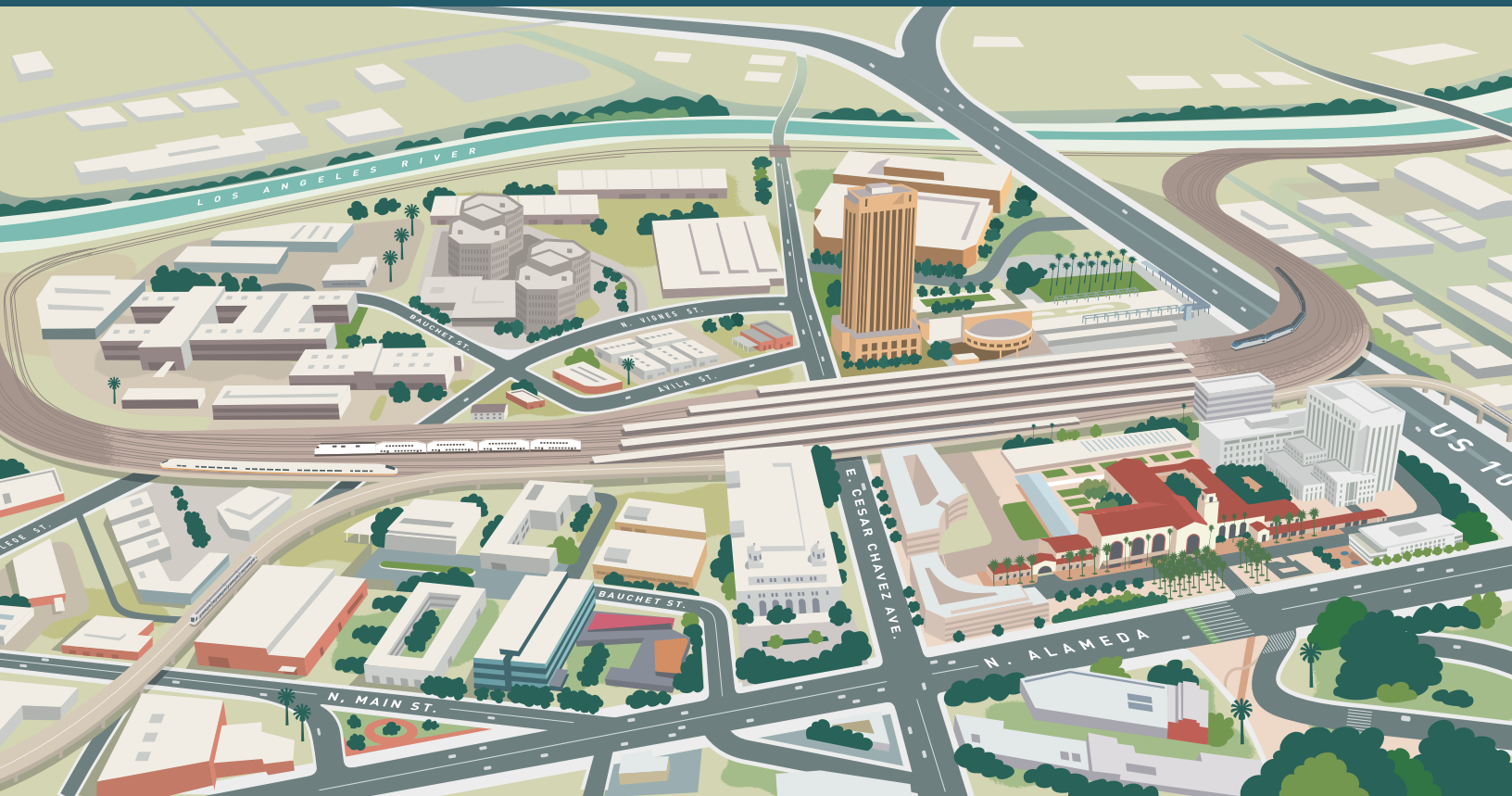


Link Union Station

Preliminary Low Impact Development Report

June 2019



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ACRONYMS

BMP	best management practice
Caltrans	California Department of Transportation
HSR	High-Speed Rail
LAUS	Los Angeles Union Station
LID	low impact development
Link US	Link Union Station
Metro	Los Angeles County Metropolitan Transportation Authority
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollution Discharge Elimination System
POC	pollutants of concern
RCP	reinforced concrete pipe
ROW	right-of-way
TMDL	total maximum daily load
U.S. EPA	United States Environmental Protection Agency
UV	ultraviolet

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ES.0 Executive Summary

This Preliminary Low Impact Development (LID) Report serves as the preliminary LID plan for the Link Union Station project (project). The preliminary LID plan applies to portions of the project that would occur outside of the jurisdiction of the California Department of Transportation's (Caltrans) National Pollution Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) permit, which applies to the right-of-way (ROW) for US-101. The project would be designed to be consistent with City of Los Angeles LID Ordinance No. 183833 (LID Ordinance). The LID Ordinance is consistent with Los Angeles County NPDES MS4 Permit Order No. R4-2012-0175. Consequently, City of Los Angeles Section 2.4 of the *Planning and Land Development Handbook for Low Impact Development* (LID Manual) states that agencies such as the Los Angeles County Metropolitan Transportation Authority (Metro) must prepare an LID Plan for non-roadway transportation projects, rail lines, and stations and implement stormwater mitigation measures.

This Preliminary LID Report was prepared to:

- Identify stormwater pollutants of concern (POC) in the project study area (non-Caltrans ROW) that address the post-construction phase
- Conduct preliminary stormwater quality calculations
- Recommend a conceptual best management practice (BMP) approach for the post-construction phase

This report includes an analysis of existing and proposed drainage systems and stormwater management BMPs utilizing the area encompassing the maximum extent of physical disturbance associated with the proposed project (project footprint). Although this report reflects the quantities and exhibits associated with the proposed project, project-related drainage outside of Caltrans ROW would be managed similarly for the build alternative because the respective tributary drainage subwatersheds and storm drain systems would be affected similarly. This drainage nexus extends similarly to the stormwater quality approach. Key assumptions and findings of this report are summarized below:

- One hundred percent imperviousness is assumed for elevated tracks on cellular concrete fill
- Tracks at-grade are assumed to be 15 percent imperviousness
- Reconstructed street improvements are assumed to be 91 percent imperviousness
- The total area within the project site is 110.90 acres, of which 70.44 acres (64 percent) is considered impervious surface in the existing condition
- For the proposed condition, 72.74 acres (66 percent) is considered to be impervious surface

In accordance with the LID Manual, the project falls under the “All Other Developments” category. The LID Manual specifies BMPs to be implemented in the following priority order: infiltration (Tier 1), capture and use (Tier 2), biofiltration/bioretenion (Tier 3), or a combination of any of the above. Based on the *Link US Phase I Environmental Site Assessment* (HDR 2016a), the majority of the soil where physical disturbance would occur is contaminated and not suitable for infiltration (Tier 1). Therefore, unlined landscaping improvements, including irrigation, are not feasible for the project. Tier 2 (capture and use) and Tier 3 (bioretention) are viable approaches to meet LID requirements. To mitigate for stormwater quality impacts, the preferred conceptual BMP approach is proposed.

- In Segment 1: Throat Segment, a structural stormwater vault would address the area north of Vignes Street; a capture and use BMP (cistern) would address the rest of this segment, including a portion of the concourse area (Segment 2: Concourse Segment). For the build alternative, modification of local city streets (Bolero Lane, Bloom Street, and Leroy Street) would occur, and the drainage pattern will remain the same as the existing condition. Implementation of the City of Los Angeles Green Street Standards would be applied at this location, similar to the BMPs proposed in Segment 3: Run-Through Segment.
- In Segment 2: Concourse Segment, capture and use BMP (cisterns) are proposed. The extent of BMPs in the concourse area will be refined in final design. For the build alternative with an at-grade passenger concourse, the cistern concept will remain the same as the proposed project.
- In Segment 3: Run-Through Segment, south of US-101, bioretention BMPs are proposed for the proposed project and the build alternative. Bioretention BMPs would be applied on reconstructed public streets south of US-101 (i.e., Commercial Street, Center Street, and Ducommun Street). City of Los Angeles Green Street Standard Plans may be used and modified with bioretention features and impermeable liners to convey the underdrains to a nearby storm drain system. This approach would require concurrence from the City of Los Angeles. A structural BMP (Contech Jellyfish Filter) would address the area south of Ducommun Street where the tracks sit on the cellular concrete.

The following steps are recommended for further evaluation:

1. Conduct water demand analysis for capture and use cisterns. If after further analysis determines 100 percent of the water quality design volume cannot be managed through capture and use, the remaining volume is proposed to be managed through bioretention BMPs.
2. Conduct further exploration of other BMP options as the engineering design progresses.
3. Update this Preliminary LID Report after the selection of post-construction BMP designs and consideration of operations and maintenance costs for each BMP.

1.0 Introduction

Metro is proposing the Link Union Station Project to transform Los Angeles Union Station (LAUS) from a “stub-end tracks station” into a “run-through tracks station” with a new passenger concourse that would improve the efficiency of the station and accommodate future growth and transportation demands in the region.

