INITIAL STUDY/MITIGATED NEGATIVE DECLARATION

1. Project Title: Mountain Transit (MT) Facility Relocation Conditional Use Permit (CUP) 2022-74

2. Lead Agency Name and Address:
   City of Big Bear Lake
   PO Box 10000, 39707 Big Bear Blvd., Big Bear Lake, CA 92315

3. Contact Person and Phone Number: Andrew Mellon, 909-866-5831 Ext. 194

4. Project Location: 170 Business Center Dr.; northwest corner of Business Center Dr. and Sandalwood Dr.

5. Project Sponsor's Name and Address:
   Mountain Area Regional Transit Authority
   PO Box 1501, 41939 Fox Farm Rd., Big Bear Lake, CA 92315

6. General Plan Designation: Commercial General 7. Zoning: Commercial – General (C-2)

8. Description of Project:

Mountain Area Regional Transit Authority ("MT") ("Project Applicant") is a public transit agency that primarily serves the rural communities in the San Bernardino Mountains, including the Big Bear Valley, Crestline, Lake Arrowhead, Running Springs; and the City of Big Bear Lake. The current facilities located at 41939 Fox Farm Road in the City of Big Bear Lake, and 621 Forest Shade Road, Crestline, are both under-sized and have a variety of challenges that make service provisions difficult. In addition, MT is experiencing a growth in service and ridership, with expansions in fixed-route and Dial-A-Ride service in Big Bear Valley (BBV) and a ridership increase (not including service expansion) of 1.32% annually. MT proposed the following service expansions in their 2016 Short Range Transit Plan: RIM trolley/summer weekend service expansion, RIM Dial-A-Ride expansion, BBV fixed route expansion, BBV resort expansion, BBV Off-the-Mountain (OTM) expansion, leasing buses for the Big Bear Mountain Resort (BBMR) service during winter months, and BBV Dial-A-Ride expansion.

To accommodate the projected service increase, MT proposes to relocate operations from the current locations to 170 Business Center Drive in the City of Big Bear Lake, San Bernardino County (see Figure 1 – Regional Location). The relocation would require approval of a Conditional Use Permit (CUP) to develop a comprehensive administrative, bus storage, and bus maintenance facility at the proposed Project Site. The 3.55-acre Project Site is located on the northwest corner of Business Center Drive and Sandalwood Drive (see Figure 2 – Local Vicinity) and consists of Assessor's Parcel Numbers (APN) 2328-021-12 and -13.

The Project Site was created as part of Tentative Tract Map (TTM) Application 2007-278, which was approved by the Planning Commission on August 20, 2008 (Resolution PC 2008-24). TTM Application 2007-278 proposed to subdivide an 11.02-acre parcel and develop eight business park lots for General Commercial uses, including rough grading of individual pads and the installation of street and utility infrastructure, including wet and dry utilities and storm drains within the 11.02-acre site. MT's Project Site comprises two of the parcels created by the subdivision. Since the underlying Mitigated Negative Declaration adopted for the subdivision did not include evaluation of specific land uses and potential environmental impacts, this Initial Study/Mitigated Negative Declaration has been prepared to address details associated with the proposed use of the two parcels by MT as well as provide analyses of environmental resources that may be impacted in accordance with current 2022 CEQA Guidelines.

The Project Site is designated in the General Plan as Commercial General and zoned Commercial – General (C-2). Subject to a CUP, the Proposed Project is an allowable use within the C-2 zoning district. The Proposed Project would include an 11,470-square-foot (SF) maintenance building and an 11,200-SF administrative building (see Figure 3 – Site Plan). The maintenance facility would consist of service bays, a bus wash, and other support spaces for drivers and MT's bus fleet. The proposed administration/operations building would house administrative offices and support spaces for staff. See table below for description of the proposed buildings.

Bus Maintenance Facility	Administration Offices
11,470-SF maintenance building and electrical yard	11,200 SF-office
1 story, about 29' in height	1 story, about 23' in height
Includes 4 bus mechanic bays, 1 wash bay, ancillary office, shop storage, employee lockers and break room	Includes offices, restrooms, dispatch, lockers, break room, and board meeting room

The Project Site is currently vacant and partially graded, consisting mostly of bare ground with fill material. It is relatively flat, sloping downward to the northwest at a gradient less than 4 percent. As proposed, the Project Site would be developed with 119,355 SF of hardscape (parking and buildings) and 35,312 SF of landscaping.

MT is working towards the 2018 California Air Resources Board (CARB) mandate that all California bus fleets must be zero emission by 2040. In order to accommodate this transformation, MT would be adding electric charging stations and additional parking as the MT would need an estimated two electric buses to run each route due to battery limitations. Facilities would include electrical infrastructure for bus charging at all bus stalls and electrical infrastructure for future bus canopies and solar panel carports.

The Proposed Project includes two parking lots that would provide a total of 58 parking spaces: 36 for passenger cars, 5 car-accessible spaces, 2 van-accessible spaces, and 30 bus stalls. Access to the Project Site would be provided by one 25-foot-wide driveway and one 30-foot-wide driveway, both along Business Center Drive. A bus stop shelter is proposed near the southeast corner of the Project Site on Business Center Drive.

9. Surrounding Land Uses and Setting: The Project Site is located in a commercial area surrounded by a mix of developed and undeveloped land.

	Existing	General Plan Designation	Zoning
Project Site	Vacant & graded	Commercial General	Commercial – General (C-2)
North	Vacant & undeveloped land	Commercial General	Commercial – General (C-2)
South	Southwest Gas Corporation facility; Self- storage facility	Commercial General	Commercial – General (C-2)

East	Undergoing construction; Vacant & undeveloped land	Commercial General	Commercial – General (C-2)
West	Vacant & undeveloped land; storage yard	Public Facility; Commercial General	Public/Open Space (P-OS); Commercial – General (C-2)

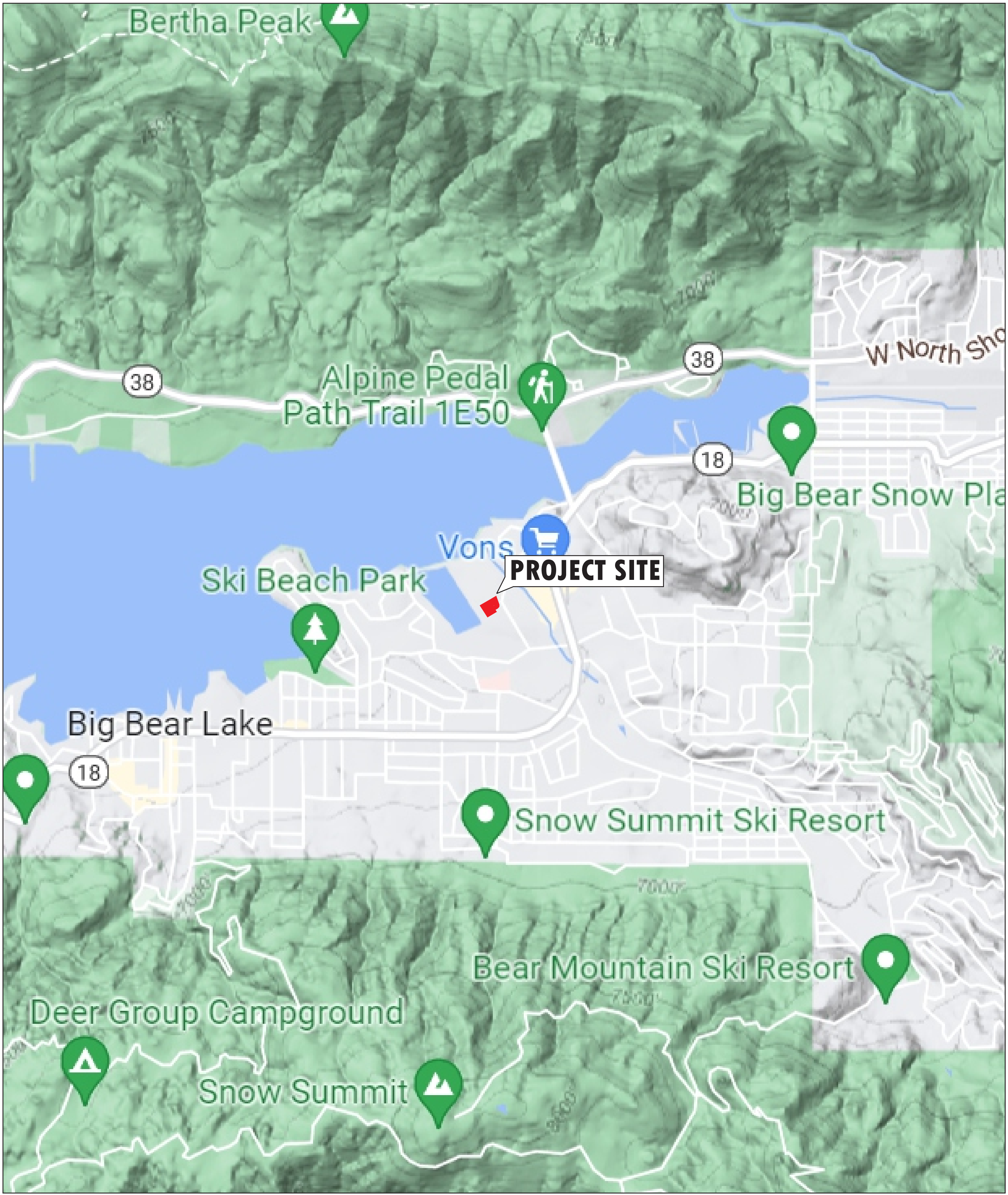
10. Other public agencies whose approval is required (e.g., permits, financing approval, or participation agreement):

    None anticipated

11. Have California Native American tribes traditionally and culturally affiliated with the project area requested consultation pursuant to Public Resources Code section 21080.3.1? If so, is there a plan for consultation that includes, for example, the determination of significance of impacts to tribal cultural resources, procedures regarding confidentiality, etc.?

    Consultation pursuant to PRC section 21080.3.1 is completed and no further consultation is requested from the tribes.

Note: Conducting consultation early in the CEQA process allows tribal governments, lead agencies, and project proponents to discuss the level of environmental review, identify and address potential adverse impacts to tribal cultural resources, and reduce the potential for delay and conflict in the environmental review process. (See Public Resources Code section 21080.3.2.) Information may also be available from the California Native American Heritage Commission's Sacred Lands File per Public Resources Code section 5097.96 and the California Historical Resources Information System administered by the California Office of Historic Preservation. Please also note that Public Resources Code section 21082.3(c) contains provisions specific to confidentiality.



Source: Lilburn Corp., November, 2022.

LILBURN
CORPORATION

REGIONAL LOCATION

MTA Bus Facility Relocation
City of Big Bear Lake, California

FIGURE 1

Source: Lilburn Corp., November, 2022.

LILBURN
CORPORATION

PROJECT VICINITY

MTA Bus Facility Relocation
City of Big Bear Lake, California

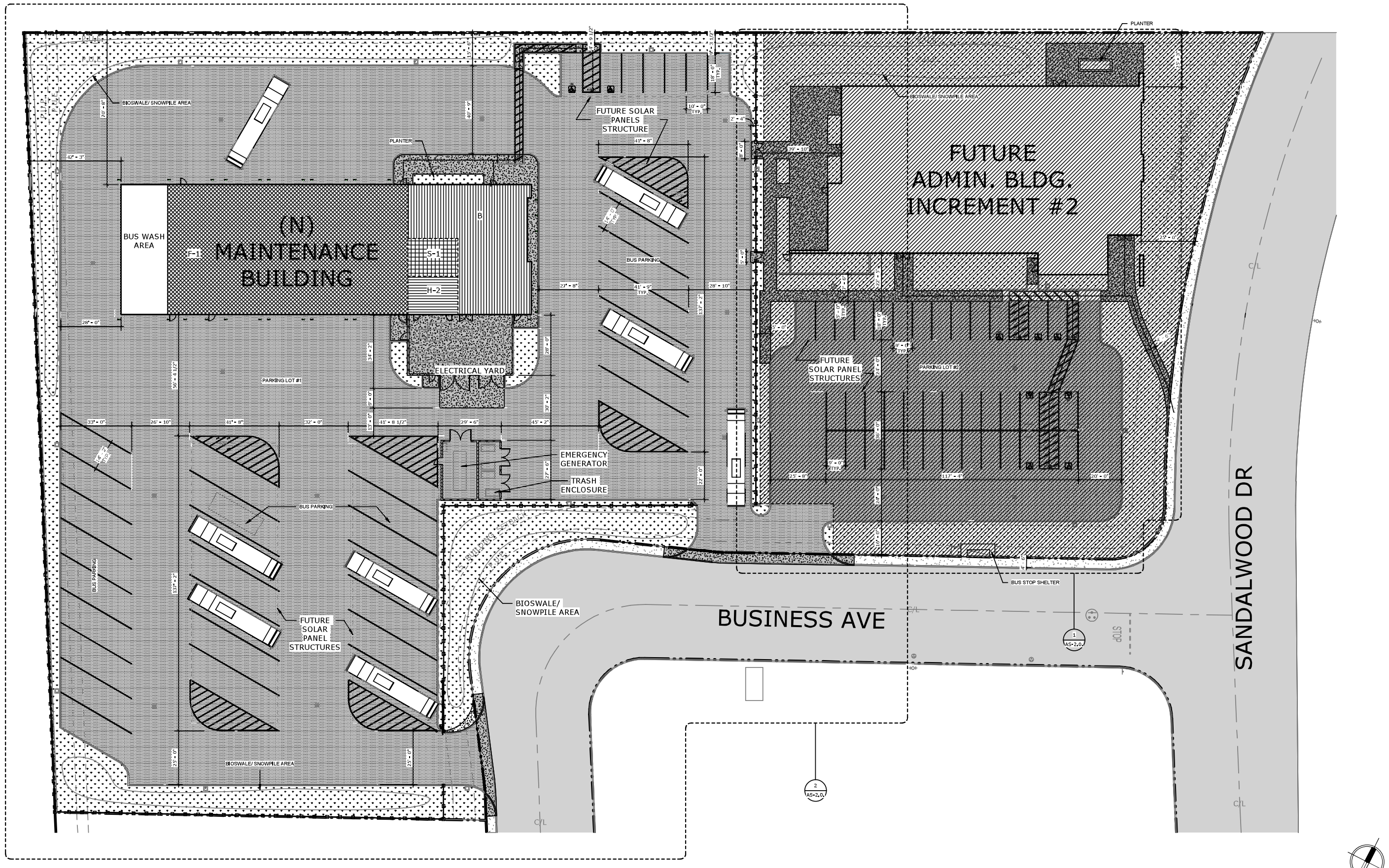
FIGURE 2

BUILDING NAME	BUILDING ANALYSIS						BUILDING AREA (S.F.)		BUILDING AREA MODIFICATION PER SECTION 506		MIXED USE/OCCUPANCY AREA CALCULATION SECTION 508	EXTERIOR WALL PROTECTION PER TABLE 601		OPENING PROTECTION TABLE 705.8	FIRE SPRINKLER	SPECIAL CONSIDERATIONS:
	OCC. TYPE	CONST. TYPE	STORY (ALLOW.) TABLE 504.4	STORY (ACTUAL)	BLDG. HT. (ALLOW.) TABLE 504.3	BLDG. HT. (ACTUAL)	ALLOWABLE BLDG. AREA (TABLE 506.2)	BLDG. AREA (ACTUAL)	FRONTAGE INCREASE CBC 506.3			BEARING	NON-BEARING			
MAINTENANCE BUILDING	B	V-B	3	1	60'-0"	19'-0"	36,000 SF	2,600 SF	-	$A_a=A_t + (NS \text{ x } I_f)$	2,600 SF / 36,000 SF = .072	-	-	-	YES	
	S-1	V-B	2	1	60'-0"	19'-0"	36,000 SF	408 SF	-	$A_a=A_t + (NS \text{ x } I_f)$	408 SF / 36,000 SF = .013	-	-	-	YES	
	F-1	V-B	2	1	60'-0"	28'-6"	34,000 SF	6,746 SF	-	$A_a=A_t + (NS \text{ x } I_f)$	6,746 SF / 34,000 SF = .198	-	-	-	YES	
	H-2	V-B	1	1	40'-0"	28'-6"	3,000 SF	416 SF	-	$A_a=A_t + (NS \text{ x } I_f)$	416 SF / 3,000 SF = .012 SUM OF RATIO'S = .3 < 1	-	-	-	YES	
ADMIN. BUILDING	B	V-B	1	1	40'-0"	22'-6"	36,000 SF	11, 200 SF	-	$A_a=A_t + (NS \text{ x } I_f)$	11,600 SF / 36,000 SF = .306	-	-	-	YES	

CODE ANALYSIS SCALE: 12" = 1'-0"

▦	OCCUPANCY S-1
▤	OCCUPANCY H-2
▩	OCCUPANCY F-1
▥	OCCUPANCY B

CODE ANALYSIS LEGEND



▒	(E) CONCRETE PAVING TO REMAIN
■	EXISTING ASPHALT ROAD TO REMAIN
▩	NEW BUILDING
▒	NEW LANDSCAPE AREA PER LANDSCAPE DWGS.
▒	NEW ASPHALT PER CIVIL'S DWGS.
▒	NEW CONCRETE PAVING PER CIVIL'S DWGS.
▨	FUTURE INCREMENT #2
—□—□—□—	NEW METAL FENCE
━ • • ━	PROPERTY LINE
———	PATH OF TRAVEL

SITE LEGEND

Parcel:	**2328-021-12 & 2328-021-13**
Zoning:	**C-2**
Land Type:	**03 = COMMERCIAL**
Access:	**1 = Public Paved**
RESPNUNIT:	**COM = Commercial Zone or Use**
Total Site Area:	**154,667.04 sq.ft.** **3.55 Acres**
Proposed Project Site Area:	**154,667.04 sq.ft.**
Total Required Site Area:(15% of site plan)	**23,200.05 sq.ft.**
Total Landscape Area Provided:	**35,312 sq.ft.**
Exsisting:	154,667.04 sq.ft.
Proposed:	35,312 sq.ft.
Total Building Area:	**22,680 sq.ft.**
Existing Single-Story Office:	0 sq.ft.
Proposed Building 100:	11,470 sq.ft.
Proposed Building 200:	11,200 sq.ft.
Total New Building Area:	22,680 sq.ft.
F.A.R. :	**0.5:1** **0.146**
Lot Coverage:	**15.22%**
Building Height:	
Proposed Building 100:	**28' - 7"**
Proposed Building 200:	**22' - 6"**

Parking:
Parking Lot #1:
7 Total Stalls; 2 ADA Stalls
Bus Stalls
30 Total Stalls
Parking Lot #2:
38 Total Stalls; 9 ADA Stalls

Required Setbacks in feet (CVMC 17.35.050):	
Minimum Lot Area:	**217800 sq.ft.**
Front:	**15 ft**
Side:	**0 ft.**
Rear:	**0 ft.**
Project Set-Backs in Feet:	
Minimum Lot Area:	
Front:	**135 ft.**
Street Side Yard:	**30 ft.**
Side:	**42 ft.**
Rear:	**25 ft**

Notes:
- **ALL DRIVE AISLES ARE TWO-WAY**
- **NO EXISTING TREES/ VEGETATION ON SITE**
- **NO SIGNIFICANT NATURAL FEATURES ON SITE**
- **BOTH BUILDINGS ARE SPRINKLERED**
- **ALL BUILDINGS WILL BE CONSTRUCTION TYPE 2-B**

PROJECT DATA

OVERALL SITE PLAN SCALE: 1" = 20'-0" REF. / 1

RUHNAU CLARKE ARCHITECTS

PHASE
CUP SUBMITTAL
DATE
Issue Date: APRIL 29, 2022

RUHNAUCLARKE.COM
3775 TENTH STREET, RIVERSIDE CALIFORNIA 92501 (951) 684 4664 / 5751 PALMER WAY, SUITE C, CARLSBAD CALIFORNIA 92010 (760) 438 5899

MOUNTAIN AREA REGIONAL TRANSIT AUTHORITY
170 BUSINESS CENTER. BIG BEAR LAKE, CALIFORNIA
BIG BEAR LAKES

OVERALL SITE PLAN **AS-1.1.**

SITE PLAN
MTA Bus Facility Relocation
City of Big Bear Lake, California

LILBURN CORPORATION

FIGURE 3

ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED:

The environmental factors checked below would be potentially affected by this project, involving at least one impact that is a "Potentially Significant Impact" as indicated by the checklist on the following pages.

☐ Aesthetics
☐ Biological Resources
☐ Greenhouse Gas Emissions
☐ Land Use / Planning
☐ Population / Housing
☐ Transportation
☐ Tribal Cultural Resources
☐ Agriculture/Forestry Resources
☐ Cultural Resources
☐ Hazards & Hazardous Materials
☐ Mineral Resources
☐ Public Services
☐ Utilities / Service Systems
☐ Wildfire
☐ Air Quality
☐ Geology / Soils
☐ Hydrology / Water Quality
☐ Noise
☐ Recreation
☐ Mandatory Findings of Significance
☐ Energy

DETERMINATION (To be completed by the Lead Agency):

On the basis of this initial evaluation:

☐ I find that the proposed project COULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.

☒ I find that although the proposed project could have a significant effect on the environment, there will not be a significant effect in this case because revisions in the project have been made by or agreed to by the project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.

☐ I find that the proposed project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.

☐ I find that the proposed project MAY have a "potentially significant" or "potentially significant unless mitigated" impact on the environment, but at least one effect 1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and 2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.

☐ I find that although the proposed project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier EIR or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier EIR or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the proposed project, nothing further is required.

Sue O'St 2/27/2023
Signature Date

Susan O'Strander, AICP
Printed Name

Community Development Director
City of Big Bear Lake

EVALUATION OF ENVIRONMENTAL IMPACTS:

1) A brief explanation is required for all answers except “No Impact” answers that are adequately supported by the information sources a Lead Agency cites in the parentheses following each question. A “No Impact” answer is adequately supported if the referenced information sources show that the impact simply does not apply to projects like the one involved (e.g. the project falls outside a fault rupture zone). A “No Impact” answer should be explained where it is based on project-specific factors as well as general standards (e.g. the project will not expose sensitive receptors to pollutants, based on a project-specific screening analysis).

2) All answers must take account of the whole action involved, including off-site as well as on-site, cumulative as well as project-level, indirect as well as direct, and construction as well as operational impacts.

3) Once the Lead Agency has determined that a particular physical impact may occur, then the checklist answers must indicate whether the impact is potentially significant, less than significant with mitigation, or less than significant. “Potentially Significant Impact” is appropriate if there is substantial evidence that an effect is significant. If there are one or more "Potentially Significant Impact" entries when the determination is made, an EIR is required.

4) “Negative Declaration: Less Than Significant With Mitigation Incorporated” applies where the incorporation of mitigation measures has reduced an effect from “Potentially Significant Impact” to a “Less than Significant Impact.” The Lead Agency must describe the mitigation measures, and briefly explain how they reduce the effect to a less than significant level (mitigation measures from Section XVII, “Earlier Analyses,” may be cross-referenced).

5) Earlier analyses may be used where, pursuant to the tiering, program EIR, or other CEQA process, an effect has been adequately analyzed in an earlier EIR or negative declaration. Section 15063(c)(3)(D). In this case, a brief discussion should identify the following:

   a) Earlier Analyses Used. Identify and state where they are available for review.

   b) Impacts Adequately Addressed. Identify which effects from the above checklist were within the scope of and adequately analyzed in an earlier document pursuant to applicable legal standards, and state whether such effects were addressed by mitigation measures based on the earlier analysis.

   c) Mitigation Measures. For effects that are “Less than Significant with Mitigation Measures Incorporated,” describe the mitigation measures which were incorporated or refined from the earlier document and the extent to which they address site-specific conditions for the project.

6) Lead agencies are encouraged to incorporate into the checklist references to information sources for potential impacts (e.g. general plans, zoning ordinances). Reference to a previously prepared or outside document should, where appropriate, include a reference to the page or pages where the statement is substantiated.

7) Supporting Information Sources. A source list should be attached, and other sources used or individuals contacted should be cited in the discussion.

8) This is only a suggested form, and lead agencies are free to use different formats; however, lead agencies should normally address the questions from this checklist that are relevant to a project's environmental effects in whatever format is selected.

9) The explanation of each issue should identify:

   a) the significance criteria or threshold, if any, used to evaluate each question; and

   b) the mitigation measure identified, if any, to reduce the impact to less than significance.

	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
I. AESTHETICS. Except as provided in Public Resources Code section 21099, would the project:				
a) Have a substantial adverse effect on a scenic vista?	☐	☐	☒	☐
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?	☐	☐	☐	☒
c) In non-urbanized areas, substantially degrade the existing visual character or quality of public views of the site and its surroundings? (Public views are those that are experienced from publicly accessible vantage point). If the project is in an urbanized area, would the project conflict with applicable zoning and other regulations governing scenic quality?)	☐	☐	☐	☒
d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?	☐	☐	☒	☐

a) The City of Big Bear Lake is located in the San Bernardino Mountains and is surrounded by mountain peaks. The slopes of the surrounding peaks as well as Big Bear Lake are the main visual resources provided to the City. The Project Site is currently surrounded by undeveloped land to the north, undeveloped land and land that is currently being developed to the east, Southwest Gas Corporation facility and a self-storage facility to the south, and undeveloped land and a storage yard to the west. The proposed maintenance building would be 28’-7” tall and the proposed administrative building would be 22’-6” tall. In addition, per the Development Code, the Proposed Project is required to provide a minimum 15-foot setback along the front with no requirements for side and rear setbacks. However, the Proposed Project is anticipated with ample room from property lines, providing a 135-foot setback along the front, a 42-foot setback along the street side yard, 42-foot setback along the sides, and a 25-foot setback along the rear. Therefore, the Proposed Project is not anticipated to substantially block views of scenic vistas of the mountains or the lake from the vantage point of the surrounding uses. Furthermore, the land between the Project Site and the lake is adjacent to Sandalwood Drive and remains vacant. Therefore, Big Bear Lake would still be viewable from Sandalwood Drive. Less than significant impacts are identified or anticipated, and no mitigation measures are required.

b) The Project Site is currently vacant and partially graded, consisting mostly of bare ground with fill material. The Project Site is not located within the viewshed of a designated State scenic highway.[1] The nearest State scenic highway is Big Bear Boulevard, located approximately 0.21 mile east of the Project Site. Also, there is existing development between the Project Site and Big Bear Boulevard. Therefore, no impacts are identified or anticipated, and no mitigation measures are required.

c) The Proposed Project would be located in an area designated for commercial uses. The Project Site is currently surrounded by undeveloped land to the north, undeveloped land and land that is currently being developed to the east, Southwest Gas Corporation facility and a self-storage facility to the south, and

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[1] California Department of Transportation. California State Scenic Highway map. Accessed September 30, 2022.

undeveloped land and a storage yard to the west. The architecture of the Proposed Project would be similar to that of the surrounding, existing uses. The buildings are within the permitted uses of the General Plan for a commercial area, and would be required to comply with all applicable development standards of the zone, including building height, setbacks, landscaping, etc. The C-2 zone allows for commercial development and heights up to 40 feet for primary structures and up to 20 feet for accessory structures. The proposed administration building and maintenance building would be 22'-6" and 28'-7", respectively. Design of the Proposed Project would comply with all applicable development standards, including but not limited to, Section 17.35.080 of the Municipal Code and the Community Design Element of the General Plan[2] which requires all development within Big Bear Lake to be designed to fit into its natural setting and respect special site features such as views. Therefore, no impacts are identified or anticipated, and no mitigation measures are required.

d) The Project Site is currently undeveloped and disturbed. Therefore, implementation of the Proposed Project would create a new source of nighttime lighting in the local area and would be visible from surrounding land uses. The facility would create new sources of light from the bus maintenance and wash facilities, street light, the buses, and employee/visitor automobiles. Additionally, the Proposed Project would install solar panel canopies over the bus parking that would provide security lighting from underneath. However, project lighting would not have significant impact on the surrounding land uses as the Project Site is located in a developed area. The Project Site is currently surrounded by land that is currently being developed to the east, Southwest Gas Corporation facility and a self-storage facility to the south, and a storage yard to the west. Moreover, the Proposed Project would be required to comply with the lighting standards identified in Section 17.35.080 of the City's Municipal Code. Therefore, less than significant impacts are identified or anticipated, and no mitigation measures are required.

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[2] City of Big Bear Lake. General Plan - Community Design Element. 1999

	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
II. AGRICULTURE AND FOREST RESOURCES. In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Dept. of Conservation as an optional model to use in assessing impacts on agriculture and farmland. In determining whether impacts to forest resources, including timberland, are significant environmental effects, lead agencies may refer to information compiled by the California Department of Forestry and Fire Protection regarding the state's inventory of forest land, including the Forest and Range Assessment Project and the Forest Legacy Assessment project; and forest carbon measurement methodology provided in Forest protocols adopted by the California Air Resources Board. Would the project:				
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	☐	☐	☐	☒
b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?	☐	☐	☐	☒
c) Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code section 12220(g)), timberland (as defined by Public Resources Code section 4526), or timberland zoned Timberland Production (as defined by Government Code section 51104(g))?	☐	☐	☐	☒
d) Result in the loss of forest land or conversion of forest land to non-forest use?	☐	☐	☐	☒
e) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use or conversion of forest land to non-forest use?	☐	☐	☐	☒

a) The Project Site is located outside of the survey area for the California Department of Conservation's Important Farmland map data. The General Plan Land Use Map does not indicate that any areas within the City of Big Bear Lake are agricultural. Therefore, no impacts are identified or anticipated, and no mitigation measures are required.

b) The Project Site is designated in the General Plan as Commercial General and zoned Commercial – General (C-2). Therefore, the Proposed Project would not conflict with existing zoning for agricultural use. Furthermore, the Project Site is not under or adjacent to any lands under a Williamson Contract as no Williamson Contracts exist within the City.[3] Therefore, no impacts are identified or anticipated, and no mitigation measures are required.

c) The Project Site is designated Commercial General and zoned C-2. Therefore, the Proposed Project would not conflict with existing zoning for, or cause rezoning of, forest land. No impacts are identified or anticipated, and no mitigation measures are required.

d) While the City of Big Bear Lake is located within the San Bernardino National Forest, the Project Site does not contain trees of any type of trees.[4] The site is completely bare of any vegetation and is currently being maintained as a storage yard for vehicles (plowing and weeding). Therefore, the Proposed Project would not result in the loss of forest land or conversion of forest land to non-forest use. The Proposed Project would be constructed on a vacant and graded land. No impacts are identified or anticipated, and no mitigation measures are required.

e) The Project Site does not support agricultural or forest land uses that would be lost as a result of the Proposed Project implementation. Therefore, no impacts are identified or anticipated, and no mitigation measures are required.

III. AIR QUALITY. Where available, the significance criteria established by the applicable air quality management district or air pollution control district may be relied upon to make the following determinations. Would the project:

a) Conflict with or obstruct implementation of the applicable air quality plan?	☐	☐	☒	☐
b) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard?	☐	☐	☒	☐
c) Expose sensitive receptors to substantial pollutant concentrations?	☐	☐	☒	☐
d) Result in other emissions (such as those leading to odors) adversely affecting a substantial number of people?	☐	☐	☒	☐

a) The Project Site is located in the South Coast Air Basin (SCAB). The South Coast Air Quality Management District (SCAQMD) has jurisdiction over air quality issues and regulations within the SCAB. The Air Quality Management Plan (AQMP) for the SCAB establishes a program of rules and regulations administered by the SCAQMD to obtain attainment of the state and federal ambient air quality standards. The most recent AQMP (AQMP 2016) was adopted by the SCAQMD on March 3, 2017. The 2016 AQMP incorporates the latest scientific and technological information and planning assumptions,

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[3] San Bernardino County. Countywide Plan Maps. NR-5 “Agricultural Resources.” Accessed March 8, 2022.

[4] Site visits November 17, 2023 by Lilburn Corporation and January 21, 2023 by Jennings Environmental

including transportation control measures developed by the Southern California Association of Governments (SCAG) from the 2016 Regional Transportation Plan/Sustainable Communities Strategy, and updated emission inventory methodologies for various source categories. Consistency with the AQMP 2016 for general development projects is determined by demonstrating compliance with local land use plans and/or employment projections.

The Proposed Project is consistent with the City of Big Bear Lake General Plan designation of Commercial General and would therefore be consistent with the land uses assumed in the adopted General Plan growth forecasts which are used in development of the AQMP. The Proposed Project is a relocation project. The existing and proposed uses are within the same air basin, therefore, emissions from the proposed use have already been accounted for. Therefore, the Proposed Project would not result in a conflict or obstruction to the implementation of the AQMP and no significant inconsistency with the AQMP would occur. Less than significant impacts are identified or anticipated, and no mitigation measures are required.

b) The California Emissions Estimator Model (CalEEMod) is recommended by the SCAQMD for all general development projects within the South Coast Air Basin. Therefore, the Proposed Project's construction and operational emissions were estimated using CalEEMod version 2022.1 (see Appendix A for report). The criteria pollutants estimated for include: reactive organic gases (ROG), nitrogen oxides (NOx), carbon monoxide (CO), sulfur dioxide (SO2), and fugitive particulates (PM10 and PM2.5). Two of the analyzed pollutants, ROG and NOx, are ozone precursors. Both summer and winter season emission levels were estimated.

Construction Emissions

Construction emissions are considered short-term, temporary emissions and were modeled with the following construction parameters: site preparation, site grading (fine and mass grading), building construction, paving, and architectural coating. Construction is anticipated to begin in 2023 and be completed by 2024. The resulting emissions generated by construction of the Proposed Project are shown in Table 1 and Table 2, which represent summer and winter construction emissions, respectively.

Table 1
Maximum Summer Construction Emissions
(Pounds per Day)

Source/Phase	**ROG**	**NO_X**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Construction During 2023	4.04	39.8	37.1	0.05	21.7	11.8
Construction During 2024	13.9	11.4	14.0	0.02	0.66	0.50
SCAQMD Threshold	75	100	550	150	150	55
Significant	**No**	**No**	**No**	**No**	**No**	**No**

Source: CalEEMod.2022.1 Summer Emissions.

Table 2
Maximum Winter Construction Emissions
(Pounds per Day)

Source/Phase	**ROG**	**NO_X**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
Construction During 2023	1.31	12.0	13.9	0.02	0.71	0.55
Construction During 2024	1.25	11.4	13.8	0.02	0.66	0.50
SCAQMD Threshold	75	100	550	150	150	55
Significant	**No**	**No**	**No**	**No**	**No**	**No**

Source: CalEEMod.2022.1 Winter Emissions.

As shown in Table 1 and Table 2, construction emissions during either summer or winter seasonal conditions would not exceed the SCAQMD thresholds. Although the Proposed Project does not exceed SCAQMD thresholds for construction emissions, the Project Proponent would be required to comply with all applicable SCAQMD rules and regulations as the SCAB is in non-attainment status for ozone and suspended particulates (PM_{10} and $PM_{2.5}$).

Operational Emissions

The operational mobile emissions were based on existing trips generated by the MT facilities to be relocated which were estimated to be 100 trips. No additional trips are anticipated with the relocation. However, as a worst-case analysis, the model was run assuming 100 trips would be generated by buses and another 100 trips would be generated by passenger cars.

The Proposed Project's long-term operational emissions have been calculated and are summarized below in Table 3 and Table 4.

Table 3
Summer Operational Emissions Summary
(Pounds per Day)

Source	ROG	NO_X	CO	SO_2	PM_{10}	$PM_{2.5}$
Mobile	0.63	4.06	279	0.04	3.48	0.80
Area	0.72	0.01	0.99	0.00	0.00	0.00
Energy	0.01	0.26	0.22	0.00	0.02	0.02
Totals	**1.37**	**4.33**	**280**	**0.04**	**3.50**	**0.82**
SCAQMD Threshold	55	55	550	150	150	55
Significant	**No**	**No**	**No**	**No**	**No**	**No**

Source: CalEEMod.2022.1 Summer Emissions.
Emissions represent the daily maximum emissions.

Table 4
Winter Operational Emissions Summary
(Pounds per Day)

Source	ROG	NO_X	CO	SO_2	PM_{10}	$PM_{2.5}$
Mobile	0.61	4.12	277	0.03	3.48	0.80
Area	0.56	--	--	--	--	--
Energy	0.01	0.26	0.22	0.00	0.02	0.02
Totals	**1.19**	**4.39**	**277**	**0.04**	**3.49**	**0.82**
SCAQMD Threshold	55	55	550	150	150	55
Significant	**No**	**No**	**No**	**No**	**No**	**No**

Source: CalEEMod.2022.1 Winter Emissions.
Emissions represent the daily maximum emissions.

As shown, both summer and winter season operational emissions are below SCAQMD thresholds. The Proposed Project does not exceed applicable SCAQMD regional thresholds either during construction or operational activities. The Proposed Project would not violate any air quality standard or contribute substantially to an existing or projected air quality violation. Therefore, no significant adverse impacts are identified or are anticipated, and no mitigation measures are required.

c) SCAQMD has developed a methodology to assess the localized impacts of emissions from a proposed project as outlined within the Final Localized Significance Threshold (LST) Methodology report;

completed in June 2003 and revised in July 2008. The use of LSTs is voluntary, to be implemented at the discretion of local public agencies acting as a lead agency pursuant to CEQA. LSTs apply to projects that must undergo CEQA or the National Environmental Policy Act (NEPA) and are five acres or less. LST methodology is incorporated to represent worst-case scenario emissions thresholds. CalEEMod version 2022.1 was used to estimate the on-site and off-site construction emissions. The LSTs were developed to analyze the significance of potential air quality impacts of proposed projects to sensitive receptors (i.e. schools, single family residences, etc.) and provide screening tables for small projects (one, two, or five acres). Projects are evaluated based on geographic location and distance from the sensitive receptor (25, 50, 100, 200, or 500 meters from the site).

For the purposes of a CEQA analysis, the SCAQMD considers a sensitive receptor to be a receptor such as a residence, hospital, convalescent facility or anywhere that it is possible for an individual to remain for 24 hours. Additionally, schools, playgrounds, childcare centers, and athletic facilities can also be considered as sensitive receptors. Commercial and industrial facilities are not included in the definition of sensitive receptor because employees do not typically remain on-site for a full 24 hours, but are usually present for shorter periods of time, such as eight hours.

The Project Site is approximately 3.55 acres and therefore the "two-acre" LSTs were utilized for the analysis and represents a worst-case scenario as the larger the site the larger the screening threshold. The nearest sensitive receptor is the residential development located approximately 400 feet (~125 meters) west of the Project Site; therefore, LSTs are based on a 100-meter distance. The Proposed Project's construction and operational emissions with the appropriate LST are presented in Table 5.

Table 5
Localized Significance Thresholds
(Pounds Per Day)

Source	NOx	CO	PM10		PM2.5	
Construction Emissions (Max. from Table 1 and Table 2)	39.8	37.1	21.7		11.8	
Operational Emissions (Max. Total from Table 3 and Table 4)	4.39	280	**3.50**		**0.82**	
Highest Value (lbs/day)	**39.8**	**280**	**21.7**	**3.50**	**11.8**	**0.82**
LST	263	3,029	44*	11†	13*	4†
Greater Than Threshold	**No**	**No**	**No**	**No**	**No**	**No**

Sources: CalEEMod.2022.1 Summer and Winter Emissions; SCAQMD Final Localized Significance Threshold Methodology; SCAQMD Mass Rate Look-up Tables for a one-acre site in SRA No. 38, distance of 100 meters.
Note: PM10 and PM2.5 emissions are separated into construction and operational thresholds in accordance with the SCAQMD Mass Rate LST Look-up Tables.
* Construction emissions LST
† Operational emissions LST

As shown in Table 5, the Proposed Project's emissions are not anticipated to exceed the LSTs. Therefore, the Proposed Project is not anticipated to expose sensitive receptors to substantial pollutant concentrations. No mitigation measures are required.

d) The nearest sensitive receptor is the residential development located approximately 400 feet west of the Project Site. Potential temporary odor sources associated with the Proposed Project may result from construction equipment exhaust and the application of asphalt and architectural coatings during construction activities. Construction would be completed in two phases, further reducing potential pollutant exposure or odor impacts to sensitive receptors in the area. The Proposed Project would be required to comply with SCAQMD Rule 402 to prevent occurrences of public nuisances. SCAQMD Rule 402 regarding nuisances states: “A person shall not discharge from any source whatsoever such quantities of air contaminants or other material which cause injury, detriment, nuisance, or annoyance to any considerable number of persons or to the public, or which endanger the comfort, repose, health, or safety of any such persons or the public, or which cause, or have a natural tendency to cause, injury or damage to business or property.” The nearest sensitive receptor is at a distance far enough that typical odors associated with bus maintenance would disperse prior to becoming a nuisance. During operations, project-generated refuse would be stored in covered containers and removed at regular intervals in compliance with the City of Big Bear’s solid waste regulations. Therefore, no significant adverse impacts are identified or are anticipated, and no mitigation measures are required.

IV. BIOLOGICAL RESOURCES. Would the project:

	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?	☐	☒	☐	☐
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?	☐	☐	☒	☐
c) Have a substantial adverse effect on state or federally protected wetlands (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	☐	☐	☒	☐
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?	☐	☐	☒	☐
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	☐	☐	☐	☒

	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?	☐	☐	☐	☒

a) A Biological Resources Assessment (BRA) and Jurisdictional Delineation (JD) report was prepared for the Proposed Project in January 2023 (see Appendix B for report). According to the California Natural Diversity Database (CNDDB), California Native Plant Society's Electronic Inventory (CNPSEI), and other relevant literature and databases, 104 sensitive species, 20 of which are listed as threatened or endangered, and 2 sensitive habitats, have been documented in the Big Bear Lake, Fawnskin, Big Bear City, and Moonridge quads. The Big Bear City and Moonridge quads were included in this search due the Project Site's proximity to their borders. This list of sensitive species and habitats includes any State and/or federally listed threatened or endangered species, California Department of Fish and Wildlife (CDFW) designated Species of Special Concern (SSC) and otherwise Special Animals. The BRA includes an analysis of the likelihood for the occurrence of all CNDDB sensitive species documented. The analysis takes into account species range as well as documentation within the vicinity of the Project Site and includes the habitat requirements for each species and the potential for their occurrence on the site, based on required habitat elements and range relative to the current site conditions. There is no habitat within the Proposed Project, as well as the immediate surrounding area, that is suitable for the sensitive species identified in the CNDDB search. Additionally, no plant species with the California Rare Plant Rank (CRPR) of 1 or 2 were observed on-site. Findings for specific species are provided below.

Special Status Species

Southern rubber boa – Threatened (State)

Southern Rubber boa have been documented to the south and west of the Project Site. Additional observations have been recorded in Little Bear Creek, which is located 0.03-mile northwest of the Project Site. These occurrences likely represent movement corridors for this species. In addition to the Little Bear Creek occurrences, there are 10 rubber boa occurrences documented within approximately 5 miles of the Project Site. There is no suitable habitat within the Project Site boundary. The site is mostly disturbed and the dirt areas are exposed to direct sunlight most of the year and do not retain moisture. Additionally, the Project Site does not contain any fallen debris for hibernacula and there are no south-facing slopes to provide any rock outcrops. The site is also separated from the occupied habitat by multiple development projects. Therefore, this species is considered absent from the Project Site and the Proposed Project will not affect the Southern rubber boa.

Bald eagle – Delisted (Federal)/ Endangered (State)

According to the CNDDB, the nearest occurrence for the Bald eagle (BAEA) is 0.83-mile northeast of the Project Site. Some of the area surrounding the Project Site does provide habitat suitable to support BAEA however, the Project Site is not within or adjacent to any suitable BAEA foraging or nesting habitat. The nearest suitable habitat for this species is the Big Bear Lake shoreline, which is approximately 0.47-mile north of the Project Site. Additionally, the Proposed Project does not require the removal of large old-growth vegetation. Therefore, the Proposed Project will not affect BAEA and no further investigation relative to this species is warranted or required.

California spotted owl – SSC

Per the CNDDB Spotted Owl (SPOW) Observations Database (2021), the nearest documented SPOW activity center (roosting or nesting site) is approximately 0.68-mile southwest of the Project Site. Some of the area surrounding the Project Site provide habitat suitable to support SPOW. The Project Site is within an already disturbed area and the immediate vicinity has been subject to ongoing human disturbances associated with the existing commercial and residential developments in the area for several years. Therefore, it is unlikely that the immediate surrounding area would be utilized by SPOW for nesting or roosting. Additionally, the Project Site lacks the basic habitat requirements for this species. Furthermore, this species has not been documented within the project area. Although the U.S. Forest Service does not survey for SPOW on private property, the San Bernardino National Forest areas nearby have been surveyed extensively by the Forest Service since the late 1980s. The Project Site is not occupied by SPOW, and development of the Proposed Project will not affect this species.

San Bernardino flying squirrel – SSC

Per the San Diego Natural History Museum (SDNHM) database, the nearest documented flying squirrel occurrence (2008) is approximately 0.72-mile southwest of the Project Site, within a denser tree canopy area. The Project Site and surrounding area do not provide habitat suitable to support flying squirrel. The surrounding area is either residential or commercial developments with scrub on the vacant adjacent parcels. This species has been documented within approximately 0.72-mile of the Project Site, in mixed conifer forest habitat. The habitat within the surrounding vicinity is not suitable to support flying squirrel and the Proposed Project would not result in impacts to this species. Additionally, the Proposed Project does not include the removal of large old-growth vegetation as there is none on the site. Therefore, the Proposed Project will not impact this species.

Bird-foot checkerbloom – Endangered (Federal/State)

There are documented historical occurrences for bird-foot checkerbloom (*Sidalcea pedata*) adjacent to the Project Site. It is likely that the Project Site did at one time contain suitable habitat for this species. However, the site is no longer suitable for this species. The soil on-site consists of 3 feet of non-native fill material and is continually disturbed by maintenance activities (mowing in the spring and plowing in the winter) and vehicle parking. Therefore, this species is considered absent from the Project Site.

Nesting Birds

The immediate surrounding area contains habitat suitable for nesting birds (developed shrubs and tall trees). As such the Project Site is subject to the Migratory Bird Treaty Act and the California Fish and Game Code. The season for bird nesting generally extends from February 1 through September 15 in southern California and specifically, March 15 through August 31 for migratory passerine birds. Therefore, Mitigation Measure BIO-1 shall be implemented to address potential impacts to nesting birds.

> **Mitigation Measure BIO-1:** Whenever possible, impacts to native nesting birds will be avoided by not conducting project activities that involve clearing of vegetation, generation of mechanical noise, or ground disturbance during the typical breeding season (February 1 to September 1), if species covered under the Migratory Bird Treaty Act and Fish and Game Code sections 3503, 3503.5, and 3513 are determined to be present. If project activities must be conducted during the nesting bird season, a qualified Avian Biologist will conduct pre-construction Nesting Bird Surveys (NBS) prior to project-related disturbance to nestable vegetation to identify any active nests within a 500-ft radius of the construction area. If no active nests are found, no further action will be required. If an active nest is found, the biologist will set appropriate no-work buffers around the nest which will be based

upon the nesting species, its sensitivity to disturbance, nesting stage and expected types, intensity and duration of disturbance. Buffers around active nests will be a minimum of 250 feet,[5] unless the biologist determines that smaller buffers would be sufficient to avoid impacts to nesting birds. The nests and buffer zones shall be field checked weekly by a qualified biological monitor. The approved no-work buffer zone shall be clearly marked in the field, within which no disturbance activity shall commence until the qualified biologist has determined the young birds have successfully fledged and the nest is inactive.

b) The Project Site is completely bare of any vegetation and is currently being maintained as a storage yard for vehicles (plowing and weeding). Additionally, the site is comprised of fill material from non-native sources. The neighboring parcels do have some native vegetation in the form of *Ericameria nauseosa* Shrubland Alliance (rubber rabbitbrush scrub). According to the databases, no sensitive habitat, including United States Fish and Wildlife Service (USFWS) designated critical habitat, occurs within or adjacent to the Project Site. The CDFW asserts jurisdiction over any drainage feature that contains a definable bed and bank or associated riparian vegetation. The Project Site was surveyed with 100 percent visual coverage and no definable bed or bank features exist on the Project Site. As such, the subject parcel does not contain any areas under CDFW jurisdiction. No significant impacts are identified or anticipated, and no mitigation measures are required.

c) Aerial imagery of the Project Site was examined and compared with the surrounding USGS 7.5-minute topographic quadrangle maps to identify drainage features within the survey area as indicated from topographic changes, blue-line features, or visible drainage patterns. The USFWS National Wetland Inventory and Environmental Protection Agency (EPA) Water Program "My Waters" data layers were also reviewed to determine whether any hydrologic features and wetland areas have been documented within the vicinity of the site. Similarly, the Soil maps from the U.S. Department of Agriculture (USDA) - Natural Resources Conservation Service (NRCS) Web Soil Survey (USDA 2023) were reviewed to identify the soil series on-site and to check if they have been identified regionally as hydric soils. Upstream and downstream connectivity of waterways (if present) was reviewed in the field, on aerial imagery, and topographic maps to determine jurisdictional status. After a review of the aerials, it appeared that there was a jurisdictional feature on the western edge of the parcel.

The United States Army Corps of Engineers (USACE) has the authority to permit the discharge of dredged or fill material in Waters of the U.S. (WOUS) under Section 404 Clean Water Act (CWA) while the Regional Water Quality Board has authority over the discharge of dredged or fill material in Waters of the State under Section 401 CWA as well as the Porter-Cologne Water Quality Control Act. The Project Site was surveyed with 100 percent visual coverage and no drainage features were present on-site that met the definition for WOUS. As such, the Project Site does not contain any wetlands, WOUS, or Waters of the State. Therefore, no permit from any regulatory agency will be required. No significant impacts are identified or anticipated, and no mitigation measures are required.

d) According to the California Essential Habitat Connectivity Project, the Project Site is not mapped within an area for wildlife movement. Rubber boa have been documented to the south and west of the Project Site. Additional observations have been recorded in Little Bear Creek, which is located 0.03-mile northwest of the Project Site. These occurrences likely represent movement corridors for this species. As stated previously, the Project Site is mostly disturbed, does not contain any fallen debris for hibernacula, and there are no south-facing slopes to provide any rock outcrops. The site is also separated from the

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[5] California Department of Fish and Wildlife. CDFW's Conservation Measures for Biological Resources That May Be Affected by Program-level Actions

occupied habitat by multiple development projects. Therefore, this species is considered absent from the Project Site and the Proposed Project will not impact rubber boa. No significant impacts are identified or anticipated, and no mitigation measures are required.

e) The Project Site is disturbed and partially graded. There are no trees present on the Project Site. Therefore, the City's Tree Conservation ordinance[6] is not applicable. No impacts are identified or anticipated, and no mitigation measures are required.

f) The Project Site is not within or adjacent to a habitat conservation plan. Therefore, the Proposed Project will not have an impact on any habitat conservation plans. No impacts are identified or anticipated, and no mitigation measures are required.

V. CULTURAL RESOURCES. Would the project:

	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Cause a substantial adverse change in the significance of a historical resource pursuant to § 15064.5?	☐	☒	☐	☐
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to § 15064.5?	☐	☒	☐	☐
c) Disturb any human remains, including those interred outside of dedicated cemeteries?	☐	☒	☐	☐

a) A Cultural Resources Study, dated November 30, 2022, was prepared for the Proposed Project by BFSA Environmental Services (see Appendix C for report). The purpose of this investigation was to locate and record any cultural resources within the Project Site and subsequently evaluate any resources as part of the City of Big Bear Lake environmental review process conducted in compliance with the CEQA. The archaeological investigation of the project includes an archaeological records search requested from the South Central Coastal Information Center (SCCIC) at California State University, Fullerton in order to assess previous archaeological studies and identify any previously recorded archaeological sites within the Project Site or in the immediate vicinity.

The records search identified 21 previously recorded resources (five prehistoric, three multicomponent, and 13 historic) within one mile of the Project Site. The historic resources consist of artifact scatters, foundations, structures, roads, single-family properties, and structures associated with Camp Juniper. Multicomponent sites consist of two sites containing a prehistoric lithic scatter and historic trash scatter while the third multicomponent site contains a historic trash scatter with prospecting pits and a prehistoric isolate. However, no resources are recorded within the Project Site. A review of aerial photographs shows that the property has been vacant since at least the late 1930s and was repeatedly cleared of vegetation. Based on the project's Development Review Application, the property "was previously master plan graded for superpads" (City of Big Bear Lake 2022).

BFSA reviewed the following sources to help facilitate a better understanding of the historic use of the property:

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[6] City of Big Bear Development Code. Chapter 17.10 "Tree Conservation"

- The National Register of Historic Places Index
- The OHP, Archaeological Determinations of Eligibility
- The OHP, Directory of Properties in the Historic Property Data File
- The 1949 and 1964 Lucerne Valley 15-minute series topographic maps
- The 1957 San Gorgonio Mountain 15-minute series topographic maps
- The 1975 Fawnskin 7.5-minute series topographic map
- The 1975 and 1984 Big Bear Lake 7.5-minute series topographic maps
- 1938, 1948, 1952, 1966, 1969, 1983, 1995, 2005, 2010, 2016, and 2021 aerial photographs

These sources did not indicate the presence of any additional archaeological resources within the Project Site. According to the historic maps and aerial photographs, the property has been vacant since at least 1938 and no structures appear to have ever been located within the property. Generally, the aerial photographs show the project as vacant land; however, the 1995 and subsequent aerial photographs appear to show the project being impacted and repeatedly cleared as properties to the south, along with Sandalwood Drive, were developed. Further, the aerial photographs appear to show the project graded between 2012 and 2013.

An archaeological survey was conducted on November 16, 2022 as an intensive reconnaissance consisting of a series of survey transects across the Project Site. Approximately 90 percent of the property was noted as being previously developed and covered in three to four feet of imported fill. The survey did not result in the identification of any historic cultural resources within the Project Site.

Cultural resources have the potential for occurring anywhere. Therefore, possible significant adverse impacts have been identified and the following mitigation measure is required as a condition of project approval to reduce these impacts to a level below significant.

> **Mitigation Measure CR-1:** In the event that any historic or prehistoric cultural resources are inadvertently discovered, all construction work in the immediate vicinity of the discovery shall stop and a qualified archaeologist shall be engaged to discuss the discovery and determine if further mitigation measures are warranted.

b) The archaeological investigation of the project includes an archaeological records search requested from the SCCIC in order to assess previous archaeological studies and identify any previously recorded archaeological sites within the project or in the immediate vicinity. The results of the SCCIC records search did not identify any resources within the Project Site. However, the search did identify 21 cultural resources (five prehistoric, three multicomponent, and 13 historic) within one mile of the Project Site. The prehistoric resources consist of one lithic scatter, a bedrock milling feature, and three isolates. Multicomponent sites consist of two sites containing a prehistoric lithic scatter and historic trash scatter while the third multicomponent site contains a historic trash scatter with prospecting pits and a prehistoric isolate.

A Sacred Lands File (SLF) search was also requested from the Native American Heritage Commission (NAHC) to search for the presence of any recorded Native American sacred sites or locations of religious or ceremonial importance within one mile of the project. The SLF search was returned with negative results. The archaeological survey did not result in the identification of any historic or prehistoric cultural resources within the Project Site.

Mitigation Measure CR-1 identified above would address potential impacts associated with unanticipated archaeological finds.

c) The discovery of human remains is always a possibility during ground-disturbing activities. Therefore, possible significant adverse impacts have been identified or anticipated and Mitigation Measure CR-2 is required as a condition of project approval to reduce these impacts to a less than significant level.

Mitigation Measure CR-2: If human remains are discovered, work shall halt in that area until a determination can be made regarding the provenance of the human remains; and the procedures set forth in CEQA Section 15064.5(e), the California PRC (Section 5097.98), and the State Health and Safety Code (Section 7050.5) shall be undertaken.

10) **ENERGY.** Would the project:

	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Result in potentially significant environmental impact due to wasteful, inefficient, or unnecessary consumption of energy resources, during project construction or operation?	☐	☐	☒	☐
b) Conflict with or obstruct a state or local plan for renewable energy or energy efficiency?	☐	☐	☒	☐

a) Electrical service for operations would be provided by Bear Valley Department of Power and Water (BVDPW) and natural gas would be provided by Southwest Gas Corporation (SGC). The Proposed Project's construction and operations would comply with State building code (Title 24) and City codes regarding energy efficiency requirements. Operational energy use (electricity and natural gas) would be typical of similar uses and building design and construction would be in compliance with Municipal Code Chapter 15.04 (Energy Efficiency Standards). In addition, the Proposed Project is a relocation of an existing fleet and facilities to an undeveloped site 0.3-mile north of the current MT facility site. Therefore, energy demand within the BVDOW and SGC service areas are not anticipated to substantially increase with implementation of the Proposed Project.

However, some increase in energy demand is anticipated as the new facility would include charging facilities for the zero emission buses (ZEBs). Assuming a 1:1 replacement ratio, each existing bus will eventually be replaced with an equivalent-length ZEB bus. The last conventional (gasoline) bus is expected to be purchased in 2028.[7] All new bus purchases are anticipated to be battery electric buses (BEB) starting in 2029. Based on the recommended three 60 kW ground-mounted direct current (DC) plug-in charging solution, there will be eight plug-in charging positions in a 1:2 charger to bus dispenser ratio installed on site. This will require an additional demand load of 420 kW for a maximum of 18 buses (which is the number of buses to be on-site by year 2027). The site is anticipated to support up to 26 buses by 2037. Solar arrays would generate on-site renewable energy for the charging facilities and would off-set the project's energy demand. Therefore, impacts related to inefficient energy use would be less than significant.

b) As concluded above, the Proposed Project's total impact on regional energy supplies would be minor. The

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[7] San Bernardino County Transportation Authority. San Bernardino County Wide Zero Emission Bus Study Master Plan. April 24, 2020.

proposed buildings would be required to comply with the California Building Code (CBC) and California Green Building Standards Code (CALGreen Code) pertaining to energy and water conservation standards in effect at the time of construction. In order to reduce its grid energy consumption and increase its renewable energy sources, MT proposes to install a solar array at the proposed facility, which would generate renewable energy for the charging stations. This solar array would help offset increased energy demand from the future use of zero emission buses. The Proposed Project would also decrease MT's reliance on fossil fuels and increase its use of renewable energy. Therefore, less than significant impacts are identified or anticipated, and no mitigation measures are required.

11) **GEOLOGY AND SOILS.** Would the project:

		Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
a)	Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury or death involving:	☐	☒	☐	☐
(i)	Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.	☐	☐	☒	☐
(ii)	Strong seismic ground shaking?	☐	☐	☒	☐
(iii)	Seismic-related ground failure, including liquefaction?	☐	☒	☐	☐
(iv)	Landslides?	☐	☐	☐	☒
b)	Result in substantial soil erosion or the loss of topsoil?	☐	☐	☒	☐
c)	Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?	☐	☒	☐	☐
d)	Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code, creating substantial direct or indirect risks to life or property?	☐	☐	☐	☒
e)	Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?	☐	☐	☐	☒

	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
f) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	☐	☐	☒	☐

a)

i) The City of Big Bear Lake is not within an Alquist-Priolo Earthquake Fault Zone, and no known active faults underlie the City.[8] A Geotechnical Investigation report, dated April 11, 2022, was prepared for the Proposed Project by John R. Byerly, Inc. (see Appendix D for report). As stated in the report, the North Frontal fault zone, located approximately 4.5 miles north of the Project Site, would create the most significant earthshaking event. The Proposed Project would be subject to compliance with the Uniform Building Code requirements to reduce the risk of seismic-related loss, injury, or death. No significant impacts are identified or anticipated, and no mitigation measures are required.

ii) It is anticipated that ground shaking from the North Frontal fault zone will occur during the lifetime of the Proposed Project. Based on an earthquake magnitude of 7.0, a peak horizontal ground acceleration of 0.81 g is assigned to the site. However, as stated previously, the Proposed Project would be subject to compliance with the Uniform Building Code requirements to reduce the risk of seismic-related loss, injury, or death. No significant impacts are identified or anticipated, and no mitigation measures are required.

iii) Liquefaction is a phenomenon that occurs where there is a loss of strength or stiffness in the soils that can result in the settlement of buildings, ground failures, or other related hazards. The main factors contributing to this phenomenon are: cohesionless, granular soils having relatively low densities (usually of Holocene age); shallow groundwater (generally less than 50 feet); and moderate-high seismic ground shaking. As stated in the report, the Project Site is located within a "Zone of Suspected Liquefaction Susceptibility." Additionally, groundwater was encountered within the exploratory borings drilled at the site at a depth of 26½ feet. Therefore, there may be a potential for liquefaction to occur. Mitigation Measures GEO-1 through GEO-3 shall be implemented in order to reduce potential impacts to a less than significant level.

> **Mitigation Measure GEO-1:** All structures shall be designed to meet the California Building Code provisions in the most current CBC edition and the ASCE Standard 7-16, where applicable. It is the responsibility of both the property owner and project structural engineer to determine the risk factors with respect to using CBC minimum design values for the proposed facilities.
>
> **Mitigation Measure GEO-2:** The potential for liquefaction should be properly evaluated by the project Geotechnical Engineer.
>
> **Mitigation Measure GEO-3:** Site preparation recommendations as listed in a City-approved Final Geotechnical Investigation report shall be incorporated into project design.

iv) As stated in the April 11, 2022 Geotechnical Investigation report, due to the low-lying relief of the Project Site and adjacent areas, the Project Site is not susceptible to landslides. In addition, the Project Site is not located within a mapped area susceptible to landslides. Therefore, no impacts are identified or anticipated, and no mitigation measures are required.

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[8] City of Big Bear Lake. General Plan - Environmental Resource Element, 1999.

b) Construction activities could result in soil erosion if the Project Site is not properly designed. The potential impacts of soil erosion would be minimized through the preparation and implementation of a Storm Water Pollution Prevention Plan (SWPPP). The SWPPP would prescribe temporary Best Management Practices (BMPs) to control wind and water erosion during and shortly after the construction of the Proposed Project. Under proposed conditions, the Project Site would be developed with impervious surfaces and landscaping, thereby reducing the potential for soil erosion. Therefore, no significant adverse impacts are identified or are anticipated, and no mitigation measures are required.

c) The potential for lateral spreading or lurching is highest in areas underlain by soft, saturated materials, especially where bordered by steep banks or adjacent hard ground. Due to the relatively flat nature of the Project Site and distance from embankments, the potential for ground lurching and/or lateral spreading is considered low. Seismically-induced settlement generally occurs within areas of loose, granular soils during periods of strong ground motion. The geotechnical investigation determined that the potential for seismically-induced settlement at the Project Site is considered very low. As stated previously, the potential for landslides is considered low and Mitigation Measures GEO-1 through GEO-3 shall be implemented in order to address liquefaction potential. Therefore, no significant adverse impacts are anticipated with implementation of Mitigation Measures GEO-1 through GEO-3 as identified above.

d) As presented in the April 11, 2022 Geotechnical Investigation report, the Project Site soils have a very low expansion potential. Therefore, no impacts are identified or anticipated, and no mitigation measures are required.

e) The Proposed Project would connect to the City's existing sewer line along Sandalwood Drive. No septic tanks or alternative wastewater disposal are proposed. No impacts are identified or are anticipated, and no mitigation measures are required.

f) The potential for unique paleontological resources or unique geologic features located within the Project Site is not known. However, the Project Site has been graded and no excavations (either for building footings or utilities) into native soils are proposed. Approximately 90 percent of the Project Site is covered in three to four feet of imported fill. Therefore, less than significant impacts are identified or anticipated, and no mitigation measures are proposed.

12) **GREENHOUSE GAS EMISSIONS.** Would the project:

a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?	☐	☐	☒	☐
b) Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emission of greenhouse gases?	☐	☐	☒	☐

a) Many gases make up the group of pollutants which contribute to global climate change. However, three gases are currently evaluated and represent the highest concentration of GHG: Carbon dioxide (CO_2), Methane (CH_4), and Nitrous oxide (N_2O). Emissions were estimated using CalEEMod version 2022.1 with construction anticipated to begin in 2023 and be completed in 2024. The CalEEMod defaults were used for other parameters which are used to estimate construction emissions, such as the worker and vendor trips, and trip lengths. The Proposed Project is anticipated to generate approximately 100 total daily trips based on the trip generation from the existing facility. No additional trips are anticipated with the relocation. However, as a worst-case analysis, the model was run assuming 100 trips would be generated by buses and another 100 trips would be generated by passenger cars.

The Proposed Project's emissions were compared to SCAQMD screening threshold of 10,000 metric tons CO2e for industrial uses. A summary of the results is shown below in Table 6 and Table 7.

Table 6
Greenhouse Gas Construction Emissions
(Metric Tons per Year)

Source/Phase	**CO_2**	**CH_4**	**N_20**	**R^1**
2023	141	0.01	0.00	0.02
2024	175	0.01	0.00	0.03
Total ($MTCO_2e$)	**318**			
Construction Amortized 30 Years	**10.6**			

Source: CalEEMod.2022.1 Annual Emissions.
1) Common refrigerant GHGs used in air conditioning and refrigeration equipment.

Table 7
Greenhouse Gas Operational Emissions
(Metric Tons per Year)

Source/Phase	**CO_2**	**CH_4**	**N_20**	**R^1**
Mobile	3,020	3.19	0.51	2.06
Area	0.46	0.00	0.00	--
Energy	189	0.01	0.00	--
Water	17.7	0.17	0.00	--
Waste	2.51	0.25	0.00	--
Refrigeration	--	--	--	0.98
Construction Amortized 30 Years	10.6			
Total ($MTCO_2e$)	**3,486.6**			
SCAQMD Threshold	**10,000**			
Significant	**No**			

Source: CalEEMod.2022.1 Annual Emissions.
Common refrigerant GHGs used in air conditioning and refrigeration equipment.

As shown in Table 6 and Table 7, the Proposed Project's emissions would not exceed SCAQMD's screening threshold. Additionally, MT is working towards the 2018 California Air Resources Board (CARB) mandate that all California bus fleets must be zero emission by 2040. The Project Site is anticipated to support up to 26 zero emission buses by 2037. Therefore, less than significant impacts are identified or anticipated, and no mitigation measures are required.

b) The SCAQMD's thresholds used the California Governor Executive Order S-3-05 goals as the basis for deriving the screening level. The Proposed Project's emissions meet the threshold for compliance with Executive Order S-3-05, the Proposed Project's emissions also comply with the goals of AB 32. Additionally, as the Proposed Project meets the current interim emissions targets/thresholds established by the SCAQMD (as described in Section III. Air Quality of this Initial Study), the

Proposed Project would also be on track to meet the reduction target of 40 percent below 1990 levels by 2030 as mandated by SB 32. Furthermore, all of the post-2020 reductions in GHG emissions are addressed via regulatory requirements at the State level and the Proposed Project will be required to comply with these regulations as they come into effect. As discussed, the Proposed Project's GHG emissions fall below SCAQMD screening threshold of 10,000 metric tons of CO_2 equivalent per year and the Proposed Project is in compliance with the reduction goals AB 32 and SB 32.

MT is working towards the 2018 California Air Resources Board (CARB) mandate that all California bus fleets must be zero emission by 2040. In order to accommodate this transformation, MT would be adding electric charging stations and additional parking as the MT would need an estimated two electric buses to run each route due to battery limitations. Facilities would include electrical infrastructure for bus charging at all bus stalls and electrical infrastructure for future bus canopies and solar panel carports. Therefore, construction and operation of the Proposed Project will not conflict with any applicable plan, local or regional greenhouse gas plans. No significant impacts are identified or anticipated, and no mitigation measures are required.

13) **HAZARDS AND HAZARDOUS MATERIALS.**
Would the project:

	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	☐	☐	☒	☐
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	☐	☐	☒	☐
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	☐	☐	☐	☒
d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	☐	☐	☐	☒
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard or excessive noise for people residing or working in the project area?	☐	☐	☒	☐
f) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	☐	☐	☒	☐

	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
g) Expose people or structures, either directly or indirectly, to a significant risk of loss, injury or death involving wildland fires?	☐	☐	☒	☐

a,b) The Proposed Project includes the construction and operation of a bus parking and maintenance facility, as well as administrative offices. The maintenance facility would require the routine transport, use, storage, and disposal of limited quantities of common hazardous materials such as gasoline, diesel fuel, oils, solvents, paint, fertilizers, pesticides, and other similar materials. Operations would include standard maintenance (i.e., landscape upkeep, exterior painting and similar activities) involving the use of commercially available products (e.g., pesticides, herbicides, gas, oil, paint, etc.) the use of which would not create a significant hazard to the public. MT would be required to properly handle and mitigate contamination from hazardous materials related to bus maintenance. The Hazardous Waste Business Plan and Spill Contingency Plan on-file with the County and City would be updated for the relocation site. Additionally, compliance with federal regulations – namely the Hazardous Materials Transportation Act (HMTA) and the US Department of Transportation (DOT)'s 49 CFR 172[9] would ensure that impacts related to the release of hazardous materials (gasoline, chemicals associated with bus maintenance, etc.) would be *less than significant*. All materials required during construction would be kept in compliance with State and local regulations and BMPs. Therefore, no significant impacts are identified or anticipated, and no mitigation measures are required.

c) The nearest school to Project Site is Big Bear Middle School, approximately 0.9-mile southwest of the Project Site. No schools exist within 0.25-mile of the Project Site. Therefore, no impacts are identified or anticipated, and no mitigation measures are required.

d) The Project Site is not included on a list of hazardous material sites as compiled pursuant to Government Code Section 65962.5 and reported in the EnviroStor database.[10] Therefore, no impacts are identified or anticipated, and no mitigation measures are required.

e) The closest airport in the project vicinity is the Big Bear Airport, located about 1.5 miles from the Project Site. The Project Site is not located within a Safety Review Area,[11] nor within the vicinity of a private air strip. The Project Site is not in the vicinity of a private airstrip; however, it is in the vicinity of Bear Valley Community Hospital, which has a heliport. The Proposed Project does not include uses that would result in a safety hazard or excessive noise for people residing or working in the project area. Therefore, no significant impacts are identified or anticipated, and no mitigation measures are required.

f) The City of Big Bear Local Hazard Mitigation Plan[12] describes the process for identifying hazards, risks and vulnerabilities, and identify and prioritize mitigation actions within the City. The Project Site does not contain any critical facilities.[13] The nearest evacuation route to the Project Site is Big Bear Boulevard, located approximately 0.23-mile east of the Project Site. The Proposed Project would provide the minimum required parking spaces and therefore, project vehicles are not anticipated to park off-site and interfere with the use of evacuation routes. As part of the standard development procedures, development plans are submitted to the City for review and approval to ensure adequate emergency access is provided.

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[9] https://www.fmcsa.dot.gov/regulations/hazardous-materials/how-comply-federal-hazardous-materials-regulations & https://www.govinfo.gov/content/pkg/CFR-1998-title49-vol2/xml/CFR-1998-title49-vol2-part172.xml, (Accessed September 2, 2022)

[10] California Department of Toxic Substances Control. EnviroStor database. Accessed November 9, 2022.

[11] City of Big Bear. Airport Master Plan. 2014. https://www.bigbearcityairport.com/wp-content/uploads/2014/12/Big-Bear-City-Airport-Master-Plan-56.5MB.pdf.

[12] Big Bear Fire Authority/City of Big Bear Lake/Big Bear City Community Services District. Local Hazard Mitigation Plan. January 2020.

[13] San Bernardino County. Countywide Policy Plan web maps: PP-1 "Critical Facilities." Accessed December 2, 2022.

Therefore, no significant impacts are identified or anticipated, and no mitigation measures are required.

g) The Project Site is located in a moderate and high fire hazard severity zone.[14] It is not located within a Very High Fire Hazard Severity Zone. The Proposed Project would comply with the Multi-Jurisdictional Big Bear Valley Community Wildfire Protection Plan (CWPP) regarding wildfire prevention.[15] The Proposed Project would be designed according to existing regulations, which include provisions for emergency access on the site and defensible space in the event of wildfire.[16] Per the Development Code, the Proposed Project is required to provide a minimum 15-foot setback along the front with no requirements for side and rear setbacks. However, the Proposed Project would provide a 135-foot setback along the front, a 42-foot setback along the street side yard, 42-foot setback along the sides, and a 25-foot setback along the rear. Therefore, no significant impacts are identified or anticipated, and no mitigation measures are required.

14) **HYDROLOGY AND WATER QUALITY.** Would the project:

		Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
a)	Violate any water quality standards or waste discharge requirements or otherwise substantially degrade surface or ground water quality?	☐	☐	☒	☐
b)	Substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the project may impede sustainable groundwater management of the basin?	☐	☐	☒	☐
c)	Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river or through the addition of impervious surfaces, in a manner which would:	☐	☐	☒	☐
(i)	result in substantial erosion or siltation on- or off-site;	☐	☐	☒	☐
(ii)	substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or offsite;	☐	☐	☒	☐

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[14] San Bernardino County. Countywide Policy Plan web maps: HZ-5 "Fire Hazard Severity Zones." Accessed December 2, 2022.

[15] Big Bear Fire Department, Community Wildfire Protection Plan (CWPP), June 2006, https://bigbearfire.com/community-wildfire-protection-plan-cwpp (Accessed August 31, 2022)

[16] City of Big Bear Lake, Municipal Code Chapter 17.35.080 Site design standards, Chapter 17.10 Tree Conservation and Defensible Space, and Chapter 15.40.010 Amendments to California Fire Code

	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
(iii) create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff; or	☐	☐	☒	☐
(iv) impede or redirect flood flows?	☐	☐	☒	☐
d) In flood hazard, tsunami, or seiche zones, risk release of pollutants due to project inundation?	☐	☐	☒	☐
e) Conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan?	☐	☐	☒	☐

a) The Proposed Project would disturb an approximate 3.55-acre site and would therefore be subject to the National Pollutant Discharge Elimination System (NPDES) permit. The State of California is authorized to administer various aspects of the NPDES. Construction activities covered under the State's General Construction permit include the removal of vegetation, grading, excavating, or any other activity that causes the disturbance of one acre or more. The General Construction permit requires recipients to reduce or eliminate non-storm water discharges into stormwater systems, and to develop and implement a SWPPP. The SWPPP is based on the principles of Best Management Practices (BMPs) to control and abate pollutants. The SWPPP must include BMPs to prevent project-related pollutants from impacting surface waters. The purpose of a SWPPP is to: 1) identify pollutant sources that may affect the quality of discharges of storm water associated with construction activities; and 2) identify, construct and implement storm water pollution control measures to reduce pollutants in storm water discharges from the construction site during and after construction. No significant adverse impacts are identified or are anticipated, and no mitigation measures are required.

b) The City of Big Bear Lake is served by City of Big Bear Lake Department of Water and Power (BBLDWP), which supplies water to its customers through groundwater derived from the Bear Valley Groundwater Basin.[17] Groundwater levels generally correlate with annual fluctuations of precipitation.[18] The Project Site is currently undeveloped but partially graded. Under proposed conditions, the Project Site would be developed with 119,355 SF of hardscape/buildings and 35,312 SF of landscaping. The Proposed Project would include the installation of detention basins and chambers that would assist with infiltration of surface runoff. Implementation of the project Best Management Practices (BMPs) would ensure that stormwater discharge does not substantially alter the existing drainage pattern and water quality, thereby allowing runoff from the Project Site to be utilized as a resource that can eventually be used for groundwater recharge. Since the Proposed Project is a relocation of MT's existing facilities, demand for water would not place a substantial demand above and beyond current facility demands in a way that would impede the sustainable groundwater management of the basin. The Project Site is designated in the General Plan as Commercial General and zoned Commercial – General (C-2). Subject to a CUP, the Proposed Project is an allowable use within the C-2 zoning district. Therefore, the Proposed Project is not anticipated to have a substantial impact on groundwater supplies or interfere substantially with groundwater recharge. No significant adverse impacts are identified or are anticipated, and no mitigation measures are required.

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[17] Carollo Engineers, Inc. City of Big Bear Lake Department of Water and Power 2020 Urban Water Management Plan. March 2022.

[18] Carollo Engineers, Inc. City of Big Bear Lake Department of Water and Power 2020 Urban Water Management Plan. March 2022.

c)

i) Erosion is the wearing away of the ground surface as a result of the movement of wind or water, and siltation is the process by which water is affected by fine mineral particles in the water. Soil erosion could occur due to a storm event. The Construction General Permit requires the development and implementation of a SWPPP. The SWPPP must list BMPs to avoid and minimize soil erosion. Adherence to BMPs would prevent substantial soil erosion or the loss of topsoil. Therefore, less than significant impacts are identified or anticipated, and no mitigation measures are required.

ii, iii, iv) An Infiltration Rate Study for Storm Water Disposal, dated April 18, 2022, was prepared for the Proposed Project by John R. Byerly, Inc. (see Appendix E for report). As part of the development, detention basins and chambers are planned to retain and dispose of storm water runoff. Percolation testing was performed at four locations and yielded infiltration rates of 0.01 inch per hour and 0.09 inch per hour. The tests conducted yielded percolation rates that are generally considered unacceptably slow.

A Water Quality Management Plan, submitted April 2022 and revised January 2023, was prepared for the Proposed Project by Valued Engineering, Inc. (see Appendix F for report). Drainage Area DA 1 is delineated into two subareas, DMA A and DMA B, that include building roofs, PCC walkway, AC pavement and landscaping. Flows generated from the DA 1 will be directed to curb openings that will direct stormwater into above ground detention basins along with an underground chamber system for DMA B. For the design rainfall depth, stormwater will be routed through the proposed Modular Wetland System (MWS) (Biofiltration System). The design capture volume (DCV) storm event flows would be transported into the MWS treatment system. In scenarios where the storm event exceeds the volume, stormwater runoff will be diverted into Sandalwood Drive. From there, flows continue via City of Big Bear storm drain to Big Bear Lake as they do historically. Excess stormwater greater than the 2-year, 1-hour storm event will be released by filling up the detention systems, treat through the MWS system and released to the public right-of-way.

Drainage Area DA 2 consists of the northeast portion of the site, which includes the parking lot, the building roof and minimal landscaping. The building roof runoff will discharge to the pervious landscape area. Any DCV not treated by hydrologic source controls (HSC) will be captured with an inlet and collected in a bioretention basin for stormwater treatment. The overflow outlet will be used for drainage to allow for excess water to flow to Sandalwood Drive.

Therefore, less than significant impacts are identified or anticipated, and no mitigation measures are required.

d) Due to the inland distance from the Pacific Ocean and high elevation, tsunamis are not potential hazards at the site.[19] The Project Site is located approximately 0.4-mile south of Big Bear Lake. The eastern portion of the Project Site is located within a 100-year floodplain.[20] As such, design criteria would be required to be implemented during final design of the Proposed Project. Specifically, habitable structures (i.e., the Administration Building) constructed within Zone AE are required to have their lowest floor elevated to at least one (1) foot above the base flood elevation per City of Big Bear Municipal Code Article III Chapter 15.64.150. The bus wash, maintenance shop, and parking lot would be placed on the

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[19] California Department of Conservation. California Tsunami Maps and Data. Accessed February 2, 2023.

[20] City of Big Bear Lake. General Plan - Environmental Hazards Element, 1999. Exhibit EH-3 “Flood Hazards and Inundation Map.”

western portion, which is an area of minimal flood hazard. Therefore, less than significant impacts are identified or anticipated, and no mitigation measures are required.

e) Requirements of a NPDES permit to be issued for the Proposed Project would include development and implementation of a SWPPP and is subject to Santa Ana Regional water Quality Control Board (RWQCB) review and approval. The purpose of an SWPPP is to: 1) identify pollutant sources that may affect the quality of discharges of stormwater associated with construction activities; and 2) identify, construct and implement stormwater pollution control measures to reduce pollutants in stormwater discharges from the construction site during and after construction. The SWPPP would include BMPs to control and abate pollutants, and treat runoff that can be used for groundwater recharge. The Proposed Project would not otherwise substantially degrade water quality as appropriate measures relating to water quality protection would be implemented. Therefore, no significant impacts are identified or anticipated, and no mitigation measures are required.

15) **LAND USE AND PLANNING.** Would the project:

a) Physically divide an established community?	☐	☐	☐	☒
b) Cause a significant environmental impact due to a conflict with any land use plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect?	☐	☐	☒	☐

a) The physical division of an established community is typically associated with construction of a linear feature, such as a major highway or railroad tracks, or removal of a means of access, such as a local road or bridge, which would impair mobility in an existing community or between a community and an outlying area. The Proposed Project does not include the construction of a linear feature and the Project Site is currently vacant. Therefore, the Proposed Project would neither physically divide an established community nor cause a significant environmental impact due to conflict with any land use plans or policies. No impacts would occur, and no mitigation measures are required.

b) The Project Site is currently undeveloped. It is designated in the General Plan as Commercial General and zoned Commercial – General (C-2). The Proposed Project would include an 11,470-square-foot (SF) maintenance building and an 11,200-SF administrative building. The maintenance building would consist of maintenance bays, a bus wash, and support spaces for repairs and maintenance of MT's bus fleet. The proposed administration/operations building would house administrative offices and support spaces for staff. Subject to a CUP, the Proposed Project is an allowable use within the C-2 zoning district. The Proposed Project would be subject to the development standards required for uses within the C-2 zoning district. Therefore, the Proposed Project would not cause a significant environmental impact due to a conflict with any land use plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect. No significant impacts are identified or anticipated, and no mitigation measures are required.

16) **MINERAL RESOURCES.** Would the project:

a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?	☐	☐	☒	☐

	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
b) Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?	☐	☐	☒	☐

a, b) The State of California Department of Conservation, Division of Mines and Geology identified three Mineral Resource Zones (MRZ), MRZ-1, MRZ-2, and MRZ-3, within the City of Big Bear Lake. The mineral deposits that are of significant value are located in and around Sugarloaf. They include talus that consists largely of quartzite. Talus has been quarried at a site near the north City boundary and could be quarried at additional sites around Gold Mountain, northwest of the City boundary. However, it is not the City's intent to allow mining within the urbanized or developing areas of the community.[21] Furthermore, the Project Site is not zoned for mineral resources extraction. It is currently surrounded by undeveloped land to the north, undeveloped land and land that is currently being developed to the east, Southwest Gas Corporation facility and a self-storage facility to the south, and undeveloped land and a storage yard to the west. The Project Site is located in a commercial area that would not be suitable for mining. Therefore, less than significant impacts are identified or anticipated, and no mitigation measures are required.

17) **NOISE.** Would the project result in:

	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	☐	☒	☐	☐
b) Generation of excessive groundborne vibration or groundborne noise levels?	☐	☐	☒	☐
c) For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☒	☐

a) A Noise Study report, dated January 31, 2023, was prepared for the Proposed Project by Ganddini Group, Inc. (see Appendix G for report). The purpose of the report is to provide an assessment of the noise and vibration impacts resulting from development of the Proposed Project and to identify mitigation measures that may be necessary to reduce those impacts. The noise and vibration issues related to the proposed land use and development have been evaluated in light of applicable federal, state and local policies, including those of the City of Big Bear Lake. The City of Big Bear Lake does not currently have specific numerical noise standards for stationary noise sources.

On-Site Construction Noise

Construction noise will vary depending on the construction process, type of equipment involved, location of the construction site with respect to sensitive receptors, the schedule proposed to carry out each task

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[21] City of Big Bear Lake. General Plan - Environmental Resources Element, 1999.

(e.g., hours and days of the week) and the duration of the construction work. The existing residential dwelling units located to the southwest, west, and northeast and existing commercial uses to the east, south, and west of the Project Site may be affected by short-term noise impacts associated with construction noise.

Construction noise associated with the proposed project was calculated utilizing methodology presented in the Federal Transit Administration (FTA) Transit Noise and Vibration Impact Assessment Manual (2018) together with several key construction parameters including: distance to each sensitive receiver, equipment usage, percent usage factor, and baseline parameters for the project site. Distances to receptors were based on the acoustical center of the proposed construction activity. Construction noise levels were calculated for each phase.

Modeled unmitigated construction noise levels are expected to reach up to 65.4 dBA Leq at the nearest residential property lines to the southwest, 62.6 dBA Leq at the nearest residential property lines to the west, 61 dBA Leq at the nearest residential property lines to the northeast, 62.6 dBA Leq at the nearest commercial property lines to the east, 73.7 dBA Leq at the nearest commercial property lines to the south, and 72.9 dBA Leq at the nearest commercial property lines to the west of the Project Site.

Table 9 of Appendix G includes a comparison of existing noise levels and project construction noise levels. Short-term Noise Measurement (STNM)1 was used for residential receptors to the southwest, STNM3 was used for residential receptors to the west, STNM4 was used for residential receptors to the northeast and commercial receptors to the east, STNM7 was used for commercial receptors to the south, and STNM8 was used for commercial receptors to the west of the Project Site.

Construction noise sources are regulated within the City of Big Bear Lake under 17.01.090(J) of the City's Municipal Code which exempts noise related to construction activities from the provisions of the City's noise standards provided said activities take place between the hours of 7:00 AM and 7:00 PM. Construction activities are not permitted on Sundays or national holidays.

Project construction will not occur outside of the hours outlined as "exempt" in the City of Big Bear Lake Municipal Code Section 17.01.090(J). Additionally, BMPs related to on-site equipment use shall be required as project conditions of approval and included in construction contract documents. Therefore, project construction will not result in the generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance.

Construction noise impacts would be less than significant.

Off-Site Construction

Construction truck trips would occur throughout the construction period. Given the Project Site's proximity to State Route 18 (Big Bear Boulevard), it is anticipated that vendor and/or haul truck traffic would take the most direct routes to State Route 18.

According to the Federal Highway Administration (FHWA), the traffic volumes need to be doubled in order to increase noise levels by 3 dBA CNEL. In the vicinity of the Project Site, the estimated existing weekday average daily trips along Business Center Drive is 865 average daily vehicle trips, along Sandalwood Drive is 3,610 average daily vehicle trips, and along Big Bear Boulevard is 18,800 average daily vehicle trips. As shown in the CalEEMod output files provided in the Air Quality Analysis prepared for the Proposed Project, the greatest number of construction-related vehicle trips per day would be during grading at up to 22 vehicle trips per day (15 for worker trips and 6.25 for hauling trips). Therefore, the addition of project vendor/haul trucks and worker vehicles per day along off-site roadway segments would not be anticipated to result in a doubling of the existing traffic volumes along Business Center, Sandalwood, or Big Bear Boulevard. Off-site project generated construction vehicle trips would result in a negligible noise level increase and would not result in a substantial increase in ambient noise levels. Impacts would be less than significant. No mitigation measures are required.

Project Operational Noise – Off-Site

During operation, the Proposed Project is expected to generate approximately 100 average daily passenger car vehicle trips and 100 average daily bus vehicle trips for a total of 200 average daily vehicle trips. A project generated vehicle noise along affected roadways was modeled utilizing a computer program that replicates the FHWA Traffic Noise Prediction Model FHWA-RD-77-108. Modeled Existing traffic noise levels range between 58-76 dBA CNEL at the right-of-way of each modeled roadway segment; and the modeled Existing Plus Project traffic noise levels range between 66-76 dBA CNEL at the right-of-way of each modeled roadway segment.

Project generated vehicle trips are anticipated to increase noise levels by up to 0.3 dB along Big Bear Boulevard, 3.55 dB along Sandalwood Drive, and 7.97 dB along Business Center Drive. Therefore, project generated vehicle trips are anticipated to result in an increase greater than 5 dB along Business Center Drive. However, the existing land uses located along Business Center Drive are commercial uses and vacant land. In addition, the zoning of the land adjacent to Business Center Drive is general commercial. Commercial land uses are considered “normally acceptable” in areas with noise levels reaching up to 65 dBA CNEL and “conditionally acceptable” in areas reaching up to 70 dBA CNEL. The modeled existing plus project noise level along Business Center Drive is 65.9 dBA CNEL. Therefore, although the Proposed Project is anticipated to result in a greater than 5 dBA CNEL increase along Business Center Drive, the modeled existing plus project noise level does not exceed the City’s applicable land use standards for commercial uses. Therefore, a change in noise level would not be audible and would be considered less than significant. No mitigation is required.

Project Operational Noise – On-Site

The Proposed Project will be subject to City of Big Bear Ordinance 17.01.090 which prohibits the use of any lawn mower, backpack blower, lawn edger, riding tractor, chain saw, or any other machinery, equipment, or other mechanical or electrical device, or any hand tool which creates an unusually loud, excessive, raucous, impulsive, or disturbing sound, within any residential zone, or within any commercial zone which can be heard from any inhabited real property in residentially used or designated properties, or from a commercial lodging facility between the hours of 7 P.M. and 7 A.M. of the following day. This ordinance does not set numerical noise standards that apply to operation of the project. Therefore, as long as the Proposed Project operates between the hours of 7:00 AM and 10:00 PM, it will not be in violation with the City’s applicable code.

To ensure compliance with the City Development Code and General Plan, Mitigation Measure N-1 described below shall be implemented.

> **Mitigation Measure N-1**: The use of noisy equipment outside or within the repair building shall not be loud, excessive, raucous, disturbing, or exceeding 60db at the property line.

With implementation of Mitigation Measure N-1, impacts are anticipated to be less than significant.

b) There are several types of construction equipment that can cause vibration levels high enough to annoy persons in the vicinity and/or result in architectural or structural damage to nearby structures and improvements.

Architectural Damage

The Caltrans Transportation and Construction Vibration Guidance Manual (2020) provides a comprehensive discussion regarding groundborne vibration and the appropriate thresholds to use to assess the potential for damage. The threshold at which there is a risk of "architectural" damage to historic structures is a peak particle velocity (PPV) of 0.25 in/sec, and a PPV of 0.3 in/sec at older residential structures. There is a risk of architectural damage at newer residential structures and modern commercial/industrial buildings at a PPV of 0.5 in/sec. There are existing residential structures located as close as approximately 638 feet west, 377 feet southwest, and 837 feet northeast feet and existing commercial structures located as close as approximately 110 feet south, 636 feet east, 204 feet west, and 246 feet southwest of the project property lines. The residential threshold of 0.3 PPV in/sec will not be exceeded at existing residential structures to the west, southwest, and northeast and the commercial/industrial threshold of 0.5 PPV in/sec will not be exceeded at the existing commercial structures to the south, east, west, and southwest. Therefore, project construction would not result in the exposure of persons to excessive groundborne vibration and impacts would be less than significant.

Annoyance to Persons

Section 17.01.090(A) of the City's Municipal Code states that generation of vibration of a duration and intensity so as to be excessive, disturbing, or objectionable to persons located offsite, shall not be permitted. The Caltrans Noise and Vibration Manual identifies 0.1 PPV in./sec. as the level that is "strongly perceptible."

Operation of a vibratory roller may result in groundborne vibration levels of up to 0.1 PPV (in./sec.) at a distance of 41 feet and bulldozers at a distance of 24 feet. Therefore, sensitive receptors within 41 feet of an operating vibratory roller or 24 feet of an operating large bulldozer may experience annoyance during construction activities. Industrial and commercial receptors are not considered to be sensitive receptors with respect to annoyance. The nearest residential structures are located as close as approximately 377 feet from the western property line of the Project Site. Therefore, project construction activities would not cause vibration related annoyance to existing residential receptors. Furthermore, any potential impacts will be temporary and will occur only during daytime hours. This impact would be less than significant. No mitigation is required.

Operational Vibration

Operation of the Proposed Project will involve the movement of passenger vehicles and trucks. Driving surfaces associated with the project will be paved and will generally be smooth. Loaded trucks generally have a PPV of 0.076 at a distance of 25 feet (Caltrans 2020). Groundborne vibration levels associated with passenger vehicles is much lower. The movement of vehicles on the Project Site would not result in the generation of excessive groundborne vibration or groundborne noise. Impacts would be less than significant. No mitigation is required.

c) The closest airport in the project vicinity is the Big Bear City Airport, located about 1.5 miles northeast of the Project Site. The Project Site is not located within a Safety Review Area,[22] nor within the vicinity

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[22] City of Big Bear. Airport Master Plan. 2014. https://www.bigbearcityairport.com/wp-content/uploads/2014/12/Big-Bear-City-Airport-Master-Plan-56.5MB.pdf.

of a private air strip. The Project Site is not in the vicinity of a private airstrip; however, it is in the vicinity of Bear Valley Community Hospital, which has a heliport. The Proposed Project does not include uses that would result in a safety hazard or excessive noise for people residing or working in the project area. Per the Airport Comprehensive Land Use Plan for the Big Bear City Airport (February 1992), the Project Site is well outside the 65 dBA CNEL noise contour for the airport. The project would not expose people residing or working in the project area to excessive noise levels associated with airports. Therefore, no significant impacts are identified or anticipated, and no mitigation measures are required.

18) **POPULATION AND HOUSING**. Would the project:

	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Induce substantial unplanned population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of road or other infrastructure)?	☐	☐	☒	☐
b) Displace substantial numbers of existing people or housing, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒

a) The Proposed Project is a relocation of an existing facility to an undeveloped property. As the new location is within ½-mile of the existing facility, the Proposed Project would retain the existing employees. Two additional employees are anticipated in the future, and are anticipated to come from the local community. Therefore, the Proposed Project would not induce substantial unplanned population growth within the City. No significant adverse impacts are identified or anticipated, and no mitigation measures are required.

b) The Project Site is currently undeveloped. Implementation of the Proposed Project would neither displace existing housing nor require construction of replacement housing elsewhere. Therefore, no impacts are identified or anticipated, and no mitigation measures are required.

19) **PUBLIC SERVICES.** Would the project:

a) Result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services:	☐	☐	☒	☐
Fire protection?	☐	☐	☒	☐
Police protection?	☐	☐	☒	☐
Schools?	☐	☐	☐	☒
Parks?	☐	☐	☐	☒

	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
Other public facilities?	☐	☐	☒	☐

Fire Protection

The Big Bear Lake Fire Protection District currently operates four fire stations.[23] There would be no increase in demand for fire protection services, as the Proposed Project is the relocation of the existing MT facility to a new site 0.3-mile away. However, MT would still pay development impact fees, which would offset their fair share of the costs if there were any new fire protection personnel or facilities needed (Ordinance 2005-347, Part 2, 2005).[24] This fee includes a share of the estimated cost of constructing and/or acquiring and/or staffing the fire suppression facilities, vehicles, and equipment. Therefore, less than significant impacts are identified or anticipated, and no mitigation measures are required.

Police Protection

The City has contracted with the San Bernardino County Sheriff's Department for law enforcement services since its incorporation in 1980. There would be no increase in demand for police protection services, as the Proposed Project is the relocation of the existing MT facility to a new site 0.3-mile away. Furthermore, the Proposed Project does not propose uses that are crime-inducing. Therefore, less than significant impacts are identified or anticipated, and no mitigation measures are required.

Schools

The Proposed Project does not include construction of homes; therefore, there would be no increase in demand for school. The Proposed Project is not anticipated to substantially increase population growth within the area as the Proposed Project is a relocation of an existing facility to an undeveloped site 0.3-mile away. Therefore, the Proposed Project would not generate new students. No impacts are identified or anticipated, and no mitigation measures are required.

Parks

The Proposed Project does not include construction of homes; therefore, there would be no increase in demand for parks. The Proposed Project is not anticipated to substantially increase population growth within the area as the Proposed Project is a relocation of an existing facility to an undeveloped site 0.3-mile away. No impacts are identified or anticipated, and no mitigation measures are required.

Other Public Facilities

The Proposed Project would employ residents in the area, including the existing facility employees. It is not anticipated to substantially increase population growth within the area. Collection of developer impact fees would ensure no significant impacts to other public facilities would occur. Less than significant impacts are identified or anticipated, and no mitigation measures are required.

20) **RECREATION.**

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[23] https://bigbearfire.com/about-us/stations

[24] City of Big Bear Lake Burbank Manor Project Initial Study/Mitigated Negative Declaration, UltraSystems Environmental, Inc. (2008), pg. 3-41.

	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	☐	☐	☐	☒
b) Does the project include recreational facilities or require the construction or expansion of recreational facilities which have an adverse physical effect on the environment?	☐	☐	☐	☒

a) Implementation of the Proposed Project would not induce residential development because it does not include construction of homes. It is not anticipated to substantially increase population growth within the area as the Proposed Project is a relocation of an existing facility to an undeveloped site 0.3-mile away. No impacts are identified or anticipated, and no mitigation measures are required.

b) The Proposed Project does not include recreational facilities or require the construction or expansion of recreational facilities. Therefore, no impacts are identified or anticipated, and no mitigation measures are required.

21) **TRANSPORTATION.** Would the project:

a) Conflict with a program plan, ordinance or policy addressing the circulation system, including transit, roadway, bicycle and pedestrian facilities?	☐	☐	☒	☐
b) Conflict or be inconsistent with CEQA Guidelines section 15064.3, subdivision (b)?	☐	☐	☒	☐
c) Substantially increase hazards due to a geometric design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	☐	☐	☒	☐
d) Result in inadequate emergency access?	☐	☐	☒	☐

a. The current facilities located at 41939 Fox Farm Road in the City of Big Bear Lake, and 621 Forest Shade Road, Crestline, are both under-sized and have a variety of technical difficulties that make service provisions difficult. In addition, MT is experiencing a growth in service and ridership, with expansions in fixed-route and Dial-A-Ride service in Big Bear Valley (BBV) and a ridership increase (not including service expansion) of 1.32% annually. MT proposed the following service expansions in their 2016 Short Range Transit Plan: RIM trolley/summer weekend service expansion, RIM Dial-A-Ride expansion, BBV fixed route expansion, BBV resort expansion, BBV Off-the-Mountain (OTM) expansion, leasing buses for the Big Bear Mountain Resort (BBMR) service during winter months, and BBV Dial-A-Ride expansion.

The Proposed Project is a relocation of the existing MT facility to an undeveloped site 0.3-mile away. Therefore, no new trips are anticipated with development of the Proposed Project. The increase in the number of trips from the addition of two new employees would not be substantial. The trip distribution is not anticipated to change as the new location is only 0.3-mile from the existing facility. TTM Application

2007-278 included construction of interior circulator streets, which includes sidewalks along the Project Site frontage. Therefore, no street improvements would be required to be constructed for the Proposed Project. The Project Site is adjacent to Business Center Drive and Sandalwood Drive; there are no bicycle facilities that are planned to be constructed along these roadways.[25] As the Proposed Project is intended to meet the increase in ridership demand and solve the issue of technical difficulties at the existing facility, implementation of the Proposed Project would result in improvements to the existing transit facilities. Therefore, no significant impacts are identified or anticipated, and no mitigation measures are required.

b) The Proposed Project is the relocation of an existing transit facility. Institutional/government and public service uses that support community health, safety and welfare may be screened from subsequent CEQA VMT analysis. These facilities (e.g., police stations, fire stations, government offices, utilities, public libraries, community centers, and refuse stations) would be a part of the community and, as public services, the VMT would be accounted for within the community.[26] As such, these uses would result in reductions in total VMT due to the proximity of these services within the community. Additionally, many of these facilities would generate fewer than 500 average daily trips and/or use vehicles other than passenger-cars or light-duty trucks. Therefore, less than significant impacts are identified or anticipated, and no mitigation measures are required.

c) Access to the Project Site would be provided by one 25-foot-wide driveway and one 30-foot-wide driveway, both along Business Center Drive. Due to the location and length of Business Center Drive, the only vehicles utilizing this roadway are solely from businesses located along this roadway. Therefore, buses entering and exiting the Project Site would not be susceptible to hazards from incoming traffic. The proposed driveways would provide adequate turning radius and line of sight for buses entering and exiting the Project Site. The Project Site Plans including bus turning templates would require approval by the City Engineering Division to ensure the Proposed Project does not result in safety hazards. Therefore, less than significant adverse impacts are identified or anticipated, and no mitigation measures are required.

d) The City of Big Bear Local Hazard Mitigation Plan[27] describes the process for identifying hazards, risks and vulnerabilities, and identify and prioritize mitigation actions within the City. The Project Site does not contain any critical facilities.[28] The nearest evacuation route to the Project Site is Big Bear Boulevard, located approximately 0.23-mile east of the Project Site. The Proposed Project would provide the minimum required parking spaces and therefore, project vehicles are not anticipated to park off-site and interfere with the use of evacuation routes. Access to the Project Site would be provided by one 25-foot-wide driveway and one 30-foot-wide driveway, both along Business Center Drive. The driveways would be wide enough to allow evacuation and emergency vehicles simultaneous access. As part of the standard development procedures, development plans are submitted to the City for review and approval to ensure adequate emergency access is provided. Therefore, no significant impacts are identified or anticipated, and no mitigation measures are required.

XVIII. TRIBAL CULTURAL RESOURCES

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[25] City of Big Bear. Big Bear Valley Pedestrian, Bicycle, and Equestrian Master Plan. February 2014.

[26] LSA Associates, Inc. VMT Thresholds and Implementation Analysis. Adopted February 7, 2022/.

[27] Big Bear Fire Authority/City of Big Bear Lake/Big Bear City Community Services District. Local Hazard Mitigation Plan. January 2020.

[28] San Bernardino County. Countywide Policy Plan web maps: PP-1 “Critical Facilities.” Accessed December 2, 2022.

	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Would the project cause a substantial adverse change in the significance of a tribal cultural resource, defined in Public Resources Code section 21074 as either a site, feature, place, cultural landscape that is geographically defined in terms of the size and scope of the landscape, sacred place, or object with cultural value to a California Native American tribe, and that is:	☐	☒	☐	☐
i) Listed or eligible for listing in the California Register of Historical Resources, or in a local register of historical resources as defined in Public Resources Code section 5020.1(k), or	☐	☒	☐	☐
ii) A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of Public Resources Code section 5024.1. In applying the criteria set forth in subdivision (c) of Public Resources Code section 5024.1, the lead agency shall consider the significance of the resource to a California Native American tribe.	☐	☐	☒	☐

a)

i) BFSA's field survey did not result in the identification of any historic or prehistoric cultural resources within the Project Site. The cultural resources survey was negative for the presence of archaeological sites. Property research indicates the Project Site has been vacant since at least the late 1930s, has been repeatedly cleared, and was recently graded. Cultural resources have the potential for occurring anywhere. With implementation of Mitigation Measure CR-1 identified above, potential impacts to historical resources with Native American cultural value are anticipated to be less than significant.

ii) California Assembly Bill 52 (AB52) was approved by Governor Brown on September 25, 2014. AB52 specifies that CEQA projects with an effect that may cause a substantial adverse change in the significance of a tribal cultural resource may have a significant effect on the environment. As such, the bill requires lead agency consultation with California Native American tribes traditionally and culturally affiliated with the geographic area of a proposed project, if the tribe requested to the lead agency, in writing, to be informed of proposed projects in that geographic area. The legislation further requires that the tribe-requested consultation be completed prior to determining whether a negative declaration, mitigated negative declaration, or environmental impact report is required for a project.

On August 25, 2022, the City provided notification to the following tribes in accordance with AB52: Yuhaaviatam of San Manuel Nation (YSMN), Cabazon Band of Mission Indians, Torres Martinez Desert Cahuilla Indians, and Twenty-Nine Palms Band of Mission Indians. The YSMN requested consultation. In an email dated September 2, 2022, the YSMN indicated that the Project Site exists within Serrano ancestral territory and, therefore, is of interest to the Tribe. They requested a cultural report, geotechnical, and project plans, which were provided by the City. YSMN concurred with the findings in the cultural report and no mitigation measures were requested. Therefore, no significant impacts are identified or anticipated, and no mitigation measures are required.

XIX. UTILITIES AND SERVICE SYSTEMS.

Would the project:

	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Require or result in the relocation or construction of new or expanded water, wastewater treatment or storm water drainage, electric power, natural gas, or telecommunications facilities, the construction or relocation of which could cause significant environmental effects?	☐	☐	☒	☐
b) Have sufficient water supplies available to serve the project and reasonably foreseeable future development during normal, dry and multiple dry years?	☐	☐	☒	☐
c) Result in a determination by the wastewater treatment provider which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?	☐	☐	☒	☐
d) Generate solid waste in excess of State or local standards, or in excess of the capacity of local infrastructure, or otherwise impair the attainment of solid waste reduction goals?	☐	☐	☒	☐
e) Comply with federal, state, and local management and reduction statutes and regulations related to solid waste?	☐	☐	☒	☐

a) The Project Site is located within the City of Big Bear water and sewer service area. The Proposed Project would connect to the existing water line along Business Center Drive and to the existing sewer line in Sandalwood Drive that front the Project Site.

The Proposed Project would be serviced by Big Bear Department of Water and Power, which provides electrical service to the general area. There are existing electric and telephone poles along the western boundary of the Project Site that the Proposed Project would connect to.

Southwest Gas Corporation (SGC) would provide natural gas for the Proposed Project. There are existing natural gas distribution lines along Business Center Drive that the Proposed Project would connect to.

The Proposed Project would convey the project runoff to the proposed detention basins and chambers before discharging to the existing drainage facilities along Sandalwood Drive.

The Proposed Project is not anticipated to require or result in the relocation or construction of new or expanded water, wastewater treatment or storm water drainage, electrical power, natural gas, or telecommunications facilities that would cause significant environmental effects. No significant adverse impacts are identified or are anticipated, and no mitigation measures are required.

b) The City of Big Bear Lake is served by City of Big Bear Lake Department of Water and Power (BBLDWP), which supplies water to its customers through groundwater derived from the Bear Valley Groundwater Basin. The Urban Water Management Plan (UWMP) prepared for BBLDWP indicates that groundwater levels generally correlate with annual fluctuations of precipitation. In the event of single and multiple dry years, reduced rainfall results in lower groundwater recharge. However, aquifers contain more water in storage than the perennial yield. Thus, water remains available. The State Department of Water Resources (DWR) estimates total storage of the Basin at approximately 42,000 acre-feet. The UWMP indicates that provided annual pumping does not exceed safe yield, the groundwater basin will continue to contain sufficient water during multiple dry-year conditions. BBLDWP is projected to have sufficient supply available to meet water demands through the year 2045 for average year, single-dry year, and multiple-dry year conditions.[29]

Because the City's Urban Water Management Plan (UWMP) is based on buildout of anticipated General Plan growth, and the Proposed Project is in conformance with the City's General Plan land use designation of Commercial General, the Proposed Project's anticipated water demands would be consistent with the water demands identified in the UWMP. The Proposed Project would comply with Chapter 13.26, which requires new developments to offset their incremental estimated water demand by paying a water demand offset charge with which the DWP will designate for retrofit projects that create additional water capacity.[30] Furthermore, as the Proposed Project is the relocation of an existing use, an increase in water demand is not anticipated with implementation of the Proposed Project. Therefore, less than significant impacts are identified or anticipated, and no mitigation measures are required.

c) Wastewater from the Proposed Project would be conveyed to the Big Bear Area Regional Wastewater Agency's (BBARWA) facility. The Proposed Project is a relocation of the existing MT facility, which is currently served by the BBARWA. Therefore, wastewater generation within the BBARWA is not anticipated to increase with implementation of the Proposed Project. BBARWA would have adequate capacity to serve the Proposed Project's projected demand. No significant impacts are identified or anticipated, and no mitigation measures are required.

d) The City of Big Bear Lake is served by Big Bear Disposal, a contractor that collects residential and commercial solid waste for trash and recycling disposal. Big Bear Disposal is located at 700 North Shore Drive and encompasses 3.40 acres. Its maximum permitted throughput is 50 tons per day.[31] As the Proposed Project is the relocation of the existing MT facility, which is also served by Big Bear Disposal, the increase, if any, in waste generation from the Proposed Project operations would be insignificant. Solid waste produced during the construction phase or operational phase of the Proposed Project would be disposed of in accordance with all applicable statutes and regulations. No significant impacts are identified or anticipated, and no mitigation measures are required.

e) The Proposed Project would comply with the regulations under Municipal Code Chapter 8.64 Solid Waste Management and Collection of Solid Waste and Recyclable Materials. In order to comply with the provisions of the California Integrated Waste Management Act of 1989 (AB 939) and the Mandatory

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[29] Carollo Engineers, Inc. City of Big Bear Lake Department of Water and Power 2020 Urban Water Management Plan. March 2022.

[30] Big Bear Lake Municipal Code, Chapter 13.26, Water Demand Offset Program

[31] CalRecycle. Solid Waste Information System database. Accessed January 20, 2023.

Commercial Recycling measure (as clarified in AB 341 (Chesbro, Chapter 476, Statutes of 2011)), the City of Big Bear Lake is a part of a Joint Powers Authority who develops and implements regional cost-effective programs to maximize waste diversion. These programs are applicable to all commercial and residential sites in the City. The Proposed Project shall adhere the California Integrated Waste Management Act of 1989 (AB 939), AB 1327, Chapter 18 (California Solid Waste Reuse and Recycling Access Act of 1991), and any other applicable local, State, and federal solid waste management regulations. Therefore, no significant adverse impacts are identified or are anticipated, and no mitigation measures are required.

XX. **WILDFIRE**. If located in or near state responsibility areas or lands classified as very high fire hazard severity zones, would the project:				
a) Substantially impair an adopted emergency response plan or emergency evacuation plan?	☐	☐	☒	☐
b) Due to slope, prevailing winds, and other factors, exacerbate wildfire risks, and thereby expose project occupants to, pollutant concentrations from a wildfire or the uncontrolled spread of a wildfire?	☐	☐	☒	☐
c) Require the installation or maintenance of associated infrastructure (such as roads, fuel breaks, emergency water sources, power lines or other utilities) that may exacerbate fire risk or that may result in temporary or ongoing impacts to the environment?	☐	☐	☒	☐
d) Expose people or structures to significant risks, including downslope or downstream flooding or landslides, as a result of runoff, post-fire slope instability, or drainage changes?	☐	☐	☒	☐

a) The Project Site does not contain any critical facilities.[32] The nearest evacuation route to the Project Site is Big Bear Boulevard, located approximately 0.23-mile east of the Project Site. The Proposed Project would provide the minimum required parking spaces and therefore, project vehicles are not anticipated to park off-site and interfere with the use of evacuation routes. Projects located in high wildfire risk areas present an increased risk of ignition and/or evacuation impacts. The Project Site is located in a moderate and high fire hazard severity zone. It is not located within a Very High Fire Hazard Severity Zone. The Proposed Project would comply with the Multi-Jurisdictional Big Bear Valley Community Wildfire Protection Plan (CWPP) regarding wildfire prevention. The Proposed Project would be designed according to existing regulations, which include provisions for emergency access on the site and defensible space in the event of wildfire. As part of the standard development procedures, development plans are submitted to the City for review and approval to ensure adequate emergency access is provided. Therefore, no significant impacts are identified or anticipated, and no mitigation measures are required.

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[32] San Bernardino County. Countywide Policy Plan web maps: PP-1 “Critical Facilities.” Accessed December 2, 2022.

b) Fire spread and structure loss is more likely to occur in low- to intermediate-density developments.[33] The Project Site is located in a moderate and high fire hazard severity zone. It is not located within a Very High Fire Hazard Severity Zone. The Proposed Project would comply with the Multi-Jurisdictional Big Bear Valley Community Wildfire Protection Plan (CWPP) regarding wildfire prevention. The Proposed Project would be designed according to existing regulations, which include provisions for emergency access on the site and defensible space in the event of wildfire. Per the Development Code, the Proposed Project is required to provide a minimum 15-foot setback along the front with no requirements for side and rear setbacks. However, the Proposed Project would provide a 135-foot setback along the front, a 42-foot setback along the street side yard, 42-foot setback along the sides, and a 25-foot setback along the rear. Therefore, no significant impacts are identified or anticipated, and no mitigation measures are required.

c) The Proposed Project would not include the installation of utilities but connect with service laterals to existing water, sewer, and power mains. As stated previously, the Project Site is not located within a Very High Fire Hazard Severity Zone. The Proposed Project would include buildings with fire safety and fire suppression design elements, and proper landscaping as to not exacerbate wildfire risks. Therefore, no significant impacts are identified or anticipated, and no mitigation measures are required.

d) The eastern portion of the Project Site is located within a 100-year floodplain,[34] therefore design criteria would be required to be implemented during final design of the Proposed Project. The finished floor of the administration building would be elevated to one (1) foot above the base floodplain elevation. The bus wash, maintenance shop, and bus parking lot would be placed on the western portion, which is an area of minimal flood hazard. The property is located in a relatively flat area. Therefore, the Proposed Project would not expose persons or structures to postfire slope instability or post-fire drainage. No significant impacts are identified or are anticipated, and no mitigation measures are required.

XXI. MANDATORY FINDINGS OF SIGNIFICANCE. (State CEQA Guidelines section 15065(a).)

a) Does the project have the potential to substantially degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, substantially reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?	☐	☒	☐	☐

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[33] Alexandra D. Syphard, *The Relative Influence of Climate and Housing Development on Current and Projected Future Fire Patterns and Structure Loss Across Three California Landscapes* (2019) GLOBAL ENVIRONMENTAL CHANGE; Alexandra D. Syphard, et al., *Housing Arrangement and Location Determine the Likelihood of Housing Loss Due to Wildfire* (Mar. 28, 2012) PLOS ONE, available at https://journals.plos .org/plosone/article?id=10.1371/journal.pone.0033954.

[34] City of Big Bear Lake. General Plan - Environmental Hazards Element, 1999. Exhibit EH-3 "Flood Hazards and Inundation Map."

	Potentially Significant Impact	Less Than Significant With Mitigation Incorporated	Less Than Significant Impact	No Impact
b) Does the project have the potential to achieve short-term environmental goals to the disadvantage of long-term environmental goals?	☐	☐	☒	☐
c) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current project, and the effects of probable future projects.)	☐	☐	☒	☐
d) Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?	☐	☒	☐	☐

a) The archaeological investigation of the project includes an archaeological records search requested from the SCCIC in order to assess previous archaeological studies and identify any previously recorded archaeological sites within the project or in the immediate vicinity. The records search identified 21 previously recorded resources (five prehistoric, three multicomponent, and 13 historic) within one mile of the Project Site; however, no resources are recorded within the subject property. A review of aerial photographs shows that the property has been vacant since at least the late 1930s and was repeatedly cleared of vegetation. A Sacred Lands File search was also requested from the Native American Heritage Commission. The survey of the Project Site did not result in the identification of any cultural resources within the property. Based upon the results of the study, no prehistoric or historic sites are present within the boundaries of the Project Site. However, Mitigation Measure CR-1 shall be implemented in order to address potential impacts from unanticipated cultural discoveries.

According to the CNDDB, CNPSEI, and other relevant literature and databases, 104 sensitive species, 20 of which are listed as threatened or endangered, and 2 sensitive habitats, have been documented in the Big Bear Lake, Fawnskin, Big Bear City, and Moonridge quads. Based on the literature review and personal observations made on-site and in the immediate vicinity, no State and/or federally listed threatened or endangered species are documented/or expected to occur within the Project Site. Additionally, no plant species with the California Rare Plant Rank (CRPR) of 1 or 2 were observed on-site. No other sensitive species were observed within the Project Site or buffer area. Since there is some habitat within the immediate surrounding area that is suitable for nesting birds in general, Mitigation Measure BIO-1 shall be implemented to address potential impacts to nesting birds.

b) The Proposed Project is the relocation of an existing fleet and facilities to an undeveloped site. MT is working towards the 2018 California Air Resources Board (CARB) mandate that all California bus fleets must be zero emission by 2040. In order to accommodate this transformation, MT would be adding electric charging stations and additional parking as the MT would need an estimated two electric buses to run each route due to battery limitations. Facilities would include electrical infrastructure for bus charging at all bus stalls and electrical infrastructure for future bus canopies and solar panel carports. Therefore, the Proposed Project would not have the potential to achieve short-term environmental goals to the disadvantage of long-term environmental goals. No significant impacts are identified or anticipated, and no mitigation measures are required.

c) Cumulative impacts are defined as two or more individual affects that, when considered together, are considerable or that compound or increase other environmental impacts. The cumulative impact from several projects is the change in the environment that results from the incremental impact of the development when added to the impacts of other closely related past, present, and reasonably foreseeable or probable future developments. Cumulative impacts can result from individually minor, but collectively significant, developments taking place over a period. The CEQA Guidelines, Section 15130 (a) and (b), states:

> (a) Cumulative impacts shall be discussed when the project's incremental effect is cumulatively considerable.
>
> (b) The discussion of cumulative impacts shall reflect the severity of the impacts and their likelihood of occurrence, but the discussion need not provide as great detail as is provided of the effects attributable to the project. The discussion should be guided by the standards of practicality and reasonableness.

Air Quality

Development of the Proposed Project will be conditioned to comply with current SCAQMD rules and regulations to minimize impacts to air quality as discussed. Approval of the project does not require a zone change nor a general plan amendment and is consistent with the City General Plan land use designation. Therefore, cumulative impacts are anticipated to be less than significant.

Greenhouse Gas

Greenhouse gas (GHG) emissions are cumulative in nature, in that, no one single project can measurably contribute to climate change and its affects (global average change in temperature, rising sea levels etc.). The direct or indirect GHG impacts are therefore not evaluated on a local level, but whether or not the GHG emissions resulting from the project are cumulative; that is, they add considerably to an increase in GHGs as compared to the existing environmental setting based on: 1) an established significance threshold(s); or 2) the extent to which the project complies with regulations or requirements adopted to implement a statewide, regional, or local plan for the reduction or mitigation of greenhouse gas emissions.

As summarized previously, the Proposed Project's GHG emissions fall below the SCAQMD screening threshold of 10,000 metric tons of CO2 equivalent per year and the Proposed Project is in compliance with the reduction goals AB 32 and SB 32. Furthermore, all of the post-2020 reductions in GHG emissions are addressed via regulatory requirements at the State level and the Proposed Project will be required to comply with these regulations as they come into effect. As such, the Proposed Project's incremental contribution to greenhouse gas emissions and their effects on climate change would not be cumulatively considerable.

Therefore, no significant impacts are identified or anticipated, and no mitigation measures are required.

d) As discussed, the Proposed Project would not impact sensitive receptors due to criterial pollutant emissions, noise generation, odor generation, and hazardous material emissions and handling. Mitigation Measures GEO-1 to GEO-3 shall be implemented in order to reduce potential impacts from geologic hazards. With adherence to the City of Big Bear Development Code, the Proposed Project is not anticipated to result in a safety hazard for people residing or working at the Project Site. Therefore, the development of the Proposed Project would not cause adverse impacts on humans, either directly or indirectly.

From: Sandy Benson
Mountain Transit
41939 Fox Farm Road
Big Bear Lake, CA 92336

RE: Initial Study/Mitigated Negative Declaration
Conditional Use Permit 2022-074, Mountain Transit

To: Planning Division Manager

Pursuant to Section 15070 (Negative or Mitigated Negative Declaration Process) of the State Guidelines implementing the California Environmental Quality Act, I/we, acting as agents for the property owner/developer, hereby agree to all of the following:

1) The draft initial study identifies potentially significant effects from the project, but the study also identifies mitigation measures that would avoid or mitigate the effects to a level where clearly no significant effects would occur;
2) The mitigation measures are hereby incorporated into the project prior to releasing the draft initial study and mitigated negative declaration for public comment;
3) I/we agree to the mitigation measures as necessary to avoid or mitigate significant effects that would otherwise arise from the project. I/we accept the mitigation measures included in the draft initial study and have resolved all questions and concerns regarding the mitigation measures;
4) If, during the public comment period and/or decision-making process, substitute or additional mitigation measures are proposed, the appropriate process must take place for determining whether or not to substitute or apply additional measures;
5) This agreement is binding upon the applicant for this project and any successors in interest or assignees.

This acknowledgment is binding upon the applicant and any successors in interest or assignees:

Signature

2|27|2023
Date

Sandy Benson
Print Name

General Manager Mountain Transit
Title & Company Name

This acknowledgment must be attached to the draft initial study/mitigated negative declaration released for public comment and review.

APPENDIX A
CALEEMOD TABLES

Big Bear MT Facility Detailed Report

Table of Contents

1. Basic Project Information

1.1. Basic Project Information

Data Field	Value
Project Name	Big Bear MT Facility
Lead Agency	City of Big Bear
Land Use Scale	Project/site
Analysis Level for Defaults	County
Windspeed (m/s)	2.50
Precipitation (days)	1.80
Location	34.25040024584777, -116.88907728368146
County	San Bernardino-South Coast
City	Big Bear Lake
Air District	South Coast AQMD
Air Basin	South Coast
TAZ	5155
EDFZ	10
Electric Utility	Bear Valley Electric Service
Gas Utility	Southwest Gas Corp.

1.2. Land Use Types

Land Use Subtype	Size	Unit	Lot Acreage	Building Area (sq ft)	Landscape Area (sq ft)	Special Landscape Area (sq ft)	Population	Description
General Light Industry	22.7	1000sqft	0.52	22,670	0.00	—	—	—
Parking Lot	132	1000sqft	3.03	0.00	35,312	—	—	—

1.3. User-Selected Emission Reduction Measures by Emissions Sector

No measures selected

2. Emissions Summary

2.1. Construction Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	ROG	NOx	CO	SO2	PM10T	PM2.5T	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—
Unmit.	13.9	39.8	37.1	0.05	21.7	11.8	5,552	0.23	0.10	1.87	5,575
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—
Unmit.	1.31	12.0	13.9	0.02	0.71	0.55	2,643	0.11	0.04	0.02	2,659
Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—
Unmit.	1.21	4.59	5.65	0.01	0.67	0.40	1,060	0.04	0.02	0.17	1,066
Annual (Max)	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.22	0.84	1.03	< 0.005	0.12	0.07	175	0.01	< 0.005	0.03	176

2.2. Construction Emissions by Year, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Year	ROG	NOx	CO	SO2	PM10T	PM2.5T	CO2T	CH4	N2O	R	CO2e
Daily - Summer (Max)	—	—	—	—	—	—	—	—	—	—	—
2023	4.04	39.8	37.1	0.05	21.7	11.8	5,552	0.23	0.10	1.87	5,575
2024	13.9	11.4	14.0	0.02	0.66	0.50	2,651	0.11	0.04	1.15	2,667
Daily - Winter (Max)	—	—	—	—	—	—	—	—	—	—	—

2023	1.31	12.0	13.9	0.02	0.71	0.55	2,643	0.11	0.04	0.02	2,659
2024	1.25	11.4	13.8	0.02	0.66	0.50	2,640	0.11	0.04	0.02	2,655
Average Daily	—	—	—	—	—	—	—	—	—	—	—
2023	0.45	4.17	4.65	0.01	0.67	0.40	854	0.04	0.01	0.13	859
2024	1.21	4.59	5.65	0.01	0.27	0.20	1,060	0.04	0.02	0.17	1,066
Annual	—	—	—	—	—	—	—	—	—	—	—
2023	0.08	0.76	0.85	< 0.005	0.12	0.07	141	0.01	< 0.005	0.02	142
2024	0.22	0.84	1.03	< 0.005	0.05	0.04	175	0.01	< 0.005	0.03	176

2.4. Operations Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	ROG	NOx	CO	SO2	PM10T	PM2.5T	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—
Unmit.	1.37	4.33	280	0.04	3.50	0.82	19,726	21.9	3.10	34.7	21,230
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—
Unmit.	1.19	4.39	277	0.04	3.49	0.82	19,464	21.9	3.10	6.65	20,942
Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—
Unmit.	1.30	4.41	278	0.04	3.50	0.82	19,507	21.9	3.10	18.3	20,997
Annual (Max)	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.24	0.80	50.7	0.01	0.64	0.15	3,230	3.62	0.51	3.03	3,476

2.5. Operations Emissions by Sector, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Sector	ROG	NOx	CO	SO2	PM10T	PM2.5T	CO2T	CH4	N2O	R	CO2e

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.63	4.06	279	0.04	3.48	0.80	18,460	19.3	3.07	28.8	19,884
Area	0.72	0.01	0.99	< 0.005	< 0.005	< 0.005	4.05	< 0.005	< 0.005	—	4.07
Energy	0.01	0.26	0.22	< 0.005	0.02	0.02	1,141	0.06	< 0.005	—	1,143
Water	—	—	—	—	—	—	107	1.03	0.02	—	140
Waste	—	—	—	—	—	—	15.2	1.51	0.00	—	53.0
Refrig.	—	—	—	—	—	—	—	—	—	5.90	5.90
Total	1.37	4.33	280	0.04	3.50	0.82	19,726	21.9	3.10	34.7	21,230
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.61	4.12	277	0.03	3.48	0.80	18,202	19.3	3.07	0.75	19,600
Area	0.56	—	—	—	—	—	—	—	—	—	—
Energy	0.01	0.26	0.22	< 0.005	0.02	0.02	1,141	0.06	< 0.005	—	1,143
Water	—	—	—	—	—	—	107	1.03	0.02	—	140
Waste	—	—	—	—	—	—	15.2	1.51	0.00	—	53.0
Refrig.	—	—	—	—	—	—	—	—	—	5.90	5.90
Total	1.19	4.39	277	0.04	3.49	0.82	19,464	21.9	3.10	6.65	20,942
Average Daily	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.61	4.14	277	0.03	3.48	0.80	18,242	19.3	3.07	12.4	19,652
Area	0.67	0.01	0.68	< 0.005	< 0.005	< 0.005	2.78	< 0.005	< 0.005	—	2.79
Energy	0.01	0.26	0.22	< 0.005	0.02	0.02	1,141	0.06	< 0.005	—	1,143
Water	—	—	—	—	—	—	107	1.03	0.02	—	140
Waste	—	—	—	—	—	—	15.2	1.51	0.00	—	53.0
Refrig.	—	—	—	—	—	—	—	—	—	5.90	5.90
Total	1.30	4.41	278	0.04	3.50	0.82	19,507	21.9	3.10	18.3	20,997
Annual	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.11	0.76	50.6	0.01	0.63	0.15	3,020	3.19	0.51	2.06	3,254

Area	0.12	< 0.005	0.12	< 0.005	< 0.005	< 0.005	0.46	< 0.005	< 0.005	—	0.46
Energy	< 0.005	0.05	0.04	< 0.005	< 0.005	< 0.005	189	0.01	< 0.005	—	189
Water	—	—	—	—	—	—	17.7	0.17	< 0.005	—	23.2
Waste	—	—	—	—	—	—	2.51	0.25	0.00	—	8.78
Refrig.	—	—	—	—	—	—	—	—	—	0.98	0.98
Total	0.24	0.80	50.7	0.01	0.64	0.15	3,230	3.62	0.51	3.03	3,476

3. Construction Emissions Details

3.1. Site Preparation (2023) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	ROG	NOx	CO	SO2	PM10T	PM2.5T	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	3.95	39.7	35.5	0.05	1.81	1.66	5,295	0.21	0.04	—	5,314
Dust From Material Movement	—	—	—	—	19.7	10.1	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.05	0.54	0.49	< 0.005	0.02	0.02	72.5	< 0.005	< 0.005	—	72.8
Dust From Material Movement	—	—	—	—	0.27	0.14	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Annual	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.10	0.09	< 0.005	< 0.005	< 0.005	12.0	< 0.005	< 0.005	—	12.1
Dust From Material Movement	—	—	—	—	0.05	0.03	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—
Worker	0.10	0.09	1.62	0.00	0.23	0.05	257	0.01	0.01	1.10	261
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	0.02	0.00	< 0.005	< 0.005	3.27	< 0.005	< 0.005	0.01	3.32
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.00	< 0.005	< 0.005	0.54	< 0.005	< 0.005	< 0.005	0.55
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.3. Grading (2023) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	ROG	NOx	CO	SO2	PM10T	PM2.5T	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	2.04	20.0	19.7	0.03	0.94	0.87	2,958	0.12	0.02	—	2,968
Dust From Material Movement	—	—	—	—	7.09	3.43	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.04	0.44	0.43	< 0.005	0.02	0.02	64.8	< 0.005	< 0.005	—	65.1
Dust From Material Movement	—	—	—	—	0.16	0.08	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.08	0.08	< 0.005	< 0.005	< 0.005	10.7	< 0.005	< 0.005	—	10.8
Dust From Material Movement	—	—	—	—	0.03	0.01	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—
Worker	0.08	0.08	1.39	0.00	0.20	0.05	220	0.01	0.01	0.94	224
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.01	0.56	0.31	< 0.005	0.12	0.04	447	0.05	0.07	0.93	470
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—

Average Daily	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	0.02	0.00	< 0.005	< 0.005	4.49	< 0.005	< 0.005	0.01	4.55
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	9.79	< 0.005	< 0.005	0.01	10.3
Annual	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.00	< 0.005	< 0.005	0.74	< 0.005	< 0.005	< 0.005	0.75
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	1.62	< 0.005	< 0.005	< 0.005	1.70

3.5. Building Construction (2023) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	ROG	NOx	CO	SO2	PM10T	PM2.5T	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.26	11.8	13.2	0.02	0.55	0.51	2,397	0.10	0.02	—	2,406
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.26	11.8	13.2	0.02	0.55	0.51	2,397	0.10	0.02	—	2,406
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.33	3.12	3.48	0.01	0.15	0.13	633	0.03	0.01	—	636
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—

Off-Road Equipment	0.06	0.57	0.64	< 0.005	0.03	0.02	105	< 0.005	< 0.005	—	105
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.05	0.88	0.00	0.12	0.03	140	0.01	< 0.005	0.60	142
Vendor	< 0.005	0.14	0.08	< 0.005	0.03	0.01	118	0.01	0.02	0.32	123
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.06	0.66	0.00	0.12	0.03	128	0.01	< 0.005	0.02	130
Vendor	< 0.005	0.15	0.08	< 0.005	0.03	0.01	118	0.01	0.02	0.01	123
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.02	0.19	0.00	0.03	0.01	34.3	< 0.005	< 0.005	0.07	34.8
Vendor	< 0.005	0.04	0.02	< 0.005	0.01	< 0.005	31.1	< 0.005	< 0.005	0.04	32.6
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	0.03	0.00	0.01	< 0.005	5.69	< 0.005	< 0.005	0.01	5.76
Vendor	< 0.005	0.01	< 0.005	< 0.005	< 0.005	< 0.005	5.15	< 0.005	< 0.005	0.01	5.39
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.7. Building Construction (2024) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	ROG	NOx	CO	SO2	PM10T	PM2.5T	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—

Off-Road Equipment	1.20	11.2	13.1	0.02	0.50	0.46	2,398	0.10	0.02	—	2,406
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.20	11.2	13.1	0.02	0.50	0.46	2,398	0.10	0.02	—	2,406
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.44	4.13	4.83	0.01	0.18	0.17	882	0.04	0.01	—	885
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.08	0.75	0.88	< 0.005	0.03	0.03	146	0.01	< 0.005	—	147
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.05	0.81	0.00	0.12	0.03	137	0.01	< 0.005	0.55	139
Vendor	< 0.005	0.13	0.07	< 0.005	0.03	0.01	116	0.01	0.02	0.32	122
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.05	0.61	0.00	0.12	0.03	126	0.01	< 0.005	0.01	127
Vendor	< 0.005	0.14	0.07	< 0.005	0.03	0.01	117	0.01	0.02	0.01	122
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.02	0.24	0.00	0.05	0.01	46.9	< 0.005	< 0.005	0.09	47.5
Vendor	< 0.005	0.05	0.03	< 0.005	0.01	< 0.005	42.9	< 0.005	0.01	0.05	44.9

Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	0.04	0.00	0.01	< 0.005	7.76	< 0.005	< 0.005	0.01	7.87
Vendor	< 0.005	0.01	< 0.005	< 0.005	< 0.005	< 0.005	7.10	< 0.005	< 0.005	0.01	7.43
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.9. Paving (2024) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	ROG	NOx	CO	SO2	PM10T	PM2.5T	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.76	6.87	8.89	0.01	0.33	0.30	1,351	0.05	0.01	—	1,355
Paving	0.44	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.04	0.34	0.44	< 0.005	0.02	0.01	66.6	< 0.005	< 0.005	—	66.8
Paving	0.02	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.06	0.08	< 0.005	< 0.005	< 0.005	11.0	< 0.005	< 0.005	—	11.1
Paving	< 0.005	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—
Worker	0.10	0.10	1.69	0.00	0.26	0.06	288	0.01	0.01	1.15	292
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	0.01	0.07	0.00	0.01	< 0.005	13.2	< 0.005	< 0.005	0.02	13.4
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	0.01	0.00	< 0.005	< 0.005	2.19	< 0.005	< 0.005	< 0.005	2.22
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.11. Architectural Coating (2024) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	ROG	NOx	CO	SO2	PM10T	PM2.5T	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.14	0.91	1.15	< 0.005	0.03	0.03	134	0.01	< 0.005	—	134
Architectural Coatings	13.7	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—

Average Daily	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.04	0.06	< 0.005	< 0.005	< 0.005	6.58	< 0.005	< 0.005	—	6.61
Architectural Coatings	0.68	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	1.09	< 0.005	< 0.005	—	1.09
Architectural Coatings	0.12	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.16	0.00	0.02	0.01	27.4	< 0.005	< 0.005	0.11	27.8
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	0.01	0.00	< 0.005	< 0.005	1.26	< 0.005	< 0.005	< 0.005	1.27
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.00	< 0.005	< 0.005	0.21	< 0.005	< 0.005	< 0.005	0.21
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

4. Operations Emissions Details

4.1. Mobile Emissions by Land Use

4.1.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	ROG	NOx	CO	SO2	PM10T	PM2.5T	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—
General Light Industry	0.63	4.06	279	0.04	3.48	0.80	18,460	19.3	3.07	28.8	19,884
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.63	4.06	279	0.04	3.48	0.80	18,460	19.3	3.07	28.8	19,884
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—
General Light Industry	0.61	4.12	277	0.03	3.48	0.80	18,202	19.3	3.07	0.75	19,600
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.61	4.12	277	0.03	3.48	0.80	18,202	19.3	3.07	0.75	19,600
Annual	—	—	—	—	—	—	—	—	—	—	—
General Light Industry	0.11	0.76	50.6	0.01	0.63	0.15	3,020	3.19	0.51	2.06	3,254
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.11	0.76	50.6	0.01	0.63	0.15	3,020	3.19	0.51	2.06	3,254

4.2. Energy

4.2.1. Electricity Emissions By Land Use - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	ROG	NOx	CO	SO2	PM10T	PM2.5T	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—
General Light Industry	—	—	—	—	—	—	540	0.02	< 0.005	—	541
Parking Lot	—	—	—	—	—	—	289	0.01	< 0.005	—	289
Total	—	—	—	—	—	—	829	0.03	< 0.005	—	831
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—
General Light Industry	—	—	—	—	—	—	540	0.02	< 0.005	—	541
Parking Lot	—	—	—	—	—	—	289	0.01	< 0.005	—	289
Total	—	—	—	—	—	—	829	0.03	< 0.005	—	831
Annual	—	—	—	—	—	—	—	—	—	—	—
General Light Industry	—	—	—	—	—	—	89.4	< 0.005	< 0.005	—	89.6
Parking Lot	—	—	—	—	—	—	47.8	< 0.005	< 0.005	—	47.9
Total	—	—	—	—	—	—	137	< 0.005	< 0.005	—	138

4.2.3. Natural Gas Emissions By Land Use - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	ROG	NOx	CO	SO2	PM10T	PM2.5T	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—
General Light Industry	0.01	0.26	0.22	< 0.005	0.02	0.02	312	0.03	< 0.005	—	312
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	0.01	0.26	0.22	< 0.005	0.02	0.02	312	0.03	< 0.005	—	312
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—

General Light Industry	0.01	0.26	0.22	< 0.005	0.02	0.02	312	0.03	< 0.005	—	312
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	0.01	0.26	0.22	< 0.005	0.02	0.02	312	0.03	< 0.005	—	312
Annual	—	—	—	—	—	—	—	—	—	—	—
General Light Industry	< 0.005	0.05	0.04	< 0.005	< 0.005	< 0.005	51.6	< 0.005	< 0.005	—	51.7
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00
Total	< 0.005	0.05	0.04	< 0.005	< 0.005	< 0.005	51.6	< 0.005	< 0.005	—	51.7

4.3. Area Emissions by Source

4.3.2. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Source	ROG	NOx	CO	SO2	PM10T	PM2.5T	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	0.50	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	0.07	—	—	—	—	—	—	—	—	—	—
Landscape Equipment	0.16	0.01	0.99	< 0.005	< 0.005	< 0.005	4.05	< 0.005	< 0.005	—	4.07
Total	0.72	0.01	0.99	< 0.005	< 0.005	< 0.005	4.05	< 0.005	< 0.005	—	4.07
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	0.50	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	0.07	—	—	—	—	—	—	—	—	—	—
Total	0.56	—	—	—	—	—	—	—	—	—	—

Annual	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	0.09	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	0.01	—	—	—	—	—	—	—	—	—	—
Landscape Equipment	0.02	< 0.005	0.12	< 0.005	< 0.005	< 0.005	0.46	< 0.005	< 0.005	—	0.46
Total	0.12	< 0.005	0.12	< 0.005	< 0.005	< 0.005	0.46	< 0.005	< 0.005	—	0.46

4.4. Water Emissions by Land Use

4.4.2. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	ROG	NOx	CO	SO2	PM10T	PM2.5T	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—
General Light Industry	—	—	—	—	—	—	99.2	1.03	0.02	—	132
Parking Lot	—	—	—	—	—	—	7.52	< 0.005	< 0.005	—	7.53
Total	—	—	—	—	—	—	107	1.03	0.02	—	140
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—
General Light Industry	—	—	—	—	—	—	99.2	1.03	0.02	—	132
Parking Lot	—	—	—	—	—	—	7.52	< 0.005	< 0.005	—	7.53
Total	—	—	—	—	—	—	107	1.03	0.02	—	140
Annual	—	—	—	—	—	—	—	—	—	—	—
General Light Industry	—	—	—	—	—	—	16.4	0.17	< 0.005	—	21.9
Parking Lot	—	—	—	—	—	—	1.24	< 0.005	< 0.005	—	1.25

Total	—	—	—	—	—	—	17.7	0.17	< 0.005	—	23.2

4.5. Waste Emissions by Land Use

4.5.2. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	ROG	NOx	CO	SO2	PM10T	PM2.5T	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—
General Light Industry	—	—	—	—	—	—	15.2	1.51	0.00	—	53.0
Parking Lot	—	—	—	—	—	—	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	15.2	1.51	0.00	—	53.0
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—
General Light Industry	—	—	—	—	—	—	15.2	1.51	0.00	—	53.0
Parking Lot	—	—	—	—	—	—	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	15.2	1.51	0.00	—	53.0
Annual	—	—	—	—	—	—	—	—	—	—	—
General Light Industry	—	—	—	—	—	—	2.51	0.25	0.00	—	8.78
Parking Lot	—	—	—	—	—	—	0.00	0.00	0.00	—	0.00
Total	—	—	—	—	—	—	2.51	0.25	0.00	—	8.78

4.6. Refrigerant Emissions by Land Use

4.6.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	ROG	NOx	CO	SO2	PM10T	PM2.5T	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—
General Light Industry	—	—	—	—	—	—	—	—	—	5.90	5.90
Total	—	—	—	—	—	—	—	—	—	5.90	5.90
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—
General Light Industry	—	—	—	—	—	—	—	—	—	5.90	5.90
Total	—	—	—	—	—	—	—	—	—	5.90	5.90
Annual	—	—	—	—	—	—	—	—	—	—	—
General Light Industry	—	—	—	—	—	—	—	—	—	0.98	0.98
Total	—	—	—	—	—	—	—	—	—	0.98	0.98

4.7. Offroad Emissions By Equipment Type

4.7.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	ROG	NOx	CO	SO2	PM10T	PM2.5T	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—

4.8. Stationary Emissions By Equipment Type

4.8.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	ROG	NOx	CO	SO2	PM10T	PM2.5T	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—

4.9. User Defined Emissions By Equipment Type

4.9.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	ROG	NOx	CO	SO2	PM10T	PM2.5T	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—

4.10. Soil Carbon Accumulation By Vegetation Type

4.10.1. Soil Carbon Accumulation By Vegetation Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Vegetation	ROG	NOx	CO	SO2	PM10T	PM2.5T	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—

4.10.2. Above and Belowground Carbon Accumulation by Land Use Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	ROG	NOx	CO	SO2	PM10T	PM2.5T	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—

4.10.3. Avoided and Sequestered Emissions by Species - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Species	ROG	NOx	CO	SO2	PM10T	PM2.5T	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—

5. Activity Data

5.1. Construction Schedule

Phase Name	Phase Type	Start Date	End Date	Days Per Week	Work Days per Phase	Phase Description
Site Preparation	Site Preparation	7/30/2023	8/6/2023	5.00	5.00	—
Grading	Grading	8/7/2023	8/18/2023	5.00	8.00	—
Building Construction	Building Construction	8/19/2023	7/6/2024	5.00	230	—
Paving	Paving	7/7/2024	8/1/2024	5.00	18.0	—
Architectural Coating	Architectural Coating	8/2/2024	8/27/2024	5.00	18.0	—

5.2. Off-Road Equipment

5.2.1. Unmitigated

Phase Name	Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor
Site Preparation	Rubber Tired Dozers	Diesel	Average	3.00	8.00	367	0.40
Site Preparation	Tractors/Loaders/Backhoes	Diesel	Average	4.00	8.00	84.0	0.37
Grading	Excavators	Diesel	Average	1.00	8.00	36.0	0.38
Grading	Graders	Diesel	Average	1.00	8.00	148	0.41
Grading	Rubber Tired Dozers	Diesel	Average	1.00	8.00	367	0.40
Grading	Tractors/Loaders/Backhoes	Diesel	Average	3.00	8.00	84.0	0.37
Building Construction	Cranes	Diesel	Average	1.00	7.00	367	0.29
Building Construction	Forklifts	Diesel	Average	3.00	8.00	82.0	0.20
Building Construction	Generator Sets	Diesel	Average	1.00	8.00	14.0	0.74
Building Construction	Tractors/Loaders/Backhoes	Diesel	Average	3.00	7.00	84.0	0.37
Building Construction	Welders	Diesel	Average	1.00	8.00	46.0	0.45

Paving	Cement and Mortar Mixers	Diesel	Average	2.00	6.00	10.0	0.56
Paving	Pavers	Diesel	Average	1.00	8.00	81.0	0.42
Paving	Paving Equipment	Diesel	Average	2.00	6.00	89.0	0.36
Paving	Rollers	Diesel	Average	2.00	6.00	36.0	0.38
Paving	Tractors/Loaders/Backhoes	Diesel	Average	1.00	8.00	84.0	0.37
Architectural Coating	Air Compressors	Diesel	Average	1.00	6.00	37.0	0.48

5.3. Construction Vehicles

5.3.1. Unmitigated

Phase Name	Trip Type	One-Way Trips per Day	Miles per Trip	Vehicle Mix
Site Preparation	—	—	—	—
Site Preparation	Worker	17.5	18.5	LDA,LDT1,LDT2
Site Preparation	Vendor	—	10.2	HHDT,MHDT
Site Preparation	Hauling	0.00	20.0	HHDT
Site Preparation	Onsite truck	—	—	HHDT
Grading	—	—	—	—
Grading	Worker	15.0	18.5	LDA,LDT1,LDT2
Grading	Vendor	—	10.2	HHDT,MHDT
Grading	Hauling	6.25	20.0	HHDT
Grading	Onsite truck	—	—	HHDT
Building Construction	—	—	—	—
Building Construction	Worker	9.52	18.5	LDA,LDT1,LDT2
Building Construction	Vendor	3.72	10.2	HHDT,MHDT
Building Construction	Hauling	0.00	20.0	HHDT
Building Construction	Onsite truck	—	—	HHDT

Paving	—	—	—	—
Paving	Worker	20.0	18.5	LDA,LDT1,LDT2
Paving	Vendor	—	10.2	HHDT,MHDT
Paving	Hauling	0.00	20.0	HHDT
Paving	Onsite truck	—	—	HHDT
Architectural Coating	—	—	—	—
Architectural Coating	Worker	1.90	18.5	LDA,LDT1,LDT2
Architectural Coating	Vendor	—	10.2	HHDT,MHDT
Architectural Coating	Hauling	0.00	20.0	HHDT
Architectural Coating	Onsite truck	—	—	HHDT

5.4. Vehicles

5.4.1. Construction Vehicle Control Strategies

Non-applicable. No control strategies activated by user.

5.5. Architectural Coatings

Phase Name	Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)
Architectural Coating	0.00	0.00	34,005	11,335	7,920

5.6. Dust Mitigation

5.6.1. Construction Earthmoving Activities

Phase Name	Material Imported (cy)	Material Exported (cy)	Acres Graded (acres)	Material Demolished (sq. ft.)	Acres Paved (acres)
Site Preparation	—	—	7.50	0.00	—
Grading	—	400	8.00	0.00	—
Paving	0.00	0.00	0.00	0.00	3.03

5.6.2. Construction Earthmoving Control Strategies

Non-applicable. No control strategies activated by user.

5.7. Construction Paving

Land Use	Area Paved (acres)	% Asphalt
General Light Industry	0.00	0%
Parking Lot	3.03	100%

5.8. Construction Electricity Consumption and Emissions Factors

kWh per Year and Emission Factor (lb/MWh)

Year	kWh per Year	CO2	CH4	N2O
2023	0.00	912	0.03	< 0.005
2024	0.00	912	0.03	< 0.005

5.9. Operational Mobile Sources

5.9.1. Unmitigated

Land Use Type	Trips/Weekday	Trips/Saturday	Trips/Sunday	Trips/Year	VMT/Weekday	VMT/Saturday	VMT/Sunday	VMT/Year
General Light Industry	200	200	200	73,064	8,731	8,731	8,731	3,186,788
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

5.10. Operational Area Sources

5.10.1. Hearths

5.10.1.1. Unmitigated

5.10.2. Architectural Coatings

Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)
0	0.00	34,005	11,335	7,920

5.10.3. Landscape Equipment

Season	Unit	Value
Snow Days	day/yr	0.00
Summer Days	day/yr	250

5.11. Operational Energy Consumption

5.11.1. Unmitigated

Electricity (kWh/yr) and CO2 and CH4 and N2O and Natural Gas (kBTU/yr)

Land Use	Electricity (kWh/yr)	CO2	CH4	N2O	Natural Gas (kBTU/yr)
General Light Industry	216,220	912	0.0330	0.0040	972,228
Parking Lot	115,629	912	0.0330	0.0040	0.00

5.12. Operational Water and Wastewater Consumption

5.12.1. Unmitigated

Land Use	Indoor Water (gal/year)	Outdoor Water (gal/year)
General Light Industry	5,242,438	0.00
Parking Lot	0.00	567,080

5.13. Operational Waste Generation

5.13.1. Unmitigated

Land Use	Waste (ton/year)	Cogeneration (kWh/year)
General Light Industry	28.1	0.00
Parking Lot	0.00	0.00

5.14. Operational Refrigeration and Air Conditioning Equipment

5.14.1. Unmitigated

Land Use Type	Equipment Type	Refrigerant	GWP	Quantity (kg)	Operations Leak Rate	Service Leak Rate	Times Serviced
General Light Industry	Other commercial A/C and heat pumps	R-410A	2,088	0.30	4.00	4.00	18.0

5.15. Operational Off-Road Equipment

5.15.1. Unmitigated

Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor

5.16. Stationary Sources

5.16.1. Emergency Generators and Fire Pumps

Equipment Type	Fuel Type	Number per Day	Hours per Day	Hours per Year	Horsepower	Load Factor

5.16.2. Process Boilers

Equipment Type	Fuel Type	Number	Boiler Rating (MMBtu/hr)	Daily Heat Input (MMBtu/day)	Annual Heat Input (MMBtu/yr)

5.17. User Defined

Equipment Type	Fuel Type
—	—

5.18. Vegetation

5.18.1. Land Use Change

5.18.1.1. Unmitigated

Vegetation Land Use Type	Vegetation Soil Type	Initial Acres	Final Acres

5.18.1. Biomass Cover Type

5.18.1.1. Unmitigated

Biomass Cover Type	Initial Acres	Final Acres

5.18.2. Sequestration

5.18.2.1. Unmitigated

Tree Type	Number	Electricity Saved (kWh/year)	Natural Gas Saved (btu/year)

6. Climate Risk Detailed Report

6.1. Climate Risk Summary

Cal-Adapt midcentury 2040–2059 average projections for four hazards are reported below for your project location. These are under Representation Concentration Pathway (RCP) 8.5 which assumes GHG emissions will continue to rise strongly through 2050 and then plateau around 2100.

Climate Hazard	Result for Project Location	Unit
Temperature and Extreme Heat	38.2	annual days of extreme heat
Extreme Precipitation	9.05	annual days with precipitation above 20 mm

Sea Level Rise	0.00	meters of inundation depth
Wildfire	34.2	annual hectares burned

Temperature and Extreme Heat data are for grid cell in which your project are located. The projection is based on the 98th historical percentile of daily maximum/minimum temperatures from observed historical data (32 climate model ensemble from Cal-Adapt, 2040–2059 average under RCP 8.5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.
Extreme Precipitation data are for the grid cell in which your project are located. The threshold of 20 mm is equivalent to about ¾ an inch of rain, which would be light to moderate rainfall if received over a full day or heavy rain if received over a period of 2 to 4 hours. Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.
Sea Level Rise data are for the grid cell in which your project are located. The projections are from Radke et al. (2017), as reported in Cal-Adapt (2040–2059 average under RCP 8.5), and consider different increments of sea level rise coupled with extreme storm events. Users may select from four model simulations to view the range in potential inundation depth for the grid cell. The four simulations make different assumptions about expected rainfall and temperature are: Warmer/drier (HadGEM2-ES), Cooler/wetter (CNRM-CM5), Average conditions (CanESM2), Range of different rainfall and temperature possibilities (MIROC5). Each grid cell is 50 meters (m) by 50 m, or about 164 feet (ft) by 164 ft.
Wildfire data are for the grid cell in which your project are located. The projections are from UC Davis, as reported in Cal-Adapt (2040–2059 average under RCP 8.5), and consider historical data of climate, vegetation, population density, and large (> 400 ha) fire history. Users may select from four model simulations to view the range in potential wildfire probabilities for the grid cell. The four simulations make different assumptions about expected rainfall and temperature are: Warmer/drier (HadGEM2-ES), Cooler/wetter (CNRM-CM5), Average conditions (CanESM2), Range of different rainfall and temperature possibilities (MIROC5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.

6.2. Initial Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	5	0	0	N/A
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	1	0	0	N/A
Wildfire	1	0	0	N/A
Flooding	N/A	N/A	N/A	N/A
Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	0	0	0	N/A

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores do not include implementation of climate risk reduction measures.

6.3. Adjusted Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score

Temperature and Extreme Heat	5	1	1	4
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	1	1	1	2
Wildfire	1	1	1	2
Flooding	N/A	N/A	N/A	N/A
Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	1	1	1	2

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores include implementation of climate risk reduction measures.

6.4. Climate Risk Reduction Measures

7. Health and Equity Details

7.1. CalEnviroScreen 4.0 Scores

The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Exposure Indicators	—
AQ-Ozone	98.7
AQ-PM	2.84
AQ-DPM	12.5
Drinking Water	8.34
Lead Risk Housing	22.3
Pesticides	0.00
Toxic Releases	7.61

Traffic	26.2
Effect Indicators	—
CleanUp Sites	0.00
Groundwater	37.6
Haz Waste Facilities/Generators	35.6
Impaired Water Bodies	87.0
Solid Waste	66.7
Sensitive Population	—
Asthma	87.3
Cardio-vascular	99.6
Low Birth Weights	99.2
Socioeconomic Factor Indicators	—
Education	55.8
Housing	37.5
Linguistic	31.3
Poverty	65.1
Unemployment	—

7.2. Healthy Places Index Scores

The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Economic	—
Above Poverty	61.14461696
Employed	76.78686
Median HI	33.70973951
Education	—
Bachelor's or higher	52.99627871

High school enrollment	100
Preschool enrollment	95.7141024
Transportation	—
Auto Access	98.98626973
Active commuting	76.08109842
Social	—
2-parent households	71.41023996
Voting	89.67021686
Neighborhood	—
Alcohol availability	48.05594765
Park access	32.22122418
Retail density	40.51071474
Supermarket access	35.27524702
Tree canopy	94.14859489
Housing	—
Homeownership	60.78532016
Housing habitability	78.68600026
Low-inc homeowner severe housing cost burden	81.86834339
Low-inc renter severe housing cost burden	82.36879251
Uncrowded housing	66.03361992
Health Outcomes	—
Insured adults	39.29167201
Arthritis	0.0
Asthma ER Admissions	30.4
High Blood Pressure	0.0
Cancer (excluding skin)	0.0
Asthma	0.0

Coronary Heart Disease	0.0
Chronic Obstructive Pulmonary Disease	0.0
Diagnosed Diabetes	0.0
Life Expectancy at Birth	36.3
Cognitively Disabled	99.3
Physically Disabled	13.7
Heart Attack ER Admissions	1.4
Mental Health Not Good	0.0
Chronic Kidney Disease	0.0
Obesity	0.0
Pedestrian Injuries	19.6
Physical Health Not Good	0.0
Stroke	0.0
Health Risk Behaviors	—
Binge Drinking	0.0
Current Smoker	0.0
No Leisure Time for Physical Activity	0.0
Climate Change Exposures	—
Wildfire Risk	82.8
SLR Inundation Area	0.0
Children	97.7
Elderly	4.3
English Speaking	54.6
Foreign-born	5.7
Outdoor Workers	39.6
Climate Change Adaptive Capacity	—
Impervious Surface Cover	91.0

Traffic Density	45.4
Traffic Access	23.0
Other Indices	—
Hardship	33.2
Other Decision Support	—
2016 Voting	86.4

7.3. Overall Health & Equity Scores

Metric	Result for Project Census Tract
CalEnviroScreen 4.0 Score for Project Location (a)	53.0
Healthy Places Index Score for Project Location (b)	76.0
Project Located in a Designated Disadvantaged Community (Senate Bill 535)	No
Project Located in a Low-Income Community (Assembly Bill 1550)	Yes
Project Located in a Community Air Protection Program Community (Assembly Bill 617)	No

a: The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.
b: The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

7.4. Health & Equity Measures

No Health & Equity Measures selected.

7.5. Evaluation Scorecard

Health & Equity Evaluation Scorecard not completed.

7.6. Health & Equity Custom Measures

No Health & Equity Custom Measures created.

8. User Changes to Default Data

Screen	Justification

Operations: Vehicle Data	The existing MT facility generates 100 trips. No new trips are anticipated with the relocation. As a worst case analysis, the project was modeled with 100 daily trips from buses and an additional 100 trips from passenger vehicles.
Operations: Fleet Mix	The existing MT facility generates 100 trips. No new trips are anticipated with the relocation. As a worst case analysis, the project was modeled with 100 daily trips from buses and an additional 100 trips from passenger vehicles.
Construction: Construction Phases	The Project Site is vacant.

APPENDIX B
BIOLOGICAL RESOURCES ASSESSMENT & JURISDICTIONAL DELINEATION
JANUARY 2023

BIOLOGICAL RESOURCES ASSESSMENT AND JURISDICTIONAL DELINEATION FOR THE PROPOSED ADMINISTRATION AND MAINTENANCE BUILDING FOR THE MOUNTAIN AREA REGIONAL TRANSIT AUTHORITY, IN THE CITY OF BIG BEAR LAKE, CALIFORNIA

Prepared for:

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Contents

SECTION 1.0 – INTRODUCTION

Jennings Environmental, LLC (Jennings) was retained by Lilburn Corporation (Lilburn) to conduct a literature review and reconnaissance-level survey for the proposed Administrative and Maintenance Buildings for the Mountain Area Regional Transit Authority (Project), within the City of Big Bear Lake, San Bernardino County, California. The survey identified vegetation communities, the potential for the occurrence of special status species, or habitats that could support special status wildlife species, and recorded all plants and animals observed or detected within the Project boundary. This biological resources assessment is designed to address potential effects of the proposed project to designated critical habitats and/or any species currently listed or formally proposed for listing as endangered or threatened under the federal Endangered Species Act (ESA) and the California Endangered Species Act (CESA) or species designated as sensitive by the California Department of Fish and Wildlife (CDFW) or the California Native Plant Society (CNPS). Information contained in this document is in accordance with accepted scientific and technical standards that are consistent with the requirements of the United States Fish and Wildlife Service (USFWS) and (CDFW). Additionally, the site was surveyed for any drainage features that would meet the definition of the Waters of the US (WOUS), Waters of the State (WOS), or CDFW jurisdiction.

1.1 PROJECT LOCATION

The project is generally located in the southern portion of Sections 16 and 21, Township 2 North, Range 1 East, and is depicted on the *Fawskin and Big Bear Lake* U.S. Geological Survey's (USGS) 7.5-minute quadrangles topographic map. More specifically the project is located within Assessor Parcel Numbers (APNs) 2328-021-12 and -13, within the City of Big Bear Lake, San Bernardino County, California. The Project site is located on the northwest corner of the intersection of Business Center Drive and Sandalwood Drive. The site is surrounded by undeveloped land and land that is currently being developed to the east. (Figures 1 and 2 in Appendix A).

1.2 PROJECT DESCRIPTION

The Mountain Area Regional Transit Authority ("MT") ("Project Applicant") is a public transit agency that primarily serves the rural communities in the San Bernardino Mountains, including the Big Bear Valley, Crestline, Lake Arrowhead, Running Springs; and the City of Big Bear Lake. The current facilities located at 41939 Fox Farm Road in the City of Big Bear Lake, and 621 Forest Shade Road, Crestline, are both under-sized and have a variety of technical difficulties that make service provisions difficult. In addition, MT is experiencing a growth in service and ridership, with expansions in fixed-route and Dial-A-Ride service in Big Bear Valley (BBV) and a ridership increase (not including service expansion) of 1.32% annually. MT proposed the following service expansions in their 2016 Short Range Transit Plan: RIM trolley/summer weekend service expansion, RIM Dial-A-Ride expansion, BBV fixed route expansion, BBV resort expansion, BBV Off-the-Mountain (OTM) expansion, leasing buses for the Big Bear Mountain Resort (BBMR) service during winter months, and BBV Dial-A-Ride expansion.

As such, MT is proposing to relocate operations from the current locations to 170 Business Center Drive in the City of Big Bear Lake, San Bernardino County. The relocation would require approval of a Conditional

Use Permit (CUP) to develop an administrative and bus maintenance facility at the proposed Project Site. The 3.55-acre Project Site is located on the northwest corner of Business Center Drive and Sandalwood Drive.

The Project Site is part of Tentative Tract Map (TTM) Application 2007-278, which was approved by the Planning Commission by the adoption of Resolution PC 2008-24 on August 20, 2008. TTM Application 2007-278 proposed to subdivide an 11.02-acre parcel and develop eight business park lots for General Commercial uses. The TTM Application included the rough grading of individual pads and the installation of street and utility infrastructure, including wet and dry utilities and storm drains within the 11.02-acre site. MT has acquired two of the parcels within the subdivision; however, the City of Big Bear Lake has determined that the underlying Mitigated Negative Declaration adopted for the subdivision did not include evaluation of specific land uses.

The Project Site is designated in the General Plan as Commercial General and zoned Commercial – General (C-2). Subject to a CUP, the Proposed Project is an allowable use within the C-2 zoning district. The Proposed Project would include an 11,470-square-foot (SF) maintenance building and an 11,200-SF administrative building (see Figure 3 – Site Plan). The maintenance building would consist of maintenance bays, a bus wash, and support spaces for repairs and maintenance of MT's bus fleet. The proposed administration/operations building would house administrative offices and support spaces for staff. See table below for description of the proposed buildings.

SECTION 2.0 – METHODOLOGY

2.1 LITERATURE REVIEW

Prior to performing the field survey, existing documentation relevant to the Project site was reviewed. The most recent records were reviewed for the following quadrangle containing and surrounding the Project site: *Big Bear Lake, Fawnskin, Big Bear City,* and *Moonridge,* USGS 7.5-minute quadrangles. The *Big Bear City* and *Moonridge* quads were included in this search due to the site's proximity to their borders. These databases contain records of reported occurrences of federal- or state-listed endangered or threatened species, California Species of Concern (SSC), or otherwise special status species or habitats that may occur within or in the immediate vicinity of the Project site. These sources include:

- California Natural Diversity Database (CNDDB) managed by CDFW (CDFW 2023)
- USFWS Critical Habitat Mapper (USFWS 2023)
- California Native Plant Society's Electronic Inventory (CNPSEI) of Rare and Endangered Vascular Plants of California (CNPS 2023), issuer of the California Rare Plant Rank.
- U.S. Fish and Wildlife (USFWS) threatened and endangered species occurrence GIS overlay;
- USDA Natural Resources Conservation Service (NRCS) Web Soil Survey;
- USGS National Map;
- Calwater Watershed Maps
- Environmental Protection Agency My Waters Maps
- USFWS Designated Critical Habitat Maps
- San Bernardino County Biotic Resources Map

2.2 SOILS

Before conducting the surveys, soil maps for San Bernardino County were referenced online to determine the types of soil found within the Project site. Soils were determined in accordance with categories set forth by the United States Department of Agriculture (USDA) Soil Conservation Service and by referencing the USDA Natural Resources Conservation Service (NRCS) Web Soil Survey (USDA 2023).

2.3 BIOLOGICAL RECONNAISSANCE-LEVEL SURVEY

Jennings biologist, Gene Jennings, conducted the general reconnaissance survey within the Project site to identify the potential for the occurrence of special status species, vegetation communities, or habitats that could support special status wildlife species. The surveys were conducted on foot, throughout the Project site between 0735 and 0900 hours on January 21, 2023. Weather conditions during the survey included temperatures ranging from 12.5 to 14.6 degrees Fahrenheit, with clear skies, no precipitation, and 0 to 1.9 mile-per-hour winds. Photographs of the Project site were taken to document existing conditions (Appendix B).

2.4 JURISDICTIONAL FEATURES

A general assessment of jurisdictional waters regulated by the United States Army Corps of Engineers (USACE), Regional Water Quality Control Board (RWQCB), and CDFW was conducted for the proposed Project area. Pursuant to Section 404 of the Clean Water Act, USACE regulates the discharge of dredged and/or fill material into waters of the United States. The State of California (State) regulates the discharge of material into waters of the State pursuant to Section 401 of the Clean Water Act and the California Porter- Cologne Water Quality Control Act (California Water Code, Division 7, §13000 et seq.). Pursuant to Division 2, Chapter 6, Sections 1600-1602 of the California Fish and Game Code, CDFW regulates all diversions, obstructions, or changes to the natural flow or bed, channel, or bank of any river, stream, or lake, which supports fish or wildlife. The assessment was conducted by a desktop survey through the USGS National Hydrography Dataset for hydrological connectivity. An additional discussion of the regulatory framework is provided in Appendix C.

2.5 VEGETATION

All plant species observed within the Project site were recorded. Vegetation communities within the Project site were identified and qualitatively described. Plant communities were determined in accordance with the *Manual of California Vegetation*, *Second Edition* (Sawyer et al. 2009). Plant nomenclature follows that of *The Jepson Manual, Second Edition* (Baldwin et al. 2012). A comprehensive list of the plant species observed during the survey is provided in Appendix D.

2.6 WILDLIFE

All wildlife and wildlife signs observed and detected, including tracks, scat, carcasses, burrows, excavations, and vocalizations, were recorded. Additional survey time was spent in those habitats most likely to be utilized by wildlife (native vegetation, wildlife trails, etc.) or in habitats with the potential to support state- and/or federally listed or otherwise special status species. Notes were made on the general habitat types, species observed, and the conditions of the Project site. A comprehensive list of the wildlife species observed during the survey is provided in Appendix D.

2.7 WILDLIFE CORRIDORS AND HABITAT CONSERVATION PLAN

According to the California Essential Habitat Connectivity Project, the Project Site is not mapped within an area for wildlife movement. Additionally, the Project site is not within or adjacent to a habitat conservation plan. Therefore, the proposed Project will not have an impact on any current wildlife corridors or habitat conservation plans.

SECTION 3.0 – RESULTS

3.1 LITERATURE REVIEW RESULTS

According to the CNDDB, CNPSEI, and other relevant literature and databases, 104 sensitive species, 20 of which are listed as threatened or endangered, and 2 sensitive habitats, have been documented in the *Big Bear Lake, Fawnskin, Big Bear City,* and *Moonridge* quads. The *Big Bear City* and *Moonridge* quads were included in this search due the site's proximity to their borders. This list of sensitive species and habitats includes any State and/or federally listed threatened or endangered species, CDFW designated Species of Special Concern (SSC) and otherwise Special Animals. "Special Animals" is a general term that refers to all of the taxa the CNDDB is interested in tracking, regardless of their legal or protection status. This list is also referred to as the list of "species at risk" or "special status species." The CDFW considers the taxa on this list to be those of greatest conservation need.

An analysis of the likelihood for the occurrence of all CNDDB sensitive species documented in the *Big Bear Lake, Fawnskin, Big Bear City,* and *Moonridge* quads is provided in Table 1, in Appendix D. This analysis takes into account species range as well as documentation within the vicinity of the project area and includes the habitat requirements for each species and the potential for their occurrence on the site, based on required habitat elements and range relative to the current site conditions. According to the databases, no sensitive habitat, including USFWS designated critical habitat, occurs within or adjacent to the project site.

3.1.1 SOILS

After review of USDA Soil Conservation Service and by referencing the USDA NRCS Web Soil Survey (USDA 2023), it was determined that the Project site is located within the San Bernardino County National Forest Area, California area CA777. Figure 3 in Attachment A shows the location of the different historical soil types. Based on the results of the database search, three (3) soil types are documented in the area:

Garloaf-Urban land complex, 4 to 9 percent slopes (303). This soil is well drained with a moderately low to moderately high capacity to transmit water. This soil consists of alluvium derived from granitoid, typically ranges in elevation from 6,740 to 7,200 feet above mean sea level (amsl) and is not considered prime farmland.

Moonridge-Shayroad-cariboucreek complex, 0 to 4 percent slopes (305). This soil is well drained with a moderately high to high capacity to transmit water. This soil consists of alluvium derived from granitoid, typically ranges in elevation from 6,690 to 7,270 feet above mean sea level (amsl) and is considered prime farmland if irrigated.

Urban land (135). This classification is given to soils that are developed or no longer exist in a natural state. This classification is not considered prime farmland.

This database search contains historical soil data and does not reflect the current soil conditions on-site. As noted in the April 11, 2022, Geotechnical Investigation, the site is completely covered in fill material. The report notes that the entire site is covered with 3 feet of fill material that consists of non-native material.

3.1.2 SPECIAL STATUS SPECIES BACKGROUND

Of the 104 species found within the *Big Bear Lake, Fawnskin, Big Bear City,* and *Moonridge* quads, 20 have a special designation of either: federally listed, state listed, or a species of special concern (SSC) under California Fish and Game Code. The discussion below provides the background information on those species that have the potential to occur within the Project site or vicinity.

Southern rubber boa (Charina umbratical) – Threatened (State)

The State-listed as threatened southern rubber boa (rubber boa) is a small, rather stout-bodied snake with smooth scales and a blunt head and tail (Stewart et al. 2005). Adults grow to about 49.5-55.9 cm in length. Adults are light brown or tan in dorsal color with an unmarked yellow venter; juveniles are pale without a distinct margin between dorsal and ventral coloration (Stewart et al. 2005). Rubber boas are primarily fossorial and are rarely encountered on the surface, except on days and nights of high humidity and overcast sky. During warm months, it is active at night and on overcast days. It hibernates during winter, usually in crevices in rocky outcrops. Other potential hibernacula may be rotting stumps.

Typical habitat for this species is mixed conifer-oak forest or woodland dominated by two or more of the following species: Jeffrey pine (*Pinus jeffreyi*), yellow pine (*P. ponderosa*), sugar pine (*P. lambertiana*), incense cedar (*Calocedrus decurrens*), white fir (*Abies concolor*), and black oak (*Quercus kelloggii*) (Stewart et al., 2005). Rubber boas are usually found near streams or wet meadows or within or under surface objects with good moisture retaining properties such as rotting logs (CDFW 2014). Much of the literature suggests that the rubber boa prefers mixed conifer-oak forests and woodlands between 5,000 and 8,000 feet in elevation, especially in canyons and on cool, north facing slopes (CDFW 1987). However, the factors of overriding importance seem to be access to hibernation sites below the frost line and access to damp soil (Keasler 1982).

Rubber boa have been documented to the south and west of the Project site. Additional observations have been recorded in Little Bear Creek, which is located 0.03-miles northwest of the Project site. These occurrences likely represent movement corridors for this species. In addition to the Little Bear Creek occurrences, there are ten (10) rubber boa occurrences documented within approximately 5 miles of the subject parcel.

Bald eagle (Haliaeetus leucocephalus) – Delisted (Federal)/ Endangered (State)

The bald eagle (BAEA) was a federally-listed species until 2007 when it was delisted because of the increase in population. However, it remains a State-listed endangered species and is covered under the Migratory Bird Treaty Act (MBTA). BAEA are distinguished by a white head and white tail feathers, are powerful, brown birds that may weigh 14 pounds and have a wingspan of 8 feet. Male eagles are smaller, weighing as much as 10 pounds and have a wingspan of 6 feet. Sometimes confused with Golden Eagles, BAEA are mostly dark brown until they are four to five years old and acquire their characteristic coloring. They live near rivers, lakes, and marshes where they can find fish, their staple food. BAEA will also feed on waterfowl, turtles, rabbits, snakes, and other small animals and carrion. BAEA require a good food base, perching areas, and nesting sites. Their habitat includes estuaries, large lakes, reservoirs, rivers, and some seacoasts (CDFW 2016). In winter, the birds congregate near open water in tall trees for spotting prey and night roosts for sheltering (CDFW 1999). They mate for life, choosing the tops of large trees to build nests, which they typically use and enlarge each year. In most of California, the breeding season lasts from about January through July or August (CDFW 2016). Nests may reach 10 feet across and weigh a half ton. They may also have one or more alternate nests within their breeding territory (CDFW 2016). The young eagles are flying within three months and are on their own about a month later.

According to the CNDDB, the nearest occurrence for the BAEA is 0.83 miles northeast of the Project site. Some of the area surrounding the project site does provide habitat suitable to support BAEA.

California spotted owl (Strix occidentalis) – SSC

The California spotted owl (SPOW) is considered a SSC by the CDFW and is listed as a Sensitive Species by the U.S. Forest Service. The SPOW breeds and roosts in forests and woodlands with large old trees and snags, high basal areas of trees and snags, dense canopies (≥70% canopy closure), multiple canopy layers, and downed woody debris (Verner et al. 1992a, as cited in Davis and Gould 2008). Large, old trees are the key component; they provide nest sites and cover from inclement weather and add structure to the forest canopy and woody debris to the forest floor. These characteristics typify old-growth or late-seral-stage habitats (Davis and Gould 2008). Because the SPOW selects stands that have higher structural diversity and significantly more large trees than those generally available, it is considered a habitat specialist (Moen and Gutiérrez 1997, as cited in Davis and Gould 2008). In southern California, SPOW principally occupy montane hardwood and montane hard-wood-conifer forests, especially those with canyon live oak (*Quercus chrysolepis*) and bigcone Douglas-fir (*Pseudotsuga macrocarpa*), at mid- to high elevations (Davis and Gould 2008).

SPOW prey on small mammals, particularly dusky-footed woodrats (*Neotoma fuscipes*) at lower elevations (oak woodlands and riparian forests) and throughout southern California (Verner et al. 1992a, as cited in Davis and Gould 2008). The SPOW breeding season occurs from early spring to late summer or fall. Breeding spotted owls begin pre-laying behaviors, such as preening and roosting together, in February or March and juvenile owl dispersal likely occurs in September and October (Meyer 2007). The SPOW does not build its own nest but depends on finding suitable, naturally occurring sites in tree cavities or on broken-topped trees or snags, on abandoned raptor or common raven (*Corvus corax*) nests, squirrel nests, dwarf mistletoe (*Arceuthobium* spp.) brooms, or debris accumulations in trees (Davis and Gould 2008). In the San Bernardino Mountains, platform nests predominate (59%) and were in trees with an average diameter at breast height (dbh) of 75 cm, whereas cavity nest trees and broken-top nest trees were significantly larger (mean dbh of 108.3 cm and 122.3 cm, respectively) (LaHaye et al. 1997, as cited in Davis and Gould 2008).

According to LaHaye and Gutierrez (2005), urbanization in the form of primary and vacation homes has degraded or consumed some forest in most mountain ranges. The results of spotted owl surveys conducted between 1987 and 1998 in the San Bernardino Mountains indicated that a large area of potentially-suitable spotted owl habitat, enough to support 10-15 pairs, existed between Running Springs and Crestline (LaHaye and others 1999, as cited in LaHaye and Gutierrez 2005). However, only four pairs have been found in this area, and owls were found only in undeveloped sites. Thus, residential development within montane forests may preclude spotted owl occupancy, even when closed-canopy forest remains on developed sites (LaHaye and Gutierrez 2005).

Per the CNDDB Spotted Owl Observations Database (2021), the nearest documented SPOW activity center (roosting or nesting site) is approximately 0.68 miles southwest of the project site. Some of the area surrounding the project site does provide habitat suitable to support SPOW.

