18.0 CONSTRUCTION IMPACTS

This chapter summarizes anticipated construction impacts and mitigation measures for the proposed Light Rail Alternative and the Light Rail Alternative – Sugar Creek Design Option. A qualitative analysis has been performed to identify construction impacts in order to determine where preventative measures to minimize the adverse impacts of construction activities might be warranted. Since the No-Build Alternative would not include construction activities, it also would not create any construction-related impacts.

Impacts to the natural and built environments would be anticipated during construction of the proposed Light Rail Alternative; however, these impacts would be temporary and intermittent. The use of mitigation techniques and adherence to applicable construction regulations will help reduce the severity of impacts encountered during construction.

18.1 Construction

The construction of a major capital improvement project such as the LYNX Blue Line Extension Northeast Corridor Light Rail Project (LYNX BLE) involves four major steps before revenue service can begin: final design, pre-construction activities, construction and testing. These major steps are described in the following sections.

18.1.1 Final Design

Final design would follow the approval of the 65% Preliminary Engineering Design plans and approval to enter final design. The final design submission would include: sealed Construction Plans; Erosion and Sediment Control Plans; Traffic Control Plans; Traffic Signal Plans; Construction Specifications/Special Provisions; Quantity Summary; and the Cost Estimate.

18.1.2 Pre-Construction Activities

Pre-construction activities, as the name suggests, must occur prior to the beginning of construction activities. These activities typically include: construction contracts development; construction community outreach and education programs; environmental permits and approvals; property acquisition; and vehicle procurement. If either the Light Rail Alternative or Light Rail Alternative – Sugar Creek Design Option is chosen for implementation at the conclusion of the Environmental Impact Statement (EIS) process, pre-construction activities may begin immediately following the execution of a Record of Decision following the Final EIS.

18.1.3 Construction Activities

Construction activities include those items required to construct the light rail track, overhead catenary system, signal and safety systems, ancillary facilities, and all proposed construction required for the light rail to be able to physically operate for revenue service.

As described in the *Bid Packaging Strategy* (November 2009) document, in order to procure the services and goods needed to complete the construction of the light rail, the work is divided into separate “bid packages.” The proposed Light Rail Alternative and the design option would be accomplished through the implementation of at least eleven construction contracts. These packages would be assembled and scheduled to expedite construction, combine similar work, accommodate bonding and foster competitive bidding. The bid packages are planned to be assembled into the following categories:

- One or more advanced utility relocations
- Three civil and roadway packages, broken down by segments
- Freight track relocation plans
- Track construction
- Station finishes
- Park-and-ride facilities
- Parking garages

- Vehicle Light Maintenance Facility (VLMF)
- One or more systems contracts (traction power, overhead catenary system, signals and communication system)
- Fare collection

These packages would be advertised and awarded to the qualified low bidder through the Design-Bid-Build delivery method.

18.1.4 Testing

Following construction, testing of completed light rail components would occur. This involves the required testing of light rail vehicles. Construction would be planned to be sufficiently complete from uptown to the planned storage yard at the VLMF to facilitate testing of the light rail vehicles prior to operation. Project wide systems testing would also occur following construction activities. Systems to be tested include: communication systems; fare collection systems; signal systems; traction power substations; and overhead catenary systems.

18.2 Construction Education and Outreach Plan

Construction of the Light Rail Alternative and the Light Rail Alternative – Sugar Creek Design Option would temporarily affect local businesses, residences and traffic operations along the entire alignment. A Community Relations Program is planned to provide general construction scheduling information, coordination of construction work with adjacent business activities and assistance with the resolution of issues that may develop between local residents, motorists, the contractor and the sponsoring agency. The details of the program will be included in a Construction Education and Outreach Plan, to be executed prior to and during construction activities. The program would be implemented by the Charlotte Area Transit System (CATS) and the City of Charlotte.

18.3 Construction Regulations

The North Carolina Division of Water Quality (NCDWQ) regulates groundwater by preventing pollution, managing and restoring degraded groundwater and protecting groundwater resources. To improve water quality, Mecklenburg County enacted a Surface Water Improvement and Management (SWIM) program. Under this program, the County enacted a stream buffer ordinance to protect surface waters. Jurisdictional Waters of the United States are defined by 33 CFR 328.3(b) and are protected by Section 404 of the Clean Water Act (33 U.S.C. 1344), which is administered and enforced in North Carolina by the U.S. Army Corps of Engineers (USCOE), Wilmington District. Construction activities would also require adherence to the federal, state and local agency guidelines.

18.4 Construction Schedule

The overall construction and start-up would take approximately five years. This includes over a year for advanced utility relocations, over three years of construction and approximately six months of testing and pre-revenue service activities.

18.5 Construction Methods

The Light Rail Alternative and the Light Rail Alternative – Sugar Creek Design Option would require the construction of basic elements not found in typical roadway projects, such as: stations, park-and-ride facilities, parking garages, VLMF, track bed, trackwork and catenary poles and wires. A number of methods would be used to construct the proposed alignment of the Light Rail Alternative. These methods would vary depending on the geographic conditions and the design. The construction methods include at-grade, retained fill, built-up fill, grade separated and underpass configurations. A description of the proposed alignment for the Light Rail Alternative and the Light Rail Alternative – Sugar Creek Design Option can be found in Chapter 2.0: Alternatives Considered.

18.5.1 At-Grade Configuration

At-grade configuration example.

An at-grade configuration would position the proposed alignment at the same level as the ground surface. The actual construction for the at-grade configurations would take place within the street crossings, as is typically seen in city street construction projects in the surrounding area. The intersections that would include an at-grade configuration under the Light Rail Alternative and the Light Rail Alternative – Sugar Creek Design Option can be found in Chapter 3.0: Transportation. Construction of the at-grade configurations would involve traffic detours and temporary lane closures.

The equipment utilized during construction would be consistent with street construction. Pavement cutting machinery, rubber-tired excavators and all-terrain cranes would be necessary for at-grade construction.