1.1 Project Location and Project Study Area

LAUS is located at 800 Alameda Street in the City of Los Angeles, California. LAUS is bounded by US-101 to the south, Alameda Street to the west, Cesar Chavez Avenue to the north, and Vignes Street to the east. Figure 1-1 depicts the regional location and general vicinity of LAUS.

Figure 1-2 depicts the project study area, which encompasses the extent of environmental study associated with potential direct, indirect, and cumulative impacts from implementation of the project. The project study area includes three main segments (Segment 1: Throat Segment, Segment 2: Concourse Segment, and Segment 3: Run-Through Segment). The existing conditions within each segment are summarized north to south below.

- **Segment 1: Throat Segment** – This segment, known as the LAUS throat, includes the area north of the platforms, from Main Street at the north to Cesar Chavez Avenue at the south. In the throat segment, all arriving and departing trains traverse five lead tracks into and out of the rail yard, except for one location near the Vignes Street Bridge where the tracks reduce to four lead tracks. Currently, special track work consisting of multiple turnouts and double-slip switches are used in the throat to direct trains into and out of the appropriate assigned terminal platform tracks.
- **Segment 2: Concourse Segment** – This segment is between Cesar Chavez Avenue and US-101 and includes LAUS, the rail yard, the Garden Tracks (stub-end tracks where private train cars are currently stored, just north of the platforms and adjacent to the existing Gold Line aerial guideway), the East Portal building, the baggage handling building with aboveground parking areas and access roads, the ticketing/waiting halls, and the pedestrian passageway with connecting ramps and stairways below the rail yard.
- **Segment 3: Run-Through Segment** – This segment is south of LAUS and extends east/west from Alameda Street to the west bank of the Los Angeles River and north/south from Keller Yard to Control Point Olympic. This segment includes US-101, the Commercial Street/Ducommun Street corridor, Metro Red and Purple Lines Maintenance Yard (Division 20 Rail Yard), BNSF West Bank Yard, Keller Yard, the main line tracks on the west bank of the Los Angeles River, from Keller Yard to Control Point Olympic, and the “Amtrak Lead Track” connecting the main line tracks with Amtrak’s Los Angeles Maintenance Facility. Businesses within the run-through segment are primarily industrial and manufacturing related.

The project study area has a dense street network ranging from major highways to local city streets. The roadways within the project study area include the El Monte Busway, US-101, Bolero Lane, Leroy Street, Bloom Street, Cesar Chavez Avenue, Commercial Street, Ducommun Street, Jackson Street, East Temple Street, Banning Street, First Street, Alameda Street, Garey Street, Vignes Street, Main Street, Aliso Street, Avila Street, Bauchet Street, and Center Street.

1.2 Proposed Project Overview

The proposed project components are summarized north to south below.

- **Throat and Elevated Rail Yard** – The proposed project includes subgrade and structural improvements in Segment 1 of the project study area (throat segment) to increase the elevation of the tracks leading to the rail yard. The proposed project includes the addition of one new lead track in the throat segment for a total of six lead tracks to facilitate enhanced operations for regional/intercity rail service providers (Metrolink/Amtrak) and accommodate the planned High-Speed Rail (HSR) system within a shared track alignment. Regional/intercity and HSR trains would share the two western lead tracks in the throat segment. The rail yard would be elevated approximately 15 feet. New passenger platforms with individualized canopies would be constructed on the elevated rail yard, with an underlying assumption that the platform infrastructure and associated vertical circulation elements (stairs, escalators, and elevators) would be modified at a later date to accommodate the planned HSR system. The existing railroad bridges in the throat segment at Vignes Street and Cesar Chavez Avenue would also be reconstructed. North of Control Point Chavez, the proposed project also includes safety improvements at the Main Street public at-grade crossing on the west bank of the Los Angeles River (medians, restriping, signals, and pedestrian and vehicular gate systems) to facilitate future implementation of a quiet zone by the City of Los Angeles.
- **Above-Grade Passenger Concourse with New Expanded Passageway** – The proposed project includes an above-grade passenger concourse with new expanded passageway in Segment 2 of the project study area (concourse segment). The above-grade passenger concourse with new expanded passageway would include space dedicated for passenger circulation, waiting areas, ancillary support functions (back-of-house uses, baggage handling, etc.), transit-serving retail, office/commercial uses, and open spaces and terraces. The new passenger concourse would create an opportunity for an outdoor, community-oriented space and enhance Americans with Disabilities Act accessibility at LAUS. The elevated portion of the above-grade passenger concourse would be located above the rail yard, approximately 90 feet above the existing grade with new plazas east and west of the elevated rail yard (East and West Plazas). The new expanded passageway would be located below the rail yard to provide additional passenger travel-path convenience and options. Amtrak ticketing and baggage check-in services would occur at two locations at the east and west ends of LAUS, and new carousels would be constructed within the new expanded passageway. The above-grade passenger concourse includes a canopy over the West Plaza up to 70 feet in height, with individual canopies that would extend up to 25 feet over each platform. New vertical circulation elements would also be constructed throughout the concourse to enhance passenger movements

throughout LAUS while meeting Americans with Disabilities Act and National Fire Protection Association platform egress code requirements.

- **Run-Through Tracks** – The proposed project includes up to 10 new run-through tracks (including a new loop track) south of LAUS in Segment 3 of the project study area (run-through segment). The run-through tracks would facilitate connections for regional/intercity rail trains and HSR trains from LAUS to the main line tracks on the west bank of the Los Angeles River. A “common” viaduct/deck over US-101 and embankment south of US-101, from Vignes Street to Center Street, would be constructed wide enough to support regional/intercity rail run-through service, and future run-through service for the planned HSR system.

The proposed project would also require modifications to US-101 and local streets (including potential street closures and geometric modifications); railroad signal, positive train control, and communications-related improvements; modifications to the Gold Line light rail platform and tracks; modifications to the main line tracks on the west bank of the Los Angeles River; modifications to Keller Yard and BNSF West Bank Yard (First Street Yard); modifications to the Amtrak lead track; new access roadways to the railroad ROW; additional ROW; new utilities; utility relocations, replacements, and abandonments; and new drainage facilities/water quality improvements.

1.3 Build Alternative Overview

The primary differences between the proposed project and the build alternative are related to the lead tracks north of LAUS and the new passenger concourse. Compared to the proposed project, the build alternative includes the following:

- **Dedicated Lead Tracks North of LAUS** – The build alternative includes reconstruction of the throat, with two new lead tracks that would be located outside of the existing railroad ROW, facilitating a dedicated track alignment, with a total of seven lead tracks. Reconfiguration of Bolero Lane and Leroy Street would also be required.
- **At-Grade Passenger Concourse** – The build alternative includes an at-grade passenger concourse below the rail yard.

All other infrastructure elements are similar to the proposed project. The components of the build alternative are described north to south below.

- **Throat and Elevated Rail Yard** – The build alternative accommodates future HSR trains on dedicated lead tracks in the throat segment. The build alternative includes the addition of two new lead tracks for a total of seven lead tracks in the throat segment (with future HSR trains and some express/intercity services using the two western dedicated lead tracks and most regional/intercity trains using the five eastern lead tracks). The rail yard would be elevated approximately 15 feet. New passenger platforms with a grand canopy covering the elevated rail yard would be constructed, with an underlying assumption that the platform infrastructure and associated vertical circulation elements (stairs, escalators, and elevators) would be modified at a later date to accommodate the

