project for detailed design

- Staff will review and approve the scope of work for the train storage facility TPAP and initiate the formal process.
- Staff will report back to the Board prior to finalizing the TPAP study.
- Upon completion of the TPAP, in order to continue work on the Yonge Subway Extension project, options for next steps may include:
 1. Move forward to preliminary design (30%). The conceptual design represents a design level of approximately 3%. Preliminary design is expected to cost in the order of \$75 to \$100 million.
 2. Move forward to a 10% design level (design is currently at approximately 3%). This is expected to cost in the order of \$10 million.

However, these options for continuing the preliminary design are beyond the current project funding and will require funding contributions from senior levels of government.

Finance

- The YSE Conceptual Design Report was completed for less than the approved budget of \$5.75 million for the joint YRRTC/TTC study.
- The TPAP for the train storage facility will be completed within the remaining approved budget of approximately \$1.5 million.

Conclusion

- The Conceptual Design Report for the Yonge Subway Extension has been finalized and now includes an appendix with comments received from the local Municipalities.

- A scope of work will be developed to satisfy the Transit Project Assessment Process for the train storage facility, within the already approved YSE Conceptual Design Study budget.
- Staff will complete the TPAP for the train storage facility, and will report back to the board prior to finalizing the study.

For more information on this report, please contact, Paul May, Chief Engineer, York Region Rapid Transit Corporation at 905-886-6767, Ext. 1030.

Mary-Frances Turner
President

March 21, 2012

Attachment: (1)

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YONGE SUBWAY EXTENSION CONCEPTUAL DESIGN SERVICES

CONCEPTUAL DESIGN REPORT

Executive Summary

The Yonge Subway Extension (YSE) Transit Project Assessment Process (TPAP) was approved by the Province in April 2009

On June 15, 2007, the Province of Ontario announced \$17.5 billion in funding for transit project for the Greater Toronto Area and Hamilton. Named “MoveOntario 2020”, the provincial transit plan includes funding for an extension of the Yonge Subway from its current terminus at Finch Station in the City of Toronto to Highway 7 (Richmond Hill Centre) in the Town of Richmond Hill.

On June 21, 2007, York Region Council authorized commencement of a Functional Planning Study in coordination with the TTC and the City of Toronto for the timely extension of the subway.

On October 3, 2008, following completion of the Functional Planning Study, York Region initiated the TPAP for the YSE project (the Transit Project). At the end of October, 2008, the TTC and the City of Toronto became co-proponents of the Transit Project. Final approval of the YSE TPAP submission was received from the Ontario Minister of the Environment on April 7, 2009.

Metrolinx completed the initial Benefits Case Analysis (BCA) for the YSE based on the findings of the TPAP in July 2009

The Metrolinx Board received the July 2009 BCA and directed staff to undertake additional analysis related to the YSE project. The additional analysis was to examine the following areas:

1. Possible adjustments in timing or phasing of the subway extension.
2. Review of the need for some stations in order to reduce capital costs.
3. Consideration of the parallel GO Richmond Hill rail corridor to off-load some of the demand on Yonge Street.
4. The costs impacts of the various options on the subway yards strategy, Bloor-Yonge subway station improvements, and a future Downtown Relief Line to bypass the Bloor-Yonge congestion “pinch point” (Metrolinx Board report – July 23, 2009).

Additional conceptual design work and network planning was required in order to address issues that might arise out of Metrolinx’ analysis.

Work was initiated on the YSE Conceptual Design Study to maintain a state of readiness and to address outstanding issues from the initial Metrolinx BCA

In October 2009, the Regional Municipality of York and the City of Toronto authorized York Region Rapid Transit Corporation (YRRTC) and the Toronto Transit Commission (TTC) to proceed with the Conceptual Design Study for the Yonge Subway Extension. The Joint Venture of McCormick Rankin Corporation and Hatch Mott MacDonald was retained by the TTC and YRRTC to carry out the work. The purpose of the study is to undertake the additional analysis resulting from the July 2009 Metrolinx BCA, including an update of the projected ridership and estimated capital costs. The Conceptual Design Study also continues to advance the design of the YSE project to maintain a state of readiness for implementation.