18.5.2 Retained Fill Configuration

Construction of the retained fill portions of the proposed alignment would precede and/or follow construction of grade-separated sections, such as bridges. In a retained fill configuration, the location of the proposed alignment would be elevated above the existing ground on fill material.

Construction of the retained fill configurations would begin with excavation for retaining wall footings, which would typically be performed using excavators or backhoes. Piles may be required depending on soil conditions and design requirements. Piles would be installed using either conventional pile drivers or vibratory pile driving equipment. Mechanically stabilized earth (MSE) walls would subsequently be constructed. An earth embankment would form a part of the structure. Both driven and hand-operated compacting equipment would be necessary for the backfilling operations.

Retained fill configuration example.

18.5.3 Built-Up Fill Configuration

Built-up fill construction would occur where the proposed light rail tracks run on earth embankments that will be constructed on top of the existing ground. The height of the embankments would vary along the proposed alignment. In some instances, the track profile would be raised above the existing ground on built-up fill, then onto retained fill and then onto a grade separated bridge structure.

Construction of the built-up fill would be typical of earthen embankment construction. Construction equipment would include: bulldozers, dump trucks, excavators and graders. Erosion control measures, including silt fences, detention basins and seeding and drainage measures, including ditches, catch basins and underground pipes would generally involve smaller construction equipment.

18.5.4 Grade Separated Configuration

Construction would include grade separations between the proposed alignment and roadways and/or freight tracks. A grade separated configuration would consist of an aerial crossing with a bridge structure that would separate the proposed track operations from the roadway and/or freight track network. The intersections that would include a grade separated configuration under the Light Rail Alternative and the Light Rail Alternative – Sugar Creek Design Option can be found in Chapter 3.0: Transportation.

Actual construction for the grade separated configuration would be typical to new bridge construction projects. Temporary lane and road closures would be utilized to accommodate construction sequencing.

Grade separated configuration example.

When practical, temporary road closures would occur during nighttime hours to minimize traffic disruptions. Temporary roadway widening would be anticipated to accommodate construction operations and maintenance of traffic.

Grade separated configurations would require the construction of foundation systems, which would require excavation by means of track-mounted excavators or backhoes. Additionally, drill rigs and/or pile driving equipment would be used to install various foundation elements. Cranes, track-mounted and/or truck mounted, would subsequently be used to erect superstructure components, such as girders. Additional all-terrain cranes would be utilized when installing other various bridge components.

18.5.5 Underpass Configuration

The underpass configuration would position the proposed alignment below grade entailing excavation of material to form a trench and/or covered passageway. The underpass configuration would be situated just north of Grove Lake Drive, where the proposed alignment would cross under the North Tryon Street/US-29 northbound travel lanes and enter the University of North Carolina at Charlotte (UNC Charlotte) campus.

Underpass configuration example.

Staged construction would be required for this underpass configuration. Temporary shoring would be utilized during the construction operations. Soil nail walls with concrete wall facing and bottom slab and overhead support structures would be constructed for maintaining grade above the proposed alignment.

Construction equipment necessary for both at-grade and grade-separated construction would be used for the construction of the underpass configuration. Additionally, specialty equipment for soil nail wall installation would be required.

18.5.6 Trackwork Installation

Light rail track construction would include the installation of the fixed guideway elements, such as: ballast, ties and rail. These items would be placed in construction staging areas throughout the corridor to minimize haul distances and facilitate construction. The contractor would be responsible for obtaining the construction staging areas.

18.5.7 Parking Facilities

Transit only park-and-ride lots would be constructed at seven station locations and construction would utilize grading equipment, asphalt pavers and rollers.

Three surface parking lots are proposed under the Sugar Creek Park-and-Ride Option 1, which would realign Raleigh Street. Construction equipment used in typical highway construction projects would be used for the road realignment, such as: pavement breakers, loaders, haulers, grading equipment, asphalt pavers and rollers.

Parking garages would be constructed at the Sugar Creek Station Park-and-Ride Option 2, four levels on two separate garage structures; and at the I-485/N. Tryon Station, five levels within one garage structure. For the Sugar Creek Station Park-and-Ride Option 2, the existing topography would cause varying portions of each garage structure to be situated below grade. A vehicular bridge and a separate pedestrian bridge would connect the two parking garages on the top level. An additional pedestrian bridge

would span the freight railroad tracks to the north and connect to a staircase and elevator to access the Sugar Creek Station platform. For the I-485/N. Tryon Station, the existing topography would cause a portion of the structure to be situated below grade. Pedestrians would walk out to the station platform from the third level; therefore, a pedestrian bridge is not necessary.

Foundation systems for the parking garages would require excavation by means of track-mounted excavators or backhoes. Drill rigs and pile driving equipment would be used to install various foundation elements. Cranes, track-mounted and/or truck-mounted, would subsequently be used to erect parking garage structure components, such as girders. Concrete pumps and vibrators would be utilized when placing concrete for the parking garage structures. Additional all-terrain cranes would be utilized when installing the vehicular and pedestrian bridge components. Careful coordination between the contractor and freight railroad will be required when constructing the pedestrian bridge over the freight railroad tracks so that the freight tracks remain open during all phases of construction.

18.5.8 Vehicle Light Maintenance Facility

The Light Rail Alternative and Light Rail Alternative – Sugar Creek Design Option propose the construction of a VLMF to provide light maintenance, repair, interior cleaning, inspection and testing of light rail vehicles. The VLMF would be comprised of: the site, track yard and a building that would house the Rail Car Services and Rail Operations. The facility would be located within the existing Norfolk Southern Intermodal Yard located just northeast of Brevard Street and would occupy approximately 18 acres.

Construction of the VLMF would utilize equipment used in typical highway and building construction. Light rail tracks would also be installed, which would include ballast, ties and rail. The VLMF building would require foundation construction by means of excavators, backhoes, concrete pumps and vibrators.