San Bernardino flying squirrel (Glaucomys oregonensis californicus) – SSC

The San Bernardino flying squirrel (flying squirrel) is considered a SSC by the CDFW and is listed as a Sensitive Species by the U.S. Forest Service. The flying squirrel is a nocturnally active, arboreal squirrel that is distinguished by the furred membranes extending from wrist to ankle that allow squirrels to glide through the air between trees at distances up to 91 meters (300 feet) (Wolf 2010). The San Bernardino flying squirrel is the most southerly distributed subspecies of northern flying squirrel (*Glaucomys sabrinus*) and is paler in color and smaller than most other northern flying squirrel subspecies. It inhabits high-elevation mixed conifer forests comprised of white fir, Jeffrey pine, and black oak between ~4,000 to 8,500 feet. It has specific habitat requirements that include associations with mature forests, large trees and snags, closed canopy, downed woody debris, and riparian areas, and it is sensitive to habitat fragmentation. It specializes in eating truffles (e.g. hypogeous mycorrhizal sporocarps) buried in the forest floor as well as arboreal lichens in winter when truffles are covered with snow and unavailable (Wolf 2010). This flying squirrel historically occurred as three isolated populations in the San Gabriel, San Bernardino, and San Jacinto mountain forests.

Flying squirrel populations are adversely affected by habitat fragmentation. Rosenberg and Raphael (1984) found that in northwestern California, the abundance of squirrels increased with stand size, they were generally absent in stands smaller than 20 hectares (ha), and approximately 75% of stands over 100 ha had flying squirrels. An additional problem with fragmented habitats is the constraints that open spaces pose to the movements of individuals and the colonization of unoccupied habitat patches. Mowrey and Zasada (1982) reported an average gliding distance of about 20 meters in *sabrinus*, with a maximum of 48 meters, and concluded that movements are unimpeded in areas with average openings of 20 meters and occasional openings of 30 to 40 meters.

The Flying Squirrels of Southern California is a project of the San Diego Natural History Museum (SDNHM), in collaboration with the U.S. Forest Service and the USFWS, to try to determine the distribution and habitat use of the flying squirrel in southern California. Per the SDNHM database, the nearest documented flying squirrel occurrence (2008) is approximately 0.72 miles southwest of the project site, within a more dense tree canopy area.

Bird-foot checkerbloom (Sidalcea pedate) – Endangered (Federal/State)

Bird-foot checkerbloom (Sidalcea pedata) is a narrow endemic restricted to the Big Bear Valley in the San Bernardino Mountains of San Bernardino County in Southern California. In 1984, it was listed as endangered in response to development pressures across its narrow geographical range (Krantz 1985). Sidalcea pedata is endemic to wet montane meadows and some adjacent drier habitats; remaining wet meadow fragments in the Big Bear Valley are estimated to total to 20 acres or less. Very little checkerbloom habitat is protected, and its habitat is threatened by urban development. Before a reserve or mitigation system can be developed for Sidalcea pedata, key biological attributes such as breeding system and pollinator ecology must be identified. The recovery plan (USDI Fish and Wildlife Service 1998) recognized that little is known about the biology of S. pedata despite the many surveys that have been done. In order to propose specific actions that will benefit the management and recovery of S. pedata, sound biological information on this species is required. Such science-based knowledge is essential for informing those involved in prioritizing habitat protection and in managing protected habitat.

3.1.3 JURISDICTIONAL WATERS

Aerial imagery of the site was examined and compared with the surrounding USGS 7.5-minute topographic quadrangle maps to identify drainage features within the survey area as indicated from topographic changes, blue-line features, or visible drainage patterns. The U.S. Fish and Wildlife Service National Wetland Inventory and Environmental Protection Agency (EPA) Water Program “My Waters” data layers were also reviewed to determine whether any hydrologic features and wetland areas had been documented within the vicinity of the site. Similarly, the Soil maps from the U.S. Department of Agriculture (USDA) - Natural Resources Conservation Service (NRCS) Web Soil Survey (USDA 2023) were reviewed to identify the soil series on-site and to check if they have been identified regionally as hydric soils. Upstream and downstream connectivity of waterways (if present) was reviewed in the field, on aerial imagery, and topographic maps to determine jurisdictional status. After a review of the aerials, it appeared that there was a jurisdictional feature on the western edge of the parcel.

3.1.4 HYDROLOGY AND HYDROLOGIC CONNECTIVITY

Hydrologically, the project site is located within Bear Valley Hydrologic Sub-Area (HSA 801.71), as identified on the Calwater Watershed maps. This undefined area comprises a 34,333-acre drainage area within the larger Bear Creek Watershed Area (Hydrologic Unit Code [HUC10] 1807020301, US Watershed Maps) (CalTrans, 2023). The Bear Creek watershed in Big Bear is bordered to the north by the Deep Creek, Crystal Creek – Lucerne Lake, and Arrastre Creek-Melville Lake watersheds, to the east by the Arrastre Creek-Melville Lake watershed, to the south by the Headwaters Santa Ana River watershed, and to the west by Deep Creek and Upper Santa Ana River watersheds. (Figure 4 in Appendix A).

3.1.5 DESIGNATED CRITICAL HABITAT

The site is not located within or adjacent to any USFWS-designated Critical Habitat. No further action is required.

3.2 FIELD STUDY RESULTS

3.2.1 VEGETATION

The site is completely bare of any vegetation and is currently being maintained as a storage yard for vehicles (plowing and weeding). Additionally, the site is comprised of fill material from non-native sources. The neighboring parcels do have some native vegetation in the form of *Ericameria nauseosa* Shrubland Alliance (rubber rabbitbrush scrub).

3.2.2 WILDLIFE

One bird was seen or heard during the survey. Species observed or otherwise detected on or in the vicinity of the project site during the surveys included; common raven (*Corvus corax*).

The project site is located within a partially developed area of Big Bear. As mentioned above the site is currently being used as an overflow parking area and is subject to mowing and plowing. Additionally, as noted in the Geotech Report, the site is non-native fill material. No natural land exists within the parcel boundary. There is no habitat within the proposed project footprint, as well as the immediate surrounding area, that is suitable for the sensitive species identified in the CNDDB search (Table 1 in Appendix D).

3.2.3 SPECIAL STATUS SPECIES

Southern rubber boa – Threatened (State)

Although this species has been observed within 5-miles of the project site, there is no suitable habitat within the Project boundary. The site is mostly disturbed with concrete or asphalt, and the small dirt landscaped areas are exposed to direct sunlight most of the year and do not retain moisture. Additionally, the Project site does not contain any fallen debris for hibernacula and there are no south-facing slopes to provide any rock outcrops. The site is also separated from the occupied habitat by multiple development projects. Therefore, this species is considered absent from the Project site and the proposed Project will not affect rubber boa.

Bald eagle – Delisted (Federal)/ Endangered (State)

The Project is not within or adjacent to any suitable BAEA foraging or nesting habitat. The nearest suitable habitat for this species is the Big Bear shoreline, which is approximately 0.47-miles north of the Project site. Additionally, the proposed Project does not require the removal of large old-growth vegetation. Therefore, the proposed project is will not affect BAEA and no further investigation relative to this species is warranted or required.

California spotted owl – SSC

The Project site is within an already disturbed area and the immediate vicinity has been subject to ongoing human disturbances associated with the existing commercial and residential developments in the area for a long time. Therefore, it is unlikely that the immediate surrounding area would be utilized by SPOW for nesting or roosting. Additionally, the Project site lacks the basic habitat requirements for this species. Furthermore, this species has not been documented within the project area. Although the U.S. Forest

Service does not survey for SPOW on private property, the surrounding San Bernardino National Forest areas have been surveyed extensively by the Forest Service since the late 1980s. For the reasons discussed, the Project area is not occupied by SPOW, and the proposed Project will not affect this species.

San Bernardino flying squirrel – SSC

The Project site and surrounding area does not provide habitat suitable to support flying squirrel. The surrounding area is either residential or commercial developments with scrub on the vacant adjacent parcels. Furthermore, this species has been documented within approximately 0.72 miles of the Project site, in mixed conifer forest habitat. The habitat within the surrounding vicinity is not suitable to support flying squirrel and the proposed Project would not result in impacts to this species. Additionally, the Project does not propose to remove large old-growth vegetation. Therefore, the proposed Project will not have an effect on this species.

Bird-foot checkerbloom – Endangered (Federal/State)

There are documented historical occurrences adjacent to the Project site. It is likely that the Project site did at one time contain suitable habitat for this species. However, the site is long suitable for this species. The soil on-site consists of 3 feet of non-native fill material and is continually disturbed by maintenance activities (mowing in the spring and plowing in the winter) and vehicle parking. Therefore, this species is considered absent from the Project site.

3.2.4 NESTING BIRDS

The immediate surrounding area does contain habitat suitable for nesting birds (developed shrubs and tall trees). As such the Project is subject to the following nesting bird regulations. Recommendations for avoidance and minimization are in section 4.

Migratory Bird Treaty Act

The Migratory Bird Treaty Act of 1918. This Act implements four international conservation treaties that the U.S. entered into with Canada in 1916, Mexico in 1936, Japan in 1972, and Russia in 1976. It is intended to ensure the sustainability of populations of all protected migratory bird species. The Act has been amended with the signing of each treaty, as well as when any of the treaties were amended, such as with Mexico in 1976 and Canada in 1995. The Act prohibits the take (including killing, capturing, selling, trading, and transport) of protected migratory bird species without prior authorization by the Department of Interior U.S. Fish and Wildlife Service.

California Fish and Game Code

The Project site is also subject to Sections 3503 and 3503.5 of the Fish and Game Code. Section 3503 states, "It is unlawful to take, possess, or needlessly destroy the nest or eggs of any bird, except as otherwise provided by this code or any regulation made pursuant thereto". And Section 3503.5 states, "It is unlawful to take, possess, or destroy any birds in the orders Falconiformes or Strigiformes (birds-of-prey) or to take, possess, or destroy the nest or eggs of any such bird except as otherwise provided by this code or any regulation adopted pursuant thereto".

3.2.5 JURISDICTIONAL WATERS

Waters of the United States and Waters of the State

The USACE has the authority to permit the discharge of dredged or fill material in Waters of the U.S. (WOUS) under Section 404 CWA. While the Regional Water Quality Board has authority over the discharge of dredged or fill material in Waters of the State under Section 401 CWA as well as the Porter-Cologne Water Quality Control Act. The Project area was surveyed with 100 percent visual coverage and no drainage features were present on site that met the definition for WOUS. As such, the subject parcel does not contain any wetlands, Waters of the U.S., or Waters of the State.

Fish and Game Code Section 1602 - State Lake and/or Streambed

The CDFW asserts jurisdiction over any drainage feature that contains a definable bed and bank or associated riparian vegetation. The Project area was surveyed with 100 percent visual coverage and no definable bed or bank features exist on the project site. As such, the subject parcel does not contain any areas under CDFW jurisdiction.

Section 4.0 – CONCLUSIONS AND RECOMMENDATIONS

Based on the literature review and personal observations made on-site and in the immediate vicinity, no State and/or federally listed threatened or endangered species are documented/or expected to occur within the Project site. Additionally, no plant species with the California Rare Plant Rank (CRPR) of 1 or 2 were observed on-site. No other sensitive species were observed within the Project area or buffer area.

Jurisdictional Features

There are no streams, channels, washes, or swales that meet the definitions of Section 1600 of the State of California Fish and Game Code (FGC) under the jurisdiction of the CDFW, Section 401 ("Waters of the State") of the Clean Water Act (CWA) under the jurisdiction of the Regional Water Quality Control Board (RWQCB), or "Waters of the United States" (WoUS) as defined by Section 404 of the CWA under the jurisdiction of the U.S. Army Corps of Engineers (Corps) within the subject parcel. Therefore, no permit from any regulatory agency will be required.

Nesting Birds

Since there is some habitat within the immediate surrounding area that is suitable for nesting birds in general, the following mitigation measure should be implemented if any future construction is proposed:

> Nesting bird nesting season generally extends from February 1 through September 15 in southern California and specifically, March 15 through August 31 for migratory passerine birds. To avoid impacts to nesting birds (common and special status) during the nesting season, a qualified Avian Biologist will conduct pre-construction Nesting Bird Surveys (NBS) prior to project-related disturbance to nestable vegetation to identify any active nests. If no active nests are found, no further action will be required. If an active nest is found, the biologist will set appropriate no-work buffers around the nest which will be based upon the nesting species, its sensitivity to disturbance, nesting stage and expected types, intensity and duration of disturbance. The nests and buffer zones shall be field

checked weekly by a qualified biological monitor. The approved no-work buffer zone shall be clearly marked in the field, within which no disturbance activity shall commence until the qualified biologist has determined the young birds have successfully fledged and the nest is inactive.

Certification

I hereby certify that the statements furnished herein, and in the attached exhibits present data and information required for this analysis to the best of my ability, and the facts, statements, and information presented are true and correct to the best of my knowledge and belief. This report was prepared in accordance with professional requirements and standards. Fieldwork conducted for this assessment was performed by me. I certify that I have not signed a non-disclosure or consultant confidentiality agreement with the project proponent and that I have no financial interest in the project.

Please do not hesitate to contact me at 909-534-4547 should you have any questions or require further information.

Sincerely,

Gene Jennings

Gene Jennings
Principal/Regulatory Specialist

Appendices:

- Appendix A – Figures
- Appendix B – Site Photos
- Appendix C – Regulatory Framework
- Appendix D – Tables

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Appendix A – Figures

Admin. and Maint. Building for MARTA
Big Bear Lake, CA

Figure 1 - Regional Overview and Site Vicinity

JE JENNINGS ENVIRONMENTAL

Miles 0 0.1 0.2 0.4 0.6 0.8

1:24,000

Service Layer Credits: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community
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Admin. and Maint. Building for MARTA
Big Bear Lake, CA

Figure 2 - Site Location

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
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Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community

Date: 1/24/2023

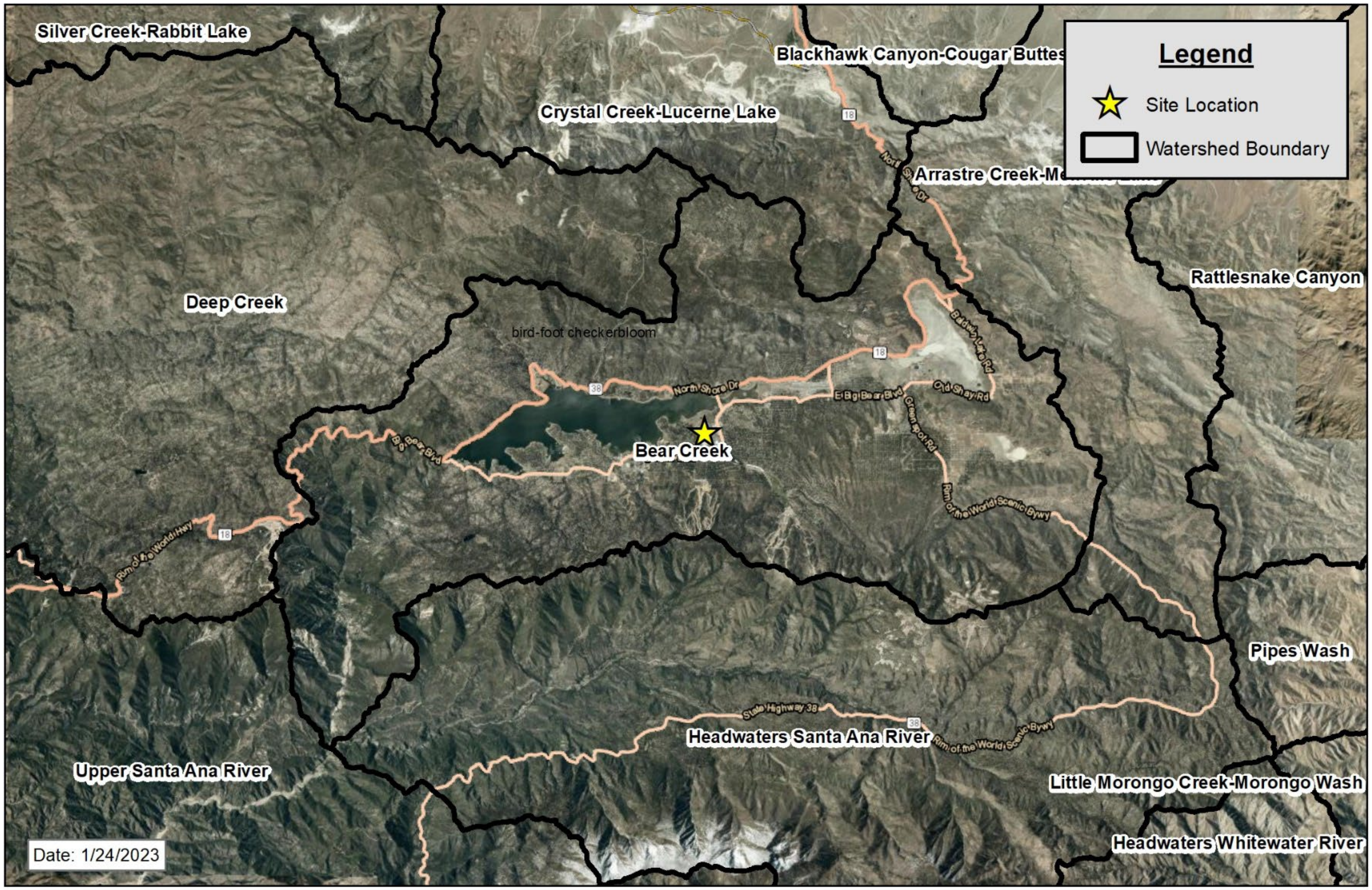
Admin. and Maint. Building for MARTA
Big Bear Lake, CA

Figure 3- Historical Soils Overlay

Feet
0 25 50 100 150 200

1:1,250

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Esri, HERE, Garmin, (c) OpenStreetMap contributors
Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community



Date: 1/24/2023

Admin. and Maint. Building for MARTA
Big Bear Lake, CA

Figure 4 - Hydrology

Miles
0 0.5 1 2 3 4

1:158,608

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
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Appendix B – Photos

	Photo 1 – Southern edge of parcel, facing east. Showing vehicle storage and fill height.
	Photo 2 – Southern section of parcel, facing northwest. Showing tire marks and fill material.

Photo 3 – Southern portion of parcel, facing southwest. Showing fill material and tire marks.

Photo 4 – Photo sample of fill material.

Appendix C – Regulatory Framework

1.1 FEDERAL JURISDICTION

1.1.1 United States Army Corps of Engineers

Activities within inland streams, wetlands, and riparian areas in California are regulated by agencies at the federal, state, and regional levels. At the federal level, the U.S. Army Corps of Engineers (USACE) Regulatory Program regulates activities within wetlands and waters of the US pursuant to Section 404 of the Federal Clean Water Act (CWA).

At the state level, the California Department of Fish and Wildlife (CDFW) regulates activities within the bed, bank, and associated habitat of a stream under the Fish and Game Code §§ 1600–1616. The California State Water Resources Board (SWRB) delegates authority at the regional level to Regional Water Quality Control Boards (RWQCB) that are responsible for regulating discharge into waters of the US under Section 401 of the federal CWA and waters of the State under the California Porter-Cologne Water Quality Act.

The CWA was implemented to maintain and restore the chemical, physical, and biological integrity of the Waters of the United States (33 Code of Federal Regulations [CFR] Part 328 Section 328.3). "Waters of the US" are defined as follows:

> **§ 328.3 Definitions.**
>
> For the purpose of this regulation these terms are defined as follows:
>
> (a) *Waters of the United States* means:
>
> (1) Waters which are:
>
> (i) Currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide;
>
> (ii) The territorial seas; or
>
> (iii) Interstate waters, including interstate wetlands;
>
> (2) Impoundments of waters otherwise defined as waters of the United States under this definition, other than impoundments of waters identified under paragraph (a)(5) of this section;
>
> (3) Tributaries of waters identified in paragraph (a)(1) or (2) of this section:
>
> (i) That are relatively permanent, standing or continuously flowing bodies of water; or
>
> (ii) That either alone or in combination with similarly situated waters in the region, significantly affect the chemical, physical, or biological integrity of waters identified in paragraph (a)(1) of this section;
>
> (4) Wetlands adjacent to the following waters:
>
> (i) Waters identified in paragraph (a)(1) of this section; or
>
> (ii) Relatively permanent, standing or continuously flowing bodies of water identified in paragraph (a)(2) or (a)(3)(i) of this section and with a continuous surface connection to those waters; or

(iii) Waters identified in paragraph (a)(2) or (3) of this section when the wetlands either alone or in combination with similarly situated waters in the region, significantly affect the chemical, physical, or biological integrity of waters identified in paragraph (a)(1) of this section;

(5) Intrastate lakes and ponds, streams, or wetlands not identified in paragraphs (a)(1) through (4) of this section:

(i) That are relatively permanent, standing or continuously flowing bodies of water with a continuous surface connection to the waters identified in paragraph (a)(1) or (a)(3)(i) of this section; or

(ii) That either alone or in combination with similarly situated waters in the region, significantly affect the chemical, physical, or biological integrity of waters identified in paragraph (a)(1) of this section.

(b) The following are not ‘‘waters of the United States’’ even where they otherwise meet the terms of paragraphs (a)(2) through (5) of this section:

(1) Waste treatment systems, including treatment ponds or lagoons, designed to meet the requirements of the Clean Water Act;

(2) Prior converted cropland designated by the Secretary of Agriculture The exclusion would cease upon a change of use, which means that the area is no longer available for the production of agricultural commodities. Notwithstanding the determination of an area’s status as prior converted cropland by any other Federal agency, for the purposes of the Clean Water Act, the final authority regarding Clean Water Act jurisdiction remains with EPA;

(3) Ditches (including roadside ditches) excavated wholly in and draining only dry land and that do not carry a relatively permanent flow of water;

(4) Artificially irrigated areas that would revert to dry land if the irrigation ceased;

(5) Artificial lakes or ponds created by excavating or diking dry land to collect and retain water and which are used exclusively for such purposes as stock watering, irrigation, settling basins, or rice growing;

(6) Artificial reflecting or swimming pools or other small ornamental bodies of water created by excavating or diking dry land to retain water for primarily aesthetic reasons;

(7) Waterfilled depressions created in dry land incidental to construction activity and pits excavated in dry land for the purpose of obtaining fill, sand, or gravel unless and until the construction or excavation operation is abandoned and the resulting body of water meets the definition of waters of the United States; and

(8) Swales and erosional features (*e.g.,* gullies, small washes) characterized by low volume, infrequent, or short duration flow.

(c) In this section, the following definitions apply:

(1) *Wetlands* means those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically

adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

(2) *Adjacent* means bordering, contiguous, or neighboring. Wetlands separated from other waters of the United States by man-made dikes or barriers, natural river berms, beach dunes, and the like are ''adjacent wetlands.''

(3) *High tide line* means the line of intersection of the land with the water's surface at the maximum height reached by a rising tide. The high tide line may be determined, in the absence of actual data, by a line of oil or scum along shore objects, a more or less continuous deposit of fine shell or debris on the foreshore or berm, other physical markings or characteristics, vegetation lines, tidal gages, or other suitable means that delineate the general height reached by a rising tide. The line encompasses spring high tides and other high tides that occur with periodic frequency but does not include storm surges in which there is a departure from the normal or predicted reach of the tide due to the piling up of water against a coast by strong winds such at those accompanying a hurricane or other intense storm.

(4) *Ordinary high water mark* means that line on the shore established by the fluctuations of water and indicated by physical characteristics such as clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas.

(5) *Tidal waters* means those waters that rise and fall in a predictable and measurable rhythm or cycle due to the gravitational pulls of the moon and sun. Tidal waters end where the rise and fall of the water surface can no longer be practically measured in a predictable rhythm due to masking by hydrologic, wind, or other effects.

(6) *Significantly affect* means a material influence on the chemical, physical, or biological integrity of waters identified in paragraph (a)(1) of this section. To determine whether waters, either alone or in combination with similarly situated waters in the region, have a material influence on the chemical, physical, or biological integrity of waters identified in paragraph (a)(1) of this section, the

functions identified in paragraph (c)(6)(i) of this section will be assessed and the factors identified in paragraph (c)(6)(ii) of this section will be considered:

(i) Functions to be assessed:

    - (A) Contribution of flow;
    - (B) Trapping, transformation, filtering, and transport of materials (including nutrients, sediment, and other pollutants);
    - (C) Retention and attenuation of floodwaters and runoff;
    - (D) Modulation of temperature in waters identified in paragraph (a)(1) of this section; or
    - (E) Provision of habitat and food resources for aquatic species located in waters identified in paragraph (a)(1) of this section;
- (ii) Factors to be considered:
    - (A) The distance from a water identified in paragraph (a)(1) of this section;
    - (B) Hydrologic factors, such as the frequency, duration, magnitude, timing, and rate of hydrologic connections, including shallow subsurface flow;
    - (C) The size, density, or number of waters that have been determined to be similarly situated;
    - (D) Landscape position and geomorphology; an
    - (E) Climatological variables such as temperature, rainfall, and snowpack.

1.2 STATE JURISDICTION

The State of California (State) regulates discharge of material into waters of the State pursuant to Section 401 of the CWA as well as the California Porter-Cologne Water Quality Control Act (Porter-Cologne; California Water Code, Division 7, §13000 et seq.). Waters of the State are defined by Porter-Cologne as “any surface water or groundwater, including saline waters, within the boundaries of the state” (Water Code Section 13050(e)). Waters of the State broadly includes all waters within the State’s boundaries (public or private), including waters in both natural and artificial channels.

1.2.1 Regional Water Quality Control Board

Under Porter-Cologne, the State Water Resources Control Board (SWRCB) and the local Regional Water Quality Control Boards (RWQCB) regulate the discharge of waste into waters of the State. Discharges of waste include “fill, any material resulting from human activity, or any other ‘discharge’ that may directly or indirectly impact ‘waters of the state.’” Porter-Cologne reserves the right for the State to regulate activities that could affect the quantity and/or quality of surface and/or groundwaters, including isolated wetlands, within the State. Wetlands were defined as waters of the State if they demonstrated both wetland hydrology and hydric soils. Waters of the State determined to be jurisdictional for these purposes require, if impacted, waste discharge requirements (WDRs).

When an activity results in fill or discharge directly below the OHWM of jurisdictional waters of the United States (federal jurisdiction), including wetlands, a CWA Section 401 Water Quality Certification is required. If a proposed project is not subject to CWA Section 401 certification but involves activities that may result in a discharge to waters of the State, the project may still be regulated under Porter-Cologne and may be subject to waste discharge requirements. In cases where waters apply to both CWA and Porter-Cologne, RWQCB may consolidate permitting requirements to one permit.

1.2.2 California Department of Fish and Wildlife

Pursuant to Division 2, Chapter 6, Sections 1600-1602 of the California Fish and Game Code, the California Department of Fish and Wildlife (CDFW) regulates all diversions, obstructions, or changes to the natural flow or bed, channel, or bank of any river, stream, or lake, which supports fish or wildlife.

CDFW defines a “stream” (including creeks and rivers) as “a body of water that flows at least periodically or intermittently through a bed or channel having banks and supports fish or other aquatic life. This includes watercourses having surface or subsurface flow that supports or has supported riparian vegetation” (California Code of Regulations, Title 14, Section 1.72). The jurisdiction of CDFW may include areas in or near intermittent streams, ephemeral streams, rivers, creeks, dry washes, sloughs, blue-line streams that are indicated on USGS maps, watercourses that may contain subsurface flows, or within the flood plain of a water body. CDFW’s definition of “lake” includes “natural lakes or man-made reservoirs.” CDFW limits of jurisdiction typically include the maximum extents of the uppermost bank-to-bank distance and/or the outermost extent of riparian vegetation dripline, whichever measurement is greater.

In a CDFW guidance of stream processes and forms in dryland watersheds (Vyverberg 2010), streams are identified as having one or more channels that may all be active or receive water only during some high flow event. Subordinate features, such as low flow channels, active channels, banks associated with secondary channels, floodplains, and stream-associated vegetation, may occur within the bounds of a single, larger channel. The water course is defined by the topography or elevations of land that confine a stream to a definite course when its waters rise to their highest level. A watercourse is defined as a stream with boundaries defined by the maximal extent or expression on the landscape even though flow may otherwise be intermittent or ephemeral.

Artificial waterways such as ditches (including roadside ditches), canals, aqueducts, irrigation ditches, and other artificially created water conveyance systems also may be under the jurisdiction of CDFW. CDFW may claim jurisdiction over these features based on the presence of habitat characteristics suitable to support aquatic life, riparian vegetation, and/or stream-dependent terrestrial wildlife. As with natural waterways, the limit of CDFW jurisdiction of artificial waterways includes the uppermost bank-to-bank distance and/or the outermost extent of riparian vegetation dripline, whichever measurement is greater.

CDFW does not have jurisdiction over wetlands but has jurisdiction to protect against a net loss of wetlands. CDFW supports the wetland criteria recognized by USFWS; one or more indicators of wetland conditions must exist for wetlands conditions to be considered present. The following is the USFWS accepted definition of a wetland:

> Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. For purposes of this classification, wetlands must have one or more of the following three attributes: (1) at least periodically, the lands supports hydrophytes, (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is nonsoil and is saturated withwater or covered by shallow water at some time during the growing season of each year (Cowardin et al. 1979).

In A Clarification of the U.S. Fish and Wildlife Service's Wetland Definition (Tiner 1989), the USFWS definition was further clarified "that in order for any area to be classified as wetland by the Service, the area must be periodically saturated or covered by shallow water, whether wetland vegetation and/or hydric soils are present or not; this hydrologic requirement is addressed in the first sentence of the definition." When considering whether an action would result in a net loss of wetlands, CDFW will extend jurisdiction to USFWS-defined wetland conditions where such conditions exist within the riparian vegetation that is associated with a stream or lake and does not depend on whether those features meet the three-parameter USACE methodology of wetland determination. If impacts to wetlands under the jurisdiction of CDFW are unavoidable, a mitigation plan will be implemented in coordination with CDFW to support the CDFW policy of "no net loss" of wetland habitat.

Appendix D – Tables

Table 1 – CNDDB Potential to Occur for the *Big Bear Lake, Fawnskin, Big Bear City, and Moonridge* USGS 7.5 minute Quadrangles

Scientific Name	Common Name	Federal / State Status	Other Status	Habitat	Potential to Occur
Acanthoscyphus parishii var. cienegensis	Cienega Seca oxytheca	None, None	G4?T2, S2, 1B.3	Upper montane coniferous forest, pinyon and juniper woodland, Joshua tree woodland. Dry gravelly banks and granitic sand. 1920-2560 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Acanthoscyphus parishii var. goodmaniana	Cushenbury oxytheca	Endangered, None	G4?T1, S1, 1B.1	Pinyon and juniper woodland. On limestone talus and rocky slopes. 1400-2350 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Accipiter cooperii	Cooper's hawk	None, None	G5, S4, CDFW-WL	Woodland, chiefly of open, interrupted or marginal type. Nest sites mainly in riparian growths of deciduous trees, as in canyon bottoms on river flood-plains; also, live oaks.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.

Scientific Name	**Common Name**	**Federal / State Status**	**Other Status**	**Habitat**	**Potential to Occur**
Anniella stebbinsi	Southern California legless lizard	None, None	G3, S3, CDFW-SSC	Generally south of the Transverse Range, extending to northwestern Baja California. Occurs in sandy or loose loamy soils under sparse vegetation. Disjunct populations in the Tehachapi and Piute Mountains in Kern County. Variety of habitats; generally in moist, loose soil. They prefer soils with a high moisture content.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Antennaria marginata	white-margined everlasting	None, None	G4G5, S1, 2B.3	Lower montane coniferous forest, upper montane coniferous forest. Dry woods. 2070-3355 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Aquila chrysaetos	golden eagle	None, None	G5, S3, CDFW-WL	Rolling foothills, mountain areas, sage-juniper flats, and desert. Cliff-walled canyons provide nesting habitat in most parts of range; also, large trees in open areas.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Arenaria lanuginosa var. saxosa	rock sandwort	None, None	G5T5, S2, 2B.3	Subalpine coniferous forest, upper montane coniferous forest. Mesic, sandy sites. 1920-2935 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.

Scientific Name	Common Name	Federal / State Status	Other Status	Habitat	Potential to Occur
Astragalus albens	Cushenbury milk-vetch	Endangered, None	G1, S1, 1B.1	Joshua tree woodland, Mojavean desert scrub, pinyon and juniper woodland. Sandy or stony flats, rocky hillsides, canyon washes, and fans, on carbonate or mixed granitic-calcareous debris. 1185-1950 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Astragalus bernardinus	San Bernardino milk-vetch	None, None	G3, S3, 1B.2	Joshua tree woodland, pinyon and juniper woodland. Granitic or carbonate substrates. 290-2290 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Astragalus lentiginosus var. sierrae	Big Bear Valley milk-vetch	None, None	G5T2, S2, 1B.2	Mojavean desert scrub, meadows and seeps, pinyon and juniper woodland, upper montane coniferous forest. Stony meadows and open pinewoods; sandy and gravelly soils in a variety of habitats. 1710-3230 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.

Scientific Name	Common Name	Federal / State Status	Other Status	Habitat	Potential to Occur
Astragalus leucolobus	Big Bear Valley woollypod	None, None	G2, S2, 1B.2	Lower montane coniferous forest, pebble plain, pinyon and juniper woodland, upper montane coniferous forest. Dry pine woods, gravelly knolls among sagebrush, or stony lake shores in the pine belt. 1460-2895 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Astragalus tidestromii	Tidestrom's milk-vetch	None, None	G4, S2, 2B.2	Mojavean desert scrub. Washes, in sandy or gravelly soil. On limestone. 765-1575 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Atriplex parishii	Parish's brittlescale	None, None	G1G2, S1, 1B.1	Vernal pools, chenopod scrub, playas. Usually on drying alkali flats with fine soils. 4-1420 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Berberis fremontii	Fremont barberry	None, None	G5, S3, 2B.3	Pinyon and juniper woodland, Joshua tree woodland. Rocky, sometimes granitic. 1140-1770 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.

Scientific Name	**Common Name**	**Federal / State Status**	**Other Status**	**Habitat**	**Potential to Occur**
Boechera dispar	pinyon rockcress	None, None	G3, S3, 2B.3	Joshua tree woodland, pinyon and juniper woodland, Mojavean desert scrub. Granitic, gravelly slopes and mesas. Often under desert shrubs which support it as it grows. 1005-2805 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Boechera lincolnensis	Lincoln rockcress	None, None	G4G5, S3, 2B.3	Chenopod scrub, Mojavean desert scrub. On limestone. 880-2410 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Boechera parishii	Parish's rockcress	None, None	G2, S2, 1B.2	Pebble plain, pinyon and juniper woodland, upper montane coniferous forest. Generally found on pebble plains on clay soil with quartzite cobbles; sometimes on limestone. 1825-2805 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Boechera shockleyi	Shockley's rockcress	None, None	G3, S2, 2B.2	Pinyon and juniper woodland. On ridges, rocky outcrops and openings on limestone or quartzite. 875-2515 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.

Scientific Name	**Common Name**	**Federal / State Status**	**Other Status**	**Habitat**	**Potential to Occur**
Bombus caliginosus	obscure bumble bee	None, None	G2G3, S1S2	Coastal areas from Santa Barbara County north to Washington state. Food plant genera include Baccharis, Cirsium, Lupinus, Lotus, Grindelia and Phacelia.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Bombus crotchii	Crotch bumble bee	None, Candidate Endangered	G2, S2	Coastal California east to the Sierra-Cascade crest and south into Mexico. Food plant genera include Antirrhinum, Phacelia, Clarkia, Dendromecon, Eschscholzia, and Eriogonum.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Bombus morrisoni	Morrison bumble bee	None, None	G3, S1S2	From the Sierra-Cascade ranges eastward across the intermountain west. Food plant genera include Cirsium, Cleome, Helianthus, Lupinus, Chrysothamnus, and Melilotus.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Botrychium crenulatum	scalloped moonwort	None, None	G4, S3, 2B.2	Bogs and fens, meadows and seeps, upper montane coniferous forest, lower montane coniferous forest, marshes and swamps. Moist meadows, freshwater marsh, and near creeks. 1185-3110 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.

Scientific Name	**Common Name**	**Federal / State Status**	**Other Status**	**Habitat**	**Potential to Occur**
Calochortus palmeri var. palmeri	Palmer's mariposa-lily	None, None	G3T2, S2, 1B.2	Meadows and seeps, chaparral, lower montane coniferous forest. Vernally moist places in yellow-pine forest, chaparral. 195-2530 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Calochortus plummerae	Plummer's mariposa-lily	None, None	G4, S4, 4.2	Coastal scrub, chaparral, valley and foothill grassland, cismontane woodland, lower montane coniferous forest. Occurs on rocky and sandy sites, usually of granitic or alluvial material. Can be very common after fire. 60-2500 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Calochortus striatus	alkali mariposa-lily	None, None	G3, S2S3, 1B.2	Chaparral, chenopod scrub, Mojavean desert scrub, meadows and seeps. Alkaline meadows and ephemeral washes. 70-1600m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Calyptridium pygmaeum	pygmy pussypaws	None, None	G1G2, S1S2, 1B.2	Upper montane coniferous forest, subalpine coniferous forest. Sandy or gravelly sites. 2145-3415 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.

Scientific Name	Common Name	Federal / State Status	Other Status	Habitat	Potential to Occur
Carex occidentalis	western sedge	None, None	G4, S3, 2B.3	Lower montane coniferous forest, meadows and seeps. 1645-2320 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Castilleja cinerea	ash-gray paintbrush	Threatened, None	G1G2, S1S2, 1B.2	Pebble plains, upper montane coniferous forest, Mojavean desert scrub, meadows and seeps, pinyon and juniper woodland. Endemic to the San Bernardino Mountains, in clay openings; often in meadow edges. 725-2860 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Castilleja lasiorhyncha	San Bernardino Mountains owl's-clover	None, None	G2?, S2?, 1B.2	Meadows and seeps, pebble plain, upper montane coniferous forest, chaparral, riparian woodland. Mesic to drying soils in open areas of stream and meadow margins or in vernally wet areas. 1140-2320 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.

Scientific Name	Common Name	Federal / State Status	Other Status	Habitat	Potential to Occur
Chaetodipus fallax pallidus	pallid San Diego pocket mouse	None, None	G5T3T4, S3S4	Desert border areas in eastern San Diego County in desert wash, desert scrub, desert succulent scrub, pinyon-juniper, etc. Sandy, herbaceous areas, usually in association with rocks or coarse gravel.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Charina umbratica	southern rubber boa	None, Threatened	G2G3, S2S3,	Found in a variety of montane forest habitats. Previously considered morphologically intermediate, recent (2022) genomic analysis clarifies individuals from Mt Pinos, Tehachapi Mts, and southern Sierra Nevada are southern rubber boa. Found in vicinity of streams or wet meadows; requires loose, moist soil for burrowing; seeks cover in rotting logs, rock outcrops, and under surface litter.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Claytonia peirsonii ssp. bernardinus	San Bernardino spring beauty	None, None	G2G3T1, S1, 1B.1	Pinyon and juniper woodland, upper montane coniferous forest. Rocky, talus slopes, carbonate, usually openings. 2360-2465 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.

Scientific Name	Common Name	Federal / State Status	Other Status	Habitat	Potential to Occur
Claytonia peirsonii ssp. californacis	Furnace spring beauty	None, None	G2G3T1, S1, 1B.1	Pinyon and juniper woodland, upper montane coniferous forest. Rocky, talus slopes, carbonate, usually openings. 2300 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Corynorhinus townsendii	Townsend's big-eared bat	None, None	G4, S2, CDFW-SSC	Throughout California in a wide variety of habitats. Most common in mesic sites. Roosts in the open, hanging from walls and ceilings. Roosting sites limiting. Extremely sensitive to human disturbance.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Cymopterus multinervatus	purple-nerve cymopterus	None, None	G4G5, S2, 2B.2	Mojavean desert scrub, pinyon and juniper woodland. Sandy or gravelly places. 765-2195 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Drymocallis cuneifolia var. cuneifolia	wedgeleaf woodbeauty	None, None	G2T1, S1, 1B.1	Upper montane coniferous forest, riparian scrub. Sometimes on carbonate. 1520-2220 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Dryopteris filix-mas	male fern	None, None	G5, S2, 2B.3	Upper montane coniferous forest. In granite crevices. 1855-3075 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.

Scientific Name	**Common Name**	**Federal / State Status**	**Other Status**	**Habitat**	**Potential to Occur**
Dudleya abramsii ssp. affinis	San Bernardino Mountains dudleya	None, None	G4T2, S2, 1B.2	Pebble (pavement) plain, upper montane coniferous forest, pinyon and juniper woodland. Outcrops, granite or quartzite, rarely limestone. 1200-2425 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Empidonax traillii extimus	southwestern willow flycatcher	Endangered, Endangered	G5T2, S1	Riparian woodlands in Southern California.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Ensatina eschscholtzii klauberi	large-blotched salamander	None, None	G5T2?, S3, CDFW-WL	Found in conifer and woodland associations. Found in leaf litter, decaying logs and shrubs in heavily forested areas.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Eremogone ursina	Big Bear Valley sandwort	Threatened, None	G1, S1, 1B.2	Pebble plain, pinyon and juniper woodland, meadows and seeps. Mesic, rocky sites. 1795-2895 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Erigeron parishii	Parish's daisy	Threatened, None	G2, S2, 1B.1	Mojavean desert scrub, pinyon and juniper woodland. Often on carbonate; limestone mountain slopes; often associated with drainages. Sometimes on grainite. 1050-2245 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.

Scientific Name	Common Name	Federal / State Status	Other Status	Habitat	Potential to Occur
Eriogonum evanidum	vanishing wild buckwheat	None, None	G2, S1, 1B.1	Chaparral, cismontane woodland, lower montane coniferous forest, pinyon and juniper woodland. Sandy sites. 975-2240 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Eriogonum kennedyi var. alpigenum	southern alpine buckwheat	None, None	G4T3, S3, 1B.3	Alpine boulder and rock fields, subalpine coniferous forest. Dry granitic gravel. 2500-3415 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Eriogonum kennedyi var. austromontanum	southern mountain buckwheat	Threatened, None	G4T2, S2, 1B.2	Pebble (pavement) plain, lower montane coniferous forest. Usually found in pebble plain habitats. 1765-3020 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Eriogonum microthecum var. johnstonii	Johnston's buckwheat	None, None	G5T2, S2, 1B.3	Subalpine coniferous forest, upper montane coniferous forest. Slopes and ridges on granite or limestone. 1795-2865 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Eriogonum microthecum var. lacus-ursi	Bear Lake buckwheat	None, None	G5T1, S1, 1B.1	Lower montane coniferous forest, Great Basin scrub. Clay outcrops. 2000-2100 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.

Scientific Name	Common Name	Federal / State Status	Other Status	Habitat	Potential to Occur
Eriogonum ovalifolium var. vineum	Cushenbury buckwheat	Endangered, None	G5T1, S1, 1B.1	Mojavean desert scrub, pinyon and juniper woodland, Joshua tree woodland. Limestone mountain slopes. Dry, usually rocky places. 1430-2440 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Erythranthe exigua	San Bernardino Mountains monkeyflower	None, None	G2, S2, 1B.2	Meadows and seeps, pebble plains, upper montane coniferous forest. Seeps and sandy sometimes disturbed soil in moist drainages of annual streams; clay soils. 2060-2630 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Erythranthe purpurea	little purple monkeyflower	None, None	G2, S2, 1B.2	Meadows and seeps, pebble plain, upper montane coniferous forest. Dry clay or gravelly soils under Jeffrey pines, along annual streams or vernal springs and seeps. 2045-2290 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.

Scientific Name	Common Name	Federal / State Status	Other Status	Habitat	Potential to Occur
Euchloe hyantis andrewsi	Andrew's marble butterfly	None, None	G4G5T1, S1	Inhabits yellow pine forest near Lake Arrowhead and Big Bear Lake, San Bernardino Mtns, San Bernardino Co, 5000-6000 ft. Hostplants are Streptanthus bernardinus and Arabis holboellii var pinetorum; larval foodplant is Descurainia richardsonii.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Euphydryas editha quino	quino checkerspot butterfly	Endangered, None	G5T1T2, S1S2	Sunny openings within chaparral and coastal sage shrublands in parts of Riverside and San Diego counties. Hills and mesas near the coast. Need high densities of food plants Plantago erecta, P. insularis, and Orthocarpus purpurescens.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Gasterosteus aculeatus williamsoni	unarmored threespine stickleback	Endangered, Endangered	G5T1, S1, CDFW-FP	Weedy pools, backwaters, and among emergent vegetation at the stream edge in small Southern California streams. Cool (<24 C), clear water with abundant vegetation.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.

Scientific Name	**Common Name**	**Federal / State Status**	**Other Status**	**Habitat**	**Potential to Occur**
Gentiana fremontii	Fremont's gentian	None, None	G4, S2, 2B.3	Meadows and seeps, upper montane coniferous forest. Wet mountain meadows. 2400-2700 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Gilia leptantha ssp. leptantha	San Bernardino gilia	None, None	G4T2, S2, 1B.3	Lower montane coniferous forest. Sandy or gravelly sites. 1520-2595 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Glaucomys oregonensis californicus	San Bernardino flying squirrel	None, None	G5T1T2, S1S2, CDFW-SSC	Known from black oak or white fir dominated woodlands between 5200 - 8500 ft in the San Bernardino and San Jacinto ranges. May be extirpated from San Jacinto range. Needs cavities in trees/snags for nests and cover. Needs nearby water.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Haliaeetus leucocephalus	bald eagle	Delisted, Endangered	G5, S3, CDFW-FP	Ocean shore, lake margins, and rivers for both nesting and wintering. Most nests within 1 mile of water. Nests in large, old-growth, or dominant live tree with open branches, especially ponderosa pine. Roosts communally in winter.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.

Scientific Name	Common Name	Federal / State Status	Other Status	Habitat	Potential to Occur
Heuchera parishii	Parish's alumroot	None, None	G3, S3, 1B.3	Lower montane coniferous forest, subalpine coniferous forest, upper montane coniferous forest, alpine boulder and rock field. Rocky places. Sometimes on carbonate. 1340-3505 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Horkelia wilderae	Barton Flats horkelia	None, None	G1, S1, 1B.1	Lower montane coniferous forest, upper montane coniferous forest, chaparral. On rocky, north aspects in openings that hold persistent snowdrifts. 1980-2895 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Hulsea vestita ssp. pygmaea	pygmy hulsea	None, None	G5T1, S1, 1B.3	Alpine boulder and rock field, subalpine coniferous forest. Gravelly sites; on granite. 2860-3502 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Hydroporus simplex	simple hydroporus diving beetle	None, None	G1?, S1S3	Known from aquatic habitats in Tuolumne and San Bernardino counties.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.

Scientific Name	**Common Name**	**Federal / State Status**	**Other Status**	**Habitat**	**Potential to Occur**
Icteria virens	yellow-breasted chat	None, None	G5, S3, CDFW-SSC	Summer resident; inhabits riparian thickets of willow and other brushy tangles near watercourses. Nests in low, dense riparian, consisting of willow, blackberry, wild grape; forages and nests within 10 ft of ground.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Ivesia argyrocoma var. argyrocoma	silver-haired ivesia	None, None	G2T2, S2, 1B.2	Meadows and seeps, pebble plains, upper montane coniferous forest. In pebble plains and meadows with other rare plants. 1490-2960 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Lewisia brachycalyx	short-sepaled lewisia	None, None	G4, S2, 2B.2	Lower montane coniferous forest, meadows and seeps. Dry to moist meadows in rich loam. 1400-2290 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Lilium parryi	lemon lily	None, None	G3, S3, 1B.2	Lower montane coniferous forest, meadows and seeps, riparian forest, upper montane coniferous forest. Wet, mountainous terrain; generally in forested areas; on shady edges of streams, in open boggy meadows and seeps. 625-2930 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.

Scientific Name	Common Name	Federal / State Status	Other Status	Habitat	Potential to Occur
Linanthus killipii	Baldwin Lake linanthus	None, None	G1, S1, 1B.2	Alkaline meadows, pebble plain, pinyon and juniper woodland, Joshua tree woodland. Usually on pebble plains with other rare species. 1645-2645 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Malaxis monophyllos var. brachypoda	white bog adder's-mouth	None, None	G5T4T5, S1, 2B.1	Meadows and seeps, bogs and fens, upper montane coniferous forest. Hillside bogs and mesic meadows. 2375-2560 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Myotis evotis	long-eared myotis	None, None	G5, S3	Found in all brush, woodland and forest habitats from sea level to about 9000 ft. Prefers coniferous woodlands and forests. Nursery colonies in buildings, crevices, spaces under bark, and snags. Caves used primarily as night roosts.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Myotis thysanodes	fringed myotis	None, None	G4, S3	In a wide variety of habitats, optimal habitats are pinyon-juniper, valley foothill hardwood and hardwood-conifer. Uses caves, mines, buildings or crevices for maternity colonies and roosts.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.

Scientific Name	**Common Name**	**Federal / State Status**	**Other Status**	**Habitat**	**Potential to Occur**
Myotis volans	long-legged myotis	None, None	G4G5, S3	Most common in woodland and forest habitats above 4000 ft. Trees are important day roosts; caves and mines are night roosts. Nursery colonies usually under bark or in hollow trees, but occasionally in crevices or buildings.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Myotis yumanensis	Yuma myotis	None, None	G5, S4	Optimal habitats are open forests and woodlands with sources of water over which to feed. Distribution is closely tied to bodies of water. Maternity colonies in caves, mines, buildings or crevices.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Navarretia peninsularis	Baja navarretia	None, None	G3, S2, 1B.2	Lower montane coniferous forest, chaparral, meadows and seeps, pinyon and juniper woodland. Wet areas in open forest. 1150-2365 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.

Scientific Name	**Common Name**	**Federal / State Status**	**Other Status**	**Habitat**	**Potential to Occur**
Neotamias speciosus speciosus	lodgepole chipmunk	None, None	G4T3T4, S2	Summits of isolated Piute, San Bernardino, and San Jacinto mountains. Usually found in open-canopy forests. Habitat is usually lodgepole pine forests in the San Bernardino Mts and chinquapin slopes in the San Jacinto Mts.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Oncorhynchus mykiss irideus pop. 10	steelhead - southern California DPS	Endangered, Candidate Endangered	G5T1Q, S1	Federal listing refers to populations from Santa Maria River south to southern extent of range (San Mateo Creek in San Diego County). Southern steelhead likely have greater physiological tolerances to warmer water and more variable conditions.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Oreonana vestita	woolly mountain-parsley	None, None	G3, S3, 1B.3	Subalpine coniferous forest, upper montane coniferous forest, lower montane coniferous forest. High ridges; on scree, talus, or gravel. 800-3370 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Oxytropis oreophila var. oreophila	rock-loving oxytrope	None, None	G5T4T5, S2, 2B.3	Alpine boulder and rock field, subalpine coniferous forest. Gravelly or rocky sites. 2615-3505 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.

Scientific Name	Common Name	Federal / State Status	Other Status	Habitat	Potential to Occur
Packera bernardina	San Bernardino ragwort	None, None	G2, S2, 1B.2	Meadows and seeps, pebble plains, upper montane coniferous forest. Mesic, sometimes alkaline meadows, and dry rocky slopes. 1615-2470 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Pebble Plains	Pebble Plains	None, None	G1, S1.1	Pavement plain	This habitat type is **absent** from the Project site.
Perideridia parishii ssp. parishii	Parish's yampah	None, None	G4T3T4, S2, 2B.2	Lower montane coniferous forest, meadows and seeps, upper montane coniferous forest. Damp meadows or along streambeds-prefers an open pine canopy. 1470-2530 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Phlox dolichantha	Big Bear Valley phlox	None, None	G2, S2, 1B.2	Pebble plains, upper montane coniferous forest. Sloping hillsides, in shade under pines and Quercus kelloggii, with heavy pine litter; also in openings. 1980-2805 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.

Scientific Name	**Common Name**	**Federal / State Status**	**Other Status**	**Habitat**	**Potential to Occur**
Phrynosoma blainvillii	coast horned lizard	None, None	G3G4, S4, CDFW-SSC	Frequents a wide variety of habitats, most common in lowlands along sandy washes with scattered low bushes. Open areas for sunning, bushes for cover, patches of loose soil for burial, and abundant supply of ants and other insects.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Physaria kingii ssp. bernardina	San Bernardino Mountains bladderpod	Endangered, None	G5T1, S1, 1B.1	Pinyon and juniper woodland, lower montane coniferous forest, subalpine coniferous forest. Dry sandy to rocky carbonate soils. 1980-2590 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Piranga rubra	summer tanager	None, None	G5, S1, CDFW-SSC	Summer resident of desert riparian along lower Colorado River, and locally elsewhere in California deserts. Requires cottonwood-willow riparian for nesting and foraging; prefers older, dense stands along streams.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Poa atropurpurea	San Bernardino blue grass	Endangered, None	G2, S2, 1B.2	Meadows and seeps. Mesic meadows of open pine forests and grassy slopes, loamy alluvial to sandy loam soil. 1255-2655 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.

Scientific Name	**Common Name**	**Federal / State Status**	**Other Status**	**Habitat**	**Potential to Occur**
Poliomintha incana	frosted mint	None, None	G5, SH, 2A	Lower montane coniferous forest. In boggy soil. 1600-1700 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Psychomastax deserticola	desert monkey grasshopper	None, None	G1G2, S1	Occurs in very arid environments in the vicinity of the San Bernardino Mtns. Known to occur on chamise (Adenostoma fasciculatum).	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Pyrrocoma uniflora var. gossypina	Bear Valley pyrrocoma	None, None	G5T1, S1, 1B.2	Pebble plain, meadows and seeps. Meadows, meadow edges, and along streams in or near pebble plain habitat. 2040-2280 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Rana muscosa	southern mountain yellow-legged frog	Endangered, Endangered	G1, S1, CDFW-WL	Disjunct populations known from southern Sierras (northern DPS) and San Gabriel, San Bernardino, and San Jacinto Mtns (southern DPS). Found at 1,000 to 12,000 ft in lakes and creeks that stem from springs and snowmelt. May overwinter under frozen lakes. Often encountered within a few feet of water. Tadpoles may require 2 - 4 yrs to complete their aquatic development.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.

Scientific Name	Common Name	Federal / State Status	Other Status	Habitat	Potential to Occur
Rosa woodsii var. glabrata	Cushenbury rose	None, None	G5T1, S1, 1B.1	Mojavean desert scrub. Springs. 1095-1220 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Saltugilia latimeri	Latimer's woodland-gilia	None, None	G3, S3, 1B.2	Chaparral, Mojavean desert scrub, pinyon and juniper woodland. Rocky or sandy substrate; sometimes in washes, sometimes limestone. 120-2200 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Sidalcea hickmanii ssp. parishii	Parish's checkerbloom	None, Rare	G3T1, S1, 1B.2	Chaparral, cismontane woodland, lower montane coniferous forest. Disturbed burned or cleared areas on dry, rocky slopes, in fuel breaks and fire roads along the mountain summits. 1095-2135 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Sidalcea malviflora ssp. dolosa	Bear Valley checkerbloom	None, None	G5T2, S2, 1B.2	Meadows and seeps, riparian woodland, lower montane coniferous forest, upper montane coniferous forest. Known from wet areas within forested habitats. Affected by hydrological changes. 1575-2590 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.

Scientific Name	Common Name	Federal / State Status	Other Status	Habitat	Potential to Occur
Sidalcea pedata	bird-foot checkerbloom	Endangered, Endangered	G1, S1, 1B.1	Meadows and seeps, pebble plains. Vernally mesic sites in meadows or pebble plains. 1840-2305 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Sisyrinchium longipes	timberland blue-eyed grass	None, None	G3, S1, 2B.2	Meadows and seeps. Mesic areas in meadows; seeps. 2060 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Southern California Threespine Stickleback Stream	Southern California Threespine Stickleback Stream	None, None	GNR, SNR,	Southern California Threespine Stickleback Stream	This habitat type is **absent** from the Project site.
Sphenopholis obtusata	prairie wedge grass	None, None	G5, S2, 2B.2	Cismontane woodland, meadows and seeps. Open moist sites, along rivers and springs, alkaline desert seeps. 15-2625 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Streptanthus bernardinus	Laguna Mountains jewelflower	None, None	G3G4, S3S4, 4.3	Chaparral, lower montane coniferous forest. Clay or decomposed granite soils; sometimes in disturbed areas such as streamsides or roadcuts. 1440-2500 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Streptanthus campestris	southern jewelflower	None, None	G3, S3, 1B.3	Chaparral, lower montane coniferous forest, pinyon and juniper woodland. Open, rocky areas. 605-2590 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.

Scientific Name	Common Name	Federal / State Status	Other Status	Habitat	Potential to Occur
Streptanthus juneae	June's jewelflower	None, None	G2, S2, 1B.2	Lower montane coniferous forest, chaparral (montane). Openings. 2155-2370 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Symphyotrichum defoliatum	San Bernardino aster	None, None	G2, S2, 1B.2	Meadows and seeps, cismontane woodland, coastal scrub, lower montane coniferous forest, marshes and swamps, valley and foothill grassland. Vernally mesic grassland or near ditches, streams and springs; disturbed areas. 3-2045 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Taraxacum californicum	California dandelion	Endangered, None	G1G2, S1S2, 1B.1	Meadows and seeps. Mesic meadows, usually free of taller vegetation. 1620-2590 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Thamnophis hammondii	two-striped gartersnake	None, None	G4, S3S4, CDFW-SSC	Coastal California from vicinity of Salinas to northwest Baja California. From sea to about 7,000 ft elevation. Highly aquatic, found in or near permanent fresh water. Often along streams with rocky beds and riparian growth.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.

Scientific Name	Common Name	Federal / State Status	Other Status	Habitat	Potential to Occur
Thelypodium stenopetalum	slender-petaled thelypodium	Endangered, Endangered	G1, S1, 1B.1	Meadows and seeps. Seasonally moist alkaline clay soils; associated with seeps and springs in the pebble plains. 2045-2240 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.
Viola pinetorum ssp. grisea	grey-leaved violet	None, None	G4G5T3, S3, 1B.2	Subalpine coniferous forest, upper montane coniferous forest, meadows and seeps. Dry mountain peaks and slopes. 1580-3700 m.	Suitable habitat for this species does not occur on site. As such, this species is considered **absent** from the Project site.

Coding and Terms

E = Endangered T = Threatened C = Candidate FP = Fully Protected WL = Watch List SSC = Species of Special Concern R = Rare

State Species of Special Concern: An administrative designation given to vertebrate species that appear to be vulnerable to extinction because of declining populations, limited acreages, and/or continuing threats. Raptor and owls are protected under section 3502.5 of the California Fish and Game code: “It is unlawful to take, possess or destroy any birds in the orders Falconiformes or Strigiformes or to take, possess or destroy the nest or eggs of any such bird.”

State Fully Protected: The classification of Fully Protected was the State's initial effort in the 1960's to identify and provide additional protection to those animals that were rare or faced possible extinction. Lists were created for fish, mammals, amphibians and reptiles. Fully Protected species may not be taken or possessed at any time and no licenses or permits may be issued for their take except for collecting these species for necessary scientific research and relocation of the bird species for the protection of livestock.

Global Rankings (Species or Natural Community Level):

G1 = Critically Imperiled – At very high risk of extinction due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors.
G2 = Imperiled – At high risk of extinction due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors.
G3 = Vulnerable – At moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors.
G4 = Apparently Secure – Uncommon but not rare; some cause for long-term concern due to declines or other factors.
G5 = Secure – Common; widespread and abundant.
? = Uncertainty in the exact status of an element (could move up or down one direction from current rank)

Subspecies Level: Taxa which are subspecies or varieties receive a taxon rank (T-rank**)** attached to their G-rank. Where the G-rank reflects the condition of the entire species, the T-rank reflects the global situation of just the subspecies. For example: the Point Reyes mountain beaver, *Aplodontia rufa* ssp. *phaea* is ranked G5T2. The G-rank refers to the whole species range i.e., *Aplodontia rufa.* The T-rank refers only to the global condition of ssp. *phaea*.

State Ranking:

S1 = Critically Imperiled – Critically imperiled in the State because of extreme rarity (often 5 or fewer populations) or because of factor(s) such as very steep declines making it especially vulnerable to extirpation from the State.
S2 = Imperiled – Imperiled in the State because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the State.
S3 = Vulnerable – Vulnerable in the State due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation from the State.
S4 = Apparently Secure – Uncommon but not rare in the State; some cause for long-term concern due to declines or other factors.
S5 = Secure – Common, widespread, and abundant in the State.

California Rare Plant Rankings (CNPS List):

1A = Plants presumed extirpated in California and either rare or extinct elsewhere.
1B = Plants rare, threatened, or endangered in California and elsewhere.
2A = Plants presumed extirpated in California, but common elsewhere.
2B = Plants rare, threatened, or endangered in California, but more common elsewhere.
3 = Plants about which more information is needed; a review list.
4 = Plants of limited distribution; a watch list.

Threat Ranks:

.1 = Seriously threatened in California (over 80% of occurrences threatened / high degree and immediacy of threat)
.2 = Moderately threatened in California (20-80% occurrences threatened / moderate degree and immediacy of threat)
.3 = Not very threatened in California (less than 20% of occurrences threatened / low degree and immediacy of threat or no current threats known)

APPENDIX C
CULTURAL RESOURCES STUDY
NOVEMBER 2022

CULTURAL RESOURCES STUDY FOR THE MTA MAINTENANCE YARD PROJECT

CITY OF BIG BEAR LAKE, SAN BERNARDINO COUNTY, CALIFORNIA

APNs 2328-021-12 and -13

Lead Agency:

City of Big Bear Lake
39707 Big Bear Boulevard
Big Bear Lake, California 92315

Preparer:

BFSA Environmental Services,
a Perennial Company
14010 Poway Road, Suite A
Poway, California 92064

Andrew J Garrison

Signature

Project Proponent:

Lilburn Corporation
1905 Business Center Drive
San Bernardino, California 92408

November 30, 2022

Archaeological Database Information

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Client/Project Proponent: Lilburn Corporation
1905 Business Center Drive
San Bernardino, California 92408

Report Date: November 30, 2022

Report Title: Cultural Resources Study for the MTA Maintenance Yard Project, City of Big Bear Lake, San Bernardino County, California

Type of Study: Phase I Cultural Resources Survey

USGS Quadrangle: Sections 16 and 21, Township 2 North, Range 1 East, of the *Fawnskin* and *Big Bear Lake, California* (7.5-minute) USGS Quadrangles

Acreage: 3.55 acres

Key Words: Survey; no cultural resources identified; *Fawnskin* and *Big Bear Lake* USGS Quadrangles; no further study recommended.

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**Deleted for public review and bound separately in the Confidential Appendix*

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MANAGEMENT SUMMARY/ABSTRACT

At the direction of Lilburn Corporation, a cultural resources study was conducted by BFSA Environmental Services, a Perennial Company (BFSA) for the proposed Mountain Area Regional Transit Authority (MTA) Maintenance Yard Project. The project proposes to develop the property constructing an office building and a bus maintenance building along with car and bus parking and associated infrastructure for the MTA. The 3.55-acre project is identified as Assessor's Parcel Numbers (APNs) 2328-021-12 and -13 and is northwest of the intersection of Fox Farm Road and Sandalwood Drive at 160-170 Business Center Drive, in the city of Big Bear Lake, San Bernardino County, California. The project is situated within Sections 16 and 21, Township 2 North, Range 1 East on the USGS *Fawnskin* and *Big Bear Lake, California* Quadrangles.

The purpose of this investigation was to locate and record any cultural resources within the project and subsequently evaluate any resources as part of the City of Big Bear Lake environmental review process conducted in compliance with the California Environmental Quality Act (CEQA). The archaeological investigation of the project includes an archaeological records search requested from the South Central Coastal Information Center (SCCIC) at California State University, Fullerton (CSU Fullerton) in order to assess previous archaeological studies and identify any previously recorded archaeological sites within the project or in the immediate vicinity. The records search identified 21 previously recorded resources (five prehistoric, three multicomponent, and 13 historic) within one mile of the project; however, no resources are recorded within the subject property. A review of aerial photographs shows that the property has been vacant since at least the late 1930s and was repeatedly cleared of vegetation. Based on the project's Development Review Application, the property "was previously master plan graded for superpads" (City of Big Bear Lake 2022). A Sacred Lands File (SLF) search was also requested from the Native American Heritage Commission (NAHC).

Survey conditions were generally good. However, it was noted that approximately 90 percent of the property appeared to have been developed and covered in three to four feet of imported fill. These conditions correspond with the property previously being graded. The Phase I survey of the MTA Maintenance Yard Project did not result in the identification of any cultural resources within the project.

Based upon the results of this study, no prehistoric or historic sites are present within the boundaries of the current project. Property research indicates the project has been vacant since at least the late 1930s, has been repeatedly cleared, and was recently graded for the creation of "superpads" (City of Big Bear Lake 2022). As such, the proposed project will not impact any known cultural resources and mitigation measures are not recommended. However, in the event that any historic or prehistoric cultural resources are inadvertently discovered, all construction work in the immediate vicinity of the discovery shall stop and a qualified archaeologist shall be engaged to discuss the discovery and determine if further mitigation measures are warranted. A copy of this report will be permanently filed with the SCCIC at CSU Fullerton. All notes,

photographs, and other materials related to this project will be curated at the archaeological laboratory of BFSA in Poway, California.

1.0 INTRODUCTION

1.1 Project Description

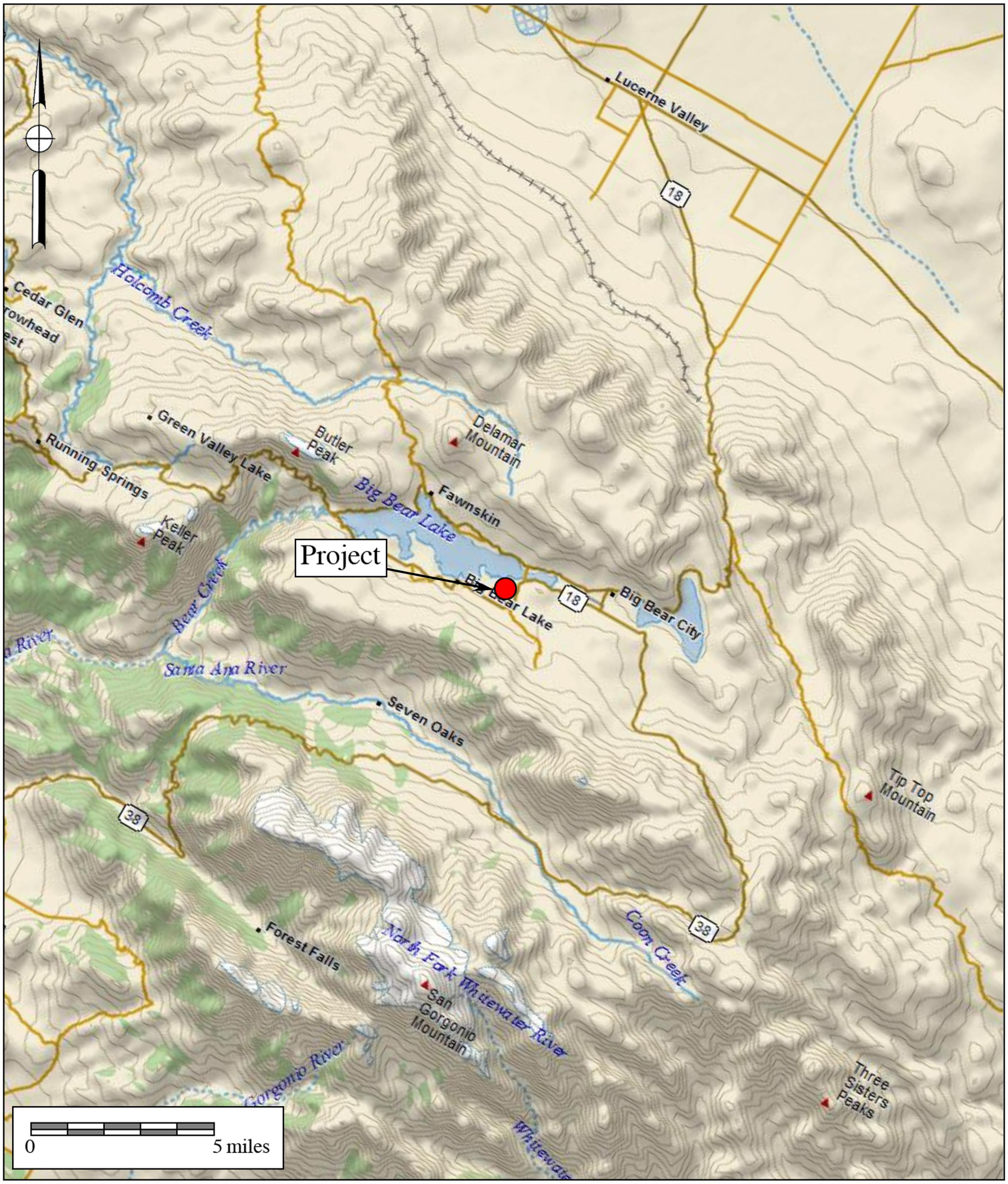
The archaeological survey program for the Mountain Area Regional Transit Authority (MTA) Maintenance Yard Project was conducted in order to comply with CEQA and City of Big Bear environmental compliance procedures. The 3.55-acre project is located northwest of the intersection of Fox Farm Road and Sandalwood Drive at 160-170 Business Center Drive, in the City of Big Bear Lake, San Bernardino County, California (APNs 2328-021-12 and -13) (Figure 1.1–1). The project is situated within Sections 16 and 21, Township 2 North, Range 1 East on the USGS *Fawnskin* and *Big Bear Lake, California* Quadrangles (Figure 1.1–2). The project proposes to develop the property constructing two buildings along with car and bus parking and associated infrastructure for the MTA (Figure 1.1–3):

> One building will house their administrative offices and supports spaces for staff. The other building will house maintenance bays and support spaces for repairing and maintaining [MTA's] bus fleet. Site improvements to include parking for staff, visitors, and buses, in addition to providing solar panel car ports for staff/ visitor and bus parking, concrete walkways for accessibility, patios, landscaping, site lighting, and wayfinding signage. [Electric vehicle] charging stations will also be provided for approximately half of the bus parking stalls. (City of Big Bear Lake 2022)

The decision to request this investigation was based upon cultural resource sensitivity of the locality as suggested by known site density and predictive modeling. Sensitivity for cultural resources in a given area is usually indicated by known settlement patterns, which in southwestern San Bernardino County were focused around freshwater resources and a food supply.

1.2 Environmental Setting

The project is located within the city of Big Bear Lake generally situated in the eastern extent of the Transverse Ranges Province. The mountains and their subparallel valleys run almost perpendicular in contrast to most of the mountain ranges in California. The mountains of the Transverse Ranges Province are some of the fastest growing in the world because of a turn in the San Andreas Fault Zone. The Transverse Ranges Province includes the Little San Bernardino Mountains to the east, which can be traced westward through the San Bernardino, San Gabriel, and Santa Monica mountains and continuing west through Ventura and southern Santa Barbara County. The Los Angeles Basin and the Santa Catalina, Santa Barbara, San Clemente, and San Nicholas islands also make up this province.



BFSA Environmental Services
A Perennial Company

Figure 1.1–1

General Location Map

The MTA Maintenance Yard Project

DeLorme World Base Map Service (1:250,000 series)

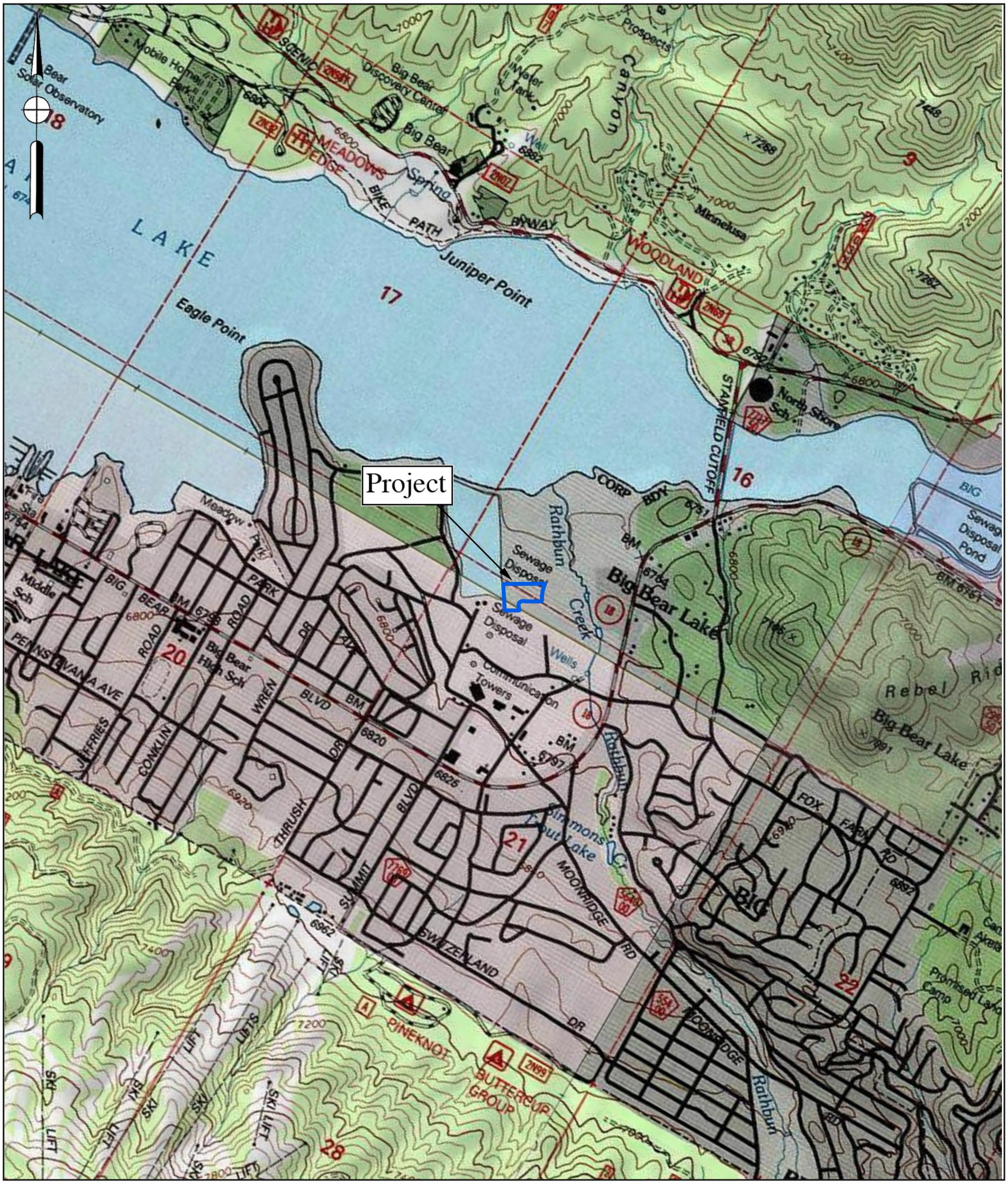


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Figure 1.1–2

Project Location Map

The MTA Maintenance Yard Project

USGS *Fawnskin* and *Big Bear Lake* Quadrangles (7.5-minute series)

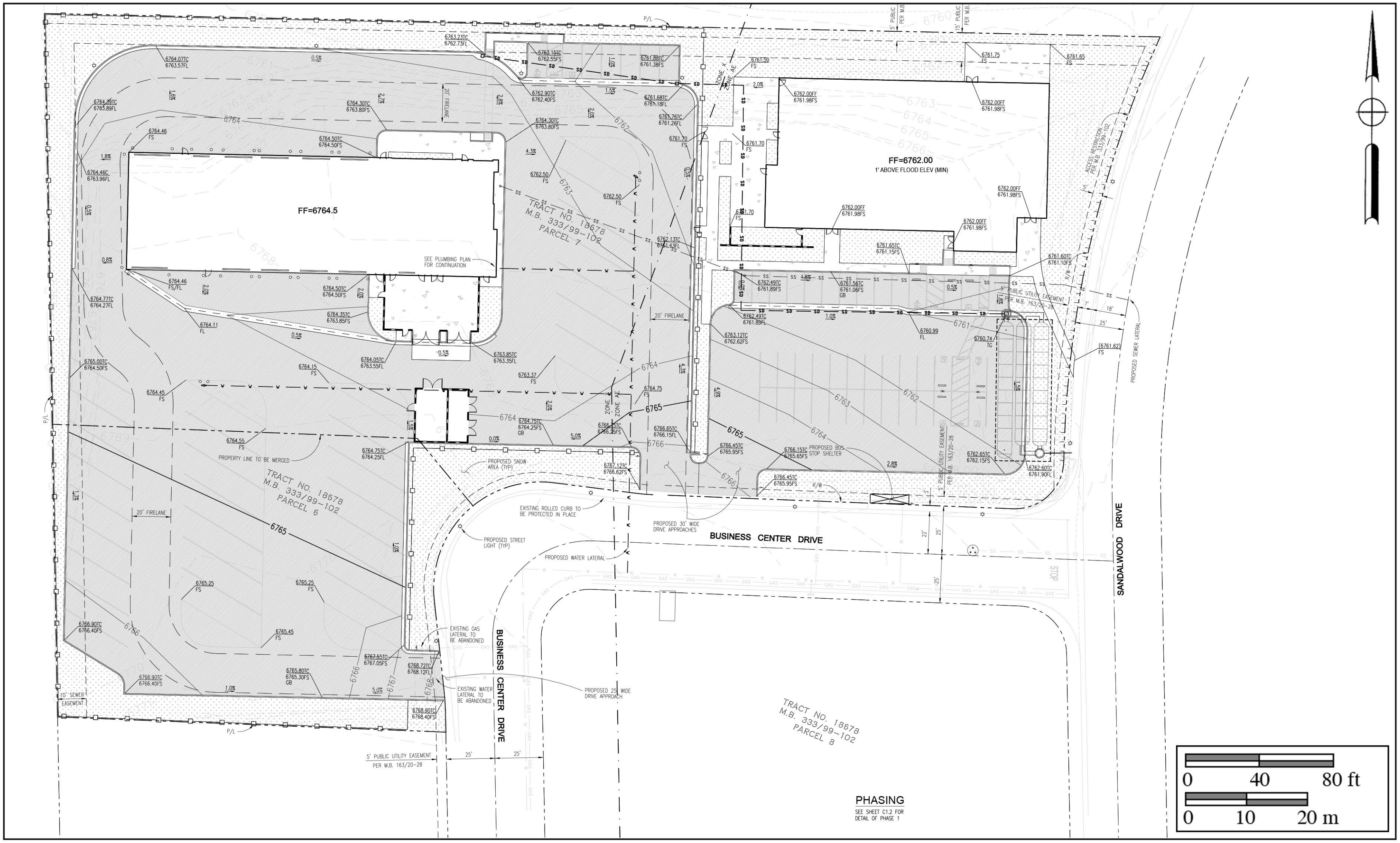

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Figure 1.1–3

Project Development Map

The MTA Maintenance Yard Project

Big Bear Lake is situated within the Big Bear Valley in the San Bernardino Mountains approximately 25 miles northeast of the city of San Bernardino. Given the city of Big Bear Lake's geographic location, the city and surrounding environment is comprised primarily of Montane Coniferous Forest habitat "composed of a mixture of Jeffrey and Ponderosa pine and white fir, and also includes sugar and lodgepole pines, western juniper and black oak" (City of Big Bear Lake 1999). The subject property is just west of Rathbone Creek which flows north into Big Bear Lake. The lake sits at an elevation of 6,752 feet above mean sea level (AMSL) in San Bernardino County while the project, located just south of the lake, has an average elevation of 6,780 feet AMSL.

1.3 Cultural Setting

1.3.1 Prehistoric Period

Paleo Indian, Archaic Period Milling Stone Horizon, and the Late Prehistoric Shoshonean groups are the three general cultural periods represented in San Bernardino County. The following discussion of the cultural history of San Bernardino County references the San Dieguito Complex, Encinitas Tradition, Milling Stone Horizon, La Jolla Complex, Pauma Complex, and San Luis Rey Complex, since these culture sequences have been used to describe archaeological manifestations in the region. The Late Prehistoric component in San Bernardino County was represented by the Cahuilla, Serrano, and potentially the Vanyume Indians.

Absolute chronological information, where possible, will be incorporated into this discussion to examine the effectiveness of continuing to use these terms interchangeably. Reference will be made to the geological framework that divides the culture chronology of the area into four segments: late Pleistocene (20,000 to 10,000 years before the present [YBP]), early Holocene (10,000 to 6,650 YBP), middle Holocene (6,650 to 3,350 YBP), and late Holocene (3,350 to 200 YBP).

Paleo Indian Period (Late Pleistocene: 11,500 to circa 9,000 YBP)

The Paleo Indian Period is associated with the terminus of the late Pleistocene (12,000 to 10,000 YBP). The environment during the late Pleistocene was cool and moist, which allowed for glaciation in the mountains and the formation of deep, pluvial lakes in the deserts and basin lands (Moratto 1984). However, by the terminus of the late Pleistocene, the climate became warmer, which caused the glaciers to melt, sea levels to rise, greater coastal erosion, large lakes to recede and evaporate, extinction of Pleistocene megafauna, and major vegetation changes (Moratto 1984; Martin 1967, 1973; Fagan 1991). The coastal shoreline at 10,000 YBP, depending upon the particular area of the coast, was near the 30-meter isobath, or two to six kilometers further west than its present location (Masters 1983).

Paleo Indians were likely attracted to multiple habitat types, including mountains, marshlands, estuaries, and lakeshores. These people likely subsisted using a more generalized hunting, gathering, and collecting adaptation while utilizing a variety of resources including birds, mollusks, and both large and small mammals (Erlandson and Colten 1991; Moratto 1984; Moss and Erlandson 1995).

Archaic Period (Early and Middle Holocene: circa 9,000 to 1,300 YBP)

The Archaic Period of prehistory begins with the onset of the Holocene around 9,000 YBP. The transition from the Pleistocene to the Holocene was a period of major environmental change throughout North America (Antevs 1953; Van Devender and Spaulding 1979). The general warming trend caused sea levels to rise, lakes to evaporate, and drainage patterns to change. In southern California, the general climate at the beginning of the early Holocene was marked by cool/moist periods and an increase in warm/dry periods and sea levels. The coastal shoreline at 8,000 YBP, depending upon the particular area of the coast, was near the 20-meter isobath, or one to four kilometers further west than its present location (Masters 1983).

The rising sea level during the early Holocene created rocky shorelines and bays along the coast by flooding valley floors and eroding the coastline (Curray 1965; Inman 1983). Shorelines were primarily rocky with small littoral cells, as sediments were deposited at bay edges but rarely discharged into the ocean (Reddy 2000). These bays eventually evolved into lagoons and estuaries, which provided a rich habitat for mollusks and fish. The warming trend and rising sea levels generally continued until the late Holocene (4,000 to 3,500 YBP).

At the beginning of the late Holocene, sea levels stabilized, rocky shores declined, lagoons filled with sediment, and sandy beaches became established (Gallegos 1985; Inman 1983; Masters 1994; Miller 1966; Warren and Pavesic 1963). Many former lagoons became saltwater marshes surrounded by coastal sage scrub by the late Holocene (Gallegos 2002). The sedimentation of the lagoons was significant in that it had profound effects on the types of resources available to prehistoric peoples. Habitat was lost for certain large mollusks, namely *Chione* and *Argopecten,* but habitat was gained for other small mollusks, particularly *Donax* (Gallegos 1985; Reddy 2000). The changing lagoon habitats resulted in the decline of larger shellfish, loss of drinking water, and loss of Torrey Pine nuts, causing a major depopulation of the coast as people shifted inland to reliable freshwater sources and intensified their exploitation of terrestrial small game and plants, including acorns (originally proposed by Rogers 1929; Gallegos 2002).

The Archaic Period in southern California is associated with several different cultures, complexes, traditions, periods, and horizons, including San Dieguito, La Jolla, Encinitas, Milling Stone, Pauma, and Intermediate.

Late Prehistoric Period (Late Holocene: 1,300 YBP to 1790)

Around approximately 1,350 YBP, a Shoshonean-speaking group from the Great Basin region moved into San Bernardino County, marking the transition to the Late Prehistoric Period. This period has been characterized by higher population densities and elaborations in social, political, and technological systems. Economic systems diversified and intensified during this period, with the continued elaboration of trade networks, the use of shell-bead currency, and the appearance of more labor-intensive, yet effective, technological innovations. Technological developments during this period included the introduction of the bow and arrow between A.D. 400 and 600 and the introduction of ceramics. Atlatl darts were replaced by smaller arrow darts, including the Cottonwood series points. Other hallmarks of the Late Prehistoric Period include extensive trade networks as far reaching as the Colorado River Basin and cremation of the dead.

Protohistoric Period (Late Holocene: 1790 to Present)

Prior to the arrival of the Spanish missionaries, the San Bernardino area was inhabited by the Cahuilla, Serrano, and potentially the Vanyume Indians. The territory of the Vanyume was covered by small and relatively sparse populations focused primarily along the Mojave River, north of the Serrano and southeast of the Kawaiisu. It is believed that the southwestern extent of their territory went as far as Cajon Pass and portions of Hesperia. Bean and Smith (1978) noted that it was uncertain if the Vanyume spoke a dialect of Serrano or a separate Takic-based language. However, King and Blackburn (1978) suggest that the Vanyume and other Kitanemuk speakers once occupied most of Antelope Valley. In contrast to the Serrano, the Vanyume maintained friendly social relations with the Mohave and Chemehuevi to the east and northeast (Kroeber 1976). As with the majority of California native populations, Vanyume populations were decimated around the 1820s by placement in Spanish missions and asistencias. It is believed that by 1900, the Vanyume had become extinct (Bean and Smith 1978). However, given the settlement patterns reported for the Vanyume, it is more probable that the population was dispersed rather than completely wiped out.

At the time of Spanish contact in the sixteenth century, the Cahuilla occupied territory that included the San Bernardino Mountains, Orocopia Mountain, and the Chocolate Mountains to the west, Salton Sea and Borrego Springs to the south, Palomar Mountain and Lake Mathews to the west, and the Santa Ana River to the north. The Cahuilla are a Takic-speaking people closely related to their Gabrielino and Luiseño neighbors, although relations with the Gabrielino were more intense than with the Luiseño. They differ from the Luiseño and Gabrielino in that their religion is more similar to the Mohave tribes of the eastern deserts than the Chingichngish cult of the Luiseño and Gabrielino. The following is a summary of ethnographic data regarding this group (Bean 1978; Kroeber 1976).

Cahuilla villages were typically permanent and located on low terraces within canyons in proximity to water sources. These locations proved to be rich in food resources and afforded protection from prevailing winds. Villages had areas that were publicly owned as well as areas that were privately owned by clans, families, or individuals. Each village was associated with a particular lineage and series of sacred sites that included unique petroglyphs and pictographs. Villages were occupied throughout the year; however, during a several-week period in the fall, most of the village members relocated to mountain oak groves to take part in acorn harvesting (Bean 1978; Kroeber 1976).

The Serrano and Vanyume, however, were primarily hunters and gatherers. Individual family dwellings were likely circular, domed structures. Vegetal staples varied with locality; acorns and piñon nuts were found in the foothills, and mesquite, yucca roots, cacti fruits, and piñon nuts were found in or near the desert regions. Diets were supplemented with other roots, bulbs, shoots, and seeds (Heizer 1978). Deer, mountain sheep, antelopes, rabbits, and other small rodents were among the principal food packages. Various game birds, especially quail, were also hunted. The bow and arrow were used for large game, while smaller game and birds were killed with curved throwing sticks, traps, and snares. Occasionally, game was hunted communally, often during mourning ceremonies (Benedict 1924; Drucker 1937; Heizer 1978). In general, manufactured goods included baskets, some pottery, rabbit-skin blankets, awls, arrow straighteners, sinew-backed bows, arrows, fire drills, stone pipes, musical instruments (rattles, rasps, whistles, bull-roarers, and flutes), feathered costumes, mats, bags, storage pouches, and nets (Heizer 1978). Food acquisition and processing required the manufacture of additional items such as knives, stone or bone scrapers, pottery trays and bowls, bone or horn spoons, and stirrers. Mortars, made of either stone or wood, and metates were also manufactured (Strong 1971; Drucker 1937; Benedict 1924).

Much like the Vanyume, the Serrano suffered large population decreases during the early 1800s. While the missionaries are credited with developing the first stable water supply in the area by diverting water from Mill Creek into a zanja that terminated at the Asistencia de Mission San Gabriel on Barton Road, the task was completed through labor provided by the Serrano. The zanja, known as the Mill Creek Zanja, has been listed on the National Register of Historic Places (NRHP) since 1976.

1.3.2 Historic Period

Traditionally, the history of the state of California has been divided into three general periods: the Spanish Period (1769 to 1821), the Mexican Period (1822 to 1846), and the American Period (1848 to present) (Caughey 1970). The American Period is often further subdivided into additional phases: the nineteenth century (1848 to 1900), the early twentieth century (1900 to 1950), and the Modern Period (1950 to present). From an archaeological standpoint, all of these phases can be referred to together as the Ethnohistoric Period. This provides a valuable tool for archaeologists, as ethnohistory is directly concerned with the study of indigenous or non-Western peoples from a combined historical/anthropological viewpoint, which employs written documents, oral narrative, material culture, and ethnographic data for analysis.

European exploration along the California coast began in 1542 with the landing of Juan Rodriguez Cabrillo and his men at San Diego Bay. Sixty years after the Cabrillo expeditions, an expedition under Sebastian Viscaíno made an extensive and thorough exploration of the Pacific coast. Although the voyage did not extend beyond the northern limits of the Cabrillo track, Viscaíno had the most lasting effect upon the nomenclature of the coast. Many of his place names have survived, whereas practically every one of the names created by Cabrillo have faded from use. For instance, Cabrillo named the first (now) United States port he stopped at “San Miguel”;

60 years later, Viscaíno changed it to "San Diego" (Rolle 1969). The early European voyages observed Native Americans living in villages along the coast but did not make any substantial, long-lasting impact. At the time of contact, the Luiseño population was estimated to have ranged from 4,000 to as many as 10,000 individuals (Bean and Shipek 1978; Kroeber 1976).

The historic background of the project area began with the Spanish colonization of Alta California. The first Spanish colonizing expedition reached southern California in 1769 with the intention of converting and civilizing the indigenous populations, as well as expanding the knowledge of and access to new resources in the region (Brigandi 1998). As a result, by the late eighteenth century, a large portion of southern California was overseen by Mission San Luis Rey (San Diego County), Mission San Juan Capistrano (Orange County), and Mission San Gabriel (Los Angeles County), who began colonizing the region and surrounding areas (Chapman 1921).

Native Californians may have first coalesced with Europeans around 1769 when the first Spanish mission was established in San Diego. In 1771, Friar Francisco Graces first searched the Californian desert for potential mission sites. Interactions between local tribes and Franciscan priests occurred by 1774 when Juan Bautista De Anza made an exploration of Alta California.

Serrano contact with the Europeans may have occurred as early as 1771 or 1772, but it was not until approximately 1819 that the Spanish directly influenced the culture. The Spanish established asistencias in San Bernardino, Pala, and Santa Ysabel. Between the founding of the asistencia and secularization in 1834, most of the Serranos in the San Bernardino Mountains were removed to the nearby missions (Beattie and Beattie 1951:366) while the Cahuilla maintained a high level of autonomy from Spain (Bean 1978).

Each mission gained power through the support of a large, subjugated Native American workforce. As the missions grew, livestock holdings increased and became increasingly vulnerable to theft. In order to protect their interests, the southern California missions began to expand inland to try and provide additional security (Beattie and Beattie 1939; Caughey 1970). In order to meet their needs, the Spaniards embarked upon a formal expedition in 1806 to find potential locations within what is now the San Bernardino Valley. As a result, by 1810, Father Francisco Dumetz of Mission San Gabriel had succeeded in establishing a religious site, or capilla, at a Cahuilla rancheria called Guachama (Beattie and Beattie 1939). San Bernardino Valley received its name from this site, which was dedicated to San Bernardino de Siena by Father Dumetz. The Guachama rancheria was located in present-day Bryn Mawr in San Bernardino County.

These early colonization efforts were followed by the establishment of estancias at Puente (circa 1816) and San Bernardino (circa 1819) near Guachama (Beattie and Beattie 1939). These efforts were soon mirrored by the Spaniards from Mission San Luis Rey, who in turn established a presence in what is now Lake Elsinore, Temecula, and Murrieta (Chapman 1921). The indigenous groups who occupied these lands were recruited by missionaries, converted, and put to work in the missions (Pourade 1961). Throughout this period, the Native American populations were decimated by introduced diseases, a drastic shift in diet resulting in poor nutrition, and social conflicts due to the introduction of an entirely new social order (Cook 1976).

Mexico achieved independence from Spain in 1822 and became a federal republic in 1824. As a result, both Baja and Alta California became classified as territories (Rolle 1969). Shortly thereafter, the Mexican Republic sought to grant large tracts of private land to its citizens to begin to encourage immigration to California and to establish its presence in the region. Part of the establishment of power and control included the desecularization of the missions circa 1832. These same missions were also located on some of the most fertile land in California and, as a result, were considered highly valuable. The resulting land grants, known as "ranchos," covered expansive portions of California and by 1846, more than 600 land grants had been issued by the Mexican government. Rancho Jurupa was the first rancho to be established and was issued to Juan Bandini in 1838. Although Bandini primarily resided in San Diego, Rancho Jurupa was located in what is now Riverside County (Pourade 1963). A review of Riverside County place names quickly illustrates that many of the ranchos in Riverside County lent their names to present-day locations, including Jurupa, El Rincon, La Sierra, El Sobrante de San Jacinto, La Laguna (Lake Elsinore), Santa Rosa, Temecula, Pauba, San Jacinto Nuevo y Potrero, and San Jacinto Viejo (Gunther 1984). As was typical of many ranchos, these were all located in the valley environments within western Riverside County.

The treatment of Native Americans grew worse during the Rancho Period. Most of the Native Americans were forced off of their land or put to work on the now privately-owned ranchos, most often as slave labor. In light of the brutal ranchos, the degree to which Native Americans had become dependent upon the mission system is evident when, in 1838, a group of Native Americans from Mission San Luis Rey petitioned government officials in San Diego to relieve suffering at the hands of the rancheros:

> We have suffered incalculable losses, for some of which we are in part to be blamed for because many of us have abandoned the Mission … We plead and beseech you … to grant us a Rev. Father for this place. We have been accustomed to the Rev. Fathers and to their manner of managing the duties. We labored under their intelligent directions, and we were obedient to the Fathers according to the regulations, because we considered it as good for us. (Brigandi 1998:21)

Native American culture had been disrupted to the point where they could no longer rely upon prehistoric subsistence and social patterns. Not only does this illustrate how dependent the Native Americans had become upon the missionaries, but it also indicates a marked contrast in the way the Spanish treated the Native Americans as compared to the Mexican and United States ranchers. Spanish colonialism (missions) is based upon utilizing human resources while integrating them into their society. The ranchers, both Mexican and American, did not accept Native Americans into their social order and used them specifically for the extraction of labor, resources, and profit. Rather than being incorporated, they were either subjugated or exterminated

(Cook 1976).

In 1846, war erupted between Mexico and the United States. In 1848, with the signing of the Treaty of Guadalupe Hidalgo, the region was annexed as a territory of the United States, and in 1850, California became a state. These events generated a steady flow of settlers into the area, including gold miners, entrepreneurs, health-seekers, speculators, politicians, adventurers, seekers of religious freedom, and individuals desiring to create utopian colonies. As the non-native population increased through immigration, the indigenous population rapidly declined from the high morbidity of European diseases, low birth rates, and conflict and violence. California became a state in 1850 and was divided into 21 counties. The dwindling native populations were eventually displaced into reservations after California became a state.

By the late 1880s and early 1890s, there was growing discontent between San Bernardino and Riverside, its neighbor 10 miles to the south, due to differences in opinion concerning religion, morality, the Civil War, politics, and fierce competition to attract settlers. After a series of instances in which charges were claimed about unfair use of tax monies to the benefit of only the city of San Bernardino, several people from Riverside decided to investigate the possibility of a new county. In May 1893, voters living within portions of San Bernardino County (to the north) and San Diego County (to the south) approved the formation of Riverside County. Early business opportunities were linked to the agriculture industry, but commerce, construction, manufacturing, transportation, and tourism also provided a healthy local economy.

A Brief History of the Big Bear Lake Area

In 1845, Benjamin Wilson was commissioned by Governor Pio Pico to lead an expedition to exact revenge on a group of Native Americans. Wilson and his companions traveled into the relatively unexplored eastern portions of the San Bernardino Mountains and found the Big Bear Valley (City of Big Bear Lake 1999). At this time, the lake area was primarily a small seasonal marsh and swamp land. The area was named by Wilson based upon the large number of bears they encountered in the region (City of Big Bear Lake 1999).

Early on, industry in the Big Bear Lake region was dominated by lumber, mining, and animal grazing. For a short period of time between 1851 and 1857, the Mormons created a large-scale lumbering industry in the San Bernardino Mountains. However, when Brigham Young recalled the Mormons to Salt Lake City, many sold their holdings which opened up the lumber industry in the area to other groups. Gold was first discovered in the area in 1848; however, in 1860, the Big Bear Valley gold rush was “triggered when Bill Holcomb and a companion uncovered a vein of gold-bearing ore on a hillside above Bear Valley” (City of Big Bear Lake 1999). This led to the development of mining boom towns in the Upper Holcomb Valley. A group of Chinese prospectors, driven out of the Holcomb Valley by the white residents, settled within the area surrounding the current project which is now known as China Gardens. The Chinese prospectors turned to farming and supplied the Holcomb Valley miners with vegetables (City of Big Bear Lake 1999). Mining continued in the region throughout the twentieth century; however, the large-scale excitement had generally dissipated by the early half of the twentieth century (City of Big Bear Lake 1999). Cattle and sheep grazing also developed in the region during the latter part of the nineteenth century. "By the 1880s the number of animals swelled into the thousands. Animal grazing, including sheep, cattle, horses, oxen, goats, and swine, was more important commercially in the Western forests than lumbering or mining" (City of Big Bear Lake 1999).

The rise of citrus cultivation in San Bernardino, Redlands, and Riverside increased demand for water. Frank Brown developed a plan to convey water from Bear Valley to the area to these areas and in the fall of 1883 had organized the Bear Valley Land and Water Company (City of Big Bear Lake 1999). This included the construction of a dam which began in late summer of 1883. This original dam, now called Old Bear Valley Dam, is a registered California Historical Landmark (CHL No. 725):

> In 1884 Frank Brown built an unusual dam here to supply irrigation water for the Redlands area. The single-arch granite dam formed Big Bear Lake, then the world's largest man-made lake. Engineers claimed the dam would not hold, and declared it "The Eighth Wonder of the World" when it did. The old dam is usually underwater because of the 20-foot higher dam built 200 feet west in 1912. (Office of Historic Preservation [OHP] N.d.)

In 1903, the Bear Valley Mutual Water Company was formed and plans were set to develop a taller, more robust dam, which was constructed between 1910 and 1911 (City of Big Bear Lake 1999). In 1964, the Big Bear Municipal Water District was formed. After years of court battles, the water district was able to purchase the lake and dams so as to better manage the water level of the lake (City of Big Bear Lake 1999).

Beginning in the early twentieth century, the area was called Pine Knot, named after the Pine Knot Resort Company, who had purchased 112 acres in the region. Around this time, the lake was referred to as Big Bear Lake to differentiate it from Little Bear Lake (now Lake Arrowhead). Between 1915 and 1921, 52 resorts opened in the region. Spurred on by tourism, the population of the region grew steadily. After World War II, the Bear Valley Mutual Water Company began to subdivide land adjacent to the lake into residential lots which brought more people to the region. This led to the City of Big Bear Lake being incorporated as the first (and only) city in the San Bernardino Mountains in 1980 (City of Big Bear Lake 1999).

1.4 Results of the Archaeological Records Search

The results of the SCCIC records search (Appendix C) did not identify any resources within the project. However, the search did identify 21 cultural resources (five prehistoric, three multicomponent, and 13 historic) within one mile of the MTA Maintenance Yard Project (Table 1.3−1). The prehistoric resources consist of one lithic scatter, a bedrock milling feature, and three isolates. Multicomponent sites consist of two sites containing a prehistoric lithic scatter and historic trash scatter while the third multicomponent site contains a historic trash scatter with prospecting pits and a prehistoric isolate. The historic resources consist of artifact scatters, foundations, structures, roads, single-family properties, and structures associated with Camp Juniper.

Table 1.4–1

Cultural Resources Located
Within One Mile of the MTA Maintenance Yard Project

Site(s)	Description
P-36-004399	Prehistoric lithic scatter
P-36-006009	Prehistoric bedrock milling feature (not *in situ*)
P-36-022401; P-36-022511; and P-36-060757	Prehistoric isolate
P-36-001650 and P-36-022566	Multicomponent site containing a prehistoric lithic scatter and historic trash scatter
P-36-060755	Multicomponent site containing historic trash scatter, prospecting pits, and a prehistoric isolate
P-36-010094	Historic sawmill platform and associated can scatter
P-36-012990	Historic can scatter
P-36-013534 and P-36-022402	Historic foundation
P-36-013587	Historic trash scatter
P-36-014472	Historic Camp Juniper/Minnelusa Post Office
P-36-014473 and P-36-031944	Historic single-family property
P-36-024073; P-36-024075; and P-36-032487	Historic road
P-36-024074	Historic benchmark
P-36-032486	Historic Camp Juniper

The SCCIC records search results also identified 50 previous studies, four of which included portions of the subject property (San Bernardino County Museum 1979; Schroth 1987; Love and Tang 1997; Mirro 2006). No cultural resources have ever been identified within the property as a result of the previous studies.

BFSA also reviewed the following sources to help facilitate a better understanding of the historic use of the property:

- The National Register of Historic Places Index
- The OHP, Archaeological Determinations of Eligibility
- The OHP, Directory of Properties in the Historic Property Data File
- The 1949 and 1964 *Lucerne Valley* 15-minute series topographic maps
- The 1957 *San Gorgonio Mountain* 15-minute series topographic maps
- The 1975 *Fawnskin* 7.5-minute series topographic map

- The 1975 and 1984 *Big Bear Lake* 7.5-minute series topographic maps
- 1938, 1948, 1952, 1966, 1969, 1983, 1995, 2005, 2010, 2016, and 2021 aerial photographs

These sources did not indicate the presence of any additional archaeological resources within the project. According to the historic maps and aerial photographs, the property has been vacant since at least 1938 and no structures appear to have ever been located within the property. Generally, the aerial photographs show the project as vacant land; however, the 1995 and subsequent aerial photographs appear to show the project being impacted and repeatedly cleared as properties to the south, along with Sandalwood Drive, were developed. Further, the aerial photographs appear to show the project graded between 2012 and 2013. Based on the project's Development Review Application, the project "was previously master plan graded for superpads" (City of Big Bear Lake 2022).

BFSA also requested a SLF search from the NAHC to search for the presence of any recorded Native American sacred sites or locations of religious or ceremonial importance within one mile of the project. The SLF search was returned with negative results. All correspondence is provided in Appendix C.

1.5 Applicable Regulations

Resource importance is assigned to districts, sites, buildings, structures, and objects that possess exceptional value or quality illustrating or interpreting the heritage of San Bernardino County in history, architecture, archaeology, engineering, and culture. A number of criteria are used in demonstrating resource importance. Specifically, the criteria outlined in CEQA, provide the guidance for making such a determination. The following sections detail the criteria that a resource must meet in order to be determined important.

1.5.1 California Environmental Quality Act

According to CEQA (§15064.5a), the term "historical resource" includes the following:

1) A resource listed in or determined to be eligible by the State Historical Resources Commission for listing in the California Register of Historical Resources (CRHR) (Public Resources Code SS5024.1, Title 14 CCR. Section 4850 et seq.).
2) A resource included in a local register of historical resources, as defined in Section 5020.1(k) of the Public Resources Code or identified as significant in an historical resource survey meeting the requirements of Section 5024.1(g) of the Public Resources Code, shall be presumed to be historically or culturally significant. Public agencies must treat any such resource as significant unless the preponderance of evidence demonstrates that it is not historically or culturally significant.
3) Any object, building, structure, site, area, place, record, or manuscript, which a lead

agency determines to be historically significant or significant in the architectural, engineering, scientific, economic, agricultural, educational, social, political, military, or cultural annals of California may be considered to be an historical resource, provided the lead agency's determination is supported by substantial evidence in light of the whole record. Generally, a resource shall be considered by the lead agency to be "historically significant" if the resource meets the criteria for listing on the CRHR (Public Resources Code SS5024.1, Title 14, Section 4852) including the following:

   a) Is associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage;
   b) Is associated with the lives of persons important in our past;
   c) Embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of an important creative individual, or possesses high artistic values; or
   d) Has yielded, or may be likely to yield, information important in prehistory or history.

4) The fact that a resource is not listed in, or determined eligible for listing in the CRHR, not included in a local register of historical resources (pursuant to Section 5020.1[k] of the Public Resources Code), or identified in an historical resources survey (meeting the criteria in Section 5024.1(g) of the Public Resources Code) does not preclude a lead agency from determining that the resource may be an historical resource as defined in Public Resources Code Section 5020.1(j) or 5024.1.

According to CEQA (§15064.5b), a project with an effect that may cause a substantial adverse change in the significance of an historical resource is a project that may have a significant effect on the environment. CEQA defines a substantial adverse change as:

1) Substantial adverse change in the significance of an historical resource means physical demolition, destruction, relocation, or alteration of the resource or its immediate surroundings such that the significance of an historical resource would be materially impaired.
2) The significance of an historical resource is materially impaired when a project:

   a) Demolishes or materially alters in an adverse manner those physical characteristics of an historical resource that convey its historical significance and that justify its inclusion in, or eligibility for inclusion in the CRHR; or
   b) Demolishes or materially alters in an adverse manner those physical characteristics that account for its inclusion in a local register of historical

resources pursuant to Section 5020.1(k) of the Public Resources Code or its identification in an historical resources survey meeting the requirements of Section 5024.1(g) of the Public Resources Code, unless the public agency reviewing the effects of the project establishes by a preponderance of evidence that the resource is not historically or culturally significant; or,

c) Demolishes or materially alters in an adverse manner those physical characteristics of an historical resource that convey its historical significance and that justify its eligibility for inclusion in the CRHR as determined by a lead agency for purposes of CEQA.

Section 15064.5(c) of CEQA applies to effects on archaeological sites and contains the following additional provisions regarding archaeological sites:

1) When a project will impact an archaeological site, a lead agency shall first determine whether the site is an historical resource, as defined in subsection (a).
2) If a lead agency determines that the archaeological site is an historical resource, it shall refer to the provisions of Section 21084.1 of the Public Resources Code, Section 15126.4 of the guidelines, and the limits contained in Section 21083.2 of the Public Resources Code do not apply.
3) If an archaeological site does not meet the criteria defined in subsection (a), but does meet the definition of a unique archaeological resource in Section 21083.2 of the Public Resources Code, the site shall be treated in accordance with the provisions of Section 21083.2. The time and cost limitations described in Public Resources Code Section 21083.2 (c-f) do not apply to surveys and site evaluation activities intended to determine whether the project location contains unique archaeological resources.
4) If an archaeological resource is neither a unique archaeological nor historical resource, the effects of the project on those resources shall not be considered a significant effect on the environment. It shall be sufficient that both the resource and the effect on it are noted in the Initial Study or Environmental Impact Report, if one is prepared to address impacts on other resources, but they need not be considered further in the CEQA process.

Section 15064.5(d) and (e) contain additional provisions regarding human remains. Regarding Native American human remains, paragraph (d) states:

(d) When an Initial Study identifies the existence of, or the probable likelihood of, Native American human remains within the project, a lead agency shall work with the appropriate Native Americans as identified by the NAHC as provided in Public Resources Code SS5097.98. The applicant may develop an agreement for treating or disposing of, with appropriate dignity, the human remains and any items associated with Native American burials with the appropriate Native Americans as identified by the NAHC. Action implementing such an agreement is exempt from:

1) The general prohibition on disinterring, disturbing, or removing human remains from any location other than a dedicated cemetery (Health and Safety Code Section 7050.5).
2) The requirements of CEQA and the Coastal Act.

2.0 RESEARCH DESIGN

The primary goal of the research design is to attempt to understand the way in which humans have used the land and resources within the project through time, as well as to aid in the determination of resource significance. For the current project, the study area under investigation is the Bear Valley and San Bernardino Mountain area of San Bernardino County. The scope of work for the cultural resources study conducted for the MTA Maintenance Yard Project included the survey of a 3.55-acre study area. Given the area involved and the presence of nearby archaeological sites, the research design for this project was focused upon realistic study options. Since the main objective of the investigation was to identify the presence of and potential impacts to cultural resources, the goal here is not necessarily to answer wide-reaching theories regarding the development of early southern California, but to investigate the role and importance of identified resources. Nevertheless, the assessment of the significance of a resource must take into consideration a variety of factors, as well as the ability of a resource to address regional research topics and issues.

Although elementary resource evaluation programs are limited in terms of the amount of information available, several specific research questions were developed that could be used to guide the initial investigations of any observed cultural resources. The following research questions consider the small size and location of the project discussed above.

Research Questions:

- Can located cultural resources be associated with a specific time period, population, or individual?
- Do the types of any located cultural resources allow a site activity/function to be determined from a preliminary investigation? What are the site activities? What is the site function? What resources were exploited?
- How do located sites compare to others reported from different surveys conducted in the area?
- How do located sites fit existing models of settlement and subsistence for mountainous environments of the region?

Data Needs

At the survey level, the principal research objective is a generalized investigation of changing settlement patterns in both the prehistoric and historic periods within the study area. The overall goal is to understand settlement and resource procurement patterns of the project occupants. Therefore, adequate information on site function, context, and chronology from an archaeological perspective is essential for the investigation. The fieldwork and archival research were undertaken with the following primary research goals in mind:

1) To identify cultural resources occurring within the project;
2) To determine, if possible, site type and function, context of the resource(s), and chronological placement of each cultural resource identified;
3) To place each cultural resource identified within a regional perspective; and
4) To provide recommendations for the treatment of each cultural resources identified.

3.0 ANALYSIS OF PROJECT EFFECTS

The cultural resources study of the project site consisted of an institutional records search, archival research, an intensive cultural resource survey of the entire 3.55-acre study area, and the preparation of this technical report. This study was conducted in conformance with Section 21083.2 of the California Public Resources Code, and CEQA. Statutory requirements of CEQA (Section 15064.5) were followed for the identification and evaluation of resources. Specific definitions for archaeological resource type(s) used in this report are those established by the State Historic Preservation Office (SHPO 1995).

3.1 Survey Methods

The survey methodology employed during the current investigation followed standard archaeological field procedures and was sufficient to accomplish a thorough assessment of the project. The field methodology employed for the project included walking evenly spaced survey transects set approximately 10 meters apart while visually inspecting the ground surface. All potentially sensitive areas where cultural resources might be located were closely inspected. Photographs documenting survey areas and overall survey conditions were taken frequently.

3.2 Results of the Field Survey

Field Archaeologist Mary Chitjian conducted the archaeological survey for the project on November 16, 2022. The archaeological survey was an intensive reconnaissance consisting of a series of survey transects across the project. The property was mostly devoid of vegetation; however, some short shrubs and non-native weeds and grasses were noted around the periphery. Survey conditions were generally good; however, visibility of the natural ground surface was limited by fill soil and snow. Approximately 90 percent of the property was noted as being previously developed and covered in three to four feet of imported fill (Plates 3.2–1 to 3.2–4). This characterization of the project as previously developed corresponds with the documented property history as being previously mass graded for “superpads” (City of Big Bear Lake 2022). The survey did not result in the identification of any historic or prehistoric cultural resources within the project.

Plate 3.2–1: Overview of the project from the southeast corner, facing north.

Plate 3.2–2: Overview of the project from the northeast corner, facing south.

Plate 3.2–3: Overview of the project from the northwest corner, facing south.

Plate 3.2–4: Overview of the project from the northwest corner, facing east.

4.0 RECOMMENDATIONS

The archaeological study for the MTA Maintenance Yard Project was completed in accordance with the City of Big Bear Lake environmental policies and CEQA significance evaluation criteria. The cultural resources survey was negative for the presence of archaeological sites. Property research indicates the project has been vacant since at least the late 1930s, has been repeatedly cleared, and was recently graded. Based upon the absence of any cultural resources within the subject property, no site-specific mitigation measures are recommended for this project. Further, given the prior impacts to the property primarily associated with the previous grading of the parcels, archaeological monitoring of future grading is not recommended. However, in the event that any historic or prehistoric cultural resources are inadvertently discovered, all construction work in the immediate vicinity of the discovery shall stop and a qualified archaeologist shall be engaged to discuss the discovery and determine if further mitigation measures are warranted. Should human remains be discovered, treatment of these remains shall follow California Public Resources Code 5097.9. Any human remains that are determined to be Native American shall be reported to the Riverside County sheriff-coroner and subsequently to the NAHC.

5.0 LIST OF PREPARERS AND ORGANIZATIONS CONTACTED

The archaeological survey program for the MTA Maintenance Yard Project was directed by Principal Investigator Brian F. Smith. The archaeological fieldwork was conducted field archaeologist Mary Chitjian. The report text was prepared by Andrew Garrison. Report graphics were provided by Emily Soong. Technical editing and report production was conducted by Courtney McNair. The archaeological records search was requested from the SCCIC at CSU Fullerton.

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APPENDIX A

Resumes of Key Personnel

Andrew J. Garrison, MA, RPA

Project Archaeologist

Brian F. Smith and Associates, Inc.
14010 Poway Road • Suite A •
Phone: (858) 679-8218 • Fax: (858) 679-9896 • E-Mail: agarrison@bfsa-ca.com

Education

Master of Arts, Public History, University of California, Riverside	**2009**
Bachelor of Science, Anthropology, University of California, Riverside	**2005**
Bachelor of Arts, History, University of California, Riverside	**2005**

Professional Memberships

Register of Professional Archaeologists
Society for California Archaeology
Society for American Archaeology
California Council for the Promotion of History
Society of Primitive Technology
Lithic Studies Society
California Preservation Foundation
Pacific Coast Archaeological Society

Experience

Project Archaeologist **June 2017–Present**
Brian F. Smith and Associates, Inc. **Poway, California**

Project management of all phases of archaeological investigations for local, state, and federal agencies including National Register of Historic Places (NRHP) and California Environmental Quality Act (CEQA) level projects interacting with clients, sub-consultants, and lead agencies. Supervise and perform fieldwork including archaeological survey, monitoring, site testing, comprehensive site records checks, and historic building assessments. Perform and oversee technological analysis of prehistoric lithic assemblages. Author or co-author cultural resource management reports submitted to private clients and lead agencies.

Senior Archaeologist and GIS Specialist **2009–2017**
Scientific Resource Surveys, Inc. **Orange, California**

Served as Project Archaeologist or Principal Investigator on multiple projects, including archaeological monitoring, cultural resource surveys, test excavations, and historic building assessments. Directed projects from start to finish, including budget and personnel hours proposals, field and laboratory direction, report writing, technical editing, Native American consultation, and final report submittal. Oversaw all GIS projects including data collection, spatial analysis, and map creation.

Preservation Researcher **2009**
City of Riverside Modernism Survey **Riverside, California**

Completed DPR Primary, District, and Building, Structure and Object Forms for five sites for a grant-funded project to survey designated modern architectural resources within the City of Riverside.

Information Officer **2005, 2008–2009**
Eastern Information Center (EIC), University of California, Riverside **Riverside, California**

Processed and catalogued restricted and unrestricted archaeological and historical site record forms. Conducted research projects and records searches for government agencies and private cultural resource firms.

Reports/Papers

2019 A Class III Archaeological Study for the Tuscany Valley (TM 33725) Project National Historic Preservation Act Section 106 Compliance, Lake Elsinore, Riverside County, California. Contributing author. Brian F. Smith and Associates, Inc.

2019 A Phase I and II Cultural Resources Assessment for the Jack Rabbit Trail Logistics Center Project, City of Beaumont, Riverside County, California. Brian F. Smith and Associates, Inc.

2019 A Phase I Cultural Resources Assessment for the 10575 Foothill Boulevard Project, Rancho Cucamonga, California. Brian F. Smith and Associates, Inc.

2019 Cultural Resources Study for the County Road and East End Avenue Project, City of Chino, San Bernardino County, California. Brian F. Smith and Associates, Inc.

2019 Phase II Cultural Resource Study for the McElwain Project, City of Murrieta, California. Contributing author. Brian F. Smith and Associates, Inc.

2019 A Section 106 (NHPA) Historic Resources Study for the McElwain Project, City of Murrieta, Riverside County, California. Brian F. Smith and Associates, Inc.

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2018 Phase I Cultural Resource Survey for the Stone Residence Project, 1525 Buckingham Drive, La Jolla, California 92037. Brian F. Smith and Associates, Inc.

2018 A Phase I Cultural Resources Assessment for the Seaton Commerce Center Project, Riverside County, California. Brian F. Smith and Associates, Inc.

2017 A Phase I Cultural Resources Assessment for the Marbella Villa Project, City of Desert Hot Springs, Riverside County, California. Brian F. Smith and Associates, Inc.

2017 Phase I Cultural Resources Survey for TTM 37109, City of Jurupa Valley, County of Riverside. Brian F. Smith and Associates, Inc.

2017 A Phase I Cultural Resources Assessment for the Winchester Dollar General Store Project, Riverside County, California. Brian F. Smith and Associates, Inc.

2016 John Wayne Airport Jet Fuel Pipeline and Tank Farm Archaeological Monitoring Plan. Scientific Resource Surveys, Inc. On file at the County of Orange, California.

2016 Historic Resource Assessment for 220 South Batavia Street, Orange, CA 92868 Assessor's Parcel Number 041-064-4. Scientific Resource Surveys, Inc. Submitted to the City of Orange as part of

Mills Act application.

2015 Historic Resource Report: 807-813 Harvard Boulevard, Los Angeles. Scientific Resource Surveys, Inc. On file at the South Central Coastal Information Center, California State University, Fullerton.

2015 Exploring a Traditional Rock Cairn: Test Excavation at CA-SDI-13/RBLI-26: The Rincon Indian Reservation, San Diego County, California. Scientific Resource Surveys, Inc.

2014 Archaeological Monitoring Results: The New Los Angeles Federal Courthouse. Scientific Resource Surveys, Inc. On file at the South Central Coastal Information Center, California State University, Fullerton.

2012 Bolsa Chica Archaeological Project Volume 7, Technological Analysis of Stone Tools, Lithic Technology at Bolsa Chica: Reduction Maintenance and Experimentation. Scientific Resource Surveys, Inc.

Presentations

2017 "Repair and Replace: Lithic Production Behavior as Indicated by the Debitage Assemblage from CA-MRP-283 the Hackney Site." Presented at the Society for California Archaeology Annual Meeting, Fish Camp, California.

2016 "Bones, Stones, and Shell at Bolsa Chica: A Ceremonial Relationship?" Presented at the Society for California Archaeology Annual Meeting, Ontario, California.

2016 "Markers of Time: Exploring Transitions in the Bolsa Chica Assemblage." Presented at the Society for California Archaeology Annual Meeting, Ontario, California.

2016 "Dating Duress: Understanding Prehistoric Climate Change at Bolsa Chica." Presented at the Society for California Archaeology Annual Meeting, Ontario, California.

2014 "New Discoveries from an Old Collection: Comparing Recently Identified OGR Beads to Those Previously Analyzed from the Encino Village Site." Presented at the Society for California Archaeology Annual Meeting, Visalia, California.

2012 Bolsa Chica Archaeology: Part Seven: Culture and Chronology. Lithic demonstration of experimental manufacturing techniques at the April meeting of The Pacific Coast Archaeological Society, Irvine, California.

APPENDIX B

Archaeological Records Search Results

(Deleted for Public Review; Bound Separately)

APPENDIX C

NAHC Sacred Lands File Search Results

(Deleted for Public Review; Bound Separately)

APPENDIX D
GEOTECHNICAL INVESTIGATION REPORT
APRIL 2022

John R. Byerly
INCORPORATED

GEOTECHNICAL INVESTIGATION

NEW ADMINISTRATION BUILDING
AND MAINTENACE FACILITY

160-170 BUSINESS CENTER DRIVE

BIG BEAR LAKE, CALIFORNIA

MOUNTAIN AREA REGIONAL TRANSIT AUTHORITY

GEOTECHNICAL ENGINEERS • TESTING AND INSPECTION
2257 South Lilac Ave., Bloomington, CA 92316-2903
Bloomington (909) 877-1324 Riverside (909) 783-1910 Fax (909) 877-5210

John R. Byerly
INCORPORATED

GEOTECHNICAL INVESTIGATION

APRIL 11, 2022

NEW ADMINISTRATION BUILDING AND MAINTENACE FACILITY
160-170 BUSINESS CENTER DRIVE
BIG BEAR LAKE, CALIFORNIA

MOUNTAIN AREA REGIONAL TRANSIT AUTHORITY (MARTA)
41939 FOX FARM ROAD
BIG BEAR LAKE, CALIFORNIA 92315
ATTENTION: MS. SANDY BENSON, GENERAL MANAGER

RPT. NO.: 7341
FILE NO.: S-14447

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INTRODUCTION

From January through April of 2022, an investigation of the soil conditions underlying the site of the proposed administration building and maintenance facility was conducted by this firm. The purpose of our investigation was to evaluate the surface and subsurface conditions at the site with respect to safe and economical foundation types, vertical and lateral bearing values, liquefaction and seismic settlement potential, support of concrete slabs-on-grade, and site preparation. Included in the recommendations are the seismic design parameters as required by the 2019 edition of the California Building Code and ASCE Standard 7-16. Our consulting engineering geologist, Terra Geosciences, has conducted a geologic hazards analysis. The report of this analysis is presented as Enclosure 10. Recommendations are also provided for the design of asphalt concrete pavement for fire lanes and parking and driveway areas. Percolation testing was performed for the proposed bioswales and underground infiltration systems to retain and dispose of storm water runoff. The report of the results of the percolation testing is presented under separate cover. Our geotechnical investigation, together with our conclusions and recommendations, is discussed in detail in the following report.

This report has been prepared for the exclusive use of the Mountain Area Regional Transit Authority and their design consultants for specific application to the project described herein. Should the project be modified, the conclusions and recommendations presented in this report should be reviewed by the geotechnical engineer. Our professional services have been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted engineering principles and practices. This warranty is in lieu of all other warranties, express or implied.

PROJECT DESCRIPTION

For the preparation of this report, we reviewed a site plan (Site Plan, Schematic Design, New Administration Building and Maintenance Facility, Mountain Area Regional Transit Authority, Ruhnau Clarke Architects, Inc., #5-08-01, July 21, 2021) that was submitted to this office. We understand the proposed Mountain Transit Facility will consist of a 12,188 square-foot bus maintenance building and an administration building with a plan area of 11,355 square feet. The proposed buildings will be single-story structures incorporating concrete slab-on-grade floors and supported by conventional isolated and continuous footings that will exert relatively light loads on the underlying soils. The buildings will be located in the northeastern portion of the site. Four solar shade structures, bus and vehicle parking and drive areas are also planned. The shade structures will be used as parking stalls and bus stalls. The project is currently in the conceptual design stage, so it is not known if the shade structures will be supported by drilled piers or conventional shallow foundations. The drive and parking areas will be paved with asphalt concrete pavement. The administration building will be accessed by conventional passenger vehicles, and mid-size to large buses will access the maintenance building. The driveway areas will also be used as fire lanes. A masonry-block screen wall is proposed along the northwestern perimeter of the site. Bioswales and underground infiltration systems are planned to retain and dispose of storm water runoff. Major slope and retaining wall construction is not anticipated. Based on the site topography, it is anticipated that maximum cuts and fills will be on the order of 5 feet. The site configuration and proposed development are illustrated on Enclosure 1.

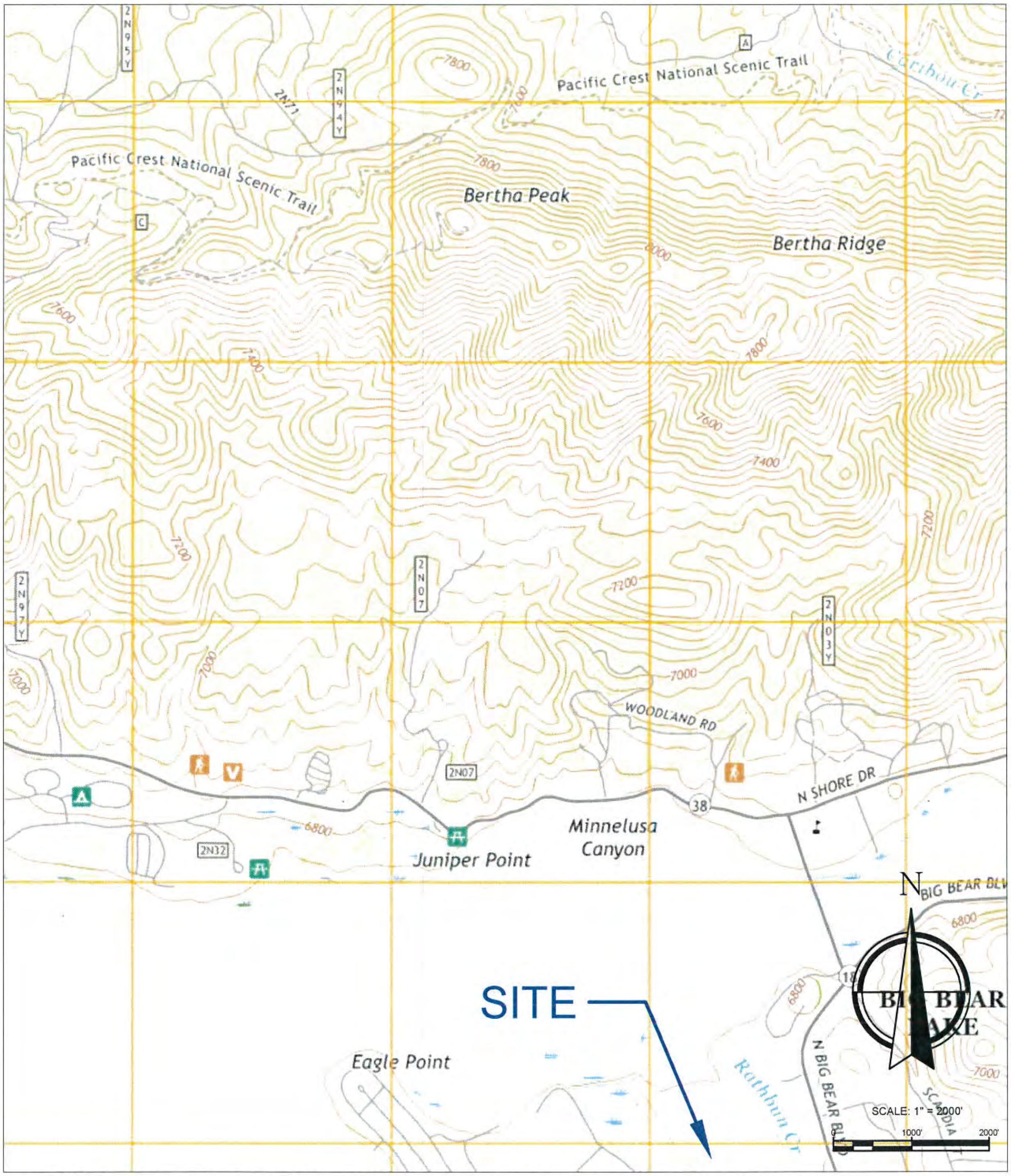
SITE CONDITIONS

The approximately 3-acre site is located on the west corner of Business Center Drive and Sandalwood Drive in the city of Big Bear Lake. An Index Map showing the general vicinity of the site is presented on the following page. The coordinates of the site are latitude 34.2505° N and longitude -116.8888° W utilizing the North American Datum (NAD) from 1983. The property is currently dirt-covered and has a very light growth of vegetation. At the time of our investigation, buildings were not present on the property, however some buses were parked on the site. The site is relatively flat, sloping downward to the northwest at a gradient of less than 4 percent. A Southwest Gas building is present to the southeast, and the property to the north is vacant.

FIELD AND LABORATORY INVESTIGATION

The soils underlying the site were explored by means of 10 test borings drilled with a truck-mounted flight-auger to depths of up to 71.5 feet below the existing ground surface. The approximate locations of the test borings are shown on Enclosure 1. The soils encountered were examined and visually classified by one of our field engineers. A summary of the soil classifications appears as Enclosure 2. The exploration logs show subsurface conditions at the dates and locations indicated, and may not be representative of other locations and times. The stratification lines presented on the logs represent the approximate boundaries between soil

INDEX MAP



SOURCE DOCUMENTS: USGS FAWNSKIN QUADRANGLE, CALIFORNIA, 7.5 MINUTE SERIES, 2018

TOWNSHIP AND RANGE: SECTION 21, T2N, R1E

LATITUDE: 34.2505° N

LONGITUDE: 116.8888° W

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Rpt. No.: 7341
File No.: S-14447

types, and the transitions may be gradual. A hollow-stem auger with an outside diameter of 7.9 inches was utilized. The inside diameter of the auger was 4.3 inches.

Bulk and relatively undisturbed samples were obtained at selected levels within the explorations and delivered to our laboratory for testing and evaluation. The driving energy or blow counts required to advance the sampler at each sample interval were noted. Relatively undisturbed soil samples were recovered at various intervals in the borings with a California sampler. The California sampler was a 2.9-inch outside diameter, 2.5-inch inside diameter, split-barrel sampler lined with brass tubes. The sampler was 18 inches long. The sampler conformed to the requirements of ASTM D 3550. A 140-pound automatic trip hammer was lifted hydraulically and was dropped 30 inches for each blow. Standard penetration tests were performed as Boring 1 was advanced. The standard penetration test blow counts are shown on the logs for this boring. Standard penetration testing was performed with a 2.0-inch outside diameter, 1.5-inch inside diameter, split-barrel sampler. The sampler was 18 inches long and is machined to fit liners. The sampler was unlined and conformed to the requirements of ASTM D 1586. A 140-pound automatic trip hammer was lifted hydraulically and was dropped 30 inches for each blow. An efficiency value of 1.0 was assumed for the automatic trip hammer.

Included in our laboratory testing were moisture/density determinations on all undisturbed samples. Optimum moisture content/maximum dry density relationships were established for typical soil types so that the relative compaction of the subsoils could be determined. Consolidation testing was conducted on selected samples to evaluate the compressibility characteristics of the soil. The moisture/density data are presented on the boring logs presented in Enclosure 2. The maximum density and consolidation test results appear on Enclosures 3 and 4, respectively. Direct shear and expansion index tests were conducted on selected samples to determine their strength parameters and expansion potential, respectively. These test results are presented on Enclosures 5 and 6, respectively. Composite samples of potential subgrade soil were tested for gradation, sand equivalent and "R" value for pavement design purposes. The subgrade test results appear on Enclosure 7. Chemical testing, comprised of pH, soluble sulfate, chloride, redox potential and resistivity testing was also performed. These test results are presented in the "Chemical Test Results" section of this report.

SOIL CONDITIONS

Undocumented fill consisting of loose to very dense gravelly sands with silt and a trace of clay was encountered in the majority of the test borings to the depths shown on the following table:

BORING NO.	DEPTH OF UNDOCUMENTED FILL (ft.)	DEPTH TO COMPETENT NATURAL GROUND (ft)
1	6.0	11.5
2	3.0	3.0
3	3.0	5.0
4	6.0	9.0
5	0.0	0.0
6	4.0	8.0
7	0.0	0.0
8	2.0	9.0
9	2.0	2.0
10	2.0	2.0

The relative compaction of the fill varied from 84 percent to 93 percent (ASTM D 1557). In Boring 1 some debris was observed in the fill. The natural soils encountered in our test borings consisted of loose to very dense sands and silty sands with varying amounts of gravel and an occasional trace of clay. Some of the near-surface soils exhibited a relatively high moisture content. The loose natural soil is susceptible to hydroconsolidation. The depth to competent natural ground as encountered in each boring is also presented in the table above. Ground water was encountered in Borings 1 and 2 at depths of 26.6 feet and 29.9 feet, respectively, and at a depth of 27.4 feet in Boring 6. Bedrock was not encountered in our test borings. Refusal on very dense soil occurred in Boring 10 at a depth of 6.2 feet. The soils encountered in our test borings have a very low expansion potential in accordance with ASTM D 4829.

LIQUEFACTION AND DYNAMIC SETTLEMENT

Liquefaction is a phenomenon that occurs when a soil undergoes a transformation from a solid state to a liquefied condition due to the effects of increased pore-water pressure. Loose saturated soils with particle sizes in the medium sand to silt range are particularly susceptible to liquefaction when subjected to seismic ground shaking. Affected soils lose all strength during liquefaction, and foundation failure can occur.

Ground water was encountered in Borings 1 and 2 at depths of 26.6 feet and 29.9 feet, respectively, and at a depth of 27.4 feet in Boring 6. Currently the site is approximately 52 feet above the water level of Big Bear Lake. Our consulting engineering geologist estimates that the shallowest historic depth to ground water is expected to have been 8 feet. For the purpose of this evaluation, we have assumed an historic high ground water table of 5 feet below the ground surface. This is the value used in our liquefaction analysis.

It is anticipated that major earthquake ground shaking will occur during the lifetime of the proposed development from the North Frontal fault zone, located approximately 4.5 miles north of the site. This fault would create the most significant earthshaking event. Based on an earthquake magnitude of 7.0, a peak horizontal ground acceleration of 0.81g is assigned to the site. To evaluate the potential for seismically induced liquefaction and settlement of the subsoils, the soils were analyzed for relative density. The most effective measurement of relative density of sands with respect to liquefaction and seismic settlement potential is standard penetration resistance. Standard penetration tests were performed as Boring 1 was advanced.

Using the information presented in Table 3 of Page 73 of the publication by Idriss and Boulanger (Soil Liquefaction During Earthquakes, Idriss and Boulanger, MNO-12, 2008) an analysis was conducted to determine the sampler correction factor Cs. The SPT sampler is machined to fit liners, therefore a correction factor of 1.0 may not be appropriate. Throughout the test boring, a calculation was performed to determine the average $(N_1)_{60}$ value from which Cs was subsequently determined. An average Cs value greater than 1.3 was calculated, therefore a value of 1.3 was used in the analysis.

The standard penetration data provided input for the LiquefyPro Version 4.3 program for seismically induced liquefaction and dynamic settlement potential. As indicated in Special Publication 117A (Revised), "Guidelines for Evaluating and Mitigating Seismic Hazards in California, March 2009," a safety factor of 1.3 was used in this analysis. We have assumed that the loose and potentially liquefiable soil will be overexcavated and recompacted, and can then be represented by an N value of 30. The results of this evaluation are shown on Enclosure 9 and reveal a low potential for liquefaction. The analysis also reveals a very low potential for dynamic settlement. We conclude that neither liquefaction nor dynamic settlement need be a concern for this site after the recommended site preparation.

CONCLUSIONS

The undocumented fill is inconsistent in density and has relative compaction values ranging from 84 percent to 93 percent (ASTM D1557). The fill should be overexcavated and replaced as engineered fill below building, retaining wall, site wall, and shade structure areas. The complete stabilization of the existing soil may not be economically warranted in hardscape and pavement areas. Significant stabilization can be obtained by overexciting and recompacting the upper 3 feet of the existing artificial fill in these areas. The natural soils are in a loose to very dense condition. The lose natural soil should also be overexcavated and recompacted. With appropriate site preparation, we conclude that the soil conditions underlying the areas of the new improvements are compatible with the proposed construction. Recommendations for foundation design are provided below for soils with a very low expansion potential.

RECOMMENDATIONS

FOUNDATION DESIGN

Shallow Foundations: Where the site is prepared as recommended, the proposed buildings, shade structures, retaining walls and site walls may be founded on conventional continuous and isolated footings. Footings supporting the buildings, shade structures, and retaining walls should be at least 18 inches deep, and should be designed for a maximum safe soil bearing pressure of 2,500 pounds per square foot for dead plus live loads. Site wall footings should be at least 12 inches in depth and designed for a maximum safe soil bearing pressure of 2,000 pounds per square foot. These values may be increased by one-third for wind and seismic loading.

Continuous footings should be reinforced with at least four No. 4 bars, two placed near the top and two near the bottom of the footings. This recommendation for foundation reinforcement is based on geotechnical considerations. Structural design may require additional foundation reinforcement.

For footings thus designed and constructed, we would anticipate a maximum settlement of less than 1 inch and a maximum differential settlement slope of 1:850.

Deep Foundations: We have assumed that the existing artificial fill and loose natural soil underlying the shade structures will be overexcavated and recompacted. For the site prepared as recommended, an average skin friction of 250 pounds per square foot should be assumed for the soil for pier embedment depths of at least 9 feet. This value may be increased by one-third for wind or seismic loading. Lateral load capacity of the pier footings may be computed using any accepted pole footing formula assuming an allowable lateral earth pressure of 300 pounds per square foot per foot of depth to a maximum of 3,000 pounds per square foot. Each cast-in-place concrete pier should be filled with concrete the same day it is excavated.

SEISMIC DESIGN PARAMETERS

The seismic design coefficients as required by the 2019 California Building Code and ASCE Standard 7-16 are provided in the following table:

Factor or Coefficient	***Value***
Latitude	34.2505° N
Longitude	-116.8888° W
Mapped S_S	1.642g
Mapped S_1	0.568g
F_a	1.0
F_v	1.732
Final S_{MS}	1.818g
Final S_{M1}	1.136g
Final S_{DS}	1.210g
Final S_{D1}	0.760g
PGA	0.81g
T_L	8 seconds
Site Class	D

LATERAL LOADING

Retaining wall backfill within 6 feet of the walls should consist of granular soil exhibiting a very low (expansion potential between 0 and 21) expansion potential. For a level backfill surface and cantilever retaining wall conditions, we recommend an active earth pressure of 35 pounds per square foot per foot of depth, exclusive of surcharge loads. For braced walls with level backfill surface conditions, we recommend an at-rest earth pressure of 60 pounds per square foot per foot of depth, exclusive of surcharge loads. For shallow footings, resistance to lateral loads will be provided by passive earth pressure and basal friction. For footings bearing against compacted fill, passive earth pressure may be considered to develop at a rate of 300 pounds per square foot per foot of depth. Basal friction may be computed at 0.35 times the normal dead load. The resistance from basal friction and passive earth pressure may be combined directly without reduction. A backdrain system or weep holes should be provided to prevent buildup of hydrostatic pressure behind retaining walls. The allowable lateral resistance may be increased by one-third for wind and seismic loading.

SLABS-ON-GRADE

Concrete slab-on-grade design recommendations are presented below. The slab-on-grade recommendations assume underlying utility trench backfills and pad subgrade soils have been densified to a relative compaction of at least 90 percent (ASTM D1557).

1. It is our opinion that the compacted fill soils should provide adequate support for concrete slabs-on-grade without the use of a gravel base. The final pad surface should be rolled to provide a smooth dense surface upon which to place the concrete.

2. Slab-on-grade floors should be at least 4 inches thick – structural considerations may require a thicker slab. The concrete slabs-on-grade may be designed using a modulus of subgrade reaction of 250 pounds per cubic inch.

3. It is recommended that concrete slabs-on-grade be reinforced with at least No. 3 bars at 16 inches each way in the middle third of the slab. Structural considerations may require additional reinforcement. All slab reinforcement should be supported by chairs or precast concrete blocks to ensure positioning of reinforcement of the slab. Lifting of unsupported reinforcement during concrete placement should not be allowed.

4. Slabs to receive moisture-sensitive floor coverings should be underlain with a moisture vapor retardant membrane, such as 10-mil Stego Wrap or equivalent. The moisture vapor retardant membrane should conform to ASTM E 1745-11 (Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs). The moisture vapor retardant membrane should be lapped into the footing excavations to provide

full coverage of the subgrade soils. Punctures and/or holes cut for plumbing should be taped to minimize moisture emissions through the membrane. The project superintendent and/or a representative of the geotechnical engineer should inspect the placement of the moisture vapor retardant membrane prior to covering. Installation of the moisture vapor retardant membrane should be performed in accordance with ASTM E 1643-11 (Standard Practice for Selection, Design, Installation and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill under Concrete Slabs).

5. A 2-inch layer of clean sand (SE>30, no more than 7 percent passing the No. 200 sieve) should be placed over the moisture vapor retardant membrane to promote uniform setting of the concrete. Concrete should be placed on the sand blanket when the sand is damp. Excess moisture should not be allowed to accumulate within the sand blanket prior to concrete placement. At the time of concrete placement, the moisture content of the sand blanket above the moisture vapor retardant membrane should not exceed 2 percent below the optimum moisture content.

6. In lieu of placing the sand blanket described above and to further minimize future moisture vapor emissions through the slabs-on-grade, the slab concrete may be placed directly on the moisture vapor retardant membrane. Placing concrete directly on the moisture vapor retardant membrane will increase shrinkage and curling forces and make finishing more difficult. To accommodate these concerns, the structural engineer should provide appropriate mix design criteria for concrete placed directly on the moisture vapor retardant membrane.

7. We recommend a maximum water-cement ratio of 0.50 for all building slab concrete. Architectural or structural considerations may require the utilization of a lower water-cement ratio. Where slab concrete is placed directly on the moisture vapor retardant membrane without the presence of an intervening layer of absorptive sand, a lower maximum water-cement ratio may be needed.

8. Preparation of the concrete floor slabs should conform to ASTM F 710-11 (Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring) and the manufacturer's recommendations. Moisture vapor emission tests should be performed to verify acceptable moisture emission rates prior to flooring installation.

SITE PREPARATION

We assume that the site will be prepared in accordance with the California Building Code or the current City of Big Bear Lake Grading Ordinance. The recommendations presented below are to establish additional grading criteria. These recommendations should be considered preliminary and are subject to modification or expansion based on a geotechnical review of the project foundation and grading plans.

- All areas to be graded should be stripped of organic matter and other deleterious materials. All cavities created during site clearing should be cleaned of loose and disturbed soil, shaped to provide access for construction equipment, and backfilled with fill placed and compacted as described below.

- Undocumented fill should be removed from building, retaining wall and screen wall areas. Removal of the artificial fill in hardscape and pavement areas may be limited to a depth of 3 feet. Deleterious material should be separated from the removed fill and hauled from the site. The excavated fill should be stockpiled pending replacement or be placed in previously prepared areas.

- Overexcavation
    - The loose natural soils underlying building, retaining wall, and screen wall areas should be overexcavated until competent natural soil is encountered. Competent natural soil is defined as relatively non-porous undisturbed soil exhibiting a relative compaction of at least 85 percent (ASTM D1557). The natural soil should be further overexcavated so there is at least 2 feet of recompacted soil below the bottom of the footings. The soils exposed in the bottom of the excavations should be evaluated by a representative of the geotechnical engineer.

    - Limits of overexcavation – The overexcavation should extend beyond the building areas and retaining wall and screen wall footings a horizontal distance at least equal to the depth of overexcavation below the bottom of the foundation elements or 5 feet, whichever is greater. Due to property line constraints, overexcavation may not be possible outside the northwestern perimeter of the screen wall footing.

  - Asphalt concrete parking and driveway areas – Undocumented fill should be removed below parking, driveway and fire lane areas to a maximum depth of 3 feet. The soils exposed in the subexcavated surface should be scarified to a depth of at least 12 inches, moisture conditioned to at least the optimum moisture content, and densified to a minimum relative compaction of 90 percent (ASTM D1557).

  - Hardscape areas – Undocumented fill should be removed below proposed hardscape areas to a maximum depth of 3 feet. The exposed soils below these areas should be scarified to a depth of at least 12 inches, moisture conditioned to at least the optimum moisture content and densified to a minimum relative compaction of 90 percent (ASTM D1557).

- Approved subexcavated surfaces and all other surfaces to receive fill should be scarified to a minimum depth of 12 inches, moisture conditioned to at least the optimum moisture content, and densified to a minimum relative compaction of 90 percent (ASTM D1557).

- The on-site soils should provide adequate quality fill material provided they are free from significant organic matter and other deleterious materials, and are at acceptable moisture contents. Import fill should be inorganic, granular, non-expansive soil free from rocks or lumps greater than 8 inches in maximum dimension and should exhibit a very low expansion potential (expansion index less than 21), negligible sulfate content (less than 1,000 ppm soluble sulfate by weight), and low corrosion potential. Prior to bringing import fill to the site, the contractor should obtain certification to verify that the proposed import meets the State of California Department of Toxic Substance Control (DTSC) environmental standards. Proposed import should be sampled at the source and tested by this firm for expansion index, soluble sulfate content, and corrosion potential.

- All fill should be placed in 8-inch or less lifts, moisture conditioned to at least the optimum moisture content and densified to a minimum relative compaction of 90 percent (ASTM D 1557). Where the overexcavation cannot extend to the horizontal limits recommended, the fill should be densified to a relative compaction of at least 95 percent.

- The surface of the site should be graded to provide positive drainage away from the structures. Drainage should be directed to established swales and then to appropriate drainage structures to minimize the possibility of erosion. Water should not be allowed to pond adjacent to footings.

SHRINKAGE AND SUBSIDENCE

Volume change in going from cut to fill conditions is anticipated where near-surface grading will occur. Assuming the fill will be compacted to an average relative compaction of 93 percent, an average cut-fill shrinkage of 10 to 15 percent is estimated. Further volume loss will occur through subsidence during preparation of the natural ground surface. Although the contractor's methods and equipment utilized in preparing the natural ground will have a significant effect on the amount of natural ground subsidence that will occur, our experience indicates as much as 0.10 to 0.15 foot of subsidence in areas prepared to receive fill should be anticipated. These values are exclusive of losses due to stripping or removal of subsurface obstructions.

FLOODING

Our geologist has indicated that the eastern portion of the site is situated within a flood hazard zone that is denoted as being "Special Flood Hazard Areas Subject to Inundation by the 1% Annual Chance Flood." The potential for flood hazards should be evaluated by the project civil engineer.

ASPHALT CONCRETE AND PORTLAND CEMENT CONCRETE HARDSCAPE

Representative samples of near-surface soil at the site have been tested for relevant subgrade properties. A Traffic Index of 5.0 was assumed for the new parking lots and drive areas for conventional vehicular traffic, and a Traffic Index of 7.0 was assumed for areas accommodating heavier truck and bus traffic and fire lanes. In conjunction with the test data shown on Enclosure 7, we believe the sections presented on the following table should provide durable pavement.

Asphalt Concrete Pavement

Location	TI	"R" Value	Thickness (Inches) Asphalt Concrete	Aggregate Base
Conventional Passenger Vehicles	5.0	45	2.5	4.0
Fire Lane and Truck Traffic Areas	7.0	45	3.0	8.0

For hardscape areas to receive only pedestrian traffic, we recommend portland cement concrete pavement be at least 3.5 inches in thickness and be placed directly on compacted subgrade soil. Prior to the placement of hardscape concrete, we recommend that the final subgrade surface be scarified to a depth of at least 12 inches, moisture conditioned to near the optimum moisture content, and densified to a minimum relative compaction of 90 percent (ASTM D1557).

The above designs are preliminary and for estimating purposes only. We recommend that during the process of rough grading, observation and additional testing of the actual subgrade soils should be performed. Final pavement design sections can then be determined. The foregoing pavement sections assume that utility trench backfill below all proposed pavement areas will be compacted to at least 90 percent relative compaction. Prior to the placement of aggregate base, we recommend that the final subgrade surface be scarified to a depth of at least 12 inches, moisture conditioned to near the optimum moisture content, and compacted to a minimum relative compaction of 90 percent (ASTM D1557). Aggregate base should be densified to at least 95 percent relative compaction. Suggested specifications for aggregate base material are presented on Enclosure 8. The preparation of the subgrade and compaction of the aggregate base should be monitored by a representative of the geotechnical engineer.

CHEMICAL TEST RESULTS

The chemical test results from a sample taken from Boring 1 between the ground surface and a depth of 5 feet are shown on the following table:

Analysis	Result	Units
Saturated Resistivity	3700	ohm-cm
Chloride	ND (Not Detected)	ppm
Sulfate	30	ppm
pH	7.7	pH units
Redox Potential	295	mV

The chemical test results from a sample taken from Boring 2 between the ground surface and a depth of 5 feet are shown on the following table:

Analysis	Result	Units
Saturated Resistivity	5000	ohm-cm
Chloride	ND (Not Detected)	ppm
Sulfate	30	ppm
pH	7.3	pH units
Redox Potential	260	mV

The soil tested in both borings exhibited negligible soluble sulfate content, therefore, sulfate-resistant concrete will not be required for this project. In addition, the results of the corrosivity testing indicate that the soil tested is not detrimentally corrosive to buried ferrous-metal pipes.

GAS ODOR

During our field investigation and during our review of the soil samples in the laboratory, there was no gas odor detected from the boreholes or from any of the samples.

FOUNDATION AND GRADING PLAN REVIEW

The project foundation and grading plans should be reviewed by the geotechnical engineer. Additional recommendations may be required at that time.

CONSTRUCTION OBSERVATIONS

All grading operations, including the preparation of the natural ground surface, should be observed and compaction tests performed by this firm. No fill should be placed on any prepared surface until that surface has been evaluated by the representative of the geotechnical engineer. The footing excavations for the buildings and shade structures should be evaluated by a representative of the geotechnical engineer. All footing excavations should be observed by the representative of the geotechnical engineer prior to placement of forms or reinforcing steel.

The conclusions and recommendations presented in this report are based upon the field and laboratory investigation described herein and represent our best engineering judgment. Should conditions be encountered in the field that appear different from those described in this report, we should be contacted immediately in order that appropriate recommendations might be prepared.

Respectfully submitted,

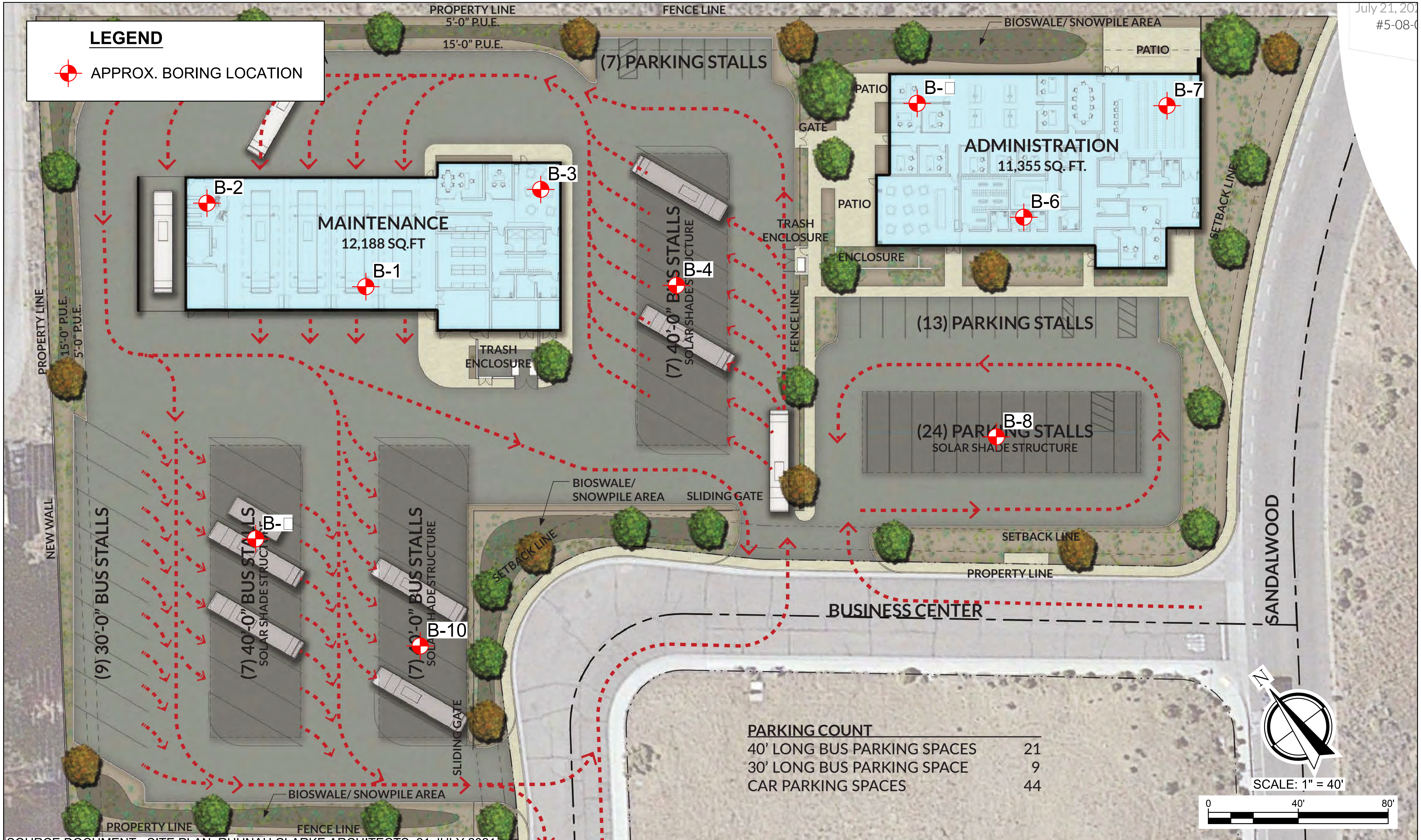
JOHN R. BYERLY, INC.

Licensed Professional Engineer
John R. Byerly
GE 000179
EXP. 06/30/23
Geotechnical
State of California

John R. Byerly, Geotechnical Engineer
President

JRB:GSF:jet

Enclosures:
(1) Plot Plan
(2) Test Boring Logs
(3) Maximum Density Determinations
(4) Consolidation Test Results
(5) Direct Shear Test Data
(6) Expansion Index Test Results
(7) Subgrade Test Results
(8) Specifications for Aggregate Base
(9) Liquefaction Analysis
(10) Geologic Hazards Report



PARKING COUNT

40' LONG BUS PARKING SPACES	21
30' LONG BUS PARKING SPACE	9
CAR PARKING SPACES	44

SOURCE DOCUMENT: SITE PLAN, RUHNAU CLARKE ARCHITECTS, 21 JULY 2021

John R. Byerly
INCORPORATED

GEOTECHNICAL INVESTIGATION

MOUNTAIN AREA REGIONAL TRANSIT AUTHORITY
160-170 BUSINESS CENTER
BIG BEAR LAKE, CALIFORNIA

Enclosure 1
Rpt. No.: 7341
File No.: S-14447

B-1

Boring Date: 1/20/22
Surface Elevation:
Drilling Method: Flight-Auger

Depth	Std. Pen. "N" Value	Blows/Ft.	Dry Density (PCF)	Moisture Content (%)	Rel. Compaction (%)	Water Table		
0		50	122	8.6	91		SM	Red-brown gravelly fine to coarse sand with silt and a trace of clay and debris, moist and dense (FILL)
		50/6"	---	9.3	---			- becoming very dense at 3.5 feet
		50/9"	124	10.6	93			
	11						SM	Light gray-brown silty fine to medium sand, moist and dense (NATURAL GROUND)
10		50/9"	---	---	---			
	13							- becoming medum dense at 11.5 feet
		50	105	23.3	81			- becoming wet and loose to medium dense at 15.0 feet
	29							
20		50/10"	107	19.5	92		SM	Light gray-brown silty fine to medium sand with a trace of clay, wet and dense
	42							
		50/8"	109	15.3	93	▼		
	31							- ground water encountered at 26.6 feet
							SP	Light brown fine to medium sand, saturated and dense
30		43	99	36.0	---			
	83							- becoming very dense at 31.5 feet
	58						SM	Brown silty fine to medium sand, saturated and very dense
40	49							- becoming dense at 40.0 feet
	34							
50	55							- becoming very dense at 50.0 feet
							SM	Gray-brown silty fine to medium sand with a trace of clay, saturated and very dense
	100							
60	51							
	50							
70								

LOG OF BORING

John R. Byerly, Inc.

MARTA New Administration Building and Maintenance Facility

Enclosure 2, Page 1
Rpt. No.: 7341
File No.: S-14447

B-1

Boring Date: 1/20/22
Surface Elevation:
Drilling Method: Flight-Auger

Depth	Std. Pen. "N" Value	Blows/Ft.	Dry Density (PCF)	Moisture Content (%)	Rel. Compaction (%)	Water Table			
70	81						⁞⁞⁞⁞⁞	SM	Gray-brown silty fine to medium sand with a trace of clay, saturated and very dense
									Total Depth at 71.5 Feet Free Ground Water Encountered at 26.6 Feet
80									
90									
100									
110									
120									
130									
140									

LOG OF BORING

John R. Byerly, Inc.

MARTA New Administration
Building and Maintenance Facility

Enclosure 2, Page 2
Rpt. No.: 7341
File No.: S-14447

B-2

Boring Date: 3/10/22
Surface Elevation:
Drilling Method: Flight-Auger

Depth	Std. Pen. "N" Value Blows/Ft.	Dry Density (PCF)	Moisture Content (%)	Rel. Compaction (%)	Water Table		
0						SM	Gray-brown gravelly fine to medium sand with silt and a trace of clay, moist and medium dense (FILL)
	14	118	12.7	89			
	15	113	11.0	86		SM	Red-brown silty fine to medium sand with gravel, moist and medium dense (NATURAL GROUND)
5	50/3"	---	---	---			- becoming very dense at 5.0 feet
						SM	Light brown silty fine to medium sand, wet to saturated and medium dense
	40	---	27.1	---			
10	50/10"	111	16.2	85			
15	45	111	26.3	85			
20	50/11"	---	24.8	---			- becoming dense at 20.0 feet
25	50/7"	119	14.8	92			
30	50/11"	110	21.1	85	▼		- ground water encountered at 29.9 feet
35							

Total Depth at 31.4 Feet
Free Ground Water Encountered at 29.9 Feet

LOG OF BORING

B-3

Boring Date: 1/20/22
Surface Elevation:
Drilling Method: Flight-Auger

Depth	Std. Pen. "N" Value	Blows/Ft.	Dry Density (PCF)	Moisture Content (%)	Rel. Compaction (%)	Water Table		
0						GWT not encountered	SM	Gray-brown gravelly fine to medium sand with silt and a trace of clay, moist and dense (FILL)
		50/9"	119	12.8	90			
		12	109	14.2	83		SM	Red-brown silty fine to medium sand with gravel, wet and loose (NATURAL GROUND)
5		24	---	5.8	---			- becoming damp and medium dense at 5.5 feet
		35	105	27.6	81		SM	Light brown silty fine to medium sand, wet to saturated and loose to medium dense
10		50/11"	107	20.6	82			- becoming wet at 10.5 feet
15		50	110	18.7	85			- becoming medium dense at 15.0 feet
								Total Depth at 16.5 Feet No Free Ground Water Encountered
20								
25								
30								
35								

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LOG OF BORING

John R. Byerly, Inc.

MARTA New Administration
Building and Maintenance Facility

Enclosure 2, Page 4
Rpt. No.: 7341
File No.: S-14447

B-4

Boring Date: 1/20/22
Surface Elevation:
Drilling Method: Flight-Auger

Depth	Std. Pen. "N" Value Blows/Ft.	Dry Density (PCF)	Moisture Content (%)	Rel. Compaction (%)	Water Table
0					GWT not encountered
	50	113	9.0	86	
	40	123	12.6	93	
5	45	121	9.4	92	
	11	110	12.3	83	
10	46	114	6.1	---	
15	43	110	24.0	85	
20	50/7"	---	---	---	
25					
30					
35					

SM	Red-brown gravelly fine to medium sand with silt, and a trace of clay, moist and medium dense (FILL) - becoming dense at 3.5 feet
SM	Brown silty fine to medium sand with gravel, moist and loose (NATURAL GROUND)
SP	Red-brown fine to coarse sand with gravel and rock fragments, damp and dense
SM	Gray-brown silty fine to medium sand, wet and medium dense - becoming very dense at 17.0 feet

Total Depth at 20.6 Feet
No Free Ground Water Encountered

LOG OF BORING

B-5

Boring Date: 3/10/22
Surface Elevation:
Drilling Method: Flight-Auger

Depth	Std. Pen. "N" Value	Blows/Ft.	Dry Density (PCF)	Moisture Content (%)	Rel. Compaction (%)	Water Table		
0						GWT not encountered	SM	Dark brown gravelly fine to medium sand with silt, moist and medium dense
		42	---	12.6	---			
		25	117	13.5	89		SM	Gray-brown silty fine to medium sand with gravel, moist and medium dense
5		15	114	9.3	86			
		28	---	6.4	---		SM	Light brown fine to coarse sand with gravel and rock fragments, damp and medium dense
							SM	Light gray silty fine to medium sand, moist and medium dense
10		50/10"	113	14.6	87			
15		50/9"	---	20.8	---			- becoming wet and dense at 15.0 feet
20		50	111	17.3	85			- becoming medium dense at 20.0 feet
25		50/11"	112	21.0	86			
30		50/7"	---	15.6	---			- becoming very dense at 30.0 feet
								Total Depth at 31.0 Feet No Free Ground Water Encountered
35								

LOG OF BORING

B-6

Boring Date: 1/20/22
Surface Elevation:
Drilling Method: Flight-Auger

Depth	Std. Pen. "N" Value	Blows/Ft.	Dry Density (PCF)	Moisture Content (%)	Rel. Compaction (%)	Water Table
0						
		16	111	12.8	84	
		36	118	9.0	89	
5		26	115	11.9	87	
		11	106	17.7	82	
10		50/9"	---	7.6	---	
15		50/6"	124	4.6	95	
20		50/10"	100	25.6	86	
25		50/7"	---	---	---	
						▼
30		42	---	26.6	---	
35						

SM	Dark brown gravelly fine to medium sand with silt and a trace of clay, moist and loose (FILL) - becoming medium dense at 3.5 feet
SM	Red-brown silty fine to medium sand with gravel, moist and medium dense (NATURAL GROUND)
SM	Red-brown silty fine to medium sand, wet and loose
SP	Red-brown fine to coarse sand with gravel and rock fragments, wet and dense
SM	Light gray-brown silty fine to medium sand, damp and very dense
SM	Light gray-brown silty fine to medium sand with a trace of clay, wet and medium dense to dense - becoming saturated at 27.4 feet

Total Depth at 31.5 Feet
Ground Water Encountered at 27.4 Feet

LOG OF BORING

John R. Byerly, Inc.

MARTA New Administration
Building and Maintenance Facility

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B-7

Boring Date: 1/20/22
Surface Elevation:
Drilling Method: Flight-Auger

Depth	Std. Pen. "N" Value Blows/Ft.	Dry Density (PCF)	Moisture Content (%)	Rel. Compaction (%)	Water Table		
0					GWT not encountered	SM	Dark brown silty fine to medium sand with gravel, moist and medium dense
	30	115	13.8	87			
	18	117	13.4	89			
5	22	---	3.7	---			- becoming damp at 5.5 feet
	50/2"	---	---	---			- becoming very dense at 7.5 feet
10	50/6"	---	---	---			
						SM	Light gray-brown silty fine to coarse sand with a trace of clay, wet and very dense
15	50/3"	---	---	---			
							Total Depth at 15.8 Feet No Free Ground Water Encountered
20							
25							
30							
35							

LOG OF BORING

John R. Byerly, Inc.

MARTA New Administration Building and Maintenance Facility

Enclosure 2, Page 8
Rpt. No.: 7341
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B-8

Boring Date: 1/20/22
Surface Elevation:
Drilling Method: Flight-Auger

Std. Pen. "N" Value Blows/Ft.	Dry Density (PCF)	Moisture Content (%)	Rel. Compaction (%)
50/11"	---	---	---
23	114	9.4	86
27	114	19.5	86
10	109	11.0	84
50/8"	106	13.3	91
50/10"	108	18.0	93
50/7"	---	---	---

Depth: 0, 5, 10, 15, 20, 25, 30, 35

Water Table: GWT not encountered

SM	Dark brown gravelly fine to medium sand with silt and a trace of clay, moist and dense (FILL)
SM	Red-brown silty fine to medium sand with gravel, moist and medium dense (NATURAL GROUND) - becoming wet at 5.5 feet
SM	Red-brown silty fine to medium sand, moist and loose
SM	Light gray-brown silty fine to medium sand with a trace of clay, wet and very dense

Total Depth at 21.0 Feet
No Free Ground Water Encountered

LOG OF BORING

John R. Byerly, Inc.

MARTA New Administration Building and Maintenance Facility

Enclosure 2, Page 9
Rpt. No.: 7341
File No.: S-14447

B-9

Boring Date: 1/20/22
Surface Elevation:
Drilling Method: Flight-Auger

Depth	Std. Pen. "N" Value	Blows/Ft.	Dry Density (PCF)	Moisture Content (%)	Rel. Compaction (%)	Water Table		
0							SM	Dark brown gravelly fine to medium sand with silt and a trace of clay, moist and medium dense (FILL)
		48	115	10.0	87	GWT not encountered		
		50/6"	---	11.9	---		SM	Red-brown silty fine to medium sand with gravel, moist and very dense (NATURAL GROUND)
5		50/9"	120	7.5	91			
		18	113	10.9	87		SM	Red-brown silty fine to medium sand, moist and medium dense
10		50/9"	---	3.4	---			- becoming damp and dense at 10.5 feet
15		50/10"	118	15.8	91			- becoming wet at 15.5 feet
20		50/8"	---	14.1	---			- becoming very dense at 20.0 feet
25								
30								
35								

Total Depth at 21.2 Feet
No Free Ground Water Encountered

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LOG OF BORING

John R. Byerly, Inc.