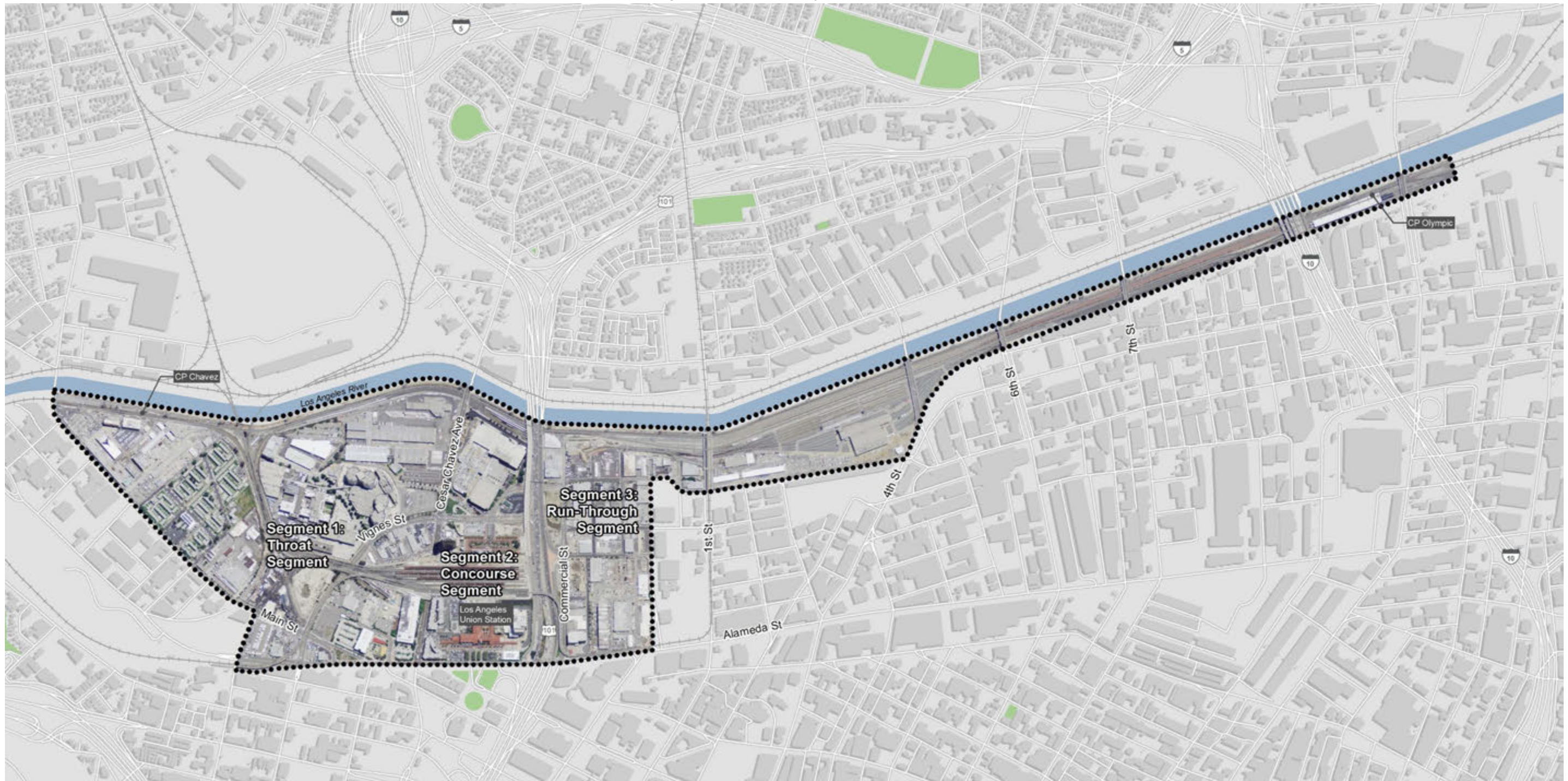
planned HSR system. The existing railroad bridges in the throat segment at Vignes Street and Cesar Chavez Avenue would also be reconstructed under the build alternative. North of Control Point Chavez, the build alternative also includes safety improvements at the Main Street public at-grade crossing on the west bank of the Los Angeles River (medians, restriping, signals, and pedestrian and vehicular gate systems) to facilitate future implementation of a quiet zone by the City of Los Angeles.

- **At-Grade Passenger Concourse** – The build alternative includes a new at-grade passenger concourse that would include space dedicated for passenger circulation, waiting areas, ancillary support functions (back-of-house uses, baggage handling, etc.), transit-serving retail, office/commercial uses, and open spaces and terraces. The at-grade passenger concourse would also create an opportunity for an outdoor, community-oriented space and enhanced Americans with Disabilities Act accessibility. The at-grade passenger concourse would be constructed below the elevated rail yard. Amtrak ticketing and baggage check-in services would occur at a centralized location where new carousels would be constructed at the concourse level. The at-grade passenger concourse also includes new plazas east and west of the elevated rail yard (East and West Plazas), and a grand canopy that would extend up to 70 feet above the elevated rail yard and West Plaza. New vertical circulation elements would also be constructed throughout the concourse to enhance passenger movements throughout LAUS while meeting Americans with Disabilities Act and National Fire Protection Association platform egress code requirements.
- **Run-Through Tracks** – The build alternative includes up to 10 new run-through tracks (including a new loop track) in the run-through segment. All infrastructure south of LAUS is the same as described above for the proposed project.

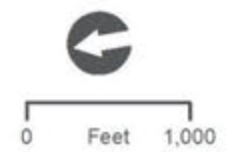
The build alternative would also require modifications to US-101 and local streets (including potential street closures and geometric modifications); railroad signal, positive train control, and communications-related improvements; modifications to the Gold Line light rail platform and tracks; modifications to the main line tracks on the west bank of the Los Angeles River; modifications to Keller Yard and BNSF West Bank Yard (First Street Yard); modifications to the Amtrak lead track; new access roadways to the railroad ROW; additional ROW; new utilities; utility relocations, replacements, and abandonments; and new drainage facilities/water quality improvements.

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Figure 1-2. Link US – Project Study Area



LEGEND
Project Study Area



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1.4 Purpose

This Preliminary LID Report was prepared to:

- Identify stormwater POC in the project study area (non-Caltrans ROW) that address the post-construction phase
- Conduct preliminary stormwater quality calculations
- Identify a preferred conceptual BMP approach for the post-construction phase
- Provide recommendations for further consideration in the final engineering phase

1.5 Approach

The following approach was taken during preparation of this Preliminary LID Report:

- **Baseline Assumptions** – Establish baseline assumptions and criteria to be used for this analysis.
- **Agency Requirements** – Provide an overview of agency standards, guidelines, and methodology to be used in this document.
- **POC** – Identify POC from the stormwater runoff tributary to the project site within the project study area that may contribute to the stormwater conveyance system.
- **Stormwater Quantity Calculations** – Describe drainage characteristics and conduct stormwater quality calculations.
- **BMP Selections** – Provide discussion of potential stormwater BMPs that could be implemented.
- **Recommendations for Future Explorations** – Provide recommendations for next steps.

1.6 Baseline Assumptions

The analysis included in this report was based on the following assumptions:

- This report was prepared to be consistent with City of Los Angeles LID Ordinance.
- This report includes an analysis of existing and proposed drainage systems and stormwater management, utilizing the area encompassing the maximum extent of physical disturbance associated with the proposed project (project footprint). Although this report reflects the quantities and exhibits associated with the proposed project, project-related drainage outside of Caltrans ROW would be managed similarly for the build alternative because the respective tributary drainage subwatersheds and storm drain systems would be affected similarly. This drainage nexus extends to the similarity of the stormwater quality approach.
- The elevated rail yard would be supported on cellular concrete fill. Tracks on cellular concrete are assumed to be 100 percent impervious. For a conservative approach in this preliminary plan, all

track and platform surfaces and the concourse building footprint (either proposed project or the build alternative) are considered to be impervious.

- Throat tracks are supported on cellular concrete fill up to the proposed tie-in location to existing tracks. Tracks at-grade are assumed to be 15 percent impervious, according to Appendix D (Proportion Impervious Data) of the *Los Angeles County Hydrology Manual*.
- The area south of US-101 includes street improvements on the newly realigned Commercial Street, Center Street, and adjacent properties. These areas are assumed to be 91 percent impervious.
- As part of the existing condition, LAUS is identified as railroads with open storage to account for the platforms and canopies. Railroads with open storage utilize a percent impervious value of 66 percent.
- A few pockets of lots adjacent to the proposed run-through track structures south of US-101 would be re-graded and are assumed to be “vacant undifferentiated” type, utilizing a percent impervious value of 1 percent.

Appendix A depicts the existing and proposed impervious surface where project-related impacts would occur. The impervious surfaces are also broken down by ROW under different jurisdictions. The estimate of total impervious surfaces for the existing and proposed project conditions for areas within the project footprint is shown in Table 1-1.

The total area within project study area is 110.90 acres.

Table 1-1. Summary of Impervious Surfaces			
Condition	Area (acres)	Impervious Surface (%)	Impervious Surface (acres)
Existing	61.12	91	55.62
	14.42	66	9.52
	35.35	15	5.30
Existing Total	110.90	64	70.44
Proposed	35.61	100	35.61
	35.30	91	32.12
	32.96	15	4.94
	7.02	1	0.07
Proposed Total	110.90	66	72.74

Source: HDR 2018

2.0 Agency Requirements and Methodology

This section provides an overview of associated agency standards and guidelines that would shape the scope of the stormwater quality design, and the methodology to be used in this analysis.

2.1 Agency Standards and Guidelines

The following agency standards and guidelines were used to prepare this Preliminary LID Report:

- County of Los Angeles Hydrology Manual, 2006 (County of Los Angeles 2006)
- Planning and Land Development Handbook for Low Impact Development, Part B Planning Activities, Watershed Protection Division (City of Los Angeles 2016)
- *Development Best Management Practices Handbook*, Part A Construction Activities, Watershed Protection Division (City of Los Angeles 2004)
- Low Impact Development Standards Manual (County of Los Angeles 2014)
- Leadership in Energy and Environmental Design (United States Green Building Council 2013)
- California Green Building Standards Code (California Building Standards Commission 2013)
- Technical Manual for Stormwater BMP in the County of Los Angeles (County of Los Angeles 2004)

2.2 Methodology

2.2.1 Regulatory Setting

There are several related entities whose jurisdictions intersect with the project. Refer to the *Link US Water Quality Assessment Report* (HDR 2018) for additional information.

Construction General Permit (Order No. 2009-009-DWQ), adopted on September 2, 2009, became effective on July 1, 2010. This permit has since been amended twice by Orders No. 2010-0004-DWQ and 2012-0006-DWQ. The permit regulates stormwater discharges from construction sites that result in a Disturbed Soil Area of 1 acre or greater, and/or are smaller sites that are part of a larger common plan of development. The permit also includes post-construction stormwater standards that apply to jurisdictions not subject to a Phase I or II MS4 jurisdiction.

The City of Los Angeles is a permittee under the Phase I NPDES Permit and Waste Discharge Requirements for MS4 Discharges within the Coastal Watersheds of Los Angeles County, except those discharges originating from the City of Long Beach MS4, Order No. R4-2012-0175 (NPDES No. CAS004001). The NPDES permit prohibits discharges, sets limits on pollutants being discharged into receiving waters, and requires implementation of technology-based standards. These requirements are outlined in the LID Manual, Part B Planning Activities, Watershed Protection Division (City of Los Angeles 2016).