18.6 Utilities

The proposed Light Rail Alternative and Light Rail Alternative – Sugar Creek Design Option would conflict with existing utilities along North Tryon Street/US-29 and where the proposed project within the existing rail corridor could cross roadways. Access to utilities that require constant inspection and maintenance would not be allowed to be located within the clearance envelope of the light rail vehicles and tracks. Those utilities within the proposed right-of-way would be the most likely to require relocation.

The utilities affected include: electrical power utilities, primarily overhead electric lines and poles; telecommunication, including telephone and cable (both above and below ground); water and sewer mains; natural gas utilities; and traffic signals and communications.

A substantial amount of the utility adjustments and relocations would occur between Old Concord Road and JW Clay Boulevard, along North Tryon Street/US-29. The proposed Light Rail Alternative alignment would be situated in the median and would necessitate the widening of North Tryon Street/US-29. Many utilities run parallel to, and cross, North Tryon Street/US-29, which creates conflicts with the proposed construction. Widening would require that these utilities be relocated to make room for the new typical section. Asymmetrical widening is proposed from Old Concord Road to the “weave,” which will minimize the number of utility relocations required in this segment. If the Light Rail Alternative – Sugar Creek Design Option is chosen, there would be additional utility adjustments and relocations along North Tryon Street/US-29, since the proposed alignment would require more median construction than the Light Rail Alternative. Asymmetrical widening is also proposed for this section.

The construction of the underpass configuration where the light rail tracks would descend below the northbound side of North Tryon Street/US-29 would require excavation below existing underground utilities. The change in ground elevations would require relocations of existing underground utilities and aerial utility poles. Staged construction would allow relocations to occur once a portion of the roadway excavation is complete.

Mitigation techniques would include relocation, removal and protection (e.g., pipe casing). Utility conflicts would typically be addressed via in-kind replacement. In certain cases, overhead utilities may be

relocated underground. Existing utilities in conflict with the proposed Light Rail Alternative would potentially be relocated to "utility corridors" identified by the engineering team. These utility corridors would potentially be located between the back-of-curb and the outside ROW.

Construction equipment typically required for relocating utilities would include excavators/backhoes, trenchers, boring machines, trucks, cranes and generators/compressors. Utility relocations located in existing streets would require the demolition of pavement, sidewalks and curbs where open trench construction is employed. This work would require breaking operations consistent with sawing, jack hammering or breaking. In order to repair the damaged structures, concrete or asphalt construction methods would be utilized. Jack and bore and tunneling methods would reduce the amount of demolition needed and would typically be employed at sensitive locations, major intersections and perpendicular crossings. The design of utility adjustments and relocations would be developed as part of the final construction plans. Relocations would be addressed in the traffic control plans by the use of lane closures or temporary road closures.

To minimize scheduling conflicts and coordination issues during construction, it is anticipated that numerous utility relocations would occur prior to the start of major construction activities. This advance utility relocation would facilitate the subsequent construction and minimize delays required to resolve utility conflicts.

18.7 Transportation, Traffic and Parking

Construction of the Light Rail Alternative and the Light Rail Alternative – Sugar Creek Design Option would affect numerous major and minor roadways. Careful planning would be required to reduce disruptions to traffic. The majority of the proposed Light Rail Alternative construction would take place in, or immediately adjacent to, the railroad right-of-way or would occur within the median of North Tryon Street/US-29. If the Light Rail Alternative – Sugar Creek Design Option is chosen, additional impacts would occur to local business access and traffic patterns, since the proposed alignment would occupy additional length in the median of North Tryon Street/US-29. Currently, there is no on-street parking along North Tryon Street/US-29 or the side streets. As a result, only private parking lots would be affected by construction activities.

The staging of construction would require astute planning and coordination to minimize the need for traffic detours while maintaining adequate traffic flow. Maintaining business access and safe passage of materials and equipment throughout the construction areas would be priorities for the contractor. Temporary lane and road closures would be required during construction of the Light Rail Alternative and the Light Rail Alternative – Sugar Creek Design Option. CATS and its contractors would coordinate with the traffic control divisions of CDOT and NCDOT to maintain reasonable and safe traffic operations along the corridor.

Construction in or adjacent to railroad right-of-way would require planning and coordination with NCRR, NS and CSX railroads. Track construction staging plans would be developed to maintain freight track operations throughout construction. Construction within the railroad right-of-way would be subject to the control of railroad flagmen as required by the freight railroads.

18.8 Land Use, Community Facilities and Businesses

A combination of newly acquired right-of-way, permanent easements and temporary construction easements would be necessary for the construction of the Light Rail Alternative and the Light Rail Alternative – Sugar Creek Design Option. Temporary construction easements would typically be acquired to provide the necessary room to construct the proposed features. The contractor would be required to return these easement areas to the appropriate condition based on the plan specifications and the existing conditions. The contractor would be responsible for negotiating the rights to, or purchasing, staging areas needed for construction. The contractor would be responsible for returning these sites to the appropriate conditions, as agreed upon with the individual property owners. CATS may choose to make land that is purchased for the construction of the project available to the contractor for staging areas. The conditions for the use of these areas would be addressed in the specifications. However, CATS would not purchase property for the sole purpose of providing staging areas.

Construction of the Light Rail Alternative and Light Rail Alternative – Sugar Creek Design Option would cause temporary impacts to community facilities (i.e. police station, fire station, school) due to access restrictions and temporary blocking of adjoining roadway intersections. The availability of alternative routes, in addition to the temporary duration of construction periods, would minimize the disruptions to the community facilities. Furthermore, alternative routes would ensure that access to the community facilities is maintained throughout all phases of construction.

Local businesses would be affected by the construction of the Light Rail Alternative and the Light Rail Alternative – Sugar Creek Design Option due to access restrictions, loss of parking and landscape, business signage removal, traffic congestion, noise, dust and aesthetic disruptions. CATS would be responsible for providing local business owners with notification of traffic interruptions and descriptions of alternative routes. Furthermore, attempts would be made to minimize the duration of parking disruptions.