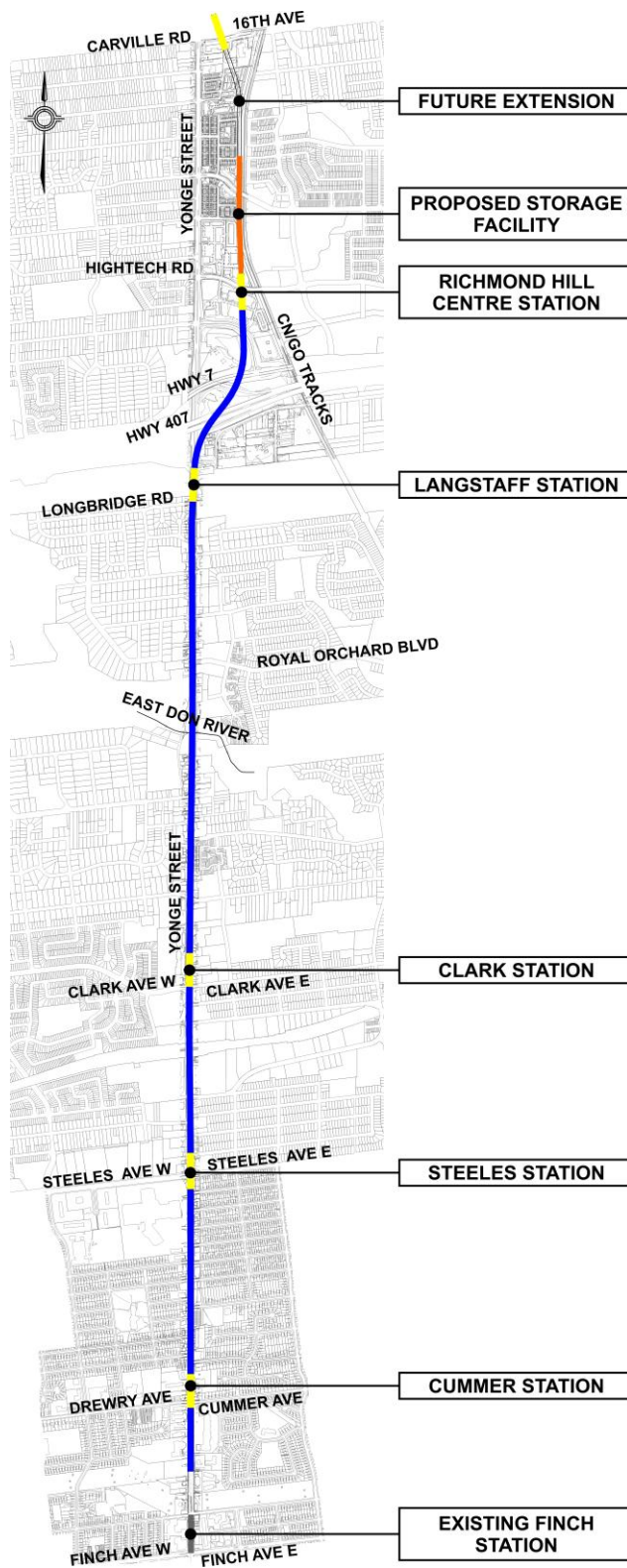
GENERAL DESCRIPTION

The YSE project is 7.42km in length and it is primarily underground with the exception of the crossing of the East Don River

The YSE project is 7.42km in length with 1.61km in the City of Toronto (south of Steeles Avenue) and 5.81km in York Region (north of Steeles Avenue). The project comprises a total of 5.08km of twin-bored tunnel, five stations, two major bus terminals, two bus loops, five substations, eight emergency exit buildings (EEBs), one bridge, six cross passages, 513m of twin or triple box structure and an 831m below grade triple track train storage facility north of the Richmond Hill Centre Station. There are three sections of special trackwork: the extension of the Finch Tail Tracks, the crossover south of Steeles Station, and the crossover south of Richmond Hill Station.