MARTA New Administration Building and Maintenance Facility

Enclosure 2, Page 10
Rpt. No.: 7341
File No.: S-14447

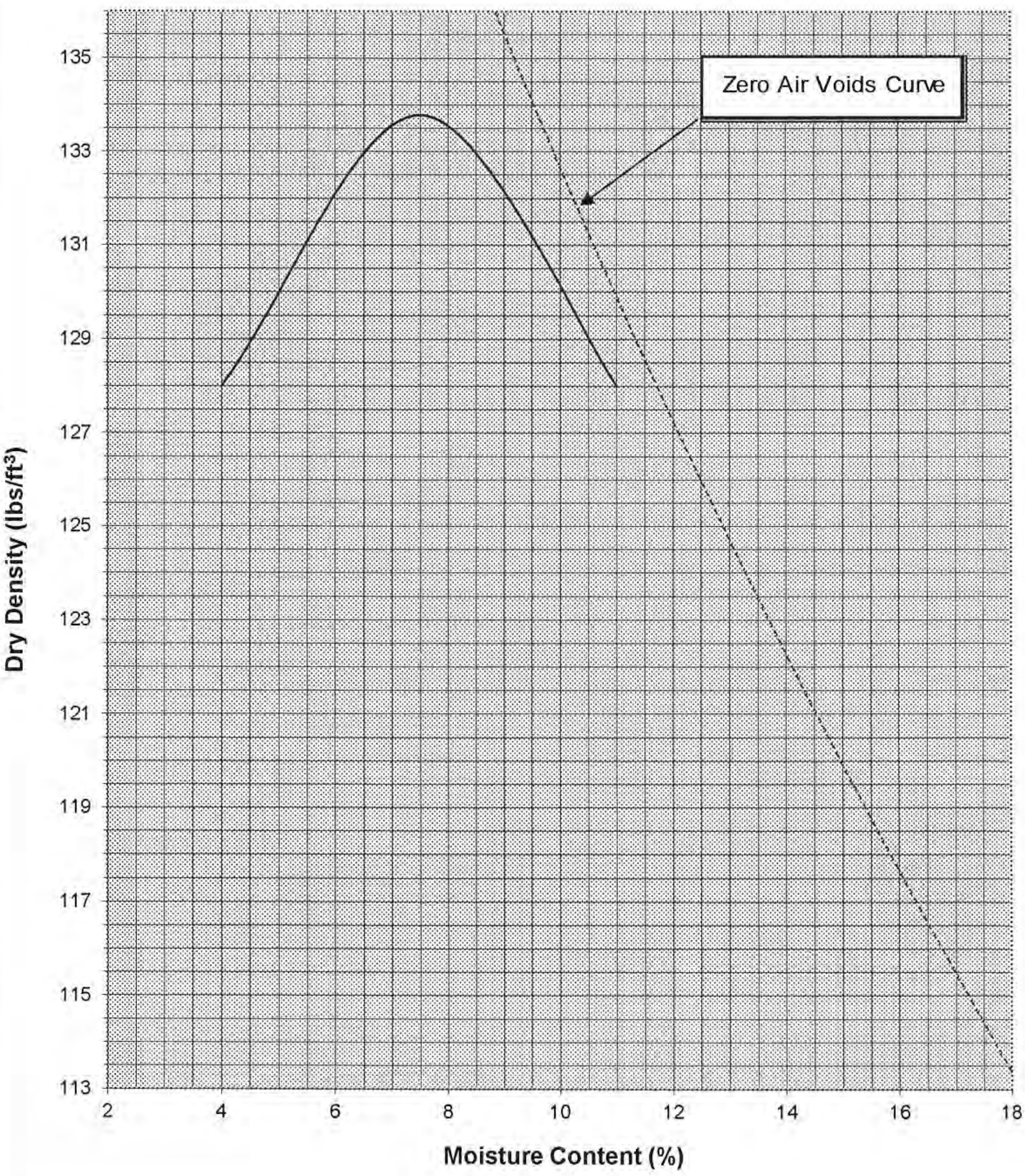
B-10

Boring Date: 1/20/22
Surface Elevation:
Drilling Method: Flight-Auger

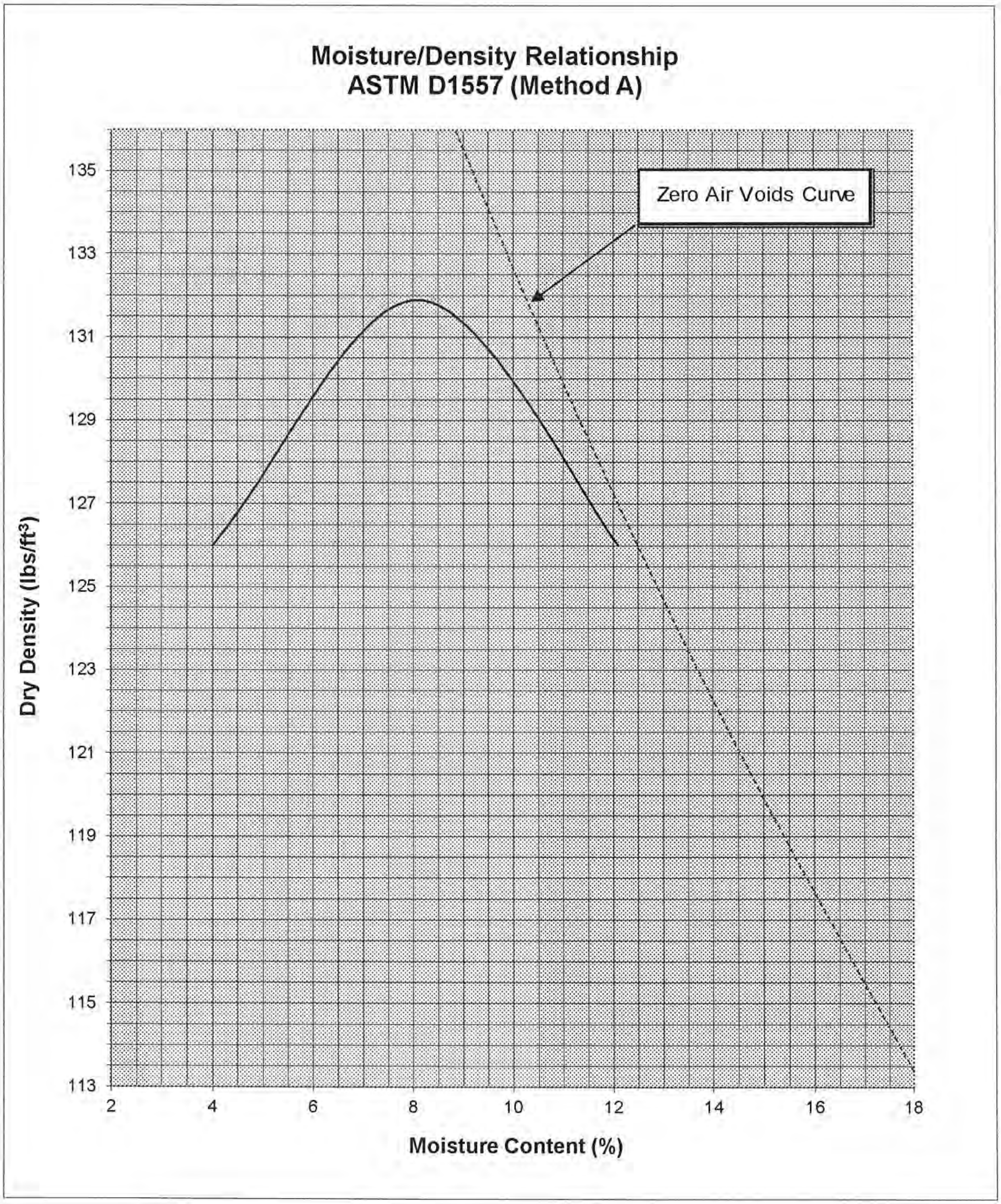
Depth	Std. Pen. "N" Value	Blows/Ft.	Dry Density (PCF)	Moisture Content (%)	Rel. Compaction (%)	Water Table		
0						GWT not encountered	SM	Dark brown gravelly fine to medium sand with silt and a trace of clay, moist and dense (FILL)
		50/9"	120	8.0	91			
							SM	Red-brown silty fine to medium sand with gravel, moist and very dense (NATURAL GROUND)
		50/8"	121	7.8	92			
5		50/8"	123	6.6	93			
								Refusal on Very Dense Soil at 6.2 Feet No Free Ground Water Encountered
10								
15								
20								
25								
30								
35								

LOG OF BORING

Moisture/Density Relationship
ASTM D1557 (Method A)

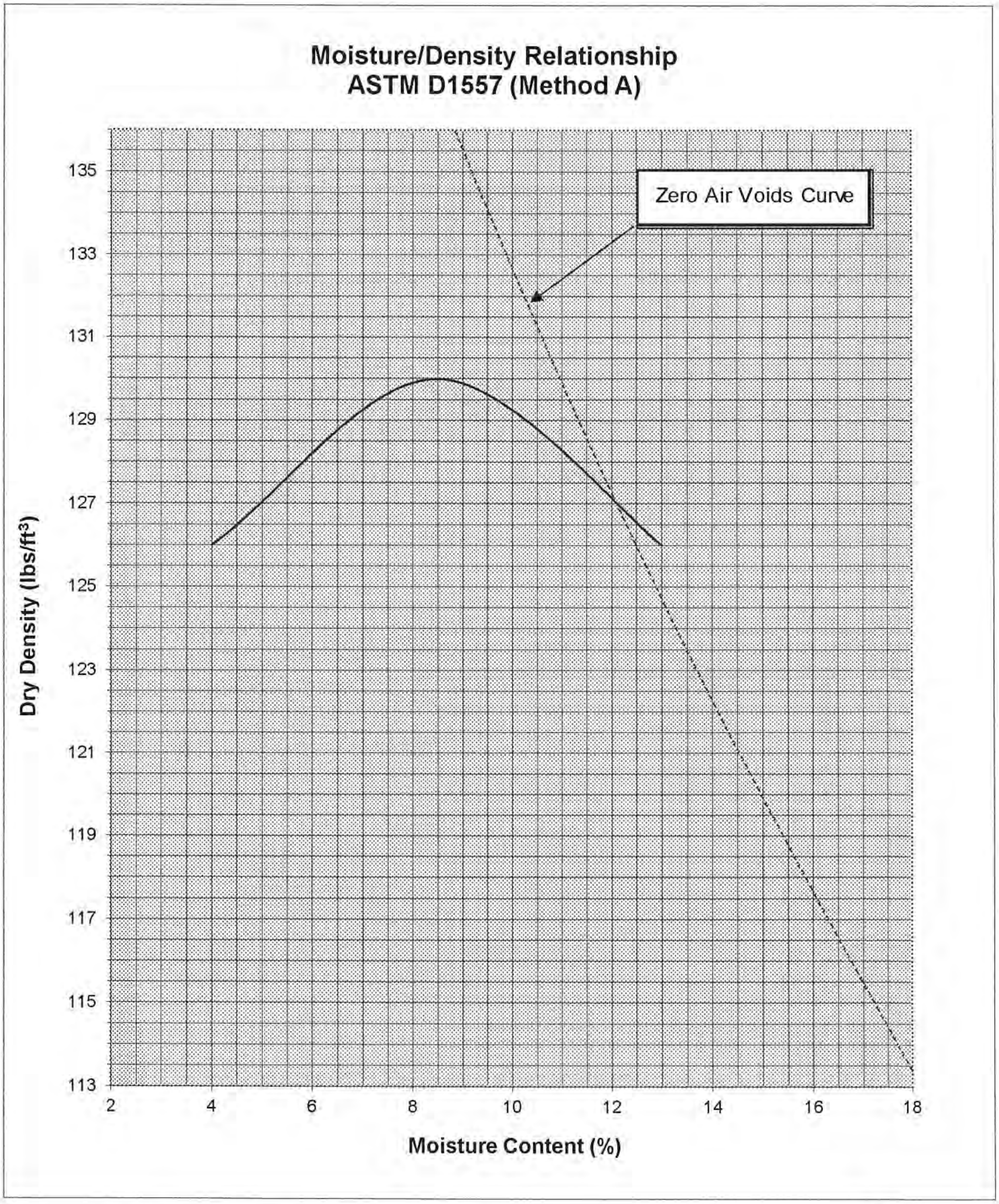


Boring No.	B-1
Depth (ft.)	3.5
Optimum Moisture (%)	7.5
Maximum Dry Density (pcf)	133.8
Soil Classification	Brown gravelly fine to coarse sand with silt and a trace of clay



Boring No.	B-2
Depth (ft.)	5.5
Optimum Moisture (%)	8.1
Maximum Dry Density (pcf)	131.9
Soil Classification	Red-brown silty fine to medium sand with gravel (SM)

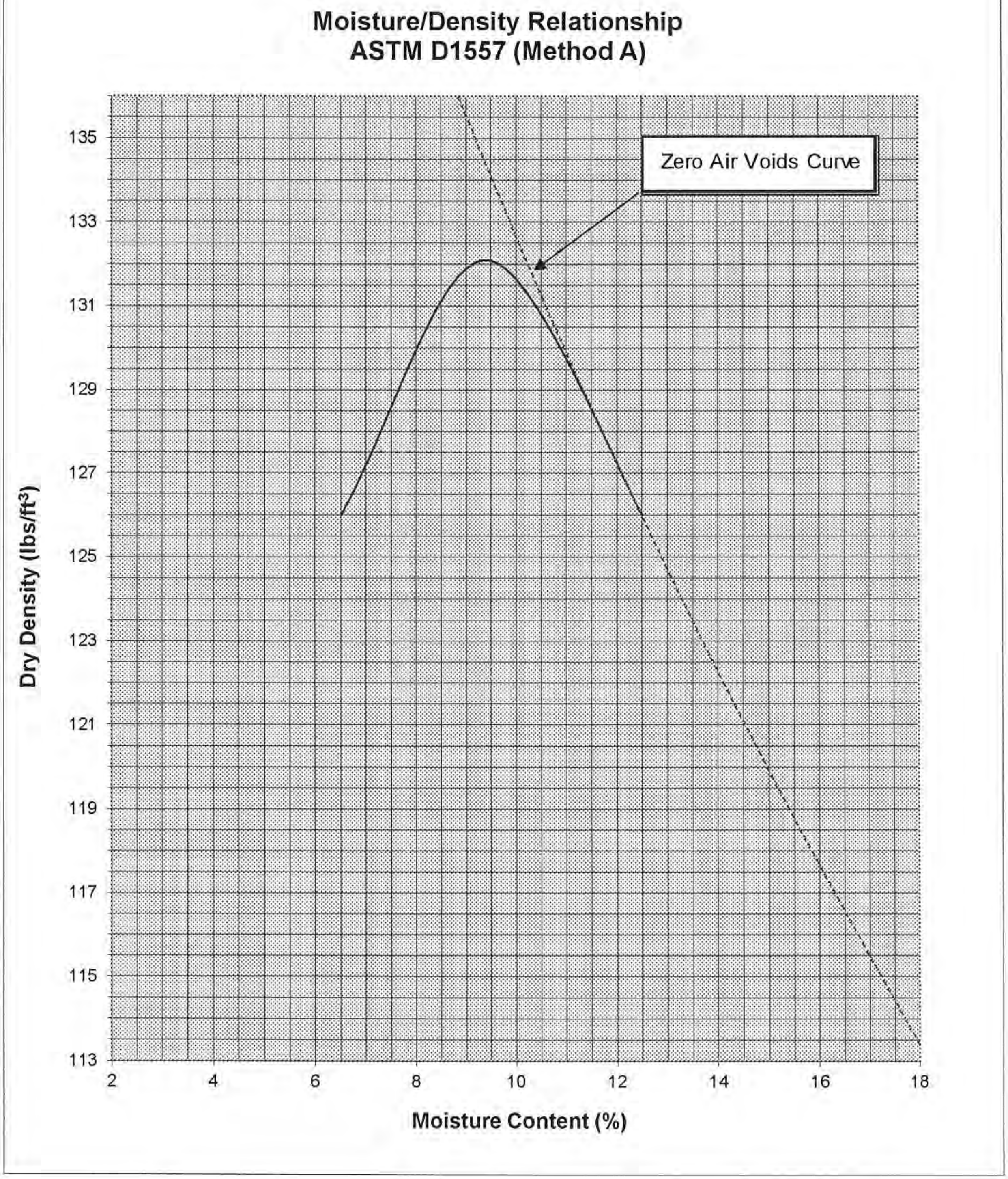
MARTA Administration Building
Big Bear Lake, California



Boring No.	B-2
Depth (ft.)	7.5
Optimum Moisture (%)	8.5
Maximum Dry Density (pcf)	130.0
Soil Classification	Light brown silty fine to medium sand (SM)

MARTA Administration Building
Big Bear Lake, California

Enclosure 3, Page 3
Rpt. No.: 7341
File No.: S-14447

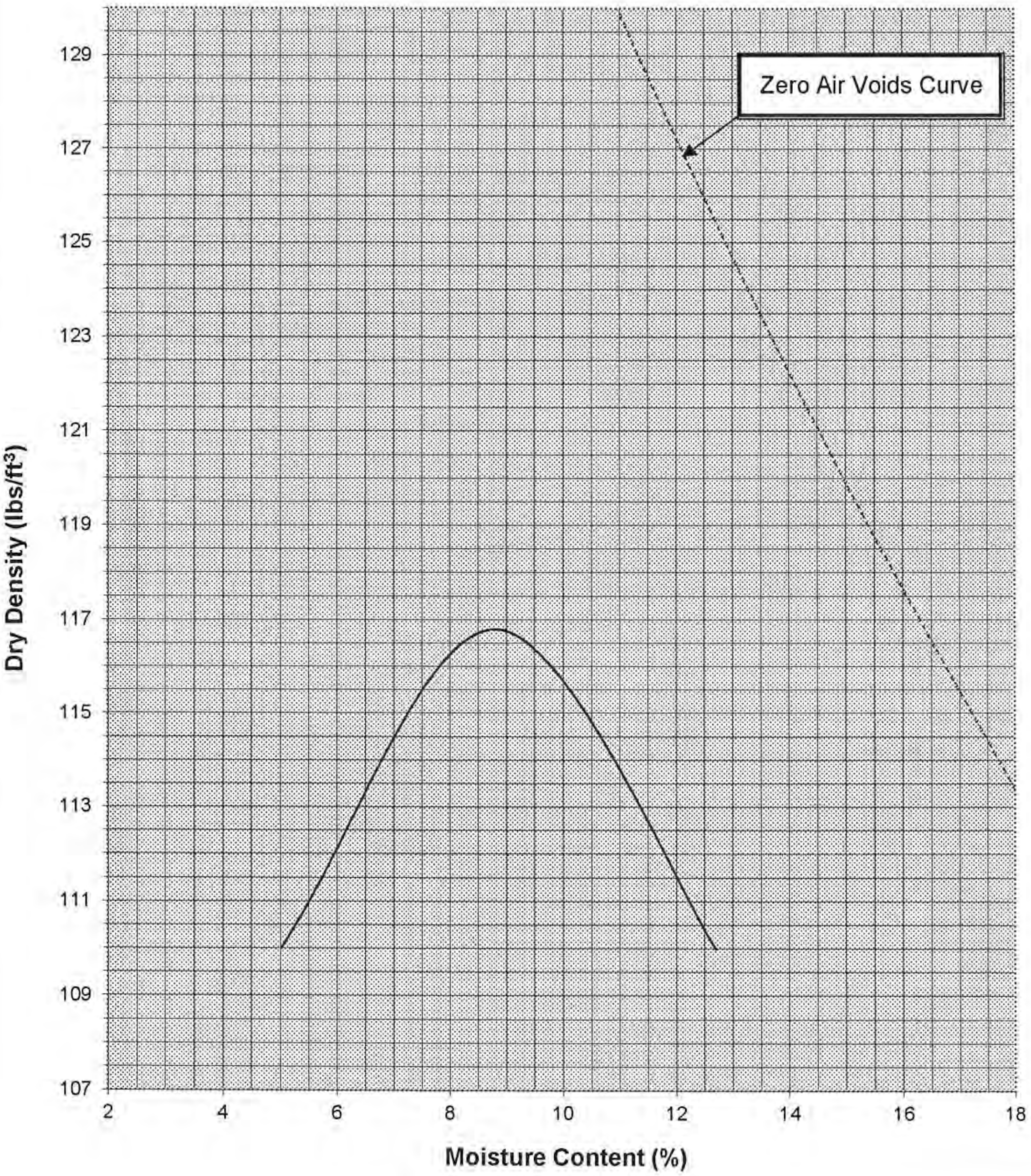


Boring No.	B-3
Depth (ft.)	1.5
Optimum Moisture (%)	9.4
Maximum Dry Density (pcf)	132.1
Soil Classification	Gray-brown gravelly f-m sand with silt and a trace of clay (SM)

MARTA Administration Building
Big Bear Lake, California

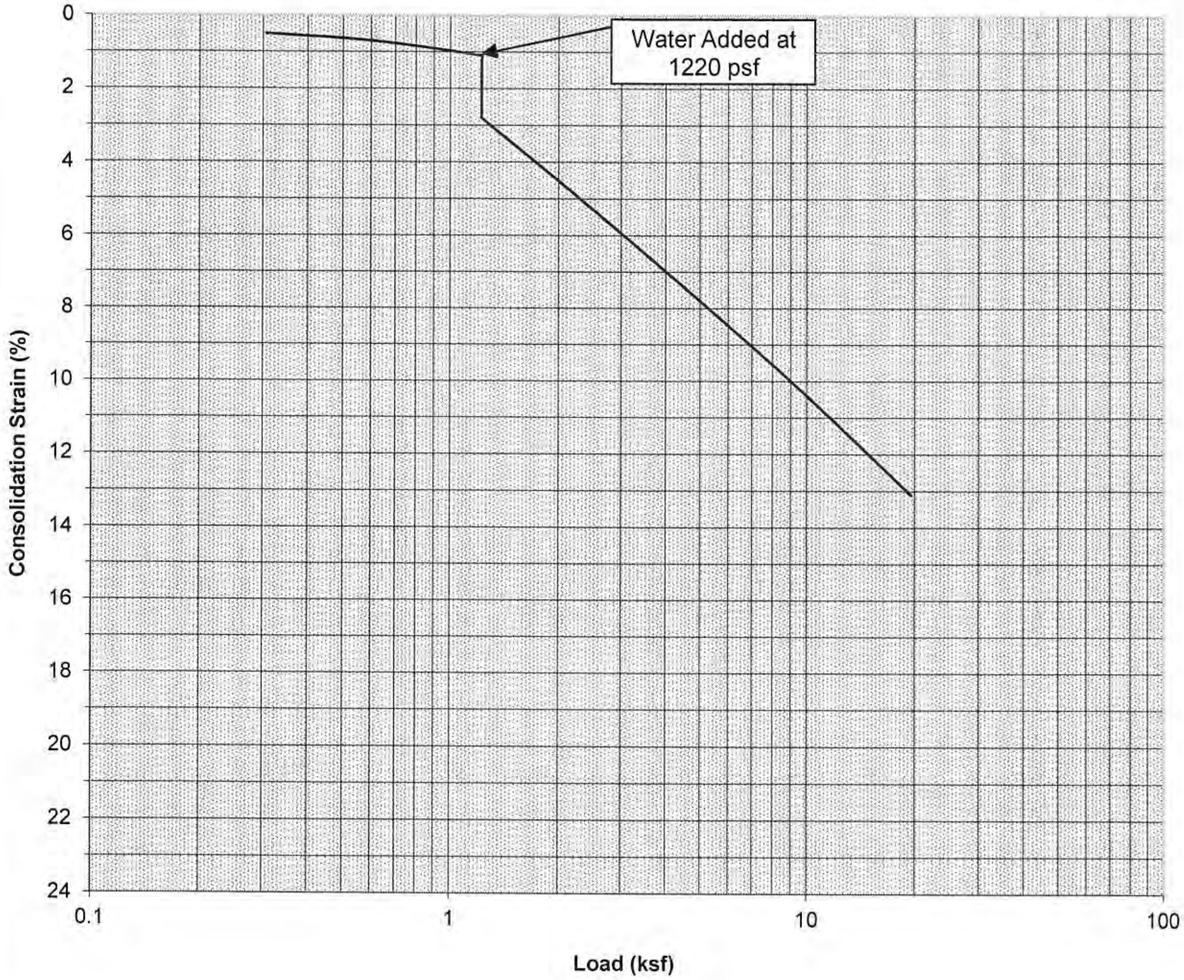
Enclosure 3, Page 4
Rpt. No.: 7341
File No.: S-14447

Moisture/Density Relationship
ASTM D1557 (Method A)



Boring No.	B-8
Depth (ft.)	15.5
Optimum Moisture (%)	8.8
Maximum Dry Density (pcf)	116.8
Soil Classification	Light gray-brown silty fine to medium sand with a trace of clay

Consolidation Test Results

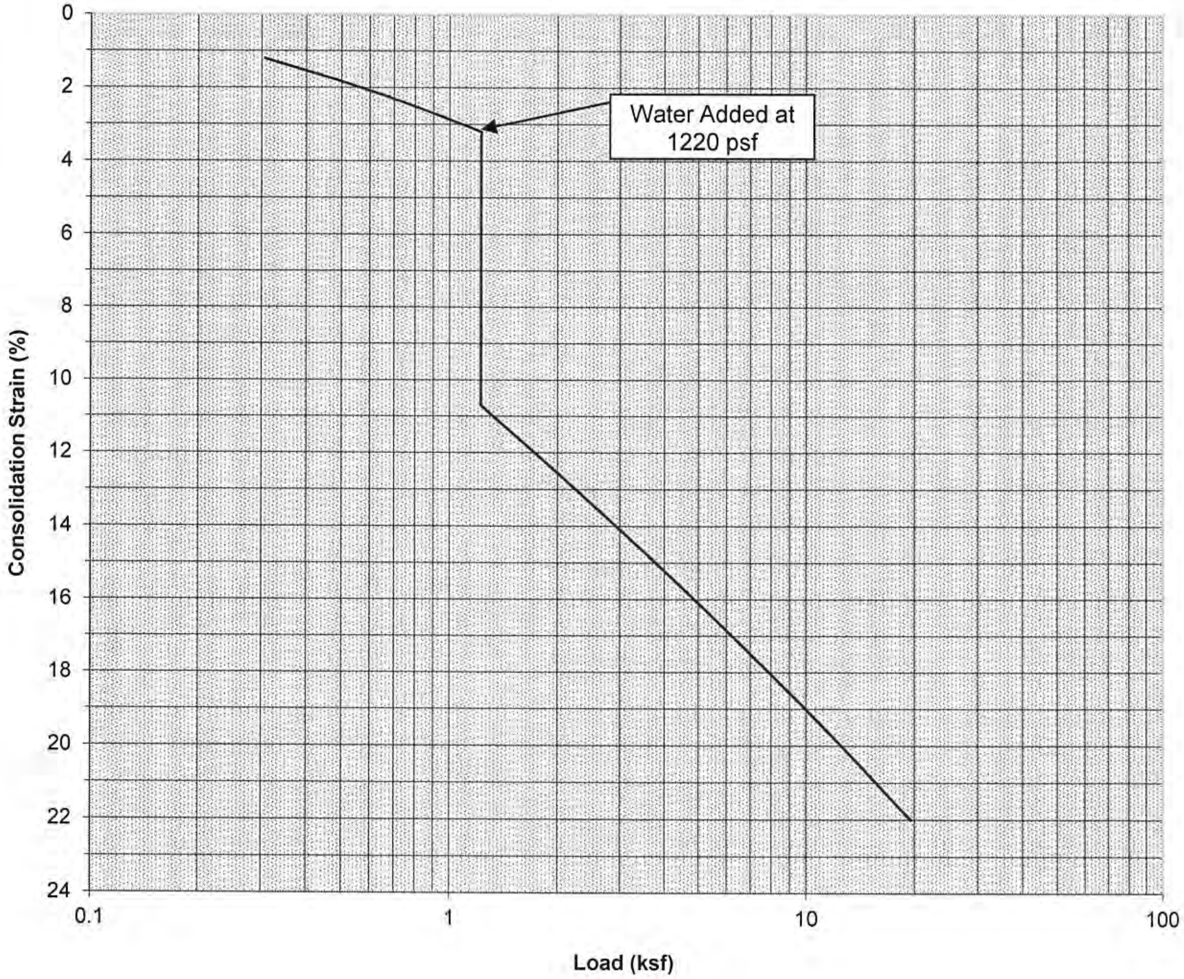


Classification: SM

Boring Number:	B-4	Initial Moisture Content (%)	12.3
Depth (ft)	7.5	Final Moisture Content (%)	15.8
Specimen Diameter (in)	2.4	Initial Dry Density (pcf)	110
Specimen Thickness (in)	1.0		

Enclosure 4, Page 1
Rpt. No.: 7341
File No.: S-14447

Consolidation Test Results



Classification: SM

Boring Number:	B-8
Depth (ft)	7.5
Specimen Diameter (in)	2.4
Specimen Thickness (in)	1.0

Initial Moisture Content (%)	11.0
Final Moisture Content (%)	16.8
Initial Dry Density (pcf)	109

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Rpt. No.: 7341
File No.: S-14447

DIRECT SHEAR TESTS

Test Boring No.	Depth of Sample (Ft.)	Angle of Internal Friction (°)	Cohesion (PSF)
B-4	7.5	31	50
B-8	7.5	31	50
B-9	5.5	33	0

EXPANSION INDEX TEST DATA
ASTM D 4829/ASTM D 2488

Project: Mountain Area Regional Transit Authority **Date:** April 11, 2022

Soil Description: Silty fine to coarse sand with a trace of clay

Location: B-1 at 3.5'

Soil I.D.	Initial Height (0.001 in.)	Initial Water Content (%)	Initial Dry Unit Weight (0.1 lbf/ft^3)	Degree of Saturation (%)	Initial Dial Reading (0.001)	Final Dial Reading (0.001)	Final Water Content (0.1%)	Expansion Index	Classification of Potential Expansion
B-1	1.000	9.6	112.7	52.0	0.1677	0.1646	16.7	3	Very low

Expansion Index determined by adjusting the water content to achieve a degree of saturation of 50 +/- 2%.

Enclosure 6
Rpt. No.: 7341
File No.: S-14447

RESULTS OF SUBGRADE SOIL TESTS

California Department of Transportation Test Methods 202, 217, & 301
ASTM Designations C136 and D2419

PROJECT: Mountain Area Regional Transit Authority

		Percent Passing Sieve Size:															
Sample No.	**Location**	**3”**	**2½”**	**2”**	**1½”**	**1”**	**3/4”**	**1/2”**	**3/8”**	**No. 4**	**No. 8**	**No. 16**	**No. 30**	**No. 50**	**No. 100**	**No. 200**	**Sand Equiv.**
1	B-2 at 0-5’			100	97	95	93	89	85	75	70	64	58	50	40	30	10
2	B-5 at 0-5’		100	99	96	92	86	81	75	66	64	59	53	45	36	28	10

STABILOMETER “R” VALUE

1

Sample No.		1	
Moisture Content (%)	10.3	10.7	11.1
Dry Density (lbs./cu. ft.)	125.0	123.5	122.2
Exudation Pressure (psi)	653	447	252
Expansion Pressure (psf)	108.25	64.95	34.64
“R” Value	60	52	43
“R” Value at 300 PSI Exudation		45	

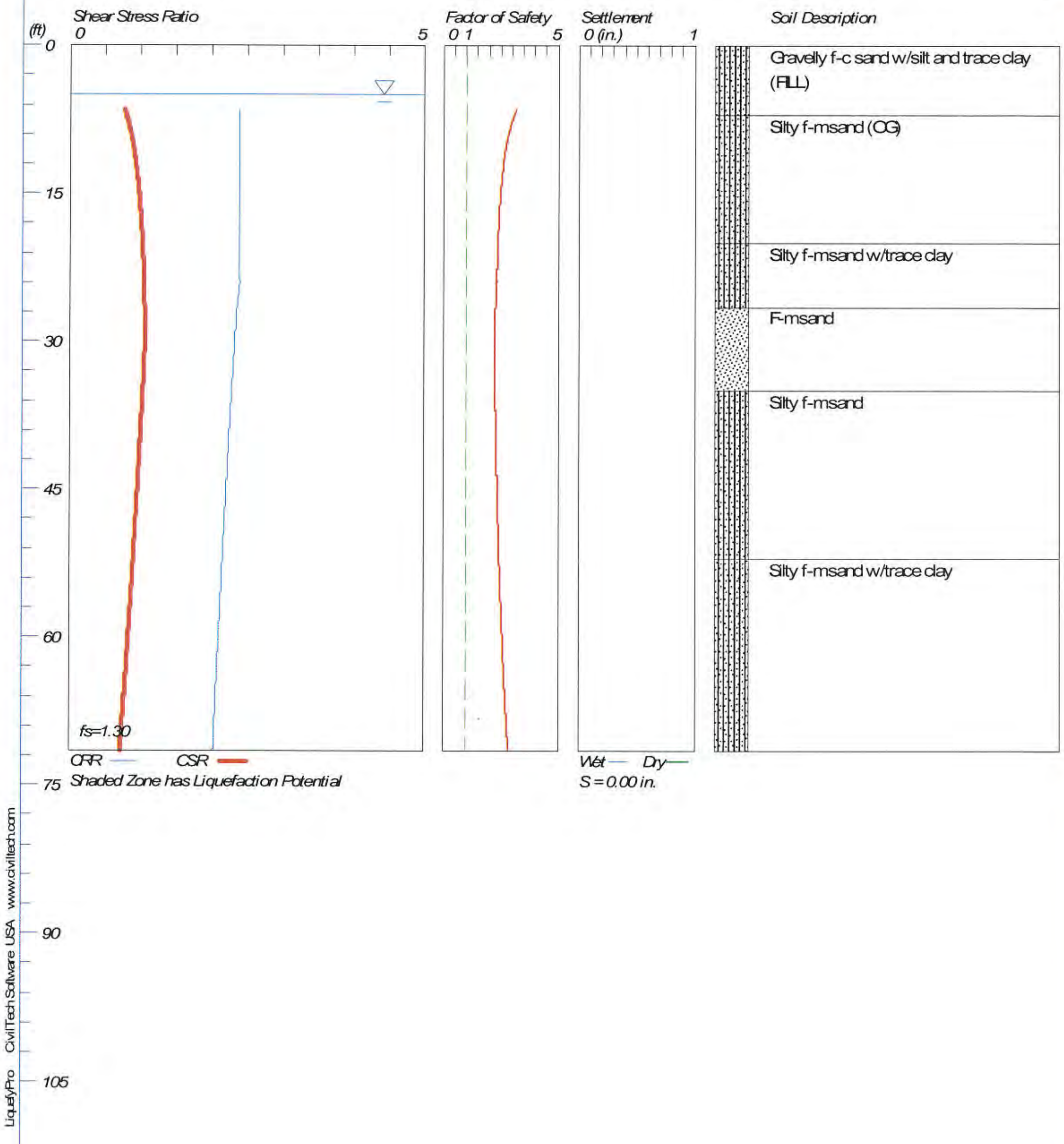
SUGGESTED SPECIFICATIONS FOR CLASS II BASE

Sieve Size	**Percent Finer Than**
1 Inch	100
3/4 Inch	90 - 100
No. 4	35 - 60
No. 30	10 - 30
No. 200	2 - 9
Sand Equivalent (Minimum)	25
"R" Value (minimum) at 300 psi Exudation	78

LIQUEFACTION ANALYSIS

MARTA - NEW ADMINISTRATION BUILDING AND MAINTENANCE FACILITY

Hole No.=B-1 Water Depth=5.0 ft Surface Elev.=6779 feet AMSL *Magnitude=7.0*
Acceleration=0.81g



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                                            LIQUEFACTION ANALYSIS CALCULATION SHEET

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        Title:  MARTA - NEW ADMINISTRATION BUILDING AND MAINTENANCE FACILITY
        Subtitle:  S-14447

        Surface Elev.=6779 feet AMSL
        Hole No.=B-1
        Depth of Hole= 71.5 ft
        Water Table during Earthquake= 5.0 ft
        Water Table during In-Situ Testing= 26.6 ft
        Max. Acceleration= 0.81 g
        Earthquake Magnitude= 7.0
        User defined factor of safty (applied to CSR)       User fs=1.3
        fs=user,  Plot one CSR (fs=user)

        Hammer Energy Ratio, Ce=1
        Borehole Diameter, Cb=1.15
        Sampeling Method, Cs=1.3
        SPT Fines Correction Method: Stark/Olson et al.*
        Settlement Analysis Method: Ishihara / Yoshimine*
        Fines Correction for Liquefaction: Stark/Olson et al.*
        Fine Correction for Settlement: Post-Liq. Correction *
        Average Input Data: Smooth*
        * Recommended Options

Input Data:
        Depth    SPT      Gamma    Fines
        ft                pcf      %
        ____________________________________
        6.5      30.0     130.0    28.0
        11.5     30.0     130.0    20.0
        16.5     29.0     129.0    20.0
        21.5     42.0     128.0    25.0
        26.5     31.0     135.0    1.0
        31.5     83.0     135.0    1.0
        35.0     58.0     135.0    15.0
        40.0     49.0     135.0    15.0
        45.0     34.0     135.0    15.0
        50.0     55.0     135.0    15.0
        55.0     100.0    135.0    25.0
        60.0     51.0     135.0    25.0
        65.0     50.0     135.0    25.0
        70.0     81.0     135.0    25.0
        ____________________________________

Output Results:
        Settlement of saturated sands=0.00 in.
        Settlement of dry sands=0.00 in.
        Total settlement of saturated and dry sands=0.00 in.
```

```
Differential Settlement=0.000 to 0.000 in.

Depth   CRRm     CSRfs    F.S.     S_sat.   S_dry    S_all
ft               w/fs              in.      in.      in.
_______________________________________________________________
6.50    2.39     0.76     3.15     0.00     0.00     0.00
7.50    2.39     0.80     2.98     0.00     0.00     0.00
8.50    2.39     0.84     2.85     0.00     0.00     0.00
9.50    2.39     0.87     2.75     0.00     0.00     0.00
10.50   2.39     0.89     2.67     0.00     0.00     0.00
11.50   2.39     0.91     2.61     0.00     0.00     0.00
12.50   2.39     0.93     2.56     0.00     0.00     0.00
13.50   2.39     0.95     2.51     0.00     0.00     0.00
14.50   2.39     0.96     2.47     0.00     0.00     0.00
15.50   2.39     0.98     2.44     0.00     0.00     0.00
16.50   2.39     0.99     2.41     0.00     0.00     0.00
17.50   2.39     1.00     2.39     0.00     0.00     0.00
18.50   2.39     1.01     2.36     0.00     0.00     0.00
19.50   2.39     1.02     2.34     0.00     0.00     0.00
20.50   2.39     1.02     2.33     0.00     0.00     0.00
21.50   2.39     1.03     2.31     0.00     0.00     0.00
22.50   2.39     1.04     2.30     0.00     0.00     0.00
23.50   2.39     1.04     2.29     0.00     0.00     0.00
24.50   2.39     1.05     2.28     0.00     0.00     0.00
25.50   2.37     1.05     2.26     0.00     0.00     0.00
26.50   2.36     1.05     2.24     0.00     0.00     0.00
27.50   2.35     1.05     2.23     0.00     0.00     0.00
28.50   2.34     1.06     2.21     0.00     0.00     0.00
29.50   2.33     1.06     2.20     0.00     0.00     0.00
30.50   2.32     1.06     2.20     0.00     0.00     0.00
31.50   2.31     1.05     2.20     0.00     0.00     0.00
32.50   2.30     1.04     2.21     0.00     0.00     0.00
33.50   2.30     1.04     2.21     0.00     0.00     0.00
34.50   2.29     1.03     2.22     0.00     0.00     0.00
35.50   2.28     1.02     2.23     0.00     0.00     0.00
36.50   2.27     1.02     2.23     0.00     0.00     0.00
37.50   2.26     1.01     2.24     0.00     0.00     0.00
38.50   2.26     1.00     2.25     0.00     0.00     0.00
39.50   2.25     1.00     2.26     0.00     0.00     0.00
40.50   2.24     0.99     2.27     0.00     0.00     0.00
41.50   2.23     0.98     2.28     0.00     0.00     0.00
42.50   2.23     0.97     2.29     0.00     0.00     0.00
43.50   2.22     0.97     2.30     0.00     0.00     0.00
44.50   2.21     0.96     2.31     0.00     0.00     0.00
45.50   2.20     0.95     2.32     0.00     0.00     0.00
46.50   2.20     0.94     2.33     0.00     0.00     0.00
47.50   2.19     0.93     2.35     0.00     0.00     0.00
48.50   2.18     0.92     2.36     0.00     0.00     0.00
49.50   2.17     0.92     2.37     0.00     0.00     0.00
50.50   2.17     0.91     2.39     0.00     0.00     0.00
51.50   2.16     0.90     2.40     0.00     0.00     0.00
52.50   2.15     0.89     2.42     0.00     0.00     0.00
53.50   2.15     0.88     2.43     0.00     0.00     0.00
54.50   2.14     0.87     2.45     0.00     0.00     0.00
55.50   2.13     0.86     2.47     0.00     0.00     0.00
56.50   2.13     0.86     2.48     0.00     0.00     0.00
57.50   2.12     0.85     2.50     0.00     0.00     0.00
58.50   2.11     0.84     2.52     0.00     0.00     0.00
59.50   2.11     0.83     2.54     0.00     0.00     0.00
60.50   2.10     0.82     2.56     0.00     0.00     0.00
61.50   2.09     0.81     2.58     0.00     0.00     0.00
62.50   2.09     0.80     2.60     0.00     0.00     0.00
63.50   2.08     0.79     2.62     0.00     0.00     0.00
```

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        64.50   2.07    0.78    2.65    0.00    0.00    0.00
        65.50   2.07    0.77    2.67    0.00    0.00    0.00
        66.50   2.06    0.77    2.69    0.00    0.00    0.00
        67.50   2.06    0.76    2.72    0.00    0.00    0.00
        68.50   2.05    0.75    2.75    0.00    0.00    0.00
        69.50   2.04    0.74    2.77    0.00    0.00    0.00
        70.50   2.04    0.73    2.80    0.00    0.00    0.00
        71.50   2.03    0.72    2.83    0.00    0.00    0.00
        _______________________________________________________
        * F.S.<1, Liquefaction Potential Zone
        (F.S. is limited to 5,  CRR is limited to 2,    CSR is limited to 2)

        Units           Depth = ft, Stress or Pressure = tsf (atm), Unit Weight =
pcf, Settlement = in.

_________________________________________________________________________________
        CRRm            Cyclic resistance ratio from soils
        CSRfs           Cyclic stress ratio induced by a given earthquake (with user
request factor of safety)
        F.S.            Factor of Safety against liquefaction, F.S.=CRRm/CSRfs
        S_sat           Settlement from saturated sands
        S_dry           Settlement from dry sands
        S_all           Total settlement from saturated and dry sands
        NoLiq           No-Liquefy Soils
```

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************************************************************************************
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                                       LIQUEFACTION ANALYSIS CALCULATION SHEET

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                                                   www.civiltech.com
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************************************************************************************
*******************
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        Input File Name: T:\Liquefy4\S-14447.1.liq
        Title:  MARTA - NEW ADMINISTRATION BUILDING AND MAINTENANCE FACILITY
        Subtitle:  S-14447

 Input Data:

        Surface Elev.=6779 feet AMSL
        Hole No.=B-1
        Depth of Hole=71.5 ft
        Water Table during Earthquake= 5.0 ft
        Water Table during In-Situ Testing= 26.6 ft
        Max. Acceleration=0.81 g
        Earthquake Magnitude=7.0
        User defined factor of safty (applied to CSR)       User fs=1.3
        fs=user,  Plot one CSR (fs=user)

        Hammer Energy Ratio, Ce=1
        Borehole Diameter, Cb=1.15
        Sampeling Method, Cs=1.3
        SPT Fines Correction Method: Stark/Olson et al.*
        Settlement Analysis Method: Ishihara / Yoshimine*
        Fines Correction for Liquefaction: Stark/Olson et al.*
        Fine Correction for Settlement: Post-Liq. Correction *
        Average Input Data: Smooth*
        * Recommended Options

        Depth    SPT      Gamma    Fines
        ft                pcf      %
        ____________________________________
        6.5      30.0     130.0    28.0
        11.5     30.0     130.0    20.0
        16.5     29.0     129.0    20.0
        21.5     42.0     128.0    25.0
        26.5     31.0     135.0    1.0
        31.5     83.0     135.0    1.0
        35.0     58.0     135.0    15.0
        40.0     49.0     135.0    15.0
        45.0     34.0     135.0    15.0
        50.0     55.0     135.0    15.0
        55.0     100.0    135.0    25.0
        60.0     51.0     135.0    25.0
        65.0     50.0     135.0    25.0
        70.0     81.0     135.0    25.0
        ____________________________________

 Output Results:           (Interval = 1.00 ft)
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CSR Calculation:
Depth    gamma    sigma    gamma'   sigma'   rd       CSR      fs       CSRfs
ft       pcf      tsf      pcf      tsf                        (user)   w/fs
_____________________________________________________________________________
6.50     130.0    0.423    67.6     0.376    0.98     0.58     1.3      0.76
7.50     130.0    0.488    67.6     0.410    0.98     0.62     1.3      0.80
8.50     130.0    0.553    67.6     0.443    0.98     0.64     1.3      0.84
9.50     130.0    0.618    67.6     0.477    0.98     0.67     1.3      0.87
10.50    130.0    0.683    67.6     0.511    0.98     0.69     1.3      0.89
11.50    130.0    0.748    67.6     0.545    0.97     0.70     1.3      0.91
12.50    129.8    0.812    67.4     0.578    0.97     0.72     1.3      0.93
13.50    129.6    0.877    67.2     0.612    0.97     0.73     1.3      0.95
14.50    129.4    0.942    67.0     0.646    0.97     0.74     1.3      0.96
15.50    129.2    1.007    66.8     0.679    0.96     0.75     1.3      0.98
16.50    129.0    1.071    66.6     0.712    0.96     0.76     1.3      0.99
17.50    128.8    1.136    66.4     0.746    0.96     0.77     1.3      1.00
18.50    128.6    1.200    66.2     0.779    0.96     0.78     1.3      1.01
19.50    128.4    1.264    66.0     0.812    0.95     0.78     1.3      1.02
20.50    128.2    1.328    65.8     0.845    0.95     0.79     1.3      1.02
21.50    128.0    1.393    65.6     0.878    0.95     0.79     1.3      1.03
22.50    129.4    1.457    67.0     0.911    0.95     0.80     1.3      1.04
23.50    130.8    1.522    68.4     0.945    0.95     0.80     1.3      1.04
24.50    132.2    1.588    69.8     0.979    0.94     0.80     1.3      1.05
25.50    133.6    1.654    71.2     1.014    0.94     0.81     1.3      1.05
26.50    135.0    1.721    72.6     1.050    0.94     0.81     1.3      1.05
27.50    135.0    1.789    72.6     1.087    0.94     0.81     1.3      1.05
28.50    135.0    1.856    72.6     1.123    0.93     0.81     1.3      1.06
29.50    135.0    1.924    72.6     1.159    0.93     0.81     1.3      1.06
30.50    135.0    1.991    72.6     1.196    0.93     0.81     1.3      1.06
31.50    135.0    2.059    72.6     1.232    0.92     0.81     1.3      1.05
32.50    135.0    2.126    72.6     1.268    0.91     0.80     1.3      1.04
33.50    135.0    2.194    72.6     1.304    0.90     0.80     1.3      1.04
34.50    135.0    2.261    72.6     1.341    0.89     0.79     1.3      1.03
35.50    135.0    2.329    72.6     1.377    0.89     0.79     1.3      1.02
36.50    135.0    2.396    72.6     1.413    0.88     0.78     1.3      1.02
37.50    135.0    2.464    72.6     1.450    0.87     0.78     1.3      1.01
38.50    135.0    2.531    72.6     1.486    0.86     0.77     1.3      1.00
39.50    135.0    2.599    72.6     1.522    0.85     0.77     1.3      1.00
40.50    135.0    2.666    72.6     1.559    0.84     0.76     1.3      0.99
41.50    135.0    2.734    72.6     1.595    0.84     0.75     1.3      0.98
42.50    135.0    2.801    72.6     1.631    0.83     0.75     1.3      0.97
43.50    135.0    2.869    72.6     1.667    0.82     0.74     1.3      0.97
44.50    135.0    2.936    72.6     1.704    0.81     0.74     1.3      0.96
45.50    135.0    3.004    72.6     1.740    0.80     0.73     1.3      0.95
46.50    135.0    3.071    72.6     1.776    0.80     0.72     1.3      0.94
47.50    135.0    3.139    72.6     1.813    0.79     0.72     1.3      0.93
48.50    135.0    3.206    72.6     1.849    0.78     0.71     1.3      0.92
49.50    135.0    3.274    72.6     1.885    0.77     0.71     1.3      0.92
50.50    135.0    3.341    72.6     1.922    0.76     0.70     1.3      0.91
51.50    135.0    3.409    72.6     1.958    0.75     0.69     1.3      0.90
52.50    135.0    3.476    72.6     1.994    0.75     0.69     1.3      0.89
53.50    135.0    3.544    72.6     2.030    0.74     0.68     1.3      0.88
54.50    135.0    3.611    72.6     2.067    0.73     0.67     1.3      0.87
55.50    135.0    3.679    72.6     2.103    0.72     0.67     1.3      0.86
56.50    135.0    3.746    72.6     2.139    0.71     0.66     1.3      0.86
57.50    135.0    3.814    72.6     2.176    0.71     0.65     1.3      0.85
58.50    135.0    3.881    72.6     2.212    0.70     0.64     1.3      0.84
59.50    135.0    3.949    72.6     2.248    0.69     0.64     1.3      0.83
60.50    135.0    4.016    72.6     2.285    0.68     0.63     1.3      0.82
61.50    135.0    4.084    72.6     2.321    0.67     0.62     1.3      0.81
62.50    135.0    4.151    72.6     2.357    0.67     0.62     1.3      0.80
63.50    135.0    4.219    72.6     2.393    0.66     0.61     1.3      0.79
64.50    135.0    4.286    72.6     2.430    0.65     0.60     1.3      0.78
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         65.50     135.0     4.354     72.6      2.466    0.64      0.60     1.3       0.77
         66.50     135.0     4.421     72.6      2.502    0.63      0.59     1.3       0.77
         67.50     135.0     4.489     72.6      2.539    0.62      0.58     1.3       0.76
         68.50     135.0     4.556     72.6      2.575    0.62      0.57     1.3       0.75
         69.50     135.0     4.624     72.6      2.611    0.61      0.57     1.3       0.74
         70.50     135.0     4.691     72.6      2.648    0.60      0.56     1.3       0.73
         71.50     135.0     4.759     72.6      2.684    0.59      0.55     1.3       0.72
         ____________________________________________________________________________________
         CSR is based on water table at 5.0 during earthquake

         CRR Calculation from SPT or BPT data:
         Depth    SPT       Cebs      Cr        sigma'    Cn        (N1)60    Fines     d(N1)60
(N1)60f  CRR7.5
         ft                                                                   %

_____________________________________________________________________________________________

_
         6.50     30.00     1.49      0.75      0.423     1.54      51.75     28.0      5.52
57.27    2.00
         7.50     30.00     1.49      0.75      0.488     1.43      48.18     26.4      5.14
53.31    2.00
         8.50     30.00     1.49      0.85      0.553     1.35      51.29     24.8      4.75
56.04    2.00
         9.50     30.00     1.49      0.85      0.618     1.27      48.51     23.2      4.37
52.88    2.00
         10.50    30.00     1.49      0.85      0.683     1.21      46.15     21.6      3.98
50.13    2.00
         11.50    30.00     1.49      0.85      0.748     1.16      44.09     20.0      3.60
47.69    2.00
         12.50    29.80     1.49      0.85      0.812     1.11      42.01     20.0      3.60
45.61    2.00
         13.50    29.60     1.49      0.85      0.877     1.07      40.16     20.0      3.60
43.76    2.00
         14.50    29.40     1.49      0.85      0.942     1.03      38.49     20.0      3.60
42.09    2.00
         15.50    29.20     1.49      0.95      1.007     1.00      41.33     20.0      3.60
44.93    2.00
         16.50    29.00     1.49      0.95      1.071     0.97      39.79     20.0      3.60
43.39    2.00
         17.50    31.60     1.49      0.95      1.136     0.94      42.11     21.0      3.84
45.95    2.00
         18.50    34.20     1.49      0.95      1.200     0.91      44.34     22.0      4.08
48.42    2.00
         19.50    36.80     1.49      0.95      1.264     0.89      46.48     23.0      4.32
50.80    2.00
         20.50    39.40     1.49      0.95      1.328     0.87      48.55     24.0      4.56
53.11    2.00
         21.50    42.00     1.49      0.95      1.393     0.85      50.55     25.0      4.80
55.35    2.00
         22.50    39.80     1.49      0.95      1.457     0.83      46.83     20.2      3.65
50.48    2.00
         23.50    37.60     1.49      0.95      1.522     0.81      43.29     15.4      2.50
45.78    2.00
         24.50    35.40     1.49      0.95      1.588     0.79      39.90     10.6      1.34
41.25    2.00
         25.50    33.20     1.49      0.95      1.654     0.78      36.66     5.8       0.19
36.86    2.00
         26.50    31.00     1.49      0.95      1.721     0.76      33.56     1.0       0.00
33.56    2.00
         27.50    41.40     1.49      0.95      1.762     0.75      44.29     1.0       0.00
44.29    2.00
         28.50    51.80     1.49      1.00      1.798     0.75      57.74     1.0       0.00
57.74    2.00
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         29.50     62.20     1.49     1.00     1.835    0.74     68.65    1.0      0.00
68.65    2.00
         30.50     72.60     1.49     1.00     1.871    0.73     79.35    1.0      0.00
79.35    2.00
         31.50     83.00     1.49     1.00     1.907    0.72     89.84    1.0      0.00
89.84    2.00
         32.50     75.86     1.49     1.00     1.944    0.72     81.35    5.0      0.00
81.35    2.00
         33.50     68.72     1.49     1.00     1.980    0.71     73.01    9.0      0.96
73.97    2.00
         34.50     61.57     1.49     1.00     2.016    0.70     64.83    13.0     1.92
66.75    2.00
         35.50     57.10     1.49     1.00     2.053    0.70     59.58    15.0     2.40
61.98    2.00
         36.50     55.30     1.49     1.00     2.089    0.69     57.20    15.0     2.40
59.60    2.00
         37.50     53.50     1.49     1.00     2.125    0.69     54.87    15.0     2.40
57.27    2.00
         38.50     51.70     1.49     1.00     2.161    0.68     52.57    15.0     2.40
54.97    2.00
         39.50     49.90     1.49     1.00     2.198    0.67     50.32    15.0     2.40
52.72    2.00
         40.50     47.50     1.49     1.00     2.234    0.67     47.51    15.0     2.40
49.91    2.00
         41.50     44.50     1.49     1.00     2.270    0.66     44.15    15.0     2.40
46.55    2.00
         42.50     41.50     1.49     1.00     2.307    0.66     40.85    15.0     2.40
43.25    2.00
         43.50     38.50     1.49     1.00     2.343    0.65     37.60    15.0     2.40
40.00    2.00
         44.50     35.50     1.49     1.00     2.379    0.65     34.41    15.0     2.40
36.81    2.00
         45.50     36.10     1.49     1.00     2.416    0.64     34.72    15.0     2.40
37.12    2.00
         46.50     40.30     1.49     1.00     2.452    0.64     38.47    15.0     2.40
40.87    2.00
         47.50     44.50     1.49     1.00     2.488    0.63     42.17    15.0     2.40
44.57    2.00
         48.50     48.70     1.49     1.00     2.524    0.63     45.82    15.0     2.40
48.22    2.00
         49.50     52.90     1.49     1.00     2.561    0.62     49.42    15.0     2.40
51.82    2.00
         50.50     59.50     1.49     1.00     2.597    0.62     55.19    16.0     2.64
57.83    2.00
         51.50     68.50     1.49     1.00     2.633    0.62     63.10    18.0     3.12
66.22    2.00
         52.50     77.50     1.49     1.00     2.670    0.61     70.91    20.0     3.60
74.51    2.00
         53.50     86.50     1.49     1.00     2.706    0.61     78.61    22.0     4.08
82.69    2.00
         54.50     95.50     1.49     1.00     2.742    0.60     86.21    24.0     4.56
90.77    2.00
         55.50     95.11     1.49     1.00     2.779    0.60     85.30    25.0     4.80
90.10    2.00
         56.50     85.31     1.49     1.00     2.815    0.60     76.01    25.0     4.80
80.81    2.00
         57.50     75.51     1.49     1.00     2.851    0.59     66.85    25.0     4.80
71.65    2.00
         58.50     65.71     1.49     1.00     2.888    0.59     57.81    25.0     4.80
62.61    2.00
         59.50     55.91     1.49     1.00     2.924    0.58     48.88    25.0     4.80
53.68    2.00
         60.50     50.90     1.49     1.00     2.960    0.58     44.23    25.0     4.80
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49.03   2.00
        61.50   50.70   1.49    1.00    2.996   0.58    43.79   25.0    4.80
48.59   2.00
        62.50   50.50   1.49    1.00    3.033   0.57    43.35   25.0    4.80
48.15   2.00
        63.50   50.30   1.49    1.00    3.069   0.57    42.93   25.0    4.80
47.73   2.00
        64.50   50.10   1.49    1.00    3.105   0.57    42.50   25.0    4.80
47.30   2.00
        65.50   53.10   1.49    1.00    3.142   0.56    44.78   25.0    4.80
49.58   2.00
        66.50   59.30   1.49    1.00    3.178   0.56    49.73   25.0    4.80
54.53   2.00
        67.50   65.50   1.49    1.00    3.214   0.56    54.62   25.0    4.80
59.42   2.00
        68.50   71.70   1.49    1.00    3.251   0.55    59.45   25.0    4.80
64.25   2.00
        69.50   77.90   1.49    1.00    3.287   0.55    64.24   25.0    4.80
69.04   2.00
        70.50   81.00   1.49    1.00    3.323   0.55    66.43   25.0    4.80
71.23   2.00
        71.50   81.00   1.49    1.00    3.359   0.55    66.07   25.0    4.80
70.87   2.00

____________________________________________________________________________________
_
        CRR is based on water table at 26.6 during In-Situ Testing

        Factor of Safety,  - Earthquake Magnitude= 7.0:
        Depth   sigC'   CRR7.5  Ksigma  CRRv    MSF     CRRm    CSRfs   F.S.
        ft      tsf     tsf                                     w/fs    CRRm/CSRfs
        ____________________________________________________________________________
        6.50    0.27    2.00    1.00    2.00    1.19    2.39    0.76    3.15
        7.50    0.32    2.00    1.00    2.00    1.19    2.39    0.80    2.98
        8.50    0.36    2.00    1.00    2.00    1.19    2.39    0.84    2.85
        9.50    0.40    2.00    1.00    2.00    1.19    2.39    0.87    2.75
        10.50   0.44    2.00    1.00    2.00    1.19    2.39    0.89    2.67
        11.50   0.49    2.00    1.00    2.00    1.19    2.39    0.91    2.61
        12.50   0.53    2.00    1.00    2.00    1.19    2.39    0.93    2.56
        13.50   0.57    2.00    1.00    2.00    1.19    2.39    0.95    2.51
        14.50   0.61    2.00    1.00    2.00    1.19    2.39    0.96    2.47
        15.50   0.65    2.00    1.00    2.00    1.19    2.39    0.98    2.44
        16.50   0.70    2.00    1.00    2.00    1.19    2.39    0.99    2.41
        17.50   0.74    2.00    1.00    2.00    1.19    2.39    1.00    2.39
        18.50   0.78    2.00    1.00    2.00    1.19    2.39    1.01    2.36
        19.50   0.82    2.00    1.00    2.00    1.19    2.39    1.02    2.34
        20.50   0.86    2.00    1.00    2.00    1.19    2.39    1.02    2.33
        21.50   0.91    2.00    1.00    2.00    1.19    2.39    1.03    2.31
        22.50   0.95    2.00    1.00    2.00    1.19    2.39    1.04    2.30
        23.50   0.99    2.00    1.00    2.00    1.19    2.39    1.04    2.29
        24.50   1.03    2.00    1.00    2.00    1.19    2.39    1.05    2.28
        25.50   1.08    2.00    0.99    1.99    1.19    2.37    1.05    2.26
        26.50   1.12    2.00    0.99    1.98    1.19    2.36    1.05    2.24
        27.50   1.15    2.00    0.98    1.97    1.19    2.35    1.05    2.23
        28.50   1.17    2.00    0.98    1.96    1.19    2.34    1.06    2.21
        29.50   1.19    2.00    0.98    1.95    1.19    2.33    1.06    2.20
        30.50   1.22    2.00    0.97    1.95    1.19    2.32    1.06    2.20
        31.50   1.24    2.00    0.97    1.94    1.19    2.31    1.05    2.20
        32.50   1.26    2.00    0.97    1.93    1.19    2.30    1.04    2.21
        33.50   1.29    2.00    0.96    1.92    1.19    2.30    1.04    2.21
        34.50   1.31    2.00    0.96    1.92    1.19    2.29    1.03    2.22
        35.50   1.33    2.00    0.96    1.91    1.19    2.28    1.02    2.23
        36.50   1.36    2.00    0.95    1.90    1.19    2.27    1.02    2.23
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37.50    1.38     2.00     0.95     1.90     1.19     2.26     1.01     2.24
38.50    1.40     2.00     0.95     1.89     1.19     2.26     1.00     2.25
39.50    1.43     2.00     0.94     1.89     1.19     2.25     1.00     2.26
40.50    1.45     2.00     0.94     1.88     1.19     2.24     0.99     2.27
41.50    1.48     2.00     0.94     1.87     1.19     2.23     0.98     2.28
42.50    1.50     2.00     0.93     1.87     1.19     2.23     0.97     2.29
43.50    1.52     2.00     0.93     1.86     1.19     2.22     0.97     2.30
44.50    1.55     2.00     0.93     1.85     1.19     2.21     0.96     2.31
45.50    1.57     2.00     0.92     1.85     1.19     2.20     0.95     2.32
46.50    1.59     2.00     0.92     1.84     1.19     2.20     0.94     2.33
47.50    1.62     2.00     0.92     1.83     1.19     2.19     0.93     2.35
48.50    1.64     2.00     0.91     1.83     1.19     2.18     0.92     2.36
49.50    1.66     2.00     0.91     1.82     1.19     2.17     0.92     2.37
50.50    1.69     2.00     0.91     1.82     1.19     2.17     0.91     2.39
51.50    1.71     2.00     0.91     1.81     1.19     2.16     0.90     2.40
52.50    1.74     2.00     0.90     1.81     1.19     2.15     0.89     2.42
53.50    1.76     2.00     0.90     1.80     1.19     2.15     0.88     2.43
54.50    1.78     2.00     0.90     1.79     1.19     2.14     0.87     2.45
55.50    1.81     2.00     0.89     1.79     1.19     2.13     0.86     2.47
56.50    1.83     2.00     0.89     1.78     1.19     2.13     0.86     2.48
57.50    1.85     2.00     0.89     1.78     1.19     2.12     0.85     2.50
58.50    1.88     2.00     0.89     1.77     1.19     2.11     0.84     2.52
59.50    1.90     2.00     0.88     1.77     1.19     2.11     0.83     2.54
60.50    1.92     2.00     0.88     1.76     1.19     2.10     0.82     2.56
61.50    1.95     2.00     0.88     1.76     1.19     2.09     0.81     2.58
62.50    1.97     2.00     0.87     1.75     1.19     2.09     0.80     2.60
63.50    1.99     2.00     0.87     1.74     1.19     2.08     0.79     2.62
64.50    2.02     2.00     0.87     1.74     1.19     2.07     0.78     2.65
65.50    2.04     2.00     0.87     1.73     1.19     2.07     0.77     2.67
66.50    2.07     2.00     0.86     1.73     1.19     2.06     0.77     2.69
67.50    2.09     2.00     0.86     1.72     1.19     2.06     0.76     2.72
68.50    2.11     2.00     0.86     1.72     1.19     2.05     0.75     2.75
69.50    2.14     2.00     0.86     1.71     1.19     2.04     0.74     2.77
70.50    2.16     2.00     0.85     1.71     1.19     2.04     0.73     2.80
71.50    2.18     2.00     0.85     1.70     1.19     2.03     0.72     2.83
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* F.S.<1: Liquefaction Potential Zone.  (If above water table: F.S.=5)
(F.S. is limited to 5,  CRR is limited to 2,    CSR is limited to 2)


CPT convert to SPT for Settlement Analysis:
Fines Correction for Settlement Analysis:
Depth    Ic       qc/N60   qc1      (N1)60   Fines    d(N1)60  (N1)60s
ft                         tsf               %
_________________________________________________________________
6.50     -        -        -        51.75    28.0     2.41     54.16
7.50     -        -        -        48.18    26.4     2.29     50.47
8.50     -        -        -        51.29    24.8     2.17     53.46
9.50     -        -        -        48.51    23.2     2.04     50.56
10.50    -        -        -        46.15    21.6     1.92     48.06
11.50    -        -        -        44.09    20.0     1.79     45.88
12.50    -        -        -        42.01    20.0     1.79     43.80
13.50    -        -        -        40.16    20.0     1.79     41.95
14.50    -        -        -        38.49    20.0     1.79     40.28
15.50    -        -        -        41.33    20.0     1.79     43.12
16.50    -        -        -        39.79    20.0     1.79     41.58
17.50    -        -        -        42.11    21.0     1.87     43.98
18.50    -        -        -        44.34    22.0     1.95     46.29
19.50    -        -        -        46.48    23.0     2.03     48.51
20.50    -        -        -        48.55    24.0     2.11     50.66
21.50    -        -        -        50.55    25.0     2.19     52.73
22.50    -        -        -        46.83    20.2     1.80     48.64
23.50    -        -        -        43.29    15.4     1.41     44.69
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  24.50    -      -      -      39.90   10.6     0.99     40.89
  25.50    -      -      -      36.66   5.8      0.55     37.21
  26.50    -      -      -      33.56   1.0      0.10     33.66
  27.50    -      -      -      44.29   1.0      0.10     44.39
  28.50    -      -      -      57.74   1.0      0.10     57.84
  29.50    -      -      -      68.65   1.0      0.10     68.75
  30.50    -      -      -      79.35   1.0      0.10     79.44
  31.50    -      -      -      89.84   1.0      0.10     89.94
  32.50    -      -      -      81.35   5.0      0.48     81.82
  33.50    -      -      -      73.01   9.0      0.84     73.85
  34.50    -      -      -      64.83   13.0     1.20     66.03
  35.50    -      -      -      59.58   15.0     1.37     60.96
  36.50    -      -      -      57.20   15.0     1.37     58.57
  37.50    -      -      -      54.87   15.0     1.37     56.24
  38.50    -      -      -      52.57   15.0     1.37     53.94
  39.50    -      -      -      50.32   15.0     1.37     51.69
  40.50    -      -      -      47.51   15.0     1.37     48.88
  41.50    -      -      -      44.15   15.0     1.37     45.52
  42.50    -      -      -      40.85   15.0     1.37     42.22
  43.50    -      -      -      37.60   15.0     1.37     38.98
  44.50    -      -      -      34.41   15.0     1.37     35.78
  45.50    -      -      -      34.72   15.0     1.37     36.09
  46.50    -      -      -      38.47   15.0     1.37     39.85
  47.50    -      -      -      42.17   15.0     1.37     43.55
  48.50    -      -      -      45.82   15.0     1.37     47.19
  49.50    -      -      -      49.42   15.0     1.37     50.79
  50.50    -      -      -      55.19   16.0     1.46     56.65
  51.50    -      -      -      63.10   18.0     1.62     64.73
  52.50    -      -      -      70.91   20.0     1.79     72.69
  53.50    -      -      -      78.61   22.0     1.95     80.56
  54.50    -      -      -      86.21   24.0     2.11     88.32
  55.50    -      -      -      85.30   25.0     2.19     87.48
  56.50    -      -      -      76.01   25.0     2.19     78.20
  57.50    -      -      -      66.85   25.0     2.19     69.04
  58.50    -      -      -      57.81   25.0     2.19     59.99
  59.50    -      -      -      48.88   25.0     2.19     51.06
  60.50    -      -      -      44.23   25.0     2.19     46.41
  61.50    -      -      -      43.79   25.0     2.19     45.97
  62.50    -      -      -      43.35   25.0     2.19     45.54
  63.50    -      -      -      42.93   25.0     2.19     45.11
  64.50    -      -      -      42.50   25.0     2.19     44.69
  65.50    -      -      -      44.78   25.0     2.19     46.97
  66.50    -      -      -      49.73   25.0     2.19     51.91
  67.50    -      -      -      54.62   25.0     2.19     56.80
  68.50    -      -      -      59.45   25.0     2.19     61.64
  69.50    -      -      -      64.24   25.0     2.19     66.42
  70.50    -      -      -      66.43   25.0     2.19     68.61
  71.50    -      -      -      66.07   25.0     2.19     68.25
  _______________________________________________________________


  Settlement of Saturated Sands:
  Settlement Analysis Method: Ishihara / Yoshimine*
  Depth    CSRfs   F.S.    Fines   (N1)60s Dr      ec      dsz     dsv     S
  ft       w/fs            %               %       %       in.     in.     in.

_____________________________________________________________________
  71.45    0.72    2.83    25.0    68.27   100.00  0.000   0.000   0.000
0.000
  70.50    0.73    2.80    25.0    68.61   100.00  0.000   0.000   0.000
0.000
  69.50    0.74    2.77    25.0    66.42   100.00  0.000   0.000   0.000
0.000
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       68.50   0.75   2.75   25.0   61.64   100.00  0.000   0.000   0.000
0.000
       67.50   0.76   2.72   25.0   56.80   100.00  0.000   0.000   0.000
0.000
       66.50   0.77   2.69   25.0   51.91   100.00  0.000   0.000   0.000
0.000
       65.50   0.77   2.67   25.0   46.97   100.00  0.000   0.000   0.000
0.000
       64.50   0.78   2.65   25.0   44.69   100.00  0.000   0.000   0.000
0.000
       63.50   0.79   2.62   25.0   45.11   100.00  0.000   0.000   0.000
0.000
       62.50   0.80   2.60   25.0   45.54   100.00  0.000   0.000   0.000
0.000
       61.50   0.81   2.58   25.0   45.97   100.00  0.000   0.000   0.000
0.000
       60.50   0.82   2.56   25.0   46.41   100.00  0.000   0.000   0.000
0.000
       59.50   0.83   2.54   25.0   51.06   100.00  0.000   0.000   0.000
0.000
       58.50   0.84   2.52   25.0   59.99   100.00  0.000   0.000   0.000
0.000
       57.50   0.85   2.50   25.0   69.04   100.00  0.000   0.000   0.000
0.000
       56.50   0.86   2.48   25.0   78.20   100.00  0.000   0.000   0.000
0.000
       55.50   0.86   2.47   25.0   87.48   100.00  0.000   0.000   0.000
0.000
       54.50   0.87   2.45   24.0   88.32   100.00  0.000   0.000   0.000
0.000
       53.50   0.88   2.43   22.0   80.56   100.00  0.000   0.000   0.000
0.000
       52.50   0.89   2.42   20.0   72.69   100.00  0.000   0.000   0.000
0.000
       51.50   0.90   2.40   18.0   64.73   100.00  0.000   0.000   0.000
0.000
       50.50   0.91   2.39   16.0   56.65   100.00  0.000   0.000   0.000
0.000
       49.50   0.92   2.37   15.0   50.79   100.00  0.000   0.000   0.000
0.000
       48.50   0.92   2.36   15.0   47.19   100.00  0.000   0.000   0.000
0.000
       47.50   0.93   2.35   15.0   43.55   100.00  0.000   0.000   0.000
0.000
       46.50   0.94   2.33   15.0   39.85   100.00  0.000   0.000   0.000
0.000
       45.50   0.95   2.32   15.0   36.09   100.00  0.000   0.000   0.000
0.000
       44.50   0.96   2.31   15.0   35.78   100.00  0.000   0.000   0.000
0.000
       43.50   0.97   2.30   15.0   38.98   100.00  0.000   0.000   0.000
0.000
       42.50   0.97   2.29   15.0   42.22   100.00  0.000   0.000   0.000
0.000
       41.50   0.98   2.28   15.0   45.52   100.00  0.000   0.000   0.000
0.000
       40.50   0.99   2.27   15.0   48.88   100.00  0.000   0.000   0.000
0.000
       39.50   1.00   2.26   15.0   51.69   100.00  0.000   0.000   0.000
0.000
       38.50   1.00   2.25   15.0   53.94   100.00  0.000   0.000   0.000
0.000
       37.50   1.01   2.24   15.0   56.24   100.00  0.000   0.000   0.000
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0.000
    36.50   1.02   2.23   15.0   58.57   100.00  0.000   0.000   0.000
0.000
    35.50   1.02   2.23   15.0   60.96   100.00  0.000   0.000   0.000
0.000
    34.50   1.03   2.22   13.0   66.03   100.00  0.000   0.000   0.000
0.000
    33.50   1.04   2.21   9.0    73.85   100.00  0.000   0.000   0.000
0.000
    32.50   1.04   2.21   5.0    81.82   100.00  0.000   0.000   0.000
0.000
    31.50   1.05   2.20   1.0    89.94   100.00  0.000   0.000   0.000
0.000
    30.50   1.06   2.20   1.0    79.44   100.00  0.000   0.000   0.000
0.000
    29.50   1.06   2.20   1.0    68.75   100.00  0.000   0.000   0.000
0.000
    28.50   1.06   2.21   1.0    57.84   100.00  0.000   0.000   0.000
0.000
    27.50   1.05   2.23   1.0    44.39   100.00  0.000   0.000   0.000
0.000
    26.50   1.05   2.24   1.0    33.66   98.98   0.000   0.000   0.000
0.000
    25.50   1.05   2.26   5.8    37.21   100.00  0.000   0.000   0.000
0.000
    24.50   1.05   2.28   10.6   40.89   100.00  0.000   0.000   0.000
0.000
    23.50   1.04   2.29   15.4   44.69   100.00  0.000   0.000   0.000
0.000
    22.50   1.04   2.30   20.2   48.64   100.00  0.000   0.000   0.000
0.000
    21.50   1.03   2.31   25.0   52.73   100.00  0.000   0.000   0.000
0.000
    20.50   1.02   2.33   24.0   50.66   100.00  0.000   0.000   0.000
0.000
    19.50   1.02   2.34   23.0   48.51   100.00  0.000   0.000   0.000
0.000
    18.50   1.01   2.36   22.0   46.29   100.00  0.000   0.000   0.000
0.000
    17.50   1.00   2.39   21.0   43.98   100.00  0.000   0.000   0.000
0.000
    16.50   0.99   2.41   20.0   41.58   100.00  0.000   0.000   0.000
0.000
    15.50   0.98   2.44   20.0   43.12   100.00  0.000   0.000   0.000
0.000
    14.50   0.96   2.47   20.0   40.28   100.00  0.000   0.000   0.000
0.000
    13.50   0.95   2.51   20.0   41.95   100.00  0.000   0.000   0.000
0.000
    12.50   0.93   2.56   20.0   43.80   100.00  0.000   0.000   0.000
0.000
    11.50   0.91   2.61   20.0   45.88   100.00  0.000   0.000   0.000
0.000
    10.50   0.89   2.67   21.6   48.06   100.00  0.000   0.000   0.000
0.000
    9.50    0.87   2.75   23.2   50.56   100.00  0.000   0.000   0.000
0.000
    8.50    0.84   2.85   24.8   53.46   100.00  0.000   0.000   0.000
0.000
    7.50    0.80   2.98   26.4   50.47   100.00  0.000   0.000   0.000
0.000
    6.50    0.76   3.15   28.0   54.16   100.00  0.000   0.000   0.000
0.000
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_______________________________________________________________________
        Settlement of Saturated Sands=0.000 in.
        dsz is per each segment: dz=0.05 ft
        dsv is per each print interval: dv=1 ft
        S is cumulated settlement at this depth

        Settlement of Dry Sands:
        Depth   sigma'  sigC'   (N1)60s CSRfs   Gmax    g*Ge/Gm g_eff   ec7.5   Cec
ec      dsz     dsv     S
        ft      tsf     tsf             w/fs    tsf                     %
%       in.     in.     in.

__________________________________________________________________________
________________________

__________________________________________________________________________
________________________
        Settlement of Dry Sands=0.000 in.
        dsz is per each segment: dz=0.05 ft
        dsv is per each print interval: dv=1 ft
        S is cumulated settlement at this depth

        Total Settlement of Saturated and Dry Sands=0.000 in.
        Differential Settlement=0.000 to 0.000 in.

        Units           Depth = ft, Stress or Pressure = tsf (atm), Unit Weight =
pcf, Settlement = in.

__________________________________________________________________________
___________
        SPT             Field data from Standard Penetration Test (SPT)
        BPT             Field data from Becker Penetration Test (BPT)
        qc              Field data from Cone Penetration Test (CPT)
        fc              Friction from CPT testing
        Gamma           Total unit weight of soil
        Gamma'          Effective unit weight of soil
        Fines           Fines content [%]
        D50             Mean grain size
        Dr              Relative Density
        sigma           Total vertical stress [tsf]
        sigma'          Effective vertical stress [tsf]
        sigC'           Effective confining pressure [tsf]
        rd              Stress reduction coefficient
        CSR             Cyclic stress ratio induced by earthquake
        fs              User request factor of safety, apply to CSR
        w/fs            With user request factor of safety inside
        CSRfs           CSR with User request factor of safety
        CRR7.5          Cyclic resistance ratio (M=7.5)
        Ksigma          Overburden stress correction factor for CRR7.5
        CRRv            CRR after overburden stress correction, CRRv=CRR7.5 * Ksigma
        MSF             Magnitude scaling factor for CRR (M=7.5)
        CRRm            After magnitude scaling correction CRRm=CRRv * MSF
        F.S.            Factor of Safety against liquefaction F.S.=CRRm/CSRfs
        Cebs            Energy Ratio, Borehole Dia., and Sample Method Corrections
        Cr              Rod Length Corrections
        Cn              Overburden Pressure Correction
        (N1)60          SPT after corrections, (N1)60=SPT * Cr * Cn * Cebs
        d(N1)60         Fines correction of SPT
        (N1)60f         (N1)60 after fines corrections, (N1)60f=(N1)60 + d(N1)60
        Cq              Overburden stress correction factor
        qc1             CPT after Overburden stress correction
        dqc1            Fines correction of CPT
```

