Appendix G

Park Lane Homes Phase Preliminary Water Quality Management Plan

(Available on the city website)

Project Specific
Preliminary Water Quality Management Plan

Abode Park Lane Homes
14320 Palm Drive, Desert Hot Springs, CA 92240

Prepared for:

Abode Communities
1149 S Hill Street, Suite 700
Los Angeles, CA 90015
Brendan O'Donnell - Associate Vice President, Development
(213) 629-2702

Prepared by:

The Altum Group
James R. Bazua, PE
44-600 Village Court, Suite 100
Palm Desert, CA 92260
Telephone: (760) 346-4750
james.bazua@thealtumgroup.com

James R. Bazua
RCE 58394

3/3/25
Date
Exp. 12/31/2026

REGISTERED PROFESSIONAL ENGINEER
JAMES RON BAZUA
No 58394
Exp. 12/31/26
CIVIL
STATE OF CALIFORNIA

February 14, 2025

OWNER'S CERTIFICATION

This project-specific Preliminary Water Quality Management Plan (PWQMP) has been prepared for:

Abode Communities by The Altum Group for the project known as Park Lane Homes, located on the northeast corner of Palm Drive and Park Lane in Desert Hot Springs, CA.

This PWQMP is intended to comply with the requirements of the City of Desert Hot Springs Ordinance 13.08 and the requirements of the California Regional Water Quality Control Board MS-4 Permit for the Colorado River Region Basin for the preparation and implementation of a project-specific Preliminary WQMP.

The undersigned, while owning the property/project described in the preceding paragraph, shall be responsible for the implementation of the Final WQMP and will ensure that it is amended as appropriate to reflect up-to-date conditions on the site. The Final WQMP will be reviewed with the facility operator, facility supervisors, employees, tenants, maintenance and service contractors, or any other party (or parties) having responsibility for its implementation. At least one copy of the Final WQMP will be maintained at the project site in perpetuity.

The undersigned is authorized to certify and to approve implementation of the Final WQMP. The undersigned is aware that implementation of the Final WQMP is enforceable under the City of Desert Hot Springs ordinance 13.08.

If the undersigned transfers its interest in the subject property/project, the undersigned shall notify the successor in interest of its responsibility to implement the Final WQMP.

"I, the undersigned, certify under penalty of law that I am the owner of the property that is the subject of this WQMP, and that the provisions of this WQMP have been reviewed and accepted and that the WQMP will be transferred to future successors in interest."

____
Property Owner's Signature

____
Property Owner's Printed Name

____
Property Owner's Title/Position

____
Date

Abode Communities
1149 S Hill Street, Suite 700
Los Angeles, CA 90015

ATTEST

____
Notary Signature

____
Printed Name

____
Title/Position

____
Date

THIS FORM SHALL BE NOTARIZED BEFORE ACCEPTANCE OF THE PROJECT SPECIFIC FINAL WQMP

Contents

APPENDICES

A. Conditions of Approval (See Final WQMP)
B. Vicinity Map, PWQMP Site Plan, and Receiving Waters Map
C. Supporting Detail Related to Hydraulic Conditions of Concern – N/A
D. Educational Materials
E. Soils Report
F. Site Design and Treatment Control BMP Sizing Calculations and Design Details
G. Agreements – CC&Rs, Covenant and Agreements and/or Other Mechanisms for ensuring ongoing Operation, Maintenance, Funding and Transfer of Requirements for this project-specific PWQMP
H. Phase 1 Environmental Site Assessment - Summary of Site Remediation Conducted and Use Restrictions – N/A
I. Project-Specific PWQMP Summary Data Form

VII. Project Description

Project Owner: **Abode Communities**
1149 S Hill Street, Suite 700
Los Angeles, CA 90015
Brendan O' Donnell
Associate Vice President, Development
(213) 629-2702

PWQMP Preparer: The Altum Group
44-600 Village Court, Suite 100
Palm Desert, CA 92260
Telephone: (760) 346-4750

Project Site Address: 14320 Palm Drive, Desert Hot Springs, CA 92240

Zoning: R-L: Residential Low

Land Use Designation: Residential

APN Number(s): 656-040-061 (a portion of)

Project Watershed: Whitewater River Watershed, Mission Creek Sub-Watershed

Project Site Size: 7.54 acres

Standard Industrial Classification (SIC) Code: 6552 – Land Subdividers and Developers

Formation of Home Owners' Association (HOA)
or Property Owners Association (POA): Y ☐ N ☒

Additional Permits/Approvals required for the Project:

AGENCY	Permit required
State Department of Fish and Game, 1601 Streambed Alteration Agreement	Y ☐ N☒
-State Water Resources Control Board, Clean Water Act (-CWA) Section 401 Water Quality Certification	Y ☐ N☒
US Army Corps of Engineers, CWA Section 404 permit	Y ☐ N☒
US Fish and Wildlife, Endangered Species Act Section 7 biological opinion	Y ☐ N☒
City of Desert Hot Springs - Building Permit	Y ☒ N☐
City of Desert Hot Springs - Grading Permit	Y ☒ N☐
State Water Resources Control Board - Construction Stormwater General Permit (SWPPP and NOI)	Y ☒ N☐
South Coast Air Quality Management District - PM10 Approval to comply with Rule 403	Y ☒ N☐

Project Description:

The proposed project consists of the development of 167 apartments on a portion of an existing lot (APN 656-040-061.). The proposed apartment site is approximately 7.54 acres and will consist of seven (7) multi-story apartment buildings, a childhood education building, streets, parking, utilities, landscape, pool, clubhouse and other amenities, and an on-site retention area. The project is bounded to the west by a Riverside County Health building, County Library building, parking lot, landscape and retention basins; to the south by Park Lane, a public street; to the east by Desert Springs Middle School (Palm Springs Unified School District property) with adjacent facilities including basketball courts, grassed play fields, parking and secondary access to Park Lane; and to the north by a neighborhood commercial/retail site anchored by Vons grocery store.

The project site is currently undeveloped and 100% impervious, with topography sloping gently from the northwest corner to the southeast corner. In general, the existing site is not subject to offsite storm flows and there is no existing onsite retention of storm flow. To the west, both the Riverside County Health Building and the Riverside County Library have their own retention facilities. These are designed to capture the storm flow, and if exceeded, overflow at the southwest corner of our project site. The proposed concept plans will include a new overflow for the library retention basin which drains directly to Park Lane. The Von's commercial/retail site drains southeasterly to an existing retention basin, near the northeast corner of our project. The overflow for this off-site basin is along the project's northerly property line, where a 25'x 50' easement was dedicated to provide room for acceptance/conveyance of any overflow. Since the Vons's commercial/retail site was developed more than twenty years ago, no as-built drawings or reports were available for our review. Nevertheless, we contend that this adjacent site is responsible for retaining the developed 100-year storm flow onsite, its basin should be sized appropriately, and that any overflow will be passed through our site and will not be considered as "comingled" flow for the purposes of water quality. Any overflow from this off-site basin will be directed southerly along the project's onsite streets, towards Park Lane.

Although the site and the Desert Hot Springs watershed is not connected hydraulically to waters of the United States, Desert Hot Springs is a co-permittee of the MS4 permit and requires that priority development projects follow a Water Quality Management Plan (WQMP) designed to prevent pollutants from leaving sites due to development.

Appendix A of the project-specific Final WQMP will include a complete copy of the final Conditions of Approval. Appendix B of this project-specific PWQMP includes:

a. A Vicinity Map identifying the project site in sufficient detail to allow the project site to be plotted on Permittee base mapping; and

b. A Site Plan for the project. The Site Plan included as part of Appendix B depicts the following project features:

    - Location and identification of all structural BMPs, including Treatment Control BMPs.
    - Landscaped areas.
    - Paved areas and intended uses (i.e., parking, sidewalks, etc.).
    - Number and type of structures and intended uses (e.g., buildings, etc.).
    - Infrastructure (i.e., streets, storm drains, etc.) that will revert to public agency ownership and operation.
    - Location of existing and proposed public and private storm drainage facilities (i.e., storm drains, channels, basins, etc.), including catch basins, drywells and other inlets/outlet structures.
    - Location(s) of Receiving Waters to which the project directly or indirectly discharges.
    - Location of points where onsite (or tributary offsite) flows exit the property/project site.
    - Proposed drainage area boundaries, including tributary offsite areas, for each location where flows exit the property/project site. Each tributary area should be clearly denoted.
    - Pre- and post-project topography.

Appendix I is a one page form that summarizes pertinent information relative to this project-specific PWQMP.

VII. Site Characterization

Land Use Designation or Zoning: R-L Residential Low

Current Property Use: Partially Developed

Proposed Property Use: Residential Subdivision

Availability of Soils Report: Y ☒ N ☐ *Note: A soils report is required if infiltration BMPs are utilized. Attach report in Appendix E.*

Phase 1 Site Assessment: Y ☐ N ☒ *Note: If prepared, attached remediation summary and use restrictions in Appendix H.*

Receiving Waters for Urban Runoff from Site

Receiving Waters	303(d) List Impairments	Designated Beneficial Uses	Proximity to RARE Beneficial Use
Whitewater River	None	MUN, AGR, GWR, REC 1, REC 2, WARM, COLD, WILD, POW	Not designated as RARE (18.0 miles)
Coachella Valley Storm Water Channel	Pathogens, Toxephene	FRSH, REC 1, REC 2, WARM, WILD, RARE	Designated as RARE (26.0 miles)
Salton Sea[1]	Nutrients, Salinity, and Selenium	AQUA, IND, REC 1, REC 2, WARM, WILD, RARE	Designated as RARE (41.0 miles)

Note: 1) The Salton Sea is the terminus for the Coachella Valley Storm Water Channel. However, note that the Salton Sea is not located within the "Whitewater Region" receiving waters as outlined in the Riverside County WQMP.

VII. Pollutants

Table 1. Pollutant of Concern Summary

Pollutant Category	Potential for Project	Causing Receiving Water Impairment
Bacteria/Virus (pathogens[1])	No	Yes
Heavy Metals	Yes	No
Nutrients	No	Yes
Pesticides	No	No
Toxaphene[2]	No	Yes
Organic Compounds[3]	Yes	No
Sediments and Turbidity	No	No
Trash & Debris	Yes	No
Oxygen Demanding Substances	Yes	No
Oil & Grease[4]	Yes	No

Notes: 1) Pathogens are disease causing virus or bacteria. Pathogens are an impairment in the Coachella Valley Storm Water Channel from Dillon Road to the Salton Sea.
2) Toxaphene is an insecticide which was banned from use in the United States in 1990. Therefore, it is not a potential for the project but is currently a receiving water impairment.
3) Petroleum hydrocarbons are one of the most common organic compounds associated with street and parking lots and are a potential pollutant for the site. See Section V.2 for a description of appropriate Source Control BMPs.
4) Oil and grease associated with landscaping and onsite operations are potential pollutants for the development. See Section V.2 for a description of appropriate Source Control BMPs.

Discussion of Receiving Water Impairment:

Most of the pollutants which have caused impairment to the project's receiving waters are no longer being used. Many of these pollutants can be traced back to agricultural operations prevalent in the Coachella Valley. In addition, water quality management practices (i.e., the MS4 Permit requirements) have been implemented throughout the region to govern storm and non-storm water discharges to the designated receiving waters. These discharges have the ability to impact the "Beneficial Uses" of the receiving waters and can cause or threaten to cause a condition of "pollution" or "nuisance".

The purpose of the project PWQMP is to provide Best Management Practices (BMPs) which the property owner or their designee will implement and maintain to meet the requirements of the MS4 permit, thus minimizing the pollutant load associated with urban runoff.

VII. Hydrologic Conditions of Concern

Local Jurisdiction Requires On-Site Retention of Urban Runoff:

Yes ☒ The project will be required to retain urban runoff onsite in conformance with the local jurisdictions drainage requirements (See Table 6, Permittees Requiring Onsite Retention of Stormwater, of the Whitewater River Region WQMP). This section does not need to be completed.

No ☐ This section must be completed.

This Project meets the following condition:

☐ **Condition A**: Runoff from the Project is discharged directly to a publicly-owned, operated and maintained MS4; the discharge is in full compliance with Permittee requirements for connections and discharges to the MS4 (including both quality and quantity requirements); the discharge would not significantly impact stream habitat in proximate Receiving Waters; and the discharge is authorized by the Permittee.

☐ **Condition B**: The project disturbs less than 1 acre and is not part of a larger common plan of development that exceeds 1 acre of disturbance. The disturbed area calculation must include all disturbances associated with larger plans of development.

☐ **Condition C**: The project's runoff flow rate, volume, velocity and duration for the post-development condition do not exceed the pre-development condition for the 2-year, 24-hour and 10-year 24-hour rainfall events. This condition can be achieved by minimizing impervious area on a site and incorporating other site-design concepts that mimic pre-development conditions. This condition must be substantiated by hydrologic modeling methods acceptable to the Permittee.

☐ **None**

Refer to Section 3.4 of the Whitewater River Region WQMP for additional requirements.

	2 year – 24 hour		10 year – 24 hour	
	Precondition	**Post-condition**	**Precondition**	**Post-condition**
Discharge (cfs)				
Velocity (fps)				
Volume (cubic feet)				
Duration (minutes)				

V. Best Management Practices

This project implements Best Management Practices (BMPs) to address the Pollutants of Concern that may potentially be generated from the use of the project site. These BMPs have been selected and implemented to comply with the Section 3.5 of the WQMP and consist of Site Design, Source Control and, if/where necessary, Treatment Control BMPs as described herein.

V.1 Site Design and Treatment Control BMPs

Local Jurisdiction Requires On-Site Retention of Urban Runoff:

Yes ☒ The project will be required to retain urban runoff onsite in conformance with local ordinance (See Table 6, Permittees Requiring Onsite Retention of Stormwater, of the Whitewater River Region WQMP). Section V.1 does not need to be completed.

No ☐ Section V.1 must be completed.

This section of the Project-Specific PWQMP documents the Site Design BMPs and, if/where necessary the Treatment Control BMPs that will be implemented on the Project to meet the requirements within Section 3.5.1 of the Whitewater River Region WQMP. Section 3.5.1, includes requirements to implement Site Design Concepts and BMPs, and includes requirements to address the project's Pollutants of Concern with BMPs. Further sub-section 3.5.1.1 of the Whitewater River Region WQMP specifically requires that the projects Pollutants of Concern be addressed with Site Design BMPs to the extent feasible.

This project incorporates Site Design BMPs to fully address the Pollutants of Concern where and to the extent feasible. If and where it has been acceptably demonstrated to the Permittee that it is infeasible to fully meet this requirement with Site Design BMPs, this section includes a description of the conventional Treatment Control BMPs that will be substituted to meet the same requirements.

In addressing pollutants of concern, BMPs are selected using Table 2 below.

Table 2. BMP Selection Matrix Based Upon Pollutant of Concern Removal Efficiency (1)

(Sources: Riverside County Flood Control & Water Conservation District Design Handbook for Low Impact Development Best Management Practices, dated September 2011, the Orange County Technical Guidance Document for Water Quality Management Plans, dated May 19, 2011, and the Caltrans Treatment BMP Technology Report, dated April 2010 and April 2008)

Pollutant of Concern	Landscape Swale[2, 3]	Landscape Strip[2, 3]	Biofiltration (with underdrain)[2, 3]	Extended Detention Basin[2]	Sand Filter Basin[2]	Infiltration Basin[2]	Infiltration Trench[2]	Permeable Pavement[2]	Bioretention (w/o underdrain)[2, 3]	Other BMPs Including Proprietary BMPs[4, 6]
Sediment & Turbidity	M	M	H	M	H	H	H	H	H	Varies by Product[5]
Nutrients	L/M	L/M	M	L/M	L/M	H	H	H	H	
Toxic Organic Compounds	M/H	M/H	M/H	L	L/M	H	H	H	H	
Trash & Debris	L	L	H	H	H	H	H	L	H	
Bacteria & Viruses (also: Pathogens)	L	M	H	L	M	H	H	H	H	
Oil & Grease	M	M	H	M	H	H	H	H	H	
Heavy Metals	M	M/H	M/H	L/M	M	H	H	H	H	

Abbreviations:

L: Low removal efficiency M: Medium removal efficiency H: High removal efficiency

Notes:

(1) Periodic performance assessment and updating of the guidance provided by this table may be necessary.

(2) Expected performance when designed in accordance with the most current edition of the document, "Riverside County, Whitewater River Region Stormwater Quality Best Management Practice Design Handbook".

(3) Performance dependent upon design which includes implementation of thick vegetative cover. Local water conservation and/or landscaping requirements should be considered; approval is based on the discretion of the local land use authority.

(4) Includes proprietary stormwater treatment devices as listed in the CASQA Stormwater Best Management Practices Handbooks, other stormwater treatment BMPs not specifically listed in this PWQMP (including proprietary filters, hydrodynamic separators, inserts, etc.), or newly developed/emerging stormwater treatment technologies.

(5) Expected performance should be based on evaluation of unit processes provided by BMP and available testing data. Approval is based on the discretion of the local land use authority.

(6) When used for primary treatment as opposed to pre-treatment, requires site-specific approval by the local land use authority.

V.1.A Site Design BMPs

This section documents the Site Design BMP concepts and LID/Site Design BMPs that will be implemented on this project to comply with the requirements detailed in Section 3.5.1 of the WQMP Guidance document.

- Table 3 herein documents the implementation of the Site Design BMP Concepts described in sub-sections 3.5.1.3 and 3.5.1.4.
- Table 4 herein documents the extent to which this project has implemented the LID/Site Design goals described in sub-section 3.5.1.1.

Table 3. Implementation of Site Design Concepts

Design Concept	Technique	Specific BMP	Included			Brief Reason for BMPs Indicated as No or N/A
			Yes	No	N/A	
Site Design Concept 1	**Minimize Urban Runoff, Minimize Impervious Footprint, and Conserve Natural Areas** **(See Whitewater River Region WQMP Section 3.5.1.3)**	Conserve natural areas by concentrating or cluster development on the least environmentally sensitive portions of a site while leaving the remaining land in a natural, undisturbed condition.	☐	☐	☐	.
		Conserve natural areas by incorporating the goals of the Multi-Species Habitat Conservation Plan or other natural resource plans.	☐	☐	☐	
		Preserve natural drainage features and natural depressional storage areas on the site.	☐	☐	☐	
		Maximize canopy interception and water conservation by preserving existing native trees and shrubs, and planting additional native or drought tolerant trees and large shrubs.	☐	☐	☐	
		Use natural drainage systems.	☐	☐	☐	
		Increase the building floor area ratio (i.e., number of stories above or below ground).	☐	☐	☐	
		Construct streets, sidewalks and parking lot aisles to minimum widths necessary, provided that public safety and a walkable environment for pedestrians is not compromised.	☐	☐	☐	
		Reduce widths of streets where off-street parking is available.	☐	☐	☐	
		Design driveways with shared access, flared (single lane at street), or wheel strips (paving only under the tires).	☐	☐	☐	
		Minimize the use of impervious surfaces, such as decorative concrete, in the landscape design.	☐	☐	☐	
		Other comparable and equally effective Site Design BMP (or BMPs) as approved by the Permittee (Note: Additional narrative required to describe BMP and how it addresses site design concept).	☐	☐	☐	

Table 3. Site Design BMPs (continued)

Design Concept	Technique	Specific BMP	Included			Brief Reason for Each BMP Indicated as No or N/A
			Yes	No	N/A	
Site Design Concept 2	**Minimize Directly Connected Impervious Area** **(See Whitewater River Region WQMP Section 3.5.1.4)**	Residential and commercial sites must be designed to contain and infiltrate roof runoff, or direct roof runoff to vegetative swales or buffer areas.	☐	☐	☐	
		Drain impervious sidewalks, walkways, trails, and patios into adjacent landscaping.	☐	☐	☐	
		Incorporate landscaped buffer areas between sidewalks and streets.	☐	☐	☐	
		Uncovered temporary or guest parking on residential lots paved with a permeable surface, or designed to drain into landscaping.	☐	☐	☐	Street sheet flow runoff to be collected and conveyed to designated drainage collection areas within the site.
		Rural swale system: street sheet flows to vegetated swale or gravel shoulder, curbs used at street corners, and culverts used under driveways and street crossings.	☐	☐	☐	
		Urban curb/swale system: street slopes to curb; periodic swale inlets drain to vegetated swale or biofilter.	☐	☐	☐	
		Dual drainage system: first flush captured in street catch basins and discharged to adjacent vegetated swale or gravel shoulder; high flows connect directly to MS4s.	☐	☐	☐	.
		Maximize the permeable area by constructing walkways, trails, patios, overflow parking, alleys, driveways, low-traffic streets, and other low-traffic areas with open-jointed paving materials or permeable surfaces such as pervious concrete, porous asphalt, unit pavers, and granular materials.	☐	☐	☐	
		Use vegetated drainage swales in lieu of underground piping or imperviously lined swales.	☐	☐	☐	
		Incorporate parking area landscaping into the drainage design.	☐	☐	☐	
		Where soil conditions are suitable, use perforated pipe or gravel filtration pits for low flow infiltration.	☐	☐	☐	
		Construct onsite infiltration BMPs such as dry wells, infiltration trenches, and infiltration basins consistent with vector control objectives.	☐	☐	☐	
		Construct onsite ponding areas or detention facilities to increase opportunities for infiltration consistent with vector control objectives.	☐	☐	☐	

Table 3. Site Design BMPs (continued)

Design Concept	Technique	Specific BMP	Included			Brief Reason for Each BMP Indicated as No or N/A
			Yes	No	N/A	
Site Design Concept 2 (cont' d)	**Minimize Directly Connected Impervious Area** **(See Whitewater River Region WQMP Section 3.5.1.4)**	Direct roof runoff into cisterns or rain barrels for reuse.	☐	☐	☐	
		Use vegetated drainage swales in lieu of underground piping or imperviously lined swales.	☐	☐	☐	
		Incorporate tree well filters, flow-through planters, and/or bioretention areas into landscaping and drainage plans.	☐	☒	☐	Infiltration basin provides 100% Site Design BMP
		Other comparable and equally effective Site Design BMP (or BMPs) as approved by the Permittee (Note: Additional narrative required describing BMP and how it addresses site design concept).	☐	☒	☐	Infiltration basin provides 100% Site Design BMP

Project Site Design BMPs:

The new improvements will flow toward an on-site retention basin required to store the runoff volume generated during the 100 year design storm under the proposed condition.

Alternative Project Site Design BMPs:

No alternatives to the infiltration facility have been proposed. The infiltration basin system for the disturbed area will serve as the main Site Design BMP.

Table 4. Site Design BMPs Meeting the Measureable Goal in WQMP Section 3.5.1.1

(1) **DRAINAGE SUBAREA ID OR NO.**	**(2)** **SITE DESIGN BMP TYPE *** (See Table 2)	**(3)** **POLLUTANTS WITHIN SUBAREA CAUSING RECEIVING WATER IMPAIRMENTS** (refer to Table 1)	**(4)** **RELATIVE EFFECTIVENESS OF BMP (COLUMN 2) AT ADDRESSING IDENTIFIED POLLUTANTS (COLUMN 3)** (U, L, M, H/M, H; see Table 2)	**(5)** **BMP MEETS WHICH DESIGN CRITERIA?** (identify as V_{BMP} OR Q_{BMP})	**(6)** **BMP TRIBUTARY AREA** (nearest 0.1 acre)
	INFILTRATION			V_{BMP}	7.54 AC
TOTAL AREA TREATED WITH SITE DESIGN BMPS (NEAREST 0.1 ACRE)**					13.16 AC

* Site Design BMPs included in this table are those that completely address the Treatment Requirements for their tributary area.

Justification of infeasibility for sub-areas not addressed with LID/Site Design BMPs

All sub-areas are addressed 100% by the LID/Site Design BMP described in Section V.1.A of this PWQMP.

V.1.B TREATMENT CONTROL BMPS

Conventional Treatment Control BMPs shall be implemented to address the project's Pollutants of Concern as required in WQMP Section 3.5.1 where, and to the extent that, Section V.1.A has demonstrated that it is infeasible to meet these requirements through implementation of LID/Site Design BMPs.

☒ The LID/Site Design BMPs described in Section V.1.A of this project-specific PWQMP completely address the 'Treatment Control BMP requirement' for the entire project site (and where applicable, entire existing site) as required in Section 3.5.1.1 of the WQMP Guidance document. Supporting documentation for the sizing of these LID/Site Design BMPs is included in Appendix F. ***Section V.1.B does not need to be completed**.

☐ The LID/Site Design BMPs described in Section V.1.A of this project-specific PWQMP do **NOT** completely address the 'Treatment Control BMP requirement' for the entire project site (or where applicable, entire existing site) as required in Section 3.5.1.1 of the WQMP. ***Section V.1.B must be completed.**

Table 5: Treatment Control BMP Summary

(1) **DRAINAGE SUB-AREA ID OR NO.**	**(2)** **TREATMENT CONTROL BMP TYPE*** (See Table 2)	**(3)** **POTENTIAL POLLUTANTS OF CONCERN WITHIN DRAINAGE SUB-AREA** (Refer to Table 1)	**(4)** **POTENTIAL POLLUTANTS WITHIN SUB-AREA CAUSING RECEIVING WATER IMPAIRMENTS** (Refer to Table 1)	**(5)** **EFFECTIVENESS OF TREATMENT CONTROL BMP AT ADDRESSING IDENTIFIED POTENTIAL POLLUTANTS** (U, L, M, H/M, H; see Table 2)	**(6)** **BMP MEETS WHICH DESIGN CRITERIA?** (Identify as V_{BMP} OR Q_{BMP})	**(7)** **TOTAL AREA WITHIN DRAINAGE SUB-AREA** (Nearest 0.1 acre)
	TOTAL PROJECT AREA TREATED WITH TREATMENT CONTROL BMPs (NEAREST 0.1 ACRE)					0.0 ACRES

V.1.C Measureable Goal Summary

This section documents the extent to which this project meets the measureable goal described in the Whitewater River Region WQMP Section 3.5.1.1 of addressing all of the projects Treatment Requirements with Site Design BMPs.

Table 6. Measureable Goal Summary

(1) Total Area Treated with Site Design BMPs	**(2)** Total Area Treated with Treatment Control BMPs	**(3)** % of Treatment Requirement addressed with Site Design BMPs
7.54 Acres	0.0 Acres	100%

Note – The entire 7.54 acre disturbed area site is treated with site design BMPs.

V.2 Source Control BMPs

This section identifies and describes the Source Control BMPs applicable and implemented on this project.

Table 7. Source Control BMPs

BMP Name	Check One		If not applicable, state brief reason
	Included	Not Applicable	
Non-Structural Source Control BMPs			
Education for Property Owners, Operators, Tenants, Occupants, or Employees	☒	☐	
Activity Restrictions	☒	☐	
Irrigation System and Landscape Maintenance	☒	☐	
Common Area Litter Control	☒	☐	
Street Sweeping Private Streets and Parking Lots	☒	☐	
Drainage Facility Inspection and Maintenance	☒	☐	
Structural Source Control BMPs			
MS4 Stenciling and Signage	☒	☐	
Landscape and Irrigation System Design	☒	☐	
Protect Slopes and Channels	☐	☒	Not applicable
Provide Community Car Wash Racks	☐	☒	Not part of project design
Properly Design*:			
Fueling Areas	☒	☐	
Air/Water Supply Area Drainage	☐	☒	No facilities.
Trash Storage Areas	☒	☐	
Loading Docks	☐	☒	No facilities.
Maintenance Bays	☐	☒	No facilities.
Vehicle and Equipment Wash Areas	☐	☒	No facilities.
Outdoor Material Storage Areas	☐	☒	No facilities.
Outdoor Work Areas or Processing Areas	☐	☒	No facilities.
Provide Wash Water Controls for Food Preparation Areas	☐	☒	No facilities.

*Details demonstrating proper design must be included in Appendix F.

5.2.1 Non-Structural Source Control BMPs

5.2.1.1 Education

Yes

The owner, as responsible party for implementing the Final WQMP, will ensure that owner's employees, operators and managers are properly trained and attend continuing education classes.

5.2.1.2 Activity Restrictions

Yes

Certain activities within the project area may be restricted to enable the owner/operator to meet the City's water quality requirements. For example, maintenance of vehicles (which contributes to storm water contamination by oil and grease) is not authorized in this area.

Similarly, washing of vehicles and equipment shall be restricted to offsite locations which include properly designed wash racks or other areas which meet the intent of the best management practices.

5.2.1.3 Irrigation System and Landscape Maintenance

Yes

Owner shall ensure that the irrigation systems within the project site are operating properly. Owner shall also ensure that the ground's landscaping is maintained regularly so that the project site is in compliance with all City and Coachella Valley Water District water quality requirements.

5.2.1.4 Common Area Litter Control

Yes

Owner shall ensure that employees regularly patrol the site in an effort to keep it free of litter so that the project site is in compliance with all City water quality requirements.

5.2.1.5 Street Sweeping

Yes

Owner shall ensure that the parking lot is regularly swept so that the project site is in compliance with all City water quality requirements. Streets/driveways and parking lots shall be swept at least quarterly, including just prior to start of the rainy season (October 1st). The frequency shall be no less than the frequency of street sweeping by the Co-Permittee on public streets.

5.2.1.6 Drainage Facility Inspection and Maintenance

Yes

Owner shall ensure that drainage facilities within the project area are regularly inspected (at least annually) and maintained properly so that the project site is in compliance with all City water quality requirements. At a minimum, routine maintenance of drainage facilities should take place in the late summer or early fall prior to the start of the rainy season (October 1st). Drainage facilities must be cleaned if accumulated sediment/debris fills 25% or more of the storage capacity of the facility.

5.2.2 Structural Source Control BMPs

5.2.2.1 MS4 Stenciling and Signage

Yes

The existing site does drain directly to MS4 facilities. However, the redevelopment area will include an infiltration facility (BMP) which will intercept a portion of the post-development storm flow prior to entering the MS4 facility offsite. Provide stenciling or labeling of all storm drain inlets and catch basins constructed within the project area with prohibitive language icons to discourage illegal dumping.

5.2.2.2 Landscape and Irrigation System Design

Yes

The project will be designed to include native, drought tolerant plants. These plants use less water, and help reduce the use of fertilizers and pesticides. The irrigation system will be programmable and utilize drip emitters, limiting excess irrigation runoff. The landscape and irrigation system will be designed in accordance with the City's water quality requirements and the Coachella Valley Water District's irrigation requirements.

5.2.2.3 Protect Slopes and Channels

No

Slopes and channels are not in the vicinity of the project.

5.2.2.4 Provide Community Car Wash Racks

No

The project site will not include community car wash racks as part of the project design.

5.2.2.5 Fueling Areas

No

The project site will not include fueling areas.

5.2.2.6 Air/Water Supply Area Drainage

No

The project site will not include air/water supply areas.

5.2.2.7 Trash Storage Areas

Yes

The project site will include trash storage areas. Trash storage (or trash enclosures) will be located in the northwest and northeast corners of the site. Also, trash dumpsters will have attached covers and shall be leak proof. The entire trash storage surface area will be concrete.

5.2.2.8 Loading Docks

No

The project site will not include loading docks.

5.2.2.9 Maintenance Bays

No

The project site will not include maintenance bays.

5.2.2.10 Vehicle and Equipment Wash Areas

No

The project site will not include vehicle and equipment wash areas.

5.2.2.11 Outdoor Material Storage Areas

No

The project site will not include outdoor work areas or processing areas.

5.2.2.12 Outdoor Work Areas or Processing Areas

No

The project site will not include outdoor work areas or processing areas.

5.2.2.13 Wash Water Areas for Food Preparation Areas

No

The project site will not include wash water areas for preparation areas.

Appendix D includes copies of the educational materials that will be used in implementing the project-specific Final PWQMP.

V.3 Equivalent Treatment Control Alternatives

This project will not include any other treatment control alternatives.

V.4 Regionally-Based Treatment Control BMPs

This project will not include any regionally-based treatment control BMPs.

VII. Operations and Maintenance Responsibility for BMPs

Appendix G of the project-specific Final WQMP will include copies of CC&Rs, Covenant and Agreements, BMP Maintenance Agreement and/or other mechanisms used to ensure the ongoing operation, maintenance, funding, transfer and implementation of the project-specific Final WQMP requirements. Operations and maintenance (O&M) will be performed, as necessary, by Abode Communities, their agents, and/or their assignees.

O&M staff will inspect the site regularly (suggested monthly/quarterly) to ensure that the site is clear of trash and debris. This can be accomplished when staff is performing other routine maintenance onsite. At the same time, infiltration systems and drainage facilities can be inspected to see if any minor repairs are required. These facilities should be inspected quarterly (at a minimum) and prior to the beginning of the rainy season (October 1st). See Appendix G for a recommended “Infiltration System Maintenance and Inspection Checklist”.

Routine inspection and required maintenance of all BMPs and the site will begin immediately upon completion of construction and continue throughout the life of the project. Records of all inspection and repair/modifications shall be kept by person who will be announced on the Final WQMP. The following person shall be responsible for all O&M and inspections, until such time as another staff member is designated:

Contact:

Abode Communities
1149 S Hill Street, Suite 700
Los Angeles, CA 90015
Brendan O’Donnell - Associate Vice President, Development
(213) 629-2702

(1) ALL BMPS REQUIRING MAINTENANCE	(2) DESCRIPTION OF O&M ACTIVITIES	(3) START DATE	(4) O&M FREQUENCY	(5) PARTY RESPONSIBLE FOR O&M	(6) SELF INSPECTION AND RECORD KEEPING REQUIREMENTS	(7) WATER QUALITY MONITORS (IF APPLICABLE)
IRRIGATION SYSTEM AND LANDSCAPE MAINTENANCE	REPAIR DAMAGED FACILITIES CAUSING EXCESSIVE RUNOFF	PROJECT COMPLETION	QUARTERLY	ABODE COMMUNITIES	N	N
COMMON AREA LITTER CONTROL	INSPECT DURING ROUTINE MAINTENANCE	PROJECT COMPLETION	AS NEEDED	ABODE COMMUNITIES	Y	N
STREET SWEEPING	INSPECT FOR SEDIMENT DURING ROUTINE MAINTENANCE ADJUST FREQUENCY OF SWEEPING OPERATIONS	PROJECT COMPLETION	QUARTERLY AND AS NEEDED	ABODE COMMUNITIES	Y	N
DRAINAGE FACILITY PROTECTION	REMOVE SEDIMENT AND DEBRIS ON BASIN BOTTOM WHEN 25% FULL	AFTER GRADING	QUARTERLY AND AFTER A QUALIFYING RAIN EVENT OF 0.5” /24HRS	ABODE COMMUNITIES	Y	N
STENCILING AND SIGNAGE	INSPECT FOR LEGIBILITY REPAIR DAMAGED STENCILING AND SIGNAGE	PROJECT COMPLETION	ANNUALY	ABODE COMMUNITIES	Y	N
TRASH STORAGE AREA	INSPECT INTEGRITY OF STRUCTURAL ELEMENTS REPLACE CONTAINERS WHEN NEEDED	PROJECT COMPLETION	MONTHLY AND AS NEEDED	ABODE COMMUNITIES	Y	N

VII. Funding

Source funding and long term funding will be provided by Abode Communities, their agents, and/or assignees. Operations and maintenance of the project BMP is limited in frequency and funding due to the simple nature of the BMP. Funding is addressed in an agreement included with the Final WQMP.

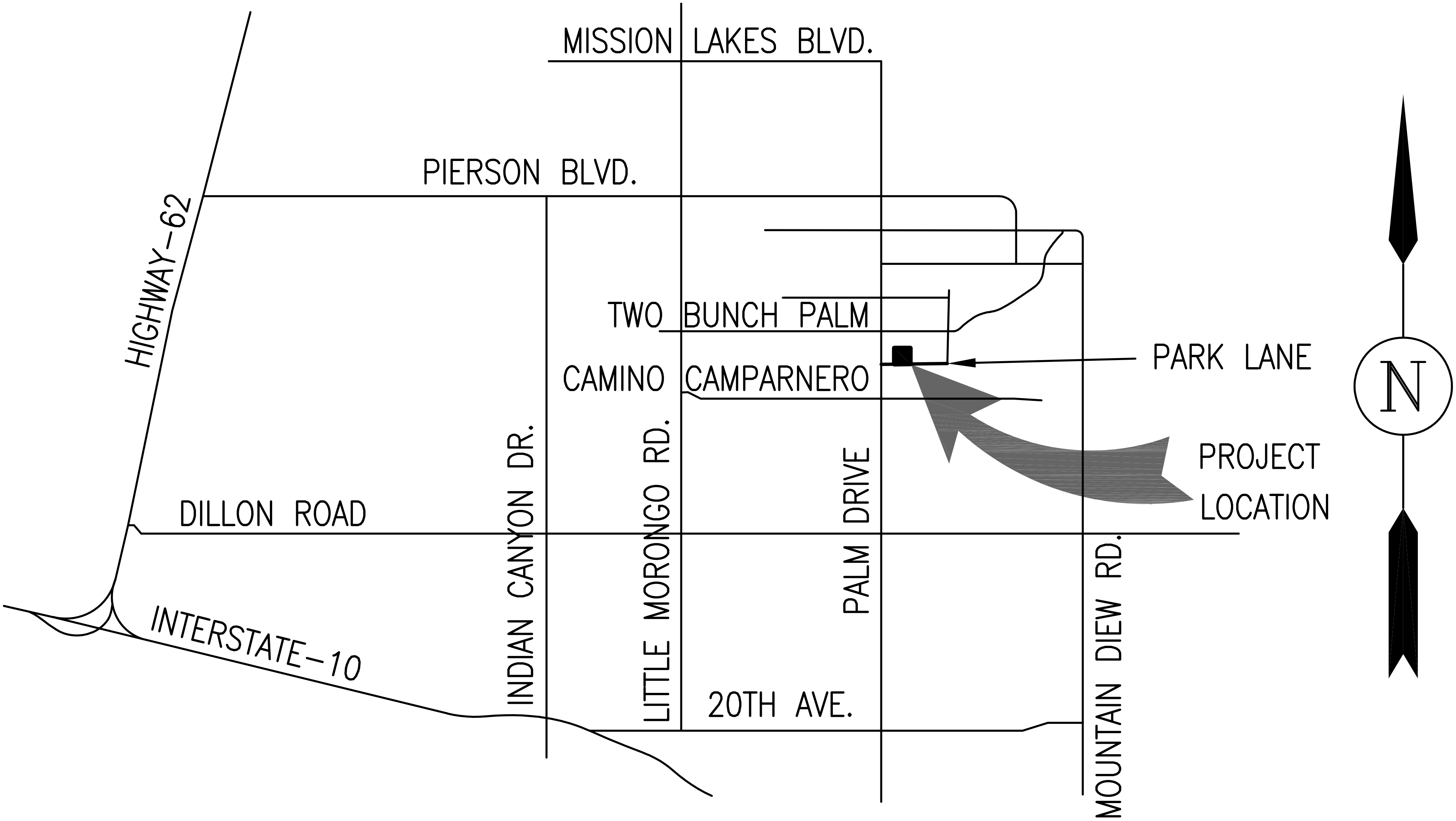
Appendix A

Conditions of Approval

Appendix B

Vicinity Map, PWQMP Site Plan, and Receiving Waters Map

(The project site is not connected hydraulically to water of the United States, therefore a receiving waters map is not included.



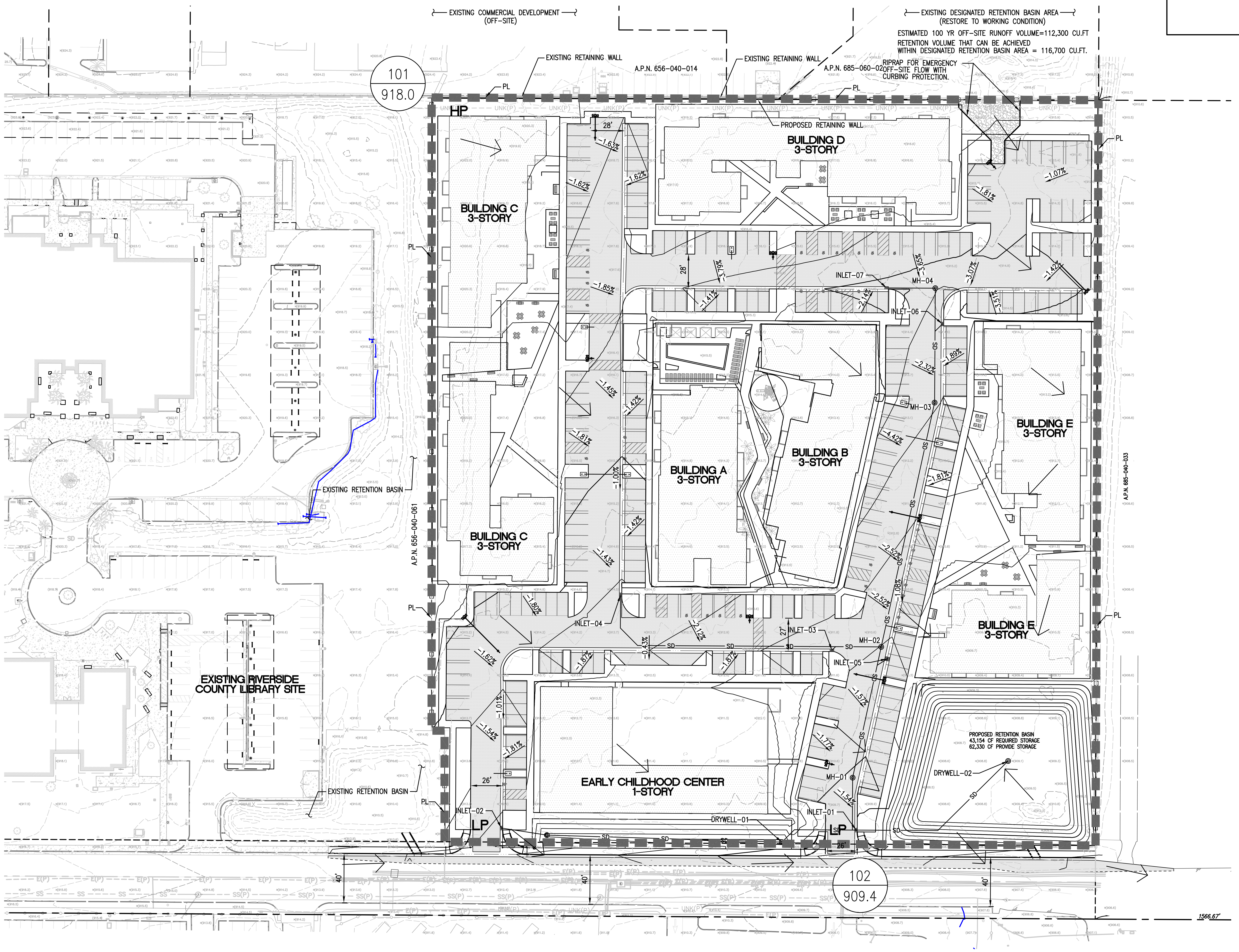
VICINITY MAP
NOT TO SCALE

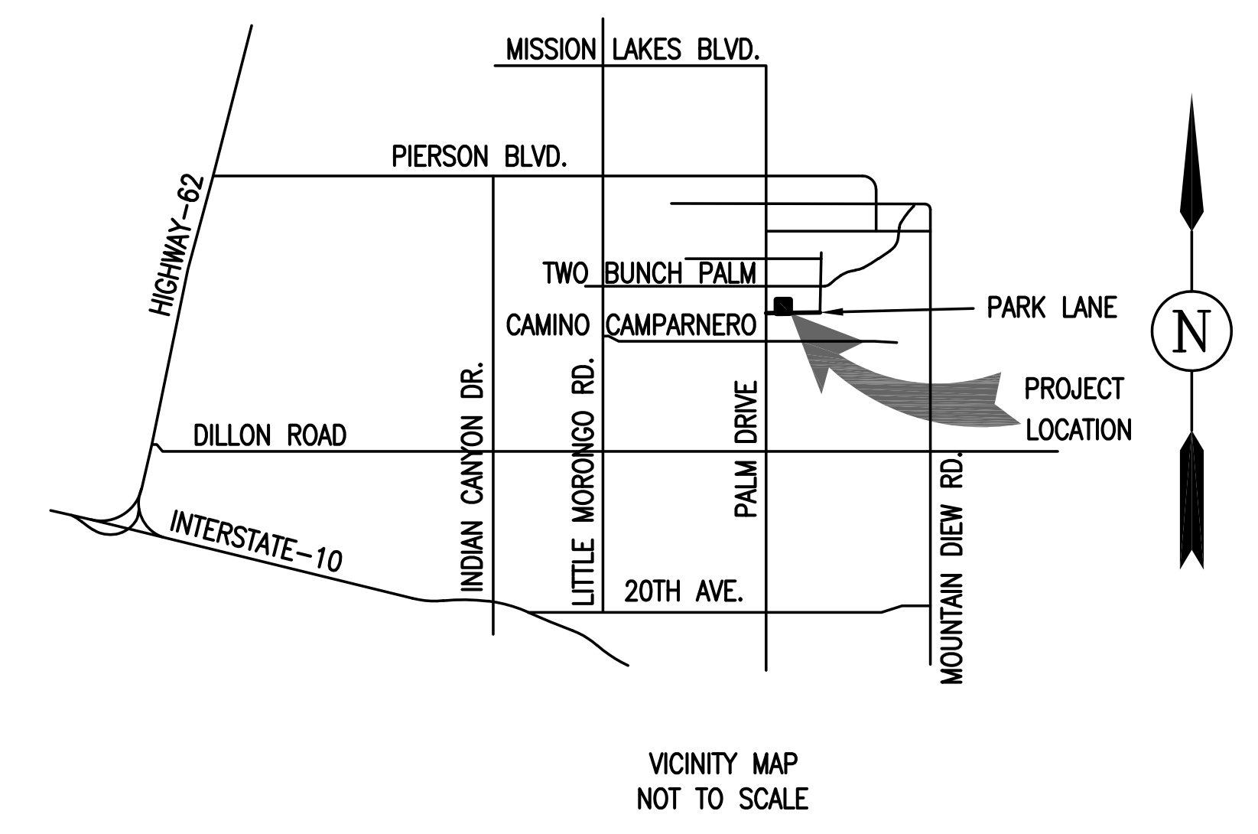
IN THE CITY OF DESERT HOT SPRINGS, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA

LOCATED IN THE PORTION OF THE SOUTH 1/2 OF THE NORTH 1/2 OF THE NORTHEAST 1/4 OF SECTION 6, TOWNSHIP 5 SOUTH, RANGE 5 EAST

CONCEPTUAL HYDROLOGY PLAN

PARK LANE HOMES





VICINITY MAP
NOT TO SCALE

SHEET INDEX

C01 – CONCEPTUAL GRADING & DRAINAGE PLAN
C02 – CONCEPTUAL GRADING & DRAINAGE PLAN
C03 – CONCEPTUAL UTILITY PLAN
C04 – FIRE ACCESS PLAN
C05 – CONCEPTUAL HYDROLOGY PLAN

SHEET NOTES

SITE DATA

TOTAL SITE AREA: 7.547 ACRES

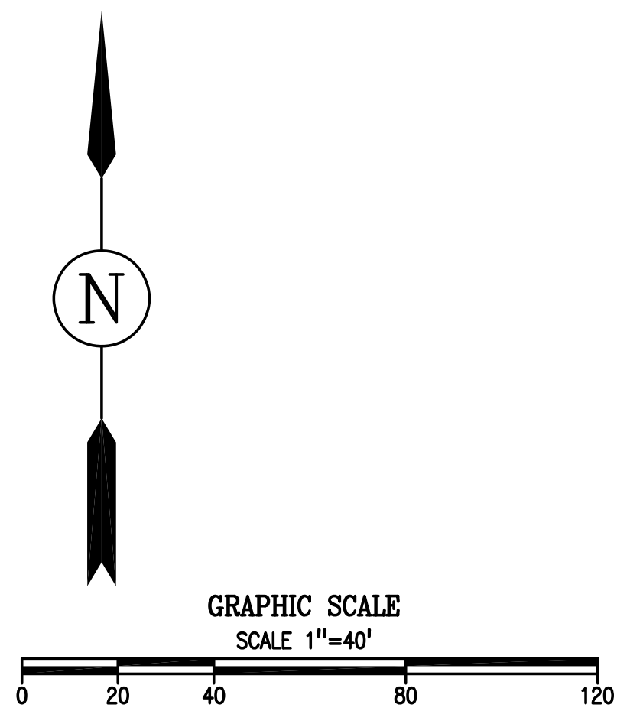
PERCENT PERVIOUS AREA (APARTMENT TYPE LAND USE) = 80%

TOTAL AREA	328769 SF.	7.547 AC
TOTAL VOLUME	43,154 CF REQUIRED	62,330 CF PROVIDED

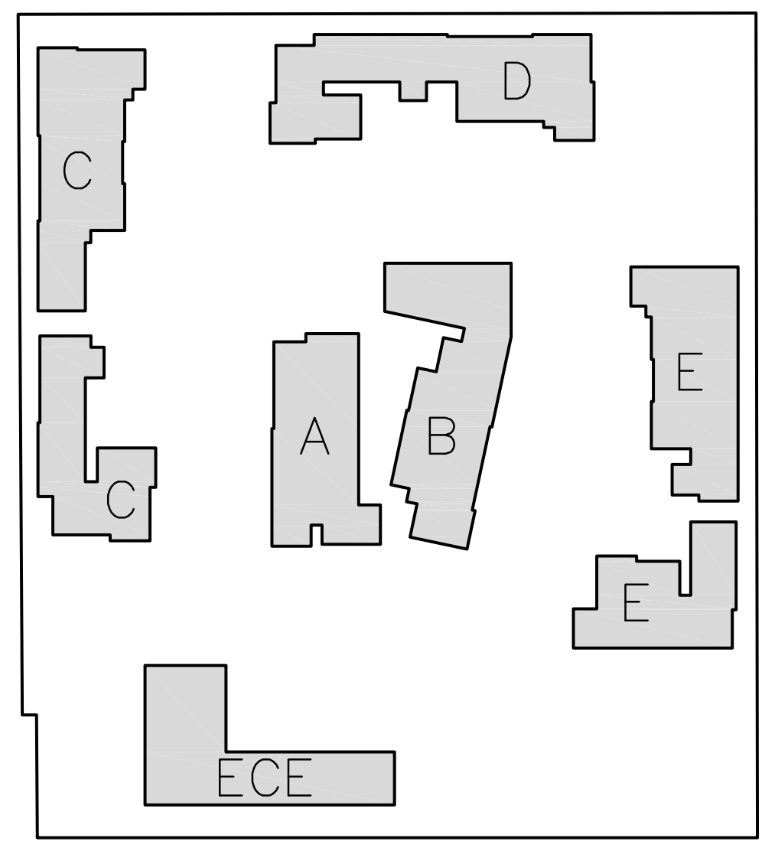
NOTE: THE ABODE PARK LANE HOMES PROJECT IS DESIGNED TO RETAIN 100% OF THE STORM RUNOFF GENERATED ON-SITE DURING THE 100 YEAR DESIGN STORM RAIN EVENT

LEGEND

P.A.	PERVIOUS PLANTER AREA
L.P.	LOW POINT
H.P.	HIGH POINT
▨	AC PAVED ACCESS & DRIVE
▨	DRAINAGE RIPRAP FOR EMERGENCY OFF-SITE FLOW
↘ ↘	EXISTING DIRECTIONAL DRAINAGE ARROWS
X.XX% X.XX%	PROPOSED DIRECTIONAL DRAINAGE ARROWS
NODE / ELEV.	HYDROLOGY NODE AND ELEVATIONS
■ ■ ■ ■	DRAINAGE AREA BOUNDARY



KEY PLAN



The Altum Group
44-600 Village Court, Suite 100
Palm Desert, CA 92260
t.760.346.4750 f. 760.340.0089
TheAltumGroup.com
ENGINEERING | PLANNING | SURVEY | ENVIRONMENTAL

Abode Park Lane Homes

Park Lane
Desert Hot Springs, CA
92240

Abode Communities
1149 S Hill Street, Ste 700
Los Angeles, CA
90015

THIS DRAWING AND THE INFORMATION CONTAINED HEREIN ARE COPYRIGHTED WORK OF KFA, LLP AND MAY NOT BE REPRODUCED WITHOUT WRITTEN PERMISSION

SUBMITTAL:
ENTITLEMENT SET

JOB NUMBER:
2024–081.00

DATE:
02/10/25

REVISIONS:

SHEET TITLE:
CONCEPTUAL HYDROLOGY PLAN

SHEET NUMBER:
C05

Plotted: Mar 04, 2025 – 1:05pm DWG: L:\projects\C2013 Park Lane Homes\engineering\drawings\plan_sets\rough_grade\CG2013001.dwg

Appendix C

Supporting Detail Related to Hydrologic Conditions of Concern

Appendix D

Educational Materials

After the Storm

For more information contact:

or visit
www.epa.gov/npdes/stormwater
www.epa.gov/nps

A Citizen's Guide to Understanding Stormwater

United States Environmental Protection Agency

EPA 833-B-03-002

January 2003

Internet Address (URL) ● HTTP://www.epa.gov
Recycled/Recyclable ● Printed With Vegetable
Oil Based Inks on 100% Postconsumer,
Process Chlorine Free Recycled Paper

What is stormwater runoff?

Stormwater runoff occurs when precipitation from rain or snowmelt flows over the ground. Impervious surfaces like driveways, sidewalks, and streets prevent stormwater from naturally soaking into the ground.

Why is stormwater runoff a problem?

Stormwater can pick up debris, chemicals, dirt, and other pollutants and flow into a storm sewer system or directly to a lake, stream, river, wetland, or coastal water. Anything that enters a storm sewer system is discharged untreated into the waterbodies we use for swimming, fishing, and providing drinking water.

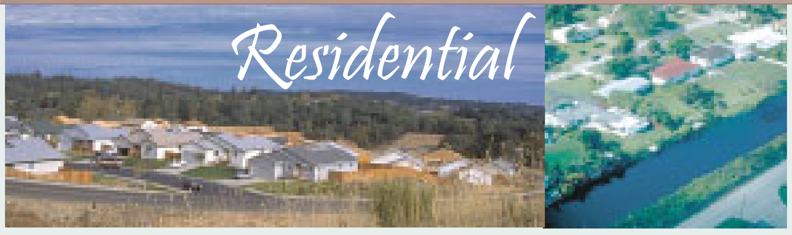
The effects of pollution

Polluted stormwater runoff can have many adverse effects on plants, fish, animals, and people.

- Sediment can cloud the water and make it difficult or impossible for aquatic plants to grow. Sediment also can destroy aquatic habitats.
- Excess nutrients can cause algae blooms. When algae die, they sink to the bottom and decompose in a process that removes oxygen from the water. Fish and other aquatic organisms can't exist in water with low dissolved oxygen levels.
- Bacteria and other pathogens can wash into swimming areas and create health hazards, often making beach closures necessary.
- Debris—plastic bags, six-pack rings, bottles, and cigarette butts—washed into waterbodies can choke, suffocate, or disable aquatic life like ducks, fish, turtles, and birds.
- Household hazardous wastes like insecticides, pesticides, paint, solvents, used motor oil, and other auto fluids can poison aquatic life. Land animals and people can become sick or die from eating diseased fish and shellfish or ingesting polluted water.
- Polluted stormwater often affects drinking water sources. This, in turn, can affect human health and increase drinking water treatment costs.

Stormwater Pollution Solutions

Residential



Recycle or properly dispose of household products that contain chemicals, such as insecticides, pesticides, paint, solvents, and used motor oil and other auto fluids. Don't pour them onto the ground or into storm drains.

Lawn care

Excess fertilizers and pesticides applied to lawns and gardens wash off and pollute streams. In addition, yard clippings and leaves can wash into storm drains and contribute nutrients and organic matter to streams.

- Don't overwater your lawn. Consider using a soaker hose instead of a sprinkler.
- Use pesticides and fertilizers sparingly. When use is necessary, use these chemicals in the recommended amounts. Use organic mulch or safer pest control methods whenever possible.
- Compost or mulch yard waste. Don't leave it in the street or sweep it into storm drains or streams.
- Cover piles of dirt or mulch being used in landscaping projects.

Septic systems

Leaking and poorly maintained septic systems release nutrients and pathogens (bacteria and viruses) that can be picked up by stormwater and discharged into nearby waterbodies. Pathogens can cause public health problems and environmental concerns.

- Inspect your system every 3 years and pump your tank as necessary (every 3 to 5 years).
- Don't dispose of household hazardous waste in sinks or toilets.

Auto care

Washing your car and degreasing auto parts at home can send detergents and other contaminants through the storm sewer system. Dumping automotive fluids into storm drains has the same result as dumping the materials directly into a waterbody.

- Use a commercial car wash that treats or recycles its wastewater, or wash your car on your yard so the water infiltrates into the ground.
- Repair leaks and dispose of used auto fluids and batteries at designated drop-off or recycling locations.

Pet waste

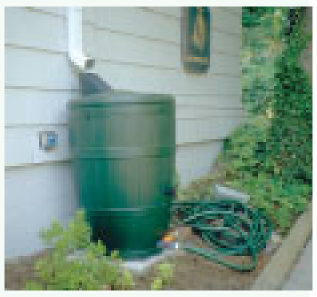
Pet waste can be a major source of bacteria and excess nutrients in local waters.

- When walking your pet, remember to pick up the waste and dispose of it properly. Flushing pet waste is the best disposal method. Leaving pet waste on the ground increases public health risks by allowing harmful bacteria and nutrients to wash into the storm drain and eventually into local waterbodies.

Education is essential to changing people's behavior. Signs and markers near storm drains warn residents that pollutants entering the drains will be carried untreated into a local waterbody.

Residential landscaping

Permeable Pavement—Traditional concrete and asphalt don't allow water to soak into the ground. Instead these surfaces rely on storm drains to divert unwanted water. Permeable pavement systems allow rain and snowmelt to soak through, decreasing stormwater runoff.



Rain Barrels—You can collect rainwater from rooftops in mosquito-proof containers. The water can be used later on lawn or garden areas.

Rain Gardens and Grassy Swales—Specially designed areas planted with native plants can provide natural places for rainwater to collect and soak into the ground. Rain from rooftop areas or paved areas can be diverted into these areas rather than into storm drains.

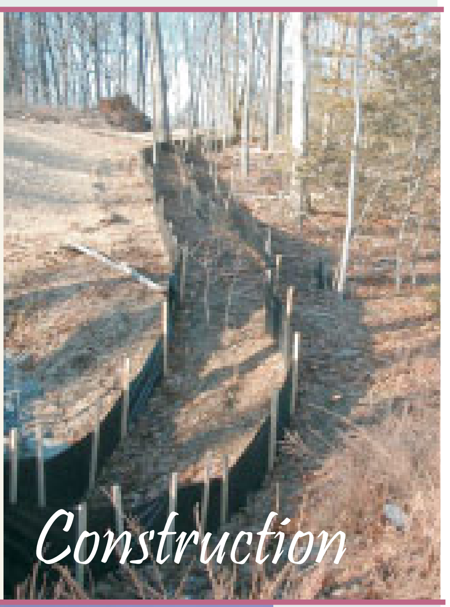
Vegetated Filter Strips—Filter strips are areas of native grass or plants created along roadways or streams. They trap the pollutants stormwater picks up as it flows across driveways and streets.

Commercial

Dirt, oil, and debris that collect in parking lots and paved areas can be washed into the storm sewer system and eventually enter local waterbodies.

- Sweep up litter and debris from sidewalks, driveways and parking lots, especially around storm drains.
- Cover grease storage and dumpsters and keep them clean to avoid leaks.
- Report any chemical spill to the local hazardous waste cleanup team. They'll know the best way to keep spills from harming the environment.

Construction



Erosion controls that aren't maintained can cause excessive amounts of sediment and debris to be carried into the stormwater system. Construction vehicles can leak fuel, oil, and other harmful fluids that can be picked up by stormwater and deposited into local waterbodies.

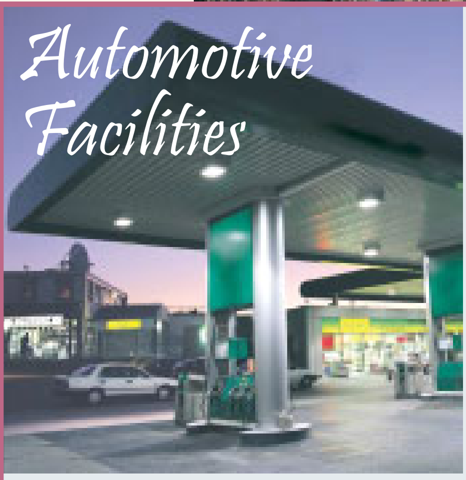
- Divert stormwater away from disturbed or exposed areas of the construction site.
- Install silt fences, vehicle mud removal areas, vegetative cover, and other sediment and erosion controls and properly maintain them, especially after rainstorms.
- Prevent soil erosion by minimizing disturbed areas during construction projects, and seed and mulch bare areas as soon as possible.

Agriculture

Lack of vegetation on streambanks can lead to erosion. Overgrazed pastures can also contribute excessive amounts of sediment to local waterbodies. Excess fertilizers and pesticides can poison aquatic animals and lead to destructive algae blooms. Livestock in streams can contaminate waterways with bacteria, making them unsafe for human contact.

- Keep livestock away from streambanks and provide them a water source away from waterbodies.
- Store and apply manure away from waterbodies and in accordance with a nutrient management plan.
- Vegetate riparian areas along waterways.
- Rotate animal grazing to prevent soil erosion in fields.
- Apply fertilizers and pesticides according to label instructions to save money and minimize pollution.

Automotive Facilities



Uncovered fueling stations allow spills to be washed into storm drains. Cars waiting to be repaired can leak fuel, oil, and other harmful fluids that can be picked up by stormwater.

- Clean up spills immediately and properly dispose of cleanup materials.
- Provide cover over fueling stations and design or retrofit facilities for spill containment.
- Properly maintain fleet vehicles to prevent oil, gas, and other discharges from being washed into local waterbodies.
- Install and maintain oil/water separators.

Forestry

Improperly managed logging operations can result in erosion and sedimentation.

- Conduct preharvest planning to prevent erosion and lower costs.
- Use logging methods and equipment that minimize soil disturbance.
- Plan and design skid trails, yard areas, and truck access roads to minimize stream crossings and avoid disturbing the forest floor.
- Construct stream crossings so that they minimize erosion and physical changes to streams.
- Expedite revegetation of cleared areas.

RIVERSIDE COUNTY
ANIMAL SERVICES LOCATIONS:

www.rcdas.org

BLYTHE
16450 West Hobson Way
Blythe, CA 92225
760-921-7857

COACHELLA VALLEY ANIMAL CAMPUS
72-050 Petland Place
Thousand Palms, CA 92276
760-343-3644

RIVERSIDE COUNTY ANIMAL SERVICES
6851 Van Buren Blvd.
Riverside, CA 92509
951-688-4340

OTHER ANIMAL SHELTERS:

ANIMAL CARE CENTER OF INDIO
45-355 Van Buren
Indio, CA 92201
760-391-4138

ANIMAL FRIENDS OF THE VALLEYS
29001 Bastron Avenue
Lake Elsinore, CA 92530
951-674-0618
(Serving incorporated Temecula, Wildomar,
Lake Elsinore, Murrieta and Canyon Lake)

MARY S. ROBERTS PET ADOPTION CENTER
6185 Industrial Avenue
Riverside, CA 92504
951-688-4340

RAMONA HUMANE SOCIETY
690 Humane Way
San Jacinto 92586
951-654-8002
(Serving Sun City, Menifee, Romoland and Homeland)

Looking to adopt a pet?
This website is linked to many animal shelters.
www.petfinder.com

To report illegal storm drain disposal, call
1-800-506-2555

Or visit our website at www.rcflood.org

E-mail fcnpdes@rcflood.org

What's the Scoop?

TIPS FOR A HEALTHY PET AND A HEALTHIER ENVIRONMENT

CREATE A HEALTHY ENVIRONMENT in and around your home by following these simple pet practices. Your pet, family and neighbors will appreciate their clean comfortable surroundings.

HOUSEHOLD PETS

We all love our pets, but pet waste is a subject everyone likes to avoid. Pet waste left on trails, sidewalks, streets and grassy areas can be washed into the nearest waterway when it rains. Even if you can't see streams or lakes near you, rainfall (stormwater) or sprinkler runoff can wash pet waste into the storm drains that carry runoff to the nearest streams or lakes untreated. The risk of stormwater contamination increases if pet waste is allowed to accumulate in outdoor animal pen areas or left on sidewalks, streets or driveways.

Pet waste contains nutrients and bacteria. Nutrients can promote the growth of algae in streams and lakes. Algae can cause fish kills and other environmental damage if it is fed too many nutrients. Pet Waste also contains e. Coli and fecal bacteria, which can cause disease in other animals and humans that come in contact with it when swimming or splashing in streams and lakes. Dogs also carry salmonella and giardia, which can make people sick.

Pet waste that is not picked up and properly disposed can also increase vector problems. Flies and other insects are not only attracted to and feed on pet waste, but can also be infected with diseases and spread those diseases to humans and other animals.

WHAT CAN YOU DO?

- SCOOP up pet waste and flush it down the toilet or place in trash can.
- NEVER DUMP pet waste into a storm drain or catch basin.
- USE the complimentary bags or mutt mitts offered in dispensers at local parks.
- CARRY EXTRA BAGS when walking your dog and make them available to other pet owners who are without.
- TEACH CHILDREN how to properly clean up after a pet.
- TELL FRIENDS AND NEIGHBORS about the ill effects of animal waste on the environment. Encourage them to clean up after pets.

Call 1-800-506-2555 TOLL FREE to report illegal dumping to the storm drain, find the dates and times of local Household Hazardous Waste Collection Events, obtain additional information on stormwater problems and solutions, request presentations about stormwater pollution in your child's classroom, or learn about free grasscycling and composting workshops.

SCOOP THE POOP

Many communities have "Scoop the Poop" laws that govern pet waste cleanup. Some of these laws specifically require anyone who walks an animal off their property to carry a bag, shovel, or scooper. Any waste left by the animal must be cleaned up immediately. CALL YOUR LOCAL CODE ENFORCEMENT OFFICE to find out more about pet waste regulations.

OTHER WAYS TO PROTECT YOUR PETS AND THE ENVIRONMENT

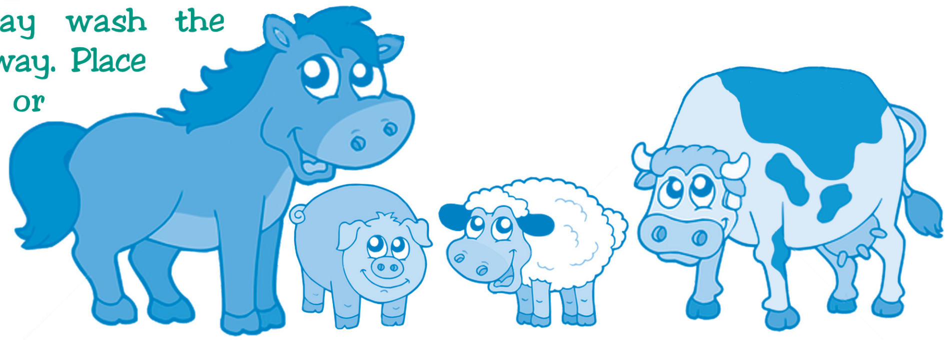
Pets are only one of many sources that contribute to water pollution. However, these other sources of water pollution cannot only harm the environment but also harm your pet. Improperly used or stored lawn fertilizers, pesticides, soaps, grease and vehicle fluids cannot only be washed into local streams and lakes, these chemicals can also harm your pet if they ingest or touch these chemicals. Call 1-800-506-2555 for information regarding how to properly dispose of household hazardous wastes such as these. You can also keep your pets and our environment healthy by properly maintaining your vehicles, and limiting use of pesticides and fertilizers to only the amount that is absolutely needed.

Make sure to not only protect your pets, but to also protect your neighbors pets. NEVER HOSE VEHICLE FLUIDS into the street or gutter. USE ABSORBENT MATERIALS such as cat litter to clean-up spills. SWEEP UP used absorbent materials and place it in the trash.

HORSES AND LIVESTOCK

Fortunate enough to own a horse or livestock? You, too, can play a part in protecting and cleaning up our water resources. The following are a few simple Best Management Practices (BMPs) specifically designed for horses and livestock.

- STORE your manure properly. Do not store unprotected piles of manure in places where stormwater runoff may wash the manure away. Place a cover or tarp over the pile to keep rainwater out.



- BUILD a manure storage facility to protect your pets, property and the environment. These structures usually consist of a concrete pad to protect groundwater and a short wall on one or two sides to make manure handling easier.
- READ the Only Rain Down the Storm Drain brochure titled "Tips for Horse Care" for additional guidance and recommendations. This brochure should be available from your local city office or for download at www.rcflood.org/stormwater.
- KEEP animals out of streams - Horses and livestock can deficate in streams causing stormwater pollution. Livestock and horses in streams can also disturb sensitive habitat and vegetation, causing additional environmental damage. Keep livestock and horses away from streams and use designated stream crossings whenever possible.
- MATERIAL STORAGE SAFETY TIPS Many of the chemicals found in barns require careful handling and proper disposal. When using these chemicals, be certain to follow these common sense guidelines:
    - ◆ Buy only what you need.
    - ◆ Treat spills of hoof oils like a fuel spill. Use kitty litter to soak up the oil and dispose of it in a tightly sealed plastic bag.
    - ◆ Store pesticides in a locked, dry, well-ventilated area.
    - ◆ Protect stored fertilizer and pesticides from rain and surface water.

RESOURCE CONSERVATION DISTRICTS CAN HELP

Call 1-800-506-2555 for assistance with locating a local conservation district that can help you properly manage your manure, re-establish healthy pastures, control weeds, or identify appropriate grasses for your soils.

Thank you for doing your part to protect your watershed, the environment, your pets and your community!