18.9 Displacements and Relocation of Existing Uses

Property acquisitions would be required for both the Light Rail Alternative and the Light Rail Alternative – Sugar Creek Design Option. However, no additional displacements or relocations are anticipated due to construction activities outside the planned right-of-way. The contractor would be responsible for identifying potential staging areas and negotiating mutually agreeable terms with individual property owners in order to secure permission to utilize them. Property owners would be compensated; therefore, mitigation would not be required. A detailed list of the partial property acquisitions and displacements, along with the necessary temporary construction easements, can be found in Appendix C.

18.10 Visual and Aesthetic Qualities

The construction activities related to the Light Rail Alternative and the Light Rail Alternative – Sugar Creek Design Option would be highly visible but would only temporarily affect the visual environment, with the exception of trees that must be removed to accommodate construction activities. Temporary visual impacts would include the presence and movement of construction machinery, equipment, building materials, temporary roads and access ways, construction cranes, temporary construction fences and screens. Furthermore, staging areas would be dispersed along the alignment and would require temporary access for the storage of equipment and materials. Nighttime construction may occur, subject to local regulations. Lights used for nighttime construction could affect residents within one or two blocks of the construction or staging areas. Impacts from lights used during nighttime operations would be minimized by aiming construction lights directly at the work area and/or shielding the lights to avoid disturbing nearby residences. Additional access and clearing would potentially be required at bridge construction sites. These and any other areas requiring temporary access would be restored in accordance with the appropriate construction contract special provisions. Construction of the Light Rail Alternative would also affect existing landscaping. Where existing vegetation serving to buffer adjacent properties is altered or removed, vegetation or other screening would be restored as outlined in the *Urban Design Framework*.

18.11 Neighborhoods, Community Services and Environmental Justice

Construction of the Light Rail Alternative and the Light Rail Alternative – Sugar Creek Design Option is not anticipated to significantly impact communities within the proposed project corridor. Despite the close proximity of the Howie Acres community to Sugar Creek Road, construction of the Light Rail Alternative in this area would not isolate the community, as access would be maintained throughout all phases of construction. Similarly, lengthening of the bridge on Eastway Drive would not isolate the Hampshire Hills neighborhood. Access to this neighborhood would be maintained during all phases of construction. There is a potential impact to the neighborhood related to traffic from construction vehicles and equipment to access the railroad right-of-way. To avoid this impact, CATS would include provisions that restrict contractors from accessing the worksite through the Hampshire Hills neighborhood. Access would occur along the right-of-way. Furthermore, CATS and its contractors would continuously coordinate with community service providers (i.e. police, fire and ambulance service) to ensure emergency vehicles have access to all areas.

18.12 Air Quality

Construction activities for the proposed Light Rail Alternative and Light Rail Alternative – Sugar Creek Design Option could result in increases in localized air quality emissions. Potential air quality impacts would be related to increases in fugitive dust, particulates ($PM_{2.5}$, PM_{10}) and gaseous pollutant emissions (CO, VOCs, and NO_x) from mobile and stationary construction related equipment. Pollutant emissions would be generated from the following construction activities:

- Excavation related to cut-and-cover construction;
- Mobile emissions from construction workers' private vehicles as they travel to and from the construction site;
- Mobile emissions from trucks delivering and hauling construction supplies and debris to and from the construction site;
- Stationary emissions from on-site construction equipment; and
- Mobile emissions from diverted vehicles due to road closures and vehicles whose speeds are slowed because of increased congestion caused by construction activity.

In addition, under the Light Rail Alternative – Sugar Creek Design Option, the transition from the existing NCRR right-of-way to the North Tryon Street/US-29 median would involve substantially more building demolition than the Light Rail Alternative in the area of Raleigh Street. The additional demolition could generate a considerable amount of dust, which would have a greater impact to the existing air quality during construction.

Any increase in construction related pollutant emissions from both the Light Rail Alternative and the Light Rail Alternative – Sugar Creek Design Option would be temporary in nature with exposure to construction related dust lasting only the duration of construction. Staged construction would proceed in a linear fashion with site excavation, bed preparation and track installation beginning at one or more locations along the proposed alignment. As such, although the overall construction would last approximately three years, the period of time for which specific locations would be exposed to increased emissions would be far less. Air quality impacts would be minimized by adherence to the following recommended construction control measures:

- Shutting off construction equipment not in direct use;
- Watering areas of exposed soil;
- Covering open body trucks transporting materials to and from construction sites;
- Rerouting truck traffic away from schools and residential communities when possible;
- Repaving and/or replanting exposed areas as soon as possible following construction;
- Employing adequately secured tarps, plastic or other material to further reduce dust emissions from debris piles; and
- Prohibiting delivery trucks or other equipment from idling during periods of extended unloading or inactivity.

18.13 Noise and Vibration

18.13.1 Noise

Noise during construction would be an inconvenience to nearby residents and some businesses. The most common noise source in construction areas would be from engine powered machinery, such as bulldozers, cranes and generators. Mobile equipment would operate in a sporadic manner, while stationary equipment would generate noise at fairly constant levels. The loudest and most disruptive construction activities would be associated with pile driving, which would occur in areas where bridges would be constructed. Building demolition incorporates several types of construction related machinery, which could also produce significant potential community disruption. Chapter 13.0: Noise and Vibration provides some typical construction equipment noise emission levels. In general, the majority of construction activities fall within the 75 to 95 decibel range at 50 feet. The human ear perceives noise to be intrusive at around 65 decibels and detrimental at 90 decibels. At 80 decibels, people must shout to be heard. Hearing protection is recommended at noise levels above 90 decibels. Construction noise at

locations further than 50 feet from the source would decrease by approximately six decibels for each doubling of the distance from the source. For example, if the noise level is 90 decibels at 50 feet from a jackhammer, it would decrease to about 84 decibels at 100 feet from that noise source (Bearden, 2006). Noise impacts resulting from a proposed project are determined by comparing the existing and future project-related outdoor noise levels. Essentially, as the existing level of ambient noise increases, the allowable level of noise generated by construction also increases, but the total amount by which a community's noise can increase without an impact is reduced.