The alignment is underground for its entire length with the exception of the crossing of the East Don River where the subway emerges from the tunnels and crosses through the river valley via a two-level bridge – with auto traffic on the upper level and subway on the lower level. The subway level of the bridge will be enclosed to maintain the integrity of the tunnel ventilation system and to mitigate against noise transfer to the surrounding community.

Between Finch Station and Langstaff Station, the alignment runs north below Yonge Street. North of Langstaff Station, two reverse curves are provided to divert the subway to the east of Yonge Street to the preferred location for Richmond Hill Centre Station. Slight modifications have been made to these curves since the TPAP to allow the Langstaff Station to shift as far north as possible to best serve the Langstaff Gateway development.



Yonge Subway Extension – Key Plan

The operational design basis is to minimize the time between trains with every other Yonge Subway train to continue north from Finch Station to Richmond Hill Centre Station with an average headway of 3.5 minutes (210 seconds) during the peak hour and assuming Automatic Train Operation (ATO). As passenger volumes increase, the design protects for the ability to operate every train to RHC.

PASSENGER DEMAND

Projected ridership at Richmond Hill Centre Station increased 25 percent relative to the TPAP

The projected transit ridership – developed during the TPAP – was updated during the Conceptual Design Study to reflect revised 2031 land use projections from York Region and the City of Toronto. Results suggest that more people (about a 25% increase) will board the subway at Richmond Hill Centre Station during the morning peak hour in 2031 than previously projected during the TPAP. The resultant increase reflects the implications of new secondary plans and development applications received since the completion of the TPAP in 2009. Based on current analysis, it is projected that ridership volumes in the Yonge corridor will warrant a subway within the next 10 years (i.e. before the year 2021). The minimum ridership required to warrant a subway is approximately 10,000 passengers during the peak hour. Within the next 10 years, over 12,000 peak hour passengers are expected to board or depart at RHC station alone. By 2031, ridership at RHC is expected to increase to 14,000 peak hour passengers.

STATION DESIGN PHILOSOPHY

The station design philosophy is to provide high quality architecture, urban design, streetscape, and landscape architecture with:

- potential for increased Transit Oriented Development (TOD), with entrances that can be incorporated into future development as economically as possible
- Sustainable above and below grade facilities which minimize negative impact on the environment
- Clearly identifiable entrance facilities that allow daylight to penetrate to lower levels where economically feasible
- Urban gateways at Steeles Avenue and at Langstaff Gateway/Richmond Hill Centre
- Circulation routes to vehicle boarding points that are convenient, intuitive, straight forward, well signed, comfortable, and well lit
- Obvious and convenient intermodal transfers.

- Train and bus platform areas that offer an attractive environment, visual diversions to help pass the time, such as public art, architectural design, televised media, advertising etc.
- Emergency egress routes which are clear, convenient, and safe
- At least one barrier-free accessible entrance

CUMMER STATION

The conceptual layout for Cummer Station remains largely the same relative to the TPAP

The length of the station box has been increased by about 20m as a result of conflict with an underground storm sewer. This conflict necessitates a modification of the station's ventilation configuration which resulted in a lengthening of the station box.

Analysis carried out during the Conceptual Design Study has shown that an electrical substation, providing traction power to the subway, will be required at Cummer Station. The substation is currently shown above the Main Entrance building in the northeast corner of the Yonge Street/Cummer Avenue intersection.

STEELES STATION

Steeles Station still includes an underground bus terminal but the design has evolved to connect all four quadrants of the Yonge/Steeles intersection with a public concourse

The total number of bus bays at the station has been reduced from 25 to 16 bays by relocating some of the YRT routes from Steeles Station to Clark Station. As a result, there is no longer a need to provide a portal on Yonge Street for YRT buses to access the underground bus terminal from the north. A new concourse level, connecting all four quadrants of the Yonge/Steeles intersection, has been added to the previous two-level concept developed during the TPAP. The new concourse will be situated one level underground and directly above the underground bus terminal. The design recognizes the constraint posed by the York-Durham Sewage System infrastructure located within the Steeles Avenue right-of-way.