Helpful telephone numbers and links:

Riverside County Stormwater Protection Partners

Flood Control District	(951) 955-1200
County of Riverside	(951) 955-1000
City of Banning	(951) 922-3105
City of Beaumont	(951) 769-8520
City of Calimesa	(909) 795-9801
City of Canyon Lake	(951) 244-2955
Cathedral City	(760) 770-0327
City of Coachella	(760) 398-4978
City of Corona	(951) 736-2447
City of Desert Hot Springs	(760) 329-6411
City of Eastvale	(951) 361-0900
City of Hemet	(951) 765-2300
City of Indian Wells	(760) 346-2489
City of Indio	(760) 391-4000
City of Lake Elsinore	(951) 674-3124
City of La Quinta	(760) 777-7000
City of Menifee	(951) 672-6777
City of Moreno Valley	(951) 413-3000
City of Murrieta	(951) 304-2489
City of Norco	(951) 270-5607
City of Palm Desert	(760) 346-0611
City of Palm Springs	(760) 323-8299
City of Perris	(951) 943-6100
City of Rancho Mirage	(760) 324-4511
City of Riverside	(951) 361-0900
City of San Jacinto	(951) 654-7337
City of Temecula	(951) 694-6444
City of Wildomar	(951) 677-7751

REPORT ILLEGAL STORM DRAIN DISPOSAL
1-800-506-2555 or e-mail us at
fcnpdes@rcflood.org

- Riverside County Flood Control and Water Conservation District
  www.rcflood.org

Online resources include:

- California Storm Water Quality Association
  www.casqa.org
- State Water Resources Control Board
  www.waterboards.ca.gov
- Power Washers of North America
  www.thepwna.org

Stormwater Pollution

What you should know for...

Outdoor Cleaning Activities and Professional Mobile Service Providers

Storm drain pollution prevention information for:

- Car Washing / Mobile Detailers
- Window and Carpet Cleaners
- Power Washers
- Waterproofers / Street Sweepers
- Equipment cleaners or degreasers and all mobile service providers

---

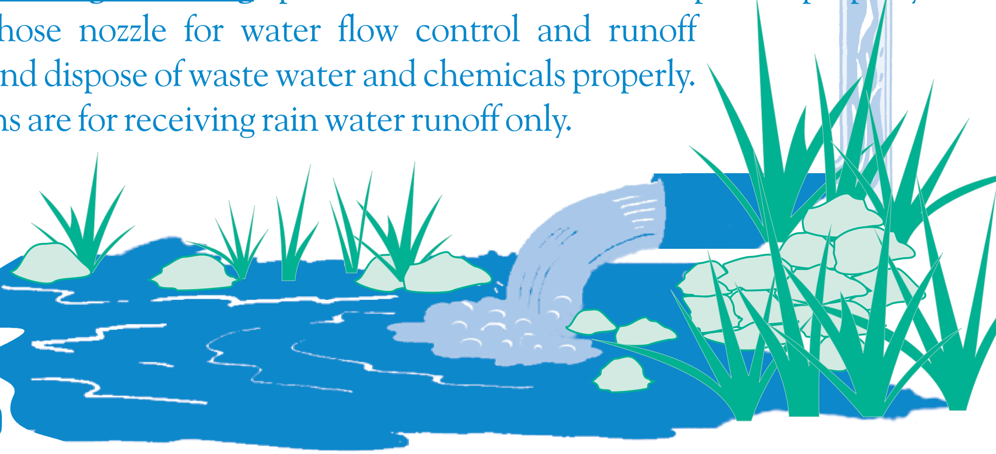
Do you know where street flows actually go?

Storm drains are NOT connected to sanitary sewer systems and treatment plants!

The primary purpose of storm drains is to carry *rain* water away from developed areas to prevent flooding. Pollutants discharged to storm drains are transported directly into rivers, lakes and streams. Soaps, degreasers, automotive fluids, litter and a host of materials are washed off buildings, sidewalks, plazas and parking areas. Vehicles and equipment must be properly managed to prevent the pollution of local waterways.

Unintentional spills by mobile service operators can flow into storm drains and pollute our waterways. **Avoid mishaps.** *Always* have a **Spill Response Kit** on hand to clean up unintentional spills. Only emergency **Mechanical** repairs should be done in City streets, using drip pans for spills. **Plumbing** should be done on private property. Always store chemicals in a leak-proof container and keep covered when not in use. **Window/Power Washing** waste water shouldn't be released into the streets, but should be disposed of in a sanitary sewer, landscaped area or in the soil. Soiled **Carpet Cleaning** wash water should be filtered before being discharged into the sanitary sewer. Dispose of all filter debris properly. **Car Washing/Detailing** operators should wash cars on private property and use a regulated hose nozzle for water flow control and runoff prevention. Capture and dispose of waste water and chemicals properly. Remember, storm drains are for receiving rain water runoff only.

REPORT ILLEGAL STORM DRAIN DISPOSAL 1-800-506-2555



Help Protect Our Waterways!

Use these guidelines for Outdoor Cleaning Activities and Wash Water Disposal

Did you know that disposing of pollutants into the street, gutter, storm drain or body of water is *PROHIBITED* by law and can result in stiff penalties?

Best Management Practices

Waste wash water from Mechanics, Plumbers, Window/Power Washers, Carpet Cleaners, Car Washing and Mobile Detailing activities may contain significant quantities of motor oil, grease, chemicals, dirt, detergents, brake pad dust, litter and other materials.

Best Management Practices, or BMPs as they are known, are guides to prevent pollutants from entering the storm drains. ***Each of us*** can do our part to keep stormwater clean by using the suggested BMPs below:

Simple solutions for both light and heavy duty jobs:

Do...consider dry cleaning methods first such as a mop, broom, rag or wire brush. Always keep a spill response kit on site.

Do...prepare the work area before power cleaning by using sand bags, rubber mats, vacuum booms, containment pads or temporary berms to keep wash water away from the gutters and storm drains.

Do...use vacuums or other machines to remove and collect loose debris or litter before applying water.

Do...obtain the property owner's permission to dispose of ***small amounts*** of power washing waste water on to landscaped, gravel or unpaved surfaces.

Do...check your local sanitary sewer agency's policies on wash water disposal regulations before disposing of wash water into the sewer. (See list on reverse side)

Do...be aware that if discharging to landscape areas, soapy wash water may damage landscaping. Residual wash water may remain on paved surfaces to evaporate. Sweep up solid residuals and dispose of properly. Vacuum booms are another option for capturing and collecting wash water.

Do...check to see if local ordinances prevent certain activities.

Do not let...wash or waste water from sidewalk, plaza or building cleaning go into a street or storm drain.

...ONLY RAIN... DOWN THE STORM DRAIN

Report illegal storm drain disposal
Call Toll Free
1-800-506-2555

Using Cleaning Agents

Try using biodegradable/phosphate-free products. They are easier on the environment, but don't confuse them with being toxic free. Soapy water entering the storm drain system can impact the delicate aquatic environment.

When cleaning surfaces with a ***high-pressure washer*** or ***steam cleaner***, additional precautions should be taken to prevent the discharge of pollutants into the storm drain system. These two methods of surface cleaning can loosen additional material that can contaminate local waterways.

Think Water Conservation

Minimize water use by using high pressure, low volume nozzles. Be sure to check all hoses for leaks. Water is a precious resource, don't let it flow freely and be sure to shut it off in between uses.

Screening Wash Water

Conduct thorough dry cleanup before washing exterior surfaces, such as buildings and decks ***with loose paint***, sidewalks or plaza areas. Keep debris from entering the storm drain after cleaning by first passing the wash water through a "20 mesh" or finer screen to catch the solid materials, then dispose of the mesh in a refuse container. Do not let the remaining wash water enter a street, gutter or storm drain.

Drain Inlet Protection & Collection of Wash Water

- Prior to any washing, block all storm drains with an impervious barrier such as sandbags or berms, or seal the storm drain with plugs or other appropriate materials.
- Create a containment area with berms and traps or take advantage of a low spot to keep wash water contained.
- Wash vehicles and equipment on grassy or gravel areas so that the wash water can seep into the ground.
- Pump or vacuum up all wash water in the contained area.

Concrete/Coring/Saw Cutting and Drilling Projects

Protect any down-gradient inlets by using dry activity techniques whenever possible. If water is used, minimize the amount of water used during the coring/drilling or saw cutting process. Place a barrier of sandbags and/or absorbent berms to protect the storm drain inlet or watercourse. Use a shovel or wet vacuum to remove the residue from the pavement. Do not wash residue or particulate matter into a storm drain inlet or watercourse.

Saltwater Pools

- Salt water pools, although different from regular pools, are in fact, sanitized using chlorine. A salt-chlorine generator separates the chlorine and sodium molecules in salt and reintroduces them into the pool water. The same harmful effects of chlorine still apply.
- A salt water pool is still maintained with chemicals such as Muriatic acid, soda ash and sodium carbonate to help keep a proper pH, total Alkalinity, Calcium Hardness and Stabilizer levels.

- It may be illegal to discharge salt water to land. The salt may kill plants and the build-up of salt in soil puts animals, plants, and groundwater at risk. Consult your city representatives to determine local requirements regarding salt water drainage.

NEVER put unused chemicals into the trash, onto the ground or down a storm drain.

IMPORTANT: The discharge of pollutants into the street, gutter, storm drain system or waterways - without a permit or waiver - is strictly prohibited by local ordinances, state and federal law. Violations may result in monetary fines and enforcement actions.

Helpful telephone numbers and links

RIVERSIDE COUNTY WATER AGENCIES:

City of Banning	(951) 922-3130
City of Beaumont/Cherry Valley	(951) 845-9581
City of Blythe	(760) 922-6161
City of Coachella	(760) 398-3502
City of Corona	(951) 736-2263
City of Hemet	(951) 765-3710
City of Norco	(951) 270 5607
City of Riverside Public Works	(951) 351-6140
City of San Jacinto	(951) 654-4041
Coachella Valley Water District	(760) 398-2651
Desert Water Agency (Palm Springs)	(760) 323-4971
Eastern Municipal Water District	(951) 928-3777
Elsinore Valley Municipal Water District	(951) 674 3146
Elsinore Water District	(951) 674-2168
Farm Mutual Water Company	(951) 244-4198
Idyllwild Water District	(951) 659-2143
Indio Water Authority	(760) 391-4129
Jurupa Community Services District	(951) 685-7434
Lee Lake Water	(951) 658-3241
Mission Springs Water	(760) 329-6448
Rancho California Water District	(951) 296-6900
Ripley, CSA #62	(760) 922-4951
Riverside Co. Service Area #51	(760) 227-3203
Rubidoux Community Services District	(951) 684-7580
Valley Sanitary District	(760) 347-2356
Western Municipal Water District	(951) 789-5000
Yucaipa Valley Water District	(909) 797-5117

CALL 1-800-506-2555 to:

- Report clogged storm drains or illegal storm drain disposal from residential, industrial, construction and commercial sites into public streets, storm drains and/or water bodies.
- Find out about our various storm drain pollution prevention materials.
- Locate the dates and times of Household Hazardous Waste (HHW) Collection Events.
- Request adult, neighborhood, or classroom presentations.
- Locate other County environmental services.
- Receive grasscycling information and composting workshop information.

Or visit our
Riverside County Flood Control and Water Conservation District
website at: www.rcflood.org

Other links to additional storm drain pollution information:

- County of Riverside Environmental Health: www.rivcoeh.org
- State Water Resources Control Board: www.waterboards.ca.gov
- California Stormwater Quality Association: www.casqa.org
- United States Environmental Protection Agency (EPA): www.epa.gov/compliance/assistance (compliance assistance information)

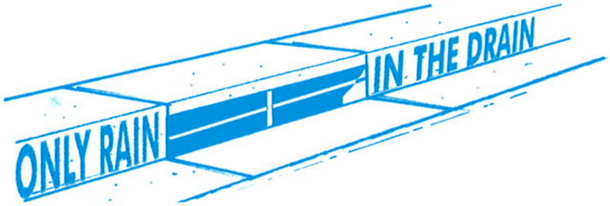
ONLY RAIN DOWN THE STORM DRAIN

Riverside County's, "Only Rain Down the Storm Drain" Pollution Prevention Program gratefully acknowledges the Bay Area Stormwater Management Agencies Association and the Cleaning Equipment Trade Association for information provided in this brochure.

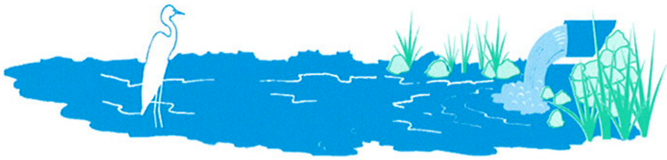
Guidelines for Maintaining your...

Swimming Pool, Jacuzzi and Garden Fountain

Where does the water go?



Pool, Jacuzzi and Fountain wastewater and rain water runoff (also called stormwater) that reach streets can enter the storm drain and be conveyed directly into local streams, rivers and lakes.



A storm drain's purpose is to prevent flooding by carrying rain water away from developed areas. Storm drains are not connected to sanitary sewers systems and treatment plants!

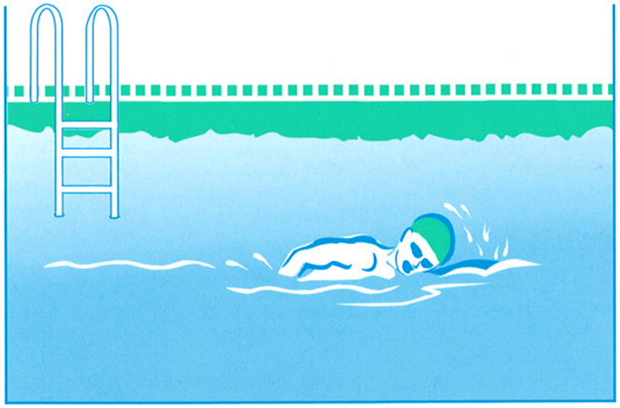
Wastewater, from residential swimming pools, Jacuzzis, fishponds and fountains, often contains chemicals used for sanitizing or cleansing purposes. Toxic chemicals (such as chlorine or copper-based algaecides) may pollute the environment when discharged into a storm drain system.

The Cities and County of Riverside have adopted ordinances that prohibit the discharge of wastewater to the street and storm drain system.

Discharge Regulations

Regulatory requirements for discharging wastewater from your pool may differ from city to city. Chlorinated water should not be discharged into the street, storm drain or surface waters. Check with your water agency to see if disposal to the sanitary sewer line is allowed for pool discharges (see reverse for Riverside County sewer agencies).

If allowed, a hose can be run from the pool Jacuzzi, or fountain to the private sewer cleanout, washing machine drain or a sink or bathtub.



If you cannot discharge to the sewer, you may drain your fountain, pool, or jacuzzi to your landscaping by following these guidelines:

First, reduce or eliminate solids (e.g. debris, leaves or dirt) in the pool water and allow the chemicals in the pool water to dissipate before draining the pool (this could take up to 7 days, verify using a home pool test kit).

Second, slowly drain to a landscaped area away from buildings or structures. Control the flow to prevent soil erosion; it may take more than one day to empty. Do not allow sediment to enter the street, gutter or storm drain.

Maintenance & Chemicals

Cleaning Filters

Filter rinse water and backwash must be discharged to the sanitary sewer, on-site septic tank and drain field system (if properly designed and adequately sized), or a seepage pit. Alternatively, rinse water or backwash may be diverted to landscaped or dirt areas. Filter media and other non-hazardous solids should be picked up and disposed of in the trash.

Algaecides

Avoid using copper-based algaecides unless absolutely necessary. Control algae with chlorine, organic polymers or other alternatives to copper-based pool chemicals. Copper is a heavy metal that can be toxic to aquatic life when you drain your pool.

Chemical Storage and Handling

- Use only the amount indicated on product labels
- Store chlorine and other chemicals in a covered area to prevent runoff. Keep out of reach of children and pets.
- Chlorine kits, available at retail swimming pool equipment and supply stores, should be used to monitor the chlorine and pH levels before draining your pool.
- Chlorine and other pool chemicals should never be allowed to flow into the gutter or storm drain system.

Take unwanted chemicals to a Household Hazardous Waste (HHW) Collection Event. There's no cost for taking HHW items to collection events – it's FREE! Call **1-800-506-2555** for a schedule of HHW events in your community.

Infiltration System
Inspection and Maintenance Checklist

Property Address: ____ Property Owner: _____________________________

Treatment Measure No.: ___________ Date of Inspection: __________ Type of Inspection: ☐ Monthly ☐ Pre-Wet Season
☐ After heavy runoff (1" or greater)
☐ End of Wet Season ☐ Other:____________

Inspector(s): ____________________

Defect	**Conditions When Maintenance Is Needed**	**Maintenance Needed? (Yes/No)**	**Comments** (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)	**Results Expected When Maintenance Is Performed**
1. Standing Water	When water stands in the infiltration system between storms and does not drain within 3 days after rainfall.			There should be no areas of standing water once inflow has ceased. Any of the following may apply: sediment or trash blockages removed, improved grade from head to foot of infiltration system.
2. Trash and Debris Accumulation	Trash and debris accumulated in the infiltration system.			Trash and debris removed from infiltration system and disposed of properly.
3. Sediment	Evidence of sedimentation in system.			Material removed and disposed of properly so that there is no clogging or blockage.
4. Inlet/Outlet	Inlet/outlet areas clogged with sediment or debris, and/or eroded.			Material removed and disposed of properly so that there is no clogging or blockage in the inlet and outlet areas.
5. Overflow Spillway	Clogged with sediment or debris, and/or eroded.			Material removed and disposed of properly so that there is no clogging or blockage, and system is restored to design condition.
6. Miscellaneous	Any condition not covered above that needs attention in order for the infiltration system to function as designed.			Meet the design specifications.

SAMPLE

Infiltration System Maintenance Plan
for

Routine Maintenance Activities

The principal maintenance objective is to prevent sediment buildup and clogging, which reduces pollutant removal efficiency and may lead to system failure. Routine maintenance activities, and the frequency at which they will be conducted, are shown in Table 1.

Table 1
Routine Maintenance Activities for Infiltration Systems

No.	Maintenance Task	Frequency of Task
1	Remove obstructions, debris and trash from infiltration system and dispose of properly. Drywells may cleaned by vacuuming the upper chamber with a vacuum truck.	Monthly, or as needed after storm events
2	Inspect system to ensure that it drains between storms, and within 3 days after rainfall. Check drywell/observation well 2-3 days after storm to confirm drainage.	Monthly during wet season, or as needed after storm events
3	For drywells, replace filter material (and screen if it is damaged) in accordance with City of Rancho Mirage Standard Detail No. 306 (see attached).	Monthly, or as needed after storm events
4	Monitor drywell/observation well to confirm that system has drained during dry season.	Annually, during dry season
5	Remove any trash, grass clippings and other debris in the streets, gutters or parking area (see BMP SC-43) and near the system perimeter. Dispose of properly.	As needed
6	Inspect infiltration system using the inspection checklist.	Monthly, or after storm events 1” or greater, and after removal of accumulated debris or material

Mosquito Abatement

Standing water shall not remain in the treatment measures for more than three days, to prevent mosquito generation.

Inspections

The Infiltration System Inspection and Maintenance Checklist provided shall be used to conduct inspections monthly (or as needed), identify needed maintenance, and record maintenance that is conducted.

10. PUBLIC EDUCATION AND OUTREACH

WATERSHED SPECIFIC EDUCATIONAL ACTIVITIES CONDUCTED DURING THE REPORTING PERIOD

This section provides an overview of watershed specific education activities conducted by the Permittees. During the reporting period **Appendix E** contains images of most public education materials that are described in this section.

Program Overview

The Riverside County NPDES Permittees have established an ongoing watershed based public education and outreach program known as the "**Only Rain Down the Storm Drain"** pollution prevention program. The specific objectives of the public education program include:

- Fostering a broad public awareness of water pollution concerns;
- Increasing public acceptance of pollution prevention activities to curtail everyday human behaviors that contribute to water quality problems;
- Educating/informing the general public, regulators and key local government and state decision makers on Urban Runoff conditions in Riverside County; and
- Promoting stewardship of local water resources.

The "Only Rain Down the Storm Drain" program implements the public awareness objectives by focusing on three areas of pollutant reduction/prevention:

- Public Behavior;
- Proper Management of Pollutants; and
- Business Specific Education Outreach.

In addition, when attempting to make use of the finite resources available to the Public Education Program, the Permittees use these management goals to ensure that resources are used effectively:

- Focusing on pollutants of concern specific to each watershed region;
- Coordinating public education efforts with adjacent storm water management programs and other related education programs to share resources, coordinate outreach efforts, and avoid costly duplication of effort; and
- Adapt public education programs and objectives, based on effectiveness analysis, to address changing MS4 programs and objectives.

Program Highlights

The public education program continues to develop changes for the better. Highlights include:

- The public education program has developed surveys in both English and Spanish. The purpose of these surveys is to evaluate the effectiveness of the public education program and are distributed to the public at community events. The results of these surveys are contained in **Appendix E**. Two surveys were also developed for the K-3 and 4 through 6 grades education outreach programs.

- The public education web page continues to be revamped and improved.
- The program continues to update brochures and develop outreach programs specific to the needs of the MS4.
- As part of the on-going effectiveness evaluation for the municipal training programs, testing has been incorporated into the training for evaluation of its efficiency. In addition, the overall training program was evaluated and is included in the Assessment and Enhancement Analysis of the NPDES Traning Program, August 2006 in **Appendix E.**
- Each month, the County hosts a New Employee Orientation to an average of forty new employees. All the attendees receive “Only Rain Down the Storm Drain” materials and promotionals. The Toll Free 800 Number the message to call to report illegal storm drain disposal is incorporated into all materials.

Santa Ana Pollutants of Concern

Based on monitoring data collected to date, the current 303(d) list and discussions among the Co-Permittees, and stakeholders, the following preventative pollutants of concern were established for this watershed. More discussion on the selection of preventative pollutants of concern can be found in the monitoring section of this report. After each identified pollutant, specific BMP outreach activities are identified to address the pollutant:

- Sedimentation associated with Urban Development and Land Uses

    - Specific section on construction, municipal, industrial/commercial and new development training focusing on the need to address sedimentation within the watershed;
    - Distribution of dust pans at public education outreach events to promote dry cleaning of drive ways and impervious surfaces;
    - Construction BMP Poster;
    - School/Student program incorporates education on controlling soil erosion;
    - The “After the Storm” and Storm Water Pollution, what you should know brochures
    - General Construction Activities & Outdoor Activities brochure

- Nutrients and pathogens associated with Urban Development and Land Uses

    - Specific section on construction, municipal, industrial/commercial and new development training focusing on the need to address increased nutrients within the watershed;
    - Pet Waste “What’s the Scoop” brochure;
    - Partnership with SGA Advertising to place pet waste information in pet stores, veterinarian clinics, kennels and pet grooming facilities;
    - Coordination with Riverside County Animal Control Department to distribute “What’s the Scoop” and “After the Storm” brochures to families adopting pets;
    - The Agricultural Commissioner assist in educating on water conservation, fertilizer management and integrated pest management practices. In conjunction with County Waste Management’s Composting Workshop, the “After the Storm” brochure and

Household Hazardous Waste flyer is included in the adult informational packet.

- "Keep Our Water Clean" video to cover proper use of fertilizers as well as excess runoff from sprinklers;
- Earth Day mailing inserts were developed to inform residents about the problem of storm water pollution and provide simple pollution prevention activities in gardening;
- Adult presentations conducted by RCRCD discussing the effects of fertilizers and pesticides on local waterways;
- The “After the Storm” brochure; and
- Construction BMP Activities brochure and poster.

In addition, the District has developed other outreach materials to focus on other pollutants and pollutant causing activities/businesses commonly associated with urban runoff. Outreach methods can be combined to focus on specific pollutants that may exist within the watershed.

24-hour Watershed-Wide Outreach Portals

The Permittees maintain three 24-hour/7 days per week watershed wide portals to receive and distribute information regarding the “Only Rain Down the Storm Drain” program. These portals include a website, 1-800 number, and an e-mail address.

Storm Water Protection Program Website

The District operates a website that provides information on how to report illegal dumping, clogged storm drains, facility signage and worn or missing curb markers, as well as provide information on upcoming activities, opportunities for public participation in program development and general information about Urban Runoff pollution prevention techniques. The website is located at:

http://www.floodcontrol.co.riverside.ca.us/stormwater/

Almost all of the District’s outreach materials have been scanned into an electronic .pdf format and are available for download. Online Order forms and phone numbers are also available to assist in obtaining information that might not be available online.

The website contains pages specific to the following target audiences:

- General Public/Residents
- Businesses
- Developers
- Contractors
- Schools and Teachers
- Kids Page

In addition the website contains links to:

- Assist viewers in locating their watershed
- An online media library
- Materials order form
- 1-800 information to report storm drain pollution

The District tracks the number of hits to its public education website. The website was completely revamped during the previous reporting period and the web-page counter replaced this reporting period. Results of the webpage counter report are included in **Appendix E.**

Storm Water toll free 1-800 Hotline

On October 1994, a Toll Free “800” telephone number for reporting suspected Urban Runoff pollution and obtaining pollution prevention information was established.

1. This call line offers easy to understand instructions for connecting to County Environmental Health or Waste Management to obtain grasscycling, composting, or household hazardous waste collection dates and locations.
2. The 24-hour Hotline also allows callers to report clogged catch basin inlets, illegal dumping and other illicit discharge violations.
3. Finally, the hotline allows people to order public education materials and/or request storm water presentations for schools or community groups. The Permittees advertise the hotline in all appropriate County telephone directories, public education outreach materials, and in other appropriate venues and locations. Callers to the hotline are given options to seek emergency services if the spill is of a suspicious origin or a safety issue.

The 1-800 line diverts callers to appropriate Permittee departments based on caller selections. Callers requesting information on pollution collection activities are diverted to either County Environmental Health or Waste Management depending on their specific selection. Callers reporting illicit discharges are directed to County Code Enforcement, who accepts the calls and then re-directs them to appropriate Permittee Code Enforcement Departments. Calls for public education materials or presentations are directed to the district’s front desk and then to the District’s Public Education Staff. School presentation inquiries are directed to the Riverside County Conservation District office, who have been contracted to provide education to elementary schools in the Santa Ana Region. The specific text to the hotline is included as **Exhibit A**.

The provider of the 1-800 line, Riverside County Communication, tracks the number of incoming calls to the line. This tracking mechanism was discontinued during past reporting period but restored this reporting period.

Exhibit A
"ONLY RAIN DOWN THE STORM DRAIN" POLLUTION PREVENTION PROGRAM

TOLL FREE 1-800 LINE DIALOGUE

Thank you for calling the "Only Rain Down the Storm Drain" Pollution Prevention Program. To better serve the needs of our County communities, please listen carefully to the following options:

If this is an emergency, or you wish to report a significant release or threatened releases of hazardous material into the storm drain or elsewhere in the environment, please hang up and immediately Dial 911.

(Si esta llamada es una emergencia o decea reportar desechos de contaminantes peligrosos en las alcantarillas o en el medio ambiente, por favor cuelge y llame 911.)

For water service connection, disconnection, or any other water utility information, call your local water service provider.

To report illegal dumping at residential, commercial, industrial or construction sites, please call Environmental Health at 951.955.8982, or press #1 to be directly connected.

For information regarding Household Hazardous Waste Collection Events, please Press #2.

To report clogged storm drains, please call your local municipal public works department. To report faded or missing "Only Rain Down the Storm Drain" storm drain markers, please press #3.

For General or specific business pollution prevention information or to receive other pollution prevention information please press #3.

(Drop Off Dialogue)

Thank you for your interest in obtaining information on storm drain pollution protection. Basic, construction, industrial, commercial and children's storm water protection outreach packets are available. For a quick response to your request, please slowly and clearly leave your name, address, city and zip code. Also state the type and quantity of the materials you are interested in receiving. Should you need additional assistance, provide your area code and phone number and someone will contact you as soon as possible.

To inquire about our free storm water classroom presentations, workshops, youth group activities and other outreach programs, please press #4.

(Drop Off Dialogue)

The "Only Rain Down the Storm Drain" public education program offers classroom presentations, workshops, youth group activities, special event opportunities and other programs. For inquiries for the Temecula or Murrieta area, please press #1 (Drops to Mission Resource Conservation District)

For inquiries in all other Riverside County areas, press 2 (drops to Riverside/Corona Resource Conservation District).

For Grasscycling and composting information or workshops, please PRESS #5. (to 951.486.3200)

For additional assistance regarding our storm drain pollution prevention program during regular business office hours, Monday through Thursday from 7:30 am to 5:30 pm and on Friday from 7:30 am to 4:30 pm

E-mail

The Permittees also maintain an e-mail address that can be used to report illicit discharges or request storm water related public information. The e-mail address is:

Flood.fcnpdes@co.riverside.ca.us

E-mails are received by the District's Public Information Specialist and are responded to, in most cases, within 2 business days.

Program Coordination with other Stakeholders

The "Only Rain Down the Storm Drain" program has used partnerships to leverage and increase available resources. The Permittees utilize every opportunity to work with Co-permittees, local environmental groups, and other public, private and business organizations to maximize use of existing distribution outlets, events, programs and materials. Impressions, attendance, and other measures of effectiveness relative to these programs are included in **Appendix E** (Public Education) of this Watershed Annual Report.

To facilitate statewide awareness of storm water public education, educate local and state decision makers, and assist in the development of more effective public education outreach programs, the District participates in the following public education committees:

- Public Information Public Participation Committee (PIPP) – A subcommittee of the California Storm Water Quality Association, and
- Western Regional Pollution Prevention Network (WRPPN)

To leverage education outreach resources and coordinate public education activities with other environmental programs, the Permittees closely coordinate and/or have existing partnerships with the following entities/organizations:

- Household Hazardous Waste Information Exchange (HHWIE); This is an eGroup that provides household hazardous waste affiliates the ability to better communicate, share ideas and the latest in legislative rulings.
- Riverside-Corona Resource Conservation District (RCRCD);
- Partnership to provide student education outreach in the Santa Ana and Whitewater Watersheds
- Partnership to provide adult education outreach activities in the Santa Ana and Whitewater Watersheds
- Partnership to provide support services for public education outreach activities at community events
- Mission Resource Conservation District (RCRCD);
- Partnership to provide student education outreach in the Santa Ana and Santa Margarita Watersheds
- Partnership to provide adult education outreach activities in the Santa Ana and Santa Margarita Watersheds

  - Partnership to provide support services for public education outreach activities at community events

- California Regional Environmental Education Community Network (CREEC)
  - A network whose mission is to develop a communication network which provides educators with access to high quality environmental education resources to enhance the environmental literacy of California students.

- Santa Ana River Watershed Clean Up Stakeholders Group in coordination with Riverside Corona Conservation District, Keep Riverside Clean and Beautiful and the California Coastal Commission's Coast. This collaboration of environmental partners support and encourage volunteers, allies and groups to gather for a day to remove trash and debris from the Santa Ana River that might otherwise flow downstream, through the river to the ocean.

- In addition the "Only Rain Down the Storm Drain" program also coordinates with the following City/County departments to distribute appropriate storm water education outreach materials:

  - City/County/District Front Counters
  - County Waste Management
  - County Public Health Department
  - Agriculture Department
  - County Executive Offices
  - Code Enforcement
  - County Parks
  - Animal Control;
  - Economic Development Agency
  - County Assessor/Recorders Office
  - Bio-terrorism
  - Fleet Services
  - Human Resources
  - Library System
  - Central Mail
    - Stamp on every piece of mail sent by the County that identifies the 1-800 Number and requests that citizens call it to report storm drain pollution.
  - County Safety
  - County DPSS
  - Transportation and Land Management

In general, brochures and promotional items are provided to these departments for distribution in public lobbies, training sessions, through customer interactions and new employee orientations.

Finally, the "Only Drain Down the Storm Drain" Program also coordinates with the following state and/or local government or business entities to distribute public education information:

- Western Riverside Council of Governments
- Santa Ana Regional Water Quality Control Board
- Orange County Watershed & Coastal Resources Division
- Santa Ana Watershed Association
- South Coast Air Quality Management District
- Santa Rosa Plateau
- Bureau of Reclamation
- Elsinore Valley Municipal Water District
- Metropolitan Water District
- Lake Elsinore/San Jacinto Watershed Authority
- Eastern Municipal Water District
- The Water Education Center
- Rancho California Water District
- Valley Greeters
- Department of Water Resources Southern District
- Western Municipal Water District
- Business Industrial Association (BIA)
- Caltrans

Outreach Tools to Change Public Behavior

The "Only Rain Down the Storm Drain" program conducts a wide range of outreach activities to residents, students, community groups, new home owners, homeowner associations; informing them of how their "everyday activities" may contribute to the pollution of Receiving Waters, and encouraging them to adopt alternatives that will lessen or eliminate pollution-causing behaviors. Program efforts include providing information on pollution prevention techniques and informing residents about the proper disposal of household hazardous wastes, construction materials, used motor oil, pet waste and litter. Public education materials and media emphasize the theme that all citizens have a role to play in reducing and preventing the polluting of Receiving Waters. The goal is to present a clear and consistent message that explains the simple connections between people's everyday activities and their impacts upon Receiving Water quality.

As the public education and outreach program continues to be implemented and enhanced, the Permittees hope to broaden public awareness of Urban Runoff quality problems, promote proper disposal of household hazardous waste and motor oil, encourage illegal discharge reporting, foster good stewardship of Receiving Waters, and take personal responsibility for their actions in preventing pollution.

While public education outreach at events indicates that most people are willing to act in an environmentally responsible manner if given simple ways to change their behavior to avoid polluting our water bodies; most are unaware of the sources of pollution from everyday urban land use. The "Only Rain Down the Storm Drain" pollution prevention program using various media forms educates the County's population about modified behaviors to prevent storm water pollution by focusing on residents, general public, students, home gardeners, do-it-yourselfers, mobile businesses, etc.

Direct Outreach Methods

The “Only Rain Down the Storm Drain” program interfaces directly via program staff, or through contracts and partnerships, to the public through attendance at community events, school education programs, adult education programs and/or by providing classroom based training. Specific outreach activities, segregated by target audiences, are described below.

General Community Outreach

The “Only Rain Down the Storm Drain” program participates in various community events to ensure that our message is delivered to the largest possible municipal audience. At these community events, surveys, to assess overall program effectiveness, have been used.

In addition, the “Only Rain Down the Storm Drain” program has partnered with County Environmental Health to ensure that a storm drain pollution prevention material is available and distributed at all Household Hazardous Waste and Antifreeze, Batteries, Oil and Paint Collection Centers and/or Events throughout each of the Watershed Region’s within Riverside County. These events provide free disposal sites for receiving common pollutants that can impair Receiving Waters.

Elementary School Outreach

Elementary (K-6)

The Riverside County Resource Conservation District (RCRCD) continues to provide a variety of K-6 education programs for the “Only Rain Down the Storm Drain” Program. The K-6 education program includes materials such as the Storm Water Pollution Prevention Patrol workbook, the Fancy Fin hands-on classroom presentation and accompanying coloring book, various word match and crossword activity sheets and videos. A second story line featuring Fancy Fin and her friend Phinnious J. Green (a Pacific Tree Frog) educate students about point and non-point pollution and their effects on the environment and other creatures in the watershed. School materials are offered to all public and provide schools in the Santa Ana Watershed Region, as well as to youth groups such as the boy and girl scouts.

Secondary Schools

A video entitled “How to Conduct an Environmentally Friendly Car Wash and Make Money Too” was developed for the “Car Wash Challenge” program. An accompanying flyer is also used which informs students/groups of the potential storm water problems generated from car wash runoff, and provides practical BMPs to minimize or eliminate contaminated runoff. The original focus of the program was high school clubs. However, after contacting several high schools, it was discovered that car washing fundraisers are relatively rare and revenue deficient in comparison with other high school fund raising activities. Nevertheless, church groups, scout troops and other organizations do conduct car wash fundraisers. Thus, the scope of the Car Wash Challenge program has been expanded to include these additional fundraising organizations.

Adult Outreach

Valley Greeters is a "Welcoming Wagon" business taking discount coupons, product samples and general vicinity information door to door to new residents and homeowners to the Temecula, Murrieta and Lake Elsinore area. For the past four years, Valley Greeters has included our MS4 materials, (After the Storm; What's the Scoop; Pool, Spa and Fountain Maintenance and HHW Collection Schedule). This information is accompanied with a handy full size dustpan, shop cloth and vehicle air freshener. Every material and promotional is clearly imprinted with the 1-800 Toll Free number for reporting illegal discharges into the storm drain. Young family members receive a copy of Fancy Finn and box of crayons. This business is solely dependent on the status of the construction economy and by January, 07 experienced a considerable slowdown.

The "Only Rain Down the Storm Drain" program contracts with the Riverside/Corona Resource Conservation District for public outreach. Storm Water Pollution Prevention presentations are given to community groups who call and request such services.

Steve Groner & Associates has been retained to prepare and present workshops at major home improvement stores throughout Riverside County. The workshops include passing out reading material regarding targeted BMPs to the public through established corporate partnerships (paint, hardware, home show coordinators, home improvement, garden centers, nurseries and pet stores). All commercial employees are informed about storm water impacts that could occur from the improper application of all types of home and garden hazardous chemicals. In turn, the employees are then able to share with customers on the proper use and disposal of products that are potential storm drain pollutants. Attendees at the workshop receive "Only Rain Down the Storm Drain" promotionals to help emphasize the storm water pollution prevention message. Fixed advertising tools such as counter displays, tear sheets have been placed throughout to attract attention.

Brochures

Residential*:* After the Storm; Storm Water Pollution and the Solutions, Household Hazardous Waste Collection Schedule, Outdoor Activities; Swimming Pool, Jacuzzi and Fountain Maintenance; and What's the Scoop (Pet waste).

Outreach Materials

In addition to the brochures mentioned above, the program utilizes other effective outreach materials such as, magnets, a billboard ad, videos, newspaper supplements, flyers, door knob hangers, calendars, promotionals items, workbooks, curriculum, shop rags, shelf talkers, tear sheets, posters and print ads to cultivate interest in the program.

A door hanger is also being utilized to help address problem discharges that are commonly observed in residential settings. The door hanger notifies the recipient that a problem discharge was observed flowing in to the street and offering help by following recommended pollution prevention activities. The door hanger is provided to all cities and is used by various County departments and the NPDES staff when conducting field or site activities/inspections.

Mailing Inserts/Slugs

The "Only Rain Down the Storm Drain" Pollution Prevention Program encourages advertising the County's Household Hazardous Waste Collection events via the use of mail inserts. The inserts are included in various utility bills and special notice mass mailings.

In addition, the "Only Rain Down the Storm Drain" program has coordinated with the County Mail Department to have the postage meter carry the "Only Rain Down the Storm Drain" message and the 1-800 Toll Free number to report an illegal storm drain disposal or spill. In 05/06, over 5,000,000 pieces of outgoing County mail were stamped with the message. In November of 06, the postage system was replaced with more sophisticated postage meter units but the cost of the ink in the new system far exceeded the costs and benefits from other media options and therefore this media venue was dissolved.

Media Outreach

The "Only Rain Down the Storm Drain" Program continues to utilize various mass media to reach the public and promote the storm water pollution prevention. Special newspaper inserts, fliers, and advertisements help increase public awareness of storm water pollution and environmental protection.

- Our Sixth Edition of a four-page insert called the National Pollution Prevention or P-2, (National Pollution Prevention Week recognization), was distributed Countywide through the PennySaver. The insert included topics on proper disposal of pet waste, pesticide alternatives, motor oil recycling, grass-cycling, pool and spa best management practices, storm drain marking program, storm water school presentations, general storm drain pollution protection, business storm water pollution information, household hazardous waste (HHW) collection events, syringe disposal program, composting workshops and motor oil specific recycling locations. The insert is released to over 650,500 Riverside County homes generating an increase of calls to the 800 Toll Free Hotline and District IC/ID investigations.

Cooperative Used Oil Program

The Western Riverside Council of Governments (WRCOG) is responsible for administering the Used Oil Block Cycle Grant on behalf of ten cities within WRCOG's boundaries. These cities include: Banning, Beaumont, Canyon Lake, Lake Elsinore, Murrieta, Norco, Perris, Riverside, San Jacinto and Temecula.

The objective of the Used Oil Block Grant is to make it convenient for Do-It-Yourselfers (DIYers) to recycle their used oil and to make it easy for them to find a Certified Center accepting used oil. In order for these centers to be certified, they need to apply for certification with the California Integrated Waste Management Board (CIWMB). As a grant recipient, WRCOG contacts non-certified centers in the jurisdiction to interest them in becoming certified used motor oil collection center. The goal is to see a significant decrease in the amount of illegally dumped motor oil by adding more oil collection centers within close proximity to users.

Through the same grant funding source, WRCOG also provides used oil containers for distribution to DIYers who need proper containers for automotive fluids. Through WRCOG efforts, all certified centers in the County are in compliance to state and local mandates.

The Storm Drain Pollution Prevention Program assists WRCOG's efforts by making available our MS4 information and supporting promotionals for distributions to their targeted groups.

At various venues, WRCOG staff obtain participant responses to a ten question survey. The survey examines the public's understanding on:

- used oil recycling,
- used oil drop-off locations,
- curbside programs, and other local recycling programs.

The program also maintains an English and Spanish 800 hotline that can be used to get answers to any recycling question a resident may have regarding, "where the nearest Certified Center is located?" and "where can I find a used oil container?". The phone number is printed on all distributed materials including the oil containers.

Cleanest County in the West Program

Through another grant funding source, WRCOG created the "Cleanest County in the West" program to address issues relating to litter and illegal dumping. The program was designed to assist jurisdictions in meeting the 50% diversion goals mandated by Assembly Bill 939. AB 939 was a state mandate signed in 1989 that required cities to reduce their waste by 50% by the Year 2000.

The core of the program is the elementary school assembly. WRCOG partners with Radio Disney AM 1290 to present an interactive and informational presentation for children in grades K-6th. This program continually reinforces the responsibility of everyone to recycle and pick up litter.

WRCOG at the end of the assembly gives the school two recycling containers for the collection of cans and bottles. During the 06/07 school year, over 18,000 students and 600 teachers have experienced the assembly. Each student receives an environmental activity book and an application to join the Riverside County Kids Recycle Club where they will receive a quarterly newspaper. This club has over 200 members.

Like the "Only Rain Down the Storm Drain" Program which promotes litter reduction and recycling throughout the Santa Ana Region, WRCOG also participates in events to promote litter reduction and beverage container recycling. These events gives staff an opportunity to assess how informed the local community is regarding recycling and also allows us to distribute brochures and informational flyers that will assist people in finding the nearest recycling center. During these events promotional items made from recycled content are also given out to show examples on how used items such as money can be recycled into new things such as a pencil, a promotional product first used by the "Only Rain Down the Storm Drain" Program. This particular promotional item especially increases the interest of the people visiting out booth and demonstrates how almost anything can be recycled and reused.

Outreach tools specific to Business Specific

The "Only Rain Down the Storm Drain" Program conducts a wide range of outreach activities to businesses; informing them of how their "everyday activities" may contribute to the pollution of Receiving Waters, and encouraging them to adopt alternatives that will lessen or eliminate polluting-causing activities. Program efforts include providing information on pollution prevention techniques and informing businesses about the proper disposal of wastes. Public education materials and media emphasize the theme that all businesses have a role to play in reducing and preventing the polluting of Receiving waters. The goal is to present a clear and consistent message that explains the simple connections between a business' everyday activities and their impacts upon Receiving Water quality.

Originally, the business education program mainly consisted of the development and distribution of formal BMP guidance and outreach to business associations. The program has now expanded to include direct outreach to businesses through classroom formats, advertising in business trade papers and providing exhibits at various business specific symposiums.

Discussion of the current Business Specific Outreach tools implemented by the Permittees are discussed below.

Direct Business Outreach Activities

The "Only Rain Down the Storm Drain" Program partners with various entities to provide training and education. Currently, the District has allowed AEI-CASC Engineering, a consultant who provides the Permittees internal education programs to train developers and consultants regarding the new WQMP/SUSMP requirements for Riverside County. The District has partnered with Riverside/Corona Resource Conservation District, to develop a Water Quality Design class that focuses on sub-regional solutions and low impact development. This class was offered for the first time through UCR extension in October 2005. Additionally, the District presented at Construction Storm Water Compliance Workshop hosted by the Building Industry Association of Southern California (BIA/SC) on March 22, 2006. The workshop focused on state and municipal construction requirements for contractors, developers, and consultants.

Through the Compliance Assistance Program (CAP), a partnership with County Environmental Health restaurants and businesses that handle hazardous wastes are reviewed for potential storm water impacts from their activities. Each business is provided with storm drain pollution prevention public education outreach information specific to their activities.

Steve Groner Associates has been retained to prepare and present workshops at major home improvement stores throughout Riverside County. The workshops include a handout educating the store's employees about storm water impacts that could occur from improper application of paint, pesticides or fertilizers. Attendees at the workshop also receive "Only Rain Down the Storm Drain" information and promotionals to help highlight the storm water protection message. Employees are then able to share with customers the proper use and disposal of products that are potential storm drain pollutants. Point of purchase displays, tearsheets, and counter displays have been installed at strategic locations to educate the public directly.

Each new business trade in Riverside County that is listed in the Inland Business Press newspaper is provided with an "Only Rain Down the Storm Drain" Pollution Prevention packet.

Brochures

Commercial*:* After the Storm; Food Facilities; Outdoor Cleaning Activities and Non-Point Source Discharges; Automotive Maintenance & Car Care. Note: (Staff is revising the Outdoor Activity brochure to include broader examples of urban pollution causing activities such as, power washers and mobile vehicle maintenance operators).

Industrial*:* After the Storm; Outdoor Cleaning Activities and Non-Point Source Discharges; and Your Facility May Need a Storm Water Permit.

Construction*:* After the Storm; Outdoor Cleaning Activities and Non-Point Source Discharges; General Construction & Site Supervision The revision to the construction brochure is pending the finalization of the construction permit.

Posters

BMP posters for automotive, food service establishments (available in Spanish) and construction employees are available. The posters address activities associated with the automotive repair industry, and the food/restaurant industry that may pose a threat to water quality. There are also two new posters for the Fueling Stations and Service Bay Service centers. All the posters recommend storm water BMPs and are designed to serve as informative and attractive visual reminders for employees.

Media Outreach

In March, 07, a full-page ad was placed in the Inland Business Press newspaper to draw the attention of Inland Empire businesses whose urban runoff activities might be threatening local water quality. The ad also provided links to the District's and CASQA's website for more detailed BMP information.

Supplemental Environmental Projects (SEP)

In an effort to change the behaviors of large storm drain pollution prevention offenders in the County, Environmental Health established a Supplemental Environmental Project (S.E.P.). The S.E.P. requires from the violator a monetary fine and/or the violator's cooperation for the development of a public education tool on the effects of polluted urban run off. S.E.P.'s to date include:

- A Downs Energy SEP project resulted in the development of a billboard ad that has been greeting commuters traveling Westbound on the 60 Freeway lanes.

Outreach tools specific to Pollutants

"Only Rain Down the Storm Drain" Pollution Prevention Program conducts a wide range of outreach activities focusing on reduction of certain pollutants in the receiving waters. These outreach activities focus on sources of those pollutants whether it is residential, business, municipal or some other state or federal source. Education materials explain how "everyday activities" of potential sources may contribute to the pollution of receiving waters, and encourage the sources to adopt alternative approaches to pollutant management that will lessen or eliminate polluting-causing activities. Program efforts include providing information on pollution prevention techniques and informing sources about the proper disposal of pollutants. Public education materials and media emphasize the theme that all citizens/businesses have a role to play in reducing and preventing the polluting of receiving waters. The goal is to present a clear and consistent message that explains the simple connections between a business' everyday activities and their impacts upon receiving water quality.

Each subsection that follows identifies how existing outreach materials previously described address specific potential pollutant sources in the watershed.

Use of pesticides, fertilizers, and herbicides

A. The Riverside County Agricultural Commissioner's Pesticide Applicator's License renewal information package includes materials on the proper use of pesticides and offers information on training workshops. The license renewal process requires continuing education of applicants and detailed record keeping of pesticide applications. Municipal employees that are responsible for the application of pesticides are encouraged to obtain and maintain credentials as Certified Applicators and/or licensed Pest Control Advisors.

B. The "Home Garden Care" materials are being revised to draw and attract the interest of the general public and amateur gardener. The new materials will include Integrated Pest Management and plant selection and materials from the State Water Resource Control Board, Central Contra Costa IPM Outreach Program, University of California and The

Orange County Storm Water Program are being used. All the materials selected offer alternatives to using chemically based pesticides, herbicides and fertilizers.

C. The "Keep Our Water Clean" video covers proper use of pesticides, fertilizers and herbicides as well as excess runoff from sprinklers.

D. The September annual “Only Rain Down The Storm Drain’s” participation in the National Pollution Prevention Week insert informs residents about the problem of storm water pollution and provides simple pollution prevention activities in gardening.

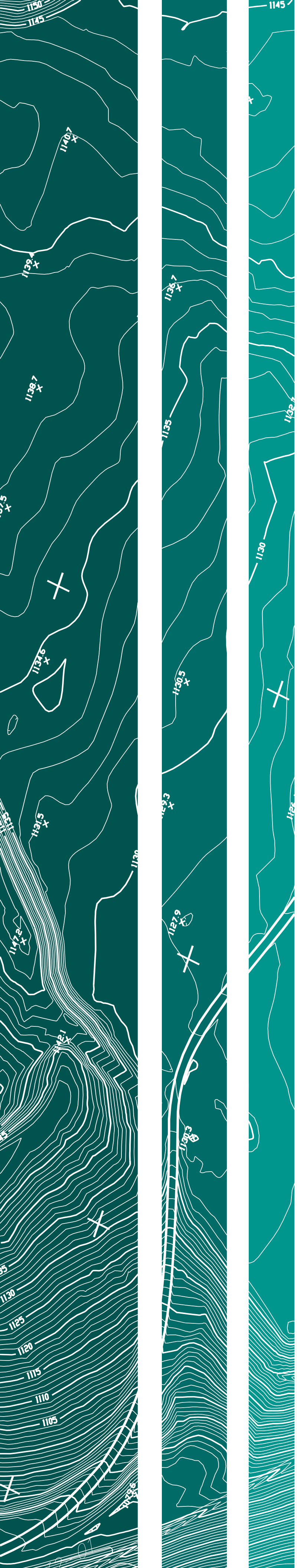
E. The “Only Rain Down The Storm Drain” adult presentations conducted by RCRCD discusses the effects of pesticides and fertilizers on local waterways. The materials distributed following the presentation promote alternatives to pesticide use in the yard and garden.

F. The 2006 Environmental Calendar included a wide array of storm water protection information. It is designed to attract the adult audience by listing best management practices, scheduled special events, household hazardous waste collection sites, used oil collection sites, composting workshops, citywide clean ups, and each of the watersheds along with geographical information. Throughout the calendar the main message is “Only Rain Down The Storm Drain” and the hotline number to call for additional home garden care information.

G. Steve Groner Associates has been retained to prepare and present employee workshops at major home improvement stores throughout Riverside County. This information is then passed on to the public via the shelf talkers accessible to the public or when an employee is addressed with a question. The workshops include information on BMPs the public should be aware of for pesticide and fertilizer application, use, and storage.

Appendix E

Soils Report



PRELIMINARY GEOTECHNICAL INVESTIGATION

PROPOSED MULTI-FAMILY RESIDENTIAL DEVELOPMENT
14320 PALM DRIVE
DESERT HOT SPRINGS, CALIFORNIA

SEPTEMBER 12, 2024
PROJECT NO. T3082-22-01

PREPARED FOR:
ABODE COMMUNITIES
LOS ANGELES, CALIFORNIA

GEOCON
WEST, INC.
GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS

Project No. T3082-22-01
September 12, 2024

Abode Communities
1149 S. Hill Street, Suite 700
Los Angeles, CA 90015

Attention: Sergio Rosas, Senior Project Manager

Subject: PRELIMINARY GEOTECHNICAL INVESTIGATION
PROPOSED MULTI-FAMILY RESIDENTIAL DEVELOPMENT
14320 PALM DRIVE
DESERT HOT SPRINGS, CALIFORNIA

Mr. Rosas:

In accordance with your authorization of our Proposal CV-24-1225-P-GT, dated July 8, 2024, Geocon West, Inc. (Geocon) performed a preliminary geotechnical investigation for the proposed multi-family residential development, planned east of the Desert Hot Springs Library, at 14320 Palm Drive in the City of Desert Hot Springs, California. The accompanying report presents our findings, conclusions, and preliminary recommendations pertaining to the geotechnical aspects of the proposed development. Based on the results of this study, it is our opinion the site is considered suitable for the proposed development provided the recommendations of this report are followed.

The primary intent of this study was to address potential geologic hazards and geotechnical conditions that could impact the project. An updated geotechnical study will be required when more finalized project plans become available for review, to provide updated geotechnical recommendations for design and construction.

Should you have any questions regarding this report, or if we may be of further service, please contact the undersigned at your convenience.

Very truly yours,

GEOCON WEST, INC.

LISA A. BATTIATO
No. 2316
CERTIFIED ENGINEERING GEOLOGIST

ANDREW T. SHOASHEKAN
No. 93940
CIVIL

Lisa A. Battiato
CEG 2316

Andrew T. Shoashekan
PE 92940

PETRINA ZEN
GE3217
GEOTECHNICAL

Petrina Zen

Petrina Zen
GE 3217

LAB:ATS:PZ:hd

(email) Addressee

TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED)

PRELIMINARY GEOTECHNICAL INVESTIGATION

1. PURPOSE AND SCOPE

This report presents the results of our preliminary geotechnical investigation for the proposed multi-family residential development, planned within a square parcel located immediately east of the Desert Hot Springs Library, at 14320 Palm Drive in the City of Desert Hot Springs, California, as depicted on the *Vicinity Map*, Figure 1.

The purpose of this investigation was to perform a subsurface exploration and percolation testing, laboratory testing, and provide geotechnical analyses and, based on the conditions encountered, provide preliminary recommendations pertaining to the geotechnical aspects of developing the property. An updated geotechnical study will be required when more finalized plans become available, to provide updated geotechnical recommendations for design and construction.

The scope of this investigation included reviewing aerial photographs and published geologic information; conducting a subsurface exploration and performing sample collection, percolation testing, laboratory testing on the samples collected; engineering analyses; and preparing this preliminary geotechnical report. A summary of the information and documentation reviewed for this study is presented in the *List of References*.

Our field investigation was conducted on August 9 and 12, 2024, and included:

- Drilling of nine (9) exploratory borings (Borings B-1 through B-9) to depths ranging between approximately 16½ feet and 50½ feet, to observe the subsurface geological conditions at the site, collect relatively undisturbed in-situ and disturbed bulk samples for laboratory testing, and evaluate the depth to static groundwater, if encountered.
- Backfilling and performing percolation testing in one (1) geotechnical boring (Boring B-3), at a depth of approximately 10 feet, to provide a preliminary evaluation of the subsurface infiltration rate in areas where stormwater infiltration systems are expected. The percolation test is identified as Test P-1. A bentonite plug was installed at 10 feet of depth, after backfilling and prior to performing percolation testing. Additional percolation testing should be performed when the exact location and depth of the proposed stormwater infiltration system is known.

Appendix A presents a discussion of the field investigation, and detailed logs of the borings and percolation test data. The approximate locations of the exploratory borings and the percolation test are presented on Figure 2, *Geologic Map and Site Plan*. We performed laboratory testing on select soil samples obtained from our field investigation to evaluate physical and chemical properties for engineering analysis. Appendix B presents the results of our laboratory testing.

If project details vary significantly from those described herein, Geocon should be contacted to determine the necessity for review and possible revision of this report.

2. SITE AND PROJECT DESCRIPTION

The site is an approximately 8-acre square parcel that is vacant and undeveloped. Based on Google Earth aerial imagery, the site appears to have been natural since at least 1996. The site consists of a loose sand surface with moderate to sparce growth of shrubs. Access is via a gate along Park Lane. The site is bounded on the north by a retail shopping center, the west by Desert Hot Springs Library and Riverside County Behavioral Health and Nutrition Services Center, on the south by Park Lane, and on the east by the play fields of Desert Springs Middle School.

The site is relatively flat to gently sloping down toward the southeast. Existing elevations range from approximately 917 feet above mean sea level (MSL) in the northwest portion of the site, to approximately 906 feet MSL in the southeast portion of the site. Drainage appears to be by sheet flow toward the southeast. The site coordinates are at latitude 33.9441 degrees and longitude -116.4989 degrees.

The *Site Plan*, prepared by Abode Communities Architecture Studio and dated October 17, 2023, indicates the proposed development will include eight multi-family residential buildings up to three stories high, a community center, and an early childcare center. Additionally, associated utility, parking, drive aisle, flatwork, and landscape improvements are proposed for the site. The stormwater mitigation plan has not been developed for the site at this time; however, we expect infiltration systems will be constructed in the southeastern corner of the site where the lowest elevation exists.

We expect that rough grading will result in cuts and fills of less than 5 feet (exclusive of remedial grading). Graded slopes are not proposed on the site at this time.

Structural plans and loading information were not provided to us at this time; however, we expect the proposed structures will be one- to three-story buildings constructed of wood or light gauge steel framing, with shallow concrete foundations and concrete slab-on-grade floors. For preliminary evaluation purposes, we assume that column loads for the proposed structures will be up to 300 kips, and wall loads will be up to 3 kips per linear foot.

Once the design phase and foundation loading configuration proceeds to a more finalized plan, the recommendations within this report should be reviewed and revised, if necessary. Any changes in the design, location or elevation of any structure, as outlined in this report, should be reviewed by this office. If project details differ significantly from those described, Geocon should be contacted for review and possible revision to this report.

3. GEOLOGIC SETTING

The site is located within the northern end of the Coachella Valley approximately 35 miles northwest of the Salton Sea. The Coachella Valley is a pull apart geologic basin formed by extensional faulting and step-overs along the San Andreas fault. A thickness of more than 3,000 feet of sediment has accumulated within the Coachella Valley in the last 0.5 million years since the extension began. The site is located east of the San Jacinto Mountains and is subject to alluvial deposits carried from the nearby foothills to the west. The sediments consist primarily of sands and gravels with varying amounts of silt.

The Coachella Valley is part of the Colorado Desert geomorphic province, which is bounded on the west by the Santa Rosa Mountains and the north by the Transverse Ranges. The Colorado Desert extends beyond California to the east and south. The San Andreas fault is geologically mapped approximately ½ mile northeast of the site. Geothermal resources associated with the pull-apart basin are present near the southern area of the Salton Sea.

Regional subsidence has occurred in recent history within the Coachella Valley. Initial subsidence occurred between the 1920’s and 1940’s when groundwater was over pumped and ground water levels declined on the order of 50 feet. The introduction of Colorado River water in 1949 reduced groundwater pumping and the related subsidence temporarily stopped. In the 1970’s overdraft of the groundwater occurred resulting in groundwater level declines of 50 to 100 feet. Subsidence resumed. In 1996 the United States Geologic Survey (USGS) in cooperation with Coachella Valley Water District (CVWD) implemented a geodetic measurement of ground levels from Palm Desert, southwestward to the Salton Sea. Subsidence was not studied in the Desert Hot Springs area. CVWD has embarked on a groundwater replenishment program which has slowed the rate of subsidence in the region. Ongoing studies from the USGS have discovered that the dominant factor in ground subsidence is the presence of silt layers which compress upon groundwater withdrawal (Sneed, APWA Presentation March 2013). Ground subsidence could occur in the future and the site could be affected especially if groundwater withdrawal were to re-initiate. We expect the subsidence to be on a regional scale that could cause settlement across the project site. However, the settlement occurs over a relatively large geographic area and typically does not cause differential settlement over a relatively short horizontal distance that should be addressed as a design concern as part of the site development.

4. GEOLOGIC MATERIALS

4.1 General

Based on the field investigation and published geologic maps of the area, the soil exposed at the surface and underlying the site to depths of several hundred feet is generally referred to as alluvium. The alluvium at the site includes cohesionless, undissected alluvial sand and gravel of the valley areas (Dibblee, 2008). Although undocumented artificial fill was not encountered in our borings, it may be present on the site. The soil and geologic units encountered at the site are discussed in general terms below. The site soil is described in detail on the boring logs in Appendix A.

4.2 Alluvial Sand and Gravel of the Valley Areas (Qa)

The alluvial soils encountered consist predominantly of poorly graded sand, poorly graded sand with silt, and silty sand. Cobbles were encountered, along with several “no recoveries” with locally high blow counts, within our borings at depth. Where explored, the alluvial soils are generally loose to very dense, dry to slightly moist, and are pale brown. This soil is highly susceptible to caving. Cobbles and boulders were observed scattered across the surface of the site. Based on what we encountered within our borings and what we observed across the surface of the site, cobbles and boulders should be expected to be encountered during grading operations. Furthermore, laboratory testing indicates site soils are dry, with average in-situ moisture contents within borings ranging between 0.7 and 6.6 percent.

5. GROUNDWATER

Static groundwater was not encountered during this investigation to the maximum depth explored of approximately 50½ feet. Based on a well record located approximately 0.8 mile west of the site (Well 03S04E01J001S), static groundwater may be as shallow as 176 feet beneath the ground surface at the site. We do not expect static groundwater to impact grading operations or the construction of improvements at the subject site. Static groundwater elevations are dependent on seasonal precipitation, irrigation, and land use, among other factors, and vary as a result.

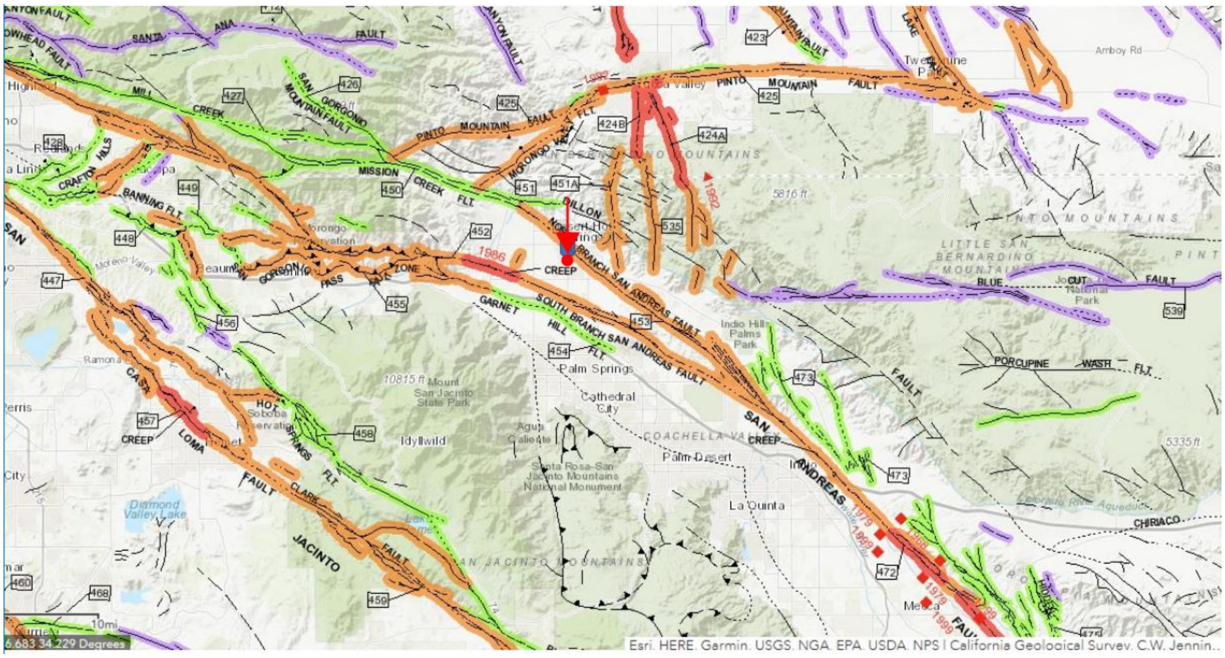
6. GEOLOGIC HAZARDS

6.1 Surface Fault Rupture

The numerous faults in Southern California include Holocene-active, pre-Holocene, and inactive faults. The criteria for these major groups are based on criteria developed by the California Geological Survey (CGS, formerly known as CDMG) for the Alquist-Priolo Earthquake Fault Zone Program (CGS, 2018). By definition, a Holocene-active fault is one that has had surface displacement within Holocene time (about the last 11,700 years). A pre-Holocene fault has demonstrated surface displacement during Quaternary time (approximately the last 1.6 million years) but has had no known Holocene movement. Faults that have not moved in the last 1.6 million years are considered inactive.

The site is not within a state-designated Alquist-Priolo Earthquake Fault Zone (CGS, 2023a; 2023b; 2017; Riverside County Map My County 2024) for surface fault rupture hazards. No Holocene-active or pre-Holocene faults with the potential for surface fault rupture are known to pass directly beneath the site. Therefore, the potential for surface rupture due to faulting occurring beneath the site during the design life of the proposed development is considered low. However, the site is located in the seismically active Southern California region and could be subjected to moderate to strong ground shaking in the event of an earthquake on one of the many active Southern California faults. The faults in the vicinity of the site are shown on the following Regional Fault Map.

REGIONAL FAULT MAP



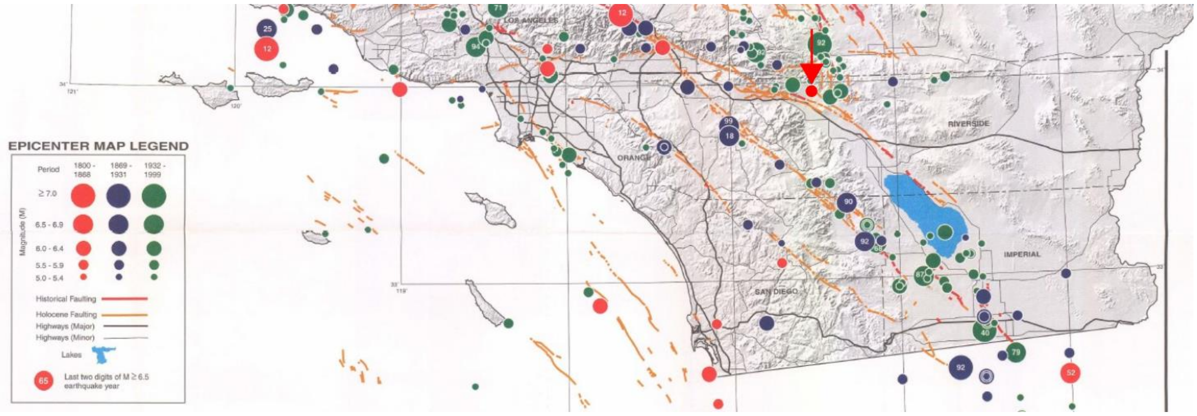
Esri. HERE. Garmin. USGS. NGA. EPA. USDA. NPS | California Geological Survey. C.W. Jennin...

The closest surface trace of an active fault to the site is the North Branch of the San Andreas Fault located approximately ½ mile to the northeast. Other nearby active faults are the South Branch of the San Andreas Fault, San Gorgonio Pass Fault, and Morongo Fault located approximately 2½ miles southwest, 14 miles west, and 9 miles northwest, respectively (Bryant, 2010).

6.2 Seismicity

As with all Southern California, the site has experienced historic earthquakes from various regional faults. The seismicity of the region surrounding the site was formulated based on research of an electronic database of earthquake data. The epicenters of recorded earthquakes with magnitudes equal to or greater than 5.0 in the site vicinity are depicted on the following Regional Seismicity Map.

REGIONAL SEISMICITY MAP



A partial list of moderate to major magnitude earthquakes that have occurred in the Southern California area within the last 100 years is included in the following table.

HISTORIC EARTHQUAKE EVENTS WITH RESPECT TO THE SITE

Earthquake (Oldest to Youngest)	Date of Earthquake	Magnitude	Distance to Epicenter (Miles)	Direction to Epicenter
Near Redlands	March 10, 1933	6.3	43	W
Long Beach	March 10, 1933	6.4	87	WSW
Tehachapi	July 21, 1952	7.5	161	WNW
San Fernando	February 9, 1971	6.6	113	WNW
Whittier Narrows	October 1, 1987	5.9	91	W
Sierra Madre	June 28, 1991	5.8	89	WNW
Landers	June 28, 1992	7.3	18	NNE
Big Bear	June 28, 1992	6.4	26	NW
Northridge	January 17, 1994	6.7	118	W
Hector Mine	October 16, 1999	7.1	47	NNE
Ridgecrest China Lake Fault	July 5, 2019	7.1	140	NW

6.3 Seismic Design Criteria

The following table summarizes the site-specific design criteria obtained from the 2022 California Building Code (CBC; Based on the 2021 International Building Code [IBC] and ASCE 7-16), Chapter 16 Structural Design, Section 1613 Earthquake Loads. The data was calculated using the online application U.S. Seismic Design Maps, provided by the Structural Engineers Association of California (SEAOC). The short spectral response uses a period of 0.2 second. We evaluated the Site Class based on the discussion in Section 1613.2.2 of the 2022 CBC and Table 20.3-1 of ASCE 7-16. The values presented in the following table are for the risk-targeted maximum considered earthquake (MCE_R).

2022 CBC SEISMIC DESIGN PARAMETERS

Parameter	Value	2022 CBC Reference
Site Class	D	Section 1613.2.2
MCE_R Ground Motion Spectral Response Acceleration – Class B (short), S_S	2.372g	Figure 1613.2.1(1)
MCE_R Ground Motion Spectral Response Acceleration – Class B (1 sec), S_1	0.884g	Figure 1613.2.1(3)
Site Coefficient, F_A	1	Table 1613.2.3(1)
Site Coefficient, F_V	1.7	Table 1613.2.3(2)
Site Class Modified MCE_R Spectral Response Acceleration (short), S_{MS}	2.372g	Section 1613.2.3 (Eqn 16-20)
Site Class Modified MCE_R Spectral Response Acceleration – (1 sec), S_{M1}	1.503g*	Section 1613.2.3 (Eqn 16-21)
5% Damped Design Spectral Response Acceleration (short), S_{DS}	1.581g	Section 1613.2.4 (Eqn 16-22)
5% Damped Design Spectral Response Acceleration (1 sec), S_{D1}	1.002g*	Section 1613.2.4 (Eqn 16-23)

*Per Supplement 3 of ASCE 7-16, a ground motion hazard analysis (GMHA) shall be performed for projects on Site Class "D" sites with 1-second spectral acceleration (S_1) greater than or equal to 0.2g, which is true for this site. However, Supplement 3 of ASCE 7-16 provides an exception stating that that the GMHA may be waived provided that the parameter S_{M1} is increased by 50% for all applications of S_{M1}. The values for parameters S_{M1} and S_{D1} presented above have not been increased in accordance with Supplement 3 of ASCE 7-16.