South of 30th Street, construction noise would be similar to that produced by typical highway/bridge and city street construction projects. This section would include one bridge structure over the CSX tracks and two bridges over Little Sugar Creek and the VLMF site, which includes the Site Yard and a VLMF building containing Rail Car Services and Operations. Pile foundations for the bridge structures would typically be used, which would require the use of pile hammers. Although this section would include pile driving, any potential elevated noise levels would be relatively short in duration. The other major construction operations in this area would be grading and track construction. However, as these would be done in a linear fashion, any potential elevated noise levels would be temporary.

In the area between 30th Street and the proposed Old Concord Road Station, construction noise levels would be typical of those experienced during highway construction projects. Construction of several bridges, park-and-ride facilities and the parking garages associated with the Sugar Creek Station Park-and-Ride Option 2 would be anticipated in this section. A combination of pile and/or drilled shaft foundations would most likely support the bridges and parking garages. The other major construction operations in this section would be grading and track construction. Construction noise related to bridge and retaining wall construction could potentially be experienced by the Howie Acres and Hampshire Hills communities under the Light Rail Alternative. Construction of the bridge over Sugar Creek Road could produce noise impacts to the Howie Acres community, while the bridge at Eastway Drive could produce noise impacts to the Hampshire Hills community. Additionally, constructing the parking garage associated with the Sugar Creek Station Park-and-Ride Option 2 could produce elevated noise levels to a portion of the Howie Acres community. The alignment for the Light Rail Alternative – Sugar Creek Design Option shifts north towards North Tryon Street/US-29 approximately 300 feet east of Sugar Creek Road and would not likely affect the Hampshire Hills community.

North of the Old Concord Road Station to the entrance into the North Tryon Street/US-29 median, potential construction noise would be typical of highway and bridge construction projects. As with other project sections, construction operations in this area would include pile driving activities. The Light Rail Alternative would propose a bridge over Old Concord Road and noise from the pile driving operations would be greater than those under the Light Rail Alternative – Sugar Creek Design Option, which does not propose a bridge in this area.

Construction activities within the median of North Tryon Street/US-29 could potentially result in elevated noise levels. Activities in this area would generally include the widening of North Tryon Street/US-29 to accommodate the median width required for the proposed light rail alignment. Widening operations would include demolition, utility relocations, grading, retaining wall construction, paving and signalization. Construction of the proposed light rail would begin once roadway widening is sufficiently complete to allow traffic shifts. This would include grading, drainage, utility relocations, retaining wall, bridge and track construction.

A significant portion of the construction on the UNC Charlotte campus would be on a greenfield site removed from residents and businesses. Construction in this section would include the underpass construction, grading, drainage and track construction. The other major elements in this section would be the construction of two stations and two bridges. The station construction would be closer to the business/residential locations than the bridge construction. The bridges in this area would most likely require pile driving or drilled shaft operations. The underpass construction would require major excavation.

The I-485/North Tryon Station would include the construction of a station, light rail bridges, parking garage and all associated entrance roadways and surface lots. Construction noise could result from pile

driving, grading and other typical highway construction activities. Construction of the I-485/North Tryon Station and the accompanying design elements could produce elevated noise levels to the Harris-Houston neighborhood, particularly the Queen's Grant Mobile Home Park south of I-485. The majority of the construction noise would result from pile driving for the bridges and parking garage.

A detailed noise assessment would be conducted to accurately assess the potential for temporary and long-term noise impacts. Site specific mitigation would be developed at that time when sufficient engineering detail is available.

18.13.2 Vibration

Vibration would result from the use of construction equipment, such as pile hammers, jack hammers and hoe rams. The movement of heavy equipment, such as large vibratory compaction equipment, dump trucks and bulldozers, would also contribute to vibration. The nature of this type of vibration is temporary and intermittent. Generally speaking, sensitive receivers for highway and light rail construction would not experience vibration unless they are in close proximity to the construction operations. A damage threshold for fragile buildings (such as historic structures) is 0.2 inches per second (Harris Miller Miller and Hanson Inc., 2006). Chapter 13.0: Noise and Vibration details the typical vibration source levels for construction. Preliminary engineering indicates that construction operations would maintain adequate distances from historic buildings.

Construction of the Light Rail Alternative would take place adjacent to two historic properties in the Center City: McNeil Paper Company Warehouse Complex (301-307 East 8th Street), Philip Carey Company Warehouse (301 East 7th Street). Construction in this area would include grading, drainage, utility relocations and track construction, which are not likely to create vibration impacts. Construction of the Light Rail Alternative in the NoDa neighborhood at 36th Street would take place close to historic resources: Herrin Brothers Coal and Ice Company Complex (315 East 36th Street) and two contributing properties to the North Charlotte Historic District, the Johnston & Mecklenburg Mill (407 East 36th Street) and Newco Fiber Company (430 East 36th Street). The proposed bridges, station and retaining walls at this site would require construction operations such as pile driving that would produce significant vibration. The close proximity of the construction activities to the historic properties will be examined in the detailed vibration assessment and resulting impacts may require minimization techniques.

Some residential properties along the NCRR right-of-way would be in close proximity to the construction of the proposed retaining walls and bridges. As a result, these residences could experience vibration resulting from construction activities.

Under the Light Rail Alternative, the proposed bridge over Old Concord Road would occupy an area near a historic property that is currently operating as the Crossroads Charter High School. The anticipated foundation type for this structure would include driven piles and drilled shafts. Retaining walls would be proposed for the bridge approaches. Pile driving, drilled shaft installation and compaction equipment could generate vibrations that may affect this facility. The Light Rail Alternative – Sugar Creek Design Option would not include a bridge in this location. The demolition of the buildings for the proposed park-and-ride lot may result in temporarily elevated vibration levels for the Crossroads Charter High School.