The portion of the project within Caltrans ROW is to be subject to NPDES Statewide Stormwater Permit Waste Discharge Requirements for Caltrans adopted on September 19, 2012 (as amended). This is a Phase I permit that applies statewide.

On February 5, 2013, the State Water Resources Control Board renewed the Phase II General Permit for the Discharge of Stormwater from Small MS4s General Permit (Order No. 2013-0001-DWQ) to provide permit coverage for smaller municipalities (population less than 100,000), including non-traditional Small MS4s, which are facilities such as military bases, public campuses, prisons, and hospital complexes. It became effective on July 1, 2013. The Phase II Small MS4 General Permit covers Phase II permittees statewide. Metro is not a Phase II permittee.

The California High-Speed Rail Authority was designated on August 22, 2014 as a Phase II entity subject to the Small MS4 General Permit. South of LAUS, for the proposed project and the build alternative, the planned HSR system would be on dedicated tracks with dedicated facilities, and this portion of the project would be under the jurisdiction of the Phase II permit.

The City of Los Angeles LID Ordinance (consistent with Los Angeles County NPDES MS4 Permit, Order No. R4-2012-0175) is assumed to be more stringent than the Phase II requirements for which California High-Speed Rail Authority is subject to compliance. Due to the project being designed to be consistent with the City of Los Angeles LID Ordinance (non-Caltrans ROW), California High-Speed Rail Authority Phase II requirements would be met or exceeded.

2.2.2 Low Impact Development Compliance

For development that results in an alteration of at least 50 percent or more of the impervious surface of an existing developed site, the entire site would be consistent with the City of Los Angeles LID Ordinance. The project would include 66 percent of impervious area, per Table 1-1, based on the assumptions identified in Section 1.6, and it falls under the “All Other Developments” category. The project would be designed to be consistent with the requirements of the LID Manual.

2.2.3 Hydromodification

Projects that drain into the natural drainage systems in a small part of the Upper Los Angeles River Area would apply hydromodification control. Per Appendix J of the LID Manual, which shows the extents of the Upper Los Angeles River Area, the project study area is not located in the Upper Los Angeles River Area. Furthermore, the Los Angeles River adjacent to the project study area is entirely concrete lined. Hydromodification control is not required for the project.

2.2.4 Prioritization of Best Management Practice Selection

According to the LID Manual, the following is the priority order for implementing BMPs:

1. Infiltration Systems
2. Stormwater Capture and Use
3. High Efficiency Biofiltration/Bioretenion Systems
4. Combination of Any of the Above

Infiltration Feasibility Screening

Infiltration systems are the first priority type of BMP improvements, as they provide for percolation and infiltration of the stormwater into the ground, which not only reduces the volume of stormwater runoff entering the MS4, in some cases they can also contribute to groundwater recharge. If stormwater infiltration is not possible based on the project site conditions, the developer will utilize the next priority BMP.

According to the *Link US Phase I Environmental Site Assessment* (HDR 2016a), there are active oil and gas reserves located through the City of Los Angeles. Adjacent to the project is the Union Station Oil Field. Naturally occurring oil seeps have also been documented throughout the project study area. Surface oil stains were also noted within the railroad tracks on the ballast material. Groundwater samples taken from the United States Postal Service Terminal Annex property, located adjacent to Segment 1: Throat Segment, detected total petroleum hydrocarbons, volatile organic compounds, and chlorinated solvents, which are contaminants of concern. Based on these considerations, the majority of the soil in the project study area is contaminated and not suitable for proposed infiltration. Therefore, unlined landscaping improvements, including irrigation, are not feasible.

The area where existing tracks are currently at-grade would still be able to support infiltration.

Capture and Use Feasibility Screening

Capture and use, commonly referred to as rainwater harvesting, collects and stores stormwater for later use, thereby offsetting potable water demand and reducing pollutant loading to the storm drain system. Sufficient landscaped area with appropriate water demand, to which the captured runoff can be directed, is needed. Partial capture and use can also be achieved as part of a treatment train by directing the overflow to a bioretention system. This can provide additional volume-reduction and water quality treatment in instances where the quantity of runoff from a storm event exceeds the volume of the collection tank.

In the City of Los Angeles, the use of collected stormwater is primarily limited to landscape irrigation. Landscape soil must contain suitable fill material. Excavation and replacement of contaminated or otherwise inadequate soil may be required. Use of landscaped areas for the collection of stormwater is subject to review and approval via the City of Los Angeles Land Development Plan Check procedure.

It is anticipated that the proposed capture and use system would supply water for landscape irrigation only. Water for toilet flushing may be considered as an option for use of stormwater during final design, as there

may be insufficient landscape area to meet capture and use requirements. Other uses for treated stormwater, such as toilet flushing or cooling tower makeup, would require further study and compliance with city, regional, and/or state codes. This would be investigated further during the plan, specification, and estimate phase.

A cistern is proposed as the capture and use BMP system. Please see Section 5.2.1 for a detailed description of cisterns.

Bioretention with Underdrain

Projects that have demonstrated that 100 percent of the water quality design volume cannot be managed on-site through Tier 1 (infiltration) and/or Tier 2 (capture and use) may utilize Biofiltration/Bioretention for the remaining volume. Biofiltration/Bioretention BMPs would need to capture 1.5 times the design volume not managed through capture and use. Bioretention facilities are landscaped shallow depressions that capture and filter stormwater runoff. As stormwater passes down through the planting soil, pollutants are filtered, adsorbed, and bio-degraded by the soil and plants.

As stated above, the project site is contaminated; therefore, it does not pass the infiltration screening. An impermeable liner would be needed to prevent incidental infiltration.

2.2.5 Other Stormwater Management Measures

Natural Areas

There are no natural areas within the project footprint for the proposed project or the build alternative.

Slopes and Channels

The Los Angeles River runs directly east of the project study area. The portion of the Los Angeles River adjacent to the project study area is entirely concrete lined. No modifications to the Los Angeles River Channel would be required.

Slopes would be vegetated within the project footprint for the proposed project or the build alternative.

Storm Drain Stenciling and Signage

Storm drain stencils would be provided at all new or affected drain inlets and catch basins within the project footprint for the proposed project or the build alternative.

3.0 Pollutants of Concern

The project is located within the Los Angeles River Watershed (Figure 3-1).

Table 3-1 shows the pollutant assessments for Los Angeles River Watershed (Los Angeles River Reach 2) as determined by the 2014/2016 Section 303(d) impaired waters list.

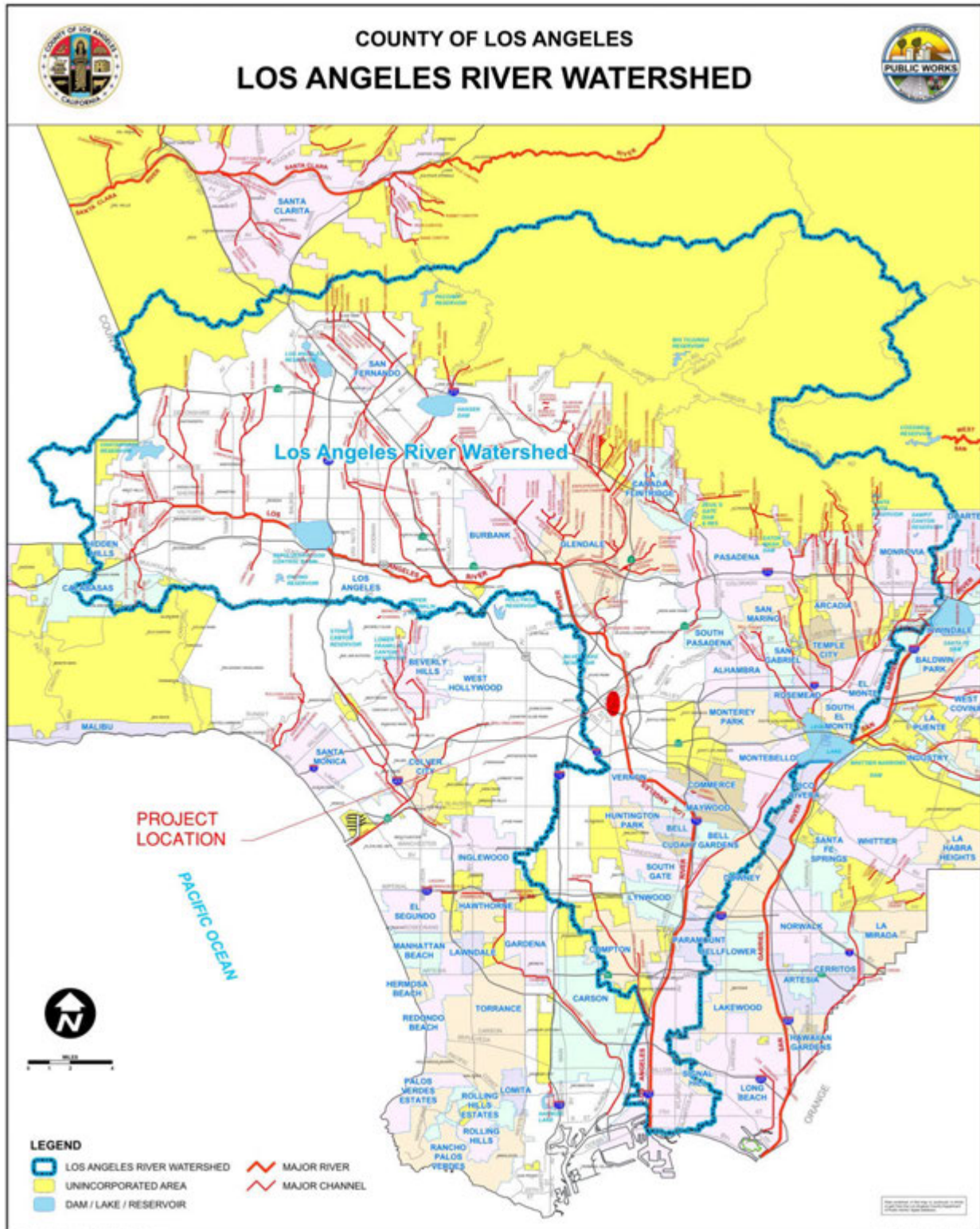
The POC for Los Angeles River Reach 2, which is adjacent to the project, are:

- Ammonia
- Copper
- Indicator bacteria
- Nutrients (algae)
- Oil
- Trash

These POCs will be the same for US-101 after Caltrans updates the Water Quality Planning Tool. The land uses include a mixture of developed educational, extraction, industrial, retail, and commercial properties. Other sources referenced for identifying POC are the California Stormwater Quality Association Stormwater BMP Handbook for New Development and Redevelopment (California Stormwater Quality Association 2009), and the Clean Water Act Section 303(d) List (California Environmental Protection Agency 2016).

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Figure 3-1. Los Angeles River Watershed Map



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Table 3-1. Pollutant Assessment for Los Angeles River Watershed: Los Angeles River Reach 2 (Carson to Figueroa Street)

Pollutants	Listing Decision	Detailed Report	Potential Sources	Schedule
Ammonia	List on Section 303(d) list (being addressed by U.S. EPA approved TMDL)	18253	—	U.S. EPA TMDL approval: 2004
Indicator Bacteria	List on Section 303(d) list (being addressed by U.S. EPA approved TMDL)	20674	—	Est. TMDL completion: 2012
Copper	List on Section 303(d) list (being addressed by U.S. EPA approved TMDL)	19818	—	U.S. EPA TMDL approval: 2005
Nutrients (Algae)	List on Section 303(d) list (being addressed by U.S. EPA approved TMDL)	18196	—	U.S. EPA TMDL approval: 2004
Oil	List on Section 303(d) list (TMDL required list)	20676	—	TMDL required list
Trash	List on Section 303(d) list (being addressed by U.S. EPA approved TMDL)	18022	—	U.S. EPA TMDL approval: 2008

Source: California Environmental Protection Agency 2016

Notes:

TMDL=total maximum daily load; U.S. EPA=United States Environmental Protection Agency,

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4.0 Stormwater Quantity Results

4.1 Hydrology

LID calculations for the water quality volume and flow are based on the City of Los Angeles LID Manual (City of Los Angeles 2016), and County of Los Angeles Department of Public Works, LID, *Standards Manual* (County of Los Angeles 2014).

Current water quality requirements are based on treating a specific volume of stormwater runoff from the project site (Stormwater Quality Design Volume). By treating the Stormwater Quality Design Volume, it is expected that pollutant loads, which are typically higher during the beginning of storm events, would be reduced in the discharge or prevented from reaching the receiving waters. The design storm, from which the Stormwater Quality Design Volume is calculated, is defined as the greater of: the 0.75-inch, 24-hour rain event; or the 85th percentile, 24-hour rain event as determined from the Los Angeles County 85th percentile precipitation isohyet map

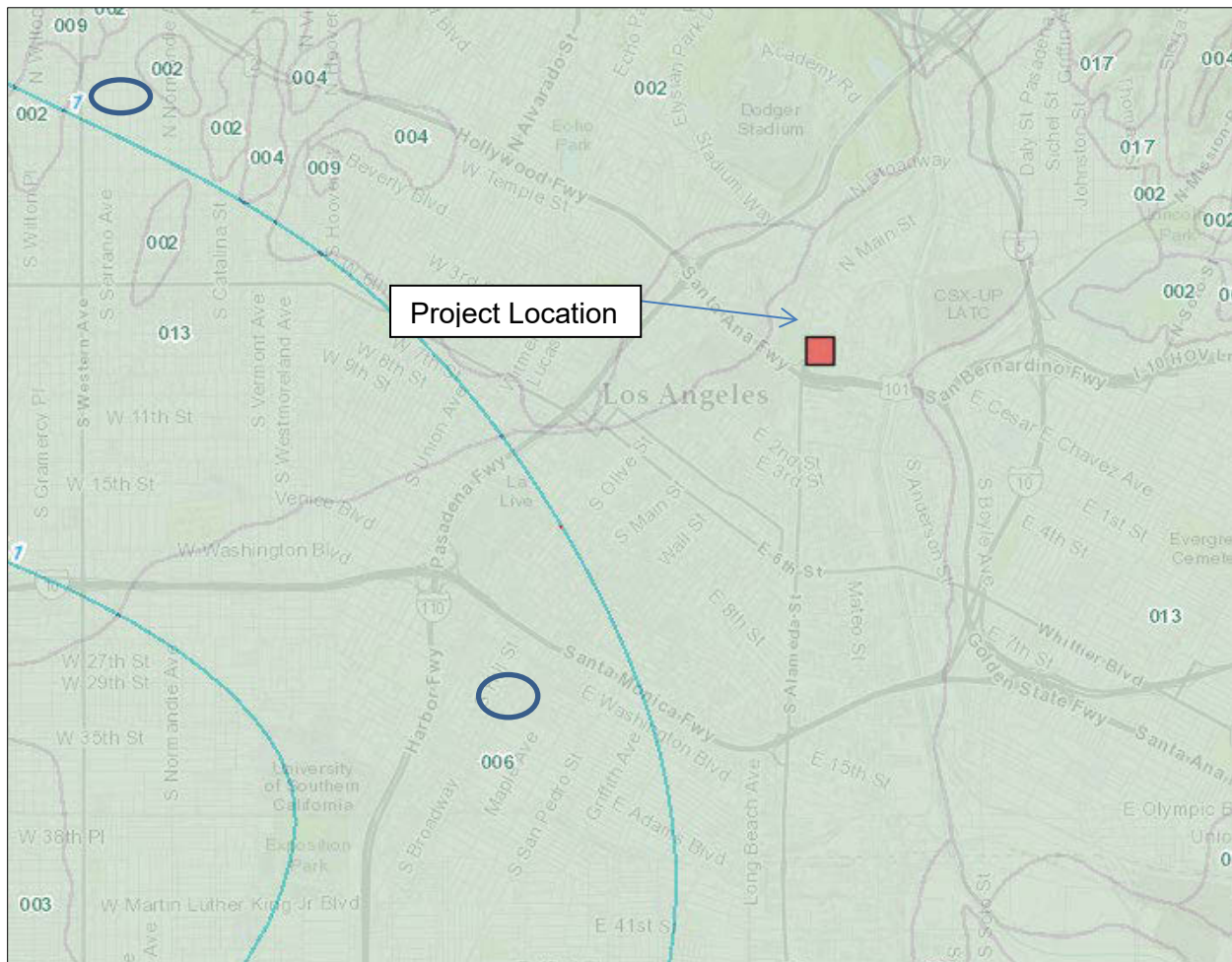
According to the Los Angeles County 85th percentile precipitation isohyet map (County of Los Angeles n.d.), the 85th percentile 24-hour rainfall equals 1.0 inch and soil type 006 (Figure 4-1).

The HydroCalc program was used to calculate the Stormwater Quality Design Volume.

Table 4-1 in Section 4.3 details the mitigated volume for each area and Appendix B details supporting calculations.