The following table presents the mapped maximum considered geometric mean (MCE_G) seismic design parameters for projects located in Seismic Design Categories of D through F in accordance with ASCE 7-16.

ASCE 7-16 PEAK GROUND ACCELERATION

Parameter	Value	ASCE 7-16 Reference
Mapped MCE_G Peak Ground Acceleration, PGA	0.982g	Figure 22-9
Site Coefficient, F_{PGA}	1.1	Table 11.8-1
Site Class Modified MCE_G Peak Ground Acceleration, PGA_M	1.08g	Section 11.8.3 (Eqn 11.8-1)

Deaggregation of the Maximum Considered Earthquake (MCE) peak ground acceleration was performed using the USGS online Unified Hazard Tool, 2014 Conterminous U.S. Dynamic edition (v4.2.0). The result of the deaggregation analysis indicates that the predominant earthquake contributing to the MCE peak ground acceleration is characterized as a modal 7.5 magnitude event occurring at a hypocentral distance of 3.41 kilometers from the site.

Conformance to the criteria in the above tables for seismic design does not constitute any kind of guarantee or assurance that significant structural damage or ground failure will not occur if a large earthquake occurs. The primary goal of seismic design is to protect life, not to avoid all damage, since such design may be economically prohibitive.

6.4 Liquefaction Potential

Liquefaction is a phenomenon in which loose, saturated, relatively cohesionless soil deposits lose shear strength during strong ground motions. Primary factors controlling liquefaction include intensity and duration of ground motion, gradation characteristics of the subsurface soils, in-situ stress conditions, and the depth to groundwater. Liquefaction is typified by a loss of shear strength in the liquefied layers due to rapid increases in pore water pressure generated by earthquake accelerations.

The current standard of practice, as outlined in the “Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Liquefaction in California” and “Special Publication 117A, Guidelines for Evaluating and Mitigating Seismic Hazards in California” requires liquefaction analysis to a depth of 50 feet below the lowest portion of the proposed structure. Liquefaction typically occurs in areas where the soils below the water table are composed of poorly consolidated, fine- to medium-grained, primarily sandy soil. In addition to the requisite soil conditions, the ground acceleration and duration of the earthquake must also be of a sufficient level to induce liquefaction.

The Riverside County Map My County website indicates that the site is in an area designated as having a moderate potential for liquefaction.

We performed a liquefaction analysis of the soils underlying the site using the 1996 NCEER method of analysis with the updates by Youd et al. (2001). The liquefaction potential evaluation was performed by utilizing a static groundwater depth of greater than 50 feet, a magnitude 7.5 earthquake, and the site class modified MCE_G peak ground acceleration (PGA_M) of 1.08g. This semi-empirical method is based on a correlation between values of Standard Penetration Test (SPT) resistance. An average conversion factor of 0.63 was used to derive SPT blow-count values from California Modified Sampler blow-count values.

Due to the lack of shallow static groundwater at the project site, liquefaction is not a design consideration. Our *Empirical Estimation of Liquefaction Potential* is included as Figure 3.

Additionally, an evaluation of seismically induced “dry-sand” settlement was performed, with the resulting seismic “dry-sand” settlement estimated to be up to ¾ inch, with differential settlement on the order ½ inch across 40 feet. An analysis of seismically induced “dry-sand” settlement is included as Figure 4.

6.5 Expansive Soil

The geologic units near the ground surface at the site consist of sandy soils. Laboratory testing indicates site soils have a “very low” expansion potential (Expansion Index [EI] 0 to 20).

6.6 Hydrocompression

Hydrocompression is the tendency of unsaturated soil structure to collapse upon wetting resulting in the overall settlement of the affected soil and overlying foundations or improvements supported thereon. Potentially compressible soils underlying the site are typically removed and compacted during remedial site grading. However, if compressible soil is left in-place, a potential for settlement due to hydrocompression of the soil exists.

Based on the laboratory test results, the potential for hydrocompression ranges from approximately 0.4 to 2.6 percent within the alluvial soils. We expect that the hydrocompressive characteristics of site soils will be effectively reduced as a result of remedial grading operations and adequate drainage measures; therefore, it is our opinion that hydrocompression is not a design consideration for this project.

6.7 Slope Stability

The topography at the site and surrounding areas is relatively level with a gentle slope to the south-southeast. There are no known landslides near the site, nor is the site in the path of any known or potential landslides (Dibblee, 2008). Therefore, the potential for slope stability hazards to adversely affect the proposed development is considered low.

6.8 Earthquake-Induced Flooding

Earthquake-induced flooding is inundation caused by failure of dams or other water-retaining structures due to earthquakes. Based on a review of the USGS dam inundation database, the site is not located within a potential inundation area for an earthquake-induced dam failure. Therefore, the probability of earthquake-induced flooding is considered very low.

6.9 Tsunamis, Seiches, and Flooding

The site is not located within a coastal area. Therefore, tsunamis are not considered a significant hazard at the site.

Seiches are large waves generated in enclosed bodies of water in response to ground shaking. No major water-retaining structures are located immediately up gradient from the project site. Therefore, flooding resulting from a seismically induced seiche is considered unlikely.

The site is not located in an area of flooding per Riverside County Map My County website (RCIT 2024).

6.10 Oil Fields & Methane Potential

Based on a review of the California Geologic Energy Management Division (CalGEM) Well Finder Website, the site is not located within an oil field and oil or gas wells are not documented within ½-mile of the site (CalGEM, 2023). However, due to the voluntary nature of record reporting by the oil well drilling companies, wells may be improperly located or not shown on the location map and undocumented wells could be encountered during construction. Any wells encountered during construction will need to be properly abandoned in accordance with the current requirements of the CalGEM.

Since the site is not located within the boundaries of a known oil field, the potential for the presence of methane or other volatile gases at the site is considered low. However, should it be determined that a methane study is required for the proposed development it is recommended that a qualified methane consultant be retained to perform the study and provide mitigation measures as necessary.

6.11 Subsidence

Subsidence occurs when a large portion of land is displaced vertically, usually due to the withdrawal of groundwater, oil, or natural gas. Soils that are particularly subject to subsidence include those with high silt or clay content. The site is not located within an area of known ground subsidence (USGS, 2024). No large-scale extraction of groundwater, gas, oil, or geothermal energy is occurring or planned at the site or in the general site vicinity. There appears to be little or no potential for ground subsidence due to withdrawal of fluids or gases at the site.

Regional subsidence has occurred in recent history within the Coachella Valley. Initial subsidence occurred between the 1920’s and 1940’s when groundwater was over-pumped and groundwater levels declined to the order of 50 feet. The introduction of Colorado River water in 1949 reduced groundwater pumping and the related subsidence temporarily stopped. In the 1970’s overdraft of the groundwater occurred resulting in groundwater level declines of 50 to 100 feet and subsidence resumed. In 1996, the United States Geologic Survey (USGS) in cooperation with CVWD implemented a geodetic measurement of ground levels from Palm Desert, southwestward to the Salton Sea. Subsidence of 0.39 to 0.57 ft. has occurred within the La Quinta Subsidence Zone, located southwest of the site, between 1996 and 2005. Subsidence at a point located near the intersection of Avenue 54 and Jackson was recorded at 44 mm in 1998. Since that time, no subsidence has been recorded at that location. CVWD has embarked on a groundwater replenishment program which has slowed the rate of subsidence in the region. Ongoing studies from the USGS have discovered that the dominant factor in ground subsidence is the presence of silt layers which compress upon groundwater withdraw (Sneed, APWA Presentation March 2013). Ground subsidence could occur in the future and the site could be affected especially if groundwater withdrawal were to re-initiate. We anticipate the subsidence to be on a regional scale that could cause settlement across the project site. However, the settlement occurs over a relatively large geographic area and typically does not cause differential settlement over a relatively short horizontal distance that should be addressed as a design concern as part of the site development.

7. SITE INFILTRATION

Preliminary percolation testing was performed in accordance with the procedures outlined in *Riverside County Flood Control and Water Conservation District LID BMP, Appendix A* (Handbook) for infiltration basins. The percolation test locations are depicted on the *Geologic Map and Site Plan*, Figure 2.

Percolation Test P-1 was performed within geotechnical Boring B-3, at a depth of 10 feet below existing grade. Initially, Boring B-3 was excavated using a CME-75 hollow-stem auger drilling machine with 8-inch-diameter augers for geotechnical logging and sampling. At the completion of the geotechnical portion of Boring B-3, the boring was backfilled with cuttings to approximately 10 feet of depth, and a bentonite plug was installed. Approximately two inches of gravel was placed at the bottom of the test hole, and a perforated pipe was placed atop the gravel to keep the test hole open. Gravel was placed around the bottom of the test hole to support the test pipe. The test location was pre-saturated prior to testing. The Boring B-3 log and the Test P-1 percolation data are presented in Appendix A. A summary of Test P-1 percolation data and infiltration rate results are provided in the following table.

CALCULATED INFILTRATION RATES FROM PERCOLATION TEST RESULTS

Parameter	P-1
Depth (inches)	120
Test Type	Sandy
Change in Head Over Time: ΔH (inches)	42.8
Average Head: H_{avg} (inches)	21.7
Time Interval: Δt (minutes)	10
Radius of Test Hole: r (inches)	4.0
Calculated Infiltration Rate: I_t (inches/hour)	21.7

The results of the preliminary percolation testing indicate that the calculated infiltration rates at the location tested is 21.7 inches per hour. The *Handbook* requires a factor of safety of 3 be applied to the values above based on the test method used.

The in-situ field percolation tests performed provide short-term infiltration rates. Where appropriate, the short-term infiltration rates shall be converted to long-term infiltration rates using reduction factors depending on the degree of infiltration quality, maintenance access and frequency, site variability, subsurface stratigraphy variation, and other factors. The small-scale percolation testing cannot model the complexity of the effect of interbedded layers of different soil composition, and our test results should be considered only as index values of infiltration rates.

Due to the presence of potentially hydrocompressive soils, the proposed infiltration system should be located a minimum distance of 20 feet from proposed settlement-sensitive structures and a minimum distance of 15 feet from site improvements to reduce the potential for induced settlements to adversely impact the proposed structures and improvements. Provided these offsets are maintained, there is a low potential for infiltration-related soil settlement to adversely affect the proposed structures; some settlement may occur locally within the area of the infiltration system.

The civil engineer should also evaluate the impact on surface drainage should some soil settlement occur locally within the area of the infiltration system. It is suggested that flexible connections be utilized between the storm drainpipes and infiltration chambers. The project owner should understand that it is not our intent to completely prevent any soil settlement and/or associated distress of overlying pavement as a result of stormwater infiltration, as doing so would be cost-prohibitive to the proposed project.

8. CONCLUSIONS AND RECOMMENDATIONS

8.1 General

8.1.1 Soil or geologic conditions were not encountered during the investigation that would preclude the proposed development of the project, provided the recommendations presented herein are followed and implemented during design and construction. This report should be considered as preliminary, and the geotechnical design parameters presented herein should be verified once the project progresses to a more finalized state.

8.1.2 Potential geologic hazards at the site include seismic shaking, seismically induced settlement, and compressible near surface soils.

8.1.3 Based on our investigation and available geologic information, active, potentially active, or inactive faults are not present underlying or trending toward the site.

8.1.4 An evaluation of seismically induced settlement was performed, with the resulting seismic “dry-sand” settlement estimated to be up to ¾ inch, with differential settlement on the order ½ inch across 40 feet.

8.1.5 The upper portion of alluvial soils present at the site, in their current state, are not considered suitable for the support of additional compacted fill or settlement-sensitive improvements. Remedial grading of the surficial soil will be required as discussed herein. The site soils are suitable for re-use as engineered fill provided the recommendations in the *Grading* section of this report are followed.

8.1.6 Based on laboratory testing and our observations during our investigation, we expect onsite soils can be processed to meet gradation and sand equivalent requirements for trench bedding and shading.

8.1.7 Although static groundwater was not encountered during our subsurface investigation, it is possible that seepage may be encountered during the wet-weather season.

8.1.8 Cobbles and boulders were observed across the site surface, and cobbles were encountered within our borings at depth. We expect cobbles and boulders to be encountered during grading operations. The contractor should be prepared to screen cobbles and boulders from the soils during earthwork operations. Grading recommendations addressing oversize rock are discussed herein.

8.1.9 Based on the laboratory test results, the potential for hydrocompression ranges from approximately 0.4 to 2.6 percent within the alluvial soils. We expect that the hydrocompressive characteristics of site soils will be effectively reduced as a result of remedial grading operations and adequate drainage measures.

8.1.10 Site soils are generally comprised of sand with little or no cohesion that are highly susceptible to caving in un-shored excavations. It is the responsibility of the contractor to ensure that excavations and trenches are properly shored and maintained in accordance with Cal-OSHA rules and regulations to maintain the stability of adjacent existing improvements. The contractor should be aware that formwork may be required to prevent caving of shallow spread foundation excavations. Shoring recommendations are provided in the *Temporary Excavations* section of this report. In addition, the soil is susceptible to rapid erosion during a wet-weather event.

8.1.11 In-situ moisture and density laboratory testing indicate that site soils are significantly dry when compared to the optimum moisture content, determined by ASTM D1557. Significant moisture conditioning of material to be used as engineered fill should be expected during grading operations. Wet-weather events may affect the in-situ moisture content of site soils.

8.1.12 Proper drainage should be maintained to preserve the design properties of the engineered fill in the sheet-graded pads. Recommendations for site drainage are provided herein.

8.1.13 Once design or civil grading plans are made available, the recommendations within this report should be reviewed and revised, as necessary. Additionally, as the project design progresses toward a final design, changes in the design, location, or elevation of the proposed improvement should be reviewed by this office. Geocon should be contacted to evaluate the necessity for review and possible revision of this report.

8.2 Soil and Excavation Characteristics

8.2.1 The in-situ soils and oversize rock material at the site should generally be excavatable with moderate to heavy effort using conventional earth moving equipment in proper functioning order. The contractor should expect the presence of cobbles and boulders in the alluvial soils will present difficulties during the excavation process, and that formwork may be required to prevent caving of shallow spread foundation excavations. Special handling of these oversize materials should be performed in accordance with the *Recommended Grading Specifications* of Appendix C.

8.2.2 It is the responsibility of the contractor to ensure that all excavations and trenches are properly shored and maintained in accordance with applicable Cal-OSHA rules and regulations to maintain safety and the stability of existing improvements. All onsite excavations must be conducted in such a manner that potential surcharges from existing structures, construction equipment, and vehicle loads are resisted. The surcharge area may be defined by a 1:1 projection down and away from the bottom of an existing foundation or vehicle load. Penetrations below this 1:1 projection will require special excavation measures such as sloping and shoring. Excavation recommendations are provided in the *Temporary Excavations* section of this report.

8.2.3 Based on laboratory expansion index (EI) testing, site soils generally possess a "very low" expansion potential, EI of 0 to 20, and are considered "non-expansive" as defined by 2022 CBC Section 1803.5.3. The following table presents soil classifications based on the EI.

SOIL CLASSIFICATION BASED ON EXPANSION INDEX

Expansion Index (EI)	Expansion Classification	2022 CBC Expansion Classification
0 – 20	**Very Low**	**Non-Expansive**
21 – 50	Low	Expansive
51 – 90	Medium	
91 – 130	High	
Greater Than 130	Very High	

8.2.4 The recommendations presented herein assume that foundations and slabs will derive support in these materials.

8.2.5 Testing for expansion potential should be performed during finish grading to confirm the expansion potential of building pad fill material. Plasticity index testing should be performed on soils with expansion indices greater than 20.

8.3 Minimum Resistivity, pH, and Water-Soluble Chloride and Sulfate

8.3.1 We performed laboratory tests on samples of the site materials to evaluate the percentage of water-soluble sulfate content. Appendix B presents results of the laboratory water-soluble sulfate content tests. Laboratory tests performed on samples of the site materials indicate that the on-site materials possess an "S0" sulfate exposure to concrete structures as defined by 2022 CBC Section 1904 and ACI 318-19, Chapter 19. The following table presents a summary of concrete requirements set forth by 2022 CBC Section 1904.3 and ACI 318. The presence of water-soluble sulfates is not a visually discernible characteristic;

therefore, other soil samples from the site could yield different concentrations. Additionally, over time landscaping activities (i.e., addition of fertilizers and other soil nutrients) may affect the concentration.

REQUIREMENTS FOR CONCRETE EXPOSED TO SULFATE-CONTAINING SOLUTIONS

Exposure Class		Water-Soluble Sulfate (SO_4) Percent by Weight	Cement Type (ASTM C 150)	Maximum Water to Cement Ratio by Weight[1]	Minimum Compressive Strength (psi)
S0		**$SO_4<0.10$**	**No Type Restriction**	**n/a**	**2,500**
S1		$0.10 \leq SO_4<0.20$	II	0.50	4,000
S2		$0.20 \leq SO_4 \leq 2.00$	V	0.45	4,500
S3	Option 1	$SO_4>2.00$	V+Pozzolan or Slag	0.45	4,500
	Option 2		V	0.40	5,000

[1] Maximum water to cement ratio limits do not apply to lightweight concrete.

8.3.2 Laboratory test results indicate a resistivity of 13,000 ohm-cm, pH of 8.8, chloride content of 150 ppm, and sulfate content of 10 ppm. Based on the laboratory test results, the site soils would not be considered corrosive to metal improvements based on resistivity in accordance with Caltrans *Corrosion Guidelines* (Caltrans, 2021) as shown in the following table.

CALTRANS CORROSION GUIDELINES

Corrosion Exposure	Resistivity (ohm-cm)	Chloride (ppm)	Sulfate (ppm)	pH
Corrosive	<1,500	500 or greater	1,500 or greater	5.5 or less

8.3.3 Geocon does not practice in the field of corrosion engineering. Therefore, further evaluation by a corrosion engineer may be performed if improvements that could be susceptible to corrosion are planned.

8.4 Grading

8.4.1 Grading should be performed in accordance with the *Recommended Grading Specifications* contained in Appendix C and the grading ordinances of the City of Desert Hot Springs.

8.4.2 Prior to commencing grading, a preconstruction conference should be held at the site with the City inspector, owner or developer, grading contractor, civil engineer, and geotechnical engineer in attendance. Special soil handling and/or the grading plans can be discussed at that time.

8.4.3 Site preparation should begin with the removal of deleterious material, debris, buried and surficial trash, and vegetation. The depth of removal should be such that material exposed in cut areas or soil to be used as fill is relatively free of organic matter. Material generated during stripping and/or site demolition should be exported from the site. Rock greater than 6 inches in dimension should not be used in the engineered fill, and rock greater than 3 inches in dimension should not be used in backfill within utility trench corridors.

8.4.4 Dry, loose, soft, or compressible alluvial soils within a 1:1 (h:v) projection of the limits of grading should be removed to expose competent alluvial soils with a relative compaction of at least 85 percent, based on ASTM D1557. Based on our findings, we expect surficial alluvial soils will require remedial excavation and proper compaction. Removals should extend at least 5 feet below the existing ground surface, or at least 2 feet below the bottom of the planned foundations, whichever is deeper. Removals in pavement and walkway areas should extend at least 2 feet below subgrade and into competent alluvial soils. The engineering geologist should evaluate the actual depth of removal during grading operations to ensure the excavation bottoms do not contain dry, loose, soft, or compressible soils. Where over-excavation and compaction is to be conducted, the excavations should be extended laterally a minimum distance of 5 feet beyond the building footprint or for a distance equal to the depth of removal, whichever is greater. Patios and building appurtenances should be considered a part of the building footprint when determining the limits of lateral excavation. The bottom of the excavations should be competent alluvial soils, as defined above, and should be scarified to a depth of at least 1 foot, moisture conditioned at or slightly above optimum moisture content, and properly compacted to 90 percent of the laboratory maximum dry density, as determined by ASTM D1557.

8.4.5 Additional grading should be conducted as necessary to maintain the required 2 feet of newly placed engineered fill below foundations. The grading contractor should verify all bottom of footing elevations prior to commencement of grading activities to ensure that grading is conducted deep enough to provide the required 2 feet of engineered fill below foundations.

8.4.6 Geocon should observe the removal bottoms to check the competence of the exposed soil. Deeper excavations may be required if dry, loose, soft, or compressible soils are present at the base of the removals.

8.4.7 The fill placed within 3 feet of proposed foundations should possess a “very low” expansion potential (EI of 20 or less).

8.4.8 The site should be brought to finish grade elevations with fill compacted in layers. Layers of fill should be no thicker than will allow for adequate bonding and compaction. Fill, including backfill and scarified ground surfaces, should be compacted to a dry density of at least 90 percent of the laboratory maximum dry density, at or slightly above optimum moisture content as determined by ASTM D1557. Fill materials placed below optimum moisture content may require additional moisture conditioning prior to placing additional fill. Earthwork should be observed, and compacted fill tested by representatives of Geocon.

8.4.9 Oversized rock should be expected to be encountered during grading operations. The oversize rock will require special handling and placement. Rocks greater than 3 inches in maximum dimensions should not be placed within utility trench backfill. Rocks greater than 6 inches in maximum dimension should not be placed in soil fill within the upper 3 feet of finish grade. Rocks 6 to 12 inches in maximum dimension should be placed deeper than 3 feet below finished grade elevations. Rocks 12 inches or larger in maximum dimension should be exported from the site or placed at least 10 feet below finished grade elevations, in accordance with the *Recommended Grading Specifications* of Appendix C.

8.4.10 If needed, import fill should consist of granular materials with a “very low” expansion potential (EI of 20 or less), non-corrosive, generally free of deleterious material, and contain rock no larger than 6 inches. Geocon should be notified of the import soil source and should be afforded the opportunity to perform laboratory testing of the import soil prior to its arrival at the site to evaluate its suitability as fill material.

8.4.11 We do not expect perched groundwater or saturated materials to be encountered during remedial grading; however, should they be encountered (such as a result of seepage during the wet-weather season) extensive drying and mixing with dryer soil may be required if the saturated material is to be utilized as fill material in achieving finished grades. The materials should then be moisture conditioned at or slightly above optimum moisture content, prior to placement as compacted fill.

8.4.12 Foundation excavation bottoms must be observed and approved in writing by the Geotechnical Engineer, prior to placing fill, steel, gravel, or concrete.

8.5 Earthwork Grading Factors

8.5.1 Estimates of shrinkage factors are based on empirical judgments comparing the material in its existing or natural state as encountered in the exploratory excavations to a compacted state. Variations in natural soil density and in compacted fill density render shrinkage value estimates as rough approximations. As an example, the contractor can compact the fill to a dry density of 90 percent or higher of the laboratory maximum dry density. Thus, the contractor has an approximately 10 percent range of control over the fill volume. Due to the variations in the actual shrinkage/bulking factors, a balance area should be provided to accommodate variations.

8.6 Utility Trench Backfill

8.6.1 Utility trenches should be properly backfilled in accordance with the requirements of the City of Desert Hot Springs and the following recommendations. Pipes should be bedded with well-graded crushed rock or clean sands (sand equivalent greater than 30) to a depth of at least one foot over the pipe; based on our experience with site soils, we expect site soils will have a sand equivalent of greater than 30. The bedding material must be inspected and approved in writing by a qualified representative of Geocon. <u>The use of well-graded crushed rock is only acceptable if used in conjunction with filter fabric to prevent the gravel from having direct contact with soil.</u> The remainder of the trench backfill may be derived from onsite soil or approved import soil. Backfill of utility trenches should not contain rocks greater than 3 inches in diameter. The use of 2-sack slurry and controlled low strength material (CLSM) are also acceptable as backfill. However, consideration should be given to the possibility of differential settlement where the slurry ends and earthen backfill begins. These transitions should be minimized and additional stabilization should be considered at these transitions.

8.6.2 Trench excavation bottoms must be observed and approved in writing by a representative of Geocon, prior to placing bedding materials, fill, gravel, or concrete.

8.6.3 Utility trench backfill should be placed in layers no thicker than will allow for adequate bonding and compaction. Utility backfill should be compacted to a dry density of at least 90 percent of the laboratory maximum dry density and moisture conditioned at or slightly above optimum moisture content as determined by ASTM D1557. Backfill at the finish subgrade elevation of new pavements should be compacted to at least 95 percent of the maximum dry density. Backfill materials placed below the recommended moisture content may require additional moisture conditioning prior to placing additional fill.

8.7 Conventional Foundation Design

8.7.1 Proposed structures can be supported on shallow foundation systems supported on newly placed engineered fill, following the completion of grading, per the recommendations provided in the *Grading* section of this report. Due to the presence of abundant gravel, cobbles, and boulders, foundation excavations may result in irregular surfaces where not appropriately screened from the engineered fill; here cobbles and boulders are removed from the bottom of the foundation excavations, the resulting depression should be backfilled with site soils and compacted as necessary. In addition, due to the granular nature of soils and potential for caving, the contractor should be prepared to form foundation excavations, if necessary.

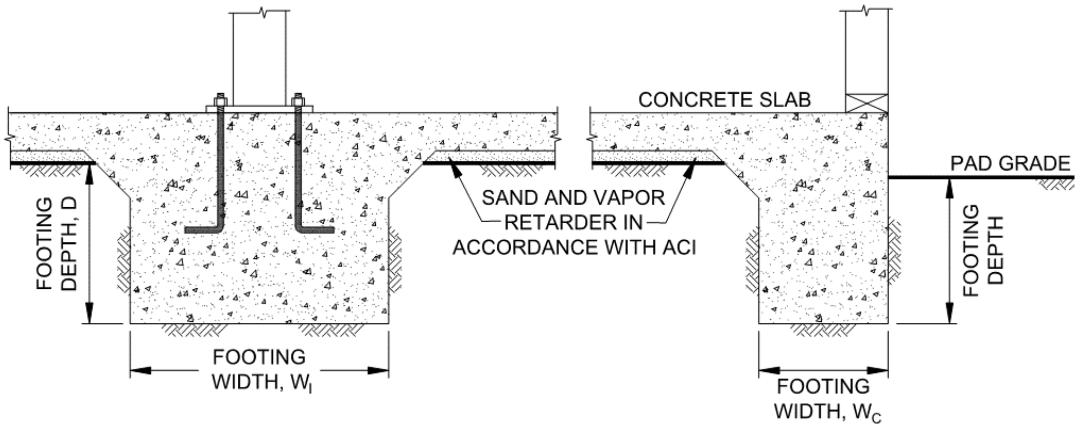
8.7.2 Foundations deriving support in newly placed engineered fill should be underlain by a minimum of 2 feet of engineered fill. Foundations for the structure should consist of continuous strip footings and/or isolated spread footings. The following table provides a summary of the foundation design recommendations.

SUMMARY OF FOUNDATION RECOMMENDATIONS

Parameter	Value
Minimum Continuous Foundation Width, W_C	12 inches
Minimum Isolated Foundation Width, W_I	24 inches
Minimum Foundation Depth, D	18 inches Below Lowest Adjacent Grade
Minimum Steel Reinforcement	Four No. 4 Bars, Two at the Top and Two at the Bottom
Allowable Bearing Pressure	3,000 psf
Bearing Pressure Increase	500 psf per Foot of Depth
	250 psf per Foot of Width
Maximum Allowable Bearing Pressure	4,000 psf
*Estimated Total Static Settlement	1¼ inches
*Estimated Static Differential Settlement	⅝ inch in 20 Feet
Design Expansion Index	20 or less

*The calculated seismic settlements provided in the *Liquefaction Potential* section of this report should be added to the static settlements for design purposes.

8.7.3 The foundations should be embedded in accordance with the recommendations herein and the *Wall/Column Footing Dimension Detail* below. The embedment depths should be measured from the lowest adjacent pad grade for both interior and exterior footings. Footings should be deepened such that the bottom outside edge of the footing is at least 7 feet horizontally from the face of the slope.



Wall/Column Footing Dimension Detail

8.7.4 The bearing capacity values presented herein are for dead plus live loads and may be increased by one-third when considering transient loads due to wind or seismic forces.

8.7.5 We should observe the foundation excavations prior to the placement of reinforcing steel and concrete to check that the exposed soil conditions are similar to those expected and that they have been extended to the appropriate bearing strata. Foundation modifications may be required if unexpected soil conditions are encountered.

8.7.6 Geocon should be consulted to provide additional design parameters as required by the structural engineer.

8.8 Concrete Slabs-On-Grade

8.8.1 Concrete slabs-on-grade for the structures should be constructed in accordance with the following table.

MINIMUM CONCRETE SLAB-ON-GRADE RECOMMENDATIONS

Parameter	Value
Minimum Concrete Slab Thickness	4 inches
Minimum Steel Reinforcement	No. 3 Bars 18 Inches on Center, Both Directions
Typical Slab Underlayment	3 to 4 Inches of Sand/Gravel/Base
Design Expansion Index	20 or less

8.8.2 Slabs that may receive moisture-sensitive floor coverings or may be used to store moisture-sensitive materials should be underlain by a vapor retarder. The vapor retarder design should be consistent with the guidelines presented in the American Concrete Institute's (ACI) *Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials* (ACI 302.2R-06) as well as ASTM E1745. In addition, the membrane should be installed in accordance with manufacturer's recommendations and ASTM requirements and installed in a manner that prevents puncture. The vapor retarder used should be specified by the project architect or developer based on the type of floor covering that will be installed and if the structure will possess a humidity controlled environment.

8.8.3 The bedding sand thickness should be determined by the project foundation engineer, architect, and/or developer. It is common to have 3 to 4 inches of sand for 5-inch and 4-inch thick slabs, respectively, in the Southern California region. However, we should be contacted to provide recommendations if the bedding sand is thicker than 6 inches. The foundation design engineer should provide appropriate concrete mix design criteria and curing measures to assure proper curing of the slab by reducing the potential for rapid moisture loss and subsequent cracking and/or slab curl. We suggest that the foundation design engineer present the concrete mix design and proper curing methods on the foundation plans. It is critical that the foundation contractor understands and follows the recommendations presented on the foundation plans.

8.8.4 Some projects remove the sand layer below the slab in parking structure areas. This is acceptable from a geotechnical engineering standpoint; however, relatively minor cracks could form due to differential curing. Therefore, the structural engineer and/or the concrete contractor should provide recommendations for proper curing techniques to help prevent cracking.

8.8.5 Concrete slabs should be provided with adequate crack-control joints, construction joints and/or expansion joints to reduce unsightly shrinkage cracking. The design of joints should consider criteria of the American Concrete Institute (ACI) when establishing crack-control spacing. Crack-control joints should be spaced at intervals no greater than 12 feet. Additional steel reinforcing, concrete admixtures and/or closer crack control joint spacing should be considered where concrete-exposed finished floors are planned.

8.8.6 Special subgrade presaturation is not deemed necessary prior to placing concrete; however, the exposed foundation and slab subgrade soil should be moisturized to maintain a moist condition as would be expected in any such concrete placement.

8.8.7 The concrete slab-on-grade recommendations are based on soil support characteristics only. The project structural engineer should evaluate the structural requirements of the concrete slabs for supporting expected loads.

8.8.8 Where exterior flatwork abuts the structure at entrant or exit areas, the exterior slab should be dowelled into the structure's foundation stemwall. This recommendation is intended to reduce the potential for differential elevations that could result from differential settlement or minor heave of the flatwork. Dowelling details should be designed by the project structural engineer.

8.8.9 The recommendations of this report are intended to reduce the potential for cracking of slabs due to expansive soil (if present), differential settlement of existing soil or soil with varying thicknesses. However, even with the incorporation of the recommendations presented herein, foundations, stucco walls, and slabs-on-grade placed on such conditions may still exhibit some cracking due to soil movement and/or shrinkage. The occurrence of concrete shrinkage cracks is independent of the supporting soil characteristics. Their occurrence may be reduced and/or controlled by limiting the slump of the concrete, proper concrete placement and curing, and by the placement of crack control joints at periodic intervals, in particular, where re-entrant slab corners occur.

8.9 Miscellaneous Foundations

8.9.1 Foundations for small outlying structures, such as block walls up to 6 feet in height, planter walls or trash enclosures, which will not be tied to the proposed structure, can be supported on shallow foundation systems supported by a minimum 2 feet of engineered fill.. If the soils exposed in the excavation bottom are soft or loose, compaction of the soils will be required prior to placing steel or concrete. Compaction of the foundation excavation bottom is typically accomplished with a compaction wheel or mechanical whacker and must be observed and approved by a Geocon representative.

8.9.2 Miscellaneous foundations may be designed for a bearing value of 1,500 psf and should be a minimum of 12 inches in width, 18 inches in depth below the lowest adjacent grade, and 12 inches into the recommended bearing material. The allowable bearing pressure may be increased by up to one-third for transient loads due to wind or seismic forces.

8.9.3 Foundation excavations should be observed and approved in writing by a representative of Geocon, prior to the placement of reinforcing steel and concrete to verify that the excavations and exposed soil conditions are consistent with those anticipated.

8.10 Conventional Retaining Walls

8.10.1 The recommendations presented herein are generally applicable to the design of rigid concrete or masonry retaining walls having a maximum height of 5 feet. In the event that walls higher than 5 feet or other types of walls are planned, Geocon should be consulted for additional recommendations.

8.10.2 Retaining walls not restrained at the top and having a level backfill surface should be designed for an active soil pressure equivalent to the pressure exerted by a fluid density of 40 pounds per cubic foot (pcf). These soil pressures assume that the backfill materials within an area bounded by the wall and a 1:1 plane extending upward from the base of the wall possess an EI of 20 or less. For walls where backfill materials do not conform to the criteria herein, Geocon should be consulted for additional recommendations.

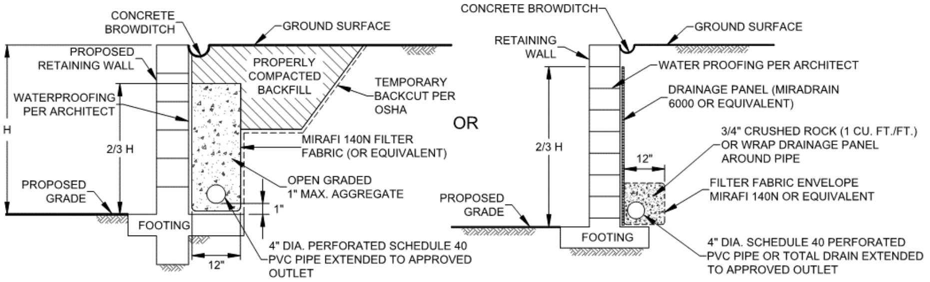
8.10.3 Unrestrained walls are those that are allowed to rotate more than 0.001H (where H equals the height of the retaining portion of the wall in feet) at the top of the wall. Where level walls are restrained from movement at the top, the walls should be designed for a soil pressure equivalent to the pressure exerted by a fluid density of 58 pcf.

8.10.4 The wall pressures provided above assume that the proposed retaining walls will support relatively undisturbed alluvial soils or engineered fill derived from onsite soil. If import soil is used to backfill proposed walls, revised earth pressures may be required to account for the geotechnical properties of the soil placed as engineered fill. This should be evaluated once the use of import soil is established. All imported fill shall be observed, tested, and approved by Geocon West, Inc. prior to bringing soil to the site.

8.10.5 It is common to see retaining walls constructed in the areas of the elevator pits. The retaining walls should be properly drained and designed in accordance with the recommendations presented herein. If the elevator pit walls are not drained, the walls should be designed with an at-rest pressure with an equivalent fluid density of 90 pcf. It is also common to see seepage and water collection within the elevator pit. The pit should be designed and properly waterproofed to prevent seepage and water migration into the elevator pit.

8.10.6 Unrestrained walls will move laterally when backfilled and loading is applied. The amount of lateral deflection is dependent on the wall height, the type of soil used for backfill, and loads acting on the wall. The retaining walls and improvements above the retaining walls should be designed to incorporate an appropriate amount of lateral deflection as determined by the structural engineer.

8.10.7 Retaining walls should be provided with a drainage system adequate to prevent the buildup of hydrostatic forces and waterproofed as required by the project architect. The soil immediately adjacent to the backfilled retaining wall should be composed of free draining material completely wrapped in Mirafi 140N (or equivalent) filter fabric for a lateral distance of 1 foot for the bottom two-thirds of the height of the retaining wall. The upper one-third should be backfilled with less permeable compacted fill to reduce water infiltration. Alternatively, a drainage panel, such as a Miradrain 6000 or equivalent, can be placed along the back of the wall. The use of drainage openings through the base of the wall (weep holes) is not recommended where the seepage could be a nuisance or otherwise adversely affect the property adjacent to the base of the wall. The recommendations herein assume a properly compacted backfill (EI of 20 or less) with no hydrostatic forces or imposed surcharge load. If conditions different than those described are expected or if specific drainage details are desired, Geocon should be contacted for additional recommendations. A graphic depicting typical retaining wall drainage is provided below.



Typical Retaining Wall Drainage Detail

8.10.8 Wall foundations should be designed in accordance with the foundation recommendations in the *Conventional Foundation Design* section of this report.

8.10.9 Additional pressure should be added for a surcharge condition due to sloping ground, vehicular traffic or adjacent structures and should be designed for each condition as the project progresses.

8.10.10 It is recommended that line-load surcharges from adjacent wall footings, use horizontal pressures generated from NAV-FAC DM 7.2. The governing equations are:

$$For\ {}^{x}/_{H} \leq 0.4$$

$$\sigma_H(z) = \frac{0.20 \times \left(\frac{z}{H}\right)}{\left[0.16 + \left(\frac{z}{H}\right)^2\right]^2} \times \frac{Q_L}{H}$$

and

$$For\ {}^{x}/_{H} > 0.4$$

$$\sigma_H(z) = \frac{1.28 \times \left(\frac{x}{H}\right)^2 \times \left(\frac{z}{H}\right)}{\left[\left(\frac{x}{H}\right)^2 + \left(\frac{z}{H}\right)^2\right]^2} \times \frac{Q_L}{H}$$

where *x* is the distance from the face of the excavation or wall to the vertical line-load, *H* is the distance from the bottom of the footing to the bottom of excavation or wall, *z* is the depth at which the horizontal pressure is desired, Q_L is the vertical line-load and $\sigma_H(z)$ is the horizontal pressure at depth *z*.

8.10.11 It is recommended that vertical point-loads, from construction equipment outriggers or adjacent building columns use horizontal pressures generated from NAV-FAC DM 7.2. The governing equations are:

$$For\ {}^{x}/_{H} \leq 0.4$$

$$\sigma_H(z) = \frac{0.28 \times \left(\frac{z}{H}\right)^2}{\left[0.16 + \left(\frac{z}{H}\right)^2\right]^3} \times \frac{Q_P}{H^2}$$

and

$$For\ {}^{x}/_{H} > 0.4$$

$$\sigma_H(z) = \frac{1.77 \times \left(\frac{x}{H}\right)^2 \times \left(\frac{z}{H}\right)^2}{\left[\left(\frac{x}{H}\right)^2 + \left(\frac{z}{H}\right)^2\right]^3} \times \frac{Q_P}{H^2}$$

then

$$\sigma'_H(z) = \sigma_H(z)cos^2(1.1\theta)$$

where x is the distance from the face of the excavation/wall to the vertical point-load, H is distance from the outrigger/bottom of column footing to the bottom of excavation, z is the depth at which the horizontal pressure is desired, Qp is the vertical point-load, $\sigma_H(z)$ is the horizontal pressure at depth z, Θ is the angle between a line perpendicular to the excavation/wall and a line from the point-load to location on the excavation/wall where the surcharge is being evaluated, and $\sigma_H(z)$ is the horizontal pressure at depth z.

8.10.12 In addition to the recommended earth pressure, the upper 10 feet of the retaining wall adjacent to the street or driveway areas should be designed to resist a uniform lateral pressure of 100 psf, acting as a result of an assumed 300 psf surcharge behind the shoring due to normal street traffic. If the traffic is kept back at least 10 feet from the wall, the traffic surcharge may be neglected.

8.11 Elevator Pit Design

8.11.1 If used, the elevator pit slab and retaining wall should be designed by the project structural engineer. Elevator pit foundation and walls may be designed in accordance with the recommendations in the *Conventional Foundation Design* and *Conventional Retaining Walls* sections of this report.

8.11.2 Additional pressure should be added for a surcharge condition due to sloping ground, vehicular traffic or adjacent foundations and should be designed for each condition as the project progresses.

8.11.3 If retaining wall drainage is to be provided, the drainage system should be designed in accordance with the *Conventional Retaining Walls* section of this report.

8.11.4 We recommend that the exterior walls and slab be waterproofed to prevent excessive moisture inside of the elevator pit. Waterproofing design and installation are not the responsibility of the Geotechnical Engineer.

8.12 Elevator Piston

8.12.1 If a plunger-type elevator piston is installed for this project, a deep drilled excavation will be required. It is important to verify that the drilled excavation is not situated immediately adjacent to a foundation, or the drilled excavation could compromise the existing foundation support, especially if the drilling is performed subsequent to the foundation construction. In addition, boulders and cobbles may be encountered in the existing fill or alluvial soils, and some of the site soils have little to no cohesion and are prone to excessive caving. The contractor should be prepared for difficult drilling conditions.

8.12.2 Caving is expected, and the contractor should be prepared to use casing and should have it readily available at the commencement of drilling activities. Continuous observation of the drilling and installation of the elevator piston by the Geotechnical Engineer should be performed.

8.12.3 The annular space between the piston casing and drilled excavation wall should be filled with a minimum of 1½-sack slurry pumped from the bottom up. As an alternative, pea gravel may be utilized. The use of soil to backfill the annular space is not acceptable.

8.13 Swimming Pools

8.13.1 For the proposed pools, the shell bottoms should be designed as a free-standing structure and may derive support on a minimum of 2 feet of engineered fill compacted to a dry density of at least 90 percent of the laboratory maximum dry density at or slightly above optimum moisture content as determined by ASTM D1557.

8.13.2 Swimming pool foundations and walls may be designed in accordance with the recommendations in the *Conventional Foundation Design* and *Conventional Retaining Walls* sections of this report. A hydrostatic relief valve should be considered as part of the swimming pool design unless a gravity drain system can be placed beneath the pool shell.

8.13.3 Based on the soil overburden load that will be removed during excavation of the swimming pool, anticipated settlements are expected to be small. Static differential settlement of the pool is not expected to exceed ¼ inch over a horizontal distance of 40 feet.

8.13.4 Surface drainage around the pool/spa should be designed to prevent water from ponding and seeping into the ground. Surface water should be collected and conducted through non-erosive devices to the street, storm drain or other approved water course or disposal area. Leakage from the proposed pool/spa could create an artificial groundwater condition that will likely create instability problems. Therefore, all plumbing and the pool/spa should be leak free.

8.13.5 The deck for the swimming pool/spa should be cast separately from the swimming pool/spa, and water stops should be provided between the bond beam and the deck. Jointing for concrete flatwork should be provided in accordance with the recommendations of the American Concrete Institute. The joints should be sealed with an approved flexible sealant to reduce the potential for introduction of surface water into the underlying soil.

8.13.6 To mitigate the potential for moisture infiltration into the subgrade soils beneath the pool deck, we recommend the construction of a deepened footing along the outside edge of the pool deck flatwork. A subdrain consisting of 4-inch diameter perforated PVC pipe should be installed inside the deepened footing and sloped to drain into an approved outlet. The pipe should be surrounded by ¾ inch open-graded gravel and wrapped with filter fabric.

8.13.7 If the proposed pools are in proximity to a proposed or existing structure, consideration should be given to the construction sequence. If the proposed pool is to be constructed near an existing structure, or a proposed structure that is constructed before the pool construction, the excavation required for the pool could remove a critical component of lateral support from the foundations of the structure and would therefore require shoring to safeguard the foundations. Once information regarding the pool locations and depth becomes available, this information should be provided to Geocon for review and possible revision of these recommendations.

8.14 Lateral Design

8.14.1 To resist lateral loads, a passive pressure exerted by an equivalent fluid weight of 270 pounds per cubic foot (pcf) with a maximum earth pressure of 2,700 pcf should be used for the design of footings or shear keys poured neat against properly compacted fill. The allowable passive pressure assumes a horizontal surface extending at least 5 feet, or three times the surface generating the passive pressure, whichever is greater. The upper 12 inches of material in areas not protected by floor slabs or pavement should not be included in design for passive resistance.

8.14.2 If friction is to be used to resist lateral loads, an allowable coefficient of friction between soil and concrete of 0.4 should be used for design.

8.14.3 The passive and frictional resistant loads can be combined for design purposes. When combining passive and friction for lateral resistance, the passive component should be reduced by one-third. The lateral passive pressures may be increased by one-third when considering transient loads due to wind or seismic forces.

8.15 Exterior Concrete Flatwork

8.15.1 Exterior concrete flatwork not subject to vehicular traffic should be constructed in accordance with the recommendations presented in the following table. The recommended steel reinforcement would help reduce the potential for cracking.

MINIMUM CONCRETE FLATWORK RECOMMENDATIONS

Expansion Index, EI	Minimum Reinforcing Steel* Options	Minimum Thickness
EI $\leq$ 20	6x6-W2.9/W2.9 (6x6-6/6) welded wire mesh	4 Inches
	No. 3 Bars 18 inches on center, Both Directions	

*In excess of 8 feet square.

8.15.2 The subgrade soil should be properly moisturized and compacted prior to the placement of steel and concrete. The subgrade soil should be compacted to a dry density of at least 90 percent of the laboratory maximum dry density at or slightly above optimum moisture content in accordance with ASTM D1557.

8.15.3 Even with the incorporation of the recommendations of this report. The reinforcing steel should overlap continuously in flatwork to reduce the potential for vertical offsets within flatwork. Additionally, flatwork should be structurally connected to the curbs, where possible, to reduce the potential for offsets between the curbs and the flatwork.

8.15.4 Concrete flatwork should be provided with crack control joints to reduce and/or control shrinkage cracking. Crack control spacing should be determined by the project Structural Engineer based upon the slab thickness and intended usage. Criteria of the American Concrete Institute (ACI) should be taken into consideration when establishing crack control spacing. Subgrade soil for exterior slabs not subjected to vehicle loads should be compacted in accordance with criteria presented in the grading section prior to concrete placement. Subgrade soil should be properly compacted and the moisture content of subgrade soil should be verified prior to placing concrete. Base materials will not be required below concrete improvements.

8.15.5 Where exterior flatwork abuts the structure at entrant or exit points, the exterior slab should be dowelled into the structure's foundation stemwall. This recommendation is intended to reduce the potential for differential elevations that could result from differential settlement or minor heave of the flatwork. Dowelling details should be designed by the project structural engineer.

8.15.6 The recommendations presented herein are intended to reduce the potential for cracking of exterior slabs as a result of differential movement. However, even with the incorporation of the recommendations presented herein, slabs-on-grade will still crack. The occurrence of concrete shrinkage cracks is independent of the soil supporting characteristics. Their occurrence may be reduced and/or controlled by limiting the slump of the concrete, the use of crack control joints and proper concrete placement and curing. Crack control joints should be spaced at intervals no greater than 12 feet. Literature provided by the Portland Concrete Association (PCA) and American Concrete Institute (ACI) present recommendations for proper concrete mix, construction, and curing practices, and should be incorporated into project construction.

8.16 Preliminary Pavement Design

8.16.1 Where new paving is to be placed, we recommend that undocumented fill or soft/loose soils be excavated and properly compacted for paving support in accordance with the recommendations provided in the *Grading* section of this report. The client should be aware that excavation and compaction of undocumented fill or soft/loose soils in the area of new paving is not required; however, paving constructed over existing uncertified fill or unsuitable soils may experience increased settlement and/or cracking, and may therefore have a shorter design life and increased maintenance costs. As a minimum, the upper 12 inches of paving subgrade should be scarified, moisture conditioned at or slightly above optimum moisture content, and properly compacted to at least 95 percent relative compaction, as determined by ASTM D1557.

8.16.2 The final pavement design should be based on R-value testing of soils at roadway subgrade elevation. Roadways should be designed in accordance with the City of Desert Hot Springs *Standard Plans & Specifications* when final Traffic Indices (TI) and R-Value test results of subgrade soils are completed. The roadway classifications and TI's selected for our preliminary evaluation are in accordance with those specified in *Section III.C., Street Standards* of the City of Desert Hot Springs *Standard Plans & Specifications*. Based on our observation and experience with site soils, we used an assumed R-value of 50 for our preliminary evaluation of pavements. Preliminary flexible pavement sections are presented in the following table. Geocon should be contacted if other roadway classifications and traffic indices are appropriate for the project.

PRELIMINARY FLEXIBLE PAVEMENT SECTIONS

Road Classification	Assumed Traffic Index	Assumed Subgrade R-Value	Asphalt Concrete (inches)	Crushed Aggregate Base (inches)
Alley/Cul-de-Sac	3.5	50	3	4
Local Collector	4.0		3	6
Collector	5.5		3	8

8.16.3 The crushed aggregated base and asphalt concrete materials should conform to Section 200-2.2 and Section 203-6, respectively, of the *Greenbook*. Base materials should be moisture conditioned at or slightly above optimum moisture content and properly compacted to at least 95 percent relative compaction, as determined by ASTM D1557. Asphalt concrete should be compacted to a density of 95 percent of the laboratory Hveem density in accordance with ASTM D1561.

8.16.4 A rigid Portland cement concrete (PCC) pavement section should be placed in roadway aprons and cross gutters. We calculated the rigid pavement section in general conformance with the procedure recommended by the American Concrete Institute report ACI 330-21 Commercial Concrete Parking Lots and Site Paving Design and Construction – Guide. The following table provides the traffic categories and design parameters used for the calculations for 20-year design life.

TRAFFIC CATEGORIES

Traffic Category	Description	Reliability (%)	Slabs Cracked at End of Design Life (%)
A	Car Parking Areas and Access Lanes	60	15
B	Entrance and Truck Service Lanes	60	15
C	School or City Buses (Excluding Large Articulated Buses)	75	15
D	Heavy Duty Trucks (Gross Weight of 80 Kips)	75	15
E	Garbage or Fire Truck Lane	75	15

8.16.5 We used the parameters presented in the following table to calculate the pavement design sections. We should be contacted to provide updated design sections, if necessary.

RIGID PAVEMENT DESIGN PARAMETERS

Design Parameter	Design Value
Modulus of subgrade reaction, k	100 pci
Modulus of rupture for concrete, M_R	500 psi
Concrete Compressive Strength	3,000 psi
Concrete Modulus of Elasticity, E	3,150,000

8.16.6 Based on the criteria presented herein, the PCC pavement sections should have a minimum thickness as presented in the following table.

RIGID VEHICULAR PAVEMENT RECOMMENDATIONS

Traffic Category	Trucks Per Day	Portland Cement Concrete, T (Inches)
A = Car Parking Areas and Access Lanes	10	5½
B = Entrance and Truck Service Lanes	10	6
	50	6½
	100	6½
C = School or City Buses	50	9½
	100	9½
D = Heavy Duty Trucks	50	6½
	100	7
E = Garbage or Fire Truck Lanes	5	6½
	10	7

8.16.7 The PCC vehicular pavement should be placed over subgrade soil that is compacted to a dry density of at least 95 percent of the laboratory maximum dry density, at or slightly above optimum moisture content, as determined by ASTM D1557.

8.16.8 Adequate joint spacing should be incorporated into the design and construction of the rigid pavement in accordance with the following table.

MAXIMUM JOINT SPACING

Pavement Thickness, T (Inches)	Maximum Joint Spacing (Feet)
4<T<5	10
5≤T<6	12.5
6≤T	15

8.16.9 The rigid pavement should also be designed and constructed incorporating the parameters presented in the following table.

ADDITIONAL RIGID PAVEMENT RECOMMENDATIONS

Subject	Value
Thickened Edge	1.2 Times Slab Thickness Adjacent to Structures
	1.5 Times Slab Thickness Adjacent to Soil
	Minimum Increase of 2 Inches
	4 Feet Wide
Crack Control Joint Depth	Early Entry Sawn = T/6 to T/5, 1.25 Inch Minimum
	Conventional (Tooled or Conventional Sawing) = T/4 to T/3
Crack Control Joint Width	¼-Inch for Sealed Joints and Per Sealer Manufacturer's Recommendations
	$^{1}/_{16}$- to $^{1}/_{4}$-Inch is Common for Unsealed Joints

8.16.10 Reinforcing steel will not be necessary within the concrete for geotechnical purposes with the possible exception of dowels at construction joints as discussed herein.

8.16.11 To control the location and spread of concrete shrinkage cracks, crack-control joints (weakened plane joints) should be included in the design of the concrete pavement slab. Crack-control joints should be sealed with an appropriate sealant to prevent the migration of water through the control joint to the subgrade materials. The depth of the crack-control joints should be in accordance with the referenced ACI guide.

8.16.12 To provide load transfer between adjacent pavement slab sections, a butt-type construction joint should be constructed. The butt-type joint should be thickened by at least 20 percent at the edge and taper back at least 4 feet from the face of the slab.

8.16.13 Concrete curb and gutter should be placed on soil subgrade compacted to a dry density of at least 95 percent of the laboratory maximum dry density at or slightly above optimum moisture content. Cross-gutters that receive vehicular traffic should be placed on subgrade soil compacted to a dry density of at least 95 percent of the laboratory maximum dry density at or slightly above optimum moisture content. Base materials should not be placed below the curb and gutter, or cross-gutters so water is not able to migrate from the adjacent parkways to the pavement sections. Where flatwork is located directly adjacent to the curb and gutter, the concrete flatwork should be structurally connected to the curbs to help reduce the potential for offsets between the curbs and the flatwork.

8.17 Temporary Excavations

8.17.1 Excavations of up to 10 feet in height may be required during earthwork and utility installation operations. The excavations are expected to expose engineered fill or alluvial soils that are highly susceptible to caving. Vertical excavations up to 5 feet in height may be attempted where not surcharged by adjacent foundations or traffic; however, the contractor should be prepared for caving sands to be present in open excavations and formwork may be required in foundation excavations. Sloping measures will likely be required to provide a stable excavation. Excavations should be observed for the presence of cobbles and boulders to determine if further safety measures are required.

8.17.2 Vertical excavations greater than 5 feet or where surcharged by existing structures will require sloping or shoring measures in order to provide a stable excavation. The contractor’s competent person should evaluate the appropriate slope based on soil type, per Cal-OSHA regulations. We anticipate that sufficient space is available to complete the required earthwork for this project using sloping measures.

8.17.3 Where there is insufficient space for sloped excavations, shoring or trench shields should be used to support excavations. Shoring may also be necessary where sloped excavation could remove vertical or lateral support of existing improvements, including existing utilities and adjacent structures. The contractor’s competent person should evaluate the appropriate shoring system to provide per Cal-OSHA regulations.

8.17.4 Where temporary construction slopes are utilized, the top of the slope should be barricaded to prevent vehicles and storage loads at the top of the slope within a horizontal distance equal to the height of the slope. If the temporary construction slopes are to be maintained during the rainy season, berms are suggested along the tops of the slopes where necessary to prevent runoff water from entering the excavation and eroding the slope faces. The contractor's competent person should inspect the soils exposed in the cut slopes during excavation in accordance with Cal-OSHA regulations so that modifications of the slopes can be made if variations in the soil conditions occur.

8.17.5 It is difficult to accurately predict the amount of deflection of a shored embankment, but some deflection will occur. We recommend that the deflection be minimized to prevent damage to existing structures and adjacent improvements. Where a public right-of-way is present or adjacent offsite structures do not surcharge the shoring excavation, the shoring deflection should be limited to less than 1 inch at the top of the shored embankment. Where offsite structures are within the shoring surcharge area it is recommended that the beam deflection be limited to less than ½ inch at the elevation of the adjacent offsite foundation, and no deflection at all if deflections will damage existing structures. The allowable deflection is dependent on many factors, such as the presence of structures and utilities near the top of the embankment and will be assessed and designed by the project shoring engineer.

8.18 Site Drainage and Moisture Protection

8.18.1 Adequate site drainage is critical to reduce the potential for differential soil movement, erosion and subsurface seepage. Under no circumstances should water be allowed to pond adjacent to footings. The site should be graded and maintained such that surface drainage is directed away from structures in accordance with 2022 CBC 1804.4 or other applicable standards. In addition, surface drainage should be directed away from the top of slopes into swales or other controlled drainage devices. Roof and pavement drainage should be directed into conduits that carry runoff away from the proposed structure.

8.18.2 Underground utilities should be leak free. Utility and irrigation lines should be checked periodically for leaks and detected leaks should be repaired promptly. Detrimental soil movement could occur if water can infiltrate the soil for prolonged periods of time.

8.18.3 Landscaping planters adjacent to paved areas are not recommended due to the potential for surface or irrigation water to infiltrate the pavement's subgrade and base course. We recommend area drains to collect excess irrigation water and transmit it to drainage structures or impervious above-grade planter boxes be used. In addition, where landscaping is planned adjacent to the pavement, we recommend construction of a cutoff wall or the use of an impermeable geosynthetic along the edge of the pavement that extends at least 6 inches below the bottom of the base material.

8.18.4 Proposed infiltration systems should be offset from the outside edge of planned foundations a minimum lateral distance of 20 feet to reduce the occurrence of water migrating below the load projection of planned structures, and a minimum lateral distance of 15 feet from site improvements. These minimum offsets will reduce the potential for settlements induced by migrating water that could adversely impact the proposed structures and improvements.

8.18.5 If not properly constructed, there is a potential for distress to improvements and properties located hydrologically down gradient or adjacent to infiltration areas. Factors such as the amount of water to be detained, its residence time, and soil permeability have an important effect on seepage transmission and the potential adverse impacts that may occur if the storm water management features are not properly designed and constructed. We have not performed a hydrogeology study at the site. Downgradient and adjacent structures may be subjected to seeps, movement of foundations and slabs, or other impacts as a result of water infiltration.

8.19 Plan Review

8.19.1 Grading and structural/foundation plans should be reviewed by Geocon prior to finalization of design to check that the plans have been prepared in substantial conformance with the recommendations of this report, and to provide additional analyses or recommendations, if necessary.

LIMITATIONS AND UNIFORMITY OF CONDITIONS

The recommendations of this report pertain only to the site investigated and are based upon the assumption that the soil conditions do not deviate from those disclosed in this investigation. If any variations or undesirable conditions are encountered during construction, or if the proposed construction will differ from that expected herein, Geocon West, Inc., should be notified so that supplemental recommendations can be given. The evaluation or identification of the potential presence of hazardous materials was not part of the scope of services provided by Geocon West, Inc.

This report is issued with the understanding that it is the responsibility of the owner, or of their representative, to ensure that the information and recommendations contained herein are brought to the attention of the architect and engineer for the project and incorporated into the plans, and the necessary steps are taken to see that the contractor and subcontractors carry out such recommendations in the field.

The requirements for concrete and reinforcing steel presented in this report are preliminary recommendations from a geotechnical perspective. The Structural Engineer should provide the final recommendations for structural design of concrete and reinforcing steel for foundation systems, floor slabs, exterior concrete, or other systems where concrete and reinforcing steel are utilized, in accordance with the latest version of applicable codes.

The findings of this report are valid as of the date of this report. However, changes in the conditions of a property can occur with the passage of time, whether they are due to natural processes or the works of man on this or adjacent properties. In addition, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and should not be relied upon after a period of three years.

The firm that performed the geotechnical investigation for the project should be retained to provide testing and observation services during construction to provide continuity of geotechnical interpretation and to check that the recommendations presented for geotechnical aspects of site development are incorporated during site grading, construction of improvements, and excavation of foundations. If another geotechnical firm is selected to perform the testing and observation services during construction operations, that firm should prepare a letter indicating their intent to assume the responsibilities of project Geotechnical Engineer of Record. A copy of the letter should be provided to the regulatory agency for their records. In addition, that firm should provide revised recommendations concerning the geotechnical aspects of the proposed development, or a written acknowledgement of their concurrence with the recommendations presented in our report. They should also perform additional analyses deemed necessary to assume the role of Geotechnical Engineer of Record.

LIST OF REFERENCES

1. Abode Communities Architecture Studio, *Site Plan*, Desert Hot Springs RFQ, dated October 17, 2023.

2. American Concrete Institute, 2019, *Building Code Requirements for Structural Concrete*, Report by ACI Committee 318.

3. ACI 330-21, *Commercial Concrete Parking Lots and Site Paving Design and Construction,* prepared by the American Concrete Institute, dated May 2021.

4. ASCE 7-16, 2019, *Minimum Design Loads for Buildings and Other Structures*.

5. Boore, D. M. and G. M Atkinson, *Ground-Motion Prediction for the Average Horizontal Component of PGA, PGV, and 5%-Damped PSA at Spectral Periods Between 0.01 and 10.0 S*, Earthquake Spectra, Volume 24, Issue 1, pages 99-138, February 2008.

6. California Building Standards Commission, 2022, *California Building Code (CBC)*, California Code of Regulations Title 24, Part 2.

7. California Geological Survey (CGS), *Earthquake Shaking Potential for California*, from USGS/CGS Seismic Hazards Model, CSSC No. 03-02, 2003.

8. California Geological Survey (CGS), *Probabilistic Seismic Hazards Mapping-Ground Motion Page*, 2003, CGS Website: www.conserv.ca.gov/cgs/rghm/pshamap.

9. California Geological Survey, *Seismic Shaking Hazards in California,* Based on the USGS/*CGS Probabilistic* Seismic Hazards Assessment (PSHA) Model, 2002 (revised April 2003). 10% probability of being exceeded in 50 years;

   http://redirect.conservation.ca.gov/cgs/rghm/pshamap/pshamain.html.

10. California Department of Transportation (Caltrans), Division of Engineering Services, Materials Engineering and Testing Services, 2021, *Corrosion Guidelines, Version 3.2,* dated March.

11. California Department of Transportation (Caltrans), 2020, *Highway Design Manual*, 7th Edition, dated July 1.

12. California Department of Water Resources (DWR), *Water Data Library* online database, www.water.ca.gov/waterdatalibrary/, accessed August 2024.

13. Campbell, K. W. and Y. Bozorgnia, *NGA Ground Motion Model for the Geometric Mean Horizontal Component of PGA, PGV, PGD and 5% Damped Linear Elastic Response Spectra for Periods Ranging from 0.01 to 10 s*, Preprint of version submitted for publication in the NGA Special Volume of Earthquake Spectra, Volume 24, Issue 1, pages 139-171, February 2008.

14. Chiou, Brian S. J. and Robert R. Youngs, *A NGA Model for the Average Horizontal Component of Peak Ground Motion and Response Spectra*, preprint for article to be published in NGA Special Edition for Earthquake Spectra, Spring 2008.

LIST OF REFERENCES (CONTINUED)

15. Thomas W. Dibblee Jr., 2008, *Geologic Map of the Thousand Palms and Lost Horse Mountain 15 Minute Quadrangles, Riverside County, California*, Dibblee Foundation Map DF-372.

16. Jennings, Charles W. and Bryant, William A., 2010, *Fault Activity Map of California,* California Division of Mines and Geology Map No. 6.

17. Legg*,* M. R., J. C. Borrero, and C. E. Synolakis*, Evaluation of Tsunami Risk to Southern California Coastal Cities*, 2002 NEHRP Professional Fellowship Report, dated January 2003.

18. Desert Hot Springs Public Works & Engineering Department, 2008, *Street Pavement Requirements*, dated January 30.

19. Public Works Standards, Inc., 2022, *Standard Specifications for Public Works Construction "Greenbook,"* Published by BNi Building News.

20. Riverside County GIS (RC GIS), *Map My County* website, http://mmc.rivcoit.org/MMC_Public/Custom/disclaimer/Default.htm; accessed August 2024.

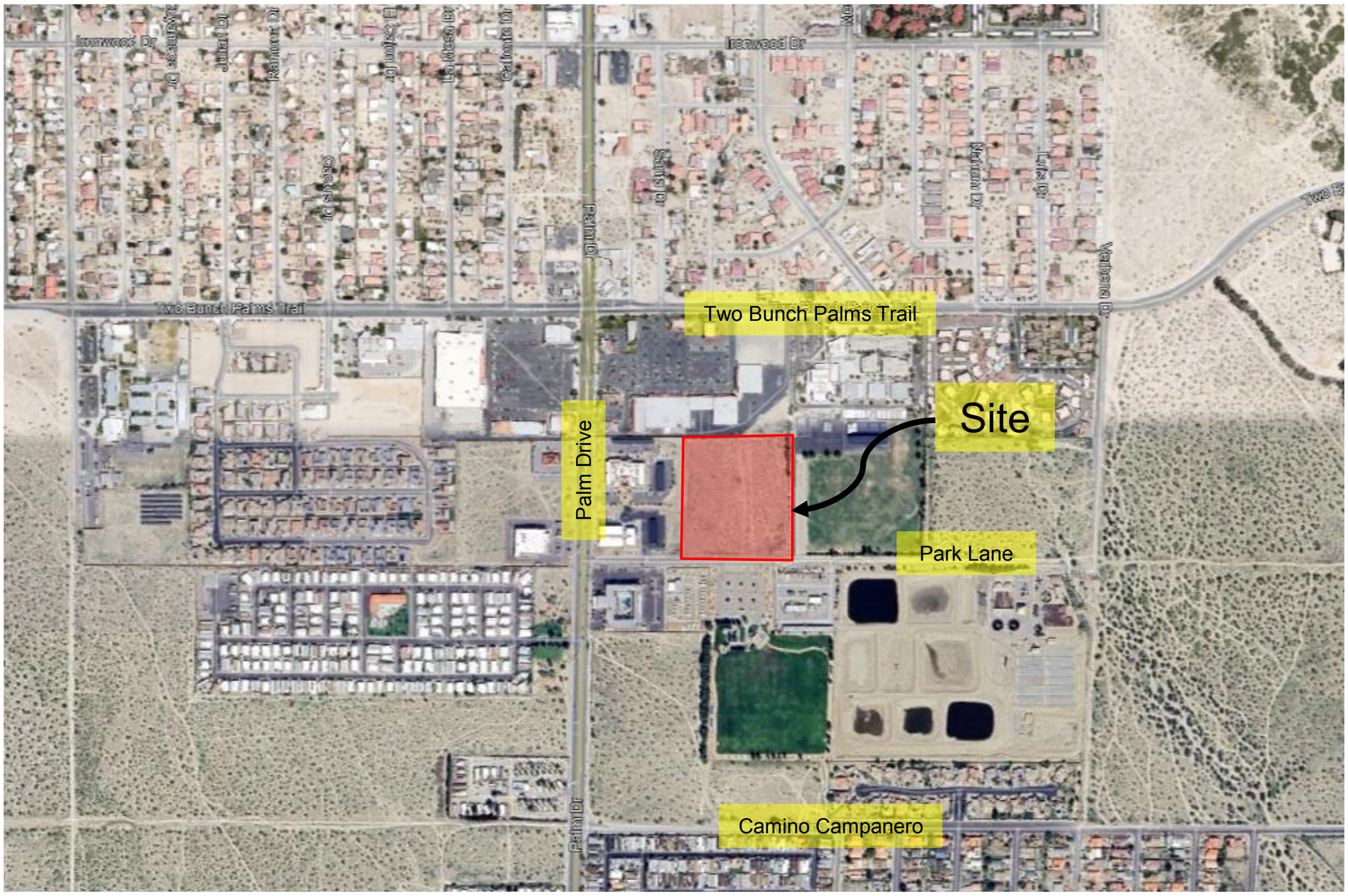
21. Riverside County Flood Control and Water Conservation District, 2011, *Design Handbook for Low Impact Development Best Management Practices,* dated September.

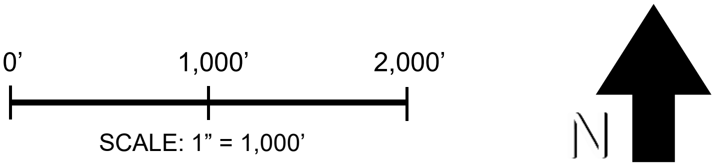
22. Riverside County, 2013, *General Plan Amendment No. 960, Section 4.11 Flood and Dam Inundation Hazards.*

23. Sneed, 2013, *Hydrogeology of the Thermal Springs in The Palm Springs Area – Indian Canyons & Agua Caliente Hot Springs*, AEG Inland Empire, March 14

24. U.S. Geological Survey (USGS), *Deaggregation of Seismic Hazard for PGA and 2 Periods of Spectral Acceleration*, 2002, USGS Website: www.earthquake.usgs.gov/research/hazmaps.

25. U.S. Geological Survey (USGS), *U.S. Seismic Design Maps* online database, http://earthquake.usgs.gov/designmaps/us/application.php, accessed August 2024.