```
qc1f          CPT after Fines and Overburden correction, qc1f=qc1 + dqc1
qc1n          CPT after normalization in Robertson's method
Kc            Fine correction factor in Robertson's Method
qc1f          CPT after Fines correction in Robertson's Method
Ic            Soil type index in Suzuki's and Robertson's Methods
(N1)60s       (N1)60 after seattlement fines corrections
ec            Volumetric strain for saturated sands
ds            Settlement in each Segment dz
dz            Segment for calculation, dz=0.050 ft
Gmax          Shear Modulus at low strain
g_eff         gamma_eff, Effective shear Strain
g*Ge/Gm       gamma_eff * G_eff/G_max,       Strain-modulus ratio
ec7.5         Volumetric Strain for magnitude=7.5
Cec           Magnitude correction factor for any magnitude
ec            Volumetric strain for dry sands, ec=Cec * ec7.5
NoLiq         No-Liquefy Soils
```

References:

NCEER Workshop on Evaluation of Liquefaction Resistance of Soils. Youd, T.L., and Idriss, I.M., eds., Technical Report NCEER 97-0022.

SP117. Southern California Earthquake Center. Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Liquefaction in California. University of Southern California. March 1999.

TERRA GEOSCIENCES

GEOLOGIC HAZARDS REPORT

MOUNTAIN TRANSIT ADMINISTRATIVE FACILITY PROJECT

160-170 BUSINESS CENTER DRIVE

BIG BEAR LAKE, SAN BERNARDINO COUNTY, CALIFORNIA

Project No. 223769-1

February 7, 2022

Prepared for:

John R. Byerly, Inc.
2257 South Lilac Avenue
Bloomington, CA 92316

Consulting Engineering Geology & Geophysics

P.O. Box 1090, Loma Linda, CA 92354 • 909 796-4667

John R. Byerly, Inc.
2257 South Lilac Avenue
Bloomington, CA 92316

Attention: Mr. John R. Byerly

Regarding: Geologic Hazards Report
Mountain Transit Administrative Facility Project
160-170 Business Center Drive
Big Bear Lake, San Bernardino County, California
JRB File No. S-14447

INTRODUCTION

At your request, this firm has prepared a geologic hazards report for the proposed administrative building and maintenance facility project. The purpose of this study was to evaluate the existing geologic conditions and any corresponding potential geologic and/or seismic hazards, with respect to the proposed development from a geologic standpoint, as this property lies within the San Bernardino County Geologic Hazard Overlay District (San Bernardino County, 2010a & 2010b). We understand that the subject property will be utilized for construction of a 12,188 square-foot bus maintenance building, an 11,355 square-foot administrative building, along with various site improvements, appurtenances, and landscaping. The scope of services provided for this evaluation included the following:

- ***Review of available published and unpublished geologic/seismic data in our files pertinent to the site, including the provided site-specific boring logs.***
- ***Performing a seismic surface-wave survey by a licensed State of California Professional Geophysicist that included one traverse for shear-wave velocity analysis purposes.***
- ***Evaluation of the local and regional tectonic setting and historical seismic activity, including performing a site-specific CBC ground motion analysis.***
- ***Preparation of this report presenting our findings, conclusions, and recommendations from a geologic standpoint.***

Accompanying Maps, Illustrations, and Appendices

Plate 1	-	Regional Geologic Map
Plate 2	-	Geologic Hazard Overlay Map
Plate 3	-	Google™ Earth Imagery Map
Plate 4	-	Site Plan
Appendix A	-	Shear-Wave Survey
Appendix B	-	Site-Specific Ground Motion Analysis
Appendix C	-	References

GEOLOGIC SETTING

The subject property is regionally situated within a natural geomorphic province in Southern California known as the Transverse Ranges. The Transverse Ranges consist of a set of easterly-trending mountains and geologic structures that are distinct from the general northwest-southeast grain of the other provinces of California. More specifically, the site is located within the San Bernardino Mountains, an easterly-trending structural block that is roughly 55 miles long and 20 miles wide. This mountain range was formed by intense folding and faulting in very late geologic time (predominantly Tertiary time).

The geomorphology of this region of the San Bernardino Mountains indicates that the range is very young, from a geologic standpoint, whereas it was uplifted tectonically predominantly during Quaternary time. Regionally, the site is located within the northern block of the San Bernardino Mountain Range, which is an old erosion surface generally forming a broad plateau. Originally, this portion of the San Bernardino Mountains regionally was a part of the crystalline bedrock complex of the southern Mojave Desert prior to its uplift. The northern block of the San Bernardino Mountains is bordered on the north by a zone of south-dipping thrust faults (North Frontal Fault System), and along the south by the San Andreas Fault.

Locally, as mapped by Miller et al. (2001) and as shown on the Regional Geologic Map (see Plate 1), the subject site is shown to be mantled by late Holocene age active-wash deposits (map symbol Qw), generally described as being unconsolidated to locally cemented sand and gravel deposits in active washes of streams and on active surfaces of alluvial fans. These surficial deposits are noted to range from a few centimeters to only a few meters in thickness.

Underlying these surficial deposits at depth, such as mapped locally to the east and west of the site (map symbol Tsl), are believed to be Miocene age moderately-well consolidated sedimentary rocks comprised of siltstone, fine- to coarse-grained sandstone, pebble sandstone, and greenish mudstone. These sedimentary rocks overlie the deeper basement rocks that are found throughout most of the Big Bear area, which are estimated to be around 400± feet thick locally (United States Geological Survey, 2012).

EARTH MATERIALS

Based on the subsurface exploration performed by JRB (2022), the upper 7± feet of the site locally appear to consist of artificial fill comprised generally of silty fine- to coarse-grained sand with gravel, cobbles and occasional debris. Underlying these fill materials are interbedded silty fine- to medium-grained sand and silty-clayey fine- to medium-grained sand. These deposits were found to be in a dense to very-dense condition, to a depth of at least 71 feet.

GROUNDWATER

The subject site is located within the Bear Valley Groundwater Basin, which is situated within the Big Bear Lake and Baldwin Lake surface-water drainage basins. This basin is bounded by crystalline rocks of the San Bernardino Mountains that locally surround Bear Valley on all sides (California Department of Water Resources, 2003). Here groundwater is found primarily within unconsolidated Quaternary age alluvial deposits, which is recharged from percolation and runoff, and underflow from fractured crystalline rocks. More specifically, the site is located within a subbasin referred to as the Village Basin, that is defined by surface-water drainage divides.

The nearest groundwater well is located 1,300± feet to the northwest (Well Site Code 342535N1168920W001), where the groundwater ranges from 8 to 20 feet in depth during the time period of 2015 to 2021 (California Department of Water Resources, 2022). Another nearby well located 1,400± feet to the southeast (Well Site Code 342471N1168864W001), has groundwater ranging from 11 to 38 feet in depth during the time period of 2015 to 2021.

Currently, the subject site is located approximately 52± feet above the current water level of Big Bear Lake (Big Bear Municipal Water District, 2022). Based on the exploratory borings performed by John R. Byerly, Inc. (JRB, 2022), groundwater was encountered as shallow as 26½ feet in depth.

FAULTING

There are at least thirty-seven major late Quaternary active/potentially active faults that are located within a 100-kilometer (62-mile) radius of the subject site (Blake, 1989-2000). Of these, there are no "active" faults known to traverse the site, nor were any indications of active faulting or related features observed at the site during our field reconnaissance or photogeologic analysis. In addition, the site is not located within a State of California "Alquist-Priolo Earthquake Fault Zone" for surface fault rupture hazard (CGS, 2018 and C.D.M.G.,1988), defined as activity along a fault that has occurred during the Holocene time period. The nearest such zone is located approximately 7± miles to the north (North Frontal Fault Zone, M_W6.9, eastern segment). This fault has also been referred to as the North Frontal Fault System, which is comprised of numerous reverse fault segments which, in subsurface, may or may not form a single through-going fault (Miller, 1980).

Earthquake activity relating to the Landers-Big Bear events of June 28, 1992, and thereafter have led speculation into the fault mechanics in this region. The 6.7 magnitude earthquake (M_W6.3) that struck the Big Bear region was epicentered just south of the Sugarloaf area, approximately 5± miles to the southeast. This earthquake had a deep hypocenter being 5½± kilometers in depth and has an overall northeasterly trend, dipping steeply to the southeast. The subsurface fault is characterized left-lateral, strike-slip movement and no known surface fault rupture has been documented to date. Since no active surface trace has been identified to date, the actual location of this fault is unable to be defined. However, it can be assumed that based on the aftershock sequence pattern that has been recorded since the main shock, the most likely area of possible surface rupture would be located along a northeast trend, with the greater Sugarloaf area for a central reference. Because this fault has never been previously identified or postulated, and the fact that the Big Bear area is characterized generally by northwest-trending faults, the mechanics are not well known and much scientific work will have to be performed before an understanding of the local seismic parameters and conditions can be better understood. This fault is for discussion purposes only, and should not be used for permanent location or design purposes.

For preliminary evaluation purposes only, the Big Bear Fault has been tentatively estimated to have a maximum moment magnitude event of M_W6.9 using the "empirical earthquake size-fault-rupture-length relation" of dePolo and Slemmons (1990). This equation basically relates the length parameter of a fault to an earthquake size, based on historical earthquake data. This design event is considered very tentative and possibly conservative due to the lack of unknown seismic parameters (i.e., slip-rate, length, characteristic rate, etc.). The length of the Big Bear Fault was chosen to include the San Andreas Fault as the southwest terminus end and the area of the Landers surface fault ruptures (Johnson Valley Fault, Camp Rock Fault, etc.) as the northeast terminus end as visually shown on the recorded aftershock sequence patterns, which correlates to a length of approximately 42 miles.

Another nearby significant mapped fault is the southern terminus of the Helendale-South Lockhart Fault Zone, located 6± miles to the northeast. The southern terminus is not zoned as “active” by the State of California, but is zoned at a distance of 7½± miles farther to the north where it intersects the North Frontal Fault Zone.

GROUND MOTION ANALYSIS

According to California Geological Survey Note 48 (CGS, 2019), a site-specific ground motion analysis is required for the subject site (CBC, 2019, Section 1613 and also as required by ASCE 7-16, Chapter 21), the detailed results of which are presented within Appendix B. Additionally, a seismic shear-wave survey was conducted for this study by our firm as presented within Appendix A of this report, for purposes of determining the Site Classification and V_{S30} input values for the ground motion analysis. Geographically, the proposed construction area is located at Longitude -116.8888 and Latitude 34.2505 (World Geodetic System of 1984 coordinates). The mapped spectral acceleration parameters, coefficients, and other related seismic parameters, were evaluated using the OSHPD Seismic Design Maps (OSHPD, 2022) and the California Building Code criteria (CBC, 2019), with the site-specific ground motion analysis being performed following Section 21 of the ASCE 7-16 Standard (2017). The results of this site-specific analysis have been summarized and are tabulated below:

TABLE 1 – SUMMARY OF SEISMIC DESIGN PARAMETERS

Factor or Coefficient	Value
S_S	**1.642g**
S_1	**0.568g**
F_a	**1.0**
F_v	**1.732**
S_{DS}	**1.210g**
S_{D1}	**0.760g**
S_{MS}	**1.818g**
S_{M1}	**1.136g**
T_L	**8 Seconds**
MCE_G PGA	**0.81g**
Shear-Wave Velocity (V100)	**1,163.1 ft/sec**
Site Classification	**D**
Risk Category	**II**

HISTORIC SEISMICITY

A computerized search, based on Southern California historical earthquake catalogs, has been performed using the programs EQSEARCH (Blake, 1989-2021) and the ANSS Comprehensive Earthquake Catalog (U.S.G.S., 2022). The following table and discussion summarizes the historic seismic events (greater than or equal to M4.0) that have been estimated and/or recorded during this time period of 1800 to January 2022, within a 100-kilometer radius of the site.

TABLE 2 - HISTORIC SEISMIC EVENTS; 1800-2022 (100-kilometer radius)

4.0 - 4.9	563
5.0 - 5.9	70
6.0 - 6.9	14
7.0 - 7.9	2
8.0+	0

These data have been compiled generally based on the reported intensities throughout the region, thus focusing in on the most likely epicentral location. Seismic instrumentation beyond 1932 has greatly increased the accuracy of locating earthquake epicenters. It should be noted that pre-instrumental seismic events (occurring generally before 1932) have been estimated from isoseismal maps (Toppozada, et al., 1981 and 1982).

A summary of the historic earthquake data is as follows:

- ☐ The closest recorded earthquake epicenter (>M4.0) was located approximately 1,000± feet south of the site (June 30, 1979, M4.4).
- ☐ The nearest estimated significant historic earthquake epicenter (pre-1932) was approximately five miles southwest of the site (January 16, 1930, M5.2).
- ☐ The nearest recorded significant historic earthquake epicenter was located approximately 1¼ miles west-northwest of the site (June 28, 1992, M5.3).
- ☐ The largest estimated historical earthquake epicenter (pre-1932) within a 62-mile radius of the site is a M6.9 event of December 8, 1812 (44± miles southwest).
- ☐ The largest recorded historical earthquake was the M7.6 (M_W 7.3) Landers's event, located approximately 26 miles to the east-southeast (June 28, 1992).
- ☐ The largest estimated ground acceleration estimated to have been experienced at the site was 0.421g which resulted from the M6.7 (M_W 6.3) Big Bear event of June 28, 1992, which was located approximately five miles southeast of the subject site (Blake, 1989-2000b).

An Earthquake Epicenter Map which includes magnitudes 4.0 and greater for a 100-kilometer (62-mile) radius has been included below as Figure 1, for reference (Blue circle), with the site shown as the central blue dot. This map was prepared using the ANSS Comprehensive Earthquake Catalog (U.S.G.S., 2022) of instrumentally recorded events that have occurred from the period of 1932 to January 2022, superimposed on a captured Google™ Earth image (Google™ Earth, 2022).

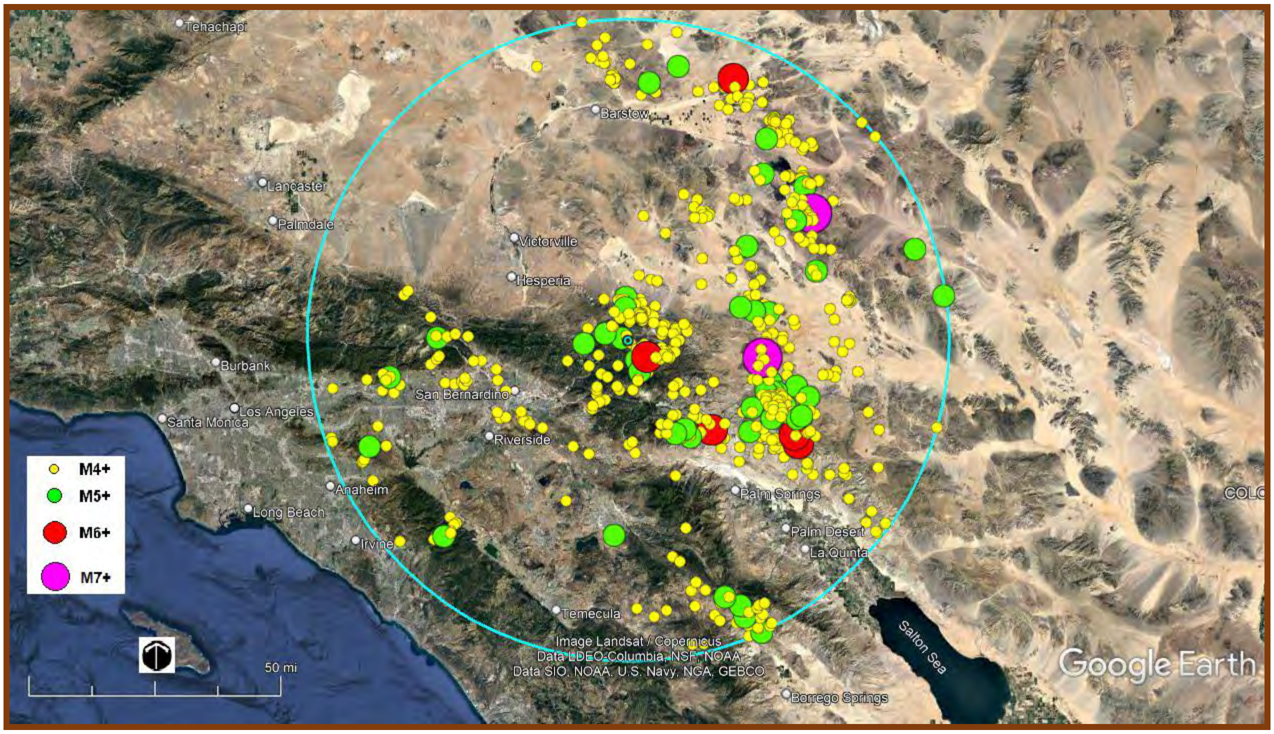

FIGURE 1- Earthquake Epicenter Map showing events of M4.0+ within a 100-kilometer radius.

SECONDARY SEISMIC HAZARDS

Secondary permanent or transient seismic hazards that are generally associated with severe ground shaking during an earthquake include ground rupture, liquefaction, seiches or tsunamis, ground lurching/lateral spreading, flooding (water storage facility failure), landsliding, rockfalls, and seismically-induced settlement, which are discussed below.

Ground Rupture:

Ground rupture is generally considered most likely to occur along pre-existing faults. Since there are no faults that are known to traverse the site, the potential for ground rupture is considered to be very low to nil.

Ground Lurching/Lateral Spreading:

Ground lurching is the horizontal movement of soil, sediments, or fill located on relatively steep embankments or scarps as a result of seismic activity, forming irregular ground surface cracks. The potential for lateral spreading or lurching is highest in areas underlain by soft, saturated materials, especially where bordered by steep banks or adjacent hard ground. Due to the relatively flat-lying nature of the site and distance from embankments, the potential for ground lurching and/or lateral spreading is considered to be nil.

Liquefaction:

In general, liquefaction is a phenomenon that occurs where there is a loss of strength or stiffness in the soils that can result in the settlement of buildings, ground failures, or other related hazards. The main factors contributing to this phenomenon are: 1) cohesionless, granular soils having relatively low densities (usually of Holocene age); 2) shallow groundwater (generally less than 50 feet); and 3) moderate-high seismic ground shaking. According to San Bernardino County (2010a & 2010b), the subject property is shown to be located within a "Zone of Suspected Liquefaction Susceptibility", as shown on Plate 2. Additionally, groundwater was encountered within the exploratory borings drilled at the site at a depth of 26½ feet, therefore there may be a potential for liquefaction to occur.

Seiches/Tsunamis:

Based on the far distance of large, open bodies of water and the elevation of the site with respect to sea level or Big Bear Lake, the possibility of seiches/tsunamis is considered nil. Additionally, mapping by the California Geological Survey (2014) does not indicate the site to be located within a tsunami inundation zone.

Rockfalls:

Since no large rock outcrops are present at or adjacent to the site, the possibility of rockfalls during seismic shaking is nil.

Landsliding:

Due to the low-lying relief of the site and adjacent areas, landsliding due to seismic shaking is considered nil. Additionally, mapping by Tan (1990) does not indicate the subject property to be located within a mapped area susceptible to landsliding. According to the County of San Bernardino (2010a & 2010b) the subject property is not shown to be located within a "Zone of Suspected Landslide Susceptibility", as shown on Plate 2.

Flooding (Water Storage Facility Failure):

There are no water storage facilities on or near the site that could cause flooding due to failure during a seismic event.

Seismically-Induced Settlement:

Seismically-induced settlement generally occurs within areas of loose, granular soils during periods of strong ground motion. Since the subject site is underlain by generally dense to very dense sediments, and based on the subsurface data and SPT blow counts from the exploratory boring excavations performed by JRB (2022), to a depth of at least 71 feet, seismically-induced settlement is considered very low.

FLOODING

According to the Federal Emergency Management Agency (FEMA, 2008a & 2008b), the subject site is shown to be partially located within the boundaries of a designated flood hazard zone. This map indicates that the eastern portion of the site is located within "Zone AE," which is defined as "Special Flood Hazard Areas Subject to Inundation by the 1% Annual Chance Flood (Base flood elevations determined)," as shown on Figure 2 below for reference. The remainder of the western portion of the site is not located within a flood hazard zone and is included within "Zone X" which is defined as "Areas to be Outside the 0.2% Annual Chance Floodplain." During peak periods of rainfall, however, heavy runoff could be anticipated.

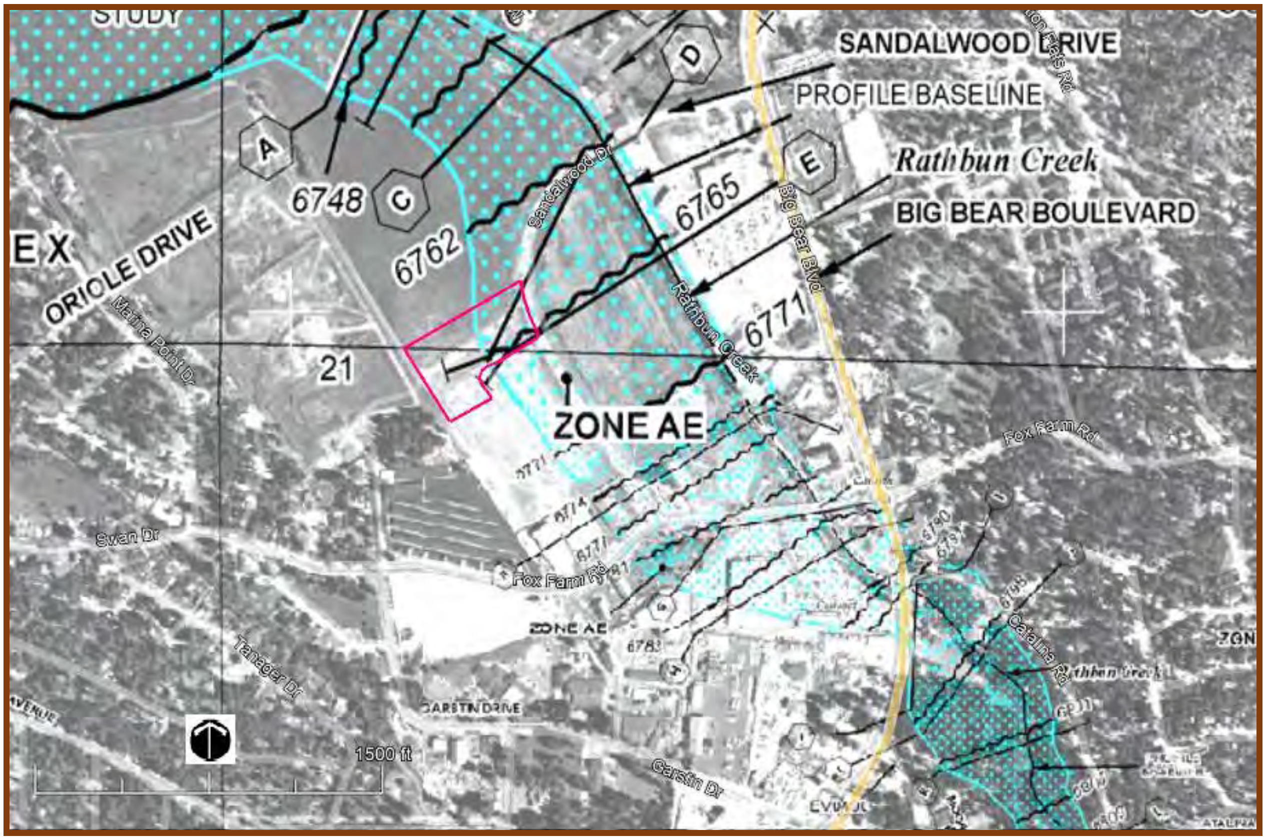

FIGURE 2- FEMA Flood Map; Site boundaries approximated by red outline.

OTHER GEOLOGIC HAZARDS

There are other potential geologic hazards not necessarily associated with seismic activity that occur statewide. These hazards include; natural hazardous materials (such as methane gas, hydrogen-sulfide gas, and tar seeps); Radon-222 gas (EPA, 1993); naturally occurring asbestos; volcanic hazards (Martin, 1982); and regional subsidence. Of these hazards, there are none that appear to impact the site.

CONCLUSIONS AND RECOMMENDATIONS

General:

Based on our field reconnaissance and review of available pertinent published and unpublished geologic/seismic literature, construction of the proposed administrative building and maintenance facility appears to be feasible from a geologic standpoint, providing our recommendations are considered during planning and construction.

Conclusions:

1. Available published geologic data indicates that the subject property is mantled by late Holocene age active-wash deposits, generally described as being unconsolidated to locally cemented sand and gravel deposits. Underlying these surficial deposits are believed to be Miocene age moderately-well consolidated sedimentary rocks comprised of siltstone, fine- to coarse-grained sandstone, pebble sandstone, and greenish mudstone. The provided exploratory boring log indicates that the site is mantled by 7± feet of artificial fill comprised generally of silty fine- to coarse-grained sand with gravel, cobbles and occasional debris. These materials are in turn underlain by interbedded silty fine- to medium-grained sand and silty-clayey fine- to medium-grained sand, to a depth of at least 71 feet. These deposits were found to be in a dense to very-dense condition.

2. Groundwater was encountered during subsurface exploration within the proposed project area at a depth of 26½ feet. Groundwater levels are expected to fluctuate in response to the water level of Big Bear Lake, which is located 2,000± feet to the north. Currently the lake water level is approximately 15± feet below the “full” lake level, suggesting that groundwater could approach within 11½± feet of the surface, which includes the height of the 7± foot-high artificial fill locally placed at the site.

3. There are no active faults that are known to traverse the subject site based on published literature. Additionally, no geomorphic or photogeologic evidence was observed that would suggest the presence of active faulting traversing through or towards the site. In addition, the subject site is not located within a designated Alquist-Priolo Earthquake Fault Zone that would indicate a potential for surface-fault rupture hazards. The nearest known “active” fault which is zoned by the State of California is the North Frontal Fault, located 7±-miles to the north.

4. The primary geologic hazard that exists at the site is that of ground shaking. Moderate to severe ground shaking could be anticipated during the life of the proposed facility. Ground shaking from earthquakes accounts for nearly all earth-quake losses.

5. Other than the potential for liquefaction, there do not appear to be any potential permanent or transient secondary seismic hazards that would affect the proposed project development.

6. The eastern portion of the site is shown to be located within a flood hazard zone that is denoted as being "Special Flood Hazard Areas Subject to Inundation by the 1% Annual Chance Flood (Base flood elevations determined)".

Recommendations:

1. It is recommended that all structures be designed to at least meet the current California Building Code provisions in the latest 2019 CBC edition and the ASCE Standard 7-16, where applicable. However, it should be noted that the building code is intended as a minimum construction design and is often the maximum level to which structures are designed. It is the responsibility of both the property owner and project structural engineer to determine the risk factors with respect to using CBC minimum design values for the proposed facilities.

2. The potential for liquefaction should be properly evaluated by the project Geotechnical Engineer. Any appropriate site-specific mitigation measures should be implemented as recommended, if warranted.

3. Any possible flood hazards associated within this zone, or elsewhere within the site should be properly evaluated by the design Civil Engineer.

CLOSURE

Our conclusions and recommendations are based on a review of available existing geologic/seismic data and the provided site-specific provided subsurface exploratory boring logs. No subsurface exploration was performed by this firm for this evaluation. We make no warranty, either express or implied. Should conditions be encountered at a later date or more information becomes available that appear to be different than those indicated in this report, we reserve the right to reevaluate our conclusions and recommendations and provide appropriate mitigation measures, if warranted. It is assumed that all the conclusions and recommendations outlined in this report are understood and followed. If any portion of this report is not understood, it is the responsibility of the owner, contractor, engineer, and/or governmental agency, etc., to contact this office for further clarification.

Respectfully submitted,
TERRA GEOSCIENCES

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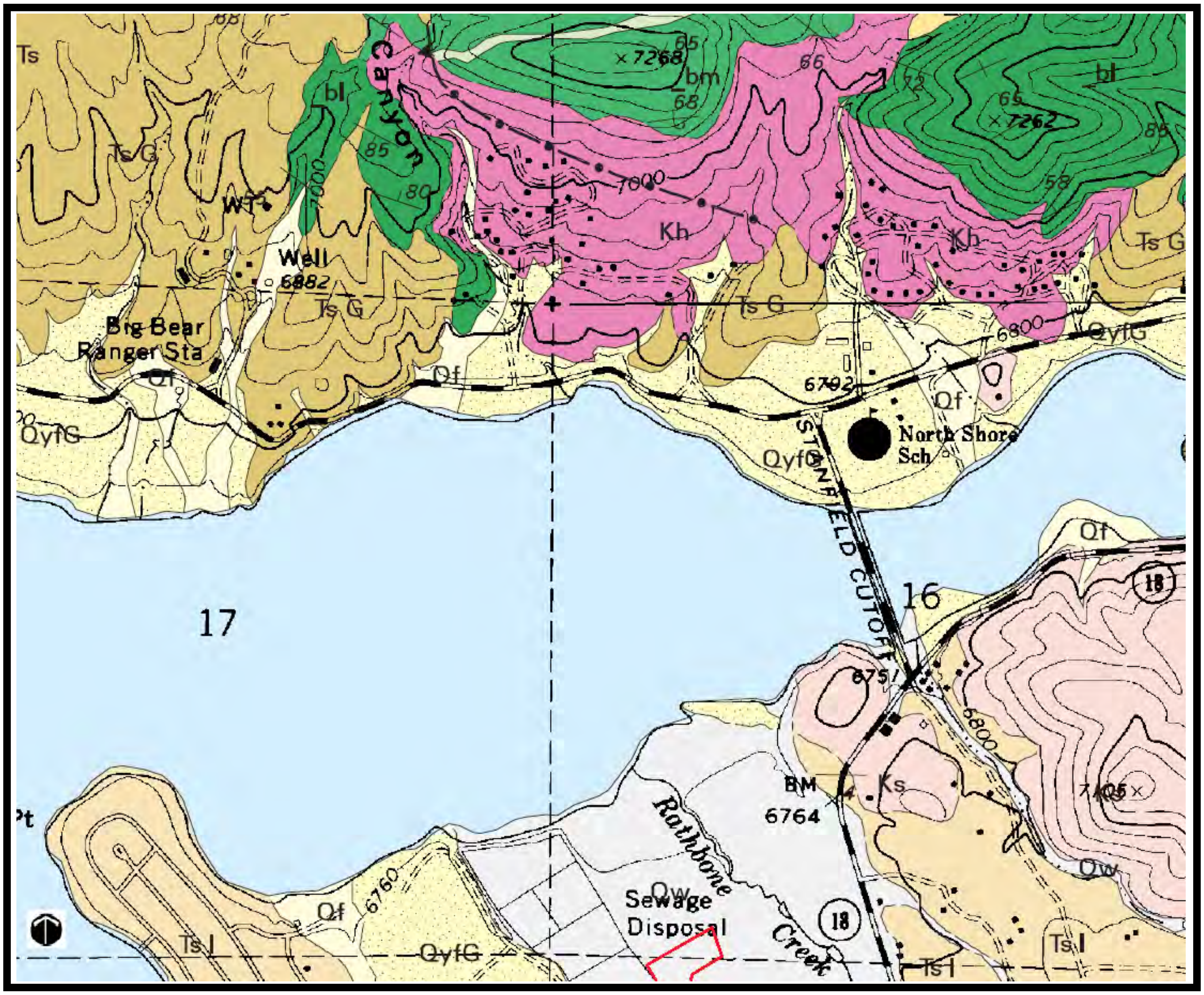
REGIONAL GEOLOGIC MAP



BASE MAP: Miller et al. (2001), U.S.G.S. Open-File Report 98-579, Site partially outlined in red.

PARTIAL LEGEND

Qw	**WASH DEPOSITS**	Unconsolidated to locally cemented sand and gravel deposits in active washes of streams and on active surfaces of alluvial fans (late Holocene).
— - - -	**GEOLOGIC CONTACT**	Solid where located within ±15 meters, dashed where located within ±30 meters.

GEOLOGIC HAZARD OVERLAY MAP

BASE MAP: San Bernardino County (2010), Map Nos. FI09-C & FI71-C, Site outlined in red.

PARTIAL LEGEND

Zone of Suspected Liquefaction Susceptibility

▨ Zone of Susceptibility

Generalized Liquefaction Susceptibility

■ Low

■ Medium

■ High

Generalized Landslide Susceptibility

▤ Low to moderate

▤ Moderate to high

▥ Mapped, Existing Landslide

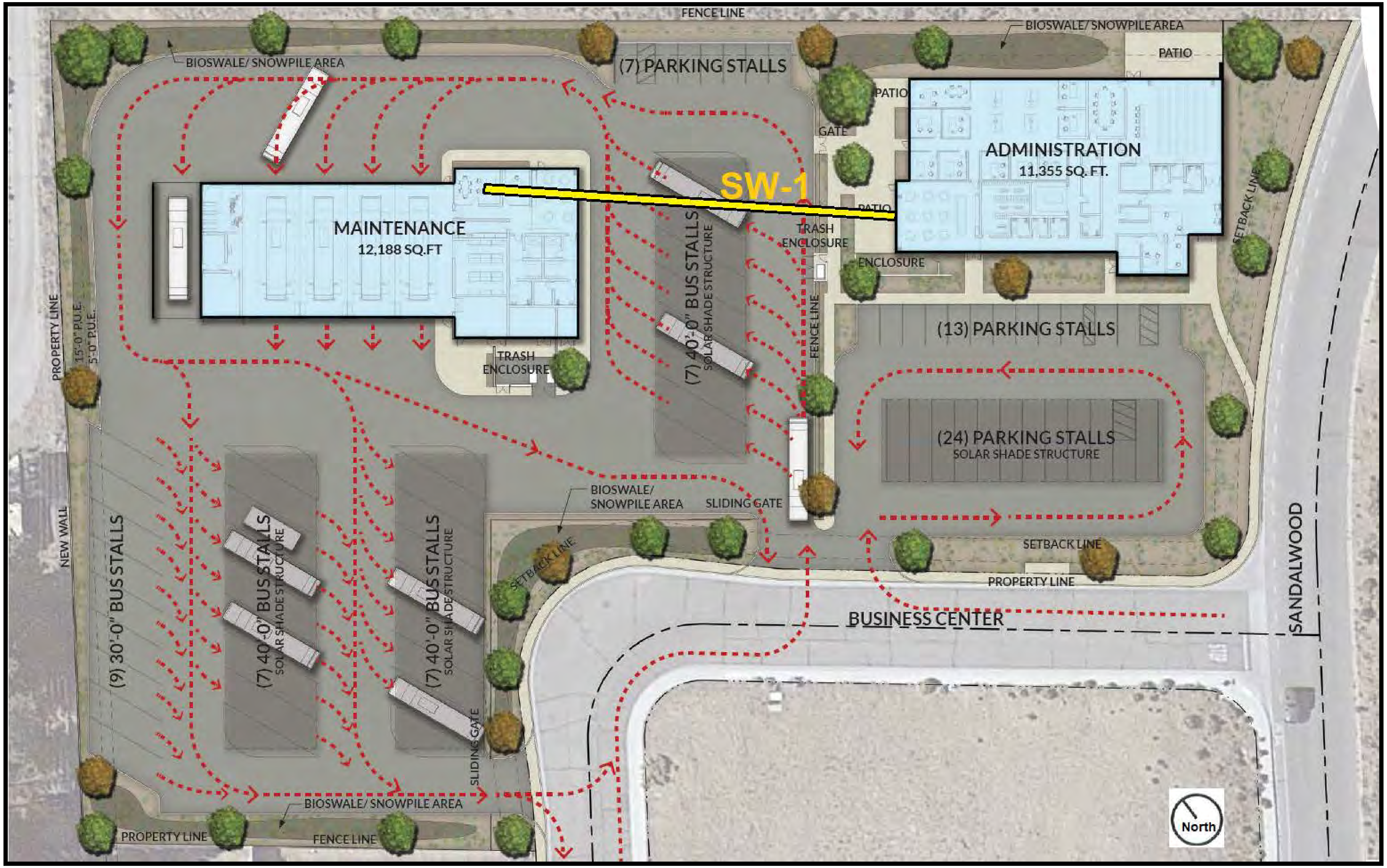
GOOGLE™ EARTH IMAGERY MAP

Base Map: Google™ Earth (2022); Seismic shear-wave traverse SW-1 shown as yellow line, approximate project boundaries outlined in red.

PROJECT NO. 223769-1

PLATE 3

SITE PLAN



BASE MAP: Partial modified copy of the Site Plan (Ruhnau Clarke Architects); Seismic shear-wave traverse SW-1 shown as black/yellow line.

APPENDIX A

SHEAR-WAVE SURVEY

SHEAR-WAVE SURVEY

Methodology

The fundamental premise of this survey uses the fact that the Earth is always in motion at various seismic frequencies. These relatively constant vibrations of the Earth's surface are called microtremors, which are very small with respect to amplitude and are generally referred to as background "noise" that contain abundant surface waves. These microtremors are caused by both human activity (i.e., cultural noise, traffic, factories, etc.) and natural phenomenon (i.e., wind, wave motion, rain, atmospheric pressure, etc.) which have now become regarded as useful signal information. Although these signals are generally very weak, the recording, amplification, and processing of these surface waves has greatly improved by the use of technologically improved seismic recording instrumentation and recently developed computer software. For this application, we are mainly concerned with the Rayleigh wave portion of the seismic signals, which is also referred to as "ground roll" since the Rayleigh wave is the dominant component of ground roll.

For the purposes of this study, there are two ways that the surface waves were recorded, one being "active" and the other being "passive." Active means that seismic energy is intentionally generated at a specific location relative to the survey spread and recording begins when the source energy is imparted into the ground (i.e., MASW survey technique). Passive surveying, also called "microtremor surveying," is where the seismograph records ambient background vibrations (i.e., MAM survey technique), with the ideal vibration sources being at a constant level. Longer wavelength surface waves (longer-period and lower-frequency) travel deeper and thus contain more information about deeper velocity structure and are generally obtained with passive survey information. Shorter wavelength (shorter-period and higher-frequency) surface waves travel shallower and thus contain more information about shallower velocity structure and are generally collected with the use of active sources.

For the most part, higher frequency active source surface waves will resolve the shallower velocity structure and lower frequency passive source surface waves will better resolve the deeper velocity structure. Therefore, the combination of both of these surveying techniques provides a more accurate depiction of the subsurface velocity structure.

The assemblage of the data that is gathered from these surface wave surveys results in development of a dispersion curve. Dispersion, or the change in phase velocity of the seismic waves with frequency, is the fundamental property utilized in the analysis of surface wave methods. The fundamental assumption of these survey methods is that the signal wavefront is planar, stable, and isotropic (coming from all directions) making it independent of source locations and for analytical purposes uses the spatial autocorrelation method (SPAC). The SPAC method is based on theories that are able to detect "signals" from background "noise" (Okada, 2003). The shear wave velocity (V_S) can then be calculated by mathematical inversion of the dispersive phase velocity of the surface waves which can be significant in the presence of velocity layering, which is common in the near-surface environment.

Field Procedures

One shear-wave survey traverse (SW-1) was performed within the proposed construction area, as approximated on Plates 3 and 4. For data collection, the field survey employed a twenty-four channel Geometrics StrataVisor™ NZXP model signal-enhancement refraction seismograph. This survey employed both active source (MASW) and passive (MAM) methods to ensure that both quality shallow and deeper shear-wave velocity information was recorded (Park et al., 2005).

Both the MASW and MAM survey lines used the same linear geometry array that consisted of a 184-foot-long spread using a series of twenty-four 4.5-Hz geophones that were spaced at regular eight-foot intervals. For the active source MASW survey, the ground vibrations were recorded using a one second record length at a sampling rate of 0.5-milliseconds. Two separate seismic records were obtained using a 30-foot shot offset at both ends of the line utilizing a 16-pound sledge-hammer as the energy source to produce the seismic waves. Numerous seismic impacts were used at each shot location to improve the signal-to-noise ratio.

The MAM survey did not require the introduction of any artificial seismic sources with only background ambient noise (i.e., air and vehicle traffic, etc.) being necessary. These ambient ground vibrations were recorded using a thirty-two second record length at a two-millisecond sampling rate with 30 separate seismic records being obtained for quality control purposes. The frequency spectrum data that was displayed on the seismograph screen were used to assess the recorded seismic wave data for quality control purposes in the field. The acceptable records were digitally recorded on the in-board seismograph computer and subsequently transferred to a flash drive so that they could be subsequently transferred to our office computer for analysis.

Data Reduction

For analysis and presentation of the shear-wave profile and supportive illustration, this study used the **SeisImager/SW™** computer software program that was developed by Geometrics, Inc. (2009). Both the active (MASW) and passive (MAM) survey results were combined for this analysis (Park et al., 2005). The combined results maximize the resolution and overall depth range in order to obtain one high resolution V_s curve over the entire sampled depth range. These methods economically and efficiently estimate one-dimensional subsurface shear-wave velocities using data collected from standard primary-wave (P-wave) refraction surveys.

However, it should be noted that surface waves by their physical nature cannot resolve relatively abrupt or small-scale velocity anomalies and this model should be considered as an approximation. Processing of the data then proceeded by calculating the dispersion curve from the input data from both the active and passive data records, which were subsequently combined creating an initial shear-wave (V_s) model based on the observed data. This initial model was then inverted in order to converge on the best fit of the initial model and the observed data, creating the final V_s curve as presented within this appendix.

Summary of Data Analysis

Data acquisition went very smoothly and the quality was considered to be good. Analysis revealed that the average shear-wave velocity ("weighted average") in the upper 100 feet of the subject survey area is **1,163.1** feet per second as shown on the shear-wave model for Seismic Line SW-1, as presented within this appendix. This average velocity classifies the underlying soils to that of Site Class "**D**" (Stiff Soil), which has a velocity range from 600 to 1,200 ft/sec (ASCE, 2017; Table 20.3-1).

The "weighted average" velocity is computed from a formula that is used by the ASCE (2017; Section 20.4, Equation 20.4-1) to determine the average shear-wave velocity for the upper 100 feet of the subsurface (V100).

$$\mathbf{Vs = 100/[(d1/v1) + (d2/v2) + ...+ (dn/vn)]}$$

Where d1, d2, d3,...,tn, are the thicknesses for layers 1, 2, 3,...n, up to 100 feet, and v1, v2, v3,...,vn, are the seismic velocities (feet/second) for layers 1, 2, 3,...n. The detailed shear-wave model displays these calculated layer boundaries/depths and associated velocities (feet/second) for the 218-foot profile where locally measured. The constrained data is represented by the dark-gray shading on the shear-wave model. The associated Dispersion Curves (for both the active and passive methods) which show the data quality and picks, along with the resultant combined dispersion curve model, are also included within this appendix, for reference purposes.

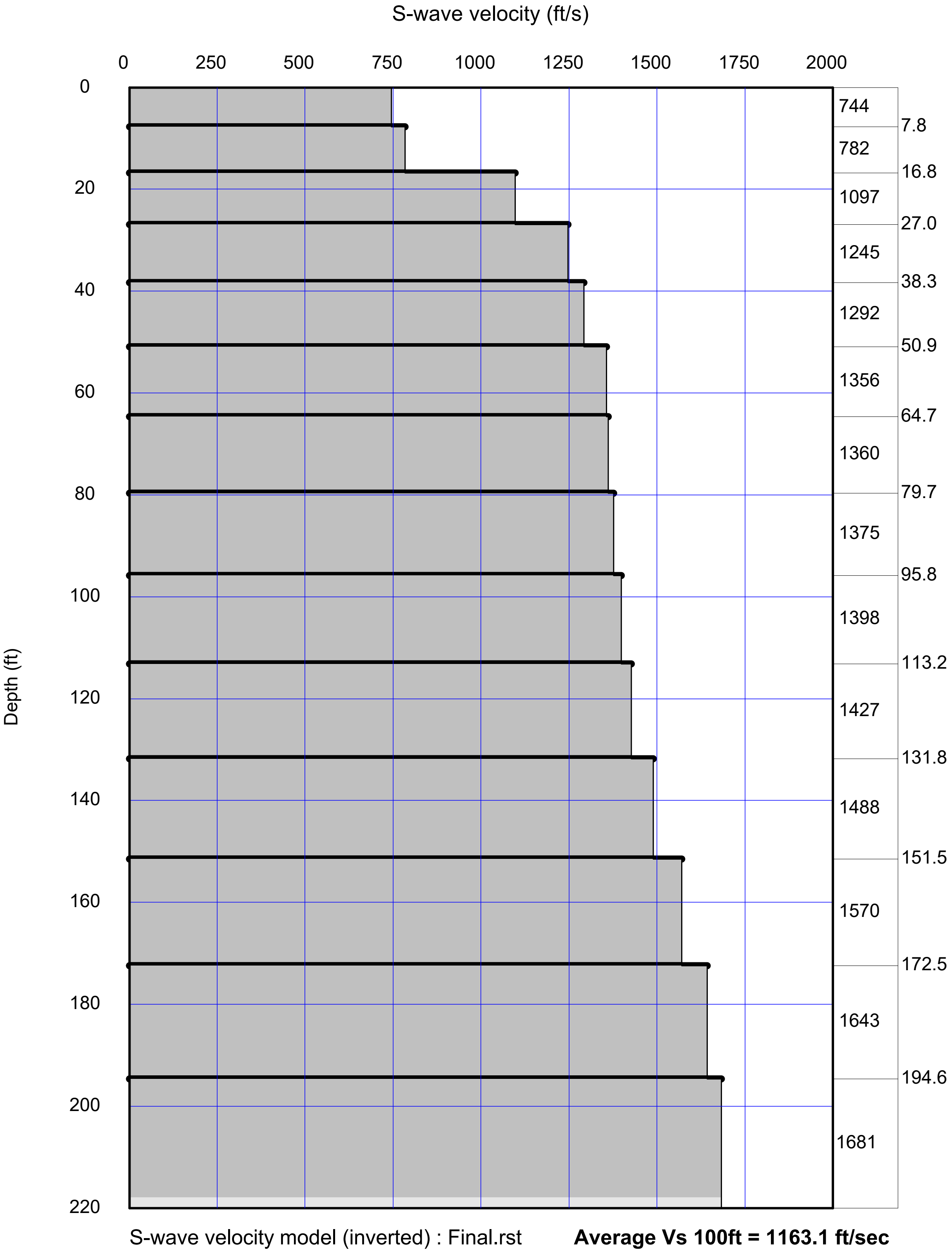
SURVEY LINE PHOTOGRAPHS

View looking northeast along Seismic Line SW-1.

View looking southwest along Seismic Line SW-1.

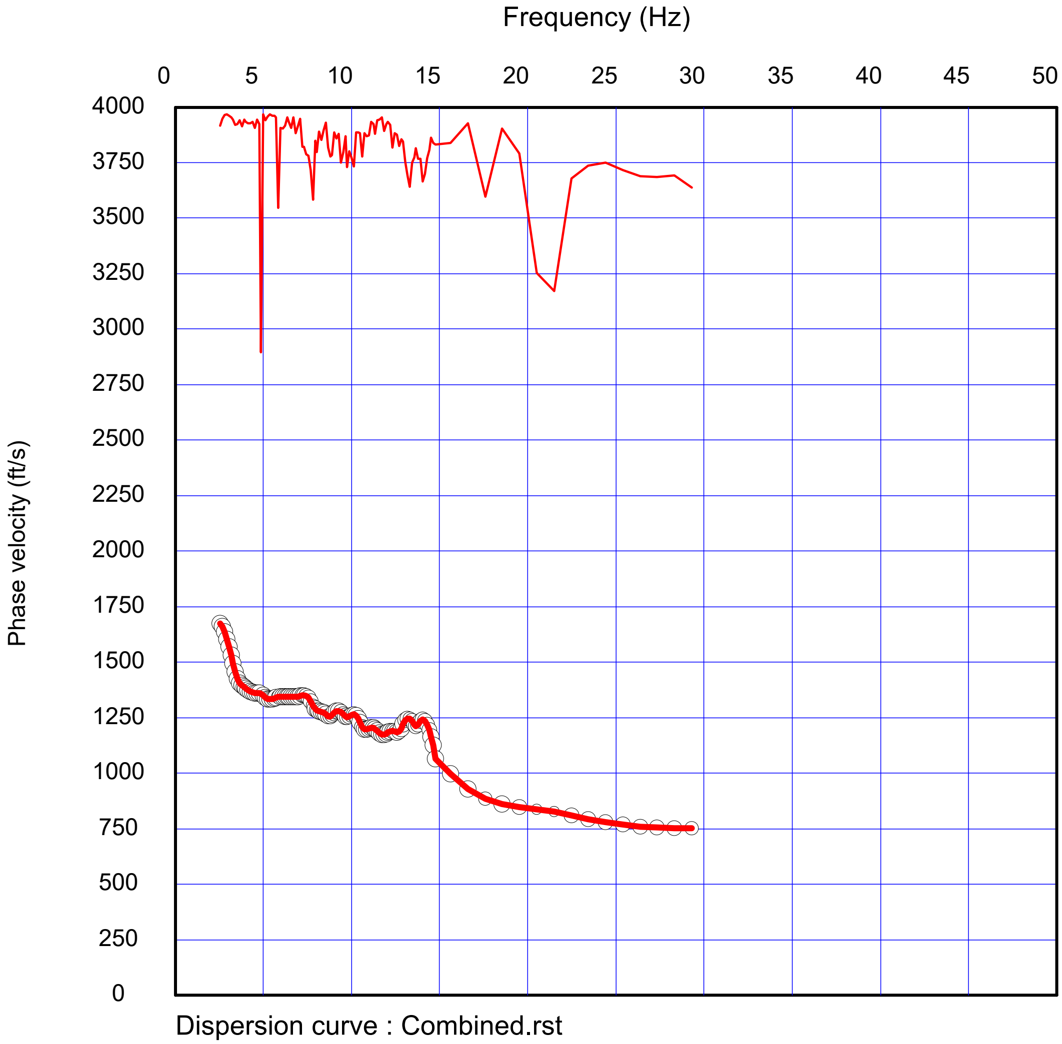
SEISMIC LINE SW-1

SHEAR-WAVE MODEL



S-wave velocity model (inverted) : Final.rst **Average Vs 100ft = 1163.1 ft/sec**

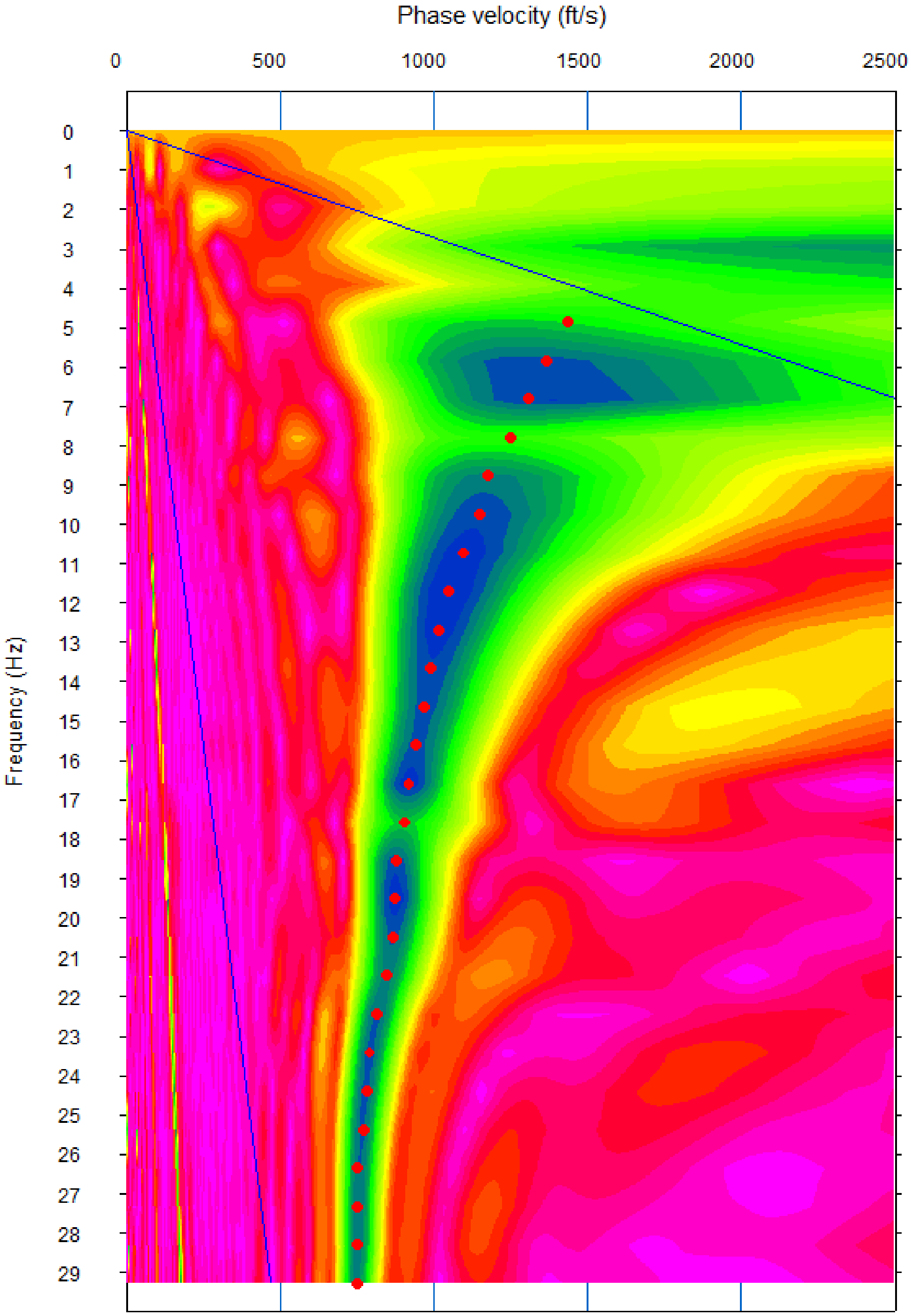
SHEAR-WAVE MODEL SW-1



Dispersion curve : Combined.rst

COMBINED DISPERSION CURVE

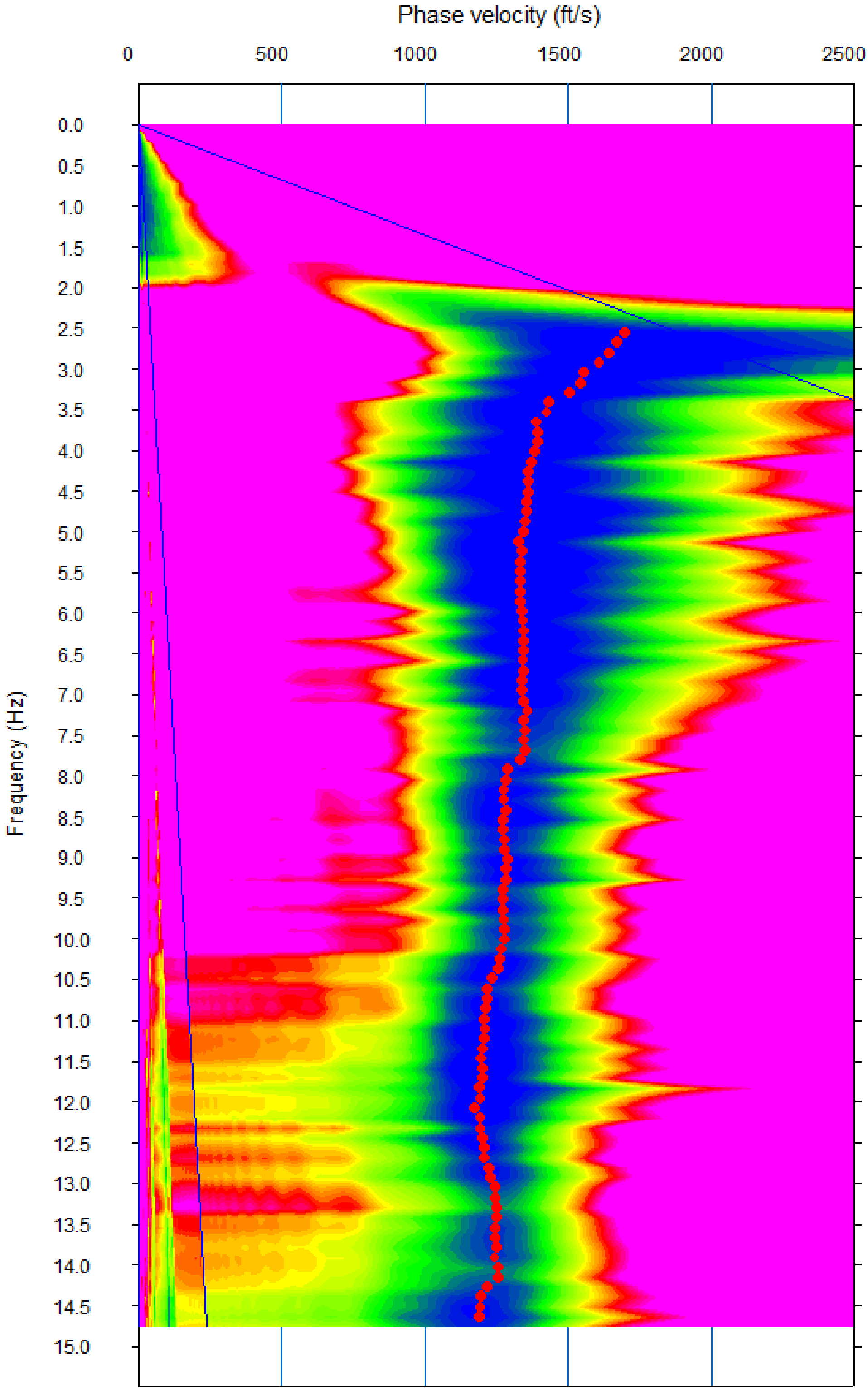
SEISMIC LINE SW-1



Dispersion Cure: Active.dat

ACTIVE DISPERSION CURVE

SEISMIC LINE SW-1



Dispersion Curve: Passive.dat

PASSIVE DISPERSION CURVE

APPENDIX B

SITE-SPECIFIC GROUND MOTION ANALYSIS

SITE-SPECIFIC GROUND MOTION ANALYSIS

A detailed summary of the site-specific ground motion analysis, which follows Section 21 of the ASCE Standard 7-16 (2017) and the 2019 California Building Code is presented below, with the Seismic Design Parameters Summary included within this appendix following the summary text.

- ***Mapped Spectral Acceleration Parameters (CBC 1613.2.1)***-

  Based on maps prepared by the U.S.G.S (Risk-Adjusted Maximum Considered Earthquake (MCE$_R$) Ground Motion Parameter for the Conterminous United States for the 0.2 and 1-second Spectral Response Acceleration (5% of Critical Damping; Site Class B/C), a value of **1.642g** for the 0.2 second period (S$_S$) and **0.568** for the 1.0 second period (S$_1$) was calculated (ASCE 7-16 Figures 22-1, 22-2 and CBC 1613.2.1).

- ***Site Classification (CBC 1613.2.2 & ASCE 7-16 Chapter 20)***-

  Based on the site-specific measured shear-wave value of 1,163.1 feet/second (354.1 m/sec), the soil profile type used should be Site Class **"D."** This Class is defined as having the upper 100 feet (30 meters) of the subsurface being underlain by "Stiff Soil" with average shear-wave velocities of 600 to 1,200 feet/second (180 to 360 meters/second), as detailed within Appendix A.

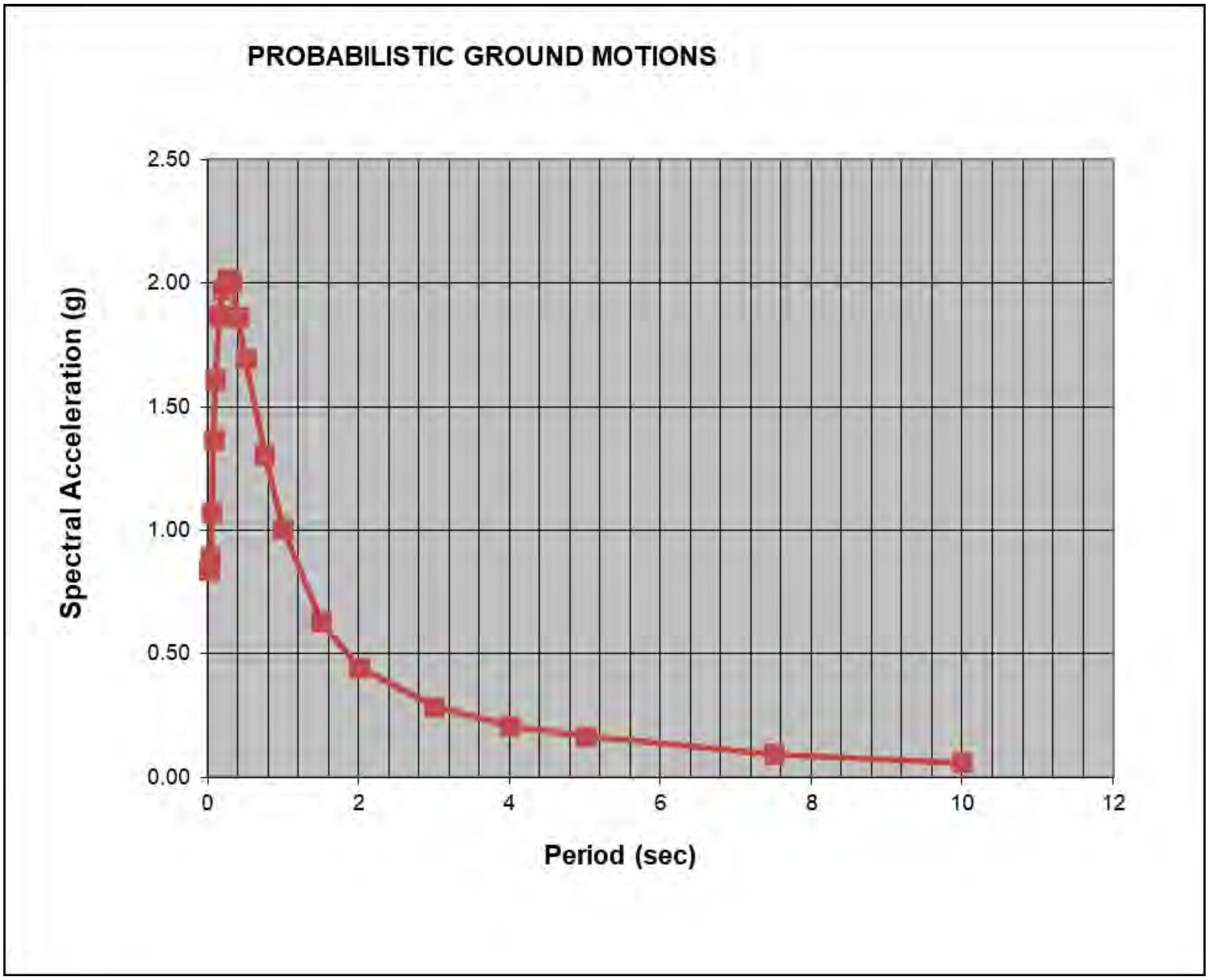
- ***Site Coefficients (CBC 1613.2.3)***-

  Based on CBC Tables 1613.2.3(1) and 1613.2.3(2), the site coefficient **F_a = 1.0** and **F_v = 1.732**, respectively.

- ***Probabilistic (MCE$_R$) Ground Motions (ASCE 7 Section 21.2.1)***-

  Per Section 21.2.1.1 (**Method 1**), the probabilistic MCE spectral accelerations shall be taken as the spectral response accelerations in the direction of maximum response represented by a five percent damped acceleration response spectrum that is expected to achieve a one percent probability of collapse within a 50-year period.

  The probabilistic analysis included the use of the Open Seismic Hazard Analysis (OpenSHA). The selected Earthquake Rupture Forecast (ERF) was UCERF3 along with a Probability of Exceedance of 2% in 50 Years. The average of four Next Generation Attenuation West-2 Relations (2014 NGA) were utilized to produce a response spectrum. These included Chiou & Youngs (2014), Abrahamsom et al. (2014), Campbell & Bozorgnia (2014), Boore et al. (2014), and Campbell & Bozorgnia (2014). The Probabilistic Risk Targeted Response Spectrum was determined as the product of the ordinates of the probabilistic response spectrum and the applicable risk coefficient (C$_R$). These values were then modified to produce a spectrum based upon the maximum rotated components of ground motion. The resulting MCE$_R$ Response Spectrum is indicated below:



- ***Deterministic Spectral Response Analyses (ASCE 7 Section 21.2.2)***-

The deterministic MCE$_R$ response acceleration at each period shall be calculated as an 84th-percentile 5 percent damped spectral response acceleration in the direction of maximum horizontal response computed at that period. The largest such acceleration calculated for the characteristic earthquakes on all known active faults within the region shall be used. Analyses were conducted using the average of four Next Generation Attenuation West-2 Relations (2014 NGA), including Chiou & Youngs (2014), Abrahamsom et al. (2014), Boore et al. (2014), and Campbell & Bozorgnia (2014).

Based on our review of the Fault Section Database within the Uniform California Earthquake Rupture Forecast (UCERF 3; Field et al., 2013) and other published geologic data and maps, the Helendale-South Lockhart Fault Zone (M_W 7.4), the North Frontal Fault Zone (Eastern section, M_W 7.0), and the San Andreas Fault Zone (San Bernardino Section, M_W 8.3) were used for this analysis.

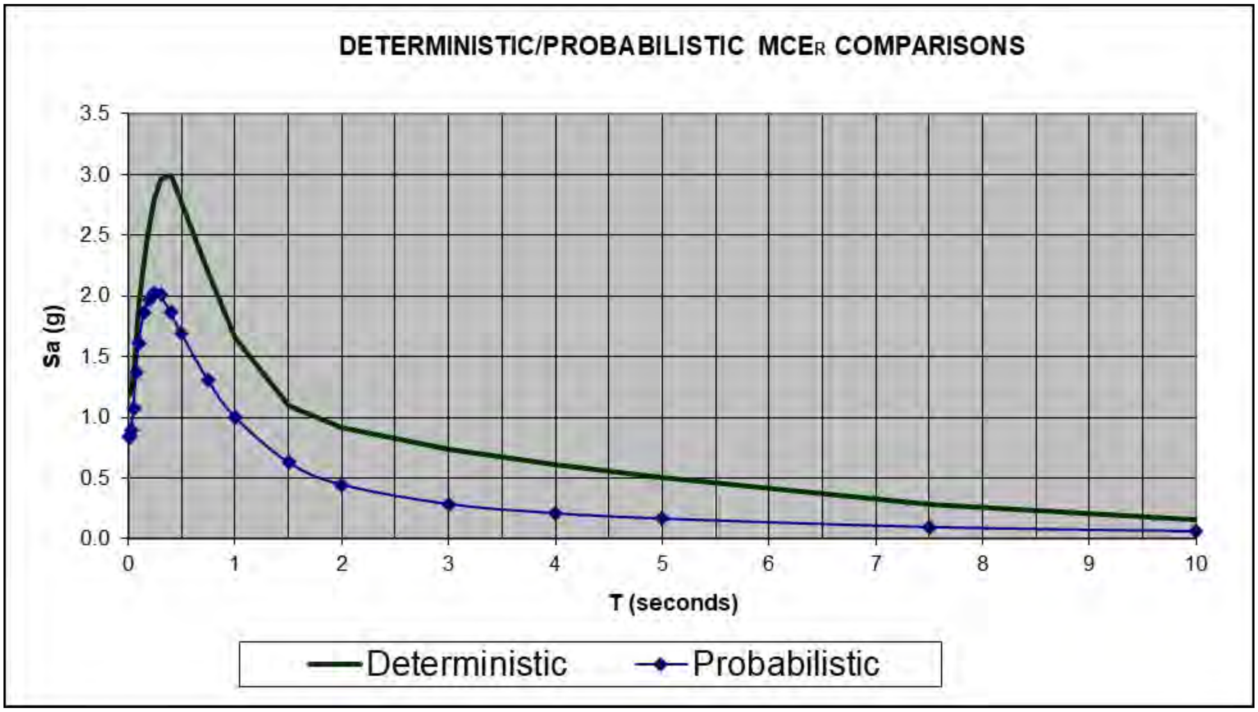
- **Site Specific MCE_R (ASCE 7 Section 21.2.3)**-

  The site-specific MCE_R spectral response acceleration at any period, S_{aM}, shall be taken as the lesser of the spectral response accelerations from the probabilistic ground motions of Section 21.2.1 and the deterministic ground motions of Section 21.2.2. The deterministic ground motions were compared with the probabilistic ground motions that were determined in accordance with Section 21.2.1. These results are tabulated below:

Comparison of Deterministic MCE_R Values with Probabilistic MCE_R Values - Section 21.2.3

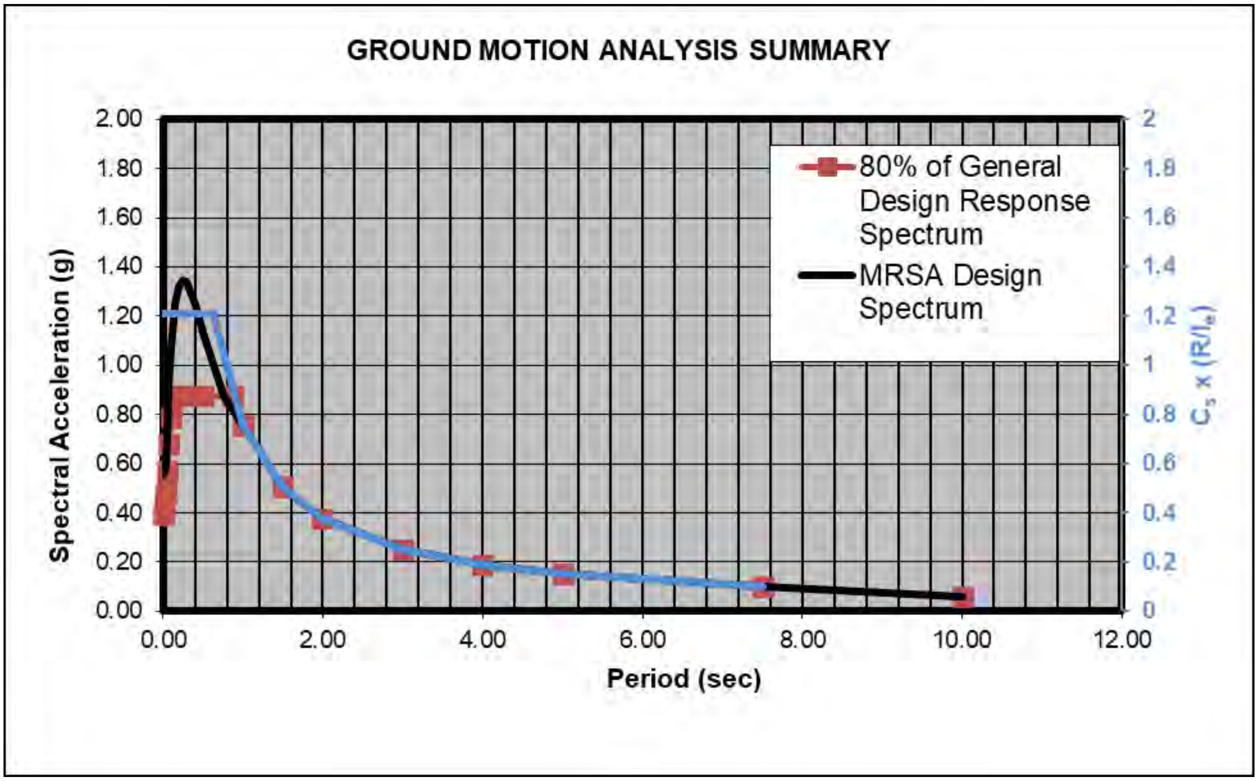
Period	Deterministic	Probabilistic	Lower Value (Site Specific MCE_R)	Governing Method	
T	MCE_R	MCE_R			
0.010	1.18	0.84	0.84	Probabilistic Governs	
0.020	1.19	0.84	0.84	Probabilistic Governs	
0.030	1.23	0.89	0.89	Probabilistic Governs	
0.050	1.39	1.07	1.07	Probabilistic Governs	
0.075	1.68	1.37	1.37	Probabilistic Governs	
0.100	1.94	1.61	1.61	Probabilistic Governs	
0.150	2.30	1.87	1.87	Probabilistic Governs	
0.200	2.58	1.98	1.98	Probabilistic Governs	
0.250	2.80	2.02	2.02	Probabilistic Governs	
0.300	2.97	2.01	2.01	Probabilistic Governs	
0.400	2.99	1.87	1.87	Probabilistic Governs	
0.500	2.77	1.70	1.70	Probabilistic Governs	
0.750	2.20	1.31	1.31	Probabilistic Governs	
1.000	1.66	1.01	1.01	Probabilistic Governs	
1.500	1.09	0.63	0.63	Probabilistic Governs	
2.000	0.91	0.45	0.45	Probabilistic Governs	
3.000	0.73	0.28	0.28	Probabilistic Governs	
4.000	0.61	0.21	0.21	Probabilistic Governs	
5.000	0.51	0.17	0.17	Probabilistic Governs	
7.500	0.29	0.09	0.09	Probabilistic Governs	
10.000	0.16	0.06	0.06	Probabilistic Governs	

These comparisons are plotted in the following diagram:



- ◆ **Design Response Spectrum (ASCE 7 Section 21.3)**-

In accordance with Section 21.3, the Design Response Spectrum was developed by the following equation: $S_a = 2/3S_{aM}$, where S_{aM} is the MCE$_R$ spectral response acceleration obtained from Section 21.1 or 21.2. The design spectral response acceleration shall not be taken less than 80 percent of S_a. These are plotted and compared with 80% of the CBC Spectrum values in the following diagram:



♦ Design Acceleration Parameters (ASCE 7 Section 21.4)-

Where the site-specific procedure is used to determine the design ground motion in accordance with Section 21.3, the parameter S_{DS} shall obtained from the site-specific spectra at a period of 0.2 s, except that it shall not be taken less than 90 percent of the peak spectral acceleration, S_a, at any period larger than 0.2 s. The parameter S_{D1} shall be taken as the greater of the products of Sa * T for periods between 1 and 5 seconds. The parameters S_{MS}, and S_{M1} shall be taken as 1.5 times S_{DS} and S_{D1}, respectively. The values so obtained shall not be less than 80 percent of the values determined in accordance with Section 11.4.4 for S_{MS}, and S_{M1} and Section 11.4.5 for S_{DS} and S_{D1}.

♦ Site Specific Design Parameters -

For the 0.2 second period (S_{DS}), a value of 1.21g was computed, based upon the average spectral accelerations. The maximum average acceleration for any period exceeding 0.2 seconds was 1.35g occurring at T=0.25 seconds. This was multiplied by 0.9 to produce a value of 1.21g making this the applicable value. A value of 0.76g was calculated for S_{D1} at a period of 1 second (ASCE 7-16, 21.4). For the MCE_R 0.2 second period, a value of 1.818g (S_{MS}) was computed, along with a value of 1.136g (S_{M1}) for the MCE_R 1.0 second period was also calculated (ASCE 7-16, 21.2.3).

♦ Site-Specific MCE_G Peak Ground Accelerations (ASCE 7 Section 21.5)-

The probabilistic geometric mean peak ground acceleration (2 percent probability of exceedance within a 50-year period) was calculated as 0.81g. The deterministic geometric mean peak ground acceleration (largest 84th percentile geometric mean peak ground acceleration for characteristic earthquakes on all known active faults within the site region) was calculated as 1.07g. The site-specific MCE_G peak ground acceleration was calculated to be **0.81g**, which was determined by using the lesser of the probabilistic (0.81g) or the deterministic (1.07g) geometric mean peak ground accelerations, but not taken as less than 80 percent of PGA_M (i.e., 0.76g x 0.80 = 0.61g).

SEISMIC DESIGN PARAMETERS SUMMARY

Project: Mountain Area Regional Transit Authority
Project #: 223769-1
Date: 1/21/22

Lattitude: 34.2505
Longitude: -116.8888

CALIFORNIA BUILDING CODE CHAPTER 16/ASCE7-16

Mapped Acceleration Parameters per ASCE 7-16, Chapter 22

S_s=	1.642	Figure 22-1
S_1=	0.568	Figure 22-2

Site Class per Table 20.3-1

Site Class=	D - Stiff Soil

Site Coefficients per ASCE 7-16 CHAPTER 11

F_a=	1	Table 11.4-1	=	1	For Site Specific Analysis per ASCE7-16 21.3
F_v=	1.732	Table 11.4-2	=	2.50	For Site Specific Analysis per ASCE7-16 21.3

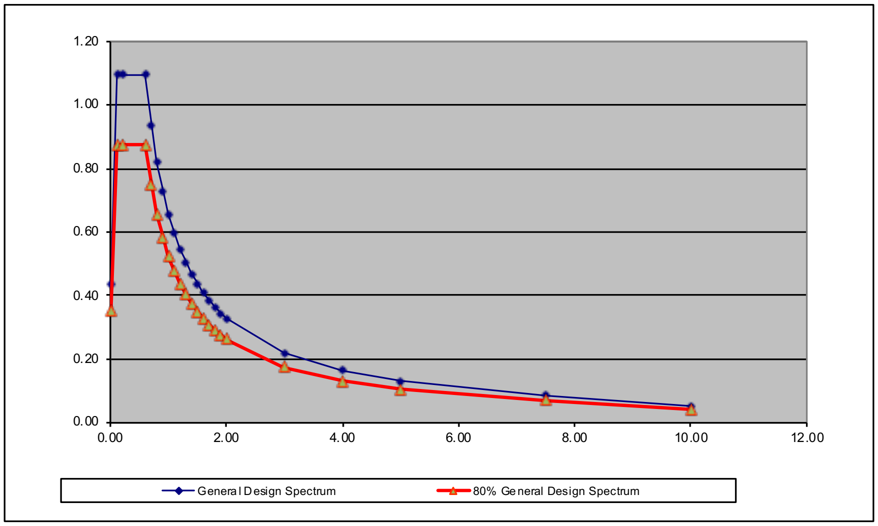
Mapped Design Spectral Response Acceleration Parameters

S_{MS}=	1.642	Equation 11.4-1	1.642	For Site Specific Analysis per ASCE7-16 21.3
S_{M1}=	0.984	Equation 11.4-2	1.420	For Site Specific Analysis per ASCE7-16 21.3

S_{DS}=	1.095	Equation 11.4-3
S_{D1}=	0.656	Equation 11.4-4

T_0=	0.120	sec	
T_S=	0.599	sec	
T_L=	8	sec	From Fig 22-12
PGA	0.69	g	
F_{PGA}=	1.1		From Table 11.8-1
C_{RS}=	0.936		Figure 22-17
C_{R1}=	0.915		Figure 22-18

Period (T)	Sa (ASCE7-16 - 11.4.6)	80% General Design Spectrum
0.01	0.44	0.35
0.12	1.09	0.88
0.20	1.09	0.88
0.60	1.09	0.88
0.70	0.94	0.75
0.80	0.82	0.66
0.90	0.73	0.58
1.00	0.66	0.52
1.10	0.60	0.48
1.20	0.55	0.44
1.30	0.50	0.40
1.40	0.47	0.37
1.50	0.44	0.35
1.60	0.41	0.33
1.70	0.39	0.31
1.80	0.36	0.29
1.90	0.35	0.28
2.00	0.33	0.26
3.00	0.22	0.17
4.00	0.16	0.13
5.00	0.13	0.10
7.50	0.09	0.07
10.00	0.05	0.04



ASCE 7-16 - RISK-TARGETED MAXIMUM CONSIDERED EARTHQUAKE GROUND MOTION ANALYSIS

Use Maximum Rotated Horizontal Component?* (Y/N) y

Presented data are the average of Chiou & Youngs (2014), Abrahamson et. al. (2014) , Boore et. al (2014) and Campbell & Bozorgnia (2014) NGA West-2 Relationships

PROBABILISTIC MCER per 21.2.1.1 **Method 1**

Earthquake Rupture Forecast - UCERF3

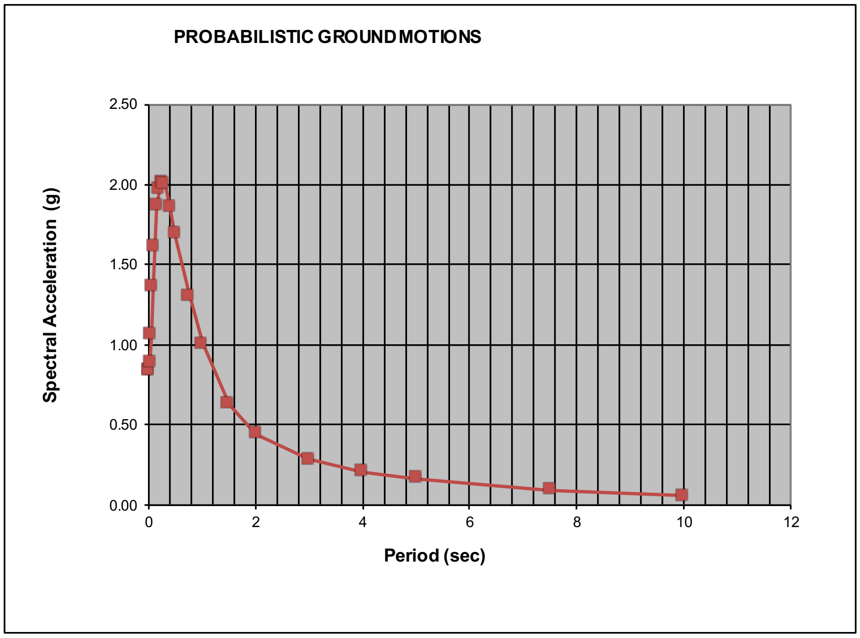
Field, E.H., T.H. Jordan, and C.A. Cornell (2003), OpenSHA: A Developing Community-Modeling Environment for Seismic Hazard Analysis, Seismological Research Letters, 74, no. 4, p. 406-419.

OpenSHA data

2% Probability Of Exceedance in 50 years

Maximum Rotated Horizontal Component determined per ASCE7-16

T	Sa 2% in 50	MCER
0.01	0.90	0.84
0.02	0.90	0.84
0.03	0.95	0.89
0.05	1.14	1.07
0.08	1.46	1.37
0.10	1.72	1.61
0.15	2.00	1.87
0.20	2.11	1.98
0.25	2.16	2.02
0.30	2.15	2.01
0.40	2.00	1.87
0.50	1.83	1.70
0.75	1.42	1.31
1.00	1.10	1.01
1.50	0.69	0.63
2.00	0.49	0.45
3.00	0.31	0.28
4.00	0.23	0.21
5.00	0.18	0.17
7.50	0.10	0.09
10.00	0.07	0.06



S_s=	2.11	1.98
S_1=	1.10	1.01
PGA	0.81 g	

Risk Coefficients:			
C_{RS}	0.936	Figure 22-18	Get from Mapped Values
C_{R1}	0.915	Figure 22-19	
Fa=	1	Table 11.4-1	Per ASCE7-16 - 21.2.3
Is $Sa_{(max)}$<1.2XFa?		NO	If "YES", Probabilistic Spectrum prevails

DETERMINISTIC MCE per 21.2.2

Input Parameters				
Fault		ndale-S. Lock	North Frontal (Eastern)	San Andreas (San Bernardino S)
M	= Moment magnitude	7.4	7	8.3
R_{RUP}	= Closest distance to coseismic rupture (km)	9.6	7.3	22
R_{JB}	= Closest distance to surface projection of coseismic rupture (km)	9.6	0	19.08
Rx	= Horizontal distance to top edge of rupture measured perpendicular to strike (km)	9.6	11.2	19.08
U	= Unspecified Faulting Flag (Boore et.al.)	0	0	0
F_{RV}	= Reverse-faulting factor: 0 for strike slip, normal, normal-oblique; 1 for reverse, reverse-oblique and thrust	0	1	0
F_{NM}	= Normal-faulting factor: 0 for strike slip, reverse, reverse-oblique and thrust; 1 for normal and normal-obliqu	0	0	0
F_{HW}	= Hanging-wall factor: 1 for site on down-dip side of top of rupture; 0 otherwise, used in AS08 and CY08	0	1	0
Z_{TOR}	= Depth to top of coseismic rupture (km)	0	0	0
δ	= Average dip of rupture plane (degrees)	90	41	90
V_{S30}	= Average shear-wave velocity in top 30m of site profile	354.5	354.5	354.5
$F_{Measured}$		1	1	1
$Z_{1.0}$	= Depth to Shear Wave Velocity of 1.0 km/sec (km)	0.06	0.06	60
$Z_{2.5}$	= Depth to Shear Wave Velocity of 2.5 km/sec (km)	1.35	1.35	1.35
Site Class		D	D	D
W (km)	= Fault rupture width (km)	12.8	25.3	12.8
F_{AS}	= 0 for mainshock; 1 for aftershock	0	0	0
σ	=Standard Deviation	1	1	1

Deterministic Summary - Section 21.2.2 (Supplement 1)

T	**Helendale-S. Lockhart**	**North Frontal (Eastern)**	**San Andreas (San Bernardino S)**	**Maximum $S_{a\ (Average)}$**	***Corrected* S_a (per ASCE7-16)***	***Scaled $S_{a(Average)}$***	**Controlling Fault**
0.010	0.61	1.07	0.67	1.07	1.18	1.18	North Frontal (Eastern)
0.020	0.61	1.08	0.67	1.08	1.19	1.19	North Frontal (Eastern)
0.030	0.64	1.12	0.69	1.12	1.23	1.23	North Frontal (Eastern)
0.050	0.73	1.27	0.64	1.27	1.39	1.39	North Frontal (Eastern)
0.075	0.89	1.52	0.77	1.52	1.68	1.68	North Frontal (Eastern)
0.100	1.04	1.77	1.00	1.77	1.94	1.94	North Frontal (Eastern)
0.150	1.26	2.09	1.05	2.09	2.30	2.30	North Frontal (Eastern)
0.200	1.40	2.35	1.27	2.35	2.58	2.58	North Frontal (Eastern)
0.250	1.47	2.52	1.24	2.52	2.80	2.80	North Frontal (Eastern)
0.300	1.49	2.64	1.32	2.64	2.97	2.97	North Frontal (Eastern)
0.400	1.43	2.60	1.35	2.60	2.99	2.99	North Frontal (Eastern)
0.500	1.31	2.36	1.34	2.36	2.77	2.77	North Frontal (Eastern)
0.750	0.98	1.78	1.16	1.78	2.20	2.20	North Frontal (Eastern)
1.000	0.75	1.27	1.03	1.27	1.66	1.66	North Frontal (Eastern)
1.500	0.47	0.72	0.82	0.82	1.09	1.09	San Andreas (San Bernardino S)
2.000	0.32	0.45	0.68	0.68	0.91	0.91	San Andreas (San Bernardino S)
3.000	0.20	0.22	0.52	0.52	0.73	0.73	San Andreas (San Bernardino S)
4.000	0.13	0.12	0.42	0.42	0.61	0.61	San Andreas (San Bernardino S)
5.000	0.10	0.08	0.34	0.34	0.51	0.51	San Andreas (San Bernardino S)
7.500	0.05	0.04	0.19	0.19	0.29	0.29	San Andreas (San Bernardino S)
10.000	0.03	0.02	0.11	0.11	0.16	0.16	San Andreas (San Bernardino S)
PGA	0.61	1.07	0.54	1.07		1.07	g

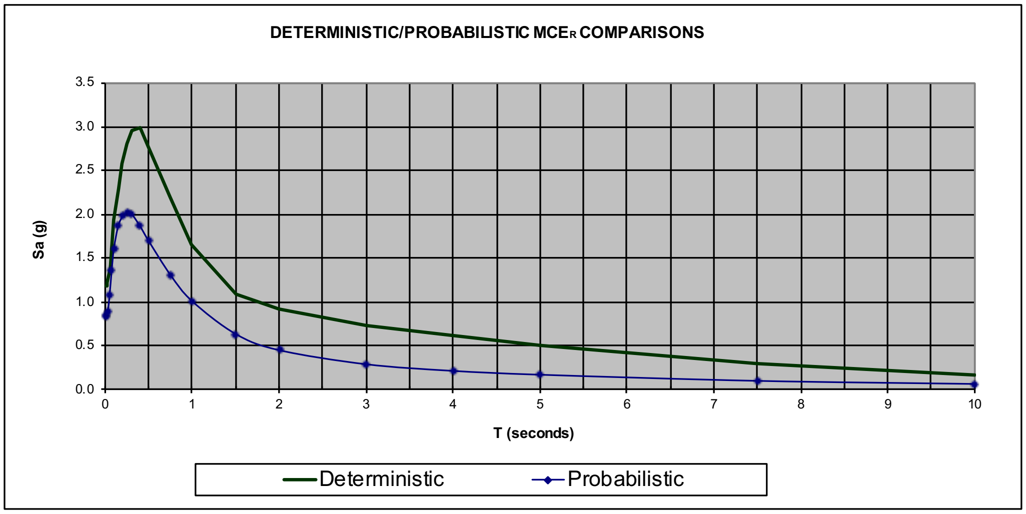
Max Sa=	2.99	
Fa =	1.00	Per ASCE7-16 21.2.2
1.5XFa=	1.5	
Scaling Factor=	1.00	

* Correction is the adjustment for Maximum Rotated Value if Applicable

SITE SPECIFIC MCE$_R$ - Compare Deterministic MCE$_R$ Values (S$_a$) with Probabilistic MCE$_R$ Values (S$_a$) per 21.2.3

Presented data are the average of Chiou & Youngs (2014), Abrahamson et. al. (2014) , Boore et. al (2014) and Campbell & Bozorgnia (2014) NGA West-2 Relationships

Period	Deterministic	Probabilistic	Lower Value (Site Specific MCE$_{R)}$	Governing Method
T	MCE$_R$	MCE$_R$		
0.010	1.18	0.84	0.84	ProbabilisticGoverns
0.020	1.19	0.84	0.84	ProbabilisticGoverns
0.030	1.23	0.89	0.89	ProbabilisticGoverns
0.050	1.39	1.07	1.07	ProbabilisticGoverns
0.075	1.68	1.37	1.37	ProbabilisticGoverns
0.100	1.94	1.61	1.61	ProbabilisticGoverns
0.150	2.30	1.87	1.87	ProbabilisticGoverns
0.200	2.58	1.98	1.98	ProbabilisticGoverns
0.250	2.80	2.02	2.02	ProbabilisticGoverns
0.300	2.97	2.01	2.01	ProbabilisticGoverns
0.400	2.99	1.87	1.87	ProbabilisticGoverns
0.500	2.77	1.70	1.70	ProbabilisticGoverns
0.750	2.20	1.31	1.31	ProbabilisticGoverns
1.000	1.66	1.01	1.01	ProbabilisticGoverns
1.500	1.09	0.63	0.63	ProbabilisticGoverns
2.000	0.91	0.45	0.45	ProbabilisticGoverns
3.000	0.73	0.28	0.28	ProbabilisticGoverns
4.000	0.61	0.21	0.21	ProbabilisticGoverns
5.000	0.51	0.17	0.17	ProbabilisticGoverns
7.500	0.29	0.09	0.09	ProbabilisticGoverns
10.000	0.16	0.06	0.06	ProbabilisticGoverns



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Rpt. No.: 7341
File No.: S-14447

DESIGN RESPONSE SPECTRUM per Section 21.3

DESIGN ACCELERATION PARAMETERS per Section 21.4 (MRSA)

Period	2/3*MCE$_R$	80% General Design Response Spectrum (per ASCE 7-16 23.3-1)	Design Response Spectrum	TXSa
0.01	0.56	0.39	0.56	
0.02	0.56	0.44	0.56	
0.03	0.59	0.48	0.59	
0.05	0.71	0.57	0.71	
0.08	0.91	0.68	0.91	
0.10	1.07	0.79	1.07	
0.15	1.25	0.88	1.25	
0.20	1.32	0.88	1.32	
0.25	1.35	0.88	1.35	
0.30	1.34	0.88	1.34	
0.40	1.24	0.88	1.24	
0.50	1.13	0.88	1.13	
0.75	0.87	0.88	0.88	
1.00	0.67	0.76	0.76	0.76
1.50	0.42	0.50	0.50	0.76
2.00	0.30	0.38	0.38	0.76
3.00	0.19	0.25	0.25	0.76
4.00	0.14	0.19	0.19	0.76
5.00	0.11	0.15	0.15	0.76
7.50	0.06	0.10	0.10	
10.00	0.04	0.06	0.06	

Highest value of S_a for any period exceeding 0.2 sec.= 1.35
90%of Highest Value = 1.21
80% of Mapped S_{DS}= 0.88
Maximum TXSa from T=1s-5s = 0.76
80% of Mapped S_{D1}= 0.52

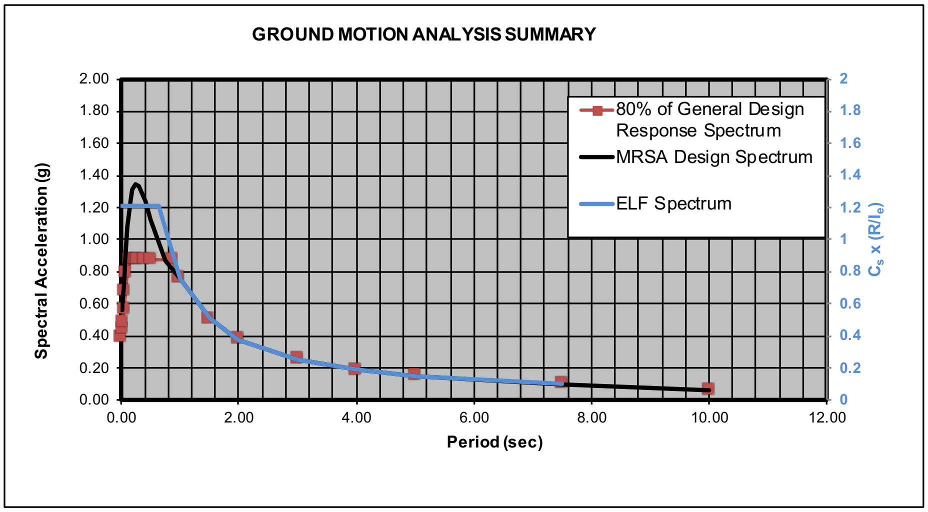
S_{DS}= 1.21
S_{D1}= 0.76
T_s = 0.62

S_{MS}= 1.818
S_{M1}= 1.136

PGA Determination:

Site Coefficient F_{PGA}= 1.1
Mapped PGA= 0.69 Figure 22-7
PGA_M = 0.76 g

Deterministic PGA = 1.07 g
Probabilistic PGA = 0.81 g
Lesser of Deterministic/Probabilistic = 0.81 g
80% of $PGA_{M=}$ 0.61 g
MCE_G PGA= 0.81 g



APPENDIX C

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APPENDIX E
INFILTRATION RATE STUDY FOR STORM WATER DISPOSAL
APRIL 2022

John R. Byerly
INCORPORATED

April 18, 2022

Mountain Area Regional Transit Authority (MARTA)
41939 Fox Farm Road
Big Bear Lake, California 92315

Rpt. No.: 7347
File No.: S-14447

Attention: Ms. Sandy Benson, General Manager

Project: New Administration Building and Maintenance Facility, 160-170 Business Center Drive, Big Bear Lake, California

Subject: Infiltration Rate Study for Storm Water Disposal

References:
(a) San Bernardino County Stormwater Program, Technical Guidance Document for Water Quality Management Plans (WQMP), June 7, 2013

(b) e-mail re: 50801, Request for Proposal, Geotech, Byerley, MTTransit Admin&M&O-Facility.pdf, Devanie Donadio, Ruhnau Clarke Architects, August 27, 2021 with attached Annotated Site Plan

(c) Geotechnical Investigation, New Administration Building and Maintenance Facility, 160-170 Business Center Drive, Big Bear Lake, California, John R. Byerly, Inc., Rpt. No. 7341, April 11, 2022

Ladies and Gentlemen:

We understand that development of the proposed Mountain Transit facility will include the construction of infiltration systems to retain and dispose of storm water runoff. The referenced annotated site plan identifies three percolation test areas where the infiltration systems may be constructed. An investigation of the percolation characteristics of the soils underlying these three locations was performed by our firm during January of 2022. The purpose of our investigation was to assist in the determination of a design infiltration rate for the proposed storm water disposal systems.

GEOTECHNICAL ENGINEERS • TESTING AND INSPECTION
2257 South Lilac Ave., Bloomington, CA 92316-2907
Bloomington(909) 877-1324 Riverside (909) 783-1910 Fax (909) 877-5210

PROJECT DESCRIPTION

For the preparation of this report, we reviewed the referenced San Bernardino County's Technical Guidance Document for Water Quality Management Plans (Reference a), the referenced geotechnical investigation report (Reference c), and the referenced annotated site plan. We understand that the proposed Mountain Transit facility will consist of a 12,188-square-foot bus maintenance building and a 11,355-square-foot administration building. Four solar shade structures, bus and vehicle parking, drive areas, trash enclosure, fencing, gates, and landscape areas are also proposed. As part of the development, bioswales and underground infiltration systems are planned to retain and dispose of storm water runoff. We assume that the bottom of the proposed bioswales will be about 2 to 4 feet below the presently existing grade. We anticipate that the bottom of the underground infiltration systems will be about 3.3 to 9.8 feet below the presently existing grade. The site configuration is illustrated on Enclosure 1.

REVIEW OF GEOTECHNICAL REPORT

A geotechnical investigation for the new proposed administration building and maintenance facility site was conducted by this firm as described in Reference (c). The subsurface explorations consisted of 10 test borings drilled with a truck-mounted flight-auger to depths of up to 71.5 feet below the existing ground surface. Some of the test borings were excavated in close proximity to the infiltration system areas to explore for ground water or impermeable soil strata. Laboratory testing included maximum density, consolidation, direct shear, expansion index, gradation, sand equivalent, "R" value, and chemical tests. This report presented grading and foundation design recommendations. Preliminary recommendations were presented for the design of asphalt concrete pavement for fire lanes and parking and driveway areas.

SITE CONDITIONS

The approximately 3-acre site is located on the west corner of Business Center Drive and Sandalwood Drive in the city of Big Bear Lake. An Index Map showing the general vicinity of the site is presented on the following page. The coordinates of the site are latitude 34.2505° N

INDEX MAP

SOURCE DOCUMENTS: USGS FAWNSKIN QUADRANGLE, CALIFORNIA, 7.5 MINUTE SERIES, 2018

TOWNSHIP AND RANGE: SECTION 21, T2N, R1E

LATITUDE: 34.2505° N

LONGITUDE: 116.8888° W

John R. Byerly
INCORPORATED

and longitude -116.8888° W (World Geodetic System of 1984). The property is currently dirt-covered and has a very light growth of vegetation. The site is relatively flat, sloping downward to the northwest at a gradient of less than 4 percent. A Southwest Gas building is present to the southeast, and the property to the north is vacant.

FIELD INVESTIGATION

We explored the soils underlying the area currently proposed for the storm water disposal systems by means of four percolation test borings drilled with a truck-mounted flight-auger to depths of about 2 to 9.8 feet below the existing ground surface. The approximate locations of the field explorations are shown on Enclosure 1. The soils encountered were examined and visually classified by one of our field engineers. A summary of the soil classifications appears as Enclosure 2. The exploration logs show subsurface conditions at the dates and locations indicated and may not be representative of subsurface conditions at other locations and times. The stratification depths presented on the logs represent the approximate soil type boundaries. We investigated the percolation characteristics of the soils underlying the proposed infiltration basin by four percolation tests using the falling-head test method. Percolation testing was performed using the borehole-type method and following test procedures required by Reference (a).

On January 21, 2022, percolation testing was performed at four locations. The weather condition was dry and cold with an average temperature of 47 degrees Fahrenheit. Two inches of clean gravel were placed in the bottoms of the test holes. Perforated plastic cans, 12 inches in height and 6 inches in diameter, were then placed in the test holes to control scour. Clear water was introduced into each test hole, and the soils were allowed to soak and condition overnight prior to determination of the percolation rate. The following day, approximately 30.0 inches, 1.5 inches, and 25.1 inches of caving occurred in the bottom of percolation test locations P-1, P-2, and P-4, respectively. Water was reintroduced into the test holes, and the water was allowed to percolate into the soil. At timed intervals, the level of water was measured, and additional water was added to the test holes. The test was continued until steady-state conditions were attained. Enclosure 3 presents the percolation test data. Percolation rates have been corrected for the contribution of the test hole sidewall.

SOIL CONDITIONS

The upper soils consisted of medium dense to very dense gravelly sands with silt, silty sands with gravel, and silty sands with traces of clay to the maximum depth penetrated. The underlying soils encountered in our recent percolation investigation are consistent with the findings of our referenced geotechnical investigation. As described in Reference (c), ground water was encountered in Borings 1 and 2 at depths of 26.6 feet and 29.9 feet, respectively, and at a depth of 27.4 feet in Boring 6. Bedrock was not encountered in our test borings. Currently the site is approximately 52 feet above the water level of Big Bear Lake. Our consulting engineering geologist estimates that the shallowest historic depth to ground water is expected to have been 8 feet.

CONCLUSIONS AND RECOMMENDATIONS

The percolation tests yielded infiltration rates of 0.01 inch per hour and 0.09 inch per hour. The infiltration rates were computed utilizing the percolation rate conversion equation (Porchet Method, aka Inverse Borehole Method) provided by the San Bernardino County's Technical Guidance Document for Water Quality Management Plans (Reference a), which accommodates the contribution of the test hole sidewall to the measured percolation rate. The percolation rate conversion equation is presented below.

$$I_t = \frac{\Delta H \text{ (60 min./hr.) } r}{\Delta t \ (r+2\ H_{avg})}$$

Where: I_t = *tested infiltration rate (in./hr.)*

Δt = *time interval (min.)*

r = *test hole radius (in.)*

ΔH = *change in height over the time interval (in.)*

H_{avg} = *average head height over the time interval (in.)*

The converted percolation rates are presented in the following table.

Percolation Number	Depth of Test (inches)	Converted Percolation Rate (inch per hour)
P-1	18.0	0.08
P-2	22.5	0.05
P-3	117.6	0.01
P-4	14.5	0.09

A safety factor has not been applied to these design values. We note that the tests conducted yielded percolation rates are generally considered unacceptably slow. It is our opinion that the slow infiltration rates are attributable to the slightly clayey and medium dense to very dense nature of the soils that underlie the proposed storm water disposal system areas. Our field test boring logs demonstrate that the soils conditions encountered at the depths of our percolation tests will be similar to the soils encountered at the maximum depth drilled for the percolation test borings.

We appreciate this opportunity to be of service. Should there be questions, please feel free to contact this office.

Respectfully submitted,

JOHN R. BYERLY, INC.

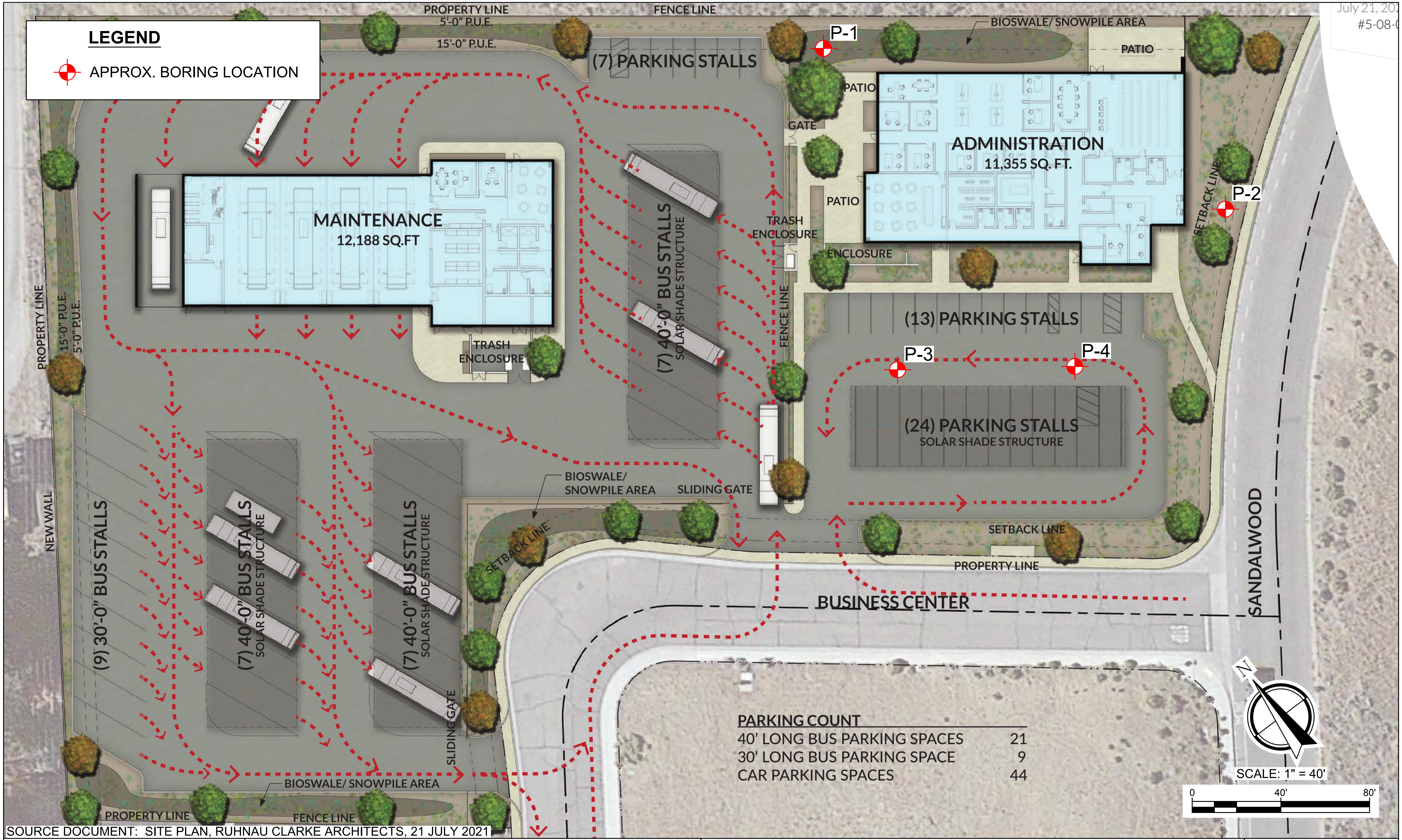
John R. Byerly, Geotechnical Engineer
President

JOHN R. BYERLY
GE 000179
EXP. 06/30/23

JRB:MLL:jet

Enclosures: (1) Plot Plan
(2) Exploration Logs
(3) Summary of Field Test Data

Copies: (1) Client
(1) Charles Abbott Associates, Inc.



PARKING COUNT

40' LONG BUS PARKING SPACES	21
30' LONG BUS PARKING SPACE	9
CAR PARKING SPACES	44

SOURCE DOCUMENT: SITE PLAN, RUHNAU CLARKE ARCHITECTS, 21 JULY 2021

John R. Byerly
INCORPORATED

INFILTRATION RATE STUDY

MOUNTAIN AREA REGIONAL TRANSIT AUTHORITY
160-170 BUSINESS CENTER
BIG BEAR LAKE, CALIFORNIA

Enclosure 1
Rpt. No.: 7347
File No.: S-14447

P-1

Boring Date: 1/20/22
Surface Elevation:
Drilling Method: Truck-Mounted Flight-Auger

Depth	Std. Pen. "N" Value	Blows/Ft.	Dry Density (PCF)	Moisture Content (%)	Rel. Compaction (%)	Water Table			
0						GWT not encountered	▨	SM	Dark brown gravelly fine to medium sand with silt, moist and medium dense
							▨	SM	Gray-brown silty fine to medium sand with gravel, moist and medium dense
5									Total Depth at 4.0 Feet No Free Ground Water Encountered
10									
15									
20									
25									
30									
35									

LOG OF BORING

P-2

Boring Date: 1/20/22
Surface Elevation:
Drilling Method: Truck-Mounted Flight-Auger

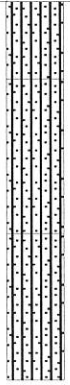
Depth	Std. Pen. "N" Value	Blows/Ft.	Dry Density (PCF)	Moisture Content (%)	Rel. Compaction (%)	Water Table			
0						GWT not encountered	▨	SM	Dark brown gravelly fine to medium sand with silt, moist and medium dense
									Total Depth at 2.0 Feet No Free Ground Water Encountered
5									
10									
15									
20									
25									
30									
35									

LOG OF BORING

P-3

Boring Date: 1/20/22
Surface Elevation:
Drilling Method: Truck-Mounted Flight-Auger

Depth	Std. Pen. "N" Value	Blows/Ft.	Dry Density (PCF)	Moisture Content (%)	Rel. Compaction (%)	Water Table
0						GWT not encountered
5						
10						
15						
20						
25						
30						
35						



SM	Dark brown gravelly fine to medium sand with silt, moist and dense
SM	Red-brown silty fine to medium sand with gravel, moist and medium dense
SM	Dark gray-brown silty fine to medium sand with a trace of clay, moist and very dense

Total Depth at 9.8 Feet
No Free Ground Water Encountered

LOG OF BORING

John R. Byerly, Inc.

Mountain Area Regional Transit Authority

Enclosure 2, Page 3
Rpt. No.: 7347
File No.: S-14447

P-4

Boring Date: 1/20/22
Surface Elevation:
Drilling Method: Truck-Mounted Flight-Auger

Depth	Std. Pen. "N" Value	Blows/Ft.	Dry Density (PCF)	Moisture Content (%)	Rel. Compaction (%)	Water Table			
0						GWT not encountered	▨	SM	Dark brown gravelly fine to medium sand with silt, moist and dense
									Total Depth at 3.3 Feet No Free Ground Water Encountered
5									
10									
15									
20									
25									
30									
35									

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECTS-14447 (Rpt. No. 7347).log Date: 4/18/2022

LOG OF BORING

John R. Byerly, Inc.

Mountain Area Regional Transit Authority

Enclosure 2, Page 4
Rpt. No.: 7347
File No.: S-14447

JOHN R. BYERLY, INC.

2257 South Lilac Avenue, Bloomington, CA 92316-2907
Phone: (909) 877-1324
Fax: (909) 877-5210

Percolation Test Data Sheet

Project:	MARTA – Admin. Bldg. & Maint. Facility	File No.:	S-14447	Date:	01-21-22
Test Hole No.:	P-1	Tested By:	Rocky Casino		
Depth of Test Hole, (D_T)	18.0 in.	USCS Soil Classification:	SM		
Test Hole Dimensions (inches)			Length	Width	
Diameter (if round)	8.0 in.	Sides (if irregular)			

Sandy Soil Criteria Test*

Trial No.	Start Time	Stop Time	Time Interval, (min.)	Initial Depth to Water (in.)	Final Depth to Water (In.)	Change In Water Level (in.)	≥ 6" ? (Y/N)
1							
2							

*If two consecutive measurements show that 6 inches of water seeps away in less than 25 minutes the test shall be run for an additional hour with measurements taken every 10 minutes. Otherwise pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximately 30 minute intervals) with a precision of at least 0.25".

Trial No.	Start Time	Stop Time	Δt Time Interval, (min.)	D_o Initial Depth to Water (in.)	D_f Final Depth to Water (In.)	ΔD Change In Water Level (in.)	Percolation Rate (min./in.)
1	11:00	11:30	30	7.50	7.75	0.25	120.0
2	11:31	12:01	30	7.50	7.75	0.25	120.0
3	12:02	12:32	30	7.50	7.75	0.25	120.0
4	12:33	1:03	30	7.50	7.75	0.25	120.0
5	1:04	1:34	30	7.50	7.75	0.25	120.0
6	1:35	2:05	30	7.50	7.75	0.25	120.0
7	2:06	2:36	30	7.50	7.75	0.25	120.0
8	2:37	3:07	30	7.50	7.75	0.25	120.0
9	3:08	3:38	30	7.50	7.75	0.25	120.0
10	3:39	4:09	30	7.50	7.75	0.25	120.0
11	4:10	4:40	30	7.50	7.75	0.25	120.0
12	4:41	5:11	30	7.50	7.75	0.25	120.0
13							
14							
15							

Comments: The percolation test yielded a percolation rate of 120.0 minutes per inch which converts to an infiltration rate of 0.08 inch per hour. The infiltration rate was computed utilizing the percolation rate conversion equation (Porchet Method) provided by the San Bernardino County's Technical Guidance Document for Water Quality Management Plans.

Percolation Test Data Sheet

Project: MARTA – Admin. Bldg. & Maint. Facility File No.: S-14447 Date: 01-21-22

Test Hole No.: P-2 Tested By: Rocky Casino

Depth of Test Hole, (D_T) 22.5 in. USCS Soil Classification: SM

Test Hole Dimensions (inches)			Length	Width	
Diameter (if round)	8.0 in.	Sides (if irregular)			

Sandy Soil Criteria Test*

Trial No.	Start Time	Stop Time	Time Interval, (min.)	Initial Depth to Water (in.)	Final Depth to Water (In.)	Change In Water Level (in.)	≥ 6” ? (Y/N)
1							
2							

*If two consecutive measurements show that 6 inches of water seeps away in less than 25 minutes the test shall be run for an additional hour with measurements taken every 10 minutes. Otherwise pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximately 30 minute intervals) with a precision of at least 0.25”.

Trial No.	Start Time	Stop Time	Δt Time Interval, (min.)	D_o Initial Depth to Water (in.)	D_f Final Depth to Water (In.)	ΔD Change In Water Level (in.)	Percolation Rate (min./in.)
1	11:02	11:32	30	5.50	5.75	0.25	120.0
2	11:33	12:03	30	5.50	5.75	0.25	120.0
3	12:04	12:34	30	5.50	5.75	0.25	120.0
4	12:35	1:05	30	5.50	5.75	0.25	120.0
5	1:06	1:36	30	5.50	5.75	0.25	120.0
6	1:37	2:07	30	5.50	5.75	0.25	120.0
7	2:08	2:38	30	5.50	5.75	0.25	120.0
8	2:39	3:09	30	5.50	5.75	0.25	120.0
9	3:10	3:40	30	5.50	5.75	0.25	120.0
10	3:41	4:11	30	5.50	5.75	0.25	120.0
11	4:12	4:42	30	5.50	5.75	0.25	120.0
12	4:43	5:13	30	5.50	5.75	0.25	120.0
13							
14							
15							

Comments: The percolation test yielded a percolation rate of 120.0 minutes per inch which converts to an infiltration rate of 0.05 inch per hour. The infiltration rate was computed utilizing the percolation rate conversion equation (Porchet Method) provided by the San Bernardino County’s Technical Guidance Document for Water Quality Management Plans.

JOHN R. BYERLY, INC.

2257 South Lilac Avenue, Bloomington, CA 92316-2907
Phone: (909) 877-1324
Fax: (909) 877-5210

Percolation Test Data Sheet

Project:	MARTA – Admin. Bldg. & Maint. Facility			File No.:	S-14447	Date:	01-21-22
Test Hole No.:		P-3	Tested By:	Rocky Casino			
Depth of Test Hole, (D_T)		117.6 in.	USCS Soil Classification:		SM		
Test Hole Dimensions (inches)					Length	Width	
Diameter (if round)		8.0 in.	Sides (if irregular)				

Sandy Soil Criteria Test*

Trial No.	Start Time	Stop Time	Time Interval, (min.)	Initial Depth to Water (in.)	Final Depth to Water (In.)	Change In Water Level (in.)	≥ 6" ? (Y/N)
1							
2							

*If two consecutive measurements show that 6 inches of water seeps away in less than 25 minutes the test shall be run for an additional hour with measurements taken every 10 minutes. Otherwise pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximately 30 minute intervals) with a precision of at least 0.25".

Trial No.	Start Time	Stop Time	Δt Time Interval, (min.)	D_o Initial Depth to Water (in.)	D_f Final Depth to Water (In.)	ΔD Change In Water Level (in.)	Percolation Rate (min./in.)
1	11:06	11:36	30	12.25	12.50	0.25	120.0
2	11:37	12:07	30	12.25	12.50	0.25	120.0
3	12:08	12:38	30	12.25	12.50	0.25	120.0
4	12:39	1:09	30	12.25	12.50	0.25	120.0
5	1:10	1:40	30	12.25	12.50	0.25	120.0
6	1:41	2:11	30	12.25	12.50	0.25	120.0
7	2:12	2:42	30	12.25	12.50	0.25	120.0
8	2:43	3:13	30	12.25	12.50	0.25	120.0
9	3:14	3:44	30	12.25	12.50	0.25	120.0
10	3:45	4:15	30	12.25	12.50	0.25	120.0
11	4:16	4:46	30	12.25	12.50	0.25	120.0
12	4:47	5:17	30	12.25	12.50	0.25	120.0
13							
14							
15							

Comments: The percolation test yielded a percolation rate of 120.0 minutes per inch which converts to an infiltration rate of 0.01 inch per hour. The infiltration rate was computed utilizing the percolation rate conversion equation (Porchet Method) provided by the San Bernardino County's Technical Guidance Document for Water Quality Management Plans.

JOHN R. BYERLY, INC.

2257 South Lilac Avenue, Bloomington, CA 92316-2907
Phone: (909) 877-1324
Fax: (909) 877-5210

Percolation Test Data Sheet

Project:	MARTA – Admin. Bldg. & Maint. Facility		File No.:	S-14447	Date:	01-21-22	
Test Hole No.:		P-4	Tested By:	Rocky Casino			
Depth of Test Hole, (D_T)		14.5 in.	USCS Soil Classification:	SM			
Test Hole Dimensions (inches)				Length	Width		
Diameter (if round)		8.0 in.	Sides (if irregular)				

Sandy Soil Criteria Test*

Trial No.	Start Time	Stop Time	Time Interval, (min.)	Initial Depth to Water (in.)	Final Depth to Water (In.)	Change In Water Level (in.)	≥ 6" ? (Y/N)
1							
2							

*If two consecutive measurements show that 6 inches of water seeps away in less than 25 minutes the test shall be run for an additional hour with measurements taken every 10 minutes. Otherwise pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximately 30 minute intervals) with a precision of at least 0.25".

Trial No.	Start Time	Stop Time	Δt Time Interval, (min.)	D_o Initial Depth to Water (in.)	D_f Final Depth to Water (In.)	ΔD Change In Water Level (in.)	Percolation Rate (min./in.)
1	11:08	11:38	30	5.25	5.50	0.25	120.0
2	11:39	12:09	30	5.25	5.50	0.25	120.0
3	12:10	12:40	30	5.25	5.50	0.25	120.0
4	12:41	1:11	30	5.25	5.50	0.25	120.0
5	1:12	1:42	30	5.25	5.50	0.25	120.0
6	1:43	2:13	30	5.25	5.50	0.25	120.0
7	2:14	2:44	30	5.25	5.50	0.25	120.0
8	2:45	3:15	30	5.25	5.50	0.25	120.0
9	3:16	3:46	30	5.25	5.50	0.25	120.0
10	3:47	4:17	30	5.25	5.50	0.25	120.0
11	4:18	4:48	30	5.25	5.50	0.25	120.0
12	4:49	5:19	30	5.25	5.50	0.25	120.0
13							
14							
15							

Comments: The percolation test yielded a percolation rate of 120.0 minutes per inch which converts to an infiltration rate of 0.09 inch per hour. The infiltration rate was computed utilizing the percolation rate conversion equation (Porchet Method) provided by the San Bernardino County's Technical Guidance Document for Water Quality Management Plans.

APPENDIX F
WATER QUALITY MANAGEMENT PLAN
APRIL 2022

Water Quality Management Plan

For:

MOUNTAIN AREA REGIONAL TRANSIT AUTHORITY

M-2022-0120

APN 2328-021-12 & -13

170 BUSINESS CENTER DRIVE

BIG BEAR LAKE, CA 92315

Prepared for:

Mountain Area Regional Transit Authority

41939 Fox Farm Road

Big Bear Lake, CA 92315

(909) 878-5200

Prepared by:

Valued Engineering, Inc

600 N. Mountain Avenue, Suite C102

Upland, 91786

(909) 982-4601

Submittal Date: April 2022

Revision Date: January 2023

Approval Date:____________________

Project Owner's Certification

This Water Quality Management Plan (WQMP) has been prepared for Mountain Area Regional Transit Authority by Valued Engineering, Inc. The WQMP is intended to comply with the requirements of the County of San Bernardino and the NPDES Areawide Stormwater Program requiring the preparation of a WQMP. The undersigned, while it owns the subject property, is responsible for the implementation of the provisions of this plan and will ensure that this plan is amended as appropriate to reflect up-to-date conditions on the site consistent with San Bernardino County's Municipal Storm Water Management Program and the intent of the NPDES Permit for San Bernardino County and the incorporated cities of San Bernardino County within the Santa Ana Region. Once the undersigned transfers its interest in the property, its successors in interest and the city/county shall be notified of the transfer. The new owner will be informed of its responsibility under this WQMP. A copy of the approved WQMP shall be available on the subject site in perpetuity.

"I certify under a penalty of law that the provisions (implementation, operation, maintenance, and funding) of the WQMP have been accepted and that the plan will be transferred to future successors."

.

Project Data			
Permit/Application Number(s):	M-2022-0120	Grading Permit Number(s):	T.B.D
Tract/Parcel Map Number(s):	Tract No. 18698 M.B. 333/99-102	Building Permit Number(s):	T.B.D
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN 2328-021-12 & -13

Owner's Signature			
Owner Name: Ms. Sandy Benson			
Title	General Manager		
Company	Mountain Area Regional Transit Authority		
Address	3775 Tenth Street, Riverside, CA 92501		
Email	sbenson@mountaintransit.org		
Telephone #	(909) 878-5200		
Signature		Date	

Preparer’s Certification

Project Data

Permit/Application Number(s):	M-2022-0120	Grading Permit Number(s):	T.B.D
Tract/Parcel Map Number(s):	Tract No. 18698 M.B. 333/99-102	Building Permit Number(s):	T.B.D
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN 2328-021-12 & -13

“The selection, sizing and design of stormwater treatment and other stormwater quality and quantity control measures in this plan were prepared under my oversight and meet the requirements of Regional Water Quality Control Board Order No. R8-2010-0036.”

Engineer:	Mr. Jeff Meiter
Title	President
Company	Valued Engineering, Inc
Address	600 N. Mountain Ave Suite C102, Upland, CA 91786
Email	jeff@valued-eng.com
Telephone #	(909) 982-4601
Signature	
Date	01-16-2023

PE Stamp Below

REGISTERED PROFESSIONAL ENGINEER
JEFFEREY D. MEITER
No. 64696
CIVIL
STATE OF CALIFORNIA

Table of Contents

Forms

Section 6. WQMP Attachments

6.1 WQMP Site Plan and Drainage Plan

6.2 Post Construction

6.3 Other Supporting Documentation

Section 1 Discretionary Permit(s)

Form 1-1 Project Information

<table>
<tr><td>Project Name</td><td colspan="5">Mountain Area Regional Transit Authority</td></tr>
<tr><td>Project Owner Contact Name:</td><td colspan="5">Ms. Sandy Benson</td></tr>
<tr><td>Mailing Address:</td><td>41939 Fox Farm Road, Big Bear Lake, CA 92315</td><td>E-mail Address:</td><td>sbenson@mountaintransit.org</td><td>Telephone:</td><td>(909) 878-5200</td></tr>
<tr><td>Permit/Application Number(s):</td><td>M-2022-0120</td><td colspan="2">Tract/Parcel Map Number(s):</td><td colspan="2">Tract No. 18698
M.B. 333/99-102</td></tr>
<tr><td>Additional Information/ Comments:</td><td colspan="5">170 Business Center Drive, Big Bear Lake, CA 92315</td></tr>
<tr><td>Description of Project:</td><td colspan="5">The project proposes the development of a 3.55 acre undeveloped property that includes a 12,188 sq.ft bus maintenance building, a 11,355 sq.ft administration building for Mountain Transit Facility and parking lot in the City of Big Bear. This development proposes 121,530 square foot of impervious surface throughout the property. The impervious area consists of parking (AC pavement), proposed buildings, PCC pavement hardscape such as curbs, gutters and sidewalks. The pervious area will include the 33,293 square feet of landscaping. The site will be treated as two distinct drainage areas, DA1 and DA2.
Drainage Area DA 1 is delineated into two subareas, DMA A and DMA B that include building roofs, PCC walkway, AC pavement and landscaping. Flows generated from the DA 1 will be directed to curb openings that will direct stormwater into above ground detention basins along with an underground chamber system for DMA B. For the design rainfall depth, stormwater will be routed through the proposed Modular Wetland System (Biofiltration System). The use of detention basins and chambers the design stormwater volume and transport the DCV storm event flows into the MWS treatment system. In scenarios where the storm event exceeds the volume, stormwater runoff will be diverted into the right-of-way, Sandalwood Drive. From here, flows continue via City of Big Bear storm drain to Big Bear Lake as they do historically.
Drainage Area DA 2 consists of northest portion of the site including the parking lot and the building roof runoff which will discharge to the pervious landscape area, any DCV not treated by HSC will be captured with an inlet and collect in a bioretention basin for stormwater treatment. The overflow outlet will be used for drainage area to allow for excess water to flow greater than the 2 year storm event to the public right-of-way, Sandalwood Drive.</td></tr>
</table>

Provide summary of Conceptual WQMP conditions (if previously submitted and approved). Attach complete copy.	

Section 2 Project Description

2.1 Project Information

This section of the WQMP should provide the information listed below. The information provided for Conceptual/ Preliminary WQMP should give sufficient detail to identify the major proposed site design and LID BMPs and other anticipated water quality features that impact site planning. Final Project WQMP must specifically identify all BMP incorporated into the final site design and provide other detailed information as described herein.

The purpose of this information is to help determine the applicable development category, pollutants of concern, watershed description, and long term maintenance responsibilities for the project, and any applicable water quality credits. This information will be used in conjunction with the information in Section 3, Site Description, to establish the performance criteria and to select the LID BMP or other BMP for the project or other alternative programs that the project will participate in, which are described in Section 4.

Form 2.1-1 Description of Proposed Project

1 Development Category (Select all that apply):

☐ Significant re-development involving the addition or replacement of 5,000 ft^2 or more of impervious surface on an already developed site	☒ New development involving the creation of 10,000 ft^2 or more of impervious surface collectively over entire site	☐ Automotive repair shops with standard industrial classification (SIC) codes 5013, 5014, 5541, 7532- 7534, 7536-7539	☐ Restaurants (with SIC code 5812) where the land area of development is 5,000 ft^2 or more
☐ Hillside developments of 5,000 ft^2 or more which are located on areas with known erosive soil conditions or where the natural slope is 25 percent or more	☐ Developments of 2,500 ft^2 of impervious surface or more adjacent to (within 200 ft) or discharging directly into environmentally sensitive areas or waterbodies listed on the CWA Section 303(d) list of impaired waters.	☒ Parking lots of 5,000 ft^2 or more exposed to storm water	☐ Retail gasoline outlets that are either 5,000 ft^2 or more, or have a projected average daily traffic of 100 or more vehicles per day

☐ Non-Priority / Non-Category Project May require source control LID BMPs and other LIP requirements. Please consult with local jurisdiction on specific requirements.

2 Project Area (ft2):	154,823	3 Number of Dwelling Units:	N/A	4 SIC Code:	1542 & 4173

5 Is Project going to be phased? Yes ☐ No ☒ If yes, ensure that the WQMP evaluates each phase as a distinct DA, requiring LID BMPs to address runoff at time of completion.

6 Does Project include roads? Yes ☐ No ☒ If yes, ensure that applicable requirements for transportation projects are addressed (see Appendix A of TGD for WQMP)

2.2 Property Ownership/Management

Describe the ownership/management of all portions of the project and site. State whether any infrastructure will transfer to public agencies (City, County, Caltrans, etc.) after project completion. State if a homeowners or property owners association will be formed and be responsible for the long-term maintenance of project stormwater facilities. Describe any lot-level stormwater features that will be the responsibility of individual property owners.

Form 2.2-1 Property Ownership/Management

Describe property ownership/management responsible for long-term maintenance of WQMP stormwater facilities:

The property will be maintained by Mountain Area Regional Transit Authority (hereinafter referred to as "Owner/Property Owner". All Non-structural source control BMPs and structural source control BMPs including but not limited to drop inlets, landscape areas, storm drain manholes, catch basins and underground chambers will be maintained by the owner. Onsite sweeping is performed daily and all activities throughout the site are performed in compliance with the County of San Bernardino and State General Industrial Stormwater permit.

Initial ownership of the project will be held with Mountain Area Regional Transit Authority and as state above, the long term maintenance will be the responsibility of the owner, until the property is sold or transferred to new owners. The City will be notified immediately through applicable documentation upon transfer of ownership for this property.

The current owner/responsible party: Mountain Area Regional Transit Authority

41939 Fox Farm Road

Big Bear Lake, CA 92315

Phone: (909) 878-5200

Contact: Sandy Benson

No infrastructure will be transferred to a public agency after project completion.

2.3 Potential Stormwater Pollutants

Determine and describe expected stormwater pollutants of concern based on land uses and site activities (refer to Table 3-3 in the TGD for WQMP).

Form 2.3-1 Pollutants of Concern

Pollutant	Please check: E=Expected, N=Not Expected		Additional Information and Comments
Pathogens (Bacterial / Virus)	E ☒	N ☐	Common runoff pollutant from pavement and landscape areas, including wild birds, and animals together with garbage
Nutrients - Phosphorous	E ☒	N ☐	Common runoff pollutant from landscaping, including fertilizer, food waste, and garbage
Nutrients - Nitrogen	E ☒	N ☐	Common runoff pollutant from landscaping, including fertilizer,and food waste
Noxious Aquatic Plants	E ☒	N ☐	Common runoff pollutant from landscaping
Sediment	E ☒	N ☐	Runoff from pavement, landscaping and rooftops
Metals	E ☒	N ☐	Cars, trucks, and parking areas
Oil and Grease	E ☒	N ☐	Vehicle parking areas
Trash/Debris	E ☒	N ☐	Trash containers and parking areas
Pesticides / Herbicides	E ☒	N ☐	Runoff from landscaping
Organic Compounds	E ☒	N ☐	Parking areas and fertilizers
Other: Petroleum	E ☐	N ☒	N/A
Other: Hydrocarbons	E ☐	N ☒	N/A
Other: Solvents	E ☐	N ☒	N/A
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	

2.4 Water Quality Credits

A water quality credit program is applicable for certain types of development projects if it is not feasible to meet the requirements for on-site LID. Proponents for eligible projects, as described below, can apply for water quality credits that would reduce project obligations for selecting and sizing other treatment BMP or participating in other alternative compliance programs. Refer to Section 6.2 in the TGD for WQMP to determine if water quality credits are applicable for the project.

Form 2.4-1 Water Quality Credits

1 Project Types that Qualify for Water Quality Credits: Select all that apply			
☐ Redevelopment projects that reduce the overall impervious footprint of the project site. [Credit = % impervious reduced]	Higher density development projects ☐Vertical density [20%] ☐7 units/ acre [5%]	☐ Mixed use development, (combination of residential, commercial, industrial, office, institutional, or other land uses which incorporate design principles that demonstrate environmental benefits not realized through single use projects) [20%]	☐Brownfield redevelopment (redevelop real property complicated by presence or potential of hazardous contaminants) [25%]
☐ Redevelopment projects in established historic district, historic preservation area, or similar significant core city center areas [10%]	☐ Transit-oriented developments (mixed use residential or commercial area designed to maximize access to public transportation) [20%]	☐ In-fill projects (conversion of empty lots & other underused spaces < 5 acres, substantially surrounded by urban land uses, into more beneficially used spaces, such as residential or commercial areas) [10%]	☐ Live-Work developments (variety of developments designed to support residential and vocational needs) [20%]
2 Total Credit % 0 (Total all credit percentages up to a maximum allowable credit of 50 percent)			
Description of Water Quality Credit Eligibility (if applicable)	N/A		

Section 3 Site and Watershed Description

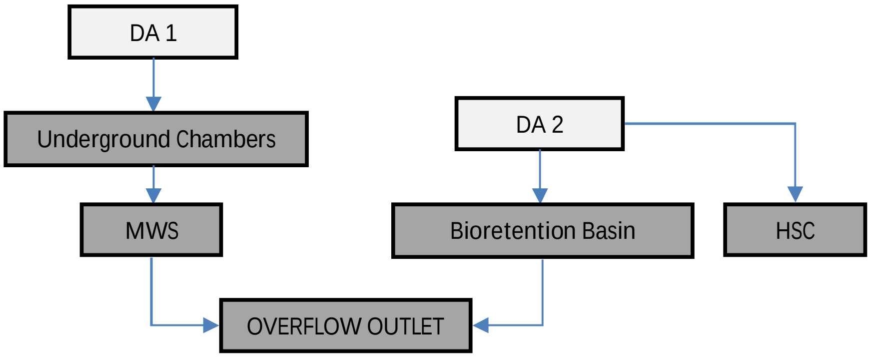
Describe the project site conditions that will facilitate the selection of BMP through an analysis of the physical conditions and limitations of the site and its receiving waters. Identify distinct drainage areas (DA) that collect flow from a portion of the site and describe how runoff from each DA (and sub-watershed DMAs) is conveyed to the site outlet(s). Refer to Section 3.2 in the TGD for WQMP. The form below is provided as an example. Then complete Forms 3.2 and 3.3 for each DA on the project site. If the project has more than one drainage area for stormwater management, then complete additional versions of these forms for each DA / outlet.

Form 3-1 Site Location and Hydrologic Features

Site coordinates	Latitude 34.25078	Longitude -116.88867	Thomas Bros Map page 4741

1 San Bernardino County climatic region: ☐ Valley ☒ Mountain

2 Does the site have more than one drainage area (DA): Yes☒ No☐ If no, proceed to Form 3-2. If yes, then use this form to show a conceptual schematic describing DMAs and hydrologic feature connecting DMAs to the site outlet(s). An example is provided below that can be modified for proposed project or a drawing clearly showing DMA and flow routing may be attached



DA 1 to Underground Chambers with Biofiltration System	The southeasterly portion of the site will be designed as DA 1. This drainage area includes building roof, PCC walkway, AC pavement and landscaping. Stormwater in this drainage area will be captured at local low points with inlets and conveyed via underground storm drain to proposed underground dentention chambers and above ground detention basins at the southeasterly (DMA A) and northwesterly (DMA B) portions of the site. The captured stormwater will be conveyed into the MWS treatment system. Excess stormwater greater than the 2-year, 1-hour stormevent will be released by filling up the detention systems, treat through the MWS system and released to the public right-of-way.
DA 2 to Bioretention Basin	The northeasterly portion of the site is designated as DA 2. This drainage area includes the parking lot, the building roof and minimal landscaping. Stormwater in this drainage area will flow into the proposed landscaped area where impervious area dispersion will be applied. Area inlets will capture any DCV not treated by HSC will tie into the pipe which will be conveyed to the bioretention basin.

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 1

For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DMA A	DMA B		
1 DMA drainage area (ft²)	37,409	68,297		
2 Existing site impervious area (ft²)	0	0		
3 Antecedent moisture condition For desert areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf	1	1		
4 Hydrologic soil group Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/	B	B		
5 Longest flowpath length (ft)	242	298		
6 Longest flowpath slope (ft/ft)	0.017	0.034		
7 Current land cover type(s) Select from Fig C-3 of Hydrology Manual	Grass	Grass		
8 Pre-developed pervious area condition: Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50% Attach photos of site to support rating	Poor	Poor		

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 2				
For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DMA C			
1 DMA drainage area (ft²)	49,117			
2 Existing site impervious area (ft²)	0			
3 Antecedent moisture condition For desert areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf	1			
4 Hydrologic soil group Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/	B			
5 Longest flowpath length (ft)	305			
6 Longest flowpath slope (ft/ft)	0.023			
7 Current land cover type(s) Select from Fig C-3 of Hydrology Manual	Grass			
8 Pre-developed pervious area condition: Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50% Attach photos of site to support rating	Poor			

Form 3-3 Watershed Description for Drainage Area

Receiving waters Refer to Watershed Mapping Tool - http://permitrack.sbcounty.gov/wap/ See 'Drainage Facilities" link at this website	Big Bear Lake
Applicable TMDLs Refer to Local Implementation Plan	Nutrients
303(d) listed impairments Refer to Local Implementation Plan and Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/ and State Water Resources Control Board website – http://www.waterboards.ca.gov/santaana/water_issues/programs/tmdl/index.shtml	Nutrients, Noxious aquatic plants, Sediments
Environmentally Sensitive Areas (ESA) Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/	N/A
Unlined Downstream Water Bodies Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/	N/A
Hydrologic Conditions of Concern	☐ Yes Complete Hydrologic Conditions of Concern (HCOC) Assessment. Include Forms 4.2-2 through Form 4.2-5 and Hydromodification BMP Form 4.3-10 in submittal ☒ No
Watershed–based BMP included in a RWQCB approved WAP	☐ Yes Attach verification of regional BMP evaluation criteria in WAP • More Effective than On-site LID • Remaining Capacity for Project DCV • Upstream of any Water of the US • Operational at Project Completion • Long-Term Maintenance Plan ☒ No

Section 4 Best Management Practices (BMP)

4.1 Source Control BMP

4.1.1 Pollution Prevention

Non-structural and structural source control BMP are required to be incorporated into all new development and significant redevelopment projects. Form 4.1-1 and 4.1-2 are used to describe specific source control BMPs used in the WQMP or to explain why a certain BMP is not applicable. Table 7-3 of the TGD for WQMP provides a list of applicable source control BMP for projects with specific types of potential pollutant sources or activities. The source control BMP in this table must be implemented for projects with these specific types of potential pollutant sources or activities.

The preparers of this WQMP have reviewed the source control BMP requirements for new development and significant redevelopment projects. The preparers have also reviewed the specific BMP required for project as specified in Forms 4.1-1 and 4.1-2. All applicable non-structural and structural source control BMP shall be implemented in the project.

Form 4.1-1 Non-Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, if not applicable, state reason
		Included	Not Applicable	
N1	Education of Property Owners, Tenants and Occupants on Stormwater BMPs	☒	☐	Property owner and managing/operating staff will be provided the WQMP, specification manuals, BMP sheets and filters to contractors to monitor, inspect and maintain proposed BMPs.
N2	Activity Restrictions	☒	☐	Owner will be limited to SIC code (1542 & 4173) activities. Prohibited activities include: discharge of fertilizers/ pesticides/ animal wastes/ trash/ debris/ paint into storm drain inlets.
N3	Landscape Management BMPs	☒	☐	Landscape maintenance activities are performed in a manner consistent with BMP fact sheet SD-10 & SD-12 in Appendix 6.4.C.
N4	BMP Maintenance	☒	☐	BMPs will be maintained per Appendix 6.3.C "Operation and Maintenance" and Appendix 6.4.C "CASQA"
N5	Title 22 CCR Compliance (How development will comply)	☐	☒	No hazardous waste material anticipated. Any hazardous waste activies anticipated will comply with Title 22 California Code of Regulations
N6	Local Water Quality Ordinances	☒	☐	No additional water quality ordinances apply beyond what is required by the WQMP Technical Guidance, effective September 19, 2013
N7	Spill Contingency Plan	☒	☐	All spills will be cleaned and disposed of immediately.
N8	Underground Storage Tank Compliance	☐	☒	No underground storage tanks are proposed this time.
N9	Hazardous Materials Disclosure Compliance	☐	☒	Hazardous Materials are not anticipated for this site. Any hazardous material will be stored in water tight containers and covered or secondary containment will be provided. Use of alternative nonhardous materials will be used in place of hardous materials when practicable.

Form 4.1-1 Non-Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, if not applicable, state reason
		Included	Not Applicable	
N10	Uniform Fire Code Implementation	☒	☐	The uniform fire code will strictly be enforced on-site and all fire related activities will be prohibited on-site.
N11	Litter/Debris Control Program	☒	☐	Litter and debris will be deposited in appropriate covered receptacles. Any accumulated trash or debris on-site will be removed and disposed properly.
N12	Employee Training	☒	☐	Managing/operating staff will be provided a copy of this WQMP to train employees on post-construction storm water treatment management.
N13	Housekeeping of Loading Docks	☐	☒	Propety owners shall maintain loading docks. A program of sweeping and litter ccontrol and immediate cleanup of spills and broken containers will be in place. Clean-up procedures shall eliminate the use of water.
N14	Catch Basin Inspection Program	☒	☐	Catch basin maintenance activities are performed in a manner consistent with BMP fact sheet SD-13 & SC-44 in Appendix 6.4.C.
N15	Vacuum Sweeping of Private Streets and Parking Lots	☒	☐	The parking lots will be swept monthly. Driveway entrance will be swept annually before the rainy season and periodcally as necessary to remove accumulated sediment and debris.
N16	Other Non-structural Measures for Public Agency Projects	☐	☒	No other Non-structural Measures are proposed for Public Agency Projects.
N17	Comply with all other applicable NPDES permits	☒	☐	This project will acquire a WDID # to demonstrate compliance with the General Construction Permit.

Form 4.1-2 Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, If not applicable, state reason
		Included	Not Applicable	
S1	Provide storm drain system stencilling and signage (CASQA New Development BMP Handbook SD-13)	☒	☐	All drainage inlets will be stenciled or signage will be provided that indicates "Drains to Waterways" or equivalent.
S2	Design and construct outdoor material storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-34)	☐	☒	Outdoor material storage areas shall not be allowed on-site.
S3	Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	☒	☐	Trash Enclosure will be water tight containers with lids and will remain closed at all times. A trash enclosure roof will be provided per city standards.
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control (Statewide Model Landscape Ordinance; CASQA New Development BMP Handbook SD-12)	☒	☐	Landscaping will use minimal water. Inspection of sprinkler heads will occur quarterly and errant heads will be replaced.
S5	Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	☒	☐	Landscaping in will be sumped 2-inches below finished grade to create detention. Inspection wil occur before rainy season and after any rain events.
S6	Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	☐	☒	No energy dissipation is being proposed for this project.
S7	Covered dock areas (CASQA New Development BMP Handbook SD-31)	☐	☒	No loading dock is being proposed for this project.
S8	Covered maintenance bays with spill containment plans (CASQA New Development BMP Handbook SD-31)	☐	☒	No maintenanced bays proposed. No vehicles will be maintained on the premises.
S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	No vehicle wash areas proposed. No vehicles shall be washed on the premises.
S10	Covered outdoor processing areas (CASQA New Development BMP Handbook SD-36)	☐	☒	No outdoor processing area proposed.

Form 4.1-2 Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, If not applicable, state reason
		Included	Not Applicable	
S11	Equipment wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	No Equipment wash areas proposed.
S12	Fueling areas (CASQA New Development BMP Handbook SD-30)	☐	☒	No fueling areas proposed.
S13	Hillside landscaping (CASQA New Development BMP Handbook SD-10)	☐	☒	Project is not within a designated hillside zone.
S14	Wash water control for food preparation areas	☐	☒	No food preparation areas proposed outddoors, all existing food preparation occurs indoors.
S15	Community car wash racks (CASQA New Development BMP Handbook SD-33)	☐	☒	No wash racks proposed.

4.1.2 Preventative LID Site Design Practices

Site design practices associated with new LID requirements in the MS4 Permit should be considered in the earliest phases of a project. Preventative site design practices can result in smaller DCV for LID BMP and hydromodification control BMP by reducing runoff generation. Describe site design and drainage plan including:

- A narrative of site design practices utilized or rationale for not using practices
- A narrative of how site plan incorporates preventive site design practices
- Include an attached Site Plan layout which shows how preventative site design practices are included in WQMP

Refer to Section 5.2 of the TGD for WQMP for more details.

Form 4.1-3 Preventative LID Site Design Practices Checklist

Site Design Practices

If yes, explain how preventative site design practice is addressed in project site plan. If no, other LID BMPs must be selected to meet targets

Minimize impervious areas: Yes ☐ No ☒

Explanation: Due to site constraints only 21% of the site is landscaped. Required parking and fire code drive aisle widths limited the available area for landscaping.

Maximize natural infiltration capacity: Yes ☒ No ☐

Explanation: No hardscape proposed in landscaped areas, native trees and vegetation to be preserved as much as possible. On-site proposed slopes do not allow drainage flow through landscape areas. All hardscape drainage will go to U.G. Chambers.

Preserve existing drainage patterns and time of concentration: Yes ☐ No ☒

Explanation: On-site proposed grades and slopes require drainage flows to be concentrated into drainage swales, decreasing the time of concentration. Underground retention system will greatly increase the time of concentration.

Disconnect impervious areas: Yes ☒ No ☐

Explanation: Drop inlets at low points are proposed in landscaped areas to prevent surface flows from crossing pervious surfaces into impervious surfaces.

Protect existing vegetation and sensitive areas: Yes ☐ No ☒

Explanation: The existing vegetation and sensitive areas will not be protected.

Re-vegetate disturbed areas: Yes ☒ No ☐

Explanation: Vegetation that was removed in the existing condition will be re-vegetated where the plans call for landscaping.

Minimize unnecessary compaction in stormwater retention/infiltration basin/trench areas: Yes ☐ No ☒

Explanation: Manufacturer of underground retention chambers required stablized base and gravel under chambers.

Utilize vegetated drainage swales in place of underground piping or imperviously lined swales: Yes ☐ No ☒

Explanation: Proposed site constraints don't allow for construction of vegetated swales to transport stormwater. The runoff will be transported through curb and gutters.

Stake off areas that will be used for landscaping to minimize compaction during construction : Yes ☒ No ☐

Explanation: Landscape area will be staked of during grading to minimize compaction.

4.2 Project Performance Criteria

The purpose of this section of the Project WQMP is to establish targets for post-development hydrology based on performance criteria specified in the MS4 Permit. These targets include runoff volume for water quality control (referred to as LID design capture volume), and runoff volume, time of concentration, and peak runoff for protection of any downstream waterbody segments with a HCOC. If the project has more than one outlet for stormwater runoff, then complete additional versions of these forms for each DA / outlet.

Methods applied in the following forms include:

- For LID BMP Design Capture Volume (DCV), the San Bernardino County Stormwater Program requires use of the P_6 method (MS4 Permit Section XI.D.6a.ii) – Form 4.2-1
- For HCOC pre- and post-development hydrologic calculation, the San Bernardino County Stormwater Program requires the use of the Rational Method (San Bernardino County Hydrology Manual Section D). Forms 4.2-2 through Form 4.2-5 calculate hydrologic variables including runoff volume, time of concentration, and peak runoff from the project site pre- and post-development using the Hydrology Manual Rational Method approach. For projects greater than 640 acres (1.0 mi^2), the Rational Method and these forms should not be used. For such projects, the Unit Hydrograph Method (San Bernardino County Hydrology Manual Section E) shall be applied for hydrologic calculations for HCOC performance criteria.

Refer to Section 4 in the TGD for WQMP for detailed guidance and instructions.

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 1)

1 Project area DA 1 (ft^2): 105,706	2 Imperviousness after applying preventative site design practices (Imp%): 83.92%	3 Runoff Coefficient (Rc): 0.647 R_c = 0.858(Imp%)^3-0.78(Imp%)^2+0.774(Imp%)+0.04
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr-1hr}$ (in): 0.508 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html		
5 Compute P_6, Mean 6-hr Precipitation (inches): 0.970 P_6 = Item 4 *C_1, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Valley = 1.4807; Mountain = 1.909; Desert = 1.2371)		
6 Drawdown Rate Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.	24-hrs ☐ 48-hrs ☒	
7 Compute design capture volume, DCV (ft^3): 10,852 DCV = 1/12 * [Item 1* Item 3 *Item 5 * C_2], where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963) Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2		

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 2)

1 Project area DA 1 (ft^2): 49,117	2 Imperviousness after applying preventative site design practices (Imp%): 66.83%	3 Runoff Coefficient (Rc): 0.465 $R_c = 0.858(Imp\%)^{\wedge 3}-0.78(Imp\%)^{\wedge 2}+0.774(Imp\%)+0.04$

4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.508 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html

5 Compute P_6, Mean 6-hr Precipitation (inches): 0.970

P_6 = Item 4 *C_1, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Valley = 1.4807; Mountain = 1.909; Desert = 1.2371)

6 Drawdown Rate Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.	24-hrs ☐ 48-hrs ☒

7 Compute design capture volume, DCV (ft^3): 3,624

DCV = 1/12 * [Item 1* Item 3 *Item 5 * C_2], where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963)

Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2

Form 4.2-2 Summary of HCOC Assessment (DA 1)

Does project have the potential to cause or contribute to an HCOC in a downstream channel: Yes ☐ No ☒

Go to: http://permitrack.sbcounty.gov/wap/

If "Yes", then complete HCOC assessment of site hydrology for 2yr storm event using Forms 4.2-3 through 4.2-5 and insert results below (Forms 4.2-3 through 4.2-5 may be replaced by computer software analysis based on the San Bernardino County Hydrology Manual)

If "No," then proceed to Section 4.3 Project Conformance Analysis

Condition	Runoff Volume (ft^3)	Time of Concentration (min)	Peak Runoff (cfs)
Pre-developed	1 Form 4.2-3 Item 12	2 Form 4.2-4 Item 13	3 Form 4.2-5 Item 10
Post-developed	4 Form 4.2-3 Item 13	5 Form 4.2-4 Item 14	6 Form 4.2-5 Item 14
Difference	7 Item 4 – Item 1	8 Item 2 – Item 5	9 Item 6 – Item 3
Difference (as % of pre-developed)	10 % Item 7 / Item 1	11 % Item 8 / Item 2	12 % Item 9 / Item 3

Form 4.2-3 HCOC Assessment for Runoff Volume (DA 1)

Weighted Curve Number Determination for: Pre-developed DA	DMA A	DMA B	DMA C	DMA D	DMA E	DMA F	DMA G	DMA H
1a Land Cover type								
2a Hydrologic Soil Group (HSG)								
3a DMA Area, ft^2 sum of areas of DMA should equal area of DA								
4a Curve Number (CN) use Items 1 and 2 to select the appropriate CN from Appendix C-2 of the TGD for WQMP								
Weighted Curve Number Determination for: Post-developed DA	DMA A	DMA B	DMA C	DMA D	DMA E	DMA F	DMA G	DMA H
1b Land Cover type								
2b Hydrologic Soil Group (HSG)								
3b DMA Area, ft^2 sum of areas of DMA should equal area of DA								
4b Curve Number (CN) use Items 5 and 6 to select the appropriate CN from Appendix C-2 of the TGD for WQMP								

5 Pre-Developed area-weighted CN:	7 Pre-developed soil storage capacity, S (in): S = (1000 / Item 5) - 10	9 Initial abstraction, I_a (in): I_a = 0.2 * Item 7
6 Post-Developed area-weighted CN:	8 Post-developed soil storage capacity, S (in): S = (1000 / Item 6) - 10	10 Initial abstraction, I_a (in): I_a = 0.2 * Item 8

11 Precipitation for 2 yr, 24 hr storm (in):
Go to: http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html

12 Pre-developed Volume (ft^3):
V_{pre} =(1 / 12) * (Item sum of Item 3) * [(Item 11 – Item 9)^2 / ((Item 11 – Item 9 + Item 7)

13 Post-developed Volume (ft^3):
V_{pre} =(1 / 12) * (Item sum of Item 3) * [(Item 11 – Item 10)^2 / ((Item 11 – Item 10 + Item 8)

14 Volume Reduction needed to meet HCOC Requirement, (ft^3):
V_{HCOC} = (Item 13 * 0.95) – Item 12

Form 4.2-4 HCOC Assessment for Time of Concentration (DA 1)

Compute time of concentration for pre and post developed conditions for each DA (For projects using the Hydrology Manual complete the form below)

Variables	Pre-developed DA1 Use additional forms if there are more than 4 DMA				Post-developed DA1 Use additional forms if there are more than 4 DMA			
	DMA A	DMA B	DMA C	DMA D	DMA A	DMA B	DMA C	DMA D
1 Length of flowpath (ft) Use Form 3-2 Item 5 for pre-developed condition								
2 Change in elevation (ft)								
3 Slope (ft/ft), S_o = Item 2 / Item 1								
4 Land cover								
5 Initial DMA Time of Concentration (min) Appendix C-1 of the TGD for WQMP								
6 Length of conveyance from DMA outlet to project site outlet (ft) May be zero if DMA outlet is at project site outlet								
7 Cross-sectional area of channel (ft^2)								
8 Wetted perimeter of channel (ft)								
9 Manning's roughness of channel (n)								
10 Channel flow velocity (ft/sec) V_{fps} = (1.49 / Item 9) * (Item 7/Item 8)^0.67 * (Item 3)^0.5								
11 Travel time to outlet (min) T_t = Item 6 / (Item 10 * 60)								
12 Total time of concentration (min) T_c = Item 5 + Item 11								

13 Pre-developed time of concentration (min): Minimum of Item 12 pre-developed DMA

14 Post-developed time of concentration (min): Minimum of Item 12 post-developed DMA

15 Additional time of concentration needed to meet HCOC requirement (min): T_{C-HCOC} = (Item 13 * 0.95) – Item 14

Form 4.2-5 HCOC Assessment for Peak Runoff (DA 1)

<table>
<tr><td colspan="8">Compute peak runoff for pre- and post-developed conditions</td></tr>
<tr><td colspan="2" rowspan="2">Variables</td><td colspan="3">Pre-developed DA to Project Outlet (Use additional forms if more than 3 DMA)</td><td colspan="3">Post-developed DA to Project Outlet (Use additional forms if more than 3 DMA)</td></tr>
<tr><td>DMA A</td><td>DMA B</td><td>DMA C</td><td>DMA A</td><td>DMA B</td><td>DMA C</td></tr>
<tr><td colspan="2">1 Rainfall Intensity for storm duration equal to time of concentration
I_{peak} = 10^(LOG Form 4.2-1 Item 4 - 0.6 LOG Form 4.2-4 Item 5 /60)</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">2 Drainage Area of each DMA (Acres)
For DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">3 Ratio of pervious area to total area
For DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">4 Pervious area infiltration rate (in/hr)
Use pervious area CN and antecedent moisture condition with Appendix C-3 of the TGD for WQMP</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">5 Maximum loss rate (in/hr)
F_m = Item 3 * Item 4
Use area-weighted F_m from DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">6 Peak Flow from DMA (cfs) Q_p =Item 2 * 0.9 * (Item 1 - Item 5)</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="3">7 Time of concentration adjustment factor for other DMA to site discharge point
Form 4.2-4 Item 12 DMA / Other DMA upstream of site discharge point (If ratio is greater than 1.0, then use maximum value of 1.0)</td><td>DMA A</td><td>n/a</td><td></td><td></td><td>n/a</td><td></td><td></td></tr>
<tr><td>DMA B</td><td></td><td>n/a</td><td></td><td></td><td>n/a</td><td></td></tr>
<tr><td>DMA C</td><td></td><td></td><td>n/a</td><td></td><td></td><td>n/a</td></tr>
<tr><td colspan="2">8 Pre-developed Q_p at T_c for DMA A:
Q_p = Item 6_{DMAA} + [Item 6_{DMAB} * (Item 1_{DMAA} - Item 5_{DMAB})/(Item 1_{DMAB} - Item 5_{DMAB})* Item $7_{DMAA/2}$] + [Item 6_{DMAC} * (Item 1_{DMAA} - Item 5_{DMAC})/(Item 1_{DMAC} - Item 5_{DMAC})* Item $7_{DMAA/3}$]</td><td colspan="3">9 Pre-developed Q_p at T_c for DMA B:
Q_p = Item 6_{DMAB} + [Item 6_{DMAA} * (Item 1_{DMAB} - Item 5_{DMAA})/(Item 1_{DMAA} - Item 5_{DMAA})* Item $7_{DMAB/1}$] + [Item 6_{DMAC} * (Item 1_{DMAB} - Item 5_{DMAC})/(Item 1_{DMAC} - Item 5_{DMAC})* Item $7_{DMAB/3}$]</td><td colspan="3">10 Pre-developed Q_p at T_c for DMA C:
Q_p = Item 6_{DMAC} + [Item 6_{DMAA} * (Item 1_{DMAC} - Item 5_{DMAA})/(Item 1_{DMAA} - Item 5_{DMAA})* Item $7_{DMAC/1}$] + [Item 6_{DMAB} * (Item 1_{DMAC} - Item 5_{DMAB})/(Item 1_{DMAB} - Item 5_{DMAB})* Item $7_{DMAC/2}$]</td></tr>
<tr><td colspan="8">10 Peak runoff from pre-developed condition confluence analysis (cfs): Maximum of Item 8, 9, and 10 (including additional forms as needed)</td></tr>
<tr><td colspan="2">11 Post-developed Q_p at T_c for DMA A:
Same as Item 8 for post-developed values</td><td colspan="3">12 Post-developed Q_p at T_c for DMA B:
Same as Item 9 for post-developed values</td><td colspan="3">13 Post-developed Q_p at T_c for DMA C:
Same as Item 10 for post-developed values</td></tr>
<tr><td colspan="8">14 Peak runoff from post-developed condition confluence analysis (cfs): Maximum of Item 11, 12, and 13 (including additional forms as needed)</td></tr>
<tr><td colspan="8">15 Peak runoff reduction needed to meet HCOC Requirement (cfs): Q_{p-HCOC} = (Item 14 * 0.95) – Item 10</td></tr>
</table>

4.3 Project Conformance Analysis

Complete the following forms for each project site DA to document that the proposed LID BMPs conform to the project DCV developed to meet performance criteria specified in the MS4 Permit (WQMP Template Section 4.2). For the LID DCV, the forms are ordered according to hierarchy of BMP selection as required by the MS4 Permit (see Section 5.3.1 in the TGD for WQMP). The forms compute the following for on-site LID BMP:

- Site Design and Hydrologic Source Controls (Form 4.3-2)
- Retention and Infiltration (Form 4.3-3)
- Harvested and Use (Form 4.3-4) or
- Biotreatment (Form 4.3-5).

At the end of each form, additional fields facilitate the determination of the extent of mitigation provided by the specific BMP category, allowing for use of the next category of BMP in the hierarchy, if necessary.

The first step in the analysis, using Section 5.3.2.1 of the TGD for WQMP, is to complete Forms 4.3-1 and 4.3-3) to determine if retention and infiltration BMPs are infeasible for the project. For each feasibility criterion in Form 4.3-1, if the answer is “Yes,” provide all study findings that includes relevant calculations, maps, data sources, etc. used to make the determination of infeasibility.

Next, complete Forms 4.3-2 and 4.3-4 to determine the feasibility of applicable HSC and harvest and use BMPs, and, if their implementation is feasible, the extent of mitigation of the DCV.

If no site constraints exist that would limit the type of BMP to be implemented in a DA, evaluate the use of combinations of LID BMPs, including all applicable HSC BMPs to maximize on-site retention of the DCV. If no combination of BMP can mitigate the entire DCV, implement the single BMP type, or combination of BMP types, that maximizes on-site retention of the DCV within the minimum effective area.

If the combination of LID HSC, retention and infiltration, and harvest and use BMPs are unable to mitigate the entire DCV, then biotreatment BMPs may be implemented by the project proponent. If biotreatment BMPs are used, then they must be sized to provide sufficient capacity for effective treatment of the remainder of the volume-based performance criteria that cannot be achieved with LID BMPs (TGD for WQMP Section 5.4.4.2). Under no circumstances shall any portion of the DCV be released from the site without effective mitigation and/or treatment.

Form 4.3-1 Infiltration BMP Feasibility (DA 1)

Feasibility Criterion – Complete evaluation for each DA on the Project Site

1 Would infiltration BMP pose significant risk for groundwater related concerns? Yes ☐ No ☒
Refer to Section 5.3.2.1 of the TGD for WQMP

If Yes, Provide basis: (attach)

2 Would installation of infiltration BMP significantly increase the risk of geotechnical hazards? Yes ☐ No ☒
(Yes, if the answer to any of the following questions is yes, as established by a geotechnical expert):

- The location is less than 50 feet away from slopes steeper than 15 percent
- The location is less than eight feet from building foundations or an alternative setback.
- A study certified by a geotechnical professional or an available watershed study determines that stormwater infiltration would result in significantly increased risks of geotechnical hazards.

If Yes, Provide basis: (attach)

3 Would infiltration of runoff on a Project site violate downstream water rights? Yes ☐ No ☒

If Yes, Provide basis: (attach)

4 Is proposed infiltration facility located on hydrologic soil group (HSG) D soils or does the site geotechnical investigation indicate presence of soil characteristics, which support categorization as D soils? Yes ☐ No ☒

If Yes, Provide basis: (attach)

5 Is the design infiltration rate, after accounting for safety factor of 2.0, below proposed facility less than 0.3 in/hr (accounting for soil amendments)? Yes ☒ No ☐

If Yes, Provide basis:
The geotechnical investigation for site has been performed by John R. Byerly, Inc on April 18, 2022 to determine the design infiltration rate. The percolation tests yielded infiltration rates of 0.01 in/hr, 0.05 in/hr, 0.08 in/hr and 0.09 in/hr. The infiltration rate of 0.08 in/hr is where the chambers are going to be located and 0.05 in/hr is located where bioretention basin is going to be located. The infiltration rates were computed utilizing the percolation rate conversion equation (Porchet Method) provided by the San Bernardino County's Technical Guidance Document for WQMP.

6 Would on-site infiltration or reduction of runoff over pre-developed conditions be partially or fully inconsistent with watershed management strategies as defined in the WAP, or impair beneficial uses? Yes ☐ No ☒
See Section 3.5 of the TGD for WQMP and WAP

If Yes, Provide basis: (attach)

7 Any answer from Item 1 through Item 3 is "Yes": Yes ☐ No ☒
If yes, infiltration of any volume is not feasible onsite. Proceed to Form 4.3-4, Harvest and Use BMP. If no, then proceed to Item 8 below.

8 Any answer from Item 4 through Item 6 is "Yes": Yes ☐ No ☒
If yes, infiltration is permissible but is not required to be considered. Proceed to Form 4.3-2, Hydrologic Source Control BMP.
If no, then proceed to Item 9, below.

9 All answers to Item 1 through Item 6 are "No":
Infiltration of the full DCV is potentially feasible, LID infiltration BMP must be designed to infiltrate the full DCV to the MEP.
Proceed to Form 4.3-2, Hydrologic Source Control BMP.

4.3.1 Site Design Hydrologic Source Control BMP

Section XI.E. of the Permit emphasizes the use of LID preventative measures; and the use of LID HSC BMPs reduces the portion of the DCV that must be addressed in downstream BMPs. Therefore, all applicable HSC shall be provided except where they are mutually exclusive with each other, or with other BMPs. Mutual exclusivity may result from overlapping BMP footprints such that either would be potentially feasible by itself, but both could not be implemented. Please note that while there are no numeric standards regarding the use of HSC, if a project cannot feasibly meet BMP sizing requirements or cannot fully address HCOCs, feasibility of all applicable HSC must be part of demonstrating that the BMP system has been designed to retain the maximum feasible portion of the DCV. Complete Form 4.3-2 to identify and calculate estimated retention volume from implementing site design HSC BMP. Refer to Section 5.4.1 in the TGD for more detailed guidance.

Form 4.3-2 Site Design Hydrologic Source Control BMPs (DA 1)

1 Implementation of Impervious Area Dispersion BMP (i.e. routing runoff from impervious to pervious areas), excluding impervious areas planned for routing to on-lot infiltration BMP: Yes ☐ No ☒ If yes, complete Items 2-5; If no, proceed to Item 6	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type (Use additional forms for more BMPs)
2 Total impervious area draining to pervious area (ft^2)			
3 Ratio of pervious area receiving runoff to impervious area			
4 Retention volume achieved from impervious area dispersion (ft^3) V = Item2 * Item 3 * (0.5/12), assuming retention of 0.5 inches of runoff			
5 Sum of retention volume achieved from impervious area dispersion (ft^3):	$V_{retention}$ =Sum of Item 4 for all BMPs		
6 Implementation of Localized On-lot Infiltration BMPs (e.g. on-lot rain gardens): Yes ☐ No ☒ If yes, complete Items 7-13 for aggregate of all on-lot infiltration BMP in each DA; If no, proceed to Item 14	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type (Use additional forms for more BMPs)
7 Ponding surface area (ft^2)			
8 Ponding depth (ft)			
9 Surface area of amended soil/gravel (ft^2)			
10 Average depth of amended soil/gravel (ft)			
11 Average porosity of amended soil/gravel			
12 Retention volume achieved from on-lot infiltration (ft^3) $V_{retention}$ = (Item 7 *Item 8) + (Item 9 * Item 10 * Item 11)			
13 Runoff volume retention from on-lot infiltration (ft^3): 0	$V_{retention}$ =Sum of Item 12 for all BMPs		

Form 4.3-2 Site Design Hydrologic Source Control BMPs (DA 1)

14 Implementation of evapotranspiration BMP (green, brown, or blue roofs): Yes ☐ No ☒ If yes, complete Items 15-20. If no, proceed to Item 21	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type (Use additional forms for more BMPs)
15 Rooftop area planned for ET BMP (ft^2)			
16 Average wet season ET demand (in/day) Use local values, typical ~ 0.1			
17 Daily ET demand (ft^3/day) Item 15 * (Item 16 / 12)			
18 Drawdown time (hrs) Copy Item 6 in Form 4.2-1			
19 Retention Volume (ft^3) $V_{retention}$ = Item 17 * (Item 18 / 24)			

20 Runoff volume retention from evapotranspiration BMPs (ft^3): $V_{retention}$ =Sum of Item 19 for all BMPs

21 Implementation of Street Trees: Yes ☐ No ☒ If yes, complete Items 22-25. If no, proceed to Item 26	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type (Use additional forms for more BMPs)
22 Number of Street Trees			
23 Average canopy cover over impervious area (ft^2)			
24 Runoff volume retention from street trees (ft^3) $V_{retention}$ = Item 22 * Item 23 * (0.05/12) assume runoff retention of 0.05 inches			

25 Runoff volume retention from street tree BMPs (ft^3): $V_{retention}$ = Sum of Item 24 for all BMPs

26 Implementation of residential rain barrel/cisterns: Yes ☐ No ☒ If yes, complete Items 27-29; If no, proceed to Item 30	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type (Use additional forms for more BMPs)
27 Number of rain barrels/cisterns			
28 Runoff volume retention from rain barrels/cisterns (ft^3) $V_{retention}$ = Item 27 * 3			

29 Runoff volume retention from residential rain barrels/Cisterns (ft3): $V_{retention}$ =Sum of Item 28 for all BMPs

30 Total Retention Volume from Site Design Hydrologic Source Control BMPs: 0 Sum of Items 5, 13, 20, 25 and 29

Form 4.3-2 Site Design Hydrologic Source Control BMPs (DA 2)

1 Implementation of Impervious Area Dispersion BMP (i.e. routing runoff from impervious to pervious areas), excluding impervious areas planned for routing to on-lot infiltration BMP: Yes ☒ No ☐ If yes, complete Items 2-5; If no, proceed to Item 6	DA 2 DMA C BMP Type Impervious Area Dispersion	DA DMA BMP Type	DA DMA BMP Type (Use additional forms for more BMPs)
2 Total impervious area draining to pervious area (ft^2)	32,824		
3 Ratio of pervious area receiving runoff to impervious area	0.3317		
4 Retention volume achieved from impervious area dispersion (ft^3) V = Item2 * Item 3 * (0.5/12), assuming retention of 0.5 inches of runoff	454		
5 Sum of retention volume achieved from impervious area dispersion (ft^3): 454 $V_{retention}$ =Sum of Item 4 for all BMPs			
6 Implementation of Localized On-lot Infiltration BMPs (e.g. on-lot rain gardens): Yes ☐ No ☒ If yes, complete Items 7-13 for aggregate of all on-lot infiltration BMP in each DA; If no, proceed to Item 14	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type (Use additional forms for more BMPs)
7 Ponding surface area (ft^2)			
8 Ponding depth (ft)			
9 Surface area of amended soil/gravel (ft^2)			
10 Average depth of amended soil/gravel (ft)			
11 Average porosity of amended soil/gravel			
12 Retention volume achieved from on-lot infiltration (ft^3) $V_{retention}$ = (Item 7 *Item 8) + (Item 9 * Item 10 * Item 11)			
13 Runoff volume retention from on-lot infiltration (ft^3): 0 $V_{retention}$ =Sum of Item 12 for all BMPs			

Form 4.3-2 cont. Site Design Hydrologic Source Control BMPs (DA 1)

14 Implementation of evapotranspiration BMP (green, brown, or blue roofs): Yes ☐ No ☒ If yes, complete Items 15-20. If no, proceed to Item 21	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type (Use additional forms for more BMPs)
15 Rooftop area planned for ET BMP (ft^2)			
16 Average wet season ET demand (in/day) Use local values, typical ~ 0.1			

Form 4.3-2 Site Design Hydrologic Source Control BMPs (DA 2)

17 Daily ET demand (ft^3/day) Item 15 * (Item 16 / 12)			
18 Drawdown time (hrs) Copy Item 6 in Form 4.2-1			
19 Retention Volume (ft^3) $V_{retention}$ = Item 17 * (Item 18 / 24)			
20 Runoff volume retention from evapotranspiration BMPs (ft^3): $V_{retention}$ =Sum of Item 19 for all BMPs			
21 Implementation of Street Trees: Yes ☐ No ☒ If yes, complete Items 22-25. If no, proceed to Item 26	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type (Use additional forms for more BMPs)
22 Number of Street Trees			
23 Average canopy cover over impervious area (ft^2)			
24 Runoff volume retention from street trees (ft^3) $V_{retention}$ = Item 22 * Item 23 * (0.05/12) assume runoff retention of 0.05 inches			
25 Runoff volume retention from street tree BMPs (ft^3): $V_{retention}$ = Sum of Item 24 for all BMPs			
26 Implementation of residential rain barrel/cisterns: Yes☐ No ☒ If yes, complete Items 27-29; If no, proceed to Item 30	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type (Use additional forms for more BMPs)
27 Number of rain barrels/cisterns			
28 Runoff volume retention from rain barrels/cisterns (ft^3) $V_{retention}$ = Item 27 * 3			
29 Runoff volume retention from residential rain barrels/Cisterns (ft3): $V_{retention}$ =Sum of Item 28 for all BMPs			
30 Total Retention Volume from Site Design Hydrologic Source Control BMPs: 454 Sum of Items 5, 13, 20, 25 and 29			

4.3.2 Infiltration BMPs

Use Form 4.3-3 to compute on-site retention of runoff from proposed retention and infiltration BMPs. Volume retention estimates are sensitive to the percolation rate used, which determines the amount of runoff that can be infiltrated within the specified drawdown time. The infiltration safety factor reduces field measured percolation to account for potential inaccuracy associated with field measurements, declining BMP performance over time, and compaction during construction. Appendix D of the TGD for WQMP provides guidance on estimating an appropriate safety factor to use in Form 4.3-3.

If site constraints limit the use of BMPs to a single type and implementation of retention and infiltration BMPs mitigate no more than 40% of the DCV, then they are considered infeasible and the Project Proponent may evaluate the effectiveness of BMPs lower in the LID hierarchy of use (Section 5.5.1 of the TGD for WQMP)

If implementation of infiltrations BMPs is feasible as determined using Form 4.3-1, then LID infiltration BMPs shall be implemented to the MEP (section 4.1 of the TGD for WQMP).

Form 4.3-3 Infiltration LID BMP - including underground BMPs (DA 1)

1 Remaining LID DCV not met by site design HSC BMP (ft^3): 10,852 V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item 30

BMP Type Use columns to the right to compute runoff volume retention from proposed infiltration BMP (select BMP from Table 5-4 in TGD for WQMP) - Use additional forms for more BMPs	DA 1 Underground Chambers - MC7200		
2 Infiltration rate of underlying soils (in/hr) See Section 5.4.2 and Appendix D of the TGD for WQMP for minimum requirements for assessment methods	0.08		
3 Infiltration safety factor See TGD Section 5.4.2 and Appendix D	2.5		
4 Design percolation rate (in/hr) P_{design} = Item 2 / Item 3	0.03		
5 Ponded water drawdown time (hr) Copy Item 6 in Form 4.2-1	48		
6 Maximum ponding depth (ft) BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details	5.75		
7 Ponding Depth (ft) d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6	5.75		
8 Infiltrating surface area, SA_{BMP} (ft^2) the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP	2,950		
9 Amended soil depth, d_{media} (ft) Only included in certain BMP types, see Table 5-4 in the TGD for WQMP for reference to BMP design details	---		
10 Amended soil porosity	N/A		
11 Gravel depth, d_{media} (ft) Only included in certain BMP types, see Table 5-4 of the TGD for WQMP for BMP design details	1.0		
12 Gravel porosity	40%		
13 Duration of storm as basin is filling (hrs) Typical ~ 3hrs	3		
14 Above Ground Retention Volume (ft^3) $V_{retention}$ = Item 8 * [Item7 + (Item 9 * Item 10) + (Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]	----		
15 Underground Retention Volume (ft^3) Volume determined using manufacturer's specifications and calculations	12,050 (Per 6.4.A Manufacturer's Specs)		

16 Total Retention Volume from LID Infiltration BMPs: 12,050 (Sum of Items 14 and 15 for all infiltration BMP included in plan)

17 Fraction of DCV achieved with infiltration BMP: 111% Retention% = Item 16 / Form 4.2-1 Item 7

18 Is full LID DCV retained onsite with combination of hydrologic source control and LID retention/infiltration BMPs? Yes ☒ No ☐

If yes, demonstrate conformance using Form 4.3-10; If no, then reduce Item 3, Factor of Safety to 2.0 and increase Item 8, Infiltrating Surface Area, such that the portion of the site area used for retention and infiltration BMPs equals or exceeds the minimum effective area thresholds (Table 5-7 of the TGD for WQMP) for the applicable category of development and repeat all above calculations.

4.3.3 Harvest and Use BMP

Harvest and use BMP may be considered if the full LID DCV cannot be met by maximizing infiltration BMPs. Use Form 4.3-4 to compute on-site retention of runoff from proposed harvest and use BMPs.

Volume retention estimates for harvest and use BMPs are sensitive to the on-site demand for captured stormwater. Since irrigation water demand is low in the wet season, when most rainfall events occur in San Bernardino County, the volume of water that can be used within a specified drawdown period is relatively low. The bottom portion of Form 4.3-4 facilitates the necessary computations to show infeasibility if a minimum incremental benefit of 40 percent of the LID DCV would not be achievable with MEP implementation of on-site harvest and use of stormwater (Section 5.5.4 of the TGD for WQMP).

Form 4.3-4 Harvest and Use BMPs (DA 1)

1 Remaining LID DCV not met by site design HSC or infiltration BMP (ft^3): 0
V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item 30 – Form 4.3-3 Item 16

BMP Type(s) Compute runoff volume retention from proposed harvest and use BMP (Select BMPs from Table 5-4 of the TGD for WQMP) - Use additional forms for more BMPs	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type (Use additional forms for more BMPs)
2 Describe cistern or runoff detention facility			
3 Storage volume for proposed detention type (ft^3) Volume of cistern			
4 Landscaped area planned for use of harvested stormwater (ft^2)			
5 Average wet season daily irrigation demand (in/day) Use local values, typical ~ 0.1 in/day			
6 Daily water demand (ft^3/day) Item 4 * (Item 5 / 12)			
7 Drawdown time (hrs) Copy Item 6 from Form 4.2-1			
8 Retention Volume (ft^3) $V_{retention}$ = Minimum of (Item 3) or (Item 6 * (Item 7 / 24))			

9 Total Retention Volume (ft^3) from Harvest and Use BMP 0 Sum of Item 8 for all harvest and use BMP included in plan

10 Is the full DCV retained with a combination of LID HSC, retention and infiltration, and harvest & use BMPs? Yes ☒ No ☐
If yes, demonstrate conformance using Form 4.3-10. If no, then re-evaluate combinations of all LID BMP and optimize their implementation such that the maximum portion of the DCV is retained on-site (using a single BMP type or combination of BMP types). If the full DCV cannot be mitigated after this optimization process, proceed to Section 4.3.4.

4.3.4 Biotreatment BMP

Biotreatment BMPs may be considered if the full LID DCV cannot be met by maximizing retention and infiltration, and harvest and use BMPs. A key consideration when using biotreatment BMP is the effectiveness of the proposed BMP in addressing the pollutants of concern for the project (see Table 5-5 of the TGD for WQMP).

Use Form 4.3-5 to summarize the potential for volume based and/or flow based biotreatment options to biotreat the remaining unmet LID DCV w. Biotreatment computations are included as follows:

- Use Form 4.3-6 to compute biotreatment in small volume based biotreatment BMP (e.g. bioretention w/underdrains);
- Use Form 4.3-7 to compute biotreatment in large volume based biotreatment BMP (e.g. constructed wetlands);
- Use Form 4.3-8 to compute sizing criteria for flow-based biotreatment BMP (e.g. bioswales)

Form 4.3-5 Selection and Evaluation of Biotreatment BMP (DA 2)

1 Remaining LID DCV not met by site design HSC, infiltration, or harvest and use BMP for potential biotreatment (ft³): 3,170 Form 4.2-1 Item 7 - Form 4.3-2 Item 30 – Form 4.3-3 Item 16- Form 4.3-4 Item 9	List pollutants of concern Copy from Form 2.3-1. Sediments, Pathogens, Organic Compounds, Trash

2 Biotreatment BMP Selected	Volume-based biotreatment Use Forms 4.3-6 and 4.3-7 to compute treated volume	Flow-based biotreatment Use Form 4.3-8 to compute treated volume
(Select biotreatment BMP(s) necessary to ensure all pollutants of concern are addressed through Unit Operations and Processes, described in Table 5-5 of the TGD for WQMP)	☒ Bioretention with underdrain ☐ Planter box with underdrain ☐ Constructed wetlands ☐ Wet extended detention ☐ Dry extended detention	☐ Vegetated swale ☐ Vegetated filter strip ☐ Proprietary biotreatment

3 Volume biotreated in volume based biotreatment BMP (ft³): 3,265 Form 4.3-6 Item 15 + Form 4.3-7 Item 13	4 Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft³): 95 Item 1 – Item 3	5 Remaining fraction of LID DCV for sizing flow based biotreatment BMP: 3.0% Item 4 / Item 1

6 Flow-based biotreatment BMP capacity provided (cfs): 0 Use Figure 5-2 of the TGD for WQMP to determine flow capacity required to provide biotreatment of remaining percentage of unmet LID DCV (Item 5), for the project's precipitation zone (Form 3-1 Item 1)

7 Metrics for MEP determination:

- Provided a WQMP with the portion of site area used for suite of LID BMP equal to minimum thresholds in Table 5-7 of the TGD for WQMP for the proposed category of development: ☒ If maximized on-site retention BMPs is feasible for partial capture, then LID BMP implementation must be optimized to retain and infiltrate the maximum portion of the DCV possible within the prescribed minimum effective area. The remaining portion of the DCV shall then be mitigated using biotreatment BMP.

Form 4.3-6 Volume Based Biotreatment (DA 2) – Bioretention and Planter Boxes with Underdrains

Biotreatment BMP Type (Bioretention w/underdrain, planter box w/underdrain, other comparable BMP)	DA 2 DMA C BMP Type Bioretention w/ underdrain	DA DMA BMP Type	DA DMA BMP Type (Use additional forms for more BMPs)
1 Pollutants addressed with BMP List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in Table 5-5 of the TGD for WQMP	Sediments, Pathogens, Organic Compounds, Trash		
2 Amended soil infiltration rate Typical ~ 5.0	5.0		
3 Amended soil infiltration safety factor Typical ~ 2.0	2.0		
4 Amended soil design percolation rate (in/hr) P_{design} = Item 2 / Item 3	2.5		
5 Ponded water drawdown time (hr) Copy Item 6 from Form 4.2-1	48		
6 Maximum ponding depth (ft) see Table 5-6 of the TGD for WQMP for reference to BMP design details	1.5		
7 Ponding Depth (ft) d_{BMP} = Minimum of (1/12 * Item 4 * Item 5) or Item 6	0.5		
8 Amended soil surface area (ft^2)	1,501		
9 Amended soil depth (ft) see Table 5-6 of the TGD for WQMP for reference to BMP design details	3.0		
10 Amended soil porosity, n	0.30		
11 Gravel depth (ft) see Table 5-6 of the TGD for WQMP for reference to BMP design details	1.0		
12 Gravel porosity, n	0.4		
13 Duration of storm as basin is filling (hrs) Typical ~ 3hrs	3.0		
14 Biotreated Volume (ft^3) $V_{biotreated}$ = Item 8 * [(Item 7/2) + (Item 9 * Item 10) +(Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]	3,265		
15 Total biotreated volume from bioretention and/or planter box with underdrains BMP: 3,265 Sum of Item 14 for all volume-based BMPs included in this form			

Form 4.3-7 Volume Based Biotreatment (DA 1) – Constructed Wetlands and Extended Detention

Biotreatment BMP Type Constructed wetlands, extended wet detention, extended dry detention, or other comparable proprietary BMP. If BMP includes multiple modules (e.g. forebay and main basin), provide separate estimates for storage and pollutants treated in each module.	DA DMA BMP Type		DA DMA BMP Type (Use additional forms for more BMPs)	
	Forebay	Basin	Forebay	Basin
1 Pollutants addressed with BMP forebay and basin List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in Table 5-5 of the TGD for WQMP				
2 Bottom width (ft)				
3 Bottom length (ft)				
4 Bottom area (ft^2) A_{bottom} = Item 2 * Item 3				
5 Side slope (ft/ft)				
6 Depth of storage (ft)				
7 Water surface area (ft^2) $A_{surface}$ =(Item 2 + (2 * Item 5 * Item 6)) * (Item 3 + (2 * Item 5 * Item 6))				
8 Storage volume (ft^3) For BMP with a forebay, ensure fraction of total storage is within ranges specified in BMP specific fact sheets, see Table 5-6 of the TGD for WQMP for reference to BMP design details V =Item 6 / 3 * [Item 4 + Item 7 + (Item 4 * Item 7)^0.5]				
9 Drawdown Time (hrs) Copy Item 6 from Form 2.1				
10 Outflow rate (cfs) Q_{BMP} = (Item $8_{forebay}$ + Item 8_{basin}) / (Item 9 * 3600)				
11 Duration of design storm event (hrs)				
12 Biotreated Volume (ft^3) $V_{biotreated}$ = (Item $8_{forebay}$ + Item 8_{basin}) +(Item 10 * Item 11 * 3600)				
13 Total biotreated volume from constructed wetlands, extended dry detention, or extended wet detention : 0 (Sum of Item 12 for all BMP included in plan)				

Form 4.3-8 Flow Based Biotreatment (DA 1)

Biotreatment BMP Type Vegetated swale, vegetated filter strip, or other comparable proprietary BMP	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type (Use additional forms for more BMPs)
1 Pollutants addressed with BMP List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in TGD Table 5-5			
2 Flow depth for water quality treatment (ft) BMP specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details			
3 Bed slope (ft/ft) BMP specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details			
4 Manning's roughness coefficient			
5 Bottom width (ft) b_w = (Form 4.3-5 Item 6 * Item 4) / (1.49 * Item $2^{\wedge 1.67}$ * Item $3^{\wedge 0.5}$)			
6 Side Slope (ft/ft) BMP specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details			
7 Cross sectional area (ft^2) A = (Item 5 * Item 2) + (Item 6 * Item $2^{\wedge 2}$)			
8 Water quality flow velocity (ft/sec) V = Form 4.3-5 Item 6 / Item 7			
9 Hydraulic residence time (min) Pollutant specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details			
10 Length of flow based BMP (ft) L = Item 8 * Item 9 * 60			
11 Water surface area at water quality flow depth (ft^2) SA_{top} = (Item 5 + (2 * Item 2 * Item 6)) * Item 10			

4.3.5 Conformance Summary

Complete Form 4.3-9 to demonstrate how on-site LID DCV is met with proposed site design hydrologic source control, infiltration, harvest and use, and/or biotreatment BMP. The bottom line of the form is used to describe the basis for infeasibility determination for on-site LID BMP to achieve full LID DCV, and provides methods for computing remaining volume to be addressed in an alternative compliance plan. If the project has more than one outlet, then complete additional versions of this form for each outlet.

Form 4.3-9 Conformance Summary and Alternative Compliance Volume Estimate (DA 1)

1 Total LID DCV for the Project DA-1 (ft^3): 10,852 Copy Item 7 in Form 4.2-1

2 On-site retention with site design hydrologic source control LID BMP (ft^3): 0 Copy Item 30 in Form 4.3-2

3 On-site retention with LID infiltration BMP (ft^3): 12,050 Copy Item 16 in Form 4.3-3

4 On-site retention with LID harvest and use BMP (ft^3): 0 Copy Item 9 in Form 4.3-4

5 On-site biotreatment with volume based biotreatment BMP (ft^3): 0 Copy Item 3 in Form 4.3-5

6 Flow capacity provided by flow based biotreatment BMP (cfs): 0 Copy Item 6 in Form 4.3-5

7 LID BMP performance criteria are achieved if answer to any of the following is "Yes":

- Full retention of LID DCV with site design HSC, infiltration, or harvest and use BMP: Yes ☒ No ☐
  If yes, sum of Items 2, 3, and 4 is greater than Item 1
- Combination of on-site retention BMPs for a portion of the LID DCV and volume-based biotreatment BMP that address all pollutants of concern for the remaining LID DCV: Yes ☐ No ☐
  If yes, a) sum of Items 2, 3, 4, and 5 is greater than Item 1, and Items 2, 3 and 4 are maximized; or b) Item 6 is greater than Form 4.3--5 Item 6 and Items 2, 3 and 4 are maximized
- On-site retention and infiltration is determined to be infeasible and biotreatment BMP provide biotreatment for all pollutants of concern for full LID DCV: Yes ☐ No ☐
  If yes, Form 4.3-1 Items 7 and 8 were both checked yes

8 If the LID DCV is not achieved by any of these means, then the project may be allowed to develop an alternative compliance plan. Check box that describes the scenario which caused the need for alternative compliance:

- Combination of HSC, retention and infiltration, harvest and use, and biotreatment BMPs provide less than full LID DCV capture: ☐
  Checked yes for Form 4.3-5 Item 7, Item 6 is zero, and sum of Items 2, 3, 4, and 5 is less than Item 1. If so, apply water quality credits and calculate volume for alternative compliance, V_{alt} = (Item 1 – Item 2 – Item 3 – Item 4 – Item 5) * (100 - Form 2.4-1 Item 2)%
- An approved Watershed Action Plan (WAP) demonstrates that water quality and hydrologic impacts of urbanization are more effective when managed in at an off-site facility: ☐
  Attach appropriate WAP section, including technical documentation, showing effectiveness comparisons for the project site and regional watershed

Form 4.3-9 Conformance Summary and Alternative Compliance Volume Estimate (DA 2)

1 Total LID DCV for the Project DA-1 (ft^3): 3,624 Copy Item 7 in Form 4.2-1

2 On-site retention with site design hydrologic source control LID BMP (ft^3): 454 Copy Item 30 in Form 4.3-2

3 On-site retention with LID infiltration BMP (ft^3): 0 Copy Item 16 in Form 4.3-3

4 On-site retention with LID harvest and use BMP (ft^3): 0 Copy Item 9 in Form 4.3-4

5 On-site biotreatment with volume based biotreatment BMP (ft^3): 3,342 Copy Item 3 in Form 4.3-5

6 Flow capacity provided by flow based biotreatment BMP (cfs): 0 Copy Item 6 in Form 4.3-5

7 LID BMP performance criteria are achieved if answer to any of the following is "Yes":

- Full retention of LID DCV with site design HSC, infiltration, or harvest and use BMP: Yes ☒ No ☐
  If yes, sum of Items 2, 3, and 4 is greater than Item 1
- Combination of on-site retention BMPs for a portion of the LID DCV and volume-based biotreatment BMP that address all pollutants of concern for the remaining LID DCV: Yes ☐ No ☐
  If yes, a) sum of Items 2, 3, 4, and 5 is greater than Item 1, and Items 2, 3 and 4 are maximized; or b) Item 6 is greater than Form 4.3--5 Item 6 and Items 2, 3 and 4 are maximized
- On-site retention and infiltration is determined to be infeasible and biotreatment BMP provide biotreatment for all pollutants of concern for full LID DCV: Yes ☐ No ☐
  If yes, Form 4.3-1 Items 7 and 8 were both checked yes

8 If the LID DCV is not achieved by any of these means, then the project may be allowed to develop an alternative compliance plan. Check box that describes the scenario which caused the need for alternative compliance:

- Combination of HSC, retention and infiltration, harvest and use, and biotreatment BMPs provide less than full LID DCV capture: ☐
  Checked yes for Form 4.3-5 Item 7, Item 6 is zero, and sum of Items 2, 3, 4, and 5 is less than Item 1. If so, apply water quality credits and calculate volume for alternative compliance, V_{alt} = (Item 1 – Item 2 – Item 3 – Item 4 – Item 5) * (100 - Form 2.4-1 Item 2)%
- An approved Watershed Action Plan (WAP) demonstrates that water quality and hydrologic impacts of urbanization are more effective when managed in at an off-site facility: ☐
  Attach appropriate WAP section, including technical documentation, showing effectiveness comparisons for the project site and regional watershed

4.3.6 Hydromodification Control BMP

Use Form 4.3-10 to compute the remaining runoff volume retention, after LID BMP are implemented, needed to address HCOC, and the increase in time of concentration and decrease in peak runoff necessary to meet targets for protection of waterbodies with a potential HCOC. Describe hydromodification control BMP that address HCOC, which may include off-site BMP and/or in-stream controls. Section 5.6 of the TGD for WQMP provides additional details on selection and evaluation of hydromodification control BMP.

Form 4.3-10 Hydromodification Control BMPs (DA 1)

1 Volume reduction needed for HCOC performance criteria (ft³): 0 (Form 4.2-2 Item 4 * 0.95) – Form 4.2-2 Item 1	2 On-site retention with site design hydrologic source control, infiltration, and harvest and use LID BMP (ft³): 0 Sum of Form 4.3-9 Items 2, 3, and 4 Evaluate option to increase implementation of on-site retention in Forms 4.3-2, 4.3-3, and 4.3-4 in excess of LID DCV toward achieving HCOC volume reduction
3 Remaining volume for HCOC volume capture (ft³): Item 1 – Item 2	4 Volume capture provided by incorporating additional on-site or off-site retention BMPs (ft³): Existing downstream BMP may be used to demonstrate additional volume capture (if so, attach to this WQMP a hydrologic analysis showing how the additional volume would be retained during a 2-yr storm event for the regional watershed)

5 If Item 4 is less than Item 3, incorporate in-stream controls on downstream waterbody segment to prevent impacts due to hydromodification ☐ Attach in-stream control BMP selection and evaluation to this WQMP

6 Is Form 4.2-2 Item 11 less than or equal to 5%: Yes ☐ No ☐

If yes, HCOC performance criteria is achieved. If no, select one or more mitigation options below:

- Demonstrate increase in time of concentration achieved by proposed LID site design, LID BMP, and additional on-site or off-site retention BMP ☐
  BMP upstream of a waterbody segment with a potential HCOC may be used to demonstrate increased time of concentration through hydrograph attenuation (if so, show that the hydraulic residence time provided in BMP for a 2-year storm event is equal or greater than the addition time of concentration requirement in Form 4.2-4 Item 15)
- Increase time of concentration by preserving pre-developed flow path and/or increase travel time by reducing slope and increasing cross-sectional area and roughness for proposed on-site conveyance facilities ☐
- Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California ☐

7 Form 4.2-2 Item 12 less than or equal to 5%: Yes ☐ No ☐

If yes, HCOC performance criteria is achieved. If no, select one or more mitigation options below:

- Demonstrate reduction in peak runoff achieved by proposed LID site design, LID BMPs, and additional on-site or off-site retention BMPs ☐
  BMPs upstream of a waterbody segment with a potential HCOC may be used to demonstrate additional peak runoff reduction through hydrograph attenuation (if so, attach to this WQMP, a hydrograph analysis showing how the peak runoff would be reduced during a 2-yr storm event)
- Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California ☐

4.4 Alternative Compliance Plan (if applicable)

Describe an alternative compliance plan (if applicable) for projects not fully able to infiltrate, harvest and use, or biotreat the DCV via on-site LID practices. A project proponent must develop an alternative compliance plan to address the remainder of the LID DCV. Depending on project type some projects may qualify for water quality credits that can be applied to reduce the DCV that must be treated prior to development of an alternative compliance plan (see Form 2.4-1, Water Quality Credits). Form 4.3-9 Item 8 includes instructions on how to apply water quality credits when computing the DCV that must be met through alternative compliance. Alternative compliance plans may include one or more of the following elements:

- On-site structural treatment control BMP - All treatment control BMP should be located as close to possible to the pollutant sources and should not be located within receiving waters;
- Off-site structural treatment control BMP - Pollutant removal should occur prior to discharge of runoff to receiving waters;
- Urban runoff fund or In-lieu program, if available

Depending upon the proposed alternative compliance plan, approval by the executive officer may or may not be required (see Section 6 of the TGD for WQMP).

Section 5 Inspection and Maintenance Responsibility for Post Construction BMP

All BMP included as part of the project WQMP are required to be maintained through regular scheduled inspection and maintenance (refer to Section 8, Post Construction BMP Requirements, in the TGD for WQMP). Fully complete Form 5-1 summarizing all BMP included in the WQMP. Attach additional forms as needed.

Form 5-1 BMP Inspection and Maintenance (use additional forms as necessary)

BMP	Reponsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
N1-Education of Property Owners, Tenants and Occupants on Stormwater BMPs	Owner	Owner will implement an education program for BMP information and maintenance. Material will be provided by owner to employees and occupants regarding the protection of storm water quality. The provided materials will include, but not limited to, approved "County of San Bernardino Stormwater Pollution Prevention" education materials for commercial sites, California Stormwater Quality Association(CASQA) BMP education materials from the "Stormwater Best Management Practice Handbook" and applicable manufacturer's maintenance specifications for proposed structural BMPs. BMP education material found in, but not limited to, Section 6.3 and 6.4 of this report and accessible for employees and occupants of the property. The property owner will maintain, enforce and revise the BMP education program as necessary.	Within 14 days after new hiring of employee, contractor or transfer of ownership.
N2-Activity Restriction	Owner	Owner will prohibit outdoor aircraft maintenance/fueling activities without spill containment and shall prohibit the discharge of fertilizers/ pesticides/ animal wastes/ trash/ debris/ paint into storm drain inlets.	Restriction for property to be implemented at all times.
N3-Landscape Management BMPs	Owner	Landscaped area in parking lots will be sumped at the 12" curb openings to receive runoff from pavement. Landscape maintenance activities are performed in a manner consistent with BMP fact sheet SD-10 & SD-12 in Appendix 6.4.C	Weekly inspections of BMPs and irrigation system, through a licensed landscape contractor.
N4-BMP Maintenance	Owner	BMPs will be inspected and maintained per Appendix 6.3.B "Operation and Maintenance" and Appendix 6.4.C "CASQA"	Inspection before wet season (October 1) and after each major rain event (>

			0.5"). Repair immediately if repairs needed.
N6-Local Water Quality Ordinances	Owner	The owner will enforce all City of Chino stormwater Ordinance requirements for this site.	City ordinances for property to be implemented at all times.
N7-Spill Contingency Plan	Owner	Owner shall prepare any required spill contingency plan and maintain spill clean up equipment and materials as required by the San Bernardino County CUPA agency for hazardous materials stored on site.	Weekly or As Needed
N10-Uniform Fire Code Implementation	Owner	All fire code requirements regarding product storage and safety from Article 80 of the Uniform Fire Code shall be implemented.	Product storage and safety for property to be implemented at all times.
N11-Litter/Debris Control Program	Owner	The owner will implement a litter/debris control program. Regular mainenance of common areas including, but not limited to, emptying trash receptacles, trash enclosure maintenance/repair to ensure leak proof receptacles and daily check of litter/debris clean up throughout site.	Daily sweeping, litter disposal and inspection of trash enclosures. Weekly removal of garbage containers by refuse company.
N12-Employee Training	Owner	Employees will be provided copies of Source Control and BMP Educational materials on post-construction storm wate treatment management to train new employees within 1 month of hire. Current employees will be trained upon completion of construction and have annual training sessions by owner or his representative.	Daily sweeping, litter disposal and inspection of trash enclosures. Weekly removal of garbage containers by refuse company.
N15-Vacuum Sweeping of Private Streets and Parking Lots	Owner	Parking lots shall be vaccum swept weekly to prevent sediment, garden waste, trash, or other pollutants from entering on-site drains and public storm system. Sweeping will be done by a contractor provided by the owner.	Within 14 days after new hiring of employee, contractor or transfer of ownership.
S1-Storm Drain Signage	Owner	All on-site drainage inlets will be stenciled or signage will be provided that indicates "NO DUMPING, DRAINS TO RIVER". The owner will annually inspect and maitain anti-dumping/pollution signage on all on-site drain inlets, for legibility.	Annually before Wet Season (October 1)

S3-Trash Enclosure	Owner	Trash Enclosures are designed with impervious bottoms (portland cement concrete) to prevent infiltration into pervious surfaces. Solid cover rooof awnings will be provided to prevent exposure of trash enclosure areas to direct over head precipitation. Screen walls will be built around trash enclosure to prevent off-site transport of trash. Drainage for trash enclosure will prevent run-on from adjoining areas.	Daily sweeping, litter disposal and inspection of trash enclosures. Weekly removal of garbage containers by refuse company.
S4-Efficient Irrigation	Owner	Efficient landscape design shall include weater-based controllers, rain shutoff devices and drip irrigation. Landscape plantings shall comply with state and local water conservation ordinances.	Weekly sweeping of parking lots.
S5-Finished Grade Design 1" to 2" Below Hardscape (Top of Curb, Sidewalk and Pavement)	Owner	Landscaped areas adjacent to curbs and sidewalks will be sumped at a minimum of 2-inches below the finished surface. All routine landscaping maintenance shall be done in conformance with City and County Ordinances and shall be performed on a weekly schedule.	Before Wet Season (October 1) and After Each Major Rain Event
Underground Storm Chambers	Owner	Owner will hire a contractor to inspect and maintain chambers in accordance with the manufacturers specifications and 48 hours after rainfall to determine full drawdown of stormwater has occurred. Owner is required to fix BMP to meet the maximum 48 hour stormwater drawdown requirement. BMP to be fixed within one month of discovery of faulty system. Inspect port and measure sediment stadia rod if sediment measure 3 or more inches remove using JetVac.	Before Wet Season (October 1) and after each major rain event
Bioretention Basin with Underdrain	Owner	Maintenance will be required to maintain adequate trash capture capacity and to ensure that trapped tash does not migrate offsite. The owner should establish a maintenance schedule based on site-specific factors, including the size of the bioretention BMP trench, storm frequency, and characterization of upstream trash and vegetation accumulation. Trash capture and maintenance may be improved by addition of various forms of pretreatment.	Before Wet Season (October 1) and after each major rain event
MWS Stormwater Biofiltration System	Owner	Maintenance will be required to remove trash from screening device, sediment from separation chamber, replace Catridge Filter Media, and trim vegetation. The owner shall keep maintenance/inspection records for a minimium of 5 years from the date of maintenance.	Before Wet Season (October 1) and after each major rain event
ADS-Flexstorm catch basin inserts	Owner	Maintenance shall be performed by a contractor to inspect and maintain in accordance with the vendors specifications.	Before wet season and after each major rain event.

Section 6 WQMP Attachments

6.1. Site Plan and Drainage Plan

Include a site plan and drainage plan sheet set containing the following minimum information:

- Project location
- Site boundary
- Land uses and land covers, as applicable
- Suitability/feasibility constraints
- Structural Source Control BMP locations
- Site Design Hydrologic Source Control BMP locations
- LID BMP details
- Drainage delineations and flow information
- Drainage connections

6.2 Electronic Data Submittal

Minimum requirements include submittal of PDF exhibits in addition to hard copies. Format must not require specialized software to open. If the local jurisdiction requires specialized electronic document formats (as described in their local Local Implementation Plan), this section will describe the contents (e.g., layering, nomenclature, geo-referencing, etc.) of these documents so that they may be interpreted efficiently and accurately.

6.3 Post Construction

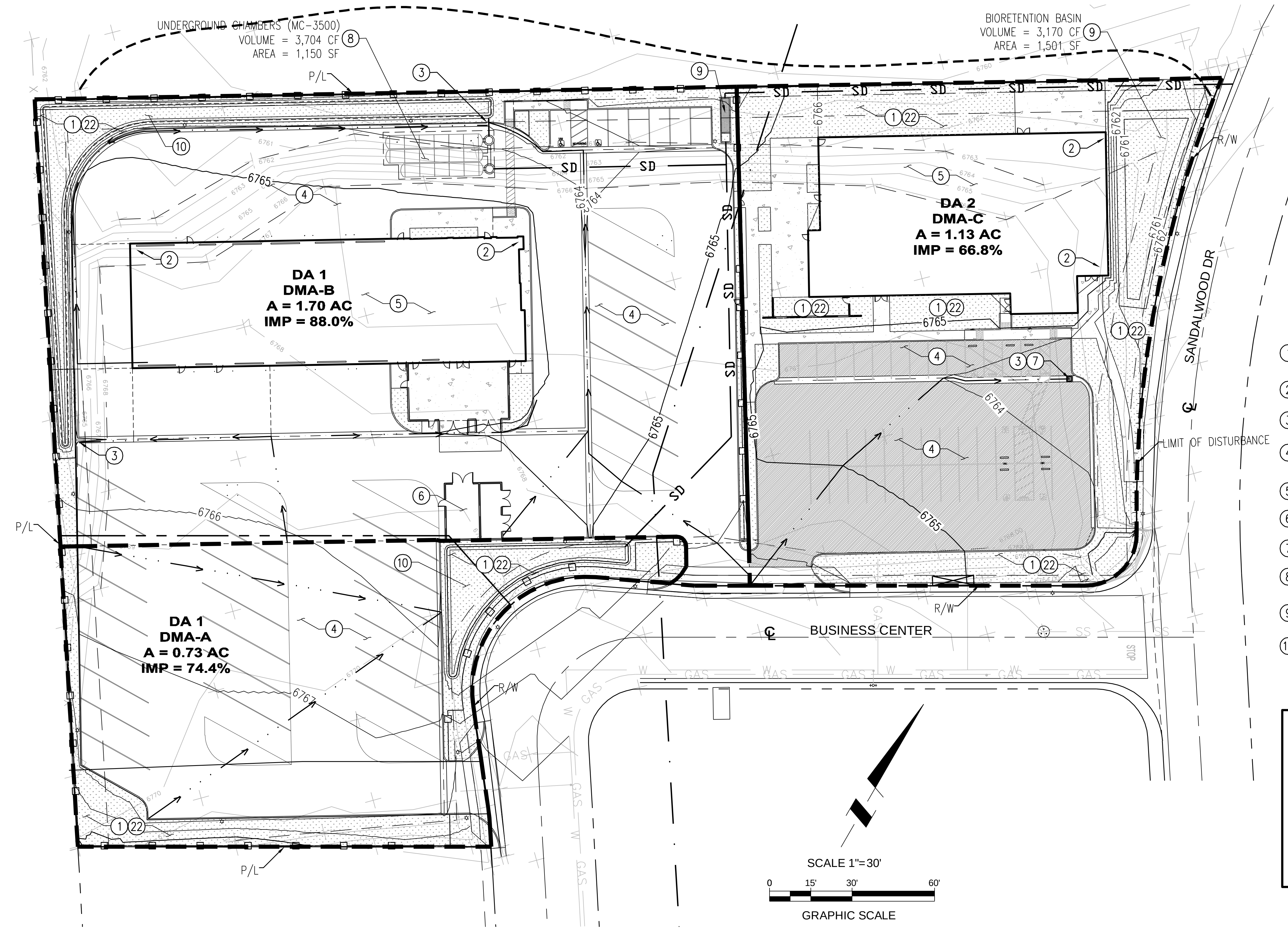
Attach all O&M Plans and Maintenance Agreements for BMP to the WQMP.

6.4 Other Supporting Documentation

- BMP Educational Materials
- Activity Restriction – C, C&R's & Lease Agreements

SECTION ‘6.1.A’

WQMP BMP Exhibit
WQMP DMA BMP Exhibit
Vicinity Map
Receiving Water Map



EXISTING AREA

IMPERVIOUS AREA: 0 SF
PERVIOUS AREA: 154,823 SF

PROPOSED AREA

IMPERVIOUS AREA: 121,530 SF
PERVIOUS AREA: 33,293 SF

LAND USE

C-2 COMMERCIAL-GENERAL

SUITABILITY/FEASIBILITY CONSTRAINTS

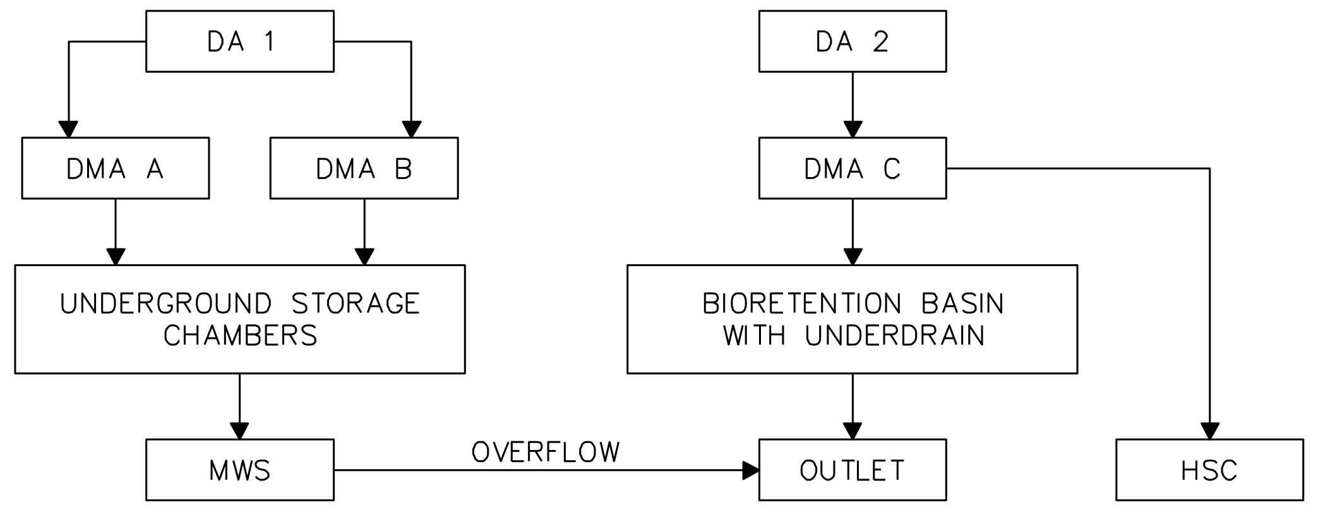
NOT APPLICABLE

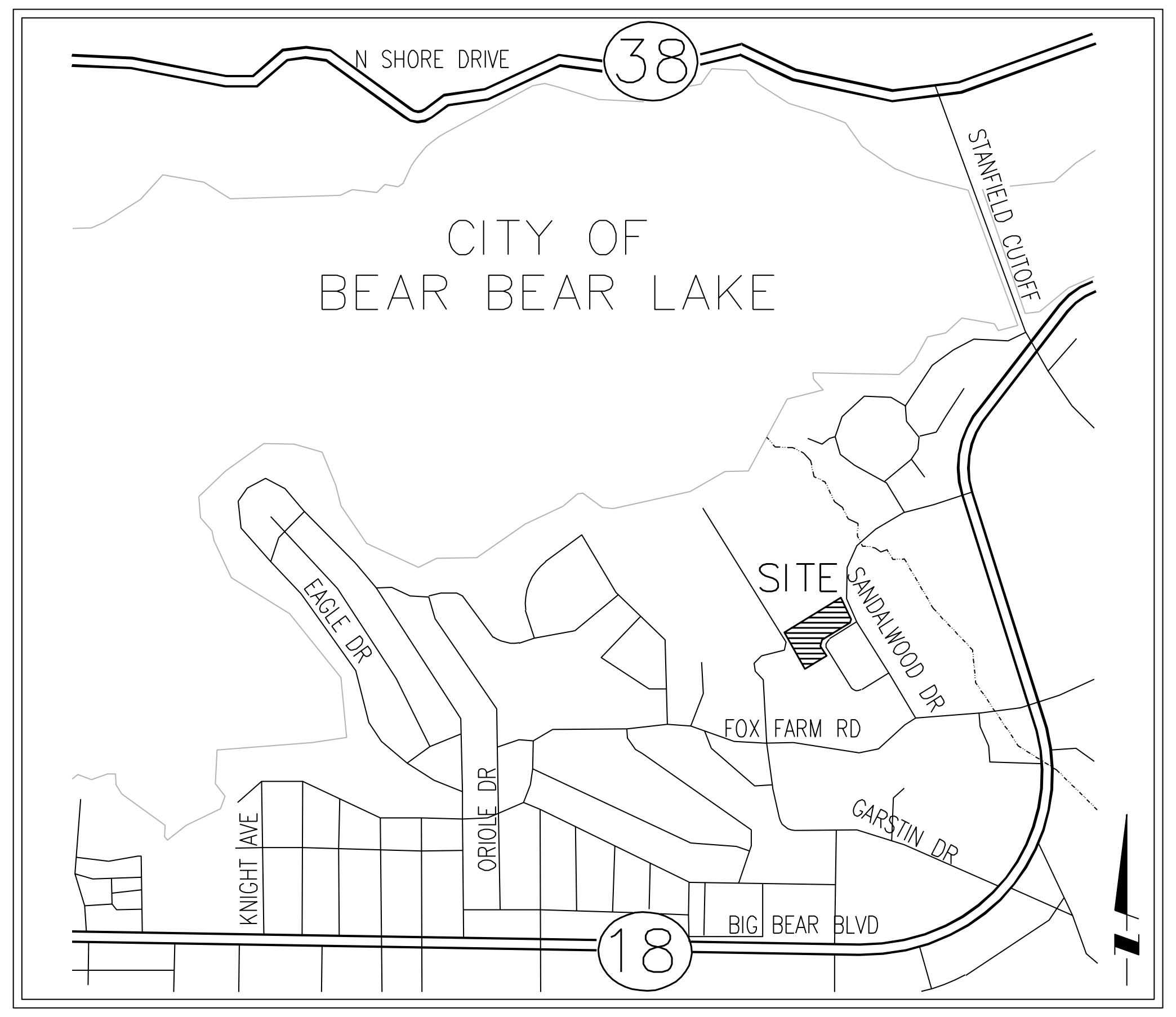
DISTURBED AREA

154,823 SF

WQMP GROSS AREA

154,823 SF





VICINITY MAP

N.T.S

BMP ITEMS

① LANDSCAPING DESIGN AND MAINTENANCE (CASQA SD-10, SD-12 AND SC-73)
② ROOF DOWNSPOUT DISCONNECT (CASQA SD-11)
③ STORM DRAIN STENCIL (CASQA SD-13)
④ PARKING LOT, COMMON AREA MAINTENANCE AND SWEEPING (CASQA SC-43 AND SC-60)
⑤ BUILDING AND GROUND MAINTENANCE (CASQA SC-41)
⑥ TRASH ENCLOSURE WITH COVER
⑦ STORM DRAIN INLET FILTER INSERT (CASQA MP-52)
⑧ UNDERGROUND CHAMBERS (MC-3500)
⑨ MWS STORMWATER BIOFILTRATION SYSTEM - MWS-L-4-21-V PER DETAIL HEREON
⑩ DETENTION BASIN

LID PREVENTATIVE MEASURES

㉒ CONTRACTOR TO STAKE OFF ALL PERVIOUS LANDSCAPING TO MINIMIZE COMPACTION DURING CONSTRUCTION

NON-STRUCTURAL BMP

N1 - BMP EDUCATION
N2 - ACTIVITY RESTRICTIONS
N3 - LANDSCAPE MANAGEMENT
N4 - BMP MAINTENANCE
N6 - LOCAL WATER QUALITY ORDINANCES
N7 - SPILL CONTINGENCY PLAN
N10 - UNIFORM FIRE CODE IMPLEMENTATION
N11 - LITTER/DEBRIS CONTROL PROGRAM
N12 - EMPLOYEE TRAINING
N15 - VACUUM SWEEPING OF PRIVATE STREETS AND PARKING LOTS
N17 - COMPLY WITH APPLICABLE NPDES PERMITS
S1 - STORM DRAIN SIGNAGE
S3 - TRASH ENCLOSURE
S4 - EFFICIENT IRRIGATION
S5 - FINISHED GRADE DESIGN 1"TO 2" BELOW HARDSCAPE

LEGEND

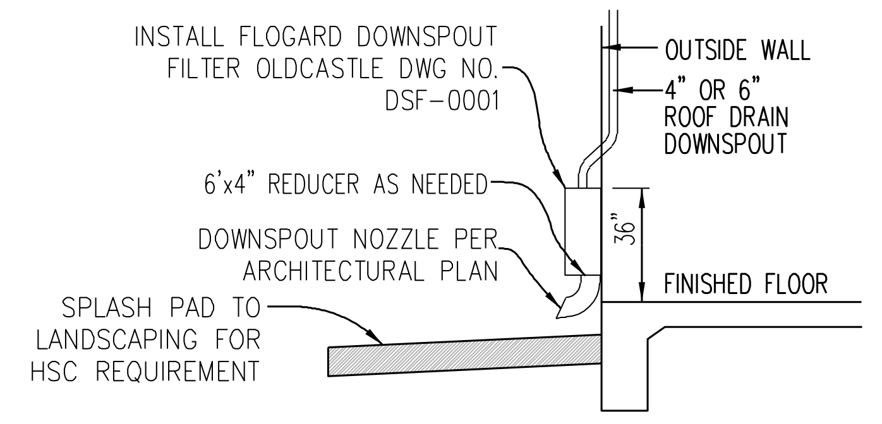
···→···→	FLOW DIRECTION
▬ ▬ ▬	DRAINAGE MANAGEMENT AREA
⬚	LANDSCAPED PERVIOUS SURFACE
◫	UNDERGROUND STORAGE CHAMBERS
▭	PCC IMPERVIOUS SURFACE
▦	CATCH BASIN
▨	AC IMPERVIOUS SURFACE

WQMP SUMMARY

DRAINAGE AREA	REQUIRED DCV (FT^3)	HSC STORAGE (FT^3)	REMAINING DCV FOR TREAMEMENT CONTROL (FT^3)	MWS BIOFILTRATION WITH MC-3500 (FT^3)	BIORETENTION BASIN (FT^3)
DA 1	10852	0	10852	12050	0
DA 2	3624	454	3170	0	3265

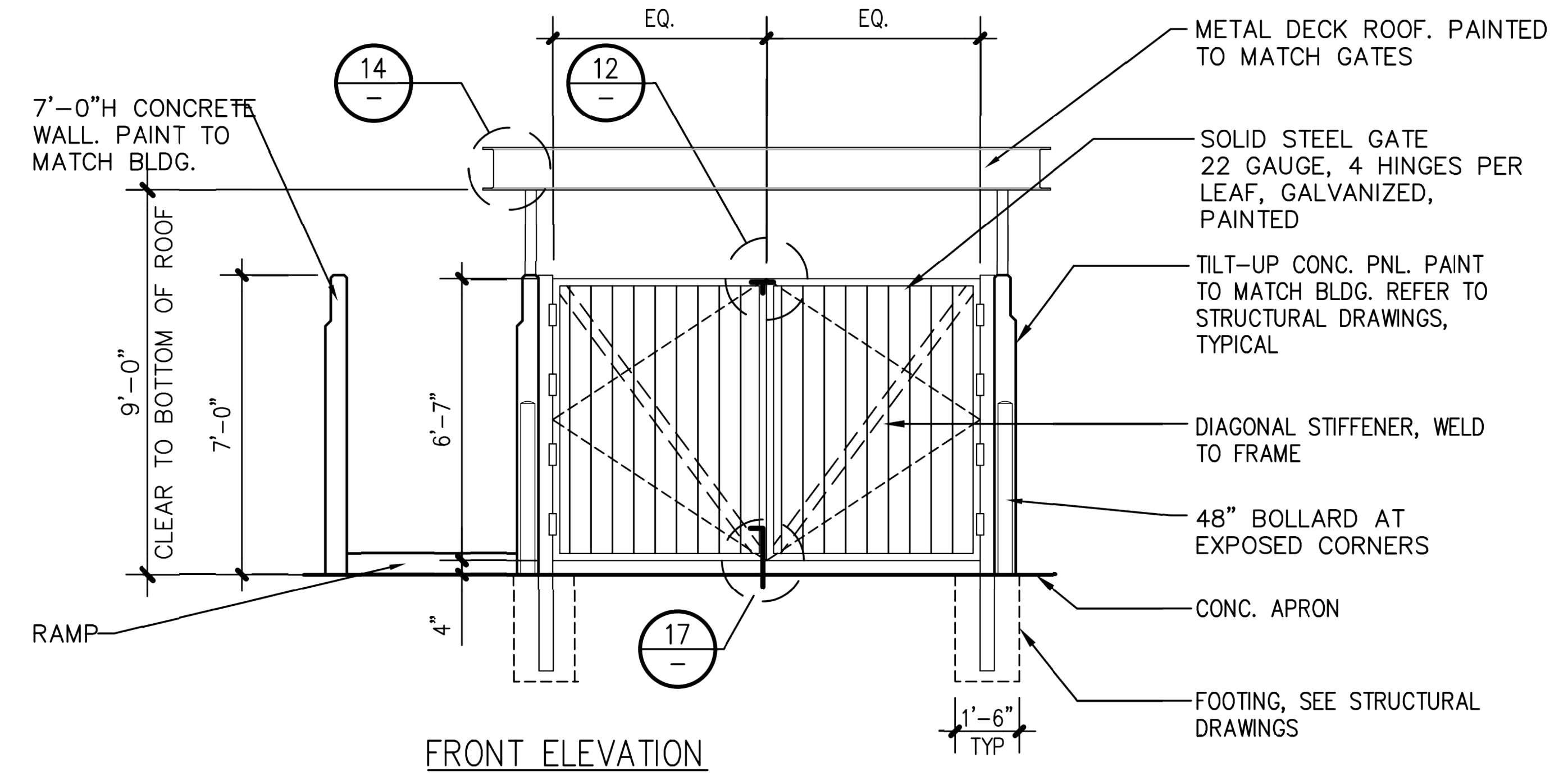
③ STENCIL SIGNAGE

LETTERS 2" HIGH - NTS



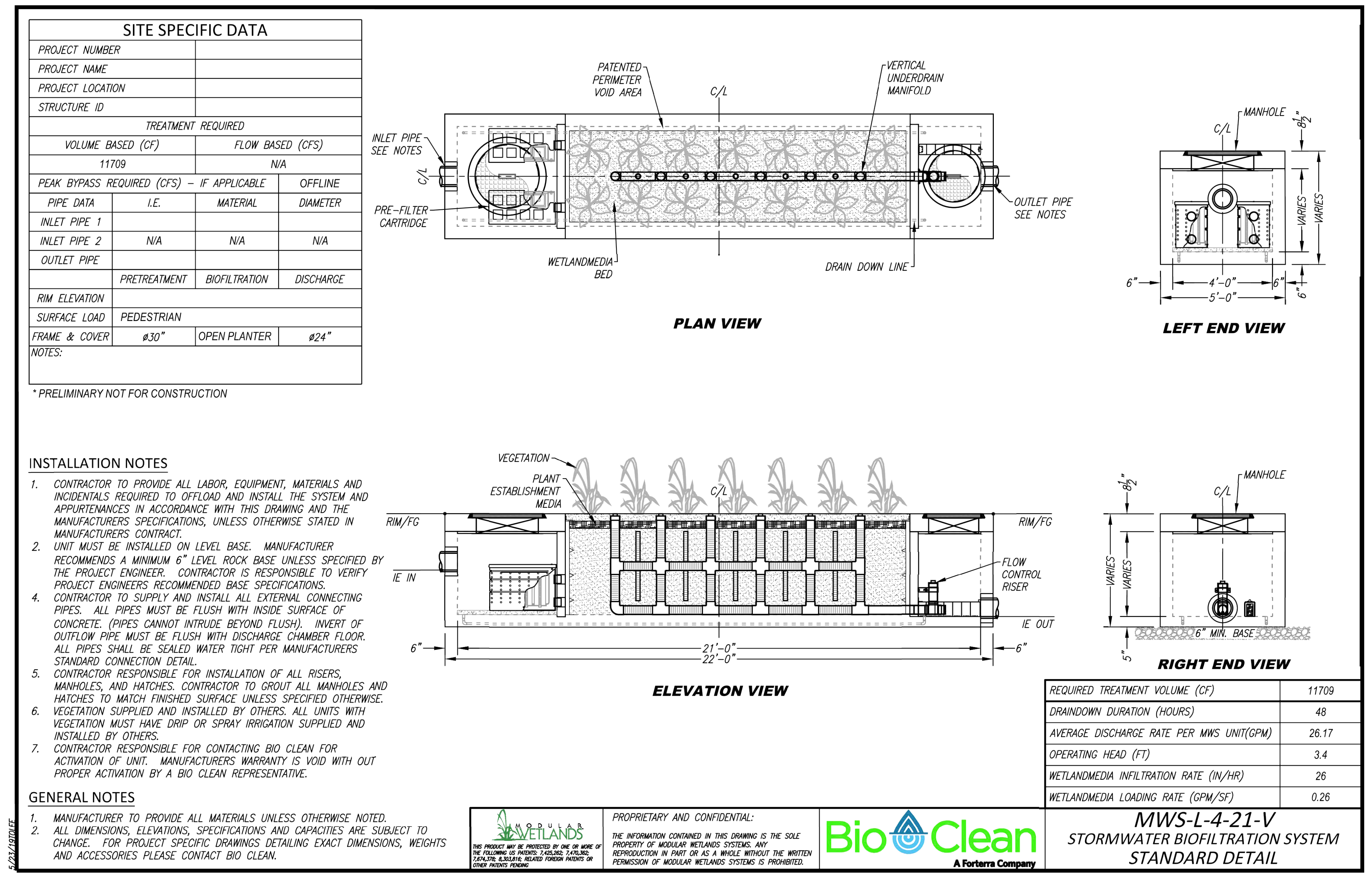
② ROOF DRAIN DOWNSPOUT FILTER

NOT TO SCALE



⑥ TRASH ENCLOSURE

NOT TO SCALE



SITE SPECIFIC DATA

PROJECT NUMBER			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
11709		N/A	
PEAK BYPASS REQUIRED (CFS) - IF APPLICABLE			OFFLINE
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2	N/A	N/A	N/A
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PEDESTRIAN		
FRAME & COVER	ø30"	OPEN PLANTER	ø24"
NOTES:			

* PRELIMINARY NOT FOR CONSTRUCTION

INSTALLATION NOTES

1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE. (PIPES CANNOT INTRUDE BEYOND FLUSH). INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH DISCHARGE CHAMBER FLOOR. ALL PIPES SHALL BE SEALED WATER TIGHT PER MANUFACTURERS STANDARD CONNECTION DETAIL.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. VEGETATION SUPPLIED AND INSTALLED BY OTHERS. ALL UNITS WITH VEGETATION MUST HAVE DRIP OR SPRAY IRRIGATION SUPPLIED AND INSTALLED BY OTHERS.
7. CONTRACTOR RESPONSIBLE FOR CONTACTING BIO CLEAN FOR ACTIVATION OF UNIT. MANUFACTURERS WARRANTY IS VOID WITH OUT PROPER ACTIVATION BY A BIO CLEAN REPRESENTATIVE.

GENERAL NOTES

1. MANUFACTURER TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS AND ACCESSORIES PLEASE CONTACT BIO CLEAN.

REQUIRED TREATMENT VOLUME (CF)	11709
DRAINDOWN DURATION (HOURS)	48
AVERAGE DISCHARGE RATE PER MWS UNIT(GPM)	26.17
OPERATING HEAD (FT)	3.4
WETLANDMEDIA INFILTRATION RATE (IN/HR)	26
WETLANDMEDIA LOADING RATE (GPM/SF)	0.26

MODULAR WETLANDS

THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING US PATENTS: 7,425,262; 7,470,362; 7,674,378; 8,303,816; RELATED FOREIGN PATENTS OR OTHER PATENTS PENDING

PROPRIETARY AND CONFIDENTIAL:

THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF MODULAR WETLANDS SYSTEMS. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF MODULAR WETLANDS SYSTEMS IS PROHIBITED.

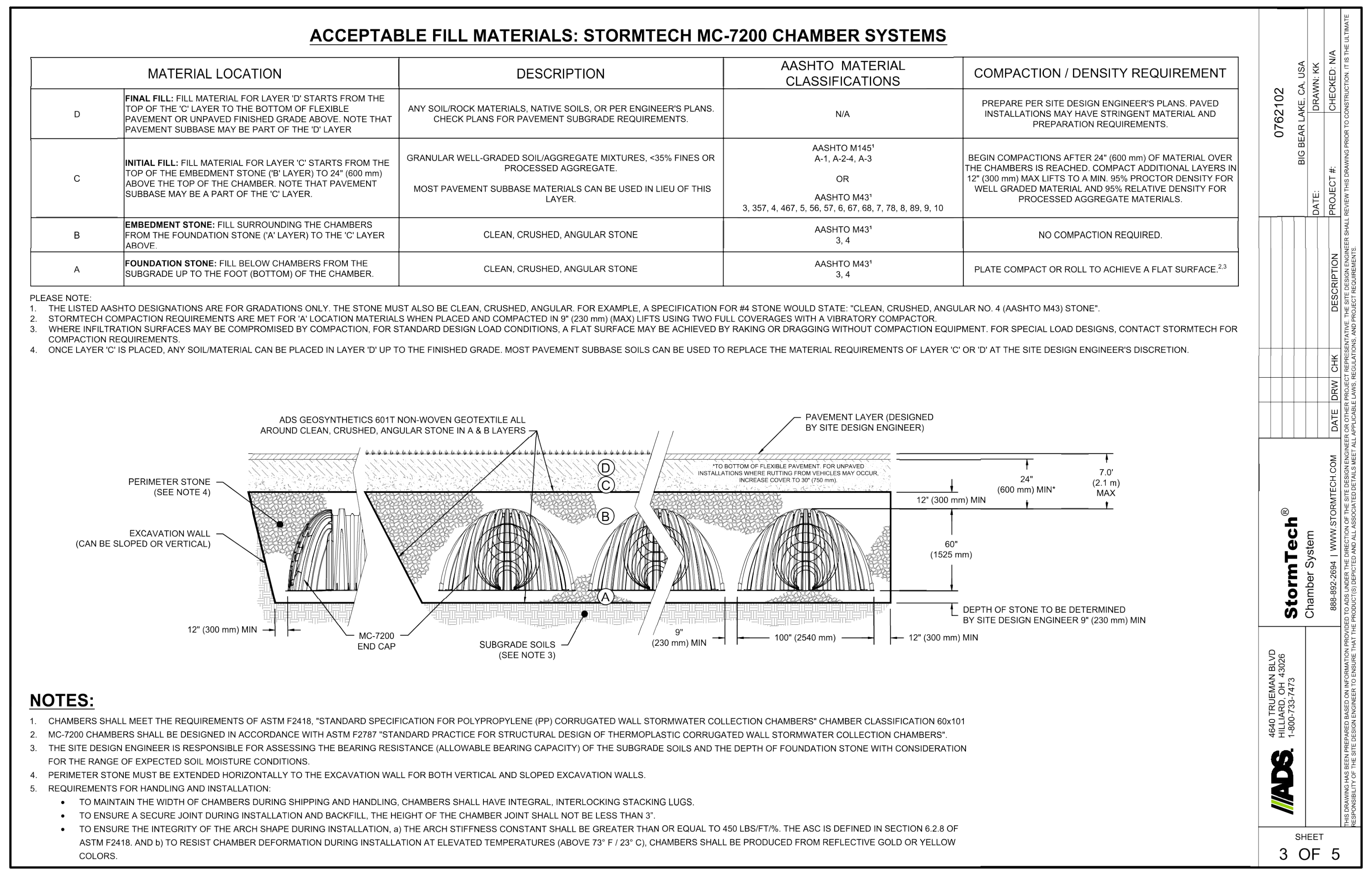
Bio Clean
A Forterra Company

MWS-L-4-21-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

5/23/19TOLEE

⑨ STORMWATER BIOFILTRATION SYSTEM

MWS-L-4-21-V
OR APPROVED EQUAL



ACCEPTABLE FILL MATERIALS: STORMTECH MC-7200 CHAMBER SYSTEMS

MATERIAL LOCATION		DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 24" (600 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145¹ A-1, A-2-4, A-3 OR AASHTO M43¹ 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 24" (600 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 12" (300 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS.
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43¹ 3, 4	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43¹ 3, 4	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE.^{2,3}

PLEASE NOTE:

1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 9" (230 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.
4. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.

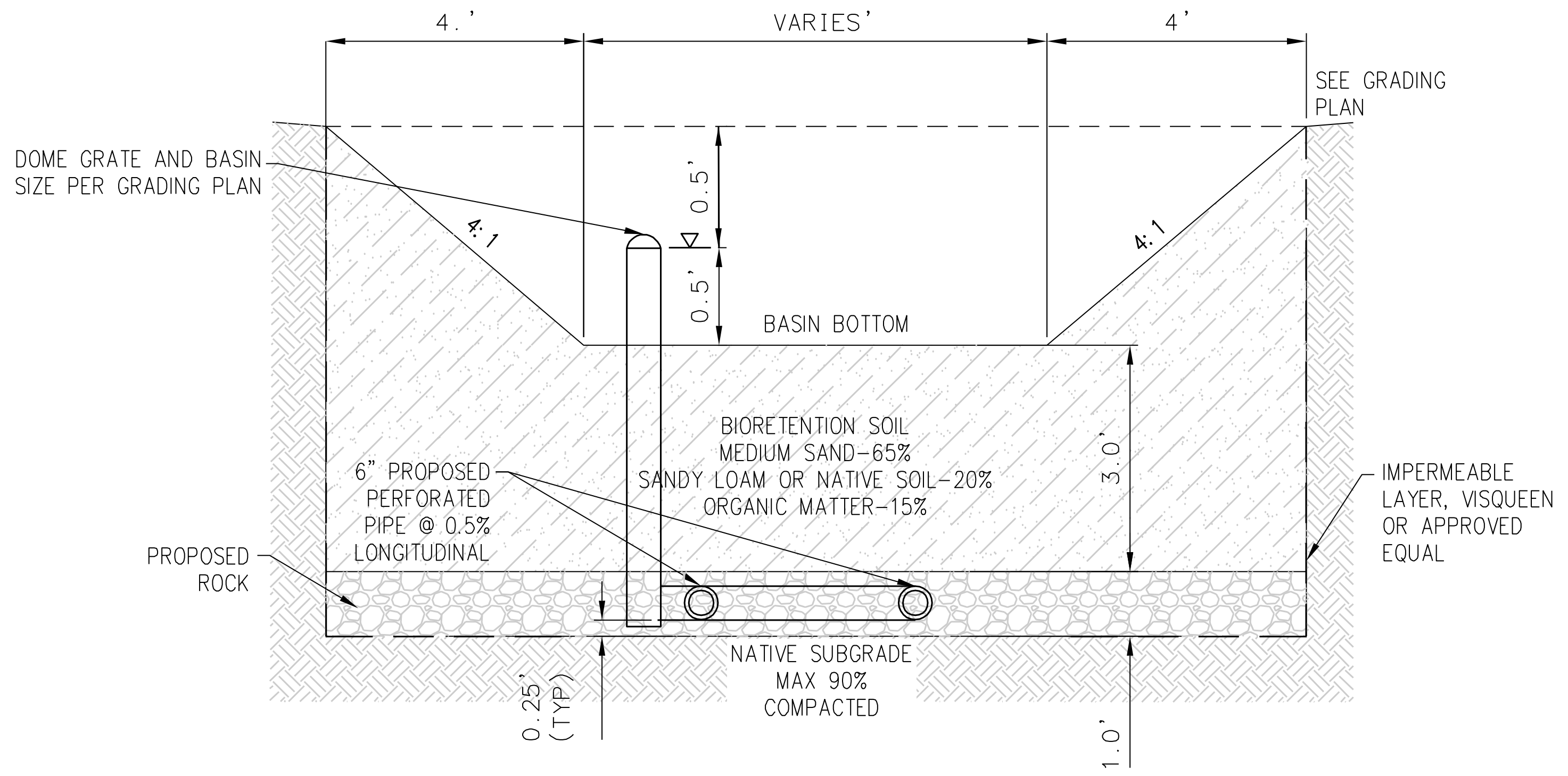
NOTES:

1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 60x101
2. MC-7200 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT SHALL BE GREATER THAN OR EQUAL TO 450 LBS/FT/%. THE ASC IS DEFINED IN SECTION 6.2.8 OF ASTM F2418. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

0762102
BIG BEAR LAKE, CA, USA
DRAWN: KK
CHECKED: N/A
DATE:
PROJECT #:
DATE DRW CHK DESCRIPTION
StormTech® Chamber System
888-892-2694 | WWW.STORMTECH.COM
ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026
1-800-733-7473
SHEET
3 OF 5

⑧ STORAGE CHAMBERS

ADVANCED DRAINAGE SYSTEMS
STORMTECH MC-7200



⑩ BIORETENTION BASIN

NOT TO SCALE

REVISIONS			
MARK	DATE	BY	DESCRIPTION

DESIGNED BY VEInc
DATE APRIL 2022
DRAWN BY VEInc
DATE APRIL 2022
CHECKED BY JDM
DATE APRIL 2022

JEFFEREY D. MEITER
No. 64696

VALUED
ENGINEERING, INC
CIVIL ENGINEERING • LAND SURVEYING • LAND PLANNING
600 N. MOUNTAIN AVE, STE C102, UPLAND, CA 91786
PHONE: (909) 982-4601

CITY OF BIG BEAR LAKE
DRC# XXXX-XXXXX
BPR# XXXX-XXXXX
PGR# XXXX-XXXXX

MOUNTAIN AREA REGIONAL TRANSIT AUTHORITY
170 BUSINESS CENTER DRIVE
EXHIBIT 1 - WQMP BMP EXHIBIT

SHEET 1 OF 2
CONTRACT ______
DWG. No. ______

WQMP SUMMARY					
DRAINAGE AREA	REQUIRED DCV (FT^3)	HSC STORAGE (FT^3)	REMAINING DCV FOR TREAMEMENT CONTROL (FT^3)	MWS BIOFILTRATION WITH MC-3500 (FT^3)	BIORETENTION BASIN (FT^3)
DA 1	10852	0	10852	12050	0
DA 2	3624	454	3170	0	3265

REVISIONS			
MARK	DATE	BY	DESCRIPTION

DESIGNED BY VEInc
DATE APRIL 2022
DRAWN BY VEInc
DATE APRIL 2022
CHECKED BY JDM
DATE APRIL 2022

REGISTERED PROFESSIONAL ENGINEER
JEFFEREY D. MEITER
No. 64696
CIVIL
STATE OF CALIFORNIA

VALUED
ENGINEERING, INC
CIVIL ENGINEERING • LAND SURVEYING • LAND PLANNING
600 N. MOUNTAIN AVE, STE C102, UPLAND, CA 91786
PHONE: (909) 982-4601

CITY OF BIG BEAR LAKE
DRC# XXXX-XXXXX
BPR# XXXX-XXXXX
PGR# XXXX-XXXXX

MOUNTAIN AREA REGIONAL TRANSIT AUTHORITY
170 BUSINESS CENTER DRIVE
EXHIBIT 2 - WQMP DMA BMP EXHIBIT

SHEET 2 OF 2
CONTRACT ____
DWG. No. ____

VICINITY MAP

SECTION '6.2.A'

City of Big Bear Lake Memorandum of Agreement of Storm Water Quality Management Plan

SECTION ‘6.3.A’

Design Capture Volume Calculations

SAN BERNARDINO COUNTY STORMWATER PROGRAM
MODEL WATER QUALITY MANAGEMENT PLAN GUIDANCE

BMP Drainage Area	Area (Acres)	Impervious Area Ratio	Region	NOAA Atlas 14 Precipitiation on Depth (2yr, 1Hr)	Factor of Saftey[1]	Volume Base BMP drawdown time[2]	Composite runoff coefficient, C_{BMP}	Intensity regression coefficient, I	Design rainfall intensity, I_{BMP}	6-hour rainfall regression coefficient	6-hour mean storm rainfall, P_6 inches	Drawdown time regression constant, a	Maximized detention volume, P_0	Target capture volume, V_0 Acre-Feet	Targe capture volume, V_0 Ft^3
DA 1	2.43	0.839	Mountain	0.508	2	48	0.647	0.361	0.367	1.909	0.970	1.963	1.232	0.249	10852
DA 2	1.13	0.668	Mountain	0.508	2	48	0.465	0.361	0.367	1.909	0.970	1.963	0.885	0.083	3624
													DA 1 SUM =		14476

Regression Coefficients for Intensity (I) and 6-hour mean storm rainfall (P_6)

Quantity	Valley	Mountain	Desert
	85% upper confidence limits		
I	0.2787	0.3614	0.3250
P_6	1.4807	1.9090	1.2371

Drawdown Time Regression Constant, a

Time hours	a
24	1.582
48	1.963

Notes:

[1] The SBC MWQMPG recommends a factor of safety of 2.

[2] The SBC MWQMPG recommends a drawdown time of 48 hours. (A shorter time is not feasible for all soil types. A longer time can negatively affect vector control efforts.)

NOAA Atlas 14, Volume 6, Version 2
Location name: Big Bear Lake, California, USA*
Latitude: 34.2506°, Longitude: -116.8887°
Elevation: 6785.84 ft**

* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

AMS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Annual exceedance probability (1/years)								
	1/2	**1/5**	**1/10**	**1/25**	**1/50**	**1/100**	**1/200**	**1/500**	**1/1000**
5-min	**0.142** (0.118-0.173)	**0.242** (0.200-0.296)	**0.318** (0.261-0.392)	**0.431** (0.341-0.550)	**0.528** (0.409-0.688)	**0.638** (0.483-0.853)	**0.763** (0.561-1.05)	**1.11** (0.783-1.59)	**1.59** (1.09-2.36)
10-min	**0.204** (0.169-0.249)	**0.347** (0.287-0.425)	**0.456** (0.373-0.562)	**0.617** (0.489-0.788)	**0.757** (0.587-0.986)	**0.915** (0.692-1.22)	**1.09** (0.805-1.50)	**1.59** (1.12-2.28)	**2.29** (1.56-3.39)
15-min	**0.246** (0.204-0.301)	**0.420** (0.347-0.514)	**0.551** (0.452-0.680)	**0.747** (0.591-0.953)	**0.915** (0.709-1.19)	**1.11** (0.837-1.48)	**1.32** (0.973-1.82)	**1.93** (1.36-2.76)	**2.76** (1.88-4.10)
30-min	**0.360** (0.297-0.439)	**0.613** (0.506-0.750)	**0.805** (0.659-0.992)	**1.09** (0.862-1.39)	**1.34** (1.03-1.74)	**1.62** (1.22-2.16)	**1.93** (1.42-2.65)	**2.81** (1.98-4.02)	**4.03** (2.75-5.98)
60-min	**0.508** (0.421-0.620)	**0.866** (0.715-1.06)	**1.14** (0.932-1.40)	**1.54** (1.22-1.97)	**1.89** (1.46-2.46)	**2.28** (1.73-3.05)	**2.73** (2.01-3.75)	**3.97** (2.80-5.69)	**5.70** (3.89-8.45)
2-hr	**0.751** (0.621-0.917)	**1.25** (1.03-1.53)	**1.61** (1.32-1.98)	**2.11** (1.67-2.69)	**2.53** (1.96-3.29)	**2.98** (2.25-3.98)	**3.48** (2.56-4.77)	**4.20** (2.96-6.01)	**5.76** (3.92-8.53)
3-hr	**0.945** (0.782-1.15)	**1.56** (1.29-1.91)	**1.99** (1.63-2.45)	**2.59** (2.05-3.31)	**3.08** (2.39-4.01)	**3.61** (2.73-4.82)	**4.17** (3.07-5.73)	**4.99** (3.52-7.15)	**5.82** (3.96-8.62)
6-hr	**1.38** (1.14-1.69)	**2.26** (1.86-2.76)	**2.87** (2.35-3.54)	**3.71** (2.94-4.73)	**4.39** (3.40-5.72)	**5.12** (3.87-6.84)	**5.90** (4.34-8.10)	**7.02** (4.95-10.0)	**7.93** (5.41-11.8)
12-hr	**1.91** (1.58-2.34)	**3.14** (2.60-3.85)	**4.03** (3.30-4.97)	**5.29** (4.19-6.75)	**6.34** (4.91-8.26)	**7.48** (5.65-9.99)	**8.73** (6.42-12.0)	**10.6** (7.46-15.1)	**12.1** (8.27-18.0)
24-hr	**2.72** (2.40-3.13)	**4.49** (3.97-5.19)	**5.84** (5.12-6.79)	**7.83** (6.64-9.43)	**9.56** (7.94-11.8)	**11.5** (9.34-14.5)	**13.7** (10.8-17.8)	**17.2** (13.0-23.1)	**20.1** (14.7-28.1)
2-day	**3.50** (3.10-4.04)	**5.76** (5.09-6.66)	**7.53** (6.60-8.76)	**10.2** (8.67-12.3)	**12.6** (10.5-15.5)	**15.4** (12.5-19.4)	**18.6** (14.7-24.1)	**23.6** (17.9-31.9)	**28.2** (20.6-39.3)
3-day	**3.92** (3.47-4.52)	**6.44** (5.69-7.43)	**8.43** (7.39-9.81)	**11.5** (9.74-13.8)	**14.2** (11.8-17.5)	**17.5** (14.1-22.0)	**21.2** (16.7-27.4)	**27.2** (20.6-36.7)	**32.6** (23.9-45.5)
4-day	**4.20** (3.72-4.84)	**6.92** (6.11-7.99)	**9.07** (7.95-10.6)	**12.4** (10.5-14.9)	**15.4** (12.8-18.9)	**18.9** (15.3-23.8)	**23.0** (18.1-29.7)	**29.5** (22.3-39.7)	**35.4** (25.9-49.4)
7-day	**4.82** (4.27-5.55)	**8.07** (7.13-9.32)	**10.6** (9.31-12.4)	**14.5** (12.3-17.5)	**18.0** (14.9-22.1)	**22.0** (17.8-27.7)	**26.6** (21.0-34.4)	**34.0** (25.7-45.8)	**40.6** (29.7-56.6)
10-day	**5.16** (4.57-5.94)	**8.73** (7.71-10.1)	**11.5** (10.1-13.4)	**15.7** (13.3-18.9)	**19.4** (16.1-23.8)	**23.6** (19.2-29.8)	**28.5** (22.5-36.9)	**36.2** (27.4-48.8)	**43.1** (31.5-60.1)
20-day	**6.11** (5.41-7.04)	**10.4** (9.21-12.0)	**13.7** (12.0-16.0)	**18.6** (15.8-22.4)	**22.9** (19.0-28.2)	**27.8** (22.5-35.0)	**33.4** (26.3-43.2)	**42.0** (31.8-56.6)	**49.6** (36.3-69.1)
30-day	**7.33** (6.49-8.45)	**12.5** (11.0-14.4)	**16.4** (14.4-19.0)	**22.2** (18.8-26.7)	**27.2** (22.6-33.4)	**32.8** (26.6-41.4)	**39.3** (31.0-50.8)	**49.1** (37.2-66.2)	**57.8** (42.2-80.6)
45-day	**8.74** (7.74-10.1)	**14.8** (13.0-17.0)	**19.3** (16.9-22.5)	**26.0** (22.1-31.3)	**31.8** (26.4-39.1)	**38.3** (31.0-48.2)	**45.6** (36.0-59.0)	**56.7** (42.9-76.5)	**66.4** (48.6-92.7)
60-day	**10.1** (8.95-11.6)	**17.0** (15.0-19.6)	**22.1** (19.4-25.7)	**29.7** (25.2-35.7)	**36.2** (30.0-44.4)	**43.4** (35.2-54.7)	**51.5** (40.6-66.7)	**63.9** (48.3-86.1)	**74.6** (54.6-104)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of annual maxima series (AMS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and annual exceedance probability) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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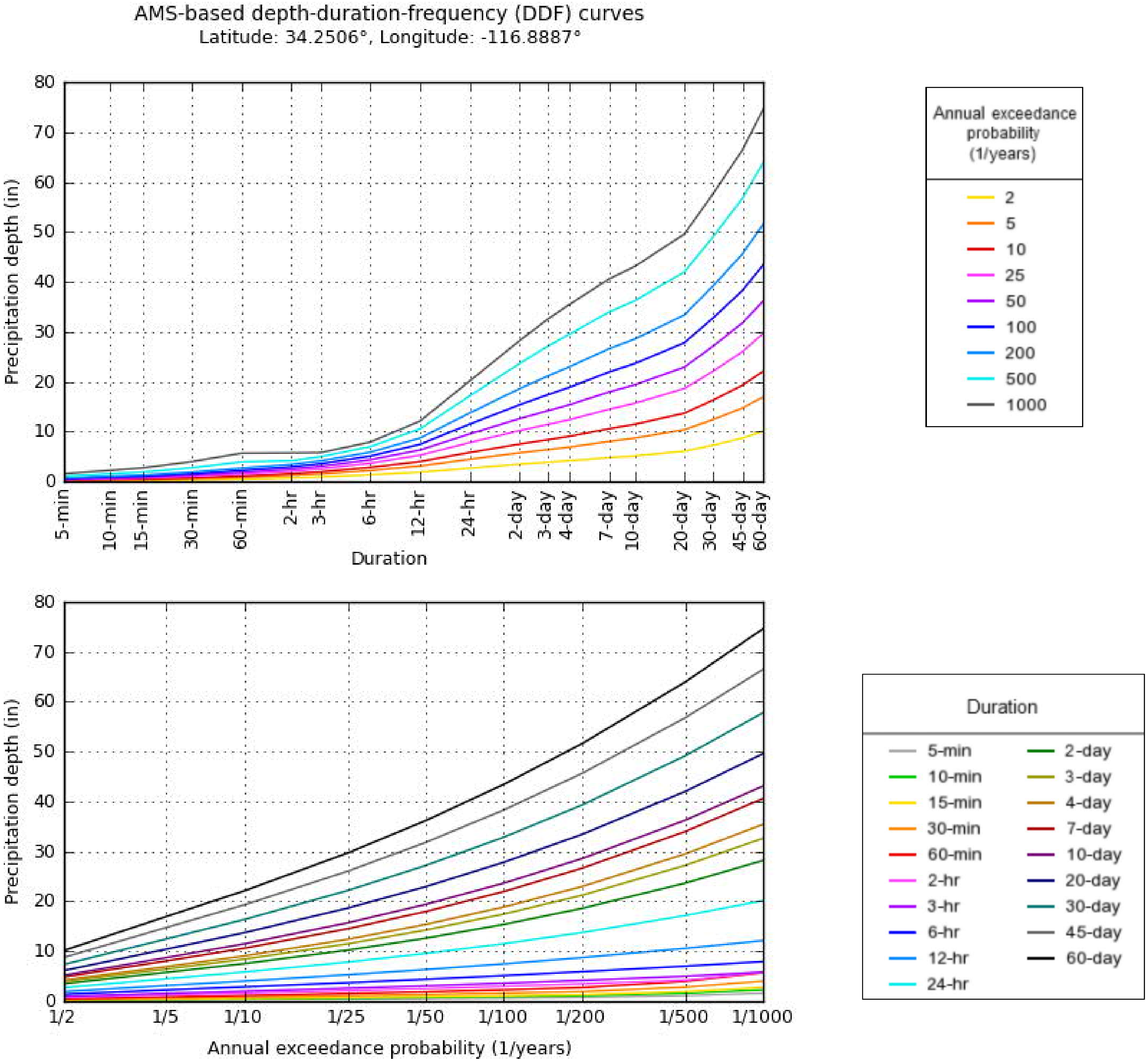
PF graphical


AMS-based depth-duration-frequency (DDF) curves
Latitude: 34.2506°, Longitude: -116.8887°

NOAA Atlas 14, Volume 6, Version 2

Created (GMT): Thu Apr 21 16:58:22 2022

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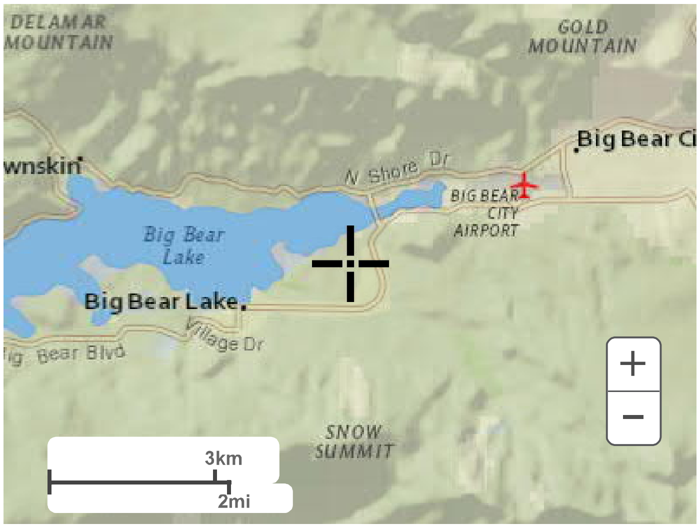
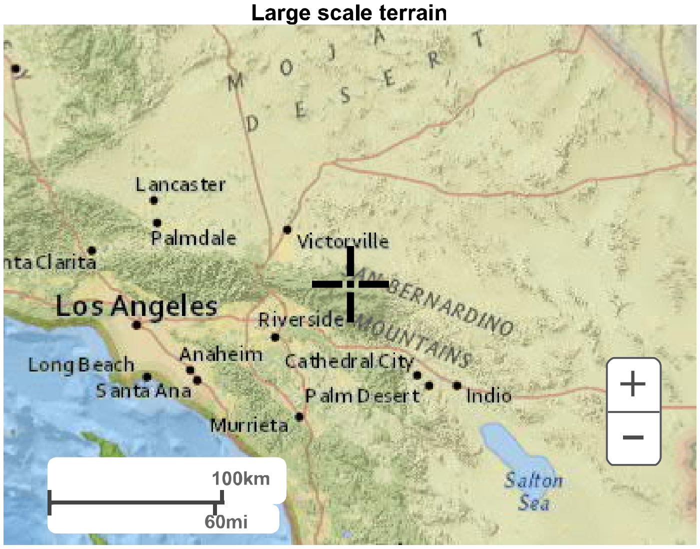
Maps & aerials

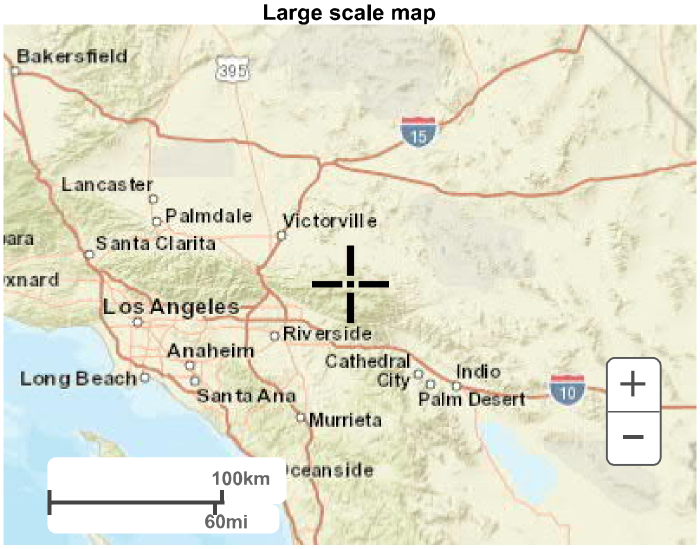
Small scale terrain



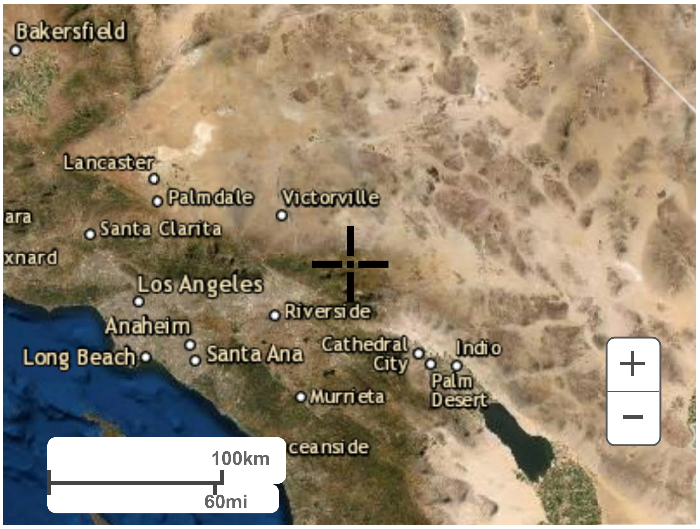
Large scale terrain



Large scale map