Several planned and existing buildings on the UNC Charlotte campus contain vibration sensitive equipment. Some of these facilities would be adjacent to the proposed light rail alignment entering campus. The anticipated construction operations of the Light Rail Alternative would include pavement removal and excavations. If rock is encountered at this site, excavation could generate substantial vibrations. A survey of the UNC Charlotte campus revealed that the existing and planned buildings employ the use of a vibration isolation system that protects the buildings' sensitive research instrumentation from localized ambient vibration. However, because vibration from construction activities would likely exceed any ambient levels, UNC Charlotte personnel should be notified in advance of any severe vibration causing operations so the use of any sensitive instrumentation could be coordinated around construction activities.

A detailed vibration assessment would be conducted to accurately assess the potential for temporary and long-term vibration impacts. Site-specific mitigation would be developed when sufficient engineering detail is available.

18.14 Natural Resources

Impacts to wildlife would result from both temporary impacts from construction and long term impacts from the elimination and/or fragmentation of forested habitat. Construction noise and construction staging may temporarily displace some wildlife species. The majority of the wildlife species common to the corridor are typical of urban and/or disturbed environments and would adapt and recover quickly. It is expected that most wildlife capable of relocating would temporarily relocate to other existing habitat near the proposed project corridor until construction has completed and vegetation along the construction limits has been re-established. The loss of terrestrial forested habitat and fragmentation of forested habitat may result in the displacement and/or loss of some wildlife species.

18.15 Water Resources

Excavation, grading and other construction activities would require adjustments and modifications to existing stormwater infrastructure. These construction activities could increase sediment levels in stormwater runoff. Staged construction of the proposed stormwater system would reduce disruptions to existing flow characteristics; however, the increased sediment load has the potential to enter nearby waterways without proper Best Management Practice (BMP) measures. The BMP measures would comply with federal, state and local guidelines on sediment discharge thresholds, particularly the City of Charlotte Post-Construction Controls Ordinance (PCCO). A detailed analysis of the sediment load anticipated to be generated by the proposed project, in addition to the BMP measures that would be employed, would be outlined in the Erosion and Sediment Control Plans developed during final design. The various water systems that would be subject to construction-related impacts are outlined in the subsequent sections.

18.15.1 Floodplains

The Federal Emergency Management Administration (FEMA) develops and updates floodway boundaries for Mecklenburg County. Construction of the Light Rail Alternative would take place in three floodplains: Little Sugar Creek, Toby Creek and Mallard Creek. FEMA has mandated that projects can cause no rise in the regulatory floodway, and a one-foot cumulative rise for all projects in the base (100-year) floodplain. Mitigation of the impacts related to construction of the Light Rail Alternative would be conducted in accordance with federal, state and local agency regulations.

Construction equipment would encroach upon the Little Sugar Creek Floodplain during construction of the bridge crossing adjacent to North Brevard Street, a portion of the proposed access drive to the Duke Energy substation and a portion of the proposed freight alignment behind the Cullman Avenue industrial facilities. The bridge crossing of Little Sugar Creek adjacent to North Brevard Street would require the construction of two bridge end bents and two center bents. The two end bents would not impact regulatory floodways. The two center bents would be composed of two columns each, each column with a drilled shaft, for a total of four drilled shafts within the mapped Community Floodplain and Community Encroachment Area. The proposed alignment behind the Cullman Avenue industrial facilities (including the 36th Street Station) would encroach upon a portion of the Community Floodplain of Little Sugar Creek for construction of fill embankments and retaining walls.

Toby Creek has a wide Community Floodplain Area northwest of the proposed UNC Charlotte Station. The proposed bridge crossing of Toby Creek would require the construction of approach fill embankments, two bridge end bents and 11 interior bents. Each of the 11 interior bents would be supported by three columns, each column with a five foot diameter drilled shaft. This would result in six interior bents (18 drilled shafts) within the FEMA floodway, two interior bents (six drilled shafts) within the Community Encroachment Area and three interior bents (nine drilled shafts) within the Community Floodplain. One proposed end bent is wholly within the Community Encroachment Area, and one proposed end bent is partially within the Community Floodplain.

Mallard Creek is the last floodplain that would potentially be affected by construction equipment. The proposed Light Rail Alternative would cross the Mallard Creek floodplain twice. The first crossing occurs at an unnamed tributary to Mallard Creek (Stream T) as the proposed alignment leaves the UNC Charlotte campus. Fill embankments would encroach upon a portion of the Community Floodplain Area and the Community Encroachment Area at the crossing of this unnamed tributary. The second crossing would occur south of the I-485/North Tryon Station. The bridge crossing of Mallard Creek would require the construction of approach fill embankments, two bridge end bents and seven interior bents. Each of the interior bents would be supported by two columns, each column with a five foot diameter drilled shaft. This would result in six interior bents (12 drilled shafts) within the FEMA Floodway; and one interior bent (two drilled shafts) and one partial end bent within the Community Encroachment Area. The remainder of the end bent and the whole of the other end bent would be located within the Community Floodplain. Additionally, construction activities at the southeast corner of the I-485/North Tryon Station park-and-ride parking garage and perimeter roadway would encroach on the floodplain.

18.15.2 Groundwater

Ten privately-owned groundwater wells and one public groundwater well are located within the study area. There is also a well located on the UNC Charlotte campus. Groundwater could potentially be affected by excavation near the wells. However, field observations have verified that the groundwater wells would be located at distances that would exclude them from experiencing any impacts; or, in the case of the well at UNC Charlotte, which is located within the proposed alignment, groundwater would not be impacted as the well is currently planned for closure. It is possible that excavation activities could encounter groundwater during the construction of the underpass configuration and the parking garage associated with the Sugar Creek Park-and-Ride Option 2, at which time dewatering would occur in accordance with all applicable rules and regulations.

18.15.3 Surface Waters

Federal, state and local governments monitor and enforce water quality standards. Construction could result in the generation of temporary impacts to surface water quality and sediment runoff. Construction activities within the floodplains could potentially increase sediment loads to perennial streams if proper erosion control methods are not consistently employed. The named perennial streams in the project vicinity include: Little Sugar Creek, Toby Creek and Mallard Creek. Other unnamed perennial streams also exist and include: Streams C, J, K A, S and T, described in Chapter 11:0 Water Resources. Minor impacts to streams that could result from construction include the degradation of water quality as a result of changes to the existing landscape. Development of the light rail stations and park-and-ride facilities could also result in changes to existing runoff patterns, which may generate soil erosion during construction. Water quality and runoff issues would be addressed for the Light Rail Alternative and the Light Rail Alternative – Sugar Creek Design Option through the development of a comprehensive Erosion and Sediment Control plan developed during final design. Also, the proposed storm water design would accommodate the changes in the runoff.