SOURCE: Google Earth, 2024

VICINITY MAP

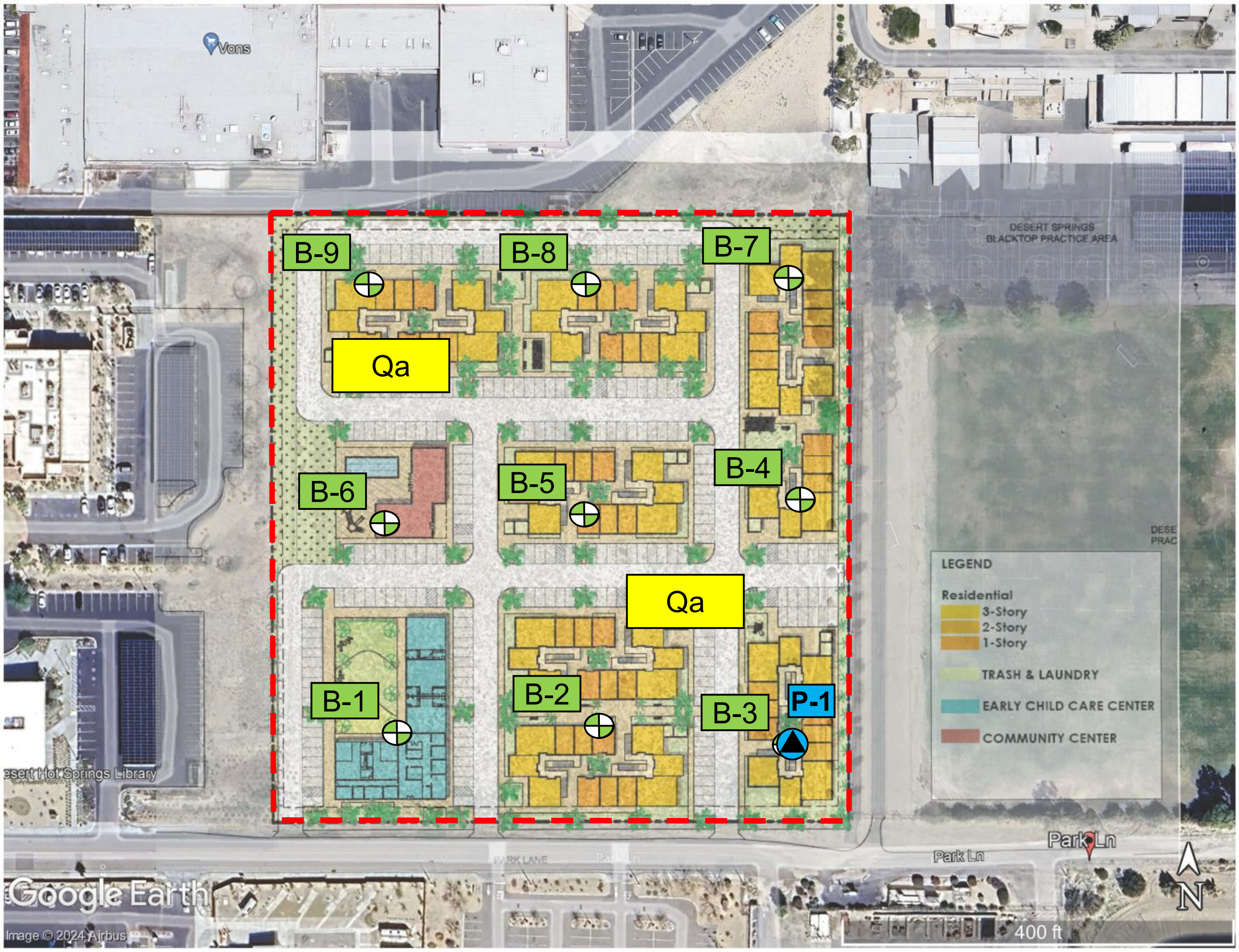
GEOCON
W E S T, I N C.

GEOTECHNICAL, ENVIRONMENTAL, MATERIALS
78-075 Main Street #G-203, La Quinta, California 92253
PHONE 951-304-2300 www.geoconinc.com

DRAFT BY: KD	CHECKED BY: ATS

MULTI-FAMILY RESIDENTIAL DEVELOPMENT
14320 PALM DRIVE
DESERT HOT SPRINGS, CALIFORNIA

SEPTEMBER 2024	PROJECT NO. T3082-22-01	FIG. 1



GEOCON LEGEND

Locations are approximate

B-9 ⊕ .... BORING LOCATION

P-1 ▲ .... PERCOLATION TEST LOCATION

▬ ▬ ▬ .... PROJECT LIMITS

Qa .... ALLUVIAL SAND AND GRAVEL OF THE VALLEY AREAS

0' 165' 330'

SCALE: 1" = 165'

N

SOURCE: Google Earth, 2024

GEOLOGIC MAP AND SITE PLAN

GEOCON
WEST, INC.

GEOTECHNICAL, ENVIRONMENTAL, MATERIALS
78-075 Main Street #G-203, La Quinta, California 92253
PHONE 951-304-2300 www.geoconinc.com

MULTI-FAMILY RESIDENTIAL DEVELOPMENT
14320 PALM DRIVE
DESERT HOT SPRINGS, CALIFORNIA

DRAFT BY: KD	CHECKED BY: ATS	SEPTEMBER 2024	PROJECT NO. T3082-22-01	FIG. 2

GEOCON

Project Name : Multi-Family Residential Deve
Project No : T3033-22-01
Boring : B-5

EMPIRICAL ESTIMATION OF LIQUEFACTION POTENTIAL
MAXIMUM CONSIDERED EARTHQUAKE

NCEER (1996) METHOD W 2001 UPDATES

EARTHQUAKE INFORMATION:

Earthquake Magnitude:	7.50
Peak Horiz. Acceleration PGA_M (g):	1.080
Magnitude Scaling Factor:	1.000
Historic High Groundwater:	176.0
Groundwater Depth During Exploration:	51.5

ENERGY & ROD CORRECTIONS:

Energy Correction (CE) for N60:	1.25
Rod Len.Corr.(CR) (0-no or 1-yes):	1
Bore Dia. Corr. (CB):	1.00
Sampler Corr. (CS):	1.20
Use Ksigma (0-no or 1-yes):	1

LIQUEFACTION CALCULATIONS:

Unit Wt. Water (pcf):	62.4

Depth to Base (ft)	Total Unit Wt. (pcf)	Water (0 or 1)	Field SPT (N)	Depth of SPT (ft)	Liq.Sus. (0 or 1)	-200 (%)		Est. Dr (%)	CN Factor	Corrected (N1)60cs	Eff. Unit Wt. (psf)	Resist. CRR 7.5	rd Factor	Induced CSR	Liquefac. Safe.Fact.
1.0	100.7	0	10.0	2.5	1	5		73	1.700	19.1	100.7	0.205	1.000	0.702	--
2.0	100.7	0	10.0	2.5	1	5		73	1.700	19.1	100.7	0.205	0.998	0.701	--
3.0	100.7	0	10.0	2.5	1	5		73	1.700	19.1	100.7	0.205	0.996	0.699	--
4.0	100.7	0	10.0	2.5	1	5		73	1.700	19.1	100.7	0.205	0.994	0.698	--
5.0	113.4	0	9.0	5.0	1	5		66	1.700	17.2	113.4	0.183	0.991	0.696	--
6.0	113.4	0	9.0	5.0	1	5		66	1.700	17.2	113.4	0.183	0.989	0.694	--
7.0	113.4	0	9.0	5.0	1	5		66	1.700	17.2	113.4	0.183	0.987	0.693	--
8.0	109.7	0	11.0	7.5	1	4		69	1.618	20.0	109.7	0.216	0.985	0.691	--
9.0	109.7	0	11.0	7.5	1	4		69	1.517	18.8	109.7	0.201	0.982	0.690	--
10.0	121.5	0	18.0	10.0	1	4		85	1.429	28.9	121.5	0.407	0.980	0.688	--
11.0	121.5	0	18.0	10.0	1	4		85	1.351	27.3	121.5	0.348	0.978	0.687	--
12.5	121.5	0	18.0	10.0	1	4		85	1.269	25.7	121.5	0.306	0.975	0.685	--
13.0	125.9	0	19.0	12.5	1	9		83	1.240	27.3	125.9	0.348	0.973	0.683	--
14.0	125.9	0	19.0	12.5	1	9		83	1.174	25.9	125.9	0.311	0.972	0.682	--
15.0	116.6	0	29.0	15.0	1	9		98	1.129	40.7	116.6	Infin.	0.970	0.681	--
16.0	116.6	0	29.0	15.0	1	9		98	1.091	39.3	116.6	Infin.	0.967	0.679	--
17.0	116.6	0	29.0	15.0	1	9		98	1.057	38.1	116.6	Infin.	0.965	0.678	--
18.0	125.9	0	23.0	17.5	1	6		83	1.024	30.4	125.9	Infin.	0.963	0.676	--
19.0	125.9	0	23.0	17.5	1	6		83	0.993	29.5	125.9	0.434	0.961	0.674	--
20.0	125.9	0	65.0	20.0	1	6		136	0.965	84.6	125.9	Infin.	0.958	0.673	--
21.0	125.9	0	65.0	20.0	1	6		136	0.939	82.3	125.9	Infin.	0.956	0.671	--
22.0	125.9	0	65.0	20.0	1	6		136	0.915	80.2	125.9	Infin.	0.953	0.669	--
23.0	125.9	0	65.0	20.0	1	6		136	0.893	78.2	125.9	Infin.	0.950	0.667	--
24.0	125.9	0	65.0	20.0	1	6		136	0.872	76.4	125.9	Infin.	0.947	0.665	--
25.0	125.9	0	41.0	25.0	1	6		101	0.853	50.3	125.9	Infin.	0.944	0.662	--
26.0	125.9	0	41.0	25.0	1	6		101	0.834	49.3	125.9	Infin.	0.940	0.660	--
27.0	125.9	0	41.0	25.0	1	6		101	0.817	48.3	125.9	Infin.	0.936	0.657	--
28.0	125.9	0	41.0	25.0	1	6		101	0.801	47.3	125.9	Infin.	0.932	0.654	--
29.0	125.9	0	41.0	25.0	1	6		101	0.786	46.4	125.9	Infin.	0.928	0.651	--
30.0	125.9	0	63.0	30.0	1	6		118	0.772	73.3	125.9	Infin.	0.923	0.648	--
31.0	125.9	0	63.0	30.0	1	6		118	0.759	72.0	125.9	Infin.	0.918	0.644	--
32.0	125.9	0	63.0	30.0	1	15	*	118	0.746	76.4	125.9	Infin.	0.912	0.641	--
33.0	125.9	0	63.0	30.0	1	15	*	118	0.734	75.2	125.9	Infin.	0.907	0.636	--
34.0	125.9	0	63.0	30.0	1	15	*	118	0.722	74.0	125.9	Infin.	0.900	0.632	--
35.0	125.9	0	63.0	30.0	1	15	*	118	0.711	72.9	125.9	Infin.	0.894	0.628	--
36.0	125.9	0	37.0	35.0	1	6	*	85	0.700	39.1	125.9	Infin.	0.887	0.623	--
37.0	125.9	0	37.0	35.0	1	6	*	85	0.690	38.5	125.9	Infin.	0.880	0.617	--
38.0	125.9	0	37.0	35.0	1	6	*	85	0.680	38.0	125.9	Infin.	0.872	0.612	--
39.0	125.9	0	37.0	35.0	1	6	*	85	0.671	37.5	125.9	Infin.	0.864	0.606	--
40.0	125.9	0	37.0	35.0	1	6	*	85	0.662	37.0	125.9	Infin.	0.855	0.600	--
41.0	108.2	0	27.0	40.0	1	15	*	69	0.654	30.3	108.2	Infin.	0.846	0.594	--
42.0	108.2	0	27.0	40.0	1	4	*	69	0.647	26.2	108.2	0.318	0.837	0.588	--
43.0	108.2	0	27.0	40.0	1	4	*	69	0.640	25.9	108.2	0.311	0.828	0.581	--
44.0	108.2	0	27.0	40.0	1	4	*	69	0.633	25.7	108.2	0.305	0.818	0.574	--
45.0	108.2	0	27.0	40.0	1	4	*	69	0.627	25.4	108.2	0.300	0.808	0.567	--
46.0	108.2	0	27.0	45.0	1	15	*	67	0.621	28.8	108.2	0.403	0.798	0.560	--
47.0	108.2	0	27.0	45.0	1	15	*	67	0.615	28.6	108.2	0.392	0.788	0.553	--
48.0	108.2	0	27.0	45.0	1	15	*	67	0.609	28.3	108.2	0.382	0.778	0.546	--
49.0	108.2	0	27.0	45.0	1	15	*	67	0.603	28.1	108.2	0.373	0.768	0.539	--
50.5	108.2	0	63.0	50.0	1	15	*	195	0.596	61.5	108.2	Infin.	0.755	0.530	--

* Indicates Assumed Value

TECHNICAL ENGINEERING AND DESIGN GUIDES AS ADAPTED FROM THE US ARMY CORPS OF ENGINEERS, NO. 9

EVALUATION OF EARTHQUAKE-INDUCED SETTLEMENTS IN DRY SANDY SOILS

MAXIMUM CONSIDERED EARTHQUAKE

MCE EARTHQUAKE INFORMATION:

Earthquake Magnitude:	7.50
Peak Horiz. Acceleration (g):	1.080

Fig 4.1 Fig 4.2 Fig 4.4

Depth of Base of Strata (ft)	Thickness of Layer (ft)	Depth of Mid-point of Layer (ft)	Soil Unit Weight (pcf)	Overburden Pressure at Mid-point (tsf	Mean Effective Pressure at Mid-point (tsf)	Average Cyclic Shear Stress [Tav]	Field SPT [N]	Correction Factor [Cer]	Relative Density [Dr] (%)	Correction Factor [Cn]	Corrected [N1]60	rd Factor	Maximum Shear Mod. [Gmax] (tsf)	[yeff]*[Geff] [Gmax]	yeff Shear Strain	[yeff]*100%	Volumetric Strain M7.5 [E15} (%)	Number of Strain Cycles [Nc]	Corrected Vol. Strains [Ec]	Estimated Settlement [S] (inches)
1.0	1.0	0.5	100.7	0.03	0.02	0.018	10	1.25	73.3	1.7	19.1	1.0	155.2	1.13E-04	2.30E-04	0.023	2.43E-02	15.0	2.43E-02	Grading
2.0	1.0	1.5	100.7	0.08	0.05	0.053	10	1.25	73.3	1.7	19.1	1.0	268.9	1.91E-04	2.30E-04	0.023	2.43E-02	15.0	2.43E-02	Grading
3.0	1.0	2.5	100.7	0.13	0.08	0.088	10	1.25	73.3	1.7	19.1	1.0	347.1	2.42E-04	3.00E-03	0.300	3.17E-01	15.0	3.17E-01	Grading
4.0	1.0	3.5	100.7	0.18	0.12	0.124	10	1.25	73.3	1.7	19.1	1.0	410.8	2.81E-04	8.10E-04	0.081	8.55E-02	15.0	8.55E-02	Grading
5.0	1.0	4.5	113.4	0.23	0.15	0.161	9	1.25	66.5	1.7	17.2	1.0	452.8	3.26E-04	5.00E-03	0.500	5.99E-01	15.0	5.99E-01	Grading
6.0	1.0	5.5	113.4	0.29	0.19	0.200	9	1.25	66.5	1.7	17.2	1.0	505.6	3.57E-04	5.00E-03	0.500	5.99E-01	15.0	5.99E-01	0.14
7.0	1.0	6.5	113.4	0.34	0.23	0.240	9	1.25	66.5	1.7	17.2	1.0	553.4	3.84E-04	1.00E-03	0.100	1.20E-01	15.0	1.20E-01	0.03
8.0	1.0	7.5	109.7	0.40	0.27	0.278	11	1.25	68.9	1.6	20.0	1.0	627.5	3.86E-04	1.00E-03	0.100	9.99E-02	15.0	9.99E-02	0.02
9.0	1.0	8.5	109.7	0.45	0.30	0.316	11	1.25	68.9	1.5	18.8	1.0	655.0	4.13E-04	2.70E-03	0.270	2.91E-01	15.0	2.91E-01	0.07
10.0	1.0	9.5	121.5	0.51	0.34	0.356	18	1.25	84.8	1.4	28.9	1.0	803.4	3.73E-04	1.00E-03	0.100	6.42E-02	15.0	6.42E-02	0.02
11.0	1.0	10.5	121.5	0.57	0.38	0.397	18	1.25	84.8	1.4	27.3	1.0	834.0	3.95E-04	1.00E-03	0.100	6.87E-02	15.0	6.87E-02	0.02
12.5	1.5	11.8	121.5	0.65	0.43	0.449	18	1.25	84.8	1.3	25.7	1.0	869.3	4.19E-04	2.70E-03	0.270	2.00E-01	15.0	2.00E-01	0.07
13.0	0.5	12.8	125.9	0.71	0.48	0.490	19	1.25	83.5	1.2	27.3	1.0	928.6	4.22E-04	2.70E-03	0.270	1.85E-01	15.0	1.85E-01	0.02
14.0	1.0	13.5	125.9	0.76	0.51	0.522	19	1.25	83.5	1.2	25.9	1.0	941.9	4.38E-04	1.20E-03	0.120	8.79E-02	15.0	8.79E-02	0.02
15.0	1.0	14.5	116.6	0.82	0.55	0.562	29	1.25	98.2	1.1	40.7	1.0	1137.6	3.85E-04	7.10E-04	0.071	3.03E-02	15.0	3.03E-02	0.01
16.0	1.0	15.5	116.6	0.88	0.59	0.600	29	1.25	98.2	1.1	39.3	1.0	1164.2	3.96E-04	7.10E-04	0.071	3.16E-02	15.0	3.16E-02	0.01
17.0	1.0	16.5	116.6	0.93	0.63	0.638	29	1.25	98.2	1.1	38.1	1.0	1189.7	4.06E-04	1.20E-03	0.120	5.54E-02	15.0	5.54E-02	0.01
18.0	1.0	17.5	125.9	0.99	0.67	0.677	23	1.25	83.4	1.0	30.4	1.0	1138.6	4.44E-04	1.20E-03	0.120	7.27E-02	15.0	7.27E-02	0.02
19.0	1.0	18.5	125.9	1.06	0.71	0.718	23	1.25	83.4	1.0	29.5	1.0	1162.1	4.55E-04	1.20E-03	0.120	7.54E-02	15.0	7.54E-02	0.02
20.0	1.0	19.5	125.9	1.12	0.75	0.758	65	1.25	136.0	1.0	84.6	1.0	1700.1	3.24E-04	7.10E-04	0.071	1.26E-02	15.0	1.26E-02	0.00
21.0	1.0	20.5	125.9	1.18	0.79	0.797	65	1.25	136.0	0.9	82.3	1.0	1731.4	3.30E-04	7.10E-04	0.071	1.30E-02	15.0	1.30E-02	0.00
22.0	1.0	21.5	125.9	1.25	0.84	0.836	65	1.25	136.0	0.9	80.2	1.0	1761.5	3.36E-04	7.10E-04	0.071	1.34E-02	15.0	1.34E-02	0.00
23.0	1.0	22.5	125.9	1.31	0.88	0.875	65	1.25	136.0	0.9	78.2	0.9	1790.7	3.42E-04	7.10E-04	0.071	1.38E-02	15.0	1.38E-02	0.00
24.0	1.0	23.5	125.9	1.37	0.92	0.913	65	1.25	136.0	0.9	76.4	0.9	1819.0	3.47E-04	7.10E-04	0.071	1.42E-02	15.0	1.42E-02	0.00
25.0	1.0	24.5	125.9	1.44	0.96	0.951	41	1.25	100.8	0.9	50.3	0.9	1618.4	4.02E-04	1.20E-03	0.120	3.96E-02	15.0	3.96E-02	0.01
26.0	1.0	25.5	125.9	1.50	1.00	0.988	41	1.25	100.8	0.8	49.3	0.9	1641.7	4.07E-04	8.10E-04	0.081	2.75E-02	15.0	2.75E-02	0.01
27.0	1.0	26.5	125.9	1.56	1.05	1.024	41	1.25	100.8	0.8	48.3	0.9	1664.4	4.11E-04	8.10E-04	0.081	2.81E-02	15.0	2.81E-02	0.01
28.0	1.0	27.5	125.9	1.62	1.09	1.060	41	1.25	100.8	0.8	47.3	0.9	1686.5	4.16E-04	8.10E-04	0.081	2.88E-02	15.0	2.88E-02	0.01
29.0	1.0	28.5	125.9	1.69	1.13	1.095	41	1.25	100.8	0.8	46.4	0.9	1708.1	4.20E-04	8.10E-04	0.081	2.95E-02	15.0	2.95E-02	0.01
30.0	1.0	29.5	125.9	1.75	1.17	1.130	63	1.25	117.6	0.8	73.3	0.9	2025.7	3.62E-04	5.20E-04	0.052	1.09E-02	15.0	1.09E-02	0.00
31.0	1.0	30.5	125.9	1.81	1.21	1.164	63	1.25	117.6	0.8	72.0	0.9	2049.8	3.65E-04	5.20E-04	0.052	1.12E-02	15.0	1.12E-02	0.00
32.0	1.0	31.5	125.9	1.88	1.26	1.198	63	1.25	117.6	0.7	76.4	0.9	2126.1	3.58E-04	5.20E-04	0.052	1.04E-02	15.0	1.04E-02	0.00
33.0	1.0	32.5	125.9	1.94	1.30	1.231	63	1.25	117.6	0.7	75.2	0.9	2150.0	3.61E-04	5.20E-04	0.052	1.06E-02	15.0	1.06E-02	0.00
34.0	1.0	33.5	125.9	2.00	1.34	1.263	63	1.25	117.6	0.7	74.0	0.9	2173.4	3.63E-04	5.20E-04	0.052	1.08E-02	15.0	1.08E-02	0.00
35.0	1.0	34.5	125.9	2.06	1.38	1.295	63	1.25	117.6	0.7	72.9	0.9	2196.4	3.65E-04	5.20E-04	0.052	1.10E-02	15.0	1.10E-02	0.00
36.0	1.0	35.5	125.9	2.13	1.43	1.326	37	1.25	85.4	0.7	39.1	0.9	1811.1	4.49E-04	8.10E-04	0.081	3.63E-02	15.0	3.63E-02	0.01
37.0	1.0	36.5	125.9	2.19	1.47	1.357	37	1.25	85.4	0.7	38.5	0.9	1828.8	4.51E-04	8.10E-04	0.081	3.69E-02	15.0	3.69E-02	0.01
38.0	1.0	37.5	125.9	2.25	1.51	1.387	37	1.25	85.4	0.7	38.0	0.9	1846.2	4.53E-04	8.10E-04	0.081	3.75E-02	15.0	3.75E-02	0.01
39.0	1.0	38.5	125.9	2.32	1.55	1.416	37	1.25	85.4	0.7	37.5	0.9	1863.2	4.55E-04	8.10E-04	0.081	3.82E-02	15.0	3.82E-02	0.01
40.0	1.0	39.5	125.9	2.38	1.59	1.445	37	1.25	85.4	0.7	37.0	0.9	1880.0	4.57E-04	8.10E-04	0.081	3.88E-02	15.0	3.88E-02	0.01
41.0	1.0	40.5	108.2	2.44	1.63	1.470	27	1.25	69.5	0.7	30.3	0.8	1780.5	4.87E-04	8.10E-04	0.081	4.93E-02	15.0	4.93E-02	0.01
42.0	1.0	41.5	108.2	2.49	1.67	1.492	27	1.25	69.5	0.6	26.2	0.8	1715.7	5.09E-04	1.30E-03	0.130	9.40E-02	15.0	9.40E-02	0.02
43.0	1.0	42.5	108.2	2.55	1.71	1.514	27	1.25	69.5	0.6	25.9	0.8	1728.0	5.09E-04	1.30E-03	0.130	9.52E-02	15.0	9.52E-02	0.02
44.0	1.0	43.5	108.2	2.60	1.74	1.535	27	1.25	69.5	0.6	25.7	0.8	1740.2	5.09E-04	1.30E-03	0.130	9.64E-02	15.0	9.64E-02	0.02
45.0	1.0	44.5	108.2	2.65	1.78	1.555	27	1.25	69.5	0.6	25.4	0.8	1752.2	5.09E-04	1.30E-03	0.130	9.76E-02	15.0	9.76E-02	0.02
46.0	1.0	45.5	108.2	2.71	1.81	1.575	27	1.25	66.8	0.6	28.8	0.8	1846.8	4.86E-04	8.10E-04	0.081	5.22E-02	15.0	5.22E-02	0.01
47.0	1.0	46.5	108.2	2.76	1.85	1.595	27	1.25	66.8	0.6	28.6	0.8	1859.5	4.86E-04	8.10E-04	0.081	5.28E-02	15.0	5.28E-02	0.01
48.0	1.0	47.5	108.2	2.82	1.89	1.613	27	1.25	66.8	0.6	28.3	0.8	1872.1	4.85E-04	8.10E-04	0.081	5.33E-02	15.0	5.33E-02	0.01
49.0	1.0	48.5	108.2	2.87	1.92	1.632	27	1.25	66.8	0.6	28.1	0.8	1884.5	4.85E-04	8.10E-04	0.081	5.39E-02	15.0	5.39E-02	0.01
50.5	1.5	49.8	108.2	2.94	1.97	1.654	63	1.25	195.1	0.6	61.5	0.8	2476.0	3.72E-04	5.20E-04	0.052	1.35E-02	15.0	1.35E-02	0.00

TOTAL SETTLEMENT = **0.75**

Figure 4

APPENDIX A

APPENDIX A
FIELD EXPLORATION

Our field investigation was conducted on August 9 and 12, 2024, and included:

- Drilling of nine (9) exploratory borings (Borings B-1 through B-9) to depths ranging between approximately 16½ feet and 50½ feet, to observe the subsurface geological conditions at the site, collect relatively undisturbed in-situ and disturbed bulk samples for laboratory testing, and evaluate the depth to static groundwater, if encountered.
- Backfilling and performing percolation testing in one (1) geotechnical boring (Boring B-3), at a depth of approximately 10 feet, to provide a preliminary evaluation of the subsurface infiltration rate in areas where storm water infiltration systems are expected. The percolation test is identified as Test P-1. A bentonite plug was installed at 10 feet of depth, after backfilling and prior to performing percolation testing. Additional percolation testing should be performed when the exact location and depth of the proposed storm water infiltration system is known.

We collected bulk and relatively undisturbed samples from the borings by driving a 3-inch O. D., California Modified Sampler into the “undisturbed” soil mass with blows from a 140-pound hammer falling 30 inches. The California Modified Sampler was equipped with 1-inch high by $2^{3}/_{8}$-inch inside diameter brass sampler rings to facilitate removal and testing. Relatively undisturbed samples and bulk samples of disturbed soils were transported to our laboratory for testing.

The soil conditions encountered in the borings were visually examined, classified and logged in general accordance with the Unified Soil Classification System (USCS). Logs of the borings are presented on Figures A-1 through A-9. The logs depict the soil and geologic conditions encountered and the depth at which samples were obtained. The approximate locations of the borings are depicted on the *Geologic Map and Site Plan*, Figure 2.

Preliminary percolation testing was performed in accordance with *Riverside County Flood Control and Water Conservation District, LID BMP Manual, Appendix A.* The percolation test data is presented on Figure A-10.

PROJECT NO. T3082-22-01

BORING B-1

ELEV. (MSL.) **910** DATE COMPLETED **8/9/2024**

EQUIPMENT **CME-75** BY: **KD**

DEPTH IN FT	SAMPLE NO.	BULK	DR/SPT	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B-1@0-5'	☒		SP-SM	**ALLUVIAL SAND AND GRAVEL OF VALLEY AREAS (Qa)** Poorly-graded SAND with silt, medium dense, dry, pale brown, fine to coarse			
2								
	B-1@2.5'		■			22	106.2	1.1
4								
	B-1@5'		■			26	116.4	0.5
6								
8	B-1@7.5'		■			31	107.8	0.8
10	B-1@10'		■	SM	Silty SAND, medium dense, slightly moist, light brown, fine to medium	28	117.6	0.3
12								
14								
	B-1@15'		■			40	106.4	0.6
16				SP	Poorly-graded SAND, medium dense, slightly moist, pale brown, fine to coarse			
18								
20	B-1@20'		■			42	116.1	1.3
22								
24								
	B-1@25'		■		- Becomes dense	58	118.8	0.9
26								

Total Depth = 26 1/2 feet
Groundwater not encountered
Penetration resistance for 140-lb hammer falling 30 inches by auto hammer
Backfilled with cuttings 8/9/2024

**Figure A-1,
Log of Boring B-1, Page 1 of 1**

T3082-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS

☐ ... SAMPLING UNSUCCESSFUL
◧ ... STANDARD PENETRATION TEST
■ ... DRIVE SAMPLE (UNDISTURBED)
☒ ... DISTURBED OR BAG SAMPLE
◪ ... CHUNK SAMPLE
▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. T3082-22-01

BORING B-2

ELEV. (MSL.) **908** DATE COMPLETED **8/9/2024**

EQUIPMENT **CME-75** BY: **KD**

DEPTH IN FT	SAMPLE NO.	BULK	DR/SPT	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0						SP-SM	**ALLUVIAL SAND AND GRAVEL OF VALLEY AREAS (Qa)** Poorly-graded SAND with silt, dense, dry, pale brown, fine to coarse			
2										
							- Cobbles encountered			
4										
	B-2@5'		■					53	118.1	0.5
6										
8										
						SM	Silty SAND, medium dense, slightly moist, light brown, fine to medium			
10	B-2@10'		■					31	104.0	0.7
12										
14										
	B-2@15'		■				- Becomes dense	49	123.3	1.1
16										

Total Depth = 16 1/2 feet
Groundwater not encountered
Penetration resistance for 140-lb hammer falling 30 inches by auto hammer
Backfilled with cuttings 8/9/2024

Figure A-2,
Log of Boring B-2, Page 1 of 1

T3082-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS

☐ ... SAMPLING UNSUCCESSFUL
◧ ... STANDARD PENETRATION TEST
■ ... DRIVE SAMPLE (UNDISTURBED)
☒ ... DISTURBED OR BAG SAMPLE
◣ ... CHUNK SAMPLE
▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. T3082-22-01

BORING B-3

ELEV. (MSL.) 906 DATE COMPLETED 8/9/2024

EQUIPMENT CME-75 BY: KD

DEPTH IN FT	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B-3@0-5'			SP	**ALLUVIAL SAND AND GRAVEL OF VALLEY AREAS (Qa)** Poorly-graded SAND, loose, dry, pale gray, fine to medium with few coarse; coarsening downward			
	B-3@2.5'					12	98.2	4.4
	B-3@5'				- Becomes slightly moist	16	110.6	1.3
8	B-3@7.5'				- Becomes light brown - Thin silt layer	15	107.0	0.9
10	B-3@10'			SP-SM	Poorly-graded SAND with silt, medium dense, slightly moist, light brown; fine to coarse	22	118.5	0.7
	B-3@15'				- Becomes pale brown	40	113.8	2.2
	B-3@20'				- Becomes dense; increase in fine sand	53	96.6	0.5
	B-3@25'				- Becomes very dense; NO RECOVERY	50/6"		

Total Depth = 26 1/2 feet
Groundwater not encountered
Penetration resistance for 140-lb hammer falling 30 inches by auto hammer
Backfilled with cuttings to 10'
Percolation Test Equipment Set on 8/9/2024
Presaturated with 5 gallons of water
Backfilled with cuttings 8/12/2024

Figure A-3,
Log of Boring B-3, Page 1 of 1

T3082-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS

☐ ... SAMPLING UNSUCCESSFUL	◧ ... STANDARD PENETRATION TEST	■ ... DRIVE SAMPLE (UNDISTURBED)
☒ ... DISTURBED OR BAG SAMPLE	◪ ... CHUNK SAMPLE	▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. T3082-22-01

BORING B-4

ELEV. (MSL.) **910** DATE COMPLETED **8/9/2024**

EQUIPMENT **CME-75** BY: **KD**

DEPTH IN FT	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SP	**ALLUVIAL SAND AND GRAVEL OF VALLEY AREAS (Qa)** Poorly-graded SAND, medium dense, dry, pale brown; fine to medium with few coarse sand; coarsening downward			
2								
4								
	B-4@5'					22	103.0	3.1
6								
8								
10	B-4@10'				-Becomes dense	53	112.3	1.0
12								
14								
	B-4@15'				NO RECOVERY	50/2"		
16								

Total Depth = 16 1/2 feet
Groundwater not encountered
Penetration resistance for 140-lb hammer falling 30 inches by auto hammer
Backfilled with cuttings 8/9/2024

Figure A-4,
Log of Boring B-4, Page 1 of 1

SAMPLE SYMBOLS			
	☐ ... SAMPLING UNSUCCESSFUL	◧ ... STANDARD PENETRATION TEST	■ ... DRIVE SAMPLE (UNDISTURBED)
	☒ ... DISTURBED OR BAG SAMPLE	◪ ... CHUNK SAMPLE	▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. T3082-22-01

BORING B-5

ELEV. (MSL.) 914 DATE COMPLETED 8/9/2024

EQUIPMENT CME-75 BY: KD

DEPTH IN FT	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B-5@0-5'			SP	**ALLUVIAL SAND AND GRAVEL OF VALLEY AREAS (Qa)** Poorly-graded SAND, loose, dry, pale brown; fine to coarse sand			
2	B-5@2.5'					10		
4								
6	B-5@5'				- Fining downward; NO RECOVERY	14		
8	B-5@7.5'				- Thin silt lens	11		
10	B-5@10'				- Increase in medium to coarse sand - Becomes medium dense; NO RECOVERY	28		
12	B-5@12.5'			SP-SM	Poorly-graded SAND with Silt, medium dense, dry, pale brown; fine to medium sand with few coarse sand; few large gravel	19		
14								
16	B-5@15'				- Increase in coarse sand	46	122.8	0.5
18	B-5@17.5'					23		
20	B-5@20'				- Becomes very dense; NO RECOVERY	77/9"		
22					- Large cobbes encountered			
24								
26	B-5@25'				- Becomes dense	41		
28								
30	B-5@30'				- Becomes very dense; large gravels (6-8') encountered	50/6"	154.4	0.4
32				SM	Silty SAND, very dense, slightly moist, light brown; fine to medium with few coarse sand			
34								

Figure A-5,
Log of Boring B-5, Page 1 of 2

SAMPLE SYMBOLS			
	☐ ... SAMPLING UNSUCCESSFUL	◧ ... STANDARD PENETRATION TEST	■ ... DRIVE SAMPLE (UNDISTURBED)
	⊠ ... DISTURBED OR BAG SAMPLE	◪ ... CHUNK SAMPLE	▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. T3082-22-01

BORING B-5

ELEV. (MSL.) 914 DATE COMPLETED 8/9/2024

EQUIPMENT CME-75 BY: KD

DEPTH IN FT	SAMPLE NO.	BULK	DR/SPT	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
36	B-5@35'		■			SP-SM	Poorly-graded SAND with silt, dense, slightly moist, pale brown; medium to coarse sand	37		
38										
40	B-5@40'		■			SM	Silty SAND, medium dense, slightly moist, light brown; fine sand	43	105.6	1.9
42						SP	Poorly-graded SAND, medium dense, slightly moist, pale brown; fine to coarse sand			
44										
46	B-5@45'		■			SM	Silty SAND, medium dense, slightly moist, pale brown; fine sand	27		
48										
50	B-5@50'		○					50/6"		

Total Depth = 50 1/2 feet
Groundwater not encountered
Penetration resistance for 140-lb hammer falling 30 inches by auto hammer
Backfilled with cuttings 8/9/2024

Figure A-5,
Log of Boring B-5, Page 2 of 2

T3082-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS			
	☐ ... SAMPLING UNSUCCESSFUL	◧ ... STANDARD PENETRATION TEST	■ ... DRIVE SAMPLE (UNDISTURBED)
	☒ ... DISTURBED OR BAG SAMPLE	◪ ... CHUNK SAMPLE	▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. T3082-22-01

BORING B-6

ELEV. (MSL.) **910** DATE COMPLETED **8/9/2024**

EQUIPMENT **CME-75** BY: **KD**

DEPTH IN FT	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SP	**ALLUVIAL SAND AND GRAVEL OF VALLEY AREAS (Qa)** Poorly-graded SAND, medium dense, slightly moist, pale gray; fine to medium with few coarse sand			
2								
4								
6	B-6@5'				- NO RECOVERY	20		
8								
10	B-6@10'					37	104.1	6.1
12								
14								
16	B-6@15'				- Becomes dense	72	124.1	0.5

Total Depth = 16 1/2 feet
Groundwater not encountered
Penetration resistance for 140-lb hammer falling 30 inches by auto hammer
Backfilled with cuttings 8/9/2024

Figure A-6,
Log of Boring B-6, Page 1 of 1

T3082-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS

- ☐ ... SAMPLING UNSUCCESSFUL
- ▨ ... DISTURBED OR BAG SAMPLE
- ◧ ... STANDARD PENETRATION TEST
- ◪ ... CHUNK SAMPLE
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. T3082-22-01

BORING B-7

ELEV. (MSL.) **913** DATE COMPLETED **8/9/2024**

EQUIPMENT **CME-75** BY: **KD**

DEPTH IN FT	SAMPLE NO.	BULK	DR/SPT	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B-7@0-5'	☒				SP-SM	**ALLUVIAL SAND AND GRAVEL OF VALLEY AREAS (Qa)** Poorly-graded SAND with silt, medium dense, dry, pale brown; fine to coarse sand			
2										
	B-7@2.5'		■					38	115.0	1.8
4							- Rootlets			
	B-7@5'		■					29	107.2	1.1
6										
8	B-7@7.5'		■				- Increase in coarse sand	38	100.3	0.7
10	B-7@10'		■					43	109.2	0.4
12										
14										
	B-7@15'		○				NO RECOVERY	50/2"		
16										

REFUSAL, LARGE COBBLES ENCOUNTERED
Total Depth = 17 feet
Groundwater not encountered
Penetration resistance for 140-lb hammer falling 30 inches by auto hammer
Backfilled with cuttings 8/9/2024

Figure A-7,
Log of Boring B-7, Page 1 of 1

T3082-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS

☐ ... SAMPLING UNSUCCESSFUL	◧ ... STANDARD PENETRATION TEST	■ ... DRIVE SAMPLE (UNDISTURBED)
☒ ... DISTURBED OR BAG SAMPLE	◪ ... CHUNK SAMPLE	▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. T3082-22-01

BORING B-8

ELEV. (MSL.) **915** DATE COMPLETED **8/9/2024**

EQUIPMENT **CME-75** BY: **KD**

DEPTH IN FT	SAMPLE NO.	BULK	DR/SPT	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0						SP	**ALLUVIAL SAND AND GRAVEL OF VALLEY AREAS (Qa)** Poorly-graded SAND, medium dense, dry, pale brown, fine to coarse sand			
2										
4										
	B-8@5'		■					33	114.1	0.6
6										
8										
10	B-8@10'		■				- Becomes very dense; NO RECOVERY	50/3"		
12										
14							- Large cobbles encountered			
	B-8@15'		■					43	111.8	0.7
16										

Total Depth = 16 1/2 feet
Groundwater not encountered
Penetration resistance for 140-lb hammer falling 30 inches by auto hammer
Backfilled with cuttings 8/9/2024

Figure A-8,
Log of Boring B-8, Page 1 of 1

T3082-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS			
	☐ ... SAMPLING UNSUCCESSFUL	◧ ... STANDARD PENETRATION TEST	■ ... DRIVE SAMPLE (UNDISTURBED)
	▨ ... DISTURBED OR BAG SAMPLE	◪ ... CHUNK SAMPLE	▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. T3082-22-01

BORING B-9

ELEV. (MSL.) 910 DATE COMPLETED 8/9/2024

EQUIPMENT CME-75 BY: KD

DEPTH IN FT	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0 2	B-9@0-5'			SP	**ALLUVIAL SAND AND GRAVEL OF VALLEY AREAS (Qa)** Poorly-graded SAND, medium dense, dry, pale brown; medium to coarse sand			
4	B-9@2.5'					19	113.3	0.9
6	B-9@5'				- Increase in fine and medium sand	24	107.0	0.8
8	B-9@7.5'					44	107.0	0.4
10 12 14	B-9@10'					27	117.2	1.4
16 18	B-9@15'					41	137.7	0.9
20 22 24	B-9@20'				- Becomes very dense; NO RECOVERY	50/3"		
26	B-9@25'				NO RECOVERY	50/3"		

Total Depth = 26 1/2 feet
Groundwater not encountered
Penetration resistance for 140-lb hammer falling 30 inches by auto hammer
Backfilled with cuttings 8/9/2024

Figure A-9,
Log of Boring B-9, Page 1 of 1

T3082-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS

☐ ... SAMPLING UNSUCCESSFUL
◧ ... STANDARD PENETRATION TEST
■ ... DRIVE SAMPLE (UNDISTURBED)
⊠ ... DISTURBED OR BAG SAMPLE
◪ ... CHUNK SAMPLE
▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PERCOLATION TEST REPORT

Project Name:	DHS		**Project No.:**	T3082-22-01
Test Hole No.:	B-3		**Date Excavated:**	8/9/2024
Length of Test Pipe:	126.0	inches	**Soil Classification:**	SP
Height of Pipe above Ground:	6.0	inches	**Presoak Date:**	8/9/2024
Depth of Test Hole:	120.0	inches	**Perc Test Date:**	8/13/2024
Check for Sandy Soil Criteria Tested by:			**Percolation Tested by:**	KD

Water level measured from BOTTOM of hole

Sandy Soil Criteria Test

Trial No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Head (in)	Final Water Head (in)	Δ in Water Level (in)	Percolation Rate (min/inch)
1							
2							

Soil Criteria: Sandy

Percolation Test

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Head (in)	Final Water Head (in)	Δ in Water Level (in)	Percolation Rate (min/inch)
1	8:16 AM 8:26 AM	10	10	30.0	0.0	30.0	0.3
2	8:26 AM 8:36 AM	10	20	46.2	0.7	45.5	0.2
3	8:36 AM 8:46 AM	10	30	43.8	1.8	42.0	0.2
4	8:46 AM 8:56 AM	10	40	52.2	1.3	50.9	0.2
5	8:56 AM 9:06 AM	10	50	49.2	0.6	48.6	0.2
6	9:06 AM 9:16 AM	10	60	43.1	0.2	42.8	0.2

Infiltration Rate (in/hr):	21.7
Radius of test hole (in):	4
Average Head (in):	21.7

Figure A-10

APPENDIX B

APPENDIX B
LABORATORY TESTING

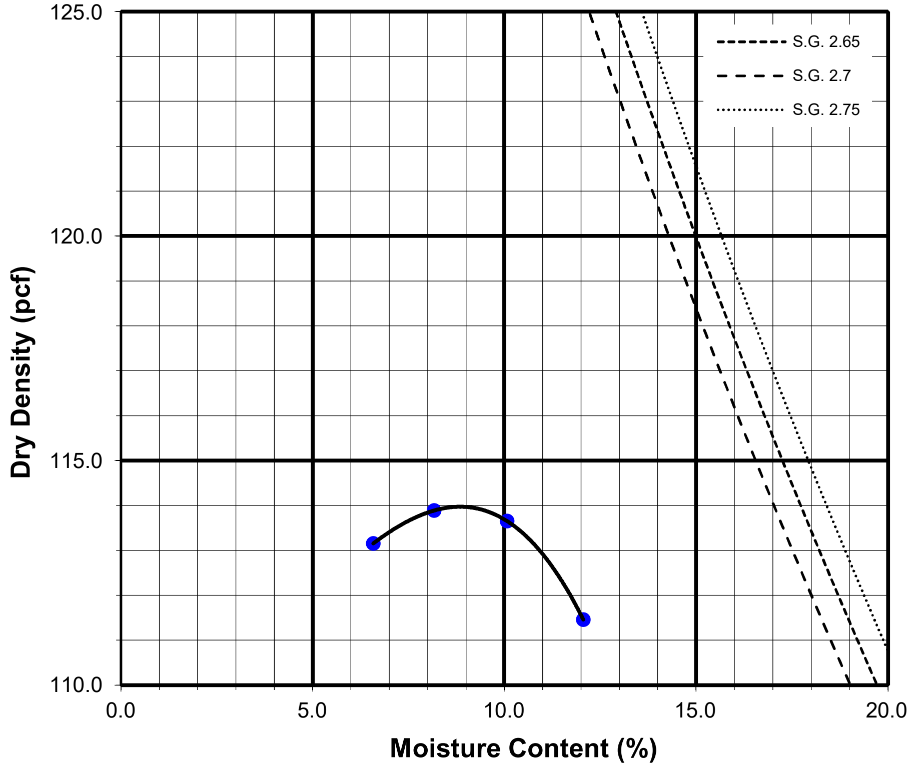
We performed laboratory tests in accordance with current, generally accepted test methods of ASTM International (ASTM) or other suggested procedures. We analyzed selected soil samples for in-situ density and moisture content, maximum dry density and optimum moisture content, corrosivity, expansion, grain size distribution, consolidation characteristics, and direct shear strength. The results of the laboratory tests are presented in Figures B-1 through B-23. The in-place dry density and moisture content of the samples tested are presented on the boring logs in Appendix A.

Sample No:

B1,B3@0-5	Poorly Graded SAND with Silt (SP-SM), light gray

TEST NO.		1	2	3	4	5	6
Wt. Compacted Soil + Mold	(g)	6113	6142	6139	6074		
Weight of Mold	(g)	4252	4252	4252	4252		
Net Weight of Soil	(g)	1861	1890	1887	1822		
Wet Weight of Soil + Cont.	(g)	895.9	764.4	824.6	937.5		
Dry Weight of Soil + Cont.	(g)	847.7	718.2	763.8	895.6		
Weight of Container	(g)	257.7	259.5	259.5	258.7		
Moisture Content	(%)	8.2	10.1	12.1	6.6		
Wet Density	(pcf)	123.2	125.1	124.9	120.6		
Dry Density	(pcf)	113.9	113.7	111.5	113.2		

Maximum Dry Density (pcf)	**114.0**	**Optimum Moisture Content (%)**	**9.0**



Preparation Method: A

COMPACTION CHARACTERISTICS USING MODIFIED EFFORT TEST RESULTS

ASTM D-1557

Checked by: ATS

GEOCON

Project No.: T3082-22-01

Multi-Family Residential Development
14320 Palm Drive
Desert Hot Springs

September 2024

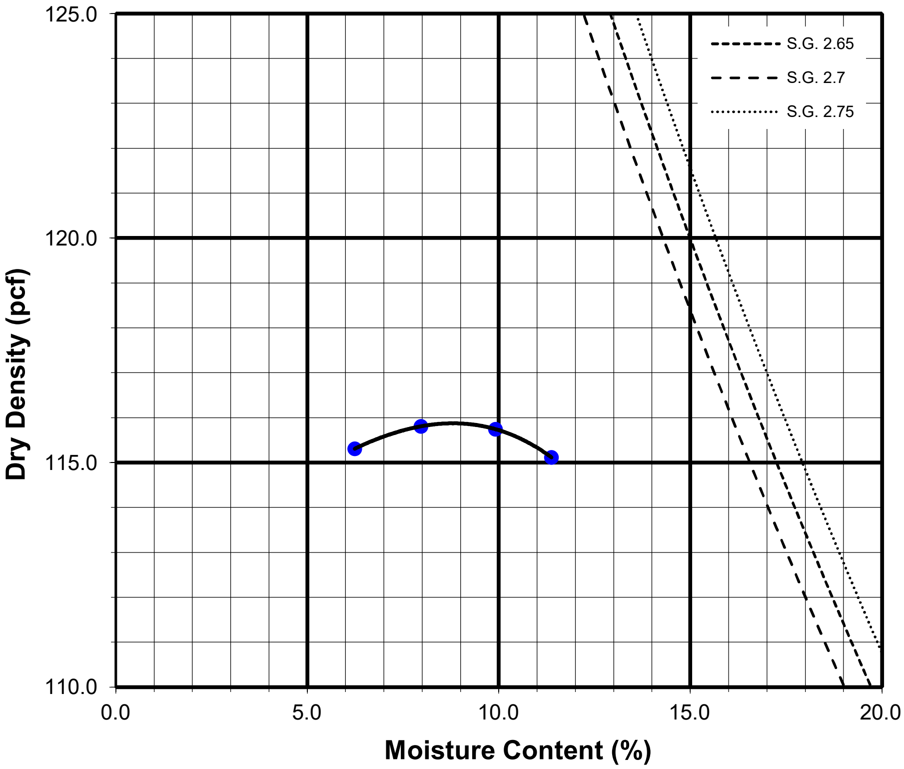
Figure B-1

Sample No:

B7,B9@0-5	Poorly Graded SAND with Silt (SP-SM), pale brown

TEST NO.		1	2	3	4	5	6
Wt. Compacted Soil + Mold	(g)	6103	6141	6174	6189		
Weight of Mold	(g)	4252	4252	4252	4252		
Net Weight of Soil	(g)	1850	1889	1922	1937		
Wet Weight of Soil + Cont.	(g)	835.7	868.0	900.2	886.0		
Dry Weight of Soil + Cont.	(g)	801.7	822.8	842.2	821.5		
Weight of Container	(g)	256.7	255.4	257.1	254.4		
Moisture Content	(%)	6.2	8.0	9.9	11.4		
Wet Density	(pcf)	122.5	125.0	127.2	128.2		
Dry Density	(pcf)	115.3	115.8	115.7	115.1		

Maximum Dry Density (pcf)	**116.0**	**Optimum Moisture Content (%)**	**9.0**



Preparation Method: A

GEOCON

COMPACTION CHARACTERISTICS USING MODIFIED EFFORT TEST RESULTS

ASTM D-1557

Checked by: ATS

Project No.: T3082-22-01

Multi-Family Residential Development
14320 Palm Drive
Desert Hot Springs

September 2024

Figure B-2

B1,B3@0-5

MOLDED SPECIMEN		BEFORE TEST	AFTER TEST
Specimen Diameter	(in.)	4.0	4.0
Specimen Height	(in.)	1.0	1.0
Wt. Comp. Soil + Mold	(gm)	599.6	615.1
Wt. of Mold	(gm)	196.8	196.8
Specific Gravity	(Assumed)	2.7	2.7
Wet Wt. of Soil + Cont.	(gm)	473.2	615.1
Dry Wt. of Soil + Cont.	(gm)	445.7	365.8
Wt. of Container	(gm)	173.2	196.8
Moisture Content	(%)	10.1	14.3
Wet Density	(pcf)	121.5	126.0
Dry Density	(pcf)	110.4	110.2
Void Ratio		0.5	0.5
Total Porosity		0.3	0.3
Pore Volume	(cc)	71.5	71.2
Degree of Saturation	(%) $[S_{meas}]$	52.1	73.6

Date	Time	Pressure (psi)	Elapsed Time (min)	Dial Readings (in.)
8/20/2024	10:00	1.0	0	0.3573
8/20/2024	10:10	1.0	10	0.3573
Add Distilled Water to the Specimen				
8/21/2024	10:00	1.0	1430	0.3561
8/21/2024	11:00	1.0	1490	0.3561

Expansion Index (EI meas) =	-1.2
Expansion Index (Report) =	**0**

Expansion Index, EI_{50}	CBC CLASSIFICATION *	UBC CLASSIFICATION **
0-20	Non-Expansive	Very Low
21-50	Expansive	Low
51-90	Expansive	Medium
91-130	Expansive	High
>130	Expansive	Very High

* Reference: 2022 California Building Code, Section 1803.5.3

** Reference: 1997 Uniform Building Code, Table 18-I-B.

GEOCON

EXPANSION INDEX TEST RESULTS

ASTM D-4829

Checked by: ATS

Project No.: T3082-22-01

Multi-Family Residential Development
14320 Palm Drive
Desert Hot Springs

September 2024

Figure B-3

B7,B9@0-5

MOLDED SPECIMEN		BEFORE TEST	AFTER TEST
Specimen Diameter	(in.)	4.0	4.0
Specimen Height	(in.)	1.0	1.0
Wt. Comp. Soil + Mold	(gm)	605.0	626.3
Wt. of Mold	(gm)	201.6	201.6
Specific Gravity	(Assumed)	2.7	2.7
Wet Wt. of Soil + Cont.	(gm)	473.2	626.3
Dry Wt. of Soil + Cont.	(gm)	447.2	368.4
Wt. of Container	(gm)	173.2	201.6
Moisture Content	(%)	9.5	15.3
Wet Density	(pcf)	121.7	127.9
Dry Density	(pcf)	111.1	111.0
Void Ratio		0.5	0.5
Total Porosity		0.3	0.3
Pore Volume	(cc)	70.5	69.7
Degree of Saturation	(%) [S_{meas}]	50.0	80.7

Date	Time	Pressure (psi)	Elapsed Time (min)	Dial Readings (in.)
8/20/2024	10:00	1.0	0	0.3395
8/20/2024	10:10	1.0	10	0.3396
Add Distilled Water to the Specimen				
8/21/2024	10:00	1.0	1430	0.3356
8/21/2024	11:00	1.0	1490	0.3356

Expansion Index (EI meas) =	-4
Expansion Index (Report) =	**0**

Expansion Index, EI_{50}	CBC CLASSIFICATION *	UBC CLASSIFICATION **
0-20	Non-Expansive	Very Low
21-50	Expansive	Low
51-90	Expansive	Medium
91-130	Expansive	High
>130	Expansive	Very High

* Reference: 2022 California Building Code, Section 1803.5.3

** Reference: 1997 Uniform Building Code, Table 18-I-B.

GEOCON

EXPANSION INDEX TEST RESULTS

ASTM D-4829

Checked by: ATS

Project No.: T3082-22-01

Multi-Family Residential Development
14320 Palm Drive
Desert Hot Springs

September 2024

Figure B-4

SUMMARY OF LABORATORY
POTENTIAL OF HYDROGEN (pH) AND RESISTIVITY TEST RESULTS
AASHTO T289 ASTM D4972 and AASHTO T288 ASTM G187

Sample No.	pH	Resistivity (ohm centimeters)
B1,B3@0-5	8.8	13000
B7,B9@0-5	9.2	15000

SUMMARY OF LABORATORY CHLORIDE CONTENT TEST RESULTS
AASHTO T291 ASTM C1218

Sample No.	Chloride Ion Content (%)
B1,B3@0-5	0.009
B7,B9@0-5	0.015

SUMMARY OF LABORATORY WATER SOLUBLE SULFATE TEST RESULTS
AASHTO T290 ASTM C1580

Sample No.	Water Soluble Sulfate (% SO_4)	Sulfate Exposure
B1,B3@0-5	0.001	S0
B7,B9@0-5	0.000	S0

GEOCON

CORROSIVITY TEST RESULTS

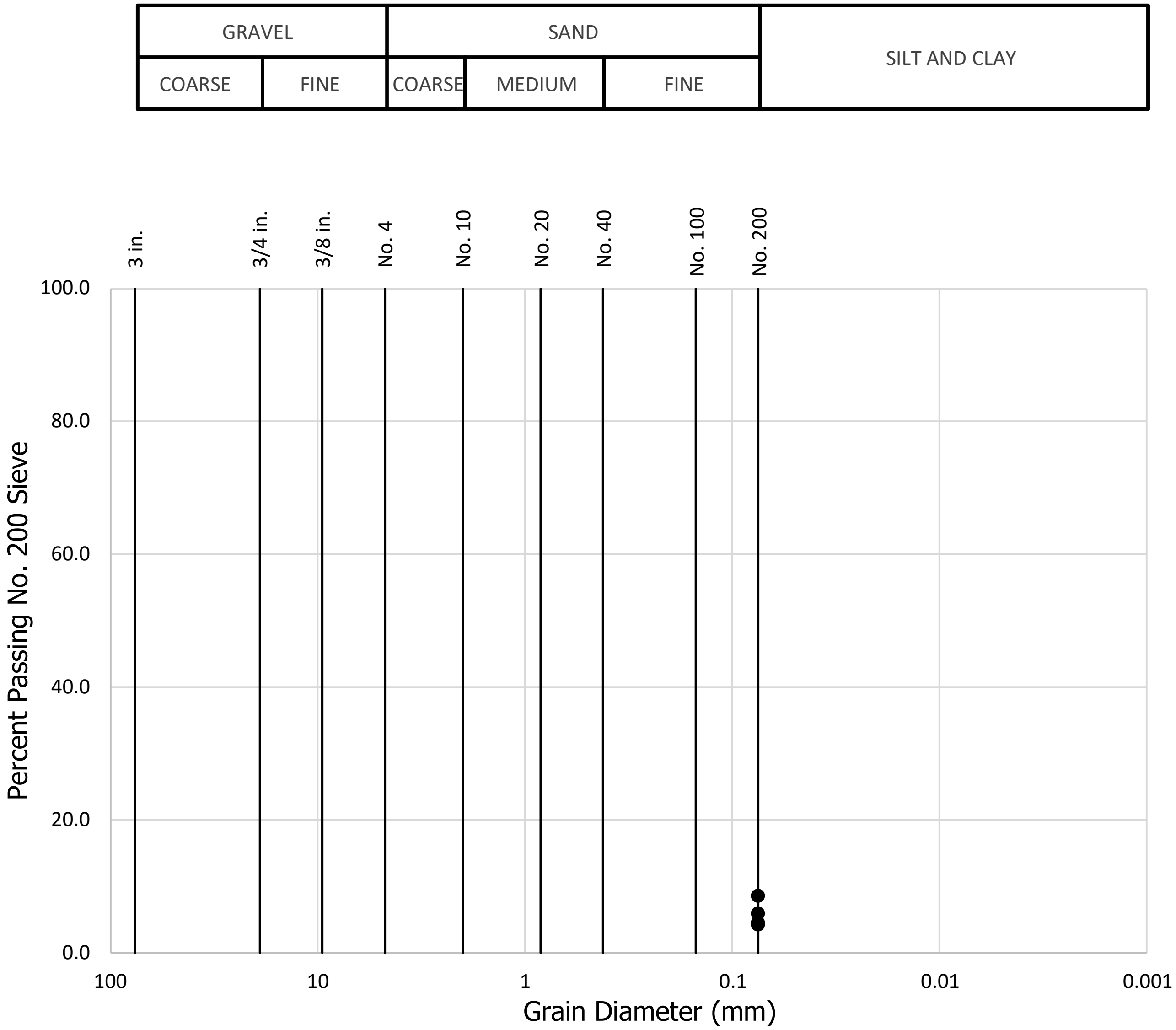
Checked by: ATS

Project No.: T3082-22-01

Multi-Family Residential Development
14320 Palm Drive
Desert Hot Springs

September 2024

Figure B-5



Sample No.	Percent Passing No. 200 Sieve
B5 @ 2.5'	4.5
B5 @ 7.5'	4.3
B5 @ 12.5'	8.6
B5 @ 17.5'	5.9

GEOCON

GRAIN SIZE ANALYSIS

ASTM D-1140

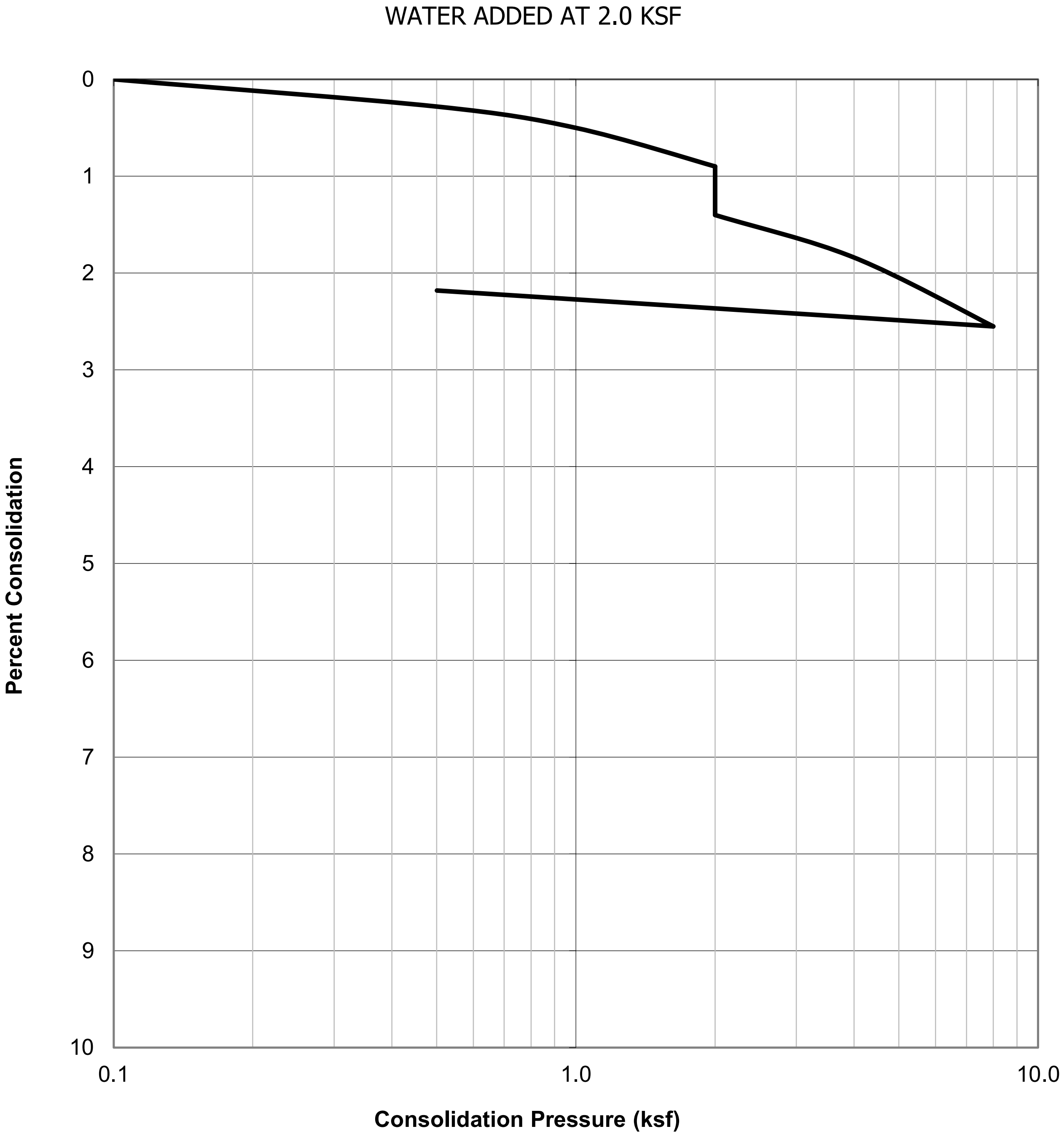
Checked by: ATS

Project No.: T3082-22-01

Multi-Family Residential Development
14320 Palm Drive
Desert Hot Springs

September 2024

Figure B-6


WATER ADDED AT 2.0 KSF

SAMPLE ID.	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B1@2.5	Poorly Graded SAND with Silt (SP-SM), pale brown	110.2	1.1	14.5

GEOCON

CONSOLIDATION TEST RESULTS

ASTM D-2435

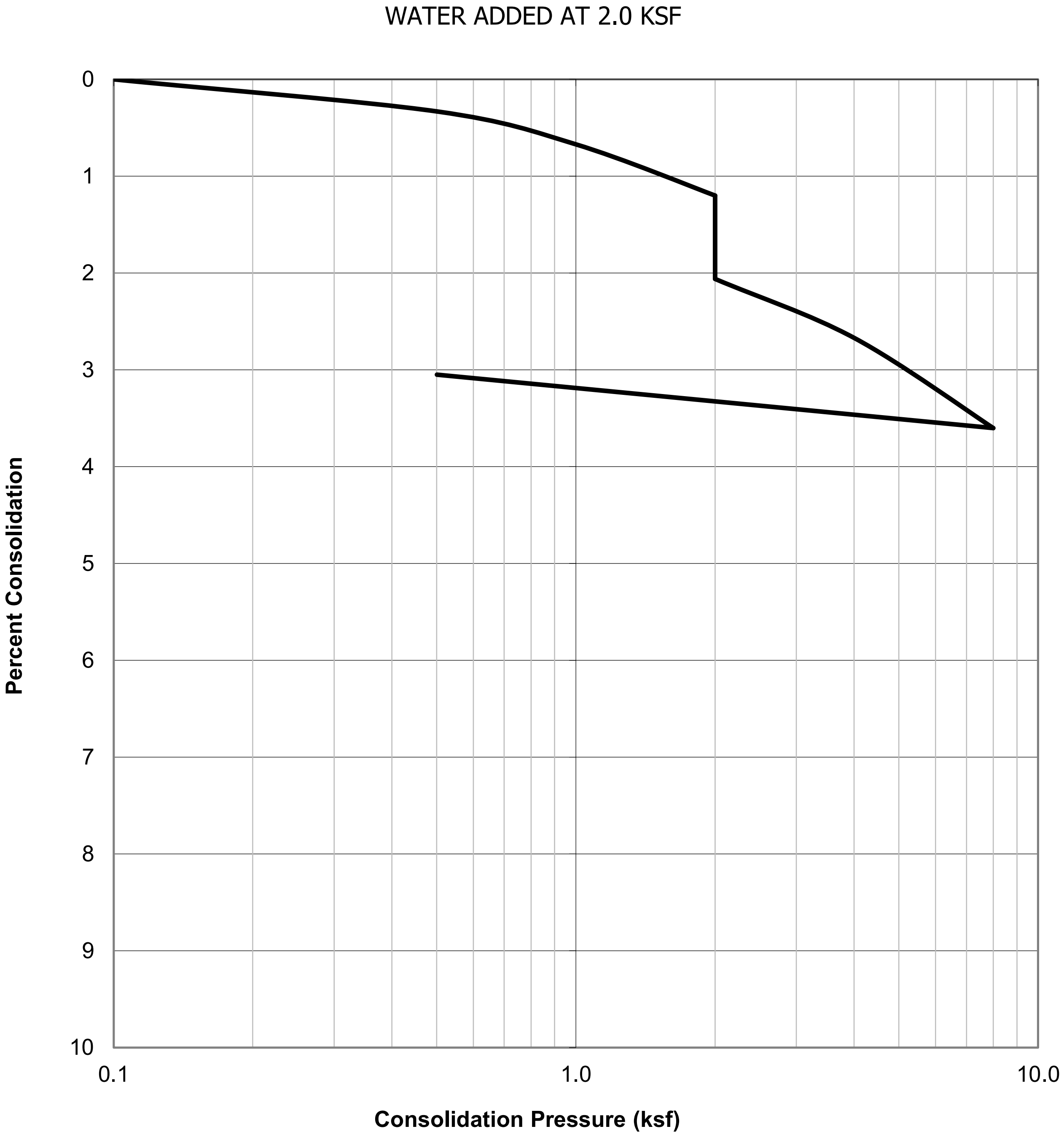
Checked by: ATS

Project No.: T3082-22-01

Multi-Family Residential Development
14320 Palm Drive
Desert Hot Springs

September 2024

Figure B-7



SAMPLE ID.	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B1@5	Poorly Graded SAND with Silt (SP-SM), pale brown	112.8	0.5	14.2

GEOCON

CONSOLIDATION TEST RESULTS

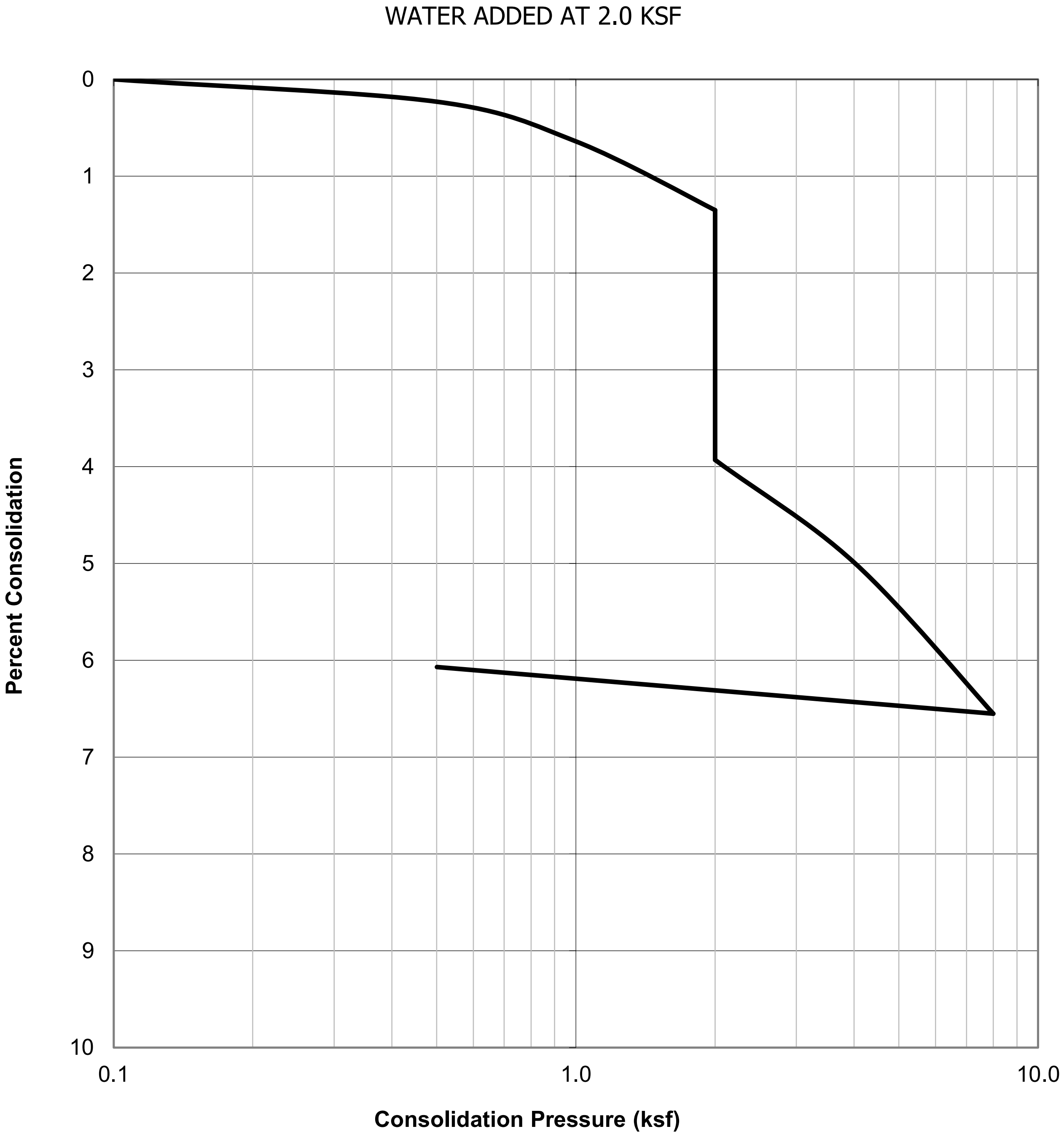
ASTM D-2435

Checked by: ATS

Project No.: T3082-22-01

Multi-Family Residential Development
14320 Palm Drive
Desert Hot Springs

September 2024



SAMPLE ID.	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B1@10	Silty SAND (SM), light brown	113.9	0.2	7.0