Large scale aerial


Bakersfield
Lancaster
Palmdale
Victorville
ara
Santa Clarita
xnard
Los Angeles
Riverside
Anaheim
Long Beach
Santa Ana
Cathedral City
Indio
Palm Desert
Murrieta
ceanside
100km
60mi
+
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762102 DMA - MOUNTAIN AREA REGIONAL TRANSIT AUTHORITY

		FT^2	AC	%	Description
EXISTING CONDITION	A_T=	154823	3.55	---	UNDEVELOPED NATIVE
	A_{PERV}=	154823	3.55	100.00%	
	A_{IMP}=	0	0.000	0.00%	
PROPOSED CONDITION	A_T=	154823	3.55	---	LANDSCAPE + ROOF + PCC + AC
	A_{PERV}=	33293	0.76	21.50%	
	A_{IMP}=	121530	2.79	78.50%	
DMA A	A_T=	31757	0.73	---	LANDSCAPE + ROOF + PCC + AC
	A_{PERV}=	8132	0.19	25.61%	
	A_{IMP}=	23625	0.54	74.39%	
DMA B	A_T=	73949	1.70	---	LANDSCAPE + ROOF + PCC + AC
	A_{PERV}=	8868	0.20	11.99%	
	A_{IMP}=	65081	1.49	88.01%	
DMA C	A_T=	49117	1.13	---	LANDSCAPE + ROOF + PCC + AC
	A_{PERV}=	16293	0.37	33.17%	
	A_{IMP}=	32824	0.75	66.83%	

UPSTREAM DETENTION BASIN VOLUME - DA1 DMA A

Bottom Basin Footprint (ft^2)	1304		Amended Soil Depth (ft)	0.0
Sloped Basin Footprint (ft^2)	404		Amended Soil Porosity	30%
Design Ponding Depth (ft)	0.5		Gravel Depth (ft)	4.0
			Gravel Porosity	40%

RESULTS

Design Capture Volume (ft^3)	=	2707
Total Detention Volume (ft^3)	=	2839
$V_{DETENTION} > V_{DCV}$???	=	YES

🟩	=	INPUT DATA
🟧	=	CALCULATED DATA

UPSTREAM DETENTION BASIN VOLUME - DA1 DMA B

Bottom Basin Footprint (ft^2)	2164		Amended Soil Depth (ft)	0.0
Sloped Basin Footprint (ft^2)	1098		Amended Soil Porosity	30%
Design Ponding Depth (ft)	0.5		Gravel Depth (ft)	4.0
			Gravel Porosity	40%

RESULTS

Design Capture Volume (ft^3)	=	8234
Total Detention Volume (ft^3)	=	4819
$V_{DETENTION} > V_{DCV}$???	=	NO

🟩	=	INPUT DATA
🟧	=	CALCULATED DATA

User Inputs

Chamber Model:	MC-3500
Outlet Control Structure:	Yes
Project Name:	0762102
Engineer:	Kent Walton Kent
Project Location:	California
Measurement Type:	Imperial
Required Storage Volume:	3415 cubic ft.
Stone Porosity:	40%
Stone Foundation Depth:	9 in.
Stone Above Chambers:	12 in.
Average Cover Over Chambers:	18 in.
Design Constraint Dimensions:	(60 ft. x 60 ft.)

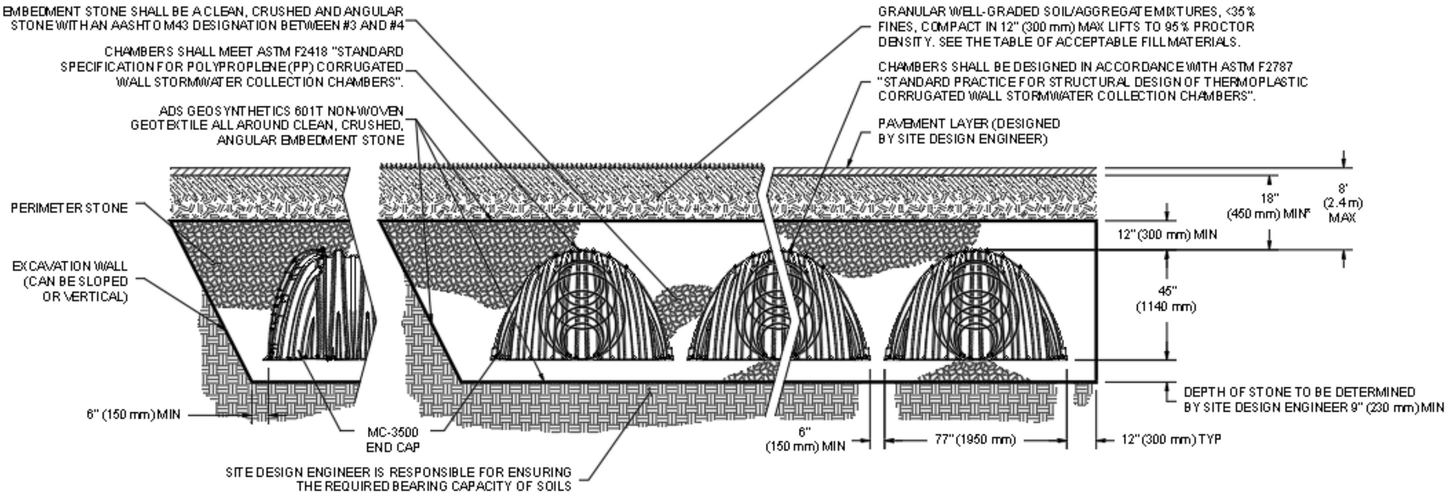
Results

System Volume and Bed Size

Installed Storage Volume:	3704.39 cubic ft.
Storage Volume Per Chamber:	109.90 cubic ft.
Number Of Chambers Required:	17
Number Of End Caps Required:	6
Chamber Rows:	3
Maximum Length:	52.68 ft.
Maximum Width:	22.85 ft.
Approx. Bed Size Required:	1149.90 square ft.

System Components

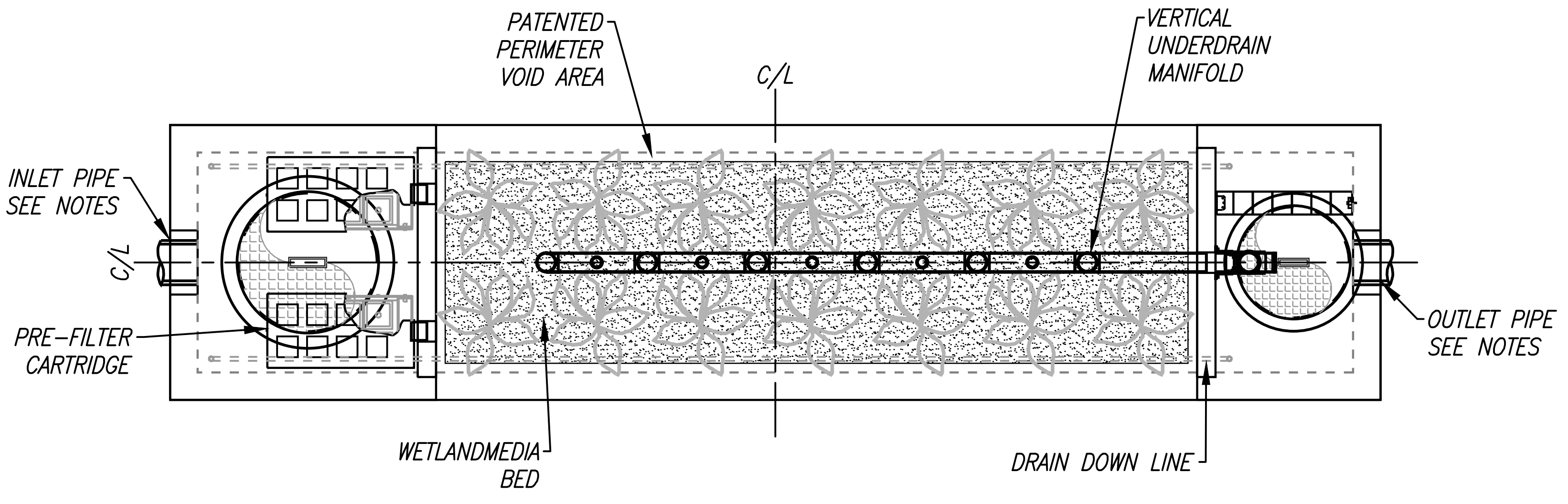
Amount Of Stone Required:	162 cubic yards
Volume Of Excavation (Not Including Fill):	235 cubic yards
Total Non-woven Geotextile Required:	418 square yards
Woven Geotextile Required (excluding Isolator Row):	34 square yards
Woven Geotextile Required (Isolator Row):	55 square yards
Total Woven Geotextile Required:	88 square yards
Impervious Liner Required:	0 square yards



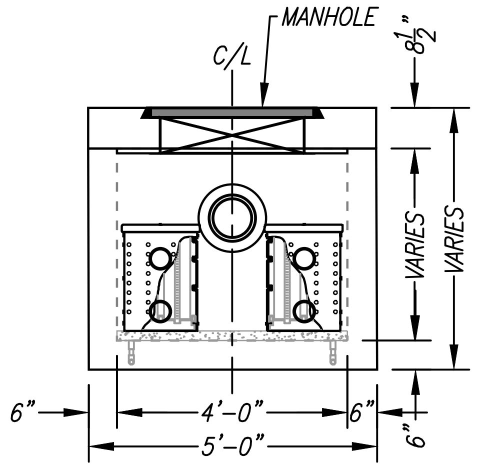
*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 24"

SITE SPECIFIC DATA			
PROJECT NUMBER			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
11709		N/A	
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			OFFLINE
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2	N/A	N/A	N/A
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PEDESTRIAN		
FRAME & COVER	ø30"	OPEN PLANTER	ø24"
NOTES:			

* PRELIMINARY NOT FOR CONSTRUCTION



PLAN VIEW



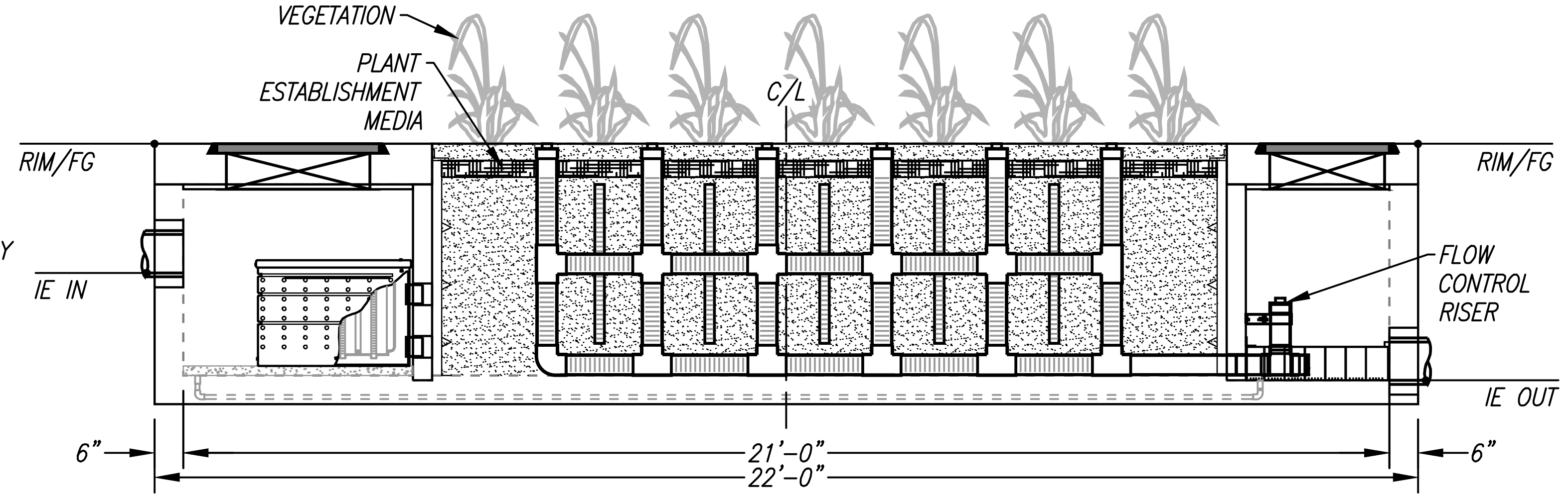
LEFT END VIEW

INSTALLATION NOTES

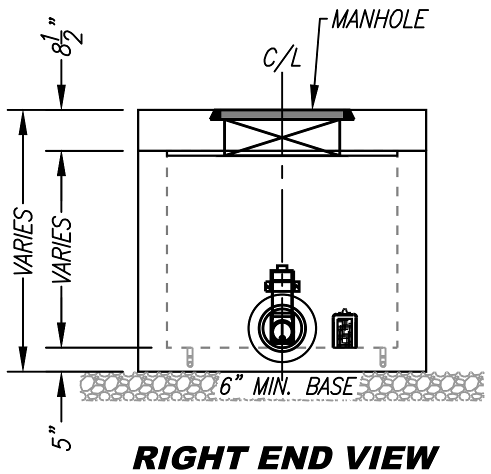
1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE. (PIPES CANNOT INTRUDE BEYOND FLUSH). INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH DISCHARGE CHAMBER FLOOR. ALL PIPES SHALL BE SEALED WATER TIGHT PER MANUFACTURERS STANDARD CONNECTION DETAIL.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. VEGETATION SUPPLIED AND INSTALLED BY OTHERS. ALL UNITS WITH VEGETATION MUST HAVE DRIP OR SPRAY IRRIGATION SUPPLIED AND INSTALLED BY OTHERS.
7. CONTRACTOR RESPONSIBLE FOR CONTACTING BIO CLEAN FOR ACTIVATION OF UNIT. MANUFACTURERS WARRANTY IS VOID WITH OUT PROPER ACTIVATION BY A BIO CLEAN REPRESENTATIVE.

GENERAL NOTES

1. MANUFACTURER TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS AND ACCESSORIES PLEASE CONTACT BIO CLEAN.



ELEVATION VIEW



RIGHT END VIEW

REQUIRED TREATMENT VOLUME (CF)	11709
DRAINDOWN DURATION (HOURS)	48
AVERAGE DISCHARGE RATE PER MWS UNIT(GPM)	26.17
OPERATING HEAD (FT)	3.4
WETLANDMEDIA INFILTRATION RATE (IN/HR)	26
WETLANDMEDIA LOADING RATE (GPM/SF)	0.26

MODULAR WETLANDS

THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING US PATENTS: 7,425,262; 7,470,362; 7,674,378; 8,303,816; RELATED FOREIGN PATENTS OR OTHER PATENTS PENDING

PROPRIETARY AND CONFIDENTIAL:

Bio Clean
A Forterra Company

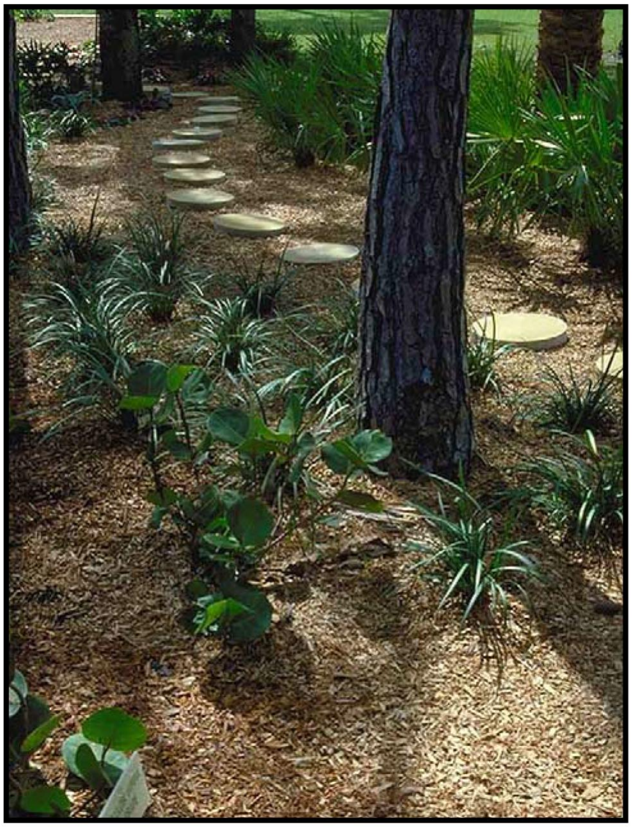
MWS-L-4-21-V
STORMWATER BIOFILTRATION SYSTEM
STANDARD DETAIL

5/23/19TOLFE

SECTION ‘6.3.B’

CASQA BMP Handbook

Site Design & Landscape Planning SD-10



Design Objectives

- ☑ Maximize Infiltration
- ☑ Provide Retention
- ☑ Slow Runoff
- ☑ Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Each project site possesses unique topographic, hydrologic, and vegetative features, some of which are more suitable for development than others. Integrating and incorporating appropriate landscape planning methodologies into the project design is the most effective action that can be done to minimize surface and groundwater contamination from stormwater.

Approach

Landscape planning should couple consideration of land suitability for urban uses with consideration of community goals and projected growth. Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment.

Design Considerations

Design requirements for site design and landscapes planning should conform to applicable standards and specifications of agencies with jurisdiction and be consistent with applicable General Plan and Local Area Plan policies.

CASQA
CALIFORNIA STORMWATER
QUALITY ASSOCIATION

Designing New Installations

Begin the development of a plan for the landscape unit with attention to the following general principles:

- Formulate the plan on the basis of clearly articulated community goals. Carefully identify conflicts and choices between retaining and protecting desired resources and community growth.

- Map and assess land suitability for urban uses. Include the following landscape features in the assessment: wooded land, open unwooded land, steep slopes, erosion-prone soils, foundation suitability, soil suitability for waste disposal, aquifers, aquifer recharge areas, wetlands, floodplains, surface waters, agricultural lands, and various categories of urban land use. When appropriate, the assessment can highlight outstanding local or regional resources that the community determines should be protected (e.g., a scenic area, recreational area, threatened species habitat, farmland, fish run). Mapping and assessment should recognize not only these resources but also additional areas needed for their sustenance.

Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Conserve Natural Areas during Landscape Planning

If applicable, the following items are required and must be implemented in the site layout during the subdivision design and approval process, consistent with applicable General Plan and Local Area Plan policies:

- Cluster development on least-sensitive portions of a site while leaving the remaining land in a natural undisturbed condition.

- Limit clearing and grading of native vegetation at a site to the minimum amount needed to build lots, allow access, and provide fire protection.

- Maximize trees and other vegetation at each site by planting additional vegetation, clustering tree areas, and promoting the use of native and/or drought tolerant plants.

- Promote natural vegetation by using parking lot islands and other landscaped areas.

- Preserve riparian areas and wetlands.

Maximize Natural Water Storage and Infiltration Opportunities Within the Landscape Unit

- Promote the conservation of forest cover. Building on land that is already deforested affects basin hydrology to a lesser extent than converting forested land. Loss of forest cover reduces interception storage, detention in the organic forest floor layer, and water losses by evapotranspiration, resulting in large peak runoff increases and either their negative effects or the expense of countering them with structural solutions.

- Maintain natural storage reservoirs and drainage corridors, including depressions, areas of permeable soils, swales, and intermittent streams. Develop and implement policies and regulations to discourage the clearing, filling, and channelization of these features. Utilize them in drainage networks in preference to pipes, culverts, and engineered ditches.

- Evaluating infiltration opportunities by referring to the stormwater management manual for the jurisdiction and pay particular attention to the selection criteria for avoiding groundwater contamination, poor soils, and hydrogeological conditions that cause these facilities to fail. If necessary, locate developments with large amounts of impervious surfaces or a potential to produce relatively contaminated runoff away from groundwater recharge areas.

Protection of Slopes and Channels during Landscape Design

- Convey runoff safely from the tops of slopes.
- Avoid disturbing steep or unstable slopes.
- Avoid disturbing natural channels.
- Stabilize disturbed slopes as quickly as possible.
- Vegetate slopes with native or drought tolerant vegetation.
- Control and treat flows in landscaping and/or other controls prior to reaching existing natural drainage systems.
- Stabilize temporary and permanent channel crossings as quickly as possible, and ensure that increases in run-off velocity and frequency caused by the project do not erode the channel.
- Install energy dissipaters, such as riprap, at the outlets of new storm drains, culverts, conduits, or channels that enter unlined channels in accordance with applicable specifications to minimize erosion. Energy dissipaters shall be installed in such a way as to minimize impacts to receiving waters.
- Line on-site conveyance channels where appropriate, to reduce erosion caused by increased flow velocity due to increases in tributary impervious area. The first choice for linings should be grass or some other vegetative surface, since these materials not only reduce runoff velocities, but also provide water quality benefits from filtration and infiltration. If velocities in the channel are high enough to erode grass or other vegetative linings, riprap, concrete, soil cement, or geo-grid stabilization are other alternatives.
- Consider other design principles that are comparable and equally effective.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define “redevelopment” in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of “ redevelopment” must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under “designing new installations” above should be followed.

Redevelopment may present significant opportunity to add features which had not previously been implemented. Examples include incorporation of depressions, areas of permeable soils, and swales in newly redeveloped areas. While some site constraints may exist due to the status of already existing infrastructure, opportunities should not be missed to maximize infiltration, slow runoff, reduce impervious areas, disconnect directly connected impervious areas.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Stormwater Management Manual for Western Washington, Washington State Department of Ecology, August 2001.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Roof Runoff Controls SD-11

Rain Garden

Design Objectives

☑ Maximize Infiltration

☑ Provide Retention

☑ Slow Runoff

Minimize Impervious Land Coverage

Prohibit Dumping of Improper Materials

☑ Contain Pollutants

Collect and Convey

Description

Various roof runoff controls are available to address stormwater that drains off rooftops. The objective is to reduce the total volume and rate of runoff from individual lots, and retain the pollutants on site that may be picked up from roofing materials and atmospheric deposition. Roof runoff controls consist of directing the roof runoff away from paved areas and mitigating flow to the storm drain system through one of several general approaches: cisterns or rain barrels; dry wells or infiltration trenches; pop-up emitters, and foundation planting. The first three approaches require the roof runoff to be contained in a gutter and downspout system. Foundation planting provides a vegetated strip under the drip line of the roof.

Approach

Design of individual lots for single-family homes as well as lots for higher density residential and commercial structures should consider site design provisions for containing and infiltrating roof runoff or directing roof runoff to vegetative swales or buffer areas. Retained water can be reused for watering gardens, lawns, and trees. Benefits to the environment include reduced demand for potable water used for irrigation, improved stormwater quality, increased groundwater recharge, decreased runoff volume and peak flows, and decreased flooding potential.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment.

Design Considerations

Designing New Installations

Cisterns or Rain Barrels

One method of addressing roof runoff is to direct roof downspouts to cisterns or rain barrels. A cistern is an above ground storage vessel with either a manually operated valve or a permanently open outlet. Roof runoff is temporarily stored and then released for irrigation or infiltration between storms. The number of rain barrels needed is a function of the rooftop area. Some low impact developers recommend that every house have at least 2 rain barrels, with a minimum storage capacity of 1000 liters. Roof barrels serve several purposes including mitigating the first flush from the roof which has a high volume, amount of contaminants, and thermal load. Several types of rain barrels are commercially available. Consideration must be given to selecting rain barrels that are vector proof and childproof. In addition, some barrels are designed with a bypass valve that filters out grit and other contaminants and routes overflow to a soak-away pit or rain garden.

If the cistern has an operable valve, the valve can be closed to store stormwater for irrigation or infiltration between storms. This system requires continual monitoring by the resident or grounds crews, but provides greater flexibility in water storage and metering. If a cistern is provided with an operable valve and water is stored inside for long periods, the cistern must be covered to prevent mosquitoes from breeding.

A cistern system with a permanently open outlet can also provide for metering stormwater runoff. If the cistern outlet is significantly smaller than the size of the downspout inlet (say ¼ to ½ inch diameter), runoff will build up inside the cistern during storms, and will empty out slowly after peak intensities subside. This is a feasible way to mitigate the peak flow increases caused by rooftop impervious land coverage, especially for the frequent, small storms.

Dry wells and Infiltration Trenches

Roof downspouts can be directed to dry wells or infiltration trenches. A dry well is constructed by excavating a hole in the ground and filling it with an open graded aggregate, and allowing the water to fill the dry well and infiltrate after the storm event. An underground connection from the downspout conveys water into the dry well, allowing it to be stored in the voids. To minimize sedimentation from lateral soil movement, the sides and top of the stone storage matrix can be wrapped in a permeable filter fabric, though the bottom may remain open. A perforated observation pipe can be inserted vertically into the dry well to allow for inspection and maintenance.

In practice, dry wells receiving runoff from single roof downspouts have been successful over long periods because they contain very little sediment. They must be sized according to the amount of rooftop runoff received, but are typically 4 to 5 feet square, and 2 to 3 feet deep, with a minimum of 1-foot soil cover over the top (maximum depth of 10 feet).

To protect the foundation, dry wells must be set away from the building at least 10 feet. They must be installed in solids that accommodate infiltration. In poorly drained soils, dry wells have very limited feasibility.

Infiltration trenches function in a similar manner and would be particularly effective for larger roof areas. An infiltration trench is a long, narrow, rock-filled trench with no outlet that receives stormwater runoff. These are described under Treatment Controls.

Pop-up Drainage Emitter

Roof downspouts can be directed to an underground pipe that daylights some distance from the building foundation, releasing the roof runoff through a pop-up emitter. Similar to a pop-up irrigation head, the emitter only opens when there is flow from the roof. The emitter remains flush to the ground during dry periods, for ease of lawn or landscape maintenance.

Foundation Planting

Landscape planting can be provided around the base to allow increased opportunities for stormwater infiltration and protect the soil from erosion caused by concentrated sheet flow coming off the roof. Foundation plantings can reduce the physical impact of water on the soil and provide a subsurface matrix of roots that encourage infiltration. These plantings must be sturdy enough to tolerate the heavy runoff sheet flows, and periodic soil saturation.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Supplemental Information

Examples

- City of Ottawa's Water Links Surface –Water Quality Protection Program
- City of Toronto Downspout Disconnection Program
- City of Boston, MA, Rain Barrel Demonstration Program

Other Resources

Hager, Marty Catherine, Stormwater, "Low-Impact Development", January/February 2003. www.stormh2o.com

Low Impact Urban Design Tools, Low Impact Development Design Center, Beltsville, MD. www.lid-stormwater.net

Start at the Source, Bay Area Stormwater Management Agencies Association, 1999 Edition

Efficient Irrigation SD-12

Design Objectives

- ☑ Maximize Infiltration
- ☑ Provide Retention
- ☑ Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Irrigation water provided to landscaped areas may result in excess irrigation water being conveyed into stormwater drainage systems.

Approach

Project plan designs for development and redevelopment should include application methods of irrigation water that minimize runoff of excess irrigation water into the stormwater conveyance system.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

Design Considerations

Designing New Installations

The following methods to reduce excessive irrigation runoff should be considered, and incorporated and implemented where determined applicable and feasible by the Permittee:

- Employ rain-triggered shutoff devices to prevent irrigation after precipitation.

- Design irrigation systems to each landscape area's specific water requirements.

- Include design featuring flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines.

- Implement landscape plans consistent with County or City water conservation resolutions, which may include provision of water sensors, programmable irrigation times (for short cycles), etc.

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- Design timing and application methods of irrigation water to minimize the runoff of excess irrigation water into the storm water drainage system.

- Group plants with similar water requirements in order to reduce excess irrigation runoff and promote surface filtration. Choose plants with low irrigation requirements (for example, native or drought tolerant species). Consider design features such as:

  - Using mulches (such as wood chips or bar) in planter areas without ground cover to minimize sediment in runoff

  - Installing appropriate plant materials for the location, in accordance with amount of sunlight and climate, and use native plant materials where possible and/or as recommended by the landscape architect

  - Leaving a vegetative barrier along the property boundary and interior watercourses, to act as a pollutant filter, where appropriate and feasible

  - Choosing plants that minimize or eliminate the use of fertilizer or pesticides to sustain growth

- Employ other comparable, equally effective methods to reduce irrigation water runoff.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Storm Drain Signage SD-13

Design Objectives

☐ Maximize Infiltration

☐ Provide Retention

☐ Slow Runoff

☐ Minimize Impervious Land Coverage

☑ Prohibit Dumping of Improper Materials

☐ Contain Pollutants

☐ Collect and Convey

Description

Waste materials dumped into storm drain inlets can have severe impacts on receiving and ground waters. Posting notices regarding discharge prohibitions at storm drain inlets can prevent waste dumping. Storm drain signs and stencils are highly visible source controls that are typically placed directly adjacent to storm drain inlets.

Approach

The stencil or affixed sign contains a brief statement that prohibits dumping of improper materials into the urban runoff conveyance system. Storm drain messages have become a popular method of alerting the public about the effects of and the prohibitions against waste disposal.

Suitable Applications

Stencils and signs alert the public to the destination of pollutants discharged to the storm drain. Signs are appropriate in residential, commercial, and industrial areas, as well as any other area where contributions or dumping to storm drains is likely.

Design Considerations

Storm drain message markers or placards are recommended at all storm drain inlets within the boundary of a development project. The marker should be placed in clear sight facing toward anyone approaching the inlet from either side. All storm drain inlet locations should be identified on the development site map.

Designing New Installations

The following methods should be considered for inclusion in the project design and show on project plans:

- Provide stenciling or labeling of all storm drain inlets and catch basins, constructed or modified, within the project area with prohibitive language. Examples include "NO DUMPING

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– DRAINS TO OCEAN" and/or other graphical icons to discourage illegal dumping.

- Post signs with prohibitive language and/or graphical icons, which prohibit illegal dumping at public access points along channels and creeks within the project area.

Note - Some local agencies have approved specific signage and/or storm drain message placards for use. Consult local agency stormwater staff to determine specific requirements for placard types and methods of application.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. If the project meets the definition of "redevelopment", then the requirements stated under " designing new installations" above should be included in all project design plans.

Additional Information

Maintenance Considerations

- Legibility of markers and signs should be maintained. If required by the agency with jurisdiction over the project, the owner/operator or homeowner's association should enter into a maintenance agreement with the agency or record a deed restriction upon the property title to maintain the legibility of placards or signs.

Placement

- Signage on top of curbs tends to weather and fade.

- Signage on face of curbs tends to be worn by contact with vehicle tires and sweeper brooms.

Supplemental Information

Examples

- Most MS4 programs have storm drain signage programs. Some MS4 programs will provide stencils, or arrange for volunteers to stencil storm drains as part of their outreach program.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Trash Storage Areas SD-32

Description

Trash storage areas are areas where a trash receptacle (s) are located for use as a repository for solid wastes. Stormwater runoff from areas where trash is stored or disposed of can be polluted. In addition, loose trash and debris can be easily transported by water or wind into nearby storm drain inlets, channels, and/or creeks. Waste handling operations that may be sources of stormwater pollution include dumpsters, litter control, and waste piles.

Approach

This fact sheet contains details on the specific measures required to prevent or reduce pollutants in stormwater runoff associated with trash storage and handling. Preventative measures including enclosures, containment structures, and impervious pavements to mitigate spills, should be used to reduce the likelihood of contamination.

Design Objectives

Maximize Infiltration
Provide Retention
Slow Runoff
Minimize Impervious Land Coverage
Prohibit Dumping of Improper Materials
☑ Contain Pollutants
Collect and Convey

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

Design Considerations

Design requirements for waste handling areas are governed by Building and Fire Codes, and by current local agency ordinances and zoning requirements. The design criteria described in this fact sheet are meant to enhance and be consistent with these code and ordinance requirements. Hazardous waste should be handled in accordance with legal requirements established in Title 22, California Code of Regulation.

Wastes from commercial and industrial sites are typically hauled by either public or commercial carriers that may have design or access requirements for waste storage areas. The design criteria in this fact sheet are recommendations and are not intended to be in conflict with requirements established by the waste hauler. The waste hauler should be contacted prior to the design of your site trash collection areas. Conflicts or issues should be discussed with the local agency.

Designing New Installations

Trash storage areas should be designed to consider the following structural or treatment control BMPs:

- Design trash container areas so that drainage from adjoining roofs and pavement is diverted around the area(s) to avoid run-on. This might include berming or grading the waste handling area to prevent run-on of stormwater.

- Make sure trash container areas are screened or walled to prevent off-site transport of trash.

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- Use lined bins or dumpsters to reduce leaking of liquid waste.
- Provide roofs, awnings, or attached lids on all trash containers to minimize direct precipitation and prevent rainfall from entering containers.
- Pave trash storage areas with an impervious surface to mitigate spills.
- Do not locate storm drains in immediate vicinity of the trash storage area.
- Post signs on all dumpsters informing users that hazardous materials are not to be disposed of therein.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Additional Information

Maintenance Considerations

The integrity of structural elements that are subject to damage (i.e., screens, covers, and signs) must be maintained by the owner/operator. Maintenance agreements between the local agency and the owner/operator may be required. Some agencies will require maintenance deed restrictions to be recorded of the property title. If required by the local agency, maintenance agreements or deed restrictions must be executed by the owner/operator before improvement plans are approved.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Drain Inserts MP-52

Description

Drain inserts are manufactured filters or fabric placed in a drop inlet to remove sediment and debris. There are a multitude of inserts of various shapes and configurations, typically falling into one of three different groups: socks, boxes, and trays. The sock consists of a fabric, usually constructed of polypropylene. The fabric may be attached to a frame or the grate of the inlet holds the sock. Socks are meant for vertical (drop) inlets. Boxes are constructed of plastic or wire mesh. Typically a polypropylene "bag" is placed in the wire mesh box. The bag takes the form of the box. Most box products are one box; that is, the setting area and filtration through media occur in the same box. Some products consist of one or more trays or mesh grates. The trays may hold different types of media. Filtration media vary by manufacturer. Types include polypropylene, porous polymer, treated cellulose, and activated carbon.

California Experience

The number of installations is unknown but likely exceeds a thousand. Some users have reported that these systems require considerable maintenance to prevent plugging and bypass.

Advantages

- Does not require additional space as inserts as the drain inlets are already a component of the standard drainage systems.
- Easy access for inspection and maintenance.
- As there is no standing water, there is little concern for mosquito breeding.
- A relatively inexpensive retrofit option.

Limitations

Performance is likely significantly less than treatment systems that are located at the end of the drainage system such as ponds and vaults. Usually not suitable for large areas or areas with trash or leaves than can plug the insert.

Design and Sizing Guidelines

Refer to manufacturer's guidelines. Drain inserts come any many configurations but can be placed into three general groups: socks, boxes, and trays. The sock consists of a fabric, usually constructed of polypropylene. The fabric may be attached to a frame or the grate of the inlet holds the sock. Socks are meant for vertical (drop) inlets. Boxes are constructed of plastic or wire mesh. Typically a polypropylene "bag" is placed in the wire mesh box. The bag takes the form of the box. Most box products are

Design Considerations

- Use with other BMPs
- Fit and Seal Capacity within Inlet

Targeted Constituents

☑ Sediment
☑ Nutrients
☑ Trash
☑ Metals
Bacteria
☑ Oil and Grease
☑ Organics

Removal Effectiveness

See New Development and Redevelopment Handbook-Section 5.

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one box; that is, the setting area and filtration through media occurs in the same box. One manufacturer has a double-box. Stormwater enters the first box where setting occurs. The stormwater flows into the second box where the filter media is located. Some products consist of one or more trays or mesh grates. The trays can hold different types of media. Filtration media vary with the manufacturer: types include polypropylene, porous polymer, treated cellulose, and activated carbon.

Construction/Inspection Considerations

Be certain that installation is done in a manner that makes certain that the stormwater enters the unit and does not leak around the perimeter. Leakage between the frame of the insert and the frame of the drain inlet can easily occur with vertical (drop) inlets.

Performance

Few products have performance data collected under field conditions.

Siting Criteria

It is recommended that inserts be used only for retrofit situations or as pretreatment where other treatment BMPs presented in this section area used.

Additional Design Guidelines

Follow guidelines provided by individual manufacturers.

Maintenance

Likely require frequent maintenance, on the order of several times per year.

Cost

- The initial cost of individual inserts ranges from less than $100 to about $2,000. The cost of using multiple units in curb inlet drains varies with the size of the inlet.

- The low cost of inserts may tend to favor the use of these systems over other, more effective treatment BMPs. However, the low cost of each unit may be offset by the number of units that are required, more frequent maintenance, and the shorter structural life (and therefore replacement).

References and Sources of Additional Information

Hrachovec, R., and G. Minton, 2001, Field testing of a sock-type catch basin insert, Planet CPR, Seattle, Washington

Interagency Catch Basin Insert Committee, Evaluation of Commercially-Available Catch Basin Inserts for the Treatment of Stormwater Runoff from Developed Sites, 1995

Larry Walker Associates, June 1998, NDMP Inlet/In-Line Control Measure Study Report

Manufacturers literature

Santa Monica (City), Santa Monica Bay Municipal Stormwater/Urban Runoff Project - Evaluation of Potential Catch basin Retrofits, Woodward Clyde, September 24, 1998

Woodward Clyde, June 11, 1996, Parking Lot Monitoring Report, Santa Clara Valley Nonpoint Source Pollution Control Program.

Non-Stormwater Discharges SC-10

Description

Non-stormwater discharges (NSWDs) are flows that do not consist entirely of stormwater. Some non-stormwater discharges do not include pollutants and may be discharged to the storm drain if local regulations allow. These include uncontaminated groundwater and natural springs. There are also some non-stormwater discharges that typically do not contain pollutants and may be discharged to the storm drain with conditions. These include: potable water sources, fire hydrant flushing, air conditioner condensate, landscape irrigation drainage and landscape watering, emergency firefighting, etc. as discussed in Section 2.

However there are certain non-stormwater discharges that pose an environmental concern. These discharges may originate from illegal dumping of industrial material or wastes and illegal connections such as internal floor drains, appliances, industrial processes, sinks, and toilets that are illegally connected to the nearby storm drainage system through on-site drainage and piping. These unauthorized discharges (examples of which may include: process waste waters, cooling waters, wash waters, and sanitary wastewater) can carry substances such as paint, oil, fuel and other automotive fluids, chemicals and other pollutants into storm drains.

Non-stormwater discharges will need to be addressed through a combination of detection and elimination. The ultimate goal is to effectively eliminate unauthorized non-stormwater discharges to the stormwater drainage system through implementation of measures to detect, correct, and enforce against illicit connections and illegal discharges of

Objectives

- *Cover*
- *Contain*
- *Educate*
- *Reduce/Minimize*
- *Product Substitution*

Targeted Constituents

Sediment	
Nutrients	✓
Trash	
Metals	✓
Bacteria	✓
Oil and Grease	✓
Organics	✓

Minimum BMPs Covered

Good Housekeeping	✓
Preventative Maintenance	
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	
Erosion and Sediment Controls	
Employee Training Program	✓
Quality Assurance Record Keeping	✓

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pollutants on streets and into the storm drain system and downstream water bodies.

Approach

Initially the Discharger must make an assessment of non-stormwater discharges to determine which types must be eliminated or addressed through BMPs. The focus of the following approach is the elimination of unauthorized non-stormwater discharges. See other BMP Fact Sheets for activity-specific pollution prevention procedures.

General Pollution Prevention Protocols

☐ Implement waste management controls described in SC-34 Waste Handling and Disposal.

☐ Develop clear protocols and lines of communication for effectively prohibiting non-stormwater discharges, especially those that are not classified as hazardous. These are often not responded to as effectively as they need to be.

☐ Stencil or demarcate storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as "Dump No Waste Drains to Stream" or similar stenciled or demarcated next to them to warn against ignorant or unintentional dumping of pollutants into the storm drainage system.

☐ Manage and control sources of water such as hose bibs, faucets, wash racks, irrigation heads, etc. Identify hoses and faucets in the SWPPP, and post signage for appropriate use.

Non-Stormwater Discharge Investigation Protocols

Identifying the sources of non-stormwater discharges requires the Discharger to conduct an investigation of the facility at regular intervals. There are several categories of non-stormwater discharges:

☐ Visible, easily identifiable discharges, typically generated as surface runoff, such as uncontained surface runoff from vehicle or equipment washing; and

☐ Non-visible, (e.g., subsurface) discharges into the site drainage system through a variety of pathways that are not obvious.

The approach to detecting and eliminating non-stormwater discharges will vary considerably, as discussed below:

Visible and identifiable discharges

☐ Conduct routine inspections of the facilities and of each major activity area and identify visible evidence of unauthorized non-stormwater discharges. This may include:

  - ✓ Visual observations of actual discharges occurring;

  - ✓ Evidence of surface staining, discoloring etc. that indicates that discharges have occurred;
  - ✓ Pools of water in low lying areas when a rain event has not occurred; and
  - ✓ Discussions with operations personnel to understand practices that may lead to unauthorized discharges.

- ☐ If evidence of non-stormwater discharges is discovered:
  - ✓ Document the location and circumstances using Worksheets 5 and 6 (Section 2 of the manual), including digital photos;
  - ✓ Identify and implement any quick remedy or corrective action (e.g., moving uncovered containers inside or to a proper location); and
  - ✓ Develop a plan to eliminate the discharge. Consult the appropriate activity-specific BMP Fact Sheet for alternative approaches to manage and eliminate the discharge.
- ☐ Consult the appropriate activity-specific BMP Fact Sheet for alternative approaches to manage and eliminate the discharge. Make sure the facility SWPPP is up-to-date and includes applicable BMPs to address the non-stormwater discharge.

Other Illegal Discharges (Non visible)

Illicit Connections

- ☐ Locate discharges from the industrial storm drainage system to the municipal storm drain system through review of "as-built" piping schematics.
- ☐ Isolate problem areas and plug illicit discharge points.
- ☐ Locate and evaluate discharges to the storm drain system.
- ☐ Visual Inspection and Inventory:
  - ✓ Inventory and inspect each discharge point during dry weather.
  - ✓ Keep in mind that drainage from a storm event can continue for a day or two following the end of a storm and groundwater may infiltrate the underground stormwater collection system.
  - ✓ Non-stormwater discharges are often intermittent and may require periodic inspections.

Review Infield Piping

- ☐ A review of the "as-built" piping schematic is a way to determine if there are any connections to the stormwater collection system.

☐ Inspect the path of loading/unloading area drain inlets and floor drains in older buildings.

☐ Never assume storm drains are connected to the sanitary sewer system.

Monitoring for investigation/detection of illegal discharges

☐ If a suspected illegal or unknown discharge is detected, monitoring of the discharge may help identify the content and/or suggest the source. This may be done with a field screening analysis, flow meter measurements, or by collecting a sample for laboratory analysis. Section 5 and Appendix D describe the necessary field equipment and procedures for field investigations.

☐ Investigative monitoring may be conducted over time. For example if, a discharge is intermittent, then monitoring might be conducted to determine the timing of the discharge to determine the source.

☐ Investigative monitoring may be conducted over a spatial area. For example, if a discharge is observed in a pipe, then monitoring might be conducted at accessible upstream locations in order to pinpoint the source of the discharge.

☐ Generally, investigative monitoring requiring collection of samples and submittal for lab analysis requires proper planning and specially trained staff.

Smoke Testing

Smoke testing of wastewater and stormwater collection systems is used to detect connections between the two piping systems. Smoke testing is generally performed at a downstream location and the smoke is forced upstream using blowers to create positive pressure. The advantage to smoke testing is that it can potentially identify multiple potential discharge sources at once.

☐ Smoke testing uses a harmless, non-toxic smoke cartridges developed specifically for this purpose.

☐ Smoke testing requires specialized equipment (e.g., cartridges, blowers) and is generally only appropriate for specially trained staff.

☐ A Standard Operating Procedure (SOP) for smoke testing is highly desirable. The SOP should address the following elements:

    ✓ Proper planning and notification of nearby residents and emergency services is necessary since introducing smoke into the system may result in false alarms;

    ✓ During dry weather, the stormwater collection system is filled with smoke and then traced back to sources;

  - ✓ Temporary isolation of segments of pipe using sand bags is often needed to force the smoke into leaking pipes; and

  - ✓ The appearance of smoke in a waste vent pipe, at a sewer manhole, or even the base of a toilet indicates that there may be a connection between the sanitary and storm water systems.

☐ Most municipal wastewater agencies will have necessary staff and equipment to conduct smoke testing and they should be contacted if cross connections with the sanitary sewer are suspected. See SC-44 Drainage System Maintenance for more information.

Dye Testing

☐ Dye testing is typically performed when there is a suspected specific pollutant source and location (i.e., leaking sanitary sewer) and there is evidence of dry weather flows in the stormwater collection system.

☐ Dye is released at a probable upstream source location, either the facility's sanitary or process wastewater system. The dye must be released with a sufficient volume of water to flush the system.

☐ Operators then visually examine the downstream discharge points from the stormwater collection system for the presence of the dye.

☐ Dye testing can be performed informally using commercially available products in order to conduct an initial investigation for fairly obvious cross-connections.

☐ More detailed dye testing should be performed by properly trained staff and follow SOPs. Specialized equipment such as fluorometers may be necessary to detect low concentrations of dye.

☐ Most municipal wastewater agencies will have necessary staff and equipment to conduct dye testing and they should be contacted if cross connections with the sanitary sewer are suspected.

TV Inspection of Drainage System

☐ Closed Circuit Television (CCTV) can be employed to visually identify illicit connections to the industrial storm drainage system. Two types of CCTV systems are available: (1) a small specially designed camera that can be manually pushed on a stiff cable through storm drains to observe the interior of the piping, or (2) a larger remote operated video camera on treads or wheels that can be guided through storm drains to view the interior of the pipe.

☐ CCTV systems often include a high-pressure water jet and camera on a flexible cable. The water jet cleans debris and biofilm off the inside of pipes so the camera can take video images of the pipe condition.

☐ CCTV units can detect large cracks and other defects such as offsets in pipe ends caused by root intrusions or shifting substrate.

☐ CCTV can also be used to detect dye introduced into the sanitary sewer.

☐ CCTV inspections require specialized equipment and properly trained staff and are generally best left to specialized contractors or municipal public works staff.

Illegal Dumping

☐ Substances illegally dumped on streets and into the storm drain systems and creeks may include paints, used oil and other automotive fluids, construction debris, chemicals, fresh concrete, leaves, grass clippings, and pet wastes. These wastes can cause stormwater and receiving water quality problems as well as clog the storm drain system itself.

☐ Establish a system for tracking incidents. The system should be designed to identify the following:

  ✓ Illegal dumping hot spots;

  ✓ Types and quantities (in some cases) of wastes;

  ✓ Patterns in time of occurrence (time of day/night, month, or year);

  ✓ Mode of dumping (abandoned containers, “midnight dumping” from moving vehicles, direct dumping of materials, accidents/spills);

  ✓ An anonymous tip/reporting mechanism; and

  ✓ Evidence of responsible parties (e.g., tagging, encampments, etc.).

☐ One of the keys to success of reducing or eliminating illegal dumping is increasing the number of people at the facility who are aware of the problem and who have the tools to at least identify the incident, if not correct it. Therefore, train field staff to recognize and report the incidents.

Once a site has been cleaned:

☐ Post “No Dumping” signs with a phone number for reporting dumping and disposal.

☐ Landscaping and beautification efforts of hot spots may also discourage future dumping, as well as provide open space and increase property values.

☐ Lighting or barriers may also be needed to discourage future dumping.

☐ See fact sheet SC-11 Spill Prevention, Control, and Cleanup.

Inspection

☐ Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.

☐ Conduct field investigations of the industrial storm drain system for potential sources of non-stormwater discharges.

☐ Pro-actively conduct investigations of high priority areas. Based on historical data, prioritize specific geographic areas and/or incident type for pro-active investigations.

Spill and Leak Prevention and Response

☐ On paved surfaces, clean up spills with as little water as possible. Use a rag for small spills, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to a certified laundry (rags) or disposed of as hazardous waste.

☐ Never hose down or bury dry material spills. Sweep up the material and dispose of properly.

☐ Use adsorbent materials on small spills rather than hosing down the spill. Remove the adsorbent materials promptly and dispose of properly.

☐ For larger spills, a private spill cleanup company or Hazmat team may be necessary.

☐ See SC-11 Spill Prevention Control and Cleanup.

Employee Training Program

☐ Training of technical staff in identifying and documenting illegal dumping incidents is required. The frequency of training must be presented in the SWPPP, and depends on site-specific industrial materials and activities.

☐ Consider posting a quick reference table near storm drains to reinforce training.

☐ Train employees to identify non-stormwater discharges and report discharges to the appropriate departments.

☐ Educate employees about spill prevention and cleanup.

☐ Well-trained employees can reduce human errors that lead to accidental releases or spills. The employee should have the tools and knowledge to immediately begin cleaning up a spill should one occur. Employees should be familiar with the Spill Prevention Control and Countermeasure Plan. Employees should be able to identify work/jobs with high potential for spills and suggest methods to reduce possibility.

☐ Determine and implement appropriate outreach efforts to reduce non-permissible non-stormwater discharges.

☐ Conduct spill response drills annually (if no events occurred) in order to evaluate the effectiveness of the plan.

☐ When a responsible party is identified, educate the party on the impacts of his or her actions.

Quality Assurance and Record Keeping

Performance Evaluation

☐ Annually review internal investigation results; assess whether goals were met and what changes or improvements are necessary.

☐ Obtain feedback from personnel assigned to respond to, or inspect for, illicit connections and illegal dumping incidents.

☐ Develop document and data management procedures.

☐ A database is useful for defining and tracking the magnitude and location of the problem.

☐ Report prohibited non-stormwater discharges observed during the course of normal daily activities so they can be investigated, contained, and cleaned up or eliminated.

☐ Document that non-stormwater discharges have been eliminated by recording tests performed, methods used, dates of testing, and any on-site drainage points observed.

☐ Annually document and report the results of the program.

☐ Maintain documentation of illicit connection and illegal dumping incidents, including significant conditionally exempt discharges that are not properly managed.

☐ Document training activities.

Potential Limitations and Work-Arounds

Some facilities may have space constraints, limited staffing and time limitations that may preclude implementation of BMPs. Provided below are typical limitations and recommended "work-arounds."

☐ Many facilities do not have accurate, up-to-date 'as-built' plans or drawings which may be necessary in order to conduct non-stormwater discharge assessments.

    ✓ Online tools such as Google Earth™ can provide an aerial view of the facility and may be useful in understanding drainage patterns and potential sources of non-stormwater discharges

    ✓ Local municipal jurisdictions may have useful drainage systems maps.

- Video surveillance cameras are commonly used to secure the perimeter of industrial facilities against break-ins and theft. These surveillance systems may also be useful for capturing illegal dumping activities. Minor, temporary adjustments to the field of view of existing surveillance camera systems to target known or suspected problem areas may be a cost-effective way of capturing illegal dumping activities and identifying the perpetrators.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

- Capital facility cost requirements may be minimal unless cross-connections to storm drains are detected.

- Indoor floor drains may require re-plumbing if cross-connections are detected.

- Leaky sanitary sewers will require repair or replacement which can have significant costs depending on the size and industrial activity at the facility.

Maintenance (including administrative and staffing)

- The primary effort is for staff time and depends on how aggressively a program is implemented.

- Costs for containment, and disposal of any leak or discharge is borne by the Discharger.

- Illicit connections can be difficult to locate especially if there is groundwater infiltration.

- Illegal dumping and illicit connection violations requires technical staff to detect and investigate them.

Supplemental Information

Permit Requirements

The IGP authorizes certain Non-Storm Water Discharges (NSWDs) provided BMPs are included in the SWPPP and implemented to:

- Reduce or prevent the contact of authorized NSWDs with materials or equipment that are potential sources of pollutants;

- Reduce, to the extent practicable, the flow or volume of authorized NSWDs;

- Ensure that authorized NSWDs do not contain quantities of pollutants that cause or contribute to an exceedance of a water quality standards (WQS); and,

☐ Reduce or prevent discharges of pollutants in authorized NSWDs in a manner that reflects best industry practice considering technological availability and economic practicability and achievability."

References and Resources

Center for Watershed Protection, 2004. *Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessments*, EPA Cooperative Agreement X-82907801-0.

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Santa Clara Valley Urban Runoff Pollution Prevention Program. http://www.scvurppp.org.

Southern California Coastal Water Research Project, 2013. *The California Microbial Source Identification Manual: A Tiered Approach to Identifying Fecal Pollution Sources to Beaches,* Technical Report 804.

The Storm Water Managers Resource Center, http://www.stormwatercenter.net/.

US EPA. National Pollutant Discharge Elimination System. Available online at: http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=factsheet_results&view=specific&bmp=111.

WEF Press Alexandria, Virginia, 2009.Existing Sewer Evaluation and Rehabilitation: *WEF Manual of Practice No. FD-6 ASCE/EWRI Manuals and Reports on Engineering Practice No. 62, Third Edition.*

Spill Prevention, Control & Cleanup SC-11

Description

Many activities that occur at an industrial or commercial site have the potential to cause accidental spills. Preparation for accidental spills, with proper training and reporting systems implemented, can minimize the discharge of pollutants to the environment.

Spills and leaks are one of the largest contributors of stormwater pollutants. Spill prevention and control plans are applicable to any site at which hazardous materials are stored or used. An effective plan should have spill prevention and response procedures that identify hazardous material storage areas, specify material handling procedures, describe spill response procedures, and provide locations of spill clean-up equipment and materials. The plan should take steps to identify and characterize potential spills, eliminate and reduce spill potential, respond to spills when they occur in an effort to prevent pollutants from entering the stormwater drainage system, and train personnel to prevent and control future spills. An adequate supply of spill clean-up materials must be maintained onsite.

Approach

General Pollution Prevention Protocols

- ☐ Develop procedures to prevent/mitigate spills to storm drain systems.
- ☐ Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures.
- ☐ Establish procedures and/or controls to minimize spills and leaks. The procedures should address:
  - ✓ Description of the facility, owner and address, activities, chemicals, and quantities present;

Objectives

- ■ *Cover*
- ■ *Contain*
- ■ *Educate*
- ■ *Reduce/Minimize*
- ■ *Product Substitution*

Targeted Constituents	
Sediment	
Nutrients	
Trash	
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

Minimum BMPs Covered	
Good Housekeeping	
Preventative Maintenance	
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	
Erosion and Sediment Controls	
Employee Training Program	✓
Quality Assurance Record Keeping	✓

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  - ✓ Facility map of the locations of industrial materials;
  - ✓ Notification and evacuation procedures;
  - ✓ Cleanup instructions;
  - ✓ Identification of responsible departments; and
  - ✓ Identify key spill response personnel.

- ☐ Recycle, reclaim, or reuse materials whenever possible. This will reduce the amount of process materials that are brought into the facility.

Spill and Leak Prevention and Response

Spill Prevention

- ☐ Develop procedures to prevent/mitigate spills to storm drain systems. Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures.
- ☐ If illegal dumping is observed at the facility:
  - ✓ Post "No Dumping" signs with a phone number for reporting illegal dumping and disposal. Signs should also indicate fines and penalties applicable for illegal dumping.
  - ✓ Landscaping and beautification efforts may also discourage illegal dumping.
  - ✓ Bright lighting and/or entrance barriers may also be needed to discourage illegal dumping.
- ☐ Store and contain liquid materials in such a manner that if the container is ruptured, the contents will not discharge, flow, or be washed into the storm drainage system, surface waters, or groundwater.
- ☐ If the liquid is oil, gas, or other material that separates from and floats on water, install a spill control device (such as a tee section) in the catch basins that collects runoff from the storage tank area.

Preventative Maintenance

- ☐ Place drip pans or absorbent materials beneath all mounted taps, and at all potential drip and spill locations during filling and unloading of tanks. Any collected liquids or soiled absorbent materials must be reused/recycled or properly disposed.
- ☐ Store and maintain appropriate spill cleanup materials in a location known to all near the tank storage area; and ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.

- ☐ Sweep and clean the storage area monthly if it is paved, *do not hose down the area to a storm drain.*
- ☐ Check tanks (and any containment sumps) daily for leaks and spills. Replace tanks that are leaking, corroded, or otherwise deteriorating with tanks in good condition. Collect all spilled liquids and properly dispose of them.
- ☐ Label all containers according to their contents (e.g., solvent, gasoline).
- ☐ Label hazardous substances regarding the potential hazard (corrosive, radioactive, flammable, explosive, poisonous).
- ☐ Prominently display required labels on transported hazardous and toxic materials (per US DOT regulations).
- ☐ Identify key spill response personnel.

Spill Response

- ☐ Clean up leaks and spills immediately.
- ☐ Place a stockpile of spill cleanup materials where it will be readily accessible (e.g., near storage and maintenance areas).
- ☐ On paved surfaces, clean up spills with as little water as possible.
  - ✓ Use a rag for small spills, a damp mop for general cleanup, and absorbent material for larger spills.
  - ✓ If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to a certified laundry (rags) or disposed of as hazardous waste.
  - ✓ If possible use physical methods for the cleanup of dry chemicals (e.g., brooms, shovels, sweepers, or vacuums).
- ☐ Never hose down or bury dry material spills. Sweep up the material and dispose of properly.
- ☐ Chemical cleanups of material can be achieved with the use of adsorbents, gels, and foams. Use adsorbent materials on small spills rather than hosing down the spill. Remove the adsorbent materials promptly and dispose of properly.
- ☐ For larger spills, a private spill cleanup company or Hazmat team may be necessary.

Reporting

- ☐ Report spills that pose an immediate threat to human health or the environment to the Regional Water Quality Control Board or local authority as location regulations dictate.

- ☐ Federal regulations require that any oil spill into a water body or onto an adjoining shoreline be reported to the National Response Center (NRC) at 800-424-8802 (24 hour).

- ☐ Report spills to 911 for dispatch and clean-up assistance when needed. Do not contact fire agencies directly.

- ☐ Establish a system for tracking incidents. The system should be designed to identify the following:

    - ✓ Types and quantities (in some cases) of wastes;

    - ✓ Patterns in time of occurrence (time of day/night, month, or year);

    - ✓ Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills);

    - ✓ Clean-up procedures; and

    - ✓ Responsible parties.

Employee Training Program

- ☐ Educate employees about spill prevention and cleanup.

- ☐ Well-trained employees can reduce human errors that lead to accidental releases or spills:

    - ✓ The employee should have the tools and knowledge to immediately begin cleaning up a spill should one occur; and

    - ✓ Employees should be familiar with the Spill Prevention Control and Countermeasure Plan.

- ☐ Employees should be educated about aboveground storage tank requirements. Employees responsible for aboveground storage tanks and liquid transfers should be thoroughly familiar with the Spill Prevention Control and Countermeasure Plan and the plan should be readily available.

- ☐ Train employees to recognize and report illegal dumping incidents.

Other Considerations (Limitations and Regulations)

- State regulations exist for facilities with a storage capacity of 10,000 gallons or more of petroleum to prepare a Spill Prevention Control and Countermeasure (SPCC) Plan (Health & Safety Code Chapter 6.67).

- State regulations also exist for storage of hazardous materials (Health & Safety Code Chapter 6.95), including the preparation of area and business plans for emergency response to the releases or threatened releases.

- Consider requiring smaller secondary containment areas (less than 200 sq. ft.) to be connected to the sanitary sewer, prohibiting any hard connections to the storm drain.

Requirements

Costs (including capital and operation & maintenance)

- Will vary depending on the size of the facility and the necessary controls.

- Prevention of leaks and spills is inexpensive. Treatment and/or disposal of contaminated soil or water can be quite expensive.

Maintenance (including administrative and staffing)

- Develop spill prevention and control plan, provide and document training, conduct inspections of material storage areas, and supply spill kits.

- Extra time is needed to properly handle and dispose of spills, which results in increased labor costs.

Supplemental Information

Further Detail of the BMP

Reporting

Record keeping and internal reporting represent good operating practices because they can increase the efficiency of the facility and the effectiveness of BMPs. A good record keeping system helps the facility minimize incident recurrence, correctly respond with appropriate cleanup activities, and comply with legal requirements. A record keeping and reporting system should be set up for documenting spills, leaks, and other discharges, including discharges of hazardous substances in reportable quantities. Incident records describe the quality and quantity of non-stormwater discharges to the storm sewer. These records should contain the following information:

- Date and time of the incident;

- Weather conditions;

- Duration of the spill/leak/discharge;

☐ Cause of the spill/leak/discharge;

☐ Response procedures implemented;

☐ Persons notified; and

☐ Environmental problems associated with the spill/leak/discharge.

Separate record keeping systems should be established to document housekeeping and preventive maintenance inspections, and training activities. All housekeeping and preventive maintenance inspections should be documented. Inspection documentation should contain the following information:

☐ Date and time the inspection was performed;

☐ Name of the inspector;

☐ Items inspected;

☐ Problems noted;

☐ Corrective action required; and

☐ Date corrective action was taken.

Other means to document and record inspection results are field notes, timed and dated photographs, videotapes, and drawings and maps.

Aboveground Tank Leak and Spill Control
Accidental releases of materials from aboveground liquid storage tanks present the potential for contaminating stormwater with many different pollutants. Materials spilled, leaked, or lost from tanks may accumulate in soils or on impervious surfaces and be carried away by stormwater runoff.

The most common causes of unintentional releases are:

☐ Installation problems;

☐ Failure of piping systems (pipes, pumps, flanges, couplings, hoses, and valves);

☐ External corrosion and structural failure;

☐ Spills and overfills due to operator error; and

☐ Leaks during pumping of liquids or gases from truck or rail car to a storage tank or vice versa.

Storage of reactive, ignitable, or flammable liquids should comply with the Uniform Fire Code and the National Electric Code. Practices listed below should be employed to enhance the code requirements:

☐ Tanks should be placed in a designated area.

☐ Tanks located in areas where firearms are discharged should be encapsulated in concrete or the equivalent.

☐ Designated areas should be impervious and paved with Portland cement concrete, free of cracks and gaps, in order to contain leaks and spills.

☐ Liquid materials should be stored in UL approved double walled tanks or surrounded by a curb or dike to provide the volume to contain 10 percent of the volume of all of the containers or 110 percent of the volume of the largest container, whichever is greater. The area inside the curb should slope to a drain.

☐ For used oil or dangerous waste, a dead-end sump should be installed in the drain.

☐ All other liquids should be drained to the sanitary sewer if available. The drain must have a positive control such as a lock, valve, or plug to prevent release of contaminated liquids.

☐ Accumulated stormwater in petroleum storage areas should be passed through an oil/water separator.

Maintenance is critical to preventing leaks and spills. Conduct routine inspections and:

☐ Check for external corrosion and structural failure.

☐ Check for spills and overfills due to operator error.

☐ Check for failure of piping system (pipes, pumps, flanges, coupling, hoses, and valves).

☐ Check for leaks or spills during pumping of liquids or gases from truck or rail car to a storage facility or vice versa.

☐ Visually inspect new tank or container installation for loose fittings, poor welding, and improper or poorly fitted gaskets.

☐ Inspect tank foundations, connections, coatings, and tank walls and piping system. Look for corrosion, leaks, cracks, scratches, and other physical damage that may weaken the tank or container system.

☐ Frequently relocate accumulated stormwater during the wet season.

☐ Periodically conduct integrity testing by a qualified professional.

Vehicle Leak and Spill Control

Major spills on roadways and other public areas are generally handled by highly trained Hazmat teams from local fire departments or environmental health departments. The measures listed below pertain to leaks and smaller spills at vehicle maintenance shops.

In addition to implementing the spill prevention, control, and clean up practices above, use the following measures related to specific activities:

Vehicle and Equipment Maintenance

☐ Perform all vehicle fluid removal or changing inside or under cover to prevent the run-on of stormwater and the runoff of spills.

☐ Regularly inspect vehicles and equipment for leaks, and repair immediately.

☐ Check incoming vehicles and equipment (including delivery trucks, and employee and subcontractor vehicles) for leaking oil and fluids. Do not allow leaking vehicles or equipment onsite.

☐ Always use secondary containment, such as a drain pan or drop cloth, to catch spills or leaks when removing or changing fluids.

☐ Immediately drain all fluids from wrecked vehicles.

☐ Store wrecked vehicles or damaged equipment under cover.

☐ Place drip pans or absorbent materials under heavy equipment when not in use.

☐ Use absorbent materials on small spills rather than hosing down the spill.

☐ Remove the adsorbent materials promptly and dispose of properly.

☐ Promptly transfer used fluids to the proper waste or recycling drums. Don't leave full drip pans or other open containers lying around.

☐ Oil filters disposed of in trashcans or dumpsters can leak oil and contaminate stormwater. Place the oil filter in a funnel over a waste oil recycling drum to drain excess oil before disposal. Oil filters can also be recycled. Ask your oil supplier or recycler about recycling oil filters.

☐ Store cracked batteries in a non-leaking secondary container. Do this with all cracked batteries, even if you think all the acid has drained out. If you drop a battery, treat it as if it is cracked. Put it into the containment area until you are sure it is not leaking.

Vehicle and Equipment Fueling

☐ Design the fueling area to prevent the run-on of stormwater and the runoff of spills:

Cover fueling area if possible.

Use a perimeter drain or slope pavement inward with drainage to a sump.

Pave fueling area with concrete rather than asphalt.

☐ If dead-end sump is not used to collect spills, install an oil/water separator.

☐ Install vapor recovery nozzles to help control drips as well as air pollution.

☐ Discourage "topping-off' of fuel tanks.

☐ Use secondary containment when transferring fuel from the tank truck to the fuel tank.

☐ Use absorbent materials on small spills and general cleaning rather than hosing down the area. Remove the absorbent materials promptly.

☐ Carry out all Federal and State requirements regarding underground storage tanks, or install above ground tanks.

☐ Do not use mobile fueling of mobile industrial equipment around the facility; rather, transport the equipment to designated fueling areas.

☐ Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.

☐ Train employees in proper fueling and cleanup procedures.

Industrial Spill Prevention Response

For the purposes of developing a spill prevention and response program to meet the stormwater regulations, facility managers should use information provided in this fact sheet and the spill prevention/response portions of the fact sheets in this handbook, for specific activities.

The program should:

☐ Integrate with existing emergency response/hazardous materials programs (e.g., Fire Department).

☐ Develop procedures to prevent/mitigate spills to storm drain systems.

☐ Identify responsible departments.

☐ Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures.

☐ Address spills at municipal facilities, as well as public areas.

☐ Provide training concerning spill prevention, response and cleanup to all appropriate personnel.

References and Resources

California's Nonpoint Source Program Plan. http://www.swrcb.ca.gov/nps/index.html.

Clark County Storm Water Pollution Control Manual. Available online at: http://www.co.clark.wa.us/pubworks/bmpman.pdf.

King County Storm Water Pollution Control Manual. Available online at: http://dnr.metrokc.gov/wlr/dss/spcm.htm.

Orange County Stormwater Program, Best Management Practices for Industrial/Commercial Business Activities. Available online at: http://ocwatersheds.com/documents/bmp/industrialcommercialbusinessesactivities

Santa Clara Valley Urban Runoff Pollution Prevention Program. http://www.scvurppp.org.

The Stormwater Managers Resource Center. http://www.stormwatercenter.net/.

Parking Area Maintenance SC-43

Description

Parking lots can contribute a number of substances, such as trash, suspended solids, hydrocarbons, oil and grease, and heavy metals that can enter receiving waters through stormwater runoff or non-stormwater discharges. The protocols in this fact sheet are intended to prevent or reduce the discharge of pollutants from parking areas and include using good housekeeping practices, following appropriate cleaning BMPs, and training employees.

BMPs for other outdoor areas on site (loading/unloading, material storage, and equipment operations) are described in SC-30 through SC-33.

Approach

The goal of this program is to ensure stormwater pollution prevention practices are considered when conducting activities on or around parking areas to reduce potential for pollutant discharge to receiving waters. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

General Pollution Prevention Protocols

- ☐ Encourage advanced designs and maintenance strategies for impervious parking lots. Refer to the treatment control BMP fact sheets in this manual for additional information.

- ☐ Keep accurate maintenance logs to evaluate BMP implementation.

Good Housekeeping

- ☐ Keep all parking areas clean and orderly. Remove debris, litter, and sediments in a timely fashion.

- ☐ Post "No Littering" signs and enforce anti-litter laws.

Objectives

- ■ *Cover*
- ■ *Contain*
- ■ *Educate*
- ■ *Reduce/Minimize*
- ■ *Product Substitution*

Targeted Constituents

Sediment	✓
Nutrients	
Trash	✓
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

Minimum BMPs Covered

Good Housekeeping	✓
Preventative Maintenance	✓
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	
Erosion and Sediment Controls	
Employee Training Program	✓
Quality Assurance Record Keeping	✓

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☐ Provide an adequate number of litter receptacles.

☐ Clean out and cover litter receptacles frequently to prevent spillage.

Preventative Maintenance

Inspection

Have designated personnel conduct inspections of parking facilities and stormwater conveyance systems associated with parking facilities on a regular basis.

☐ Inspect cleaning equipment/sweepers for leaks on a regular basis.

Surface Cleaning

☐ Use dry cleaning methods (e.g., sweeping, vacuuming) to prevent the discharge of pollutants into the stormwater conveyance system if possible.

☐ Establish frequency of public parking lot sweeping based on usage and field observations of waste accumulation.

☐ Sweep all parking lots at least once before the onset of the wet season.

☐ Dispose of parking lot sweeping debris and dirt at a landfill.

☐ Follow the procedures below if water is used to clean surfaces:

  ✓ Block the storm drain or contain runoff.

  ✓ Collect and pump wash water to the sanitary sewer or discharge to a pervious surface. Do not allow wash water to enter storm drains.

☐ Follow the procedures below when cleaning heavy oily deposits:

  ✓ Clean oily spots with absorbent materials.

  ✓ Use a screen or filter fabric over inlet, then wash surfaces.

  ✓ Do not allow discharges to the storm drain.

  ✓ Vacuum/pump discharges to a tank or discharge to sanitary sewer.

  ✓ Dispose of spilled materials and absorbents appropriately.

Surface Repair

☐ Check local ordinance for SUSMP/LID ordinance.

☐ Preheat, transfer or load hot bituminous material away from storm drain inlets.

☐ Apply concrete, asphalt, and seal coat during dry weather to prevent contamination from contacting stormwater runoff.

☐ Cover and seal nearby storm drain inlets where applicable (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and all water from emulsified oil sealants has drained or evaporated. Clean any debris from these covered manholes and drains for proper disposal.

☐ Use only as much water as necessary for dust control during sweeping to avoid runoff.

☐ Catch drips from paving equipment that is not in use with pans or absorbent material placed under the machines. Dispose of collected material and absorbents properly.

Spill Response and Prevention Procedures

☐ Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.

☐ Place a stockpile of spill cleanup materials where it will be readily accessible or at a central location.

☐ Clean up fluid spills immediately with absorbent rags or material.

☐ Dispose of spilled material and absorbents properly.

Employee Training Program

☐ Provide regular training to field employees and/or contractors regarding cleaning of paved areas and proper operation of equipment.

☐ Train employees and contractors in proper techniques for spill containment and cleanup.

☐ Use a training log or similar method to document training.

Quality Assurance and Record Keeping

☐ Keep accurate maintenance logs that document minimum BMP activities performed for parking area maintenance, types and quantities of waste disposed of, and any improvement actions.

☐ Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.

☐ Establish procedures to complete logs and file them in the central office.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

☐ Capital investments may be required at some sites to purchase sweeping equipment, train sweeper operators, install oil/water/sand separators, or implement advanced BMPs. These costs can vary significantly depending upon site conditions and the amount of BMPs required.

Maintenance

☐ Sweep and clean parking lots regularly to minimize pollutant transport into storm drains from stormwater runoff.

☐ Clean out oil/water/sand separators regularly, especially after heavy storms.

☐ Maintain advanced BMPs such as vegetated swales, infiltration trenches, or detention basins as appropriate. Refer to the treatment control fact sheets for more information.

Supplemental Information

Advanced BMPs

Some parking areas may require advanced BMPs to further reduce pollutants in stormwater runoff, and a few examples are listed below. Refer to the Treatment Control Fact Sheets and the New Development and Redevelopment Manual for more information.

☐ When possible, direct sheet runoff to flow into biofilters (vegetated strip and swale) and/or infiltration devices.

☐ Utilize sand filters or oleophilic collectors for oily waste in low quantities.

☐ Arrange rooftop drains to prevent drainage directly onto paved surfaces.

☐ Design lot to include semi-permeable hardscape.

References and Resources

City of Seattle, Seattle Public Utilities Department of Planning and Development, 2009. *Stormwater Manual Vol. 1 Source Control Technical Requirements Manual.*

California Stormwater Quality Association, 2003. *New Development and Redevelopment Stormwater Best Management Practice Handbook.* Available online at: https://www.casqa.org/resources/bmp-handbooks/new-development-redevelopment-bmp-handbook.

Kennedy/Jenks Consultants, 2007. *The Truckee Meadows Industrial and Commercial Storm Water Best Management Practices Handbook.* Available online at: http://www.cityofsparks.us/sites/default/files/assets/documents/env-control/construction/TM-I-C_BMP_Handbook_2-07-final.pdf.

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Pollution from Surface Cleaning Folder, 1996, 2003. Bay Area Stormwater Management Agencies Association. Available online at: http://basmaa.org/Portals/0/documents/pdf/Pollution%20from%20Surface%20Cleaning.pdf.

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US EPA. *Post-Construction Stormwater Management in New Development and Redevelopment*. BMP Fact Sheets. Available online at: http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=min_measure&min_measure_id=5.

Drainage System Maintenance SC-44

Description

As a consequence of its function, the stormwater drainage facilities on site convey stormwater that may contain certain pollutants either to the offsite conveyance system that collects and transports urban runoff and stormwater, or directly to receiving waters. The protocols in this fact sheet are intended to reduce pollutants leaving the site to the offsite drainage infrastructure or to receiving waters through proper on-site conveyance system operation and maintenance. The targeted constituents will vary depending on site characteristics and operations.

Approach

Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

General Pollution Prevention Protocols

- Maintain catch basins, stormwater inlets, and other stormwater conveyance structures on a regular basis to remove pollutants, reduce high pollutant concentrations during the first flush of storms, prevent clogging of the downstream conveyance system, restore catch basins' sediment trapping capacity, and ensure the system functions properly hydraulically to avoid flooding.

- Develop and follow a site specific drainage system maintenance plan that describes maintenance locations, methods, required equipment, water sources, sediment collection areas, disposal requirements, and any other pertinent information.

Good Housekeeping

Illicit Connections and Discharges

- Look for evidence of illegal discharges or illicit connections during routine maintenance of conveyance system and drainage structures:

Objectives

- *Cover*
- *Contain*
- *Educate*
- *Reduce/Minimize*

Targeted Constituents

Sediment	✓
Nutrients	✓
Trash	✓
Metals	✓
Bacteria	✓
Oil and Grease	✓
Organics	✓

Minimum BMPs Covered

Good Housekeeping	✓
Preventative Maintenance	✓
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	
Erosion and Sediment Controls	
Employee Training Program	✓
Quality Assurance Record Keeping	✓

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION®

  - ✓ Identify evidence of spills such as paints, discoloring, odors, etc.
  - ✓ Record locations of apparent illegal discharges/illicit connections.
  - ✓ Track flows back to potential discharges and conduct aboveground inspections. This can be done through visual inspection of upgradient manholes or alternate techniques including zinc chloride smoke testing, fluorometric dye testing, physical inspection testing, or television camera inspection.
  - ✓ Eliminate the discharge once the origin of flow is established.

- ☐ Stencil or demarcate storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as "Dump No Waste Drains to Stream" or similar stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.
- ☐ Refer to fact sheet SC-10 Non-Stormwater Discharges for additional information.

Illegal Dumping

- ☐ Inspect and clean up hot spots and other storm drainage areas regularly where illegal dumping and disposal occurs.
- ☐ Establish a system for tracking incidents. The system should be designed to identify the following:
  - ✓ Illegal dumping hot spots;
  - ✓ Types and quantities (in some cases) of wastes;
  - ✓ Patterns in time of occurrence (time of day/night, month, or year);
  - ✓ Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills); and
  - ✓ Responsible parties.
- ☐ Post "No Dumping" signs in problem areas with a phone number for reporting dumping and disposal. Signs should also indicate fines and penalties for illegal dumping.
- ☐ Refer to fact sheet SC-10 Non-Stormwater Discharges for additional information.

Preventative Maintenance

Catch Basins/Inlet Structures

- ☐ Staff should regularly inspect facilities to ensure compliance with the following:
  - ✓ Immediate repair of any deterioration threatening structural integrity.
  - ✓ Cleaning before the sump is 40% full. Catch basins should be cleaned as frequently as needed to meet this standard.

☐ Clean catch basins, storm drain inlets, and other conveyance structures before the wet season to remove sediments and debris accumulated during the summer.

☐ Conduct inspections more frequently during the wet season for problem areas where sediment or trash accumulates more often. Prioritize storm drain inlets; clean and repair as needed.

☐ Keep accurate logs of the number of catch basins cleaned.

☐ Store wastes collected from cleaning activities of the drainage system in appropriate containers or temporary storage sites in a manner that prevents discharge to the storm drain.

☐ Dewater the wastes if necessary with outflow into the sanitary sewer if permitted. Water should be treated with an appropriate filtering device prior to discharge to the sanitary sewer. If discharge to the sanitary sewer is not allowed, water should be pumped or vacuumed to a tank and properly disposed. Do not dewater near a storm drain or stream.

Storm Drain Conveyance System

☐ Locate reaches of storm drain with deposit problems and develop a flushing schedule that keeps the pipe clear of excessive buildup.

☐ Collect and pump flushed effluent to the sanitary sewer for treatment whenever possible.

Pump Stations

☐ Clean all storm drain pump stations prior to the wet season to remove silt and trash.

☐ Do not allow discharge to reach the storm drain system when cleaning a storm drain pump station or other facility.

☐ Conduct routine maintenance at each pump station.

☐ Inspect, clean, and repair as necessary all outlet structures prior to the wet season.

Open Channel

☐ Modify storm channel characteristics to improve channel hydraulics, increase pollutant removals, and enhance channel/creek aesthetic and habitat value.

☐ Conduct channel modification/improvement in accordance with existing laws. Any person, government agency, or public utility proposing an activity that will change the natural state of any river, stream, or lake in California, must enter into a Steam or Lake Alteration Agreement with the Department of Fish and Wildlife. The developer-applicant should also contact local governments (city, county, special districts), other state agencies (SWRCB, RWQCB, Department of Forestry, Department of Water Resources), and Army Corps of Engineers and USFWS.

Spill Response and Prevention Procedures

☐ Keep your spill prevention control plan up-to-date.

- ☐ Investigate all reports of spills, leaks, and/or illegal dumping promptly.
- ☐ Place a stockpile of spill cleanup materials where it will be readily accessible or at a central location.
- ☐ Clean up all spills and leaks using "dry" methods (with absorbent materials and/or rags) or dig up, remove, and properly dispose of contaminated soil.

Employee Training Program

- ☐ Educate employees about pollution prevention measures and goals.
- ☐ Train employees how to properly handle and dispose of waste using the source control BMPs described above.
- ☐ Train employees and subcontractors in proper hazardous waste management.
- ☐ Use a training log or similar method to document training.
- ☐ Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.
- ☐ Have staff involved in detection and removal of illicit connections trained in the following:
    - ✓ OSHA-required Health and Safety Training (29 CFR 1910.120) plus annual refresher training (as needed).
    - ✓ OSHA Confined Space Entry training (Cal-OSHA Confined Space, Title 8 and Federal OSHA 29 CFR 1910.146).
    - ✓ Procedural training (field screening, sampling, smoke/dye testing, TV inspection).

Quality Assurance and Record Keeping

- ☐ Keep accurate maintenance logs that document minimum BMP activities performed for drainage system maintenance, types and quantities of waste disposed of, and any improvement actions.
- ☐ Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.
- ☐ Keep accurate logs of illicit connections, illicit discharges, and illegal dumping into the storm drain system including how wastes were cleaned up and disposed.
- ☐ Establish procedures to complete logs and file them in the central office.

Potential Limitations and Work-Arounds

Provided below are typical limitations and recommended "work-arounds" for drainage system maintenance:

- ☐ Clean-up activities may create a slight disturbance for local aquatic species. Access to items and material on private property may be limited. Trade-offs may exist between channel hydraulics and water quality/riparian habitat. If storm channels or basins are recognized as wetlands, many activities, including maintenance, may be subject to regulation and permitting.
  - ✓ Perform all maintenance onsite and do not flush accumulated material downstream to private property or riparian habitats.
- ☐ Storm drain flushing is most effective in small diameter pipes (36-inch diameter pipe or less, depending on water supply and sediment collection capacity). Other considerations associated with storm drain flushing may include the availability of a water source, finding a downstream area to collect sediments, and liquid/sediment disposal.
  - ✓ Develop and follow a site specific drainage system maintenance plan that describes maintenance locations, methods, required equipment, water sources, sediment collection areas, disposal requirements, and any other pertinent information.
- ☐ Regulations may include adoption of substantial penalties for illegal dumping and disposal.
  - ✓ Do not dump illegal materials anywhere onsite.
  - ✓ Identify illicit connections, illicit discharge, and illegal dumping.
  - ✓ Cleanup spills immediately and properly dispose of wastes.
- ☐ Local municipal codes may include sections prohibiting discharge of soil, debris, refuse, hazardous wastes, and other pollutants into the sanitary sewer system.
  - ✓ Collect all materials and pollutants accumulated in drainage system and dispose of according to local regulations.
  - ✓ Install debris excluders in areas with a trash TMDL.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

- ☐ Capital costs will vary substantially depending on the size of the facility and characteristics of the drainage system. Significant capital costs may be associated with purchasing water trucks, vacuum trucks, and any other necessary cleaning equipment or improving the drainage infrastructure to reduce the potential .
- ☐ Developing and implementing a site specific drainage system maintenance plan will require additional capital if a similar program is not already in place.

Maintenance

☐ Two-person teams may be required to clean catch basins with vactor trucks.

☐ Teams of at least two people plus administrative personnel are required to identify illicit discharges, depending on the complexity of the storm sewer system.

☐ Arrangements must be made for proper disposal of collected wastes.

☐ Technical staff are required to detect and investigate illegal dumping violations.

☐ Methods used for illicit connection detection (smoke testing, dye testing, visual inspection, and flow monitoring) can be costly and time-consuming. Site-specific factors, such as the level of impervious area, the density and ages of buildings, and type of land use will determine the level of investigation necessary.

Supplemental Information

Storm Drain Flushing

Flushing is a common maintenance activity used to improve pipe hydraulics and to remove pollutants in storm drainage systems. Flushing may be designed to hydraulically convey accumulated material to strategic locations, such as an open channel, another point where flushing will be initiated, or the sanitary sewer and the treatment facilities, thus preventing re-suspension and overflow of a portion of the solids during storm events. Flushing prevents “plug flow” discharges of concentrated pollutant loadings and sediments. Deposits can hinder the designed conveyance capacity of the storm drain system and potentially cause backwater conditions in severe cases of clogging.

Storm drain flushing usually takes place along segments of pipe with grades that are too flat to maintain adequate velocity to keep particles in suspension. An upstream manhole is selected to place an inflatable device that temporarily plugs the pipe. Further upstream, water is pumped into the line to create a flushing wave. When the upstream reach of pipe is sufficiently full to cause a flushing wave, the inflated device is rapidly deflated with the assistance of a vacuum pump, thereby releasing the backed up water and resulting in the cleaning of the storm drain segment.

To further reduce impacts of stormwater pollution, a second inflatable device placed well downstream may be used to recollect the water after the force of the flushing wave has dissipated. A pump may then be used to transfer the water and accumulated material to the sanitary sewer for treatment. In some cases, an interceptor structure may be more practical or required to recollect the flushed waters.

It has been found that cleansing efficiency of periodic flush waves is dependent upon flush volume, flush discharge rate, sewer slope, sewer length, sewer flow rate, sewer diameter, and population density. As a rule of thumb, the length of line to be flushed should not exceed 700 feet. At this maximum recommended length, the percent removal efficiency ranges between 65-75% for organics and 55-65% for dry weather grit/inorganic material. The percent removal efficiency drops rapidly beyond that. Water is commonly supplied by a water truck, but fire hydrants can also supply water. To make the best use of water, it is recommended that reclaimed water be used if allowed or that fire hydrant line flushing coincide with storm sewer flushing.

References and Resources

City of Seattle, Seattle Public Utilities Department of Planning and Development, 2009. *Stormwater Manual Vol. 1 Source Control Technical Requirements Manual.*

Knox County Tennessee *Stormwater Management Manual* Chapter 5 Drainage System Maintenance, 2008. Available online at: http://www.knoxcounty.org/stormwater/manual/Volume%201/knoxco_swmm_v1_chap5_jan2008.pdf.

US EPA. Storm Drain System Cleaning, 2012. Available online at: http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=102.

SECTION ‘6.3.C’

Education Materials

■ Commercial landscape maintenance:

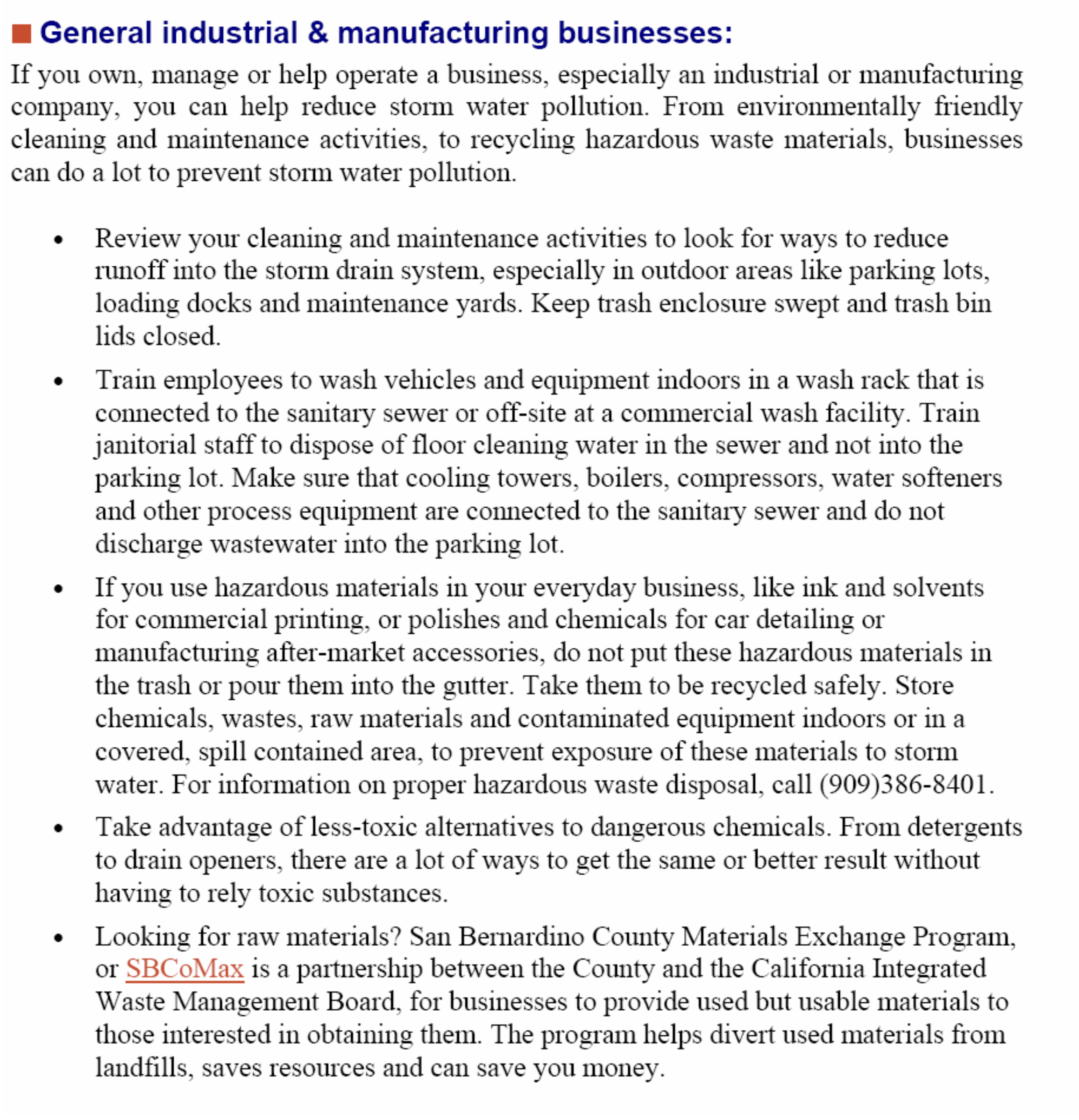
Yard waste, sediments and toxic lawn and garden chemicals used in commercial landscape maintenance often make their way into the San Bernardino County storm drain system and do not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates local waterways, making them unsafe for people and wildlife. Follow these best management practices to prevent pollution, protect public health and avoid fines or legal action.

- **Recycle Yard Waste:** Recycle leaves, grass clippings and other yard waste. Do not blow, sweep, rake or hose yard waste into the street. Let your customers know about grass cycling --the natural recycling of grass by leaving clippings on the lawn when mowing instead of using a grass catcher. Grass clippings will quickly decompose, returning valuable nutrients to the soil. You can get more information at www.ciwmb.ca.gov/Organics.
- **Use Fertilizers, Herbicides & Pesticides Safely:** Fertilizers, herbicides and pesticides are often carried into the storm drain system by sprinkler runoff. Use natural, non-toxic alternatives to traditional garden chemicals. If you must use chemical fertilizers, herbicides, or pesticides spot apply rather than blanketing entire areas, avoid applying near curbs and driveways and never apply before a rain.
- **Recycle Hazardous Waste:** Pesticides, fertilizers, herbicides and motor oil contaminate landfills and should be disposed of through a Hazardous Waste Facility. For information on proper disposal, call (909) 386-8401.
- **Use Water Wisely:** Conserve water and prevent runoff by controlling the amount of water and direction of sprinklers. Sprinklers should be on long enough to allow water to soak into the ground but not so long as to cause runoff. Periodically inspect, fix leaks and realign sprinkler heads.
- **Planting:** Plant native vegetation to reduce the need of water, fertilizers, herbicides and pesticides.
- **Prevent Erosion:** Erosion washes sediments, debris and toxic runoff into the storm drain system, polluting waterways. Prevent erosion and sediment runoff by using ground cover, berms and vegetation down-slope to capture runoff. Avoid excavation or grading during wet weather.
- **Store Materials Safely:** Keep landscaping materials and debris away from the street, gutter and storm drains. On-site stockpiles of materials should be covered with plastic sheeting to protect from rain, wind and runoff.

For more information about how you can prevent stormwater pollution:

www.sbcountystormwater.org

SAN BERNARDINO COUNTY
STORMWATER POLLUTION PREVENTION



■ General industrial & manufacturing businesses:

If you own, manage or help operate a business, especially an industrial or manufacturing company, you can help reduce storm water pollution. From environmentally friendly cleaning and maintenance activities, to recycling hazardous waste materials, businesses can do a lot to prevent storm water pollution.

- Review your cleaning and maintenance activities to look for ways to reduce runoff into the storm drain system, especially in outdoor areas like parking lots, loading docks and maintenance yards. Keep trash enclosure swept and trash bin lids closed.
- Train employees to wash vehicles and equipment indoors in a wash rack that is connected to the sanitary sewer or off-site at a commercial wash facility. Train janitorial staff to dispose of floor cleaning water in the sewer and not into the parking lot. Make sure that cooling towers, boilers, compressors, water softeners and other process equipment are connected to the sanitary sewer and do not discharge wastewater into the parking lot.
- If you use hazardous materials in your everyday business, like ink and solvents for commercial printing, or polishes and chemicals for car detailing or manufacturing after-market accessories, do not put these hazardous materials in the trash or pour them into the gutter. Take them to be recycled safely. Store chemicals, wastes, raw materials and contaminated equipment indoors or in a covered, spill contained area, to prevent exposure of these materials to storm water. For information on proper hazardous waste disposal, call (909)386-8401.
- Take advantage of less-toxic alternatives to dangerous chemicals. From detergents to drain openers, there are a lot of ways to get the same or better result without having to rely toxic substances.
- Looking for raw materials? San Bernardino County Materials Exchange Program, or SBCoMax is a partnership between the County and the California Integrated Waste Management Board, for businesses to provide used but usable materials to those interested in obtaining them. The program helps divert used materials from landfills, saves resources and can save you money.

For more information about how you can prevent stormwater pollution:

www.sbcountystormwater.org

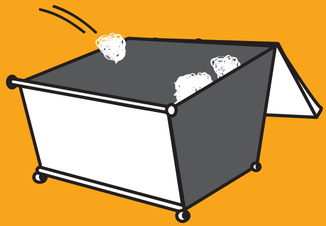
COMMERCIAL TRASH ENCLOSURES

FOLLOW THESE **REQUIREMENTS** TO **KEEP OUR WATERWAYS CLEAN**

Trash enclosures, such as those found in commercial and apartment complexes, typically contain materials that are intended to find their way to a landfill or a recycling facility. **These materials are NOT meant to go into our local lakes and rivers.**

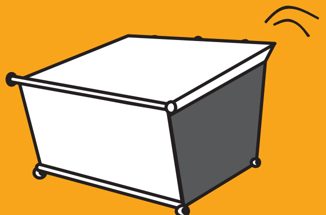
PROTECT WATER QUALITY BY FOLLOWING THESE SIMPLE STEPS

PUT TRASH INSIDE



Place trash inside the bin (preferably in sealed bags)

CLOSE THE LID



Prevent rain from entering the bin in order to avoid leakage of polluted water runoff

KEEP TOXICS OUT

- Paint
- Grease, fats and used oils
- Batteries, electronics and fluorescent lights

SOME ADDITIONAL GUIDELINES, INCLUDE

✓ SWEEP FREQUENTLY

Sweep trash enclosure areas frequently, instead of hosing them down, to prevent polluted water from flowing into the streets and storm drains.

✓ FIX LEAKS

Address trash bin leaks immediately by using dry clean up methods and report to your waste hauler to receive a replacement.

✓ CONSTRUCT ROOF

Construct a solid cover roof over the existing trash enclosure structure to prevent rainwater from coming into contact with trash and garbage. Check with your local City/County for Building Codes.

In San Bernardino County, stormwater pollution is caused by food waste, landscape waste, chemicals and other debris that are washed into storm drains and end up in our waterways - untreated! You can be part of the solution by maintaining a water-friendly trash enclosure.

THANK YOU FOR HELPING TO KEEP SAN BERNARDINO COUNTY CLEAN AND HEALTHY!

San Bernardino County STORMWATER PROGRAM

To report illegal dumping **(877-WASTE18)** or
to find a household hazardous waste facility (800-OILY CAT): **sbcountystormwater.org**
To dispose of hazardous waste call the San Bernardino County Fire Dept. - CUPA Program **(909) 386-8401**

Big Bear • Chino • Chino Hills • Colton • Fontana • Grand Terrace • Highland • Loma Linda • Montclair • Ontario • Rancho Cucamonga
Redlands • Rialto • San Bernardino • San Bernardino County • San Bernardino County Flood Control District • Upland • Yucaipa

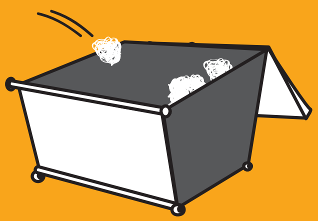
CONTENEDORES COMERCIALES PARA LA BASURA

SIGA ESTOS **PASOS** PARA MANTENER LIMPIAS NUESTRAS VÍAS FLUVIALES

Los contenedores de basura, tales como aquellos que se encuentran en las unidades comerciales y departamentos, generalmente contienen materiales que están destinados a los rellenos sanitarios o en algún establecimiento de reciclaje.
Estos materiales NO deben ser vertidos en nuestros lagos y ríos locales.

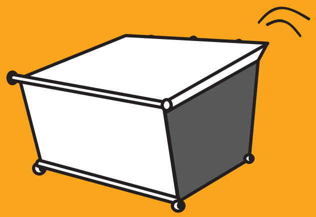
SIGA ESTOS PASOS PARA PROTEGER LA CALIDAD DEL AGUA

COLOQUE LA BASURA ADENTRO



Coloque la basura adentro del contenedor (preferentemente en bolsas selladas)

CIERRE LA TAPA



Evite que la lluvia ingrese al contenedor para evitar un escape de escorrentía contaminada

MANTENGA LOS PRODUCTOS TÓXICOS AFUERA

- Pintura
- Lubricante, grasas y aceites usados
- Baterías, componentes electrónicos y luces fluorescentes

ALGUNAS GUÍAS ADICIONALES, LAS CUALES INCLUYEN

✓ BARRER CON FRECUENCIA

Barra con frecuencia las áreas de los recintos para la basura, en lugar de lavarlas con una manguera, para evitar que el agua contaminada se vierta en las calles y los desagües de lluvia.

✓ REPARE LAS GOTERAS

Ocúpese inmediatamente de las goteras en los contenedores de basura. Use los métodos de limpieza en seco e infórmele a su recolector de basura para que reciba un reemplazo.

✓ CONSTRUYA UN TECHO

Construya un techo de cubierta sólida sobre la estructura actual del recinto para la basura a fin de evitar que el agua de lluvia entre en contacto con los desechos y la basura. Consulte con su Ciudad/Condado para conocer los Códigos de Construcción.

En el Condado de San Bernardino, los desechos de alimentos y jardines, los productos químicos y otros restos que se vierten en los desagües de aguas pluviales y que terminan en nuestras vías fluviales sin tratamiento alguno provocan la contaminación de estas aguas. Usted puede ser parte de la solución si mantiene un recinto para la basura que no contamine el agua.

¡MUCHAS GRACIAS POR AYUDAR A MANTENER EL CONDADO DE SB LIMPIO Y SIN CONTAMINACIÓN!

San Bernardino County
STORMWATER PROGRAM

Para informar acerca del vertedero ilegal, llame a **(877-WASTE18)**, o para encontrar un establecimiento donde arrojar los residuos peligrosos del hogar, llame a **(800-OILY CAT): sbcountystormwater.org**
Para deshacerse de los residuos peligrosos llame al Condado de San Bernardino Departamento de Bomberos - programa CUPA **(909) 386-8401**

Big Bear • Chino • Chino Hills • Colton • Fontana • Grand Terrace • Highland • Loma Linda • Montclair • Ontario • Rancho Cucamonga
Redlands • Rialto • San Bernardino • San Bernardino County • San Bernardino County Flood Control District • Upland • Yucaipa

STORMWATER Pollution Prevention

Important Phone Numbers

San Bernardino County Flood Control	(909) 387-8112
County of San Bernardino	(909) 387-8109
City of Big Bear Lake	(909) 866-5831
City of Chino	(909) 591-9850
City of Chino Hills	(909) 364-2722
City of Colton	(909) 370-6128
City of Fontana	(909) 350-6772
City of Grand Terrace	(909) 824-6671 x 226
City of Highland	(909) 864-8732 x 230
City of Loma Linda	(909) 799-4405
City of Montclair	(909) 625-9470
City of Ontario	(909) 395-2025
City of Rancho Cucamonga	(909) 477-2740 x 4063
City of Redlands	(909) 798-7655
City of Rialto	(909) 421-4921
City of San Bernardino	(909) 384-5154
City of Upland	(909) 931-4370
City of Yucaipa	(909) 797-2489 x 243

San Bernardino County
Stormwater Program
825 East Third Street • Room 201
San Bernardino, CA 94215-0835

STORMWATER
Pollution Prevention

INDUSTRIAL AND COMMERCIAL FACILITIES

STORMWATER

Pollution Prevention

To reduce the amount of pollutants reaching our storm drain system, which leads to the Santa Ana River and Pacific Ocean, the San Bernardino County Stormwater Program has developed Best Management Practices (BMPs) for Industrial and Commercial Facilities. City and County ordinances require that businesses comply with these BMPs, where applicable, to protect local water quality. Local cities and the County are required to verify implementation of these BMPs by performing regular facility inspections.

Prohibited Discharges

- Discontinue all non-stormwater discharges to the storm drain system. It is prohibited to discharge any chemicals, wastes or wastewater into the gutter, street or storm drain.

Outdoor Storage

- Install covers and secondary containment areas for all hazardous materials and wastes stored outdoors in accordance with County and/or City standards.
- Keep all temporary waste containers covered, except when in direct use.
- Sweep outdoor areas instead of using a hose or pressure washer.

Outdoor Processes

- Move all process operations including vehicle and equipment maintenance inside of the building or into a covered and contained area.
- Wash equipment and vehicles in a contained and covered wash bay which is closed-loop or connected to a clarifier sized to city standards, then discharged to a sanitary sewer or take them to a commercial car wash.

Spills and Clean Ups

- Clean up spills immediately when they occur, using dry clean up methods such as absorbent materials and followed by proper disposal of materials.
- Always have a spill kit available near chemical loading dock doors, vehicle maintenance and fueling areas.
- Follow your Business Emergency Plan, as filed with the County Fire Department at (909) 386-8401.

Industrial and Commercial Facilities

- Report all prohibited discharges and non-implementation of BMPs to your local Stormwater Coordinator either at (800) CLEANUP or as listed at www.sbcounty.gov/stormwater.
- Report hazardous materials spills to (800) 33 TOXIC and your local Fire Department Hazmat Team at 911.

Training

Train employees in spill response procedures and prohibited discharges to the storm drain system, as prescribed in your local Stormwater Ordinance and in applicable Best Management Practices available at www.cabmphandbooks.com and www. sbcounty.gov/stormwater.

Permitting

Stormwater discharges associated with specific categories of commercial and industrial facilities are regulated by the State Water Resources Control Board (SWRCB) through an Industrial Storm Water General Permit. A copy of the General Permit and application forms are available at: www.waterboards.ca.gov/stormwtr/industrial.html

To report illegal dumping or for more information on stormwater pollution prevention, call:

1 (800) CLEANUP

or visit our websites at:

www.sbcounty.gov/stormwater

www.1800cleanup.org

San Bernardino County STORMWATER PROGRAM

Prevención de Contaminación
AL SISTEMA DE DRENAJE

Números de Teléfono Importantes

San Bernardino County Flood Control	(909) 387-8112
County of San Bernardino	(909) 387-8109
City of Big Bear Lake	(909) 866-5831
City of Chino	(909) 591-9850
City of Chino Hills	(909) 364-2722
City of Colton	(909) 370-6128
City of Fontana	(909) 350-6772
City of Grand Terrace	(909) 824-6671 x 226
City of Highland	(909) 864-8732 x 230
City of Loma Linda	(909) 799-4405
City of Montclair	(909) 625-9470
City of Ontario	(909) 395-2025
City of Rancho Cucamonga	(909) 477-2740 x 4063
City of Redlands	(909) 798-7655
City of Rialto	(909) 421-4921
City of San Bernardino	(909) 384-5154
City of Upland	(909) 931-4370
City of Yucaipa	(909) 797-2489 x 243

San Bernardino County
Stormwater Program
825 East Third Street • Room 201
San Bernardino, CA 94215-0835

Prevención de Contaminación
AL SISTEMA DE DRENAJE
INSTALACIONES INDUSTRIALES Y COMERCIALES

San Bernardino County STORMWATER PROGRAM

Prevención de Contaminación
AL SISTEMA DE DRENAJE

Para reducir la cantidad de contaminantes que alcanzan nuestro sistema de aguas pluviales, las cuales desembocan en el Río Santa Ana y el Océano Pacífico, el Programa del Condado de San Bernandino ha desarrollado las pautas de Mejores Prácticas de Manejo (BMPs, por sus siglas en inglés) para instalaciones industriales y comerciales. Los decretos de la ciudad y del condado establecen que todas las empresas deben de cumplir con estas BMPs, cuando corresponda, para proteger la calidad del agua local. Las ciudades locales y el condado tienen la obligación de verificar la implementación de estas BMPs al llevar a cabo inspecciones regulares en sus instalaciones.

Desagües Prohibidos
- Descontinúe todo desagüe de aguas no pluviales al sistema de drenaje de aguas pluviales. Está prohibido descargar cualquier sustancia química, residuo o agua residual a los drenajes de la cuneta, de la calle o de aguas pluviales.

Almacenamiento al Aire Libre
- Instale cubiertas y áreas de retención secundarias para todos los materiales peligrosos y residuos almacenados al aire libre, estas instalaciones deberán de cumplir con los estándares establecidos por el condado y/o la ciudad.
- Mantenga todos los recipientes temporales de residuos cubiertos, con la excepción de cuando se estén utilizando directamente.
- Barra todas las áreas al aire libre en lugar de usar una manguera o un equipo de limpieza con agua a alta presión.

Procesos al Aire Libre
- Reubique todos los procesos u operaciones, incluyendo el mantenimiento de vehículos y equipo, dentro de un edificio en una área cubierta e independiente.
- Lave el equipo y los vehículos en una fosa de lavado independiente que tenga un anillo cerrado o bien, esté conectada a un clarificador del tamaño de los estándares municipales, luego elimine los residuos en un drenaje sanitario o llévelos a un lavador de carros comercial.

Derrames y Limpieza
- Limpie los derrames inmediatamente, utilice métodos de limpieza en seco como son el uso de materiales absorbentes y elimine estos materiales de la manera adecuada.
- Siempre tenga a la mano un estuche para derrames cerca de las puertas de los muelles de carga de sustancias químicas, en las áreas de mantenimiento de vehículos y en las áreas de combustible.
- Siga su Plan de Emergencia Comercial, como lo registró con el Departamento de Bomberos del Condado marcando al (909) 386-8401.
- Reporte todos los desagües prohibidos y cualquier punto no implementado de las BMPs a su coordinador local de Aguas Pluviales llamando al (800) CLEANUP o como se indica en el enlace www.sbcounty.gov/stormwater.
- Reporte cualquier derrame peligroso al (800) 33 TOXIC y al equipo Hazmat de su departamento local de bomberos marcando al 911.

Instalaciones Industriales y Comerciales

Capacitación

Capacite a los empleados sobre los procedimientos de respuesta ante un derrame y los desagües prohibidos al sistema de aguas pluviales, como lo indica el decreto local de aguas pluviales de Mejores Prácticas de Manejo (BMPs) disponibles en el sitio www.cabmphandbooks.com y www.sbcounty.gov/stormwater.

Autoridad Competente

Los desagües de aguas pluviales relacionados con categorías específicas de instalaciones comerciales e industriales están regulados por la Junta Estatal de Control de Recursos Acuáticos (State Water Resources Control Board, SWRCB) a través de un permiso industrial general de aguas pluviales. Para obtener una copia de este permiso general y una solicitud, visite el sitio: www.waterboards.ca.gov/stormwtr/industrial.html

Para reportar el desagüe de residuos ilegales o para obtener información adicional sobre la prevención de contaminación a las aguas pluviales, llame a:

1 (800) CLEANUP

o visite nuestro sitio:

www.sbcounty.gov/stormwater
www.1800cleanup.org

San Bernardino County
STORMWATER PROGRAM

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San Bernardino County Stormwater Program
825 East Third Street · Room 127
San Bernardino, CA 94215-0835

STORMWATER
Pollution Prevention
LANDSCAPE MAINTENANCE

STORMWATER

Pollution Prevention

Stormwater Management Practices for Commercial Landscape Maintenance

Yard waste, sediments, and toxic lawn/garden chemicals used in commercial landscape maintenance often make their way into the San Bernardino County storm drain system and do not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates local waterways, making them unsafe for people and wildlife. Following these best management practices will prevent pollution, comply with regulations and protect public health.

Recycle Yard Waste

Recycle leaves, grass clippings and other yard waste. Do not blow, sweep, rake or hose yard waste into the street. Try grasscycling - the natural recycling of grass by leaving clippings on the lawn when mowing. Grass clippings will quickly decompose, returning valuable nutrients to the soil. Further information can be obtained at www.ciwmb.ca.gov/Organics.

Use Fertilizers, Herbicides and Pesticides Safely

Fertilizers, herbicides and pesticides are often carried into the storm drain system by sprinkler runoff. Use of natural, non-toxic alternatives to the traditional fertilizers, herbicides and pesticides is highly recommended. If you must use chemical fertilizers, herbicides, or pesticides:

- Spot apply pesticides and herbicides, rather than blanketing entire areas.
- Avoid applying near curbs and driveways, and never apply before a rain.
- Apply fertilizers as needed, when plants can best use it, and when the potential for it being carried away by runoff is low.

Recycle Hazardous Waste

Pesticides, fertilizers, herbicides and motor oil contaminate landfills and should be disposed of through a Hazardous Waste Facility, which accepts these types of materials. For information on proper disposal call, (909) 386-8401.

Use Water Wisely

Conserve water and prevent runoff by controlling the amount of water and direction of sprinklers. Sprinklers should be on long enough to allow water to soak into the ground but not so long as to cause runoff. Periodically inspect, fix leaks and realign sprinkler heads. Plant native vegetation to reduce the need of water, fertilizers, herbicides, and pesticides.

Prevent Erosion

Erosion washes sediments, debris and toxic runoff into the storm drain system, polluting waterways.

- Prevent erosion and sediment runoff by using ground cover, berms and vegetation down-slope to capture runoff.
- Avoid excavation or grading during wet weather.

Store Materials Safely

Keep landscaping materials and debris away from the street, gutter and storm drains. On-site stockpiles of materials must be covered with plastic sheeting to protect from rain, wind and runoff.

To report illegal dumping call

(877) WASTE18

or visit our website:

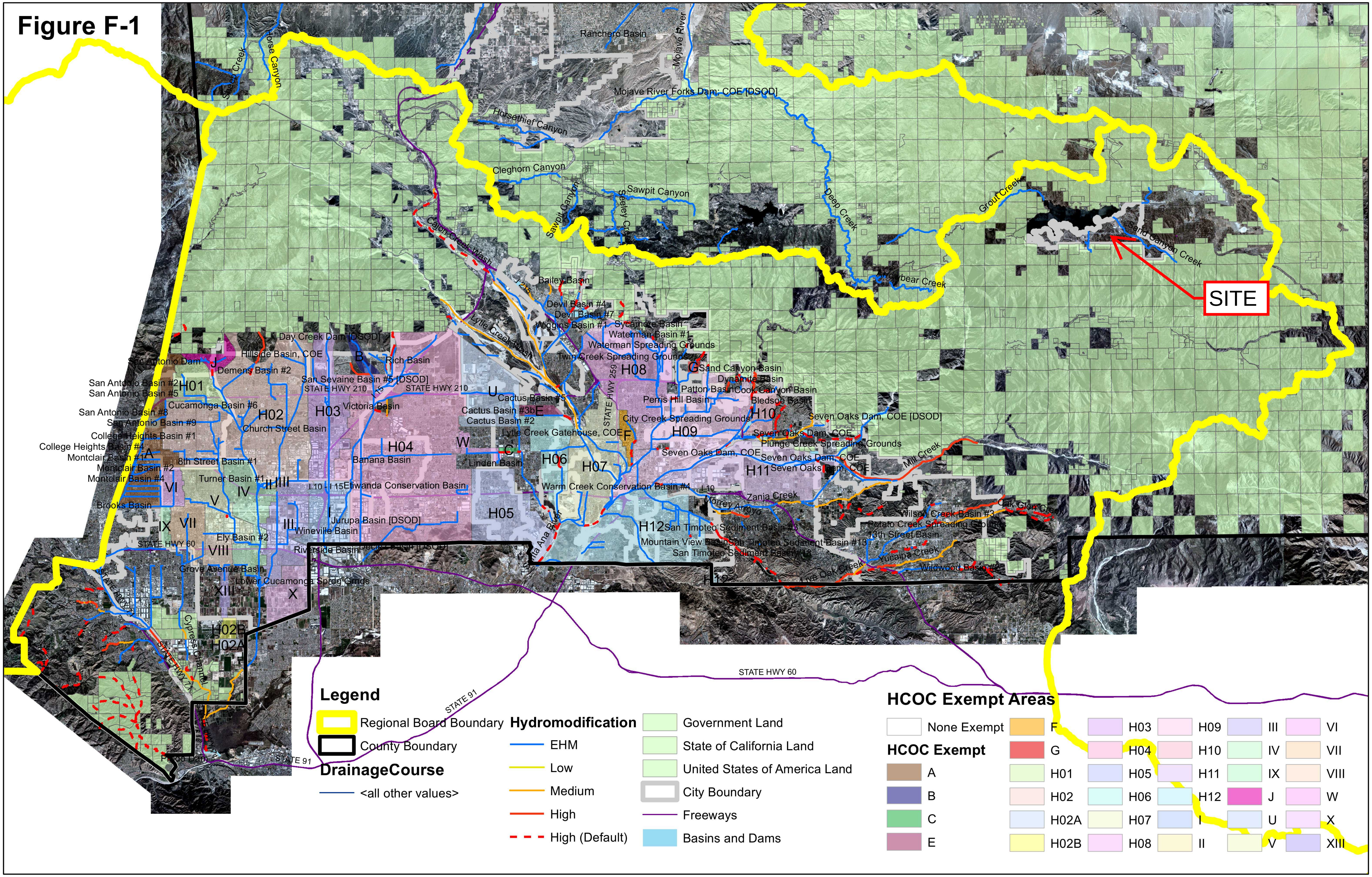
sbcountystormwater.org

San Bernardino County STORMWATER PROGRAM

SECTION ‘6.3.D’

HCOC Exemption Exhibit

Figure F-1


SITE
Ranchero Basin
Mojave River
Mojave River Forks Dam, COE [DSOD]
Horse Canyon
Sheep Creek
Horsethief Canyon
Cleghorn Canyon
Sawpit Canyon
Seeley Creek
Deep Creek
Grout Creek
Sand Canyon Creek
Metcalf Creek
Bear Creek
Cajon Creek Wash
Lytle Creek Wash
Bailey Basin
Devil Basin #4
Devil Basin #7
Wiggins Basin #1
Sycamore Basin
Waterman Basin #1
Waterman Spreading Grounds
Twin Creek Spreading Grounds
Day Creek Dam [DSOD]
Hillside Basin, COE
Rich Basin
San Antonio Dam
Demens Basin #2
San Sevaine Basin #5 [DSOD]
STATE HWY 210
San Antonio Basin #2
San Antonio Basin #5
Cucamonga Basin #6
Victoria Basin
Cactus Basin #5
Cactus Basin #3b
Cactus Basin #2
San Antonio Basin #8
San Antonio Basin #9
Church Street Basin
College Heights Basin #1
College Heights Basin #4
Montclair Basin #1
Montclair Basin #2
Montclair Basin #4
8th Street Basin #1
Banana Basin
Linden Basin
Lytle Creek Gatehouse, COE
Turner Basin #1
Etiwanda Conservation Basin
Warm Creek Conservation Basin #4
Brooks Basin
Jurupa Basin [DSOD]
Wineville Basin
Riverside Basin
Ely Basin #2
STATE HWY 60
Grove Avenue Basin
Lower Cucamonga Sprdg Grnds
Cypress Channel
STATE HWY 71
Prado Dam
Santa Ana River
STATE HWY 259
Sand Canyon Basin
Dynamite Basin
Patton Basin
Cook Canyon Basin
Perris Hill Basin
Bledsoe Basin
City Creek Spreading Grounds
Seven Oaks Dam, COE [DSOD]
Seven Oaks Dam, COE
Plunge Creek Spreading Grounds
Mill Creek
Zanja Creek
Morrey Arroyo
San Timoteo Sediment Basin
Mountain View Basin
San Timoteo Sediment Basin #13
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13th Street Basin
Oak Glen Creek
Yucaipa Creek
Live Oak Creek
Wildwood Basin
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I-15
STATE 91
STATE HWY 60
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H02
H02A
H02B
H03
H04
H05
H06
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H11
H12
A
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C
E
F
G
J
U
W
X
I
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III
IV
V
VI
VII
VIII
IX
XIII
Legend
Regional Board Boundary
County Boundary
DrainageCourse
<all other values>
Hydromodification
EHM
Low
Medium
High
High (Default)
Government Land
State of California Land
United States of America Land
City Boundary
Freeways
Basins and Dams
HCOC Exempt Areas
None Exempt
HCOC Exempt
A
B
C
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SECTION ‘6.3.E’

Geotechnical Report/Infiltration Testing

John R. Byerly
INCORPORATED

GEOTECHNICAL INVESTIGATION

NEW ADMINISTRATION BUILDING
AND MAINTENENACE FACILITY

160-170 BUSINESS CENTER DRIVE

BIG BEAR LAKE, CALIFORNIA

MOUNTAIN AREA REGIONAL TRANSIT AUTHORITY

GEOTECHNICAL ENGINEERS • TESTING AND INSPECTION
2257 South Lilac Ave., Bloomington, CA 92316-2903
Bloomington (909) 877-1324 Riverside (909) 783-1910 Fax (909) 877-5210

John R. Byerly
INCORPORATED

GEOTECHNICAL INVESTIGATION

APRIL 11, 2022

NEW ADMINISTRATION BUILDING AND MAINTENACE FACILITY
160-170 BUSINESS CENTER DRIVE
BIG BEAR LAKE, CALIFORNIA

MOUNTAIN AREA REGIONAL TRANSIT AUTHORITY (MARTA)
41939 FOX FARM ROAD
BIG BEAR LAKE, CALIFORNIA 92315
ATTENTION: MS. SANDY BENSON, GENERAL MANAGER

RPT. NO.: 7341
FILE NO.: S-14447

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(2) Test Boring Logs

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(7) Subgrade Test Results

(8) Specifications for Aggregate Base

(9) Liquefaction and Dynamic Settlement Analysis

(10) Geologic Hazards Report

INTRODUCTION

From January through April of 2022, an investigation of the soil conditions underlying the site of the proposed administration building and maintenance facility was conducted by this firm. The purpose of our investigation was to evaluate the surface and subsurface conditions at the site with respect to safe and economical foundation types, vertical and lateral bearing values, liquefaction and seismic settlement potential, support of concrete slabs-on-grade, and site preparation. Included in the recommendations are the seismic design parameters as required by the 2019 edition of the California Building Code and ASCE Standard 7-16. Our consulting engineering geologist, Terra Geosciences, has conducted a geologic hazards analysis. The report of this analysis is presented as Enclosure 10. Recommendations are also provided for the design of asphalt concrete pavement for fire lanes and parking and driveway areas. Percolation testing was performed for the proposed bioswales and underground infiltration systems to retain and dispose of storm water runoff. The report of the results of the percolation testing is presented under separate cover. Our geotechnical investigation, together with our conclusions and recommendations, is discussed in detail in the following report.

This report has been prepared for the exclusive use of the Mountain Area Regional Transit Authority and their design consultants for specific application to the project described herein. Should the project be modified, the conclusions and recommendations presented in this report should be reviewed by the geotechnical engineer. Our professional services have been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted engineering principles and practices. This warranty is in lieu of all other warranties, express or implied.

PROJECT DESCRIPTION

For the preparation of this report, we reviewed a site plan (Site Plan, Schematic Design, New Administration Building and Maintenance Facility, Mountain Area Regional Transit Authority, Ruhnau Clarke Architects, Inc., #5-08-01, July 21, 2021) that was submitted to this office. We understand the proposed Mountain Transit Facility will consist of a 12,188 square-foot bus maintenance building and an administration building with a plan area of 11,355 square feet. The proposed buildings will be single-story structures incorporating concrete slab-on-grade floors and supported by conventional isolated and continuous footings that will exert relatively light loads on the underlying soils. The buildings will be located in the northeastern portion of the site. Four solar shade structures, bus and vehicle parking and drive areas are also planned. The shade structures will be used as parking stalls and bus stalls. The project is currently in the conceptual design stage, so it is not known if the shade structures will be supported by drilled piers or conventional shallow foundations. The drive and parking areas will be paved with asphalt concrete pavement. The administration building will be accessed by conventional passenger vehicles, and mid-size to large buses will access the maintenance building. The driveway areas will also be used as fire lanes. A masonry-block screen wall is proposed along the northwestern perimeter of the site. Bioswales and underground infiltration systems are planned to retain and dispose of storm water runoff. Major slope and retaining wall construction is not anticipated. Based on the site topography, it is anticipated that maximum cuts and fills will be on the order of 5 feet. The site configuration and proposed development are illustrated on Enclosure 1.

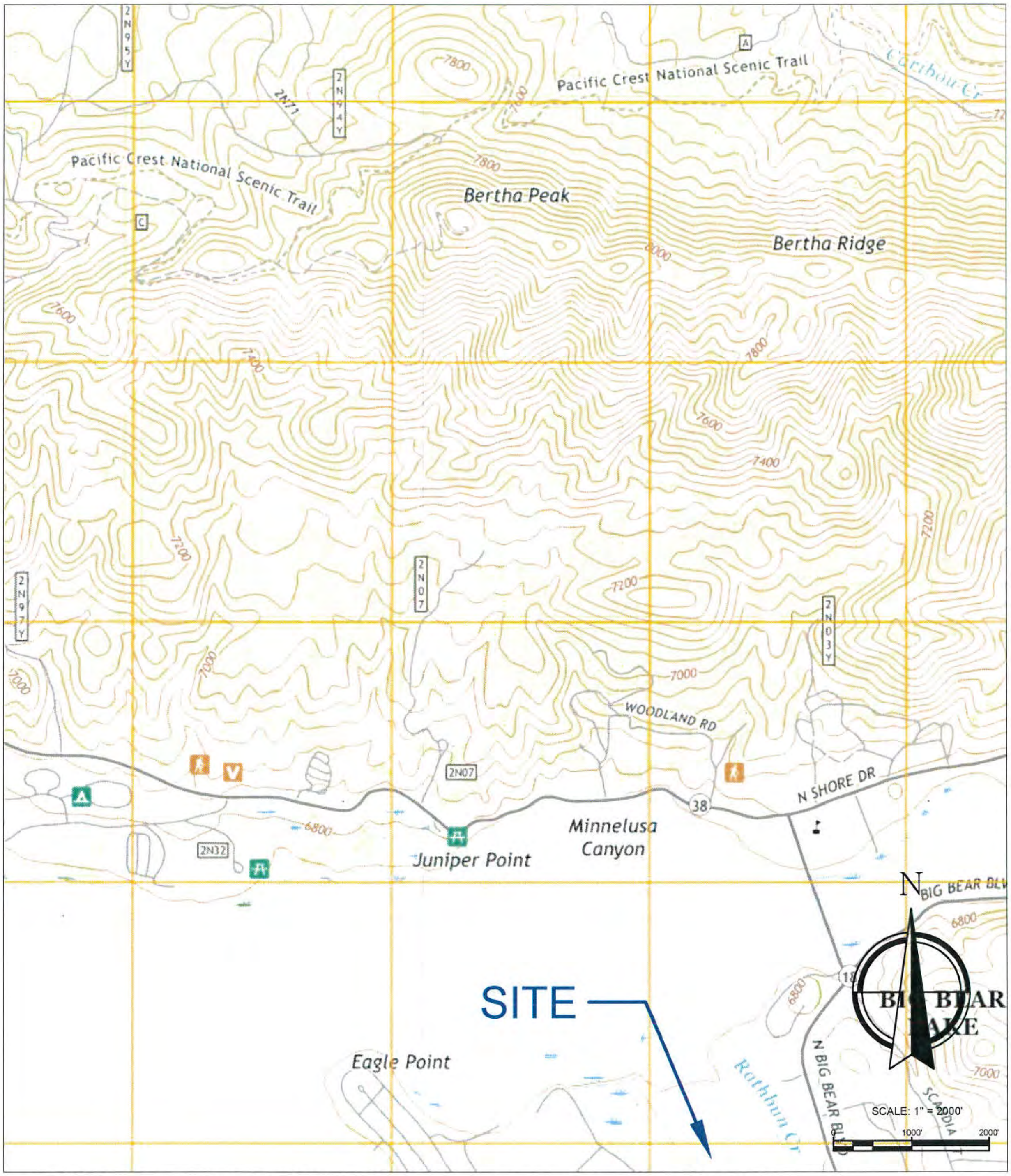
SITE CONDITIONS

The approximately 3-acre site is located on the west corner of Business Center Drive and Sandalwood Drive in the city of Big Bear Lake. An Index Map showing the general vicinity of the site is presented on the following page. The coordinates of the site are latitude 34.2505° N and longitude -116.8888° W utilizing the North American Datum (NAD) from 1983. The property is currently dirt-covered and has a very light growth of vegetation. At the time of our investigation, buildings were not present on the property, however some buses were parked on the site. The site is relatively flat, sloping downward to the northwest at a gradient of less than 4 percent. A Southwest Gas building is present to the southeast, and the property to the north is vacant.

FIELD AND LABORATORY INVESTIGATION

The soils underlying the site were explored by means of 10 test borings drilled with a truck-mounted flight-auger to depths of up to 71.5 feet below the existing ground surface. The approximate locations of the test borings are shown on Enclosure 1. The soils encountered were examined and visually classified by one of our field engineers. A summary of the soil classifications appears as Enclosure 2. The exploration logs show subsurface conditions at the dates and locations indicated, and may not be representative of other locations and times. The stratification lines presented on the logs represent the approximate boundaries between soil

INDEX MAP



SOURCE DOCUMENTS: USGS FAWNSKIN QUADRANGLE, CALIFORNIA, 7.5 MINUTE SERIES, 2018

TOWNSHIP AND RANGE: SECTION 21, T2N, R1E

LATITUDE: 34.2505° N

LONGITUDE: 116.8888° W

John R. Byerly
INCORPORATED

Rpt. No.: 7341
File No.: S-14447

types, and the transitions may be gradual. A hollow-stem auger with an outside diameter of 7.9 inches was utilized. The inside diameter of the auger was 4.3 inches.

Bulk and relatively undisturbed samples were obtained at selected levels within the explorations and delivered to our laboratory for testing and evaluation. The driving energy or blow counts required to advance the sampler at each sample interval were noted. Relatively undisturbed soil samples were recovered at various intervals in the borings with a California sampler. The California sampler was a 2.9-inch outside diameter, 2.5-inch inside diameter, split-barrel sampler lined with brass tubes. The sampler was 18 inches long. The sampler conformed to the requirements of ASTM D 3550. A 140-pound automatic trip hammer was lifted hydraulically and was dropped 30 inches for each blow. Standard penetration tests were performed as Boring 1 was advanced. The standard penetration test blow counts are shown on the logs for this boring. Standard penetration testing was performed with a 2.0-inch outside diameter, 1.5-inch inside diameter, split-barrel sampler. The sampler was 18 inches long and is machined to fit liners. The sampler was unlined and conformed to the requirements of ASTM D 1586. A 140-pound automatic trip hammer was lifted hydraulically and was dropped 30 inches for each blow. An efficiency value of 1.0 was assumed for the automatic trip hammer.

Included in our laboratory testing were moisture/density determinations on all undisturbed samples. Optimum moisture content/maximum dry density relationships were established for typical soil types so that the relative compaction of the subsoils could be determined. Consolidation testing was conducted on selected samples to evaluate the compressibility characteristics of the soil. The moisture/density data are presented on the boring logs presented in Enclosure 2. The maximum density and consolidation test results appear on Enclosures 3 and 4, respectively. Direct shear and expansion index tests were conducted on selected samples to determine their strength parameters and expansion potential, respectively. These test results are presented on Enclosures 5 and 6, respectively. Composite samples of potential subgrade soil were tested for gradation, sand equivalent and "R" value for pavement design purposes. The subgrade test results appear on Enclosure 7. Chemical testing, comprised of pH, soluble sulfate, chloride, redox potential and resistivity testing was also performed. These test results are presented in the "Chemical Test Results" section of this report.

SOIL CONDITIONS

Undocumented fill consisting of loose to very dense gravelly sands with silt and a trace of clay was encountered in the majority of the test borings to the depths shown on the following table:

BORING NO.	DEPTH OF UNDOCUMENTED FILL (ft.)	DEPTH TO COMPETENT NATURAL GROUND (ft)
1	6.0	11.5
2	3.0	3.0
3	3.0	5.0
4	6.0	9.0
5	0.0	0.0
6	4.0	8.0
7	0.0	0.0
8	2.0	9.0
9	2.0	2.0
10	2.0	2.0

The relative compaction of the fill varied from 84 percent to 93 percent (ASTM D 1557). In Boring 1 some debris was observed in the fill. The natural soils encountered in our test borings consisted of loose to very dense sands and silty sands with varying amounts of gravel and an occasional trace of clay. Some of the near-surface soils exhibited a relatively high moisture content. The loose natural soil is susceptible to hydroconsolidation. The depth to competent natural ground as encountered in each boring is also presented in the table above. Ground water was encountered in Borings 1 and 2 at depths of 26.6 feet and 29.9 feet, respectively, and at a depth of 27.4 feet in Boring 6. Bedrock was not encountered in our test borings. Refusal on very dense soil occurred in Boring 10 at a depth of 6.2 feet. The soils encountered in our test borings have a very low expansion potential in accordance with ASTM D 4829.

LIQUEFACTION AND DYNAMIC SETTLEMENT

Liquefaction is a phenomenon that occurs when a soil undergoes a transformation from a solid state to a liquefied condition due to the effects of increased pore-water pressure. Loose saturated soils with particle sizes in the medium sand to silt range are particularly susceptible to liquefaction when subjected to seismic ground shaking. Affected soils lose all strength during liquefaction, and foundation failure can occur.

Ground water was encountered in Borings 1 and 2 at depths of 26.6 feet and 29.9 feet, respectively, and at a depth of 27.4 feet in Boring 6. Currently the site is approximately 52 feet above the water level of Big Bear Lake. Our consulting engineering geologist estimates that the shallowest historic depth to ground water is expected to have been 8 feet. For the purpose of this evaluation, we have assumed an historic high ground water table of 5 feet below the ground surface. This is the value used in our liquefaction analysis.

It is anticipated that major earthquake ground shaking will occur during the lifetime of the proposed development from the North Frontal fault zone, located approximately 4.5 miles north of the site. This fault would create the most significant earthshaking event. Based on an earthquake magnitude of 7.0, a peak horizontal ground acceleration of 0.81g is assigned to the site. To evaluate the potential for seismically induced liquefaction and settlement of the subsoils, the soils were analyzed for relative density. The most effective measurement of relative density of sands with respect to liquefaction and seismic settlement potential is standard penetration resistance. Standard penetration tests were performed as Boring 1 was advanced.

Using the information presented in Table 3 of Page 73 of the publication by Idriss and Boulanger (Soil Liquefaction During Earthquakes, Idriss and Boulanger, MNO-12, 2008) an analysis was conducted to determine the sampler correction factor Cs. The SPT sampler is machined to fit liners, therefore a correction factor of 1.0 may not be appropriate. Throughout the test boring, a calculation was performed to determine the average $(N_1)_{60}$ value from which Cs was subsequently determined. An average Cs value greater than 1.3 was calculated, therefore a value of 1.3 was used in the analysis.

The standard penetration data provided input for the LiquefyPro Version 4.3 program for seismically induced liquefaction and dynamic settlement potential. As indicated in Special Publication 117A (Revised), "Guidelines for Evaluating and Mitigating Seismic Hazards in California, March 2009," a safety factor of 1.3 was used in this analysis. We have assumed that the loose and potentially liquefiable soil will be overexcavated and recompacted, and can then be represented by an N value of 30. The results of this evaluation are shown on Enclosure 9 and reveal a low potential for liquefaction. The analysis also reveals a very low potential for dynamic settlement. We conclude that neither liquefaction nor dynamic settlement need be a concern for this site after the recommended site preparation.

CONCLUSIONS

The undocumented fill is inconsistent in density and has relative compaction values ranging from 84 percent to 93 percent (ASTM D1557). The fill should be overexcavated and replaced as engineered fill below building, retaining wall, site wall, and shade structure areas. The complete stabilization of the existing soil may not be economically warranted in hardscape and pavement areas. Significant stabilization can be obtained by overexciting and recompacting the upper 3 feet of the existing artificial fill in these areas. The natural soils are in a loose to very dense condition. The lose natural soil should also be overexcavated and recompacted. With appropriate site preparation, we conclude that the soil conditions underlying the areas of the new improvements are compatible with the proposed construction. Recommendations for foundation design are provided below for soils with a very low expansion potential.

RECOMMENDATIONS

FOUNDATION DESIGN

Shallow Foundations: Where the site is prepared as recommended, the proposed buildings, shade structures, retaining walls and site walls may be founded on conventional continuous and isolated footings. Footings supporting the buildings, shade structures, and retaining walls should be at least 18 inches deep, and should be designed for a maximum safe soil bearing pressure of 2,500 pounds per square foot for dead plus live loads. Site wall footings should be at least 12 inches in depth and designed for a maximum safe soil bearing pressure of 2,000 pounds per square foot. These values may be increased by one-third for wind and seismic loading.

Continuous footings should be reinforced with at least four No. 4 bars, two placed near the top and two near the bottom of the footings. This recommendation for foundation reinforcement is based on geotechnical considerations. Structural design may require additional foundation reinforcement.

For footings thus designed and constructed, we would anticipate a maximum settlement of less than 1 inch and a maximum differential settlement slope of 1:850.

Deep Foundations: We have assumed that the existing artificial fill and loose natural soil underlying the shade structures will be overexcavated and recompacted. For the site prepared as recommended, an average skin friction of 250 pounds per square foot should be assumed for the soil for pier embedment depths of at least 9 feet. This value may be increased by one-third for wind or seismic loading. Lateral load capacity of the pier footings may be computed using any accepted pole footing formula assuming an allowable lateral earth pressure of 300 pounds per square foot per foot of depth to a maximum of 3,000 pounds per square foot. Each cast-in-place concrete pier should be filled with concrete the same day it is excavated.

SEISMIC DESIGN PARAMETERS

The seismic design coefficients as required by the 2019 California Building Code and ASCE Standard 7-16 are provided in the following table:

Factor or Coefficient	***Value***
Latitude	34.2505° N
Longitude	-116.8888° W
Mapped S_S	1.642g
Mapped S_1	0.568g
F_a	1.0
F_v	1.732
Final S_{MS}	1.818g
Final S_{M1}	1.136g
Final S_{DS}	1.210g
Final S_{D1}	0.760g
PGA	0.81g
T_L	8 seconds
Site Class	D

LATERAL LOADING

Retaining wall backfill within 6 feet of the walls should consist of granular soil exhibiting a very low (expansion potential between 0 and 21) expansion potential. For a level backfill surface and cantilever retaining wall conditions, we recommend an active earth pressure of 35 pounds per square foot per foot of depth, exclusive of surcharge loads. For braced walls with level backfill surface conditions, we recommend an at-rest earth pressure of 60 pounds per square foot per foot of depth, exclusive of surcharge loads. For shallow footings, resistance to lateral loads will be provided by passive earth pressure and basal friction. For footings bearing against compacted fill, passive earth pressure may be considered to develop at a rate of 300 pounds per square foot per foot of depth. Basal friction may be computed at 0.35 times the normal dead load. The resistance from basal friction and passive earth pressure may be combined directly without reduction. A backdrain system or weep holes should be provided to prevent buildup of hydrostatic pressure behind retaining walls. The allowable lateral resistance may be increased by one-third for wind and seismic loading.

SLABS-ON-GRADE

Concrete slab-on-grade design recommendations are presented below. The slab-on-grade recommendations assume underlying utility trench backfills and pad subgrade soils have been densified to a relative compaction of at least 90 percent (ASTM D1557).

1. It is our opinion that the compacted fill soils should provide adequate support for concrete slabs-on-grade without the use of a gravel base. The final pad surface should be rolled to provide a smooth dense surface upon which to place the concrete.

2. Slab-on-grade floors should be at least 4 inches thick – structural considerations may require a thicker slab. The concrete slabs-on-grade may be designed using a modulus of subgrade reaction of 250 pounds per cubic inch.

3. It is recommended that concrete slabs-on-grade be reinforced with at least No. 3 bars at 16 inches each way in the middle third of the slab. Structural considerations may require additional reinforcement. All slab reinforcement should be supported by chairs or precast concrete blocks to ensure positioning of reinforcement of the slab. Lifting of unsupported reinforcement during concrete placement should not be allowed.

4. Slabs to receive moisture-sensitive floor coverings should be underlain with a moisture vapor retardant membrane, such as 10-mil Stego Wrap or equivalent. The moisture vapor retardant membrane should conform to ASTM E 1745-11 (Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs). The moisture vapor retardant membrane should be lapped into the footing excavations to provide

full coverage of the subgrade soils. Punctures and/or holes cut for plumbing should be taped to minimize moisture emissions through the membrane. The project superintendent and/or a representative of the geotechnical engineer should inspect the placement of the moisture vapor retardant membrane prior to covering. Installation of the moisture vapor retardant membrane should be performed in accordance with ASTM E 1643-11 (Standard Practice for Selection, Design, Installation and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill under Concrete Slabs).

5. A 2-inch layer of clean sand (SE>30, no more than 7 percent passing the No. 200 sieve) should be placed over the moisture vapor retardant membrane to promote uniform setting of the concrete. Concrete should be placed on the sand blanket when the sand is damp. Excess moisture should not be allowed to accumulate within the sand blanket prior to concrete placement. At the time of concrete placement, the moisture content of the sand blanket above the moisture vapor retardant membrane should not exceed 2 percent below the optimum moisture content.

6. In lieu of placing the sand blanket described above and to further minimize future moisture vapor emissions through the slabs-on-grade, the slab concrete may be placed directly on the moisture vapor retardant membrane. Placing concrete directly on the moisture vapor retardant membrane will increase shrinkage and curling forces and make finishing more difficult. To accommodate these concerns, the structural engineer should provide appropriate mix design criteria for concrete placed directly on the moisture vapor retardant membrane.

7. We recommend a maximum water-cement ratio of 0.50 for all building slab concrete. Architectural or structural considerations may require the utilization of a lower water-cement ratio. Where slab concrete is placed directly on the moisture vapor retardant membrane without the presence of an intervening layer of absorptive sand, a lower maximum water-cement ratio may be needed.

8. Preparation of the concrete floor slabs should conform to ASTM F 710-11 (Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring) and the manufacturer's recommendations. Moisture vapor emission tests should be performed to verify acceptable moisture emission rates prior to flooring installation.

SITE PREPARATION

We assume that the site will be prepared in accordance with the California Building Code or the current City of Big Bear Lake Grading Ordinance. The recommendations presented below are to establish additional grading criteria. These recommendations should be considered preliminary and are subject to modification or expansion based on a geotechnical review of the project foundation and grading plans.

- All areas to be graded should be stripped of organic matter and other deleterious materials. All cavities created during site clearing should be cleaned of loose and disturbed soil, shaped to provide access for construction equipment, and backfilled with fill placed and compacted as described below.

- Undocumented fill should be removed from building, retaining wall and screen wall areas. Removal of the artificial fill in hardscape and pavement areas may be limited to a depth of 3 feet. Deleterious material should be separated from the removed fill and hauled from the site. The excavated fill should be stockpiled pending replacement or be placed in previously prepared areas.

- Overexcavation
  - The loose natural soils underlying building, retaining wall, and screen wall areas should be overexcavated until competent natural soil is encountered. Competent natural soil is defined as relatively non-porous undisturbed soil exhibiting a relative compaction of at least 85 percent (ASTM D1557). The natural soil should be further overexcavated so there is at least 2 feet of recompacted soil below the bottom of the footings. The soils exposed in the bottom of the excavations should be evaluated by a representative of the geotechnical engineer.

  - Limits of overexcavation – The overexcavation should extend beyond the building areas and retaining wall and screen wall footings a horizontal distance at least equal to the depth of overexcavation below the bottom of the foundation elements or 5 feet, whichever is greater. Due to property line constraints, overexcavation may not be possible outside the northwestern perimeter of the screen wall footing.

  - <u>Asphalt concrete parking and driveway areas</u> – Undocumented fill should be removed below parking, driveway and fire lane areas to a maximum depth of 3 feet. The soils exposed in the subexcavated surface should be scarified to a depth of at least 12 inches, moisture conditioned to at least the optimum moisture content, and densified to a minimum relative compaction of 90 percent (ASTM D1557).

  - <u>Hardscape areas</u> – Undocumented fill should be removed below proposed hardscape areas to a maximum depth of 3 feet. The exposed soils below these areas should be scarified to a depth of at least 12 inches, moisture conditioned to at least the optimum moisture content and densified to a minimum relative compaction of 90 percent (ASTM D1557).

- Approved subexcavated surfaces and all other surfaces to receive fill should be scarified to a minimum depth of 12 inches, moisture conditioned to at least the optimum moisture content, and densified to a minimum relative compaction of 90 percent (ASTM D1557).

- The on-site soils should provide adequate quality fill material provided they are free from significant organic matter and other deleterious materials, and are at acceptable moisture contents. Import fill should be inorganic, granular, non-expansive soil free from rocks or lumps greater than 8 inches in maximum dimension and should exhibit a very low expansion potential (expansion index less than 21), negligible sulfate content (less than 1,000 ppm soluble sulfate by weight), and low corrosion potential. Prior to bringing import fill to the site, the contractor should obtain certification to verify that the proposed import meets the State of California Department of Toxic Substance Control (DTSC) environmental standards. Proposed import should be sampled at the source and tested by this firm for expansion index, soluble sulfate content, and corrosion potential.

- All fill should be placed in 8-inch or less lifts, moisture conditioned to at least the optimum moisture content and densified to a minimum relative compaction of 90 percent (ASTM D 1557). Where the overexcavation cannot extend to the horizontal limits recommended, the fill should be densified to a relative compaction of at least 95 percent.

- The surface of the site should be graded to provide positive drainage away from the structures. Drainage should be directed to established swales and then to appropriate drainage structures to minimize the possibility of erosion. Water should not be allowed to pond adjacent to footings.

SHRINKAGE AND SUBSIDENCE

Volume change in going from cut to fill conditions is anticipated where near-surface grading will occur. Assuming the fill will be compacted to an average relative compaction of 93 percent, an average cut-fill shrinkage of 10 to 15 percent is estimated. Further volume loss will occur through subsidence during preparation of the natural ground surface. Although the contractor's methods and equipment utilized in preparing the natural ground will have a significant effect on the amount of natural ground subsidence that will occur, our experience indicates as much as 0.10 to 0.15 foot of subsidence in areas prepared to receive fill should be anticipated. These values are exclusive of losses due to stripping or removal of subsurface obstructions.

FLOODING

Our geologist has indicated that the eastern portion of the site is situated within a flood hazard zone that is denoted as being "Special Flood Hazard Areas Subject to Inundation by the 1% Annual Chance Flood." The potential for flood hazards should be evaluated by the project civil engineer.

ASPHALT CONCRETE AND PORTLAND CEMENT CONCRETE HARDSCAPE

Representative samples of near-surface soil at the site have been tested for relevant subgrade properties. A Traffic Index of 5.0 was assumed for the new parking lots and drive areas for conventional vehicular traffic, and a Traffic Index of 7.0 was assumed for areas accommodating heavier truck and bus traffic and fire lanes. In conjunction with the test data shown on Enclosure 7, we believe the sections presented on the following table should provide durable pavement.

Asphalt Concrete Pavement

Location	TI	"R" Value	Thickness (Inches) Asphalt Concrete	Thickness (Inches) Aggregate Base
Conventional Passenger Vehicles	5.0	45	2.5	4.0
Fire Lane and Truck Traffic Areas	7.0	45	3.0	8.0

For hardscape areas to receive only pedestrian traffic, we recommend portland cement concrete pavement be at least 3.5 inches in thickness and be placed directly on compacted subgrade soil. Prior to the placement of hardscape concrete, we recommend that the final subgrade surface be scarified to a depth of at least 12 inches, moisture conditioned to near the optimum moisture content, and densified to a minimum relative compaction of 90 percent (ASTM D1557).

The above designs are preliminary and for estimating purposes only. We recommend that during the process of rough grading, observation and additional testing of the actual subgrade soils should be performed. Final pavement design sections can then be determined. The foregoing pavement sections assume that utility trench backfill below all proposed pavement areas will be compacted to at least 90 percent relative compaction. Prior to the placement of aggregate base, we recommend that the final subgrade surface be scarified to a depth of at least 12 inches, moisture conditioned to near the optimum moisture content, and compacted to a minimum relative compaction of 90 percent (ASTM D1557). Aggregate base should be densified to at least 95 percent relative compaction. Suggested specifications for aggregate base material are presented on Enclosure 8. The preparation of the subgrade and compaction of the aggregate base should be monitored by a representative of the geotechnical engineer.

CHEMICAL TEST RESULTS

The chemical test results from a sample taken from Boring 1 between the ground surface and a depth of 5 feet are shown on the following table:

Analysis	Result	Units
Saturated Resistivity	3700	ohm-cm
Chloride	ND (Not Detected)	ppm
Sulfate	30	ppm
pH	7.7	pH units
Redox Potential	295	mV

The chemical test results from a sample taken from Boring 2 between the ground surface and a depth of 5 feet are shown on the following table:

Analysis	Result	Units
Saturated Resistivity	5000	ohm-cm
Chloride	ND (Not Detected)	ppm
Sulfate	30	ppm
pH	7.3	pH units
Redox Potential	260	mV

The soil tested in both borings exhibited negligible soluble sulfate content, therefore, sulfate-resistant concrete will not be required for this project. In addition, the results of the corrosivity testing indicate that the soil tested is not detrimentally corrosive to buried ferrous-metal pipes.

GAS ODOR

During our field investigation and during our review of the soil samples in the laboratory, there was no gas odor detected from the boreholes or from any of the samples.

FOUNDATION AND GRADING PLAN REVIEW

The project foundation and grading plans should be reviewed by the geotechnical engineer. Additional recommendations may be required at that time.

CONSTRUCTION OBSERVATIONS

All grading operations, including the preparation of the natural ground surface, should be observed and compaction tests performed by this firm. No fill should be placed on any prepared surface until that surface has been evaluated by the representative of the geotechnical engineer. The footing excavations for the buildings and shade structures should be evaluated by a representative of the geotechnical engineer. All footing excavations should be observed by the representative of the geotechnical engineer prior to placement of forms or reinforcing steel.

The conclusions and recommendations presented in this report are based upon the field and laboratory investigation described herein and represent our best engineering judgment. Should conditions be encountered in the field that appear different from those described in this report, we should be contacted immediately in order that appropriate recommendations might be prepared.

Respectfully submitted,

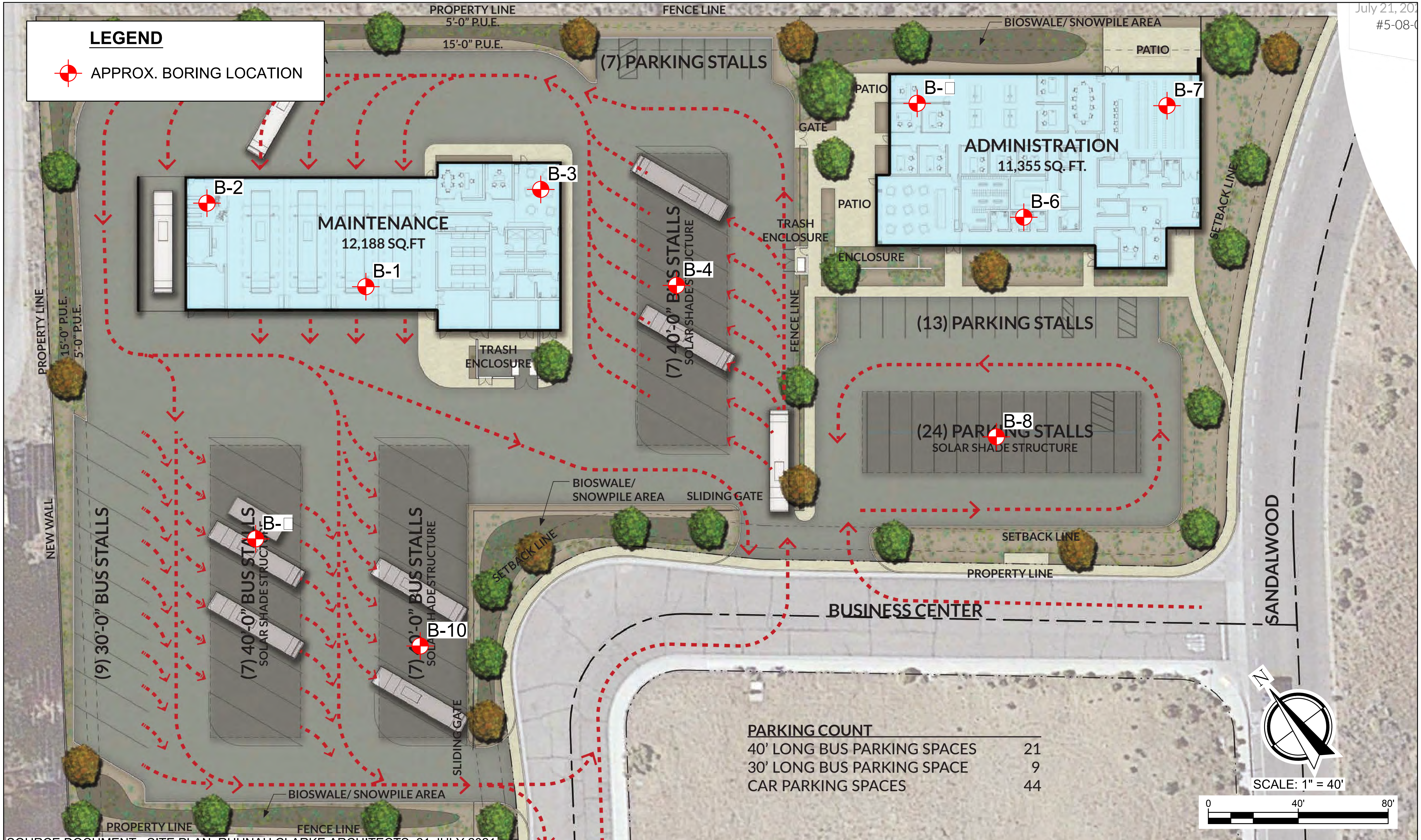
JOHN R. BYERLY, INC.

John R. Byerly, Geotechnical Engineer
President

LICENSED PROFESSIONAL ENGINEER
JOHN R. BYERLY
GE 000179
EXP. 06/30/23
GEOTECHNICAL
STATE OF CALIFORNIA

JRB:GSF:jet

Enclosures:
(1) Plot Plan
(2) Test Boring Logs
(3) Maximum Density Determinations
(4) Consolidation Test Results
(5) Direct Shear Test Data
(6) Expansion Index Test Results
(7) Subgrade Test Results
(8) Specifications for Aggregate Base
(9) Liquefaction Analysis
(10) Geologic Hazards Report



PARKING COUNT

40' LONG BUS PARKING SPACES	21
30' LONG BUS PARKING SPACE	9
CAR PARKING SPACES	44

SOURCE DOCUMENT: SITE PLAN, RUHNAU CLARKE ARCHITECTS, 21 JULY 2021

John R. Byerly
INCORPORATED

GEOTECHNICAL INVESTIGATION

MOUNTAIN AREA REGIONAL TRANSIT AUTHORITY
160-170 BUSINESS CENTER
BIG BEAR LAKE, CALIFORNIA

Enclosure 1
Rpt. No.: 7341
File No.: S-14447

B-1

Boring Date: 1/20/22
Surface Elevation:
Drilling Method: Flight-Auger

Depth	Std. Pen. "N" Value	Blows/Ft.	Dry Density (PCF)	Moisture Content (%)	Rel. Compaction (%)	Water Table		
0		50	122	8.6	91		SM	Red-brown gravelly fine to coarse sand with silt and a trace of clay and debris, moist and dense (FILL)
		50/6"	---	9.3	---			- becoming very dense at 3.5 feet
		50/9"	124	10.6	93			
	11							
							SM	Light gray-brown silty fine to medium sand, moist and dense (NATURAL GROUND)
10		50/9"	---	---	---			
	13							- becoming medum dense at 11.5 feet
		50	105	23.3	81			- becoming wet and loose to medium dense at 15.0 feet
	29							
20		50/10"	107	19.5	92		SM	Light gray-brown silty fine to medium sand with a trace of clay, wet and dense
	42							
		50/8"	109	15.3	93	▼		
	31							- ground water encountered at 26.6 feet
							SP	Light brown fine to medium sand, saturated and dense
30		43	99	36.0	---			
	83							- becoming very dense at 31.5 feet
	58						SM	Brown silty fine to medium sand, saturated and very dense
40	49							- becoming dense at 40.0 feet
	34							
50	55							- becoming very dense at 50.0 feet
							SM	Gray-brown silty fine to medium sand with a trace of clay, saturated and very dense
	100							
60	51							
	50							
70								

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LOG OF BORING

John R. Byerly, Inc.

MARTA New Administration
Building and Maintenance Facility

Enclosure 2, Page 1
Rpt. No.: 7341
File No.: S-14447

B-1

Boring Date: 1/20/22
Surface Elevation:
Drilling Method: Flight-Auger

Depth	Std. Pen. "N" Value	Blows/Ft.	Dry Density (PCF)	Moisture Content (%)	Rel. Compaction (%)	Water Table		
70	81						SM	Gray-brown silty fine to medium sand with a trace of clay, saturated and very dense
								Total Depth at 71.5 Feet Free Ground Water Encountered at 26.6 Feet
80								
90								
100								
110								
120								
130								
140								

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LOG OF BORING

John R. Byerly, Inc.

MARTA New Administration
Building and Maintenance Facility

Enclosure 2, Page 2
Rpt. No.: 7341
File No.: S-14447

B-2

Boring Date: 3/10/22
Surface Elevation:
Drilling Method: Flight-Auger

Depth	Std. Pen. "N" Value	Blows/Ft.	Dry Density (PCF)	Moisture Content (%)	Rel. Compaction (%)	Water Table		
0							SM	Gray-brown gravelly fine to medium sand with silt and a trace of clay, moist and medium dense (FILL)
		14	118	12.7	89			
		15	113	11.0	86		SM	Red-brown silty fine to medium sand with gravel, moist and medium dense (NATURAL GROUND)
5		50/3"	---	---	---			- becoming very dense at 5.0 feet
							SM	Light brown silty fine to medium sand, wet to saturated and medium dense
		40	---	27.1	---			
10		50/10"	111	16.2	85			
15		45	111	26.3	85			
20		50/11"	---	24.8	---			- becoming dense at 20.0 feet
25		50/7"	119	14.8	92			
30		50/11"	110	21.1	85	▼		- ground water encountered at 29.9 feet
35								

Total Depth at 31.4 Feet
Free Ground Water Encountered at 29.9 Feet

LOG OF BORING

B-3

Boring Date: 1/20/22
Surface Elevation:
Drilling Method: Flight-Auger

Depth	Std. Pen. "N" Value	Blows/Ft.	Dry Density (PCF)	Moisture Content (%)	Rel. Compaction (%)	Water Table		
0						GWT not encountered	SM	Gray-brown gravelly fine to medium sand with silt and a trace of clay, moist and dense (FILL)
		50/9"	119	12.8	90			
		12	109	14.2	83		SM	Red-brown silty fine to medium sand with gravel, wet and loose (NATURAL GROUND)
5		24	---	5.8	---			- becoming damp and medium dense at 5.5 feet
							SM	Light brown silty fine to medium sand, wet to saturated and loose to medium dense
		35	105	27.6	81			
10		50/11"	107	20.6	82			- becoming wet at 10.5 feet
15		50	110	18.7	85			- becoming medium dense at 15.0 feet
								Total Depth at 16.5 Feet No Free Ground Water Encountered
20								
25								
30								
35								

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LOG OF BORING

John R. Byerly, Inc.

MARTA New Administration
Building and Maintenance Facility

Enclosure 2, Page 4
Rpt. No.: 7341
File No.: S-14447

B-4

Boring Date: 1/20/22
Surface Elevation:
Drilling Method: Flight-Auger

Depth	Std. Pen. "N" Value	Blows/Ft.	Dry Density (PCF)	Moisture Content (%)	Rel. Compaction (%)	Water Table
0						GWT not encountered
		50	113	9.0	86	
		40	123	12.6	93	
5						
		45	121	9.4	92	
		11	110	12.3	83	
10						
		46	114	6.1	---	
15						
		43	110	24.0	85	
20						
		50/7"	---	---	---	
25						
30						
35						

SM	Red-brown gravelly fine to medium sand with silt, and a trace of clay, moist and medium dense (FILL) - becoming dense at 3.5 feet
SM	Brown silty fine to medium sand with gravel, moist and loose (NATURAL GROUND)
SP	Red-brown fine to coarse sand with gravel and rock fragments, damp and dense
SM	Gray-brown silty fine to medium sand, wet and medium dense - becoming very dense at 17.0 feet

Total Depth at 20.6 Feet
No Free Ground Water Encountered

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LOG OF BORING

John R. Byerly, Inc.

MARTA New Administration Building and Maintenance Facility

Enclosure 2, Page 5
Rpt. No.: 7341
File No.: S-14447

B-5

Boring Date: 3/10/22
Surface Elevation:
Drilling Method: Flight-Auger

Depth	Std. Pen. "N" Value	Blows/Ft.	Dry Density (PCF)	Moisture Content (%)	Rel. Compaction (%)	Water Table		
0						GWT not encountered	SM	Dark brown gravelly fine to medium sand with silt, moist and medium dense
		42	---	12.6	---			
		25	117	13.5	89		SM	Gray-brown silty fine to medium sand with gravel, moist and medium dense
5		15	114	9.3	86			
		28	---	6.4	---		SM	Light brown fine to coarse sand with gravel and rock fragments, damp and medium dense
							SM	Light gray silty fine to medium sand, moist and medium dense
10		50/10"	113	14.6	87			
15		50/9"	---	20.8	---			- becoming wet and dense at 15.0 feet
20		50	111	17.3	85			- becoming medium dense at 20.0 feet
25		50/11"	112	21.0	86			
30		50/7"	---	15.6	---			- becoming very dense at 30.0 feet
								Total Depth at 31.0 Feet No Free Ground Water Encountered
35								

LOG OF BORING

John R. Byerly, Inc.

MARTA New Administration Building and Maintenance Facility

B-6

Boring Date: 1/20/22
Surface Elevation:
Drilling Method: Flight-Auger

Depth	Std. Pen. "N" Value	Blows/Ft.	Dry Density (PCF)	Moisture Content (%)	Rel. Compaction (%)	Water Table
0						
		16	111	12.8	84	
		36	118	9.0	89	
5						
		26	115	11.9	87	
		11	106	17.7	82	
10						
		50/9"	---	7.6	---	
15						
		50/6"	124	4.6	95	
20						
		50/10"	100	25.6	86	
25						
		50/7"	---	---	---	
						▼
30						
		42	---	26.6	---	
35						

SM	Dark brown gravelly fine to medium sand with silt and a trace of clay, moist and loose (FILL) - becoming medium dense at 3.5 feet
SM	Red-brown silty fine to medium sand with gravel, moist and medium dense (NATURAL GROUND)
SM	Red-brown silty fine to medium sand, wet and loose
SP	Red-brown fine to coarse sand with gravel and rock fragments, wet and dense
SM	Light gray-brown silty fine to medium sand, damp and very dense
SM	Light gray-brown silty fine to medium sand with a trace of clay, wet and medium dense to dense - becoming saturated at 27.4 feet

Total Depth at 31.5 Feet
Ground Water Encountered at 27.4 Feet

LOG OF BORING

John R. Byerly, Inc.

MARTA New Administration
Building and Maintenance Facility

Enclosure 2, Page 7
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B-7

Boring Date: 1/20/22
Surface Elevation:
Drilling Method: Flight-Auger

Depth	Std. Pen. "N" Value Blows/Ft.	Dry Density (PCF)	Moisture Content (%)	Rel. Compaction (%)	Water Table
0	30	115	13.8	87	GWT not encountered
	18	117	13.4	89	
5	22	---	3.7	---	
	50/2"	---	---	---	
10	50/6"	---	---	---	
15	50/3"	---	---	---	
20					
25					
30					
35					

SM Dark brown silty fine to medium sand with gravel, moist and medium dense

- becoming damp at 5.5 feet

- becoming very dense at 7.5 feet

SM Light gray-brown silty fine to coarse sand with a trace of clay, wet and very dense

Total Depth at 15.8 Feet
No Free Ground Water Encountered

LOG OF BORING

B-8

Boring Date: 1/20/22
Surface Elevation:
Drilling Method: Flight-Auger

Depth	Std. Pen. "N" Value Blows/Ft.	Dry Density (PCF)	Moisture Content (%)	Rel. Compaction (%)	Water Table
0					GWT not encountered
	50/11"	---	---	---	
	23	114	9.4	86	
5	27	114	19.5	86	
	10	109	11.0	84	
10	50/8"	106	13.3	91	
15	50/10"	108	18.0	93	
20	50/7"	---	---	---	
25					
30					
35					

SM	Dark brown gravelly fine to medium sand with silt and a trace of clay, moist and dense (FILL)
SM	Red-brown silty fine to medium sand with gravel, moist and medium dense (NATURAL GROUND) - becoming wet at 5.5 feet
SM	Red-brown silty fine to medium sand, moist and loose
SM	Light gray-brown silty fine to medium sand with a trace of clay, wet and very dense

Total Depth at 21.0 Feet
No Free Ground Water Encountered

LOG OF BORING

B-9

Boring Date: 1/20/22
Surface Elevation:
Drilling Method: Flight-Auger

Depth	Std. Pen. "N" Value	Blows/Ft.	Dry Density (PCF)	Moisture Content (%)	Rel. Compaction (%)	Water Table
0						GWT not encountered
		48	115	10.0	87	
		50/6"	---	11.9	---	
5		50/9"	120	7.5	91	
		18	113	10.9	87	
10		50/9"	---	3.4	---	
15		50/10"	118	15.8	91	
20		50/8"	---	14.1	---	
25						
30						
35						

SM	Dark brown gravelly fine to medium sand with silt and a trace of clay, moist and medium dense (FILL)
SM	Red-brown silty fine to medium sand with gravel, moist and very dense (NATURAL GROUND)
SM	Red-brown silty fine to medium sand, moist and medium dense
	- becoming damp and dense at 10.5 feet
	- becoming wet at 15.5 feet
	- becoming very dense at 20.0 feet

Total Depth at 21.2 Feet
No Free Ground Water Encountered

LOG OF BORING

John R. Byerly, Inc.

MARTA New Administration Building and Maintenance Facility

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Rpt. No.: 7341
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B-10

Boring Date: 1/20/22
Surface Elevation:
Drilling Method: Flight-Auger

Depth	Std. Pen. "N" Value	Blows/Ft.	Dry Density (PCF)	Moisture Content (%)	Rel. Compaction (%)	Water Table
0						GWT not encountered
		50/9"	120	8.0	91	
		50/8"	121	7.8	92	
5		50/8"	123	6.6	93	
10						
15						
20						
25						
30						
35						

SM	Dark brown gravelly fine to medium sand with silt and a trace of clay, moist and dense (FILL)
SM	Red-brown silty fine to medium sand with gravel, moist and very dense (NATURAL GROUND)

Refusal on Very Dense Soil at 6.2 Feet
No Free Ground Water Encountered

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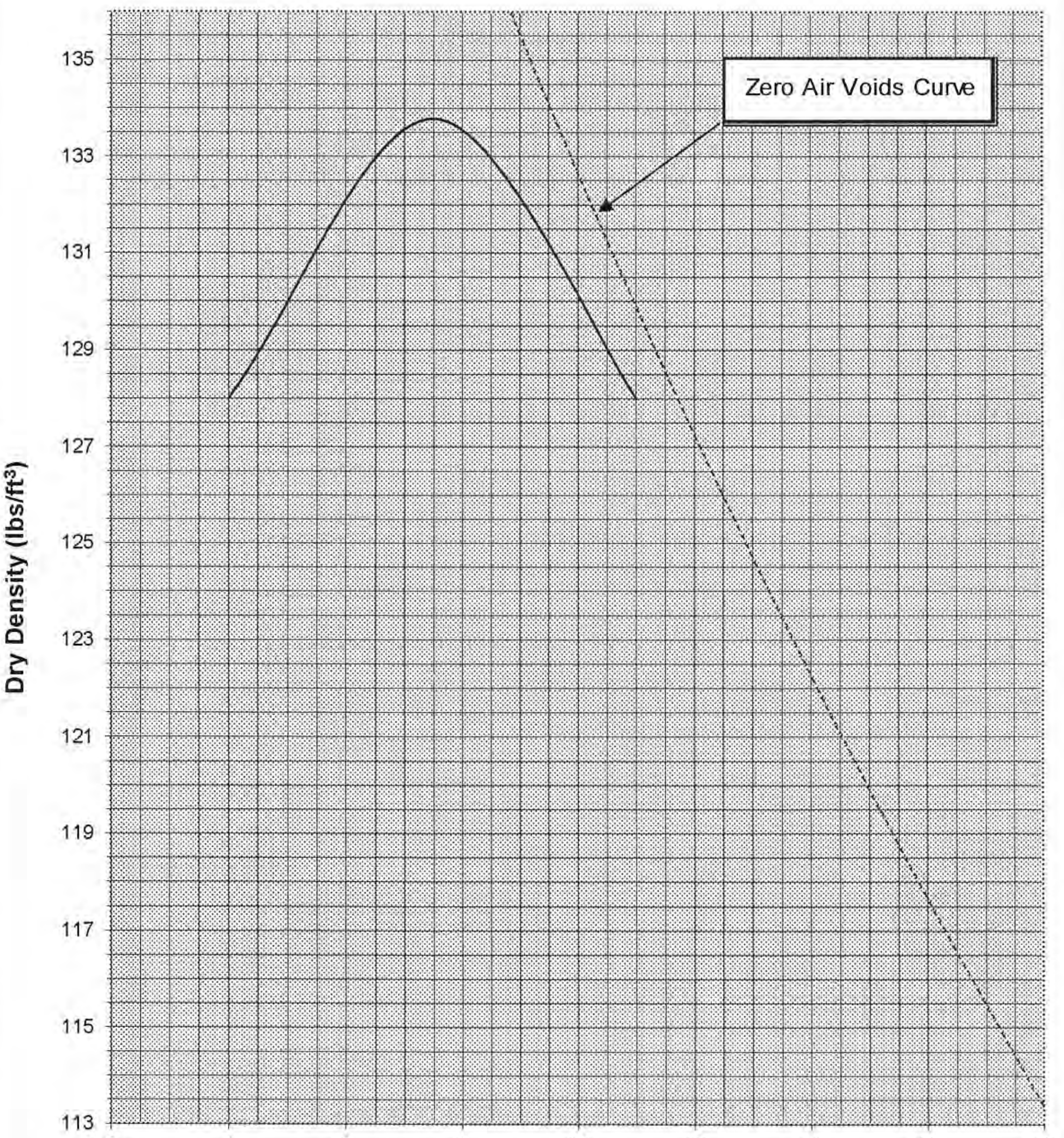
LOG OF BORING

John R. Byerly, Inc.

MARTA New Administration Building and Maintenance Facility

Moisture/Density Relationship
ASTM D1557 (Method A)

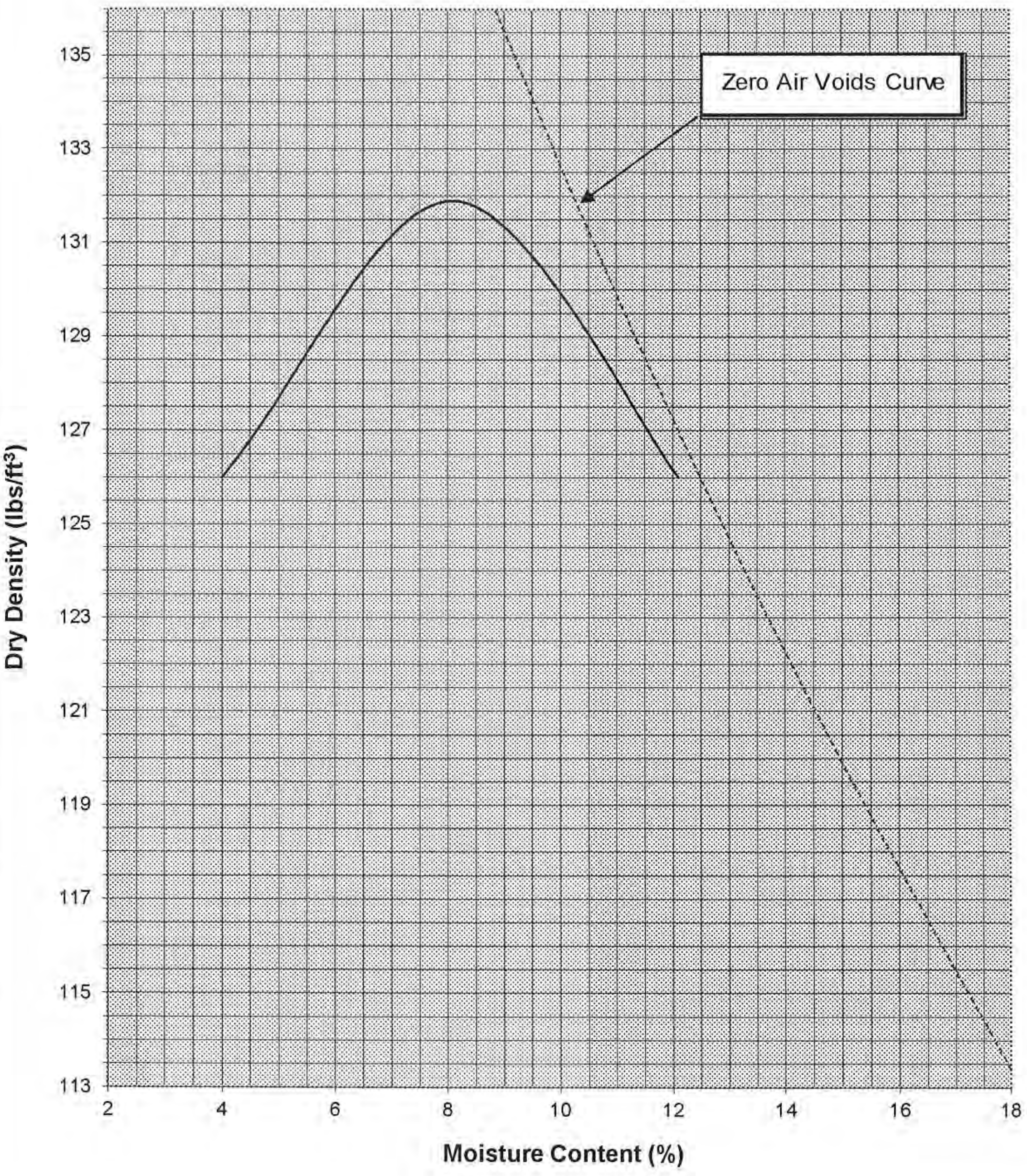


Boring No.	B-1
Depth (ft.)	3.5
Optimum Moisture (%)	7.5
Maximum Dry Density (pcf)	133.8
Soil Classification	Brown gravelly fine to coarse sand with silt and a trace of clay

MARTA Administration Building
Big Bear Lake, California

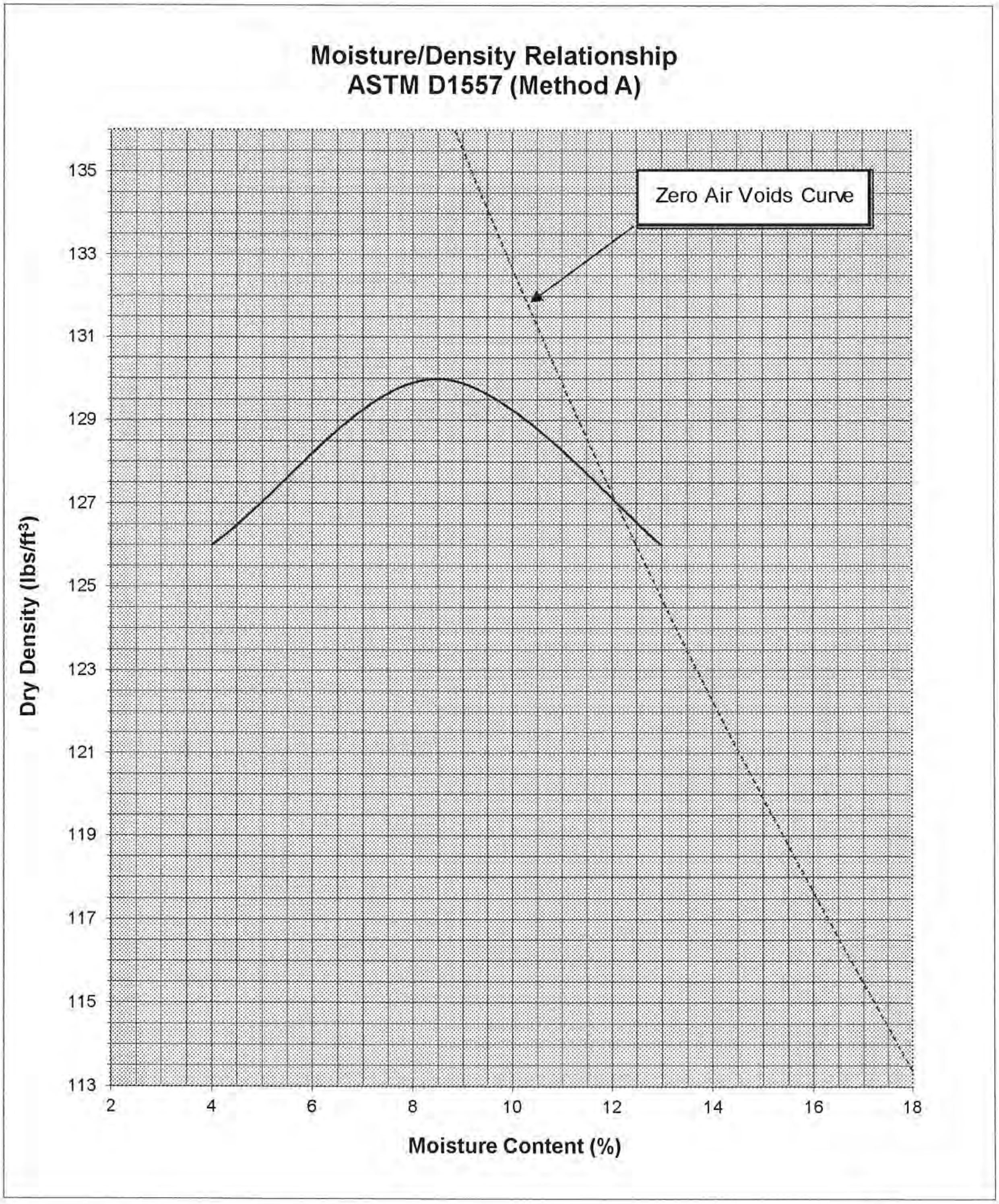
Enclosure 3, Page 1
Rpt. No.: 7341
File No.: S-14447

Moisture/Density Relationship
ASTM D1557 (Method A)



Boring No.	B-2
Depth (ft.)	5.5
Optimum Moisture (%)	8.1
Maximum Dry Density (pcf)	131.9
Soil Classification	Red-brown silty fine to medium sand with gravel (SM)

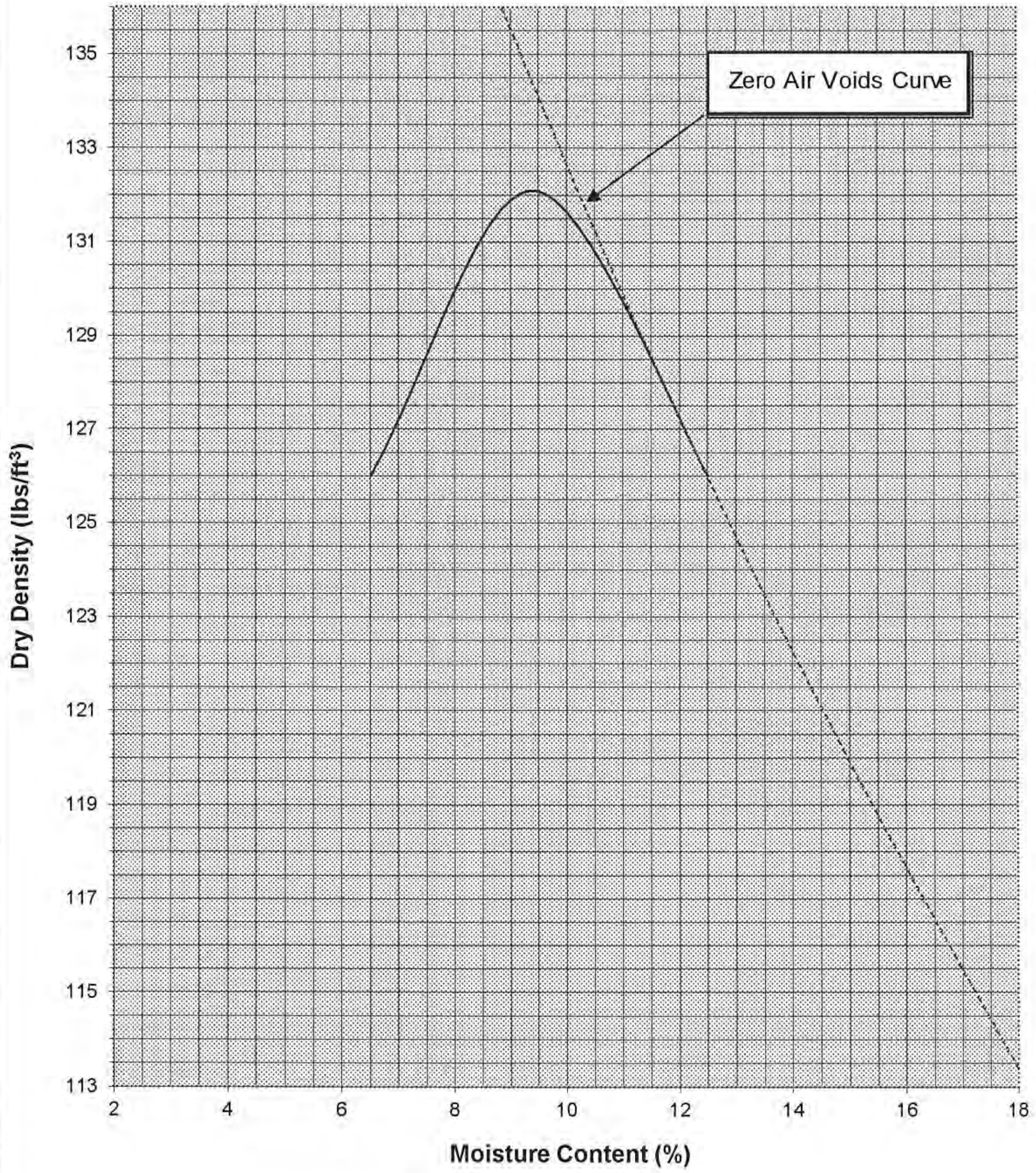
MARTA Administration Building
Big Bear Lake, California



Boring No.	B-2
Depth (ft.)	7.5
Optimum Moisture (%)	8.5
Maximum Dry Density (pcf)	130.0
Soil Classification	Light brown silty fine to medium sand (SM)

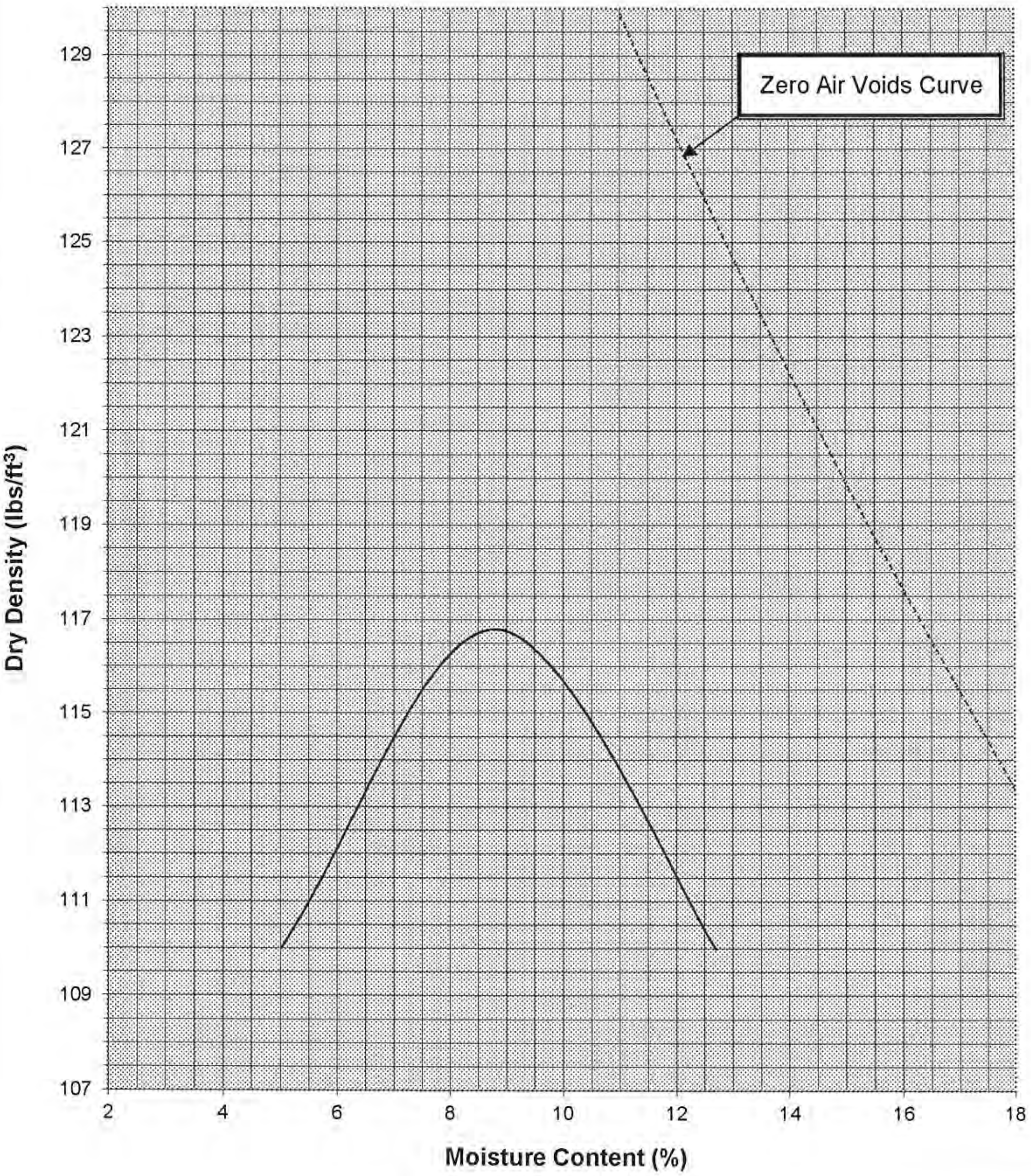
MARTA Administration Building
Big Bear Lake, California

Moisture/Density Relationship
ASTM D1557 (Method A)



Boring No.	B-3
Depth (ft.)	1.5
Optimum Moisture (%)	9.4
Maximum Dry Density (pcf)	132.1
Soil Classification	Gray-brown gravelly f-m sand with silt and a trace of clay (SM)

Moisture/Density Relationship
ASTM D1557 (Method A)

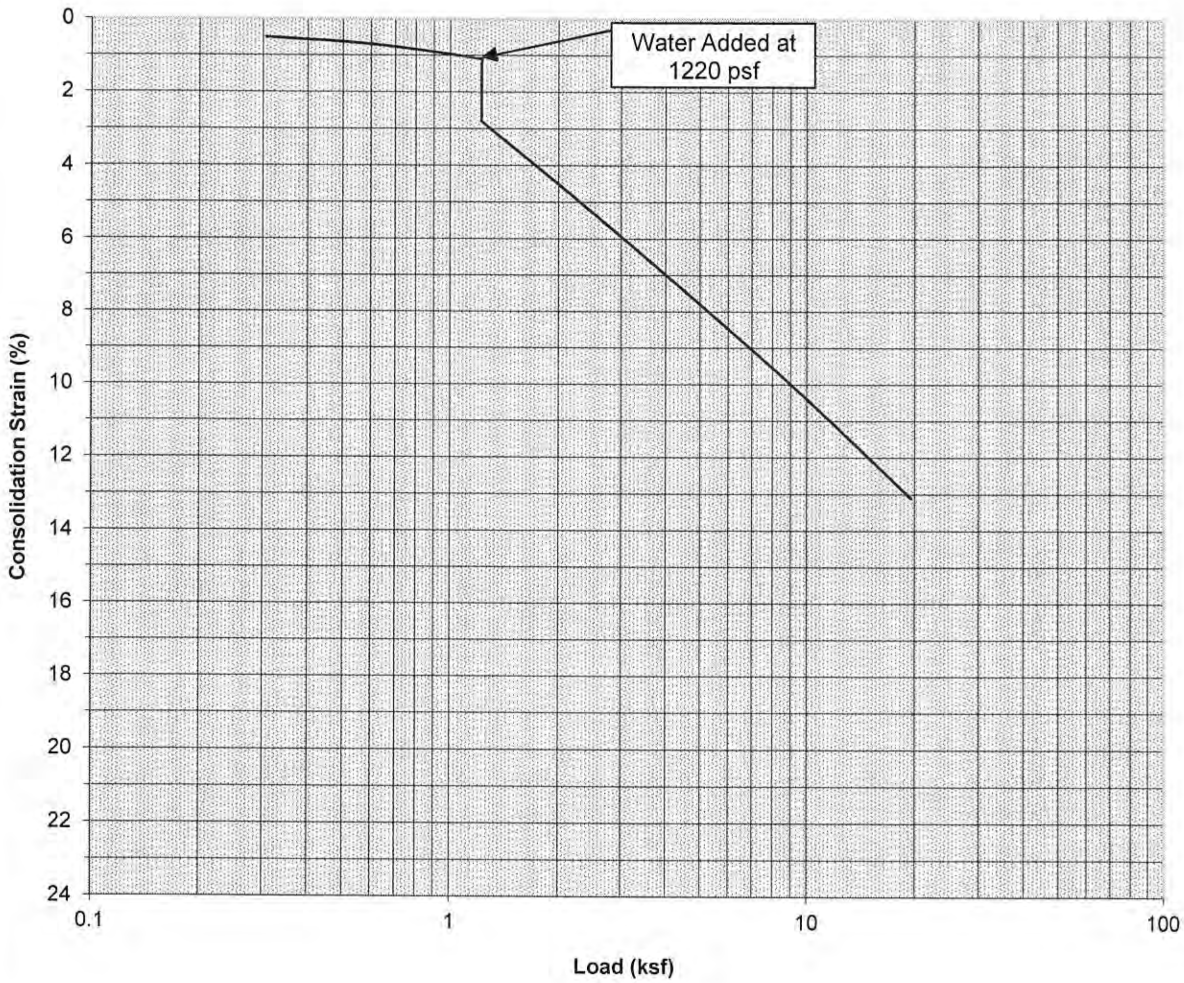


Boring No.	B-8
Depth (ft.)	15.5
Optimum Moisture (%)	8.8
Maximum Dry Density (pcf)	116.8
Soil Classification	Light gray-brown silty fine to medium sand with a trace of clay

MARTA Administration Building
Big Bear Lake, California

Enclosure 3, Page 5
Rpt. No.: 7341
File No.: S-14447

Consolidation Test Results



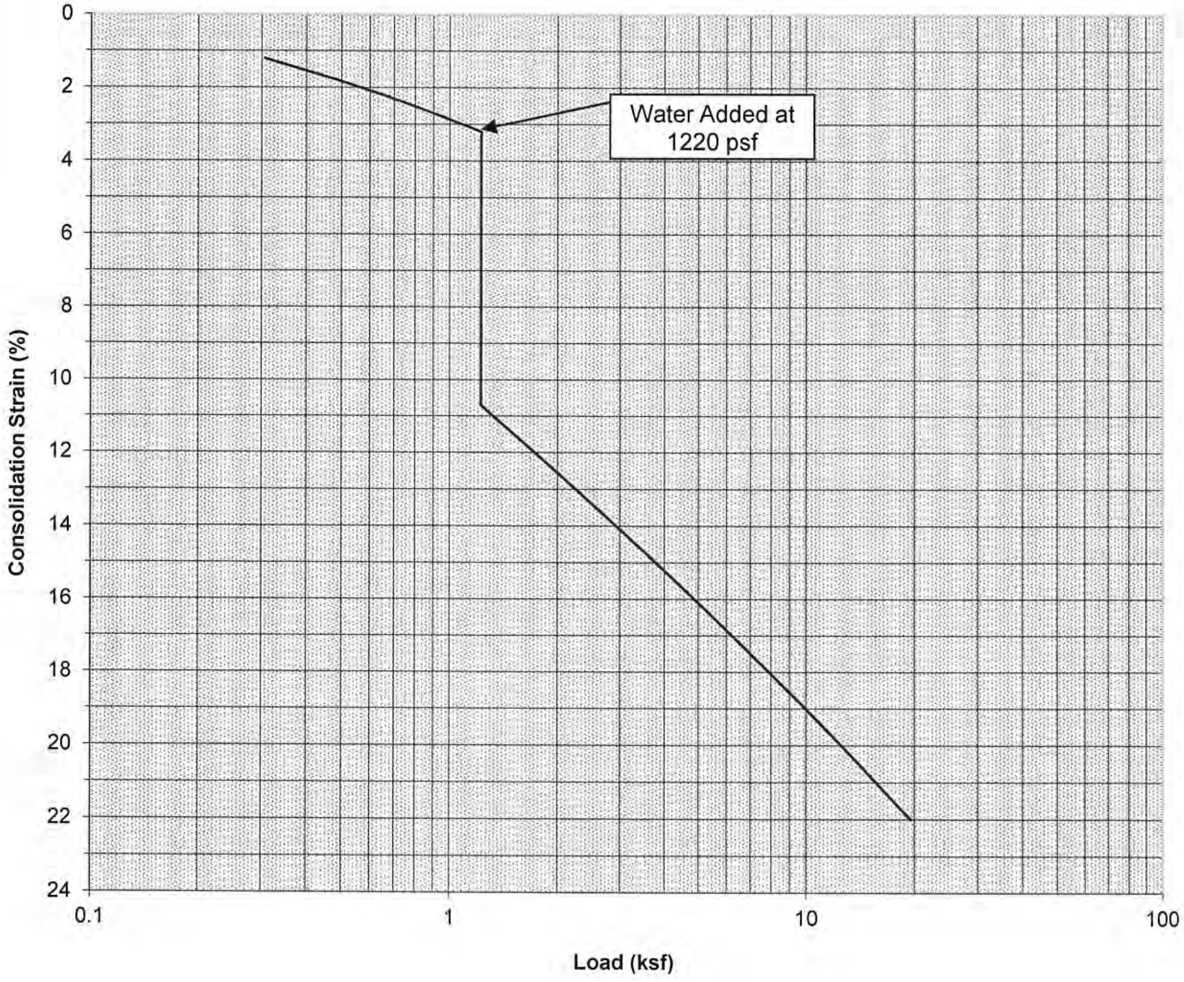
Classification: SM

Boring Number:	B-4
Depth (ft)	7.5
Specimen Diameter (in)	2.4
Specimen Thickness (in)	1.0

Initial Moisture Content (%)	12.3
Final Moisture Content (%)	15.8
Initial Dry Density (pcf)	110

Enclosure 4, Page 1
Rpt. No.: 7341
File No.: S-14447

Consolidation Test Results



Classification: SM

Boring Number:	B-8
Depth (ft)	7.5
Specimen Diameter (in)	2.4
Specimen Thickness (in)	1.0

Initial Moisture Content (%)	11.0
Final Moisture Content (%)	16.8
Initial Dry Density (pcf)	109

Enclosure 4, Page 2
Rpt. No.: 7341
File No.: S-14447

DIRECT SHEAR TESTS

Test Boring No.	Depth of Sample (Ft.)	Angle of Internal Friction (°)	Cohesion (PSF)
B-4	7.5	31	50
B-8	7.5	31	50
B-9	5.5	33	0

EXPANSION INDEX TEST DATA
ASTM D 4829/ASTM D 2488

Project: Mountain Area Regional Transit Authority

Date: April 11, 2022

Soil Description: Silty fine to coarse sand with a trace of clay

Location: B-1 at 3.5'

Soil I.D.	Initial Height (0.001 in.)	Initial Water Content (%)	Initial Dry Unit Weight (0.1 lbf/ft^3)	Degree of Saturation (%)	Initial Dial Reading (0.001)	Final Dial Reading (0.001)	Final Water Content (0.1%)	Expansion Index	Classification of Potential Expansion
B-1	1.000	9.6	112.7	52.0	0.1677	0.1646	16.7	3	Very low

Expansion Index determined by adjusting the water content to achieve a degree of saturation of 50 +/- 2%.

Enclosure 6
Rpt. No.: 7341
File No.: S-14447

RESULTS OF SUBGRADE SOIL TESTS

California Department of Transportation Test Methods 202, 217, & 301
ASTM Designations C136 and D2419

PROJECT: Mountain Area Regional Transit Authority

		Percent Passing Sieve Size:														
Sample No.	**Location**	**3"**	**2½"**	**2"**	**1½"**	**1"**	**3/4"**	**1/2"**	**3/8"**	**No. 4**	**No. 8**	**No. 16**	**No. 30**	**No. 50**	**No. 100**	**No. 200**	**Sand Equiv.**
1	B-2 at 0-5'			100	97	95	93	89	85	75	70	64	58	50	40	30	10
2	B-5 at 0-5'		100	99	96	92	86	81	75	66	64	59	53	45	36	28	10

STABILOMETER "R" VALUE

1

Sample No.		1	
Moisture Content (%)	10.3	10.7	11.1
Dry Density (lbs./cu. ft.)	125.0	123.5	122.2
Exudation Pressure (psi)	653	447	252
Expansion Pressure (psf)	108.25	64.95	34.64
"R" Value	60	52	43
"R" Value at 300 PSI Exudation		45	

Enclosure 7
Rpt. No.: 7341
File No.: S-14447

SUGGESTED SPECIFICATIONS FOR CLASS II BASE

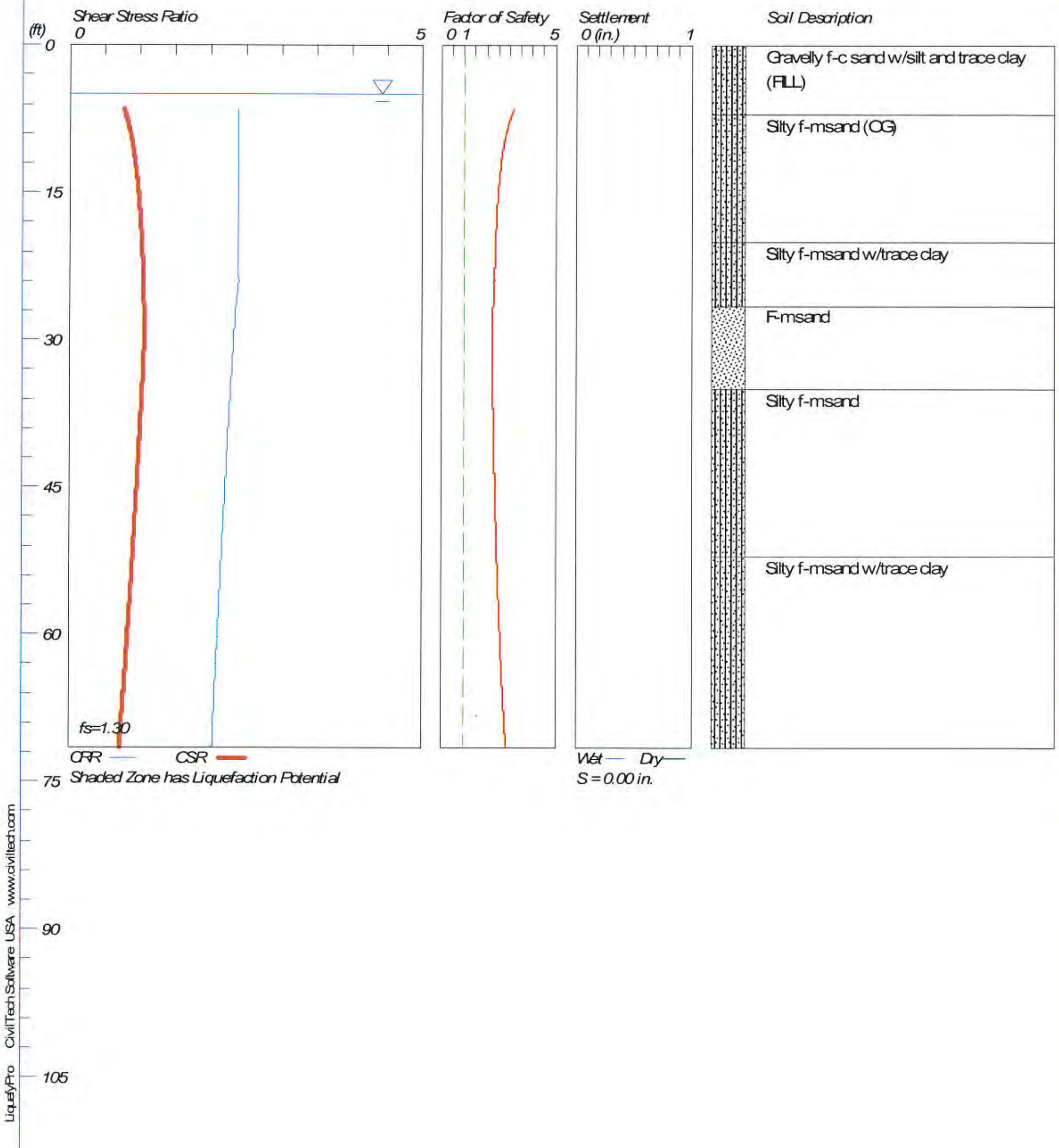
Sieve Size	**Percent Finer Than**
1 Inch	100
3/4 Inch	90 - 100
No. 4	35 - 60
No. 30	10 - 30
No. 200	2 - 9
Sand Equivalent (Minimum)	25
"R" Value (minimum) at 300 psi Exudation	78

LIQUEFACTION ANALYSIS

MARTA - NEW ADMINISTRATION BUILDING AND MAINTENANCE FACILITY

Hole No.=B-1 Water Depth=5.0 ft Surface Elev.=6779 feet AMSL

Magnitude=7.0
Acceleration=0.81g



John R. Byerly, Inc.

S-14447

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*************************************************************************************
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                                        LIQUEFACTION ANALYSIS CALCULATION SHEET

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*************************************************************************************
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        Input File Name: T:\Liquefy4\S-14447.1.liq
        Title:  MARTA - NEW ADMINISTRATION BUILDING AND MAINTENANCE FACILITY
        Subtitle:  S-14447

        Surface Elev.=6779 feet AMSL
        Hole No.=B-1
        Depth of Hole= 71.5 ft
        Water Table during Earthquake= 5.0 ft
        Water Table during In-Situ Testing= 26.6 ft
        Max. Acceleration= 0.81 g
        Earthquake Magnitude= 7.0
        User defined factor of safty (applied to CSR)       User fs=1.3
        fs=user,  Plot one CSR (fs=user)

        Hammer Energy Ratio, Ce=1
        Borehole Diameter, Cb=1.15
        Sampeling Method, Cs=1.3
        SPT Fines Correction Method: Stark/Olson et al.*
        Settlement Analysis Method: Ishihara / Yoshimine*
        Fines Correction for Liquefaction: Stark/Olson et al.*
        Fine Correction for Settlement: Post-Liq. Correction *
        Average Input Data: Smooth*
        * Recommended Options

Input Data:
        Depth   SPT     Gamma   Fines
        ft              pcf     %
        ____________________________________
        6.5     30.0    130.0   28.0
        11.5    30.0    130.0   20.0
        16.5    29.0    129.0   20.0
        21.5    42.0    128.0   25.0
        26.5    31.0    135.0   1.0
        31.5    83.0    135.0   1.0
        35.0    58.0    135.0   15.0
        40.0    49.0    135.0   15.0
        45.0    34.0    135.0   15.0
        50.0    55.0    135.0   15.0
        55.0    100.0   135.0   25.0
        60.0    51.0    135.0   25.0
        65.0    50.0    135.0   25.0
        70.0    81.0    135.0   25.0
        ____________________________________

Output Results:
        Settlement of saturated sands=0.00 in.
        Settlement of dry sands=0.00 in.
        Total settlement of saturated and dry sands=0.00 in.
```

```
Differential Settlement=0.000 to 0.000 in.

Depth   CRRm    CSRfs   F.S.    S_sat.  S_dry   S_all
ft              w/fs            in.     in.     in.
_______________________________________________________
6.50    2.39    0.76    3.15    0.00    0.00    0.00
7.50    2.39    0.80    2.98    0.00    0.00    0.00
8.50    2.39    0.84    2.85    0.00    0.00    0.00
9.50    2.39    0.87    2.75    0.00    0.00    0.00
10.50   2.39    0.89    2.67    0.00    0.00    0.00
11.50   2.39    0.91    2.61    0.00    0.00    0.00
12.50   2.39    0.93    2.56    0.00    0.00    0.00
13.50   2.39    0.95    2.51    0.00    0.00    0.00
14.50   2.39    0.96    2.47    0.00    0.00    0.00
15.50   2.39    0.98    2.44    0.00    0.00    0.00
16.50   2.39    0.99    2.41    0.00    0.00    0.00
17.50   2.39    1.00    2.39    0.00    0.00    0.00
18.50   2.39    1.01    2.36    0.00    0.00    0.00
19.50   2.39    1.02    2.34    0.00    0.00    0.00
20.50   2.39    1.02    2.33    0.00    0.00    0.00
21.50   2.39    1.03    2.31    0.00    0.00    0.00
22.50   2.39    1.04    2.30    0.00    0.00    0.00
23.50   2.39    1.04    2.29    0.00    0.00    0.00
24.50   2.39    1.05    2.28    0.00    0.00    0.00
25.50   2.37    1.05    2.26    0.00    0.00    0.00
26.50   2.36    1.05    2.24    0.00    0.00    0.00
27.50   2.35    1.05    2.23    0.00    0.00    0.00
28.50   2.34    1.06    2.21    0.00    0.00    0.00
29.50   2.33    1.06    2.20    0.00    0.00    0.00
30.50   2.32    1.06    2.20    0.00    0.00    0.00
31.50   2.31    1.05    2.20    0.00    0.00    0.00
32.50   2.30    1.04    2.21    0.00    0.00    0.00
33.50   2.30    1.04    2.21    0.00    0.00    0.00
34.50   2.29    1.03    2.22    0.00    0.00    0.00
35.50   2.28    1.02    2.23    0.00    0.00    0.00
36.50   2.27    1.02    2.23    0.00    0.00    0.00
37.50   2.26    1.01    2.24    0.00    0.00    0.00
38.50   2.26    1.00    2.25    0.00    0.00    0.00
39.50   2.25    1.00    2.26    0.00    0.00    0.00
40.50   2.24    0.99    2.27    0.00    0.00    0.00
41.50   2.23    0.98    2.28    0.00    0.00    0.00
42.50   2.23    0.97    2.29    0.00    0.00    0.00
43.50   2.22    0.97    2.30    0.00    0.00    0.00
44.50   2.21    0.96    2.31    0.00    0.00    0.00
45.50   2.20    0.95    2.32    0.00    0.00    0.00
46.50   2.20    0.94    2.33    0.00    0.00    0.00
47.50   2.19    0.93    2.35    0.00    0.00    0.00
48.50   2.18    0.92    2.36    0.00    0.00    0.00
49.50   2.17    0.92    2.37    0.00    0.00    0.00
50.50   2.17    0.91    2.39    0.00    0.00    0.00
51.50   2.16    0.90    2.40    0.00    0.00    0.00
52.50   2.15    0.89    2.42    0.00    0.00    0.00
53.50   2.15    0.88    2.43    0.00    0.00    0.00
54.50   2.14    0.87    2.45    0.00    0.00    0.00
55.50   2.13    0.86    2.47    0.00    0.00    0.00
56.50   2.13    0.86    2.48    0.00    0.00    0.00
57.50   2.12    0.85    2.50    0.00    0.00    0.00
58.50   2.11    0.84    2.52    0.00    0.00    0.00
59.50   2.11    0.83    2.54    0.00    0.00    0.00
60.50   2.10    0.82    2.56    0.00    0.00    0.00
61.50   2.09    0.81    2.58    0.00    0.00    0.00
62.50   2.09    0.80    2.60    0.00    0.00    0.00
63.50   2.08    0.79    2.62    0.00    0.00    0.00
```

```
        64.50   2.07    0.78    2.65    0.00    0.00    0.00
        65.50   2.07    0.77    2.67    0.00    0.00    0.00
        66.50   2.06    0.77    2.69    0.00    0.00    0.00
        67.50   2.06    0.76    2.72    0.00    0.00    0.00
        68.50   2.05    0.75    2.75    0.00    0.00    0.00
        69.50   2.04    0.74    2.77    0.00    0.00    0.00
        70.50   2.04    0.73    2.80    0.00    0.00    0.00
        71.50   2.03    0.72    2.83    0.00    0.00    0.00
        _______________________________________________________
        * F.S.<1, Liquefaction Potential Zone
        (F.S. is limited to 5,  CRR is limited to 2,    CSR is limited to 2)

        Units           Depth = ft, Stress or Pressure = tsf (atm), Unit Weight =
pcf, Settlement = in.

_________________________________________________________________________________
        CRRm            Cyclic resistance ratio from soils
        CSRfs           Cyclic stress ratio induced by a given earthquake (with user
request factor of safety)
        F.S.            Factor of Safety against liquefaction, F.S.=CRRm/CSRfs
        S_sat           Settlement from saturated sands
        S_dry           Settlement from dry sands
        S_all           Total settlement from saturated and dry sands
        NoLiq           No-Liquefy Soils
```