18.15.4 Wetlands

Permanent impacts to wetlands would occur under the proposed Light Rail Alternative and the Light Rail Alternative – Sugar Creek Design Option due to fill slope encroachment, bridges, foundation elements and retaining walls. These long term impacts are discussed in Chapter 11.0: Water Resources. Heavy construction equipment such as dozers, track-mounted excavators and truck hauling equipment would be utilized during fill operations. Construction activities that may impact wetlands include increased stormwater runoff and increased sedimentation in wetland areas. The temporary effect on wetlands as a result of construction activities would be reduced by minimizing work inside wetlands to the extent feasible and as required by permits. Careful planning and coordination would reduce any unnecessary encroachment into wetlands. As previously noted, water quality and runoff issues would be addressed for the Light Rail Alternative and the Light Rail Alternative – Sugar Creek Design Option through the development of a comprehensive Erosion and Sediment Control plan developed during final design. Proposed storm water design would accommodate the changes in the runoff as well.

18.15.5 Jurisdictional Streams

Permanent impacts to jurisdictional streams would occur under the proposed Light Rail Alternative and the Light Rail Alternative – Sugar Creek Design Option due to fill slope encroachment, bridges, foundation elements and retaining walls. These long term impacts are discussed in Chapter 11.0: Water Resources. Heavy construction equipment such as dozers, track-mounted excavators and truck hauling equipment would be utilized during fill operations and extensions of existing drainage pipes. Construction activities have the potential to increase stormwater runoff and sedimentation entering jurisdictional streams. These temporary effects on jurisdictional streams resulting from construction activities would be reduced by minimizing work inside jurisdictional streams to the extent feasible and by utilizing proper erosion and sedimentation controls and other measures as required by permits.

18.16 Cultural, Historical and Archaeological Resources

Constructing the Light Rail Alternative and Light Rail Alternative – Sugar Creek Design Option would have the potential to create impacts to cultural, historical and archaeological resources. Construction impacts to these resources would generally result from activities that directly disturb a resource or produce a secondary detrimental effect to the value of the resource. Direct disturbance of a resource would consist of discovering archaeological artifacts during construction, such as excavation or grading operations. The disturbance of archaeological artifacts would be controlled by the construction contract special provisions, which will require the contractor implement a Late Discovery Archaeological Recovery Plan. Direct disturbance is not anticipated but has the potential to occur due to the proximity of historic buildings. Secondary effects also are not anticipated but could occur as a result of negligent construction practices. They could potentially include the discharge of dust, failure to restore surrounding construction areas to preconstruction conditions or poorly implemented aesthetic features.

There are several resources adjacent to the proposed light rail alignment where construction impacts would potentially occur, such as vibration in the vicinity of the proposed 36th Street Station. The vibration impacts are anticipated to be temporary and benign to the surrounding properties. Specific areas where these issues warrant evaluation and consideration are described in Chapter 8.0: Cultural, Historical and Archaeological Resources. Contractors would be instructed to maintain as much distance from historic buildings as practical. The Light Rail Alternative – Sugar Creek Design Option would bring construction activities closer to additional historic buildings not affected by the Light Rail Alternative.

18.17 Parklands

Construction of the Light Rail Alternative would have moderate impacts to parklands. Impacts to the Toby Creek Greenway (planned), which would be completed prior to construction, and Mallard Creek Greenway Extension (planned) would be due to overhead bridges crossing the greenways. Impacts to these areas would include temporary trail closures during certain construction activities. Access to the trails would generally be maintained during most construction activities and the temporary closures would be minimized to the extent practical.

Impacts to the Kirk Farm Fields park would involve temporary visual, noise and vibration impacts to the wetland viewing area. These temporary impacts would result from excavation and grading associated with station and retaining wall construction. The Mallard Creek Church Station would be located approximately 150 feet southwest of the boardwalk used to access the wetland viewing area. Construction activities would be restricted to areas adjacent to the park and outside the Kirk Farm Fields park boundary.

18.18 Energy

Approximately 30 percent, or 1,210 Billion BTUs, of the total estimated demand for indirect infrastructure energy (excluding vehicles) is estimated to be consumed locally during construction, including transporting materials and operating construction equipment (Caltrans, *Energy and Transportation Systems*, 1983). This additional energy expenditure would comprise a small fraction of the total regional energy consumed annually for transportation and would not impact regional energy sources or fuel availability.

18.19 Hazardous and Contaminated Materials

Hazardous and contaminated material impacts during construction would typically result from the removal and transportation of material on the site or the discovery of previously unidentified materials during construction. Both of these situations would be addressed by contract requirements consistent with federal, state or local law or agency regulations.

Materials necessary for construction that would be transported to the site would typically consist of native or manufactured materials. Manufactured materials would typically include concrete, metal components, reinforcing steel, fencing or similar elements that would not contain hazardous or contaminated materials. Native materials incorporated into the construction would typically consist of borrow material or select material for use in embankments and MSE retaining wall type applications. As a precautionary measure, the contractor would be required to submit the sources and the appropriate testing for approval, which would prevent hazardous or contaminated materials from being incorporated into construction operations.

Based on preliminary site investigations, several locations may contain contaminated and/or hazardous materials requiring removal and/or remediation as noted in Chapter 15.0: Hazardous and Contaminated Materials. For these operations, the contractor would be required to properly remove, contain and transport the materials in accordance with all applicable regulations. Additionally, the contractor would be required to clean its vehicles to prevent off-site contamination. This would be applicable to several sites and for equipment involved in the removal of the existing railroad ballast, which is potentially contaminated with arsenic.