GEOCON

CONSOLIDATION TEST RESULTS

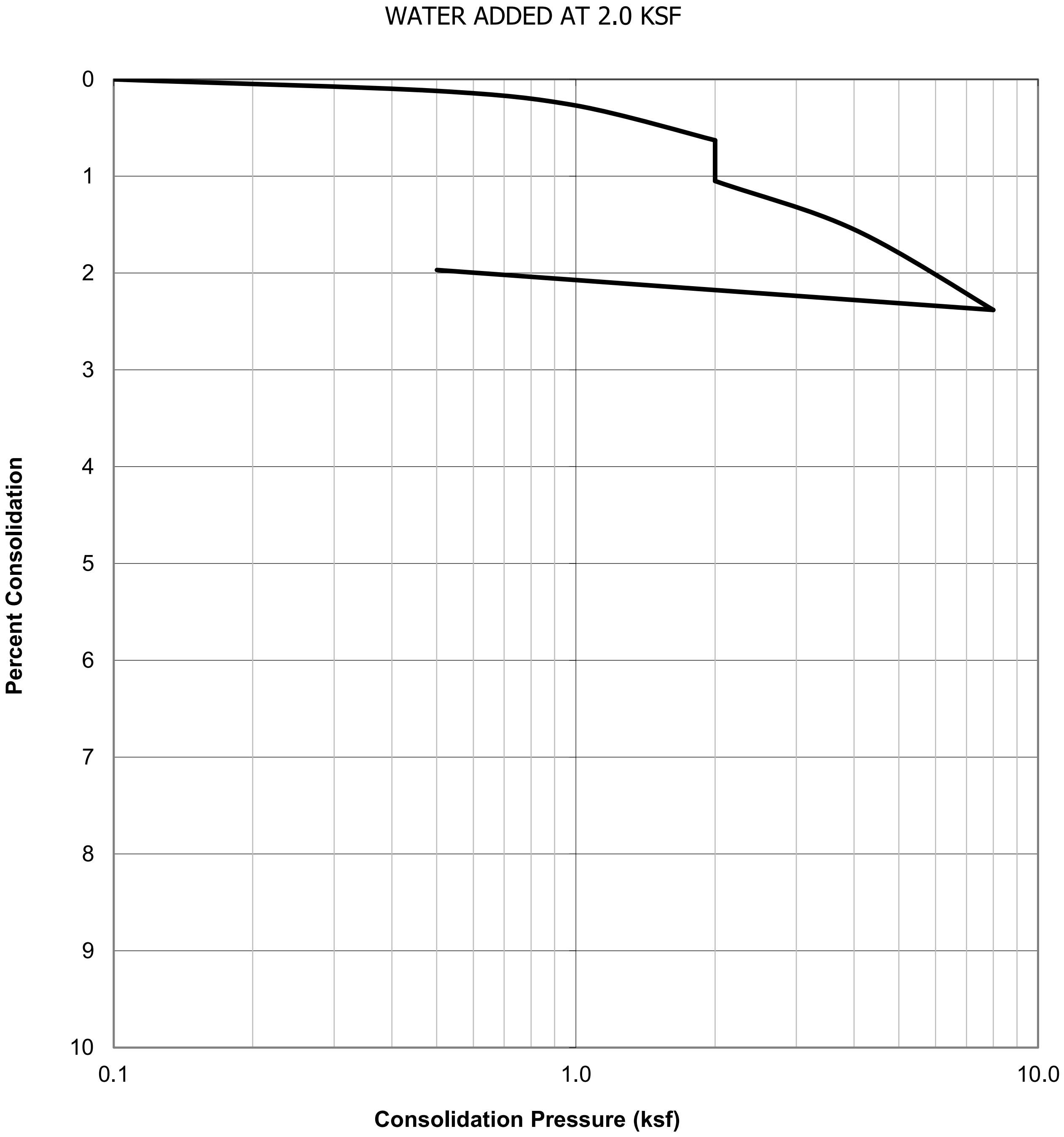
ASTM D-2435

Checked by: ATS

Project No.: T3082-22-01

Multi-Family Residential Development
14320 Palm Drive
Desert Hot Springs

September 2024



SAMPLE ID.	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B1@20	Poorly Graded SAND (SP), pale brown	109.3	1.3	15.3

GEOCON

CONSOLIDATION TEST RESULTS

ASTM D-2435

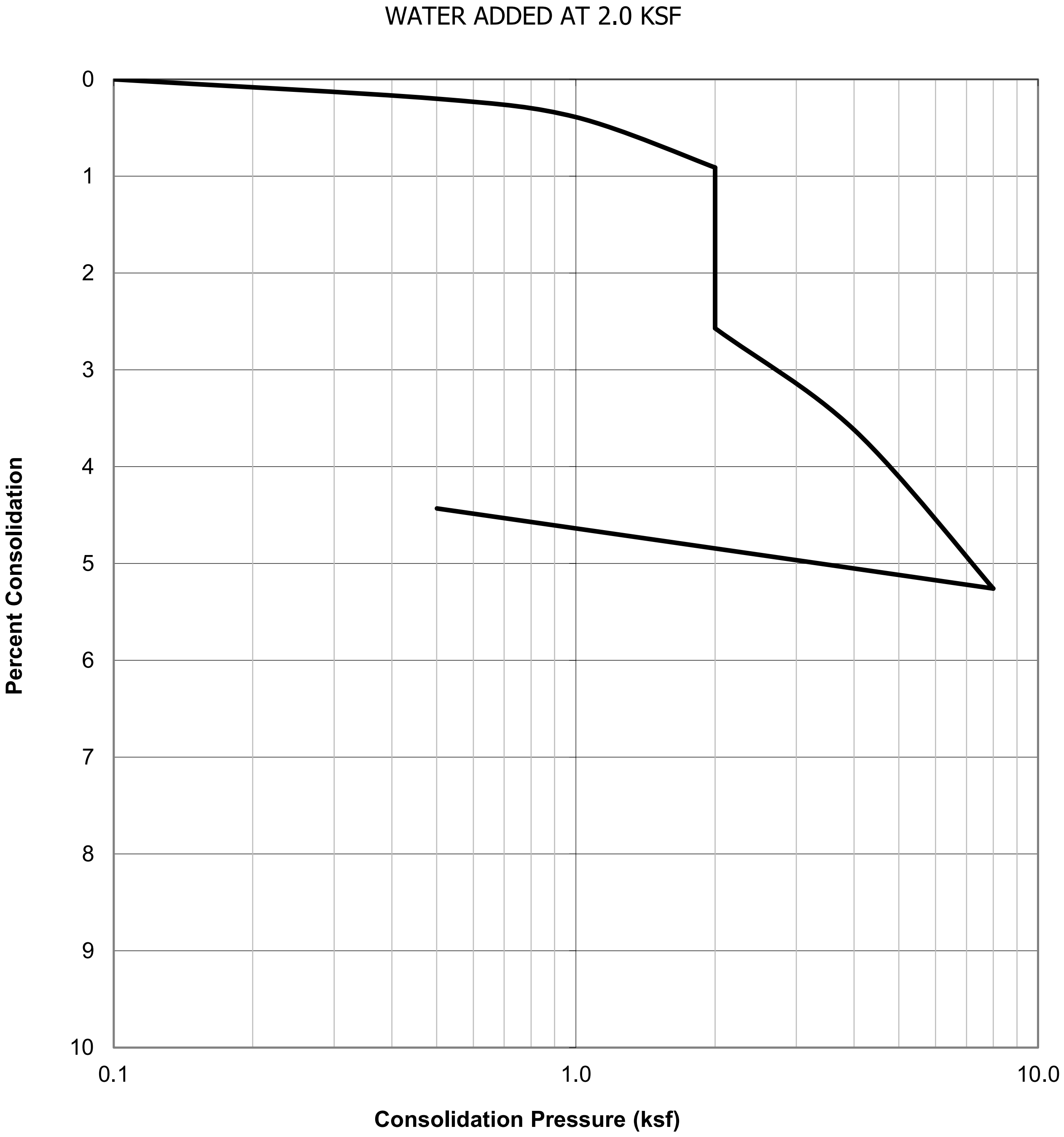
Checked by: ATS

Project No.: T3082-22-01

Multi-Family Residential Development
14320 Palm Drive
Desert Hot Springs

September 2024

Figure B-10



SAMPLE ID.	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B4@5	Poorly graded SAND (SP), pale brown	101.5	3.1	19.4

GEOCON

CONSOLIDATION TEST RESULTS

ASTM D-2435

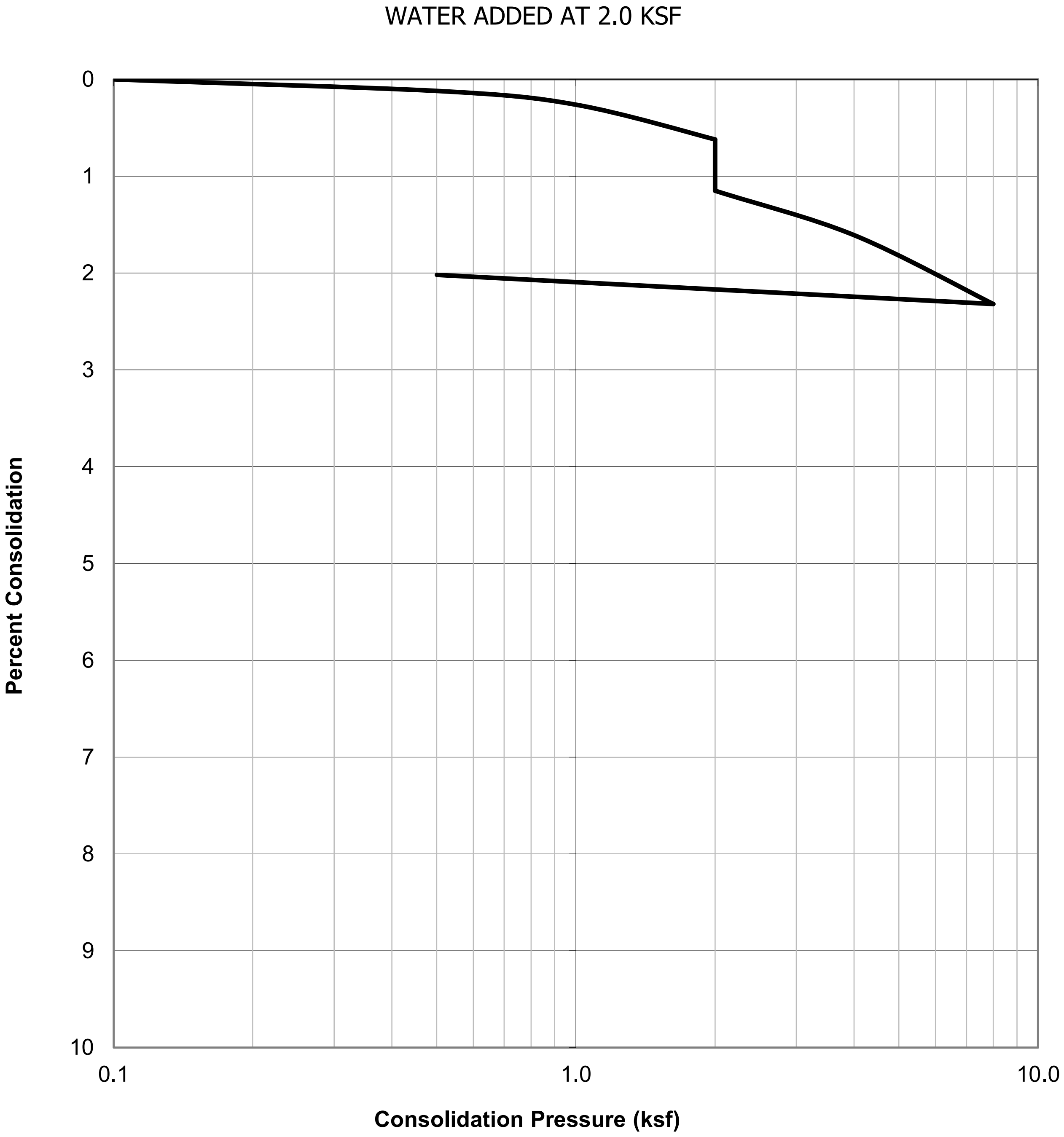
Checked by: ATS

Project No.: T3082-22-01

Multi-Family Residential Development
14320 Palm Drive
Desert Hot Springs

September 2024

Figure B-11



SAMPLE ID.	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B4@10	Poorly graded SAND (SP), pale brown	113.1	1.0	13.1

GEOCON

CONSOLIDATION TEST RESULTS

ASTM D-2435

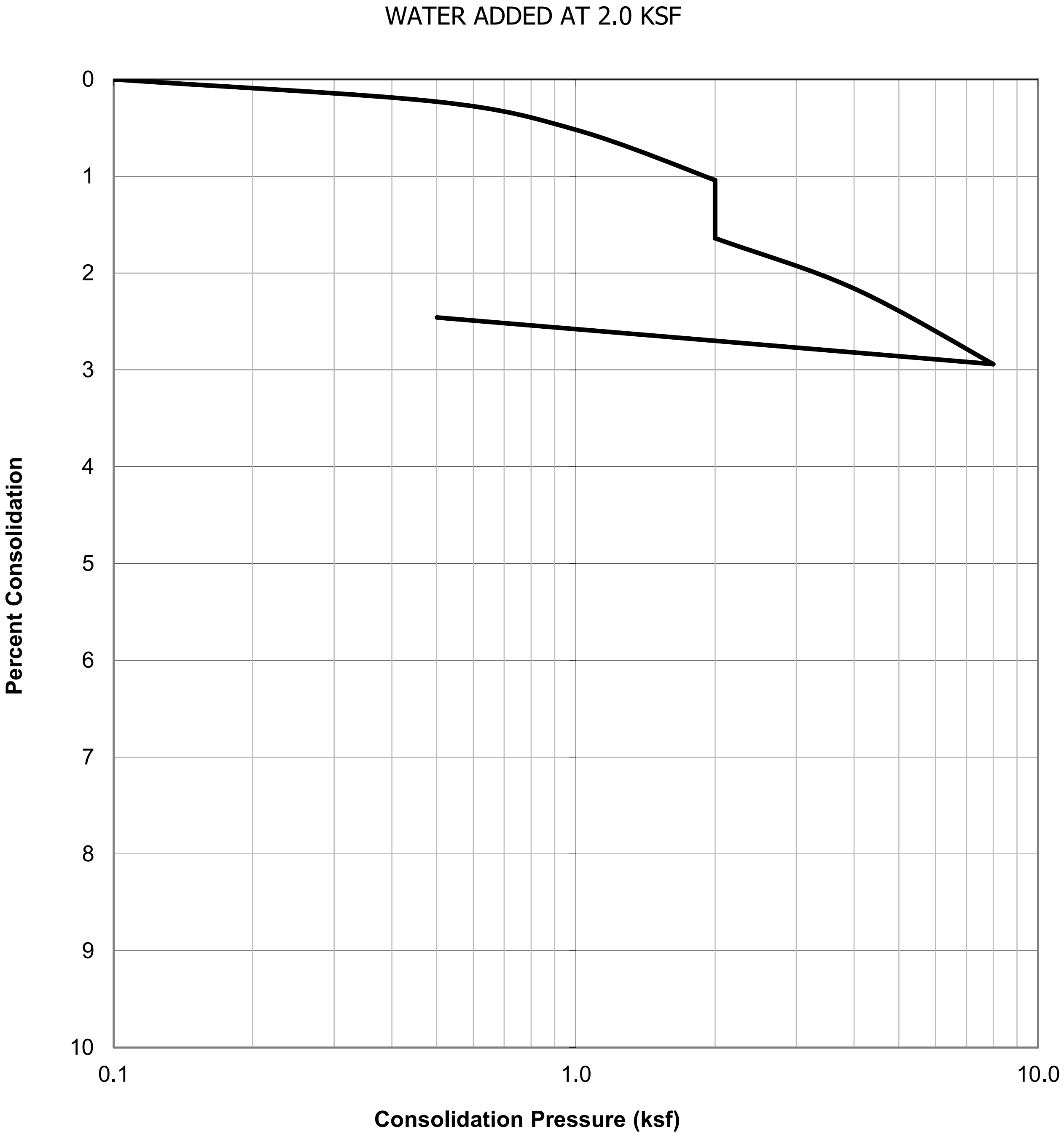
Checked by: ATS

Project No.: T3082-22-01

Multi-Family Residential Development
14320 Palm Drive
Desert Hot Springs

September 2024

Figure B-12



SAMPLE ID.	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B7@2.5	Poorly graded SAND with Silt (SP-SM), pale brown	111.7	1.8	14.8

GEOCON

CONSOLIDATION TEST RESULTS

ASTM D-2435

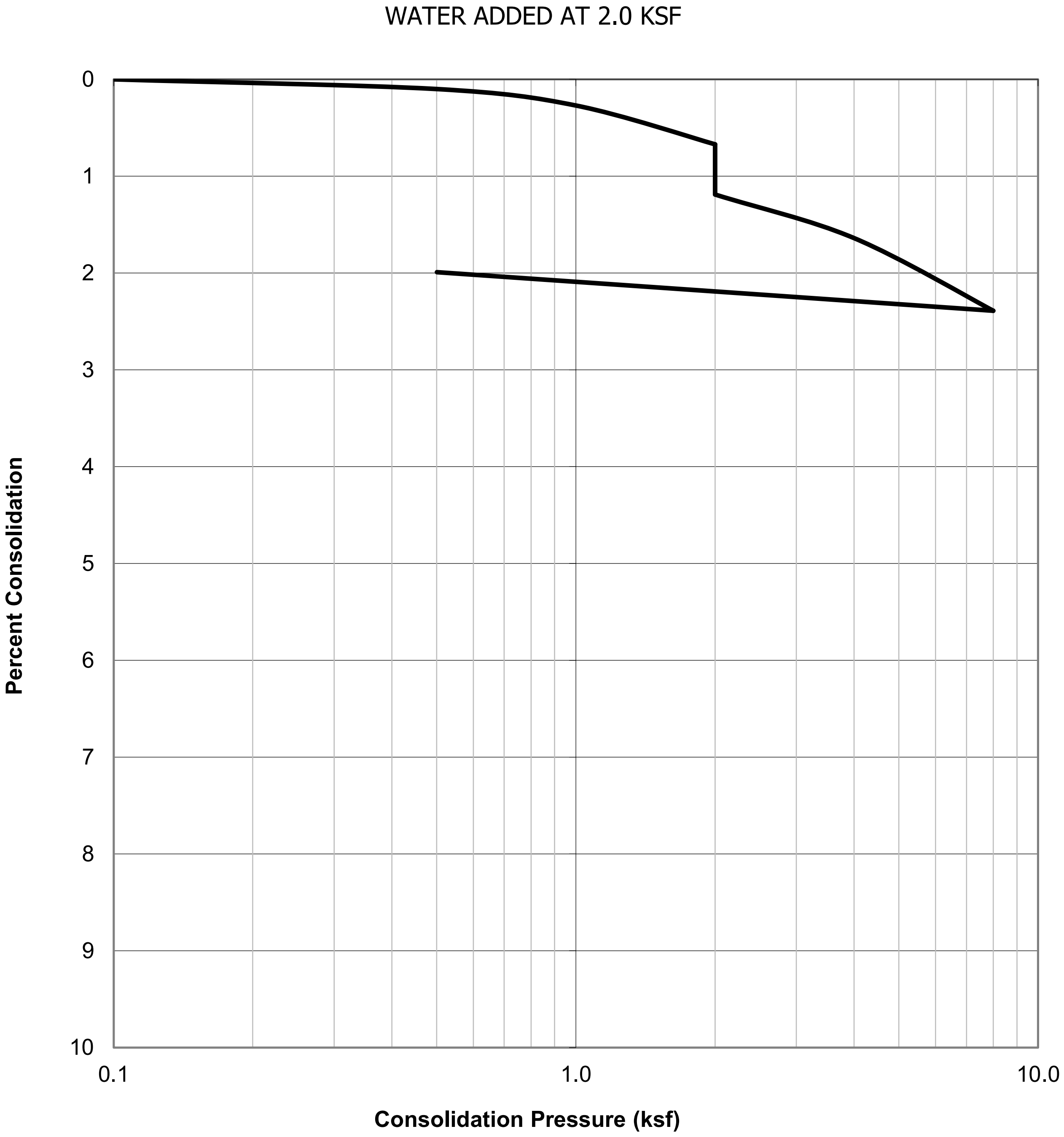
Checked by: ATS

Project No.: T3082-22-01

Multi-Family Residential Development
14320 Palm Drive
Desert Hot Springs

September 2024

Figure B-13



SAMPLE ID.	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B7@5	Poorly graded SAND with Silt (SP-SM), pale brown	110.0	1.1	15.9

GEOCON

CONSOLIDATION TEST RESULTS

ASTM D-2435

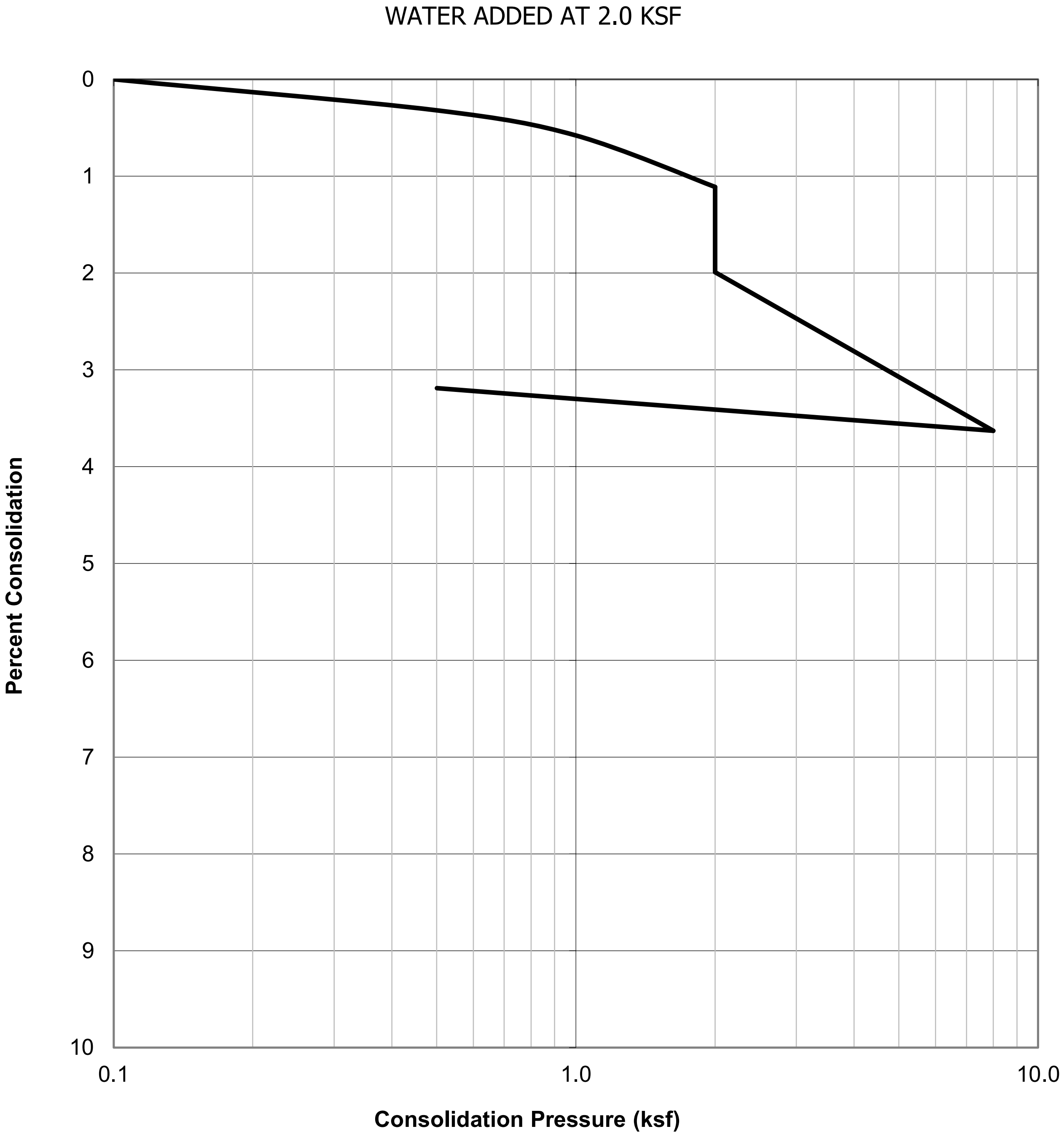
Checked by: ATS

Project No.: T3082-22-01

Multi-Family Residential Development
14320 Palm Drive
Desert Hot Springs

September 2024

Figure B-14



SAMPLE ID.	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B9@2.5	Poorly graded SAND (SP), pale brown	112.7	0.9	14.3

GEOCON

CONSOLIDATION TEST RESULTS

ASTM D-2435

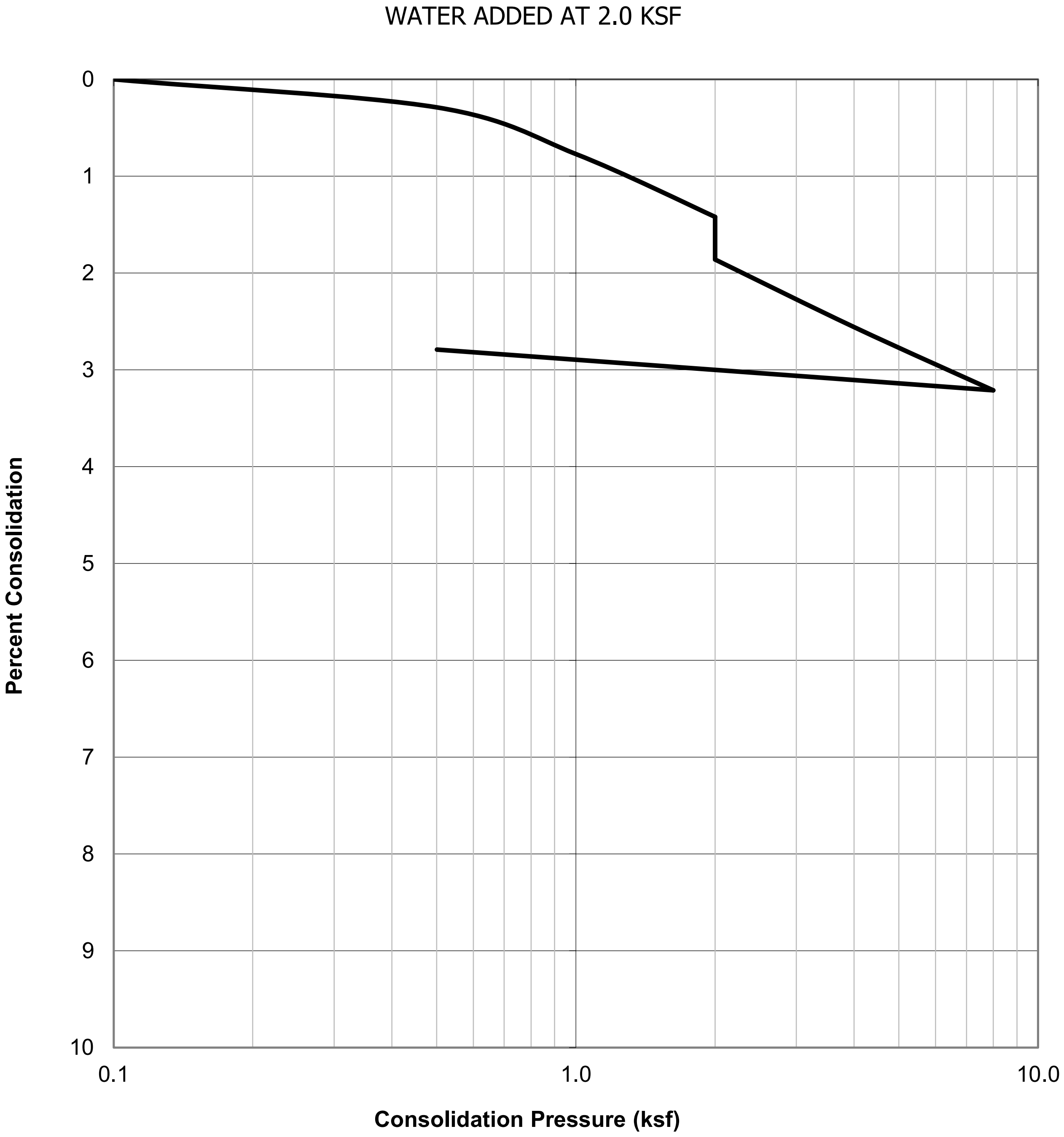
Checked by: ATS

Project No.: T3082-22-01

Multi-Family Residential Development
14320 Palm Drive
Desert Hot Springs

September 2024

Figure B-15



SAMPLE ID.	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B9@5	Poorly graded SAND (SP), pale brown	114.3	0.8	14.5

GEOCON

CONSOLIDATION TEST RESULTS

ASTM D-2435

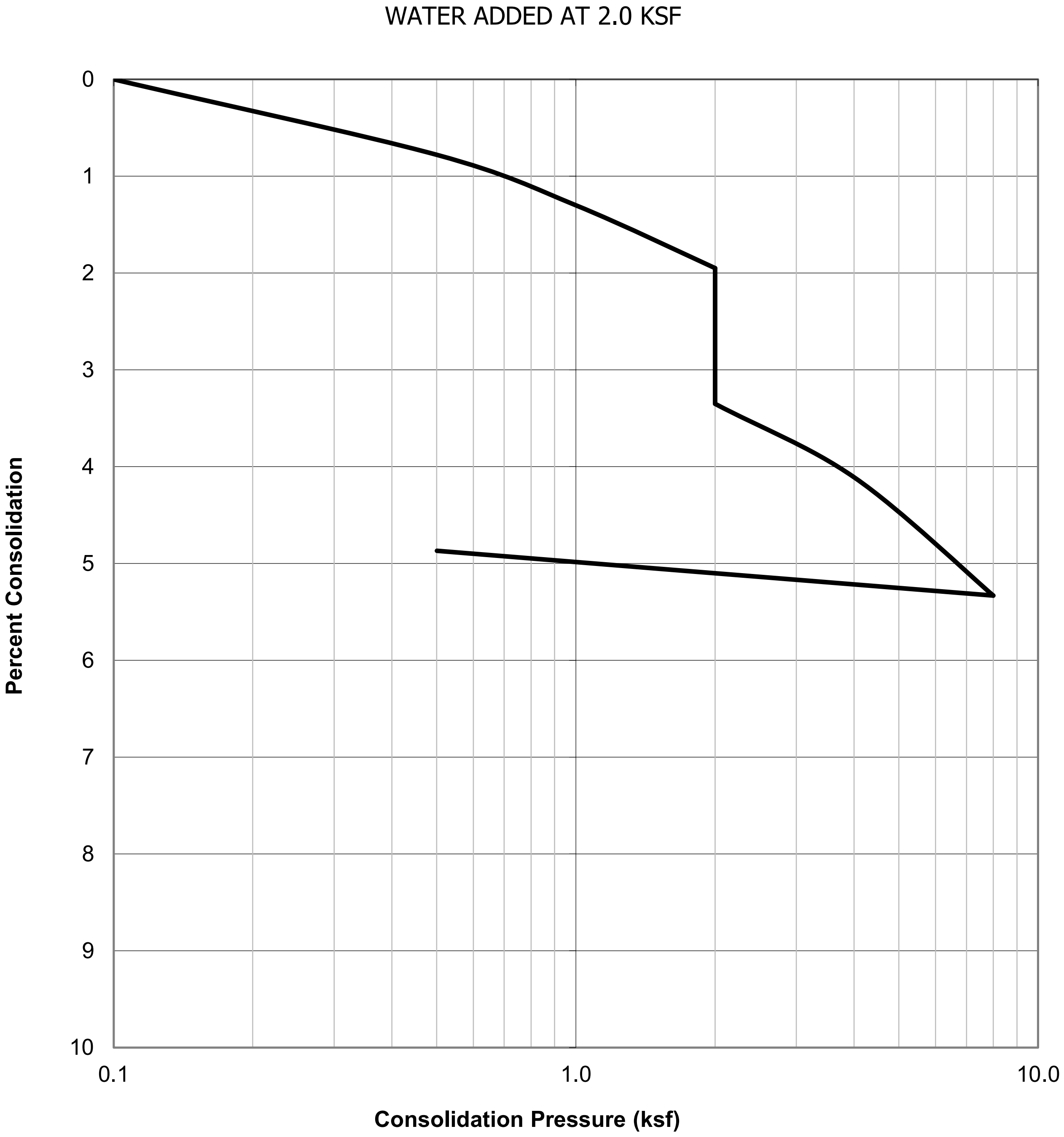
Checked by: ATS

Project No.: T3082-22-01

Multi-Family Residential Development
14320 Palm Drive
Desert Hot Springs

September 2024

Figure B-16



SAMPLE ID.	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B9@10	Poorly graded SAND (SP), pale brown	114.7	1.4	12.9

GEOCON

CONSOLIDATION TEST RESULTS

ASTM D-2435

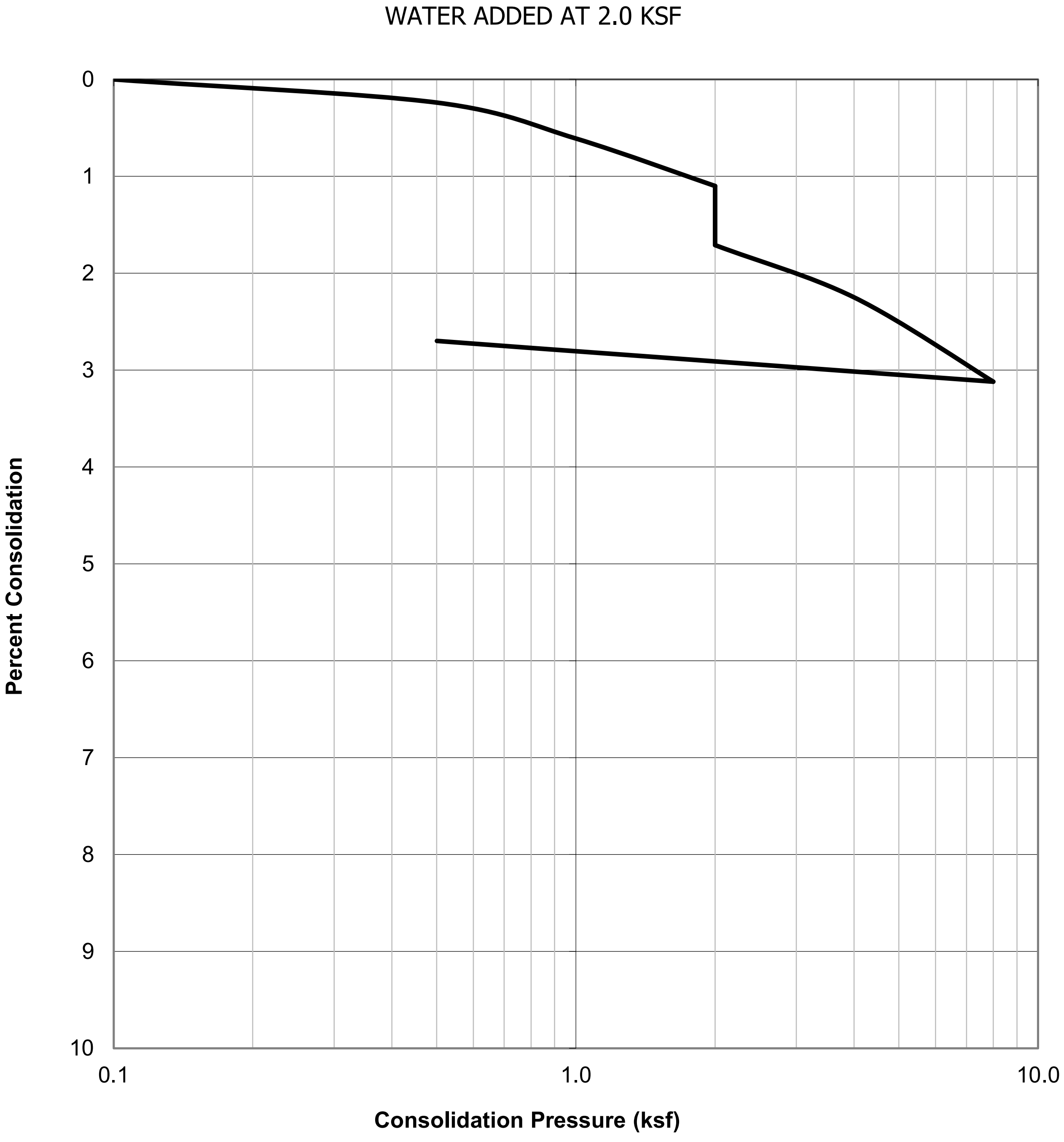
Checked by: ATS

Project No.: T3082-22-01

Multi-Family Residential Development
14320 Palm Drive
Desert Hot Springs

September 2024

Figure B-17



SAMPLE ID.	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B9@15	Poorly graded SAND (SP), pale brown	107.9	0.9	25.1

GEOCON

CONSOLIDATION TEST RESULTS

ASTM D-2435

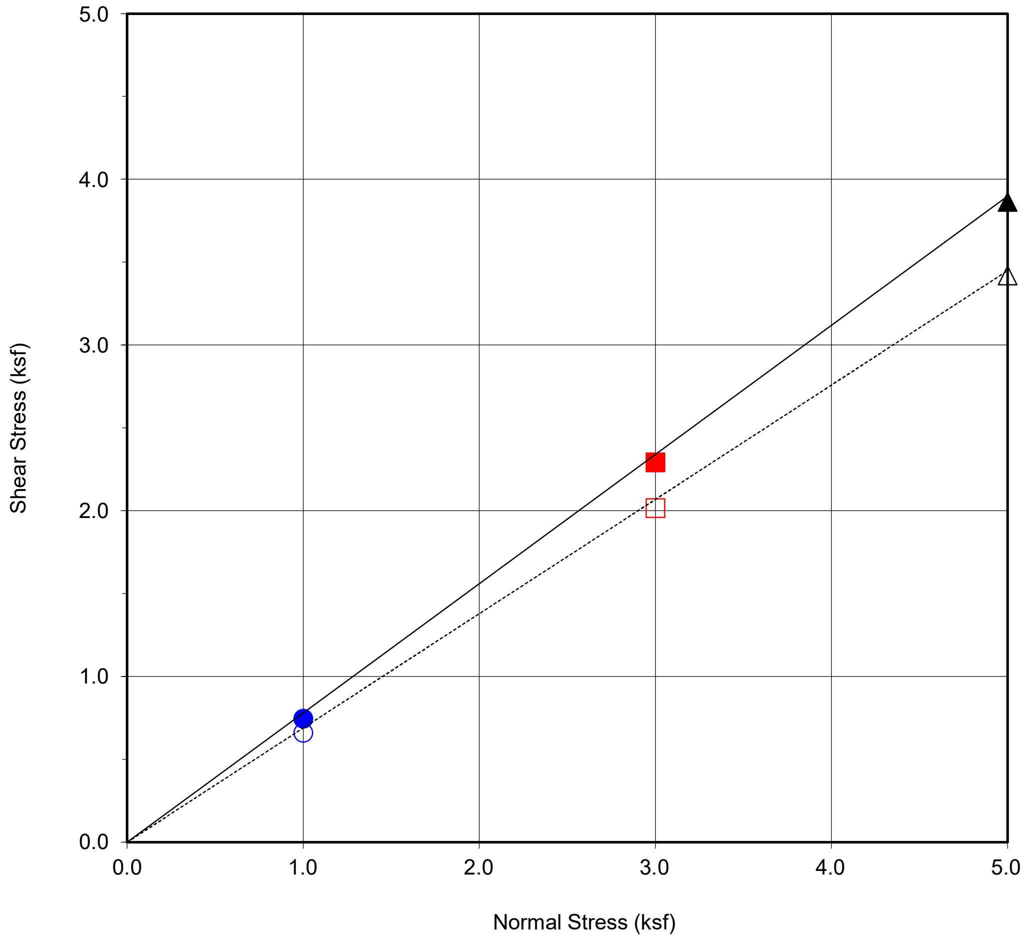
Checked by: ATS

Project No.: T3082-22-01

Multi-Family Residential Development
14320 Palm Drive
Desert Hot Springs

September 2024

Figure B-18



Boring No.	**B1,B3**
Sample No.	**B1,B3@0-5**
Depth (ft)	**0-5**
<u>Sample Type:</u>	Bulk

<u>Soil Identification:</u>

Poorly Graded SAND with Silt (SP-SM), light gray

<u>Strength Parameters</u>

	C (psf)	ϕ (°)
Peak	0	38
Ultimate	0	35

Normal Stress (kip/ft²)	1	3	5
Peak Shear Stress (kip/ft²)	● 0.74	■ 2.29	▲ 3.86
Shear Stress @ End of Test (ksf)	○ 0.66	□ 2.02	△ 3.42
Deformation Rate (in./min.)	0.05	0.05	0.05
Initial Sample Height (in.)	1.0	1.0	1.0
Ring Inside Diameter (in.)	2.375	2.375	2.375
Initial Moisture Content (%)	9.1	8.9	9.1
Initial Dry Density (pcf)	103.0	102.9	103.0
Initial Degree of Saturation (%)	38.6	37.7	38.6
Soil Height Before Shearing (in.)	1.2	1.2	1.2
Final Moisture Content (%)	12.6	7.8	13.2

GEOCON

DIRECT SHEAR TEST RESULTS

Consolidated Drained ASTM D-3080

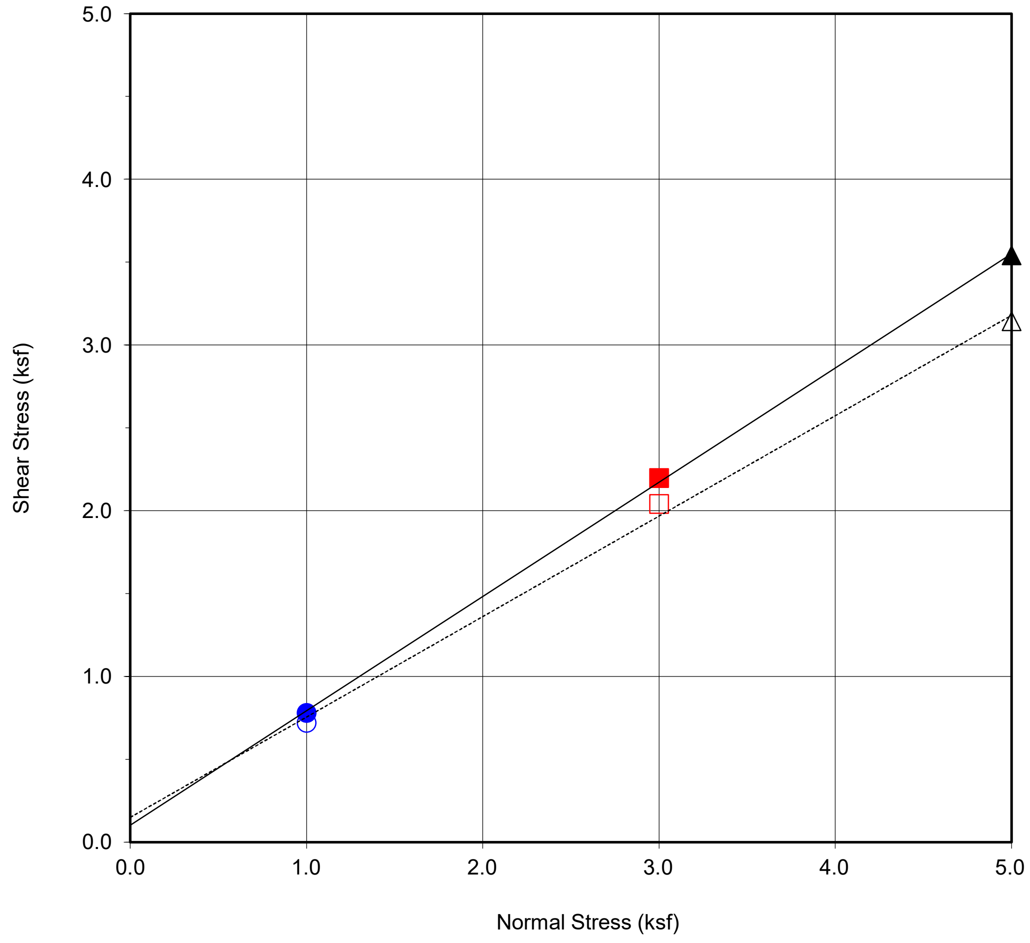
Checked by: ATS

Project No.: T3082-22-01

Multi-Family Residential Development
14320 Palm Drive
Desert Hot Springs

September 2024

Figure B-19



Boring No.	**B3**
Sample No.	**B3@2.5**
Depth (ft)	**2.5**
Sample Type:	Ring

Soil Identification:		
Poorly Graded SAND (SP), pale gray		
Strength Parameters		
	C (psf)	ϕ (°)
Peak	102	35
Ultimate	150	31

Normal Stress (kip/ft²)	1	3	5
Peak Shear Stress (kip/ft²)	● 0.78	■ 2.20	▲ 3.54
Shear Stress @ End of Test (ksf)	○ 0.72	□ 2.04	△ 3.14
Deformation Rate (in./min.)	0.05	0.05	0.05
Initial Sample Height (in.)	1.0	1.0	1.0
Ring Inside Diameter (in.)	2.375	2.375	2.375
Initial Moisture Content (%)	4.5	4.7	4.2
Initial Dry Density (pcf)	98.7	103.0	93.7
Initial Degree of Saturation (%)	17.3	20.0	14.3
Soil Height Before Shearing (in.)	1.2	1.2	1.2
Final Moisture Content (%)	18.7	18.7	15.8

GEOCON

DIRECT SHEAR TEST RESULTS

Consolidated Drained ASTM D-3080

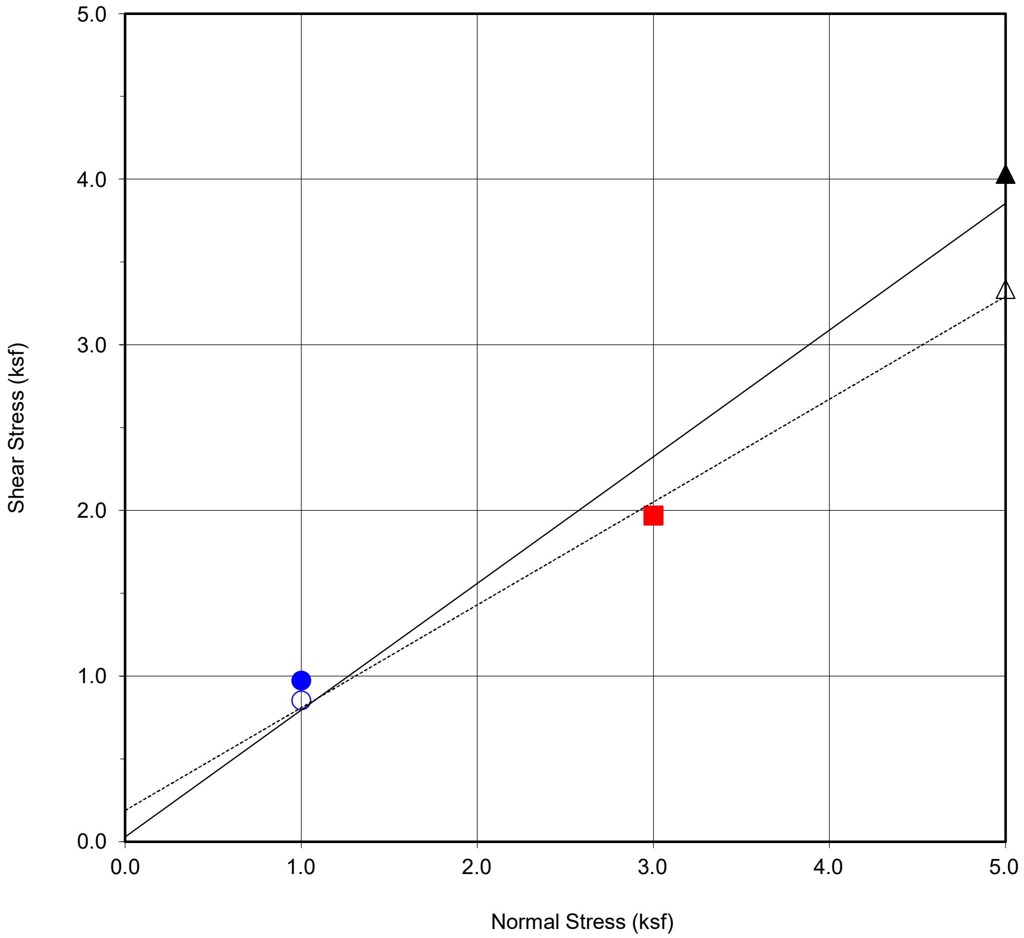
Checked by: ATS

Project No.: T3082-22-01

Multi-Family Residential Development
14320 Palm Drive
Desert Hot Springs

September 2024

Figure B-20



Boring No.	**B6**
Sample No.	**B6@10**
Depth (ft)	**10**
Sample Type:	Ring

Soil Identification:

Poorly Graded SAND (SP), pale gray

Strength Parameters

	C (psf)	ϕ (°)
Peak	29	37
Ultimate	189	32

Normal Stress (kip/ft²)	1	3	5
Peak Shear Stress (kip/ft²)	● 0.97	■ 1.97	▲ 4.03
Shear Stress @ End of Test (ksf)	○ 0.85	□ 1.97	△ 3.34
Deformation Rate (in./min.)	0.05	0.05	0.05
Initial Sample Height (in.)	1.0	1.0	1.0
Ring Inside Diameter (in.)	2.375	2.375	2.375
Initial Moisture Content (%)	6.1	6.0	7.5
Initial Dry Density (pcf)	105.4	102.4	101.0
Initial Degree of Saturation (%)	27.4	25.0	30.4
Soil Height Before Shearing (in.)	1.2	1.2	1.2
Final Moisture Content (%)	19.2	19.5	19.6

GEOCON

DIRECT SHEAR TEST RESULTS

Consolidated Drained ASTM D-3080

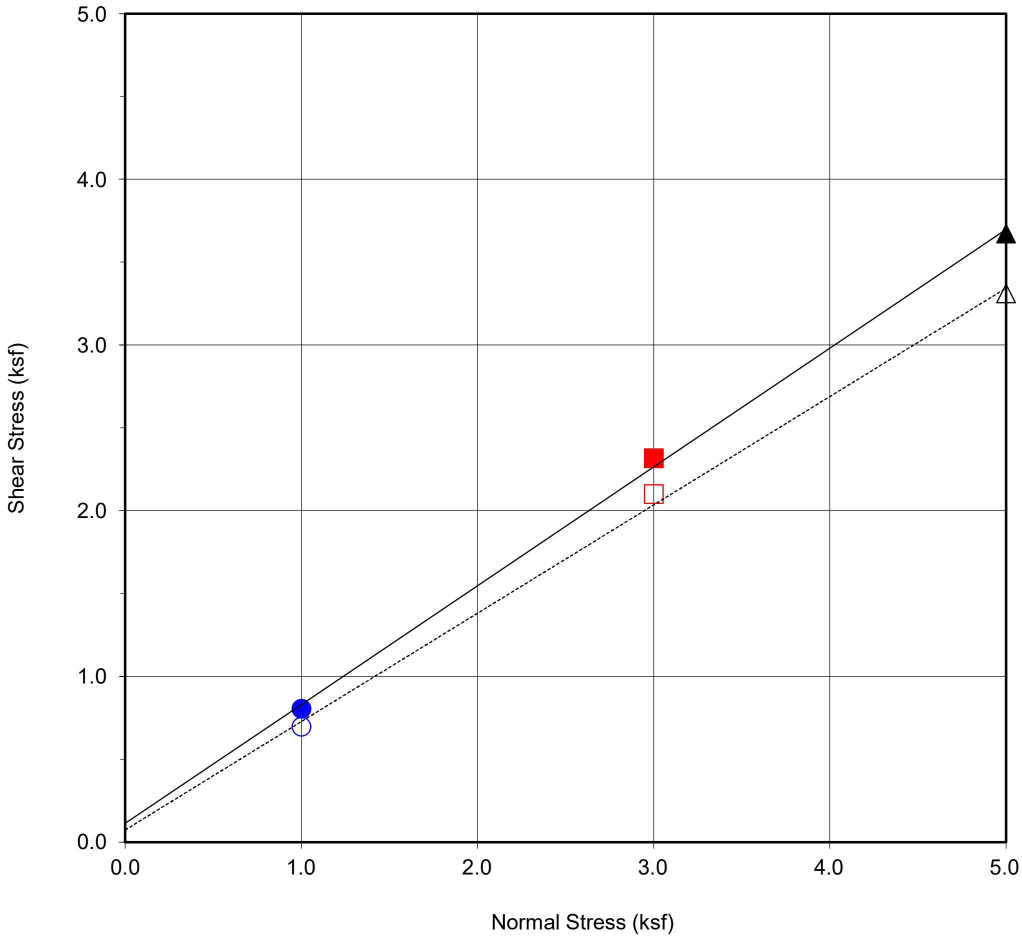
Checked by: ATS

Project No.: T3082-22-01

Multi-Family Residential Development
14320 Palm Drive
Desert Hot Springs

September 2024

Figure B-21



Boring No.	**B7,B9**
Sample No.	**B7,B9@0-5**
Depth (ft)	**0-5**
Sample Type:	Bulk

Soil Identification:

Poorly Graded SAND with Silt (SP-SM), pale brown

Strength Parameters

	C (psf)	ϕ (°)
Peak	113	36
Ultimate	74	33

Normal Stress (kip/ft²)	1	3	5
Peak Shear Stress (kip/ft²)	● 0.80	■ 2.32	▲ 3.67
Shear Stress @ End of Test (ksf)	○ 0.70	□ 2.10	△ 3.31
Deformation Rate (in./min.)	0.05	0.05	0.05
Initial Sample Height (in.)	1.0	1.0	1.0
Ring Inside Diameter (in.)	2.375	2.375	2.375
Initial Moisture Content (%)	8.9	9.0	9.0
Initial Dry Density (pcf)	104.0	104.0	104.0
Initial Degree of Saturation (%)	38.8	39.2	39.4
Soil Height Before Shearing (in.)	1.2	1.2	1.2
Final Moisture Content (%)	12.4	14.4	13.5

GEOCON

DIRECT SHEAR TEST RESULTS

Consolidated Drained ASTM D-3080

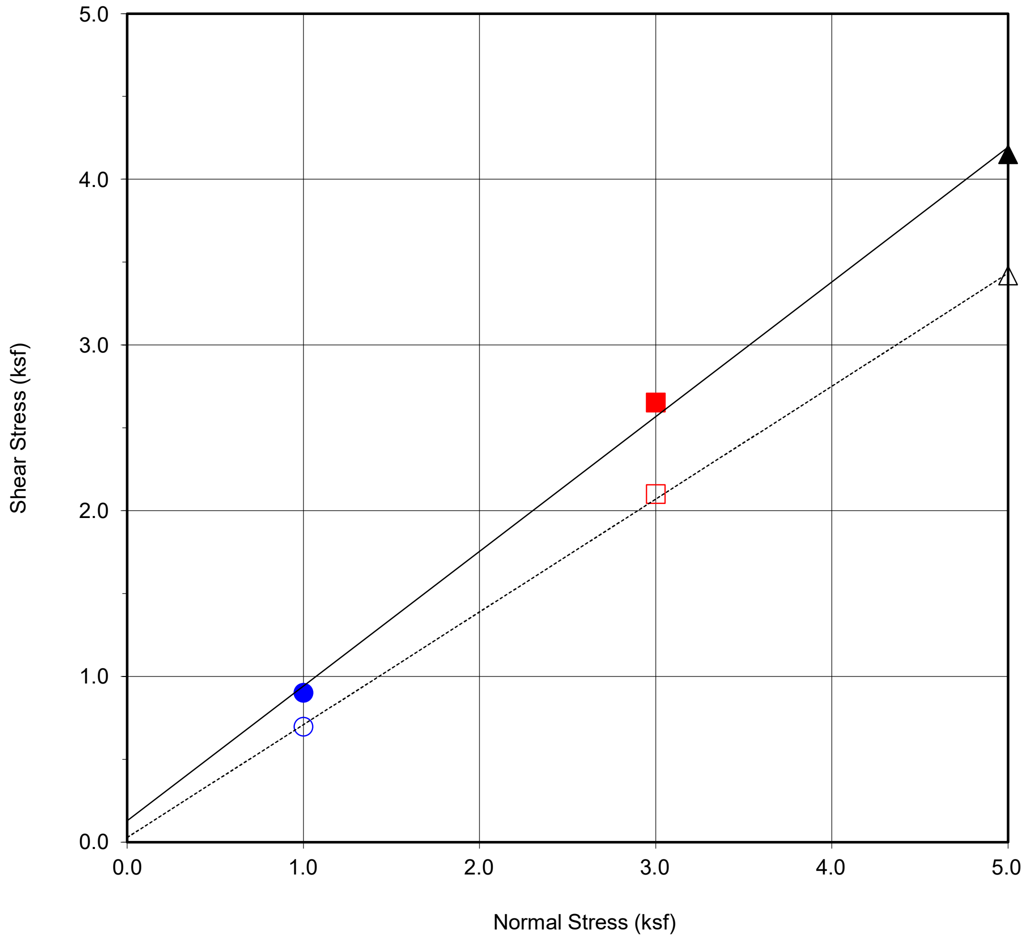
Checked by: ATS

Project No.: T3082-22-01

Multi-Family Residential Development
14320 Palm Drive
Desert Hot Springs

September 2024

Figure B-22



Boring No.	**B7**
Sample No.	**B7@2.5**
Depth (ft)	**2.5**
Sample Type:	Ring

Soil Identification:

Poorly Graded SAND with Silt (SP-SM), pale brown

Strength Parameters

	C (psf)	ϕ (°)
Peak	129	39
Ultimate	29	34

Normal Stress (kip/ft^2)	1	3	5
Peak Shear Stress (kip/ft^2)	● 0.90	■ 2.65	▲ 4.15
Shear Stress @ End of Test (ksf)	○ 0.70	□ 2.10	△ 3.42
Deformation Rate (in./min.)	0.05	0.05	0.05
Initial Sample Height (in.)	1.0	1.0	1.0
Ring Inside Diameter (in.)	2.375	2.375	2.375
Initial Moisture Content (%)	3.8	3.8	3.7
Initial Dry Density (pcf)	105.3	106.0	108.2
Initial Degree of Saturation (%)	17.1	17.3	17.8
Soil Height Before Shearing (in.)	1.2	1.2	1.2
Final Moisture Content (%)	11.5	17.3	18.3

GEOCON

DIRECT SHEAR TEST RESULTS

Consolidated Drained ASTM D-3080

Checked by: ATS

Project No.: T3082-22-01

Multi-Family Residential Development
14320 Palm Drive
Desert Hot Springs

September 2024

Figure B-23

APPENDIX C

APPENDIX C

RECOMMENDED GRADING SPECIFICATIONS

FOR

PROPOSED MULTI-FAMILY RESIDENTIAL DEVELOPMENT
14320 PALM DRIVE
DESERT HOT SPRINGS, CALIFORNIA

PROJECT NO. T3082-22-01

RECOMMENDED GRADING SPECIFICATIONS

1. GENERAL

1.1 These Recommended Grading Specifications shall be used in conjunction with the Geotechnical Report for the project prepared by Geocon. The recommendations contained in the text of the Geotechnical Report are a part of the earthwork and grading specifications and shall supersede the provisions contained hereinafter in the case of conflict.

1.2 Prior to the commencement of grading, a geotechnical consultant (Consultant) shall be employed for the purpose of observing earthwork procedures and testing the fills for substantial conformance with the recommendations of the Geotechnical Report and these specifications. The Consultant should provide adequate testing and observation services so that they may assess whether, in their opinion, the work was performed in substantial conformance with these specifications. It shall be the responsibility of the Contractor to assist the Consultant and keep them apprised of work schedules and changes so that personnel may be scheduled accordingly.

1.3 It shall be the sole responsibility of the Contractor to provide adequate equipment and methods to accomplish the work in accordance with applicable grading codes or agency ordinances, these specifications and the approved grading plans. If, in the opinion of the Consultant, unsatisfactory conditions such as questionable soil materials, poor moisture condition, inadequate compaction, and/or adverse weather result in a quality of work not in conformance with these specifications, the Consultant will be empowered to reject the work and recommend to the Owner that grading be stopped until the unacceptable conditions are corrected.

2. DEFINITIONS

2.1 **Owner** shall refer to the owner of the property or the entity on whose behalf the grading work is being performed and who has contracted with the Contractor to have grading performed.

2.2 **Contractor** shall refer to the Contractor performing the site grading work.

2.3 **Civil Engineer** or **Engineer of Work** shall refer to the California licensed Civil Engineer or consulting firm responsible for preparation of the grading plans, surveying and verifying as-graded topography.

2.4 **Consultant** shall refer to the soil engineering and engineering geology consulting firm retained to provide geotechnical services for the project.

2.5 **Soil Engineer** shall refer to a California licensed Civil Engineer retained by the Owner, who is experienced in the practice of geotechnical engineering. The Soil Engineer shall be responsible for having qualified representatives on-site to observe and test the Contractor's work for conformance with these specifications.

2.6 **Engineering Geologist** shall refer to a California licensed Engineering Geologist retained by the Owner to provide geologic observations and recommendations during the site grading.

2.7 **Geotechnical Report** shall refer to a soil report (including all addenda) which may include a geologic reconnaissance or geologic investigation that was prepared specifically for the development of the project for which these Recommended Grading Specifications are intended to apply.

3. MATERIALS

3.1 Materials for compacted fill shall consist of any soil excavated from the cut areas or imported to the site that, in the opinion of the Consultant, is suitable for use in construction of fills. In general, fill materials can be classified as *soil* fills, *soil-rock* fills or *rock* fills, as defined below.

3.1.1 **Soil fills** are defined as fills containing no rocks or hard lumps greater than 12 inches in maximum dimension and containing at least 40 percent by weight of material smaller than ¾ inch in size.

3.1.2 **Soil-rock fills** are defined as fills containing no rocks or hard lumps larger than 4 feet in maximum dimension and containing a sufficient matrix of soil fill to allow for proper compaction of soil fill around the rock fragments or hard lumps as specified in Paragraph 6.2. **Oversize rock** is defined as material greater than 12 inches.

3.1.3 **Rock fills** are defined as fills containing no rocks or hard lumps larger than 3 feet in maximum dimension and containing little or no fines. Fines are defined as material smaller than ¾ inch in maximum dimension. The quantity of fines shall be less than approximately 20 percent of the rock fill quantity.

3.2 Material of a perishable, spongy, or otherwise unsuitable nature as determined by the Consultant shall not be used in fills.

3.3 Materials used for fill, either imported or on-site, shall not contain hazardous materials as defined by the California Code of Regulations, Title 22, Division 4, Chapter 30, Articles 9 and 10; 40CFR; and any other applicable local, state or federal laws. The Consultant shall not be responsible for the identification or analysis of the potential presence of hazardous materials. However, if observations, odors or soil discoloration cause Consultant to suspect the presence of hazardous materials, the Consultant may request from the Owner the termination of grading operations within the affected area. Prior to resuming grading operations, the Owner shall provide a written report to the Consultant indicating that the suspected materials are not hazardous as defined by applicable laws and regulations.

3.4 The outer 15 feet of *soil-rock* fill slopes, measured horizontally, should be composed of properly compacted *soil* fill materials approved by the Consultant. *Rock* fill may extend to the slope face, provided that the slope is not steeper than 2:1 (horizontal:vertical) and a soil layer no thicker than 12 inches is track-walked onto the face for landscaping purposes. This procedure may be utilized provided it is acceptable to the governing agency, Owner and Consultant.

3.5 Samples of soil materials to be used for fill should be tested in the laboratory by the Consultant to determine the maximum density, optimum moisture content, and, where appropriate, shear strength, expansion, and gradation characteristics of the soil.

3.6 During grading, soil or groundwater conditions other than those identified in the Geotechnical Report may be encountered by the Contractor. The Consultant shall be notified immediately to evaluate the significance of the unanticipated condition

4. CLEARING AND PREPARING AREAS TO BE FILLED

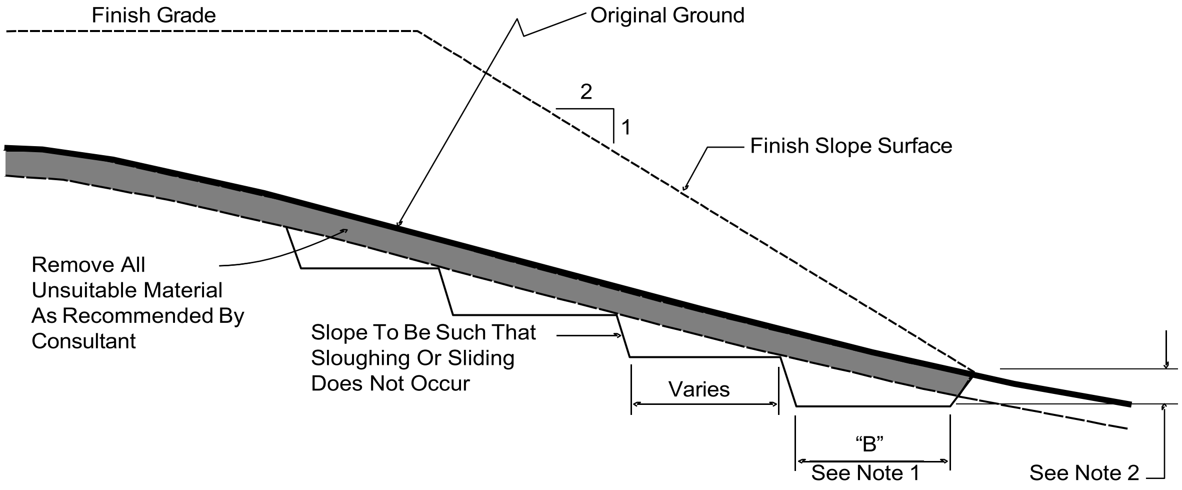
4.1 Areas to be excavated and filled shall be cleared and grubbed. Clearing shall consist of complete removal above the ground surface of trees, stumps, brush, vegetation, man-made structures, and similar debris. Grubbing shall consist of removal of stumps, roots, buried logs and other unsuitable material and shall be performed in areas to be graded. Roots and other projections exceeding 1½ inches in diameter shall be removed to a depth of 3 feet below the surface of the ground. Borrow areas shall be grubbed to the extent necessary to provide suitable fill materials.

4.2 Asphalt pavement material removed during clearing operations should be properly disposed at an approved off-site facility or in an acceptable area of the project evaluated by Geocon and the property owner. Concrete fragments that are free of reinforcing steel may be placed in fills, provided they are placed in accordance with Section 6.2 or 6.3 of this document.

4.3 After clearing and grubbing of organic matter and other unsuitable material, loose or porous soils shall be removed to the depth recommended in the Geotechnical Report. The depth of removal and compaction should be observed and approved by a representative of the Consultant. The exposed surface shall then be plowed or scarified to a minimum depth of 6 inches and until the surface is free from uneven features that would tend to prevent uniform compaction by the equipment to be used.

4.4 Where the slope ratio of the original ground is steeper than 5:1 (horizontal:vertical), or where recommended by the Consultant, the original ground should be benched in accordance with the following illustration.

TYPICAL BENCHING DETAIL



No Scale

DETAIL NOTES: (1) Key width "B" should be a minimum of 10 feet, or sufficiently wide to permit complete coverage with the compaction equipment used. The base of the key should be graded horizontal, or inclined slightly into the natural slope.

(2) The outside of the key should be below the topsoil or unsuitable surficial material and at least 2 feet into dense formational material. Where hard rock is exposed in the bottom of the key, the depth and configuration of the key may be modified as approved by the Consultant.

4.5 After areas to receive fill have been cleared and scarified, the surface should be moisture conditioned to achieve the proper moisture content, and compacted as recommended in Section 6 of these specifications.

5. COMPACTION EQUIPMENT

5.1 Compaction of *soil* or *soil-rock* fill shall be accomplished by sheepsfoot or segmented-steel wheeled rollers, vibratory rollers, multiple-wheel pneumatic-tired rollers, or other types of acceptable compaction equipment. Equipment shall be of such a design that it will be capable of compacting the *soil* or *soil-rock* fill to the specified relative compaction at the specified moisture content.

5.2 Compaction of *rock* fills shall be performed in accordance with Section 6.3.

6. PLACING, SPREADING AND COMPACTION OF FILL MATERIAL

6.1 *Soil* fill, as defined in Paragraph 3.1.1, shall be placed by the Contractor in accordance with the following recommendations:

6.1.1 *Soil* fill shall be placed by the Contractor in layers that, when compacted, should generally not exceed 8 inches. Each layer shall be spread evenly and shall be thoroughly mixed during spreading to obtain uniformity of material and moisture in each layer. The entire fill shall be constructed as a unit in nearly level lifts. Rock materials greater than 12 inches in maximum dimension shall be placed in accordance with Section 6.2 or 6.3 of these specifications.

6.1.2 In general, the *soil* fill shall be compacted at a moisture content at or above the optimum moisture content as determined by ASTM D 1557.

6.1.3 When the moisture content of *soil* fill is below that specified by the Consultant, water shall be added by the Contractor until the moisture content is in the range specified.

6.1.4 When the moisture content of the *soil* fill is above the range specified by the Consultant or too wet to achieve proper compaction, the *soil* fill shall be aerated by the Contractor by blading/mixing, or other satisfactory methods until the moisture content is within the range specified.

6.1.5 After each layer has been placed, mixed, and spread evenly, it shall be thoroughly compacted by the Contractor to a relative compaction of at least 90 percent. Relative compaction is defined as the ratio (expressed in percent) of the in-place dry density of the compacted fill to the maximum laboratory dry density as determined in accordance with ASTM D 1557. Compaction shall be continuous over the entire area, and compaction equipment shall make sufficient passes so that the specified minimum relative compaction has been achieved throughout the entire fill.

6.1.6 Where practical, soils having an Expansion Index greater than 50 should be placed at least 3 feet below finish pad grade and should be compacted at a moisture content generally 2 to 4 percent greater than the optimum moisture content for the material.

6.1.7 Properly compacted *soil* fill shall extend to the design surface of fill slopes. To achieve proper compaction, it is recommended that fill slopes be over-built by at least 3 feet and then cut to the design grade. This procedure is considered preferable to track-walking of slopes, as described in the following paragraph.