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Figure 4-1. Hydrology Map Showing 85th Percentile, 24-hour Rainfall, and Soil Type



Source: County of Los Angeles 2006

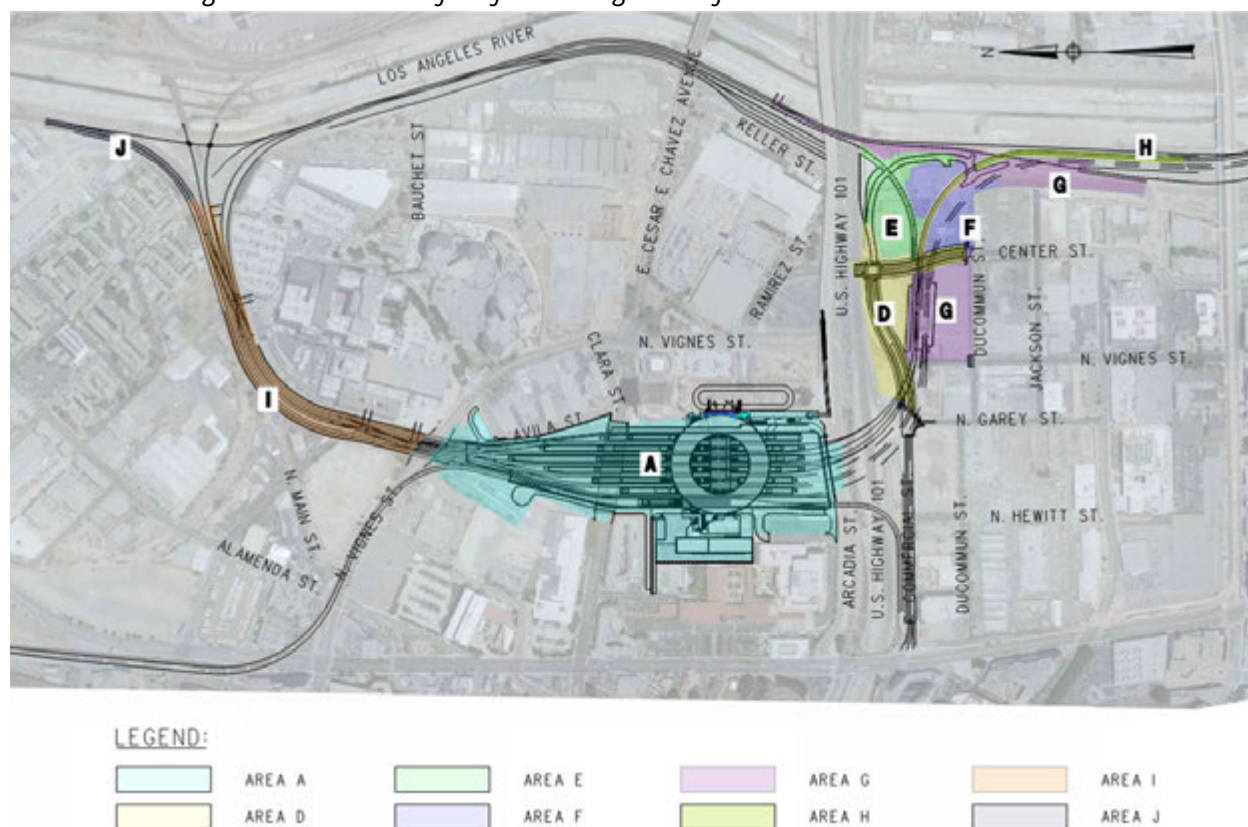
4.2 Post-Construction Drainage

For detailed existing drainage information, please see the *Expanded Preliminary Drainage Technical Memorandum* (HDR 2016b).

The site has eight major drainage areas, which are identified as Areas A, D, E, F, G, H, I, and J for LID evaluation and shown on Figure 4-2 as an overview. Drainage subareas for each major drainage area are detailed in Appendix C, Preliminary LID exhibit.

For the BMPs proposed for each area/subareas, see Section 5.0 for details.

Figure 4-2. Overview of Major Drainage Areas for Post-Construction Conditions



4.2.1 Tributary Area A

To maintain the existing drainage pattern, and implement a stormwater treatment system, Tributary Area A was divided into eight sub-areas in order to analyze the capture and conveyance of stormwater to the appropriate location for treatment.

Specific descriptions of each sub-area are provided below. The study area has two points of connection to the existing municipal storm drain system:

1. 108-inch reinforced concrete pipe (RCP) in Cesar Chavez Avenue just to the east of the Cesar Chavez Bridge
2. 138-inch reinforced concrete arch in the US-101.

Both existing systems ultimately discharge to the Los Angeles River.

Runoff from the rail yard area would drain into a ballasted track bed supported by a cellular concrete slab on-grade. The cellular concrete slab on-grade would slope away from the tracks and direct runoff into the underdrains (8-inch-diameter perforated corrugated metal pipes) running adjacent and parallel to the tracks. These underdrains would be connected to a cross-drain line (36-inch RCP) that would then connect to a Stormwater Capture System (cistern). Details on the cistern are in Section 5.1. The Stormwater Capture

System will treat stormwater for use and detain and attenuate overflow before conveyance to one of the two existing municipal storm drain systems previously mentioned. All stormwater that is not utilized on-site will be discharged to the municipal storm drain system.

Runoff from the rail yard north of the passenger tunnel (Sub-Areas A1, A2, and A4) is tributary to the Garden Track Cistern (Appendix C details the location) and discharge to the municipal storm drain in Cesar Chavez Avenue. The rail yard south of the passenger tunnel, the west plaza, the baggage handling building, and adjacent parking areas (Sub-Areas A3, A5, A6, and A8) are tributary to the West Plaza Cistern (Appendix C details the location) and discharge to the municipal storm drain in US-101.

The proposed project with an above-grade passenger concourse was chosen for this analysis although the impact would be the same as the build alternative, with an at-grade passenger concourse, as both options are assumed to be 100 percent impervious surface.

- **Sub-Area A1** – Sub-Area A1 primarily encompasses the throat portion of the rail yard and the portion of the rail yard known as the garden track area, both located north of Cesar Chavez Avenue. Precipitation that falls in these two areas is collected and conveyed to the proposed Garden Track Cistern for treatment, located north of Cesar Chavez Avenue in the Garden Track area. Treated runoff and overflow is conveyed to the existing municipal storm drain system in Avila Street, which eventually outlets to the 108-inch City of Los Angeles storm drain pipe in Cesar Chavez Avenue.
- **Sub-Area A2** - Sub-Area A2 encompasses the portion of the main rail yard between Cesar Chavez Avenue and the existing passenger tunnel that connects to the East Portal building. Precipitation that falls in this area of the rail yard is collected and conveyed to the proposed Garden Track Cistern for treatment and detention. Treated runoff and overflow is conveyed from the cistern to the existing municipal storm drain system in Avila Street which connects to the 108-inch City of Los Angeles storm drain pipe in Cesar Chavez Ave, and ultimately discharges to the Los Angeles River.
- **Sub-Area A3** – Sub-Area A3 encompasses the portion of the rail yard between the existing passenger tunnel and the access road along the southern end of the platforms. Precipitation that falls in this area is collected and conveyed to the proposed West Plaza Cistern for treatment and detention. Treated runoff and overflow is conveyed to the existing 138-inch arch pipe in the US-101, which ultimately discharges to the Los Angeles River.
- **Sub-Area A4** – Sub-Area A4 is primarily made up of the slope to the east of the garden track and west of the postal annex building. The area slopes to the west, away from the Union Station property. Runoff from this area will be collected and conveyed to the proposed Garden Track Cistern for treatment and detention. As the design progresses, the method of conveyance to the cistern will need to be further assessed. Overflow and treated runoff will be conveyed to the existing storm drain system in Avila Street which connects to the 108-inch City of Los Angeles storm drain pipe in Cesar Chavez Ave, and ultimately discharges to the Los Angeles River.
- **Sub-Area A5** – Sub-Area A5 encompasses the west plaza, the baggage handling building, adjacent parking, and the proposed loading dock. Precipitation that falls into this area is collected and

conveyed to the proposed West Plaza Cistern for treatment and detention. Overflow and treated runoff is conveyed to the existing 138-inch arch pipe in the US-101, which ultimately discharges to the Los Angeles River.

- **Sub-Area A6** – Sub-Area A6 encompasses the slope to the south of the west plaza between the Metropolitan Water District of Southern California building and the access road. Precipitation that falls in this area is collected and conveyed to the proposed West Plaza Cistern for treatment and detention. Overflow and treated runoff is conveyed to the existing 138-inch arch pipe in the US-101, which ultimately discharges to the Los Angeles River.
- **Sub-Area A7** – Sub-Area A7 primarily includes the walkway along the west side of Patsaouras Transit Plaza. This area is not tributary to the rail yard, but rather is part of the Patsaouras Transit Plaza drainage system. This area is included in the analysis as the area is affected by the proposed improvements. As a result of the proposed improvements, the area of Sub-Area A7 is reduced from 1.1 acres in the preconstruction condition down to 0.7 acre in the post-construction condition. The difference of 0.4 acre, which is tributary to Patsaouras Transit Plaza in the preconstruction condition, becomes tributary to the rail yard in the post-construction condition. This reduction in area reduces the total runoff flow and directs it to the treatment system at the West Plaza Cistern, effectively improving the drainage condition in the Patsaouras Transit Plaza drainage system.
- **Sub-Area A8** – Sub-Area A8 encompasses a small portion of the viaduct crossing over the US-101 and is included to account for the small volume of runoff that is not captured in the catch basins on the viaduct.

If the build alternative with an at-grade passenger concourse were implemented, the hydrology analysis will require minimal or no change in Area A, as the entire concourse study area was assumed to be fully impervious. The cistern concept would remain the same. The drainage pattern mimics the existing condition drainage pattern, and therefore, would also not change as a result of the concourse option.

4.2.2 Tributary Area D

Area D encompasses the area along Center Street, between Ducommun Street and under US-101, and proposed Commercial Street (realigned), west of Center Street and slopes at south. For the proposed project or the build alternative, deck drainage from the overhead viaduct would be tied into existing drainage systems. The existing 18-inch vitrified clay storm drain pipe (built in 1909) running along Commercial Street is connected to a 24-inch/36-inch storm drain pipe running along Center Street. This pipe connects to a 138-inch arch pipe system located within the freeway ROW that runs easterly across the El Monte Busway and US-101, southerly along Vignes Street, then easterly along Ducommun Street, and ultimately discharges to the Los Angeles River. The proposed project or the build alternative includes realignment of Commercial Street, resulting in removal and realignment of a portion of the existing 18-inch vitrified clay storm drain.