The design team has met with the land owner of Centerpoint Mall in the City of Toronto to discuss opportunities for a relocated bus terminal in the southwest quadrant of the Yonge/Steeles intersection. This could be explored further as part of the next stage of design.

CLARK STATION

The conceptual layout for Clark Station has evolved to include a bus loop which is incorporated as part of the already planned combined entrance and electrical substation building

To improve passenger connections to the subway, a small bus loop with three bus bays has been incorporated as part of the main entrance building and electrical substation which were identified in the TPAP. The bus loop allows YRT customers to access the subway sooner, rather than travelling further south in mixed traffic on Yonge Street to Steeles Station as was proposed in the TPAP. The proposed bus loop at Clark Station reduces the number of bus bays required at Steeles Station and eliminates the need for a portal on Yonge Street for YRT buses to access the underground bus terminal at Steeles Station.

EAST DON RIVER BRIDGE

The East Don River (EDR) Bridge has been advanced to better understand the engineering constraints and opportunities

A number of structurally and operationally acceptable options were developed during the Conceptual Design Study to inform decisions with respect to capital cost estimates. The design options considered a number of engineering issues including; issues associated with the railway enclosure, the transparency of the structure, the height of the road, the central span of the valley, constructability, capital and operational costs, etc. The long list of options was narrowed down to a short list of options which will frame discussions during the next stage of design for the incorporation of heritage aspects. Based on geotechnical concerns associated with the tunnelling under the EDR option, the EDR bridge is required regardless of whether Royal Orchard Station is included as part of the project.

ROYAL ORCHARD STATION

Based on limited redevelopment opportunities and low ridership projections, it is recommended that Royal Orchard Station be removed from the YSE project

Future redevelopment potential in the area of the proposed station is limited as a result of its location within the Vaughan Thornhill Heritage Conservation District and the established high and low density residential property fabrics which inhibit intensification on the Markham side. The limited redevelopment and land growth opportunities result in the projected subway ridership volume being too low to justify the expense of building and operating a subway station. The projected 2031 morning peak hour ridership at the station is 350 passengers, which is approximately two-thirds the current ridership of Bessarion Station on the Sheppard Subway, which is the lowest existing volume subway station operated by the TTC. It is noted that high density redevelopment is underway at Bessarion Station which will significantly increase station ridership in the coming years. Therefore, based on constrained redevelopment opportunities and low ridership projection, it is recommended that Royal Orchard Station not be included as part of the subway extension.

Nevertheless, based on the distance between Clark and Langstaff stations, an electrical substation and emergency exit building will still be required in the vicinity of the Royal Orchard Station location. Without a station, there are more options to locate these facilities so as to minimize impacts on existing and future land uses in the area.

LANGSTAFF STATION

The design has progressed for the alignment of the Langstaff and Richmond Hill Centre stations

As a result of further work carried out on the overall alignment, the platforms at Richmond Hill Centre and Langstaff Stations can shift up to 35 metres closer together. The shift requires deviations from the minimum TTC standards, which will require design variance approvals from the TTC. A shift of the Langstaff Station platform to the north will provide a shorter connection to the planned entrance building in the southeast quadrant of the Langstaff/Yonge intersection which will serve the future Langstaff Gateway development.

The design of the commuter parking lot has been advanced in order to provide new stormwater management ponds required as part of the stormwater management strategy for the site. Layout of the parking lot, noise attenuation measures, as well as sustainable design features will be determined as part of the next stage of design.

RICHMOND HILL CENTRE STATION

Several design options for the bus terminal at Richmond Hill Centre (RHC) have been explored

One option is a single level 25-bay bus terminal which connects the underground subway station to Langstaff GO Station via the existing pedestrian bridge. The design also protects for a future passenger connection to the 407 Transitway. The subway station, including the bus terminal, will be designed to be fully integrated into future development and the future road network planned by the Town of Richmond Hill.

However, given the complexity and importance of the relationship between TOD and transit facilities within the area, it is recognized that more design and planning work is required for the bus terminal and associated surface facilities at Richmond Hill Centre Station. The conceptual design of a single level terminal has been used for cost estimation purposes only.