6.1.8 As an alternative to over-building of slopes, slope faces may be back-rolled with a heavy-duty loaded sheepsfoot or vibratory roller at maximum 4-foot fill height intervals. Upon completion, slopes should then be track-walked with a D-8 dozer or similar equipment, such that a dozer track covers all slope surfaces at least twice.

6.2 *Soil-rock* fill, as defined in Paragraph 3.1.2, shall be placed by the Contractor in accordance with the following recommendations:

6.2.1 Rocks larger than 12 inches but less than 4 feet in maximum dimension may be incorporated into the compacted *soil* fill, but shall be limited to the area measured 15 feet minimum horizontally from the slope face and 5 feet below finish grade or 3 feet below the deepest utility, whichever is deeper.

6.2.2 Rocks or rock fragments up to 4 feet in maximum dimension may either be individually placed or placed in windrows. Under certain conditions, rocks or rock fragments up to 10 feet in maximum dimension may be placed using similar methods. The acceptability of placing rock materials greater than 4 feet in maximum dimension shall be evaluated during grading as specific cases arise and shall be approved by the Consultant prior to placement.

6.2.3 For individual placement, sufficient space shall be provided between rocks to allow for passage of compaction equipment.

6.2.4 For windrow placement, the rocks should be placed in trenches excavated in properly compacted *soil* fill. Trenches should be approximately 5 feet wide and 4 feet deep in maximum dimension. The voids around and beneath rocks should be filled with approved granular soil having a Sand Equivalent of 30 or greater and should be compacted by flooding. Windrows may also be placed utilizing an "open-face" method in lieu of the trench procedure, however, this method should first be approved by the Consultant.

6.2.5 Windrows should generally be parallel to each other and may be placed either parallel to or perpendicular to the face of the slope depending on the site geometry. The minimum horizontal spacing for windrows shall be 12 feet center-to-center with a 5-foot stagger or offset from lower courses to next overlying course. The minimum vertical spacing between windrow courses shall be 2 feet from the top of a lower windrow to the bottom of the next higher windrow.

6.2.6 Rock placement, fill placement and flooding of approved granular soil in the windrows should be continuously observed by the Consultant.

6.3 *Rock* fills, as defined in Section 3.1.3, shall be placed by the Contractor in accordance with the following recommendations:

6.3.1 The base of the *rock* fill shall be placed on a sloping surface (minimum slope of 2 percent). The surface shall slope toward suitable subdrainage outlet facilities. The *rock* fills shall be provided with subdrains during construction so that a hydrostatic pressure buildup does not develop. The subdrains shall be permanently connected to controlled drainage facilities to control post-construction infiltration of water.

6.3.2 *Rock* fills shall be placed in lifts not exceeding 3 feet. Placement shall be by rock trucks traversing previously placed lifts and dumping at the edge of the currently placed lift. Spreading of the *rock* fill shall be by dozer to facilitate *seating* of the rock. The *rock* fill shall be watered heavily during placement. Watering shall consist of water trucks traversing in front of the current rock lift face and spraying water continuously during rock placement. Compaction equipment with compactive energy comparable to or greater than that of a 20-ton steel vibratory roller or other compaction equipment providing suitable energy to achieve the required compaction or deflection as recommended in Paragraph 6.3.3 shall be utilized. The number of passes to be made should be determined as described in Paragraph 6.3.3. Once a *rock* fill lift has been covered with *soil* fill, no additional *rock* fill lifts will be permitted over the *soil* fill.

6.3.3 Plate bearing tests, in accordance with ASTM D 1196, may be performed in both the compacted *soil* fill and in the *rock* fill to aid in determining the required minimum number of passes of the compaction equipment. If performed, a minimum of three plate bearing tests should be performed in the properly compacted *soil* fill (minimum relative compaction of 90 percent). Plate bearing tests shall then be performed on areas of *rock* fill having two passes, four passes and six passes of the compaction equipment, respectively. The number of passes required for the *rock* fill shall be determined by comparing the results of the plate bearing tests for the *soil* fill and the *rock* fill and by evaluating the deflection variation with number of passes. The required number of passes of the compaction equipment will be performed as necessary until the plate bearing deflections are equal to or less than that determined for the properly compacted *soil* fill. In no case will the required number of passes be less than two.

6.3.4 A representative of the Consultant should be present during *rock* fill operations to observe that the minimum number of "passes" have been obtained, that water is being properly applied and that specified procedures are being followed. The actual number of plate bearing tests will be determined by the Consultant during grading.

6.3.5 Test pits shall be excavated by the Contractor so that the Consultant can state that, in their opinion, sufficient water is present and that voids between large rocks are properly filled with smaller rock material. In-place density testing will not be required in the *rock* fills.

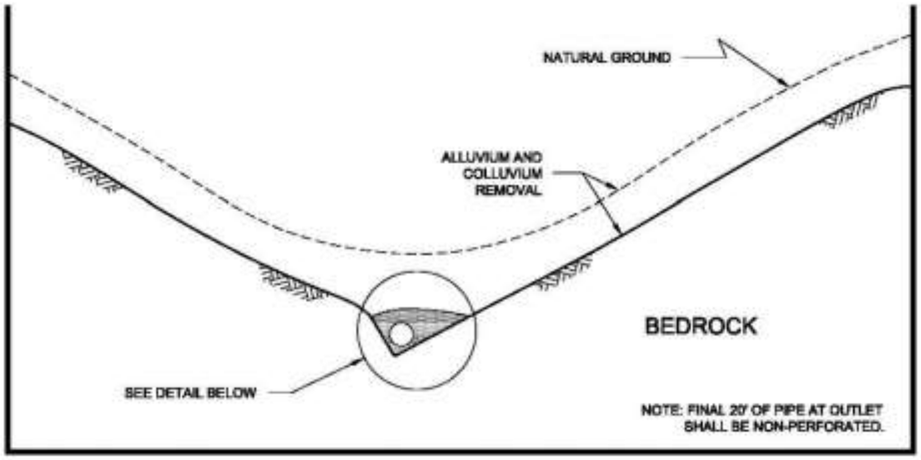
6.3.6 To reduce the potential for "piping" of fines into the *rock* fill from overlying *soil* fill material, a 2-foot layer of graded filter material shall be placed above the uppermost lift of *rock* fill. The need to place graded filter material below the *rock* should be determined by the Consultant prior to commencing grading. The gradation of the graded filter material will be determined at the time the *rock* fill is being excavated. Materials typical of the *rock* fill should be submitted to the Consultant in a timely manner, to allow design of the graded filter prior to the commencement of *rock* fill placement.

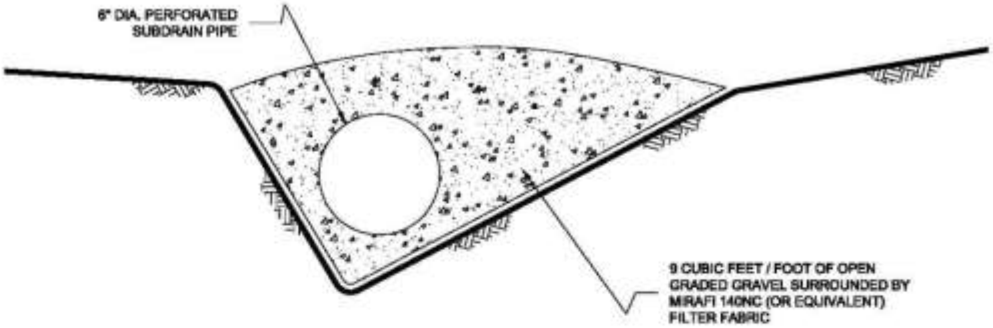
6.3.7 *Rock* fill placement should be continuously observed during placement by the Consultant.

7. SUBDRAINS

7.1 The geologic units on the site may have permeability characteristics and/or fracture systems that could be susceptible under certain conditions to seepage. The use of canyon subdrains may be necessary to mitigate the potential for adverse impacts associated with seepage conditions. Canyon subdrains with lengths in excess of 500 feet or extensions of existing offsite subdrains should use 8-inch-diameter pipes. Canyon subdrains less than 500 feet in length should use 6-inch-diameter pipes.

TYPICAL CANYON DRAIN DETAIL





NOTES:

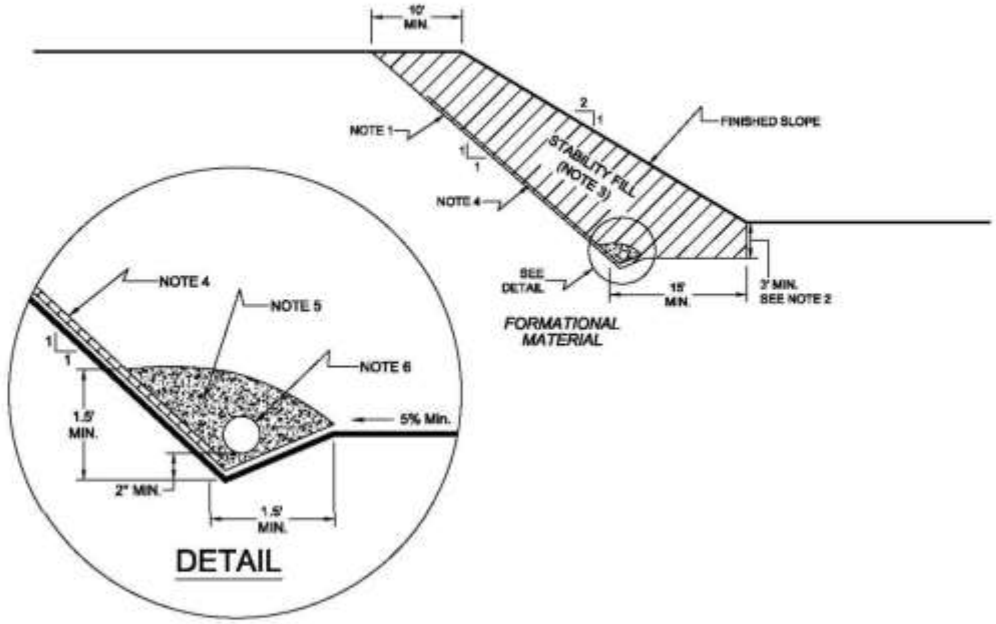
1......6-INCH DIAMETER, SCHEDULE 80 PVC PERFORATED PIPE FOR FILLS IN EXCESS OF 100-FEET IN DEPTH OR A PIPE LENGTH OF LONGER THAN 500 FEET.

2......6-INCH DIAMETER, SCHEDULE 40 PVC PERFORATED PIPE FOR FILLS LESS THAN 100-FEET IN DEPTH OR A PIPE LENGTH SHORTER THAN 500 FEET.

NO SCALE

7.2 Slope drains within stability fill keyways should use 4-inch-diameter (or lager) pipes.

TYPICAL STABILITY FILL DETAIL



NOTES:

1.....EXCAVATE BACKCUT AT 1:1 INCLINATION (UNLESS OTHERWISE NOTED).

2.....BASE OF STABILITY FILL TO BE 3 FEET INTO FORMATIONAL MATERIAL, SLOPING A MINIMUM 5% INTO SLOPE.

3.....STABILITY FILL TO BE COMPOSED OF PROPERLY COMPACTED GRANULAR SOIL.

4.....CHIMNEY DRAINS TO BE APPROVED PREFABRICATED CHIMNEY DRAIN PANELS (MIRADRAIN G200N OR EQUIVALENT) SPACED APPROXIMATELY 20 FEET CENTER TO CENTER AND 4 FEET WIDE. CLOSER SPACING MAY BE REQUIRED IF SEEPAGE IS ENCOUNTERED.

5.....FILTER MATERIAL TO BE 3/4-INCH, OPEN-GRADED CRUSHED ROCK ENCLOSED IN APPROVED FILTER FABRIC (MIRAFI 140NC).

6.....COLLECTOR PIPE TO BE 4-INCH MINIMUM DIAMETER, PERFORATED, THICK-WALLED PVC SCHEDULE 40 OR EQUIVALENT, AND SLOPED TO DRAIN AT 1 PERCENT MINIMUM TO APPROVED OUTLET.

NO SCALE

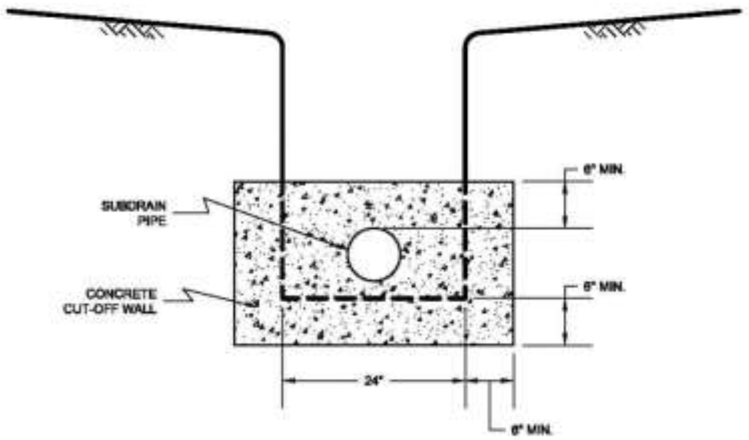
7.3 The actual subdrain locations will be evaluated in the field during the remedial grading operations. Additional drains may be necessary depending on the conditions observed and the requirements of the local regulatory agencies. Appropriate subdrain outlets should be evaluated prior to finalizing 40-scale grading plans.

7.4 *Rock* fill or *soil-rock* fill areas may require subdrains along their down-slope perimeters to mitigate the potential for buildup of water from construction or landscape irrigation. The subdrains should be at least 6-inch-diameter pipes encapsulated in gravel and filter fabric. *Rock* fill drains should be constructed using the same requirements as canyon subdrains.

7.5 Prior to outletting, the final 20-foot segment of a subdrain that will not be extended during future development should consist of non-perforated drainpipe. At the non-perforated/ perforated interface, a seepage cutoff wall should be constructed on the downslope side of the pipe.

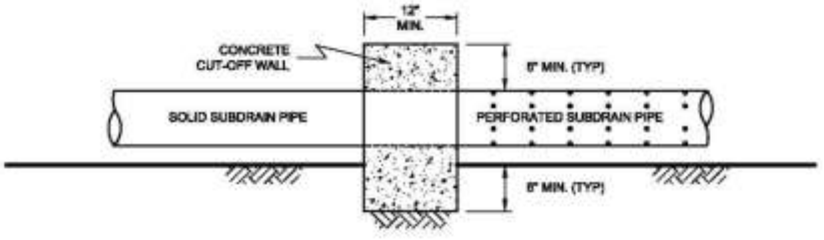
TYPICAL CUT OFF WALL DETAIL

FRONT VIEW



NO SCALE

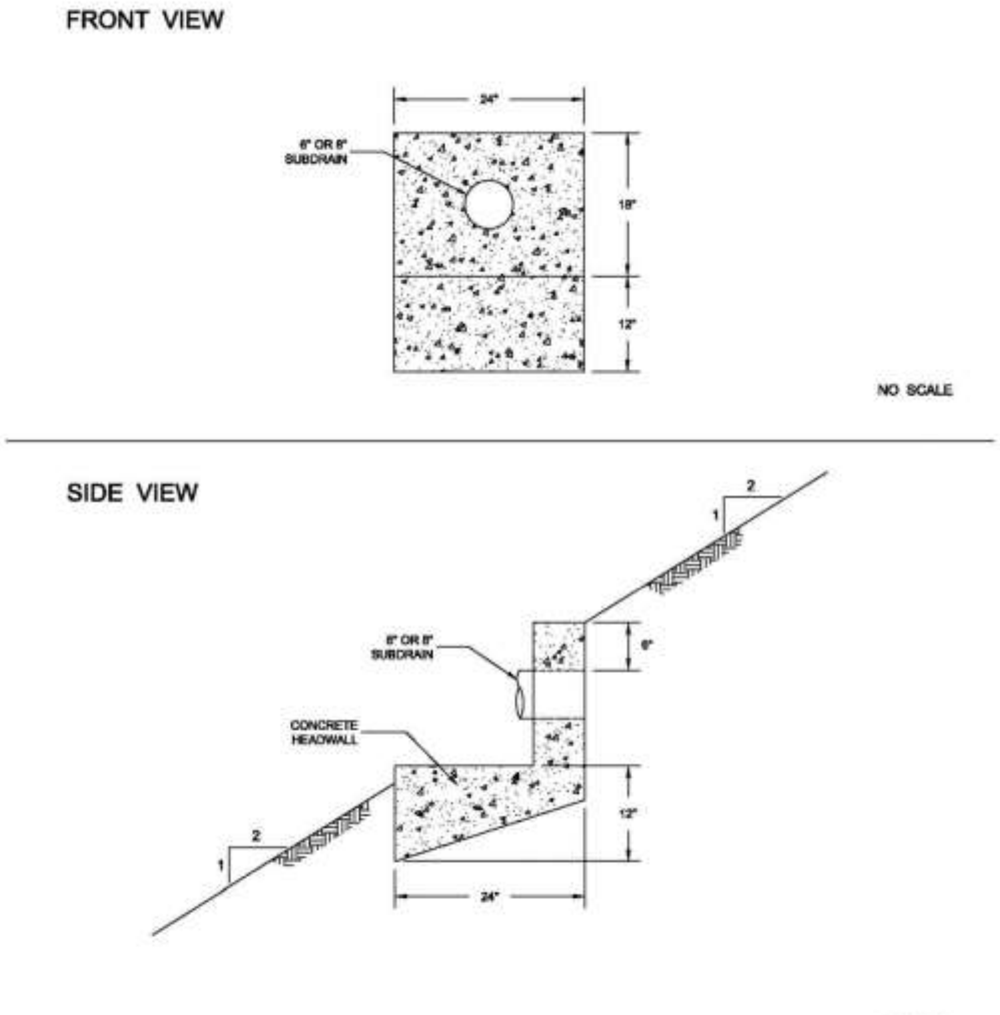
SIDE VIEW



NO SCALE

7.6 Subdrains that discharge into a natural drainage course or open space area should be provided with a permanent headwall structure.

TYPICAL HEADWALL DETAIL



NOTE: HEADWALL SHOULD OUTLET AT TOE OF FILL SLOPE OR INTO CONTROLLED SURFACE DRAINAGE

NO SCALE

7.7 The final grading plans should show the location of the proposed subdrains. After completion of remedial excavations and subdrain installation, the project civil engineer should survey the drain locations and prepare an "as-built" map showing the drain locations. The final outlet and connection locations should be determined during grading operations. Subdrains that will be extended on adjacent projects after grading can be placed on formational material and a vertical riser should be placed at the end of the subdrain. The grading contractor should consider videoing the subdrains shortly after burial to check proper installation and functionality. The contractor is responsible for the performance of the drains.

8. OBSERVATION AND TESTING

8.1 The Consultant shall be the Owner's representative to observe and perform tests during clearing, grubbing, filling, and compaction operations. In general, no more than 2 feet in vertical elevation of *soil* or *soil-rock* fill should be placed without at least one field density test being performed within that interval. In addition, a minimum of one field density test should be performed for every 2,000 cubic yards of *soil* or *soil-rock* fill placed and compacted.

8.2 The Consultant should perform a sufficient distribution of field density tests of the compacted *soil* or *soil-rock* fill to provide a basis for expressing an opinion whether the fill material is compacted as specified. Density tests shall be performed in the compacted materials below any disturbed surface. When these tests indicate that the density of any layer of fill or portion thereof is below that specified, the particular layer or areas represented by the test shall be reworked until the specified density has been achieved.

8.3 During placement of *rock* fill, the Consultant should observe that the minimum number of passes have been obtained per the criteria discussed in Section 6.3.3. The Consultant should request the excavation of observation pits and may perform plate bearing tests on the placed *rock* fills. The observation pits will be excavated to provide a basis for expressing an opinion as to whether the *rock* fill is properly seated and sufficient moisture has been applied to the material. When observations indicate that a layer of *rock* fill or any portion thereof is below that specified, the affected layer or area shall be reworked until the *rock* fill has been adequately seated and sufficient moisture applied.

8.4 A settlement monitoring program designed by the Consultant may be conducted in areas of *rock* fill placement. The specific design of the monitoring program shall be as recommended in the Conclusions and Recommendations section of the project Geotechnical Report or in the final report of testing and observation services performed during grading.

8.5 We should observe the placement of subdrains, to check that the drainage devices have been placed and constructed in substantial conformance with project specifications.

8.6 Testing procedures shall conform to the following Standards as appropriate:

8.6.1 **Soil and Soil-Rock Fills:**

8.6.1.1 Field Density Test, ASTM D 1556, *Density of Soil In-Place By the Sand-Cone Method.*

8.6.1.2 Field Density Test, Nuclear Method, ASTM D 6938, *Density of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth).*

8.6.1.3 Laboratory Compaction Test, ASTM D 1557, *Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-Pound Hammer and 18-Inch Drop*.

8.6.1.4 Expansion Index Test, ASTM D 4829, *Expansion Index Test*.

9. PROTECTION OF WORK

9.1 During construction, the Contractor shall properly grade all excavated surfaces to provide positive drainage and prevent ponding of water. Drainage of surface water shall be controlled to avoid damage to adjoining properties or to finished work on the site. The Contractor shall take remedial measures to prevent erosion of freshly graded areas until such time as permanent drainage and erosion control features have been installed. Areas subjected to erosion or sedimentation shall be properly prepared in accordance with the Specifications prior to placing additional fill or structures.

9.2 After completion of grading as observed and tested by the Consultant, no further excavation or filling shall be conducted except in conjunction with the services of the Consultant.

10. CERTIFICATIONS AND FINAL REPORTS

10.1 Upon completion of the work, Contractor shall furnish Owner a certification by the Civil Engineer stating that the lots and/or building pads are graded to within 0.1 foot vertically of elevations shown on the grading plan and that all tops and toes of slopes are within 0.5 foot horizontally of the positions shown on the grading plans. After installation of a section of subdrain, the project Civil Engineer should survey its location and prepare an *as-built* plan of the subdrain location. The project Civil Engineer should verify the proper outlet for the subdrains and the Contractor should ensure that the drain system is free of obstructions.

10.2 The Owner is responsible for furnishing a final as-graded soil and geologic report satisfactory to the appropriate governing or accepting agencies. The as-graded report should be prepared and signed by a California licensed Civil Engineer experienced in geotechnical engineering and by a California Certified Engineering Geologist, indicating that the geotechnical aspects of the grading were performed in substantial conformance with the Specifications or approved changes to the Specifications.

Appendix F

Site Design BMP Sizing and Hydrologic Data

ABODE PARK LANE HOMES

PARK LANE
DESERT HOT SPRINGS, CA

PRELIMINARY HYDROLOGY REPORT

PREPARED FOR:
ABODE COMMUNITIES
1149 S. HILL STREET, SUITE 700
LOS ANGELES, CA 90015
(213) 629-2702

PREPARED BY:
TheAltumGroup
44-600 VILLAGE COURT, SUITE 100
PALM DESERT, CA 92260
(760) 346-4750

FEBRUARY 2025

Prepared Under the Supervision of:

3/3/25

James R. Bazua, PE
R.C.E. 58394
Expiration Date: December 31, 2026

REGISTERED PROFESSIONAL ENGINEER
JAMES RON BAZUA
No 58394
Exp. 12/31/26
CIVIL
STATE OF CALIFORNIA

ABODE PARK LANE HOMES

PRELIMINARY HYDROLOGY REPORT

TABLE OF CONTENTS:

I. PURPOSE AND SCOPE

This preliminary report was prepared in support of the Abode Park Lane Homes entitlement package. The purpose of this report is to analyze the existing and proposed drainage patterns, discuss the on-site drainage design and identify the proposed on-site drainage facilities in order to meet the City of Desert Hot Springs drainage requirements.

The proposed project consists of the development of 167 apartments on a portion of an existing lot. The proposed apartment site is approximately 7.54 acres and will consist of seven (7) multi-story apartment buildings, a childhood education building, streets, parking, utilities, landscape, pool, clubhouse and other amenities, and an on-site retention area. The project is bounded to the west by a Riverside County Health building, County Library building, parking lot, landscape and retention basins; to the south by Park Lane, a public street; to the east by Desert Springs Middle School (Palm Springs Unified School District property) with adjacent facilities including basketball courts, grassed play fields, parking and secondary access to Park Lane; and to the north by a neighborhood commercial/retail site anchored by Vons grocery store.

The project site is currently undeveloped and 100% impervious, with topography sloping gently from the northwest corner to the southeast corner. In general, the existing site is not subject to offsite storm flows and there is no existing onsite retention of storm flow. However, to the west, both the Riverside County Health Building and the Riverside County Library have their own retention facilities. These are designed to capture the storm flow, and if exceeded, overflow at the southwest corner of our project site. The proposed concept plans will include a new overflow for the library retention basin which drains directly to Park Lane. Further, the Von's commercial/retail site (off-site) drains southeasterly to an existing retention basin, near the northeast corner of our project. The emergency overflow spillway for this off-site basin is along the project's northerly property line, where a 25'x 50' easement was dedicated to provide room for acceptance/conveyance of any overflow. Since the Vons's commercial/retail site was developed more than twenty years ago, no as-built drawings or reports were available for our review. Nevertheless, we contend that this adjacent site is responsible for retaining the developed 100-year storm flow onsite, its basin should be sized appropriately, and that any overflow passed through our site will be the result of emergency flood conditions and will not be considered as "comingled" flow for the purposes of water quality. Any overflow from this off-site basin will be directed southerly along the project's onsite streets, towards Park Lane. Our preliminary report includes a brief, separate analysis of the retail site's potential design storm runoff volume and analysis to confirm that the area designated for off-site retention can adequately store the volume generated off-site during the 100 year storm event.

The proposed grading for the apartment site will generally follow the topography, draining from the northwest to the southeast, where a retention basin is proposed to capture the 100-year developed storm flow. The retention basin will be developed primarily for storm retention, but may also be used as a passive park. As such, pedestrian access is proposed along with minor improvements such as a walking path, etc. Improvements must be evaluated so that impervious areas are minimized.

II. DESIGN METHODOLOGY AND CALCULATIONS

The project improvements will provide an on-site storm drain system designed to capture and convey the runoff generated from a 100 year design storm toward an on-site infiltration basin with the capacity to the runoff volume generated on-site during the design storm event. the design storm based on the existing undeveloped condition.

On-site tested infiltration rates are in excess of 20 in/hr. and an infiltration of 2 in/he has been conservatively assumed for design purposes. Riverside County Flood Control District Short Cut Synthetic Unit Hydrograph methods are used to quantify the runoff volume generated and stored on-site during the design storm return period. Local vector control standards requires that surface runoff water stored on-site must be evacuated completely via infiltration within a period of 48 hours in order to be in compliance. Section IV of this report provides an Infiltration Drawdown Summary based on the maximum design depth and volume of the retention infiltration systems to show that the evacuation design requirement has been met.

DESIGN CRITERIA

The following Riverside County Flood Control District (RCFCD) parameters were used in the preparation of the analyses:

• 100 year – 3 hour Precipitation	2.24” (NOAA)
• 100 year – 6 hour Precipitation	2.94” (NOAA)
• 100 year – 24 hour Precipitation	4.63” (NOAA)
• Hydrologic Soil Type “A”	RCFC&WCD Plate C-1.22
• Runoff Index Number	32 (RCFC&WCD Plate E-6.1)
• Assumed Design Percolation Rate	2 in/hr

	A	B	C	D
1	**RCFCD SHORT CUT SYNTHETIC UNIT HYDROGRAPH**			
2	DATA INPUT SHEET			
3				
4	WORKSHEET PREPARED BY:	JAMES R. BAZUA, P.E.		
5				
6	PROJECT NAME	PARK LANE HOMES		
7	JOB #	C2013		
8				
9	CONCENTRATION POINT DESIGNATION	RETENTION BASIN		
10	AREA DESIGNATION	ON-SITE POST-DEVELOPMENT		
11				
12	TRIBUTARY AREAS	7.547 ACRES		
13				
14	COMMERCIAL			
15	PAVING/HARDSCAPE			
16	SF - 1 ACRE			
17	SF - 1/2 ACRE			
18	SF - 1/4 ACRE			
19	MF - CONDOMINIUMS			
20	MF - APARTMENTS	7.547		
21	MOBILE HOME PARK			
22	LANDSCAPING			
23	RETENTION BASIN			
24	GOLF COURSE			
25	MOUNTAINOUS			
26	LOW LOSS RATE (PERCENT)	90%		
27				
28	LENGTH OF WATERCOURSE (L)	691		
29	LENGTH TO POINT OPPOSITE CENTROID (Lca)	350		
30				
31	ELEVATION OF HEADWATER	923.5		
32	ELEVATION OF CONCENTRATION POINT	908.5		
33				
34	AVERAGE MANNINGS 'N' VALUE	0.02		
35				
36	STORM FREQUENCY (YEAR)	100		
37				
38	POINT RAIN			
39	3-HOUR	2.45		
40	6-HOUR	3.18		
41	24-HOUR	5.23		
42				
43	BASIN CHARACTERISTICS:	ELEVATION	AREA	
44		901.4	9240	
45		902.4	10442	
46		903.4	11718	
47		904.4	13068	
48		905.4	14490	
49		906.4	15984	
50		907.4	17552	
51				
52	PERCOLATION RATE (in/hr)	2		
53		.		
54	DRYWELL DATA			
55	NUMBER USED	2		
56	PERCOLATION RATE (cfs)	0.1		

RCFCD SYNTHETIC UNIT HYDROGRAPH METHOD

BASIC DATA CALCULATION FORM

SHORTCUT METHOD

PROJECT: PARK LANE HOMES

JOB # C2013

BY ES R. BAZUA, P.E. DATE 3/3/2025

PHYSICAL DATA

[1] CONCENTRATION POINT	RETENTION BASIN
[2] AREA DESIGNATION	ON-SITE POST-DEVELOPMENT
[3] AREA - ACRES	7.547
[4] L-FEET	691
[5] L-MILES	0.131
[6] La-FEET	350.00
[7] La-MILES	0.066
[8] ELEVATION OF HEADWATER	923.5
[9] ELEVATION OF CONCENTRATION POINT	908.5
[10] H-FEET	15
[11] S-FEET/MILE	114.6
[12] S^0.5	10.71
[13] L*LCA/S^0.5	0.001
[14] AVERAGE MANNINGS 'N'	0.02
[15] LAG TIME-HOURS	0.03
[16] LAG TIME-MINUTES	1.9
[17] 100% OF LAG-MINUTES	1.9
[18] 200% OF LAG-MINUTES	3.9
[19] UNIT TIME-MINUTES (100%-200% OF LAG)	5
[24] TOTAL PERCOLATION RATE (cfs)	0.63

RAINFALL DATA

[1] SOURCE

[2] FREQUENCY-YEARS 100

[3] DURATION:

3-HOURS				6-HOURS				24-HOURS			
[4] POINT RAIN INCHES (Plate E-5.2)	[5] AREA	[6]	[7] AVERAGE POINT RAIN INCHES	[8] POINT RAIN INCHES (Plate E-5.4)	[9] AREA	[10]	[11] AVERAGE POINT RAIN INCHES	[12] POINT RAIN INCHES (Plate E-5.6)	[13] AREA	[14]	[15] AVERAGE POINT RAIN INCHES
2.45	7.547	1.00	2.45	3.18	7.547	1.00	3.18	5.23	7.547	1.00	5.23
		0.00	0.00			0.00	0.00			0.00	0.00
		0.00	0.00			0.00	0.00			0.00	0.00
		0.00	0.00			0.00	0.00			0.00	0.00
SUM [5]	7.547	SUM [7]	2.45	SUM [9]	7.55	SUM [11]	3.18	SUM [13]	7.55	SUM [15]	5.23
[16] AREA ADJ FACTOR			1.000				1.000				1.000
[17] ADJ AVG POINT RAIN			2.45				3.18				5.23

STORM EVENT SUMMARY

DURATION		3-HOUR	6-HOUR	24-HOUR
EFFECTIVE RAIN	(in)	1.83	1.96	2.24
FLOOD VOLUME	(cu-ft)	50,201	53,776	61,481
	(acre-ft)	1.15	1.23	1.41
REQUIRED STORAGE	(cu-ft)	43,154	41,406	38,933
	(acre-ft)	0.99	0.95	0.89
PEAK FLOW	(cfs)	16.63	14.56	4.02
MAXIMUM WSEL	(ft)	905.08	904.95	904.70

RCFCD SYNTHETIC UNIT HYDROGRAPH METHOD

PROJECT PARK LANE HOMES
CONCENTRATION POINT: RETENTION BASIN
BY MES R. BAZUA, P.E. DATE 3/3/2025

ADJUSTED LOSS RATE

SOIL GROUP [Plate C-1]	LAND USE	RI NUMBER [Plate E-6.1]	PERVIOUS AREA INFILTRATION RATE (in/hr) [Plate E-6.2]	DECIMAL PERCENT OF AREA IMPERVIOUS [Plate E-6.3]	ADJUSTED INFILTRATION RATE (in/hr)	AREA		AVERAGE ADJUSTED INFILTRATION RATE (in/hr)
A	COMMERCIAL	32	0.74	90%	0.14	0.00	0.000	0.0000
A	PAVING/HARDSCAPE	32	0.74	100%	0.07	0.00	0.000	0.0000
A	SF - 1 ACRE	32	0.74	20%	0.61	0.00	0.000	0.0000
A	SF - 1/2 ACRE	32	0.74	40%	0.47	0.00	0.000	0.0000
A	SF - 1/4 ACRE	32	0.74	50%	0.41	0.00	0.000	0.0000
A	MF - COND0MINIUMS	32	0.74	65%	0.31	0.00	0.000	0.0000
A	MF - APARTMENTS	32	0.74	80%	0.21	7.55	1.000	0.2072
A	MOBILE HOME PARKS	32	0.74	75%	0.24	0.00	0.000	0.0000
A	LANDSCAPING	32	0.74	0%	0.74	0.00	0.000	0.0000
A	RETENTION BASINS	32	0.74	0%	0.74	0.00	0.000	0.0000
A	GOLF COURSE	32	0.74	0%	0.74	0.00	0.000	0.0000
D	MOUNTAINOUS	93	0.95	90%	0.18	0.00	0.000	0.0000
					0.00		0.000	0.0000
					0.00		0.000	0.0000
					0.00		0.000	0.0000
					0.00		0.000	0.0000
					0.00		0.000	0.0000
					0.00		0.000	0.0000
					0.00		0.000	0.0000
					0.00		0.000	0.0000
					0.00		0.000	0.0000
					SUM	7.547	SUM	0.2072

VARIABLE LOSS RATE CURVE (24-HOUR STORM ONLY)

Fm= 0.1036
C= 0.00192

Ft=C(24-(T/60))^1.55 = 0.00192 (24-(T/60))^1.55 + 0.10 in/hr

LOW LOSS RATE (80-90 PERCENT) = 90%

Where:

T=Time in minutes. To get an average value for each unit time period, Use T=1/2 the unit time for the first time period,
T=1 1/2 unit time for the second period, etc.

RCFCD SYNTHETIC UNIT HYDROGRAPH METHOD
100 YEAR - 3 HOUR STORM EVENT

PROJECT: PARK LANE HOMES
CONCENTRATION POINT: RETENTION BASIN

BY: IES R. BAZUA, DATE 3/3/2025

EFFECTIVE RAIN CALCULATION FORM

DRAINAGE AREA-ACRES	7.55
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	1.93
UNIT TIME-PERCENT OF LAG	259.6
TOTAL ADJUSTED STORM RAIN-INCHES	2.45
CONSTANT LOSS RATE-in/hr	0.21
LOW LOSS RATE - PERCENT	90%

TOTAL PERCOLATION RATE (cfs) 0.63 cfs

Unit Time Period	Time		Pattern Percent	Storm Rain in/hr	Loss Rate in/hr		Effective Rain	Flood Hydrograph Flow	Required Storage
	Minutes	Hours	(Plate E-5.9)		Max	Low	in/hr	cfs	cf
1	5	0.08	1.3	0.382	0.21	0.34	0.18	1.32	207.88
2	10	0.17	1.3	0.382	0.21	0.34	0.18	1.32	207.88
3	15	0.25	1.1	0.323	0.21	0.29	0.12	0.88	74.76
4	20	0.33	1.5	0.441	0.21	0.40	0.23	1.76	341.01
5	25	0.42	1.5	0.441	0.21	0.40	0.23	1.76	341.01
6	30	0.50	1.8	0.529	0.21	0.48	0.32	2.43	540.71
7	35	0.58	1.5	0.441	0.21	0.40	0.23	1.76	341.01
8	40	0.67	1.8	0.529	0.21	0.48	0.32	2.43	540.71
9	45	0.75	1.8	0.529	0.21	0.48	0.32	2.43	540.71
10	50	0.83	1.5	0.441	0.21	0.40	0.23	1.76	341.01
11	55	0.92	1.6	0.470	0.21	0.42	0.26	1.99	407.58
12	60	1.00	1.8	0.529	0.21	0.48	0.32	2.43	540.71
13	65	1.08	2.2	0.647	0.21	0.58	0.44	3.32	806.97
14	70	1.17	2.2	0.647	0.21	0.58	0.44	3.32	806.97
15	75	1.25	2.2	0.647	0.21	0.58	0.44	3.32	806.97
16	80	1.33	2.0	0.588	0.21	0.53	0.38	2.87	673.84
17	85	1.42	2.6	0.764	0.21	0.69	0.56	4.21	1073.22
18	90	1.50	2.7	0.794	0.21	0.71	0.59	4.43	1139.79
19	95	1.58	2.4	0.706	0.21	0.64	0.50	3.76	940.09
20	100	1.67	2.7	0.794	0.21	0.71	0.59	4.43	1139.79
21	105	1.75	3.3	0.970	0.21	0.87	0.76	5.76	1539.17
22	110	1.83	3.1	0.911	0.21	0.82	0.70	5.31	1406.05
23	115	1.92	2.9	0.853	0.21	0.77	0.65	4.87	1272.92
24	120	2.00	3.0	0.882	0.21	0.79	0.67	5.09	1339.48
25	125	2.08	3.1	0.911	0.21	0.82	0.70	5.31	1406.05
26	130	2.17	4.2	1.235	0.21	1.11	1.03	7.76	2138.26
27	135	2.25	5.0	1.470	0.21	1.32	1.26	9.53	2670.77
28	140	2.33	3.5	1.029	0.21	0.93	0.82	6.20	1672.30
29	145	2.42	6.8	1.999	0.21	1.80	1.79	13.52	3868.93
30	150	2.50	7.3	2.146	0.21	1.93	1.94	14.63	4201.76
31	155	2.58	8.2	2.411	0.21	2.17	2.20	16.63	4800.84
32	160	2.67	5.9	1.735	0.21	1.56	1.53	11.53	3269.85
33	165	2.75	2.0	0.588	0.21	0.53	0.38	2.87	673.84
34	170	2.83	1.8	0.529	0.21	0.48	0.32	2.43	540.71
35	175	2.92	1.8	0.529	0.21	0.48	0.32	2.43	540.71
36	180	3.00	0.6	0.176	0.21	0.16	0.02	0.13	0.00

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

EFFECTIVE RAIN (in)	1.83
FLOOD VOLUME (acft)	1.15
FLOOD VOLUME (cuft)	50200.92
REQUIRED STORAGE (acft)	0.99
REQUIRED STORAGE (cuft)	43154.23
PEAK FLOW RATE (cfs)	16.63

RCFCD SYNTHETIC UNIT HYDROGRAPH METHOD
100 YEAR - 6 HOUR STORM EVENT

PROJECT: PARK LANE HOMES
CONCENTRATION POINT: RETENTION BASIN

BY: JAMES R. BAZ DATE: 3/3/2025

EFFECTIVE RAIN CALCULATION FORM

DRAINAGE AREA-ACRES	7.55
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	1.93
UNIT TIME-PERCENT OF LAG	259.6
TOTAL ADJUSTED STORM RAIN-INCHES	3.18
CONSTANT LOSS RATE-in/hr	0.207
LOW LOSS RATE - PERCENT	90%

TOTAL PERCOLATION RATE (cfs) 0.63 cfs

Unit Time Period	Time		Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr		Effective Rain in/hr	Flood Hydrograph Flow cfs	Required Storage cf
	Minutes	Hours			Max	Low			
1	5	0.08	0.5	0.191	0.21	0.17	0.02	0.14	0.00
2	10	0.17	0.6	0.229	0.21	0.21	0.02	0.16	0.00
3	15	0.25	0.6	0.229	0.21	0.21	0.02	0.16	0.00
4	20	0.33	0.6	0.229	0.21	0.21	0.02	0.16	0.00
5	25	0.42	0.6	0.229	0.21	0.21	0.02	0.16	0.00
6	30	0.50	0.7	0.267	0.21	0.24	0.06	0.45	0.00
7	35	0.58	0.7	0.267	0.21	0.24	0.06	0.45	0.00
8	40	0.67	0.7	0.267	0.21	0.24	0.06	0.45	0.00
9	45	0.75	0.7	0.267	0.21	0.24	0.06	0.45	0.00
10	50	0.83	0.7	0.267	0.21	0.24	0.06	0.45	0.00
11	55	0.92	0.7	0.267	0.21	0.24	0.06	0.45	0.00
12	60	1.00	0.8	0.305	0.21	0.27	0.10	0.74	33.73
13	65	1.08	0.8	0.305	0.21	0.27	0.10	0.74	33.73
14	70	1.17	0.8	0.305	0.21	0.27	0.10	0.74	33.73
15	75	1.25	0.8	0.305	0.21	0.27	0.10	0.74	33.73
16	80	1.33	0.8	0.305	0.21	0.27	0.10	0.74	33.73
17	85	1.42	0.8	0.305	0.21	0.27	0.10	0.74	33.73
18	90	1.50	0.8	0.305	0.21	0.27	0.10	0.74	33.73
19	95	1.58	0.8	0.305	0.21	0.27	0.10	0.74	33.73
20	100	1.67	0.8	0.305	0.21	0.27	0.10	0.74	33.73
21	105	1.75	0.8	0.305	0.21	0.27	0.10	0.74	33.73
22	110	1.83	0.8	0.305	0.21	0.27	0.10	0.74	33.73
23	115	1.92	0.8	0.305	0.21	0.27	0.10	0.74	33.73
24	120	2.00	0.9	0.343	0.21	0.31	0.14	1.03	120.13
25	125	2.08	0.8	0.305	0.21	0.27	0.10	0.74	33.73
26	130	2.17	0.9	0.343	0.21	0.31	0.14	1.03	120.13
27	135	2.25	0.9	0.343	0.21	0.31	0.14	1.03	120.13
28	140	2.33	0.9	0.343	0.21	0.31	0.14	1.03	120.13
29	145	2.42	0.9	0.343	0.21	0.31	0.14	1.03	120.13
30	150	2.50	0.9	0.343	0.21	0.31	0.14	1.03	120.13
31	155	2.58	0.9	0.343	0.21	0.31	0.14	1.03	120.13
32	160	2.67	0.9	0.343	0.21	0.31	0.14	1.03	120.13
33	165	2.75	1.0	0.382	0.21	0.34	0.17	1.32	206.53
34	170	2.83	1.0	0.382	0.21	0.34	0.17	1.32	206.53
35	175	2.92	1.0	0.382	0.21	0.34	0.17	1.32	206.53
36	180	3.00	1.0	0.382	0.21	0.34	0.17	1.32	206.53
37	185	3.08	1.0	0.382	0.21	0.34	0.17	1.32	206.53
38	190	3.17	1.1	0.420	0.21	0.38	0.21	1.60	292.92
39	195	3.25	1.1	0.420	0.21	0.38	0.21	1.60	292.92
40	200	3.33	1.1	0.420	0.21	0.38	0.21	1.60	292.92
41	205	3.42	1.2	0.458	0.21	0.41	0.25	1.89	379.32
42	210	3.50	1.3	0.496	0.21	0.45	0.29	2.18	465.72
43	215	3.58	1.4	0.534	0.21	0.48	0.33	2.47	552.12
44	220	3.67	1.4	0.534	0.21	0.48	0.33	2.47	552.12
45	225	3.75	1.5	0.572	0.21	0.52	0.37	2.76	638.52
46	230	3.83	1.5	0.572	0.21	0.52	0.37	2.76	638.52
47	235	3.92	1.6	0.611	0.21	0.55	0.40	3.04	724.91
48	240	4.00	1.6	0.611	0.21	0.55	0.40	3.04	724.91
49	245	4.08	1.7	0.649	0.21	0.58	0.44	3.33	811.31
50	250	4.17	1.8	0.687	0.21	0.62	0.48	3.62	897.71
51	255	4.25	1.9	0.725	0.21	0.65	0.52	3.91	984.11
52	260	4.33	2.0	0.763	0.21	0.69	0.56	4.20	1070.51
53	265	4.42	2.1	0.801	0.21	0.72	0.59	4.48	1156.90
54	270	4.50	2.1	0.801	0.21	0.72	0.59	4.48	1156.90
55	275	4.58	2.2	0.840	0.21	0.76	0.63	4.77	1243.30
56	280	4.67	2.3	0.878	0.21	0.79	0.67	5.06	1329.70

RCFCD SYNTHETIC UNIT HYDROGRAPH METHOD 100 YEAR - 6 HOUR STORM EVENT	PROJECT: CONCENTRATION POINT:		PARK LANE HOMES RETENTION BASIN
	BY:	JAMES R. BAZ DATE:	3/3/2025

EFFECTIVE RAIN CALCULATION FORM

DRAINAGE AREA-ACRES	7.55
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	1.93
UNIT TIME-PERCENT OF LAG	259.6
TOTAL ADJUSTED STORM RAIN-INCHES	3.18
CONSTANT LOSS RATE-in/hr	0.207
LOW LOSS RATE - PERCENT	90%

TOTAL PERCOLATION RATE (cfs) 0.63 cfs

Unit Time Period	Time		Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr		Effective Rain in/hr	Flood Hydrograph Flow cfs	Required Storage cf
	Minutes	Hours			Max	Low			
57	285	4.75	2.4	0.916	0.21	0.82	0.71	5.35	1416.10
58	290	4.83	2.4	0.916	0.21	0.82	0.71	5.35	1416.10
59	295	4.92	2.5	0.954	0.21	0.86	0.75	5.64	1502.50
60	300	5.00	2.6	0.992	0.21	0.89	0.78	5.92	1588.89
61	305	5.08	3.1	1.183	0.21	1.06	0.98	7.36	2020.88
62	310	5.17	3.6	1.374	0.21	1.24	1.17	8.80	2452.88
63	315	5.25	3.9	1.488	0.21	1.34	1.28	9.67	2712.07
64	320	5.33	4.2	1.603	0.21	1.44	1.40	10.53	2971.26
65	325	5.42	4.7	1.794	0.21	1.61	1.59	11.97	3403.25
66	330	5.50	5.6	2.137	0.21	1.92	1.93	14.56	4180.84
67	335	5.58	1.9	0.725	0.21	0.65	0.52	3.91	984.11
68	340	5.67	0.9	0.343	0.21	0.31	0.14	1.03	120.13
69	345	5.75	0.6	0.229	0.21	0.21	0.02	0.16	0.00
70	350	5.83	0.5	0.191	0.21	0.17	0.02	0.14	0.00
71	355	5.92	0.3	0.114	0.21	0.10	0.01	0.09	0.00
72	360	6.00	0.2	0.076	0.21	0.07	0.01	0.06	0.00

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

EFFECTIVE RAIN (in)	1.96
FLOOD VOLUME (acft)	1.23
FLOOD VOLUME (cuft)	53776.06
REQUIRED STORAGE (acft)	0.95
REQUIRED STORAGE (cuft)	41406.50
PEAK FLOW RATE (cfs)	14.56

RCFCD SYNTHETIC UNIT HYDROGRAPH METHOD
100 YEAR - 24 HOUR STORM EVENT

PROJECT: PARK LANE HOMES
CONCENTRATION POINT: RETENTION BASIN

BY: JAMES R. BAZ DATE: 3/3/2025

EFFECTIVE RAIN CALCULATION FORM

DRAINAGE AREA-ACRES	7.547	CONSTANT LOSS RATE-in/hr	n/a
UNIT TIME-MINUTES	15	VARIABLE LOSS RATE (AVG) in/hr	0.2072
LAG TIME - MINUTES	1.93	MINIMUM LOSS RATE (for var. loss) - in/hr	0.104
UNIT TIME-PERCENT OF LAG	778.8	LOW LOSS RATE - DECIMAL	0.90
TOTAL ADJUSTED STORM RAIN-INCHES	5.23	C	0.00192
		PERCOLATION RATE (cfs)	0.63

Unit Time Period	Time		Pattern Percent	Storm Rain in/hr	Loss Rate in/hr		Effective Rain	Flood Hydrograph Flow	Required Storage
	Minutes	Hours	(Plate E-5.9)		Max	Low	in/hr	cfs	cf
1	15	0.25	0.2	0.042	0.366	0.038	0.004	0.03	0.00
2	30	0.50	0.3	0.063	0.362	0.056	0.006	0.05	0.00
3	45	0.75	0.3	0.063	0.357	0.056	0.006	0.05	0.00
4	60	1.00	0.4	0.084	0.353	0.075	0.008	0.06	0.00
5	75	1.25	0.3	0.063	0.349	0.056	0.006	0.05	0.00
6	90	1.50	0.3	0.063	0.345	0.056	0.006	0.05	0.00
7	105	1.75	0.3	0.063	0.341	0.056	0.006	0.05	0.00
8	120	2.00	0.4	0.084	0.337	0.075	0.008	0.06	0.00
9	135	2.25	0.4	0.084	0.333	0.075	0.008	0.06	0.00
10	150	2.50	0.4	0.084	0.329	0.075	0.008	0.06	0.00
11	165	2.75	0.5	0.105	0.325	0.094	0.010	0.08	0.00
12	180	3.00	0.5	0.105	0.321	0.094	0.010	0.08	0.00
13	195	3.25	0.5	0.105	0.317	0.094	0.010	0.08	0.00
14	210	3.50	0.5	0.105	0.313	0.094	0.010	0.08	0.00
15	225	3.75	0.5	0.105	0.309	0.094	0.010	0.08	0.00
16	240	4.00	0.6	0.126	0.305	0.113	0.013	0.09	0.00
17	255	4.25	0.6	0.126	0.301	0.113	0.013	0.09	0.00
18	270	4.50	0.7	0.146	0.297	0.132	0.015	0.11	0.00
19	285	4.75	0.7	0.146	0.293	0.132	0.015	0.11	0.00
20	300	5.00	0.8	0.167	0.290	0.151	0.017	0.13	0.00
21	315	5.25	0.6	0.126	0.286	0.113	0.013	0.09	0.00
22	330	5.50	0.7	0.146	0.282	0.132	0.015	0.11	0.00
23	345	5.75	0.8	0.167	0.278	0.151	0.017	0.13	0.00
24	360	6.00	0.8	0.167	0.275	0.151	0.017	0.13	0.00
25	375	6.25	0.9	0.188	0.271	0.169	0.019	0.14	0.00
26	390	6.50	0.9	0.188	0.267	0.169	0.019	0.14	0.00
27	405	6.75	1.0	0.209	0.264	0.188	0.021	0.16	0.00
28	420	7.00	1.0	0.209	0.260	0.188	0.021	0.16	0.00
29	435	7.25	1.0	0.209	0.257	0.188	0.021	0.16	0.00
30	450	7.50	1.1	0.230	0.253	0.207	0.023	0.17	0.00
31	465	7.75	1.2	0.251	0.250	0.226	0.001	0.01	0.00
32	480	8.00	1.3	0.272	0.246	0.245	0.026	0.19	0.00
33	495	8.25	1.5	0.314	0.243	0.282	0.071	0.53	0.00
34	510	8.50	1.5	0.314	0.240	0.282	0.074	0.56	0.00
35	525	8.75	1.6	0.335	0.236	0.301	0.099	0.74	104.21
36	540	9.00	1.7	0.356	0.233	0.320	0.123	0.93	268.90
37	555	9.25	1.9	0.397	0.230	0.358	0.168	1.27	575.48
38	570	9.50	2.0	0.418	0.226	0.377	0.192	1.45	739.76
39	585	9.75	2.1	0.439	0.223	0.395	0.216	1.63	903.84
40	600	10.00	2.2	0.460	0.220	0.414	0.240	1.81	1067.70
41	615	10.25	1.5	0.314	0.217	0.282	0.097	0.73	94.60
42	630	10.50	1.5	0.314	0.214	0.282	0.100	0.76	115.94
43	645	10.75	2.0	0.418	0.210	0.377	0.208	1.57	847.55
44	660	11.00	2.0	0.418	0.207	0.377	0.211	1.59	868.46
45	675	11.25	1.9	0.397	0.204	0.358	0.193	1.46	747.07
46	690	11.50	1.9	0.397	0.201	0.358	0.196	1.48	767.54
47	705	11.75	1.7	0.356	0.198	0.320	0.157	1.19	503.61
48	720	12.00	1.8	0.377	0.195	0.339	0.181	1.37	665.74
49	735	12.25	2.5	0.523	0.192	0.471	0.331	2.49	1680.21
50	750	12.50	2.6	0.544	0.190	0.490	0.354	2.67	1841.88
51	765	12.75	2.8	0.586	0.187	0.527	0.399	3.01	2145.42
52	780	13.00	2.9	0.607	0.184	0.546	0.423	3.19	2306.63
53	795	13.25	3.4	0.711	0.181	0.640	0.530	4.00	3035.98
54	810	13.50	3.4	0.711	0.178	0.640	0.533	4.02	3054.63
55	825	13.75	2.3	0.481	0.176	0.433	0.305	2.31	1509.99
56	840	14.00	2.3	0.481	0.173	0.433	0.308	2.33	1528.15
57	855	14.25	2.7	0.565	0.170	0.508	0.394	2.98	2114.45
58	870	14.50	2.6	0.544	0.168	0.490	0.376	2.84	1990.02
59	885	14.75	2.6	0.544	0.165	0.490	0.379	2.86	2007.44
60	900	15.00	2.5	0.523	0.163	0.471	0.360	2.72	1882.51

RCFCD SYNTHETIC UNIT HYDROGRAPH METHOD
100 YEAR - 24 HOUR STORM EVENT

PROJECT: PARK LANE HOMES
CONCENTRATION POINT: RETENTION BASIN

BY: JAMES R. BAZ DATE: 3/3/2025

EFFECTIVE RAIN CALCULATION FORM

DRAINAGE AREA-ACRES	7.547	CONSTANT LOSS RATE-in/hr	n/a
UNIT TIME-MINUTES	15	VARIABLE LOSS RATE (AVG) in/hr	0.2072
LAG TIME - MINUTES	1.93	MINIMUM LOSS RATE (for var. loss) - in/hr	0.104
UNIT TIME-PERCENT OF LAG	778.8	LOW LOSS RATE - DECIMAL	0.90
TOTAL ADJUSTED STORM RAIN-INCHES	5.23	C	0.00192
		PERCOLATION RATE (cfs)	0.63

Unit Time Period	Time		Pattern Percent	Storm Rain in/hr	Loss Rate in/hr		Effective Rain	Flood Hydrograph Flow	Required Storage
	Minutes	Hours	(Plate E-5.9)		Max	Low	in/hr	cfs	cf
61	915	15.25	2.4	0.502	0.160	0.452	0.342	2.58	1757.32
62	930	15.50	2.3	0.481	0.158	0.433	0.323	2.44	1631.87
63	945	15.75	1.9	0.397	0.155	0.358	0.242	1.83	1079.88
64	960	16.00	1.9	0.397	0.153	0.358	0.245	1.85	1095.99
65	975	16.25	0.4	0.084	0.151	0.075	0.008	0.06	0.00
66	990	16.50	0.4	0.084	0.148	0.075	0.008	0.06	0.00
67	1005	16.75	0.3	0.063	0.146	0.056	0.006	0.05	0.00
68	1020	17.00	0.3	0.063	0.144	0.056	0.006	0.05	0.00
69	1035	17.25	0.5	0.105	0.142	0.094	0.010	0.08	0.00
70	1050	17.50	0.5	0.105	0.140	0.094	0.010	0.08	0.00
71	1065	17.75	0.5	0.105	0.137	0.094	0.010	0.08	0.00
72	1080	18.00	0.4	0.084	0.135	0.075	0.008	0.06	0.00
73	1095	18.25	0.4	0.084	0.133	0.075	0.008	0.06	0.00
74	1110	18.50	0.4	0.084	0.132	0.075	0.008	0.06	0.00
75	1125	18.75	0.3	0.063	0.130	0.056	0.006	0.05	0.00
76	1140	19.00	0.2	0.042	0.128	0.038	0.004	0.03	0.00
77	1155	19.25	0.3	0.063	0.126	0.056	0.006	0.05	0.00
78	1170	19.50	0.4	0.084	0.124	0.075	0.008	0.06	0.00
79	1185	19.75	0.3	0.063	0.123	0.056	0.006	0.05	0.00
80	1200	20.00	0.2	0.042	0.121	0.038	0.004	0.03	0.00
81	1215	20.25	0.3	0.063	0.119	0.056	0.006	0.05	0.00
82	1230	20.50	0.3	0.063	0.118	0.056	0.006	0.05	0.00
83	1245	20.75	0.3	0.063	0.116	0.056	0.006	0.05	0.00
84	1260	21.00	0.2	0.042	0.115	0.038	0.004	0.03	0.00
85	1275	21.25	0.3	0.063	0.113	0.056	0.006	0.05	0.00
86	1290	21.50	0.2	0.042	0.112	0.038	0.004	0.03	0.00
87	1305	21.75	0.3	0.063	0.111	0.056	0.006	0.05	0.00
88	1320	22.00	0.2	0.042	0.110	0.038	0.004	0.03	0.00
89	1335	22.25	0.3	0.063	0.109	0.056	0.006	0.05	0.00
90	1350	22.50	0.2	0.042	0.108	0.038	0.004	0.03	0.00
91	1365	22.75	0.2	0.042	0.107	0.038	0.004	0.03	0.00
92	1380	23.00	0.2	0.042	0.106	0.038	0.004	0.03	0.00
93	1395	23.25	0.2	0.042	0.105	0.038	0.004	0.03	0.00
94	1410	23.50	0.2	0.042	0.105	0.038	0.004	0.03	0.00
95	1425	23.75	0.2	0.042	0.104	0.038	0.004	0.03	0.00
96	1440	24.00	0.2	0.042	0.104	0.038	0.004	0.03	0.00

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

EFFECTIVE RAIN (in)	2.24
FLOOD VOLUME (acft)	1.41
FLOOD VOLUME (cuft)	61480.87
REQUIRED STORAGE (acft)	0.89
REQUIRED STORAGE (cuft)	38932.74
PEAK FLOW (cfs)	4.02

PROJECT: PARK LANE HOMES
JOB # C2013
RETENTION BASIN

BASIN CHARACTERISTICS

CONTOUR	DEPTH		AREA		VOLUME		
	INCR (ft)	TOTAL (ft)	INCR (sf)	TOTAL (sf)	INCR (cuft)	TOTAL (cuft)	(acre-ft)
901.4	0	0	0	9240	0	0	0.00
902.4	1	1	1202	10442	9841	9841	0.23
903.4	1	2	1276	11718	11080	20921	0.48
904.4	1	3	1350	13068	12393	33314	0.76
905.4	1	4	1422	14490	13779	47093	1.08
906.4	1	5	1494	15984	15237	62330	1.43
907.4	1	6	1568	17552	16768	79098	1.82

PERCOLATION CALCULATIONS

PERCOLATION RATE	2 in/hr	0.43	cfs	at depth=	1
		0.48	cfs	at depth=	2
		0.54	cfs	at depth=	3
		0.61	cfs	at depth=	4
		0.67	cfs	at depth=	5
		0.74	cfs	at depth=	6

MAXWELL IV DRYWELLS

NUMBER USED	2		
RATE/DRYWELL	0.1 cfs		
TOTAL DISSIPATED		0.2	cfs

TOTAL PERCOLATION RATE	0.63	cfs	at depth=	1
	0.68		at depth=	2
	0.74		at depth=	3
	0.81		at depth=	4
	0.87		at depth=	5
	0.94		at depth=	6

RETENTION BASIN
JOB # C2013
100 YEAR - 3 HOUR STORM EVENT

TIME		FLOW	VOLUME	TOTAL IN	PERC	TOTAL IN	BASIN	BALANCE IN	
UNIT	(min)	IN	IN	BASIN	OUT	BASIN	ELEV	BASIN	
PERIOD		(cfs)	(cuft)	(cuft)	(cuft)	(cuft)	(ft)	(cuft)	(acre-ft)
1	5	1.32	396	396	188	208	901.42	208	0.00
2	10	1.32	396	604	188	416	901.44	416	0.01
3	15	0.88	263	679	188	491	901.45	491	0.01
4	20	1.76	529	1,020	188	832	901.48	832	0.02
5	25	1.76	529	1,361	188	1,173	901.52	1,173	0.03
6	30	2.43	729	1,902	188	1,713	901.57	1,713	0.04
7	35	1.76	529	2,243	188	2,054	901.61	2,054	0.05
8	40	2.43	729	2,783	188	2,595	901.66	2,595	0.06
9	45	2.43	729	3,324	188	3,136	901.72	3,136	0.07
10	50	1.76	529	3,665	188	3,477	901.75	3,477	0.08
11	55	1.99	596	4,073	188	3,884	901.79	3,884	0.09
12	60	2.43	729	4,613	188	4,425	901.85	4,425	0.10
13	65	3.32	995	5,420	188	5,232	901.93	5,232	0.12
14	70	3.32	995	6,227	188	6,039	902.01	6,039	0.14
15	75	3.32	995	7,034	188	6,846	902.10	6,846	0.16
16	80	2.87	862	7,708	188	7,520	902.16	7,520	0.17
17	85	4.21	1,262	8,781	188	8,593	902.27	8,593	0.20
18	90	4.43	1,328	9,921	188	9,733	902.39	9,733	0.22
19	95	3.76	1,128	10,861	188	10,673	902.48	10,673	0.25
20	100	4.43	1,328	12,001	205	11,796	902.58	11,796	0.27
21	105	5.76	1,728	13,523	205	13,318	902.71	13,318	0.31
22	110	5.31	1,594	14,913	205	14,708	902.84	14,708	0.34
23	115	4.87	1,461	16,169	205	15,964	902.95	15,964	0.37
24	120	5.09	1,528	17,492	205	17,287	903.07	17,287	0.40
25	125	5.31	1,594	18,881	205	18,676	903.20	18,676	0.43
26	130	7.76	2,327	21,003	205	20,798	903.39	20,798	0.48
27	135	9.53	2,859	23,657	205	23,452	903.60	23,452	0.54
28	140	6.20	1,861	25,312	223	25,090	903.74	25,090	0.58
29	145	13.52	4,057	29,147	223	28,924	904.05	28,924	0.66
30	150	14.63	4,390	33,314	223	33,091	904.38	33,091	0.76
31	155	16.63	4,989	38,081	223	37,858	904.73	37,858	0.87
32	160	11.53	3,458	41,316	242	41,075	904.96	41,075	0.94
33	165	2.87	862	41,937	242	41,695	905.01	41,695	0.96
34	170	2.43	729	42,424	242	42,183	905.04	42,183	0.97
35	175	2.43	729	42,912	242	42,670	905.08	42,670	0.98
36	180	0.13	40	42,710	242	42,469	905.06	42,469	0.97

RETENTION BASIN
JOB # C2013
100 YEAR - 6 HOUR STORM EVENT

TIME		FLOW IN	VOLUME IN	TOTAL IN BASIN	PERC OUT	TOTAL IN BASIN	BASIN ELEV	BALANCE IN BASIN	
UNIT PERIOD	(min)	(cfs)	(cuft)	(cuft)	(cuft)	(cuft)	(ft)	(cuft)	(acre-ft)
1	5	0.14	43	43	188	-	901.40	-	0.00
2	10	0.16	49	49	188	-	901.40	-	0.00
3	15	0.16	49	49	188	-	901.40	-	0.00
4	20	0.16	49	49	188	-	901.40	-	0.00
5	25	0.16	49	49	188	-	901.40	-	0.00
6	30	0.45	136	136	188	-	901.40	-	0.00
7	35	0.45	136	136	188	-	901.40	-	0.00
8	40	0.45	136	136	188	-	901.40	-	0.00
9	45	0.45	136	136	188	-	901.40	-	0.00
10	50	0.45	136	136	188	-	901.40	-	0.00
11	55	0.45	136	136	188	-	901.40	-	0.00
12	60	0.74	222	222	188	34	901.40	34	0.00
13	65	0.74	222	256	188	67	901.41	67	0.00
14	70	0.74	222	290	188	101	901.41	101	0.00
15	75	0.74	222	323	188	135	901.41	135	0.00
16	80	0.74	222	357	188	169	901.42	169	0.00
17	85	0.74	222	391	188	202	901.42	202	0.00
18	90	0.74	222	424	188	236	901.42	236	0.01
19	95	0.74	222	458	188	270	901.43	270	0.01
20	100	0.74	222	492	188	304	901.43	304	0.01
21	105	0.74	222	526	188	337	901.43	337	0.01
22	110	0.74	222	559	188	371	901.44	371	0.01
23	115	0.74	222	593	188	405	901.44	405	0.01
24	120	1.03	308	713	188	525	901.45	525	0.01
25	125	0.74	222	747	188	559	901.46	559	0.01
26	130	1.03	308	867	188	679	901.47	679	0.02
27	135	1.03	308	987	188	799	901.48	799	0.02
28	140	1.03	308	1,107	188	919	901.49	919	0.02
29	145	1.03	308	1,227	188	1,039	901.51	1,039	0.02
30	150	1.03	308	1,348	188	1,159	901.52	1,159	0.03
31	155	1.03	308	1,468	188	1,279	901.53	1,279	0.03
32	160	1.03	308	1,588	188	1,400	901.54	1,400	0.03
33	165	1.32	395	1,794	188	1,606	901.56	1,606	0.04
34	170	1.32	395	2,001	188	1,813	901.58	1,813	0.04
35	175	1.32	395	2,207	188	2,019	901.61	2,019	0.05
36	180	1.32	395	2,414	188	2,226	901.63	2,226	0.05
37	185	1.32	395	2,620	188	2,432	901.65	2,432	0.06
38	190	1.60	481	2,913	188	2,725	901.68	2,725	0.06
39	195	1.60	481	3,206	188	3,018	901.71	3,018	0.07
40	200	1.60	481	3,499	188	3,311	901.74	3,311	0.08
41	205	1.89	568	3,879	188	3,690	901.77	3,690	0.08
42	210	2.18	654	4,344	188	4,156	901.82	4,156	0.10
43	215	2.47	740	4,896	188	4,708	901.88	4,708	0.11
44	220	2.47	740	5,449	188	5,260	901.93	5,260	0.12
45	225	2.76	827	6,087	188	5,899	902.00	5,899	0.14
46	230	2.76	827	6,726	188	6,537	902.06	6,537	0.15
47	235	3.04	913	7,450	188	7,262	902.14	7,262	0.17
48	240	3.04	913	8,175	188	7,987	902.21	7,987	0.18
49	245	3.33	1,000	8,987	188	8,798	902.29	8,798	0.20
50	250	3.62	1,086	9,884	188	9,696	902.39	9,696	0.22
51	255	3.91	1,172	10,869	188	10,680	902.48	10,680	0.25
52	260	4.20	1,259	11,939	205	11,734	902.57	11,734	0.27
53	265	4.48	1,345	13,079	205	12,874	902.67	12,874	0.30
54	270	4.48	1,345	14,219	205	14,014	902.78	14,014	0.32
55	275	4.77	1,432	15,446	205	15,241	902.89	15,241	0.35

RETENTION BASIN
JOB # C2013
100 YEAR - 6 HOUR STORM EVENT

TIME UNIT PERIOD	(min)	FLOW IN (cfs)	VOLUME IN (cuft)	TOTAL IN BASIN (cuft)	PERC OUT (cuft)	TOTAL IN BASIN (cuft)	BASIN ELEV (ft)	BALANCE IN BASIN (cuft)	(acre-ft)
56	280	5.06	1,518	16,759	205	16,554	903.01	16,554	0.38
57	285	5.35	1,604	18,158	205	17,953	903.13	17,953	0.41
58	290	5.35	1,604	19,558	205	19,353	903.26	19,353	0.44
59	295	5.64	1,691	21,044	205	20,839	903.39	20,839	0.48
60	300	5.92	1,777	22,616	205	22,411	903.52	22,411	0.51
61	305	7.36	2,209	24,620	223	24,397	903.68	24,397	0.56
62	310	8.80	2,641	27,039	223	26,816	903.88	26,816	0.62
63	315	9.67	2,900	29,716	223	29,493	904.09	29,493	0.68
64	320	10.53	3,160	32,653	223	32,430	904.33	32,430	0.74
65	325	11.97	3,592	36,022	223	35,799	904.58	35,799	0.82
66	330	14.56	4,369	40,168	242	39,927	904.88	39,927	0.92
67	335	3.91	1,172	41,099	242	40,858	904.95	40,858	0.94
68	340	1.03	308	41,166	242	40,925	904.95	40,925	0.94
69	345	0.16	49	40,974	242	40,732	904.94	40,732	0.94
70	350	0.14	43	40,776	242	40,534	904.92	40,534	0.93
71	355	0.09	26	40,560	242	40,319	904.91	40,319	0.93
72	360	0.06	17	40,336	242	40,094	904.89	40,094	0.92