- **Sub-Area D1** – Sub-Area D1 primarily encompasses the proposed realigned Commercial Street, west of red line tunnel. Due to constraints on running a storm drain pipe across the red line tunnel,

the runoff from this area would be routed to the 138-inch arch pipe earlier at Vignes Street, while for the existing condition, the run off from existing Commercial Street drains to the storm drain pipe running along Center Street, which eventually drains to the 138-inch arch pipe.

- **Sub-Area D2** – Sub-Area D2 primarily encompasses the slopes south of proposed Commercial Street and north of the proposed run-through regional tracks. The runoff from the slope will drain to a proposed v-ditch, which drains to an inlet connecting to the storm drain pipe on Center Street. The slopes would be impervious with landscaping.
- **Sub-Area D3** – Sub-Area D3 primarily encompasses Center Street and proposed Commercial Street east of Red Line Tunnel, and a portion of the proposed Division 20 access road east of Center Street. The runoff from streets will drain to catch basins and inlets on the street, which connect to the storm drain pipe on Center Street.

4.2.3 Tributary Area E

Area E primarily encompasses the area between Aliso Street to the north, Center Street to the West, Ducommun Street to the South, and the Los Angeles River to the east, and includes the loop track and proposed Metro Division 20 access road. A portion of the existing 22-inch vitrified clay storm drain system (in the area where the existing Commercial Street is located), which drains to the Los Angeles River, would be preserved. Track drainage from the loop track would be collected from a track underdrain, which drains to the 22-inch drain system. Runoff within this area would be collected via catch basins draining to the 22-inch storm drain system and ultimately to the Los Angeles River.

- **Sub-Area E1** – Sub-Area E1 primarily encompasses the graded, pervious area north of proposed loop track and south of Metro’s Division 20 access road. The runoff from this area drains to the low point where an inlet is proposed and connected to the existing 22-inch pipe on existing Commercial Street.
- **Sub-Area E2** – Sub-Area E2 primarily encompasses the drainage area of loop track and Metro’s Division 20 access road. The runoff from this area flows to a trench drain located at the low point of access road and track underdrains, and eventually drains to the existing 22-inch pipe at the location close to the Los Angeles River.

4.2.4 Tributary Area F

Area F encompasses the area of Division 20 Red Line Portal Trench and parking lot, and Metro-owned property. Runoff within this area drains to the existing 138-inch arch pipe system, which discharges to the Los Angeles River.

- **Sub-Area F1** – Sub-Area F1 primarily encompasses the Division 20 Red Line Portal Trench and proposed parking.
- **Sub-Area F2** – Sub-Area F2 primarily encompasses the Metro-owned property where hazardous soils are stored. The drainage pattern for this area will remain the same.

4.2.5 Tributary Area G

Area G is primarily composed of the drainage tributary area to the 42-inch RCP system along Ducommun Street. It primarily encompasses the run-through tracks on the embankment structure between Vignes Street and Center Street, the Southern California Regional Rail Authority maintenance access road next to the tracks, and slopes at south, and includes the BNSF Yard and the main line tracks on the west bank of the Los Angeles River.

- **Sub-Area G1** – Sub-Area G1 primarily encompasses the run-through tracks on the embankment structure and Southern California Regional Rail Authority maintenance access road. Runoff would drain to the dirt trapezoidal ditch and would be collected into inlets which drain to a 42-inch RCP system along Ducommun Street and ultimately discharge to the Los Angeles River.
- **Sub-Area G2** – Sub-Area F2 primarily encompasses the slopes at south of the run-through tracks and future HSR tracks. The runoff from the slope would drain to a proposed v-ditch, which drains to an inlet ultimately connecting to the 42-inch pipe along Ducommun Street. The slopes would be impervious with landscaping.
- **Sub-Area G3** – Sub-Area G3 primarily encompasses Ducommun Street between Vignes Street and Center Street. The Drainage pattern will remain the same as the existing condition.
- **Sub-Area G4** – Sub-Area G4 primarily encompasses Southern California Regional Rail Authority track, BNSF tracks, and Amtrak track by the Los Angeles River. The runoff will drain to track underdrains connecting to the 42-inch RCP.

4.2.6 Tributary Area H

Area H encompasses the run-through tracks that are located south of Ducommun Street and become parallel to the west bank of the Los Angeles River. Track underdrains collecting track runoff drain to an existing inlet located at the concrete ditch by the west bank of Los Angeles River.

4.2.7 Tributary Area I

Proposed throat tracks and rail access roads north of Vignes Street are located within this area. The majority of the southern portion of the track bed would be supported by a cellular concrete slab on-grade that is sloped away from the tracks and designed to direct runoff into perforated underdrains located adjacent to the tracks. The proposed storm drain line along the rail access roads would collect the runoff from the underdrains and drain south, to the 66-inch RCP at Vignes Street.

4.2.8 Tributary Area J

Area J encompasses the northernmost tracks for the project, parallel to Bolero Lane, north of Bloom Street. An existing 30-inch RCP collects the runoff from an existing funnel intake and an existing concrete ditch located along Bolero Lane and discharges to the Los Angeles River. Track underdrains collecting track runoff drain to this existing 30-inch RCP.

4.2.9 California Department of Transportation Right-of-Way

Stormwater collected on the common structure/deck over US-101 would be collected through a series of inlets in the center of the structure and then directed, untreated, to the Caltrans on-site drainage system through one of the structure's columns. See the *Conceptual Drainage Study Report* (WKE 2016) and the *Draft Stormwater Data Report* (WKE 2018) for more information. It is assumed that only a very small amount of stormwater north of the Caltrans ROW would be added to this area. The BMP approach for the stormwater within Caltrans ROW would be further investigated during plan, specification, and estimate phase, in cooperation with Caltrans.

4.3 Stormwater Quality Calculations

Table 4-1 is a summary of stormwater quality calculations using the 85th percentile, 24-hour rain event. See Appendix B for HydroCalc calculations.

Table 4-1. Low Impact Development Stormwater Quality Calculations					
Area ID	Sub-Area	Area (acres)	Impervious Surface (%)	Water Quality Flow (cubic feet per second)	Water Quality Runoff Volume (cubic feet)
A	A1	7.38	100	1.66	23,912
	A2	5.49	100	1.36	17,788
	A3	6.66	100	1.71	21,579
	A4	0.58	100	0.16	1,879
	A5	2.62	100	0.67	8,489
	A6	0.70	100	0.20	2,268
	A7	0.70	91	0.14	2,086
	A8	0.39	100	0.13	1,264
	Total	24.52	—	6.02	79,264
D	D1	6.90	94	1.62	21,163
	D2	3.77	91	0.95	11,237
	D3	2.43	91	0.57	7,243
	Total	13.10	—	3.14	39,643
E	E1	1.12	10	0.02	435
	E2	1.79	62	0.30	3,840
	Total	2.91	—	0.32	4,275
F	F1	1.49	47	0.29	2,557
	F2	1.07	91	0.31	3,189
	Total	2.56	—	0.60	5,746
G	G1	0.65	12	0.04	459
	G2	1.95	1	0.06	758
	G3	0.94	91	0.22	2,802

Table 4-1. Low Impact Development Stormwater Quality Calculations					
Area ID	Sub-Area	Area (acres)	Impervious Surface (%)	Water Quality Flow (cubic feet per second)	Water Quality Runoff Volume (cubic feet)
	G4	3.43	15	0.10	2,717
	Total	6.97	—	0.42	6,736
H	H	0.97	15	0.03	768
	Total	0.97	15	0.03	768
I	I	5.01	63	0.63	10,894
	Total	5.01	63	0.63	10,894
J	J	0.86	15	0.03	681
	Total	0.86	15	0.03	681

Source: HDR 2018

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5.0 Best Management Practice Selection

Implementation of unlined infiltration BMPs or Green Street Standards on impacted streets are infeasible because of existing site conditions, as described above. There may be opportunities to implement lined infiltration BMPs or bioretention BMPs as Green Street BMPs at select locations. Further evaluation would be performed in the plan, specification, and estimate phase. See Section 5.1.3 for more information. The proposed BMPs selected for implementation are summarized below:

- For drainage area A, capture and use (cistern) is the preferred BMP. If the amount of collected stormwater cannot be 100 percent used, other bioretention BMP should be considered for the remaining volume. As the project design progresses, water demand analysis for capture and use should be conducted to determine capacity constraints.
- For drainage areas D, E, F, and G, bioretention BMPs with underdrains and impermeable liners (i.e., no infiltration) are proposed.
- Drainage area J is very challenging because of its location, as there is no good location for capture and use or bioretention BMPs given that it is within the railroad ROW. Therefore, capture and use and bioretention BMPs are infeasible. A Contech StormFilter (stormwater vault with filter cartridges) is proposed for this area.

The detail and sizing of selected BMPs are as below.

5.1 Capture and Use (Cistern)

5.1.1 Description

Stormwater from the tributary areas would discharge into a water quality unit for pre-treatment prior to discharging into the cistern for storage. A mechanical skid unit would manage the distribution of the captured stormwater for use (i.e., for irrigation). The mechanical skid, being the "brain" of the system, activates the pump to convey water to the irrigation system when it detects water in the cistern. If water uses inside the proposed passenger concourse are pursued, post-treatment (filter and ultraviolet [UV] system) would be required. In the UV system, UV light sterilizes the pretreated water; this is described further at the end of this section.