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*************************************************************************************
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        Input File Name: T:\Liquefy4\S-14447.1.liq
        Title:  MARTA - NEW ADMINISTRATION BUILDING AND MAINTENANCE FACILITY
        Subtitle:  S-14447

 Input Data:

        Surface Elev.=6779 feet AMSL
        Hole No.=B-1
        Depth of Hole=71.5 ft
        Water Table during Earthquake= 5.0 ft
        Water Table during In-Situ Testing= 26.6 ft
        Max. Acceleration=0.81 g
        Earthquake Magnitude=7.0
        User defined factor of safty (applied to CSR)        User fs=1.3
        fs=user,  Plot one CSR (fs=user)

        Hammer Energy Ratio, Ce=1
        Borehole Diameter, Cb=1.15
        Sampeling Method, Cs=1.3
        SPT Fines Correction Method: Stark/Olson et al.*
        Settlement Analysis Method: Ishihara / Yoshimine*
        Fines Correction for Liquefaction: Stark/Olson et al.*
        Fine Correction for Settlement: Post-Liq. Correction *
        Average Input Data: Smooth*
        * Recommended Options

        Depth   SPT     Gamma   Fines
        ft              pcf     %
        ____________________________________
        6.5     30.0    130.0   28.0
        11.5    30.0    130.0   20.0
        16.5    29.0    129.0   20.0
        21.5    42.0    128.0   25.0
        26.5    31.0    135.0   1.0
        31.5    83.0    135.0   1.0
        35.0    58.0    135.0   15.0
        40.0    49.0    135.0   15.0
        45.0    34.0    135.0   15.0
        50.0    55.0    135.0   15.0
        55.0    100.0   135.0   25.0
        60.0    51.0    135.0   25.0
        65.0    50.0    135.0   25.0
        70.0    81.0    135.0   25.0
        ____________________________________

 Output Results:          (Interval = 1.00 ft)
```

```
CSR Calculation:
Depth   gamma   sigma   gamma'  sigma'  rd      CSR     fs      CSRfs
ft      pcf     tsf     pcf     tsf                     (user)  w/fs
______________________________________________________________________
6.50    130.0   0.423   67.6    0.376   0.98    0.58    1.3     0.76
7.50    130.0   0.488   67.6    0.410   0.98    0.62    1.3     0.80
8.50    130.0   0.553   67.6    0.443   0.98    0.64    1.3     0.84
9.50    130.0   0.618   67.6    0.477   0.98    0.67    1.3     0.87
10.50   130.0   0.683   67.6    0.511   0.98    0.69    1.3     0.89
11.50   130.0   0.748   67.6    0.545   0.97    0.70    1.3     0.91
12.50   129.8   0.812   67.4    0.578   0.97    0.72    1.3     0.93
13.50   129.6   0.877   67.2    0.612   0.97    0.73    1.3     0.95
14.50   129.4   0.942   67.0    0.646   0.97    0.74    1.3     0.96
15.50   129.2   1.007   66.8    0.679   0.96    0.75    1.3     0.98
16.50   129.0   1.071   66.6    0.712   0.96    0.76    1.3     0.99
17.50   128.8   1.136   66.4    0.746   0.96    0.77    1.3     1.00
18.50   128.6   1.200   66.2    0.779   0.96    0.78    1.3     1.01
19.50   128.4   1.264   66.0    0.812   0.95    0.78    1.3     1.02
20.50   128.2   1.328   65.8    0.845   0.95    0.79    1.3     1.02
21.50   128.0   1.393   65.6    0.878   0.95    0.79    1.3     1.03
22.50   129.4   1.457   67.0    0.911   0.95    0.80    1.3     1.04
23.50   130.8   1.522   68.4    0.945   0.95    0.80    1.3     1.04
24.50   132.2   1.588   69.8    0.979   0.94    0.80    1.3     1.05
25.50   133.6   1.654   71.2    1.014   0.94    0.81    1.3     1.05
26.50   135.0   1.721   72.6    1.050   0.94    0.81    1.3     1.05
27.50   135.0   1.789   72.6    1.087   0.94    0.81    1.3     1.05
28.50   135.0   1.856   72.6    1.123   0.93    0.81    1.3     1.06
29.50   135.0   1.924   72.6    1.159   0.93    0.81    1.3     1.06
30.50   135.0   1.991   72.6    1.196   0.93    0.81    1.3     1.06
31.50   135.0   2.059   72.6    1.232   0.92    0.81    1.3     1.05
32.50   135.0   2.126   72.6    1.268   0.91    0.80    1.3     1.04
33.50   135.0   2.194   72.6    1.304   0.90    0.80    1.3     1.04
34.50   135.0   2.261   72.6    1.341   0.89    0.79    1.3     1.03
35.50   135.0   2.329   72.6    1.377   0.89    0.79    1.3     1.02
36.50   135.0   2.396   72.6    1.413   0.88    0.78    1.3     1.02
37.50   135.0   2.464   72.6    1.450   0.87    0.78    1.3     1.01
38.50   135.0   2.531   72.6    1.486   0.86    0.77    1.3     1.00
39.50   135.0   2.599   72.6    1.522   0.85    0.77    1.3     1.00
40.50   135.0   2.666   72.6    1.559   0.84    0.76    1.3     0.99
41.50   135.0   2.734   72.6    1.595   0.84    0.75    1.3     0.98
42.50   135.0   2.801   72.6    1.631   0.83    0.75    1.3     0.97
43.50   135.0   2.869   72.6    1.667   0.82    0.74    1.3     0.97
44.50   135.0   2.936   72.6    1.704   0.81    0.74    1.3     0.96
45.50   135.0   3.004   72.6    1.740   0.80    0.73    1.3     0.95
46.50   135.0   3.071   72.6    1.776   0.80    0.72    1.3     0.94
47.50   135.0   3.139   72.6    1.813   0.79    0.72    1.3     0.93
48.50   135.0   3.206   72.6    1.849   0.78    0.71    1.3     0.92
49.50   135.0   3.274   72.6    1.885   0.77    0.71    1.3     0.92
50.50   135.0   3.341   72.6    1.922   0.76    0.70    1.3     0.91
51.50   135.0   3.409   72.6    1.958   0.75    0.69    1.3     0.90
52.50   135.0   3.476   72.6    1.994   0.75    0.69    1.3     0.89
53.50   135.0   3.544   72.6    2.030   0.74    0.68    1.3     0.88
54.50   135.0   3.611   72.6    2.067   0.73    0.67    1.3     0.87
55.50   135.0   3.679   72.6    2.103   0.72    0.67    1.3     0.86
56.50   135.0   3.746   72.6    2.139   0.71    0.66    1.3     0.86
57.50   135.0   3.814   72.6    2.176   0.71    0.65    1.3     0.85
58.50   135.0   3.881   72.6    2.212   0.70    0.64    1.3     0.84
59.50   135.0   3.949   72.6    2.248   0.69    0.64    1.3     0.83
60.50   135.0   4.016   72.6    2.285   0.68    0.63    1.3     0.82
61.50   135.0   4.084   72.6    2.321   0.67    0.62    1.3     0.81
62.50   135.0   4.151   72.6    2.357   0.67    0.62    1.3     0.80
63.50   135.0   4.219   72.6    2.393   0.66    0.61    1.3     0.79
64.50   135.0   4.286   72.6    2.430   0.65    0.60    1.3     0.78
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          65.50    135.0    4.354    72.6     2.466   0.64     0.60    1.3     0.77
          66.50    135.0    4.421    72.6     2.502   0.63     0.59    1.3     0.77
          67.50    135.0    4.489    72.6     2.539   0.62     0.58    1.3     0.76
          68.50    135.0    4.556    72.6     2.575   0.62     0.57    1.3     0.75
          69.50    135.0    4.624    72.6     2.611   0.61     0.57    1.3     0.74
          70.50    135.0    4.691    72.6     2.648   0.60     0.56    1.3     0.73
          71.50    135.0    4.759    72.6     2.684   0.59     0.55    1.3     0.72
          ____________________________________________________________________________
          CSR is based on water table at 5.0 during earthquake

          CRR Calculation from SPT or BPT data:
          Depth    SPT      Cebs     Cr       sigma'  Cn       (N1)60  Fines   d(N1)60
(N1)60f   CRR7.5
          ft                                                           %

_______________________________________________________________________________________
_
          6.50     30.00    1.49     0.75     0.423   1.54     51.75   28.0    5.52
57.27     2.00
          7.50     30.00    1.49     0.75     0.488   1.43     48.18   26.4    5.14
53.31     2.00
          8.50     30.00    1.49     0.85     0.553   1.35     51.29   24.8    4.75
56.04     2.00
          9.50     30.00    1.49     0.85     0.618   1.27     48.51   23.2    4.37
52.88     2.00
          10.50    30.00    1.49     0.85     0.683   1.21     46.15   21.6    3.98
50.13     2.00
          11.50    30.00    1.49     0.85     0.748   1.16     44.09   20.0    3.60
47.69     2.00
          12.50    29.80    1.49     0.85     0.812   1.11     42.01   20.0    3.60
45.61     2.00
          13.50    29.60    1.49     0.85     0.877   1.07     40.16   20.0    3.60
43.76     2.00
          14.50    29.40    1.49     0.85     0.942   1.03     38.49   20.0    3.60
42.09     2.00
          15.50    29.20    1.49     0.95     1.007   1.00     41.33   20.0    3.60
44.93     2.00
          16.50    29.00    1.49     0.95     1.071   0.97     39.79   20.0    3.60
43.39     2.00
          17.50    31.60    1.49     0.95     1.136   0.94     42.11   21.0    3.84
45.95     2.00
          18.50    34.20    1.49     0.95     1.200   0.91     44.34   22.0    4.08
48.42     2.00
          19.50    36.80    1.49     0.95     1.264   0.89     46.48   23.0    4.32
50.80     2.00
          20.50    39.40    1.49     0.95     1.328   0.87     48.55   24.0    4.56
53.11     2.00
          21.50    42.00    1.49     0.95     1.393   0.85     50.55   25.0    4.80
55.35     2.00
          22.50    39.80    1.49     0.95     1.457   0.83     46.83   20.2    3.65
50.48     2.00
          23.50    37.60    1.49     0.95     1.522   0.81     43.29   15.4    2.50
45.78     2.00
          24.50    35.40    1.49     0.95     1.588   0.79     39.90   10.6    1.34
41.25     2.00
          25.50    33.20    1.49     0.95     1.654   0.78     36.66   5.8     0.19
36.86     2.00
          26.50    31.00    1.49     0.95     1.721   0.76     33.56   1.0     0.00
33.56     2.00
          27.50    41.40    1.49     0.95     1.762   0.75     44.29   1.0     0.00
44.29     2.00
          28.50    51.80    1.49     1.00     1.798   0.75     57.74   1.0     0.00
57.74     2.00
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         29.50   62.20   1.49   1.00   1.835  0.74   68.65   1.0    0.00
68.65    2.00
         30.50   72.60   1.49   1.00   1.871  0.73   79.35   1.0    0.00
79.35    2.00
         31.50   83.00   1.49   1.00   1.907  0.72   89.84   1.0    0.00
89.84    2.00
         32.50   75.86   1.49   1.00   1.944  0.72   81.35   5.0    0.00
81.35    2.00
         33.50   68.72   1.49   1.00   1.980  0.71   73.01   9.0    0.96
73.97    2.00
         34.50   61.57   1.49   1.00   2.016  0.70   64.83   13.0   1.92
66.75    2.00
         35.50   57.10   1.49   1.00   2.053  0.70   59.58   15.0   2.40
61.98    2.00
         36.50   55.30   1.49   1.00   2.089  0.69   57.20   15.0   2.40
59.60    2.00
         37.50   53.50   1.49   1.00   2.125  0.69   54.87   15.0   2.40
57.27    2.00
         38.50   51.70   1.49   1.00   2.161  0.68   52.57   15.0   2.40
54.97    2.00
         39.50   49.90   1.49   1.00   2.198  0.67   50.32   15.0   2.40
52.72    2.00
         40.50   47.50   1.49   1.00   2.234  0.67   47.51   15.0   2.40
49.91    2.00
         41.50   44.50   1.49   1.00   2.270  0.66   44.15   15.0   2.40
46.55    2.00
         42.50   41.50   1.49   1.00   2.307  0.66   40.85   15.0   2.40
43.25    2.00
         43.50   38.50   1.49   1.00   2.343  0.65   37.60   15.0   2.40
40.00    2.00
         44.50   35.50   1.49   1.00   2.379  0.65   34.41   15.0   2.40
36.81    2.00
         45.50   36.10   1.49   1.00   2.416  0.64   34.72   15.0   2.40
37.12    2.00
         46.50   40.30   1.49   1.00   2.452  0.64   38.47   15.0   2.40
40.87    2.00
         47.50   44.50   1.49   1.00   2.488  0.63   42.17   15.0   2.40
44.57    2.00
         48.50   48.70   1.49   1.00   2.524  0.63   45.82   15.0   2.40
48.22    2.00
         49.50   52.90   1.49   1.00   2.561  0.62   49.42   15.0   2.40
51.82    2.00
         50.50   59.50   1.49   1.00   2.597  0.62   55.19   16.0   2.64
57.83    2.00
         51.50   68.50   1.49   1.00   2.633  0.62   63.10   18.0   3.12
66.22    2.00
         52.50   77.50   1.49   1.00   2.670  0.61   70.91   20.0   3.60
74.51    2.00
         53.50   86.50   1.49   1.00   2.706  0.61   78.61   22.0   4.08
82.69    2.00
         54.50   95.50   1.49   1.00   2.742  0.60   86.21   24.0   4.56
90.77    2.00
         55.50   95.11   1.49   1.00   2.779  0.60   85.30   25.0   4.80
90.10    2.00
         56.50   85.31   1.49   1.00   2.815  0.60   76.01   25.0   4.80
80.81    2.00
         57.50   75.51   1.49   1.00   2.851  0.59   66.85   25.0   4.80
71.65    2.00
         58.50   65.71   1.49   1.00   2.888  0.59   57.81   25.0   4.80
62.61    2.00
         59.50   55.91   1.49   1.00   2.924  0.58   48.88   25.0   4.80
53.68    2.00
         60.50   50.90   1.49   1.00   2.960  0.58   44.23   25.0   4.80
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49.03     2.00
          61.50     50.70     1.49     1.00     2.996     0.58     43.79     25.0     4.80
48.59     2.00
          62.50     50.50     1.49     1.00     3.033     0.57     43.35     25.0     4.80
48.15     2.00
          63.50     50.30     1.49     1.00     3.069     0.57     42.93     25.0     4.80
47.73     2.00
          64.50     50.10     1.49     1.00     3.105     0.57     42.50     25.0     4.80
47.30     2.00
          65.50     53.10     1.49     1.00     3.142     0.56     44.78     25.0     4.80
49.58     2.00
          66.50     59.30     1.49     1.00     3.178     0.56     49.73     25.0     4.80
54.53     2.00
          67.50     65.50     1.49     1.00     3.214     0.56     54.62     25.0     4.80
59.42     2.00
          68.50     71.70     1.49     1.00     3.251     0.55     59.45     25.0     4.80
64.25     2.00
          69.50     77.90     1.49     1.00     3.287     0.55     64.24     25.0     4.80
69.04     2.00
          70.50     81.00     1.49     1.00     3.323     0.55     66.43     25.0     4.80
71.23     2.00
          71.50     81.00     1.49     1.00     3.359     0.55     66.07     25.0     4.80
70.87     2.00

___________________________________________________________________________________________
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          CRR is based on water table at 26.6 during In-Situ Testing

          Factor of Safety,  - Earthquake Magnitude= 7.0:
          Depth     sigC'     CRR7.5    Ksigma    CRRv      MSF       CRRm      CSRfs     F.S.
          ft        tsf       tsf                                               w/fs      CRRm/CSRfs
          ____________________________________________________________________________________
          6.50      0.27      2.00      1.00      2.00      1.19      2.39      0.76      3.15
          7.50      0.32      2.00      1.00      2.00      1.19      2.39      0.80      2.98
          8.50      0.36      2.00      1.00      2.00      1.19      2.39      0.84      2.85
          9.50      0.40      2.00      1.00      2.00      1.19      2.39      0.87      2.75
          10.50     0.44      2.00      1.00      2.00      1.19      2.39      0.89      2.67
          11.50     0.49      2.00      1.00      2.00      1.19      2.39      0.91      2.61
          12.50     0.53      2.00      1.00      2.00      1.19      2.39      0.93      2.56
          13.50     0.57      2.00      1.00      2.00      1.19      2.39      0.95      2.51
          14.50     0.61      2.00      1.00      2.00      1.19      2.39      0.96      2.47
          15.50     0.65      2.00      1.00      2.00      1.19      2.39      0.98      2.44
          16.50     0.70      2.00      1.00      2.00      1.19      2.39      0.99      2.41
          17.50     0.74      2.00      1.00      2.00      1.19      2.39      1.00      2.39
          18.50     0.78      2.00      1.00      2.00      1.19      2.39      1.01      2.36
          19.50     0.82      2.00      1.00      2.00      1.19      2.39      1.02      2.34
          20.50     0.86      2.00      1.00      2.00      1.19      2.39      1.02      2.33
          21.50     0.91      2.00      1.00      2.00      1.19      2.39      1.03      2.31
          22.50     0.95      2.00      1.00      2.00      1.19      2.39      1.04      2.30
          23.50     0.99      2.00      1.00      2.00      1.19      2.39      1.04      2.29
          24.50     1.03      2.00      1.00      2.00      1.19      2.39      1.05      2.28
          25.50     1.08      2.00      0.99      1.99      1.19      2.37      1.05      2.26
          26.50     1.12      2.00      0.99      1.98      1.19      2.36      1.05      2.24
          27.50     1.15      2.00      0.98      1.97      1.19      2.35      1.05      2.23
          28.50     1.17      2.00      0.98      1.96      1.19      2.34      1.06      2.21
          29.50     1.19      2.00      0.98      1.95      1.19      2.33      1.06      2.20
          30.50     1.22      2.00      0.97      1.95      1.19      2.32      1.06      2.20
          31.50     1.24      2.00      0.97      1.94      1.19      2.31      1.05      2.20
          32.50     1.26      2.00      0.97      1.93      1.19      2.30      1.04      2.21
          33.50     1.29      2.00      0.96      1.92      1.19      2.30      1.04      2.21
          34.50     1.31      2.00      0.96      1.92      1.19      2.29      1.03      2.22
          35.50     1.33      2.00      0.96      1.91      1.19      2.28      1.02      2.23
          36.50     1.36      2.00      0.95      1.90      1.19      2.27      1.02      2.23
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37.50   1.38     2.00     0.95     1.90     1.19     2.26     1.01     2.24
38.50   1.40     2.00     0.95     1.89     1.19     2.26     1.00     2.25
39.50   1.43     2.00     0.94     1.89     1.19     2.25     1.00     2.26
40.50   1.45     2.00     0.94     1.88     1.19     2.24     0.99     2.27
41.50   1.48     2.00     0.94     1.87     1.19     2.23     0.98     2.28
42.50   1.50     2.00     0.93     1.87     1.19     2.23     0.97     2.29
43.50   1.52     2.00     0.93     1.86     1.19     2.22     0.97     2.30
44.50   1.55     2.00     0.93     1.85     1.19     2.21     0.96     2.31
45.50   1.57     2.00     0.92     1.85     1.19     2.20     0.95     2.32
46.50   1.59     2.00     0.92     1.84     1.19     2.20     0.94     2.33
47.50   1.62     2.00     0.92     1.83     1.19     2.19     0.93     2.35
48.50   1.64     2.00     0.91     1.83     1.19     2.18     0.92     2.36
49.50   1.66     2.00     0.91     1.82     1.19     2.17     0.92     2.37
50.50   1.69     2.00     0.91     1.82     1.19     2.17     0.91     2.39
51.50   1.71     2.00     0.91     1.81     1.19     2.16     0.90     2.40
52.50   1.74     2.00     0.90     1.81     1.19     2.15     0.89     2.42
53.50   1.76     2.00     0.90     1.80     1.19     2.15     0.88     2.43
54.50   1.78     2.00     0.90     1.79     1.19     2.14     0.87     2.45
55.50   1.81     2.00     0.89     1.79     1.19     2.13     0.86     2.47
56.50   1.83     2.00     0.89     1.78     1.19     2.13     0.86     2.48
57.50   1.85     2.00     0.89     1.78     1.19     2.12     0.85     2.50
58.50   1.88     2.00     0.89     1.77     1.19     2.11     0.84     2.52
59.50   1.90     2.00     0.88     1.77     1.19     2.11     0.83     2.54
60.50   1.92     2.00     0.88     1.76     1.19     2.10     0.82     2.56
61.50   1.95     2.00     0.88     1.76     1.19     2.09     0.81     2.58
62.50   1.97     2.00     0.87     1.75     1.19     2.09     0.80     2.60
63.50   1.99     2.00     0.87     1.74     1.19     2.08     0.79     2.62
64.50   2.02     2.00     0.87     1.74     1.19     2.07     0.78     2.65
65.50   2.04     2.00     0.87     1.73     1.19     2.07     0.77     2.67
66.50   2.07     2.00     0.86     1.73     1.19     2.06     0.77     2.69
67.50   2.09     2.00     0.86     1.72     1.19     2.06     0.76     2.72
68.50   2.11     2.00     0.86     1.72     1.19     2.05     0.75     2.75
69.50   2.14     2.00     0.86     1.71     1.19     2.04     0.74     2.77
70.50   2.16     2.00     0.85     1.71     1.19     2.04     0.73     2.80
71.50   2.18     2.00     0.85     1.70     1.19     2.03     0.72     2.83
-------------------------------------------------------------------------------
* F.S.<1: Liquefaction Potential Zone.  (If above water table: F.S.=5)
(F.S. is limited to 5,  CRR is limited to 2,    CSR is limited to 2)


CPT convert to SPT for Settlement Analysis:
Fines Correction for Settlement Analysis:
Depth    Ic      qc/N60   qc1      (N1)60   Fines    d(N1)60  (N1)60s
ft                        tsf               %
-------------------------------------------------------------------------
6.50     -       -        -        51.75    28.0     2.41     54.16
7.50     -       -        -        48.18    26.4     2.29     50.47
8.50     -       -        -        51.29    24.8     2.17     53.46
9.50     -       -        -        48.51    23.2     2.04     50.56
10.50    -       -        -        46.15    21.6     1.92     48.06
11.50    -       -        -        44.09    20.0     1.79     45.88
12.50    -       -        -        42.01    20.0     1.79     43.80
13.50    -       -        -        40.16    20.0     1.79     41.95
14.50    -       -        -        38.49    20.0     1.79     40.28
15.50    -       -        -        41.33    20.0     1.79     43.12
16.50    -       -        -        39.79    20.0     1.79     41.58
17.50    -       -        -        42.11    21.0     1.87     43.98
18.50    -       -        -        44.34    22.0     1.95     46.29
19.50    -       -        -        46.48    23.0     2.03     48.51
20.50    -       -        -        48.55    24.0     2.11     50.66
21.50    -       -        -        50.55    25.0     2.19     52.73
22.50    -       -        -        46.83    20.2     1.80     48.64
23.50    -       -        -        43.29    15.4     1.41     44.69
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24.50   -      -      -      39.90   10.6    0.99    40.89
25.50   -      -      -      36.66   5.8     0.55    37.21
26.50   -      -      -      33.56   1.0     0.10    33.66
27.50   -      -      -      44.29   1.0     0.10    44.39
28.50   -      -      -      57.74   1.0     0.10    57.84
29.50   -      -      -      68.65   1.0     0.10    68.75
30.50   -      -      -      79.35   1.0     0.10    79.44
31.50   -      -      -      89.84   1.0     0.10    89.94
32.50   -      -      -      81.35   5.0     0.48    81.82
33.50   -      -      -      73.01   9.0     0.84    73.85
34.50   -      -      -      64.83   13.0    1.20    66.03
35.50   -      -      -      59.58   15.0    1.37    60.96
36.50   -      -      -      57.20   15.0    1.37    58.57
37.50   -      -      -      54.87   15.0    1.37    56.24
38.50   -      -      -      52.57   15.0    1.37    53.94
39.50   -      -      -      50.32   15.0    1.37    51.69
40.50   -      -      -      47.51   15.0    1.37    48.88
41.50   -      -      -      44.15   15.0    1.37    45.52
42.50   -      -      -      40.85   15.0    1.37    42.22
43.50   -      -      -      37.60   15.0    1.37    38.98
44.50   -      -      -      34.41   15.0    1.37    35.78
45.50   -      -      -      34.72   15.0    1.37    36.09
46.50   -      -      -      38.47   15.0    1.37    39.85
47.50   -      -      -      42.17   15.0    1.37    43.55
48.50   -      -      -      45.82   15.0    1.37    47.19
49.50   -      -      -      49.42   15.0    1.37    50.79
50.50   -      -      -      55.19   16.0    1.46    56.65
51.50   -      -      -      63.10   18.0    1.62    64.73
52.50   -      -      -      70.91   20.0    1.79    72.69
53.50   -      -      -      78.61   22.0    1.95    80.56
54.50   -      -      -      86.21   24.0    2.11    88.32
55.50   -      -      -      85.30   25.0    2.19    87.48
56.50   -      -      -      76.01   25.0    2.19    78.20
57.50   -      -      -      66.85   25.0    2.19    69.04
58.50   -      -      -      57.81   25.0    2.19    59.99
59.50   -      -      -      48.88   25.0    2.19    51.06
60.50   -      -      -      44.23   25.0    2.19    46.41
61.50   -      -      -      43.79   25.0    2.19    45.97
62.50   -      -      -      43.35   25.0    2.19    45.54
63.50   -      -      -      42.93   25.0    2.19    45.11
64.50   -      -      -      42.50   25.0    2.19    44.69
65.50   -      -      -      44.78   25.0    2.19    46.97
66.50   -      -      -      49.73   25.0    2.19    51.91
67.50   -      -      -      54.62   25.0    2.19    56.80
68.50   -      -      -      59.45   25.0    2.19    61.64
69.50   -      -      -      64.24   25.0    2.19    66.42
70.50   -      -      -      66.43   25.0    2.19    68.61
71.50   -      -      -      66.07   25.0    2.19    68.25
_______________________________________________________________


        Settlement of Saturated Sands:
        Settlement Analysis Method: Ishihara / Yoshimine*
        Depth   CSRfs   F.S.    Fines   (N1)60s Dr      ec      dsz     dsv     S
        ft      w/fs            %               %       %       in.     in.     in.

________________________________________________________________________________
        71.45   0.72    2.83    25.0    68.27   100.00  0.000   0.000   0.000
0.000
        70.50   0.73    2.80    25.0    68.61   100.00  0.000   0.000   0.000
0.000
        69.50   0.74    2.77    25.0    66.42   100.00  0.000   0.000   0.000
0.000
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        68.50    0.75     2.75     25.0     61.64    100.00   0.000    0.000    0.000
0.000
        67.50    0.76     2.72     25.0     56.80    100.00   0.000    0.000    0.000
0.000
        66.50    0.77     2.69     25.0     51.91    100.00   0.000    0.000    0.000
0.000
        65.50    0.77     2.67     25.0     46.97    100.00   0.000    0.000    0.000
0.000
        64.50    0.78     2.65     25.0     44.69    100.00   0.000    0.000    0.000
0.000
        63.50    0.79     2.62     25.0     45.11    100.00   0.000    0.000    0.000
0.000
        62.50    0.80     2.60     25.0     45.54    100.00   0.000    0.000    0.000
0.000
        61.50    0.81     2.58     25.0     45.97    100.00   0.000    0.000    0.000
0.000
        60.50    0.82     2.56     25.0     46.41    100.00   0.000    0.000    0.000
0.000
        59.50    0.83     2.54     25.0     51.06    100.00   0.000    0.000    0.000
0.000
        58.50    0.84     2.52     25.0     59.99    100.00   0.000    0.000    0.000
0.000
        57.50    0.85     2.50     25.0     69.04    100.00   0.000    0.000    0.000
0.000
        56.50    0.86     2.48     25.0     78.20    100.00   0.000    0.000    0.000
0.000
        55.50    0.86     2.47     25.0     87.48    100.00   0.000    0.000    0.000
0.000
        54.50    0.87     2.45     24.0     88.32    100.00   0.000    0.000    0.000
0.000
        53.50    0.88     2.43     22.0     80.56    100.00   0.000    0.000    0.000
0.000
        52.50    0.89     2.42     20.0     72.69    100.00   0.000    0.000    0.000
0.000
        51.50    0.90     2.40     18.0     64.73    100.00   0.000    0.000    0.000
0.000
        50.50    0.91     2.39     16.0     56.65    100.00   0.000    0.000    0.000
0.000
        49.50    0.92     2.37     15.0     50.79    100.00   0.000    0.000    0.000
0.000
        48.50    0.92     2.36     15.0     47.19    100.00   0.000    0.000    0.000
0.000
        47.50    0.93     2.35     15.0     43.55    100.00   0.000    0.000    0.000
0.000
        46.50    0.94     2.33     15.0     39.85    100.00   0.000    0.000    0.000
0.000
        45.50    0.95     2.32     15.0     36.09    100.00   0.000    0.000    0.000
0.000
        44.50    0.96     2.31     15.0     35.78    100.00   0.000    0.000    0.000
0.000
        43.50    0.97     2.30     15.0     38.98    100.00   0.000    0.000    0.000
0.000
        42.50    0.97     2.29     15.0     42.22    100.00   0.000    0.000    0.000
0.000
        41.50    0.98     2.28     15.0     45.52    100.00   0.000    0.000    0.000
0.000
        40.50    0.99     2.27     15.0     48.88    100.00   0.000    0.000    0.000
0.000
        39.50    1.00     2.26     15.0     51.69    100.00   0.000    0.000    0.000
0.000
        38.50    1.00     2.25     15.0     53.94    100.00   0.000    0.000    0.000
0.000
        37.50    1.01     2.24     15.0     56.24    100.00   0.000    0.000    0.000
```

```
0.000
    36.50    1.02     2.23     15.0     58.57    100.00   0.000    0.000    0.000
0.000
    35.50    1.02     2.23     15.0     60.96    100.00   0.000    0.000    0.000
0.000
    34.50    1.03     2.22     13.0     66.03    100.00   0.000    0.000    0.000
0.000
    33.50    1.04     2.21     9.0      73.85    100.00   0.000    0.000    0.000
0.000
    32.50    1.04     2.21     5.0      81.82    100.00   0.000    0.000    0.000
0.000
    31.50    1.05     2.20     1.0      89.94    100.00   0.000    0.000    0.000
0.000
    30.50    1.06     2.20     1.0      79.44    100.00   0.000    0.000    0.000
0.000
    29.50    1.06     2.20     1.0      68.75    100.00   0.000    0.000    0.000
0.000
    28.50    1.06     2.21     1.0      57.84    100.00   0.000    0.000    0.000
0.000
    27.50    1.05     2.23     1.0      44.39    100.00   0.000    0.000    0.000
0.000
    26.50    1.05     2.24     1.0      33.66    98.98    0.000    0.000    0.000
0.000
    25.50    1.05     2.26     5.8      37.21    100.00   0.000    0.000    0.000
0.000
    24.50    1.05     2.28     10.6     40.89    100.00   0.000    0.000    0.000
0.000
    23.50    1.04     2.29     15.4     44.69    100.00   0.000    0.000    0.000
0.000
    22.50    1.04     2.30     20.2     48.64    100.00   0.000    0.000    0.000
0.000
    21.50    1.03     2.31     25.0     52.73    100.00   0.000    0.000    0.000
0.000
    20.50    1.02     2.33     24.0     50.66    100.00   0.000    0.000    0.000
0.000
    19.50    1.02     2.34     23.0     48.51    100.00   0.000    0.000    0.000
0.000
    18.50    1.01     2.36     22.0     46.29    100.00   0.000    0.000    0.000
0.000
    17.50    1.00     2.39     21.0     43.98    100.00   0.000    0.000    0.000
0.000
    16.50    0.99     2.41     20.0     41.58    100.00   0.000    0.000    0.000
0.000
    15.50    0.98     2.44     20.0     43.12    100.00   0.000    0.000    0.000
0.000
    14.50    0.96     2.47     20.0     40.28    100.00   0.000    0.000    0.000
0.000
    13.50    0.95     2.51     20.0     41.95    100.00   0.000    0.000    0.000
0.000
    12.50    0.93     2.56     20.0     43.80    100.00   0.000    0.000    0.000
0.000
    11.50    0.91     2.61     20.0     45.88    100.00   0.000    0.000    0.000
0.000
    10.50    0.89     2.67     21.6     48.06    100.00   0.000    0.000    0.000
0.000
    9.50     0.87     2.75     23.2     50.56    100.00   0.000    0.000    0.000
0.000
    8.50     0.84     2.85     24.8     53.46    100.00   0.000    0.000    0.000
0.000
    7.50     0.80     2.98     26.4     50.47    100.00   0.000    0.000    0.000
0.000
    6.50     0.76     3.15     28.0     54.16    100.00   0.000    0.000    0.000
0.000
```

```
_______________________________________________________________________________
        Settlement of Saturated Sands=0.000 in.
        dsz is per each segment: dz=0.05 ft
        dsv is per each print interval: dv=1 ft
        S is cumulated settlement at this depth

        Settlement of Dry Sands:
        Depth   sigma'  sigC'   (N1)60s CSRfs   Gmax    g*Ge/Gm g_eff   ec7.5   Cec
ec      dsz     dsv     S
        ft      tsf     tsf             w/fs    tsf                     %
%       in.     in.     in.

__________________________________________________________________________________
____________________________

__________________________________________________________________________________
____________________________
        Settlement of Dry Sands=0.000 in.
        dsz is per each segment: dz=0.05 ft
        dsv is per each print interval: dv=1 ft
        S is cumulated settlement at this depth

        Total Settlement of Saturated and Dry Sands=0.000 in.
        Differential Settlement=0.000 to 0.000 in.

        Units           Depth = ft, Stress or Pressure = tsf (atm), Unit Weight =
pcf, Settlement = in.