RETENTION BASIN
JOB # C2013
100 YEAR - 24 HOUR STORM EVENT

TIME		FLOW	VOLUME	TOTAL IN	PERC	TOTAL IN	BASIN	BALANCE IN	
UNIT PERIOD	(min)	IN (cfs)	IN (cuft)	BASIN (cuft)	OUT (cuft)	BASIN (cuft)	ELEV (ft)	BASIN (cuft)	(acre-ft)
1	15	0.03	28	28	565	-	901.40	-	0.00
2	30	0.05	43	43	565	-	901.40	-	0.00
3	45	0.05	43	43	565	-	901.40	-	0.00
4	60	0.06	57	57	565	-	901.40	-	0.00
5	75	0.05	43	43	565	-	901.40	-	0.00
6	90	0.05	43	43	565	-	901.40	-	0.00
7	105	0.05	43	43	565	-	901.40	-	0.00
8	120	0.06	57	57	565	-	901.40	-	0.00
9	135	0.06	57	57	565	-	901.40	-	0.00
10	150	0.06	57	57	565	-	901.40	-	0.00
11	165	0.08	71	71	565	-	901.40	-	0.00
12	180	0.08	71	71	565	-	901.40	-	0.00
13	195	0.08	71	71	565	-	901.40	-	0.00
14	210	0.08	71	71	565	-	901.40	-	0.00
15	225	0.08	71	71	565	-	901.40	-	0.00
16	240	0.09	85	85	565	-	901.40	-	0.00
17	255	0.09	85	85	565	-	901.40	-	0.00
18	270	0.11	99	99	565	-	901.40	-	0.00
19	285	0.11	99	99	565	-	901.40	-	0.00
20	300	0.13	114	114	565	-	901.40	-	0.00
21	315	0.09	85	85	565	-	901.40	-	0.00
22	330	0.11	99	99	565	-	901.40	-	0.00
23	345	0.13	114	114	565	-	901.40	-	0.00
24	360	0.13	114	114	565	-	901.40	-	0.00
25	375	0.14	128	128	565	-	901.40	-	0.00
26	390	0.14	128	128	565	-	901.40	-	0.00
27	405	0.16	142	142	565	-	901.40	-	0.00
28	420	0.16	142	142	565	-	901.40	-	0.00
29	435	0.16	142	142	565	-	901.40	-	0.00
30	450	0.17	156	156	565	-	901.40	-	0.00
31	465	0.01	8	8	565	-	901.40	-	0.00
32	480	0.19	174	174	565	-	901.40	-	0.00
33	495	0.53	481	481	565	-	901.40	-	0.00
34	510	0.56	504	504	565	-	901.40	-	0.00
35	525	0.74	669	669	565	104	901.41	104	0.00
36	540	0.93	834	938	565	373	901.44	373	0.01
37	555	1.27	1,140	1,514	565	949	901.50	949	0.02
38	570	1.45	1,305	2,253	565	1,688	901.57	1,688	0.04
39	585	1.63	1,469	3,157	565	2,592	901.66	2,592	0.06
40	600	1.81	1,633	4,225	565	3,660	901.77	3,660	0.08
41	615	0.73	660	4,319	565	3,754	901.78	3,754	0.09
42	630	0.76	681	4,435	565	3,870	901.79	3,870	0.09
43	645	1.57	1,413	5,283	565	4,718	901.88	4,718	0.11
44	660	1.59	1,433	6,151	565	5,586	901.97	5,586	0.13
45	675	1.46	1,312	6,898	565	6,333	902.04	6,333	0.15
46	690	1.48	1,333	7,666	565	7,101	902.12	7,101	0.16
47	705	1.19	1,069	8,170	565	7,605	902.17	7,605	0.17
48	720	1.37	1,231	8,835	565	8,270	902.24	8,270	0.19
49	735	2.49	2,245	10,516	565	9,951	902.41	9,951	0.23
50	750	2.67	2,407	12,357	615	11,742	902.57	11,742	0.27
51	765	3.01	2,710	14,453	615	13,838	902.76	13,838	0.32
52	780	3.19	2,872	16,709	615	16,094	902.96	16,094	0.37
53	795	4.00	3,601	19,695	615	19,080	903.23	19,080	0.44
54	810	4.02	3,620	22,700	615	22,085	903.49	22,085	0.51
55	825	2.31	2,075	24,160	668	23,491	903.61	23,491	0.54
56	840	2.33	2,093	25,585	668	24,916	903.72	24,916	0.57
57	855	2.98	2,679	27,596	668	26,928	903.88	26,928	0.62
58	870	2.84	2,555	29,483	668	28,814	904.04	28,814	0.66

RETENTION BASIN
JOB # C2013
100 YEAR - 24 HOUR STORM EVENT

TIME		FLOW	VOLUME	TOTAL IN	PERC	TOTAL IN	BASIN	BALANCE IN	
UNIT	(min)	IN	IN	BASIN	OUT	BASIN	ELEV	BASIN	
PERIOD		(cfs)	(cuft)	(cuft)	(cuft)	(cuft)	(ft)	(cuft)	(acre-ft)
59	885	2.86	2,572	31,387	668	30,719	904.19	30,719	0.71
60	900	2.72	2,448	33,166	668	32,498	904.33	32,498	0.75
61	915	2.58	2,322	34,820	668	34,152	904.46	34,152	0.78
62	930	2.44	2,197	36,349	725	35,624	904.57	35,624	0.82
63	945	1.83	1,645	37,269	725	36,545	904.63	36,545	0.84
64	960	1.85	1,661	38,206	725	37,481	904.70	37,481	0.86
65	975	0.06	57	37,538	725	36,813	904.65	36,813	0.85
66	990	0.06	57	36,870	725	36,146	904.61	36,146	0.83
67	1005	0.05	43	36,188	725	35,464	904.56	35,464	0.81
68	1020	0.05	43	35,507	725	34,782	904.51	34,782	0.80
69	1035	0.08	71	34,853	725	34,129	904.46	34,129	0.78
70	1050	0.08	71	34,200	725	33,475	904.41	33,475	0.77
71	1065	0.08	71	33,546	725	32,822	904.36	32,822	0.75
72	1080	0.06	57	32,878	668	32,210	904.31	32,210	0.74
73	1095	0.06	57	32,267	668	31,599	904.26	31,599	0.73
74	1110	0.06	57	31,656	668	30,987	904.21	30,987	0.71
75	1125	0.05	43	31,030	668	30,362	904.16	30,362	0.70
76	1140	0.03	28	30,390	668	29,722	904.11	29,722	0.68
77	1155	0.05	43	29,765	668	29,096	904.06	29,096	0.67
78	1170	0.06	57	29,153	668	28,485	904.01	28,485	0.65
79	1185	0.05	43	28,528	668	27,859	903.96	27,859	0.64
80	1200	0.03	28	27,888	668	27,219	903.91	27,219	0.62
81	1215	0.05	43	27,262	668	26,594	903.86	26,594	0.61
82	1230	0.05	43	26,636	668	25,968	903.81	25,968	0.60
83	1245	0.05	43	26,011	668	25,343	903.76	25,343	0.58
84	1260	0.03	28	25,371	668	24,703	903.71	24,703	0.57
85	1275	0.05	43	24,745	668	24,077	903.65	24,077	0.55
86	1290	0.03	28	24,106	668	23,437	903.60	23,437	0.54
87	1305	0.05	43	23,480	668	22,812	903.55	22,812	0.52
88	1320	0.03	28	22,840	668	22,172	903.50	22,172	0.51
89	1335	0.05	43	22,215	668	21,546	903.45	21,546	0.49
90	1350	0.03	28	21,575	668	20,906	903.40	20,906	0.48
91	1365	0.03	28	20,935	615	20,320	903.35	20,320	0.47
92	1380	0.03	28	20,348	615	19,733	903.29	19,733	0.45
93	1395	0.03	28	19,762	615	19,146	903.24	19,146	0.44
94	1410	0.03	28	19,175	615	18,560	903.19	18,560	0.43
95	1425	0.03	28	18,588	615	17,973	903.13	17,973	0.41
96	1440	0.03	28	18,002	615	17,386	903.08	17,386	0.40

	A	B	C	D
1	**RCFCD SHORT CUT SYNTHETIC UNIT HYDROGRAPH**			
2	DATA INPUT SHEET			
3				
4	WORKSHEET PREPARED BY:	JAMES R. BAZUA, P.E.		
5				
6	PROJECT NAME	PARK LANE HOMES		
7	JOB #	C2013		
8				
9	CONCENTRATION POINT DESIGNATION	RETENTION BASIN		
10	AREA DESIGNATION	OFF-SITE NORTH - EXISTING SHOPPING CENTER		
11				
12	TRIBUTARY AREAS			
13				
14	COMMERCIAL	12.8		
15	PAVING/HARDSCAPE			
16	SF - 1 ACRE			
17	SF - 1/2 ACRE			
18	SF - 1/4 ACRE			
19	MF - CONDOMINIUMS			
20	MF - APARTMENTS	0.7		
21	MOBILE HOME PARK			
22	LANDSCAPING			
23	RETENTION BASIN			
24	GOLF COURSE			
25	MOUNTAINOUS			
26	LOW LOSS RATE (PERCENT)	90%		
27				
28	LENGTH OF WATERCOURSE (L)	1000		
29	LENGTH TO POINT OPPOSITE CENTROID (Lca)	125		
30				
31	ELEVATION OF HEADWATER	931		
32	ELEVATION OF CONCENTRATION POINT	919		
33				
34	AVERAGE MANNINGS 'N' VALUE	0.02		
35				
36	STORM FREQUENCY (YEAR)	100		
37				
38	POINT RAIN			
39	3-HOUR	2.45		
40	6-HOUR	3.18		
41	24-HOUR	5.23		
42				
43	BASIN CHARACTERISTICS:	ELEVATION	AREA	
44		912	10556	
45		914	13759	
46		915	15519	
47		916	17385	
48		917	19357	
49		918	21435	
50		919	23620	
51				
52	PERCOLATION RATE (in/hr)	2		
53		.		
54	DRYWELL DATA			
55	NUMBER USED			
56	PERCOLATION RATE (cfs)			

RCFCD SYNTHETIC UNIT HYDROGRAPH METHOD	PROJECT:	PARK LANE HOMES	
BASIC DATA CALCULATION FORM	JOB #	C2013	
SHORTCUT METHOD	BY	ES R. BAZUA, P.E.	DATE 3/3/2025

PHYSICAL DATA

[1] CONCENTRATION POINT	RETENTION BASIN
[2] AREA DESIGNATION	OFF-SITE NORTH - EXISTING SHOPPING CENTER
[3] AREA - ACRES	13.500
[4] L-FEET	1000
[5] L-MILES	0.189
[6] La-FEET	125.00
[7] La-MILES	0.024
[8] ELEVATION OF HEADWATER	931
[9] ELEVATION OF CONCENTRATION POINT	919
[10] H-FEET	12
[11] S-FEET/MILE	63.4
[12] S^0.5	7.96
[13] L*LCA/S^0.5	0.001
[14] AVERAGE MANNINGS 'N'	0.02
[15] LAG TIME-HOURS	0.03
[16] LAG TIME-MINUTES	1.7
[17] 100% OF LAG-MINUTES	1.7
[18] 200% OF LAG-MINUTES	3.4
[19] UNIT TIME-MINUTES (100%-200% OF LAG)	5
[24] TOTAL PERCOLATION RATE (cfs)	0.49

RAINFALL DATA

[1] SOURCE

[2] FREQUENCY-YEARS 100

[3] DURATION:

3-HOURS				6-HOURS				24-HOURS			
[4] POINT RAIN INCHES (Plate E-5.2)	[5] AREA	[6]	[7] AVERAGE POINT RAIN INCHES	[8] POINT RAIN INCHES (Plate E-5.4)	[9] AREA	[10]	[11] AVERAGE POINT RAIN INCHES	[12] POINT RAIN INCHES (Plate E-5.6)	[13] AREA	[14]	[15] AVERAGE POINT RAIN INCHES
2.45	13.500	1.00	2.45	3.18	13.500	1.00	3.18	5.23	13.500	1.00	5.23
		0.00	0.00			0.00	0.00			0.00	0.00
		0.00	0.00			0.00	0.00			0.00	0.00
		0.00	0.00			0.00	0.00			0.00	0.00
SUM [5]	13.5	SUM [7]	2.45	SUM [9]	13.50	SUM [11]	3.18	SUM [13]	13.50	SUM [15]	5.23
[16] AREA ADJ FACTOR			1.000				1.000				1.000
[17] ADJ AVG POINT RAIN			2.45				3.18				5.23

STORM EVENT SUMMARY

DURATION		3-HOUR	6-HOUR	24-HOUR
EFFECTIVE RAIN	(in)	2.02	2.33	2.77
FLOOD VOLUME	(cu-ft) (acre-ft)	98,885 2.27	113,956 2.62	135,507 3.11
REQUIRED STORAGE	(cu-ft) (acre-ft)	92,805 2.13	102,673 2.36	112,296 2.58
PEAK FLOW	(cfs)	30.60	26.90	7.93
MAXIMUM WSEL	(ft)	917.87	918.28	918.56

RCFCD SYNTHETIC UNIT HYDROGRAPH METHOD

PROJECT PARK LANE HOMES
CONCENTRATION POINT: RETENTION BASIN
BY MES R. BAZUA, P.E. DATE 3/3/2025

ADJUSTED LOSS RATE

SOIL GROUP [Plate C-1]	LAND USE	RI NUMBER [Plate E-6.1]	PERVIOUS AREA INFILTRATION RATE (in/hr) [Plate E-6.2]	DECIMAL PERCENT OF AREA IMPERVIOUS [Plate E-6.3]	ADJUSTED INFILTRATION RATE (in/hr)	AREA		AVERAGE ADJUSTED INFILTRATION RATE (in/hr)
A	COMMERCIAL	32	0.74	90%	0.14	12.80	0.948	0.1333
A	PAVING/HARDSCAPE	32	0.74	100%	0.07	0.00	0.000	0.0000
A	SF - 1 ACRE	32	0.74	20%	0.61	0.00	0.000	0.0000
A	SF - 1/2 ACRE	32	0.74	40%	0.47	0.00	0.000	0.0000
A	SF - 1/4 ACRE	32	0.74	50%	0.41	0.00	0.000	0.0000
A	MF - COND0MINIUMS	32	0.74	65%	0.31	0.00	0.000	0.0000
A	MF - APARTMENTS	32	0.74	80%	0.21	0.70	0.052	0.0107
A	MOBILE HOME PARKS	32	0.74	75%	0.24	0.00	0.000	0.0000
A	LANDSCAPING	32	0.74	0%	0.74	0.00	0.000	0.0000
A	RETENTION BASINS	32	0.74	0%	0.74	0.00	0.000	0.0000
A	GOLF COURSE	32	0.74	0%	0.74	0.00	0.000	0.0000
D	MOUNTAINOUS	93	0.95	90%	0.18	0.00	0.000	0.0000
					0.00		0.000	0.0000
					0.00		0.000	0.0000
					0.00		0.000	0.0000
					0.00		0.000	0.0000
					0.00		0.000	0.0000
					0.00		0.000	0.0000
					0.00		0.000	0.0000
					0.00		0.000	0.0000
					0.00		0.000	0.0000
					SUM	13.5	SUM	0.1441

VARIABLE LOSS RATE CURVE (24-HOUR STORM ONLY)
Fm= 0.072026667
C= 0.00133
Ft=C(24-(T/60))^1.55 = 0.00133 (24-(T/60))^1.55 + 0.07 in/hr
LOW LOSS RATE (80-90 PERCENT) = 90%
Where:
T=Time in minutes. To get an average value for each unit time period, Use T=1/2 the unit time for the first time period,
T=1 1/2 unit time for the second period, etc.

RCFCD SYNTHETIC UNIT HYDROGRAPH METHOD
100 YEAR - 3 HOUR STORM EVENT

PROJECT: PARK LANE HOMES
CONCENTRATION POINT: RETENTION BASIN

BY: IES R. BAZUA, DATE 3/3/2025

EFFECTIVE RAIN CALCULATION FORM

DRAINAGE AREA-ACRES	13.50
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	1.68
UNIT TIME-PERCENT OF LAG	298.1
TOTAL ADJUSTED STORM RAIN-INCHES	2.45
CONSTANT LOSS RATE-in/hr	0.14
LOW LOSS RATE - PERCENT	90%

TOTAL PERCOLATION RATE (cfs) 0.49 cfs

Unit Time Period	Time		Pattern Percent (Plate E-5.9)	Storm Rain in/hr	Loss Rate in/hr		Effective Rain in/hr	Flood Hydrograph Flow cfs	Required Storage cf
	Minutes	Hours			Max	Low			
1	5	0.08	1.3	0.382	0.14	0.34	0.24	3.21	817.88
2	10	0.17	1.3	0.382	0.14	0.34	0.24	3.21	817.88
3	15	0.25	1.1	0.323	0.14	0.29	0.18	2.42	579.74
4	20	0.33	1.5	0.441	0.14	0.40	0.30	4.01	1056.02
5	25	0.42	1.5	0.441	0.14	0.40	0.30	4.01	1056.02
6	30	0.50	1.8	0.529	0.14	0.48	0.39	5.20	1413.23
7	35	0.58	1.5	0.441	0.14	0.40	0.30	4.01	1056.02
8	40	0.67	1.8	0.529	0.14	0.48	0.39	5.20	1413.23
9	45	0.75	1.8	0.529	0.14	0.48	0.39	5.20	1413.23
10	50	0.83	1.5	0.441	0.14	0.40	0.30	4.01	1056.02
11	55	0.92	1.6	0.470	0.14	0.42	0.33	4.41	1175.09
12	60	1.00	1.8	0.529	0.14	0.48	0.39	5.20	1413.23
13	65	1.08	2.2	0.647	0.14	0.58	0.50	6.79	1889.51
14	70	1.17	2.2	0.647	0.14	0.58	0.50	6.79	1889.51
15	75	1.25	2.2	0.647	0.14	0.58	0.50	6.79	1889.51
16	80	1.33	2.0	0.588	0.14	0.53	0.44	5.99	1651.37
17	85	1.42	2.6	0.764	0.14	0.69	0.62	8.37	2365.79
18	90	1.50	2.7	0.794	0.14	0.71	0.65	8.77	2484.86
19	95	1.58	2.4	0.706	0.14	0.64	0.56	7.58	2127.65
20	100	1.67	2.7	0.794	0.14	0.71	0.65	8.77	2484.86
21	105	1.75	3.3	0.970	0.14	0.87	0.83	11.15	3199.28
22	110	1.83	3.1	0.911	0.14	0.82	0.77	10.36	2961.14
23	115	1.92	2.9	0.853	0.14	0.77	0.71	9.57	2723.00
24	120	2.00	3.0	0.882	0.14	0.79	0.74	9.96	2842.07
25	125	2.08	3.1	0.911	0.14	0.82	0.77	10.36	2961.14
26	130	2.17	4.2	1.235	0.14	1.11	1.09	14.73	4270.91
27	135	2.25	5.0	1.470	0.14	1.32	1.33	17.90	5223.47
28	140	2.33	3.5	1.029	0.14	0.93	0.88	11.95	3437.42
29	145	2.42	6.8	1.999	0.14	1.80	1.86	25.04	7366.73
30	150	2.50	7.3	2.146	0.14	1.93	2.00	27.03	7962.08
31	155	2.58	8.2	2.411	0.14	2.17	2.27	30.60	9033.71
32	160	2.67	5.9	1.735	0.14	1.56	1.59	21.47	6295.10
33	165	2.75	2.0	0.588	0.14	0.53	0.44	5.99	1651.37
34	170	2.83	1.8	0.529	0.14	0.48	0.39	5.20	1413.23
35	175	2.92	1.8	0.529	0.14	0.48	0.39	5.20	1413.23
36	180	3.00	0.6	0.176	0.14	0.16	0.03	0.44	0.00

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

EFFECTIVE RAIN (in)	2.02
FLOOD VOLUME (acft)	2.27
FLOOD VOLUME (cuft)	98884.64
REQUIRED STORAGE (acft)	2.13
REQUIRED STORAGE (cuft)	92804.63
PEAK FLOW RATE (cfs)	30.60

RCFCD SYNTHETIC UNIT HYDROGRAPH METHOD
100 YEAR - 6 HOUR STORM EVENT

PROJECT: PARK LANE HOMES
CONCENTRATION POINT: RETENTION BASIN

BY: JAMES R. BAZ DATE: 3/3/2025

EFFECTIVE RAIN CALCULATION FORM

DRAINAGE AREA-ACRES	13.50
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	1.68
UNIT TIME-PERCENT OF LAG	298.1
TOTAL ADJUSTED STORM RAIN-INCHES	3.18
CONSTANT LOSS RATE-in/hr	0.144
LOW LOSS RATE - PERCENT	90%

TOTAL PERCOLATION RATE (cfs) 0.49 cfs

Unit Time Period	Time		Pattern Percent	Storm Rain in/hr	Loss Rate in/hr		Effective Rain in/hr	Flood Hydrograph Flow cfs	Required Storage cf
	Minutes	Hours	(Plate E-5.9)		Max	Low			
1	5	0.08	0.5	0.191	0.14	0.17	0.05	0.63	42.71
2	10	0.17	0.6	0.229	0.14	0.21	0.08	1.15	197.26
3	15	0.25	0.6	0.229	0.14	0.21	0.08	1.15	197.26
4	20	0.33	0.6	0.229	0.14	0.21	0.08	1.15	197.26
5	25	0.42	0.6	0.229	0.14	0.21	0.08	1.15	197.26
6	30	0.50	0.7	0.267	0.14	0.24	0.12	1.66	351.81
7	35	0.58	0.7	0.267	0.14	0.24	0.12	1.66	351.81
8	40	0.67	0.7	0.267	0.14	0.24	0.12	1.66	351.81
9	45	0.75	0.7	0.267	0.14	0.24	0.12	1.66	351.81
10	50	0.83	0.7	0.267	0.14	0.24	0.12	1.66	351.81
11	55	0.92	0.7	0.267	0.14	0.24	0.12	1.66	351.81
12	60	1.00	0.8	0.305	0.14	0.27	0.16	2.18	506.36
13	65	1.08	0.8	0.305	0.14	0.27	0.16	2.18	506.36
14	70	1.17	0.8	0.305	0.14	0.27	0.16	2.18	506.36
15	75	1.25	0.8	0.305	0.14	0.27	0.16	2.18	506.36
16	80	1.33	0.8	0.305	0.14	0.27	0.16	2.18	506.36
17	85	1.42	0.8	0.305	0.14	0.27	0.16	2.18	506.36
18	90	1.50	0.8	0.305	0.14	0.27	0.16	2.18	506.36
19	95	1.58	0.8	0.305	0.14	0.27	0.16	2.18	506.36
20	100	1.67	0.8	0.305	0.14	0.27	0.16	2.18	506.36
21	105	1.75	0.8	0.305	0.14	0.27	0.16	2.18	506.36
22	110	1.83	0.8	0.305	0.14	0.27	0.16	2.18	506.36
23	115	1.92	0.8	0.305	0.14	0.27	0.16	2.18	506.36
24	120	2.00	0.9	0.343	0.14	0.31	0.20	2.69	660.90
25	125	2.08	0.8	0.305	0.14	0.27	0.16	2.18	506.36
26	130	2.17	0.9	0.343	0.14	0.31	0.20	2.69	660.90
27	135	2.25	0.9	0.343	0.14	0.31	0.20	2.69	660.90
28	140	2.33	0.9	0.343	0.14	0.31	0.20	2.69	660.90
29	145	2.42	0.9	0.343	0.14	0.31	0.20	2.69	660.90
30	150	2.50	0.9	0.343	0.14	0.31	0.20	2.69	660.90
31	155	2.58	0.9	0.343	0.14	0.31	0.20	2.69	660.90
32	160	2.67	0.9	0.343	0.14	0.31	0.20	2.69	660.90
33	165	2.75	1.0	0.382	0.14	0.34	0.24	3.21	815.45
34	170	2.83	1.0	0.382	0.14	0.34	0.24	3.21	815.45
35	175	2.92	1.0	0.382	0.14	0.34	0.24	3.21	815.45
36	180	3.00	1.0	0.382	0.14	0.34	0.24	3.21	815.45
37	185	3.08	1.0	0.382	0.14	0.34	0.24	3.21	815.45
38	190	3.17	1.1	0.420	0.14	0.38	0.28	3.72	970.00
39	195	3.25	1.1	0.420	0.14	0.38	0.28	3.72	970.00
40	200	3.33	1.1	0.420	0.14	0.38	0.28	3.72	970.00
41	205	3.42	1.2	0.458	0.14	0.41	0.31	4.24	1124.55
42	210	3.50	1.3	0.496	0.14	0.45	0.35	4.75	1279.10
43	215	3.58	1.4	0.534	0.14	0.48	0.39	5.27	1433.64
44	220	3.67	1.4	0.534	0.14	0.48	0.39	5.27	1433.64
45	225	3.75	1.5	0.572	0.14	0.52	0.43	5.78	1588.19
46	230	3.83	1.5	0.572	0.14	0.52	0.43	5.78	1588.19
47	235	3.92	1.6	0.611	0.14	0.55	0.47	6.30	1742.74
48	240	4.00	1.6	0.611	0.14	0.55	0.47	6.30	1742.74
49	245	4.08	1.7	0.649	0.14	0.58	0.50	6.81	1897.29
50	250	4.17	1.8	0.687	0.14	0.62	0.54	7.33	2051.84
51	255	4.25	1.9	0.725	0.14	0.65	0.58	7.84	2206.38
52	260	4.33	2.0	0.763	0.14	0.69	0.62	8.36	2360.93
53	265	4.42	2.1	0.801	0.14	0.72	0.66	8.87	2515.48
54	270	4.50	2.1	0.801	0.14	0.72	0.66	8.87	2515.48
55	275	4.58	2.2	0.840	0.14	0.76	0.70	9.39	2670.03
56	280	4.67	2.3	0.878	0.14	0.79	0.73	9.90	2824.58

RCFCD SYNTHETIC UNIT HYDROGRAPH METHOD
100 YEAR - 6 HOUR STORM EVENT

PROJECT: PARK LANE HOMES
CONCENTRATION POINT: RETENTION BASIN

BY: JAMES R. BAZ DATE: 3/3/2025

EFFECTIVE RAIN CALCULATION FORM

DRAINAGE AREA-ACRES	13.50
UNIT TIME-MINUTES	5
LAG TIME - MINUTES	1.68
UNIT TIME-PERCENT OF LAG	298.1
TOTAL ADJUSTED STORM RAIN-INCHES	3.18
CONSTANT LOSS RATE-in/hr	0.144
LOW LOSS RATE - PERCENT	90%

TOTAL PERCOLATION RATE (cfs) 0.49 cfs

Unit Time Period	Time		Pattern Percent	Storm Rain in/hr	Loss Rate in/hr		Effective Rain	Flood Hydrograph Flow	Required Storage
	Minutes	Hours	(Plate E-5.9)		Max	Low	in/hr	cfs	cf
57	285	4.75	2.4	0.916	0.14	0.82	0.77	10.42	2979.12
58	290	4.83	2.4	0.916	0.14	0.82	0.77	10.42	2979.12
59	295	4.92	2.5	0.954	0.14	0.86	0.81	10.93	3133.67
60	300	5.00	2.6	0.992	0.14	0.89	0.85	11.45	3288.22
61	305	5.08	3.1	1.183	0.14	1.06	1.04	14.03	4060.96
62	310	5.17	3.6	1.374	0.14	1.24	1.23	16.60	4833.70
63	315	5.25	3.9	1.488	0.14	1.34	1.34	18.15	5297.34
64	320	5.33	4.2	1.603	0.14	1.44	1.46	19.69	5760.99
65	325	5.42	4.7	1.794	0.14	1.61	1.65	22.27	6533.73
66	330	5.50	5.6	2.137	0.14	1.92	1.99	26.90	7924.66
67	335	5.58	1.9	0.725	0.14	0.65	0.58	7.84	2206.38
68	340	5.67	0.9	0.343	0.14	0.31	0.20	2.69	660.90
69	345	5.75	0.6	0.229	0.14	0.21	0.08	1.15	197.26
70	350	5.83	0.5	0.191	0.14	0.17	0.05	0.63	42.71
71	355	5.92	0.3	0.114	0.14	0.10	0.01	0.15	0.00
72	360	6.00	0.2	0.076	0.14	0.07	0.01	0.10	0.00

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

EFFECTIVE RAIN (in)	2.33
FLOOD VOLUME (acft)	2.62
FLOOD VOLUME (cuft)	113955.64
REQUIRED STORAGE (acft)	2.36
REQUIRED STORAGE (cuft)	102673.36
PEAK FLOW RATE (cfs)	26.90

RCFCD SYNTHETIC UNIT HYDROGRAPH METHOD
100 YEAR - 24 HOUR STORM EVENT

PROJECT: PARK LANE HOMES
CONCENTRATION POINT: RETENTION BASIN

BY: JAMES R. BAZ DATE: 3/3/2025

EFFECTIVE RAIN CALCULATION FORM

DRAINAGE AREA-ACRES	13.500	CONSTANT LOSS RATE-in/hr	n/a
UNIT TIME-MINUTES	15	VARIABLE LOSS RATE (AVG) in/hr	0.1441
LAG TIME - MINUTES	1.68	MINIMUM LOSS RATE (for var. loss) - in/hr	0.072
UNIT TIME-PERCENT OF LAG	894.2	LOW LOSS RATE - DECIMAL	0.90
TOTAL ADJUSTED STORM RAIN-INCHES	5.23	C	0.00133
		PERCOLATION RATE (cfs)	0.49

Unit Time Period	Time		Pattern Percent	Storm Rain in/hr	Loss Rate in/hr		Effective Rain	Flood Hydrograph Flow	Required Storage
	Minutes	Hours	(Plate E-5.9)		Max	Low	in/hr	cfs	cf
1	15	0.25	0.2	0.042	0.254	0.038	0.004	0.06	0.00
2	30	0.50	0.3	0.063	0.251	0.056	0.006	0.08	0.00
3	45	0.75	0.3	0.063	0.248	0.056	0.006	0.08	0.00
4	60	1.00	0.4	0.084	0.246	0.075	0.008	0.11	0.00
5	75	1.25	0.3	0.063	0.243	0.056	0.006	0.08	0.00
6	90	1.50	0.3	0.063	0.240	0.056	0.006	0.08	0.00
7	105	1.75	0.3	0.063	0.237	0.056	0.006	0.08	0.00
8	120	2.00	0.4	0.084	0.234	0.075	0.008	0.11	0.00
9	135	2.25	0.4	0.084	0.231	0.075	0.008	0.11	0.00
10	150	2.50	0.4	0.084	0.228	0.075	0.008	0.11	0.00
11	165	2.75	0.5	0.105	0.226	0.094	0.010	0.14	0.00
12	180	3.00	0.5	0.105	0.223	0.094	0.010	0.14	0.00
13	195	3.25	0.5	0.105	0.220	0.094	0.010	0.14	0.00
14	210	3.50	0.5	0.105	0.217	0.094	0.010	0.14	0.00
15	225	3.75	0.5	0.105	0.215	0.094	0.010	0.14	0.00
16	240	4.00	0.6	0.126	0.212	0.113	0.013	0.17	0.00
17	255	4.25	0.6	0.126	0.209	0.113	0.013	0.17	0.00
18	270	4.50	0.7	0.146	0.207	0.132	0.015	0.20	0.00
19	285	4.75	0.7	0.146	0.204	0.132	0.015	0.20	0.00
20	300	5.00	0.8	0.167	0.201	0.151	0.017	0.23	0.00
21	315	5.25	0.6	0.126	0.199	0.113	0.013	0.17	0.00
22	330	5.50	0.7	0.146	0.196	0.132	0.015	0.20	0.00
23	345	5.75	0.8	0.167	0.194	0.151	0.017	0.23	0.00
24	360	6.00	0.8	0.167	0.191	0.151	0.017	0.23	0.00
25	375	6.25	0.9	0.188	0.188	0.169	0.019	0.25	0.00
26	390	6.50	0.9	0.188	0.186	0.169	0.002	0.03	0.00
27	405	6.75	1.0	0.209	0.183	0.188	0.026	0.35	0.00
28	420	7.00	1.0	0.209	0.181	0.188	0.028	0.38	0.00
29	435	7.25	1.0	0.209	0.179	0.188	0.031	0.41	0.00
30	450	7.50	1.1	0.230	0.176	0.207	0.054	0.73	216.68
31	465	7.75	1.2	0.251	0.174	0.226	0.077	1.04	500.21
32	480	8.00	1.3	0.272	0.171	0.245	0.101	1.36	783.49
33	495	8.25	1.5	0.314	0.169	0.282	0.145	1.96	1320.70
34	510	8.50	1.5	0.314	0.167	0.282	0.147	1.99	1349.30
35	525	8.75	1.6	0.335	0.164	0.301	0.171	2.30	1631.84
36	540	9.00	1.7	0.356	0.162	0.320	0.194	2.62	1914.12
37	555	9.25	1.9	0.397	0.160	0.358	0.238	3.21	2450.32
38	570	9.50	2.0	0.418	0.157	0.377	0.261	3.52	2732.09
39	585	9.75	2.1	0.439	0.155	0.395	0.284	3.84	3013.60
40	600	10.00	2.2	0.460	0.153	0.414	0.307	4.15	3294.85
41	615	10.25	1.5	0.314	0.151	0.282	0.163	2.20	1542.42
42	630	10.50	1.5	0.314	0.148	0.282	0.165	2.23	1568.97
43	645	10.75	2.0	0.418	0.146	0.377	0.272	3.67	2866.14
44	660	11.00	2.0	0.418	0.144	0.377	0.274	3.70	2892.15
45	675	11.25	1.9	0.397	0.142	0.358	0.255	3.45	2663.71
46	690	11.50	1.9	0.397	0.140	0.358	0.258	3.48	2689.18
47	705	11.75	1.7	0.356	0.138	0.320	0.218	2.94	2206.01
48	720	12.00	1.8	0.377	0.136	0.339	0.241	3.25	2485.10
49	735	12.25	2.5	0.523	0.134	0.471	0.389	5.25	4288.98
50	750	12.50	2.6	0.544	0.132	0.490	0.412	5.56	4567.51
51	765	12.75	2.8	0.586	0.130	0.527	0.456	6.16	5099.92
52	780	13.00	2.9	0.607	0.128	0.546	0.479	6.46	5377.87
53	795	13.25	3.4	0.711	0.126	0.640	0.585	7.90	6672.25
54	810	13.50	3.4	0.711	0.124	0.640	0.587	7.93	6695.43
55	825	13.75	2.3	0.481	0.122	0.433	0.359	4.85	3922.36
56	840	14.00	2.3	0.481	0.120	0.433	0.361	4.87	3944.95
57	855	14.25	2.7	0.565	0.118	0.508	0.446	6.03	4983.94
58	870	14.50	2.6	0.544	0.117	0.490	0.427	5.77	4751.74
59	885	14.75	2.6	0.544	0.115	0.490	0.429	5.79	4773.40
60	900	15.00	2.5	0.523	0.113	0.471	0.410	5.53	4540.57
61	915	15.25	2.4	0.502	0.111	0.452	0.391	5.27	4307.41

RCFCD SYNTHETIC UNIT HYDROGRAPH METHOD 100 YEAR - 24 HOUR STORM EVENT	PROJECT: PARK LANE HOMES CONCENTRATION POINT: RETENTION BASIN BY: JAMES R. BAZ DATE: 3/3/2025

EFFECTIVE RAIN CALCULATION FORM

DRAINAGE AREA-ACRES	13.500	CONSTANT LOSS RATE-in/hr	n/a
UNIT TIME-MINUTES	15	VARIABLE LOSS RATE (AVG) in/hr	0.1441
LAG TIME - MINUTES	1.68	MINIMUM LOSS RATE (for var. loss) - in/hr	0.072
UNIT TIME-PERCENT OF LAG	894.2	LOW LOSS RATE - DECIMAL	0.90
TOTAL ADJUSTED STORM RAIN-INCHES	5.23	C	0.00133
		PERCOLATION RATE (cfs)	0.49

Unit Time Period	Time		Pattern Percent	Storm Rain in/hr	Loss Rate in/hr		Effective Rain in/hr	Flood Hydrograph Flow cfs	Required Storage cf
	Minutes	Hours	(Plate E-5.9)		Max	Low			
62	930	15.50	2.3	0.481	0.110	0.433	0.372	5.02	4073.94
63	945	15.75	1.9	0.397	0.108	0.358	0.290	3.91	3077.60
64	960	16.00	1.9	0.397	0.106	0.358	0.291	3.93	3097.65
65	975	16.25	0.4	0.084	0.105	0.075	0.008	0.11	0.00
66	990	16.50	0.4	0.084	0.103	0.075	0.008	0.11	0.00
67	1005	16.75	0.3	0.063	0.102	0.056	0.006	0.08	0.00
68	1020	17.00	0.3	0.063	0.100	0.056	0.006	0.08	0.00
69	1035	17.25	0.5	0.105	0.099	0.094	0.006	0.08	0.00
70	1050	17.50	0.5	0.105	0.097	0.094	0.008	0.10	0.00
71	1065	17.75	0.5	0.105	0.096	0.094	0.009	0.12	0.00
72	1080	18.00	0.4	0.084	0.094	0.075	0.008	0.11	0.00
73	1095	18.25	0.4	0.084	0.093	0.075	0.008	0.11	0.00
74	1110	18.50	0.4	0.084	0.091	0.075	0.008	0.11	0.00
75	1125	18.75	0.3	0.063	0.090	0.056	0.006	0.08	0.00
76	1140	19.00	0.2	0.042	0.089	0.038	0.004	0.06	0.00
77	1155	19.25	0.3	0.063	0.088	0.056	0.006	0.08	0.00
78	1170	19.50	0.4	0.084	0.086	0.075	0.008	0.11	0.00
79	1185	19.75	0.3	0.063	0.085	0.056	0.006	0.08	0.00
80	1200	20.00	0.2	0.042	0.084	0.038	0.004	0.06	0.00
81	1215	20.25	0.3	0.063	0.083	0.056	0.006	0.08	0.00
82	1230	20.50	0.3	0.063	0.082	0.056	0.006	0.08	0.00
83	1245	20.75	0.3	0.063	0.081	0.056	0.006	0.08	0.00
84	1260	21.00	0.2	0.042	0.080	0.038	0.004	0.06	0.00
85	1275	21.25	0.3	0.063	0.079	0.056	0.006	0.08	0.00
86	1290	21.50	0.2	0.042	0.078	0.038	0.004	0.06	0.00
87	1305	21.75	0.3	0.063	0.077	0.056	0.006	0.08	0.00
88	1320	22.00	0.2	0.042	0.076	0.038	0.004	0.06	0.00
89	1335	22.25	0.3	0.063	0.076	0.056	0.006	0.08	0.00
90	1350	22.50	0.2	0.042	0.075	0.038	0.004	0.06	0.00
91	1365	22.75	0.2	0.042	0.074	0.038	0.004	0.06	0.00
92	1380	23.00	0.2	0.042	0.074	0.038	0.004	0.06	0.00
93	1395	23.25	0.2	0.042	0.073	0.038	0.004	0.06	0.00
94	1410	23.50	0.2	0.042	0.073	0.038	0.004	0.06	0.00
95	1425	23.75	0.2	0.042	0.072	0.038	0.004	0.06	0.00
96	1440	24.00	0.2	0.042	0.072	0.038	0.004	0.06	0.00

EFFECTIVE RAIN & FLOOD VOLUMES SUMMARY

EFFECTIVE RAIN (in)	2.77
FLOOD VOLUME (acft)	3.11
FLOOD VOLUME (cuft)	135506.66
REQUIRED STORAGE (acft)	2.58
REQUIRED STORAGE (cuft)	112296.38
PEAK FLOW (cfs)	7.93

PROJECT: PARK LANE HOMES
JOB # C2013
RETENTION BASIN

BASIN CHARACTERISTICS

CONTOUR	DEPTH		AREA		VOLUME		
	INCR	TOTAL	INCR	TOTAL	INCR	TOTAL	
	(ft)	(ft)	(sf)	(sf)	(cuft)	(cuft)	(acre-ft)
912	0	0	0	10556	0	0	0.00
914	2	2	3203	13759	24315	24315	0.56
915	1	3	1760	15519	14639	38954	0.89
916	1	4	1866	17385	16452	55406	1.27
917	1	5	1972	19357	18371	73777	1.69
918	1	6	2078	21435	20396	94173	2.16
919	1	7	2185	23620	22528	116701	2.68

PERCOLATION CALCULATIONS

PERCOLATION RATE	2 in/hr	0.49 cfs	at depth=	2
		0.64 cfs	at depth=	3
		0.72 cfs	at depth=	4
		0.80 cfs	at depth=	5
		0.90 cfs	at depth=	6
		0.99 cfs	at depth=	7

MAXWELL IV DRYWELLS

NUMBER USED	0	
RATE/DRYWELL	0 cfs	
TOTAL DISSIPATED		0 cfs

TOTAL PERCOLATION RATE	0.49 cfs	at depth=	2
	0.64	at depth=	3
	0.72	at depth=	4
	0.80	at depth=	5
	0.90	at depth=	6
	0.99	at depth=	7

RETENTION BASIN
JOB # C2013
100 YEAR - 3 HOUR STORM EVENT

TIME		FLOW	VOLUME	TOTAL IN	PERC	TOTAL IN	BASIN	BALANCE IN	
UNIT	(min)	IN	IN	BASIN	OUT	BASIN	ELEV	BASIN	
PERIOD		(cfs)	(cuft)	(cuft)	(cuft)	(cuft)	(ft)	(cuft)	(acre-ft)
1	5	3.21	964	964	147	818	912.07	818	0.02
2	10	3.21	964	1,782	147	1,636	912.13	1,636	0.04
3	15	2.42	726	2,362	147	2,216	912.18	2,216	0.05
4	20	4.01	1,203	3,418	147	3,272	912.27	3,272	0.08
5	25	4.01	1,203	4,474	147	4,328	912.36	4,328	0.10
6	30	5.20	1,560	5,887	147	5,741	912.47	5,741	0.13
7	35	4.01	1,203	6,943	147	6,797	912.56	6,797	0.16
8	40	5.20	1,560	8,357	147	8,210	912.68	8,210	0.19
9	45	5.20	1,560	9,770	147	9,623	912.79	9,623	0.22
10	50	4.01	1,203	10,826	147	10,679	912.88	10,679	0.25
11	55	4.41	1,322	12,001	147	11,854	912.98	11,854	0.27
12	60	5.20	1,560	13,414	147	13,268	913.09	13,268	0.30
13	65	6.79	2,036	15,304	147	15,157	913.25	15,157	0.35
14	70	6.79	2,036	17,193	147	17,047	913.40	17,047	0.39
15	75	6.79	2,036	19,083	147	18,936	913.56	18,936	0.43
16	80	5.99	1,798	20,734	147	20,588	913.69	20,588	0.47
17	85	8.37	2,512	23,100	147	22,953	913.89	22,953	0.53
18	90	8.77	2,631	25,585	147	25,438	914.08	25,438	0.58
19	95	7.58	2,274	27,712	191	27,521	914.22	27,521	0.63
20	100	8.77	2,631	30,153	191	29,962	914.39	29,962	0.69
21	105	11.15	3,346	33,308	191	33,117	914.60	33,117	0.76
22	110	10.36	3,108	36,224	191	36,033	914.80	36,033	0.83
23	115	9.57	2,870	38,903	191	38,712	914.98	38,712	0.89
24	120	9.96	2,989	41,700	191	41,509	915.16	41,509	0.95
25	125	10.36	3,108	44,617	216	44,402	915.33	44,402	1.02
26	130	14.73	4,418	48,819	216	48,603	915.59	48,603	1.12
27	135	17.90	5,370	53,974	216	53,758	915.90	53,758	1.23
28	140	11.95	3,584	57,342	216	57,127	916.09	57,127	1.31
29	145	25.04	7,513	64,640	241	64,398	916.49	64,398	1.48
30	150	27.03	8,109	72,507	241	72,266	916.92	72,266	1.66
31	155	30.60	9,180	81,446	241	81,205	917.36	81,205	1.86
32	160	21.47	6,442	87,646	269	87,377	917.67	87,377	2.01
33	165	5.99	1,798	89,175	269	88,907	917.74	88,907	2.04
34	170	5.20	1,560	90,466	269	90,198	917.81	90,198	2.07
35	175	5.20	1,560	91,757	269	91,489	917.87	91,489	2.10
36	180	0.44	131	91,620	269	91,351	917.86	91,351	2.10

RETENTION BASIN
JOB # C2013
100 YEAR - 6 HOUR STORM EVENT

TIME		FLOW	VOLUME	TOTAL IN	PERC	TOTAL IN	BASIN	BALANCE IN	
UNIT	(min)	IN	IN	BASIN	OUT	BASIN	ELEV	BASIN	
PERIOD		(cfs)	(cuft)	(cuft)	(cuft)	(cuft)	(ft)	(cuft)	(acre-ft)
1	5	0.63	189	189	147	43	912.00	43	0.00
2	10	1.15	344	387	147	240	912.02	240	0.01
3	15	1.15	344	584	147	437	912.04	437	0.01
4	20	1.15	344	781	147	634	912.05	634	0.01
5	25	1.15	344	978	147	832	912.07	832	0.02
6	30	1.66	498	1,330	147	1,184	912.10	1,184	0.03
7	35	1.66	498	1,682	147	1,535	912.13	1,535	0.04
8	40	1.66	498	2,034	147	1,887	912.16	1,887	0.04
9	45	1.66	498	2,386	147	2,239	912.18	2,239	0.05
10	50	1.66	498	2,737	147	2,591	912.21	2,591	0.06
11	55	1.66	498	3,089	147	2,943	912.24	2,943	0.07
12	60	2.18	653	3,596	147	3,449	912.28	3,449	0.08
13	65	2.18	653	4,102	147	3,955	912.33	3,955	0.09
14	70	2.18	653	4,608	147	4,462	912.37	4,462	0.10
15	75	2.18	653	5,115	147	4,968	912.41	4,968	0.11
16	80	2.18	653	5,621	147	5,474	912.45	5,474	0.13
17	85	2.18	653	6,127	147	5,981	912.49	5,981	0.14
18	90	2.18	653	6,634	147	6,487	912.53	6,487	0.15
19	95	2.18	653	7,140	147	6,993	912.58	6,993	0.16
20	100	2.18	653	7,646	147	7,500	912.62	7,500	0.17
21	105	2.18	653	8,153	147	8,006	912.66	8,006	0.18
22	110	2.18	653	8,659	147	8,513	912.70	8,513	0.20
23	115	2.18	653	9,166	147	9,019	912.74	9,019	0.21
24	120	2.69	808	9,826	147	9,680	912.80	9,680	0.22
25	125	2.18	653	10,333	147	10,186	912.84	10,186	0.23
26	130	2.69	808	10,994	147	10,847	912.89	10,847	0.25
27	135	2.69	808	11,655	147	11,508	912.95	11,508	0.26
28	140	2.69	808	12,315	147	12,169	913.00	12,169	0.28
29	145	2.69	808	12,976	147	12,830	913.06	12,830	0.29
30	150	2.69	808	13,637	147	13,491	913.11	13,491	0.31
31	155	2.69	808	14,298	147	14,152	913.16	14,152	0.32
32	160	2.69	808	14,959	147	14,812	913.22	14,812	0.34
33	165	3.21	962	15,775	147	15,628	913.29	15,628	0.36
34	170	3.21	962	16,590	147	16,443	913.35	16,443	0.38
35	175	3.21	962	17,405	147	17,259	913.42	17,259	0.40
36	180	3.21	962	18,221	147	18,074	913.49	18,074	0.41
37	185	3.21	962	19,036	147	18,890	913.55	18,890	0.43
38	190	3.72	1,117	20,006	147	19,860	913.63	19,860	0.46
39	195	3.72	1,117	20,976	147	20,830	913.71	20,830	0.48
40	200	3.72	1,117	21,946	147	21,800	913.79	21,800	0.50
41	205	4.24	1,271	23,071	147	22,924	913.89	22,924	0.53
42	210	4.75	1,426	24,350	147	24,203	913.99	24,203	0.56
43	215	5.27	1,580	25,784	147	25,637	914.09	25,637	0.59
44	220	5.27	1,580	27,217	191	27,026	914.19	27,026	0.62
45	225	5.78	1,735	28,761	191	28,570	914.29	28,570	0.66
46	230	5.78	1,735	30,305	191	30,114	914.40	30,114	0.69
47	235	6.30	1,889	32,003	191	31,812	914.51	31,812	0.73
48	240	6.30	1,889	33,701	191	33,510	914.63	33,510	0.77
49	245	6.81	2,044	35,554	191	35,363	914.75	35,363	0.81
50	250	7.33	2,198	37,561	191	37,370	914.89	37,370	0.86
51	255	7.84	2,353	39,723	191	39,532	915.04	39,532	0.91
52	260	8.36	2,508	42,040	216	41,824	915.17	41,824	0.96
53	265	8.87	2,662	44,486	216	44,271	915.32	44,271	1.02
54	270	8.87	2,662	46,933	216	46,717	915.47	46,717	1.07
55	275	9.39	2,817	49,534	216	49,318	915.63	49,318	1.13

RETENTION BASIN
JOB # C2013
100 YEAR - 6 HOUR STORM EVENT

TIME		FLOW IN (cfs)	VOLUME IN (cuft)	TOTAL IN BASIN (cuft)	PERC OUT (cuft)	TOTAL IN BASIN (cuft)	BASIN ELEV (ft)	BALANCE IN BASIN	
UNIT PERIOD	(min)							(cuft)	(acre-ft)
56	280	9.90	2,971	52,290	216	52,074	915.80	52,074	1.20
57	285	10.42	3,126	55,200	216	54,984	915.97	54,984	1.26
58	290	10.42	3,126	58,110	216	57,894	916.14	57,894	1.33
59	295	10.93	3,280	61,175	241	60,933	916.30	60,933	1.40
60	300	11.45	3,435	64,368	241	64,127	916.47	64,127	1.47
61	305	14.03	4,208	68,334	241	68,093	916.69	68,093	1.56
62	310	16.60	4,980	73,073	241	72,832	916.95	72,832	1.67
63	315	18.15	5,444	78,276	241	78,034	917.21	78,034	1.79
64	320	19.69	5,908	83,942	269	83,673	917.49	83,673	1.92
65	325	22.27	6,680	90,353	269	90,084	917.80	90,084	2.07
66	330	26.90	8,071	98,156	269	97,887	918.16	97,887	2.25
67	335	7.84	2,353	100,240	269	99,971	918.26	99,971	2.30
68	340	2.69	808	100,778	269	100,510	918.28	100,510	2.31
69	345	1.15	344	100,853	269	100,585	918.28	100,585	2.31
70	350	0.63	189	100,774	269	100,505	918.28	100,505	2.31
71	355	0.15	46	100,551	269	100,283	918.27	100,283	2.30
72	360	0.10	31	100,313	269	100,045	918.26	100,045	2.30

RETENTION BASIN
JOB # C2013
100 YEAR - 24 HOUR STORM EVENT

TIME		FLOW IN	VOLUME IN	TOTAL IN BASIN	PERC OUT	TOTAL IN BASIN	BASIN ELEV	BALANCE IN BASIN	
UNIT PERIOD	(min)	(cfs)	(cuft)	(cuft)	(cuft)	(cuft)	(ft)	(cuft)	(acre-ft)
1	15	0.06	51	51	440	-	912.00	-	0.00
2	30	0.08	76	76	440	-	912.00	-	0.00
3	45	0.08	76	76	440	-	912.00	-	0.00
4	60	0.11	102	102	440	-	912.00	-	0.00
5	75	0.08	76	76	440	-	912.00	-	0.00
6	90	0.08	76	76	440	-	912.00	-	0.00
7	105	0.08	76	76	440	-	912.00	-	0.00
8	120	0.11	102	102	440	-	912.00	-	0.00
9	135	0.11	102	102	440	-	912.00	-	0.00
10	150	0.11	102	102	440	-	912.00	-	0.00
11	165	0.14	127	127	440	-	912.00	-	0.00
12	180	0.14	127	127	440	-	912.00	-	0.00
13	195	0.14	127	127	440	-	912.00	-	0.00
14	210	0.14	127	127	440	-	912.00	-	0.00
15	225	0.14	127	127	440	-	912.00	-	0.00
16	240	0.17	153	153	440	-	912.00	-	0.00
17	255	0.17	153	153	440	-	912.00	-	0.00
18	270	0.20	178	178	440	-	912.00	-	0.00
19	285	0.20	178	178	440	-	912.00	-	0.00
20	300	0.23	203	203	440	-	912.00	-	0.00
21	315	0.17	153	153	440	-	912.00	-	0.00
22	330	0.20	178	178	440	-	912.00	-	0.00
23	345	0.23	203	203	440	-	912.00	-	0.00
24	360	0.23	203	203	440	-	912.00	-	0.00
25	375	0.25	229	229	440	-	912.00	-	0.00
26	390	0.03	28	28	440	-	912.00	-	0.00
27	405	0.35	313	313	440	-	912.00	-	0.00
28	420	0.38	343	343	440	-	912.00	-	0.00
29	435	0.41	373	373	440	-	912.00	-	0.00
30	450	0.73	657	657	440	217	912.02	217	0.00
31	465	1.04	940	1,157	440	717	912.06	717	0.02
32	480	1.36	1,223	1,940	440	1,500	912.12	1,500	0.03
33	495	1.96	1,761	3,261	440	2,821	912.23	2,821	0.06
34	510	1.99	1,789	4,610	440	4,170	912.34	4,170	0.10
35	525	2.30	2,072	6,242	440	5,802	912.48	5,802	0.13
36	540	2.62	2,354	8,156	440	7,716	912.63	7,716	0.18
37	555	3.21	2,890	10,606	440	10,167	912.84	10,167	0.23
38	570	3.52	3,172	13,339	440	12,899	913.06	12,899	0.30
39	585	3.84	3,453	16,352	440	15,912	913.31	15,912	0.37
40	600	4.15	3,735	19,647	440	19,207	913.58	19,207	0.44
41	615	2.20	1,982	21,189	440	20,750	913.71	20,750	0.48
42	630	2.23	2,009	22,758	440	22,319	913.84	22,319	0.51
43	645	3.67	3,306	25,625	440	25,185	914.06	25,185	0.58
44	660	3.70	3,332	28,517	573	27,943	914.25	27,943	0.64
45	675	3.45	3,104	31,047	573	30,474	914.42	30,474	0.70
46	690	3.48	3,129	33,603	573	33,029	914.60	33,029	0.76
47	705	2.94	2,646	35,675	573	35,102	914.74	35,102	0.81
48	720	3.25	2,925	38,027	573	37,454	914.90	37,454	0.86
49	735	5.25	4,729	42,182	573	41,609	915.16	41,609	0.96
50	750	5.56	5,007	46,616	647	45,970	915.43	45,970	1.06
51	765	6.16	5,540	51,510	647	50,863	915.72	50,863	1.17
52	780	6.46	5,818	56,681	647	56,034	916.03	56,034	1.29
53	795	7.90	7,112	63,146	724	62,422	916.38	62,422	1.43
54	810	7.93	7,135	69,557	724	68,833	916.73	68,833	1.58
55	825	4.85	4,362	73,195	724	72,470	916.93	72,470	1.66
56	840	4.87	4,385	76,855	724	76,131	917.12	76,131	1.75
57	855	6.03	5,424	81,555	807	80,748	917.34	80,748	1.85
58	870	5.77	5,192	85,940	807	85,133	917.56	85,133	1.95

RETENTION BASIN
JOB # C2013
100 YEAR - 24 HOUR STORM EVENT

TIME		FLOW IN (cfs)	VOLUME IN (cuft)	TOTAL IN BASIN (cuft)	PERC OUT (cuft)	TOTAL IN BASIN (cuft)	BASIN ELEV (ft)	BALANCE IN BASIN	
UNIT PERIOD	(min)							(cuft)	(acre-ft)
59	885	5.79	5,213	90,346	807	89,540	917.77	89,540	2.06
60	900	5.53	4,980	94,520	807	93,714	917.98	93,714	2.15
61	915	5.27	4,747	98,461	807	97,654	918.15	97,654	2.24
62	930	5.02	4,514	102,168	807	101,362	918.32	101,362	2.33
63	945	3.91	3,517	104,879	807	104,072	918.44	104,072	2.39
64	960	3.93	3,537	107,610	807	106,803	918.56	106,803	2.45
65	975	0.11	102	106,905	807	106,099	918.53	106,099	2.44
66	990	0.11	102	106,200	807	105,394	918.50	105,394	2.42
67	1005	0.08	76	105,470	807	104,663	918.47	104,663	2.40
68	1020	0.08	76	104,740	807	103,933	918.43	103,933	2.39
69	1035	0.08	74	104,007	807	103,201	918.40	103,201	2.37
70	1050	0.10	92	103,293	807	102,486	918.37	102,486	2.35
71	1065	0.12	110	102,596	807	101,789	918.34	101,789	2.34
72	1080	0.11	102	101,891	807	101,084	918.31	101,084	2.32
73	1095	0.11	102	101,186	807	100,379	918.28	100,379	2.30
74	1110	0.11	102	100,481	807	99,675	918.24	99,675	2.29
75	1125	0.08	76	99,751	807	98,944	918.21	98,944	2.27
76	1140	0.06	51	98,995	807	98,189	918.18	98,189	2.25
77	1155	0.08	76	98,265	807	97,458	918.15	97,458	2.24
78	1170	0.11	102	97,560	807	96,753	918.11	96,753	2.22
79	1185	0.08	76	96,830	807	96,023	918.08	96,023	2.20
80	1200	0.06	51	96,074	807	95,267	918.05	95,267	2.19
81	1215	0.08	76	95,344	807	94,537	918.02	94,537	2.17
82	1230	0.08	76	94,613	807	93,807	917.98	93,807	2.15
83	1245	0.08	76	93,883	807	93,077	917.95	93,077	2.14
84	1260	0.06	51	93,127	807	92,321	917.91	92,321	2.12
85	1275	0.08	76	92,397	807	91,591	917.87	91,591	2.10
86	1290	0.06	51	91,641	807	90,835	917.84	90,835	2.09
87	1305	0.08	76	90,911	807	90,105	917.80	90,105	2.07
88	1320	0.06	51	90,155	807	89,349	917.76	89,349	2.05
89	1335	0.08	76	89,425	807	88,619	917.73	88,619	2.03
90	1350	0.06	51	88,669	807	87,863	917.69	87,863	2.02
91	1365	0.06	51	87,914	807	87,107	917.65	87,107	2.00
92	1380	0.06	51	87,158	807	86,351	917.62	86,351	1.98
93	1395	0.06	51	86,402	807	85,596	917.58	85,596	1.97
94	1410	0.06	51	85,647	807	84,840	917.54	84,840	1.95
95	1425	0.06	51	84,891	807	84,084	917.51	84,084	1.93
96	1440	0.06	51	84,135	807	83,329	917.47	83,329	1.91

III RCFCD SHORTCUT SYNTHETIC UNIT HYDROGRAPH CALCULATED RETENTION VOLUMES

ON-SITE

100 YEAR STORM EVENT VOLUME REQUIRED = 43,154 CU.FT.

RETENTION BASIN VOLUME PROVIDED = 63,130 CU.FT. (WITH 1' FREEBOARD)

OFF-SITE

100 YEAR STORM EVENT VOLUME REQUIRED = 112,296 CU.FT.

ESTIMATED BASIN CAPACITY WITHIN DESIGNATED AREA = 116,701 CU.FT.

IV INFILTRATION BASIN DRAWDOWN SUMMARY

Project runoff stored in the on-site retention basin system will be designed to infiltrate into the soil to eliminate the presence of standing water and risk of vector control issues within a period of 48 hours in accordance with the local vector control requirements.

The RCFCD Synthetic Unit Hydrograph calculations in the appendix of this report show that the 100 year design storm volume storage depth in the on-site retention basin is 3.68 ft. Assuming that the effective infiltration in the underground retention system occurs along the bottom surface area of the basin, the design infiltration rate can be applied to the stored volume depth to calculate the drawdown time for complete evacuation as follows:

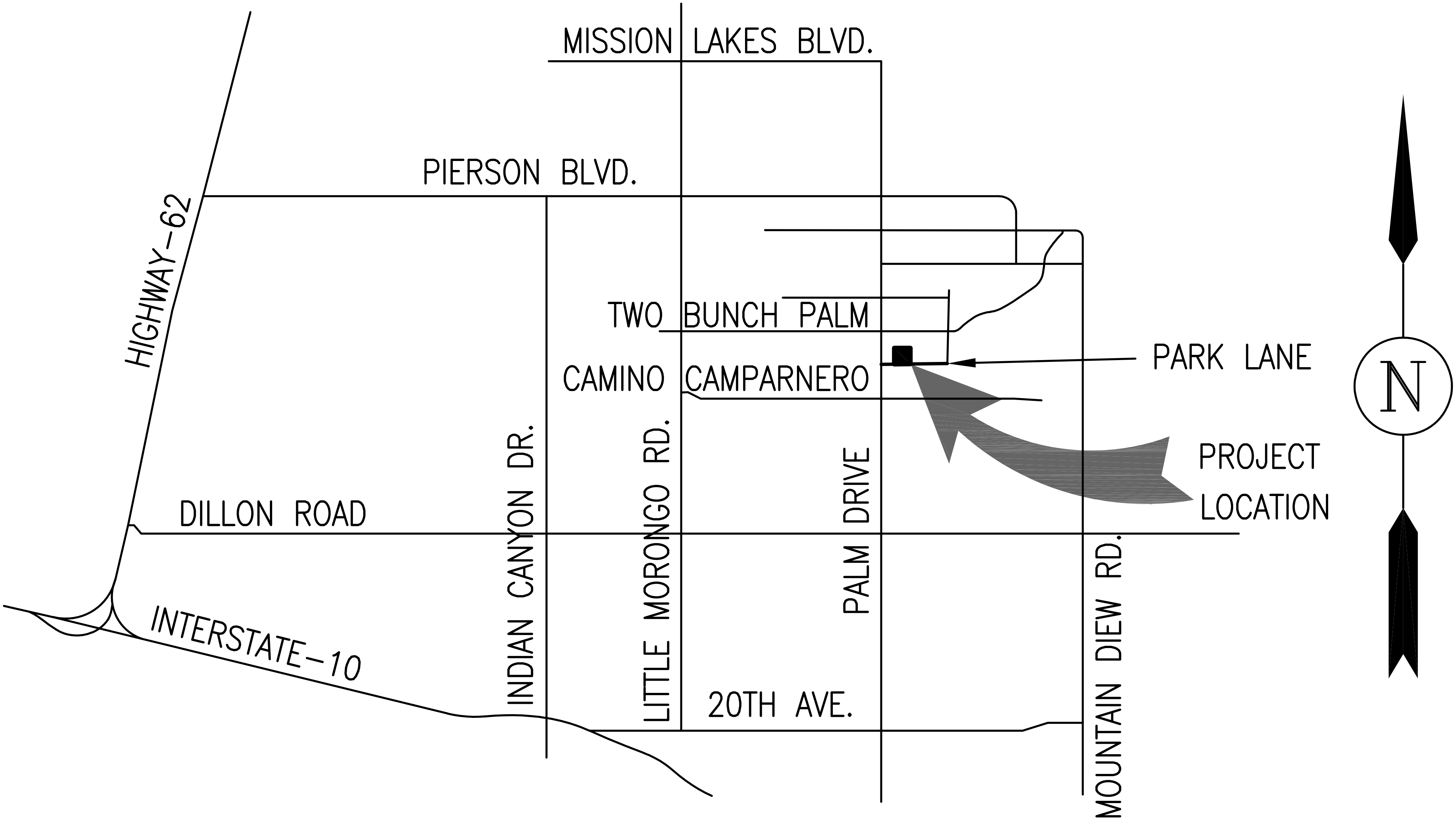
Stored Runoff Volume Depth = 3.68 ft = 44.16 in

Assumed Infiltration Rate = 2 in/hr

(44.16 in)/(2 in/hr) = 22.1 hrs < 48 hrs

The total stored runoff volume in the on-site surface retention basin can be evacuated completely via infiltration within a period of 22.1 hrs. assuming a conservative design infiltration rate of 2 in/hr.

APPENDIX – REFERENCE MATERIAL



VICINITY MAP
NOT TO SCALE

NOAA Atlas 14, Volume 6, Version 2
Location name: Desert Hot Springs, California, USA*
Latitude: 33.944°, Longitude: -116.4981°
Elevation: 911 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

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.081** (0.067-0.098)	**0.114** (0.094-0.138)	**0.163** (0.135-0.199)	**0.208** (0.171-0.256)	**0.278** (0.221-0.354)	**0.339** (0.264-0.441)	**0.409** (0.310-0.545)	**0.489** (0.360-0.670)	**0.612** (0.433-0.875)	**0.722** (0.493-1.07)
10-min	**0.116** (0.096-0.140)	**0.163** (0.135-0.198)	**0.234** (0.194-0.285)	**0.298** (0.245-0.367)	**0.399** (0.317-0.507)	**0.487** (0.378-0.632)	**0.586** (0.444-0.781)	**0.701** (0.516-0.960)	**0.877** (0.620-1.25)	**1.04** (0.706-1.53)
15-min	**0.140** (0.116-0.170)	**0.197** (0.164-0.240)	**0.283** (0.234-0.345)	**0.361** (0.296-0.444)	**0.482** (0.383-0.614)	**0.588** (0.457-0.765)	**0.709** (0.537-0.944)	**0.847** (0.624-1.16)	**1.06** (0.750-1.52)	**1.25** (0.854-1.85)
30-min	**0.221** (0.184-0.269)	**0.312** (0.259-0.380)	**0.448** (0.371-0.546)	**0.572** (0.469-0.703)	**0.764** (0.606-0.972)	**0.932** (0.724-1.21)	**1.12** (0.851-1.50)	**1.34** (0.989-1.84)	**1.68** (1.19-2.40)	**1.98** (1.35-2.93)
60-min	**0.321** (0.267-0.390)	**0.452** (0.376-0.550)	**0.649** (0.537-0.792)	**0.829** (0.680-1.02)	**1.11** (0.879-1.41)	**1.35** (1.05-1.76)	**1.63** (1.23-2.17)	**1.94** (1.43-2.66)	**2.44** (1.72-3.48)	**2.87** (1.96-4.25)
2-hr	**0.436** (0.363-0.530)	**0.602** (0.500-0.732)	**0.848** (0.703-1.04)	**1.07** (0.881-1.32)	**1.42** (1.13-1.80)	**1.72** (1.34-2.24)	**2.06** (1.56-2.74)	**2.45** (1.81-3.36)	**3.05** (2.15-4.35)	**3.57** (2.44-5.28)
3-hr	**0.529** (0.440-0.643)	**0.726** (0.603-0.883)	**1.02** (0.843-1.24)	**1.28** (1.05-1.58)	**1.69** (1.34-2.15)	**2.05** (1.59-2.66)	**2.45** (1.86-3.26)	**2.91** (2.14-3.98)	**3.61** (2.55-5.16)	**4.22** (2.88-6.25)
6-hr	**0.685** (0.570-0.833)	**0.942** (0.782-1.14)	**1.32** (1.09-1.61)	**1.67** (1.37-2.05)	**2.20** (1.75-2.80)	**2.66** (2.07-3.46)	**3.18** (2.41-4.24)	**3.78** (2.78-5.18)	**4.69** (3.32-6.70)	**5.49** (3.75-8.12)
12-hr	**0.834** (0.693-1.01)	**1.17** (0.971-1.42)	**1.67** (1.38-2.04)	**2.12** (1.74-2.61)	**2.82** (2.24-3.59)	**3.44** (2.67-4.47)	**4.13** (3.13-5.50)	**4.93** (3.63-6.75)	**6.15** (4.35-8.79)	**7.23** (4.94-10.7)
24-hr	**0.979** (0.867-1.13)	**1.41** (1.25-1.63)	**2.05** (1.81-2.38)	**2.64** (2.31-3.08)	**3.54** (3.00-4.27)	**4.34** (3.60-5.33)	**5.23** (4.24-6.58)	**6.26** (4.94-8.10)	**7.86** (5.96-10.6)	**9.27** (6.79-12.9)
2-day	**1.06** (0.935-1.22)	**1.56** (1.38-1.80)	**2.30** (2.02-2.66)	**2.97** (2.60-3.46)	**4.00** (3.39-4.82)	**4.89** (4.06-6.01)	**5.90** (4.79-7.43)	**7.06** (5.57-9.13)	**8.84** (6.70-11.9)	**10.4** (7.62-14.5)
3-day	**1.09** (0.963-1.25)	**1.62** (1.44-1.87)	**2.41** (2.13-2.79)	**3.13** (2.74-3.65)	**4.22** (3.58-5.08)	**5.16** (4.29-6.35)	**6.22** (5.05-7.83)	**7.43** (5.86-9.61)	**9.28** (7.03-12.5)	**10.9** (7.98-15.2)
4-day	**1.12** (0.996-1.30)	**1.69** (1.50-1.95)	**2.54** (2.24-2.93)	**3.29** (2.88-3.84)	**4.45** (3.77-5.35)	**5.44** (4.51-6.68)	**6.55** (5.31-8.24)	**7.81** (6.16-10.1)	**9.73** (7.37-13.1)	**11.4** (8.35-15.9)
7-day	**1.24** (1.10-1.43)	**1.91** (1.69-2.21)	**2.90** (2.56-3.36)	**3.79** (3.31-4.42)	**5.12** (4.34-6.16)	**6.25** (5.19-7.68)	**7.51** (6.09-9.45)	**8.92** (7.04-11.5)	**11.0** (8.36-14.9)	**12.9** (9.42-17.9)
10-day	**1.31** (1.16-1.50)	**2.04** (1.81-2.36)	**3.12** (2.75-3.60)	**4.07** (3.56-4.75)	**5.51** (4.67-6.64)	**6.72** (5.58-8.26)	**8.06** (6.54-10.1)	**9.56** (7.54-12.4)	**11.8** (8.94-15.9)	**13.7** (10.0-19.1)
20-day	**1.44** (1.27-1.66)	**2.27** (2.01-2.62)	**3.49** (3.08-4.04)	**4.57** (4.00-5.33)	**6.19** (5.24-7.45)	**7.55** (6.27-9.28)	**9.04** (7.33-11.4)	**10.7** (8.44-13.8)	**13.1** (9.95-17.7)	**15.2** (11.1-21.2)
30-day	**1.64** (1.45-1.88)	**2.58** (2.28-2.97)	**3.95** (3.48-4.57)	**5.17** (4.53-6.03)	**7.00** (5.94-8.44)	**8.54** (7.09-10.5)	**10.2** (8.29-12.9)	**12.1** (9.53-15.6)	**14.8** (11.2-19.9)	**17.1** (12.5-23.8)
45-day	**1.82** (1.61-2.10)	**2.85** (2.52-3.29)	**4.35** (3.84-5.04)	**5.70** (4.99-6.64)	**7.72** (6.54-9.29)	**9.42** (7.82-11.6)	**11.3** (9.14-14.2)	**13.3** (10.5-17.2)	**16.3** (12.4-21.9)	**18.8** (13.8-26.2)
60-day	**2.02** (1.79-2.32)	**3.12** (2.76-3.60)	**4.76** (4.20-5.50)	**6.22** (5.44-7.25)	**8.41** (7.13-10.1)	**10.3** (8.52-12.6)	**12.3** (9.97-15.5)	**14.5** (11.4-18.8)	**17.8** (13.5-23.9)	**20.5** (15.0-28.5)

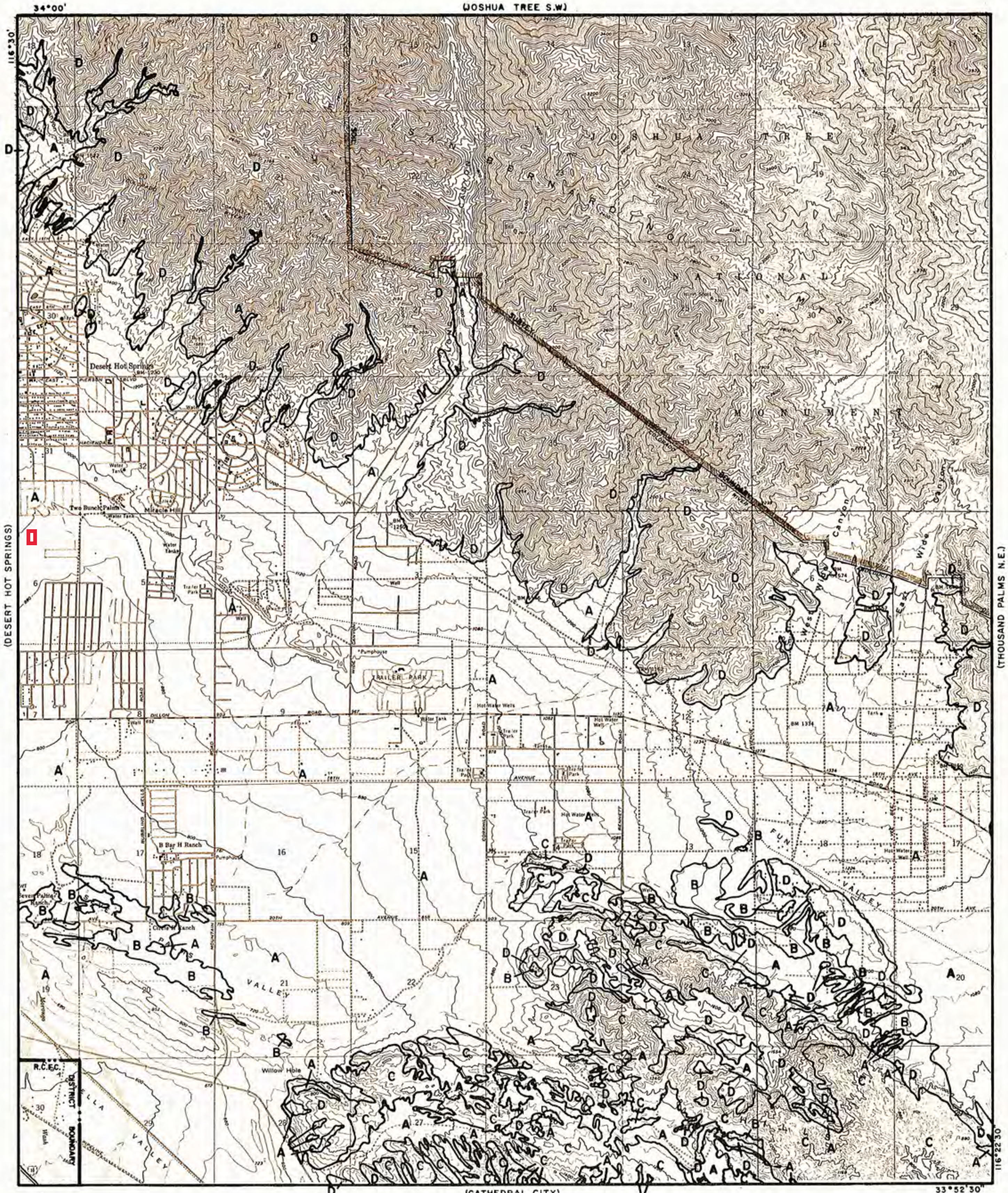
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

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 average recurrence interval) 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.