Design principles for the RHC bus terminal have been established

The key principles for the Richmond Hill Centre bus terminal design are to:

- Provide a high quality, efficient passenger connection between the various modes of transit included within the anchor hub
- Provide good access to facilitate surface transit operations

- Maximize the use of lands that are already encumbered for development purposes
- Facilitate opportunities for integration with future TOD
- Allow for construction and operation independent of the status of surrounding development

Additional work is required to design the bus terminal in conjunction with TOD, to connect the fixed rapid transit elements. This work will be developed through the next stage of design in consultation with all key stakeholders.

TRAIN STORAGE FACILITY

A preferred option for the required storage facility to accommodate 14 subway trains north of Richmond Hill Centre Station has been identified

The need for this facility was identified in the TTC Subway Rail Yard Needs Study (SRYNS), which was endorsed by the YRRTC Board in May of 2010. Options which can accommodate 14 train sets were developed, reviewed, and analysed. Considerations were given to not preclude a future extension of the Yonge Subway north from Richmond Hill Centre. Three short-listed options were evaluated in terms of; a future 16th Avenue station location, property and building impacts, constructability, future extension, capital and operating costs, noise and vibration, operational issues etc. The preferred option for the train storage facility is an 831m long triple-track structure along the west side of the CN rail corridor, under the 15m wide Town of Richmond Hill property planned for future transit use. The train storage facility will require parking, a staff building, and an elevator.

The implementation of a train storage facility for the YSE will require a separate TPAP.

CONSTRUCTION METHODS

Tunnelling and cut-and-cover construction methods will be used on the YSE project

The majority of the project will be twin tunnels which will be constructed by using tunnelling construction methods. Stations, special trackwork, and emergency exit buildings will be constructed by cut-and-cover methods. Because the majority of the YSE stations, special track work, and EEBs are located within the Yonge Street right-of-way, cut-and-cover construction for these facilities will therefore require a series of measures to initially divert traffic and utilities to permit installation of the selected excavation support system.

CAPITAL COST ESTIMATE

The conceptual design study confirms the capital cost estimate of the YSE project is in the order of \$3 billion, in 2011 dollars

Based on the costing work, the early stage of design (approximately 3 to 5 percent), and the magnitude of contingency being carried, the capital cost estimate for the YSE project is estimated to be in the order of \$3 billion in 2011 dollars. This estimate reflects inflation since 2008, input from geotechnical infield investigation, evolution of the design, as well as lessons learned from the Toronto-York Spadina Subway Extension (TYSSE). The annual impact of inflation on this project is approximately \$110 million based on an assumed 4% inflation rate per year.

FUTURE WORK AND NEXT STEPS

Preliminary comments on the draft version of this report have been received from the Town of Markham, Town of Richmond Hill, City of Vaughan, York Region, TTC and the City of Toronto. All comments, responses and action items have been included in Attachment 3.

Changes to the design for the Yonge Subway extension since the TPAP include:

- Reduction in the size of the underground bus terminal at Steeles Station;
- Removal of the bus portal on Yonge Street which accessed the underground bus terminal north of Steeles Avenue;
- Introduction of a bus loop at the Clark Station to reduce bus volumes at Steeles Station and allow the removal of the bus portal on Yonge Street;
- Removal of the Royal Orchard Station;
- Addition of the underground train storage facility north of the Richmond Hill Station.

Upon completion of the Conceptual Design Study, several issues will need to be addressed to keep the project moving forward to the next stage of design:

- Complete a TPAP for the extension of the project to include the underground train storage facility north of Richmond Hill Centre Station;
- Continue work with the Town of Richmond Hill, Town of Markham, the 407 ETR, Metrolinx, and area land owners on integration of a bus terminal with area development to connect the rapid transit infrastructure located within the Richmond Hill Centre Station and the Richmond Hill Centre / Langstaff Mobility Hub;

- Undertake a property protection study to address any property required for the YSE that is not already protected under the approved TPAP.
- Undertake the development of a preliminary engineering work program for the YSE.