__________________________________________________________________________________
_____________
        SPT             Field data from Standard Penetration Test (SPT)
        BPT             Field data from Becker Penetration Test (BPT)
        qc              Field data from Cone Penetration Test (CPT)
        fc              Friction from CPT testing
        Gamma           Total unit weight of soil
        Gamma'          Effective unit weight of soil
        Fines           Fines content [%]
        D50             Mean grain size
        Dr              Relative Density
        sigma           Total vertical stress [tsf]
        sigma'          Effective vertical stress [tsf]
        sigC'           Effective confining pressure [tsf]
        rd              Stress reduction coefficient
        CSR             Cyclic stress ratio induced by earthquake
        fs              User request factor of safety, apply to CSR
        w/fs            With user request factor of safety inside
        CSRfs           CSR with User request factor of safety
        CRR7.5          Cyclic resistance ratio (M=7.5)
        Ksigma          Overburden stress correction factor for CRR7.5
        CRRv            CRR after overburden stress correction, CRRv=CRR7.5 * Ksigma
        MSF             Magnitude scaling factor for CRR (M=7.5)
        CRRm            After magnitude scaling correction CRRm=CRRv * MSF
        F.S.            Factor of Safety against liquefaction F.S.=CRRm/CSRfs
        Cebs            Energy Ratio, Borehole Dia., and Sample Method Corrections
        Cr              Rod Length Corrections
        Cn              Overburden Pressure Correction
        (N1)60          SPT after corrections, (N1)60=SPT * Cr * Cn * Cebs
        d(N1)60         Fines correction of SPT
        (N1)60f         (N1)60 after fines corrections, (N1)60f=(N1)60 + d(N1)60
        Cq              Overburden stress correction factor
        qc1             CPT after Overburden stress correction
        dqc1            Fines correction of CPT
```

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qc1f            CPT after Fines and Overburden correction, qc1f=qc1 + dqc1
qc1n            CPT after normalization in Robertson's method
Kc              Fine correction factor in Robertson's Method
qc1f            CPT after Fines correction in Robertson's Method
Ic              Soil type index in Suzuki's and Robertson's Methods
(N1)60s         (N1)60 after seattlement fines corrections
ec              Volumetric strain for saturated sands
ds              Settlement in each Segment dz
dz              Segment for calculation, dz=0.050 ft
Gmax            Shear Modulus at low strain
g_eff           gamma_eff, Effective shear Strain
g*Ge/Gm         gamma_eff * G_eff/G_max,      Strain-modulus ratio
ec7.5           Volumetric Strain for magnitude=7.5
Cec             Magnitude correction factor for any magnitude
ec              Volumetric strain for dry sands, ec=Cec * ec7.5
NoLiq           No-Liquefy Soils

References:
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NCEER Workshop on Evaluation of Liquefaction Resistance of Soils. Youd, T.L., and Idriss, I.M., eds., Technical Report NCEER 97-0022.

SP117. Southern California Earthquake Center. Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Liquefaction in California. University of Southern California. March 1999.

GEOLOGIC HAZARDS REPORT

MOUNTAIN TRANSIT ADMINISTRATIVE FACILITY PROJECT

160-170 BUSINESS CENTER DRIVE

BIG BEAR LAKE, SAN BERNARDINO COUNTY, CALIFORNIA

Project No. 223769-1

February 7, 2022

Prepared for:

John R. Byerly, Inc.
2257 South Lilac Avenue
Bloomington, CA 92316

John R. Byerly, Inc.
2257 South Lilac Avenue
Bloomington, CA 92316

Attention: Mr. John R. Byerly

Regarding: Geologic Hazards Report
Mountain Transit Administrative Facility Project
160-170 Business Center Drive
Big Bear Lake, San Bernardino County, California
JRB File No. S-14447

INTRODUCTION

At your request, this firm has prepared a geologic hazards report for the proposed administrative building and maintenance facility project. The purpose of this study was to evaluate the existing geologic conditions and any corresponding potential geologic and/or seismic hazards, with respect to the proposed development from a geologic standpoint, as this property lies within the San Bernardino County Geologic Hazard Overlay District (San Bernardino County, 2010a & 2010b). We understand that the subject property will be utilized for construction of a 12,188 square-foot bus maintenance building, an 11,355 square-foot administrative building, along with various site improvements, appurtenances, and landscaping. The scope of services provided for this evaluation included the following:

- ***Review of available published and unpublished geologic/seismic data in our files pertinent to the site, including the provided site-specific boring logs.***
- ***Performing a seismic surface-wave survey by a licensed State of California Professional Geophysicist that included one traverse for shear-wave velocity analysis purposes.***
- ***Evaluation of the local and regional tectonic setting and historical seismic activity, including performing a site-specific CBC ground motion analysis.***
- ***Preparation of this report presenting our findings, conclusions, and recommendations from a geologic standpoint.***

Accompanying Maps, Illustrations, and Appendices

Plate 1	-	Regional Geologic Map
Plate 2	-	Geologic Hazard Overlay Map
Plate 3	-	Google™ Earth Imagery Map
Plate 4	-	Site Plan
Appendix A	-	Shear-Wave Survey
Appendix B	-	Site-Specific Ground Motion Analysis
Appendix C	-	References

GEOLOGIC SETTING

The subject property is regionally situated within a natural geomorphic province in Southern California known as the Transverse Ranges. The Transverse Ranges consist of a set of easterly-trending mountains and geologic structures that are distinct from the general northwest-southeast grain of the other provinces of California. More specifically, the site is located within the San Bernardino Mountains, an easterly-trending structural block that is roughly 55 miles long and 20 miles wide. This mountain range was formed by intense folding and faulting in very late geologic time (predominantly Tertiary time).

The geomorphology of this region of the San Bernardino Mountains indicates that the range is very young, from a geologic standpoint, whereas it was uplifted tectonically predominantly during Quaternary time. Regionally, the site is located within the northern block of the San Bernardino Mountain Range, which is an old erosion surface generally forming a broad plateau. Originally, this portion of the San Bernardino Mountains regionally was a part of the crystalline bedrock complex of the southern Mojave Desert prior to its uplift. The northern block of the San Bernardino Mountains is bordered on the north by a zone of south-dipping thrust faults (North Frontal Fault System), and along the south by the San Andreas Fault.

Locally, as mapped by Miller et al. (2001) and as shown on the Regional Geologic Map (see Plate 1), the subject site is shown to be mantled by late Holocene age active-wash deposits (map symbol Qw), generally described as being unconsolidated to locally cemented sand and gravel deposits in active washes of streams and on active surfaces of alluvial fans. These surficial deposits are noted to range from a few centimeters to only a few meters in thickness.

Underlying these surficial deposits at depth, such as mapped locally to the east and west of the site (map symbol Tsl), are believed to be Miocene age moderately-well consolidated sedimentary rocks comprised of siltstone, fine- to coarse-grained sandstone, pebble sandstone, and greenish mudstone. These sedimentary rocks overlie the deeper basement rocks that are found throughout most of the Big Bear area, which are estimated to be around 400± feet thick locally (United States Geological Survey, 2012).

EARTH MATERIALS

Based on the subsurface exploration performed by JRB (2022), the upper 7± feet of the site locally appear to consist of artificial fill comprised generally of silty fine- to coarse-grained sand with gravel, cobbles and occasional debris. Underlying these fill materials are interbedded silty fine- to medium-grained sand and silty-clayey fine- to medium-grained sand. These deposits were found to be in a dense to very-dense condition, to a depth of at least 71 feet.

GROUNDWATER

The subject site is located within the Bear Valley Groundwater Basin, which is situated within the Big Bear Lake and Baldwin Lake surface-water drainage basins. This basin is bounded by crystalline rocks of the San Bernardino Mountains that locally surround Bear Valley on all sides (California Department of Water Resources, 2003). Here groundwater is found primarily within unconsolidated Quaternary age alluvial deposits, which is recharged from percolation and runoff, and underflow from fractured crystalline rocks. More specifically, the site is located within a subbasin referred to as the Village Basin, that is defined by surface-water drainage divides.

The nearest groundwater well is located 1,300± feet to the northwest (Well Site Code 342535N1168920W001), where the groundwater ranges from 8 to 20 feet in depth during the time period of 2015 to 2021 (California Department of Water Resources, 2022). Another nearby well located 1,400± feet to the southeast (Well Site Code 342471N1168864W001), has groundwater ranging from 11 to 38 feet in depth during the time period of 2015 to 2021.

Currently, the subject site is located approximately 52± feet above the current water level of Big Bear Lake (Big Bear Municipal Water District, 2022). Based on the exploratory borings performed by John R. Byerly, Inc. (JRB, 2022), groundwater was encountered as shallow as 26½ feet in depth.

FAULTING

There are at least thirty-seven major late Quaternary active/potentially active faults that are located within a 100-kilometer (62-mile) radius of the subject site (Blake, 1989-2000). Of these, there are no "active" faults known to traverse the site, nor were any indications of active faulting or related features observed at the site during our field reconnaissance or photogeologic analysis. In addition, the site is not located within a State of California "Alquist-Priolo Earthquake Fault Zone" for surface fault rupture hazard (CGS, 2018 and C.D.M.G.,1988), defined as activity along a fault that has occurred during the Holocene time period. The nearest such zone is located approximately 7± miles to the north (North Frontal Fault Zone, M_W6.9, eastern segment). This fault has also been referred to as the North Frontal Fault System, which is comprised of numerous reverse fault segments which, in subsurface, may or may not form a single through-going fault (Miller, 1980).

Earthquake activity relating to the Landers-Big Bear events of June 28, 1992, and thereafter have led speculation into the fault mechanics in this region. The 6.7 magnitude earthquake (M_W6.3) that struck the Big Bear region was epicentered just south of the Sugarloaf area, approximately 5± miles to the southeast. This earthquake had a deep hypocenter being 5½± kilometers in depth and has an overall northeasterly trend, dipping steeply to the southeast. The subsurface fault is characterized left-lateral, strike-slip movement and no known surface fault rupture has been documented to date. Since no active surface trace has been identified to date, the actual location of this fault is unable to be defined. However, it can be assumed that based on the aftershock sequence pattern that has been recorded since the main shock, the most likely area of possible surface rupture would be located along a northeast trend, with the greater Sugarloaf area for a central reference. Because this fault has never been previously identified or postulated, and the fact that the Big Bear area is characterized generally by northwest-trending faults, the mechanics are not well known and much scientific work will have to be performed before an understanding of the local seismic parameters and conditions can be better understood. This fault is for discussion purposes only, and should not be used for permanent location or design purposes.

For preliminary evaluation purposes only, the Big Bear Fault has been tentatively estimated to have a maximum moment magnitude event of M_W6.9 using the "empirical earthquake size-fault-rupture-length relation" of dePolo and Slemmons (1990). This equation basically relates the length parameter of a fault to an earthquake size, based on historical earthquake data. This design event is considered very tentative and possibly conservative due to the lack of unknown seismic parameters (i.e., slip-rate, length, characteristic rate, etc.). The length of the Big Bear Fault was chosen to include the San Andreas Fault as the southwest terminus end and the area of the Landers surface fault ruptures (Johnson Valley Fault, Camp Rock Fault, etc.) as the northeast terminus end as visually shown on the recorded aftershock sequence patterns, which correlates to a length of approximately 42 miles.

Another nearby significant mapped fault is the southern terminus of the Helendale-South Lockhart Fault Zone, located 6± miles to the northeast. The southern terminus is not zoned as “active” by the State of California, but is zoned at a distance of 7½± miles farther to the north where it intersects the North Frontal Fault Zone.

GROUND MOTION ANALYSIS

According to California Geological Survey Note 48 (CGS, 2019), a site-specific ground motion analysis is required for the subject site (CBC, 2019, Section 1613 and also as required by ASCE 7-16, Chapter 21), the detailed results of which are presented within Appendix B. Additionally, a seismic shear-wave survey was conducted for this study by our firm as presented within Appendix A of this report, for purposes of determining the Site Classification and V_{S30} input values for the ground motion analysis. Geographically, the proposed construction area is located at Longitude -116.8888 and Latitude 34.2505 (World Geodetic System of 1984 coordinates). The mapped spectral acceleration parameters, coefficients, and other related seismic parameters, were evaluated using the OSHPD Seismic Design Maps (OSHPD, 2022) and the California Building Code criteria (CBC, 2019), with the site-specific ground motion analysis being performed following Section 21 of the ASCE 7-16 Standard (2017). The results of this site-specific analysis have been summarized and are tabulated below:

TABLE 1 – SUMMARY OF SEISMIC DESIGN PARAMETERS

Factor or Coefficient	Value
S_S	**1.642g**
S_1	**0.568g**
F_a	**1.0**
F_v	**1.732**
S_{DS}	**1.210g**
S_{D1}	**0.760g**
S_{MS}	**1.818g**
S_{M1}	**1.136g**
T_L	**8 Seconds**
MCE_G PGA	**0.81g**
Shear-Wave Velocity (V100)	**1,163.1 ft/sec**
Site Classification	**D**
Risk Category	**II**

HISTORIC SEISMICITY

A computerized search, based on Southern California historical earthquake catalogs, has been performed using the programs EQSEARCH (Blake, 1989-2021) and the ANSS Comprehensive Earthquake Catalog (U.S.G.S., 2022). The following table and discussion summarizes the historic seismic events (greater than or equal to M4.0) that have been estimated and/or recorded during this time period of 1800 to January 2022, within a 100-kilometer radius of the site.

TABLE 2 - HISTORIC SEISMIC EVENTS; 1800-2022 (100-kilometer radius)

4.0 - 4.9	563
5.0 - 5.9	70
6.0 - 6.9	14
7.0 - 7.9	2
8.0+	0

These data have been compiled generally based on the reported intensities throughout the region, thus focusing in on the most likely epicentral location. Seismic instrumentation beyond 1932 has greatly increased the accuracy of locating earthquake epicenters. It should be noted that pre-instrumental seismic events (occurring generally before 1932) have been estimated from isoseismal maps (Toppozada, et al., 1981 and 1982).

A summary of the historic earthquake data is as follows:

- ☐ The closest recorded earthquake epicenter (>M4.0) was located approximately 1,000± feet south of the site (June 30, 1979, M4.4).
- ☐ The nearest estimated significant historic earthquake epicenter (pre-1932) was approximately five miles southwest of the site (January 16, 1930, M5.2).
- ☐ The nearest recorded significant historic earthquake epicenter was located approximately 1¼ miles west-northwest of the site (June 28, 1992, M5.3).
- ☐ The largest estimated historical earthquake epicenter (pre-1932) within a 62-mile radius of the site is a M6.9 event of December 8, 1812 (44± miles southwest).
- ☐ The largest recorded historical earthquake was the M7.6 (M_W 7.3) Landers's event, located approximately 26 miles to the east-southeast (June 28, 1992).
- ☐ The largest estimated ground acceleration estimated to have been experienced at the site was 0.421g which resulted from the M6.7 (M_W 6.3) Big Bear event of June 28, 1992, which was located approximately five miles southeast of the subject site (Blake, 1989-2000b).

An Earthquake Epicenter Map which includes magnitudes 4.0 and greater for a 100-kilometer (62-mile) radius has been included below as Figure 1, for reference (Blue circle), with the site shown as the central blue dot. This map was prepared using the ANSS Comprehensive Earthquake Catalog (U.S.G.S., 2022) of instrumentally recorded events that have occurred from the period of 1932 to January 2022, superimposed on a captured Google™ Earth image (Google™ Earth, 2022).

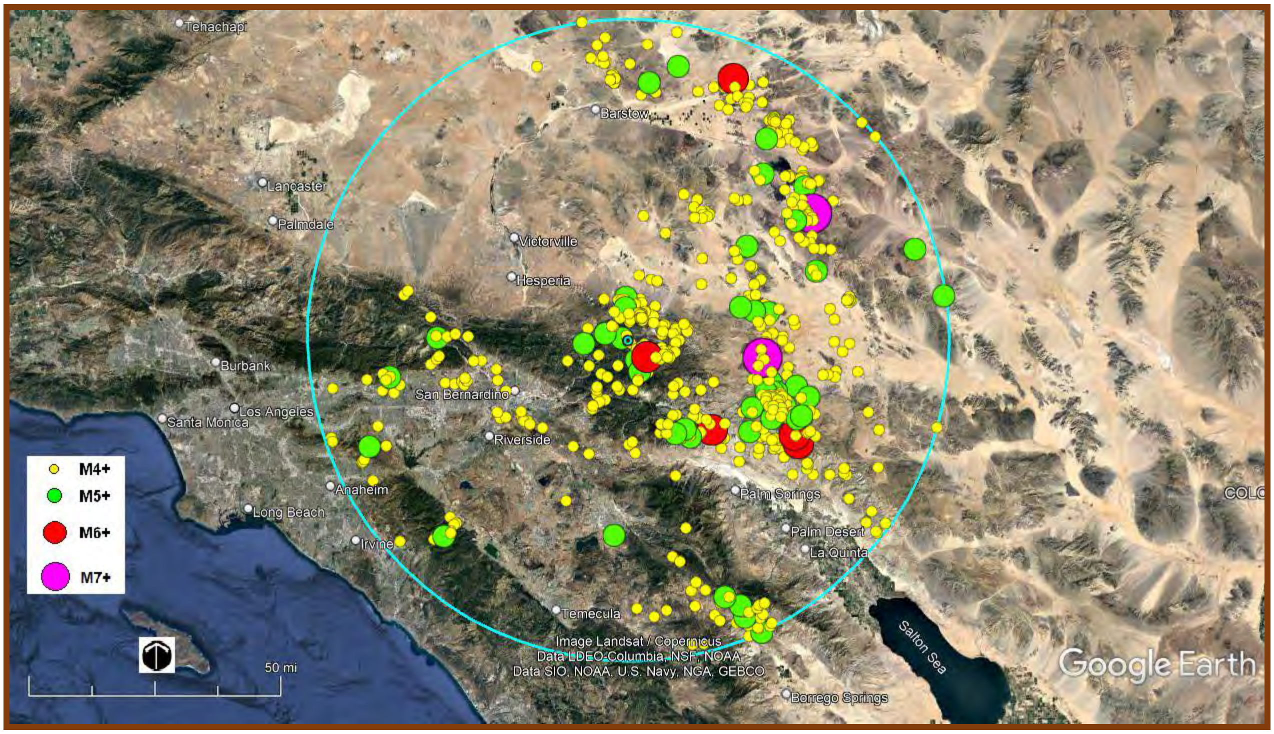

FIGURE 1- Earthquake Epicenter Map showing events of M4.0+ within a 100-kilometer radius.

SECONDARY SEISMIC HAZARDS

Secondary permanent or transient seismic hazards that are generally associated with severe ground shaking during an earthquake include ground rupture, liquefaction, seiches or tsunamis, ground lurching/lateral spreading, flooding (water storage facility failure), landsliding, rockfalls, and seismically-induced settlement, which are discussed below.

Ground Rupture:

Ground rupture is generally considered most likely to occur along pre-existing faults. Since there are no faults that are known to traverse the site, the potential for ground rupture is considered to be very low to nil.

Ground Lurching/Lateral Spreading:

Ground lurching is the horizontal movement of soil, sediments, or fill located on relatively steep embankments or scarps as a result of seismic activity, forming irregular ground surface cracks. The potential for lateral spreading or lurching is highest in areas underlain by soft, saturated materials, especially where bordered by steep banks or adjacent hard ground. Due to the relatively flat-lying nature of the site and distance from embankments, the potential for ground lurching and/or lateral spreading is considered to be nil.

Liquefaction:

In general, liquefaction is a phenomenon that occurs where there is a loss of strength or stiffness in the soils that can result in the settlement of buildings, ground failures, or other related hazards. The main factors contributing to this phenomenon are: 1) cohesionless, granular soils having relatively low densities (usually of Holocene age); 2) shallow groundwater (generally less than 50 feet); and 3) moderate-high seismic ground shaking. According to San Bernardino County (2010a & 2010b), the subject property is shown to be located within a "Zone of Suspected Liquefaction Susceptibility", as shown on Plate 2. Additionally, groundwater was encountered within the exploratory borings drilled at the site at a depth of 26½ feet, therefore there may be a potential for liquefaction to occur.

Seiches/Tsunamis:

Based on the far distance of large, open bodies of water and the elevation of the site with respect to sea level or Big Bear Lake, the possibility of seiches/tsunamis is considered nil. Additionally, mapping by the California Geological Survey (2014) does not indicate the site to be located within a tsunami inundation zone.

Rockfalls:

Since no large rock outcrops are present at or adjacent to the site, the possibility of rockfalls during seismic shaking is nil.

Landsliding:

Due to the low-lying relief of the site and adjacent areas, landsliding due to seismic shaking is considered nil. Additionally, mapping by Tan (1990) does not indicate the subject property to be located within a mapped area susceptible to landsliding. According to the County of San Bernardino (2010a & 2010b) the subject property is not shown to be located within a "Zone of Suspected Landslide Susceptibility", as shown on Plate 2.

Flooding (Water Storage Facility Failure):

There are no water storage facilities on or near the site that could cause flooding due to failure during a seismic event.

Seismically-Induced Settlement:

Seismically-induced settlement generally occurs within areas of loose, granular soils during periods of strong ground motion. Since the subject site is underlain by generally dense to very dense sediments, and based on the subsurface data and SPT blow counts from the exploratory boring excavations performed by JRB (2022), to a depth of at least 71 feet, seismically-induced settlement is considered very low.

FLOODING

According to the Federal Emergency Management Agency (FEMA, 2008a & 2008b), the subject site is shown to be partially located within the boundaries of a designated flood hazard zone. This map indicates that the eastern portion of the site is located within "Zone AE," which is defined as "Special Flood Hazard Areas Subject to Inundation by the 1% Annual Chance Flood (Base flood elevations determined)," as shown on Figure 2 below for reference. The remainder of the western portion of the site is not located within a flood hazard zone and is included within "Zone X" which is defined as "Areas to be Outside the 0.2% Annual Chance Floodplain." During peak periods of rainfall, however, heavy runoff could be anticipated.

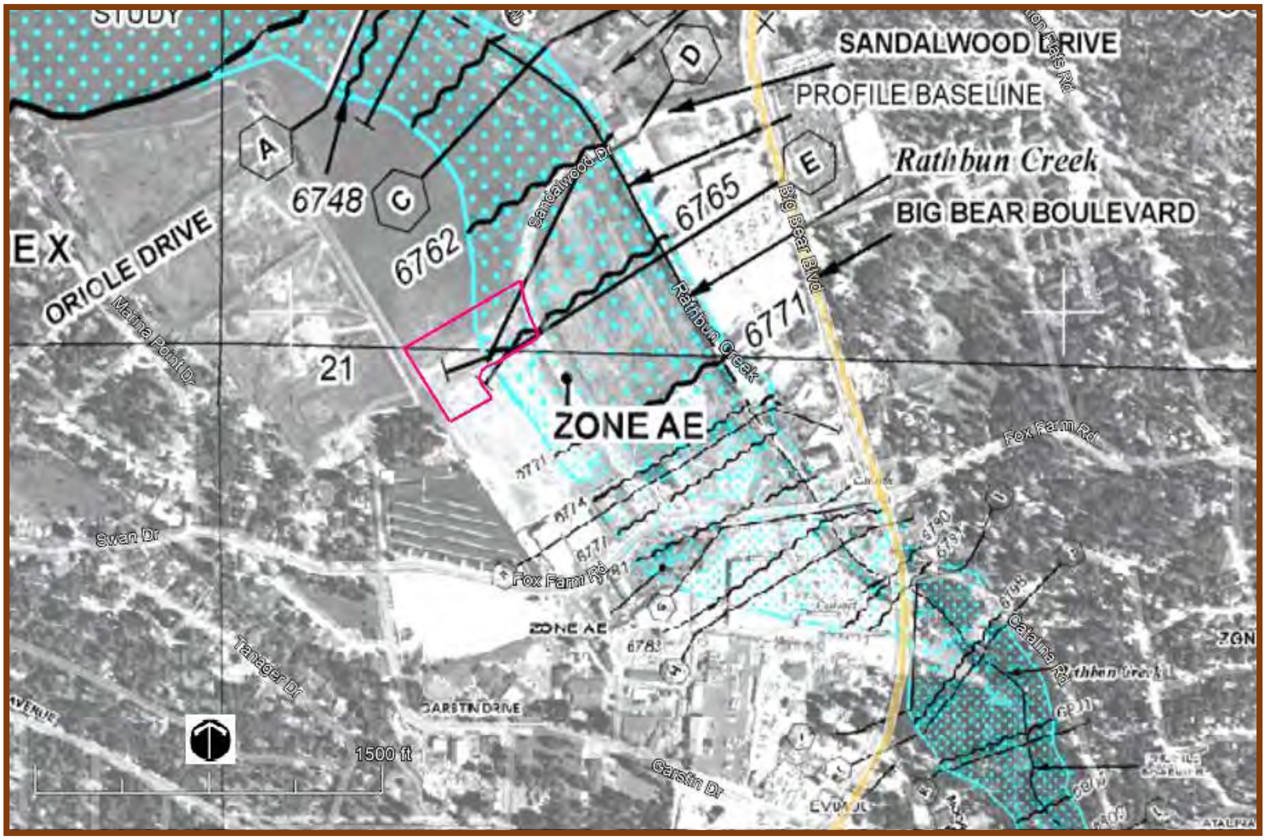

FIGURE 2- FEMA Flood Map; Site boundaries approximated by red outline.

OTHER GEOLOGIC HAZARDS

There are other potential geologic hazards not necessarily associated with seismic activity that occur statewide. These hazards include; natural hazardous materials (such as methane gas, hydrogen-sulfide gas, and tar seeps); Radon-222 gas (EPA, 1993); naturally occurring asbestos; volcanic hazards (Martin, 1982); and regional subsidence. Of these hazards, there are none that appear to impact the site.

CONCLUSIONS AND RECOMMENDATIONS

General:

Based on our field reconnaissance and review of available pertinent published and unpublished geologic/seismic literature, construction of the proposed administrative building and maintenance facility appears to be feasible from a geologic standpoint, providing our recommendations are considered during planning and construction.

Conclusions:

1. Available published geologic data indicates that the subject property is mantled by late Holocene age active-wash deposits, generally described as being unconsolidated to locally cemented sand and gravel deposits. Underlying these surficial deposits are believed to be Miocene age moderately-well consolidated sedimentary rocks comprised of siltstone, fine- to coarse-grained sandstone, pebble sandstone, and greenish mudstone. The provided exploratory boring log indicates that the site is mantled by 7± feet of artificial fill comprised generally of silty fine- to coarse-grained sand with gravel, cobbles and occasional debris. These materials are in turn underlain by interbedded silty fine- to medium-grained sand and silty-clayey fine- to medium-grained sand, to a depth of at least 71 feet. These deposits were found to be in a dense to very-dense condition.

2. Groundwater was encountered during subsurface exploration within the proposed project area at a depth of 26½ feet. Groundwater levels are expected to fluctuate in response to the water level of Big Bear Lake, which is located 2,000± feet to the north. Currently the lake water level is approximately 15± feet below the “full” lake level, suggesting that groundwater could approach within 11½± feet of the surface, which includes the height of the 7± foot-high artificial fill locally placed at the site.

3. There are no active faults that are known to traverse the subject site based on published literature. Additionally, no geomorphic or photogeologic evidence was observed that would suggest the presence of active faulting traversing through or towards the site. In addition, the subject site is not located within a designated Alquist-Priolo Earthquake Fault Zone that would indicate a potential for surface-fault rupture hazards. The nearest known “active” fault which is <u>zoned</u> by the State of California is the North Frontal Fault, located 7±-miles to the north.

4. The <u>primary</u> geologic hazard that exists at the site is that of ground shaking. Moderate to severe ground shaking could be anticipated during the life of the proposed facility. Ground shaking from earthquakes accounts for nearly all earth-quake losses.

5. Other than the potential for liquefaction, there do not appear to be any potential permanent or transient secondary seismic hazards that would affect the proposed project development.

6. The eastern portion of the site is shown to be located within a flood hazard zone that is denoted as being "Special Flood Hazard Areas Subject to Inundation by the 1% Annual Chance Flood (Base flood elevations determined)".

Recommendations:

1. It is recommended that all structures be designed to at least meet the current California Building Code provisions in the latest 2019 CBC edition and the ASCE Standard 7-16, where applicable. However, it should be noted that the building code is intended as a minimum construction design and is often the maximum level to which structures are designed. It is the responsibility of both the property owner and project structural engineer to determine the risk factors with respect to using CBC minimum design values for the proposed facilities.

2. The potential for liquefaction should be properly evaluated by the project Geotechnical Engineer. Any appropriate site-specific mitigation measures should be implemented as recommended, if warranted.

3. Any possible flood hazards associated within this zone, or elsewhere within the site should be properly evaluated by the design Civil Engineer.

CLOSURE

Our conclusions and recommendations are based on a review of available existing geologic/seismic data and the provided site-specific provided subsurface exploratory boring logs. No subsurface exploration was performed by this firm for this evaluation. We make no warranty, either express or implied. Should conditions be encountered at a later date or more information becomes available that appear to be different than those indicated in this report, we reserve the right to reevaluate our conclusions and recommendations and provide appropriate mitigation measures, if warranted. It is assumed that all the conclusions and recommendations outlined in this report are understood and followed. If any portion of this report is not understood, it is the responsibility of the owner, contractor, engineer, and/or governmental agency, etc., to contact this office for further clarification.

Respectfully submitted,
TERRA GEOSCIENCES

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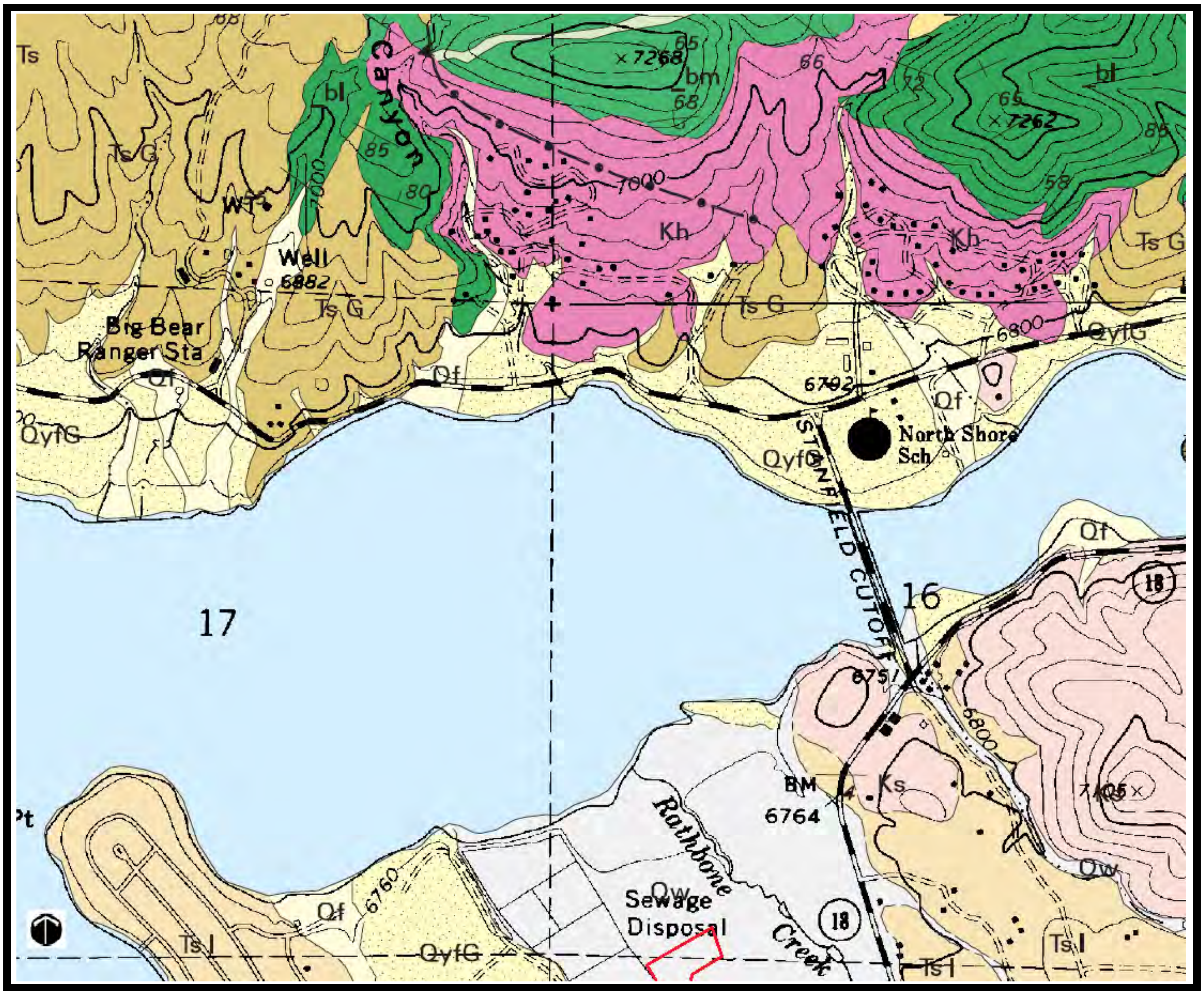
REGIONAL GEOLOGIC MAP



BASE MAP: Miller et al. (2001), U.S.G.S. Open-File Report 98-579, Site partially outlined in red.

PARTIAL LEGEND

Qw	**WASH DEPOSITS**	Unconsolidated to locally cemented sand and gravel deposits in active washes of streams and on active surfaces of alluvial fans (late Holocene).
— - - -	**GEOLOGIC CONTACT**	Solid where located within ±15 meters, dashed where located within ±30 meters.

GEOLOGIC HAZARD OVERLAY MAP

BASE MAP: San Bernardino County (2010), Map Nos. FI09-C & FI71-C, Site outlined in red.

PARTIAL LEGEND

Zone of Suspected Liquefaction Susceptibility

▨ Zone of Susceptibility

Generalized Liquefaction Susceptibility

- ■ Low
- ■ Medium
- ■ High

Generalized Landslide Susceptibility

- ▤ Low to moderate
- ▤ Moderate to high
- ▥ Mapped, Existing Landslide

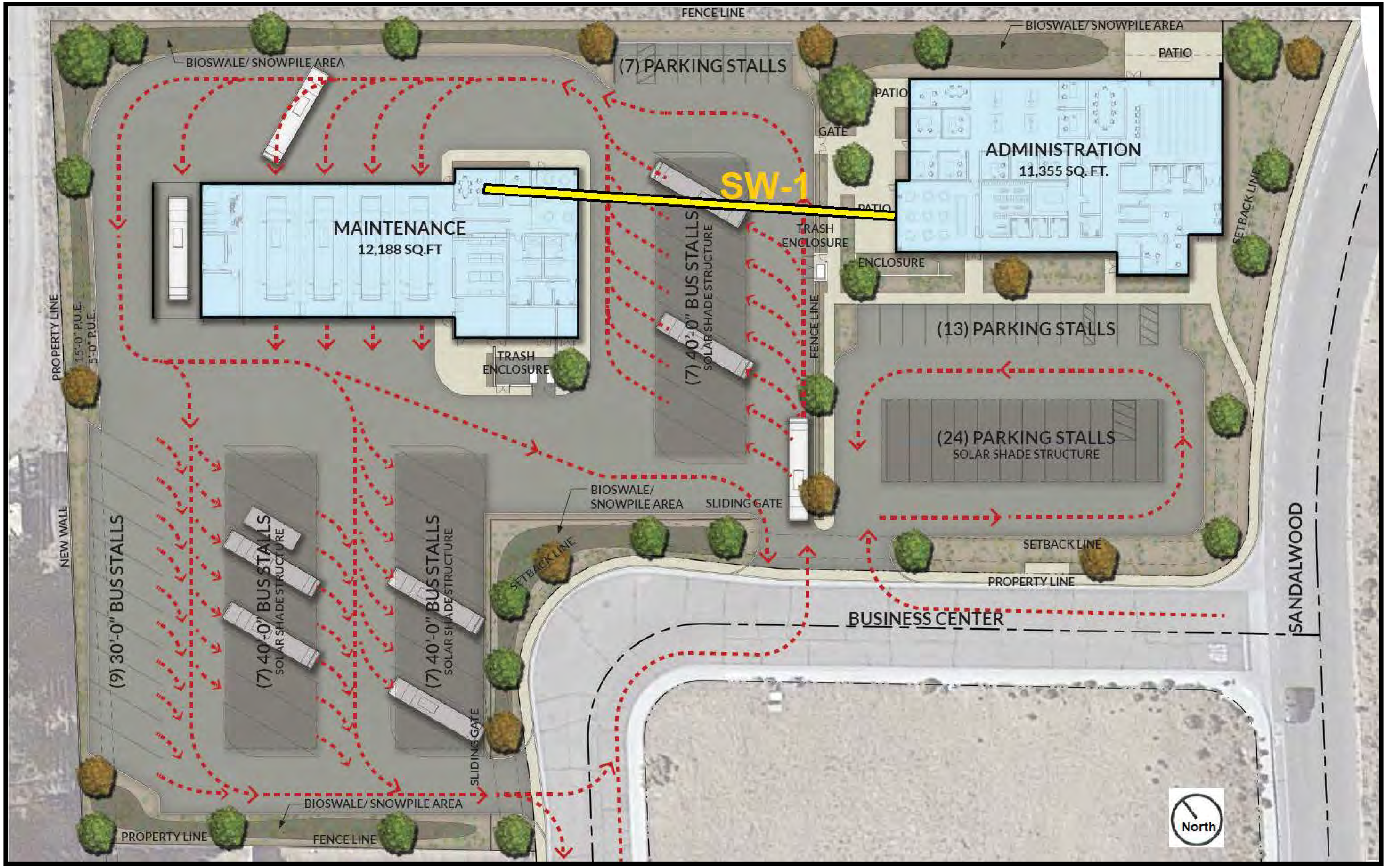
GOOGLE™ EARTH IMAGERY MAP

Base Map: Google™ Earth (2022); Seismic shear-wave traverse SW-1 shown as yellow line, approximate project boundaries outlined in red.

PROJECT NO. 223769-1

PLATE 3

SITE PLAN



BASE MAP: Partial modified copy of the Site Plan (Ruhnau Clarke Architects); Seismic shear-wave traverse SW-1 shown as black/yellow line.

PROJECT NO. 223769-1

PLATE 4

APPENDIX A

SHEAR-WAVE SURVEY

SHEAR-WAVE SURVEY

Methodology

The fundamental premise of this survey uses the fact that the Earth is always in motion at various seismic frequencies. These relatively constant vibrations of the Earth's surface are called microtremors, which are very small with respect to amplitude and are generally referred to as background "noise" that contain abundant surface waves. These microtremors are caused by both human activity (i.e., cultural noise, traffic, factories, etc.) and natural phenomenon (i.e., wind, wave motion, rain, atmospheric pressure, etc.) which have now become regarded as useful signal information. Although these signals are generally very weak, the recording, amplification, and processing of these surface waves has greatly improved by the use of technologically improved seismic recording instrumentation and recently developed computer software. For this application, we are mainly concerned with the Rayleigh wave portion of the seismic signals, which is also referred to as "ground roll" since the Rayleigh wave is the dominant component of ground roll.

For the purposes of this study, there are two ways that the surface waves were recorded, one being "active" and the other being "passive." Active means that seismic energy is intentionally generated at a specific location relative to the survey spread and recording begins when the source energy is imparted into the ground (i.e., MASW survey technique). Passive surveying, also called "microtremor surveying," is where the seismograph records ambient background vibrations (i.e., MAM survey technique), with the ideal vibration sources being at a constant level. Longer wavelength surface waves (longer-period and lower-frequency) travel deeper and thus contain more information about deeper velocity structure and are generally obtained with passive survey information. Shorter wavelength (shorter-period and higher-frequency) surface waves travel shallower and thus contain more information about shallower velocity structure and are generally collected with the use of active sources.

For the most part, higher frequency active source surface waves will resolve the shallower velocity structure and lower frequency passive source surface waves will better resolve the deeper velocity structure. Therefore, the combination of both of these surveying techniques provides a more accurate depiction of the subsurface velocity structure.

The assemblage of the data that is gathered from these surface wave surveys results in development of a dispersion curve. Dispersion, or the change in phase velocity of the seismic waves with frequency, is the fundamental property utilized in the analysis of surface wave methods. The fundamental assumption of these survey methods is that the signal wavefront is planar, stable, and isotropic (coming from all directions) making it independent of source locations and for analytical purposes uses the spatial autocorrelation method (SPAC). The SPAC method is based on theories that are able to detect "signals" from background "noise" (Okada, 2003). The shear wave velocity (V_S) can then be calculated by mathematical inversion of the dispersive phase velocity of the surface waves which can be significant in the presence of velocity layering, which is common in the near-surface environment.

Field Procedures

One shear-wave survey traverse (SW-1) was performed within the proposed construction area, as approximated on Plates 3 and 4. For data collection, the field survey employed a twenty-four channel Geometrics StrataVisor™ NZXP model signal-enhancement refraction seismograph. This survey employed both active source (MASW) and passive (MAM) methods to ensure that both quality shallow and deeper shear-wave velocity information was recorded (Park et al., 2005).

Both the MASW and MAM survey lines used the same linear geometry array that consisted of a 184-foot-long spread using a series of twenty-four 4.5-Hz geophones that were spaced at regular eight-foot intervals. For the active source MASW survey, the ground vibrations were recorded using a one second record length at a sampling rate of 0.5-milliseconds. Two separate seismic records were obtained using a 30-foot shot offset at both ends of the line utilizing a 16-pound sledge-hammer as the energy source to produce the seismic waves. Numerous seismic impacts were used at each shot location to improve the signal-to-noise ratio.

The MAM survey did not require the introduction of any artificial seismic sources with only background ambient noise (i.e., air and vehicle traffic, etc.) being necessary. These ambient ground vibrations were recorded using a thirty-two second record length at a two-millisecond sampling rate with 30 separate seismic records being obtained for quality control purposes. The frequency spectrum data that was displayed on the seismograph screen were used to assess the recorded seismic wave data for quality control purposes in the field. The acceptable records were digitally recorded on the in-board seismograph computer and subsequently transferred to a flash drive so that they could be subsequently transferred to our office computer for analysis.

Data Reduction

For analysis and presentation of the shear-wave profile and supportive illustration, this study used the **SeisImager/SW™** computer software program that was developed by Geometrics, Inc. (2009). Both the active (MASW) and passive (MAM) survey results were combined for this analysis (Park et al., 2005). The combined results maximize the resolution and overall depth range in order to obtain one high resolution V_s curve over the entire sampled depth range. These methods economically and efficiently estimate one-dimensional subsurface shear-wave velocities using data collected from standard primary-wave (P-wave) refraction surveys.

However, it should be noted that surface waves by their physical nature cannot resolve relatively abrupt or small-scale velocity anomalies and this model should be considered as an approximation. Processing of the data then proceeded by calculating the dispersion curve from the input data from both the active and passive data records, which were subsequently combined creating an initial shear-wave (V_S) model based on the observed data. This initial model was then inverted in order to converge on the best fit of the initial model and the observed data, creating the final V_s curve as presented within this appendix.

Summary of Data Analysis

Data acquisition went very smoothly and the quality was considered to be good. Analysis revealed that the average shear-wave velocity ("weighted average") in the upper 100 feet of the subject survey area is **1,163.1** feet per second as shown on the shear-wave model for Seismic Line SW-1, as presented within this appendix. This average velocity classifies the underlying soils to that of Site Class "**D**" (Stiff Soil), which has a velocity range from 600 to 1,200 ft/sec (ASCE, 2017; Table 20.3-1).

The "weighted average" velocity is computed from a formula that is used by the ASCE (2017; Section 20.4, Equation 20.4-1) to determine the average shear-wave velocity for the upper 100 feet of the subsurface (V100).

$$\mathbf{Vs = 100/[(d1/v1) + (d2/v2) + ...+ (dn/vn)]}$$

Where d1, d2, d3,...,tn, are the thicknesses for layers 1, 2, 3,...n, up to 100 feet, and v1, v2, v3,...,vn, are the seismic velocities (feet/second) for layers 1, 2, 3,...n. The detailed shear-wave model displays these calculated layer boundaries/depths and associated velocities (feet/second) for the 218-foot profile where locally measured. The constrained data is represented by the dark-gray shading on the shear-wave model. The associated Dispersion Curves (for both the active and passive methods) which show the data quality and picks, along with the resultant combined dispersion curve model, are also included within this appendix, for reference purposes.

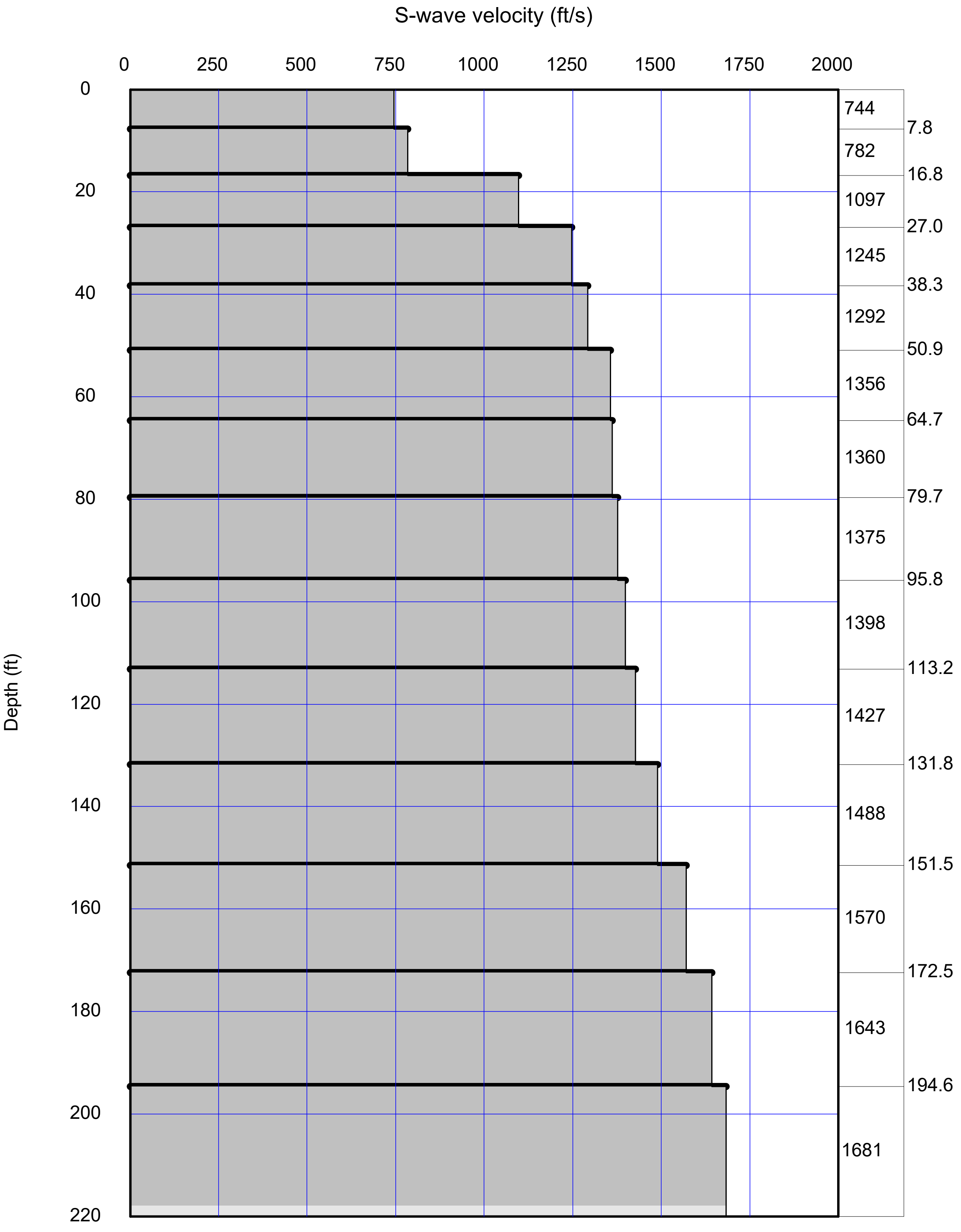
SURVEY LINE PHOTOGRAPHS

View looking northeast along Seismic Line SW-1.

View looking southwest along Seismic Line SW-1.

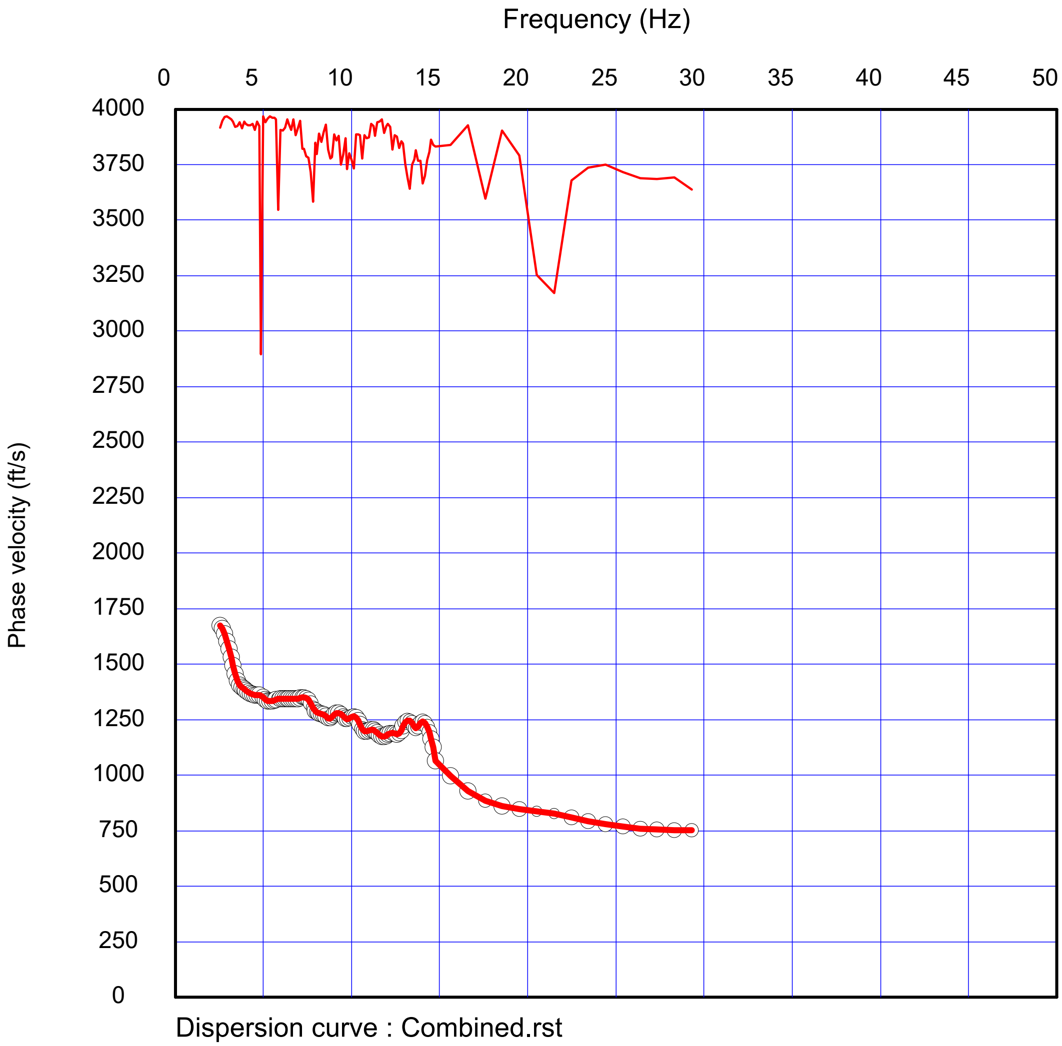
SEISMIC LINE SW-1

SHEAR-WAVE MODEL



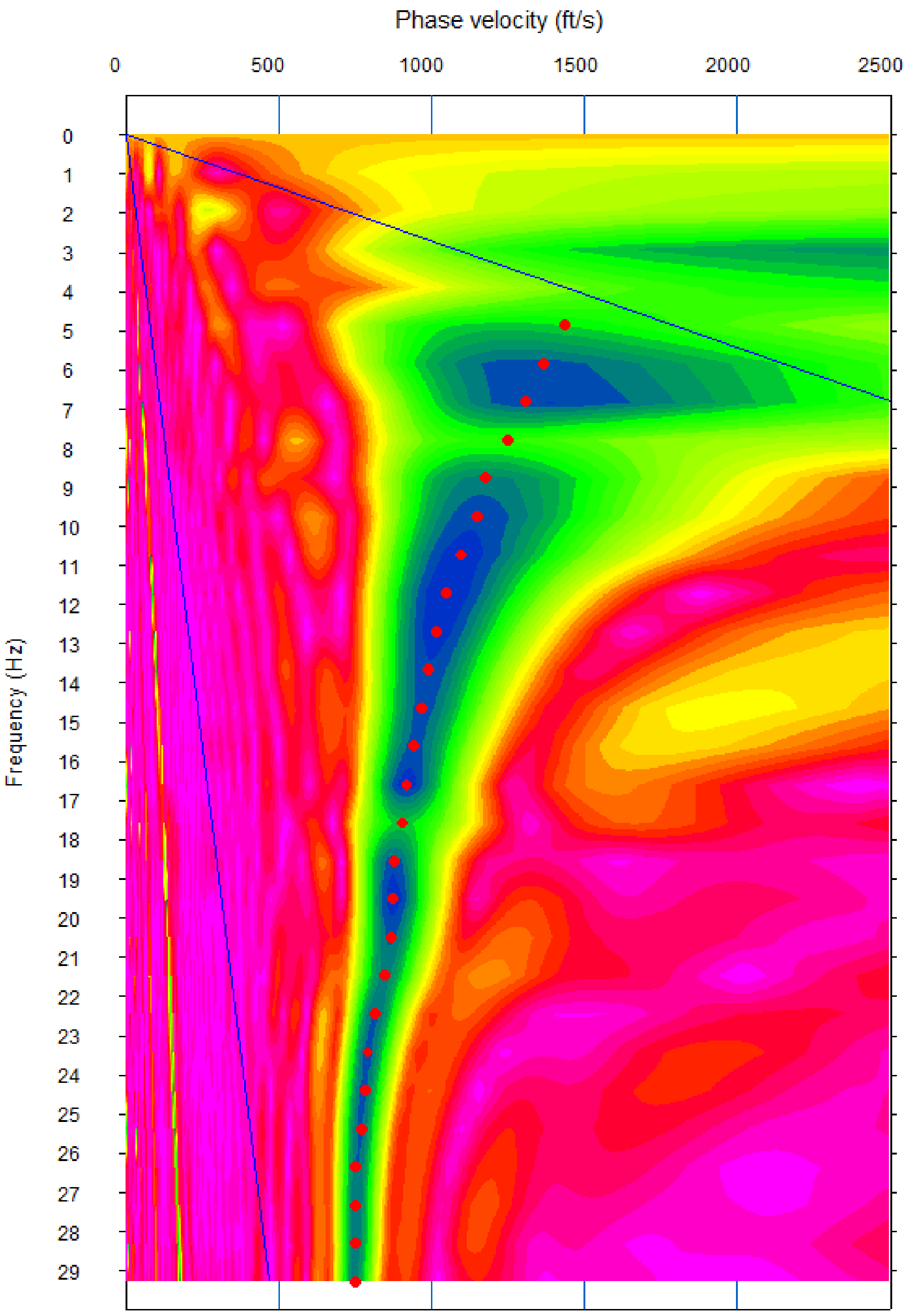
S-wave velocity model (inverted) : Final.rst **Average Vs 100ft = 1163.1 ft/sec**

SHEAR-WAVE MODEL SW-1



COMBINED DISPERSION CURVE

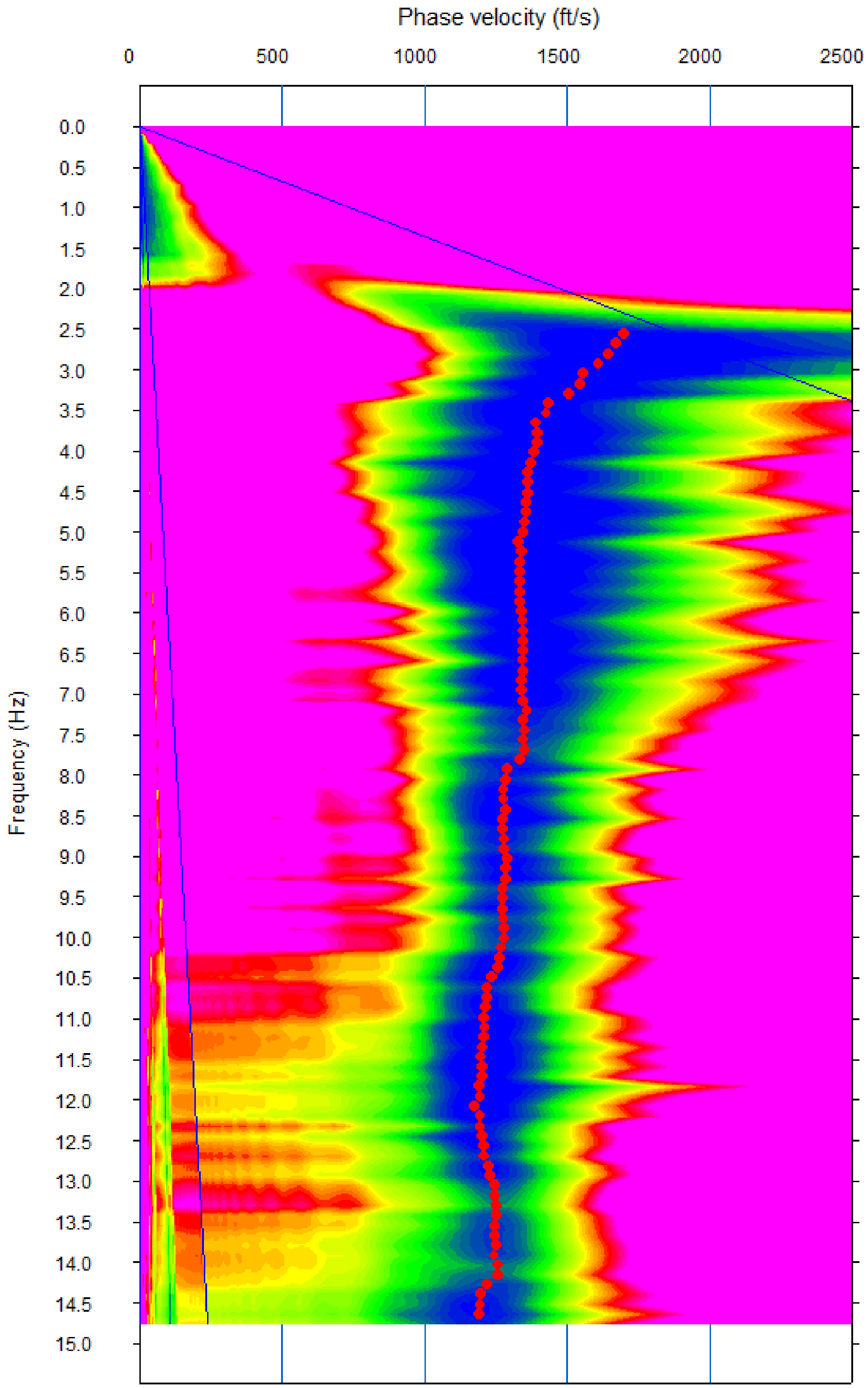
SEISMIC LINE SW-1



Dispersion Cure: Active.dat

ACTIVE DISPERSION CURVE

SEISMIC LINE SW-1



Dispersion Curve: Passive.dat

PASSIVE DISPERSION CURVE

APPENDIX B

SITE-SPECIFIC GROUND MOTION ANALYSIS

SITE-SPECIFIC GROUND MOTION ANALYSIS

A detailed summary of the site-specific ground motion analysis, which follows Section 21 of the ASCE Standard 7-16 (2017) and the 2019 California Building Code is presented below, with the Seismic Design Parameters Summary included within this appendix following the summary text.

- **Mapped Spectral Acceleration Parameters (CBC 1613.2.1)**-

  Based on maps prepared by the U.S.G.S (Risk-Adjusted Maximum Considered Earthquake (MCE_R) Ground Motion Parameter for the Conterminous United States for the 0.2 and 1-second Spectral Response Acceleration (5% of Critical Damping; Site Class B/C), a value of **1.642g** for the 0.2 second period (S_S) and **0.568** for the 1.0 second period (S_1) was calculated (ASCE 7-16 Figures 22-1, 22-2 and CBC 1613.2.1).

- **Site Classification (CBC 1613.2.2 & ASCE 7-16 Chapter 20)**-

  Based on the site-specific measured shear-wave value of 1,163.1 feet/second (354.1 m/sec), the soil profile type used should be Site Class **"D."** This Class is defined as having the upper 100 feet (30 meters) of the subsurface being underlain by "Stiff Soil" with average shear-wave velocities of 600 to 1,200 feet/second (180 to 360 meters/second), as detailed within Appendix A.

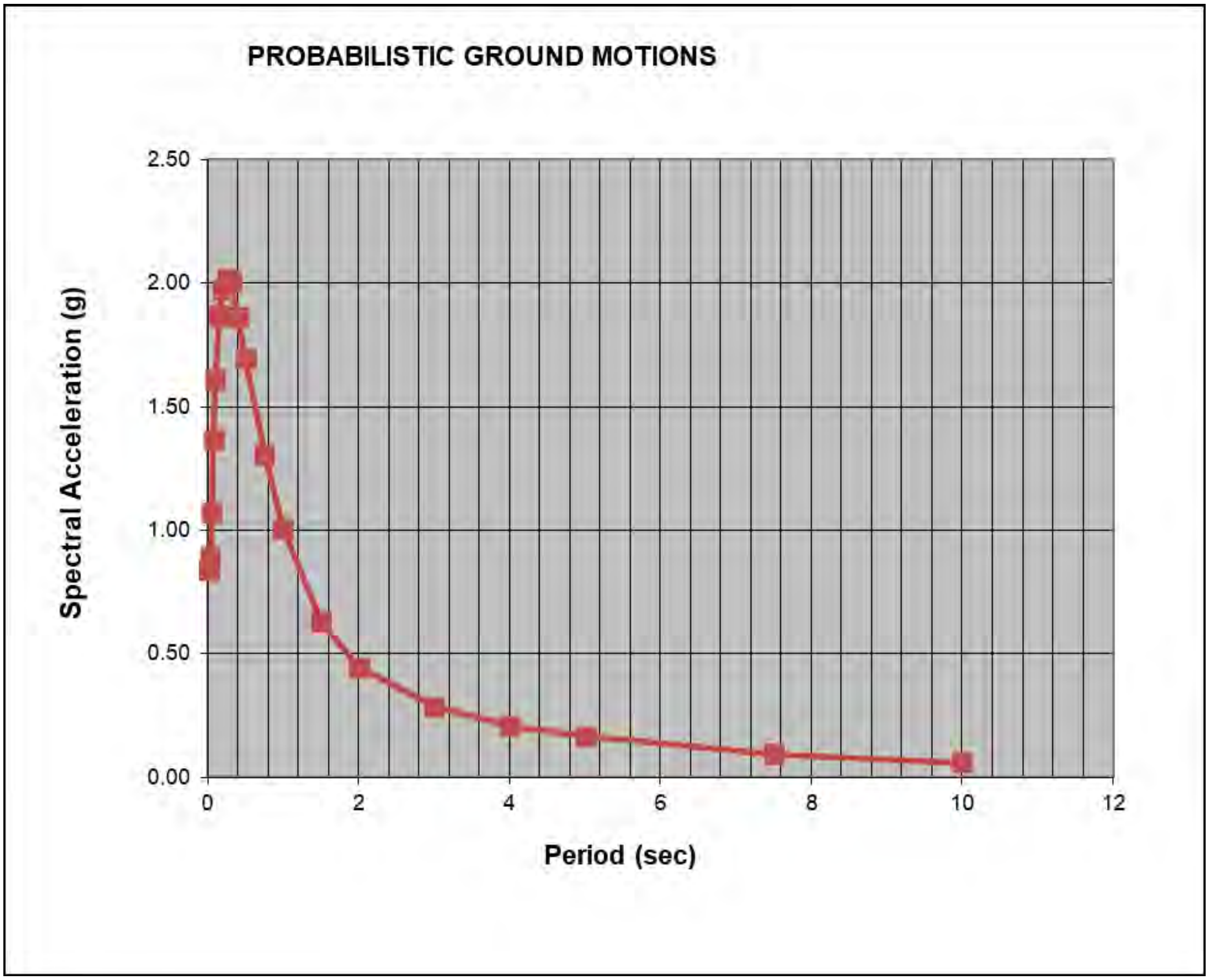
- **Site Coefficients (CBC 1613.2.3)**-

  Based on CBC Tables 1613.2.3(1) and 1613.2.3(2), the site coefficient $\mathbf{F_a = 1.0}$ and $\mathbf{F_v = 1.732}$, respectively.

- **Probabilistic (MCE_R) Ground Motions (ASCE 7 Section 21.2.1)**-

  Per Section 21.2.1.1 (**Method 1**), the probabilistic MCE spectral accelerations shall be taken as the spectral response accelerations in the direction of maximum response represented by a five percent damped acceleration response spectrum that is expected to achieve a one percent probability of collapse within a 50-year period.

  The probabilistic analysis included the use of the Open Seismic Hazard Analysis (OpenSHA). The selected Earthquake Rupture Forecast (ERF) was UCERF3 along with a Probability of Exceedance of 2% in 50 Years. The average of four Next Generation Attenuation West-2 Relations (2014 NGA) were utilized to produce a response spectrum. These included Chiou & Youngs (2014), Abrahamsom et al. (2014), Campbell & Bozorgnia (2014), Boore et al. (2014), and Campbell & Bozorgnia (2014). The Probabilistic Risk Targeted Response Spectrum was determined as the product of the ordinates of the probabilistic response spectrum and the applicable risk coefficient (C_R). These values were then modified to produce a spectrum based upon the maximum rotated components of ground motion. The resulting MCE_R Response Spectrum is indicated below:



- ***Deterministic Spectral Response Analyses (ASCE 7 Section 21.2.2)***-

The deterministic MCE_R response acceleration at each period shall be calculated as an 84th-percentile 5 percent damped spectral response acceleration in the direction of maximum horizontal response computed at that period. The largest such acceleration calculated for the characteristic earthquakes on all known active faults within the region shall be used. Analyses were conducted using the average of four Next Generation Attenuation West-2 Relations (2014 NGA), including Chiou & Youngs (2014), Abrahamsom et al. (2014), Boore et al. (2014), and Campbell & Bozorgnia (2014).

Based on our review of the Fault Section Database within the Uniform California Earthquake Rupture Forecast (UCERF 3; Field et al., 2013) and other published geologic data and maps, the Helendale-South Lockhart Fault Zone (M_W 7.4), the North Frontal Fault Zone (Eastern section, M_W 7.0), and the San Andreas Fault Zone (San Bernardino Section, M_W 8.3) were used for this analysis.

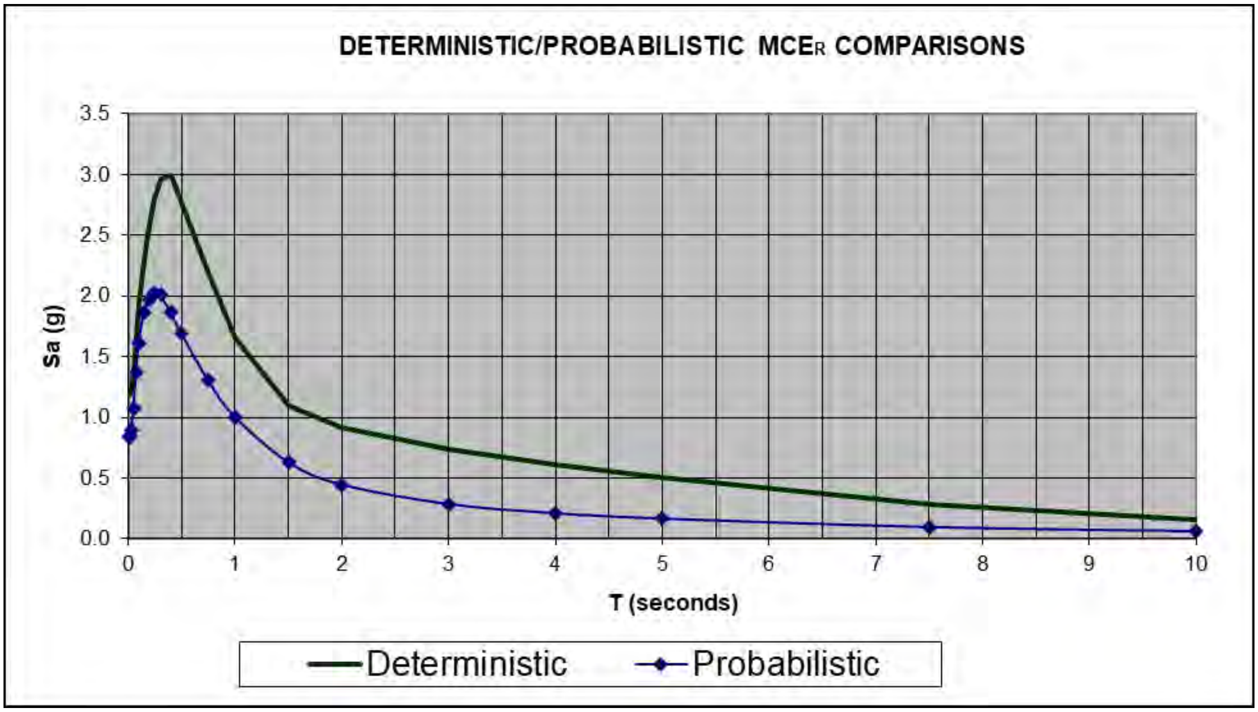
- **Site Specific MCE_R (ASCE 7 Section 21.2.3)**-

  The site-specific MCE_R spectral response acceleration at any period, S_{aM}, shall be taken as the lesser of the spectral response accelerations from the probabilistic ground motions of Section 21.2.1 and the deterministic ground motions of Section 21.2.2. The deterministic ground motions were compared with the probabilistic ground motions that were determined in accordance with Section 21.2.1. These results are tabulated below:

Comparison of Deterministic MCE_R Values with Probabilistic MCE_R Values - Section 21.2.3

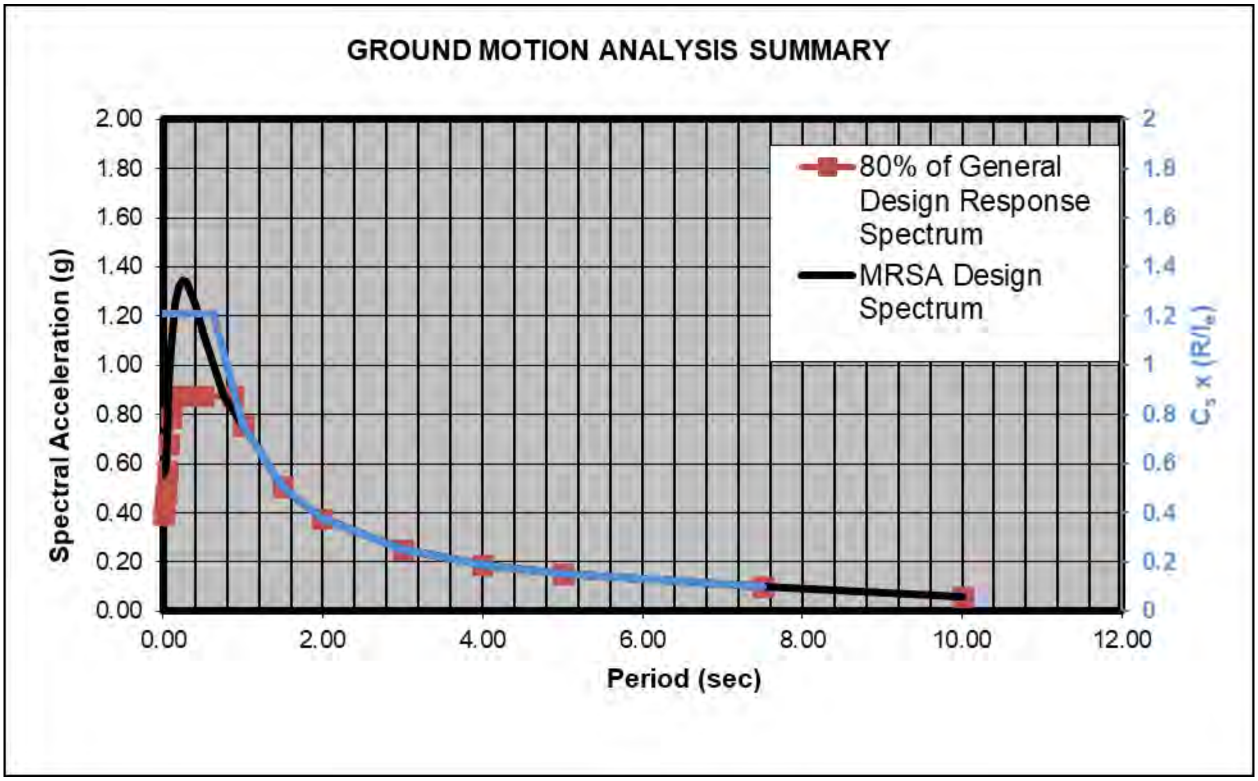
Period	Deterministic	Probabilistic	Lower Value (Site Specific MCE_R)	Governing Method	
T	MCE_R	MCE_R			
0.010	1.18	0.84	0.84	Probabilistic Governs	
0.020	1.19	0.84	0.84	Probabilistic Governs	
0.030	1.23	0.89	0.89	Probabilistic Governs	
0.050	1.39	1.07	1.07	Probabilistic Governs	
0.075	1.68	1.37	1.37	Probabilistic Governs	
0.100	1.94	1.61	1.61	Probabilistic Governs	
0.150	2.30	1.87	1.87	Probabilistic Governs	
0.200	2.58	1.98	1.98	Probabilistic Governs	
0.250	2.80	2.02	2.02	Probabilistic Governs	
0.300	2.97	2.01	2.01	Probabilistic Governs	
0.400	2.99	1.87	1.87	Probabilistic Governs	
0.500	2.77	1.70	1.70	Probabilistic Governs	
0.750	2.20	1.31	1.31	Probabilistic Governs	
1.000	1.66	1.01	1.01	Probabilistic Governs	
1.500	1.09	0.63	0.63	Probabilistic Governs	
2.000	0.91	0.45	0.45	Probabilistic Governs	
3.000	0.73	0.28	0.28	Probabilistic Governs	
4.000	0.61	0.21	0.21	Probabilistic Governs	
5.000	0.51	0.17	0.17	Probabilistic Governs	
7.500	0.29	0.09	0.09	Probabilistic Governs	
10.000	0.16	0.06	0.06	Probabilistic Governs	

These comparisons are plotted in the following diagram:



- ***Design Response Spectrum (ASCE 7 Section 21.3)***-

  In accordance with Section 21.3, the Design Response Spectrum was developed by the following equation: $S_a = 2/3S_{aM}$, where S_{aM} is the MCE_R spectral response acceleration obtained from Section 21.1 or 21.2. The design spectral response acceleration shall not be taken less than 80 percent of S_a. These are plotted and compared with 80% of the CBC Spectrum values in the following diagram:



- **Design Acceleration Parameters (ASCE 7 Section 21.4)-**

  Where the site-specific procedure is used to determine the design ground motion in accordance with Section 21.3, the parameter S_{DS} shall obtained from the site-specific spectra at a period of 0.2 s, except that it shall not be taken less than 90 percent of the peak spectral acceleration, S_a, at any period larger than 0.2 s. The parameter S_{D1} shall be taken as the greater of the products of Sa * T for periods between 1 and 5 seconds. The parameters S_{MS}, and S_{M1} shall be taken as 1.5 times S_{DS} and S_{D1}, respectively. The values so obtained shall not be less than 80 percent of the values determined in accordance with Section 11.4.4 for S_{MS}, and S_{M1} and Section 11.4.5 for S_{DS} and S_{D1}.

- **Site Specific Design Parameters -**

  For the 0.2 second period (S_{DS}), a value of 1.21g was computed, based upon the average spectral accelerations. The maximum average acceleration for any period exceeding 0.2 seconds was 1.35g occurring at T=0.25 seconds. This was multiplied by 0.9 to produce a value of 1.21g making this the applicable value. A value of 0.76g was calculated for S_{D1} at a period of 1 second (ASCE 7-16, 21.4). For the MCE_R 0.2 second period, a value of 1.818g (S_{MS}) was computed, along with a value of 1.136g (S_{M1}) for the MCE_R 1.0 second period was also calculated (ASCE 7-16, 21.2.3).

- **Site-Specific MCE_G Peak Ground Accelerations (ASCE 7 Section 21.5)-**

  The probabilistic geometric mean peak ground acceleration (2 percent probability of exceedance within a 50-year period) was calculated as 0.81g. The deterministic geometric mean peak ground acceleration (largest 84th percentile geometric mean peak ground acceleration for characteristic earthquakes on all known active faults within the site region) was calculated as 1.07g. The site-specific MCE_G peak ground acceleration was calculated to be **0.81g**, which was determined by using the lesser of the probabilistic (0.81g) or the deterministic (1.07g) geometric mean peak ground accelerations, but not taken as less than 80 percent of PGA_M (i.e., 0.76g x 0.80 = 0.61g).

SEISMIC DESIGN PARAMETERS SUMMARY

Project:	Mountain Area Regional Transit Authority	Lattitude:	34.2505
Project #:	223769-1	Longitude:	-116.8888
Date:	1/21/22		

CALIFORNIA BUILDING CODE CHAPTER 16/ASCE7-16

Mapped Acceleration Parameters per ASCE 7-16, Chapter 22

S_s=	1.642	Figure 22-1
S_1=	0.568	Figure 22-2

Site Class per Table 20.3-1

Site Class=	D - Stiff Soil

Site Coefficients per ASCE 7-16 CHAPTER 11

F_a=	1	Table 11.4-1	=	1	For Site Specific Analysis per ASCE7-16 21.3
F_v=	1.732	Table 11.4-2	=	2.50	For Site Specific Analysis per ASCE7-16 21.3

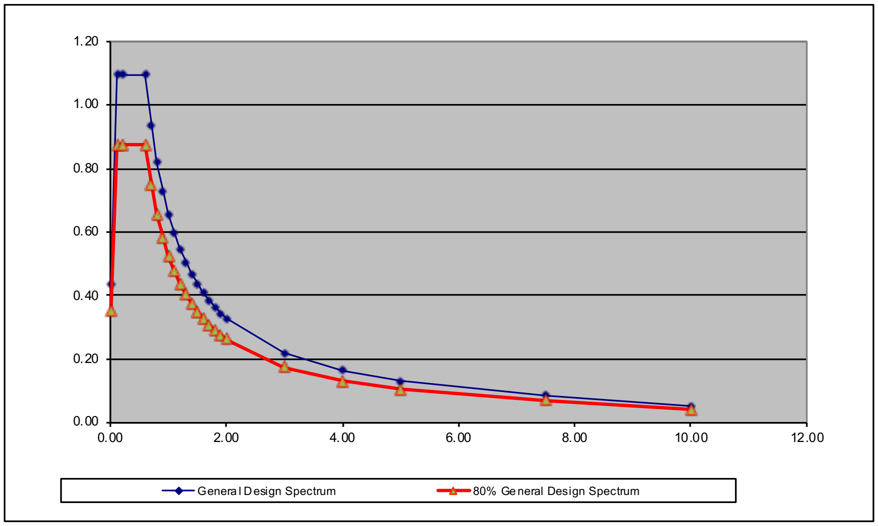
Mapped Design Spectral Response Acceleration Parameters

S_{MS}=	1.642	Equation 11.4-1	1.642	For Site Specific Analysis per ASCE7-16 21.3
S_{M1}=	0.984	Equation 11.4-2	1.420	For Site Specific Analysis per ASCE7-16 21.3

S_{DS}=	1.095	Equation 11.4-3
S_{D1}=	0.656	Equation 11.4-4

T_0=	0.120	sec	
T_S=	0.599	sec	
T_L=	8	sec	From Fig 22-12
PGA	0.69	g	
F_{PGA}=	1.1		From Table 11.8-1
C_{RS}=	0.936		Figure 22-17
C_{R1}=	0.915		Figure 22-18

Period (T)	Sa (ASCE7-16 - 11.4.6)	80% General Design Spectrum
0.01	0.44	0.35
0.12	1.09	0.88
0.20	1.09	0.88
0.60	1.09	0.88
0.70	0.94	0.75
0.80	0.82	0.66
0.90	0.73	0.58
1.00	0.66	0.52
1.10	0.60	0.48
1.20	0.55	0.44
1.30	0.50	0.40
1.40	0.47	0.37
1.50	0.44	0.35
1.60	0.41	0.33
1.70	0.39	0.31
1.80	0.36	0.29
1.90	0.35	0.28
2.00	0.33	0.26
3.00	0.22	0.17
4.00	0.16	0.13
5.00	0.13	0.10
7.50	0.09	0.07
10.00	0.05	0.04



ASCE 7-16 - RISK-TARGETED MAXIMUM CONSIDERED EARTHQUAKE GROUND MOTION ANALYSIS

Use Maximum Rotated Horizontal Component?* (Y/N) y

Presented data are the average of Chiou & Youngs (2014), Abrahamson et. al. (2014) , Boore et. al (2014) and Campbell & Bozorgnia (2014) NGA West-2 Relationships

PROBABILISTIC MCER per 21.2.1.1 **Method 1**

Earthquake Rupture Forecast - UCERF3

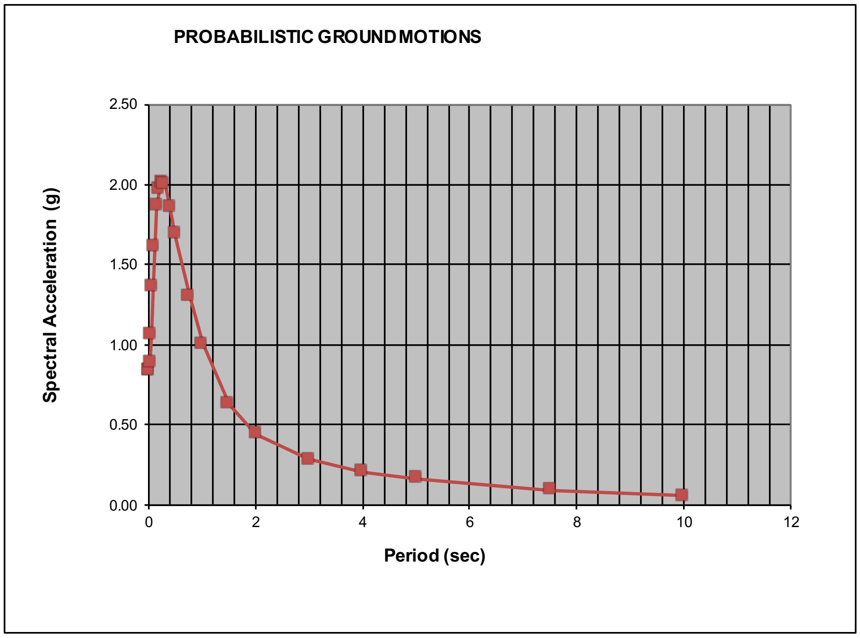
Field, E.H., T.H. Jordan, and C.A. Cornell (2003), OpenSHA: A Developing Community-Modeling Environment for Seismic Hazard Analysis, Seismological Research Letters, 74, no. 4, p. 406-419.

OpenSHA data

2% Probability Of Exceedance in 50 years

Maximum Rotated Horizontal Component determined per ASCE7-16

T	Sa 2% in 50	MCER
0.01	0.90	0.84
0.02	0.90	0.84
0.03	0.95	0.89
0.05	1.14	1.07
0.08	1.46	1.37
0.10	1.72	1.61
0.15	2.00	1.87
0.20	2.11	1.98
0.25	2.16	2.02
0.30	2.15	2.01
0.40	2.00	1.87
0.50	1.83	1.70
0.75	1.42	1.31
1.00	1.10	1.01
1.50	0.69	0.63
2.00	0.49	0.45
3.00	0.31	0.28
4.00	0.23	0.21
5.00	0.18	0.17
7.50	0.10	0.09
10.00	0.07	0.06



S_s=	2.11	1.98
S_1=	1.10	1.01
PGA	0.81 g	

Risk Coefficients:			
C_{RS}	0.936	Figure 22-18	Get from Mapped Values
C_{R1}	0.915	Figure 22-19	
Fa=	1	Table 11.4-1	Per ASCE7-16 - 21.2.3
Is $Sa_{(max)}$<1.2XFa?		NO	If "YES", Probabilistic Spectrum prevails

Enclosure 10, Page 33
Rpt. No.: 7341
File No.: S-14447

DETERMINISTIC MCE per 21.2.2

Input Parameters				
Fault		endale-S. Lock	North Frontal (Eastern)	San Andreas (San Bernardino S)
M	= Moment magnitude	7.4	7	8.3
R_{RUP}	= Closest distance to coseismic rupture (km)	9.6	7.3	22
R_{JB}	= Closest distance to surface projection of coseismic rupture (km)	9.6	0	19.08
Rx	= Horizontal distance to top edge of rupture measured perpendicular to strike (km)	9.6	11.2	19.08
U	= Unspecified Faulting Flag (Boore et.al.)	0	0	0
F_{RV}	= Reverse-faulting factor: 0 for strike slip, normal, normal-oblique; 1 for reverse, reverse-oblique and thrust	0	1	0
F_{NM}	= Normal-faulting factor: 0 for strike slip, reverse, reverse-oblique and thrust; 1 for normal and normal-obliqu	0	0	0
F_{HW}	= Hanging-wall factor: 1 for site on down-dip side of top of rupture; 0 otherwise, used in AS08 and CY08	0	1	0
Z_{TOR}	= Depth to top of coseismic rupture (km)	0	0	0
δ	= Average dip of rupture plane (degrees)	90	41	90
V_{S30}	= Average shear-wave velocity in top 30m of site profile	354.5	354.5	354.5
$F_{Measured}$		1	1	1
$Z_{1.0}$	= Depth to Shear Wave Velocity of 1.0 km/sec (km)	0.06	0.06	60
$Z_{2.5}$	= Depth to Shear Wave Velocity of 2.5 km/sec (km)	1.35	1.35	1.35
Site Class		D	D	D
W (km)	= Fault rupture width (km)	12.8	25.3	12.8
F_{AS}	= 0 for mainshock; 1 for aftershock	0	0	0
σ	=Standard Deviation	1	1	1

Deterministic Summary - Section 21.2.2 (Supplement 1)

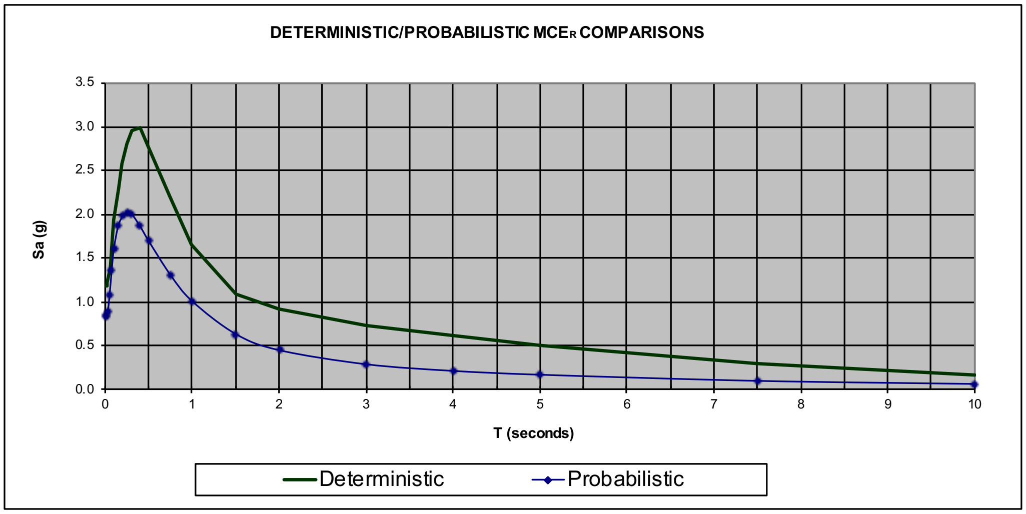
T	**Helendale-S. Lockhart**	**North Frontal (Eastern)**	**San Andreas (San Bernardino S)**	**Maximum $S_{a\ (Average)}$**	***Corrected* S_a (per ASCE7-16)***	***Scaled $S_{a(Average)}$***	**Controlling Fault**
0.010	0.61	1.07	0.67	1.07	1.18	1.18	North Frontal (Eastern)
0.020	0.61	1.08	0.67	1.08	1.19	1.19	North Frontal (Eastern)
0.030	0.64	1.12	0.69	1.12	1.23	1.23	North Frontal (Eastern)
0.050	0.73	1.27	0.64	1.27	1.39	1.39	North Frontal (Eastern)
0.075	0.89	1.52	0.77	1.52	1.68	1.68	North Frontal (Eastern)
0.100	1.04	1.77	1.00	1.77	1.94	1.94	North Frontal (Eastern)
0.150	1.26	2.09	1.05	2.09	2.30	2.30	North Frontal (Eastern)
0.200	1.40	2.35	1.27	2.35	2.58	2.58	North Frontal (Eastern)
0.250	1.47	2.52	1.24	2.52	2.80	2.80	North Frontal (Eastern)
0.300	1.49	2.64	1.32	2.64	2.97	2.97	North Frontal (Eastern)
0.400	1.43	2.60	1.35	2.60	2.99	2.99	North Frontal (Eastern)
0.500	1.31	2.36	1.34	2.36	2.77	2.77	North Frontal (Eastern)
0.750	0.98	1.78	1.16	1.78	2.20	2.20	North Frontal (Eastern)
1.000	0.75	1.27	1.03	1.27	1.66	1.66	North Frontal (Eastern)
1.500	0.47	0.72	0.82	0.82	1.09	1.09	San Andreas (San Bernardino S)
2.000	0.32	0.45	0.68	0.68	0.91	0.91	San Andreas (San Bernardino S)
3.000	0.20	0.22	0.52	0.52	0.73	0.73	San Andreas (San Bernardino S)
4.000	0.13	0.12	0.42	0.42	0.61	0.61	San Andreas (San Bernardino S)
5.000	0.10	0.08	0.34	0.34	0.51	0.51	San Andreas (San Bernardino S)
7.500	0.05	0.04	0.19	0.19	0.29	0.29	San Andreas (San Bernardino S)
10.000	0.03	0.02	0.11	0.11	0.16	0.16	San Andreas (San Bernardino S)
PGA	0.61	1.07	0.54	1.07		1.07	g
Max Sa=	2.99						
Fa =	1.00	Per ASCE7-16 21.2.2					
1.5XFa=	1.5						
Scaling Factor=	1.00						

* Correction is the adjustment for Maximum Rotated Value if Applicable

SITE SPECIFIC MCE$_R$ - Compare Deterministic MCE$_R$ Values (S$_a$) with Probabilistic MCE$_R$ Values (S$_a$) per 21.2.3

Presented data are the average of Chiou & Youngs (2014), Abrahamson et. al. (2014) , Boore et. al (2014) and Campbell & Bozorgnia (2014) NGA West-2 Relationships

Period T	Deterministic MCE$_R$	Probabilistic MCE$_R$	Lower Value (Site Specific MCE$_{R)}$	Governing Method
0.010	1.18	0.84	0.84	ProbabilisticGoverns
0.020	1.19	0.84	0.84	ProbabilisticGoverns
0.030	1.23	0.89	0.89	ProbabilisticGoverns
0.050	1.39	1.07	1.07	ProbabilisticGoverns
0.075	1.68	1.37	1.37	ProbabilisticGoverns
0.100	1.94	1.61	1.61	ProbabilisticGoverns
0.150	2.30	1.87	1.87	ProbabilisticGoverns
0.200	2.58	1.98	1.98	ProbabilisticGoverns
0.250	2.80	2.02	2.02	ProbabilisticGoverns
0.300	2.97	2.01	2.01	ProbabilisticGoverns
0.400	2.99	1.87	1.87	ProbabilisticGoverns
0.500	2.77	1.70	1.70	ProbabilisticGoverns
0.750	2.20	1.31	1.31	ProbabilisticGoverns
1.000	1.66	1.01	1.01	ProbabilisticGoverns
1.500	1.09	0.63	0.63	ProbabilisticGoverns
2.000	0.91	0.45	0.45	ProbabilisticGoverns
3.000	0.73	0.28	0.28	ProbabilisticGoverns
4.000	0.61	0.21	0.21	ProbabilisticGoverns
5.000	0.51	0.17	0.17	ProbabilisticGoverns
7.500	0.29	0.09	0.09	ProbabilisticGoverns
10.000	0.16	0.06	0.06	ProbabilisticGoverns



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Rpt. No.: 7341
File No.: S-14447

DESIGN RESPONSE SPECTRUM per Section 21.3

DESIGN ACCELERATION PARAMETERS per Section 21.4 (MRSA)

Period	2/3*MCE_R	80% General Design Response Spectrum (per ASCE 7-16 23.3-1)	Design Response Spectrum	TXSa
0.01	0.56	0.39	0.56	
0.02	0.56	0.44	0.56	
0.03	0.59	0.48	0.59	
0.05	0.71	0.57	0.71	
0.08	0.91	0.68	0.91	
0.10	1.07	0.79	1.07	
0.15	1.25	0.88	1.25	
0.20	1.32	0.88	1.32	
0.25	1.35	0.88	1.35	
0.30	1.34	0.88	1.34	
0.40	1.24	0.88	1.24	
0.50	1.13	0.88	1.13	
0.75	0.87	0.88	0.88	
1.00	0.67	0.76	0.76	0.76
1.50	0.42	0.50	0.50	0.76
2.00	0.30	0.38	0.38	0.76
3.00	0.19	0.25	0.25	0.76
4.00	0.14	0.19	0.19	0.76
5.00	0.11	0.15	0.15	0.76
7.50	0.06	0.10	0.10	
10.00	0.04	0.06	0.06	

Highest value of S_a for any period exceeding 0.2 sec.= 1.35

90%of Highest Value = 1.21

80% of Mapped S_{DS}= 0.88

Maximum TXSa from T=1s-5s = 0.76

80% of Mapped S_{D1}= 0.52

S_{DS}= 1.21

S_{D1}= 0.76

T_S = 0.62

S_{MS}= 1.818

S_{M1}= 1.136

PGA Determination:

Site Coefficient F_{PGA}= 1.1

Mapped PGA= 0.69 Figure 22-7

PGA_M = 0.76 g

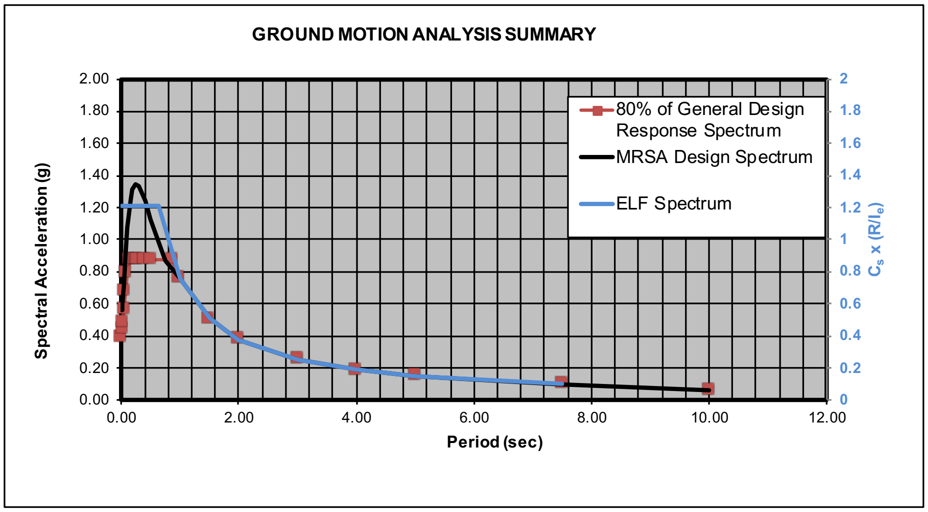
Deterministic PGA = 1.07 g

Probabilistic PGA = 0.81 g

Lesser of Deterministic/Probabilistic = 0.81 g

80% of $PGA_{M=}$ 0.61 g

MCE_G PGA= 0.81 g



APPENDIX C

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John R. Byerly
INCORPORATED

April 18, 2022

Mountain Area Regional Transit Authority (MARTA)
41939 Fox Farm Road
Big Bear Lake, California 92315

Rpt. No.: 7347
File No.: S-14447

Attention: Ms. Sandy Benson, General Manager

Project: New Administration Building and Maintenance Facility, 160-170 Business Center Drive, Big Bear Lake, California

Subject: Infiltration Rate Study for Storm Water Disposal

References:
(a) San Bernardino County Stormwater Program, Technical Guidance Document for Water Quality Management Plans (WQMP), June 7, 2013

(b) e-mail re: 50801, Request for Proposal, Geotech, Byerley, MTTransit Admin&M&O-Facility.pdf, Devanie Donadio, Ruhnau Clarke Architects, August 27, 2021 with attached Annotated Site Plan

(c) Geotechnical Investigation, New Administration Building and Maintenance Facility, 160-170 Business Center Drive, Big Bear Lake, California, John R. Byerly, Inc., Rpt. No. 7341, April 11, 2022

Ladies and Gentlemen:

We understand that development of the proposed Mountain Transit facility will include the construction of infiltration systems to retain and dispose of storm water runoff. The referenced annotated site plan identifies three percolation test areas where the infiltration systems may be constructed. An investigation of the percolation characteristics of the soils underlying these three locations was performed by our firm during January of 2022. The purpose of our investigation was to assist in the determination of a design infiltration rate for the proposed storm water disposal systems.

PROJECT DESCRIPTION

For the preparation of this report, we reviewed the referenced San Bernardino County's Technical Guidance Document for Water Quality Management Plans (Reference a), the referenced geotechnical investigation report (Reference c), and the referenced annotated site plan. We understand that the proposed Mountain Transit facility will consist of a 12,188-square-foot bus maintenance building and a 11,355-square-foot administration building. Four solar shade structures, bus and vehicle parking, drive areas, trash enclosure, fencing, gates, and landscape areas are also proposed. As part of the development, bioswales and underground infiltration systems are planned to retain and dispose of storm water runoff. We assume that the bottom of the proposed bioswales will be about 2 to 4 feet below the presently existing grade. We anticipate that the bottom of the underground infiltration systems will be about 3.3 to 9.8 feet below the presently existing grade. The site configuration is illustrated on Enclosure 1.

REVIEW OF GEOTECHNICAL REPORT

A geotechnical investigation for the new proposed administration building and maintenance facility site was conducted by this firm as described in Reference (c). The subsurface explorations consisted of 10 test borings drilled with a truck-mounted flight-auger to depths of up to 71.5 feet below the existing ground surface. Some of the test borings were excavated in close proximity to the infiltration system areas to explore for ground water or impermeable soil strata. Laboratory testing included maximum density, consolidation, direct shear, expansion index, gradation, sand equivalent, "R" value, and chemical tests. This report presented grading and foundation design recommendations. Preliminary recommendations were presented for the design of asphalt concrete pavement for fire lanes and parking and driveway areas.

SITE CONDITIONS

The approximately 3-acre site is located on the west corner of Business Center Drive and Sandalwood Drive in the city of Big Bear Lake. An Index Map showing the general vicinity of the site is presented on the following page. The coordinates of the site are latitude 34.2505° N

INDEX MAP

SOURCE DOCUMENTS: USGS FAWNSKIN QUADRANGLE, CALIFORNIA, 7.5 MINUTE SERIES, 2018

TOWNSHIP AND RANGE: SECTION 21, T2N, R1E

LATITUDE: 34.2505° N

LONGITUDE: 116.8888° W

and longitude -116.8888° W (World Geodetic System of 1984). The property is currently dirt-covered and has a very light growth of vegetation. The site is relatively flat, sloping downward to the northwest at a gradient of less than 4 percent. A Southwest Gas building is present to the southeast, and the property to the north is vacant.

FIELD INVESTIGATION

We explored the soils underlying the area currently proposed for the storm water disposal systems by means of four percolation test borings drilled with a truck-mounted flight-auger to depths of about 2 to 9.8 feet below the existing ground surface. The approximate locations of the field explorations are shown on Enclosure 1. The soils encountered were examined and visually classified by one of our field engineers. A summary of the soil classifications appears as Enclosure 2. The exploration logs show subsurface conditions at the dates and locations indicated and may not be representative of subsurface conditions at other locations and times. The stratification depths presented on the logs represent the approximate soil type boundaries. We investigated the percolation characteristics of the soils underlying the proposed infiltration basin by four percolation tests using the falling-head test method. Percolation testing was performed using the borehole-type method and following test procedures required by Reference (a).

On January 21, 2022, percolation testing was performed at four locations. The weather condition was dry and cold with an average temperature of 47 degrees Fahrenheit. Two inches of clean gravel were placed in the bottoms of the test holes. Perforated plastic cans, 12 inches in height and 6 inches in diameter, were then placed in the test holes to control scour. Clear water was introduced into each test hole, and the soils were allowed to soak and condition overnight prior to determination of the percolation rate. The following day, approximately 30.0 inches, 1.5 inches, and 25.1 inches of caving occurred in the bottom of percolation test locations P-1, P-2, and P-4, respectively. Water was reintroduced into the test holes, and the water was allowed to percolate into the soil. At timed intervals, the level of water was measured, and additional water was added to the test holes. The test was continued until steady-state conditions were attained. Enclosure 3 presents the percolation test data. Percolation rates have been corrected for the contribution of the test hole sidewall.

SOIL CONDITIONS

The upper soils consisted of medium dense to very dense gravelly sands with silt, silty sands with gravel, and silty sands with traces of clay to the maximum depth penetrated. The underlying soils encountered in our recent percolation investigation are consistent with the findings of our referenced geotechnical investigation. As described in Reference (c), ground water was encountered in Borings 1 and 2 at depths of 26.6 feet and 29.9 feet, respectively, and at a depth of 27.4 feet in Boring 6. Bedrock was not encountered in our test borings. Currently the site is approximately 52 feet above the water level of Big Bear Lake. Our consulting engineering geologist estimates that the shallowest historic depth to ground water is expected to have been 8 feet.

CONCLUSIONS AND RECOMMENDATIONS

The percolation tests yielded infiltration rates of 0.01 inch per hour and 0.09 inch per hour. The infiltration rates were computed utilizing the percolation rate conversion equation (Porchet Method, aka Inverse Borehole Method) provided by the San Bernardino County's Technical Guidance Document for Water Quality Management Plans (Reference a), which accommodates the contribution of the test hole sidewall to the measured percolation rate. The percolation rate conversion equation is presented below.

$$I_t = \frac{\Delta H \text{ (60 min./hr.) } r}{\Delta t \, (r + 2\, H_{avg})}$$

Where: I_t = *tested infiltration rate (in./hr.)*
Δt = *time interval (min.)*
r = *test hole radius (in.)*
ΔH = *change in height over the time interval (in.)*
H_{avg} = *average head height over the time interval (in.)*

The converted percolation rates are presented in the following table.

Percolation Number	Depth of Test (inches)	Converted Percolation Rate (inch per hour)
P-1	18.0	0.08
P-2	22.5	0.05
P-3	117.6	0.01
P-4	14.5	0.09

A safety factor has not been applied to these design values. We note that the tests conducted yielded percolation rates are generally considered unacceptably slow. It is our opinion that the slow infiltration rates are attributable to the slightly clayey and medium dense to very dense nature of the soils that underlie the proposed storm water disposal system areas. Our field test boring logs demonstrate that the soils conditions encountered at the depths of our percolation tests will be similar to the soils encountered at the maximum depth drilled for the percolation test borings.

We appreciate this opportunity to be of service. Should there be questions, please feel free to contact this office.

Respectfully submitted,

JOHN R. BYERLY, INC.

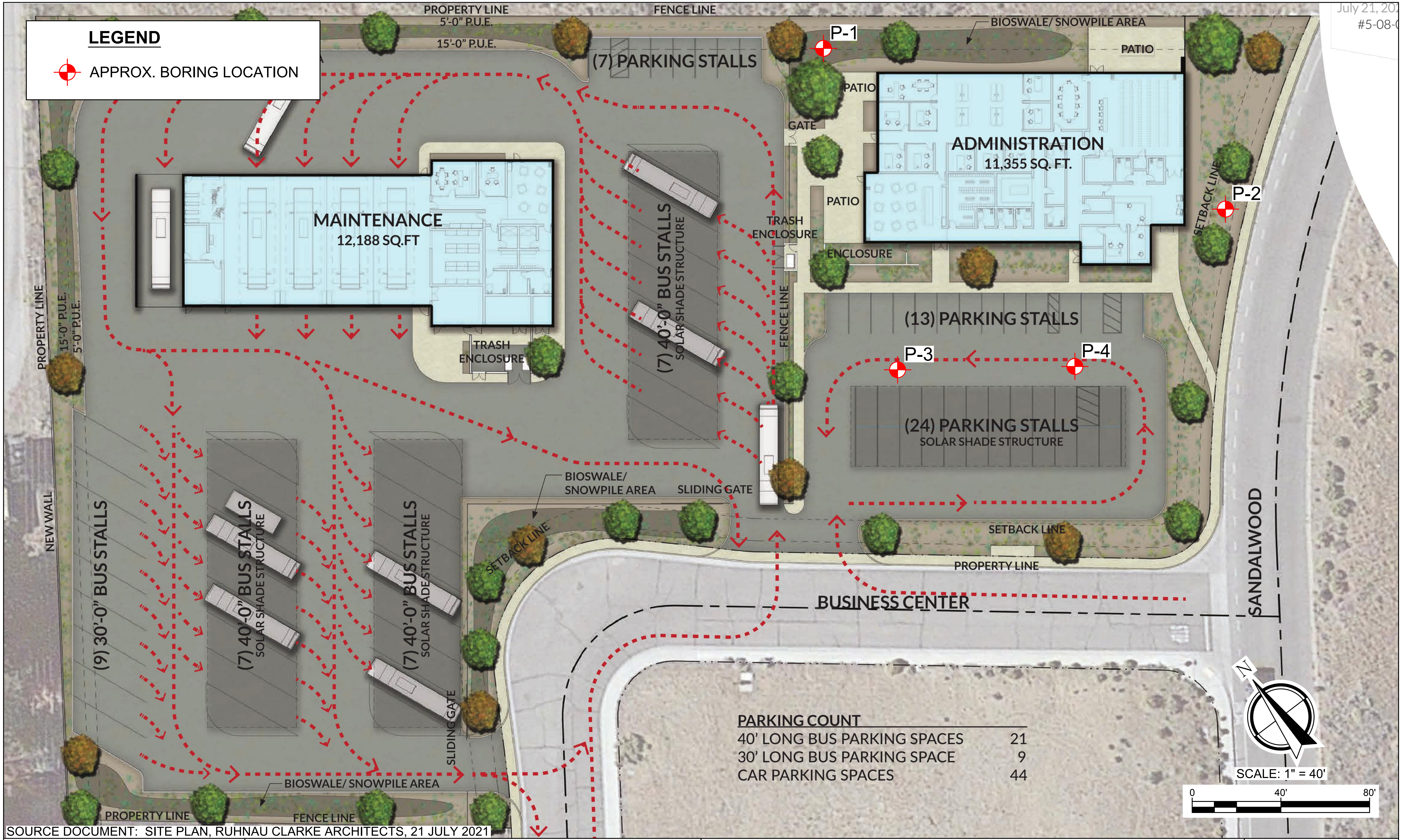
LICENSED PROFESSIONAL ENGINEER
JOHN R. BYERLY
GE 000179
EXP. 06/30/23
GEOTECHNICAL
STATE OF CALIFORNIA

John R. Byerly, Geotechnical Engineer
President

JRB:MLL:jet

Enclosures: (1) Plot Plan
(2) Exploration Logs
(3) Summary of Field Test Data

Copies: (1) Client
(1) Charles Abbott Associates, Inc.



PARKING COUNT

40' LONG BUS PARKING SPACES	21
30' LONG BUS PARKING SPACE	9
CAR PARKING SPACES	44

SOURCE DOCUMENT: SITE PLAN, RUHNAU CLARKE ARCHITECTS, 21 JULY 2021

John R. Byerly
INCORPORATED

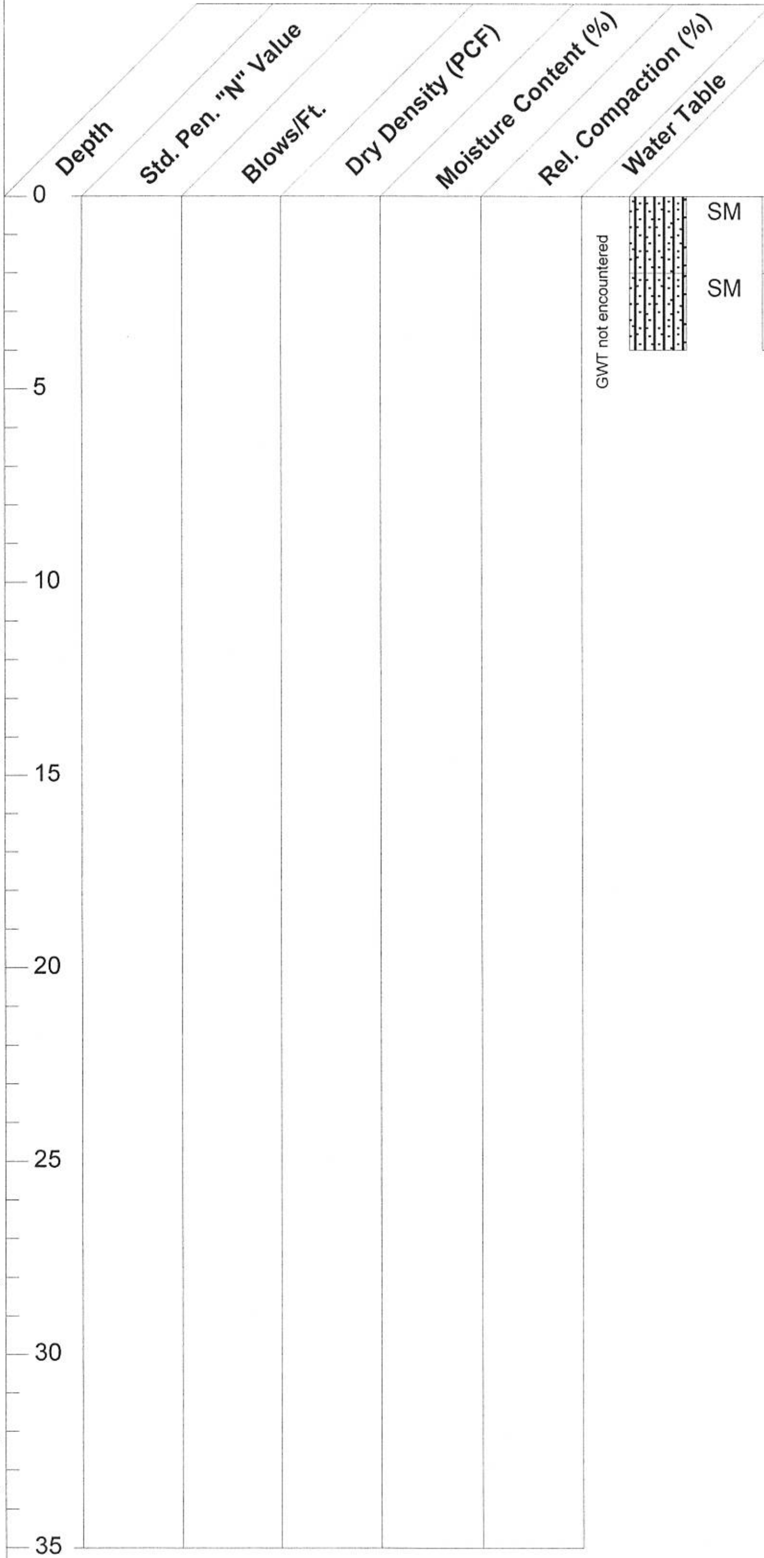
INFILTRATION RATE STUDY

MOUNTAIN AREA REGIONAL TRANSIT AUTHORITY
160-170 BUSINESS CENTER
BIG BEAR LAKE, CALIFORNIA

Enclosure 1
Rpt. No.: 7347
File No.: S-14447

P-1

Boring Date: 1/20/22
Surface Elevation:
Drilling Method: Truck-Mounted Flight-Auger



SM	Dark brown gravelly fine to medium sand with silt, moist and medium dense
SM	Gray-brown silty fine to medium sand with gravel, moist and medium dense

Total Depth at 4.0 Feet
No Free Ground Water Encountered

LOG OF BORING

John R. Byerly, Inc.

Mountain Area Regional Transit Authority

P-2

Boring Date: 1/20/22
Surface Elevation:
Drilling Method: Truck-Mounted Flight-Auger

Depth	Std. Pen. "N" Value	Blows/Ft.	Dry Density (PCF)	Moisture Content (%)	Rel. Compaction (%)	Water Table		
0						GWT not encountered	SM	Dark brown gravelly fine to medium sand with silt, moist and medium dense
								Total Depth at 2.0 Feet No Free Ground Water Encountered
5								
10								
15								
20								
25								
30								
35								

LOG OF BORING

John R. Byerly, Inc.	**Mountain Area Regional Transit Authority**	**Enclosure 2, Page 2** **Rpt. No.: 7347** **File No.: S-14447**

P-3

Depth
Std. Pen. "N" Value
Blows/Ft.
Dry Density (PCF)
Moisture Content (%)
Rel. Compaction (%)
Water Table

Boring Date: 1/20/22
Surface Elevation:
Drilling Method: Truck-Mounted Flight-Auger

0
5
10
15
20
25
30
35

GWT not encountered

SM	Dark brown gravelly fine to medium sand with silt, moist and dense
SM	Red-brown silty fine to medium sand with gravel, moist and medium dense
SM	Dark gray-brown silty fine to medium sand with a trace of clay, moist and very dense

Total Depth at 9.8 Feet
No Free Ground Water Encountered

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECTS-14447 (Rpt. No. 7347).log Date: 4/18/2022

LOG OF BORING

John R. Byerly, Inc.

Mountain Area Regional Transit Authority

Enclosure 2, Page 3
Rpt. No.: 7347
File No.: S-14447

P-4

Boring Date: 1/20/22
Surface Elevation:
Drilling Method: Truck-Mounted Flight-Auger

Depth	Std. Pen. "N" Value	Blows/Ft.	Dry Density (PCF)	Moisture Content (%)	Rel. Compaction (%)	Water Table		
0						GWT not encountered	SM	Dark brown gravelly fine to medium sand with silt, moist and dense
								Total Depth at 3.3 Feet No Free Ground Water Encountered
5								
10								
15								
20								
25								
30								
35								

LOG OF BORING

John R. Byerly, Inc.

Mountain Area Regional
Transit Authority

Enclosure 2, Page 4
Rpt. No.: 7347
File No.: S-14447

JOHN R. BYERLY, INC.

2257 South Lilac Avenue, Bloomington, CA 92316-2907
Phone: (909) 877-1324
Fax: (909) 877-5210

Percolation Test Data Sheet

Project:	MARTA – Admin. Bldg. & Maint. Facility		File No.:	S-14447	Date:	01-21-22
Test Hole No.:	P-1	Tested By:	Rocky Casino			
Depth of Test Hole, (D_T)	18.0 in.	USCS Soil Classification:	SM			
Test Hole Dimensions (inches)			Length	Width		
Diameter (if round)	8.0 in.	Sides (if irregular)				

Sandy Soil Criteria Test*

Trial No.	Start Time	Stop Time	Time Interval, (min.)	Initial Depth to Water (in.)	Final Depth to Water (In.)	Change In Water Level (in.)	≥ 6" ? (Y/N)
1							
2							

*If two consecutive measurements show that 6 inches of water seeps away in less than 25 minutes the test shall be run for an additional hour with measurements taken every 10 minutes. Otherwise pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximately 30 minute intervals) with a precision of at least 0.25".

Trial No.	Start Time	Stop Time	Δt Time Interval, (min.)	D_o Initial Depth to Water (in.)	D_f Final Depth to Water (In.)	ΔD Change In Water Level (in.)	Percolation Rate (min./in.)
1	11:00	11:30	30	7.50	7.75	0.25	120.0
2	11:31	12:01	30	7.50	7.75	0.25	120.0
3	12:02	12:32	30	7.50	7.75	0.25	120.0
4	12:33	1:03	30	7.50	7.75	0.25	120.0
5	1:04	1:34	30	7.50	7.75	0.25	120.0
6	1:35	2:05	30	7.50	7.75	0.25	120.0
7	2:06	2:36	30	7.50	7.75	0.25	120.0
8	2:37	3:07	30	7.50	7.75	0.25	120.0
9	3:08	3:38	30	7.50	7.75	0.25	120.0
10	3:39	4:09	30	7.50	7.75	0.25	120.0
11	4:10	4:40	30	7.50	7.75	0.25	120.0
12	4:41	5:11	30	7.50	7.75	0.25	120.0
13							
14							
15							

Comments: The percolation test yielded a percolation rate of 120.0 minutes per inch which converts to an infiltration rate of 0.08 inch per hour. The infiltration rate was computed utilizing the percolation rate conversion equation (Porchet Method) provided by the San Bernardino County's Technical Guidance Document for Water Quality Management Plans.

JOHN R. BYERLY, INC.

2257 South Lilac Avenue, Bloomington, CA 92316-2907
Phone: (909) 877-1324
Fax: (909) 877-5210

Percolation Test Data Sheet

Project:	MARTA – Admin. Bldg. & Maint. Facility	File No.:	S-14447	Date:	01-21-22
Test Hole No.:	P-2	Tested By:	Rocky Casino		
Depth of Test Hole, (D_T)	22.5 in.	USCS Soil Classification:	SM		
Test Hole Dimensions (inches)			Length	Width	
Diameter (if round)	8.0 in.	Sides (if irregular)			

Sandy Soil Criteria Test*

Trial No.	Start Time	Stop Time	Time Interval, (min.)	Initial Depth to Water (in.)	Final Depth to Water (In.)	Change In Water Level (in.)	≥ 6" ? (Y/N)
1							
2							

*If two consecutive measurements show that 6 inches of water seeps away in less than 25 minutes the test shall be run for an additional hour with measurements taken every 10 minutes. Otherwise pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximately 30 minute intervals) with a precision of at least 0.25".

Trial No.	Start Time	Stop Time	Δt Time Interval, (min.)	D_o Initial Depth to Water (in.)	D_f Final Depth to Water (In.)	ΔD Change In Water Level (in.)	Percolation Rate (min./in.)
1	11:02	11:32	30	5.50	5.75	0.25	120.0
2	11:33	12:03	30	5.50	5.75	0.25	120.0
3	12:04	12:34	30	5.50	5.75	0.25	120.0
4	12:35	1:05	30	5.50	5.75	0.25	120.0
5	1:06	1:36	30	5.50	5.75	0.25	120.0
6	1:37	2:07	30	5.50	5.75	0.25	120.0
7	2:08	2:38	30	5.50	5.75	0.25	120.0
8	2:39	3:09	30	5.50	5.75	0.25	120.0
9	3:10	3:40	30	5.50	5.75	0.25	120.0
10	3:41	4:11	30	5.50	5.75	0.25	120.0
11	4:12	4:42	30	5.50	5.75	0.25	120.0
12	4:43	5:13	30	5.50	5.75	0.25	120.0
13							
14							
15							

Comments: The percolation test yielded a percolation rate of 120.0 minutes per inch which converts to an infiltration rate of 0.05 inch per hour. The infiltration rate was computed utilizing the percolation rate conversion equation (Porchet Method) provided by the San Bernardino County's Technical Guidance Document for Water Quality Management Plans.

JOHN R. BYERLY, INC.

2257 South Lilac Avenue, Bloomington, CA 92316-2907
Phone: (909) 877-1324
Fax: (909) 877-5210

Percolation Test Data Sheet

Project:	MARTA – Admin. Bldg. & Maint. Facility	File No.:	S-14447	Date:	01-21-22
Test Hole No.:	P-3	Tested By:	Rocky Casino		
Depth of Test Hole, (D_T)	117.6 in.	USCS Soil Classification:	SM		
Test Hole Dimensions (inches)			Length	Width	
Diameter (if round)	8.0 in.	Sides (if irregular)			

Sandy Soil Criteria Test*

Trial No.	Start Time	Stop Time	Time Interval, (min.)	Initial Depth to Water (in.)	Final Depth to Water (In.)	Change In Water Level (in.)	≥ 6" ? (Y/N)
1							
2							

*If two consecutive measurements show that 6 inches of water seeps away in less than 25 minutes the test shall be run for an additional hour with measurements taken every 10 minutes. Otherwise pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximately 30 minute intervals) with a precision of at least 0.25".

Trial No.	Start Time	Stop Time	Δt Time Interval, (min.)	D_o Initial Depth to Water (in.)	D_f Final Depth to Water (In.)	ΔD Change In Water Level (in.)	Percolation Rate (min./in.)
1	11:06	11:36	30	12.25	12.50	0.25	120.0
2	11:37	12:07	30	12.25	12.50	0.25	120.0
3	12:08	12:38	30	12.25	12.50	0.25	120.0
4	12:39	1:09	30	12.25	12.50	0.25	120.0
5	1:10	1:40	30	12.25	12.50	0.25	120.0
6	1:41	2:11	30	12.25	12.50	0.25	120.0
7	2:12	2:42	30	12.25	12.50	0.25	120.0
8	2:43	3:13	30	12.25	12.50	0.25	120.0
9	3:14	3:44	30	12.25	12.50	0.25	120.0
10	3:45	4:15	30	12.25	12.50	0.25	120.0
11	4:16	4:46	30	12.25	12.50	0.25	120.0
12	4:47	5:17	30	12.25	12.50	0.25	120.0
13							
14							
15							

Comments: The percolation test yielded a percolation rate of 120.0 minutes per inch which converts to an infiltration rate of 0.01 inch per hour. The infiltration rate was computed utilizing the percolation rate conversion equation (Porchet Method) provided by the San Bernardino County's Technical Guidance Document for Water Quality Management Plans.

JOHN R. BYERLY, INC.

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Phone: (909) 877-1324
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Percolation Test Data Sheet

Project: MARTA – Admin. Bldg. & Maint. Facility
File No.: S-14447
Date: 01-21-22
Test Hole No.: P-4
Tested By: Rocky Casino
Depth of Test Hole, (D_T) 14.5 in.
USCS Soil Classification: SM

Test Hole Dimensions (inches)			Length	Width
Diameter (if round)	8.0 in.	Sides (if irregular)		

Sandy Soil Criteria Test*

Trial No.	Start Time	Stop Time	Time Interval, (min.)	Initial Depth to Water (in.)	Final Depth to Water (In.)	Change In Water Level (in.)	≥ 6" ? (Y/N)
1							
2							

*If two consecutive measurements show that 6 inches of water seeps away in less than 25 minutes the test shall be run for an additional hour with measurements taken every 10 minutes. Otherwise pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximately 30 minute intervals) with a precision of at least 0.25".

Trial No.	Start Time	Stop Time	Δt Time Interval, (min.)	D_o Initial Depth to Water (in.)	D_f Final Depth to Water (In.)	ΔD Change In Water Level (in.)	Percolation Rate (min./in.)
1	11:08	11:38	30	5.25	5.50	0.25	120.0
2	11:39	12:09	30	5.25	5.50	0.25	120.0
3	12:10	12:40	30	5.25	5.50	0.25	120.0
4	12:41	1:11	30	5.25	5.50	0.25	120.0
5	1:12	1:42	30	5.25	5.50	0.25	120.0
6	1:43	2:13	30	5.25	5.50	0.25	120.0
7	2:14	2:44	30	5.25	5.50	0.25	120.0
8	2:45	3:15	30	5.25	5.50	0.25	120.0
9	3:16	3:46	30	5.25	5.50	0.25	120.0
10	3:47	4:17	30	5.25	5.50	0.25	120.0
11	4:18	4:48	30	5.25	5.50	0.25	120.0
12	4:49	5:19	30	5.25	5.50	0.25	120.0
13							
14							
15							

Comments: The percolation test yielded a percolation rate of 120.0 minutes per inch which converts to an infiltration rate of 0.09 inch per hour. The infiltration rate was computed utilizing the percolation rate conversion equation (Porchet Method) provided by the San Bernardino County's Technical Guidance Document for Water Quality Management Plans.

SECTION ‘6.3.F’

Factor of Safety Calculation

Worksheet H: Factor of Safety and Design Infiltration Rate Worksheet

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
A	Suitability Assessment	Soil assessment methods	0.25	1	0.25
		Predominant soil texture	0.25	2	0.50
		Site soil variability	0.25	1	0.25
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.25
B	Design	Tributary area size	0.25	1	0.25
		Level of pretreatment/ expected sediment loads	0.25	1	0.25
		Redundancy	0.25	1	0.25
		Compaction during construction	0.25	2	0.50
		Design Safety Factor, $S_B = \Sigma p$			1.25

Combined Safety Factor, $S_{TOT} = S_A \times S_B$	2.50
Measured Infiltration Rate, inch/hr, K_M (corrected for test-specific bias)	0.08
Design Infiltration Rate, in/hr, $K_{DESIGN} = S_{TOT} / K_M$	0.032

Supporting Data

Briefly describe infiltration test and provide reference to test forms:

***Factor Values revised in accordance with the County of San Bernardino TGD requirements for Factor of Safety Risk Factors. Using the soil report the infiltration rate is proposed above for the proposed infiltration BMP (Stormtech MC-7200). The geotechnical investigation for site has been performed by John R. Byerly, Inc to determine the design infiltration rate. Infiltration is not feasible because infiltration test report for the site determined an infiltration rate equal or less than 0.3 in/hr. Due to these limited factors, the proposed underground detention system and MWS Biofiltration System act as one treatment method and being used to treat runoff.**

The soil report is provided in Section 6.4.E.*

Note: The minimum combined adjustment factor shall not be less than 2.0 and the maximum combined adjustment factor shall not exceed 9.0.

APPENDIX G
NOISE STUDY REPORT
JANUARY 2023

BIG BEAR BUS MAINTENANCE FACILITY NOISE IMPACT ANALYSIS

City of Big Bear Lake

January 31, 2023

ganddini

Traffic Engineering ● Transportation Planning ● Parking ● Noise & Vibration
Air Quality ● Global Climate Change ● Health Risk Assessment

BIG BEAR BUS MAINTENANCE FACILITY NOISE IMPACT ANALYSIS

City of Big Bear Lake

January 31, 2023

prepared by
Roma Stromberg, INCE, MS
Catherine Howe, MS

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Project No. 19574

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EXECUTIVE SUMMARY

Project Location

The 3.55-acre project site is within a commercial subdivision situated on Sandalwood Drive north of Fox Farm Road in the City of Big Bear Lake, California. The project site is currently vacant.

Project Description

The proposed project involves relocation of Mountain Transit Authority (MTA) existing bus storage/maintenance facility and consolidation of its administrative offices.

A detailed list of Best Management Practices (BMPs) intended to avoid construction related impacts is provided in the Project Description (Section 1) of this report.

Construction Impacts

<u>On-Site Construction</u>

Modeled unmitigated construction noise levels reach up to 65.4 dBA L_{eq} at the nearest residential property lines to the southwest, 62.6 dBA L_{eq} at the nearest residential property lines to the west, 61 dBA L_{eq} at the nearest residential property lines to the northeast, 62.6 dBA L_{eq} at the nearest commercial property lines to the east, 73.7 dBA L_{eq} at the nearest commercial property lines to the south, and 72.9 dBA L_{eq} at the nearest commercial property lines to the west of the project site.

Construction noise sources are regulated within the City of Big Bear Lake under 17.01.090(J) of the City's Municipal Code which exempts noise related to construction activities from the provisions of the City's noise standards provided said activities take place between the hours of 7:00 AM and 7:00 PM. Construction activities are not permitted on Sundays or national holidays.

Impacts would be less than significant, and no mitigation is required.

<u>Off-Site Construction</u>

Construction truck trips would occur throughout the construction period. Given the project site's proximity to State Route 18 (Big Bear Boulevard), it is anticipated that vendor and/or haul truck traffic would take the most direct routes to State Route 18.

According to the Federal Highway Administration (FHWA), the traffic volumes need to be doubled in order to increase noise levels by 3 dBA CNEL. In the vicinity of the project site, the estimated existing weekday average daily trips along Business Center Drive is 865 average daily vehicle trips, along Sandalwood Drive is 3,610 average daily vehicle trips, and along Big Bear Boulevard is 18,800 average daily vehicle trips.[1] As shown in the CalEEMod output files provided in the Air Quality Analysis prepared for the proposed project (Lilburn, 2023) the greatest number of construction-related vehicle trips per day would be during grading at up to 22 vehicle trips per day (15for worker trips and 6.25 for hauling trips). Therefore, the addition of project vendor/haul trucks and worker vehicles per day along off-site roadway segments would not be anticipated to result in a doubling of traffic volumes. Off-site project generated construction vehicle trips would result in a

---

[1] The existing average daily traffic volume for Big Bear Boulevard was obtained from the City of Big Bear General Plan Circulation Element Table C-2 for the segment of Big Bear Boulevard Moonridge to Stanfield (August 1999). Existing average daily traffic volumes for Sandalwood Drive and Business Center Drive were estimated based on measured ambient noise levels, STNM6 was used for Sandalwood Drive and STNM7 was used for Business Center Drive (see Table 1). See Table 8 for more details.

negligible noise level increase and would not result in a substantial increase in ambient noise levels. Impacts would be less than significant. No mitigation measures are required.

Project Operational Noise – Vehicle Trips

During operation, the proposed project is expected to generate approximately 100 average daily passenger car vehicle trips and 100 average daily bus vehicle trips for a total of 200 average daily vehicle trips.[2] A Project generated vehicle noise along affected roadways was modeled utilizing a computer program that replicates the FHWA Traffic Noise Prediction Model FHWA-RD-77-108.

Project generated vehicle trips are anticipated to increase noise levels by up to 0.3 dB along Big Bear Boulevard, 3.55 dB along Sandalwood Drive, and 7.97 dB along Business Center Drive. Therefore, project generated vehicle trips are anticipated to result in an increase greater than 5 dB along Business Center Drive. However, the existing land uses located along Business Center Drive are commercial uses and vacant land. In addition, the zoning of the land adjacent to Business Center Drive is general commercial.[3] As shown in Table 3, commercial land uses are considered "normally acceptable" in areas with noise levels reaching up to 65 dBA CNEL and "conditionally acceptable" in areas reaching up to 70 dBA CNEL. The modeled existing plus project noise level along Business Center Drive is 65.9 dBA CNEL. Therefore, although the project is anticipated to result in a greater than 5 dBA CNEL increase along Business Center Drive, the modeled existing plus project noise level does not exceed the City's applicable land use standards for commercial uses.

Therefore, a change in noise level would not be audible and would be considered less than significant. No mitigation is required.

Project Operational Noise - On-Site

The proposed project will be subject to City of Big Bear Ordinance 17.01.090 which prohibits the use of any lawn mower, backpack blower, lawn edger, riding tractor, chain saw, or any other machinery, equipment, or other mechanical or electrical device, or any hand tool which creates an unusually loud, excessive, raucous, impulsive, or disturbing sound, within any residential zone, or within any commercial zone which can be heard from any inhabited real property in residentially used or designated properties, or from a commercial lodging facility between the hours of seven p.m. and seven a.m. of the following day. This ordinance does not set a numerical noise standards that apply to operation of the project. Therefore, as long as the project does not operate between the hours of 7:00 AM and 10:00 PM it will not be in violation with the City's applicable code.

For the purposes of discussion, the following is an analysis of project operational noise in light of County of San Bernardino stationary noise standards which are presented in Table 83-2 which is located in Section 83.01.080 of the County's Code of Ordinances. These standards are presented in Table 6 in this report and those that apply to the proposed project are presented below. The Lns, or (i.e. 15 minutes per hours, 10 minutes per hours etc. are typically not addressed in a CEQA level analysis as a project is typically in compliance with these standards if it is also in compliance with the 30 minute Leq (referred to as Leq in this section) and the Lmax (the noise standard plus 20 dBA for any period of time. Please see Table 6 for more explanation. The zoning of properties surrounding the project site is shown in Figure 6. An aerial photograph and site visit was utilized to determine whether nearby land uses would be considered to be "Professional Services" or "Other Commercial".

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[2] Project average daily vehicle trips obtained from the trip generation utilized in the Air Quality Analysis prepared for the proposed project (Lilburn, 2023).

[3] City of Big Bear Lake Zoning Map (October 2006). https://www.citybigbearlake.com/images/DOWNLOADS/CITY_DEPARTMENTS/Planning/ZONING_MAP.pdf

Two operational noise scenarios were modeled. Both scenarios assume the same noise sources, with the primary noise source being pneumatic equipment, which would be by far the loudest noise source being utilized on the project site. The first scenario however, which is represented by Figures 7 and 8, assumes that the doors of the repair building would remain open during operation and the second scenario assumes that that the doors would be closed (see Figures 9 and 10). As shown in Table 11, operation of the project would be in violation of the County's Leq daytime and nighttime Leq standards at Receptors 1, 2, 5 and 7 if the repair building doors are left open during the use of noisy equipment. Table 12 shows that project operation will not exceed County standards at any receptors if repair building doors are closed during operation of noisy equipment.

If the City decides to recognize the County's stationary noise standards, then operation of noisy equipment in the repair building or anywhere outside would result in a significant impact and will require mitigation prohibiting the use of noisy equipment outside or within the repair building with the doors open. This measure would reduce impacts to less than significant.

Vibration Impacts

Construction Vibration Impacts: Architectural Damage

Caltrans identifies the threshold at which there is a risk of "architectural" damage to older residential structures as a PPV of 0.3 in/sec and modern commercial/industrial buildings as a PPV of 0.5 in/sec.

There are existing residential structures located as close as approximately 638 feet west, 377 feet southwest, and 837 feet northeast feet and existing commercial structures located as close as approximately 110 feet south, 636 feet east, 204 feet west, and 246 feet southwest of the project property lines. The residential threshold of 0.3 PPV in/sec will not be exceeded at existing residential structures to the west, southwest, and northeast and the commercial/industrial threshold of 0.5 PPV in/sec will not be exceeded at the existing commercial structures to the south, east, west, and southwest. Therefore, project construction would not result in the exposure of persons to excessive groundborne vibration and impacts would be less than significant.

Construction Vibration Impacts: Annoyance

Section 17.01.090(A) of the City's Municipal Code states that generation of vibration of a duration and intensity so as to be excessive, disturbing, or objectionable to persons located offsite, shall not be permitted. The Caltrans Noise and Vibration Manual identifies 0.1 PPV in./sec. as the level that is "strongly perceptible." Operation of a vibratory roller may result in groundborne vibration levels of up to 0.1 PPV (in./sec.) at a distance of 41 feet and bulldozers at a distance of 24 feet. Therefore, sensitive receptors within 41 feet of an operating vibratory roller or 24 feet of an operating large bulldozer may experience annoyance during construction activities. Industrial and commercial receptors are not considered to be sensitive receptors with respect to annoyance. The nearest residential structures are located as close as approximately 377 feet from the western property line of the project site. Therefore, project construction activities would not cause vibration related annoyance to existing residential receptors. Furthermore, any potential impacts will be temporary and will occur only during daytime hours. This impact would be less than significant. No mitigation is required.

1. INTRODUCTION

This section describes the purpose of this noise impact analysis, project location, proposed development, and study area. Figure 1 shows the project location map and Figure 2 illustrates the project site plan.

PURPOSE AND OBJECTIVES

The purpose of this report is to provide an assessment of the noise and vibration impacts resulting from development of the proposed Mountain Transit Authority (MTA) existing bus storage/maintenance facility and to identify mitigation measures that may be necessary to reduce those impacts. The noise and vibration issues related to the proposed land use and development have been evaluated in light of applicable federal, state and local policies, including those of the City of Big Bear Lake and the County of San Bernardino. The City of Big Bear Lake does not currently have specific numerical noise standards for stationary noise sources.

Although this is a technical report, effort has been made to write the report clearly and concisely. A list of acronyms and glossary are provided in Appendix A and Appendix B of this report to assist the reader with technical terms related to noise analysis.

PROJECT LOCATION

The 3.55-acre project site is within a commercial subdivision situated on Sandalwood Drive north of Fox Farm Road in the City of Big Bear Lake, California. The project site is currently vacant. A vicinity map showing the project location is shown on Figure 1.

PROJECT DESCRIPTION

The proposed project involves relocation of Mountain Transit Authority (MTA) existing bus storage/maintenance facility and consolidation of its administrative offices. Figure 2 illustrates the project site plan. It is unclear at this time whether any activities will occur on the project site between the hours of 10:00 PM and 7:00 AM (i.e., early morning) so this analysis provides an evaluation of activities during those hours as well as typical daytime hours.

The following Best Management Practices (BMPs) are provided on project plans and in contract specifications to minimize construction noise emanating from the proposed project.

1. All construction equipment whether fixed or mobile, will be equipped with properly operating and maintained mufflers, consistent with manufacturer standards.
2. All stationary construction equipment will be placed so that emitted noise is directed away from the noise sensitive receptors nearest the project site.
3. As applicable, all equipment shall be shut off when not in use.
4. To the degree possible, equipment staging will be located in acres that create the greatest distance between construction-related noise and vibration sources and existing sensitive receptors.
5. Jackhammers, pneumatic equipment, and all other portable stationary noise sources will be directed away and shielded from existing residences in the vicinity of the project site. Either one-inch plywood or sound blankets can be utilized for this purpose. They should reach up from the ground and block the line of sight between equipment and existing residences. The shielding should be without holes and cracks.
6. No amplified music and/or voice will be allowed on the project site.
7. Haul truck deliveries will not occur outside of the hours presented as exempt for construction per City of Big Bear Lake Municipal Code Section 17.01.090(J).

Figure 1
Project Location Map

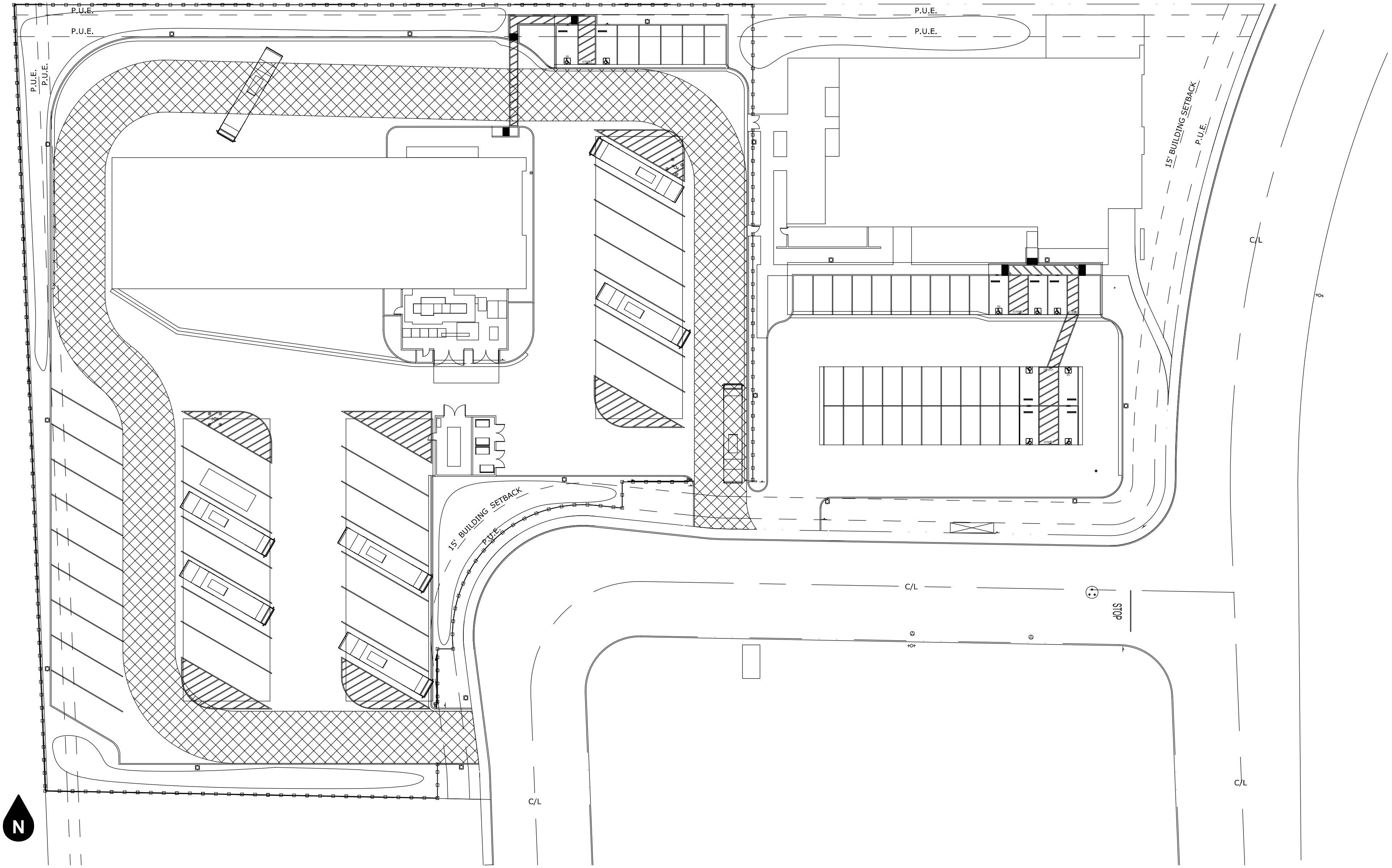


Figure 2
Site Plan

Big Bear Bus Maintenance Facility
Noise Impact Analysis
19574

2. NOISE AND VIBRATION FUNDAMENTALS

NOISE FUNDAMENTALS

Sound is a pressure wave created by a moving or vibrating source that travels through an elastic medium such as air. Noise is defined as unwanted or objectionable sound. The effects of noise on people can include general annoyance, interference with speech communication, sleep disturbance, and in extreme circumstances, hearing impairment.

Commonly used noise terms are presented in Appendix B. The unit of measurement used to describe a noise level is the decibel (dB). The human ear is not equally sensitive to all frequencies within the sound spectrum. Therefore, the "A-weighted" noise scale, which weights the frequencies to which humans are sensitive, is used for measurements. Noise levels using A-weighted measurements are written dB(A) or dBA.

From the noise source to the receiver, noise changes both in level and frequency spectrum. The most obvious is the decrease in noise as the distance from the source increases. The manner in which noise reduces with distance depends on whether the source is a point or line source as well as ground absorption, atmospheric effects and refraction, and shielding by natural and manmade features. Sound from point sources, such as air conditioning condensers, radiates uniformly outward as it travels away from the source in a spherical pattern. The noise drop-off rate associated with this geometric spreading is 6 dBA per each doubling of the distance (dBA/DD). Transportation noise sources such as roadways are typically analyzed as line sources, since at any given moment the receiver may be impacted by noise from multiple vehicles at various locations along the roadway. Because of the geometry of a line source, the noise drop-off rate associated with the geometric spreading of a line source is 3 dBA/DD.

Decibels are measured on a logarithmic scale, which quantifies sound intensity in a manner similar to the Richter scale used for earthquake magnitudes. Thus, a doubling of the energy of a noise source, such as a doubled traffic volume, would increase the noise levels by 3 dBA; halving of the energy would result in a 3 dBA decrease. Figure 3 shows the relationship of various noise levels to commonly experienced noise events.

Average noise levels over a period of minutes or hours are usually expressed as dBA L_{eq}, or the equivalent noise level for that period of time. For example, $L_{eq(3\text{-}hr)}$ would represent a 3-hour average. When no period is specified, a one-hour average is assumed.

Noise standards for land use compatibility are stated in terms of the Community Noise Equivalent Level (CNEL) and the Day-Night Average Noise Level (DNL). CNEL is a 24-hour weighted average measure of community noise. CNEL is obtained by adding five decibels to sound levels in the evening (7:00 PM to 10:00 PM), and by adding ten decibels to sound levels at night (10:00 PM to 7:00 AM). This weighting accounts for the increased human sensitivity to noise during the evening and nighttime hours. DNL is a very similar 24-hour average measure that weights only the nighttime hours.

It is widely accepted that the average healthy ear can barely perceive changes of 3 dBA; that a change of 5 dBA is readily perceptible, and that an increase (decrease) of 10 dBA sounds twice (half) as loud. This definition is recommended by the California Department of Transportation's Technical Noise Supplement to the Traffic Noise Analysis Protocol (2013).

VIBRATION FUNDAMENTALS

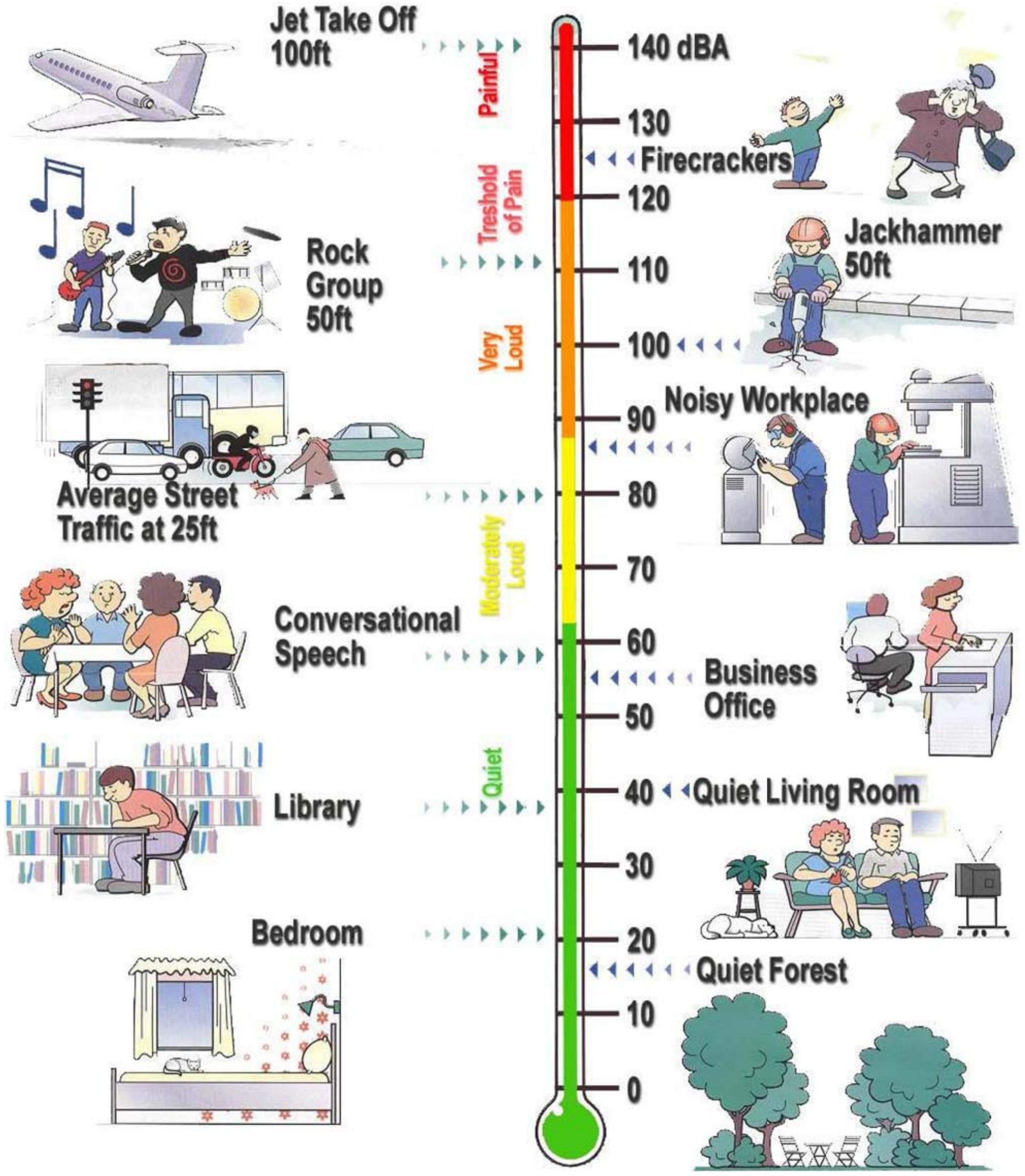
The way in which vibration is transmitted through the earth is called propagation. Propagation of earthborn vibrations is complicated and difficult to predict because of the endless variations in the soil through which waves travel. There are three main types of vibration propagation: surface, compression and shear waves. Surface waves, or Rayleigh waves, travel along the ground's surface. These waves carry most of their energy along an expanding circular wave front, similar to ripples produced by throwing a rock into a pool of water.

Compression waves, or P-waves, are body waves that carry their energy along an expanding spherical wave front. The particle motion in these waves is longitudinal (i.e., in a "push-pull" fashion). P-waves are analogous to airborne sound waves. Shear waves, or S-waves, are also body waves that carry energy along an expanding spherical wave front. However, unlike P-waves, the particle motion is transverse or "side-to-side and perpendicular to the direction of propagation".

As vibration waves propagate from a source, the energy is spread over an ever-increasing area such that the energy level striking a given point is reduced with the distance from the energy source. This geometric spreading loss is inversely proportional to the square of the distance. Wave energy is also reduced with distance as a result of material damping in the form of internal friction, soil layering, and void spaces. The amount of attenuation provided by material damping varies with soil type and condition as well as the frequency of the wave.

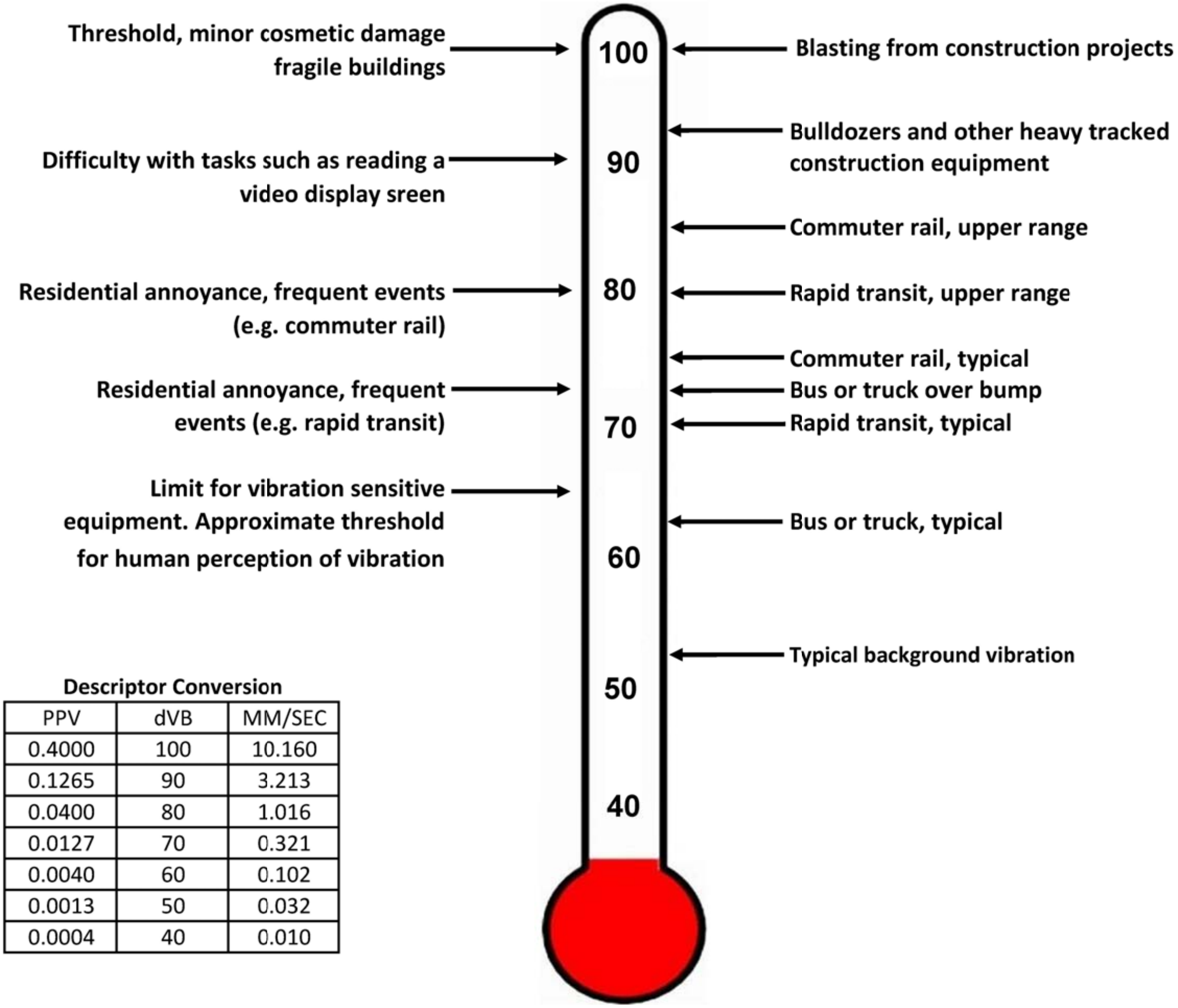
Vibration amplitudes are usually expressed as either peak particle velocity (PPV) or the root mean square (RMS) velocity. The PPV is defined as the maximum instantaneous peak of the vibration signal in inches per second. The RMS of a signal is the average of the squared amplitude of the signal in vibration decibels (VdB), ref one micro-inch per second. The Federal Railroad Administration uses the abbreviation "VdB" for vibration decibels to reduce the potential for confusion with sound decibel.

PPV is appropriate for evaluating the potential of building damage and VdB is commonly used to evaluate human response. Decibel notation acts to compress the range of numbers required in measuring vibration. Similar to the noise descriptors, L_{eq} and L_{max} can be used to describe the average vibration and the maximum vibration level observed during a single vibration measurement interval. Figure 4 illustrates common vibration sources and the human and structural responses to ground-borne vibration. As shown in the figure, the threshold of perception for human response is approximately 65 VdB; however, human response to vibration is not usually substantial unless the vibration exceeds 70 VdB. Vibration tolerance limits for sensitive instruments such as magnetic resonance imaging (MRI) or electron microscopes could be much lower than the human vibration perception threshold.



Source: Bruel & Kjaer 2001

Figure 3
Weighted Sound Levels in Common Environments



Descriptor Conversion

PPV	dVB	MM/SEC
0.4000	100	10.160
0.1265	90	3.213
0.0400	80	1.016
0.0127	70	0.321
0.0040	60	0.102
0.0013	50	0.032
0.0004	40	0.010

Source: FRA, 2012. Federal Railroad Administration High-Speed Ground Transportation Noise and Vibration Impact Assessment. Office of Railroad Policy Development, Washington, D.C. DOT/FRA/ORD-12/15. September.

Figure 4
Typical Levels of Groundborne Vibration

3. EXISTING ENVIRONMENT

EXISTING LAND USES AND SENSITIVE RECEPTORS

The project site is bordered by a vacant land to the north, Sandalwood Drive to the east, Business Center Drive to the south, and residential uses to the west.

The State of California defines sensitive receptors as those land uses that require serenity or are otherwise adversely affected by noise events or conditions. Schools, libraries, churches, hospitals, single and multiple-family residential, including transient lodging, motels and hotel uses make up the majority of these areas. Sensitive land uses that may be affected by project noise include the single-family residential uses located to the west, southwest, and northeast of the project site with the closest residential properties located approximately 360 feet southwest/west and 685 feet northeast of the project site.

AMBIENT NOISE MEASUREMENTS

An American National Standards Institute (ANSI Section S1.4 2014 Class 1) Larson Davis model LxT sound level meter was used to document existing ambient noise levels. In order to document existing ambient noise levels in the project area, eight (8) 15-minute daytime noise measurements were taken between 11:45 AM and 4:23 PM on November 29, 2022. In addition, one (1) long-term 24-hour noise measurement was also taken from November 29, 2022 to November 30, 2022. Field worksheets and noise measurement output data are included in Appendix C.

As shown in Figure 5, the noise meter was placed at the following locations:

- STNM1: represents the existing noise environment of the single-family residences located to the southwest of the project site along Garstin Drive. The noise meter was placed near the northern terminus of Garstin Drive just northeast of the property located at 41733 Garstin Drive, Big Bear Lake.
- STNM2: represents the existing noise environment of the single-family residences located to the southwest of the project site along Alp Court. The noise meter was placed near the northern terminus of Alp Court just south of the property located at 200 Alp Court, Big Bear Lake.
- STNM3: represents the existing noise environment of the single-family residences located to the west of the project site along Pinecrest Drive. The noise meter was placed near the northern terminus of Pine Crest Drive just southeast of the property located at 132 Pinecrest Drive, Big Bear Lake.
- STNM4: represents the existing noise environment of the single-family residences located to the northeast of the project site along Meadow Circle North. The noise meter was placed just west of the property located at 270 Meadow Circle North, Big Bear Lake.
- STNM5: represents the existing noise environment of the vacant land, zoned commercial, located adjacent to the north of the project site. The noise meter was placed near the center of the northern project property line.
- STNM6: represents the existing noise environment of the eastern portion of the project site as well as the vacant land (currently under construction) zoned commercial to the east of the project site (across Sandalwood Drive). The noise meter was placed near the center of the eastern project property line just west of Sandalwood Drive.
- STNM7: represents the existing noise environment of the commercial uses to the south of the project site. The noise meter was placed near the southern project property line just north of the commercial property located at 140 Business Center Drive, Big Bear Lake.

- STNM8: represents the existing noise environment of the western portion of the project site as well as the vacant land located adjacent to the west, zoned commercial, and northwest, zoned Public Open Space. The noise meter was placed near the center of the western project property line.
- LTNM1: represents the existing noise environment of the project site. The noise meter was placed near the northwestern corner of the project site.

Table 1 provides a summary of the short-term ambient noise data. Table 2 provides hourly interval ambient noise data from the long-term noise measurement. Short-term ambient noise levels were measured between 39.1 and 60.1 dBA L_{eq}. Long-term hourly noise measurement ambient noise levels ranged from 34.8 to 55 dBA L_{eq}. The dominant noise source was vehicles traffic associated with Garstin Drive, Swan Drive, Sandalwood Drive, and other surrounding roadways as well as construction activity.

Table 1
Short-Term Noise Measurement Summary (dBA)

Daytime Measurements[1,2]								
Site Location	Time Started	Leq	Lmax	Lmin	L(2)	L(8)	L(25)	L(50)
STNM1	11:45 AM	50.0	73.4	34.7	58.3	52.2	45.5	42.5
STNM2	12:20 PM	41.5	56.9	33.2	49.3	45.1	40.9	38.1
STNM3	12:53 PM	39.1	51.8	32.7	45.1	41.7	39.2	37.8
STNM4	1:27 PM	47.6	62.9	40.4	53.5	49.7	47.5	45.9
STNM5	2:47 PM	53.5	60.5	48.1	57.5	56.0	54.3	52.9
STNM6	3:12 PM	60.1	71.0	51.3	65.8	63.5	60.9	58.6
STNM7	3:38 PM	53.9	68.2	49.6	57.6	56.0	54.4	53.3
STNM8	4:08 PM	51.4	60.0	45.5	57.4	54.1	51.9	50.2

Notes:

(1) See Figure 5 for noise measurement locations. Each noise measurement was performed over a 15-minute duration.

(2) Noise measurements performed on November 29, 2022.

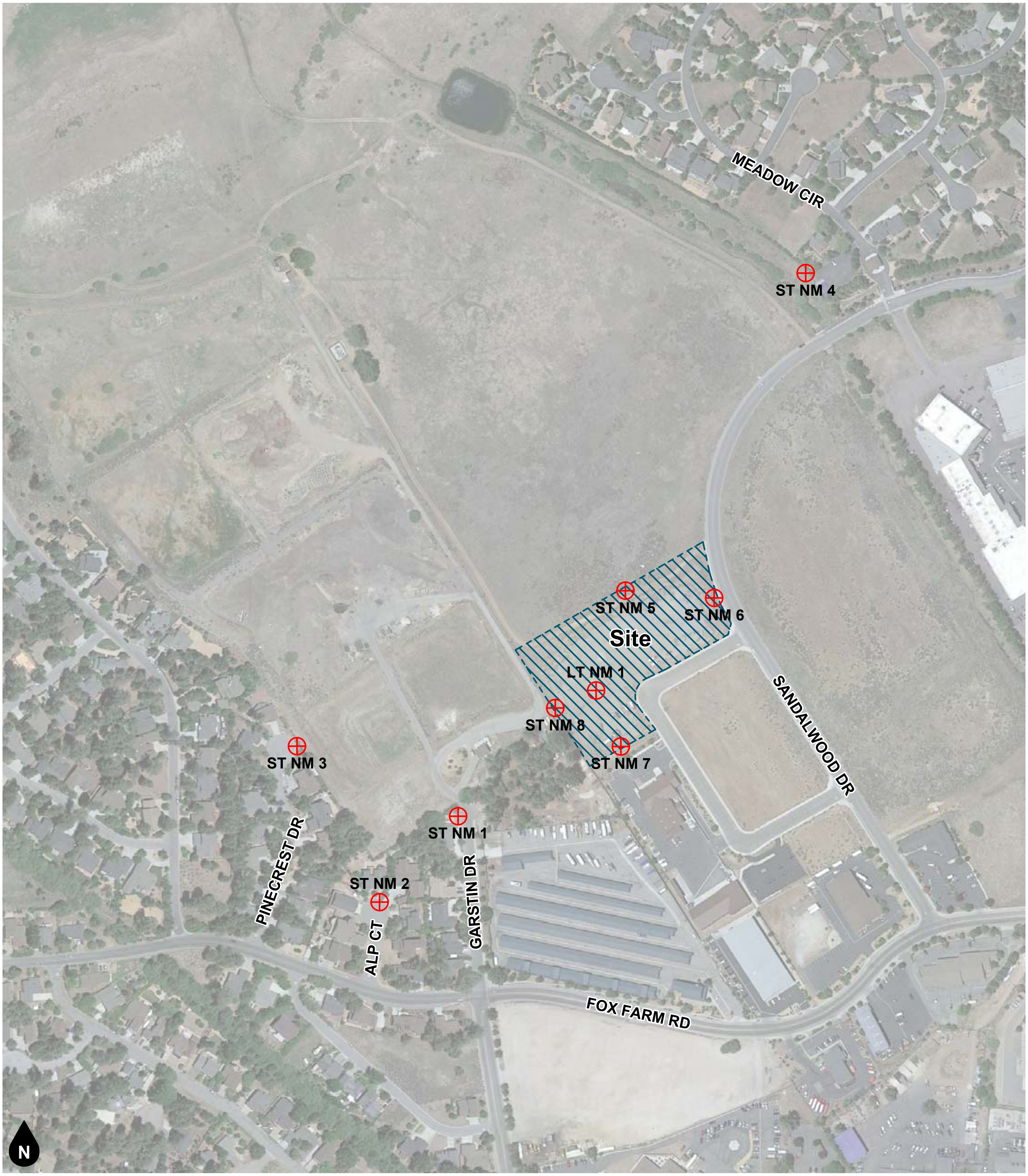
Table 2
Long-Term Noise Measurement Summary (dBA)

24-Hour Ambient Noise[1,2]								
Hourly Measurements	Time Started	Leq	Lmax	Lmin	L(2)	L(8)	L(25)	L(50)
Overall Summary	6:00 PM	46.4	80.2	30.7	48.6	45.6	43.1	40.3
1	6:00 PM	39.7	53.1	34.8	44.4	41.4	39.9	38.7
2	7:00 PM	37.3	55.2	31.5	42.5	39.9	37.5	36.1
3	8:00 PM	37.1	50.2	33.0	40.3	38.6	37.5	36.7
4	9:00 PM	37.4	45.8	33.3	41.3	39.4	37.9	36.9
5	10:00 PM	36.2	42.2	31.3	38.9	38.0	37.0	36.2
6	11:00 PM	34.8	42.6	30.7	38.5	37.2	35.4	34.2
7	12:00 AM	41.6	49.2	32.8	45.7	44.6	43.2	41.2
8	1:00 AM	42.2	48.7	37.5	45.9	44.7	43.0	41.5
9	2:00 AM	45.7	65.5	41.2	48.2	46.6	45.4	44.3
10	3:00 AM	45.7	58.1	41.0	48.1	47.2	46.3	45.5
11	4:00 AM	43.5	47.7	39.5	46.1	45.2	44.1	43.2
12	5:00 AM	42.9	50.9	39.1	45.7	44.4	43.3	42.5
13	6:00 AM	43.2	50.7	38.6	46.2	45.0	43.8	42.8
14	7:00 AM	43.9	53.2	39.7	47.6	45.9	44.5	43.4
15	8:00 AM	44.6	66.4	35.7	49.5	47.1	44.1	40.5
16	9:00 AM	36.5	57.8	31.3	40.7	38.1	35.5	34.2
17	10:00 AM	47.0	80.2	32.4	51.1	43.8	39.0	37.7
18	11:00 AM	47.8	70.6	34.1	54.6	43.1	40.5	38.7
19	12:00 PM	51.7	79.1	34.1	57.3	45.7	41.1	39.3
20	1:00 PM	49.6	74.8	36.3	60.8	46.5	42.8	41.3
21	2:00 PM	48.5	68.7	39.5	57.8	50.0	44.1	42.7
22	3:00 PM	45.3	71.8	37.2	47.1	45.2	43.7	42.7
23	4:00 PM	42.5	61.5	33.6	52.1	42.7	39.6	38.1
24	5:00 PM	55.0	77.3	33.6	62.2	48.2	42.2	39.2
CNEL	50.4							

Notes:

(1) See Figure 5 for noise measurement locations. Noise measurement was performed over a 24-hour duration.

(2) Noise measurement performed from November 29, 2022 to November 30, 2022.



Legend

⊕ NM 1	Noise Measurement Location
ST NM	Short-Term Noise Measurement
LT NM	Long-Term Noise Measurement

Figure 5
Noise Measurement Location Map

4. REGULATORY SETTING

FEDERAL REGULATION

Federal Noise Control Act of 1972

The U.S. Environmental Protection Agency (EPA) Office of Noise Abatement and Control was originally established to coordinate federal noise control activities. After its inception, EPA's Office of Noise Abatement and Control issued the Federal Noise Control Act of 1972, establishing programs and guidelines to identify and address the effects of noise on public health, welfare, and the environment. In response, the EPA published Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety (Levels of Environmental Noise). The Levels of Environmental Noise recommended that the Ldn should not exceed 55 dBA outdoors or 45 dBA indoors to prevent significant activity interference and annoyance in noise-sensitive areas.

In addition, the Levels of Environmental Noise identified five (5) dBA as an "adequate margin of safety" for a noise level increase relative to a baseline noise exposure level of 55 dBA Ldn (i.e., there would not be a noticeable increase in adverse community reaction with an increase of five dBA or less from this baseline level). The EPA did not promote these findings as universal standards or regulatory goals with mandatory applicability to all communities, but rather as advisory exposure levels below which there would be no risk to a community from any health or welfare effect of noise.

In 1981, EPA administrators determined that subjective issues such as noise would be better addressed at lower levels of government. Consequently, in 1982 responsibilities for regulating noise control policies were transferred to State and local governments. However, noise control guidelines and regulations contained in EPA rulings in prior years remain in place by designated Federal agencies, allowing more individualized control for specific issues by designated Federal, State, and local government agencies.

STATE REGULATIONS

State of California General Plan Guidelines 2017

Though not adopted by law, the State of California General Plan Guidelines 2017, published by the California Governor's Office of Planning and Research (OPR) (OPR Guidelines), provides guidance for the compatibility of projects within areas of specific noise exposure. The OPR Guidelines identify the suitability of various types of construction relative to a range of outdoor noise levels and provide each local community some flexibility in setting local noise standards that allow for the variability in community preferences. Findings presented in the Levels of Environmental Noise Document (EPA 1974) influenced the recommendations of the OPR Guidelines, most importantly in the choice of noise exposure metrics (i.e., Ldn or CNEL) and in the upper limits for the normally acceptable outdoor exposure of noise-sensitive uses.

The OPR Guidelines include a Noise and Land Use Compatibility Matrix which identifies acceptable and unacceptable community noise exposure limits for various land use categories. Where the "normally acceptable" range is used, it is defined as the highest noise level that should be considered for the construction of the buildings which do not incorporate any special acoustical treatment or noise mitigation. The "conditionally acceptable" or "normally unacceptable" ranges include conditions calling for detailed acoustical study prior to the construction or operation of the proposed project. The City of Big Bear Lake has adopted their own version of the State Land Use Compatibility Guidelines (see table 3).

California Department of Transportation (Caltrans)

The City of Big Bear Lake has not established criteria for the propagation of groundborne vibration. The California Department of Transportation has published one of the seminal works for the analysis of groundborne noise and vibration relating to transportation- and construction-induced vibrations and although the project is not subject to these regulations, it serves as useful tools to evaluate vibration impacts.

As shown in Table 4, the threshold at which there is a risk to "architectural" damage to historic and some older buildings is a peak particle velocity (PPV) of 0.25, at older residential structures a PPV of 0.3, and at new residential structures a PPV of 0.5. Table 5 shows that a PPV of 0.1 is the threshold at which groundborne vibration becomes strongly perceptible in regard to annoyance. Therefore, these guidelines recommend that a standard of 0.3 inches per second (in/sec) PPV not be exceeded for the protection of older residential structures (California Department of Transportation, 2020).

LOCAL REGULATIONS

City of Big Bear Lake General Plan

Table 3 shows the City's noise level standards related to land use compatibility. As shown in Table 3, transportation related commercial land uses are considered "normally acceptable" where noise levels are not expected to exceed 75 dBA CNEL. These standards apply to the proposed project itself.

The City of Big Bear Lake General Plan also includes the following goal and policies in regard to noise which apply to the proposed project.

Goal N1 Protection of the community from excessive noise levels and maintenance of a low-level noise environment complementary to and consistent with the City's role as a resort and vacation destination and high-quality residential environment.

Policy N1.1 Utilize appropriate land use and transportation planning to achieve noise compatibility between adjacent land uses and noise sources.

Policy N1.2 Ensure that existing and potential noise impacts are identified and mitigated to non-significant levels through environmental review and assure compliance with mitigation measures of new development projects.

Program Measures N1.2.5 sets forth a goal to regulate production of noise within the City by adopting and enforcing a noise ordinance which may include but not be limited to regulating various activities which may vary based upon time of day and may be based upon a one-hour noise level rather than the 24-hour community noise equivalency level.

The current City Ordinance has not been updated to include a new noise ordinance that is based on the time of day and because of this the City currently lacks quantitative noise standards.

City of Big Bear Lake Municipal Code

Section 17.01.090 General Performance Standards

The following requirements shall apply to the use of land throughout the city.

A. The generation of vibration of a duration and intensity so as to be excessive, disturbing, or objectionable to persons located offsite, shall not be permitted.

J. The following restrictions shall apply to noise:

   1. Noise generated from construction, maintenance, or demolition activities which is unusually loud, excessive, raucous or disturbing at or beyond the property line of the site on which the

activity is occurring shall not be permitted between the hours of seven p.m. and seven a.m., or on Sundays or national holidays, except as approved by the chief building official based on a determination that the work to be performed will not have an adverse effect on public health, safety and welfare, or that the work is necessary to correct a potentially harmful or adverse situation.

2. Between the hours of seven p.m. and seven a.m. of the following day, no person shall operate any lawn mower, backpack blower, lawn edger, riding tractor, chain saw, or any other machinery, equipment, or other mechanical or electrical device, or any hand tool which creates an unusually loud, excessive, raucous, impulsive, or disturbing sound, within any residential zone, or within any commercial zone which can be heard from any inhabited real property in residentially used or designated properties, or from a commercial lodging facility. This section shall not be interpreted to prohibit snow making or snow grooming activities within approved winter resort project areas, or snow removal operations, including any audible safety alarms that are required by law for these operations.

County of San Bernardino Development Code

The City of Big Bear Lake does not include specific noise level criteria for stationary noise sources in either its General Plan or Municipal Code. For discussion purposes, the County of San Bernardino's stationary noise source standards, presented in Section 83.01.080 of the County of San Bernardino Development Code, establishes noise criteria not to be exceeded at the property line of adjacent land uses. These criteria would apply to on-site operational noise generated by the project. Table 6, Noise Standards for Stationary Noise Sources, describes the noise standard for emanations from a stationary noise source, as it affects adjacent properties. For example, the base exterior noise level standards for residential land uses are 55 dBA L_{eq} during daytime hours and 45 dBA during nighttime hours; and the base noise level criteria for park land uses is 65 dBA (anytime). As described in Table 6, other criteria apply depending on the duration of the noise event. For example, the maximum event noise level standard for impacts to the adjacent residential land uses is 75 dBA L_{eq} during daytime hours and 65 dBA during nighttime hours. Typically, if the 30-minute L_{eq} is not exceeded the other shorter criteria, with the exception of the L_{max} would also not likely to be exceeded.

Table 3
Community Noise and Land Use Compatibility

Land Uses	CNEL (dBA)						
	50	55	60	65	70	75	80
Residential Land Uses: Single & Multi-Family Dwellings, Group Quarters, Mobile Homes	░	░					
		▒	▒	▒			
				▓	▓		
					█	█	█
Transient Lodging: Hotels, Motels	░	░	░				
			▒	▒			
					▓		
						█	█
School Classrooms, Libraries, Churches, Hospitals, Nursing Homes, & Convalescent Hospitals	░	░					
		▒	▒	▒			
				▓	▓		
						█	█
Recreation Land Uses: Golf Courses, Open Spaces (with walking, bicycling or horseback riding trails, etc.)	░						
		▒	▒				
			▓	▓			
				█	█	█	█
Office Building, Personal Business, and Professional Services	░	░					
			▒	▒			
					▓		
						█	█
Commercial Land Uses: Retail Trade, Movie Theaters, Restaurants, Bars, Entertainment Activities, Services	░	░	░				
			▒	▒			
					▓	▓	
						█	█
Heavy Commercial/Industrial: Wholesale, Manufacturing, Utilities, Transportation, Communications	░	░	░	░	░		
					▓	▓	
						█	█
Auditoriums, Concert Halls, Amphitheaters, Music Shells (may be sensitive receptors or generators)	▒	▒	▒				
				█	█	█	█
Sports Arenas, Outdoor Spectator Sports	▒	▒	▒	▒			
				█	█	█	█

░	Normally Acceptable:	With no special noise reduction requirements assuming standard construction.
▒	Conditionally Acceptable:	New construction or development should be undertaken only after a detailed analysis of the noise reduction requirement is made and needed noise insulation features included in the design.
▓	Normally Unacceptable:	New construction is discouraged. If new construction does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.
█	Clearly Unacceptable:	New construction or development should generally not be undertaken.

Notes:
Source: City of Big Bear Lake General Plan Noise Element Table N-1.

Table 4
Guideline Vibration Damage Potential Criteria

Structure Condition	Maximum PPV (in/sec)	
	Transient Sources	Continuous/Frequent Intermittent Sources
Extremely fragile historic buildings, ruins, ancient monuments	0.12	0.08
Fragile buildings	0.2	0.1
Historic and some old buildings	0.5	0.25
Older residential structures	0.5	0.3
New residential structures	1.0	0.5
Modern industrial/commercial buildings	2.0	0.5

Notes:

Source: California Department of Transportation. *Transportation and Construction Vibration Guidance Manual* (Chapter 7 - Table 19, April 2020).

(1) Transient sources create a single isolated vibration event, such as blasting or drop balls. Continuous/frequent intermittent sources include impact pile drivers, pogo-stick compactors, crack-and-seat equipment, vibratory pile drivers, and vibratory compaction equipment.

Table 5
Guideline Vibration Annoyance Potential Criteria

Human Response	Maximum PPV (in/sec)	
	Transient Sources	Intermittent Sources
Barely perceptible	0.04	0.01
Distinctly perceptible	0.25	0.04
Strongly perceptible	0.9	0.10
Severe	2.0	0.4

Source: California Department of Transportation. Transportation and Construction Vibration Guidance Manual,

Notes:

(1) Transient sources create a single isolated vibration event, such as blasting or drop balls. Continuous/frequent intermittent

Table 6
County of San Bernardino Noise Standards for Stationary Noise Sources

Affected Land Uses (Receiving Noise)	7:00 AM to 10:00 PM dBA L_{eq}	10:00 PM to 7:00 AM dBA L_{eq}
Residential	55	45
Professional Services	55	55
Other Commercial	60	60
Industrial	70	70

Noise limit categories. No person shall operate or cause to be operated a source of sound at a location or allow the creation of noise on property owned, leased, occupied, or otherwise controlled by the person, which causes the noise level, when measured on another property, either incorporated or unincorporated, to exceed any one of the following:

(A) The noise standard for the receiving land use as specified in Subsection B (Noise-impacted areas), above, for a cumulative period of more than 30 minutes in any hour.
(B) The noise standard plus 5 dB(A) for a cumulative period of more than 15 minutes in any hour.
(C) The noise standard plus 10 dB(A) for a cumulative period of more than five minutes in any hour.
(D) The noise standard plus 15 dB(A) for a cumulative period of more than one minute in any hour.
(E) The noise standard plus 20 dB(A) for any period of time.
If the measured ambient level exceeds any of the first four noise limit categories, the allowable noise exposure standard shall be increased to reflect the ambient noise level. If the ambient noise level exceeds the fifth noise limit category, the maximum allowable noise level under this category shall be increased to reflect the maximum ambient noise level.[2]

Notes:
(1) Source: County of San Bernardino Development Code, Development Code Table 83-2.

5. ANALYTICAL METHODOLOGY AND MODEL PARAMETERS

This section discusses the analysis methodologies used to assess noise impacts.

CONSTRUCTION NOISE MODELING

Construction noise associated with the proposed project was calculated at the sensitive receptor locations, utilizing methodology presented in the Federal Transit Administration (FTA) Transit Noise and Vibration Impact Assessment Manual (2018) together with several key construction parameters including: distance to each sensitive receiver, equipment usage, percent usage factor, and baseline parameters for the project site. Distances to receptors were based on the acoustical center of the project site. The equipment used to calculate the construction noise levels for each phase were based on the assumptions provided in the CalEEMod modeling in the Air Quality Analysis prepared for the proposed project (Lilburn, 2023). For construction noise purposes, the distance measured from the project site to sensitive receptors was assumed to be the acoustical center of the project site to the property line of residential properties with existing residential buildings. Sound emission levels associated with typical construction equipment as well as typical usage factors provided in Table 7 were utilized for modeling purposes. Construction noise worksheets are provided in Appendix D.

FEDERAL HIGHWAY ADMINISTRATION (FHWA) TRAFFIC NOISE PREDICTION MODEL

Traffic noise from vehicular traffic was projected using a computer program that replicates the FHWA Traffic Noise Prediction Model (FHWA-RD-77-108). The FHWA model arrives at the predicted noise level through a series of adjustments to the Reference Energy Mean Emission Level (REMEL). As a project specific traffic analysis was not required, the project average daily vehicle trips used in this analysis were obtained from the trip generation utilized in the Air Quality Analysis prepared for the proposed project (Lilburn, 2023). Based on the Air Quality Analysis, the project is estimated to generate 100 daily passenger car trips per day and 100 daily bus trips per day. As no project trip distribution was provided and in order to be conservative, it was assumed that all project generated vehicle trips would travel on each of the modeled roadways. The existing average daily traffic volume for Big Bear Boulevard was obtained from the City of Big Bear General Plan Circulation Element Table C-2 for the segment of Big Bear Boulevard Moonridge to Stanfield (August 1999). Existing average daily traffic volumes for Sandalwood Drive and Business Center Drive were estimated based on measured ambient noise levels, STNM6 was used for Sandalwood Drive and STNM7 was used for Business Center Drive (see Table 1). Key model parameters and REMEL adjustments are presented below:

- Roadway classification (e.g., freeway, major arterial, arterial, secondary, collector, etc.)
- Roadway active width (distance between the center of the outer most travel lanes on each side of the roadway)
- Average Daily Traffic volumes (ADT), Travel Speeds, Percentages of automobiles, medium trucks and heavy trucks
- Roadway grade and angle of view
- Site conditions (e.g., soft vs. hard)
- Percentage of total ADT which flows each hour throughout a 24-hour period

Table 8 indicates the roadway parameters and vehicle distribution utilized for this study. The following outlines key adjustments to the REMEL for project site parameter inputs:

- Vertical and horizontal distances (Sensitive receptor distance from noise source)
- Noise barrier vertical and horizontal distances (Noise barrier distance from sound source and receptor).
- Traffic noise source spectra
- Topography

Traffic noise levels were projected to the on-site receptors. The project noise calculation worksheets are included in Appendix E.

SOUNDPLAN NOISE MODEL

The SoundPLAN acoustical modeling software was utilized to model project operational worst-case stationary noise impacts from the proposed project to adjacent sensitive uses (e.g., residences). SoundPLAN is capable of evaluating stationary noise sources (e.g., parking lots, drive-thru menus, carwash equipment, vacuums, etc.). The SoundPLAN software utilizes algorithms (based on the inverse square law) to calculate noise level projections. The software allows the user to input specific noise sources, spectral content, sound barriers, building placement, topography, and sensitive receptor locations. In addition to the information provided below, noise modeling input and outputs assumptions are provided in Appendix F.

Sound levels associated with project operation was modeled utilizing representative sound levels in the SoundPLAN model. Modeled noise sources include pneumatic equipment, parking lot noise, and HVAC equipment noise. All noise sources were modeled to be in full operation all of the time. This is a conservative modeling effort, given that in actuality, several of the noise sources are not in operation continuously for an entire hour.

Parking Lot Noise

Parking lot noise was calculated using SoundPLAN methodology. Specifically, the traffic volume of the parking lot is entered with the number of moves per parking, the hour and the number of parking bays. The user defines whether the parking lots are for automobiles, motorcycles, or trucks, and the emission level of a parking lot is automatically adjusted accordingly. The values for the number of parking moves for each time slice is the number of parking moves per reference unit (most often per parking bay), averaged for the hour[1].

SoundPLAN utilizes parking lot noise emission levels from the 6th revised edition of the parking lot study "Recommendations for the Calculation of Sound Emissions of Parking Areas, Motorcar Centers and Bus Stations as well as of Multi-Story Car Parks and Underground Car Parks" published by the Bavarian Landesamt für Umwelt provides calculation methods to determine the emissions of parking lots.

The parking lot emission table documents the reference level (Lw, ref) from the parking lot study.

Lw, ref = Lw0 + KPA + KI + KD + KStrO + 10 log(B) [dB(A)]

With the following parameters:

Lw0 = Basic sound power, sound power level of one motion / per hour on P+R areas = 63 dB(A)
KPA = Surcharge parking lot type
KI = Surcharge for impulse character
KD = Surcharge for the traffic passaging and searching for parking bays in the driving lanes 2,5 * lg (f * B - 9)
f = Parking bays per unit of the reference value
B = Reference value
KStrO = Surcharge for the road surface
B = Reference value

Mechanical Equipment (HVAC Units) Noise

A sound power level of 78.7 dBA was utilized to represent rooftop 5 Ton Carrier HVAC units.[2] A rooftop HVAC plan is not available at the time of this analysis so the exact location and number of units per building

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[1] SoundPLAN Essential 4.0 Manual. SoundPLAN International, LLC. May 2016.
[2] MD Acoustics, LLC Noise Measurement Data for RTU –Carrier 50TFQ0006.

were estimated. A total of 10 rooftop units were modeled on the proposed rooftops. The noise source height for each HVAC unit was assumed at 1 meter above the roof top.

Pneumatic Equipment

Pneumatic equipment and associated air compressor machines are typically the loudest noise sources associated with vehicle repair activities. An air compressor was modeled inside of the proposed repair building. It was assumed that it would be operating for the entire modeled hour which is a conservative assumption because it is more likely to be operated off and on as needed. It was assumed that the pneumatic equipment would be utilized 25% of the time lowering the sound pressure level for the Leq from 120 to 114 dBA, as provided in the SoundPLAN noise model was utilized. A sound pressure of 120 dBA was utilized to calculate the Lmax.

Bus Wash

No noisy washing or drying equipment is proposed within the bus wash.

Table 7 (1 of 2)
CA/T Equipment Noise Emissions and Acoustical Usage Factor Database

Equipment Description	Impact Device?	Acoustical Use Factor (%)	Spec. Lmax @ 50ft (dBA, slow)	Actual Measured Lmax @ 50ft (dBA, slow)	No. of Actual Data Samples (Count)
All Other Equipment > 5 HP	No	50	85	-N/A-	0
Auger Drill Rig	No	20	85	84	36
Backhoe	No	40	80	78	372
Bar Bender	No	20	80	-N/A-	0
Blasting	Yes	-N/A-	94	-N/A-	0
Boring Jack Power Unit	No	50	80	83	1
Chain Saw	No	20	85	84	46
Clam Shovel (dropping)	Yes	20	93	87	4
Compactor (ground)	No	20	80	83	57
Compressor (air)	No	40	80	78	18
Concrete Batch Plant	No	15	83	-N/A-	0
Concrete Mixer Truck	No	40	85	79	40
Concrete Pump Truck	No	20	82	81	30
Concrete Saw	No	20	90	90	55
Crane	No	16	85	81	405
Dozer	No	40	85	82	55
Drill Rig Truck	No	20	84	79	22
Drum Mixer	No	50	80	80	1
Dump Truck	No	40	84	76	31
Excavator	No	40	85	81	170
Flat Bed Truck	No	40	84	74	4
Forklift[2,3]	No	50	n/a	61	n/a
Front End Loader	No	40	80	79	96
Generator	No	50	82	81	19
Generator (<25KVA, VMS signs)	No	50	70	73	74
Gradall	No	40	85	83	70
Grader	No	40	85	-N/A-	0
Grapple (on backhoe)	No	40	85	87	1
Horizontal Boring Hydr. Jack	No	25	80	82	6
Hydra Break Ram	Yes	10	90	-N/A-	0
Impact Pile Driver	Yes	20	95	101	11
Jackhammer	Yes	20	85	89	133
Man Lift	No	20	85	75	23
Mounted Impact hammer (hoe ram)	Yes	20	90	90	212
Pavement Scarafier	No	20	85	90	2
Paver	No	50	85	77	9
Pickup Truck	No	50	85	77	9
Paving Equipment	No	50	85	77	9
Pneumatic Tools	No	50	85	85	90

Table 7 (2 of 2)
CA/T Equipment Noise Emissions and Acoustical Usage Factor Database

Equipment Description	Impact Device?	Acoustical Use Factor (%)	Spec. Lmax @ 50ft (dBA, slow)	Actual Measured Lmax @ 50ft (dBA, slow)	No. of Actual Data Samples (Count)
Pumps	No	50	77	81	17
Refrigerator Unit	No	100	82	73	3
Rivit Buster/chipping gun	Yes	20	85	79	19
Rock Drill	No	20	85	81	3
Roller	No	20	85	80	16
Sand Blasting (Single Nozzle)	No	20	85	96	9
Scraper	No	40	85	84	12
Shears (on backhoe)	No	40	85	96	5
Slurry Plant	No	100	78	78	1
Slurry Trenching Machine	No	50	82	80	75
Soil Mix Drill Rig	No	50	80	-N/A-	0
Tractor	No	40	84	-N/A-	0
Vacuum Excavator (Vac-truck)	No	40	85	85	149
Vacuum Street Sweeper	No	10	80	82	19
Ventilation Fan	No	100	85	79	13
Vibrating Hopper	No	50	85	87	1
Vibratory Concrete Mixer	No	20	80	80	1
Vibratory Pile Driver	No	20	95	101	44
Warning Horn	No	5	85	83	12
Welder/Torch	No	40	73	74	5

Notes:

(1) Source: FHWA Roadway Construction Noise Model User's Guide January 2006.

(2) Warehouse & Forklift Noise Exposure - NoiseTesting.info Carl Stautins, November 4, 2014
http://www.noisetesting.info/blog/carl-strautins/page-3/

(3) Data provided Leq as measured at the operator. Sound Level at 50 feet is calculated using Inverse Square Law.

Table 8
Project Average Daily Traffic Volumes and Roadway Parameters

Roadway	Segment	Average Daily Traffic Volume[1]		Posted Travel Speeds (MPH)	Site Conditions
		Existing	Existing Plus Project		
Big Bear Boulevard	In vicinity of project site	18,800	19,000	40	Soft
Sandalwood Drive	In vicinity of project site	3,610	3,810	30	Soft
Business Center Drive	In vicinity of project site	865	1,065	30	Soft

Vehicle Distribution (Light Mix)[2]			
Motor-Vehicle Type	Daytime % (7 AM-7 PM)	Evening % (7 PM-10 PM)	Night % (10 PM-7 AM)
Automobiles	75.56	13.96	10.49
Medium Trucks	48.91	2.17	48.91
Heavy Trucks	47.30	5.41	47.30

Vehicle Distribution (Heavy Mix)[2]			
Motor-Vehicle Type	Daytime % (7 AM-7 PM)	Evening % (7 PM-10 PM)	Night % (10 PM-7 AM)
Automobiles	75.54	14.02	10.43
Medium Trucks	48.00	2.00	50.00
Heavy Trucks	48.00	2.00	50.00

Notes:

(1) Project average daily vehicle trips were obtained from the trip generation utilized in the Air Quality Analysis prepared for the proposed project (Lilburn, 2023). Based on the Air Quality Analysis, the project is estimated to generate 100 daily passenger car trips per day and 100 daily bus trips per day. As no project trip distribution was provided and in order to be conservative, it was assumed that all project generated vehicle trips would travel on each of the modeled roadways. The existing average daily traffic volume for Big Bear Boulevard was obtained from the City of Big Bear General Plan Circulation Element Table C-2 for the segment of Big Bear Boulevard Moonridge to Stanfield (August 1999). Existing average daily traffic volumes for Sandalwood Drive and Business Center Drive were estimated based on measured ambient noise levels, STNM6 was used for Sandalwood Drive and STNM7 was used for Business Center Drive (see Table 1).

(2) Existing and project vehicle percentages are based on the Riverside County Industrial Hygiene Letter for Traffic Noise.

6. IMPACT ANALYSIS

This impact discussion analyzes the potential for noise and/or groundborne vibration impacts to cause the exposure of a person to, or generation of, noise levels in excess of established City of Big Bear Lake standards related to construction, operation, and transportation noise related impacts.

IMPACTS RELATED TO CONSTRUCTION NOISE

Construction phases will include site preparation, grading, building construction, paving and architectural coating. Assumptions for the phasing, duration, and required equipment for the construction of the proposed project were obtained from the project applicant. Construction activities are anticipated to begin no sooner than the end of July 2023 and be completed by the end of August 2024.

Construction noise will vary depending on the construction process, type of equipment involved, location of the construction site with respect to sensitive receptors, the schedule proposed to carry out each task (e.g., hours and days of the week) and the duration of the construction work. The existing residential dwelling units located to the southwest, west, and northeast and existing commercial uses to the east, south, and west of the project site may be affected by short-term noise impacts associated with construction noise.

Construction noise associated with the proposed project was calculated utilizing methodology presented in the Federal Transit Administration (FTA) Transit Noise and Vibration Impact Assessment Manual (2018) together with several key construction parameters including: distance to each sensitive receiver, equipment usage, percent usage factor, and baseline parameters for the project site. Distances to receptors were based on the acoustical center of the proposed construction activity. Construction noise levels were calculated for each phase. Anticipated noise levels during each construction phase are presented in Table 9. Worksheets for each phase are included as Appendix D.

Modeled unmitigated construction noise levels are expected to reach up to 65.4 dBA L_{eq} at the nearest residential property lines to the southwest, 62.6 dBA L_{eq} at the nearest residential property lines to the west, 61 dBA L_{eq} at the nearest residential property lines to the northeast, 62.6 dBA L_{eq} at the nearest commercial property lines to the east, 73.7 dBA L_{eq} at the nearest commercial property lines to the south, and 72.9 dBA L_{eq} at the nearest commercial property lines to the west of the project site.

Table 9 also includes a comparison of existing noise levels and project construction noise levels. Short-term Noise Measurement (STNM)1 was used for residential receptors to the southwest, STNM3 was used for residential receptors to the west, STNM4 was used for residential receptors to the northeast and commercial receptors to the east, STNM7 was used for commercial receptors to the south, and STNM8 was used for commercial receptors to the west of the project site.

Construction noise sources are regulated within the City of Big Bear Lake under 17.01.090(J) of the City's Municipal Code which exempts noise related to construction activities from the provisions of the City's noise standards provided said activities take place between the hours of 7:00 AM and 7:00 PM. Construction activities are not permitted on Sundays or national holidays.