Capture volume must be equal to or less than the Estimated Total Water Usage from October 1 to April 30, as prescribed by the landscape architect. According to the LID Manual, the use of treated stormwater is primarily limited to irrigation of landscaped surfaces that have an impermeable lining. Excavation and replacement of new fill material may be required because of the potential for contaminated soils.

As new guidelines and guidance become available, the potential use of graywater for irrigation and/or flushing toilets may be considered. The demands for graywater would be dictated by fixture unit counts, as defined by the plumbing engineer. In order for water to be utilized in fixture units, the water must comply

with California Code of Regulations Title 22 regulations, Section 60301.230 Disinfected Tertiary Recycled Water Code requirements.

For the first year after installation of the cistern, it is recommended that the system be inspected quarterly. After the first year, annual inspections are recommended. Inspections should include checking of the inlet, outlet, and cistern overflow for potential blockages and accumulated sediment.

Pre-Treatment (Baffle Boxes)

Baffle boxes are a possible pre-treatment measure that could also be implemented. Baffle boxes are concrete or fiberglass structures containing a series of sediment settling chambers separated by baffles. The primary function of baffle boxes is to remove sediment, suspended particles, and associated pollutants from stormwater. Baffle boxes may also contain trash screens or skimmers to capture larger materials, trash, and floatables.

Post-Treatment (Ultraviolet System)

The UV system is a possible post-treatment for the project. In the UV system, UV sterilizers expose water to a specific wavelength of UV light that destroys the DNA of organisms present and keeps the water sterile. Sizing of the UV system is critical to maintain sufficient exposure rates to keep the water sterile.

The advantages of UV sterilization is that chemicals are not used to kill pathogens, systems typically require minimal maintenance, and they are often less expensive than chlorination systems. If pursued, the UV system would be used in addition to the pre-treatment system.

5.1.2 Cistern Sizing

The following are preliminary dimensions for each cistern unit. Appendix D shows the Stormwater Process Diagram and illustrates the treatment train for the proposed cisterns. Appendix E contains cistern details from a sample manufacturer.

- Width = 7 feet
- Length = 15 feet
- Depth = 14 feet

The cistern manufacturer is still being determined because the project is at the preliminary stage. A cistern manufacturer analysis would be conducted in the future to assist Metro in selection of a cistern manufacturer. For the time being, the cistern sizes of 12,028 gallons (1,608 cubic feet) provided by OldCastle's StormCapture Tank will be used as a reference. As stated in Section 4.1, the required design volume is 77,179 cubic feet, which is shown in Table 5-1 below; in addition to the number of cistern units required for the concourse area (Exhibit 2 in Appendix A). The manufacturer may need to be National Sanitation Foundation-350 certified for use of treated water inside the building (i.e., flushing toilets).

Table 5-1. Summary of Cistern Sizing (Low Impact Development) for Tributary Area A

Sub-Area	Required Volume (cubic feet)	Receiving Cistern
A1	23,912	Garden Track
A2	17,788	Garden Track
A3	21,579	West Plaza
A4	1,879	Garden Track
A5	8,489	West Plaza
A6	2,268	West Plaza
A8	1,264	West Plaza
Total	77,179	—

Source: HDR 2018

5.1.3 Build Alternative with At-Grade Passenger Concourse

For the build alternative with an at-grade passenger concourse, the cistern concept would remain the same as the proposed project, as will the cistern volumes because both concourse options are assumed to be 100 percent impervious surface. The drainage pattern mimics the existing condition drainage pattern, and would also not change as a result of the concourse option implemented.

5.2 Bioretention

Bioretention with underdrains are proposed in landscaped shallow depressions that capture and filter stormwater runoff. An impermeable liner (i.e., no infiltration) would be included for each bioretention BMP with an underdrain to convey overflow to a nearby existing storm drain system. This BMP is proposed for drainage areas D1, D3, and E2. It has been determined that this BMP is not feasible for other drainage areas. There is also an opportunity to use bioretention BMPs as part of Green Street features along Commercial Street, Center Street, and Ducommun Street. City of Los Angeles Green Street Standard Plans may be used and modified with bioretention features and impermeable liners to convey the underdrains to a nearby storm drain system. This approach would require concurrence from the City of Los Angeles.

5.2.1 Bioretention Sizing

Calculations were based on the LID Manual (see Appendix B for City of Los Angeles LID Sample Design Calculation).

$$A_{min} = \frac{V_{Design}}{\left[\left(\frac{T_{fill} \times K_{Sat,Design}}{12} \right) + d_p \right]}$$

See Table 5-2 for input parameters.

Table 5-2. Bioretention Sizing Parameters				
Parameters	Symbol	Value	Unit	Notes
Mitigated Volume	VM	—	cubic feet	Value per HydroCalc
Measured Infiltration Rate	Ksat, media	5	inch/hour	Assumed 5 inches/hour
Factor of Safety	FS	6	—	FS=2 if soil infiltration test and geotechnical report from professional geotechnical engineer is done; FS=6 if only a boring was done; soil infiltration rate to be determined by geotechnical engineer.
Design Infiltration Rate	Ksat, design	2.5	inch/hour	—
Time to fill	Tfill	3	hours	T=3 hours, unless a hydrologic routing model is used
Maximum Ponding Depth	dp, max	1	feet	18 inches or 12 inches
Design Volume	Vdesign	2.5	inch/hour	—

Source: HDR 2018

See Table 5-3 below for the estimated bioretention footprint to meet LID requirements. Appendix F details sizing calculations. A ponding depth of 12 inches is assumed for this preliminary sizing.

Table 5-3. Summary of Bioretention Sizing		
Area	Footprint (square feet)	Bioretention BMP
D1	1,967	Bioretention with Underdrain
D3	6,360	Bioretention with Underdrain
E2	3,372	Bioretention with Underdrain

Source: HDR 2018

*Notes:
 BMP=best management practice*

5.3 Other Best Management Practices

Drainage Area D2, E1, and G2 are pervious areas with landscaping. No BMP is evaluated for these areas.

Runoff from drainage Area G1 flows to the dirt trapezoidal ditch which could be used as stormwater treatment facilities. More information on stormwater will be provided as the project design progresses.

The majority of drainage Area F1 is associated with Metro’s Division 20 Red Line Portal project. No BMP is evaluated for this area.

No improvements are proposed for drainage area F2; therefore, no BMP is evaluated for this area.

No BMP is evaluated for drainage area J, which is composed of tracks on-grade.

Drainage area I is challenging because of its location. There is no good location for capture and use or biotention BMP given that it is within the railroad corridor. Therefore, capture and use and bioretention BMP are infeasible. It is proposed to use a Contech StormFilter (stormwater vault with filter cartridges) for drainage area J. See Appendix G for more information.

Drainage area H is on cellular concrete fill, and it has the same constraints posed by drainage area J. It is proposed to use a Contech Jellyfish Filter. See Appendix G for more information.

5.4 Summary

The proposed BMP is summarized as below:

- In Segment 1: Throat Segment, a structural stormwater vault would address the area north of Vignes Street; a capture and use BMP (cistern) would address the rest of this segment, including a portion of the concourse area (Segment 2: Concourse Segment). For the build alternative, modification of local city streets (Bolero Lane, Bloom Street, and Leroy Street) would occur, and the drainage pattern will remain the same as the existing condition. Implementation of the City of Los Angeles Green Street Standards would be applied at this location, similar to the BMPs proposed in Segment 3: Run-Through Segment.
- In Segment 2: Concourse Segment, capture and use BMP (cisterns) are proposed. The extent of BMPs in the concourse area will be refined in final design. For the build alternative with an at-grade passenger concourse, the cistern concept will remain the same as the proposed project.
- In Segment 3: Run-Through Segment, south of US-101, bioretention BMPs are proposed for the proposed project and the build alternative. Bioretention BMPs would be applied on reconstructed public streets south of US-101 (i.e., Commercial Street, Center Street, and Ducommun Street). City of Los Angeles Green Street Standard Plans may be used and modified with bioretention features and impermeable liners to convey the underdrains to a nearby storm drain system. This approach would require concurrence from the City of Los Angeles. A structural BMP (Contech Jellyfish Filter) would address the area south of Ducommun Street where the tracks sit on the cellular concrete.

6.0 Recommendations for Future Explorations

The project team has met with the City of Los Angeles Bureau of Engineering to discuss the City's LID requirements and to present the preferred conceptual BMP approach. See the meeting minutes in Appendix H.

This Preliminary LID Report highlights preliminary stormwater quality analysis and BMP options. Tier 1 (infiltration) is not feasible because of site constraints; however, Tier 2 (capture and use) and Tier 3 (bioretention) are viable approaches to meet LID requirements.

The following steps are recommended for further evaluation:

- Conduct water demand analysis for capture and use cisterns. If after further analysis determines 100 percent of the water quality design volume cannot be managed through capture and use, the remaining volume is proposed to be managed through bioretention BMPs.
- Conduct further exploration of other BMP options as the engineering design progresses.
- Update this Preliminary LID Report after selection of post-construction BMP designs and consideration of operations and maintenance costs for each BMP.

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