There is a possibility that arsenic contaminated soil may be encountered during construction within the former freight track corridor. Any arsenic contaminated soil would be disposed of as special waste consistent with methods employed during the construction of the Charlotte Trolley and LYNX Blue Line rail projects. These same requirements would be included in the construction contract special provisions. Proper handling of arsenic contaminated soil would minimize potential impacts.

Construction operations that could potentially discharge hazardous or contaminated materials would require on-site remediation so that contamination would not occur. These construction operations would include the demolition of existing buildings that may contain materials such as lead or asbestos and the painting of the existing steel girders, such as in the Eastway Drive Bridge modifications. The contractor would be responsible for removal, remediation and disposal of any contaminated materials encountered during construction activities.

Accidental spills from equipment would be another source of potentially hazardous or contaminated materials during construction. These types of spills typically occur as a result of mechanical failure of the equipment or during maintenance or repair of the equipment. The contractor would be responsible for removal, remediation and disposal of any accidental spills during construction.

The excavation of previously unidentified hazardous or contaminated materials during construction would be another potential source of impacts. Procedures for safely handling this potential circumstance would be included in the contract specifications, which would require conformance to all appropriate safety and environmental controls including the containment and remediation of any potential contaminated materials. The environmental investigations would minimize the potential for encountering previously unknown contaminated materials, but this risk would not be eliminated completely since portions of the Light Rail Alternative and Light Rail Alternative – Sugar Creek Design Option would be located in older industrial areas where complete information is either unknown or unavailable.

18.20 Safety and Security

The Light Rail Alternative and the Light Rail Alternative – Sugar Creek Design Option would be constructed according to generally accepted principles of safety and security. As a result, adverse safety and security impacts are not anticipated during construction. Pedestrian and bicyclist safety in the vicinity of construction activities would be provided through the use of temporary construction fencing and barricades around construction sites. Access to the construction sites would be controlled. The maintenance of traffic plan, developed during final design, would address motorist safety through the

construction work zones. Furthermore, police, fire and ambulance services would have continuous access to all areas.

To eliminate potential health concerns, an investigation would be undertaken prior to the commencement of construction by the contractor of each location where potential concerns have been identified. The investigation would include the development of a health and safety plan to be implemented during construction to minimize the potential exposure of workers to contaminants and hazards. In addition, all on-site personnel would be required to follow all applicable local, state and OSHA construction codes and regulations. Any contaminated materials encountered during construction would be handled and disposed of in accordance with all applicable federal, state and local regulations and in compliance with the site-specific health and safety plan.

18.21 Mitigation

Construction of the Light Rail Alternative and Light Rail Alternative – Sugar Creek Design Option could generate a variety of impacts to the existing environment and surrounding features. These potential impacts would be neither permanent nor severe. A summary of the mitigation techniques that will be applied is listed in Table 18-1.

Table 18-1
Summary of Mitigation Techniques During Construction

Impact Type	Mitigation
Utility	1. Coordinate with utility owners to ensure maintenance of utility services and timely relocation 2. Relocate, remove and protect existing utilities.
Transportation, Traffic and Parking	1. Schedule construction activities during off-peak hours, where practical. 2. Develop Maintenance of Traffic Plan. 3. Coordinate freight schedule and construction activities with the railroads.
Land Use, Community Facilities and Businesses	1. Coordinate with local business owners and provide advance notification of roadway disruptions and descriptions of alternative routes. 2. Provide temporary entrance signs during construction.
Visual and Aesthetic	1. Shield and aim night work lights directly at the work zone. 2. Stage construction activities to limit the duration of impacts at individual locations.
Neighborhoods, Community Services and Environmental Justice	1. Inform local property owners, through the Construction Education and Outreach Plan, of roadway disruptions. 2. Provide continuous coordination with community service providers to maintain access for emergency vehicles. 3. Restrict contractors from accessing the railroad right-of-way through the Hampshire Hills neighborhood.
Air Quality	1. Shut off construction equipment not in direct use. 2. Water areas of exposed soil. 3. Cover open body trucks transporting materials to and from construction sites. 4. Reroute truck traffic away from schools and residential communities when possible. 5. Repave and/or replant exposed areas as soon as possible following construction. 6. Adequately secure tarps, plastic or other material over debris piles. 7. Prohibit idling of delivery trucks or other equipment during periods of extended unloading or inactivity.
Noise and Vibration	1. Conduct detailed noise and vibration assessment during final design and employ recommended mitigation techniques identified within the assessment.
Natural Resources	1. Best management practices (BMP) would be followed by the contractor during construction. BMP would include the demarcation of the construction limits and staging areas prior to the initiation of construction, to limit the disturbances to the vegetative community.
Water Resources	1. Minimize disturbed areas. 2. Apply prompt stabilization. 3. Employ an erosion and sediment control plan to treat stormwater runoff. 4. Prevent the storage of fill or other materials in floodplains, to the extent practicable. 5. Stage construction of proposed stormwater systems to reduce the duration of construction disturbances to a given area. 6. Recycle topsoil removed during construction by using it to reclaim disturbed areas and enhance regrowth. 7. Avoid excessive slopes during excavation and blasting operations to reduce erosion. 8. Use isolation techniques, such as berming or diversion, for in-stream construction near wetlands.
Cultural Resources	1. Stop construction activities immediately upon the discovery of any new cultural resources. 2. Maintain minimum allowable distances from historic resources, to the extent practicable.
Parklands	1. Restrict construction to areas adjacent to the Kirk Farm Fields park boundary. 2. Notify MCPR 48 hours in advance of temporary closures of greenways due to construction.
Energy	1. Measures to minimize energy consumption during construction could include limiting the idling of construction equipment and employee vehicles, as well as locating staging areas and material processing facilities as close as practical to work sites.
Hazardous and Contaminated Materials	1. Dispose of hazardous materials according to applicable federal, state and local guidelines. 2. Clean construction vehicles to prevent off-site contamination.
Safety and Security	1. Provide construction barriers and fencing to secure construction sites and staging areas.