Project construction will not occur outside of the hours outlined as "exempt" in City of Big Bear Lake Municipal Code Section 17.01.090(J). Therefore, project construction will not result in the generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance.

Off-Site Construction

Construction truck trips would occur throughout the construction period. Given the project site's proximity to State Route 18 (Big Bear Boulevard), it is anticipated that vendor and/or haul truck traffic would take the most direct routes to State Route 18.

According to the Federal Highway Administration (FHWA), the traffic volumes need to be doubled in order to increase noise levels by 3 dBA CNEL. In the vicinity of the project site, the estimated existing weekday average daily trips along Business Center Drive is 865 average daily vehicle trips, along Sandalwood Drive is 3,610 average daily vehicle trips, and along Big Bear Boulevard is 18,800 average daily vehicle trips.[3] As shown in the CalEEMod output files provided in the Air Quality Analysis prepared for the proposed project (Lilburn, 2023) the greatest number of construction-related vehicle trips per day would be during grading at up to 22 vehicle trips per day (15for worker trips and 6.25 for hauling trips). Therefore, the addition of project vendor/haul trucks and worker vehicles per day along off-site roadway segments would not be anticipated to result in a doubling of traffic volumes. Off-site project generated construction vehicle trips would result in a negligible noise level increase and would not result in a substantial increase in ambient noise levels. Impacts would be less than significant. No mitigation measures are required.

NOISE IMPACTS DUE TO PROJECT OPERATION

Project Operational Noise – Off-Site

During operation, the proposed project is expected to generate approximately 100 average daily passenger car vehicle trips and 100 average daily bus vehicle trips for a total of 200 average daily vehicle trips.[4] A worst-case project generated traffic noise level was modeled utilizing the FHWA Traffic Noise Prediction Model - FHWA-RD-77-108. Traffic noise levels were calculated at the right of way from the centerline of the analyzed roadway. The modeling is theoretical and does not take into account any existing barriers, structures, and/or topographical features that may further reduce noise levels. Therefore, the levels are shown for comparative purposes only to show the difference in with and without project conditions and not necessarily existing and existing plus project traffic noise levels. Roadway input parameters including average daily traffic volumes (ADTs), speeds, and vehicle distribution data is shown in Table 8. The potential off-site noise impacts caused by an increase of traffic from operation of the proposed project on the nearby roadways were calculated for the following scenarios:

Existing Year (without Project): This scenario refers to existing year traffic noise conditions and is demonstrated in Table 8.

Existing Year (With Project): This scenario refers to existing year plus project traffic noise conditions and is demonstrated in Table 8.

As shown in Table 10, modeled Existing traffic noise levels range between 58-76 dBA CNEL at the right-of-way of each modeled roadway segment; and the modeled Existing Plus Project traffic noise levels range between 66-76 dBA CNEL at the right-of-way of each modeled roadway segment.

As stated previously, increases in ambient noise along affected roadways due to project generated vehicle traffic is considered substantial if they result in an increase of at least 5 dBA CNEL and: (1) the existing noise levels already exceed the applicable land use compatibility standard for the affected sensitive receptors set

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[3] The existing average daily traffic volume for Big Bear Boulevard was obtained from the City of Big Bear General Plan Circulation Element Table C-2 for the segment of Big Bear Boulevard Moonridge to Stanfield (August 1999). Existing average daily traffic volumes for Sandalwood Drive and Business Center Drive were estimated based on measured ambient noise levels, STNM6 was used for Sandalwood Drive and STNM7 was used for Business Center Drive (see Table 1). See Table 8 for more details.

[4] Project average daily vehicle trips obtained from the trip generation utilized in the Air Quality Analysis prepared for the proposed project (Lilburn, 2023).

forth in the Noise Element of the City's General Plan; or (2) the project increases noise levels by at least 3 dBA CNEL and raises the ambient noise level from below the applicable standard to above the applicable standard.

As shown in Table 10, project generated vehicle trips are anticipated to increase noise levels by up to 0.3 dB along Big Bear Boulevard, 3.55 dB along Sandalwood Drive, and 7.97 dB along Business Center Drive. Therefore, project generated vehicle trips are anticipated to result in an increase greater than 5 dB along Business Center Drive. However, the existing land uses located along Business Center Drive are commercial uses and vacant land. In addition, the zoning of the land adjacent to Business Center Drive is general commercial.[5] As shown in Table 3, commercial land uses are considered "normally acceptable" in areas with noise levels reaching up to 65 dBA CNEL and "conditionally acceptable" in areas reaching up to 70 dBA CNEL. The modeled existing plus project noise level along Business Center Drive is 65.9 dBA CNEL. Therefore, although the project is anticipated to result in a greater than 5 dBA CNEL increase along Business Center Drive, the modeled existing plus project noise level does not exceed the City's applicable land use standards for commercial uses.

Therefore, a change in noise level would not be audible and would be considered less than significant. No mitigation is required.

Project Operational Noise – On-Site

The proposed project will be subject to City of Big Bear Ordinance 17.01.090 which prohibits the use of any lawn mower, backpack blower, lawn edger, riding tractor, chain saw, or any other machinery, equipment, or other mechanical or electrical device, or any hand tool which creates an unusually loud, excessive, raucous, impulsive, or disturbing sound, within any residential zone, or within any commercial zone which can be heard from any inhabited real property in residentially used or designated properties, or from a commercial lodging facility between the hours of seven p.m. and seven a.m. of the following day. This ordinance does not set numerical noise standards that apply to operation of the project. Therefore, if the project does not operate between the hours of 7:00 AM and 10:00 PM, it will not be in violation of the applicable City code.

For the purposes of discussion, the following is an analysis of project operational noise in light of County of San Bernardino stationary noise standards which are presented in Table 83-2 which is located in Section 83.01.080 of the County's Code of Ordinances. These standards are presented in Table 6 in this report and those that apply to the proposed project are presented below. The Lns, or (i.e. 15 minutes per hours, 10 minutes per hours etc. are typically not addressed in a CEQA level analysis as a project is typically in compliance with these standards if it is also in compliance with the 30 minute Leq (referred to as Leq in this section) and the Lmax (the noise standard plus 20 dBA for any period of time. Please see Table 6 for more explanation. The zoning of properties surrounding the project site is shown in Figure 6. An aerial photograph and site visit was utilized to determine whether nearby land uses would be considered tp be "Professional Services" or "Other Commercial".

- Residentially Zoned Properties. Project operational noise must not cause exterior noise levels at residentially zoned properties to exceed 55 dBA Leq between the hours of 7:00 AM and 10:00 PM or 45 dBA Leq between the hours of 10:00 PM and 7:00 AM; and not exceed 75 dBA Lmax between the hours of 7:00 AM and 10:00 PM or 65 dBA Lmax between the hours of 10:00 PM and 7:00 AM.

- Properties with Zoning That Allows "Professional Services". Operational noise must not cause exterior noise levels at properties with zoning that allows Professional Services to exceed 55 dBA Leq between

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[5] City of Big Bear Lake Zoning Map (October 2006). https://www.citybigbearlake.com/images/DOWNLOADS/CITY_DEPARTMENTS/Planning/ZONING_MAP.pdf

the hours of 7:00 AM and 10:00 PM or 55 dBA Leq between the hours of 10:00 PM and 7:00 AM; and not exceed 75 dBA Lmax between the hours of 7:00 AM and 10:00 PM or 75 dBA Lmax between the hours of 10:00 PM and 7:00 AM.

- Properties with Zoning That Allows "Other Commercial". Operational noise must not cause exterior noise levels at properties with zoning that allows Professional Services to exceed 60 dBA Leq between the hours of 7:00 AM and 10:00 PM or 60 dBA Leq between the hours of 10:00 PM and 7:00 AM; and not exceed 80 dBA Lmax between the hours of 7:00 AM and 10:00 PM or 80 dBA Lmax between the hours of 10:00 PM and 7:00 AM.

Two operational noise scenarios were modeled. Both scenarios assume the same noise sources, with the primary noise source being pneumatic equipment, which would be by far the loudest noise source being utilized on the project site. The first scenario however, which is represented by Figures 7 and 8, assumes that the doors of the repair building would remain open during operation and the second scenario assumes that that the doors would be closed (see Figures 9 and 10). As shown in Table 11, operation of the project would be in violation of the County's Leq daytime and nighttime Leq standards at Receptors 1,2, 5 and 7 if the repair building doors are left open during the use of noisy equipment. Table 12 shows that project operation will not exceed County standards at any receptors if repair building doors are closed during operation of noisy equipment.

If the City decides to recognize the County's stationary noise standards, then operation of noisy equipment in the repair building or anywhere outside would result in a significant impact and will require mitigation prohibiting the use of noisy equipment outside or within the repair building with the doors open. This measure would reduce impacts to less than significant.

GROUNDBORNE VIBRATION IMPACTS

Construction-Related Vibration Impacts

There are several types of construction equipment that can cause vibration levels high enough to annoy persons in the vicinity and/or result in architectural or structural damage to nearby structures and improvements. As shown in Table 11, a vibratory roller could generate up to 0.21 PPV at a distance of 25 feet; and operation of a large bulldozer (0.089 PPV) at a distance of 25 feet (two of the most vibratory pieces of construction equipment). Groundborne vibration at sensitive receptors associated with this equipment would drop off as the equipment moves away. For example, as the vibratory roller moves further than 100 feet from the sensitive receptors, the vibration associated with it would drop below 0.0026 PPV. It should be noted that these vibration levels are reference levels and may vary slightly depending upon soil type and specific usage of each piece of equipment.

The fundamental equation used to calculate vibration propagation through average soil conditions and distance is as follows:

$$PPV_{equipment} = PPV_{ref}\ (100/D_{rec})^{n}$$

Where: PPV_{ref} = *reference PPV at 100ft.*
D_{rec} = *distance from equipment to receiver in ft.*
n = 1.1 (*the value related to the attenuation rate through ground*)

Architectural Damage

The Caltrans Transportation and Construction Vibration Guidance Manual (2020) provides a comprehensive discussion regarding groundborne vibration and the appropriate thresholds to use to assess the potential for damage. As shown in Table 4, the threshold at which there is a risk of "architectural" damage to historic structures is a peak particle velocity (PPV) of 0.25 in/sec, and a PPV of 0.3 in/sec at older residential structures. There is a risk of architectural damage at newer residential structures and modern commercial/industrial buildings at a PPV of 0.5 in/sec.

There are existing residential structures located as close as approximately 638 feet west, 377 feet southwest, and 837 feet northeast feet and existing commercial structures located as close as approximately 110 feet south, 636 feet east, 204 feet west, and 246 feet southwest of the project property lines. Groundborne vibration levels associated with project construction are provided in Table 12. As shown in Table 12, the residential threshold of 0.3 PPV in/sec will not be exceeded at existing residential structures to the west, southwest, and northeast and the commercial/industrial threshold of 0.5 PPV in/sec will not be exceeded at the existing commercial structures to the south, east, west, and southwest. Therefore, project construction would not result in the exposure of persons to excessive groundborne vibration and impacts would be less than significant. Vibration worksheets are provided in Appendix G.

Annoyance to Persons

Section 17.01.090(A) of the City's Municipal Code states that generation of vibration of a duration and intensity so as to be excessive, disturbing, or objectionable to persons located offsite, shall not be permitted. The Caltrans Noise and Vibration Manual identifies 0.1 PPV in./sec. as the level that is "strongly perceptible" (Table 5).

Operation of a vibratory roller may result in groundborne vibration levels of up to 0.1 PPV (in./sec.) at a distance of 41 feet and bulldozers at a distance of 24 feet. Therefore, sensitive receptors within 41 feet of an operating vibratory roller or 24 feet of an operating large bulldozer may experience annoyance during construction activities. Industrial and commercial receptors are not considered to be sensitive receptors with respect to annoyance. The nearest residential structures are located as close as approximately 377 feet from the western property line of the project site. Therefore, project construction activities would not cause vibration related annoyance to existing residential receptors. Furthermore, any potential impacts will be temporary and will occur only during daytime hours. This impact would be less than significant. No mitigation is required.

Table 9
Construction Noise Levels (dBA L_{eq})

Phase	Receptor Location	Existing Ambient Noise Levels (dBA Leq)[1]	Construction Noise Levels (dBA Leq)[2]
Site Preparation	Residential Use to Southwest (41733 Garstin Drive, Big Bear Lake)	50.0	65.4
	Residential Use to West (178 Pinecrest Drive, Big Bear Lake)	39.1	62.6
	Residential Use to Northeast (270 Meadow Circle N, Big Bear Lake)	47.6	61.0
	Commercial to East (42150 Big Bear Boulevard, Big Bear Lake)	47.6	62.6
	Commercial to South (Southwest Gas Corporation, 140 Business Center Drive, Big Bear Lake)	53.9	73.7
	Commercial to West (41701 Garstin Drive, Big Bear Lake)	51.4	72.9
Grading	Residential Use to Southwest (41733 Garstin Drive, Big Bear Lake)	50.0	65.0
	Residential Use to West (178 Pinecrest Drive, Big Bear Lake)	39.1	62.2
	Residential Use to Northeast (270 Meadow Circle N, Big Bear Lake)	47.6	60.6
	Commercial to East (42150 Big Bear Boulevard, Big Bear Lake)	47.6	62.2
	Commercial to South (Southwest Gas Corporation, 140 Business Center Drive, Big Bear Lake)	53.9	73.4
	Commercial to West (41701 Garstin Drive, Big Bear Lake)	51.4	72.5
Building Construction	Residential Use to Southwest (41733 Garstin Drive, Big Bear Lake)	50.0	63.6
	Residential Use to West (178 Pinecrest Drive, Big Bear Lake)	39.1	60.9
	Residential Use to Northeast (270 Meadow Circle N, Big Bear Lake)	47.6	59.2
	Commercial to East (42150 Big Bear Boulevard, Big Bear Lake)	47.6	60.9
	Commercial to South (Southwest Gas Corporation, 140 Business Center Drive, Big Bear Lake)	53.9	72.0
	Commercial to West (41701 Garstin Drive, Big Bear Lake)	51.4	71.2
Paving	Residential Use to Southwest (41733 Garstin Drive, Big Bear Lake)	50.0	62.1
	Residential Use to West (178 Pinecrest Drive, Big Bear Lake)	39.1	59.4
	Residential Use to Northeast (270 Meadow Circle N, Big Bear Lake)	47.6	57.7
	Commercial to East (42150 Big Bear Boulevard, Big Bear Lake)	47.6	59.4
	Commercial to South (Southwest Gas Corporation, 140 Business Center Drive, Big Bear Lake)	53.9	70.5
	Commercial to West (41701 Garstin Drive, Big Bear Lake)	51.4	69.7
Architectural Coating	Residential Use to Southwest (41733 Garstin Drive, Big Bear Lake)	50.0	51.7
	Residential Use to West (178 Pinecrest Drive, Big Bear Lake)	39.1	48.9
	Residential Use to Northeast (270 Meadow Circle N, Big Bear Lake)	47.6	47.3
	Commercial to East (42150 Big Bear Boulevard, Big Bear Lake)	47.6	48.9
	Commercial to South (Southwest Gas Corporation, 140 Business Center Drive, Big Bear Lake)	53.9	60.0
	Commercial to West (41701 Garstin Drive, Big Bear Lake)	51.4	59.2

Notes:

(1) Per measured existing ambient noise levels. STNM1 was used for residential receptors to the southwest, STNM3 was used for residential receptors to the west, STNM4 was used for residential receptors to the northeast and commercial receptors to the east, STNM7 was used for commercial receptors to the south, and STNM8 was used for commercial receptors to the west of the project site.

(2) Construction noise worksheets are provided in Appendix D.

Table 10
Increase in Existing Noise Levels Along Roadways as a Result of Project (dBA CNEL)

Roadway	Segment	Distance from roadway centerline to right-of-way (feet)[2]	Modeled Noise Levels (dBA CNEL)[1]				
			Existing Without Project at right-of-way	Existing Plus Project at right-of-way	Change in Noise Level	Exceeds Standards[3]	Increase of 5 dB or More?
Big Bear Boulevard	In vicinity of project site	40	75.9	76.2	0.30	Yes	No
Sandalwood Drive	In vicinity of project site	25	64.2	67.7	3.55	Yes	No
Business Center Drive	In vicinity of project site	25	58.0	65.9	7.97	Yes	Yes

Notes:

(1) Exterior noise levels calculated 5 feet above pad elevation, perpendicular to subject roadway.

(2) Right of way per the City of Big Bear Lake General Plan Circulation Element for Big Bear Boulevard. Right-of-way of Sandalwood Drive and Business Center Drive estimated utilizing Google Earth imagery.

(3) Per the City of Big Bear Lake "normally acceptable" standard for single-family detached residential dwelling units (see Table 3).

Table 11
Project Compliance with County of San Bernardino Stationary Noise Sources
With Repair Building Doors Open

Receiver	dBA, Leq			dBA, Lmax		
	County Noise Standards (Day/Night)[1]	Modeled Operational Noise Level[3]	Exceeds Standards? (Day/Night)	County Noise Standards (Day/Night)[1]	Modeled Operational Noise Level[4]	Exceeds Standards? (Day/Night)
R1	55/45	58/58	Yes/Yes	75/65	64.0	No/No
R2	55/45	53/53	No/Yes	75/65	59.0	No/No
R3	55/45	45/45	No/No	75/65	51.0	No/No
R4	55/45	43/43	No/No	75/65	49.0	No/No
R5	60/60	68/68	Yes/Yes	80/80	74.0	No/No
R6	60/60	46/46	No/No	80/80	51.0	No/No
R7	60/60	64/64	Yes/Yes	80/80	70.0	No/No
R8	n/a[2]	54/54	n/a[2]	n/a[2]	60.0	n/a[2]
R9	55/55	52/52	No/No	75/75	58.0	No/No
R10	60/60	59/59	No/No	80/80	65.0	No/No

(1) Source: County of San Bernardino Development Code, Development Code Table 83-2.

(2) This property is zoned Public/Open Space.

(3) Modeled noise levels (Leq) are shown in Figure 6.

Table 12
Project Compliance with County of San Bernardino Stationary Noise Sources With Repair Building Doors Closed

Receiver	dBA, Leq			dBA, Lmax		
	County Noise Standards (Day/Night)[1]	Modeled Operational Noise Level[3]	Exceeds Standards? (Day/Night)	County Noise Standards (Day/Night)[1]	Modeled Operational Noise Level[4]	Exceeds Standards? (Day/Night)
R1	55/45	45/45	No/No	75/65	51/51	No/No
R2	55/45	41/41	No/No	75/65	47/47	No/No
R3	55/45	45/45	No/No	75/65	51/51	No/No
R4	55/45	42/42	No/No	75/65	48/48	No/No
R5	60/60	57/57	No/No	80/80	63/63	No/No
R6	60/60	46/46	No/No	80/80	51/51	No/No
R7	60/60	53/53	No/No	80/80	58/58	No/No
R8	n/a[2]	54/54	n/a[2]	n/a[2]	60/60	n/a[2]
R9	55/55	42/42	No/No	75/75	47/47	No/No
R10	60/60	49/49	No/No	80/80	55/55	No/No

Notes:

(1) Source: County of San Bernardino Development Code, Development Code Table 83-2.

(2) This property is zoned Public/Open Space.

(3) Modeled noise levels (Leq) are shown in Figure 6.

(4) Modeled noise levels (Lmax) are shown in Figure 7.

Table 13
Construction Equipment Vibration Source Levels

Equipment		PPV at 25 ft, in/sec	Approximate Lv* at 25 ft
Pile Driver (impact)	upper range	1.518	112
	typical	0.644	104
Pile Driver (sonic)	upper range	0.734	105
	typical	0.170	93
clam shovel drop (slurry wall)		0.202	94
Hydromill (slurry wall)	in soil	0.008	66
	in rock	0.017	75
Vibratory Roller		0.210	94
Hoe Ram		0.089	87
Large Bulldozer		0.089	87
Caisson Drilling		0.089	87
Loaded Trucks		0.076	86
Jackhammer		0.035	79
Small Bulldozer		0.003	58

Source: Federal Transit Administration: Transit Noise and Vibration Impact Assessment Manual, 2018.
*RMS velocity in decibels, VdB re 1 micro-in/sec

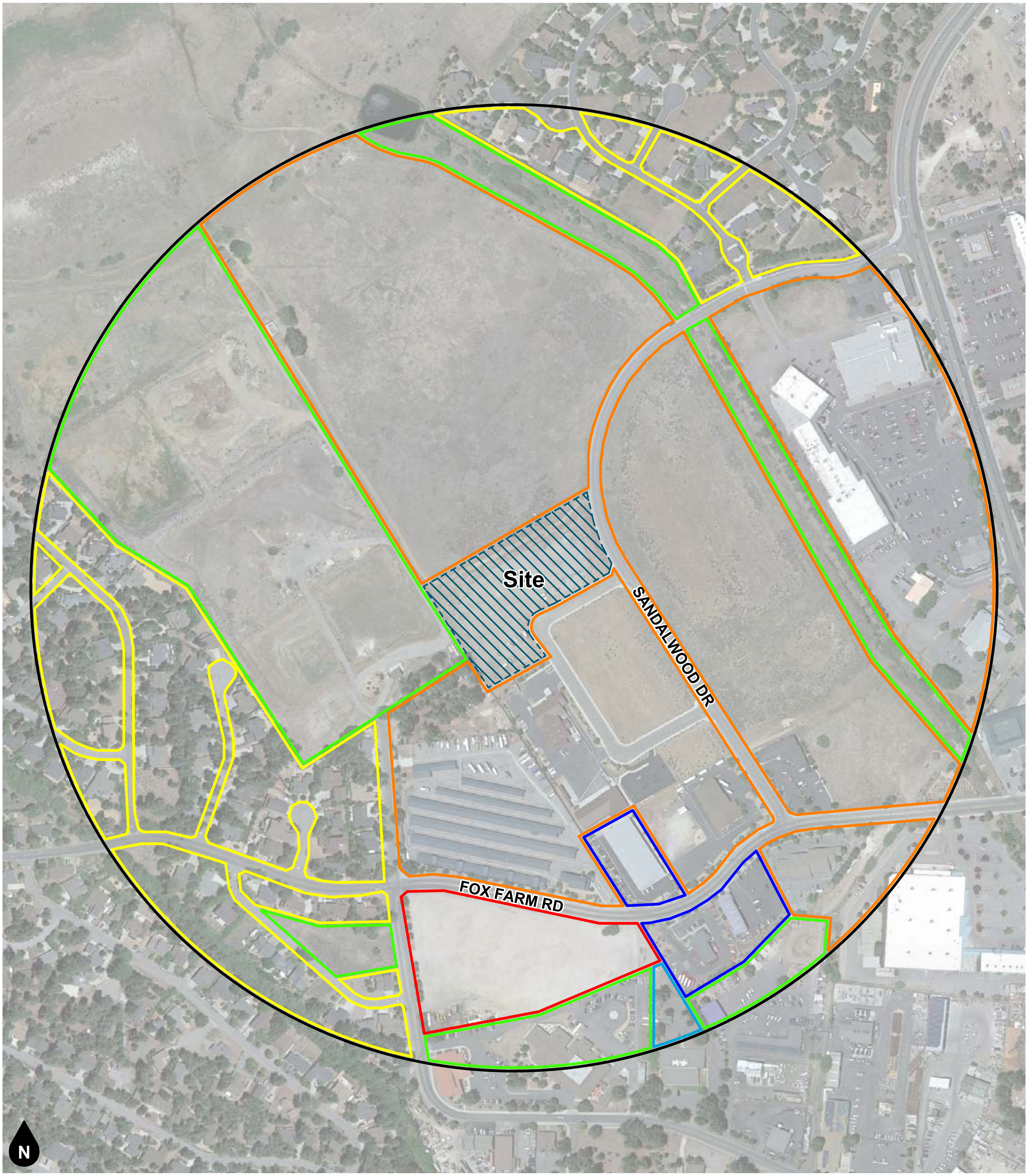
Table 14
Construction Vibration Levels at the Nearest Receptors

Receptor Location	Distance from Property Line to Nearest Structure (feet)	Equipment	Vibration Level[1]	Threshold Exceeded?[2]
Commercial to South (Southwest Gas, 140 Business Center Drive, Big Bear Lake)	110	Vibratory Roller	0.023	No
	110	Large Bulldozer	0.010	No
Commercial to East (42160 Big Bear Boulevard, Big Bear Lake)	636	Vibratory Roller	0.002	No
	636	Large Bulldozer	0.001	No
Residential to Northeast (280 Meadow Circle North, Big Bear Lake)	837	Vibratory Roller	0.001	No
	837	Large Bulldozer	0.000	No
Residential to West (157 Pinecrest Drive, Big Bear Lake)	638	Vibratory Roller	0.002	No
	638	Large Bulldozer	0.001	No
Commercial to West (41701 Garstin Drive, Big Bear Lake	204	Vibratory Roller	0.009	No
	204	Large Bulldozer	0.004	No
Residential to Southwest (41773 Garstin Drive, Big Bear Lake)	377	Vibratory Roller	0.004	No
	377	Large Bulldozer	0.002	No
Commercial to Southwest (Fox Farm Storage, 41856 Fox Farm Road, Big Bear Lake)	246	Vibratory Roller	0.007	No
	246	Large Bulldozer	0.003	No

Notes:

(1) Vibration levels are provided in PPV in/sec.

(2) Caltrans identifies the threshold at which there is a risk to "architectural" damage to older residential structures as 0.3 in/sec PPV and 0.5 in/sec PPV at modern industrial/commercial buildings (see Table 4).



Legend
- 1500 Foot Radius
- R-1 Single Family Residential
- C-1 Commercial-Service
- C-2 Commercial- General
- C-4 Commercial-Recreation
- C-5 Commercial-Industrial
- P-OS Public/Open Space

Figure 6
Surrounding Zoning

Figure 7
Operational Noise Levels
With Repair Building Doors Open (dBA, Leq)

Figure 8
Operational Noise Levels
With Repair Building Doors Closed (dBA, Leq)

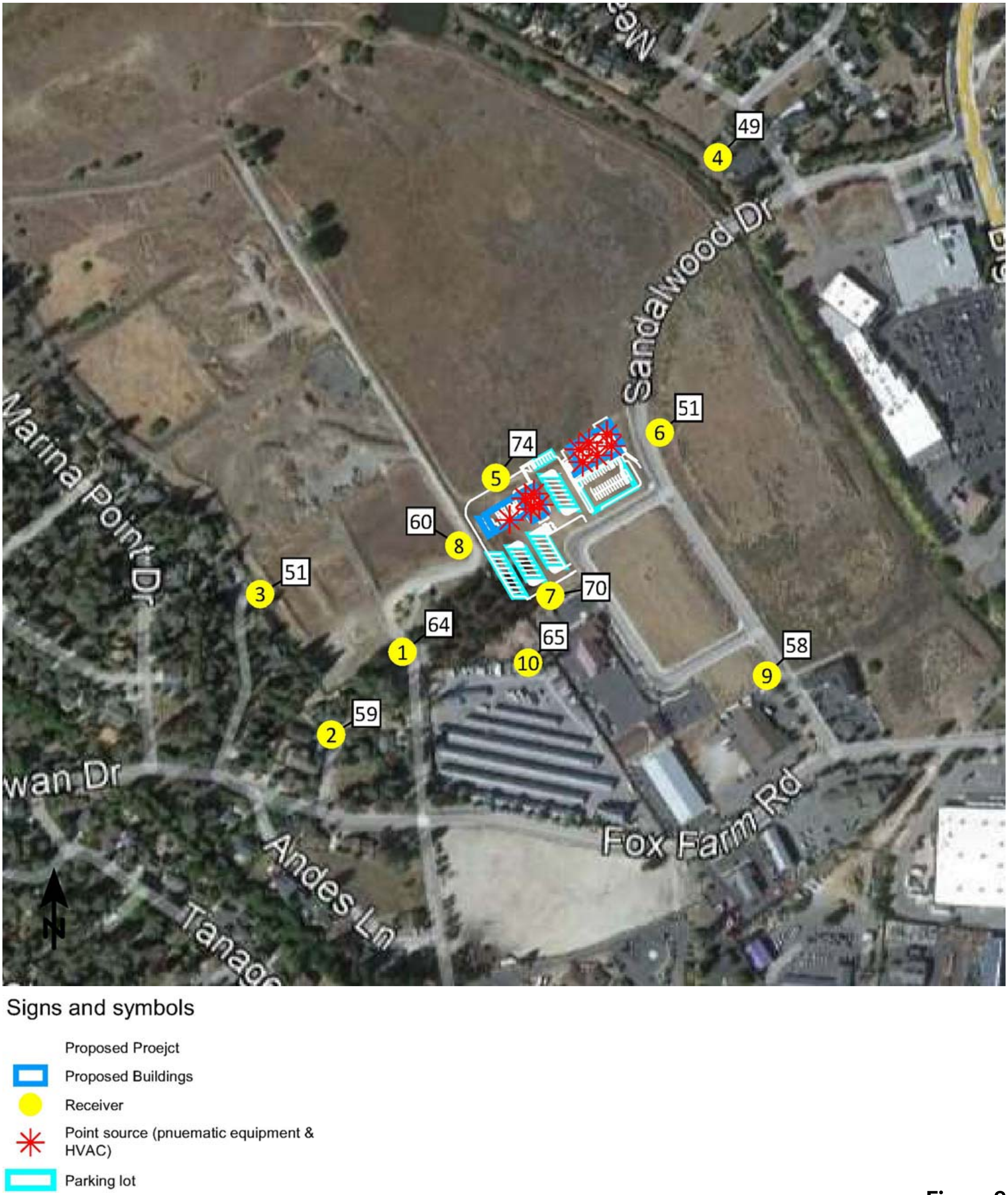


Figure 9
Operational Noise Levels
With Repair Building Doors Open (dBA, Lmax)

Figure 10
Operational Noise Levels
With Repair Building Doors Closed (dBA, Lmax)

7. CEQA IMPACT THRESHOLDS

Will the project result in the:

a) Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?

Less Than Significant Impact

On-Site Construction Noise

Construction phases will include site preparation, grading, building construction, paving and architectural coating. Assumptions for the phasing, duration, and required equipment for the construction of the proposed project were obtained from the project applicant. Construction activities are anticipated to begin no sooner than the end of July 2023 and be completed by the end of August 2024.

Construction noise will vary depending on the construction process, type of equipment involved, location of the construction site with respect to sensitive receptors, the schedule proposed to carry out each task (e.g., hours and days of the week) and the duration of the construction work. The existing residential dwelling units located to the southwest, west, and northeast and existing commercial uses to the east, south, and west of the project site may be affected by short-term noise impacts associated with construction noise.

Construction noise associated with the proposed project was calculated utilizing methodology presented in the Federal Transit Administration (FTA) Transit Noise and Vibration Impact Assessment Manual (2018) together with several key construction parameters including: distance to each sensitive receiver, equipment usage, percent usage factor, and baseline parameters for the project site. Distances to receptors were based on the acoustical center of the proposed construction activity. Construction noise levels were calculated for each phase. Anticipated noise levels during each construction phase are presented in Table 9. Worksheets for each phase are included as Appendix D.

Modeled unmitigated construction noise levels are expected to reach up to 65.4 dBA L_{eq} at the nearest residential property lines to the southwest, 62.6 dBA L_{eq} at the nearest residential property lines to the west, 61 dBA L_{eq} at the nearest residential property lines to the northeast, 62.6 dBA L_{eq} at the nearest commercial property lines to the east, 73.7 dBA L_{eq} at the nearest commercial property lines to the south, and 72.9 dBA L_{eq} at the nearest commercial property lines to the west of the project site.

Table 9 also includes a comparison of existing noise levels and project construction noise levels. Short-term Noise Measurement (STNM)1 was used for residential receptors to the southwest, STNM3 was used for residential receptors to the west, STNM4 was used for residential receptors to the northeast and commercial receptors to the east, STNM7 was used for commercial receptors to the south, and STNM8 was used for commercial receptors to the west of the project site.

Construction noise sources are regulated within the City of Big Bear Lake under 17.01.090(J) of the City's Municipal Code which exempts noise related to construction activities from the provisions of the City's noise standards provided said activities take place between the hours of 7:00 AM and 7:00 PM. Construction activities are not permitted on Sundays or national holidays.

Project construction will not occur outside of the hours outlined as "exempt" in City of Big Bear Lake Municipal Code Section 17.01.090(J). Therefore, project construction will not result in the generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance.

The following BMPs will be included on the project plans and any related contract specifications. Construction noise impacts would be less than significant.

Construction Noise - Best Management Practices

1. All construction equipment whether fixed or mobile, will be equipped with properly operating and maintained mufflers, consistent with manufacturer standards.

2. All stationary construction equipment will be placed so that emitted noise is directed away from the noise sensitive receptors nearest the project site.

3. As applicable, all equipment shall be shut off when not in use.

4. To the degree possible, equipment staging will be located in acres that create the greatest distance between construction-related noise and vibration sources and existing sensitive receptors.

5. Jackhammers, pneumatic equipment, and all other portable stationary noise sources will be directed away and shielded from existing residences in the vicinity of the project site. Either one-inch plywood or sound blankets can be utilized for this purpose. They should reach up from the ground and block the line of sight between equipment and existing residences. The shielding should be without holes and cracks.

6. No amplified music and/or voice will be allowed on the project site.

7. Haul truck deliveries will not occur outside of the hours presented as exempt for construction per City of Big Bear Lake Municipal Code Section 17.01.090(J).

Off-Site Construction

Construction truck trips would occur throughout the construction period. Given the project site's proximity to State Route 18 (Big Bear Boulevard), it is anticipated that vendor and/or haul truck traffic would take the most direct routes to State Route 18.

According to the Federal Highway Administration (FHWA), the traffic volumes need to be doubled in order to increase noise levels by 3 dBA CNEL. In the vicinity of the project site, the estimated existing weekday average daily trips along Business Center Drive is 865 average daily vehicle trips, along Sandalwood Drive is 3,610 average daily vehicle trips, and along Big Bear Boulevard is 18,800 average daily vehicle trips.[6] As shown in the CalEEMod output files provided in the Air Quality Analysis prepared for the proposed project (Lilburn, 2023) the greatest number of construction-related vehicle trips per day would be during grading at up to 22 vehicle trips per day (15for worker trips and 6.25 for hauling trips). Therefore, the addition of project vendor/haul trucks and worker vehicles per day along off-site roadway segments would not be anticipated to result in a doubling of traffic volumes. Off-site project generated construction vehicle trips would result in a negligible noise level increase and would not result in a substantial increase in ambient noise levels. Impacts would be less than significant. No mitigation measures are required.

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[6] The existing average daily traffic volume for Big Bear Boulevard was obtained from the City of Big Bear General Plan Circulation Element Table C-2 for the segment of Big Bear Boulevard Moonridge to Stanfield (August 1999). Existing average daily traffic volumes for Sandalwood Drive and Business Center Drive were estimated based on measured ambient noise levels, STNM6 was used for Sandalwood Drive and STNM7 was used for Business Center Drive (see Table 1). See Table 8 for more details.

Project Operational Noise – Off-Site

During operation, the proposed project is expected to generate approximately 100 average daily passenger car vehicle trips and 100 average daily bus vehicle trips for a total of 200 average daily vehicle trips.[7] A Project generated vehicle noise along affected roadways was modeled utilizing a computer program that replicates the FHWA Traffic Noise Prediction Model FHWA-RD-77-108.

Modeled Existing traffic noise levels range between 58-76 dBA CNEL at the right-of-way of each modeled roadway segment; and the modeled Existing Plus Project traffic noise levels range between 66-76 dBA CNEL at the right-of-way of each modeled roadway segment (see Table 10).

As shown in Table 10, project generated vehicle trips are anticipated to increase noise levels by up to 0.3 dB along Big Bear Boulevard, 3.55 dB along Sandalwood Drive, and 7.97 dB along Business Center Drive. Therefore, project generated vehicle trips are anticipated to result in an increase greater than 5 dB along Business Center Drive. However, the existing land uses located along Business Center Drive are commercial uses and vacant land. In addition, the zoning of the land adjacent to Business Center Drive is general commercial.[8] As shown in Table 3, commercial land uses are considered "normally acceptable" in areas with noise levels reaching up to 65 dBA CNEL and "conditionally acceptable" in areas reaching up to 70 dBA CNEL. The modeled existing plus project noise level along Business Center Drive is 65.9 dBA CNEL. Therefore, although the project is anticipated to result in a greater than 5 dBA CNEL increase along Business Center Drive, the modeled existing plus project noise level does not exceed the City's applicable land use standards for commercial uses.

Therefore, a change in noise level would not be audible and would be considered less than significant. No mitigation is required.

Project Operational Noise – On-Site

The proposed project will be subject to City of Big Bear Ordinance 17.01.090 which prohibits the use of any lawn mower, backpack blower, lawn edger, riding tractor, chain saw, or any other machinery, equipment, or other mechanical or electrical device, or any hand tool which creates an unusually loud, excessive, raucous, impulsive, or disturbing sound, within any residential zone, or within any commercial zone which can be heard from any inhabited real property in residentially used or designated properties, or from a commercial lodging facility between the hours of seven p.m. and seven a.m. of the following day. This ordinance does not set a numerical noise standards that apply to operation of the project. Therefore, as long as the project does not operate between the hours of 7:00 AM and 10:00 PM it will not be in violation with the City's applicable code.

For the purposes of discussion, the following is an analysis of project operational noise in light of County of San Bernardino stationary noise standards which are presented in Table 83-2 which is located in Section 83.01.080 of the County's Code of Ordinances. These standards are presented in Table 6 in this report and those that apply to the proposed project are presented below. The Lns, or (i.e. 15 minutes per hours, 10 minutes per hours etc. are typically not addressed in a CEQA level analysis as a project is typically in compliance with these standards if it is also in compliance with the 30 minute Leq (referred to as Leq in this section) and the Lmax (the noise standard plus 20 dBA for any period of time. Please see Table 6 for more explanation. The zoning of properties surrounding the project site is shown in Figure 6. An aerial photograph and site visit was utilized to determine whether nearby land uses would be considered tp be "Professional Services" or "Other Commercial".

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[7] Project average daily vehicle trips obtained from the trip generation utilized in the Air Quality Analysis prepared for the proposed project (Lilburn, 2023).

[8] City of Big Bear Lake Zoning Map (October 2006). https://www.citybigbearlake.com/images/DOWNLOADS/CITY_DEPARTMENTS/Planning/ZONING_MAP.pdf

- Residentially Zoned Properties. Project operational noise must not cause exterior noise levels at residentially zoned properties to exceed 55 dBA Leq between the hours of 7:00 AM and 10:00 PM or 45 dBA Leq between the hours of 10:00 PM and 7:00 AM; and not exceed 75 dBA Lmax between the hours of 7:00 AM and 10:00 PM or 65 dBA Lmax between the hours of 10:00 PM and 7:00 AM.

- Properties with Zoning That Allows "Professional Services." Operational noise must not cause exterior noise levels at properties with zoning that allows Professional Services to exceed 55 dBA Leq between the hours of 7:00 AM and 10:00 PM or 55 dBA Leq between the hours of 10:00 PM and 7:00 AM; and not exceed 75 dBA Lmax between the hours of 7:00 AM and 10:00 PM or 75 dBA Lmax between the hours of 10:00 PM and 7:00 AM.

- Properties with Zoning That Allows "Other Commercial." Operational noise must not cause exterior noise levels at properties with zoning that allows Professional Services to exceed 60 dBA Leq between the hours of 7:00 AM and 10:00 PM or 60 dBA Leq between the hours of 10:00 PM and 7:00 AM; and not exceed 80 dBA Lmax between the hours of 7:00 AM and 10:00 PM or 80 dBA Lmax between the hours of 10:00 PM and 7:00 AM.

Two operational noise scenarios were modeled. Both scenarios assume the same noise sources, with the primary noise source being pneumatic equipment, which would be by far the loudest noise source being utilized on the project site. The first scenario however, which is represented by Figures 7 and 8, assumes that the doors of the repair building would remain open during operation and the second scenario assumes that that the doors would be closed (see Figures 9 and 10). As shown in Table 11, operation of the project would be in violation of the County's Leq daytime and nighttime Leq standards at Receptors 1,2, 5 and 7 if the repair building doors are left open during the use of noisy equipment. Table 12 shows that project operation will not exceed County standards at any receptors if repair building doors are closed during operation of noisy equipment.

If the City decides to recognize the County's stationary noise standards, then operation of noisy equipment in the repair building or anywhere outside would result in a significant impact and will require mitigation prohibiting the use of noisy equipment outside or within the repair building with the doors open. This measure would reduce impacts to less than significant.

b) *Generation of excessive groundborne vibration of groundborne noise levels?*

Less Than Significant Impact

Construction Vibration

There are several types of construction equipment that can cause vibration levels high enough to annoy persons in the vicinity and/or result in architectural or structural damage to nearby structures and improvements. For example, as shown in Table 11, a vibratory roller could generate up to 0.21 PPV at a distance of 25 feet; and operation of a large bulldozer (0.089 PPV) at a distance of 25 feet (two of the most vibratory pieces of construction equipment). Groundborne vibration at sensitive receptors associated with this equipment would drop off as the equipment moves away. For example, as the vibratory roller moves further than 100 feet from the sensitive receptors, the vibration associated with it would drop below 0.0026 PPV. It should be noted that these vibration levels are reference levels and may vary slightly depending upon soil type and specific usage of each piece of equipment.

The fundamental equation used to calculate vibration propagation through average soil conditions and distance is as follows:

$$PPV_{equipment} = PPV_{ref} \ (100/D_{rec})^{n}$$

Where: PPV_{ref} = *reference PPV at 100ft.*
D_{rec} = *distance from equipment to receiver in ft.*
n = 1.1 (*the value related to the attenuation rate through ground*)

Architectural Damage

The Caltrans Transportation and Construction Vibration Guidance Manual (2020) provides a comprehensive discussion regarding groundborne vibration and the appropriate thresholds to use to assess the potential for damage. As shown in Table 4, the threshold at which there is a risk of "architectural" damage to historic structures is a peak particle velocity (PPV) of 0.25 in/sec, and a PPV of 0.3 in/sec at older residential structures. There is a risk of architectural damage at newer residential structures and modern commercial/industrial buildings at a PPV of 0.5 in/sec.

There are existing residential structures located as close as approximately 638 feet west, 377 feet southwest, and 837 feet northeast feet and existing commercial structures located as close as approximately 110 feet south, 636 feet east, 204 feet west, and 246 feet southwest of the project property lines. Groundborne vibration levels associated with project construction are provided in Table 12. As shown in Table 12, the residential threshold of 0.3 PPV in/sec will not be exceeded at existing residential structures to the west, southwest, and northeast and the commercial/industrial threshold of 0.5 PPV in/sec will not be exceeded at the existing commercial structures to the south, east, west, and southwest. Therefore, project construction would not result in the exposure of persons to excessive groundborne vibration and impacts would be less than significant.

Annoyance to Persons

Section 17.01.090(A) of the City's Municipal Code states that generation of vibration of a duration and intensity so as to be excessive, disturbing, or objectionable to persons located offsite, shall not be permitted. The Caltrans Noise and Vibration Manual identifies 0.1 PPV in./sec. as the level that is "strongly perceptible" (Table 5).

Operation of a vibratory roller may result in groundborne vibration levels of up to 0.1 PPV (in./sec.) at a distance of 41 feet and bulldozers at a distance of 24 feet. Therefore, sensitive receptors within 41 feet of an operating vibratory roller or 24 feet of an operating large bulldozer may experience annoyance during construction activities. Industrial and commercial receptors are not considered to be sensitive receptors with respect to annoyance. The nearest residential structures are located as close as approximately 377 feet from the western property line of the project site. Therefore, project construction activities would not cause vibration related annoyance to existing residential receptors. Furthermore, any potential impacts will be temporary and will occur only during daytime hours. This impact would be less than significant. No mitigation is required.

Operational Vibration

Operation of the proposed project will involve the movement of passenger vehicles and trucks. Driving surfaces associated with the project will be paved and will generally be smooth. Loaded trucks generally have a PPV of 0.076 at a distance of 25 feet (Caltrans 2020). Groundborne vibration levels associated with passenger vehicles is much lower. The movement of vehicles on the project site would not result in the generation of excessive groundborne vibration or groundborne noise. Impacts would be less than significant. No mitigation is required.

c) For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the area to excessive noise levels?

Less Than Significant Impact

The closest airport to the project site is the Big Bear City Airport with airport runways located as close as approximately 1.52 miles northeast of the project site. Per the Airport Comprehensive Land Use Plan for the Big Bear City Airport (February 1992) the project site is well outside the 65 dBA CNEL noise contour for the airport. The project would not expose people residing or working in the project area to excessive noise levels associated with airports. This impact would be less than significant. No mitigation is required.

8. REFERENCES

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2006 FHWA Roadway Construction Noise Model User's Guide. January.

APPENDICES

APPENDIX A

LIST OF ACRONYMS

Term	Definition
ADT	Average Daily Traffic
ANSI	American National Standard Institute
CEQA	California Environmental Quality Act
CNEL	Community Noise Equivalent Level
D/E/N	Day / Evening / Night
dB	Decibel
dBA or dB(A)	Decibel "A-Weighted"
dBA/DD	Decibel per Double Distance
dBA L_{eq}	Average Noise Level over a Period of Time
EPA	Environmental Protection Agency
FHWA	Federal Highway Administration
L_{02},L_{08},L_{50},L_{90}	A-weighted Noise Levels at 2 percent, 8 percent, 50 percent, and 90 percent, respectively, of the time period
DNL	Day-Night Average Noise Level
$L_{eq(x)}$	Equivalent Noise Level for '"x" period of time
L_{eq}	Equivalent Noise Level
L_{max}	Maximum Level of Noise (measured using a sound level meter)
L_{min}	Minimum Level of Noise (measured using a sound level meter)
Lp	Sound Pressure Level
LOS C	Level of Service C
Lw	Sound Power Level
OPR	California Governor's Office of Planning and Research
PPV	Peak Particle Velocities
RCNM	Road Construction Noise Model
REMEL	Reference Energy Mean Emission Level
RMS	Root Mean Square

APPENDIX B

GLOSSARY

Term	Definition
Ambient Noise Level	The all-encompassing noise environment associated with a given environment, at a specified time, usually a composite of sound from many sources, at many directions, near and far, in which usually no particular sound is dominant.
A-Weighted Sound Level, dBA	The sound level obtained by use of A-weighting. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear.
CNEL	Community Noise Equivalent Level. CNEL is a weighted 24-hour noise level that is obtained by adding five decibels to sound levels in the evening (7:00 PM to 10:00 PM), and by adding ten decibels to sound levels at night (10:00 PM to 7:00 AM). This weighting accounts for the increased human sensitivity to noise during the evening and nighttime hours.
Decibel, dB	A logarithmic unit of noise level measurement that relates the energy of a noise source to that of a constant reference level; the number of decibels is 10 times the logarithm (to the base 10) of this ratio.
DNL, Ldn	Day Night Level. The DNL, or Ldn is a weighted 24-hour noise level that is obtained by adding ten decibels to sound levels at night (10:00 PM to 7:00 AM). This weighting accounts for the increased human sensitivity to noise during the nighttime hours.
Equivalent Continuous Noise Level, L_{eq}	A level of steady state sound that in a stated time period, and a stated location, has the same A-weighted sound energy as the time-varying sound.
Fast/Slow Meter Response	The fast and slow meter responses are different settings on a sound level meter. The fast response setting takes a measurement every 100 milliseconds, while a slow setting takes one every second.
Frequency, Hertz	In a function periodic in time, the number of times that the quantity repeats itself in one second (i.e., the number of cycles per second).
L_{02}, L_{08}, L_{50}, L_{90}	The A-weighted noise levels that are equaled or exceeded by a fluctuating sound level, 2 percent, 8 percent, 50 percent, and 90 percent of a stated time period, respectively.
L_{max}, L_{min}	Lmax is the RMS (root mean squared) maximum level of a noise source or environment measured on a sound level meter, during a designated time interval, using fast meter response. Lmin is the minimum level.
Offensive/ Offending/Intrusive Noise	The noise that intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of sound depends on its amplitude, duration, frequency, and time of occurrence, and tonal information content as well as the prevailing ambient noise level.
Root Mean Square (RMS)	A measure of the magnitude of a varying noise source quantity. The name derives from the calculation of the square root of the mean of the squares of the values. It can be calculated from either a series of lone values or a continuous varying function.

APPENDIX C

NOISE AND VIBRATION MEASUREMENT FIELD WORKSHEETS

Noise Measurement
Field Data

Project Name: Big Bear Bus Maintenance Facility, City of Big Bear Lake. **Date:** November 29, 2022

Project #: 19574

Noise Measurement #: STNM1 Run Time: 15 minutes (1 x 15 minutes) **Technician:** Ian Edward Gallagher

Nearest Address or Cross Street: 41733 Garstin Drive, Big Bear Lake, CA 92315

Site Description (Type of Existing Land Use and any other notable features): Measurement Site: North end of Garstin Drive, asphalt paved road, residential to the W & businesses to the E. Adjacent: Residential to west, vacant land to northwest, commercial to east, & self-storage use to southeast.

Weather: Clear skies, sunny. Sunset: 4:38 PM **Settings:** [✓ SLOW] FAST

Temperature: 49 deg F **Wind:** 8 mph **Humidity:** 25% **Terrain:** Flat

Start Time: 11:45 AM **End Time:** 12:00 PM **Run Time:**

Leq: 50 dB

Lmax 73.4 dB

L2 58.3 dB

L8 52.2 dB

L25 45.5 dB

L50 42.5 dB

Primary Noise Source: 3 vehicles passing microphone traveling along Garstin Drive during 15 minute measurement. Traffice ambiance from Swan Drive & other roads.

Secondary Noise Sources: Landscaping business ambiance to the E, residential ambiance to the W, distant wind chime, people conversating, ravens/bird song, occasional overhead air traffic.

NOISE METER:	SoundTrack LXT Class 1	**CALIBRATOR:**	Larson Davis CA 250
MAKE:	Larson Davis	**MAKE:**	Larson Davis
MODEL:	LXT1	**MODEL:**	CA 250
SERIAL NUMBER:	3099	**SERIAL NUMBER:**	2723
FACTORY CALIBRATION DATE:	11/17/2021	**FACTORY CALIBRATION DATE:**	11/18/2021
FIELD CALIBRATION DATE:	11/29/2022		

Noise Measurement
Field Data

PHOTOS:

STNM1 looking NE towards N end of Garstin Drive & entry way to property 41769 Garstin Drive, Big Bear Lake.

STNM1 looking S down Garstin Drive, residence 41733 Garstin Drive, Big Bear Lake on the right of image.

Summary

File Name on Meter	LxT_Data.160.s
File Name on PC	LxT_0003099-20221129 114539-LxT_Data.160.ldbin
Serial Number	0003099
Model	SoundTrack LxT®
Firmware Version	2.404
User	Ian Edward Gallagher
Location	STNM1 34°14'57.56"N 116°53'25.18"W
Job Description	15 minute noise measurement (1 x 15 minutes)
Note	Ganddini Project 19574 Bus Maintenance Facility, City of Big Bear Lake

Measurement

Start	2022-11-29 11:45:39
Stop	2022-11-29 12:00:39
Duration	00:15:00.0
Run Time	00:15:00.0
Pause	00:00:00.0
Pre-Calibration	2022-11-29 11:45:08
Post-Calibration	None

Overall Settings

RMS Weight	A Weighting
Peak Weight	A Weighting
Detector	Slow
Preamplifier	PRMLxT1L
Microphone Correction	Off
Integration Method	Linear
OBA Range	Normal
OBA Bandwidth	1/1 and 1/3
OBA Frequency Weighting	C Weighting
OBA Max Spectrum	At LMax
Overload	122.3 dB

Results

LAeq	50.0	
LAE	79.5	
EA	9.977 µPa²h	
EA8	319.280 µPa²h	
EA40	1.596 mPa²h	
LApeak (max)	2022-11-29 11:59:58	88.3 dB
LASmax	2022-11-29 11:57:34	73.4 dB
LASmin	2022-11-29 11:55:57	34.7 dB

LCeq	62.1 dB
LAeq	50.0 dB
LCeq - LAeq	12.1 dB
LAIeq	54.8 dB
LAeq	50.0 dB
LAIeq - LAeq	4.9 dB
Overload Count	0

Statistics

LA2.00	58.3 dB
LA8.00	52.2 dB
LA25.00	45.5 dB
LA50.00	42.5 dB
LA66.60	41.1 dB
LA90.00	38.5 dB

Measurement Report

Report Summary

Meter's File Name	LxT_Data.160.s	Computer's File Name	LxT_0003099-20221129 114539-LxT_Data.160.ldbin
Meter	LxT1 0003099		
Firmware	2.404		
User	Ian Edward Gallagher	Location	STNM1 34°14'57.56"N 116°53'25.18"W
Job Description	15 minute noise measurement (1 x 15 minutes)		
Note	Ganddini Project 19574 Bus Maintenance Facility, City of Big Bear Lake		

Start Time	2022-11-29 11:45:39	Duration	0:15:00.0		
End Time	2022-11-29 12:00:39	Run Time	0:15:00.0	Pause Time	0:00:00.0

Results

Overall Metrics

LA_{eq}	50.0 dB		
LAE	79.5 dB	SEA	--- dB
EA	10.0 μPa²h	LAFTM5	59.6 dB
EA8	319.3 μPa²h		
EA40	1.6 mPa²h		
LA_{peak}	88.3 dB	2022-11-29 11:59:58	
LAS_{max}	73.4 dB	2022-11-29 11:57:34	
LAS_{min}	34.7 dB	2022-11-29 11:55:57	
LA_{eq}	50.0 dB		
LC_{eq}	62.1 dB	LC_{eq} - LA_{eq}	12.1 dB
LAI_{eq}	54.8 dB	LAI_{eq} - LA_{eq}	4.9 dB

Exceedances	Count	Duration
LAS > 65.0 dB	2	0:00:05.7
LAS > 85.0 dB	0	0:00:00.0
LApeak > 135.0 dB	0	0:00:00.0
LApeak > 137.0 dB	0	0:00:00.0
LApeak > 140.0 dB	0	0:00:00.0

Community Noise	LDN	LDay	LNight	
	--- dB	--- dB	0.0 dB	
	LDEN	LDay	LEve	LNight
	--- dB	--- dB	--- dB	--- dB

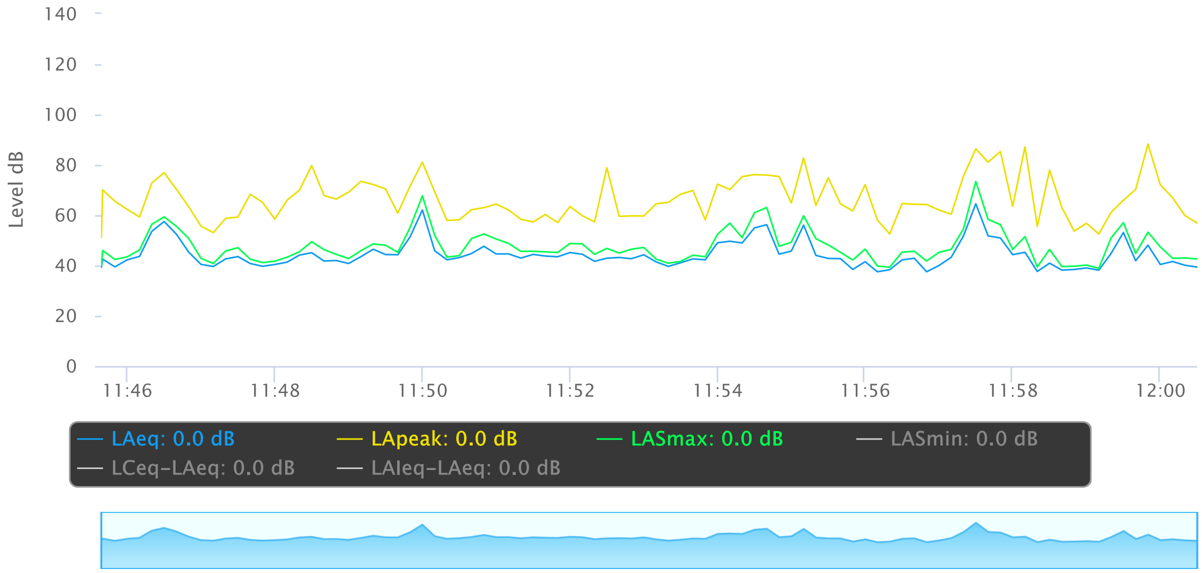
Any Data	A		C		Z	
	Level	Time Stamp	Level	Time Stamp	Level	Time Stamp
L_{eq}	50.0 dB		62.1 dB		--- dB	
$L_{S(max)}$	73.4 dB	2022-11-29 11:57:34	--- dB		--- dB	
$L_{S(min)}$	34.7 dB	2022-11-29 11:55:57	--- dB		--- dB	
$L_{Peak(max)}$	88.3 dB	2022-11-29 11:59:58	--- dB		--- dB	

Overloads	Count	Duration	OBA Count	OBA Duration
	0	0:00:00.0	0	0:00:00.0

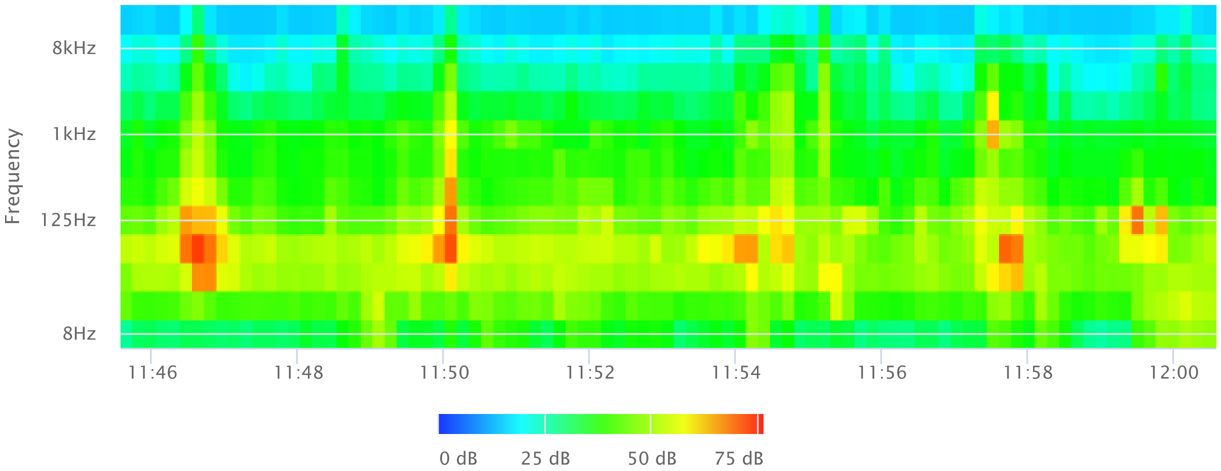
Statistics

LAS 2.0	58.3 dB
LAS 8.0	52.2 dB
LAS 25.0	45.5 dB
LAS 50.0	42.5 dB
LAS 66.6	41.1 dB
LAS 90.0	38.5 dB

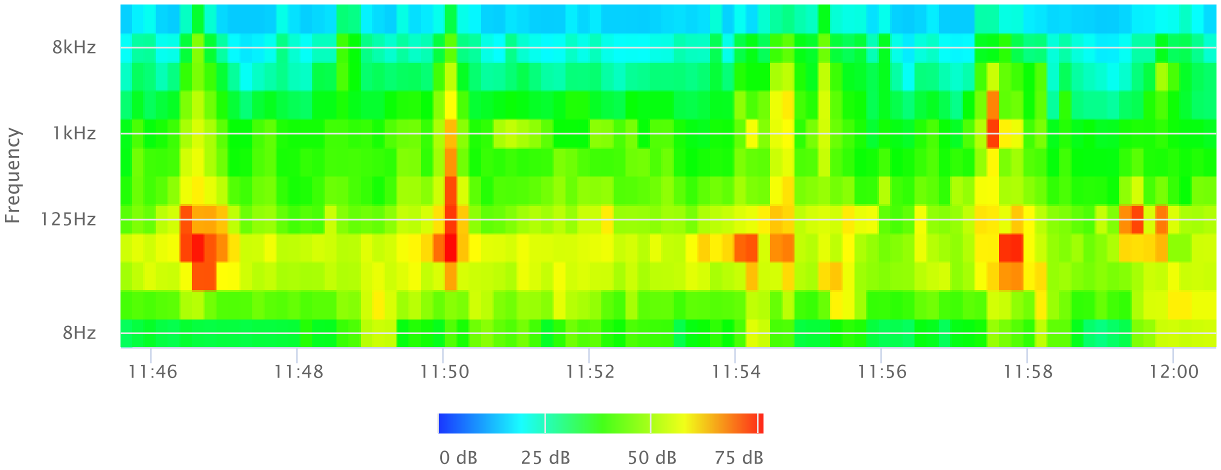
Time History



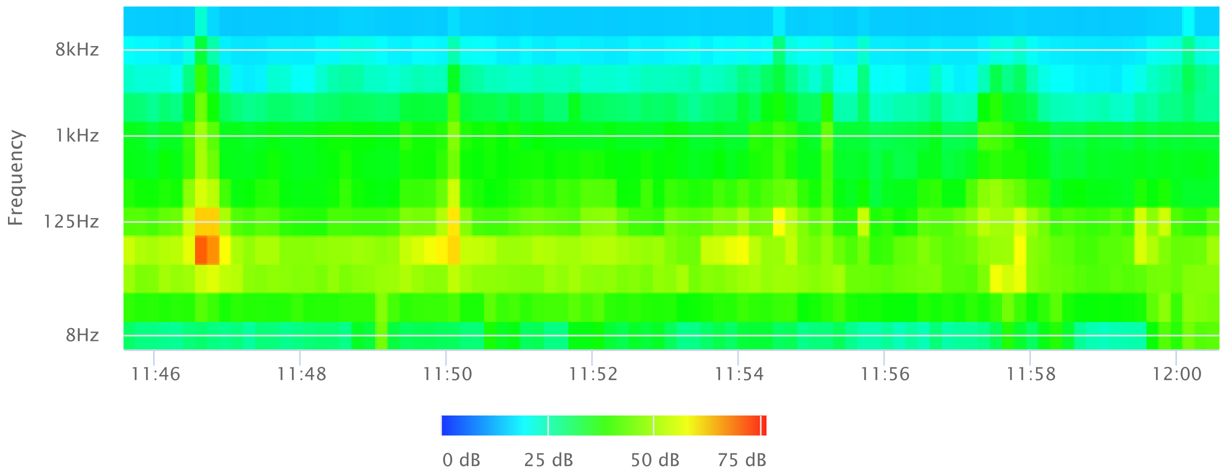
OBA 1/1 Leq



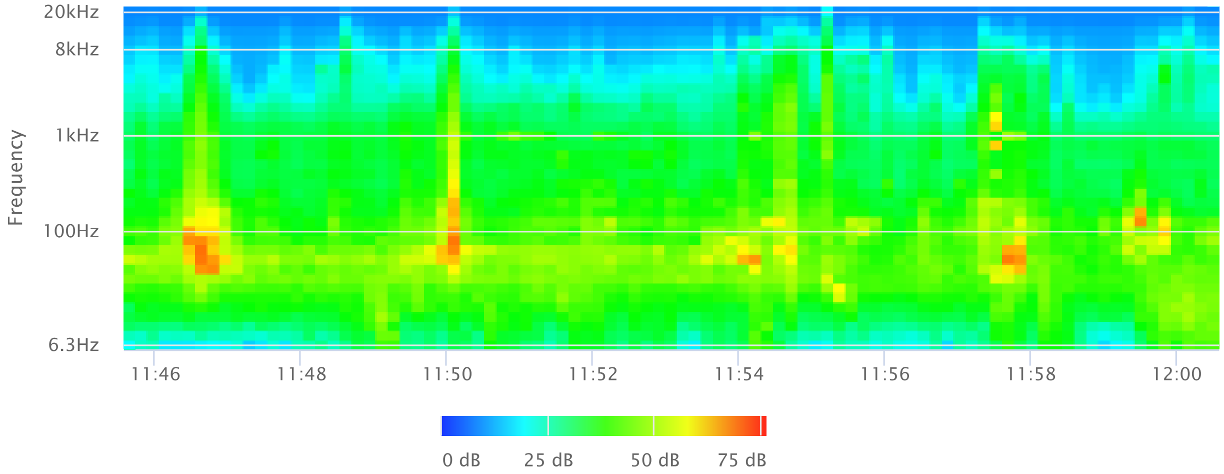
OBA 1/1 Lmax



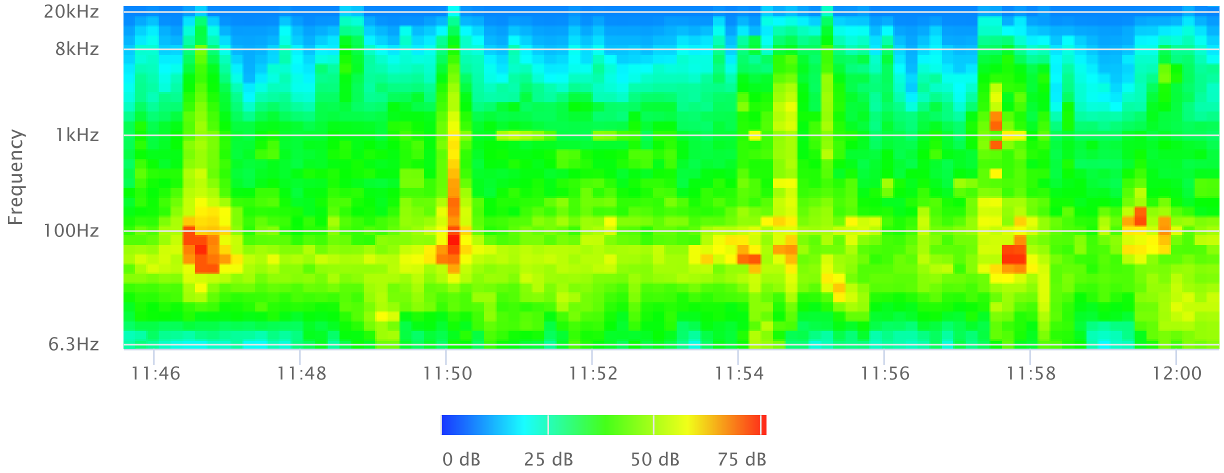
OBA 1/1 Lmin



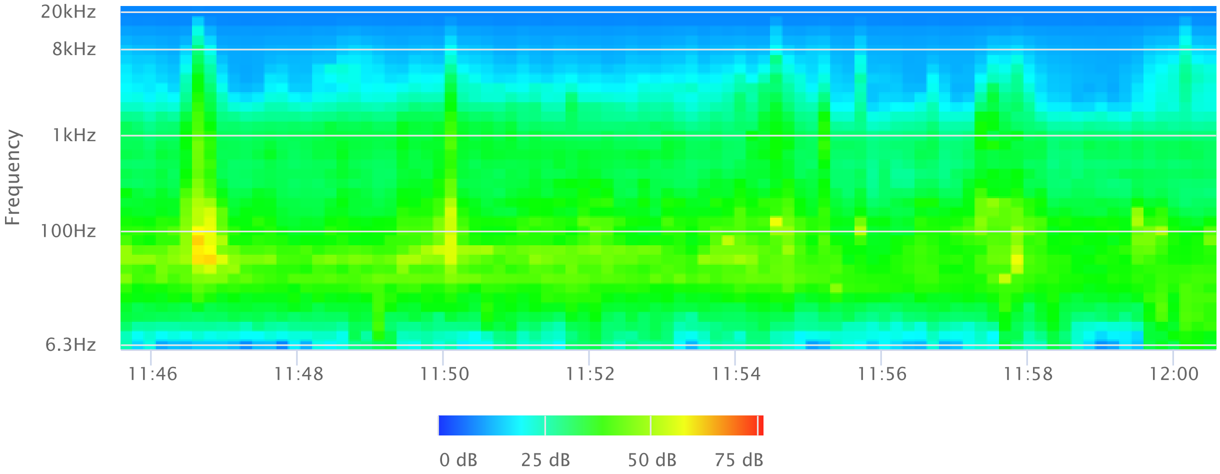
OBA 1/3 Leq



OBA 1/3 Lmax



OBA 1/3 Lmin


20kHz
8kHz
1kHz
100Hz
6.3Hz
Frequency
11:46
11:48
11:50
11:52
11:54
11:56
11:58
12:00
0 dB
25 dB
50 dB
75 dB

Noise Measurement
Field Data

Project Name: Big Bear Bus Maintenance Facility, City of Big Bear Lake. **Date:** November 29, 2022

Project #: 19574

Noise Measurement #: STNM2 Run Time: 15 minutes (1 x 15 minutes) **Technician:** Ian Edward Gallagher

Nearest Address or Cross Street: 200 Alp Ct, Big Bear Lake, CA 92315

Site Description (Type of Existing Land Use and any other notable features): Measurement Site: North end of Alp Court, asphalt paved road, residential culdesac. Adjacent: Single-family residential surrounding STNM2 site with Alp Court to south. One house was under construction.

Weather: Clear skies, sunny. Sunset: 4:38 PM **Settings:** [✓ SLOW] FAST

Temperature: 49 deg F **Wind:** 8 mph **Humidity:** 25% **Terrain:** Flat

Start Time: 12:20 PM **End Time:** 12:35 PM **Run Time:**

Leq: 41.5 dB

Lmax 56.9 dB

L2 49.3 dB

L8 45.1 dB

L25 40.9 dB

L50 38.1 dB

Primary Noise Source: Traffice ambiance from Swan Drive, Swan Drive intersection with Alp Court (~210') & traffic ambiance from other roads.

Secondary Noise Sources: Construction ambiance on new residence ~131' SE of STNM2, residential ambiance, people conversating, ravens/bird song, occasional overhead air traffic.

NOISE METER:	SoundTrack LXT Class 1	**CALIBRATOR:**	Larson Davis CA 250
MAKE:	Larson Davis	**MAKE:**	Larson Davis
MODEL:	LXT1	**MODEL:**	CA 250
SERIAL NUMBER:	3099	**SERIAL NUMBER:**	2723
FACTORY CALIBRATION DATE:	11/17/2021	**FACTORY CALIBRATION DATE:**	11/18/2021
FIELD CALIBRATION DATE:	11/29/2022		

PHOTOS:

STNM2 looking N towards closest residence 200 Alp Court, Big Bear Lake.

STNM2 looking S down Alp Court towards Swan Drive intersection (~210').
New house under construction on the left of image.

Summary

File Name on Meter	LxT_Data.161.s
File Name on PC	LxT_0003099-20221129 122051-LxT_Data.161.ldbin
Serial Number	3099
Model	SoundTrack LxT®
Firmware Version	2.404
User	Ian Edward Gallagher
Location	STNM2 34°14'55.22"N 116°53'27.94"W
Job Description	15 minute noise measurement (1 x 15 minutes)
Note	Ganddini Project 19574 Bus Maintenance Facility, City of Big Bear Lake

Measurement

Start	2022-11-29 12:20:51
Stop	2022-11-29 12:35:51
Duration	00:15:00.0
Run Time	00:15:00.0
Pause	00:00:00.0
Pre-Calibration	2022-11-29 12:20:18
Post-Calibration	None

Overall Settings

RMS Weight	A Weighting
Peak Weight	A Weighting
Detector	Slow
Preamplifier	PRMLxT1L
Microphone Correction	Off
Integration Method	Linear
OBA Range	Normal
OBA Bandwidth	1/1 and 1/3
OBA Frequency Weighting	C Weighting
OBA Max Spectrum	At LMax
Overload	122.3 dB

Results

LAeq	41.5	
LAE	71.0	
EA	1.402678 µPa²h	
EA8	44.88568 µPa²h	
EA40	224.4284 µPa²h	
LApeak (max)	2022-11-29 12:30:39	77.7 dB
LASmax	2022-11-29 12:21:22	56.9 dB
LASmin	2022-11-29 12:22:07	33.2 dB

		Statistics	
LCeq	53.7 dB	**LA2.00**	49.3 dB
LAeq	41.5 dB	**LA8.00**	45.1 dB
LCeq - LAeq	12.2 dB	**LA25.00**	40.9 dB
LAIeq	46.1 dB	**LA50.00**	38.1 dB
LAeq	41.5 dB	**LA66.60**	36.9 dB
LAIeq - LAeq	4.6 dB	**LA90.00**	35.2 dB
Overload Count	0		

Measurement Report

Report Summary

Meter's File Name	LxT_Data.161.s	Computer's File Name	LxT_0003099-20221129 122051-LxT_Data.161.ldbin
Meter	LxT1 0003099		
Firmware	2.404		
User	Ian Edward Gallagher	Location	STNM2 34°14'55.22"N 116°53'27.94"W
Job Description	15 minute noise measurement (1 x 15 minutes)		
Note	Ganddini Project 19574 Bus Maintenance Facility, City of Big Bear Lake		

Start Time	2022-11-29 12:20:51	Duration	0:15:00.0		
End Time	2022-11-29 12:35:51	Run Time	0:15:00.0	Pause Time	0:00:00.0

Results

Overall Metrics

LA_{eq}	41.5 dB		
LAE	71.0 dB	SEA	--- dB
EA	1.4 µPa²h	LAFTM5	48.1 dB
EA8	44.9 µPa²h		
EA40	224.4 µPa²h		
LA_{peak}	77.7 dB	2022-11-29 12:30:39	
LAS_{max}	56.9 dB	2022-11-29 12:21:22	
LAS_{min}	33.2 dB	2022-11-29 12:22:07	
LA_{eq}	41.5 dB		
LC_{eq}	53.7 dB	LC_{eq} - LA_{eq}	12.2 dB
LAI_{eq}	46.1 dB	LAI_{eq} - LA_{eq}	4.6 dB

Exceedances	Count	Duration
LAS > 65.0 dB	0	0:00:00.0
LAS > 85.0 dB	0	0:00:00.0
LApeak > 135.0 dB	0	0:00:00.0
LApeak > 137.0 dB	0	0:00:00.0
LApeak > 140.0 dB	0	0:00:00.0

Community Noise	LDN	LDay	LNight	
	--- dB	--- dB	0.0 dB	
	LDEN	LDay	LEve	LNight
	--- dB	--- dB	--- dB	--- dB

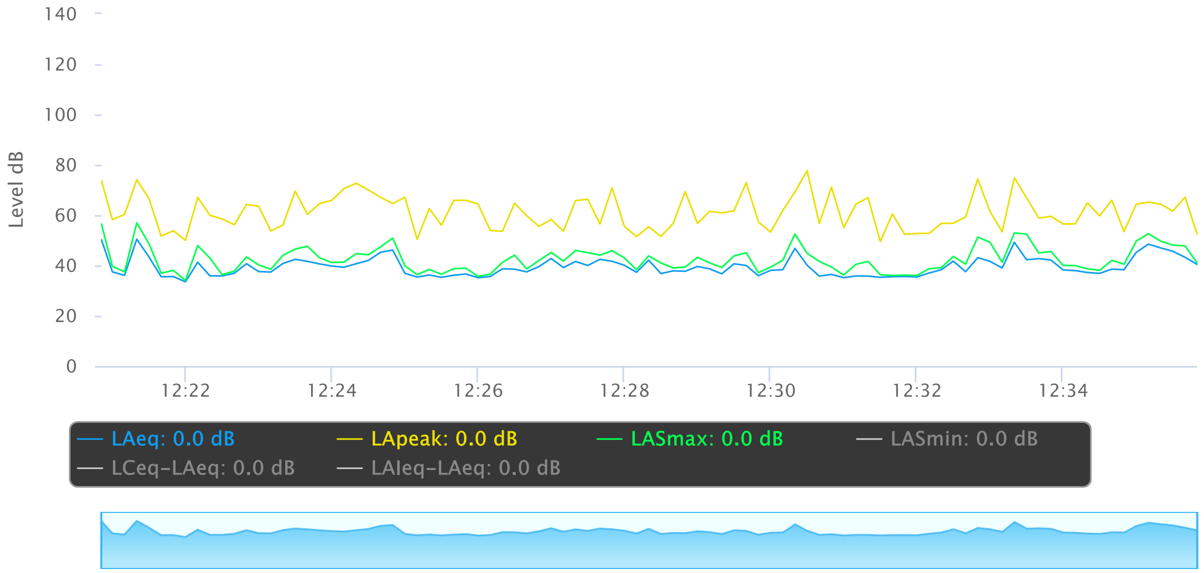
Any Data	A		C		Z	
	Level	Time Stamp	Level	Time Stamp	Level	Time Stamp
L_{eq}	41.5 dB		53.7 dB		--- dB	
$Ls_{(max)}$	56.9 dB	2022-11-29 12:21:22	--- dB		--- dB	
$LS_{(min)}$	33.2 dB	2022-11-29 12:22:07	--- dB		--- dB	
$L_{Peak(max)}$	77.7 dB	2022-11-29 12:30:39	--- dB		--- dB	

Overloads	Count	Duration	OBA Count	OBA Duration
	0	0:00:00.0	0	0:00:00.0

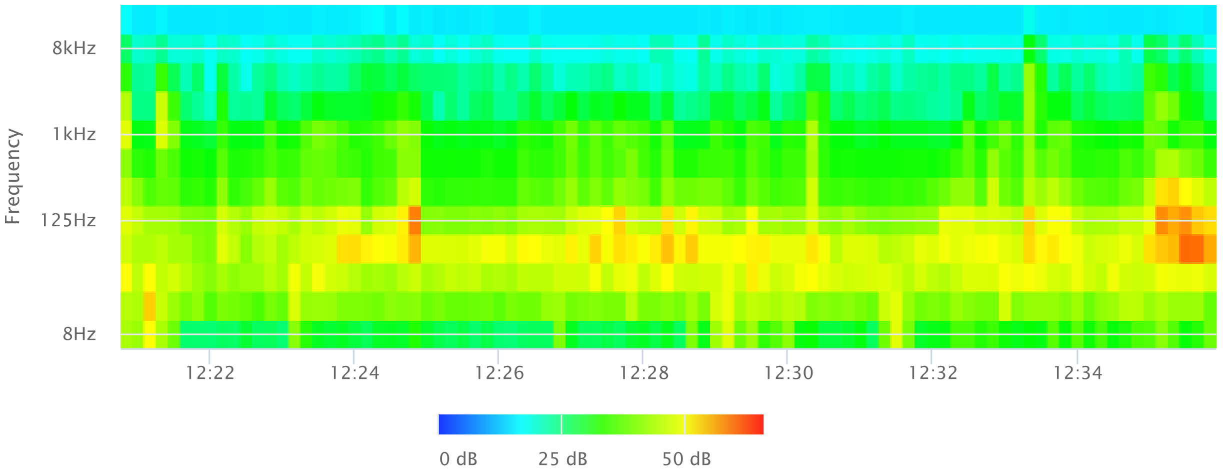
Statistics

LAS 2.0	49.3 dB
LAS 8.0	45.1 dB
LAS 25.0	40.9 dB
LAS 50.0	38.1 dB
LAS 66.6	36.9 dB
LAS 90.0	35.2 dB

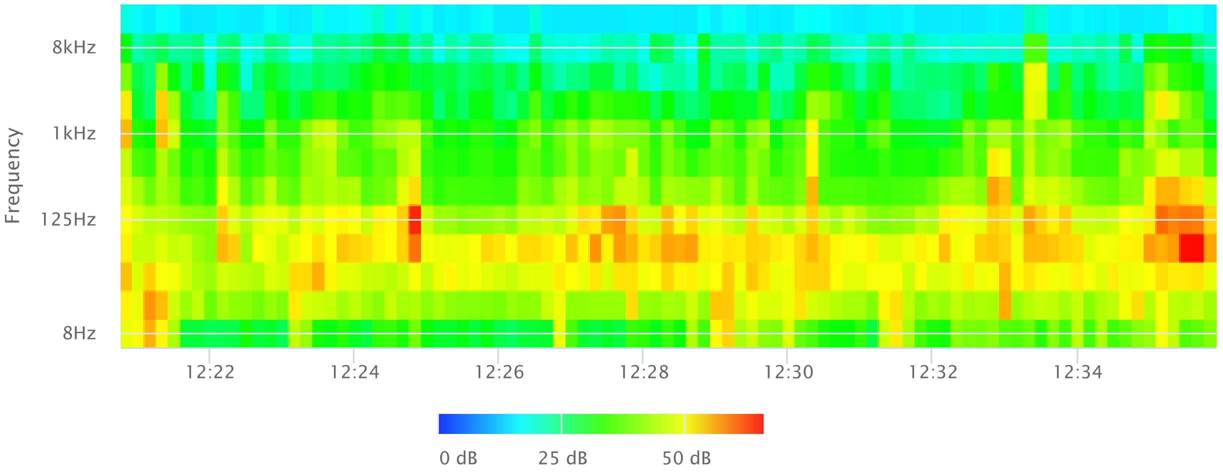
Time History



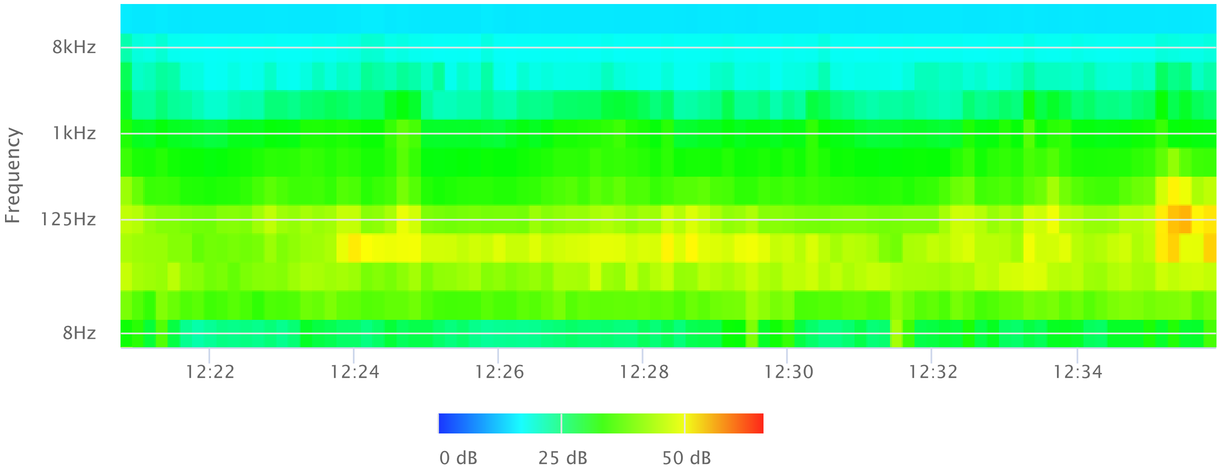
OBA 1/1 Leq



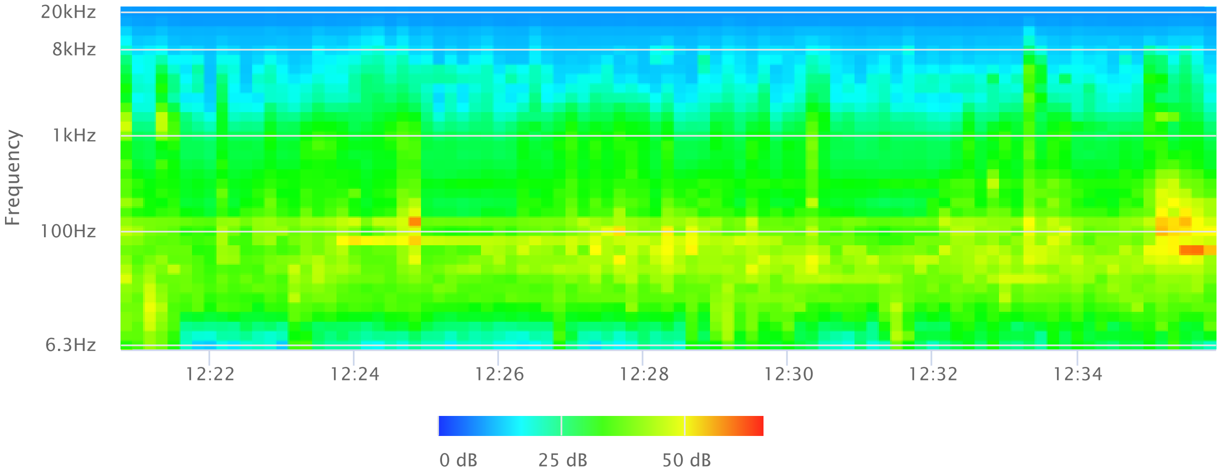
OBA 1/1 Lmax



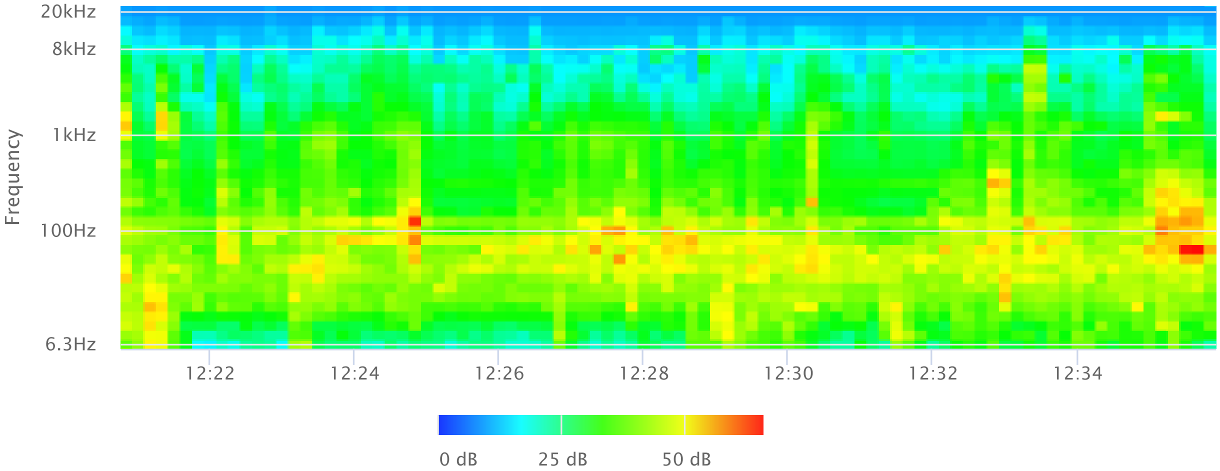
OBA 1/1 Lmin



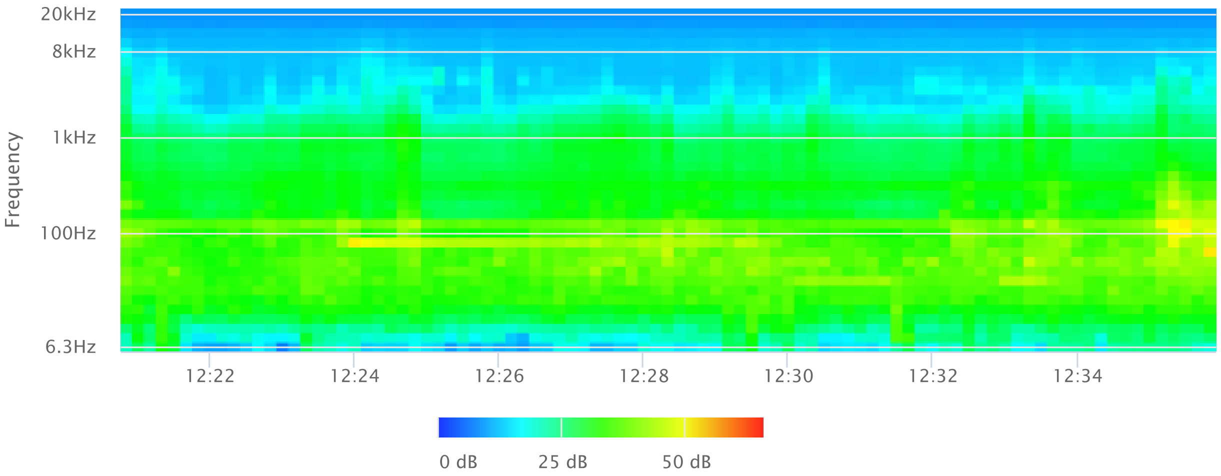
OBA 1/3 Leq



OBA 1/3 Lmax



OBA 1/3 Lmin


20kHz
8kHz
1kHz
Frequency
100Hz
6.3Hz
12:22
12:24
12:26
12:28
12:30
12:32
12:34
0 dB
25 dB
50 dB

Noise Measurement
Field Data

Project Name: Big Bear Bus Maintenance Facility, City of Big Bear Lake. **Date:** November 29, 2022

Project #: 19574

Noise Measurement #: STNM3 Run Time: 15 minutes (1 x 15 minutes) **Technician:** Ian Edward Gallagher

Nearest Address or Cross Street: 132 Pinecrest Drive, Big Bear Lake, CA 92315

Site Description (Type of Existing Land Use and any other notable features): Measurement Site: North end of Pinecrest Drive, asphalt paved road, residential culdesac. Adjacent: Single-family residential surrouding with Pinecrest Drive to south. Vacant land to nort/northwest.

Weather: Clear skies, sunny. Sunset: 4:38 PM **Settings:** [✓ SLOW] FAST

Temperature: 49 deg F **Wind:** 8 mph **Humidity:** 25% **Terrain:** Flat

Start Time: 12:53 PM **End Time:** 1:08 PM **Run Time:**

Leq: 39.1 dB **Primary Noise Source:** Traffice ambiance from surrounding roads.

Lmax 51.8 dB

L2 45.1 dB **Secondary Noise Sources:** Ravens/bird song, occasional overhead air traffic. Slight residential ambiance.

L8 41.7 dB Distant sounds of earth moving equipment from area just E of Sandalwood Drive.

L25 39.2 dB

L50 37.8 dB

NOISE METER:	SoundTrack LXT Class 1	**CALIBRATOR:**	Larson Davis CA 250
MAKE:	Larson Davis	**MAKE:**	Larson Davis
MODEL:	LXT1	**MODEL:**	CA 250
SERIAL NUMBER:	3099	**SERIAL NUMBER:**	2723
FACTORY CALIBRATION DATE:	11/17/2021	**FACTORY CALIBRATION DATE:**	11/18/2021
FIELD CALIBRATION DATE:	11/29/2022		

Noise Measurement
Field Data

PHOTOS:

STNM3 looking NW from north end of Pinecrest Drive towards residence 132 Pinecrest Drive, Big Bear Lake.

STNM3 looking W from north end of Pinecrest Drive towards residence 144 Pinecrest Drive, Big Bear Lake.

Summary

File Name on Meter	LxT_Data.162.s
File Name on PC	LxT_0003099-20221129 125307-LxT_Data.162.ldbin
Serial Number	3099
Model	SoundTrack LxT®
Firmware Version	2.404
User	Ian Edward Gallagher
Location	STNM3 34°14'59.47"N 116°53'30.74"W
Job Description	15 minute noise measurement (1 x 15 minutes)
Note	Ganddini Project 19574 Bus Maintenance Facility, City of Big Bear Lake

Measurement

Start	2022-11-29 12:53:07
Stop	2022-11-29 13:08:07
Duration	00:15:00.0
Run Time	00:15:00.0
Pause	00:00:00.0
Pre-Calibration	2022-11-29 12:52:18
Post-Calibration	None

Overall Settings

RMS Weight	A Weighting
Peak Weight	A Weighting
Detector	Slow
Preamplifier	PRMLxT1L
Microphone Correction	Off
Integration Method	Linear
OBA Range	Normal
OBA Bandwidth	1/1 and 1/3
OBA Frequency Weighting	C Weighting
OBA Max Spectrum	At LMax
Overload	122.4 dB

Results

LAeq	39.1	
LAE	68.6	
EA	0.8067181 µPa²h	
EA8	25.81498 µPa²h	
EA40	129.0749 µPa²h	
LApeak (max)	2022-11-29 12:59:47	79.1 dB
LASmax	2022-11-29 12:56:57	51.0 dB
LASmin	2022-11-29 13:06:04	32.7 dB

LCeq	55.9 dB
LAeq	39.1 dB
LCeq - LAeq	16.9 dB
LAIeq	44.6 dB
LAeq	39.1 dB
LAIeq - LAeq	5.5 dB
Overload Count	0

Statistics

LA2.00	45.1 dB
LA8.00	41.7 dB
LA25.00	39.2 dB
LA50.00	37.8 dB
LA66.60	37.0 dB
LA90.00	35.7 dB

Measurement Report

Report Summary

Meter's File Name	LxT_Data.162.s	Computer's File Name	LxT_0003099-20221129 125307-LxT_Data.162.ldbin
Meter	LxT1 0003099		
Firmware	2.404		
User	Ian Edward Gallagher	Location	STNM3 34°14'59.47"N 116°53'30.74"W
Job Description	15 minute noise measurement (1 x 15 minutes)		
Note	Ganddini Project 19574 Bus Maintenance Faciluty, City of Big Bear Lake		

Start Time	2022-11-29 12:53:07	Duration	0:15:00.0		
End Time	2022-11-29 13:08:07	Run Time	0:15:00.0	Pause Time	0:00:00.0

Results

Overall Metrics

LA_{eq}	39.1 dB		
LAE	68.6 dB	SEA	--- dB
EA	0.8 µPa^{2}h	LAFTM5	46.0 dB
EA8	25.8 µPa^{2}h		
EA40	129.1 µPa^{2}h		
LA_{peak}	79.1 dB	2022-11-29 12:59:47	
LAS_{max}	51.0 dB	2022-11-29 12:56:57	
LAS_{min}	32.7 dB	2022-11-29 13:06:04	
LA_{eq}	39.1 dB		
LC_{eq}	55.9 dB	LC_{eq} - LA_{eq}	16.9 dB
LAI_{eq}	44.6 dB	LAI_{eq} - LA_{eq}	5.5 dB

Exceedances	Count	Duration
LAS > 65.0 dB	0	0:00:00.0
LAS > 85.0 dB	0	0:00:00.0
LApeak > 135.0 dB	0	0:00:00.0
LApeak > 137.0 dB	0	0:00:00.0
LApeak > 140.0 dB	0	0:00:00.0

Community Noise	LDN	LDay	LNight	
	--- dB	--- dB	0.0 dB	
	LDEN	LDay	LEve	LNight
	--- dB	--- dB	--- dB	--- dB

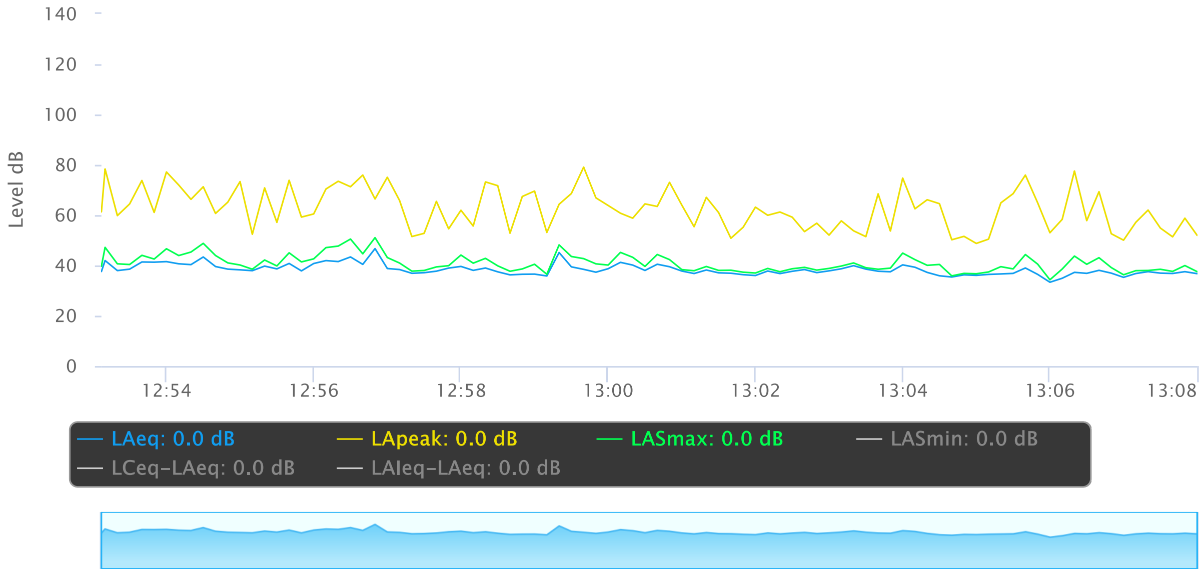
Any Data	A		C		Z	
	Level	Time Stamp	Level	Time Stamp	Level	Time Stamp
L_{eq}	39.1 dB		55.9 dB		--- dB	
$Ls_{(max)}$	51.0 dB	2022-11-29 12:56:57	--- dB		--- dB	
$LS_{(min)}$	32.7 dB	2022-11-29 13:06:04	--- dB		--- dB	
$L_{Peak(max)}$	79.1 dB	2022-11-29 12:59:47	--- dB		--- dB	

Overloads	Count	Duration	OBA Count	OBA Duration
	0	0:00:00.0	0	0:00:00.0

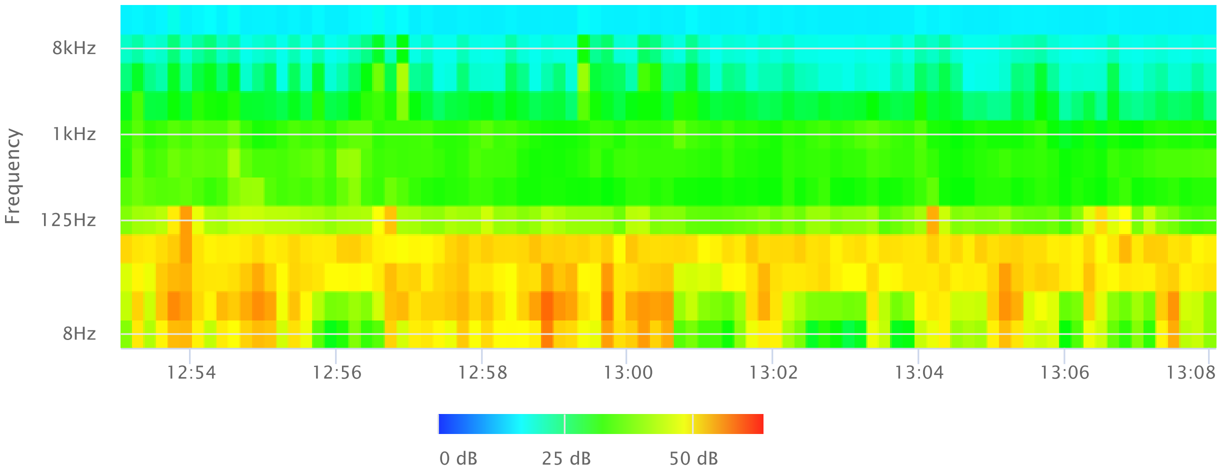
Statistics

LAS 2.0	45.1 dB
LAS 8.0	41.7 dB
LAS 25.0	39.2 dB
LAS 50.0	37.8 dB
LAS 66.6	37.0 dB
LAS 90.0	35.7 dB

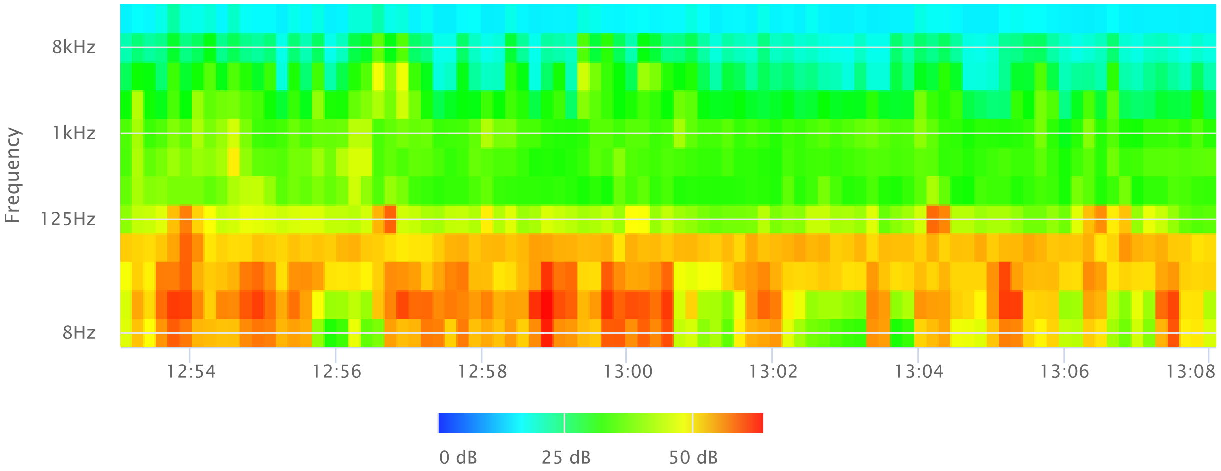
Time History



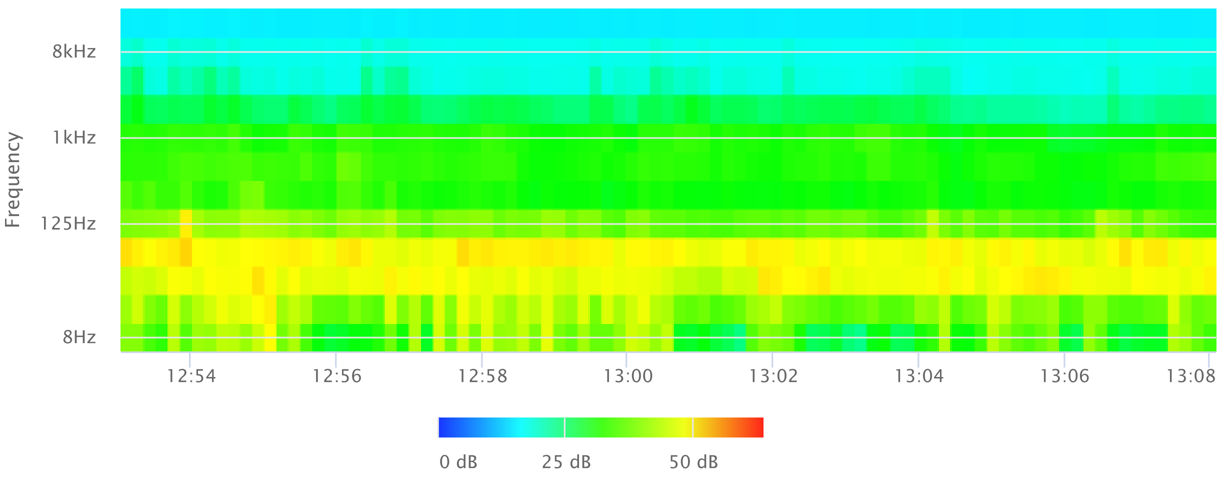
OBA 1/1 Leq



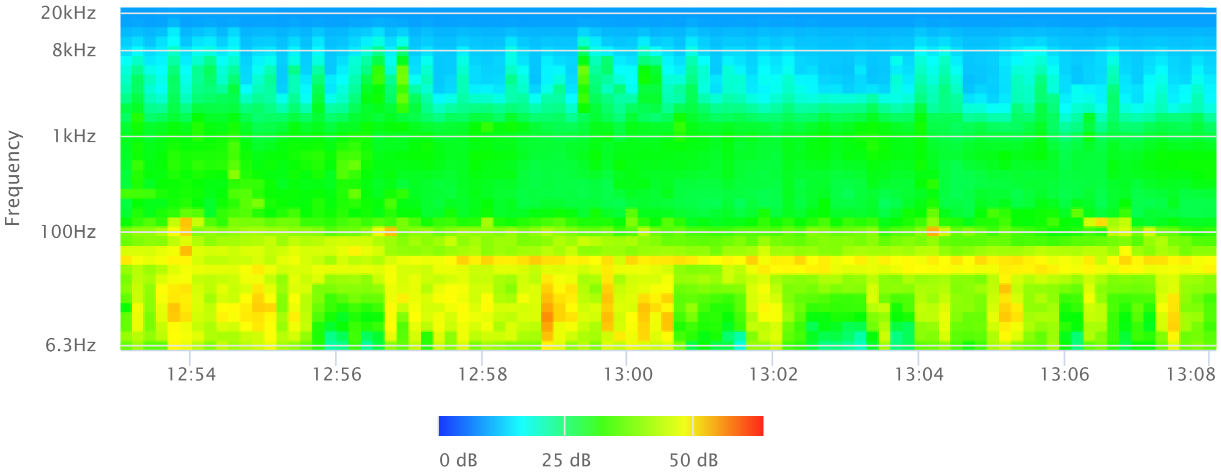
OBA 1/1 Lmax



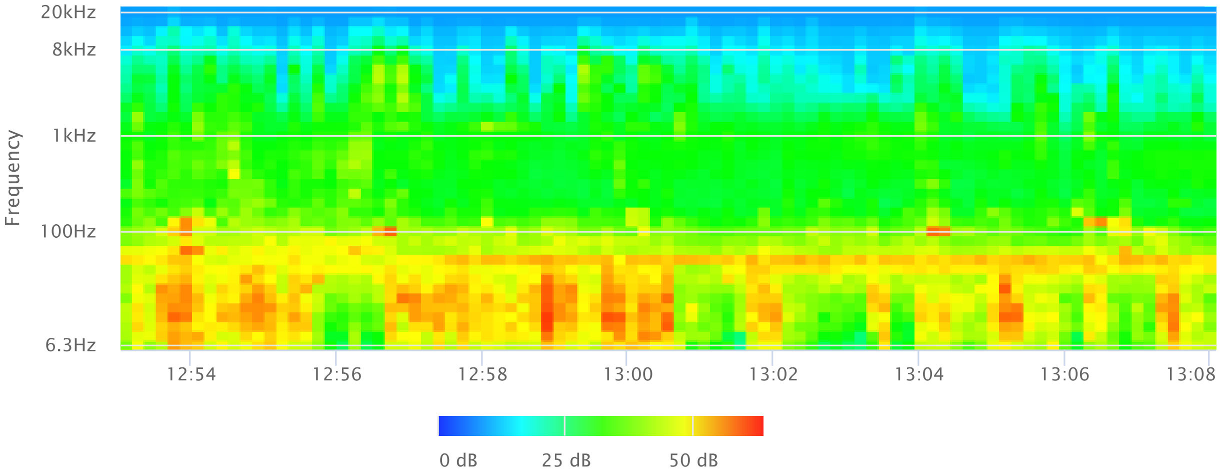
OBA 1/1 Lmin



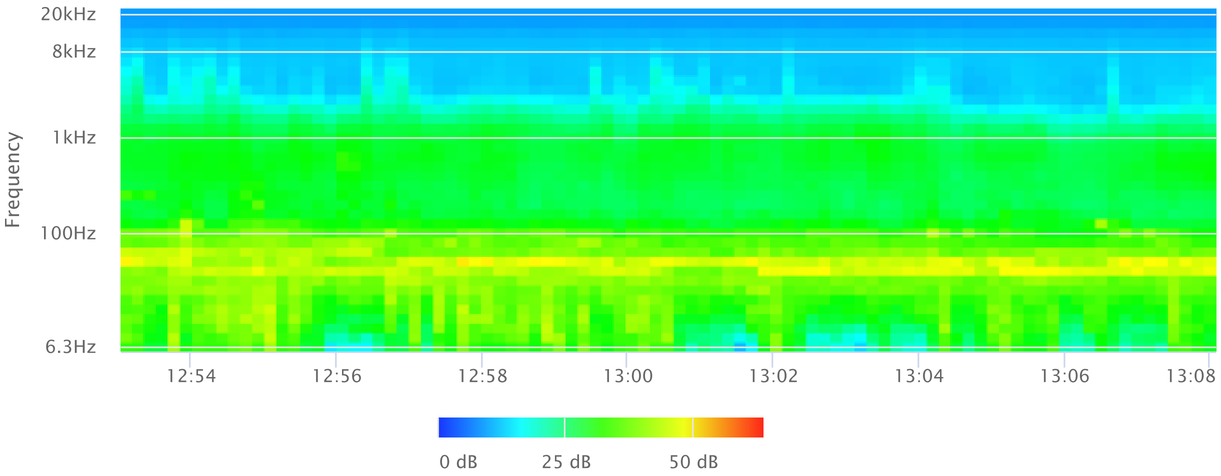
OBA 1/3 Leq



OBA 1/3 Lmax



OBA 1/3 Lmin


20kHz
8kHz
1kHz
Frequency
100Hz
6.3Hz
12:54
12:56
12:58
13:00
13:02
13:04
13:06
13:08
0 dB
25 dB
50 dB

Noise Measurement
Field Data

Project Name: Big Bear Bus Maintenance Facility, City of Big Bear Lake. **Date:** November 29, 2022

Project #: 19574

Noise Measurement #: STNM4 Run Time: 15 minutes (1 x 15 minutes) **Technician:** Ian Edward Gallagher

Nearest Address or Cross Street: 270 Meadow Cir N, Big Bear Lake, CA 92315

Site Description (Type of Existing Land Use and any other notable features): Measurement Site: Just W of backyard to residence 270 Meadow Cir N, Rathburn Creek. Adjacent: Single-family residential to east, wetland type area/vacant land to west, Sandalwood Drive to south. Big Bear Lake further north.

Weather: Clear skies, sunny. Sunset: 4:38 PM **Settings:** [✓ SLOW] FAST

Temperature: 49 deg F **Wind:** 8 mph **Humidity:** 25% **Terrain:** Flat

Start Time: 1:27 PM **End Time:** 1:52 PM **Run Time:**

Leq: 47.6 dB **Primary Noise Source:** Traffice ambiance from vehicles on Sandalwood Drive & other surrounding roads.

Lmax 62.9 dB

L2 53.5 dB **Secondary Noise Sources:** Ravens/bird song, occasional overhead air traffic. Slight residential ambiance.

L8 49.7 dB Distant sounds of earth moving equipment from area ~1,400' SSE of STNM4.

L25 47.5 dB

L50 45.9 dB

NOISE METER: SoundTrack LXT Class 1 **CALIBRATOR:** Larson Davis CA 250

MAKE: Larson Davis **MAKE:** Larson Davis

MODEL: LXT1 **MODEL:** CA 250

SERIAL NUMBER: 3099 **SERIAL NUMBER:** 2723

FACTORY CALIBRATION DATE: 11/17/2021 **FACTORY CALIBRATION DATE:** 11/18/2021

FIELD CALIBRATION DATE: 11/29/2022

Noise Measurement
Field Data

PHOTOS:

STNM4 looking NE over back chainlink fence to backyard of residence 270 Meadow Cir N, Big Bear Lake.

STNM4 looking WNW towards Big Bear Lake (~1,800'), Rathburn Creek on the left, residence 270 Meadow Cir N on the right.

Summary

File Name on Meter	LxT_Data.163.s
File Name on PC	LxT_0003099-20221129 133745-LxT_Data.163.ldbin
Serial Number	3099
Model	SoundTrack LxT®
Firmware Version	2.404
User	Ian Edward Gallagher
Location	STNM4 34°15'11.68"N 116°53'14.42"W
Job Description	15 minute noise measurement (1 x 15 minutes)
Note	Ganddini Project 19574 Bus Maintenance Facility, City of Big Bear Lake

Measurement

Start	2022-11-29 13:37:45
Stop	2022-11-29 13:52:45
Duration	00:15:00.0
Run Time	00:15:00.0
Pause	00:00:00.0
Pre-Calibration	2022-11-29 13:37:13
Post-Calibration	None

Overall Settings

RMS Weight	A Weighting
Peak Weight	A Weighting
Detector	Slow
Preamplifier	PRMLxT1L
Microphone Correction	Off
Integration Method	Linear
OBA Range	Normal
OBA Bandwidth	1/1 and 1/3
OBA Frequency Weighting	C Weighting
OBA Max Spectrum	At LMax
Overload	122.2 dB

Results

LAeq	47.6	
LAE	77.2	
EA	5.775734 µPa²h	
EA8	184.8235 µPa²h	
EA40	924.1173 µPa²h	
LApeak (max)	2022-11-29 13:38:43	84.7 dB
LASmax	2022-11-29 13:45:59	62.9 dB
LASmin	2022-11-29 13:41:45	40.4 dB

		Statistics	
LCeq	62.7 dB	**LA2.00**	53.5 dB
LAeq	47.6 dB	**LA8.00**	49.7 dB
LCeq - LAeq	15.1 dB	**LA25.00**	47.5 dB
LAIeq	50.5 dB	**LA50.00**	45.9 dB
LAeq	47.6 dB	**LA66.60**	44.7 dB
LAIeq - LAeq	2.9 dB	**LA90.00**	43.0 dB
Overload Count	0		

Measurement Report

Report Summary

Meter's File Name	LxT_Data.163.s	Computer's File Name	LxT_0003099-20221129 133745-LxT_Data.163.ldbin
Meter	LxT1 0003099		
Firmware	2.404		
User	Ian Edward Gallagher	Location	STNM4 34°15'11.68"N 116°53'14.42"W
Job Description	15 minute noise measurement (1 x 15 minutes)		
Note	Ganddini Project 19574 Bus Maintenance Faciluty, City of Big Bear Lake		

Start Time	2022-11-29 13:37:45	Duration	0:15:00.0		
End Time	2022-11-29 13:52:45	Run Time	0:15:00.0	Pause Time	0:00:00.0

Results

Overall Metrics

LA_{eq}	47.6 dB		
LAE	77.2 dB	SEA	--- dB
EA	5.8 µPa²h	LAFTM5	52.6 dB
EA8	184.8 µPa²h		
EA40	924.1 µPa²h		
LA_{peak}	84.7 dB	2022-11-29 13:38:43	
LAS_{max}	62.9 dB	2022-11-29 13:45:59	
LAS_{min}	40.4 dB	2022-11-29 13:41:45	
LA_{eq}	47.6 dB		
LC_{eq}	62.7 dB	LC_{eq} - LA_{eq}	15.1 dB
LAI_{eq}	50.5 dB	LAI_{eq} - LA_{eq}	2.9 dB

Exceedances	Count	Duration
LAS > 65.0 dB	0	0:00:00.0
LAS > 85.0 dB	0	0:00:00.0
LApeak > 135.0 dB	0	0:00:00.0
LApeak > 137.0 dB	0	0:00:00.0
LApeak > 140.0 dB	0	0:00:00.0

Community Noise	LDN	LDay	LNight	
	--- dB	--- dB	0.0 dB	
	LDEN	LDay	LEve	LNight
	--- dB	--- dB	--- dB	--- dB

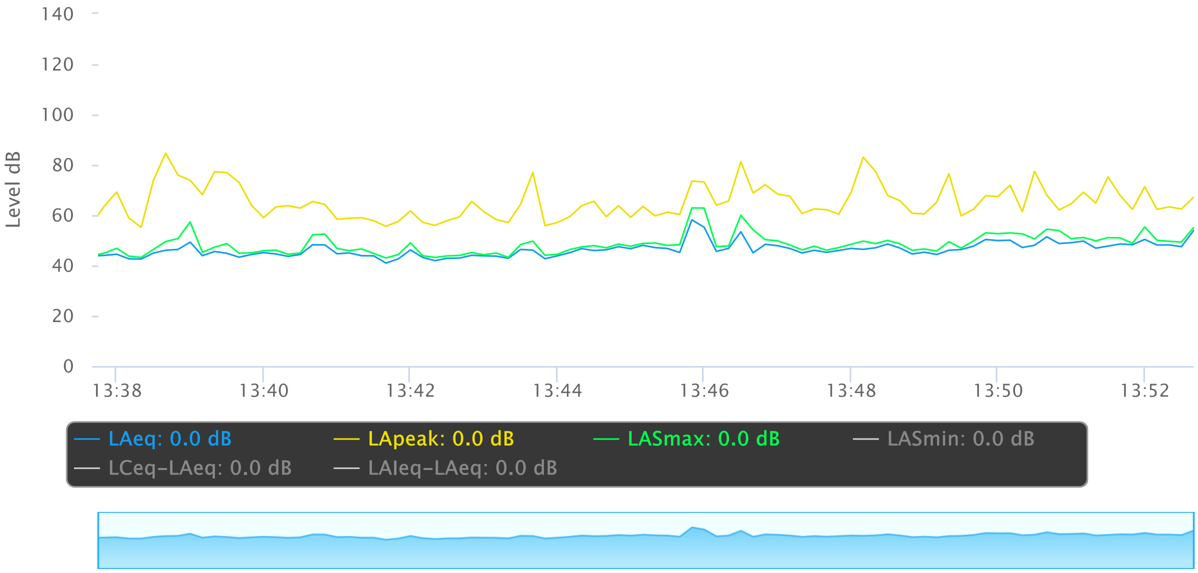
Any Data	A		C		Z	
	Level	Time Stamp	Level	Time Stamp	Level	Time Stamp
L_{eq}	47.6 dB		62.7 dB		--- dB	
$Ls_{(max)}$	62.9 dB	2022-11-29 13:45:59	--- dB		--- dB	
$LS_{(min)}$	40.4 dB	2022-11-29 13:41:45	--- dB		--- dB	
$L_{Peak(max)}$	84.7 dB	2022-11-29 13:38:43	--- dB		--- dB	

Overloads	Count	Duration	OBA Count	OBA Duration
	0	0:00:00.0	0	0:00:00.0

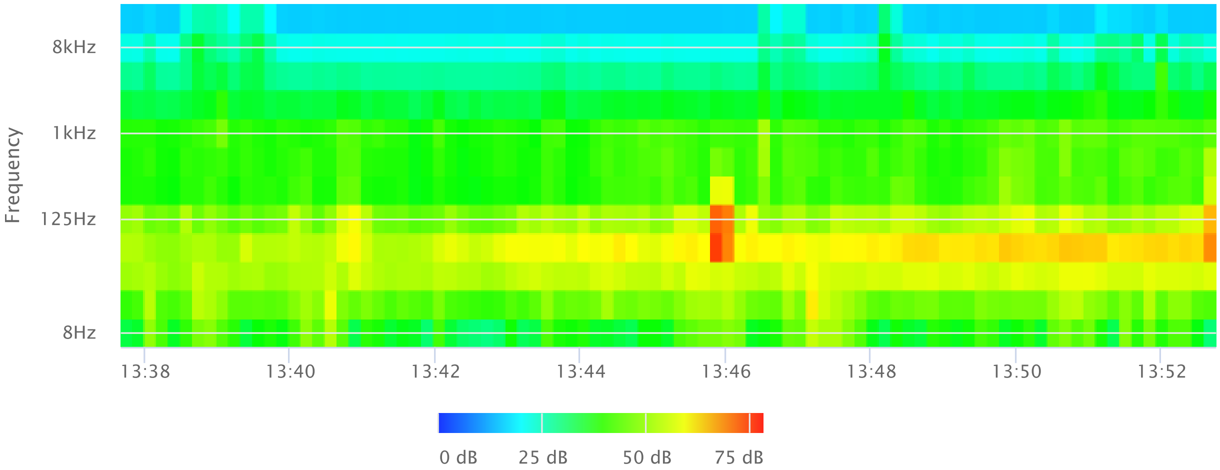
Statistics

LAS 2.0	53.5 dB
LAS 8.0	49.7 dB
LAS 25.0	47.5 dB
LAS 50.0	45.9 dB
LAS 66.6	44.7 dB
LAS 90.0	43.0 dB

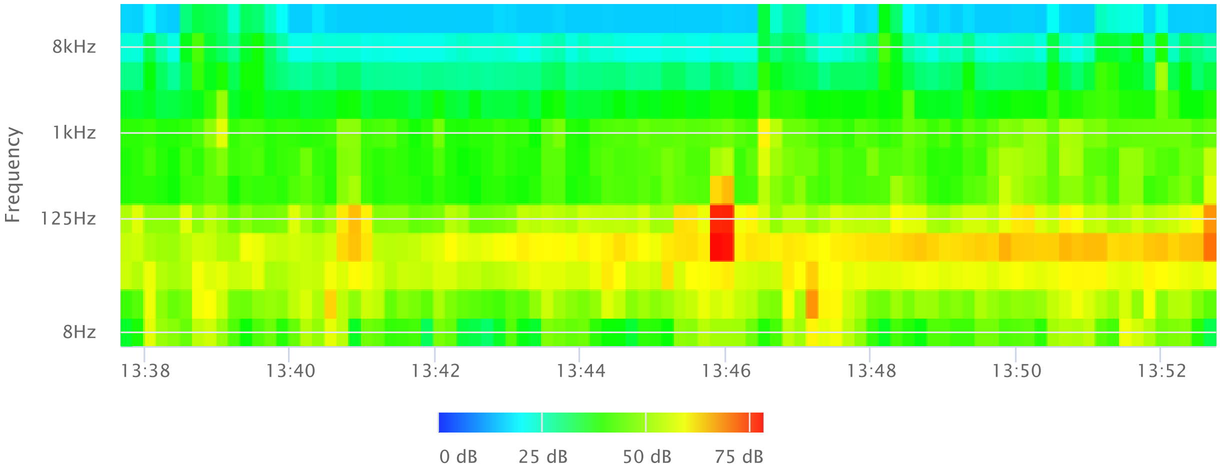
Time History



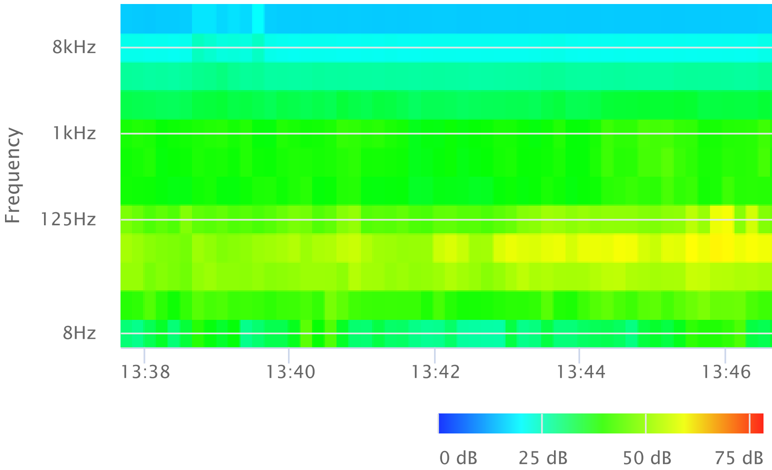
OBA 1/1 Leq



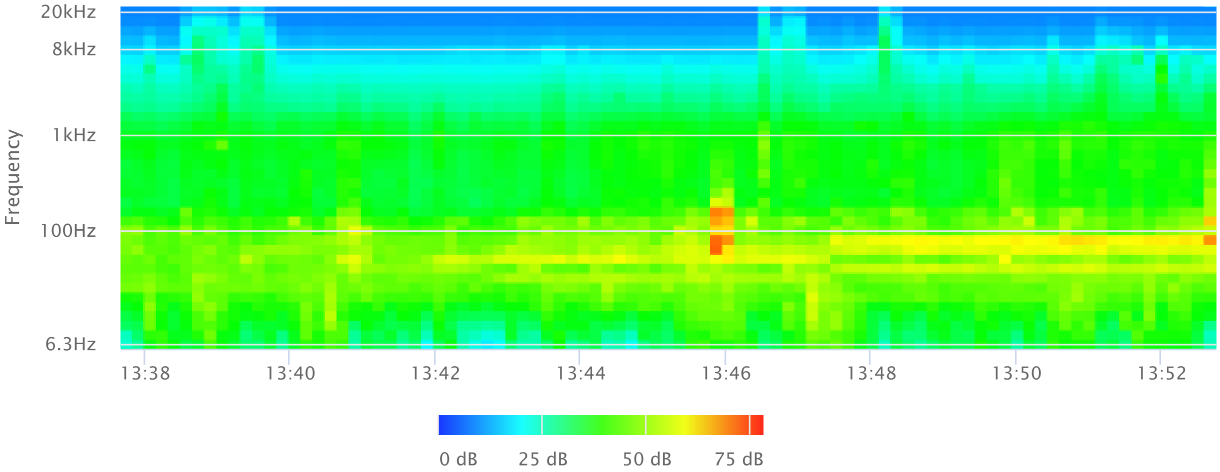
OBA 1/1 Lmax



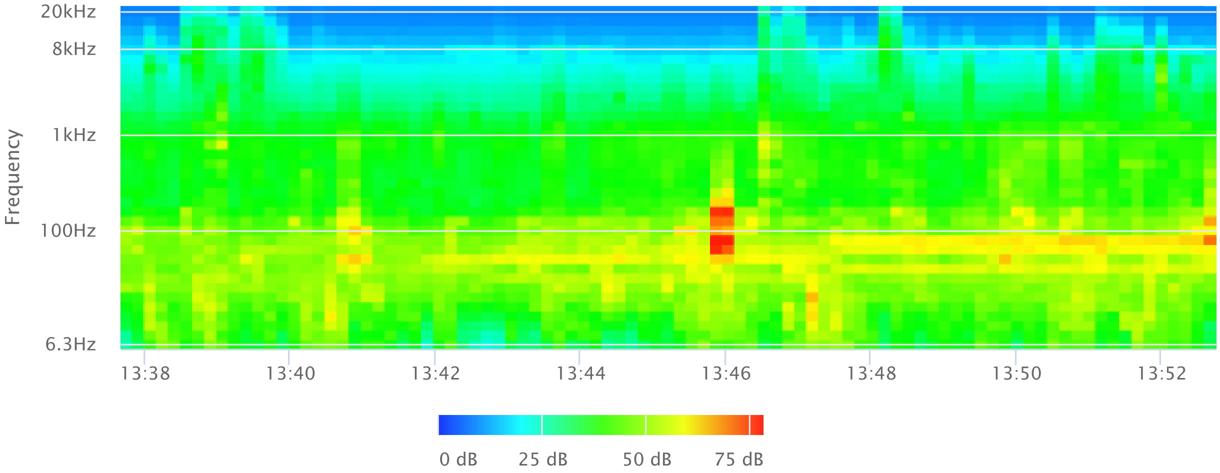
OBA 1/1 Lmin



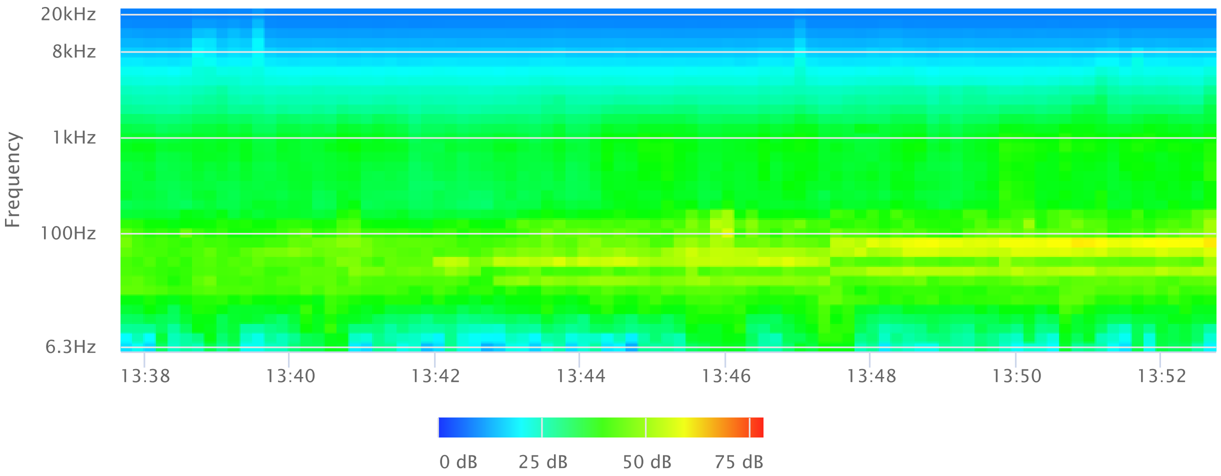
OBA 1/3 Leq



OBA 1/3 Lmax



OBA 1/3 Lmin


20kHz
8kHz
1kHz
100Hz
6.3Hz
Frequency
13:38
13:40
13:42
13:44
13:46
13:48
13:50
13:52
0 dB
25 dB
50 dB
75 dB

Noise Measurement
Field Data

Project Name: Big Bear Bus Maintenance Facility, City of Big Bear Lake. **Date:** November 29, 2022

Project #: 19574

Noise Measurement #: STNM5 Run Time: 15 minutes (1 x 15 minutes) **Technician:** Ian Edward Gallagher

Nearest Address or Cross Street: Middle of NW edge of site area, 34°15'2.83"N 116°53'20.03"W, Big Bear Lake, CA 92315

Site Description (Type of Existing Land Use and any other notable features): Measurement Site: Taken near middle of northern project property line.

Adjacent: Vacant land to north, vacant project site to south, Sandalwood Drive to east with an active construction site further east.

Weather: Clear skies, sunny. Sunset: 4:38 PM **Settings:** [✓ SLOW] FAST

Temperature: 45 deg F **Wind:** 8 mph **Humidity:** 28% **Terrain:** Flat

Start Time: 2:47 PM **End Time:** 3:02 PM **Run Time:**

Leq: 53.5 dB **Primary Noise Source:** Traffice ambiance from the 30 vehicles passing microphone, traveling on Sandalwood Drive. Noise from construction site ~1,000' SE of STNM5.

Lmax 60.5 dB

L2 57.5 dB **Secondary Noise Sources:** Occasional overhead air traffic. Slight residential ambiance. Buses arriving and leaving site area.

L8 56.0 dB

L25 54.3 dB

L50 52.9 dB

NOISE METER:	SoundTrack LXT Class 1	**CALIBRATOR:**	Larson Davis CA 250
MAKE:	Larson Davis	**MAKE:**	Larson Davis
MODEL:	LXT1	**MODEL:**	CA 250
SERIAL NUMBER:	3099	**SERIAL NUMBER:**	2723
FACTORY CALIBRATION DATE:	11/17/2021	**FACTORY CALIBRATION DATE:**	11/18/2021
FIELD CALIBRATION DATE:	11/29/2022		

Noise Measurement
Field Data

PHOTOS:

STNM5 at N of site looking ENE across Sandalwood Drive at construction area with heavy earth moving equipment, towards Interlaken Shopping Center, Big Bear Lake (~960').

STNM5 looking S across site area towards Southwest Gas Corporation building, 140 Business Center Drive, Big Bear Lake (~460').

Summary

File Name on Meter	LxT_Data.164.s
File Name on PC	LxT_0003099-20221129 144756-LxT_Data.164.ldbin
Serial Number	3099
Model	SoundTrack LxT®
Firmware Version	2.404
User	Ian Edward Gallagher
Location	STNM5 34°15'2.83"N 116°53'20.03"W
Job Description	15 minute noise measurement (1 x 15 minutes)
Note	Ganddini Project 19574 Bus Maintenance Facility, City of Big Bear Lake

Measurement

Start	2022-11-29 14:47:56
Stop	2022-11-29 15:02:56
Duration	00:15:00.0
Run Time	00:15:00.0
Pause	00:00:00.0
Pre-Calibration	2022-11-29 14:47:25
Post-Calibration	None

Overall Settings

RMS Weight	A Weighting
Peak Weight	A Weighting
Detector	Slow
Preamplifier	PRMLxT1L
Microphone Correction	Off
Integration Method	Linear
OBA Range	Normal
OBA Bandwidth	1/1 and 1/3
OBA Frequency Weighting	C Weighting
OBA Max Spectrum	At LMax
Overload	122.5 dB

Results

LAeq	53.5	
LAE	83.1	
EA	22.6091 µPa²h	
EA8	723.4913 µPa²h	
EA40	3.617456 mPa²h	
LApeak (max)	2022-11-29 14:57:27	94.3 dB
LASmax	2022-11-29 14:57:27	60.5 dB
LASmin	2022-11-29 14:56:25	48.1 dB

LCeq	65.9 dB
LAeq	53.5 dB
LCeq - LAeq	12.4 dB
LAIeq	55.1 dB
LAeq	53.5 dB
LAIeq - LAeq	1.5 dB
Overload Count	0

Statistics

LA2.00	57.5 dB
LA8.00	56.0 dB
LA25.00	54.3 dB
LA50.00	52.9 dB
LA66.60	52.1 dB
LA90.00	50.8 dB

Measurement Report

Report Summary

Meter's File Name	LxT_Data.164.s	Computer's File Name	LxT_0003099-20221129 144756-LxT_Data.164.ldbin
Meter	LxT1 0003099		
Firmware	2.404		
User	Ian Edward Gallagher	Location	STNM5 34°15'2.83"N 116°53'20.03"W
Job Description	15 minute noise measurement (1 x 15 minutes)		
Note	Ganddini Project 19574 Bus Maintenance Facility, City of Big Bear Lake		

Start Time	2022-11-29 14:47:56	Duration	0:15:00.0		
End Time	2022-11-29 15:02:56	Run Time	0:15:00.0	Pause Time	0:00:00.0

Results

Overall Metrics

LA_{eq}	53.5 dB		
LAE	83.1 dB	SEA	--- dB
EA	22.6 µPa²h	LAFTM5	56.4 dB
EA8	723.5 µPa²h		
EA40	3.6 mPa²h		
LA_{peak}	94.3 dB	2022-11-29 14:57:27	
LAS_{max}	60.5 dB	2022-11-29 14:57:27	
LAS_{min}	48.1 dB	2022-11-29 14:56:25	
LA_{eq}	53.5 dB		
LC_{eq}	65.9 dB	LC_{eq} - LA_{eq}	12.4 dB
LAI_{eq}	55.1 dB	LAI_{eq} - LA_{eq}	1.5 dB

Exceedances	Count	Duration
LAS > 65.0 dB	0	0:00:00.0
LAS > 85.0 dB	0	0:00:00.0
LApeak > 135.0 dB	0	0:00:00.0
LApeak > 137.0 dB	0	0:00:00.0
LApeak > 140.0 dB	0	0:00:00.0

Community Noise	LDN	LDay	LNight	
	--- dB	--- dB	0.0 dB	
	LDEN	LDay	LEve	LNight
	--- dB	--- dB	--- dB	--- dB

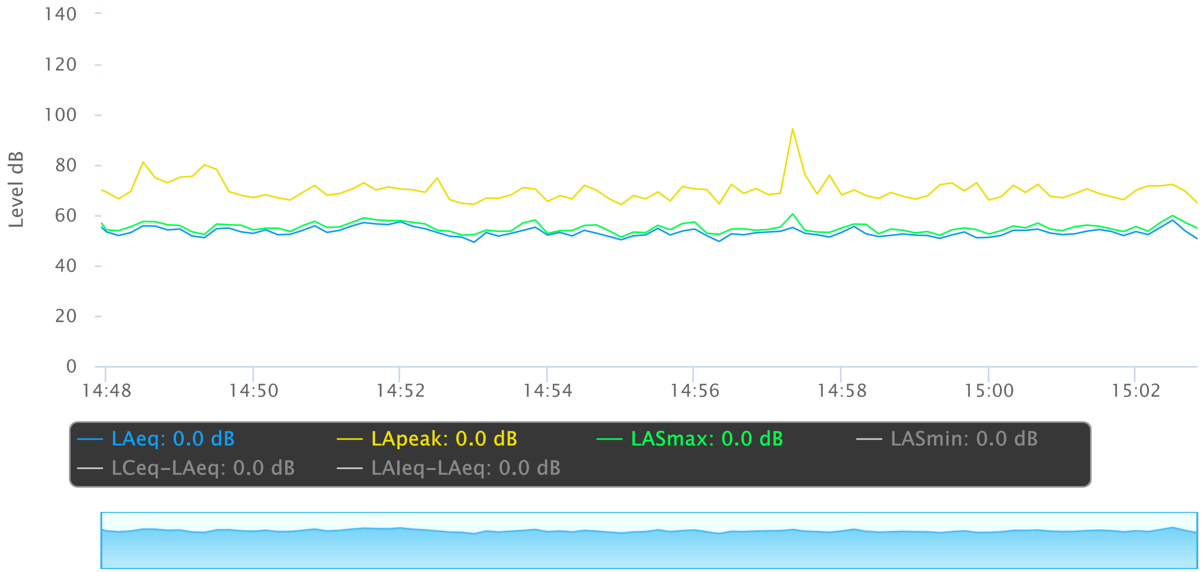
Any Data	A		C		Z	
	Level	Time Stamp	Level	Time Stamp	Level	Time Stamp
L_{eq}	53.5 dB		65.9 dB		--- dB	
$Ls_{(max)}$	60.5 dB	2022-11-29 14:57:27	--- dB		--- dB	
$LS_{(min)}$	48.1 dB	2022-11-29 14:56:25	--- dB		--- dB	
$L_{Peak(max)}$	94.3 dB	2022-11-29 14:57:27	--- dB		--- dB	

Overloads	Count	Duration	OBA Count	OBA Duration
	0	0:00:00.0	0	0:00:00.0

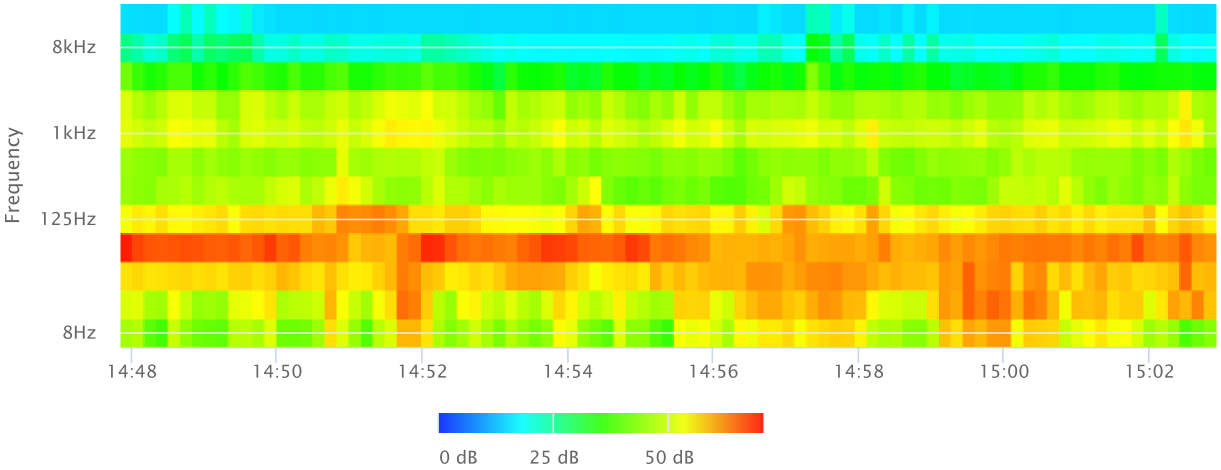
Statistics

LAS 2.0	57.5 dB
LAS 8.0	56.0 dB
LAS 25.0	54.3 dB
LAS 50.0	52.9 dB
LAS 66.6	52.1 dB
LAS 90.0	50.8 dB

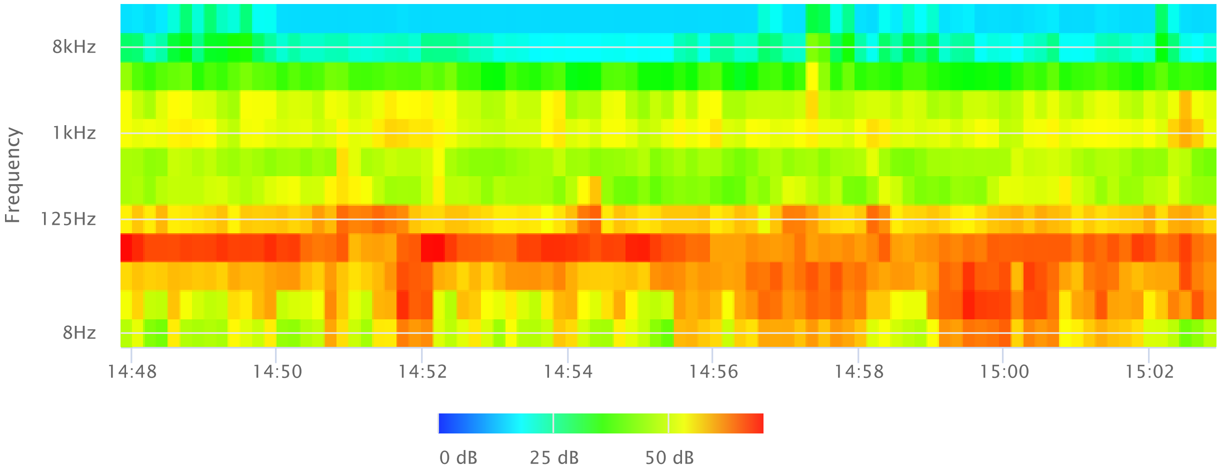
Time History



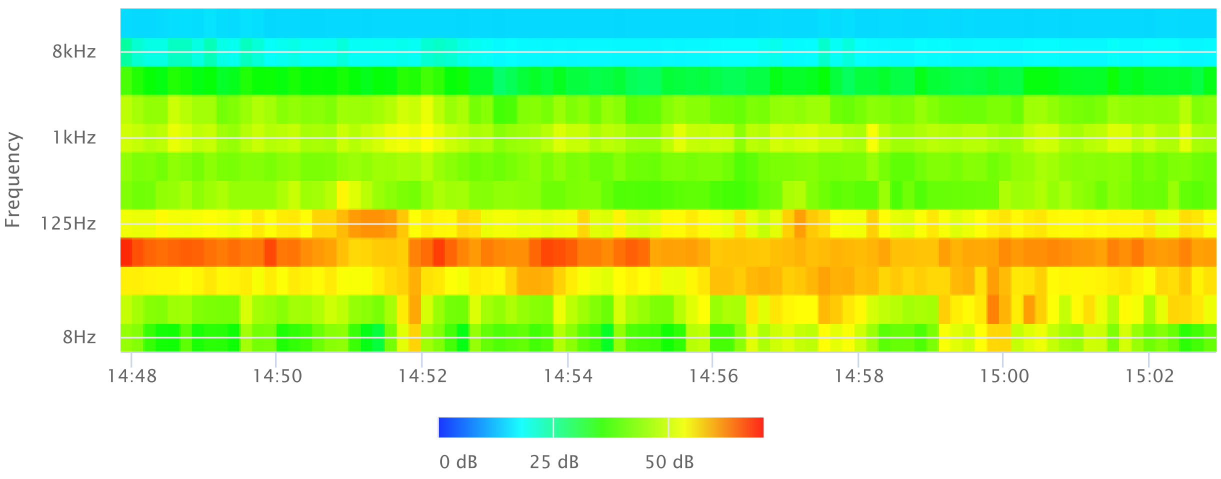
OBA 1/1 Leq



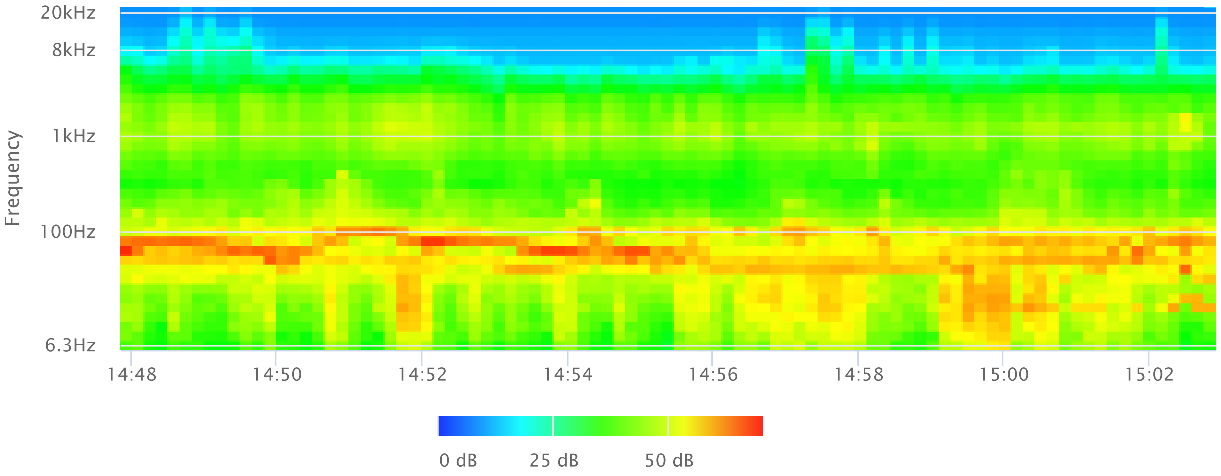
OBA 1/1 Lmax



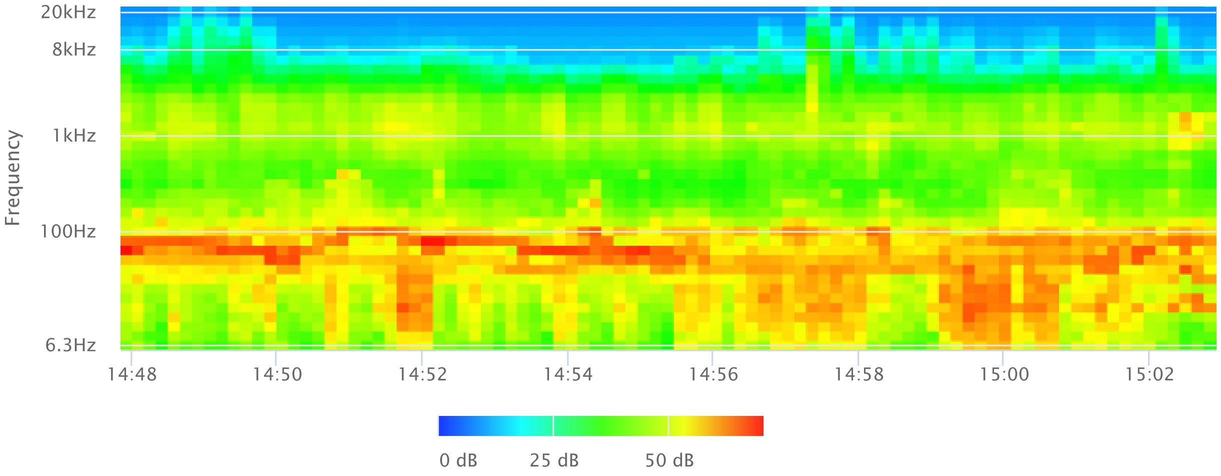
OBA 1/1 Lmin



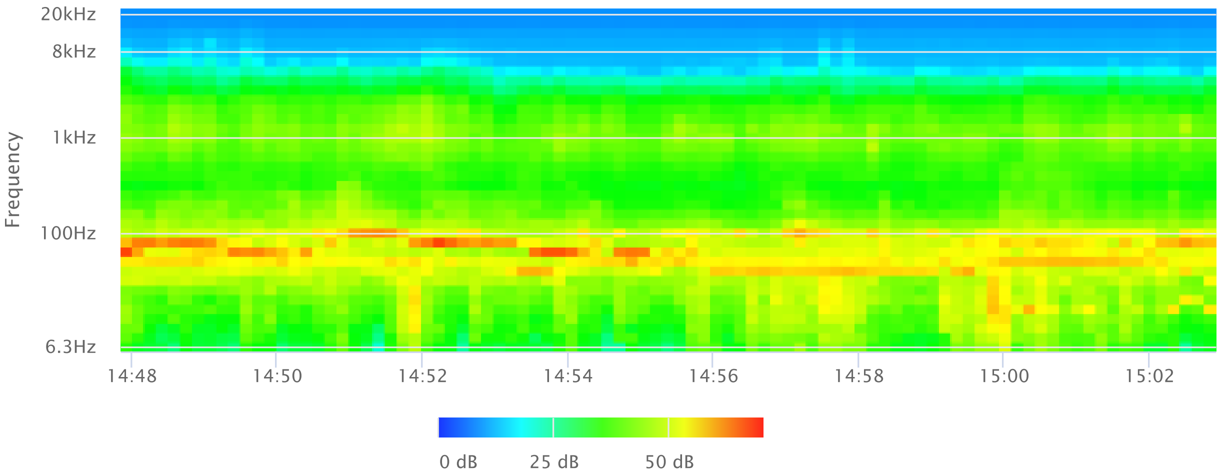
OBA 1/3 Leq



OBA 1/3 Lmax



OBA 1/3 Lmin


20kHz
8kHz
1kHz
Frequency
100Hz
6.3Hz
14:48
14:50
14:52
14:54
14:56
14:58
15:00
15:02
0 dB
25 dB
50 dB

Noise Measurement
Field Data

Project Name: Big Bear Bus Maintenance Facility, City of Big Bear Lake. **Date:** November 29, 2022

Project #: 19574

Noise Measurement #: STNM6 Run Time: 15 minutes (1 x 15 minutes) **Technician:** Ian Edward Gallagher

Nearest Address or Cross Street: Middle of NE edge of site area, Sandalwood Dr & Business Center Dr.

Site Description (Type of Existing Land Use and any other notable features): Measurement Site: Taken near middle of eastern proprety line of site area, along Sandalwood Drive. Adjacent: Active construction zone to the E (across Sandalwood Drive). Vacant project site to west, Sandalwood Drive to east w/ construction further east, & Business Center Drive to south.

Weather: Clear skies, sunny. Sunset: 4:38 PM **Settings:** [✓ SLOW] FAST

Temperature: 45 deg F **Wind:** 8 mph **Humidity:** 28% **Terrain:** Flat

Start Time: 3:12 PM **End Time:** 3:27 PM **Run Time:**

Leq: 60.1 dB

Lmax 71 dB

L2 65.8 dB

L8 63.5 dB

L25 60.9 dB

L50 58.6 dB

Primary Noise Source: Traffice ambiance from the 48 vehicles passing microphone, traveling on Sandalwood Dr Noise from construction equipment ~740' SE of STNM6.

Secondary Noise Sources: Occasional overhead air traffic. Slight residential ambiance. Buses arriving and leaving site area.

NOISE METER: SoundTrack LXT Class 1
MAKE: Larson Davis
MODEL: LXT1
SERIAL NUMBER: 3099
FACTORY CALIBRATION DATE: 11/17/2021
FIELD CALIBRATION DATE: 11/29/2022

CALIBRATOR: Larson Davis CA 250
MAKE: Larson Davis
MODEL: CA 250
SERIAL NUMBER: 2723
FACTORY CALIBRATION DATE: 11/18/2021

Noise Measurement
Field Data

PHOTOS:

STNM6 looking ENE across Sandalwood Drive across construction site area towards Interlaken Shopping Center, Big Bear Lake (~680').

STNM6 looking SE across Sandalwood Dr & Business Center Dr intersection towards area of active constructions site. Heavy dirt moving and dirt processing equipment ~740' SE.

Summary

File Name on Meter	LxT_Data.165.s
File Name on PC	LxT_0003099-20221129 151204-LxT_Data.165.ldbin
Serial Number	3099
Model	SoundTrack LxT®
Firmware Version	2.404
User	Ian Edward Gallagher
Location	STNM6 34°15'2.98"N 116°53'17.19"W
Job Description	15 minute noise measurement (1 x 15 minutes)
Note	Ganddini Project 19574 Bus Maintenance Facility, City of Big Bear Lake

Measurement

Start	2022-11-29 15:12:04
Stop	2022-11-29 15:27:04
Duration	00:15:00.0
Run Time	00:15:00.0
Pause	00:00:00.0
Pre-Calibration	2022-11-29 15:11:31
Post-Calibration	None

Overall Settings

RMS Weight	A Weighting
Peak Weight	A Weighting
Detector	Slow
Preamplifier	PRMLxT1L
Microphone Correction	Off
Integration Method	Linear
OBA Range	Normal
OBA Bandwidth	1/1 and 1/3
OBA Frequency Weighting	C Weighting
OBA Max Spectrum	At LMax
Overload	122.4 dB

Results

LAeq	60.1	
LAE	89.6	
EA	102.1065 µPa²h	
EA8	3.267407 mPa²h	
EA40	16.33703 mPa²h	
LApeak (max)	2022-11-29 15:12:38	100.7 dB
LASmax	2022-11-29 15:12:38	71.0 dB
LASmin	2022-11-29 15:16:52	51.3 dB

LCeq	69.7 dB
LAeq	60.1 dB
LCeq - LAeq	9.6 dB
LAIeq	62.3 dB
LAeq	60.1 dB
LAIeq - LAeq	2.2 dB
Overload Count	0

Statistics

LA2.00	65.8 dB
LA8.00	63.5 dB
LA25.00	60.9 dB
LA50.00	58.6 dB
LA66.60	56.8 dB
LA90.00	54.3 dB

Measurement Report

Report Summary

Meter's File Name	LxT_Data.165.s	Computer's File Name	LxT_0003099-20221129 151204-LxT_Data.165.ldbin
Meter	LxT1 0003099		
Firmware	2.404		
User	Ian Edward Gallagher	Location	STNM6 34°15'2.98"N 116°53'17.19"W
Job Description	15 minute noise measurement (1 x 15 minutes)		
Note	Ganddini Project 19574 Bus Maintenance Facility, City of Big Bear Lake		

Start Time	2022-11-29 15:12:04	Duration	0:15:00.0		
End Time	2022-11-29 15:27:04	Run Time	0:15:00.0	Pause Time	0:00:00.0

Results

Overall Metrics

LA_{eq}	60.1 dB		
LAE	89.6 dB	SEA	--- dB
EA	102.1 µPa²h	LAFTM5	63.4 dB
EA8	3.3 mPa²h		
EA40	16.3 mPa²h		
LA_{peak}	100.7 dB	2022-11-29 15:12:38	
LAS_{max}	71.0 dB	2022-11-29 15:12:38	
LAS_{min}	51.3 dB	2022-11-29 15:16:52	
LA_{eq}	60.1 dB		
LC_{eq}	69.7 dB	LC_{eq} - LA_{eq}	9.6 dB
LAI_{eq}	62.3 dB	LAI_{eq} - LA_{eq}	2.2 dB

Exceedances	Count	Duration
LAS > 65.0 dB	8	0:00:58.1
LAS > 85.0 dB	0	0:00:00.0
LApeak > 135.0 dB	0	0:00:00.0
LApeak > 137.0 dB	0	0:00:00.0
LApeak > 140.0 dB	0	0:00:00.0

Community Noise	LDN	LDay	LNight	
	--- dB	--- dB	0.0 dB	
	LDEN	LDay	LEve	LNight
	--- dB	--- dB	--- dB	--- dB

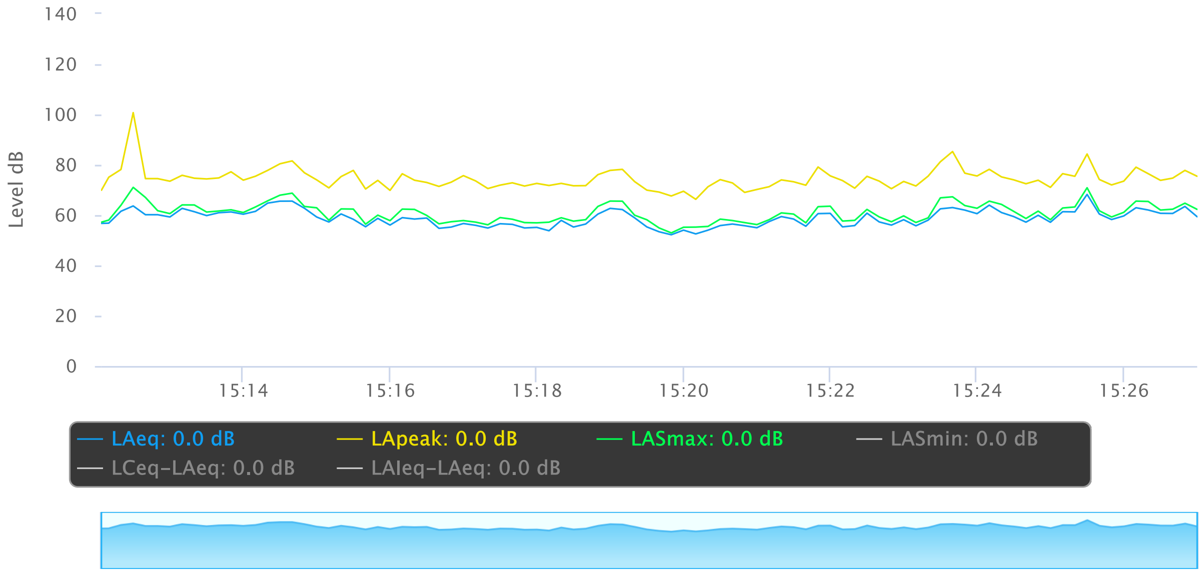
Any Data	A		C		Z	
	Level	Time Stamp	Level	Time Stamp	Level	Time Stamp
L_{eq}	60.1 dB		69.7 dB		--- dB	
$Ls_{(max)}$	71.0 dB	2022-11-29 15:12:38	--- dB		--- dB	
$LS_{(min)}$	51.3 dB	2022-11-29 15:16:52	--- dB		--- dB	
$L_{Peak(max)}$	100.7 dB	2022-11-29 15:12:38	--- dB		--- dB	

Overloads	Count	Duration	OBA Count	OBA Duration
	0	0:00:00.0	0	0:00:00.0

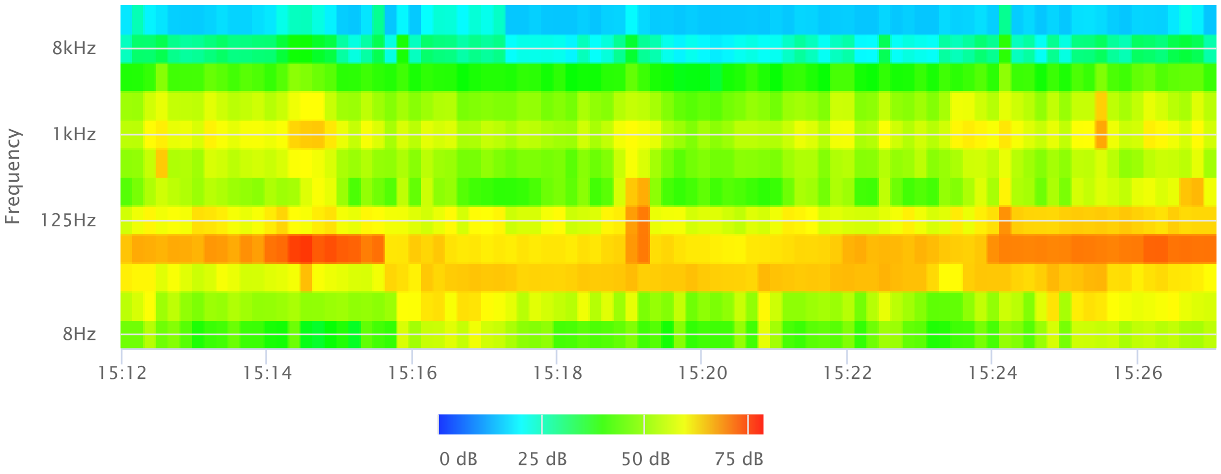
Statistics

LAS 2.0	65.8 dB
LAS 8.0	63.5 dB
LAS 25.0	60.9 dB
LAS 50.0	58.6 dB
LAS 66.6	56.8 dB
LAS 90.0	54.3 dB

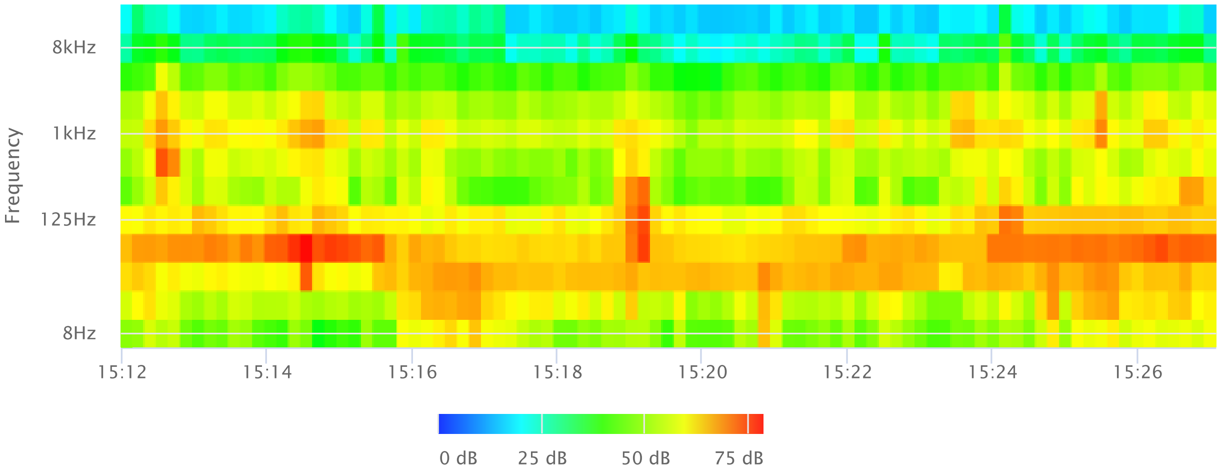
Time History



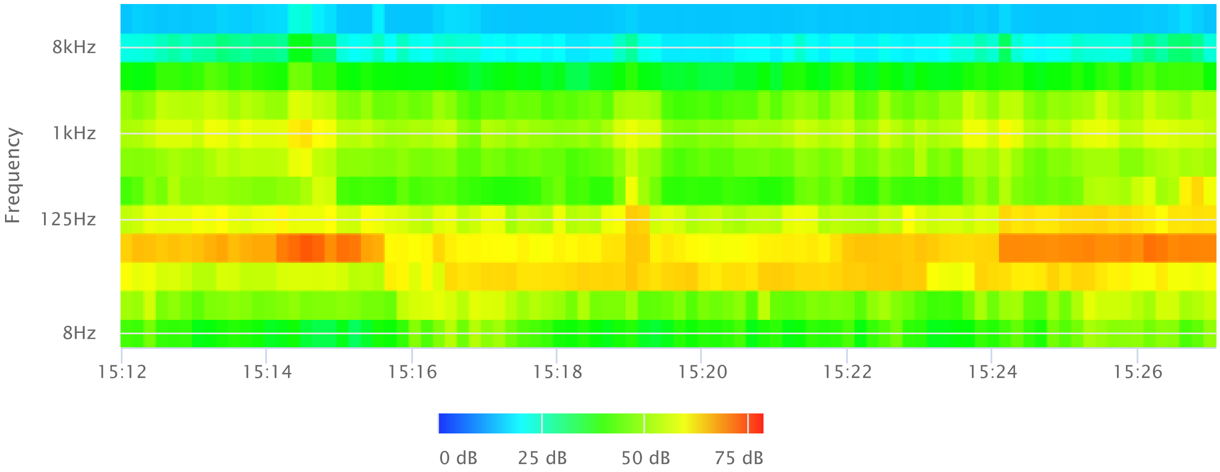
OBA 1/1 Leq



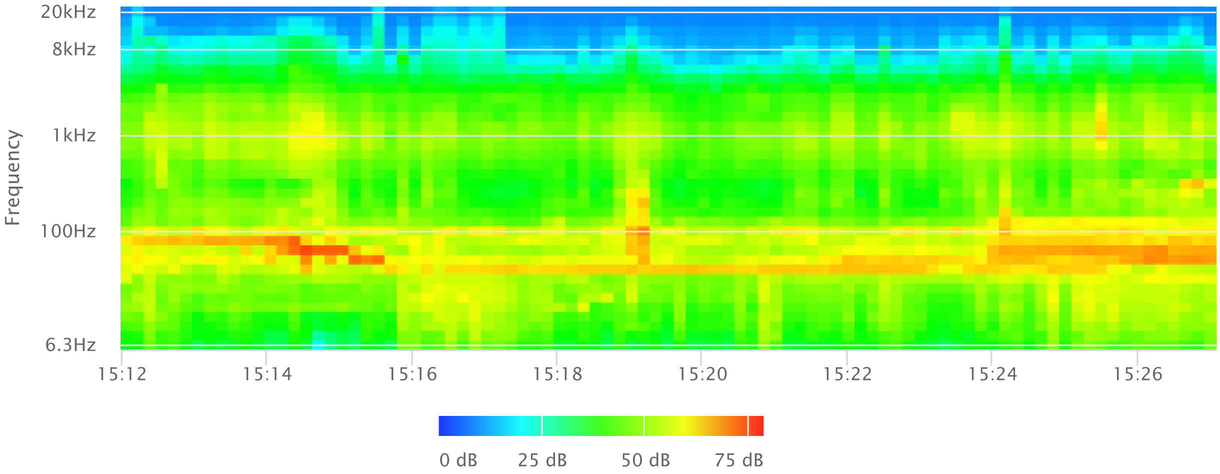
OBA 1/1 Lmax



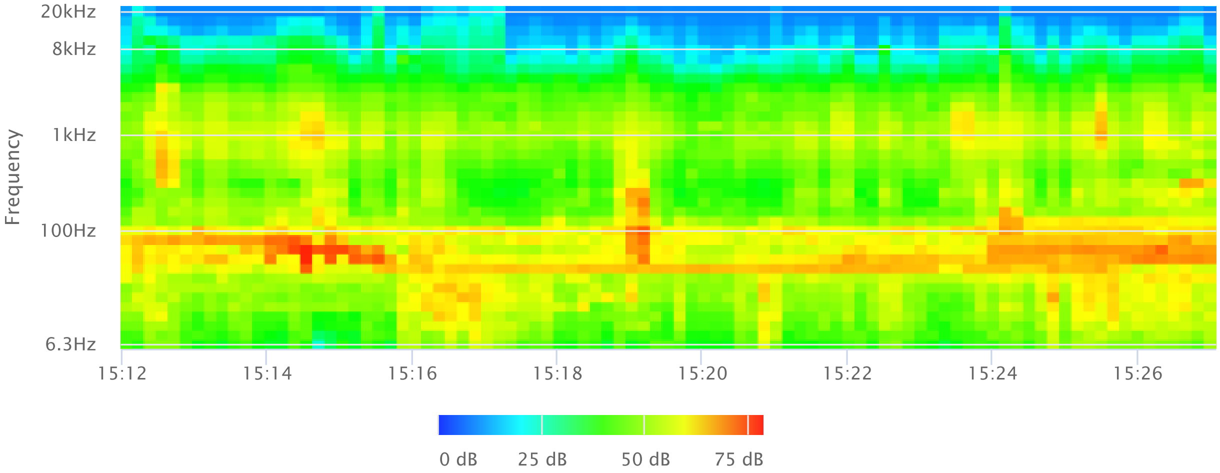
OBA 1/1 Lmin



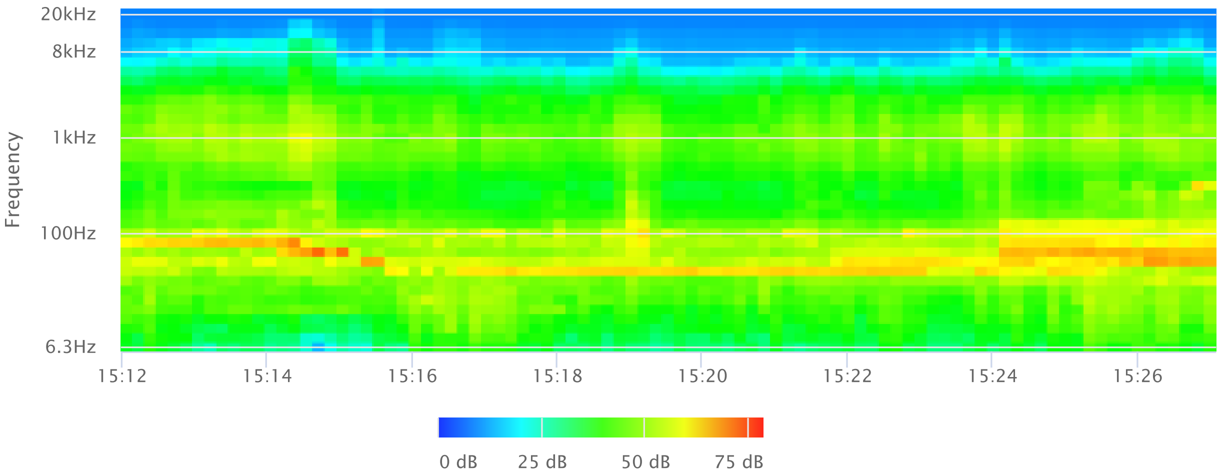
OBA 1/3 Leq



OBA 1/3 Lmax



OBA 1/3 Lmin


20kHz
8kHz
1kHz
100Hz
6.3Hz
Frequency
15:12
15:14
15:16
15:18
15:20
15:22
15:24
15:26
0 dB
25 dB
50 dB
75 dB

Noise Measurement
Field Data

Project Name: Big Bear Bus Maintenance Facility, City of Big Bear Lake. **Date:** November 29, 2022

Project #: 19574

Noise Measurement #: STNM7 Run Time: 15 minutes (1 x 15 minutes) **Technician:** Ian Edward Gallagher

Nearest Address or Cross Street: 140 Business Center Drive, Big Bear Lake, CA 92135

Site Description (Type of Existing Land Use and any other notable features): Measurement Site: Taken along the SE project property line. Adjacent: Active construction zone to the E (across Sandalwood Drive). Vacant project site to north, Business Center Drive to east, Commercial (Southwest Gas) to south, with associated parking lot, & commercial to west.

Weather: Clear skies, sunny. Sunset: 4:38 PM **Settings:** [✓ SLOW] FAST

Temperature: 45 deg F **Wind:** 8 mph **Humidity:** 28% **Terrain:** Flat

Start Time: 3:38 PM **End Time:** 3:53 PM **Run Time:**

Leq: 53.9 dB

Lmax 68.2 dB

L2 57.6 dB

L8 56.0 dB

L25 54.4 dB

L50 53.3 dB

Primary Noise Source: Traffice ambiance from vehicles passing microphone, traveling on Sandalwood Dr.
Noise from construction equipment ~800' E of STNM7.

Secondary Noise Sources: Occasional overhead air traffic. Slight residential ambiance. Buses arriving and leaving site area.

NOISE METER: SoundTrack LXT Class 1
MAKE: Larson Davis
MODEL: LXT1
SERIAL NUMBER: 3099
FACTORY CALIBRATION DATE: 11/17/2021
FIELD CALIBRATION DATE: 11/29/2022

CALIBRATOR: Larson Davis CA 250
MAKE: Larson Davis
MODEL: CA 250
SERIAL NUMBER: 2723
FACTORY CALIBRATION DATE: 11/18/2021

Noise Measurement
Field Data

PHOTOS:

STNM7 looking SSE across asphalt parking lot to building 140 Business Center Drive, Big Bear Lake.

STNM7 looking ENE across Business Center Dr & Sandalwood Dr towards Interlaken shopping Center, Big Bear Lake (~1,050').

Summary

File Name on Meter	LxT_Data.166.s
File Name on PC	LxT_0003099-20221129 153831-LxT_Data.166.ldbin
Serial Number	3099
Model	SoundTrack LxT®
Firmware Version	2.404
User	Ian Edward Gallagher
Location	STNM7 34°14'59.41"N 116°53'19.76"W
Job Description	15 minute noise measurement (1 x 15 minutes)
Note	Ganddini Project 19574 Bus Maintenance Facility, City of Big Bear Lake

Measurement

Start	2022-11-29 15:38:31
Stop	2022-11-29 15:53:31
Duration	00:15:00.0
Run Time	00:15:00.0
Pause	00:00:00.0
Pre-Calibration	2022-11-29 15:38:11
Post-Calibration	None

Overall Settings

RMS Weight	A Weighting
Peak Weight	A Weighting
Detector	Slow
Preamplifier	PRMLxT1L
Microphone Correction	Off
Integration Method	Linear
OBA Range	Normal
OBA Bandwidth	1/1 and 1/3
OBA Frequency Weighting	C Weighting
OBA Max Spectrum	At LMax
Overload	122.3 dB

Results

LAeq	53.9	
LAE	83.5	
EA	24.60766 µPa²h	
EA8	787.4452 µPa²h	
EA40	3.937226 mPa²h	
LApeak (max)	2022-11-29 15:53:15	96.5 dB
LASmax	2022-11-29 15:53:15	68.2 dB
LASmin	2022-11-29 15:51:01	49.6 dB

		Statistics	
LCeq	68.6 dB	**LA2.00**	57.6 dB
LAeq	53.9 dB	**LA8.00**	56.0 dB
LCeq - LAeq	14.7 dB	**LA25.00**	54.4 dB
LAIeq	56.9 dB	**LA50.00**	53.3 dB
LAeq	53.9 dB	**LA66.60**	52.6 dB
LAIeq - LAeq	3.0 dB	**LA90.00**	51.5 dB
Overload Count	0		

Measurement Report

Report Summary

Meter's File Name	LxT_Data.166.s	Computer's File Name	LxT_0003099-20221129 153831-LxT_Data.166.ldbin
Meter	LxT1 0003099		
Firmware	2.404		
User	Ian Edward Gallagher	Location	STNM7 34°14'59.41"N 116°53'19.76"W
Job Description	15 minute noise measurement (1 x 15 minutes)		
Note	Ganddini Project 19574 Bus Maintenance Facilty, City of Big Bear Lake		

Start Time	2022-11-29 15:38:31	Duration	0:15:00.0		
End Time	2022-11-29 15:53:31	Run Time	0:15:00.0	Pause Time	0:00:00.0

Results

Overall Metrics

LA_{eq}	53.9 dB		
LAE	83.5 dB	SEA	--- dB
EA	24.6 µPa²h	LAFTM5	57.8 dB
EA8	787.4 µPa²h		
EA40	3.9 mPa²h		

LA_{peak}	96.5 dB	2022-11-29 15:53:15
LAS_{max}	68.2 dB	2022-11-29 15:53:15
LAS_{min}	49.6 dB	2022-11-29 15:51:01

LA_{eq}	53.9 dB		
LC_{eq}	68.6 dB	LC_{eq} - LA_{eq}	14.7 dB
LAI_{eq}	56.9 dB	LAI_{eq} - LA_{eq}	3.0 dB

Exceedances	Count	Duration
LAS > 65.0 dB	1	0:00:01.6
LAS > 85.0 dB	0	0:00:00.0
LApeak > 135.0 dB	0	0:00:00.0
LApeak > 137.0 dB	0	0:00:00.0
LApeak > 140.0 dB	0	0:00:00.0

Community Noise	LDN	LDay	LNight	
	--- dB	--- dB	0.0 dB	
	LDEN	LDay	LEve	LNight
	--- dB	--- dB	--- dB	--- dB

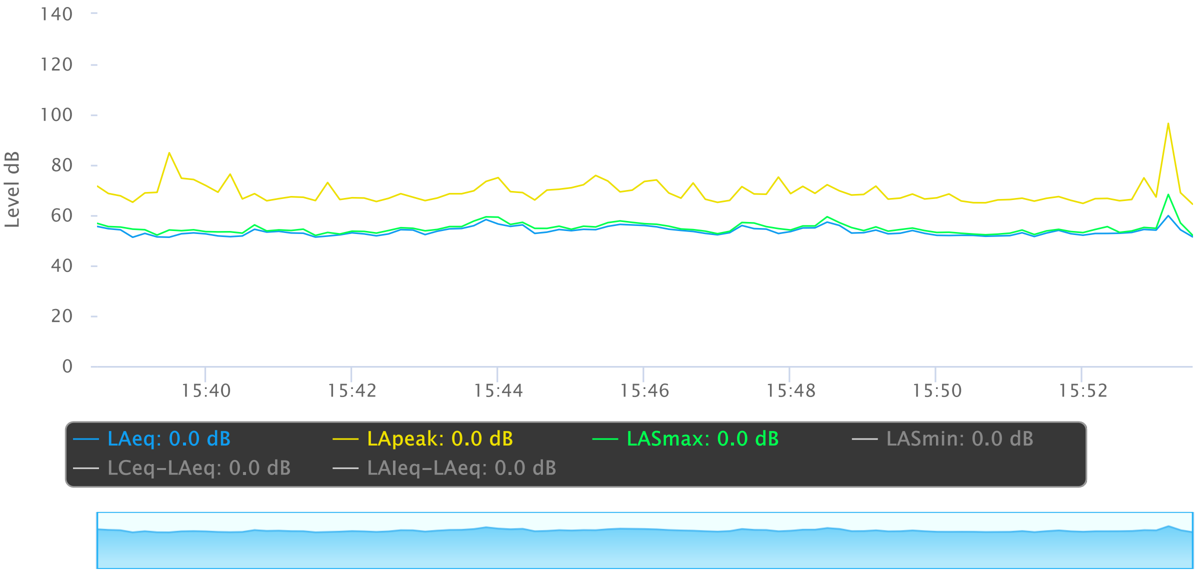
Any Data	A		C		Z	
	Level	Time Stamp	Level	Time Stamp	Level	Time Stamp
L_{eq}	53.9 dB		68.6 dB		--- dB	
$Ls_{(max)}$	68.2 dB	2022-11-29 15:53:15	--- dB		--- dB	
$LS_{(min)}$	49.6 dB	2022-11-29 15:51:01	--- dB		--- dB	
$L_{Peak(max)}$	96.5 dB	2022-11-29 15:53:15	--- dB		--- dB	

Overloads	Count	Duration	OBA Count	OBA Duration
	0	0:00:00.0	0	0:00:00.0

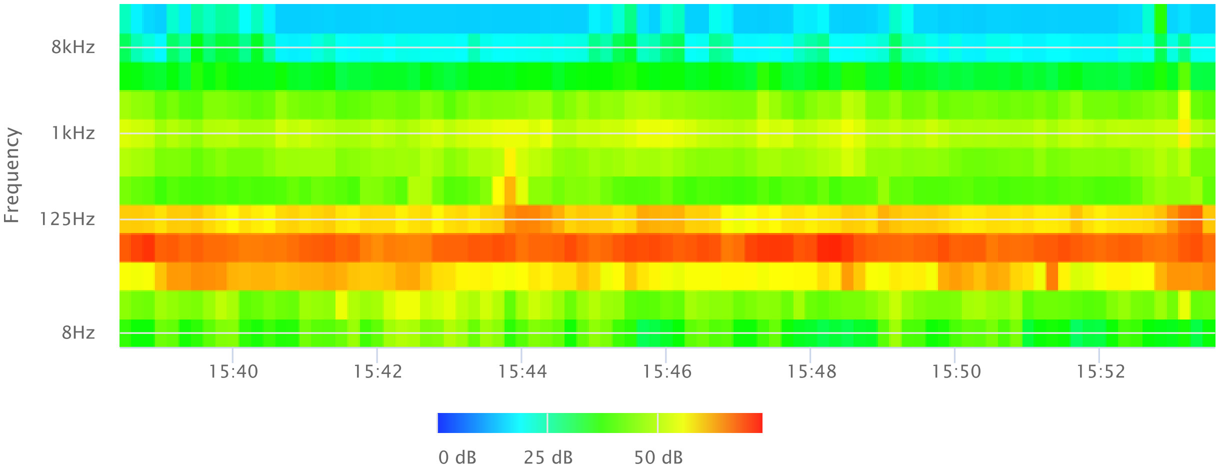
Statistics

LAS 2.0	57.6 dB
LAS 8.0	56.0 dB
LAS 25.0	54.4 dB
LAS 50.0	53.3 dB
LAS 66.6	52.6 dB
LAS 90.0	51.5 dB

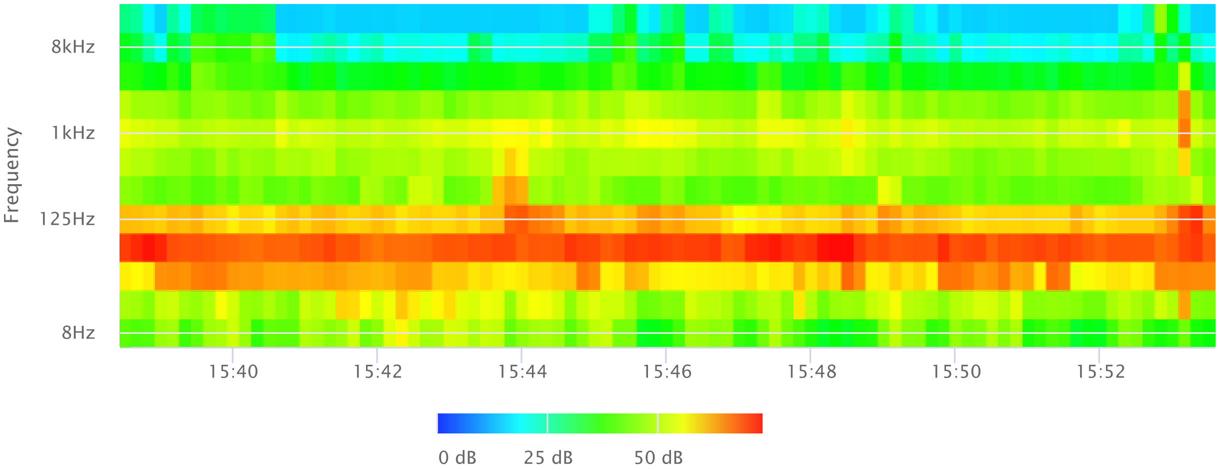
Time History



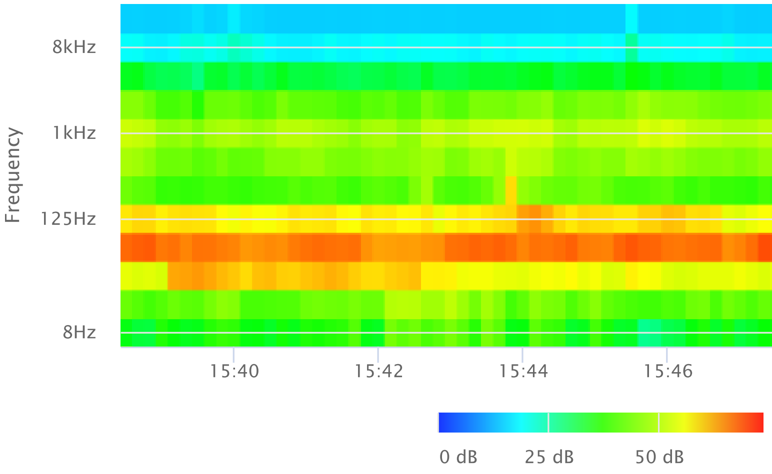
OBA 1/1 Leq



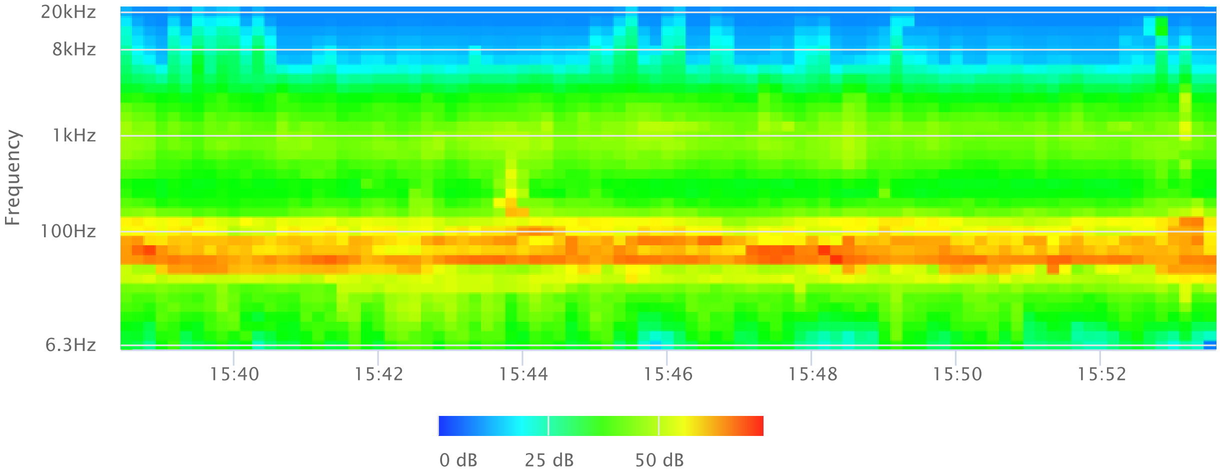
OBA 1/1 Lmax



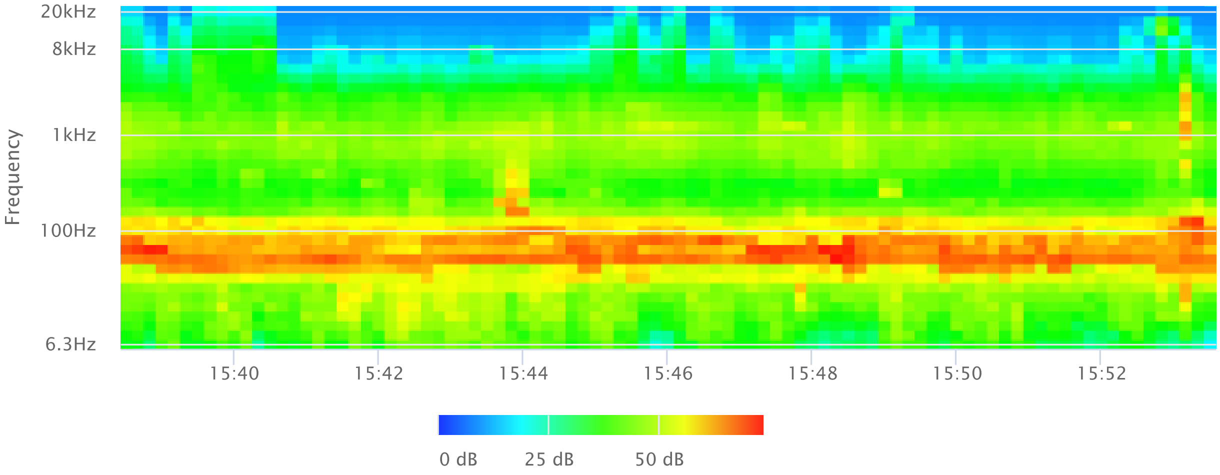
OBA 1/1 Lmin



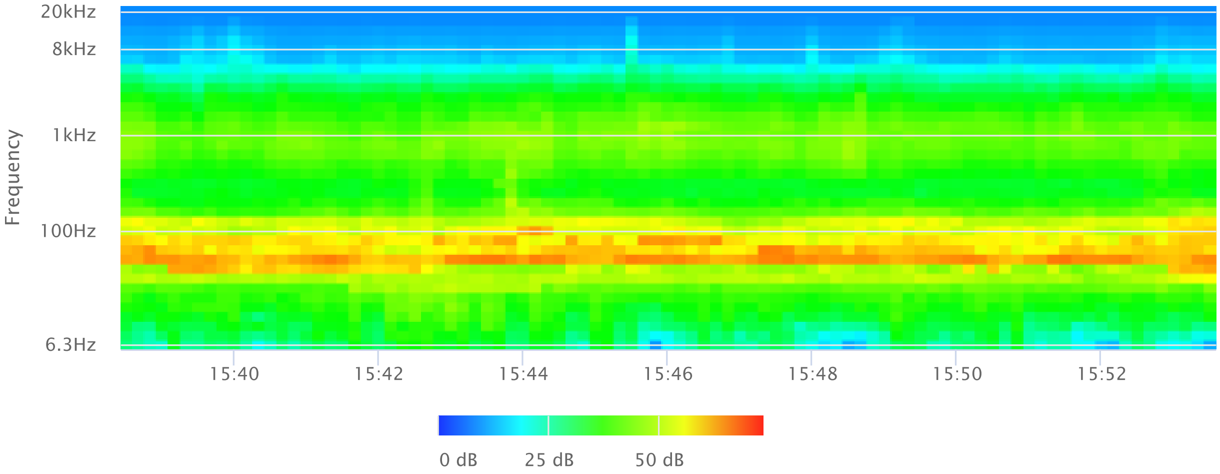
OBA 1/3 Leq



OBA 1/3 Lmax



OBA 1/3 Lmin



20kHz
8kHz
1kHz
100Hz
6.3Hz
Frequency
15:40
15:42
15:44
15:46
15:48
15:50
15:52
0 dB
25 dB
50 dB

Noise Measurement
Field Data

Project Name: Big Bear Bus Maintenance Facility, City of Big Bear Lake. **Date:** November 29, 2022

Project #: 19574

Noise Measurement #: STNM8 Run Time: 15 minutes (1 x 15 minutes) **Technician:** Ian Edward Gallagher

Nearest Address or Cross Street: Middle of SW edge of site, 34°15'0.31"N 116°53'22.14"W

Site Description (Type of Existing Land Use and any other notable features): Measurement Site: Taken near center of western project boundary. Adjacent: Active construction zone to the E (across Sandalwood Drive). Vacant project site to east, vacant land to northwest, commercial uses to southwest, with residnetial and vacant land further west/southwest.

Weather: Clear skies, sunny. Sunset: 4:38 PM **Settings:** [✓ SLOW] FAST

Temperature: 45 deg F **Wind:** 8 mph **Humidity:** 28% **Terrain:** Flat

Start Time: 4:08 PM **End Time:** 4:23 PM **Run Time:**

Leq: 51.4 dB **Primary Noise Source:** Traffice ambiance from vehicles passing microphone, traveling on Sandalwood Dr.

Lmax 60 dB Noise from construction equipment ~800' ESE of STNM8.

L2 57.4 dB **Secondary Noise Sources:** Occasional overhead air traffic. Slight residential ambiance. Buses arriving and

L8 54.1 dB leaving site area.

L25 51.9 dB

L50 50.2 dB

NOISE METER: SoundTrack LXT Class 1 **CALIBRATOR:** Larson Davis CA 250

MAKE: Larson Davis **MAKE:** Larson Davis

MODEL: LXT1 **MODEL:** CA 250

SERIAL NUMBER: 3099 **SERIAL NUMBER:** 2723

FACTORY CALIBRATION DATE: 11/17/2021 **FACTORY CALIBRATION DATE:** 11/18/2021

FIELD CALIBRATION DATE: 11/29/2022

Noise Measurement
Field Data

PHOTOS:

STNM8 looking SSE along SW edge of site towards building 140 Business Center Drive (~ 280').

STNM8 looking ENE across site area & Sandalwood Drive towards Interlaken Shopping Center, Big Bear Lake (~1,200').

Summary

File Name on Meter	LxT_Data.167.s
File Name on PC	LxT_0003099-20221129 160827-LxT_Data.167.ldbin
Serial Number	3099
Model	SoundTrack LxT®
Firmware Version	2.404
User	Ian Edward Gallagher
Location	STNM8 34°15'0.31"N 116°53'22.14"W
Job Description	15 minute noise measurement (1 x 15 minutes)
Note	Ganddini Project 19574 Bus Maintenance Facility, City of Big Bear Lake

Measurement

Start	2022-11-29 16:08:27
Stop	2022-11-29 16:23:27
Duration	00:15:00.0
Run Time	00:15:00.0
Pause	00:00:00.0
Pre-Calibration	2022-11-29 16:07:50
Post-Calibration	None

Overall Settings

RMS Weight	A Weighting
Peak Weight	A Weighting
Detector	Slow
Preamplifier	PRMLxT1L
Microphone Correction	Off
Integration Method	Linear
OBA Range	Normal
OBA Bandwidth	1/1 and 1/3
OBA Frequency Weighting	C Weighting
OBA Max Spectrum	At LMax
Overload	122.3 dB

Results

LAeq	51.4	
LAE	80.9	
EA	13.70417 µPa²h	
EA8	438.5334 µPa²h	
EA40	2.192667 mPa²h	
LApeak (max)	2022-11-29 16:17:08	80.8 dB
LASmax	2022-11-29 16:18:16	60.0 dB
LASmin	2022-11-29 16:23:11	45.5 dB

		Statistics	
LCeq	64.3 dB	**LA2.00**	57.4 dB
LAeq	51.4 dB	**LA8.00**	54.1 dB
LCeq - LAeq	12.9 dB	**LA25.00**	51.9 dB
LAIeq	52.5 dB	**LA50.00**	50.2 dB
LAeq	51.4 dB	**LA66.60**	49.3 dB
LAIeq - LAeq	1.2 dB	**LA90.00**	47.4 dB
Overload Count	0		

Measurement Report

Report Summary

Meter's File Name	LxT_Data.167.s	Computer's File Name	LxT_0003099-20221129 160827-LxT_Data.167.ldbin
Meter	LxT1 0003099		
Firmware	2.404		
User	Ian Edward Gallagher	Location	STNM8 34°15'0.31"N 116°53'22.14"W
Job Description	15 minute noise measurement (1 x 15 minutes)		
Note	Ganddini Project 19574 Bus Maintenance Faciluty, City of Big Bear Lake		

Start Time	2022-11-29 16:08:27	Duration	0:15:00.0		
End Time	2022-11-29 16:23:27	Run Time	0:15:00.0	Pause Time	0:00:00.0

Results

Overall Metrics

LA_{eq}	51.4 dB		
LAE	80.9 dB	SEA	--- dB
EA	13.7 μPa^{2}h	LAFTM5	53.8 dB
EA8	438.5 μPa^{2}h		
EA40	2.2 mPa^{2}h		
LA_{peak}	80.8 dB	2022-11-29 16:17:08	
LAS_{max}	60.0 dB	2022-11-29 16:18:16	
LAS_{min}	45.5 dB	2022-11-29 16:23:11	
LA_{eq}	51.4 dB		
LC_{eq}	64.3 dB	LC_{eq} - LA_{eq}	12.9 dB
LAI_{eq}	52.5 dB	LAI_{eq} - LA_{eq}	1.2 dB

Exceedances	Count	Duration
LAS > 65.0 dB	0	0:00:00.0
LAS > 85.0 dB	0	0:00:00.0
LApeak > 135.0 dB	0	0:00:00.0
LApeak > 137.0 dB	0	0:00:00.0
LApeak > 140.0 dB	0	0:00:00.0

Community Noise	LDN	LDay	LNight	
	--- dB	--- dB	0.0 dB	
	LDEN	LDay	LEve	LNight
	--- dB	--- dB	--- dB	--- dB

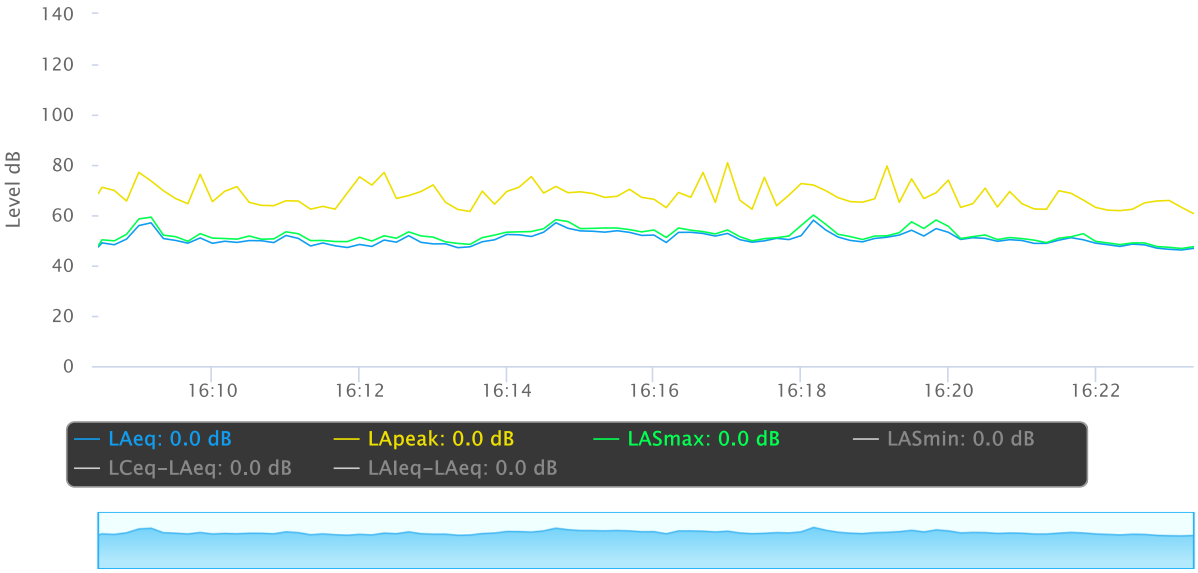
Any Data	A		C		Z	
	Level	Time Stamp	Level	Time Stamp	Level	Time Stamp
L_{eq}	51.4 dB		64.3 dB		--- dB	
$Ls_{(max)}$	60.0 dB	2022-11-29 16:18:16	--- dB		--- dB	
$LS_{(min)}$	45.5 dB	2022-11-29 16:23:11	--- dB		--- dB	
$L_{Peak(max)}$	80.8 dB	2022-11-29 16:17:08	--- dB		--- dB	

Overloads	Count	Duration	OBA Count	OBA Duration
	0	0:00:00.0	0	0:00:00.0

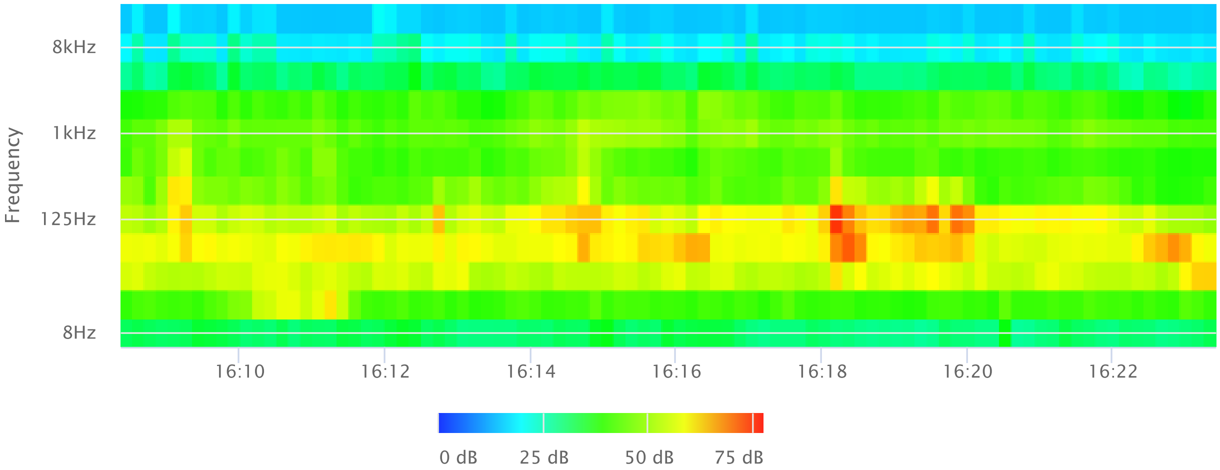
Statistics

LAS 2.0	57.4 dB
LAS 8.0	54.1 dB
LAS 25.0	51.9 dB
LAS 50.0	50.2 dB
LAS 66.6	49.3 dB
LAS 90.0	47.4 dB

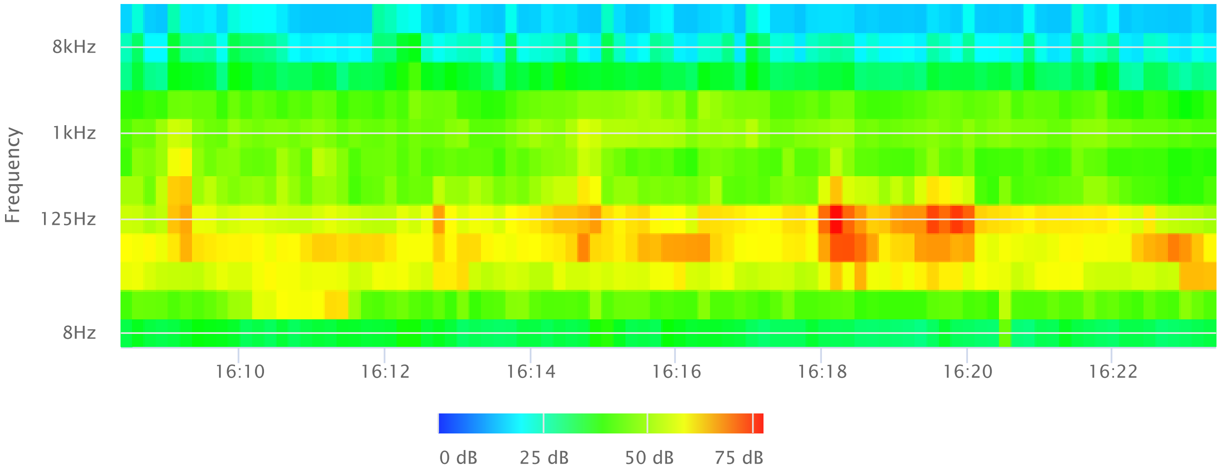
Time History



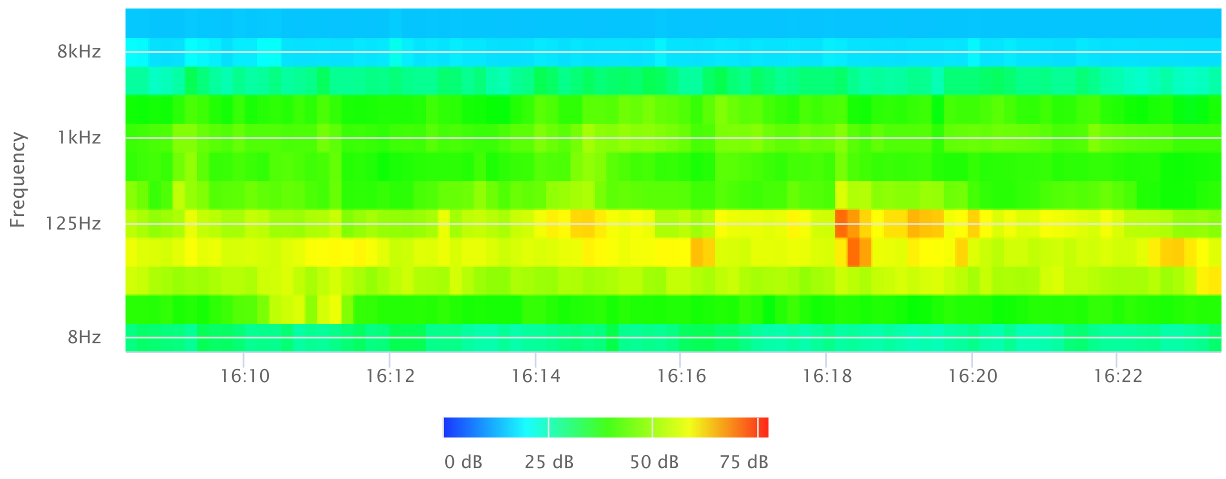
OBA 1/1 Leq



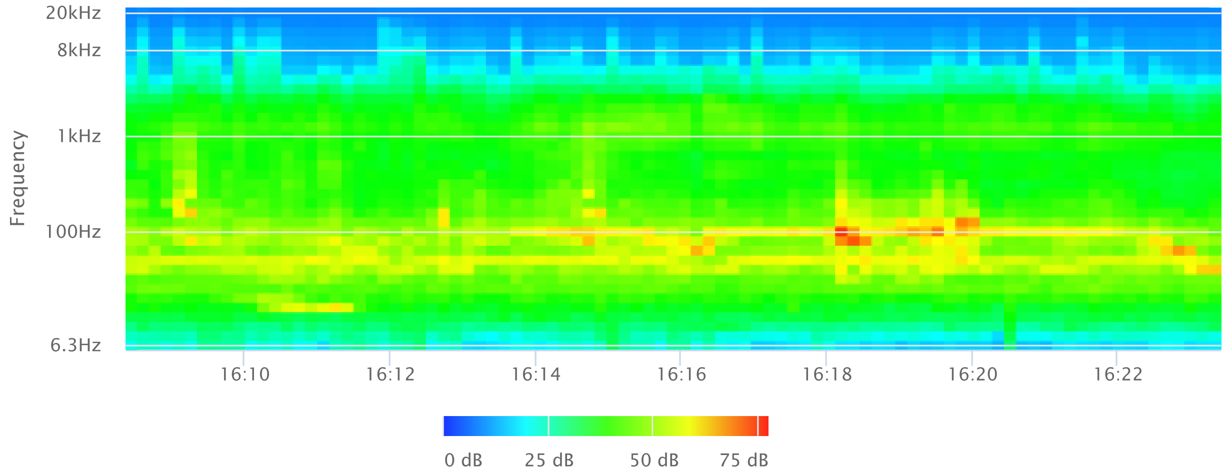
OBA 1/1 Lmax



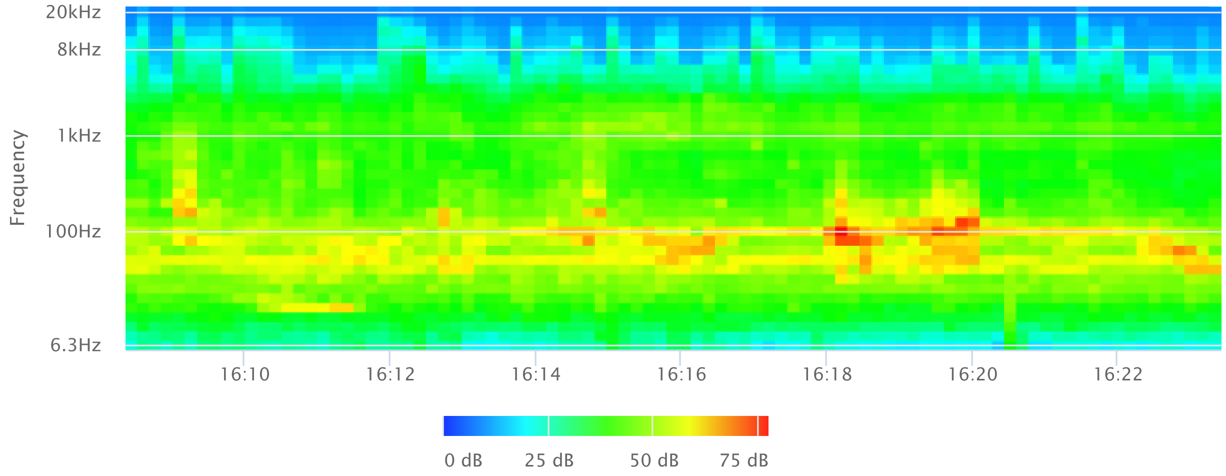
OBA 1/1 Lmin



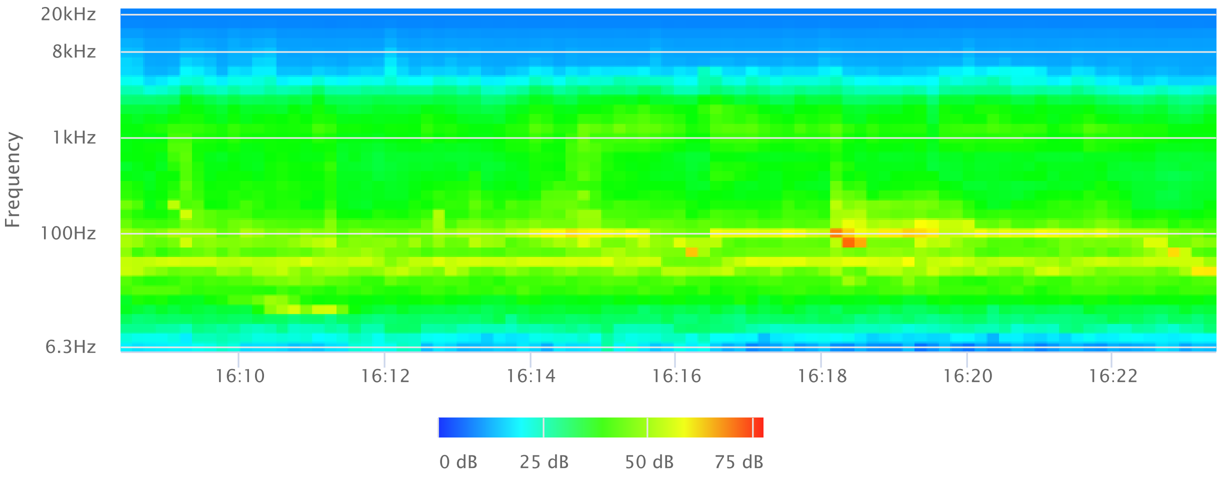
OBA 1/3 Leq



OBA 1/3 Lmax



OBA 1/3 Lmin


20kHz
8kHz
1kHz
Frequency
100Hz
6.3Hz
16:10
16:12
16:14
16:16
16:18
16:20
16:22
0 dB
25 dB
50 dB
75 dB

Noise Measurement
Field Data

Project Name: Big Bear Bus Maintenance Facility, City of Big Bear Lake. **Date:** November 29-30,2022

Project #: 19574

Noise Measurement #: LTNM1 Run Time: 24 hours (24 x 1 hours) **Technician:** Ian Edward Gallagher

Nearest Address or Cross Street: NW corner of site area, 34°15'1.69"N 116°53'23.36"W

Site Description (Type of Existing Land Use and any other notable features): Measurement Site: Taken within NW corner of project site.

Adjacent: Vacant land to N & W, project site to E & S, with commercial further south, and commercial and residential SW. Active construction zone to the E.

Weather: Clear skies, sunny by day. Sunset/rise: 4:38 PM/ 6;35 AM **Settings:** [✓ SLOW] FAST

Temperature: 49-32 deg F **Wind:** 0-8 mph **Humidity:** 28-40% **Terrain:** Flat

Start Time: 6:00 PM **End Time:** 6:00 PM **Run Time:**

Leq: 46.4 dB

Lmax 80.2 dB

L2 48.6 dB

L8 45.6 dB

L25 43.1 dB

L50 40.3 dB

Primary Noise Source: Traffice ambiance from vehicles passing microphone traveling on Sandalwood Dr.
Noise from construction site ~1,400' ESE.

Secondary Noise Sources: Occasional overhead air traffic. Slight residential ambiance. Buses arriving and leaving.

NOISE METER: SoundTrack LXT Class 1
MAKE: Larson Davis
MODEL: LXT1
SERIAL NUMBER: 3099
FACTORY CALIBRATION DATE: 11/17/2021
FIELD CALIBRATION DATE: 11/29/2022

CALIBRATOR: Larson Davis CA 250
MAKE: Larson Davis
MODEL: CA 250
SERIAL NUMBER: 2723
FACTORY CALIBRATION DATE: 11/18/2021

Noise Measurement
Field Data

PHOTOS:

LTNM1 looking SSE along SW edge of site towards building 140 Business Center Drive, Big Bear Lake (~420').

LTNM1 looking ENE across site and Sandalwood Drive towards Interlaken Shopping Center (~1,400').

Summary

File Name on Meter	LxT_Data.168.s
File Name on PC	LxT_0003099-20221129 180000-LxT_Data.168.ldbin
Serial Number	3099
Model	SoundTrack LxT®
Firmware Version	2.404
User	Ian Edward Gallagher
Location	LTNM1 34°15'1.69"N 116°53'23.36"W
Job Description	24 hour noise measurement (24 x 1 hours)
Note	Ganddini Project 19574 Bus Maintenance Facility, City of Big Bear Lake

Measurement

Start	2022-11-29 18:00:00
Stop	2022-11-30 18:00:00
Duration	24:00:00.0
Run Time	24:00:00.0
Pause	00:00:00.0
Pre-Calibration	2022-11-29 16:48:01
Post-Calibration	None
Calibration Deviation	---

Overall Settings

RMS Weight	A Weighting
Peak Weight	A Weighting
Detector	Slow
Preamplifier	PRMLxT1L
Microphone Correction	Off
Integration Method	Linear
OBA Range	Normal
OBA Bandwidth	1/1 and 1/3
OBA Frequency Weighting	A Weighting
OBA Max Spectrum	Bin Max
Overload	122.3 dB

Results

LAeq	46.4	
LAE	95.8	
EA	418.9 µPa²h	
EA8	139.6333 µPa²h	
EA40	698.1667 µPa²h	
LApeak (max)	2022-11-30 10:09:26	118.0 dB
LASmax	2022-11-30 10:09:26	80.2 dB
LASmin	2022-11-29 23:54:09	30.7 dB

		Statistics	
LCeq	59.2 dB	**LA2.00**	48.6 dB
LAeq	46.4 dB	**LA8.00**	45.6 dB
LCeq - LAeq	12.8 dB	**LA25.00**	43.1 dB
LAIeq	50.6 dB	**LA50.00**	40.3 dB
LAeq	46.4 dB	**LA90.00**	35.1 dB
LAIeq - LAeq	4.2 dB	**LA99.00**	32.5 dB
Overload Count	0		

Record #	Date	Time	Run Duration	Run Time	Pause	LAeq	LASmin	LASmin Time	LASmax	LASmax Time	LAS2.00	LAS8.00	LAS25.00	LAS50.00	LAS90.00	LAS99.00
1	2022-11-29	18:00:00	01:00:00.0	01:00:00.0	00:00:00.0	39.7	34.8	18:16:36	53.1	18:10:59	44.4	41.4	39.9	38.7	37.0	36.0
2	2022-11-29	19:00:00	01:00:00.0	01:00:00.0	00:00:00.0	37.3	31.5	19:43:34	55.2	19:09:08	42.5	39.9	37.5	36.1	33.9	32.3
3	2022-11-29	20:00:00	01:00:00.0	01:00:00.0	00:00:00.0	37.1	33.0	20:05:52	50.2	20:20:37	40.3	38.6	37.5	36.7	35.1	33.8
4	2022-11-29	21:00:00	01:00:00.0	01:00:00.0	00:00:00.0	37.4	33.3	21:29:15	45.8	21:23:19	41.3	39.4	37.9	36.9	35.4	33.9
5	2022-11-29	22:00:00	01:00:00.0	01:00:00.0	00:00:00.0	36.2	31.3	22:41:33	42.2	22:05:03	38.9	38.0	37.0	36.2	33.6	31.9
6	2022-11-29	23:00:00	01:00:00.0	01:00:00.0	00:00:00.0	34.8	30.7	23:54:09	42.6	23:33:28	38.5	37.2	35.4	34.2	32.3	31.4
7	2022-11-30	00:00:00	01:00:00.0	01:00:00.0	00:00:00.0	41.6	32.8	00:00:49	49.2	00:49:49	45.7	44.6	43.2	41.2	35.4	33.7
8	2022-11-30	01:00:00	01:00:00.0	01:00:00.0	00:00:00.0	42.2	37.5	01:24:38	48.7	01:54:35	45.9	44.7	43.0	41.5	39.5	37.9
9	2022-11-30	02:00:00	01:00:00.0	01:00:00.0	00:00:00.0	45.7	41.2	02:17:50	65.5	02:47:11	48.2	46.6	45.4	44.3	42.8	41.9
10	2022-11-30	03:00:00	01:00:00.0	01:00:00.0	00:00:00.0	45.7	41.0	03:45:30	58.1	03:19:05	48.1	47.2	46.3	45.5	44.0	42.8
11	2022-11-30	04:00:00	01:00:00.0	01:00:00.0	00:00:00.0	43.5	39.5	04:42:29	47.7	04:12:44	46.1	45.2	44.1	43.2	41.6	40.5
12	2022-11-30	05:00:00	01:00:00.0	01:00:00.0	00:00:00.0	42.9	39.1	05:32:59	50.9	05:16:19	45.7	44.4	43.3	42.5	41.2	39.9
13	2022-11-30	06:00:00	01:00:00.0	01:00:00.0	00:00:00.0	43.2	38.6	06:07:52	50.7	06:37:23	46.2	45.0	43.8	42.8	41.0	39.7
14	2022-11-30	07:00:00	01:00:00.0	01:00:00.0	00:00:00.0	43.9	39.7	07:42:20	53.2	07:20:50	47.6	45.9	44.5	43.4	41.8	41.0
15	2022-11-30	08:00:00	01:00:00.0	01:00:00.0	00:00:00.0	44.6	35.7	08:41:26	66.4	08:07:17	49.5	47.1	44.1	40.5	37.7	36.6
16	2022-11-30	09:00:00	01:00:00.0	01:00:00.0	00:00:00.0	36.5	31.3	09:46:56	57.8	09:10:53	40.7	38.1	35.5	34.2	32.8	32.0
17	2022-11-30	10:00:00	01:00:00.0	01:00:00.0	00:00:00.0	47.0	32.4	10:00:14	80.2	10:09:26	51.1	43.8	39.0	37.7	35.4	33.5
18	2022-11-30	11:00:00	01:00:00.0	01:00:00.0	00:00:00.0	47.8	34.1	11:06:52	70.6	11:59:37	54.6	43.1	40.5	38.7	36.1	35.0
19	2022-11-30	12:00:00	01:00:00.0	01:00:00.0	00:00:00.0	51.7	34.1	12:09:59	79.1	12:56:48	57.3	45.7	41.1	39.3	37.1	35.4
20	2022-11-30	13:00:00	01:00:00.0	01:00:00.0	00:00:00.0	49.6	36.3	13:20:17	74.8	13:14:11	60.8	46.5	42.8	41.3	38.5	37.0
21	2022-11-30	14:00:00	01:00:00.0	01:00:00.0	00:00:00.0	48.5	39.5	14:12:25	68.7	14:18:53	57.8	50.0	44.1	42.7	41.2	40.3
22	2022-11-30	15:00:00	01:00:00.0	01:00:00.0	00:00:00.0	45.3	37.2	15:59:30	71.8	15:19:04	47.1	45.2	43.7	42.7	39.4	38.4
23	2022-11-30	16:00:00	01:00:00.0	01:00:00.0	00:00:00.0	42.5	33.6	16:41:04	61.5	16:27:04	52.1	42.7	39.6	38.1	35.8	34.6
24	2022-11-30	17:00:00	01:00:00.0	01:00:00.0	00:00:00.0	55.0	33.6	17:02:33	77.3	17:29:32	62.2	48.2	42.2	39.2	35.8	34.4

Measurement Report

Report Summary

Meter's File Name	LxT_Data.168.s	Computer's File Name	LxT_0003099-20221129 180000-LxT_Data.168.ldbin
Meter	LxT1 0003099		
Firmware	2.404		
User	Ian Edward Gallagher	Location	LTNM1 34°15'1.69"N 116°53'23.36"W
Job Description	24 hour noise measurement (24 x 1 hours)		
Note	Ganddini Project 19574 Bus Maintenance Facility, City of Big Bear Lake		

Start Time	2022-11-29 18:00:00	Duration	24:00:00.0		
End Time	2022-11-30 18:00:00	Run Time	24:00:00.0	Pause Time	0:00:00.0

Results

Overall Metrics

LA_{eq}	46.4 dB		
LAE	95.8 dB	SEA	--- dB
EA	418.9 µPa²h	LAFTM5	51.5 dB
EA8	139.6 µPa²h		
EA40	698.2 µPa²h		
LA_{peak}	118.0 dB	2022-11-30 10:09:26	
LAS_{max}	80.2 dB	2022-11-30 10:09:26	
LAS_{min}	30.7 dB	2022-11-29 23:54:09	
LA_{eq}	46.4 dB		
LC_{eq}	59.2 dB	LC_{eq} - LA_{eq}	12.8 dB
LAI_{eq}	50.6 dB	LAI_{eq} - LA_{eq}	4.2 dB

Exceedances	Count	Duration
LAS > 65.0 dB	21	0:02:56.8
LAS > 85.0 dB	0	0:00:00.0
LApeak > 135.0 dB	0	0:00:00.0
LApeak > 137.0 dB	0	0:00:00.0
LApeak > 140.0 dB	0	0:00:00.0

Community Noise	LDN	LDay	LNight	
	--- dB	--- dB	0.0 dB	
	LDEN	LDay	LEve	LNight
	--- dB	--- dB	--- dB	--- dB

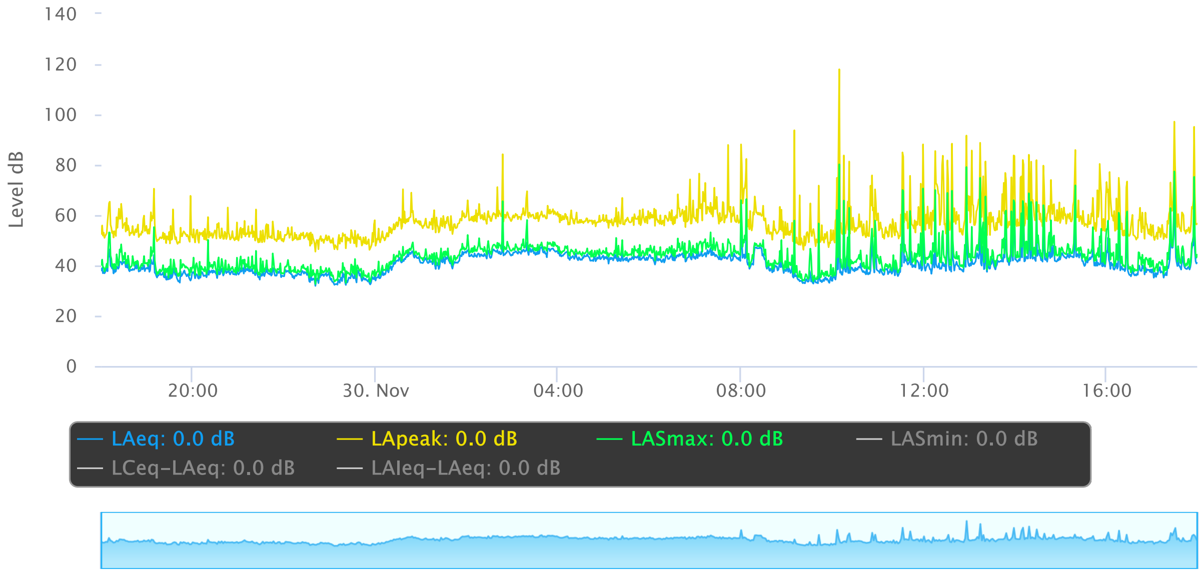
Any Data	A		C		Z	
	Level	Time Stamp	Level	Time Stamp	Level	Time Stamp
L_{eq}	46.4 dB		59.2 dB		--- dB	
$Ls_{(max)}$	80.2 dB	2022-11-30 10:09:26	--- dB		--- dB	
$LS_{(min)}$	30.7 dB	2022-11-29 23:54:09	--- dB		--- dB	
$L_{Peak(max)}$	118.0 dB	2022-11-30 10:09:26	--- dB		--- dB	

Overloads	Count	Duration	OBA Count	OBA Duration
	0	0:00:00.0	0	0:00:00.0

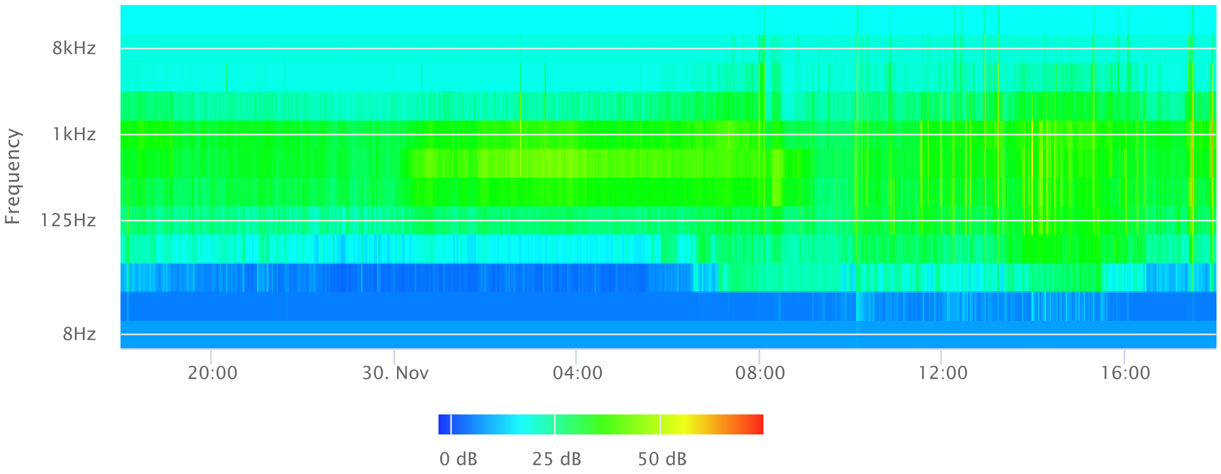
Statistics

LAS 2.0	48.6 dB
LAS 8.0	45.6 dB
LAS 25.0	43.1 dB
LAS 50.0	40.3 dB
LAS 90.0	35.1 dB
LAS 99.0	32.5 dB

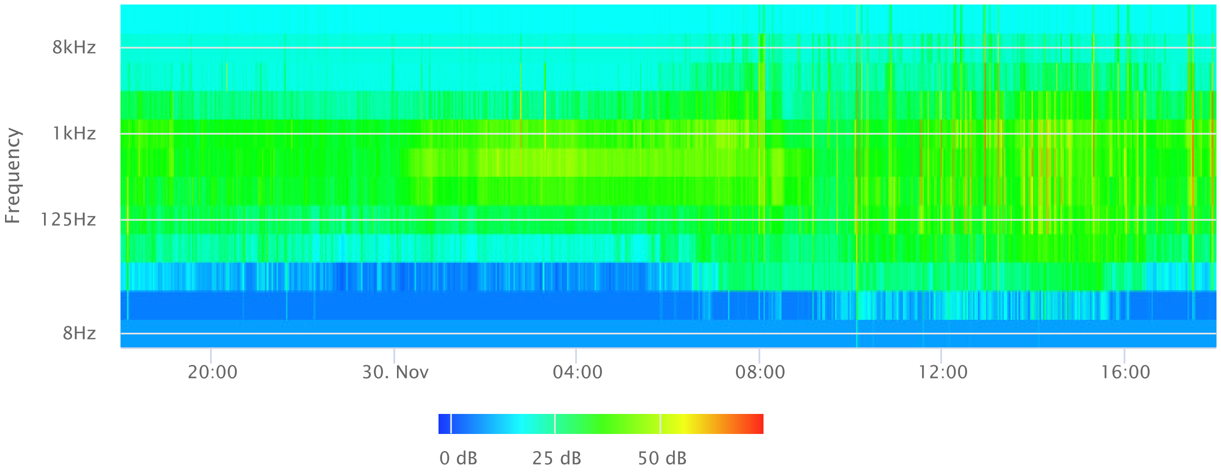
Time History



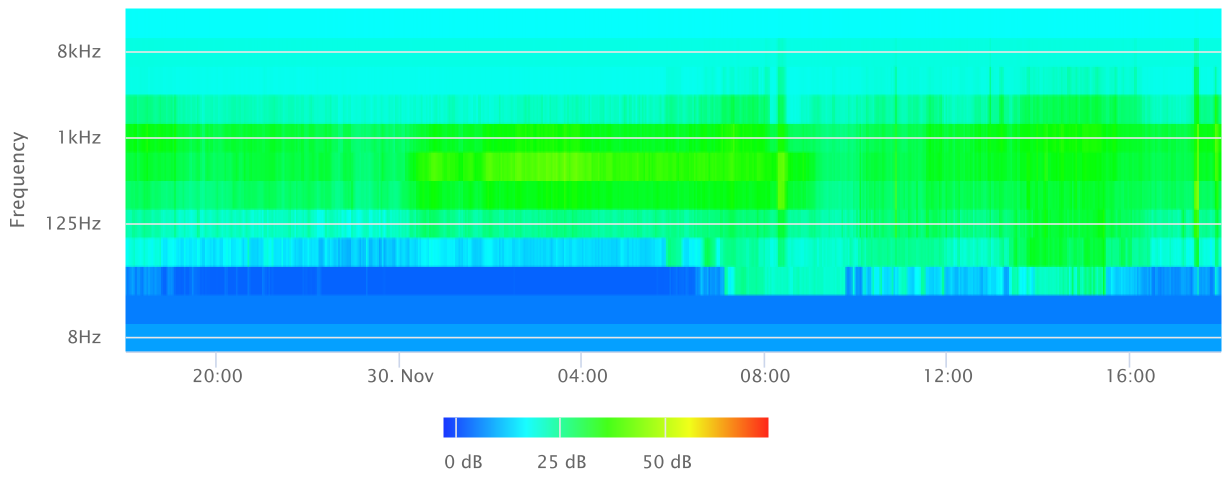
OBA 1/1 Leq



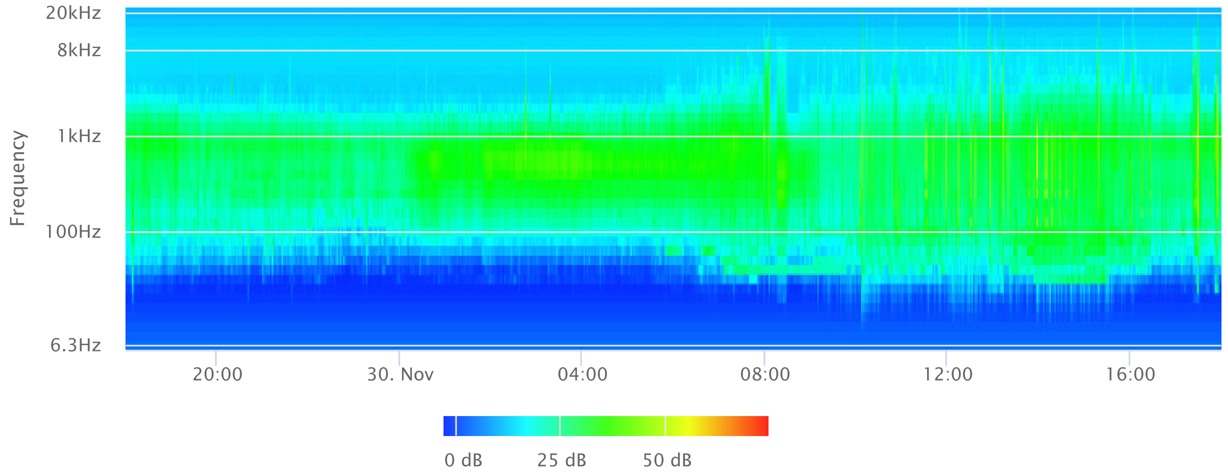
OBA 1/1 Lmax



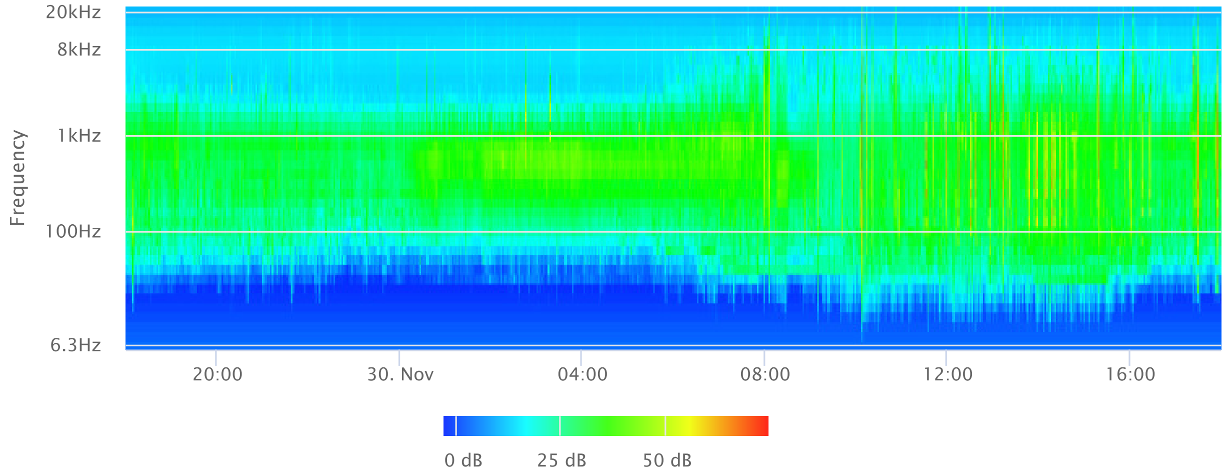
OBA 1/1 Lmin



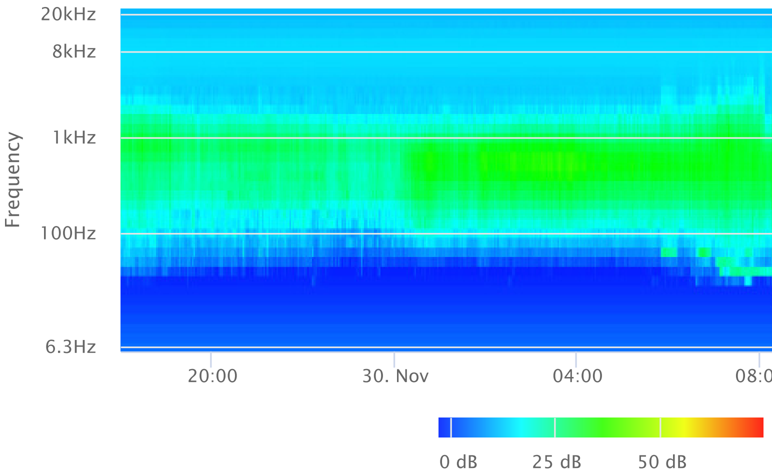
OBA 1/3 Leq



OBA 1/3 Lmax



OBA 1/3 Lmin


20kHz
8kHz
1kHz
100Hz
6.3Hz
Frequency
20:00
30. Nov
04:00
08:00
12:00
16:00
0 dB
25 dB
50 dB

APPENDIX D

CONSTRUCTION NOISE MODELING

Receptor - Residential Use to Southwest (41733 Garstin Drive, Big Bear Lake)

Construction Phase Equipment Item	# of Items	Item Lmax at 50 feet, dBA[1]	Distance to Receptor[3]	Item Usage Percent	Usage Factor	Dist. Correction dB	Usage Adj. dB	Receptor Item Lmax, dBA	Receptor Item Leq, dBA
Site Preparation									
Rubber Tired Dozers	3	82	656	40	1.20	-22.4	0.8	59.6	60.4
Tractors/Loaders/Backhoes	4	84	656	40	1.60	-22.4	2.0	61.6	63.7
								Log Sum	65.4
Grading									
Excavators	1	81	656	40	0.4	-22.4	-4.0	58.6	54.7
Rubber Tired Dozers	1	82	656	40	0.40	-22.4	-4.0	59.6	55.7
Tractors/Loaders/Backhoes	3	84	656	40	1.20	-22.4	0.8	61.6	62.4
Graders	1	85	656	40	0.40	-22.4	-4.0	62.6	58.7
								Log Sum	65.0
Building Construction									
Cranes	1	81	656	16	0.16	-22.4	-8.0	58.6	50.7
Forklifts[2]	3	48	656	40	1.20	-22.4	0.8	25.6	26.4
Generator Sets	1	81	656	50	0.50	-22.4	-3.0	58.6	55.6
Welders	1	74	656	40	0.40	-22.4	-4.0	51.6	47.7
Tractors/Loaders/Backhoes	3	84	656	40	1.20	-22.4	0.8	61.6	62.4
								Log Sum	63.6
Paving									
Pavers	1	77	656	50	0.50	-22.4	-3.0	54.6	51.6
Cement and Mortar Mixers	2	79	656	40	0.80	-22.4	-1.0	56.6	55.7
Paving Equipment	2	77	656	50	1.00	-22.4	0.0	54.6	54.6
Rollers	2	80	656	20	0.40	-22.4	-4.0	57.6	53.7
Tractors/Loaders/Backhoes	1	84	656	40	0.40	-22.4	-4.0	61.6	57.7
								Log Sum	62.1
Architectural Coating									
Air Compressors	1	78	656	40	0.40	-22.4	-4.0	55.6	51.7
								Log Sum	51.7

Notes:

(1) Source: Referenced noise levels from the Federal Transit Administration (FTA) Transit Noise and Vibration Impact Assessment Manual (September 2018) and the FHWA Roadway Construction Noise Model User's Guide (January 2006)

(2) Source: SoundPLAN reference list.

(3) Distance to receptor calculated from center of site. Construction noise projected from the center of the project site to nearest sensitive use (property line).

Receptor - Residential Use to West (178 Pinecrest Drive, Big Bear Lake)

Construction Phase Equipment Item	# of Items	Item Lmax at 50 feet, dBA[1]	Distance to Receptor[3]	Item Usage Percent	Usage Factor	Dist. Correction dB	Usage Adj. dB	Receptor Item Lmax, dBA	Receptor Item Leq, dBA
Site Preparation									
Rubber Tired Dozers	3	82	900	40	1.20	-25.1	0.8	56.9	57.7
Tractors/Loaders/Backhoes	4	84	900	40	1.60	-25.1	2.0	58.9	60.9
								Log Sum	62.6
Grading									
Excavators	1	81	900	40	0.4	-25.1	-4.0	55.9	51.9
Rubber Tired Dozers	1	82	900	40	0.40	-25.1	-4.0	56.9	52.9
Tractors/Loaders/Backhoes	3	84	900	40	1.20	-25.1	0.8	58.9	59.7
Graders	1	85	900	40	0.40	-25.1	-4.0	59.9	55.9
								Log Sum	62.2
Building Construction									
Cranes	1	81	900	16	0.16	-25.1	-8.0	55.9	47.9
Forklifts[2]	3	48	900	40	1.20	-25.1	0.8	22.9	23.7
Generator Sets	1	81	900	50	0.50	-25.1	-3.0	55.9	52.9
Welders	1	74	900	40	0.40	-25.1	-4.0	48.9	44.9
Tractors/Loaders/Backhoes	3	84	900	40	1.20	-25.1	0.8	58.9	59.7
								Log Sum	60.9
Paving									
Pavers	1	77	900	50	0.50	-25.1	-3.0	51.9	48.9
Cement and Mortar Mixers	2	79	900	40	0.80	-25.1	-1.0	53.9	52.9
Paving Equipment	2	77	900	50	1.00	-25.1	0.0	51.9	51.9
Rollers	2	80	900	20	0.40	-25.1	-4.0	54.9	50.9
Tractors/Loaders/Backhoes	1	84	900	40	0.40	-25.1	-4.0	58.9	54.9
								Log Sum	59.4
Architectural Coating									
Air Compressors	1	78	900	40	0.40	-25.1	-4.0	52.9	48.9
								Log Sum	48.9

Notes:

(1) Source: Referenced noise levels from the Federal Transit Administration (FTA) Transit Noise and Vibration Impact Assessment Manual (September 2018) and the FHWA Roadway Construction Noise Model User's Guide (January 2006)

(2) Source: SoundPLAN reference list.

(3) Distance to receptor calculated from center of site. Construction noise projected from the center of the project site to nearest sensitive use (property line).

Receptor - Residential Use to Northeast (270 Meadow Circle N, Big Bear Lake)

Construction Phase Equipment Item	# of Items	Item Lmax at 50 feet, dBA[1]	Distance to Receptor[3]	Item Usage Percent	Usage Factor	Dist. Correction dB	Usage Adj. dB	Receptor Item Lmax, dBA	Receptor Item Leq, dBA
Site Preparation									
Rubber Tired Dozers	3	82	1090	40	1.20	-26.8	0.8	55.2	56.0
Tractors/Loaders/Backhoes	4	84	1090	40	1.60	-26.8	2.0	57.2	59.3
								Log Sum	61.0
Grading									
Excavators	1	81	1090	40	0.4	-26.8	-4.0	54.2	50.3
Rubber Tired Dozers	1	82	1090	40	0.40	-26.8	-4.0	55.2	51.3
Tractors/Loaders/Backhoes	3	84	1090	40	1.20	-26.8	0.8	57.2	58.0
Graders	1	85	1090	40	0.40	-26.8	-4.0	58.2	54.3
								Log Sum	60.6
Building Construction									
Cranes	1	81	1090	16	0.16	-26.8	-8.0	54.2	46.3
Forklifts[2]	3	48	1090	40	1.20	-26.8	0.8	21.2	22.0
Generator Sets	1	81	1090	50	0.50	-26.8	-3.0	54.2	51.2
Welders	1	74	1090	40	0.40	-26.8	-4.0	47.2	43.3
Tractors/Loaders/Backhoes	3	84	1090	40	1.20	-26.8	0.8	57.2	58.0
								Log Sum	59.2
Paving									
Pavers	1	77	1090	50	0.50	-26.8	-3.0	50.2	47.2
Cement and Mortar Mixers	2	79	1090	40	0.80	-26.8	-1.0	52.2	51.3
Paving Equipment	2	77	1090	50	1.00	-26.8	0.0	50.2	50.2
Rollers	2	80	1090	20	0.40	-26.8	-4.0	53.2	49.3
Tractors/Loaders/Backhoes	1	84	1090	40	0.40	-26.8	-4.0	57.2	53.3
								Log Sum	57.7
Architectural Coating									
Air Compressors	1	78	1090	40	0.40	-26.8	-4.0	51.2	47.3
								Log Sum	47.3

Notes:

(1) Source: Referenced noise levels from the Federal Transit Administration (FTA) Transit Noise and Vibration Impact Assessment Manual (September 2018) and the FHWA Roadway Construction Noise Model User's Guide (January 2006)

(2) Source: SoundPLAN reference list.

(3) Distance to receptor calculated from center of site. Construction noise projected from the center of the project site to nearest sensitive use (property line).

Receptor - Commercial to East (42150 Big Bear Boulevard, Big Bear Lake)

Construction Phase Equipment Item	# of Items	Item Lmax at 50 feet, dBA[1]	Distance to Receptor[3]	Item Usage Percent	Usage Factor	Dist. Correction dB	Usage Adj. dB	Receptor Item Lmax, dBA	Receptor Item Leq, dBA
Site Preparation									
Rubber Tired Dozers	3	82	900	40	1.20	-25.1	0.8	56.9	57.7
Tractors/Loaders/Backhoes	4	84	900	40	1.60	-25.1	2.0	58.9	60.9
								Log Sum	62.6
Grading									
Excavators	1	81	900	40	0.4	-25.1	-4.0	55.9	51.9
Rubber Tired Dozers	1	82	900	40	0.40	-25.1	-4.0	56.9	52.9
Tractors/Loaders/Backhoes	3	84	900	40	1.20	-25.1	0.8	58.9	59.7
Graders	1	85	900	40	0.40	-25.1	-4.0	59.9	55.9
								Log Sum	62.2
Building Construction									
Cranes	1	81	900	16	0.16	-25.1	-8.0	55.9	47.9
Forklifts[2]	3	48	900	40	1.20	-25.1	0.8	22.9	23.7
Generator Sets	1	81	900	50	0.50	-25.1	-3.0	55.9	52.9
Welders	1	74	900	40	0.40	-25.1	-4.0	48.9	44.9
Tractors/Loaders/Backhoes	3	84	900	40	1.20	-25.1	0.8	58.9	59.7
								Log Sum	60.9
Paving									
Pavers	1	77	900	50	0.50	-25.1	-3.0	51.9	48.9
Cement and Mortar Mixers	2	79	900	40	0.80	-25.1	-1.0	53.9	52.9
Paving Equipment	2	77	900	50	1.00	-25.1	0.0	51.9	51.9
Rollers	2	80	900	20	0.40	-25.1	-4.0	54.9	50.9
Tractors/Loaders/Backhoes	1	84	900	40	0.40	-25.1	-4.0	58.9	54.9
								Log Sum	59.4
Architectural Coating									
Air Compressors	1	78	900	40	0.40	-25.1	-4.0	52.9	48.9
								Log Sum	48.9

Notes:

(1) Source: Referenced noise levels from the Federal Transit Administration (FTA) Transit Noise and Vibration Impact Assessment Manual (September 2018) and the FHWA Roadway Construction Noise Model User's Guide (January 2006)

(2) Source: SoundPLAN reference list.

(3) Distance to receptor calculated from center of site. Construction noise projected from the center of the project site to nearest sensitive use (property line).

Receptor - Commercial to South (Southwest Gas Corporation, 140 Business Center Drive, Big Bear Lake)

Construction Phase Equipment Item	# of Items	Item Lmax at 50 feet, dBA[1]	Distance to Receptor[3]	Item Usage Percent	Usage Factor	Dist. Correction dB	Usage Adj. dB	Receptor Item Lmax, dBA	Receptor Item Leq, dBA
Site Preparation									
Rubber Tired Dozers	3	82	250	40	1.20	-14.0	0.8	68.0	68.8
Tractors/Loaders/Backhoes	4	84	250	40	1.60	-14.0	2.0	70.0	72.1
								Log Sum	73.7
Grading									
Excavators	1	81	250	40	0.4	-14.0	-4.0	67.0	63.0
Rubber Tired Dozers	1	82	250	40	0.40	-14.0	-4.0	68.0	64.0
Tractors/Loaders/Backhoes	3	84	250	40	1.20	-14.0	0.8	70.0	70.8
Graders	1	85	250	40	0.40	-14.0	-4.0	71.0	67.0
								Log Sum	73.4
Building Construction									
Cranes	1	81	250	16	0.16	-14.0	-8.0	67.0	59.1
Forklifts[2]	3	48	250	40	1.20	-14.0	0.8	34.0	34.8
Generator Sets	1	81	250	50	0.50	-14.0	-3.0	67.0	64.0
Welders	1	74	250	40	0.40	-14.0	-4.0	60.0	56.0
Tractors/Loaders/Backhoes	3	84	250	40	1.20	-14.0	0.8	70.0	70.8
								Log Sum	72.0
Paving									
Pavers	1	77	250	50	0.50	-14.0	-3.0	63.0	60.0
Cement and Mortar Mixers	2	79	250	40	0.80	-14.0	-1.0	65.0	64.1
Paving Equipment	2	77	250	50	1.00	-14.0	0.0	63.0	63.0
Rollers	2	80	250	20	0.40	-14.0	-4.0	66.0	62.0
Tractors/Loaders/Backhoes	1	84	250	40	0.40	-14.0	-4.0	70.0	66.0
								Log Sum	70.5
Architectural Coating									
Air Compressors	1	78	250	40	0.40	-14.0	-4.0	64.0	60.0
								Log Sum	60.0

Notes:

(1) Source: Referenced noise levels from the Federal Transit Administration (FTA) Transit Noise and Vibration Impact Assessment Manual (September 2018) and the FHWA Roadway Construction Noise Model User's Guide (January 2006)

(2) Source: SoundPLAN reference list.

(3) Distance to receptor calculated from center of site. Construction noise projected from the center of the project site to nearest sensitive use (property line).

Receptor - Commercial to West (41701 Garstin Drive, Big Bear Lake)

Construction Phase Equipment Item	# of Items	Item Lmax at 50 feet, dBA[1]	Distance to Receptor[3]	Item Usage Percent	Usage Factor	Dist. Correction dB	Usage Adj. dB	Receptor Item Lmax, dBA	Receptor Item Leq, dBA
Site Preparation									
Rubber Tired Dozers	3	82	275	40	1.20	-14.8	0.8	67.2	68.0
Tractors/Loaders/Backhoes	4	84	275	40	1.60	-14.8	2.0	69.2	71.2
								Log Sum	72.9
Grading									
Excavators	1	81	275	40	0.4	-14.8	-4.0	66.2	62.2
Rubber Tired Dozers	1	82	275	40	0.40	-14.8	-4.0	67.2	63.2
Tractors/Loaders/Backhoes	3	84	275	40	1.20	-14.8	0.8	69.2	70.0
Graders	1	85	275	40	0.40	-14.8	-4.0	70.2	66.2
								Log Sum	72.5
Building Construction									
Cranes	1	81	275	16	0.16	-14.8	-8.0	66.2	58.2
Forklifts[2]	3	48	275	40	1.20	-14.8	0.8	33.2	34.0
Generator Sets	1	81	275	50	0.50	-14.8	-3.0	66.2	63.2
Welders	1	74	275	40	0.40	-14.8	-4.0	59.2	55.2
Tractors/Loaders/Backhoes	3	84	275	40	1.20	-14.8	0.8	69.2	70.0
								Log Sum	71.2
Paving									
Pavers	1	77	275	50	0.50	-14.8	-3.0	62.2	59.2
Cement and Mortar Mixers	2	79	275	40	0.80	-14.8	-1.0	64.2	63.2
Paving Equipment	2	77	275	50	1.00	-14.8	0.0	62.2	62.2
Rollers	2	80	275	20	0.40	-14.8	-4.0	65.2	61.2
Tractors/Loaders/Backhoes	1	84	275	40	0.40	-14.8	-4.0	69.2	65.2
								Log Sum	69.7
Architectural Coating									
Air Compressors	1	78	275	40	0.40	-14.8	-4.0	63.2	59.2
								Log Sum	59.2

Notes:

(1) Source: Referenced noise levels from the Federal Transit Administration (FTA) Transit Noise and Vibration Impact Assessment Manual (September 2018) and the FHWA Roadway Construction Noise Model User's Guide (January 2006)

(2) Source: SoundPLAN reference list.

(3) Distance to receptor calculated from center of site. Construction noise projected from the center of the project site to nearest sensitive use (property line).

APPENDIX E

FHWA WORKSHEETS

FHWA Traffic Noise Prediction Model FHWA-RD-77-108

Existing Traffic Noise

Project: **19574 Big Bear Bus Maintenance Facility**
Road: **Big Bear Boulevard**
Segment: **In Vicinity of Project Site**

		DAYTIME			EVENING			NIGHTTIME		ADT	18800.00
	AUTOS	M.TRUCKS	H.TRUCKS	AUTOS	M.TRUCKS	H.TRUCKS	AUTOS	M.TRUCKS	H.TRUCKS	SPEED	40.00
										DISTANCE	40.00
INPUT PARAMETERS											
Vehicles per hour	1088.83	22.56	37.60	808.40	3.76	6.27	200.53	31.33	52.22	% A	92
Speed in MPH	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00		
Left angle	-90.00	-90.00	-90.00	-90.00	-90.00	-90.00	-90.00	-90.00	-90.00		
Right angle	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	% MT	3
NOISE CALCULATIONS											
Reference levels	67.36	76.31	81.16	67.36	76.31	81.16	67.36	76.31	81.16	% HT	5
ADJUSTMENTS											
Flow	24.04	7.21	9.43	22.75	-0.57	1.64	16.70	8.63	10.85		
Distance	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	LEFT	-90.00
Finite Roadway	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	RIGHT	90.00
Barrier	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
Grade	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	CNEL	75.88
Constant	-25.00	-25.00	-25.00	-25.00	-25.00	-25.00	-25.00	-25.00	-25.00	DAY LEQ	70.29
LEQ	67.30	59.42	66.48	66.01	51.64	58.70	59.95	60.85	67.91	Day hour	89.00
										Absorbtive?	no
	DAY LEQ	70.29		EVENING LEQ	66.88		NIGHT LEQ	69.24		Use hour?	no
										GRADE dB	0.00
		CNEL	**75.88**								

FHWA Traffic Noise Prediction Model FHWA-RD-77-108

Existing Plus Project Traffic Noise

Project: **19574 Big Bear Bus Maintenance Facility**
Road: **Big Bear Boulevard**
Segment: **In Vicinity of Project Site**

		DAYTIME			EVENING			NIGHTTIME		ADT	19000.00
	AUTOS	M.TRUCKS	H.TRUCKS	AUTOS	M.TRUCKS	H.TRUCKS	AUTOS	M.TRUCKS	H.TRUCKS	SPEED	40.00
										DISTANCE	40.00
INPUT PARAMETERS											
Vehicles per hour	1095.13	22.56	41.60	813.07	3.76	6.93	201.69	31.33	57.78	% A	91.56
Speed in MPH	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00		
Left angle	-90.00	-90.00	-90.00	-90.00	-90.00	-90.00	-90.00	-90.00	-90.00		
Right angle	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	% MT	2.97
NOISE CALCULATIONS											
Reference levels	67.36	76.31	81.16	67.36	76.31	81.16	67.36	76.31	81.16	% HT	5.47
ADJUSTMENTS											
Flow	24.07	7.21	9.86	22.77	-0.57	2.08	16.72	8.63	11.29		
Distance	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	LEFT	-90.00
Finite Roadway	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	RIGHT	90.00
Barrier	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
Grade	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	CNEL	76.18
Constant	-25.00	-25.00	-25.00	-25.00	-25.00	-25.00	-25.00	-25.00	-25.00	DAY LEQ	70.49
LEQ	67.33	59.42	66.92	66.03	51.64	59.14	59.98	60.85	68.35	Day hour	89.00
										Absorbtive?	no
	DAY LEQ	70.49		EVENING LEQ	66.97		NIGHT LEQ	69.57		Use hour?	no
										GRADE dB	0.00
		CNEL	**76.18**								

FHWA Traffic Noise Prediction Model FHWA-RD-77-108

Existing Traffic Noise

Project: **19574 Big Bear Bus Maintenance Facility**
Road: **Sandalwood Drive**
Segment: **In Vicinity of Project Site**

		DAYTIME			EVENING			NIGHTTIME		ADT	3610.00
	AUTOS	M.TRUCKS	H.TRUCKS	AUTOS	M.TRUCKS	H.TRUCKS	AUTOS	M.TRUCKS	H.TRUCKS	SPEED	30.00
										DISTANCE	25.00
INPUT PARAMETERS											
Vehicles per hour	221.40	2.71	1.05	163.62	0.48	0.48	40.98	3.61	1.40	% A	97.4
Speed in MPH	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00		
Left angle	-90.00	-90.00	-90.00	-90.00	-90.00	-90.00	-90.00	-90.00	-90.00		
Right angle	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	% MT	1.84
NOISE CALCULATIONS											
Reference levels	62.51	73.11	78.76	62.51	73.11	78.76	62.51	73.11	78.76	% HT	0.74
ADJUSTMENTS											
Flow	18.37	-0.75	-4.85	17.06	-8.26	-8.25	11.05	0.50	-3.60		
Distance	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94	LEFT	-90.00
Finite Roadway	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	RIGHT	90.00
Barrier	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
Grade	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	CNEL	64.15
Constant	-25.00	-25.00	-25.00	-25.00	-25.00	-25.00	-25.00	-25.00	-25.00	DAY LEQ	60.10
LEQ	58.83	50.30	51.85	57.51	42.79	48.45	51.50	51.55	53.10	Day hour	89.00
										Absorbtive?	no
	DAY LEQ	60.10		EVENING LEQ	58.15		NIGHT LEQ	56.89		Use hour?	no
										GRADE dB	0.00
		CNEL	**64.15**								

FHWA Traffic Noise Prediction Model FHWA-RD-77-108

Existing Plus Project Traffic Noise

Project: **19574 Big Bear Bus Maintenance Facility**
Road: **Sandalwood Drive**
Segment: **In Vicinity of Project Site**

		DAYTIME			EVENING			NIGHTTIME		ADT	3810.00
	AUTOS	M.TRUCKS	H.TRUCKS	AUTOS	M.TRUCKS	H.TRUCKS	AUTOS	M.TRUCKS	H.TRUCKS	SPEED	30.00
										DISTANCE	25.00
INPUT PARAMETERS											
Vehicles per hour	227.70	2.71	4.99	168.27	0.48	2.29	42.15	3.61	6.66	% A	94.91
Speed in MPH	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00		
Left angle	-90.00	-90.00	-90.00	-90.00	-90.00	-90.00	-90.00	-90.00	-90.00		
Right angle	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	% MT	1.74
NOISE CALCULATIONS											
Reference levels	62.51	73.11	78.76	62.51	73.11	78.76	62.51	73.11	78.76	% HT	3.33
ADJUSTMENTS											
Flow	18.50	-0.75	1.91	17.18	-8.26	-1.49	11.17	0.50	3.16		
Distance	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94	LEFT	-90.00
Finite Roadway	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	RIGHT	90.00
Barrier	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
Grade	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	CNEL	67.70
Constant	-25.00	-25.00	-25.00	-25.00	-25.00	-25.00	-25.00	-25.00	-25.00	DAY LEQ	62.09
LEQ	58.95	50.30	58.61	57.64	42.79	55.21	51.62	51.55	59.86	Day hour	89.00
										Absorbtive?	no
	DAY LEQ	62.09		EVENING LEQ	59.69		NIGHT LEQ	60.99		Use hour?	no
										GRADE dB	0.00
		CNEL	**67.70**								

FHWA Traffic Noise Prediction Model FHWA-RD-77-108

Existing Traffic Noise

Project: **19574 Big Bear Bus Maintenance Facility**
Road: **Business Center Drive**
Segment: **Sandalwood Drive to Sandalwood Drive**

		DAYTIME			EVENING			NIGHTTIME		ADT	865.00
	AUTOS	M.TRUCKS	H.TRUCKS	AUTOS	M.TRUCKS	H.TRUCKS	AUTOS	M.TRUCKS	H.TRUCKS	SPEED	30.00
										DISTANCE	25.00
INPUT PARAMETERS											
Vehicles per hour	53.05	0.65	0.25	39.20	0.12	0.12	9.82	0.86	0.34	% A	97.4
Speed in MPH	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00		
Left angle	-90.00	-90.00	-90.00	-90.00	-90.00	-90.00	-90.00	-90.00	-90.00		
Right angle	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	% MT	1.84
NOISE CALCULATIONS											
Reference levels	62.51	73.11	78.76	62.51	73.11	78.76	62.51	73.11	78.76	% HT	0.74
ADJUSTMENTS											
Flow	12.17	-6.96	-11.06	10.86	-14.47	-14.45	4.84	-5.71	-9.81		
Distance	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94	LEFT	-90.00
Finite Roadway	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	RIGHT	90.00
Barrier	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
Grade	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	CNEL	57.95
Constant	-25.00	-25.00	-25.00	-25.00	-25.00	-25.00	-25.00	-25.00	-25.00	DAY LEQ	53.90
LEQ	52.62	44.10	45.64	51.31	36.59	42.25	45.30	45.35	46.89	Day hour	89.00
										Absorbtive?	no
	DAY LEQ	53.90		EVENING LEQ	51.95		NIGHT LEQ	50.68		Use hour?	no
										GRADE dB	0.00
		CNEL	**57.95**								

FHWA Traffic Noise Prediction Model FHWA-RD-77-108

Existing Plus Project Traffic Noise

Project: **19574 Big Bear Bus Maintenance Facility**
Road: **Business Center Drive**
Segment: **Sandalwood Drive to Sandalwood Drive**

		DAYTIME			EVENING			NIGHTTIME			
	AUTOS	M.TRUCKS	H.TRUCKS	AUTOS	M.TRUCKS	H.TRUCKS	AUTOS	M.TRUCKS	H.TRUCKS	ADT	1065.00
										SPEED	30.00
										DISTANCE	25.00
INPUT PARAMETERS											
Vehicles per hour	59.35	0.65	4.19	43.86	0.12	1.92	10.99	0.86	5.59	% A	88.50
Speed in MPH	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00		
Left angle	-90.00	-90.00	-90.00	-90.00	-90.00	-90.00	-90.00	-90.00	-90.00		
Right angle	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	% MT	1.49
NOISE CALCULATIONS											
Reference levels	62.51	73.11	78.76	62.51	73.11	78.76	62.51	73.11	78.76	% HT	9.99
ADJUSTMENTS											
Flow	12.66	-6.96	1.15	11.34	-14.47	-2.25	5.33	-5.71	2.40		
Distance	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94	LEFT	-90.00
Finite Roadway	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	RIGHT	90.00
Barrier	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
Grade	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	CNEL	65.92
Constant	-25.00	-25.00	-25.00	-25.00	-25.00	-25.00	-25.00	-25.00	-25.00	DAY LEQ	59.24
LEQ	53.11	44.10	57.85	51.80	36.59	54.45	45.78	45.35	59.10	Day hour	89.00
										Absorbtive?	no
	DAY LEQ	59.24		EVENING LEQ	56.38		NIGHT LEQ	59.47		Use hour?	no
										GRADE dB	0.00
		CNEL	**65.92**								

APPENDIX F

SOUNDPLAN WORKSHEETS

Noise emissions of industry sources

Source na	Referen	Level		Frequency spectrum [dB(A)]																												Correctio		
				31	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1	1.3	1.6	2	2.5	3.2	4	5	6.3	8	10	12.5	16	Cwa	CI	CT
			dB(A	Hz	Hz	Hz	Hz	Hz	Hz	Hz	Hz	Hz	Hz	Hz	Hz	Hz	Hz	Hz	kHz	kHz	kHz	kHz	kHz	kHz	kHz	kHz	kHz	kHz	kHz	kHz	kHz	dB	dB	dB
1	Lw/unit	Da	114.	-	-	-	-	-	-	-	-	-	-	-	-	114.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	Lw/unit	Da	78.7	42.	47.	42.	46.	50.	56.	59.	62.	62.	64.	66.	56.	58.5	59.	68.	69.	70.	71.	71.	71.	70.	70.	70.	73.	72.	71.	74.	72.	-	-	-
3	Lw/unit	Da	78.7	42.	47.	42.	46.	50.	56.	59.	62.	62.	64.	66.	56.	58.5	59.	68.	69.	70.	71.	71.	71.	70.	70.	70.	73.	72.	71.	74.	72.	-	-	-
4	Lw/unit	Da	78.7	42.	47.	42.	46.	50.	56.	59.	62.	62.	64.	66.	56.	58.5	59.	68.	69.	70.	71.	71.	71.	70.	70.	70.	73.	72.	71.	74.	72.	-	-	-
5	Lw/unit	Da	78.7	42.	47.	42.	46.	50.	56.	59.	62.	62.	64.	66.	56.	58.5	59.	68.	69.	70.	71.	71.	71.	70.	70.	70.	73.	72.	71.	74.	72.	-	-	-
6	Lw/unit	Da	78.7	42.	47.	42.	46.	50.	56.	59.	62.	62.	64.	66.	56.	58.5	59.	68.	69.	70.	71.	71.	71.	70.	70.	70.	73.	72.	71.	74.	72.	-	-	-
7	Lw/unit	Da	78.7	42.	47.	42.	46.	50.	56.	59.	62.	62.	64.	66.	56.	58.5	59.	68.	69.	70.	71.	71.	71.	70.	70.	70.	73.	72.	71.	74.	72.	-	-	-
8	Lw/unit	Da	78.7	42.	47.	42.	46.	50.	56.	59.	62.	62.	64.	66.	56.	58.5	59.	68.	69.	70.	71.	71.	71.	70.	70.	70.	73.	72.	71.	74.	72.	-	-	-
9	Lw/unit	Da	78.7	42.	47.	42.	46.	50.	56.	59.	62.	62.	64.	66.	56.	58.5	59.	68.	69.	70.	71.	71.	71.	70.	70.	70.	73.	72.	71.	74.	72.	-	-	-
10	Lw/unit	Da	78.7	42.	47.	42.	46.	50.	56.	59.	62.	62.	64.	66.	56.	58.5	59.	68.	69.	70.	71.	71.	71.	70.	70.	70.	73.	72.	71.	74.	72.	-	-	-
11	Lw/unit	Da	50.2	14.	18.	14.	18.	21.	28.	31.	33.	33.	36.	38.	28.	30.0	31.	40.	41.	41.	42.	43.	43.	42.	42.	41.	45.	44.	42.	46.	44.	-	-	-

Noise emissions of parking lot traffic

Name	Parking lot type	Size	Movements per hour		Road surface	Separated method	Lw,ref
			Day	Lmax			dB(A)
1	Visitors and staff	38 Parking bays	0.200	0.000	Asphaltic driving lanes	no	82.5
2	Visitors and staff	6 Parking bays	0.200	0.000	Asphaltic driving lanes	no	70.8
3	Central bus stops (Diesel)	7 Parking bays	0.500	0.000	Asphaltic driving lanes	no	81.5
4	Central bus stops (Diesel)	9 Parking bays	0.500	0.000	Asphaltic driving lanes	no	82.5
5	Central bus stops (Diesel)	7 Parking bays	0.500	0.000	Asphaltic driving lanes	no	81.5
6	Central bus stops (Diesel)	7 Parking bays	0.500	0.000	Asphaltic driving lanes	no	81.5

Receiver list

No.	Receiver name	Building side	Floor	Limit Day dB(A)	Level w/o NP Day dB(A)	Level w NP Day dB(A)	Difference Day dB	Conflict Day dB
1	1	-	EG	-	57.6	44.9	-12.6	-
2	2	-	EG	-	52.9	40.9	-12.0	-
3	3	-	EG	-	44.8	45.2	0.4	-
4	4	-	EG	-	42.7	42.4	-0.3	-
5	5	-	EG	-	67.7	57.4	-10.2	-
6	6	-	EG	-	46.0	45.8	-0.2	-
7	7	-	EG	-	64.1	52.9	-11.2	-
8	8	-	EG	-	54.5	53.9	-0.6	-
9	9	-	EG	-	52.1	41.8	-10.3	-
10	10	-	EG	-	59.1	49.0	-10.1	-

Noise emissions of industry sources

Source na	Referen	Level		Frequency spectrum [dB(A)]																												Correctio		
			dB(A	31 Hz	40 Hz	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz	1.3 kHz	1.6 kHz	2 kHz	2.5 kHz	3.2 kHz	4 kHz	5 kHz	6.3 kHz	8 kHz	10 kHz	12.5 kHz	16 kHz	Cwa dB	CI dB	CT dB
1	Lw/unit	Da	120.	-	-	-	-	-	-	-	-	-	-	-	-	120.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	Lw/unit	Da	78.7	42.	47.	42.	46.	50.	56.	59.	62.	62.	64.	66.	56.	58.5	59.	68.	69.	70.	71.	71.	71.	70.	70.	70.	73.	72.	71.	74.8	72.	-	-	-
3	Lw/unit	Da	78.7	42.	47.	42.	46.	50.	56.	59.	62.	62.	64.	66.	56.	58.5	59.	68.	69.	70.	71.	71.	71.	70.	70.	70.	73.	72.	71.	74.8	72.	-	-	-
4	Lw/unit	Da	78.7	42.	47.	42.	46.	50.	56.	59.	62.	62.	64.	66.	56.	58.5	59.	68.	69.	70.	71.	71.	71.	70.	70.	70.	73.	72.	71.	74.8	72.	-	-	-
5	Lw/unit	Da	78.7	42.	47.	42.	46.	50.	56.	59.	62.	62.	64.	66.	56.	58.5	59.	68.	69.	70.	71.	71.	71.	70.	70.	70.	73.	72.	71.	74.8	72.	-	-	-
6	Lw/unit	Da	78.7	42.	47.	42.	46.	50.	56.	59.	62.	62.	64.	66.	56.	58.5	59.	68.	69.	70.	71.	71.	71.	70.	70.	70.	73.	72.	71.	74.8	72.	-	-	-
7	Lw/unit	Da	78.7	42.	47.	42.	46.	50.	56.	59.	62.	62.	64.	66.	56.	58.5	59.	68.	69.	70.	71.	71.	71.	70.	70.	70.	73.	72.	71.	74.8	72.	-	-	-
8	Lw/unit	Da	78.7	42.	47.	42.	46.	50.	56.	59.	62.	62.	64.	66.	56.	58.5	59.	68.	69.	70.	71.	71.	71.	70.	70.	70.	73.	72.	71.	74.8	72.	-	-	-
9	Lw/unit	Da	78.7	42.	47.	42.	46.	50.	56.	59.	62.	62.	64.	66.	56.	58.5	59.	68.	69.	70.	71.	71.	71.	70.	70.	70.	73.	72.	71.	74.8	72.	-	-	-
10	Lw/unit	Da	78.7	42.	47.	42.	46.	50.	56.	59.	62.	62.	64.	66.	56.	58.5	59.	68.	69.	70.	71.	71.	71.	70.	70.	70.	73.	72.	71.	74.8	72.	-	-	-
11	Lw/unit	Da	50.2	14.	18.	14.	18.	21.	28.	31.	33.	33.	36.	38.	28.	30.0	31.	40.	41.	41.	42.	43.	43.	42.	42.	41.	45.	44.	42.	46.3	44.	-	-	-

Noise emissions of parking lot traffic

Name	Parking lot type	Size	Movements per hour		Road surface	Separated method	Lw,ref
			Day	Lmax			dB(A)
1	Visitors and staff	38 Parking bays	0.200	0.000	Asphaltic driving lanes	no	82.5
2	Visitors and staff	6 Parking bays	0.200	0.000	Asphaltic driving lanes	no	70.8
3	Central bus stops (Diesel)	7 Parking bays	0.500	0.000	Asphaltic driving lanes	no	81.5
4	Central bus stops (Diesel)	9 Parking bays	0.500	0.000	Asphaltic driving lanes	no	82.5
5	Central bus stops (Diesel)	7 Parking bays	0.500	0.000	Asphaltic driving lanes	no	81.5
6	Central bus stops (Diesel)	7 Parking bays	0.500	0.000	Asphaltic driving lanes	no	81.5

Receiver list

No.	Receiver name	Building side	Floor	Limit Day dB(A)	Level w/o NP Day dB(A)	Level w NP Day dB(A)	Difference Day dB	Conflict Day dB
1	1	-	EG	-	63.6	50.6	-12.9	-
2	2	-	EG	-	58.9	46.6	-12.2	-
3	3	-	EG	-	50.8	51.2	0.4	-
4	4	-	EG	-	48.7	48.4	-0.3	-
5	5	-	EG	-	73.7	63.4	-10.3	-
6	6	-	EG	-	51.5	51.3	-0.2	-
7	7	-	EG	-	70.1	58.1	-12.0	-
8	8	-	EG	-	60.3	59.7	-0.6	-
9	9	-	EG	-	58.1	47.5	-10.6	-
10	10	-	EG	-	65.1	54.7	-10.4	-

APPENDIX G

VIBRATION WORKSHEETS

GROUNDBORNE VIBRATION ANALYSIS

Project: 19574 Big Bear Bus Maitenance Facility Date: 11/28/22
Source: Vibratory Roller
Scenario: Unmitigated
Location: Commercial to South
Address: Southwest Gas, 140 Business Center Drive, Big Bear Lake
PPV = PPVref(25/D)^n (in/sec)

INPUT

INPUT SECTION IN GREEN

Equipment = Type	1	Vibratory Roller
PPVref =	0.21	Reference PPV (in/sec) at 25 ft.
D =	110.00	Distance from Equipment to Receiver (ft)
n =	1.50	Vibration attenuation rate through the ground

Note: Based on reference equations from Vibration Guidance Manual, California Department of Transportation, 2006, pgs 38-43.

RESULTS

PPV =	0.023	IN/SEC

OUTPUT IN BLUE

GROUNDBORNE VIBRATION ANALYSIS

Project: 19574 Big Bear Bus Maitenance Facility Date: 11/28/22
Source: Large Bulldozer
Scenario: Unmitigated
Location: Commercial to South
Address: Southwest Gas, 140 Business Center Drive, Big Bear Lake
PPV = PPVref(25/D)^n (in/sec)

INPUT

Equipment = Type	2	Large Bulldozer	INPUT SECTION IN GREEN
PPVref =	0.089	Reference PPV (in/sec) at 25 ft.	
D =	110.00	Distance from Equipment to Receiver (ft)	
n =	1.50	Vibration attenuation rate through the ground	

Note: Based on reference equations from Vibration Guidance Manual, California Department of Transportation, 2006, pgs 38-43.

RESULTS

PPV =	0.010	IN/SEC	OUTPUT IN BLUE

GROUNDBORNE VIBRATION ANALYSIS

Project:	19574 Big Bear Bus Maitenance Facility	Date: 11/28/22
Source:	Vibratory Roller	
Scenario:	Unmitigated	
Location:	Commercial to East	
Address:	42160 Big Bear Boulevard, Big Bear Lake	

PPV = PPVref(25/D)^n (in/sec)

INPUT

INPUT SECTION IN GREEN

Equipment = Type	1	Vibratory Roller
PPVref =	0.21	Reference PPV (in/sec) at 25 ft.
D =	636.00	Distance from Equipment to Receiver (ft)
n =	1.50	Vibration attenuation rate through the ground

Note: Based on reference equations from Vibration Guidance Manual, California Department of Transportation, 2006, pgs 38-43.

RESULTS

PPV =	0.002	IN/SEC

OUTPUT IN BLUE

GROUNDBORNE VIBRATION ANALYSIS

Project:	19574 Big Bear Bus Maitenance Facility	Date:	11/28/22
Source:	Large Bulldozer		
Scenario:	Unmitigated		
Location:	Commercial to East		
Address:	42160 Big Bear Boulevard, Big Bear Lake		

PPV = PPVref(25/D)^n (in/sec)

INPUT

Equipment = Type	2	Large Bulldozer	INPUT SECTION IN GREEN
PPVref =	0.089	Reference PPV (in/sec) at 25 ft.	
D =	636.00	Distance from Equipment to Receiver (ft)	
n =	1.50	Vibration attenuation rate through the ground	

Note: Based on reference equations from Vibration Guidance Manual, California Department of Transportation, 2006, pgs 38-43.

RESULTS

PPV =	0.001	IN/SEC	OUTPUT IN BLUE

GROUNDBORNE VIBRATION ANALYSIS

Project:	19574 Big Bear Bus Maitenance Facility	Date: 11/28/22
Source:	Vibratory Roller	
Scenario:	Unmitigated	
Location:	Residential to Northeast	
Address:	280 Meadow Circle North, Big Bear Lake	

PPV = PPVref(25/D)^n (in/sec)

INPUT

Equipment = Type	1	Vibratory Roller	INPUT SECTION IN GREEN
PPVref =	0.21	Reference PPV (in/sec) at 25 ft.	
D =	837.00	Distance from Equipment to Receiver (ft)	
n =	1.50	Vibration attenuation rate through the ground	

Note: Based on reference equations from Vibration Guidance Manual, California Department of Transportation, 2006, pgs 38-43.

RESULTS

PPV =	0.001	IN/SEC	OUTPUT IN BLUE

GROUNDBORNE VIBRATION ANALYSIS

Project: 19574 Big Bear Bus Maitenance Facility Date: 11/28/22

Source: Large Bulldozer

Scenario: Unmitigated

Location: Residential to Northeast

Address: 280 Meadow Circle North, Big Bear Lake

PPV = PPVref(25/D)^n (in/sec)

INPUT

INPUT SECTION IN GREEN

Equipment = Type	2	Large Bulldozer
PPVref =	0.089	Reference PPV (in/sec) at 25 ft.
D =	837.00	Distance from Equipment to Receiver (ft)
n =	1.50	Vibration attenuation rate through the ground

Note: Based on reference equations from Vibration Guidance Manual, California Department of Transportation, 2006, pgs 38-43.

RESULTS

PPV =	0.000	IN/SEC	OUTPUT IN BLUE

GROUNDBORNE VIBRATION ANALYSIS

Project: 19574 Big Bear Bus Maitenance Facility Date: 11/28/22
Source: Vibratory Roller
Scenario: Unmitigated
Location: Residential to West
Address: 157 Pinecrest Drive, Big Bear Lake
PPV = PPVref(25/D)^n (in/sec)

INPUT

Equipment = Type	1	Vibratory Roller	INPUT SECTION IN GREEN
PPVref =	0.21	Reference PPV (in/sec) at 25 ft.	
D =	638.00	Distance from Equipment to Receiver (ft)	
n =	1.50	Vibration attenuation rate through the ground	

Note: Based on reference equations from Vibration Guidance Manual, California Department of Transportation, 2006, pgs 38-43.

RESULTS

PPV =	0.002	IN/SEC	OUTPUT IN BLUE

GROUNDBORNE VIBRATION ANALYSIS

Project:	19574 Big Bear Bus Maitenance Facility	Date:	11/28/22
Source:	Large Bulldozer		
Scenario:	Unmitigated		
Location:	Residential to West		
Address:	157 Pinecrest Drive, Big Bear Lake		

PPV = PPVref(25/D)^n (in/sec)

INPUT

Equipment = Type	2	Large Bulldozer	INPUT SECTION IN GREEN
PPVref =	0.089	Reference PPV (in/sec) at 25 ft.	
D =	638.00	Distance from Equipment to Receiver (ft)	
n =	1.50	Vibration attenuation rate through the ground	

Note: Based on reference equations from Vibration Guidance Manual, California Department of Transportation, 2006, pgs 38-43.

RESULTS

PPV =	0.001	IN/SEC	OUTPUT IN BLUE

GROUNDBORNE VIBRATION ANALYSIS

Project: 19574 Big Bear Bus Maitenance Facility Date: 11/28/22
Source: Vibratory Roller
Scenario: Unmitigated
Location: Commercial to West
Address: 41701 Garstin Drive, Big Bear Lake
PPV = PPVref(25/D)^n (in/sec)

INPUT

INPUT SECTION IN GREEN

Equipment = Type	1	Vibratory Roller
PPVref =	0.21	Reference PPV (in/sec) at 25 ft.
D =	204.00	Distance from Equipment to Receiver (ft)
n =	1.50	Vibration attenuation rate through the ground

Note: Based on reference equations from Vibration Guidance Manual, California Department of Transportation, 2006, pgs 38-43.

RESULTS

PPV =	0.009	IN/SEC

OUTPUT IN BLUE

GROUNDBORNE VIBRATION ANALYSIS

Project: 19574 Big Bear Bus Maitenance Facility
Date: 11/28/22
Source: Large Bulldozer
Scenario: Unmitigated
Location: Commercial to West
Address: 41701 Garstin Drive, Big Bear Lake
PPV = PPVref(25/D)^n (in/sec)

INPUT

Equipment = Type	2	Large Bulldozer	INPUT SECTION IN GREEN
PPVref =	0.089	Reference PPV (in/sec) at 25 ft.	
D =	204.00	Distance from Equipment to Receiver (ft)	
n =	1.50	Vibration attenuation rate through the ground	

Note: Based on reference equations from Vibration Guidance Manual, California Department of Transportation, 2006, pgs 38-43.

RESULTS

PPV =	0.004	IN/SEC	OUTPUT IN BLUE

GROUNDBORNE VIBRATION ANALYSIS

Project: 19574 Big Bear Bus Maitenance Facility   Date: 11/28/22

Source: Vibratory Roller

Scenario: Unmitigated

Location: Residential to Southwest

Address: 41773 Garstin Drive, Big Bear Lake

PPV = PPVref(25/D)^n (in/sec)

INPUT

Equipment = Type	1	Vibratory Roller	INPUT SECTION IN GREEN
PPVref =	0.21	Reference PPV (in/sec) at 25 ft.	
D =	377.00	Distance from Equipment to Receiver (ft)	
n =	1.50	Vibration attenuation rate through the ground	

Note: Based on reference equations from Vibration Guidance Manual, California Department of Transportation, 2006, pgs 38-43.

RESULTS

PPV =	0.004	IN/SEC	OUTPUT IN BLUE

GROUNDBORNE VIBRATION ANALYSIS

Project: 19574 Big Bear Bus Maitenance Facility Date: 11/28/22
Source: Large Bulldozer
Scenario: Unmitigated
Location: Residential to Southwest
Address: 41773 Garstin Drive, Big Bear Lake
PPV = PPVref(25/D)^n (in/sec)

INPUT

Equipment = Type	2	Large Bulldozer	INPUT SECTION IN GREEN
PPVref =	0.089	Reference PPV (in/sec) at 25 ft.	
D =	377.00	Distance from Equipment to Receiver (ft)	
n =	1.50	Vibration attenuation rate through the ground	

Note: Based on reference equations from Vibration Guidance Manual, California Department of Transportation, 2006, pgs 38-43.

RESULTS

PPV =	0.002	IN/SEC	OUTPUT IN BLUE

GROUNDBORNE VIBRATION ANALYSIS

Project: 19574 Big Bear Bus Maitenance Facility Date: 11/28/22
Source: Vibratory Roller
Scenario: Unmitigated
Location: Commercial to Southwest
Address: Fox Farm Storage, 41856 Fox Farm Road, Big Bear Lake
PPV = PPVref(25/D)^n (in/sec)

INPUT

INPUT SECTION IN GREEN

Equipment = Type	1	Vibratory Roller
PPVref =	0.21	Reference PPV (in/sec) at 25 ft.
D =	246.00	Distance from Equipment to Receiver (ft)
n =	1.50	Vibration attenuation rate through the ground

Note: Based on reference equations from Vibration Guidance Manual, California Department of Transportation, 2006, pgs 38-43.

RESULTS

PPV =	0.007	IN/SEC

OUTPUT IN BLUE

GROUNDBORNE VIBRATION ANALYSIS

Project: 19574 Big Bear Bus Maitenance Facility Date: 11/28/22
Source: Large Bulldozer
Scenario: Unmitigated
Location: Commercial to Southwest
Address: Fox Farm Storage, 41856 Fox Farm Road, Big Bear Lake
PPV = PPVref(25/D)^n (in/sec)

INPUT

INPUT SECTION IN GREEN

Equipment = Type	2	Large Bulldozer
PPVref =	0.089	Reference PPV (in/sec) at 25 ft.
D =	246.00	Distance from Equipment to Receiver (ft)
n =	1.50	Vibration attenuation rate through the ground

Note: Based on reference equations from Vibration Guidance Manual, California Department of Transportation, 2006, pgs 38-43.

RESULTS

PPV =	0.003	IN/SEC

OUTPUT IN BLUE

GROUNDBORNE VIBRATION ANALYSIS

Project:	19574 Big Bear Bus Maitenance Facility	Date:	11/28/22
Source:	Vibratory Roller		
Scenario:	Unmitigated		
Location:	Architectural Damage - Distance to Threshold for Residential		
Address:			

PPV = PPVref(25/D)^n (in/sec)

INPUT

Equipment = Type	1	Vibratory Roller	INPUT SECTION IN GREEN
PPVref =	0.21	Reference PPV (in/sec) at 25 ft.	
D =	20.00	Distance from Equipment to Receiver (ft)	
n =	1.50	Vibration attenuation rate through the ground	

Note: Based on reference equations from Vibration Guidance Manual, California Department of Transportation, 2006, pgs 38-43.

RESULTS

PPV =	0.293	IN/SEC	OUTPUT IN BLUE

GROUNDBORNE VIBRATION ANALYSIS

Project: 19574 Big Bear Bus Maitenance Facility Date: 11/28/22
Source: Large Bulldozer
Scenario: Unmitigated
Location: Architectural Damage - Distance to Threshold for Residential
Address:
PPV = PPVref(25/D)^n (in/sec)

INPUT

INPUT SECTION IN GREEN

Equipment = Type	2	Large Bulldozer
PPVref =	0.089	Reference PPV (in/sec) at 25 ft.
D =	12.00	Distance from Equipment to Receiver (ft)
n =	1.50	Vibration attenuation rate through the ground

Note: Based on reference equations from Vibration Guidance Manual, California Department of Transportation, 2006, pgs 38-43.

RESULTS

PPV =	0.268	IN/SEC

OUTPUT IN BLUE

GROUNDBORNE VIBRATION ANALYSIS

Project:	19574 Big Bear Bus Maitenance Facility	Date:	11/28/22
Source:	Vibratory Roller		
Scenario:	Unmitigated		
Location:	Architectural Damage - Distance to Threshold for Commercial/Industrial		
Address:			

PPV = PPVref(25/D)^n (in/sec)

INPUT

Equipment = Type	1	Vibratory Roller	INPUT SECTION IN GREEN
PPVref =	0.21	Reference PPV (in/sec) at 25 ft.	
D =	15.00	Distance from Equipment to Receiver (ft)	
n =	1.50	Vibration attenuation rate through the ground	

Note: Based on reference equations from Vibration Guidance Manual, California Department of Transportation, 2006, pgs 38-43.

RESULTS

PPV =	0.452	IN/SEC	OUTPUT IN BLUE

GROUNDBORNE VIBRATION ANALYSIS

Project:	19574 Big Bear Bus Maitenance Facility	Date:	11/28/22
Source:	Large Bulldozer		
Scenario:	Unmitigated		
Location:	Architectural Damage - Distance to Threshold for Commercial/Industrial		
Address:			

PPV = PPVref(25/D)^n (in/sec)

INPUT

Equipment = Type	2	Large Bulldozer	INPUT SECTION IN GREEN
PPVref =	0.089	Reference PPV (in/sec) at 25 ft.	
D =	8.00	Distance from Equipment to Receiver (ft)	
n =	1.50	Vibration attenuation rate through the ground	

Note: Based on reference equations from Vibration Guidance Manual, California Department of Transportation, 2006, pgs 38-43.

RESULTS

PPV =	0.492	IN/SEC	OUTPUT IN BLUE

GROUNDBORNE VIBRATION ANALYSIS

Project: 19574 Big Bear Bus Maitenance Facility Date: 11/28/22
Source: Vibratory Roller
Scenario: Unmitigated
Location: Annoyance - Distance to Threshold
Address:
PPV = PPVref(25/D)^n (in/sec)

INPUT

INPUT SECTION IN GREEN

Equipment = Type	1	Vibratory Roller
PPVref =	0.21	Reference PPV (in/sec) at 25 ft.
D =	41.00	Distance from Equipment to Receiver (ft)
n =	1.50	Vibration attenuation rate through the ground

Note: Based on reference equations from Vibration Guidance Manual, California Department of Transportation, 2006, pgs 38-43.

RESULTS

OUTPUT IN BLUE

PPV =	0.100	IN/SEC

GROUNDBORNE VIBRATION ANALYSIS

Project: 19574 Big Bear Bus Maitenance Facility Date: 11/28/22
Source: Large Bulldozer
Scenario: Unmitigated
Location: Annoyance - Distance to Threshold
Address:
PPV = PPVref(25/D)^n (in/sec)

INPUT

Equipment = Type	2	Large Bulldozer	INPUT SECTION IN GREEN
PPVref =	0.089	Reference PPV (in/sec) at 25 ft.	
D =	24.00	Distance from Equipment to Receiver (ft)	
n =	1.50	Vibration attenuation rate through the ground	

Note: Based on reference equations from Vibration Guidance Manual, California Department of Transportation, 2006, pgs 38-43.

RESULTS

PPV =	0.095	IN/SEC	OUTPUT IN BLUE

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