Back to Top

PF graphical



LEGEND

——— SOILS GROUP BOUNDARY

A SOILS GROUP DESIGNATION

RCFC & WCD

HYDROLOGY MANUAL

0 FEET 5000

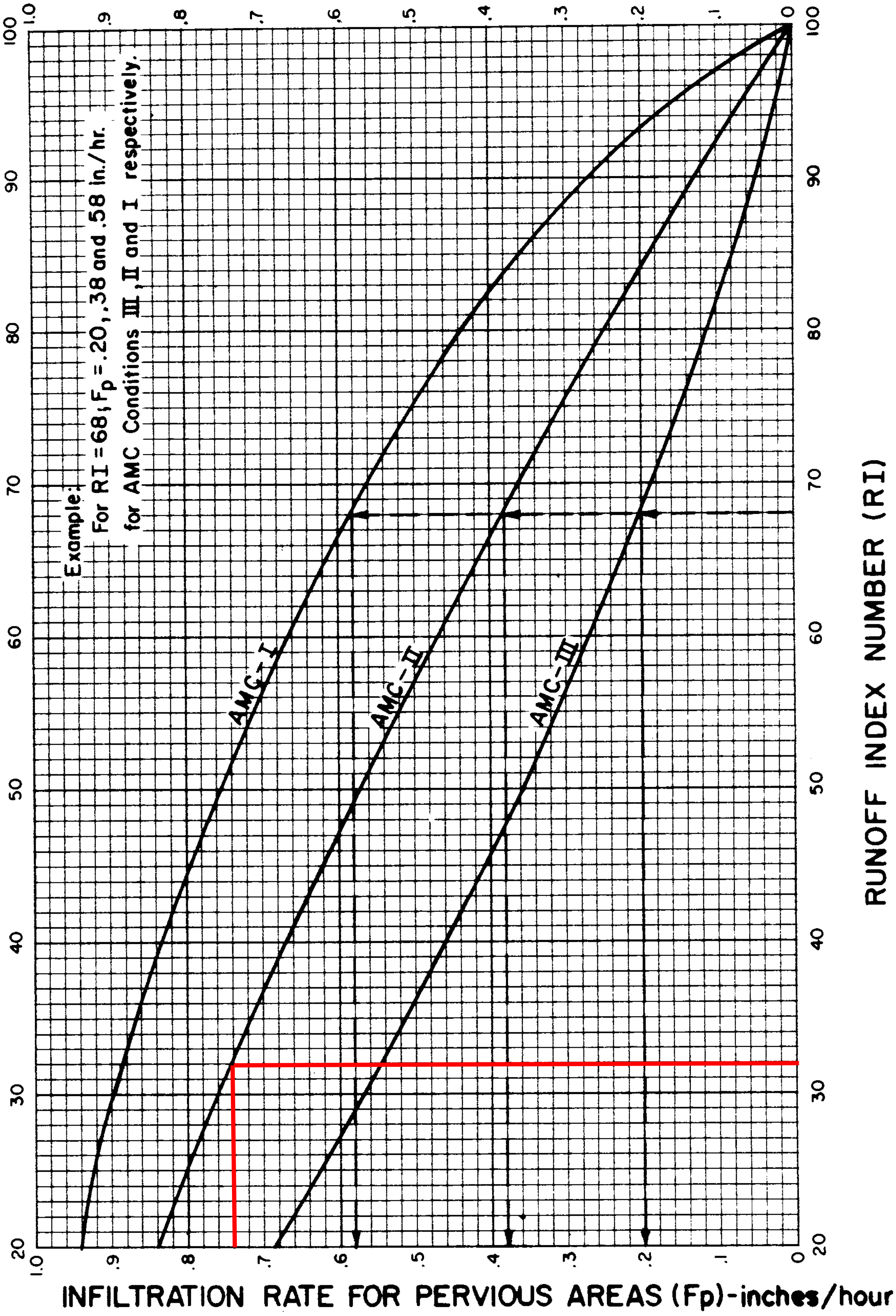
HYDROLOGIC SOILS GROUP MAP
FOR
SEVEN PALMS VALLEY

PLATE C-1.23

RUNOFF INDEX NUMBERS OF HYDROLOGIC SOIL-COVER COMPLEXES FOR PERVIOUS AREAS-AMC II

Cover Type (3)	Quality of Cover (2)	Soil Group			
		A	B	C	D
NATURAL COVERS -					
Barren (Rockland, eroded and graded land)		78	86	91	93
Chaparrel, Broadleaf (Manzonita, ceanothus and scrub oak)	Poor	53	70	80	85
	Fair	40	63	75	81
	Good	31	57	71	78
Chaparrel, Narrowleaf (Chamise and redshank)	Poor	71	82	88	91
	Fair	55	72	81	86
Grass, Annual or Perennial	Poor	67	78	86	89
	Fair	50	69	79	84
	Good	38	61	74	80
Meadows or Cienegas (Areas with seasonally high water table, principal vegetation is sod forming grass)	Poor	63	77	85	88
	Fair	51	70	80	84
	Good	30	58	72	78
Open Brush (Soft wood shrubs - buckwheat, sage, etc.)	Poor	62	76	84	88
	Fair	46	66	77	83
	Good	41	63	75	81
Woodland (Coniferous or broadleaf trees predominate. Canopy density is at least 50 percent)	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	28	55	70	77
Woodland, Grass (Coniferous or broadleaf trees with canopy density from 20 to 50 percent)	Poor	57	73	82	86
	Fair	44	65	77	82
	Good	33	58	72	79
URBAN COVERS -					
Residential or Commercial Landscaping (Lawn, shrubs, etc.)	Good	32	56	69	75
Turf (Irrigated and mowed grass)	Poor	58	74	83	87
	Fair	44	65	77	82
	Good	33	58	72	79
AGRICULTURAL COVERS -					
Fallow (Land plowed but not tilled or seeded)		76	85	90	92

RUNOFF INDEX NUMBERS
FOR
PERVIOUS AREA



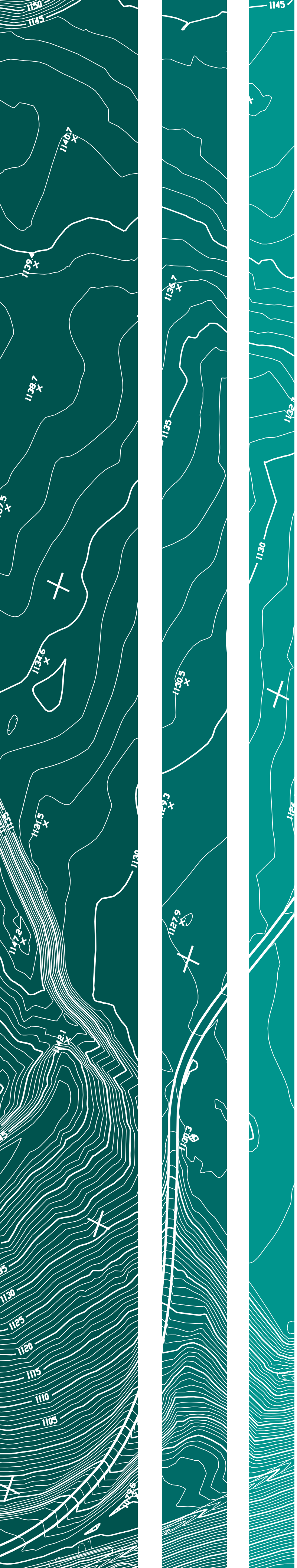
NOTES:

1. R.I. Number-Infiltration relationships are derived from rainfall-runoff relationships in Bibliography item No. 36.

RCFC & WCD

HYDROLOGY MANUAL

INFILTRATION RATE FOR PERVIOUS AREAS VERSUS RUNOFF INDEX NUMBERS



PRELIMINARY GEOTECHNICAL INVESTIGATION

PROPOSED MULTI-FAMILY RESIDENTIAL DEVELOPMENT
14320 PALM DRIVE
DESERT HOT SPRINGS, CALIFORNIA

SEPTEMBER 12, 2024
PROJECT NO. T3082-22-01

PREPARED FOR:
ABODE COMMUNITIES
LOS ANGELES, CALIFORNIA

GEOCON
WEST, INC.
GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS

Project No. T3082-22-01
September 12, 2024

Abode Communities
1149 S. Hill Street, Suite 700
Los Angeles, CA 90015

Attention: Sergio Rosas, Senior Project Manager

Subject: PRELIMINARY GEOTECHNICAL INVESTIGATION
PROPOSED MULTI-FAMILY RESIDENTIAL DEVELOPMENT
14320 PALM DRIVE
DESERT HOT SPRINGS, CALIFORNIA

Mr. Rosas:

In accordance with your authorization of our Proposal CV-24-1225-P-GT, dated July 8, 2024, Geocon West, Inc. (Geocon) performed a preliminary geotechnical investigation for the proposed multi-family residential development, planned east of the Desert Hot Springs Library, at 14320 Palm Drive in the City of Desert Hot Springs, California. The accompanying report presents our findings, conclusions, and preliminary recommendations pertaining to the geotechnical aspects of the proposed development. Based on the results of this study, it is our opinion the site is considered suitable for the proposed development provided the recommendations of this report are followed.

The primary intent of this study was to address potential geologic hazards and geotechnical conditions that could impact the project. An updated geotechnical study will be required when more finalized project plans become available for review, to provide updated geotechnical recommendations for design and construction.

Should you have any questions regarding this report, or if we may be of further service, please contact the undersigned at your convenience.

Very truly yours,

GEOCON WEST, INC.

LISA A. BATTIATO
No. 2316
CERTIFIED ENGINEERING GEOLOGIST

ANDREW T. SHOASHEKAN
No. 93940
CIVIL

Lisa A. Battiato
CEG 2316

Andrew T. Shoashekan
PE 92940

PETRINA ZEN
GE3217
GEOTECHNICAL

Petrina Zen

Petrina Zen
GE 3217

LAB:ATS:PZ:hd

(email) Addressee

78-075 Main Street #G-203 ■ La Quinta, California 92253 ■ Telephone 760.565.2002 ■ www.geoconinc.com

TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED)

PRELIMINARY GEOTECHNICAL INVESTIGATION

1. PURPOSE AND SCOPE

This report presents the results of our preliminary geotechnical investigation for the proposed multi-family residential development, planned within a square parcel located immediately east of the Desert Hot Springs Library, at 14320 Palm Drive in the City of Desert Hot Springs, California, as depicted on the *Vicinity Map*, Figure 1.

The purpose of this investigation was to perform a subsurface exploration and percolation testing, laboratory testing, and provide geotechnical analyses and, based on the conditions encountered, provide preliminary recommendations pertaining to the geotechnical aspects of developing the property. An updated geotechnical study will be required when more finalized plans become available, to provide updated geotechnical recommendations for design and construction.

The scope of this investigation included reviewing aerial photographs and published geologic information; conducting a subsurface exploration and performing sample collection, percolation testing, laboratory testing on the samples collected; engineering analyses; and preparing this preliminary geotechnical report. A summary of the information and documentation reviewed for this study is presented in the *List of References*.

Our field investigation was conducted on August 9 and 12, 2024, and included:

- Drilling of nine (9) exploratory borings (Borings B-1 through B-9) to depths ranging between approximately 16½ feet and 50½ feet, to observe the subsurface geological conditions at the site, collect relatively undisturbed in-situ and disturbed bulk samples for laboratory testing, and evaluate the depth to static groundwater, if encountered.
- Backfilling and performing percolation testing in one (1) geotechnical boring (Boring B-3), at a depth of approximately 10 feet, to provide a preliminary evaluation of the subsurface infiltration rate in areas where stormwater infiltration systems are expected. The percolation test is identified as Test P-1. A bentonite plug was installed at 10 feet of depth, after backfilling and prior to performing percolation testing. Additional percolation testing should be performed when the exact location and depth of the proposed stormwater infiltration system is known.

Appendix A presents a discussion of the field investigation, and detailed logs of the borings and percolation test data. The approximate locations of the exploratory borings and the percolation test are presented on Figure 2, *Geologic Map and Site Plan*. We performed laboratory testing on select soil samples obtained from our field investigation to evaluate physical and chemical properties for engineering analysis. Appendix B presents the results of our laboratory testing.

If project details vary significantly from those described herein, Geocon should be contacted to determine the necessity for review and possible revision of this report.

2. SITE AND PROJECT DESCRIPTION

The site is an approximately 8-acre square parcel that is vacant and undeveloped. Based on Google Earth aerial imagery, the site appears to have been natural since at least 1996. The site consists of a loose sand surface with moderate to sparce growth of shrubs. Access is via a gate along Park Lane. The site is bounded on the north by a retail shopping center, the west by Desert Hot Springs Library and Riverside County Behavioral Health and Nutrition Services Center, on the south by Park Lane, and on the east by the play fields of Desert Springs Middle School.

The site is relatively flat to gently sloping down toward the southeast. Existing elevations range from approximately 917 feet above mean sea level (MSL) in the northwest portion of the site, to approximately 906 feet MSL in the southeast portion of the site. Drainage appears to be by sheet flow toward the southeast. The site coordinates are at latitude 33.9441 degrees and longitude -116.4989 degrees.

The *Site Plan*, prepared by Abode Communities Architecture Studio and dated October 17, 2023, indicates the proposed development will include eight multi-family residential buildings up to three stories high, a community center, and an early childcare center. Additionally, associated utility, parking, drive aisle, flatwork, and landscape improvements are proposed for the site. The stormwater mitigation plan has not been developed for the site at this time; however, we expect infiltration systems will be constructed in the southeastern corner of the site where the lowest elevation exists.

We expect that rough grading will result in cuts and fills of less than 5 feet (exclusive of remedial grading). Graded slopes are not proposed on the site at this time.

Structural plans and loading information were not provided to us at this time; however, we expect the proposed structures will be one- to three-story buildings constructed of wood or light gauge steel framing, with shallow concrete foundations and concrete slab-on-grade floors. For preliminary evaluation purposes, we assume that column loads for the proposed structures will be up to 300 kips, and wall loads will be up to 3 kips per linear foot.

Once the design phase and foundation loading configuration proceeds to a more finalized plan, the recommendations within this report should be reviewed and revised, if necessary. Any changes in the design, location or elevation of any structure, as outlined in this report, should be reviewed by this office. If project details differ significantly from those described, Geocon should be contacted for review and possible revision to this report.

3. GEOLOGIC SETTING

The site is located within the northern end of the Coachella Valley approximately 35 miles northwest of the Salton Sea. The Coachella Valley is a pull apart geologic basin formed by extensional faulting and step-overs along the San Andreas fault. A thickness of more than 3,000 feet of sediment has accumulated within the Coachella Valley in the last 0.5 million years since the extension began. The site is located east of the San Jacinto Mountains and is subject to alluvial deposits carried from the nearby foothills to the west. The sediments consist primarily of sands and gravels with varying amounts of silt.

The Coachella Valley is part of the Colorado Desert geomorphic province, which is bounded on the west by the Santa Rosa Mountains and the north by the Transverse Ranges. The Colorado Desert extends beyond California to the east and south. The San Andreas fault is geologically mapped approximately ½ mile northeast of the site. Geothermal resources associated with the pull-apart basin are present near the southern area of the Salton Sea.

Regional subsidence has occurred in recent history within the Coachella Valley. Initial subsidence occurred between the 1920's and 1940's when groundwater was over pumped and ground water levels declined on the order of 50 feet. The introduction of Colorado River water in 1949 reduced groundwater pumping and the related subsidence temporarily stopped. In the 1970's overdraft of the groundwater occurred resulting in groundwater level declines of 50 to 100 feet. Subsidence resumed. In 1996 the United States Geologic Survey (USGS) in cooperation with Coachella Valley Water District (CVWD) implemented a geodetic measurement of ground levels from Palm Desert, southwestward to the Salton Sea. Subsidence was not studied in the Desert Hot Springs area. CVWD has embarked on a groundwater replenishment program which has slowed the rate of subsidence in the region. Ongoing studies from the USGS have discovered that the dominant factor in ground subsidence is the presence of silt layers which compress upon groundwater withdrawal (Sneed, APWA Presentation March 2013). Ground subsidence could occur in the future and the site could be affected especially if groundwater withdrawal were to re-initiate. We expect the subsidence to be on a regional scale that could cause settlement across the project site. However, the settlement occurs over a relatively large geographic area and typically does not cause differential settlement over a relatively short horizontal distance that should be addressed as a design concern as part of the site development.

4. GEOLOGIC MATERIALS

4.1 General

Based on the field investigation and published geologic maps of the area, the soil exposed at the surface and underlying the site to depths of several hundred feet is generally referred to as alluvium. The alluvium at the site includes cohesionless, undissected alluvial sand and gravel of the valley areas (Dibblee, 2008). Although undocumented artificial fill was not encountered in our borings, it may be present on the site. The soil and geologic units encountered at the site are discussed in general terms below. The site soil is described in detail on the boring logs in Appendix A.

4.2 Alluvial Sand and Gravel of the Valley Areas (Qa)

The alluvial soils encountered consist predominantly of poorly graded sand, poorly graded sand with silt, and silty sand. Cobbles were encountered, along with several “no recoveries” with locally high blow counts, within our borings at depth. Where explored, the alluvial soils are generally loose to very dense, dry to slightly moist, and are pale brown. This soil is highly susceptible to caving. Cobbles and boulders were observed scattered across the surface of the site. Based on what we encountered within our borings and what we observed across the surface of the site, cobbles and boulders should be expected to be encountered during grading operations. Furthermore, laboratory testing indicates site soils are dry, with average in-situ moisture contents within borings ranging between 0.7 and 6.6 percent.

5. GROUNDWATER

Static groundwater was not encountered during this investigation to the maximum depth explored of approximately 50½ feet. Based on a well record located approximately 0.8 mile west of the site (Well 03S04E01J001S), static groundwater may be as shallow as 176 feet beneath the ground surface at the site. We do not expect static groundwater to impact grading operations or the construction of improvements at the subject site. Static groundwater elevations are dependent on seasonal precipitation, irrigation, and land use, among other factors, and vary as a result.

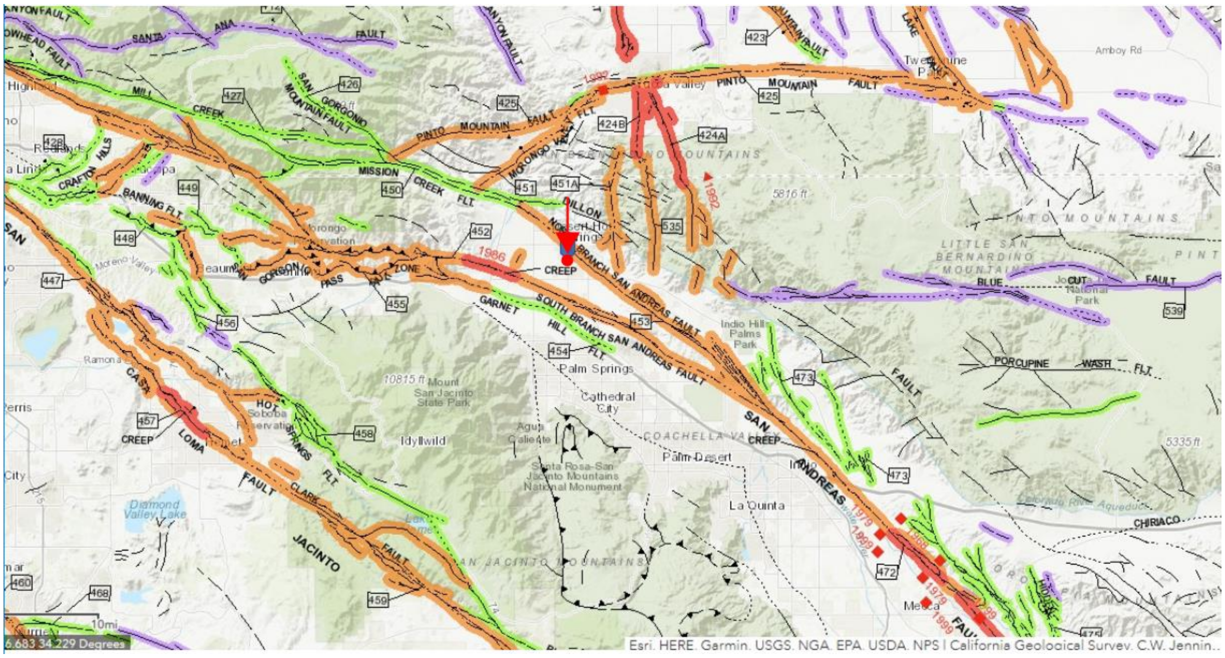
6. GEOLOGIC HAZARDS

6.1 Surface Fault Rupture

The numerous faults in Southern California include Holocene-active, pre-Holocene, and inactive faults. The criteria for these major groups are based on criteria developed by the California Geological Survey (CGS, formerly known as CDMG) for the Alquist-Priolo Earthquake Fault Zone Program (CGS, 2018). By definition, a Holocene-active fault is one that has had surface displacement within Holocene time (about the last 11,700 years). A pre-Holocene fault has demonstrated surface displacement during Quaternary time (approximately the last 1.6 million years) but has had no known Holocene movement. Faults that have not moved in the last 1.6 million years are considered inactive.

The site is not within a state-designated Alquist-Priolo Earthquake Fault Zone (CGS, 2023a; 2023b; 2017; Riverside County Map My County 2024) for surface fault rupture hazards. No Holocene-active or pre-Holocene faults with the potential for surface fault rupture are known to pass directly beneath the site. Therefore, the potential for surface rupture due to faulting occurring beneath the site during the design life of the proposed development is considered low. However, the site is located in the seismically active Southern California region and could be subjected to moderate to strong ground shaking in the event of an earthquake on one of the many active Southern California faults. The faults in the vicinity of the site are shown on the following Regional Fault Map.

REGIONAL FAULT MAP

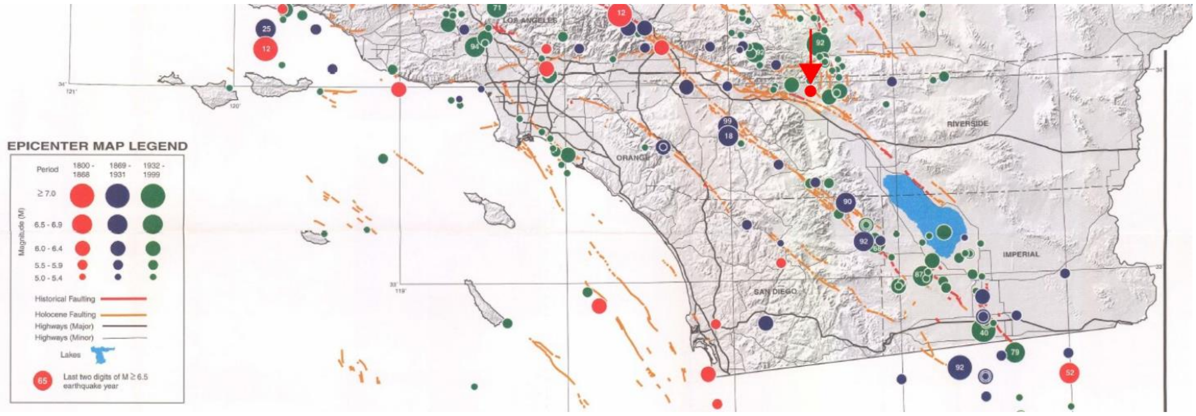


The closest surface trace of an active fault to the site is the North Branch of the San Andreas Fault located approximately ½ mile to the northeast. Other nearby active faults are the South Branch of the San Andreas Fault, San Gorgonio Pass Fault, and Morongo Fault located approximately 2½ miles southwest, 14 miles west, and 9 miles northwest, respectively (Bryant, 2010).

6.2 Seismicity

As with all Southern California, the site has experienced historic earthquakes from various regional faults. The seismicity of the region surrounding the site was formulated based on research of an electronic database of earthquake data. The epicenters of recorded earthquakes with magnitudes equal to or greater than 5.0 in the site vicinity are depicted on the following Regional Seismicity Map.

REGIONAL SEISMICITY MAP



A partial list of moderate to major magnitude earthquakes that have occurred in the Southern California area within the last 100 years is included in the following table.

HISTORIC EARTHQUAKE EVENTS WITH RESPECT TO THE SITE

Earthquake (Oldest to Youngest)	Date of Earthquake	Magnitude	Distance to Epicenter (Miles)	Direction to Epicenter
Near Redlands	March 10, 1933	6.3	43	W
Long Beach	March 10, 1933	6.4	87	WSW
Tehachapi	July 21, 1952	7.5	161	WNW
San Fernando	February 9, 1971	6.6	113	WNW
Whittier Narrows	October 1, 1987	5.9	91	W
Sierra Madre	June 28, 1991	5.8	89	WNW
Landers	June 28, 1992	7.3	18	NNE
Big Bear	June 28, 1992	6.4	26	NW
Northridge	January 17, 1994	6.7	118	W
Hector Mine	October 16, 1999	7.1	47	NNE
Ridgecrest China Lake Fault	July 5, 2019	7.1	140	NW

6.3 Seismic Design Criteria

The following table summarizes the site-specific design criteria obtained from the 2022 California Building Code (CBC; Based on the 2021 International Building Code [IBC] and ASCE 7-16), Chapter 16 Structural Design, Section 1613 Earthquake Loads. The data was calculated using the online application U.S. Seismic Design Maps, provided by the Structural Engineers Association of California (SEAOC). The short spectral response uses a period of 0.2 second. We evaluated the Site Class based on the discussion in Section 1613.2.2 of the 2022 CBC and Table 20.3-1 of ASCE 7-16. The values presented in the following table are for the risk-targeted maximum considered earthquake (MCE_R).

2022 CBC SEISMIC DESIGN PARAMETERS

Parameter	Value	2022 CBC Reference
Site Class	D	Section 1613.2.2
MCE_R Ground Motion Spectral Response Acceleration – Class B (short), S_S	2.372g	Figure 1613.2.1(1)
MCE_R Ground Motion Spectral Response Acceleration – Class B (1 sec), S_1	0.884g	Figure 1613.2.1(3)
Site Coefficient, F_A	1	Table 1613.2.3(1)
Site Coefficient, F_V	1.7	Table 1613.2.3(2)
Site Class Modified MCE_R Spectral Response Acceleration (short), S_{MS}	2.372g	Section 1613.2.3 (Eqn 16-20)
Site Class Modified MCE_R Spectral Response Acceleration – (1 sec), S_{M1}	1.503g*	Section 1613.2.3 (Eqn 16-21)
5% Damped Design Spectral Response Acceleration (short), S_{DS}	1.581g	Section 1613.2.4 (Eqn 16-22)
5% Damped Design Spectral Response Acceleration (1 sec), S_{D1}	1.002g*	Section 1613.2.4 (Eqn 16-23)

*Per Supplement 3 of ASCE 7-16, a ground motion hazard analysis (GMHA) shall be performed for projects on Site Class "D" sites with 1-second spectral acceleration (S_1) greater than or equal to 0.2g, which is true for this site. However, Supplement 3 of ASCE 7-16 provides an exception stating that that the GMHA may be waived provided that the parameter S_{M1} is increased by 50% for all applications of S_{M1}. The values for parameters S_{M1} and S_{D1} presented above have not been increased in accordance with Supplement 3 of ASCE 7-16.

The following table presents the mapped maximum considered geometric mean (MCE_G) seismic design parameters for projects located in Seismic Design Categories of D through F in accordance with ASCE 7-16.

ASCE 7-16 PEAK GROUND ACCELERATION

Parameter	Value	ASCE 7-16 Reference
Mapped MCE_G Peak Ground Acceleration, PGA	0.982g	Figure 22-9
Site Coefficient, F_{PGA}	1.1	Table 11.8-1
Site Class Modified MCE_G Peak Ground Acceleration, PGA_M	1.08g	Section 11.8.3 (Eqn 11.8-1)

Deaggregation of the Maximum Considered Earthquake (MCE) peak ground acceleration was performed using the USGS online Unified Hazard Tool, 2014 Conterminous U.S. Dynamic edition (v4.2.0). The result of the deaggregation analysis indicates that the predominant earthquake contributing to the MCE peak ground acceleration is characterized as a modal 7.5 magnitude event occurring at a hypocentral distance of 3.41 kilometers from the site.

Conformance to the criteria in the above tables for seismic design does not constitute any kind of guarantee or assurance that significant structural damage or ground failure will not occur if a large earthquake occurs. The primary goal of seismic design is to protect life, not to avoid all damage, since such design may be economically prohibitive.

6.4 Liquefaction Potential

Liquefaction is a phenomenon in which loose, saturated, relatively cohesionless soil deposits lose shear strength during strong ground motions. Primary factors controlling liquefaction include intensity and duration of ground motion, gradation characteristics of the subsurface soils, in-situ stress conditions, and the depth to groundwater. Liquefaction is typified by a loss of shear strength in the liquefied layers due to rapid increases in pore water pressure generated by earthquake accelerations.

The current standard of practice, as outlined in the “Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Liquefaction in California” and “Special Publication 117A, Guidelines for Evaluating and Mitigating Seismic Hazards in California” requires liquefaction analysis to a depth of 50 feet below the lowest portion of the proposed structure. Liquefaction typically occurs in areas where the soils below the water table are composed of poorly consolidated, fine- to medium-grained, primarily sandy soil. In addition to the requisite soil conditions, the ground acceleration and duration of the earthquake must also be of a sufficient level to induce liquefaction.

The Riverside County Map My County website indicates that the site is in an area designated as having a moderate potential for liquefaction.

We performed a liquefaction analysis of the soils underlying the site using the 1996 NCEER method of analysis with the updates by Youd et al. (2001). The liquefaction potential evaluation was performed by utilizing a static groundwater depth of greater than 50 feet, a magnitude 7.5 earthquake, and the site class modified MCE_G peak ground acceleration (PGA_M) of 1.08g. This semi-empirical method is based on a correlation between values of Standard Penetration Test (SPT) resistance. An average conversion factor of 0.63 was used to derive SPT blow-count values from California Modified Sampler blow-count values.

Due to the lack of shallow static groundwater at the project site, liquefaction is not a design consideration. Our *Empirical Estimation of Liquefaction Potential* is included as Figure 3.

Additionally, an evaluation of seismically induced "dry-sand" settlement was performed, with the resulting seismic "dry-sand" settlement estimated to be up to ¾ inch, with differential settlement on the order ½ inch across 40 feet. An analysis of seismically induced "dry-sand" settlement is included as Figure 4*.*

6.5 Expansive Soil

The geologic units near the ground surface at the site consist of sandy soils. Laboratory testing indicates site soils have a "very low" expansion potential (Expansion Index [EI] 0 to 20).

6.6 Hydrocompression

Hydrocompression is the tendency of unsaturated soil structure to collapse upon wetting resulting in the overall settlement of the affected soil and overlying foundations or improvements supported thereon. Potentially compressible soils underlying the site are typically removed and compacted during remedial site grading. However, if compressible soil is left in-place, a potential for settlement due to hydrocompression of the soil exists.

Based on the laboratory test results, the potential for hydrocompression ranges from approximately 0.4 to 2.6 percent within the alluvial soils. We expect that the hydrocompressive characteristics of site soils will be effectively reduced as a result of remedial grading operations and adequate drainage measures; therefore, it is our opinion that hydrocompression is not a design consideration for this project.

6.7 Slope Stability

The topography at the site and surrounding areas is relatively level with a gentle slope to the south-southeast. There are no known landslides near the site, nor is the site in the path of any known or potential landslides (Dibblee, 2008). Therefore, the potential for slope stability hazards to adversely affect the proposed development is considered low.

6.8 Earthquake-Induced Flooding

Earthquake-induced flooding is inundation caused by failure of dams or other water-retaining structures due to earthquakes. Based on a review of the USGS dam inundation database, the site is not located within a potential inundation area for an earthquake-induced dam failure. Therefore, the probability of earthquake-induced flooding is considered very low.

6.9 Tsunamis, Seiches, and Flooding

The site is not located within a coastal area. Therefore, tsunamis are not considered a significant hazard at the site.

Seiches are large waves generated in enclosed bodies of water in response to ground shaking. No major water-retaining structures are located immediately up gradient from the project site. Therefore, flooding resulting from a seismically induced seiche is considered unlikely.

The site is not located in an area of flooding per Riverside County Map My County website (RCIT 2024).

6.10 Oil Fields & Methane Potential

Based on a review of the California Geologic Energy Management Division (CalGEM) Well Finder Website, the site is not located within an oil field and oil or gas wells are not documented within ½-mile of the site (CalGEM, 2023). However, due to the voluntary nature of record reporting by the oil well drilling companies, wells may be improperly located or not shown on the location map and undocumented wells could be encountered during construction. Any wells encountered during construction will need to be properly abandoned in accordance with the current requirements of the CalGEM.

Since the site is not located within the boundaries of a known oil field, the potential for the presence of methane or other volatile gases at the site is considered low. However, should it be determined that a methane study is required for the proposed development it is recommended that a qualified methane consultant be retained to perform the study and provide mitigation measures as necessary.

6.11 Subsidence

Subsidence occurs when a large portion of land is displaced vertically, usually due to the withdrawal of groundwater, oil, or natural gas. Soils that are particularly subject to subsidence include those with high silt or clay content. The site is not located within an area of known ground subsidence (USGS, 2024). No large-scale extraction of groundwater, gas, oil, or geothermal energy is occurring or planned at the site or in the general site vicinity. There appears to be little or no potential for ground subsidence due to withdrawal of fluids or gases at the site.

Regional subsidence has occurred in recent history within the Coachella Valley. Initial subsidence occurred between the 1920’s and 1940’s when groundwater was over-pumped and groundwater levels declined to the order of 50 feet. The introduction of Colorado River water in 1949 reduced groundwater pumping and the related subsidence temporarily stopped. In the 1970’s overdraft of the groundwater occurred resulting in groundwater level declines of 50 to 100 feet and subsidence resumed. In 1996, the United States Geologic Survey (USGS) in cooperation with CVWD implemented a geodetic measurement of ground levels from Palm Desert, southwestward to the Salton Sea. Subsidence of 0.39 to 0.57 ft. has occurred within the La Quinta Subsidence Zone, located southwest of the site, between 1996 and 2005. Subsidence at a point located near the intersection of Avenue 54 and Jackson was recorded at 44 mm in 1998. Since that time, no subsidence has been recorded at that location. CVWD has embarked on a groundwater replenishment program which has slowed the rate of subsidence in the region. Ongoing studies from the USGS have discovered that the dominant factor in ground subsidence is the presence of silt layers which compress upon groundwater withdraw (Sneed, APWA Presentation March 2013). Ground subsidence could occur in the future and the site could be affected especially if groundwater withdrawal were to re-initiate. We anticipate the subsidence to be on a regional scale that could cause settlement across the project site. However, the settlement occurs over a relatively large geographic area and typically does not cause differential settlement over a relatively short horizontal distance that should be addressed as a design concern as part of the site development.

7. SITE INFILTRATION

Preliminary percolation testing was performed in accordance with the procedures outlined in *Riverside County Flood Control and Water Conservation District LID BMP, Appendix A* (Handbook) for infiltration basins*.* The percolation test locations are depicted on the *Geologic Map and Site Plan*, Figure 2.

Percolation Test P-1 was performed within geotechnical Boring B-3, at a depth of 10 feet below existing grade. Initially, Boring B-3 was excavated using a CME-75 hollow-stem auger drilling machine with 8-inch-diameter augers for geotechnical logging and sampling. At the completion of the geotechnical portion of Boring B-3, the boring was backfilled with cuttings to approximately 10 feet of depth, and a bentonite plug was installed. Approximately two inches of gravel was placed at the bottom of the test hole, and a perforated pipe was placed atop the gravel to keep the test hole open. Gravel was placed around the bottom of the test hole to support the test pipe. The test location was pre-saturated prior to testing. The Boring B-3 log and the Test P-1 percolation data are presented in Appendix A. A summary of Test P-1 percolation data and infiltration rate results are provided in the following table.

CALCULATED INFILTRATION RATES FROM PERCOLATION TEST RESULTS

Parameter	P-1
Depth (inches)	120
Test Type	Sandy
Change in Head Over Time: ΔH (inches)	42.8
Average Head: H_{avg} (inches)	21.7
Time Interval: Δt (minutes)	10
Radius of Test Hole: r (inches)	4.0
Calculated Infiltration Rate: I_t (inches/hour)	21.7

The results of the preliminary percolation testing indicate that the calculated infiltration rates at the location tested is 21.7 inches per hour. The *Handbook* requires a factor of safety of 3 be applied to the values above based on the test method used.

The in-situ field percolation tests performed provide short-term infiltration rates. Where appropriate, the short-term infiltration rates shall be converted to long-term infiltration rates using reduction factors depending on the degree of infiltration quality, maintenance access and frequency, site variability, subsurface stratigraphy variation, and other factors. The small-scale percolation testing cannot model the complexity of the effect of interbedded layers of different soil composition, and our test results should be considered only as index values of infiltration rates.

Due to the presence of potentially hydrocompressive soils, the proposed infiltration system should be located a minimum distance of 20 feet from proposed settlement-sensitive structures and a minimum distance of 15 feet from site improvements to reduce the potential for induced settlements to adversely impact the proposed structures and improvements. Provided these offsets are maintained, there is a low potential for infiltration-related soil settlement to adversely affect the proposed structures; some settlement may occur locally within the area of the infiltration system.

The civil engineer should also evaluate the impact on surface drainage should some soil settlement occur locally within the area of the infiltration system. It is suggested that flexible connections be utilized between the storm drainpipes and infiltration chambers. The project owner should understand that it is not our intent to completely prevent any soil settlement and/or associated distress of overlying pavement as a result of stormwater infiltration, as doing so would be cost-prohibitive to the proposed project.

8. CONCLUSIONS AND RECOMMENDATIONS

8.1 General

8.1.1 Soil or geologic conditions were not encountered during the investigation that would preclude the proposed development of the project, provided the recommendations presented herein are followed and implemented during design and construction. This report should be considered as preliminary, and the geotechnical design parameters presented herein should be verified once the project progresses to a more finalized state.

8.1.2 Potential geologic hazards at the site include seismic shaking, seismically induced settlement, and compressible near surface soils.

8.1.3 Based on our investigation and available geologic information, active, potentially active, or inactive faults are not present underlying or trending toward the site.

8.1.4 An evaluation of seismically induced settlement was performed, with the resulting seismic “dry-sand” settlement estimated to be up to ¾ inch, with differential settlement on the order ½ inch across 40 feet.

8.1.5 The upper portion of alluvial soils present at the site, in their current state, are not considered suitable for the support of additional compacted fill or settlement-sensitive improvements. Remedial grading of the surficial soil will be required as discussed herein. The site soils are suitable for re-use as engineered fill provided the recommendations in the *Grading* section of this report are followed.

8.1.6 Based on laboratory testing and our observations during our investigation, we expect onsite soils can be processed to meet gradation and sand equivalent requirements for trench bedding and shading.

8.1.7 Although static groundwater was not encountered during our subsurface investigation, it is possible that seepage may be encountered during the wet-weather season.

8.1.8 Cobbles and boulders were observed across the site surface, and cobbles were encountered within our borings at depth. We expect cobbles and boulders to be encountered during grading operations. The contractor should be prepared to screen cobbles and boulders from the soils during earthwork operations. Grading recommendations addressing oversize rock are discussed herein.

8.1.9 Based on the laboratory test results, the potential for hydrocompression ranges from approximately 0.4 to 2.6 percent within the alluvial soils. We expect that the hydrocompressive characteristics of site soils will be effectively reduced as a result of remedial grading operations and adequate drainage measures.

8.1.10 Site soils are generally comprised of sand with little or no cohesion that are highly susceptible to caving in un-shored excavations. It is the responsibility of the contractor to ensure that excavations and trenches are properly shored and maintained in accordance with Cal-OSHA rules and regulations to maintain the stability of adjacent existing improvements. The contractor should be aware that formwork may be required to prevent caving of shallow spread foundation excavations. Shoring recommendations are provided in the *Temporary Excavations* section of this report. In addition, the soil is susceptible to rapid erosion during a wet-weather event.

8.1.11 In-situ moisture and density laboratory testing indicate that site soils are significantly dry when compared to the optimum moisture content, determined by ASTM D1557. Significant moisture conditioning of material to be used as engineered fill should be expected during grading operations. Wet-weather events may affect the in-situ moisture content of site soils.

8.1.12 Proper drainage should be maintained to preserve the design properties of the engineered fill in the sheet-graded pads. Recommendations for site drainage are provided herein.

8.1.13 Once design or civil grading plans are made available, the recommendations within this report should be reviewed and revised, as necessary. Additionally, as the project design progresses toward a final design, changes in the design, location, or elevation of the proposed improvement should be reviewed by this office. Geocon should be contacted to evaluate the necessity for review and possible revision of this report.

8.2 Soil and Excavation Characteristics

8.2.1 The in-situ soils and oversize rock material at the site should generally be excavatable with moderate to heavy effort using conventional earth moving equipment in proper functioning order. The contractor should expect the presence of cobbles and boulders in the alluvial soils will present difficulties during the excavation process, and that formwork may be required to prevent caving of shallow spread foundation excavations. Special handling of these oversize materials should be performed in accordance with the *Recommended Grading Specifications* of Appendix C.

8.2.2 It is the responsibility of the contractor to ensure that all excavations and trenches are properly shored and maintained in accordance with applicable Cal-OSHA rules and regulations to maintain safety and the stability of existing improvements. All onsite excavations must be conducted in such a manner that potential surcharges from existing structures, construction equipment, and vehicle loads are resisted. The surcharge area may be defined by a 1:1 projection down and away from the bottom of an existing foundation or vehicle load. Penetrations below this 1:1 projection will require special excavation measures such as sloping and shoring. Excavation recommendations are provided in the *Temporary Excavations* section of this report.

8.2.3 Based on laboratory expansion index (EI) testing, site soils generally possess a “very low” expansion potential, EI of 0 to 20, and are considered “non-expansive” as defined by 2022 CBC Section 1803.5.3. The following table presents soil classifications based on the EI.

SOIL CLASSIFICATION BASED ON EXPANSION INDEX

Expansion Index (EI)	Expansion Classification	2022 CBC Expansion Classification
0 – 20	**Very Low**	**Non-Expansive**
21 – 50	Low	Expansive
51 – 90	Medium	
91 – 130	High	
Greater Than 130	Very High	

8.2.4 The recommendations presented herein assume that foundations and slabs will derive support in these materials.

8.2.5 Testing for expansion potential should be performed during finish grading to confirm the expansion potential of building pad fill material. Plasticity index testing should be performed on soils with expansion indices greater than 20.

8.3 Minimum Resistivity, pH, and Water-Soluble Chloride and Sulfate

8.3.1 We performed laboratory tests on samples of the site materials to evaluate the percentage of water-soluble sulfate content. Appendix B presents results of the laboratory water-soluble sulfate content tests. Laboratory tests performed on samples of the site materials indicate that the on-site materials possess an “S0” sulfate exposure to concrete structures as defined by 2022 CBC Section 1904 and ACI 318-19, Chapter 19. The following table presents a summary of concrete requirements set forth by 2022 CBC Section 1904.3 and ACI 318. The presence of water-soluble sulfates is not a visually discernible characteristic;

therefore, other soil samples from the site could yield different concentrations. Additionally, over time landscaping activities (i.e., addition of fertilizers and other soil nutrients) may affect the concentration.

REQUIREMENTS FOR CONCRETE EXPOSED TO SULFATE-CONTAINING SOLUTIONS

Exposure Class		Water-Soluble Sulfate (SO_4) Percent by Weight	Cement Type (ASTM C 150)	Maximum Water to Cement Ratio by Weight[1]	Minimum Compressive Strength (psi)
S0		**$SO_4<0.10$**	**No Type Restriction**	**n/a**	**2,500**
S1		$0.10 \leq SO_4 < 0.20$	II	0.50	4,000
S2		$0.20 \leq SO_4 \leq 2.00$	V	0.45	4,500
S3	Option 1	$SO_4>2.00$	V+Pozzolan or Slag	0.45	4,500
	Option 2		V	0.40	5,000

[1] Maximum water to cement ratio limits do not apply to lightweight concrete.

8.3.2 Laboratory test results indicate a resistivity of 13,000 ohm-cm, pH of 8.8, chloride content of 150 ppm, and sulfate content of 10 ppm. Based on the laboratory test results, the site soils would not be considered corrosive to metal improvements based on resistivity in accordance with Caltrans *Corrosion Guidelines* (Caltrans, 2021) as shown in the following table.

CALTRANS CORROSION GUIDELINES

Corrosion Exposure	Resistivity (ohm-cm)	Chloride (ppm)	Sulfate (ppm)	pH
Corrosive	<1,500	500 or greater	1,500 or greater	5.5 or less

8.3.3 Geocon does not practice in the field of corrosion engineering. Therefore, further evaluation by a corrosion engineer may be performed if improvements that could be susceptible to corrosion are planned.

8.4 Grading

8.4.1 Grading should be performed in accordance with the *Recommended Grading Specifications* contained in Appendix C and the grading ordinances of the City of Desert Hot Springs.

8.4.2 Prior to commencing grading, a preconstruction conference should be held at the site with the City inspector, owner or developer, grading contractor, civil engineer, and geotechnical engineer in attendance. Special soil handling and/or the grading plans can be discussed at that time.

8.4.3 Site preparation should begin with the removal of deleterious material, debris, buried and surficial trash, and vegetation. The depth of removal should be such that material exposed in cut areas or soil to be used as fill is relatively free of organic matter. Material generated during stripping and/or site demolition should be exported from the site. Rock greater than 6 inches in dimension should not be used in the engineered fill, and rock greater than 3 inches in dimension should not be used in backfill within utility trench corridors.

8.4.4 Dry, loose, soft, or compressible alluvial soils within a 1:1 (h:v) projection of the limits of grading should be removed to expose competent alluvial soils with a relative compaction of at least 85 percent, based on ASTM D1557. Based on our findings, we expect surficial alluvial soils will require remedial excavation and proper compaction. Removals should extend at least 5 feet below the existing ground surface, or at least 2 feet below the bottom of the planned foundations, whichever is deeper. Removals in pavement and walkway areas should extend at least 2 feet below subgrade and into competent alluvial soils. The engineering geologist should evaluate the actual depth of removal during grading operations to ensure the excavation bottoms do not contain dry, loose, soft, or compressible soils. Where over-excavation and compaction is to be conducted, the excavations should be extended laterally a minimum distance of 5 feet beyond the building footprint or for a distance equal to the depth of removal, whichever is greater. Patios and building appurtenances should be considered a part of the building footprint when determining the limits of lateral excavation. The bottom of the excavations should be competent alluvial soils, as defined above, and should be scarified to a depth of at least 1 foot, moisture conditioned at or slightly above optimum moisture content, and properly compacted to 90 percent of the laboratory maximum dry density, as determined by ASTM D1557.

8.4.5 Additional grading should be conducted as necessary to maintain the required 2 feet of newly placed engineered fill below foundations. The grading contractor should verify all bottom of footing elevations prior to commencement of grading activities to ensure that grading is conducted deep enough to provide the required 2 feet of engineered fill below foundations.

8.4.6 Geocon should observe the removal bottoms to check the competence of the exposed soil. Deeper excavations may be required if dry, loose, soft, or compressible soils are present at the base of the removals.

8.4.7 The fill placed within 3 feet of proposed foundations should possess a “very low” expansion potential (EI of 20 or less).

8.4.8 The site should be brought to finish grade elevations with fill compacted in layers. Layers of fill should be no thicker than will allow for adequate bonding and compaction. Fill, including backfill and scarified ground surfaces, should be compacted to a dry density of at least 90 percent of the laboratory maximum dry density, at or slightly above optimum moisture content as determined by ASTM D1557. Fill materials placed below optimum moisture content may require additional moisture conditioning prior to placing additional fill. Earthwork should be observed, and compacted fill tested by representatives of Geocon.

8.4.9 Oversized rock should be expected to be encountered during grading operations. The oversize rock will require special handling and placement. Rocks greater than 3 inches in maximum dimensions should not be placed within utility trench backfill. Rocks greater than 6 inches in maximum dimension should not be placed in soil fill within the upper 3 feet of finish grade. Rocks 6 to 12 inches in maximum dimension should be placed deeper than 3 feet below finished grade elevations. Rocks 12 inches or larger in maximum dimension should be exported from the site or placed at least 10 feet below finished grade elevations, in accordance with the *Recommended Grading Specifications* of Appendix C.

8.4.10 If needed, import fill should consist of granular materials with a “very low” expansion potential (EI of 20 or less), non-corrosive, generally free of deleterious material, and contain rock no larger than 6 inches. Geocon should be notified of the import soil source and should be afforded the opportunity to perform laboratory testing of the import soil prior to its arrival at the site to evaluate its suitability as fill material.

8.4.11 We do not expect perched groundwater or saturated materials to be encountered during remedial grading; however, should they be encountered (such as a result of seepage during the wet-weather season) extensive drying and mixing with dryer soil may be required if the saturated material is to be utilized as fill material in achieving finished grades. The materials should then be moisture conditioned at or slightly above optimum moisture content, prior to placement as compacted fill.

8.4.12 Foundation excavation bottoms must be observed and approved in writing by the Geotechnical Engineer, prior to placing fill, steel, gravel, or concrete.

8.5 Earthwork Grading Factors

8.5.1 Estimates of shrinkage factors are based on empirical judgments comparing the material in its existing or natural state as encountered in the exploratory excavations to a compacted state. Variations in natural soil density and in compacted fill density render shrinkage value estimates as rough approximations. As an example, the contractor can compact the fill to a dry density of 90 percent or higher of the laboratory maximum dry density. Thus, the contractor has an approximately 10 percent range of control over the fill volume. Due to the variations in the actual shrinkage/bulking factors, a balance area should be provided to accommodate variations.

8.6 Utility Trench Backfill

8.6.1 Utility trenches should be properly backfilled in accordance with the requirements of the City of Desert Hot Springs and the following recommendations. Pipes should be bedded with well-graded crushed rock or clean sands (sand equivalent greater than 30) to a depth of at least one foot over the pipe; based on our experience with site soils, we expect site soils will have a sand equivalent of greater than 30. The bedding material must be inspected and approved in writing by a qualified representative of Geocon. <u>The use of well-graded crushed rock is only acceptable if used in conjunction with filter fabric to prevent the gravel from having direct contact with soil.</u> The remainder of the trench backfill may be derived from onsite soil or approved import soil. Backfill of utility trenches should not contain rocks greater than 3 inches in diameter. The use of 2-sack slurry and controlled low strength material (CLSM) are also acceptable as backfill. However, consideration should be given to the possibility of differential settlement where the slurry ends and earthen backfill begins. These transitions should be minimized and additional stabilization should be considered at these transitions.

8.6.2 Trench excavation bottoms must be observed and approved in writing by a representative of Geocon, prior to placing bedding materials, fill, gravel, or concrete.

8.6.3 Utility trench backfill should be placed in layers no thicker than will allow for adequate bonding and compaction. Utility backfill should be compacted to a dry density of at least 90 percent of the laboratory maximum dry density and moisture conditioned at or slightly above optimum moisture content as determined by ASTM D1557. Backfill at the finish subgrade elevation of new pavements should be compacted to at least 95 percent of the maximum dry density. Backfill materials placed below the recommended moisture content may require additional moisture conditioning prior to placing additional fill.

8.7 Conventional Foundation Design

8.7.1 Proposed structures can be supported on shallow foundation systems supported on newly placed engineered fill, following the completion of grading, per the recommendations provided in the *Grading* section of this report. Due to the presence of abundant gravel, cobbles, and boulders, foundation excavations may result in irregular surfaces where not appropriately screened from the engineered fill; here cobbles and boulders are removed from the bottom of the foundation excavations, the resulting depression should be backfilled with site soils and compacted as necessary. In addition, due to the granular nature of soils and potential for caving, the contractor should be prepared to form foundation excavations, if necessary.

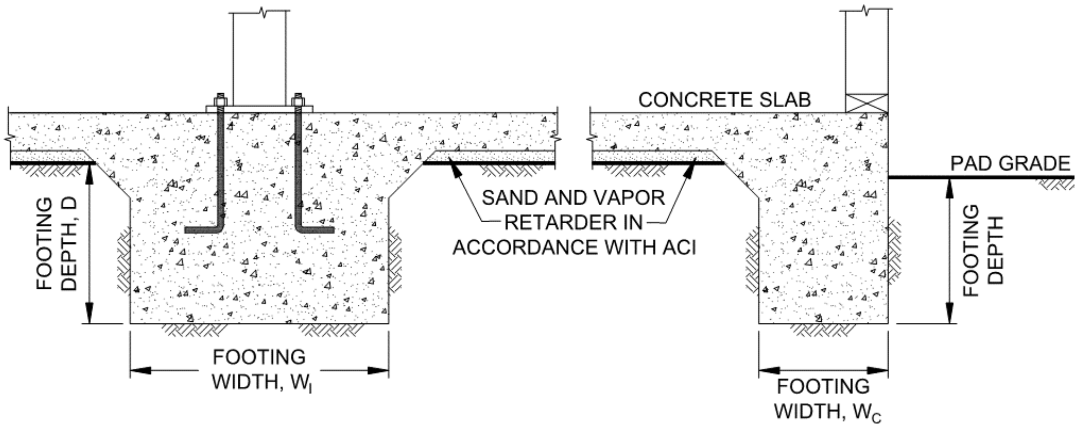
8.7.2 Foundations deriving support in newly placed engineered fill should be underlain by a minimum of 2 feet of engineered fill. Foundations for the structure should consist of continuous strip footings and/or isolated spread footings. The following table provides a summary of the foundation design recommendations.

SUMMARY OF FOUNDATION RECOMMENDATIONS

Parameter	Value
Minimum Continuous Foundation Width, W_C	12 inches
Minimum Isolated Foundation Width, W_I	24 inches
Minimum Foundation Depth, D	18 inches Below Lowest Adjacent Grade
Minimum Steel Reinforcement	Four No. 4 Bars, Two at the Top and Two at the Bottom
Allowable Bearing Pressure	3,000 psf
Bearing Pressure Increase	500 psf per Foot of Depth
	250 psf per Foot of Width
Maximum Allowable Bearing Pressure	4,000 psf
*Estimated Total Static Settlement	1¼ inches
*Estimated Static Differential Settlement	⅝ inch in 20 Feet
Design Expansion Index	20 or less

*The calculated seismic settlements provided in the *Liquefaction Potential* section of this report should be added to the static settlements for design purposes.

8.7.3 The foundations should be embedded in accordance with the recommendations herein and the *Wall/Column Footing Dimension Detail* below. The embedment depths should be measured from the lowest adjacent pad grade for both interior and exterior footings. Footings should be deepened such that the bottom outside edge of the footing is at least 7 feet horizontally from the face of the slope.



Wall/Column Footing Dimension Detail

8.7.4 The bearing capacity values presented herein are for dead plus live loads and may be increased by one-third when considering transient loads due to wind or seismic forces.

8.7.5 We should observe the foundation excavations prior to the placement of reinforcing steel and concrete to check that the exposed soil conditions are similar to those expected and that they have been extended to the appropriate bearing strata. Foundation modifications may be required if unexpected soil conditions are encountered.

8.7.6 Geocon should be consulted to provide additional design parameters as required by the structural engineer.

8.8 Concrete Slabs-On-Grade

8.8.1 Concrete slabs-on-grade for the structures should be constructed in accordance with the following table.

MINIMUM CONCRETE SLAB-ON-GRADE RECOMMENDATIONS

Parameter	Value
Minimum Concrete Slab Thickness	4 inches
Minimum Steel Reinforcement	No. 3 Bars 18 Inches on Center, Both Directions
Typical Slab Underlayment	3 to 4 Inches of Sand/Gravel/Base
Design Expansion Index	20 or less

8.8.2 Slabs that may receive moisture-sensitive floor coverings or may be used to store moisture-sensitive materials should be underlain by a vapor retarder. The vapor retarder design should be consistent with the guidelines presented in the American Concrete Institute's (ACI) *Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials* (ACI 302.2R-06) as well as ASTM E1745. In addition, the membrane should be installed in accordance with manufacturer's recommendations and ASTM requirements and installed in a manner that prevents puncture. The vapor retarder used should be specified by the project architect or developer based on the type of floor covering that will be installed and if the structure will possess a humidity controlled environment.

8.8.3 The bedding sand thickness should be determined by the project foundation engineer, architect, and/or developer. It is common to have 3 to 4 inches of sand for 5-inch and 4-inch thick slabs, respectively, in the Southern California region. However, we should be contacted to provide recommendations if the bedding sand is thicker than 6 inches. The foundation design engineer should provide appropriate concrete mix design criteria and curing measures to assure proper curing of the slab by reducing the potential for rapid moisture loss and subsequent cracking and/or slab curl. We suggest that the foundation design engineer present the concrete mix design and proper curing methods on the foundation plans. It is critical that the foundation contractor understands and follows the recommendations presented on the foundation plans.

8.8.4 Some projects remove the sand layer below the slab in parking structure areas. This is acceptable from a geotechnical engineering standpoint; however, relatively minor cracks could form due to differential curing. Therefore, the structural engineer and/or the concrete contractor should provide recommendations for proper curing techniques to help prevent cracking.

8.8.5 Concrete slabs should be provided with adequate crack-control joints, construction joints and/or expansion joints to reduce unsightly shrinkage cracking. The design of joints should consider criteria of the American Concrete Institute (ACI) when establishing crack-control spacing. Crack-control joints should be spaced at intervals no greater than 12 feet. Additional steel reinforcing, concrete admixtures and/or closer crack control joint spacing should be considered where concrete-exposed finished floors are planned.

8.8.6 Special subgrade presaturation is not deemed necessary prior to placing concrete; however, the exposed foundation and slab subgrade soil should be moisturized to maintain a moist condition as would be expected in any such concrete placement.

8.8.7 The concrete slab-on-grade recommendations are based on soil support characteristics only. The project structural engineer should evaluate the structural requirements of the concrete slabs for supporting expected loads.

8.8.8 Where exterior flatwork abuts the structure at entrant or exit areas, the exterior slab should be dowelled into the structure's foundation stemwall. This recommendation is intended to reduce the potential for differential elevations that could result from differential settlement or minor heave of the flatwork. Dowelling details should be designed by the project structural engineer.

8.8.9 The recommendations of this report are intended to reduce the potential for cracking of slabs due to expansive soil (if present), differential settlement of existing soil or soil with varying thicknesses. However, even with the incorporation of the recommendations presented herein, foundations, stucco walls, and slabs-on-grade placed on such conditions may still exhibit some cracking due to soil movement and/or shrinkage. The occurrence of concrete shrinkage cracks is independent of the supporting soil characteristics. Their occurrence may be reduced and/or controlled by limiting the slump of the concrete, proper concrete placement and curing, and by the placement of crack control joints at periodic intervals, in particular, where re-entrant slab corners occur.

8.9 Miscellaneous Foundations

8.9.1 Foundations for small outlying structures, such as block walls up to 6 feet in height, planter walls or trash enclosures, which will not be tied to the proposed structure, can be supported on shallow foundation systems supported by a minimum 2 feet of engineered fill.. If the soils exposed in the excavation bottom are soft or loose, compaction of the soils will be required prior to placing steel or concrete. Compaction of the foundation excavation bottom is typically accomplished with a compaction wheel or mechanical whacker and must be observed and approved by a Geocon representative.

8.9.2 Miscellaneous foundations may be designed for a bearing value of 1,500 psf and should be a minimum of 12 inches in width, 18 inches in depth below the lowest adjacent grade, and 12 inches into the recommended bearing material. The allowable bearing pressure may be increased by up to one-third for transient loads due to wind or seismic forces.

8.9.3 Foundation excavations should be observed and approved in writing by a representative of Geocon, prior to the placement of reinforcing steel and concrete to verify that the excavations and exposed soil conditions are consistent with those anticipated.

8.10 Conventional Retaining Walls

8.10.1 The recommendations presented herein are generally applicable to the design of rigid concrete or masonry retaining walls having a maximum height of 5 feet. In the event that walls higher than 5 feet or other types of walls are planned, Geocon should be consulted for additional recommendations.

8.10.2 Retaining walls not restrained at the top and having a level backfill surface should be designed for an active soil pressure equivalent to the pressure exerted by a fluid density of 40 pounds per cubic foot (pcf). These soil pressures assume that the backfill materials within an area bounded by the wall and a 1:1 plane extending upward from the base of the wall possess an EI of 20 or less. For walls where backfill materials do not conform to the criteria herein, Geocon should be consulted for additional recommendations.

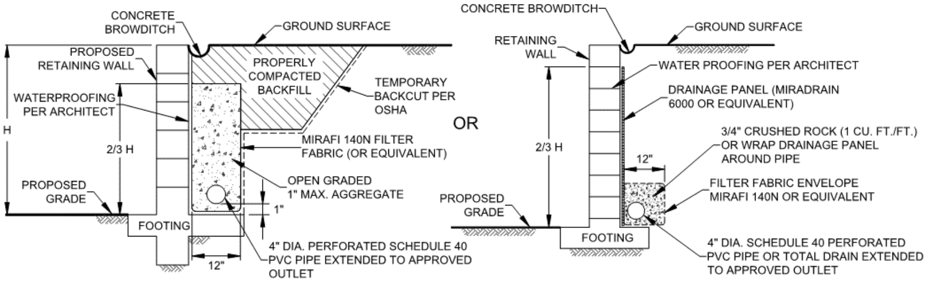
8.10.3 Unrestrained walls are those that are allowed to rotate more than 0.001H (where H equals the height of the retaining portion of the wall in feet) at the top of the wall. Where level walls are restrained from movement at the top, the walls should be designed for a soil pressure equivalent to the pressure exerted by a fluid density of 58 pcf.

8.10.4 The wall pressures provided above assume that the proposed retaining walls will support relatively undisturbed alluvial soils or engineered fill derived from onsite soil. If import soil is used to backfill proposed walls, revised earth pressures may be required to account for the geotechnical properties of the soil placed as engineered fill. This should be evaluated once the use of import soil is established. All imported fill shall be observed, tested, and approved by Geocon West, Inc. prior to bringing soil to the site.

8.10.5 It is common to see retaining walls constructed in the areas of the elevator pits. The retaining walls should be properly drained and designed in accordance with the recommendations presented herein. If the elevator pit walls are not drained, the walls should be designed with an at-rest pressure with an equivalent fluid density of 90 pcf. It is also common to see seepage and water collection within the elevator pit. The pit should be designed and properly waterproofed to prevent seepage and water migration into the elevator pit.

8.10.6 Unrestrained walls will move laterally when backfilled and loading is applied. The amount of lateral deflection is dependent on the wall height, the type of soil used for backfill, and loads acting on the wall. The retaining walls and improvements above the retaining walls should be designed to incorporate an appropriate amount of lateral deflection as determined by the structural engineer.

8.10.7 Retaining walls should be provided with a drainage system adequate to prevent the buildup of hydrostatic forces and waterproofed as required by the project architect. The soil immediately adjacent to the backfilled retaining wall should be composed of free draining material completely wrapped in Mirafi 140N (or equivalent) filter fabric for a lateral distance of 1 foot for the bottom two-thirds of the height of the retaining wall. The upper one-third should be backfilled with less permeable compacted fill to reduce water infiltration. Alternatively, a drainage panel, such as a Miradrain 6000 or equivalent, can be placed along the back of the wall. The use of drainage openings through the base of the wall (weep holes) is not recommended where the seepage could be a nuisance or otherwise adversely affect the property adjacent to the base of the wall. The recommendations herein assume a properly compacted backfill (EI of 20 or less) with no hydrostatic forces or imposed surcharge load. If conditions different than those described are expected or if specific drainage details are desired, Geocon should be contacted for additional recommendations. A graphic depicting typical retaining wall drainage is provided below.



Typical Retaining Wall Drainage Detail

8.10.8 Wall foundations should be designed in accordance with the foundation recommendations in the *Conventional Foundation Design* section of this report.

8.10.9 Additional pressure should be added for a surcharge condition due to sloping ground, vehicular traffic or adjacent structures and should be designed for each condition as the project progresses.

8.10.10 It is recommended that line-load surcharges from adjacent wall footings, use horizontal pressures generated from NAV-FAC DM 7.2. The governing equations are:

$$For\ {}^{x}/_{H} \leq 0.4$$

$$\sigma_H(z) = \frac{0.20 \times \left(\frac{z}{H}\right)}{\left[0.16 + \left(\frac{z}{H}\right)^2\right]^2} \times \frac{Q_L}{H}$$

and

$$For\ {}^{x}/_{H} > 0.4$$

$$\sigma_H(z) = \frac{1.28 \times \left(\frac{x}{H}\right)^2 \times \left(\frac{z}{H}\right)}{\left[\left(\frac{x}{H}\right)^2 + \left(\frac{z}{H}\right)^2\right]^2} \times \frac{Q_L}{H}$$

where *x* is the distance from the face of the excavation or wall to the vertical line-load, *H* is the distance from the bottom of the footing to the bottom of excavation or wall, *z* is the depth at which the horizontal pressure is desired, Q_L is the vertical line-load and $\sigma_H(z)$ is the horizontal pressure at depth *z*.

8.10.11 It is recommended that vertical point-loads, from construction equipment outriggers or adjacent building columns use horizontal pressures generated from NAV-FAC DM 7.2. The governing equations are:

$$For\ {}^{x}/_{H} \leq 0.4$$

$$\sigma_H(z) = \frac{0.28 \times \left(\frac{z}{H}\right)^2}{\left[0.16 + \left(\frac{z}{H}\right)^2\right]^3} \times \frac{Q_P}{H^2}$$

and

$$For\ {}^{x}/_{H} > 0.4$$

$$\sigma_H(z) = \frac{1.77 \times \left(\frac{x}{H}\right)^2 \times \left(\frac{z}{H}\right)^2}{\left[\left(\frac{x}{H}\right)^2 + \left(\frac{z}{H}\right)^2\right]^3} \times \frac{Q_P}{H^2}$$

then

$$\sigma'_H(z) = \sigma_H(z)cos^2(1.1\theta)$$

where x is the distance from the face of the excavation/wall to the vertical point-load, H is distance from the outrigger/bottom of column footing to the bottom of excavation, z is the depth at which the horizontal pressure is desired, Qp is the vertical point-load, $\sigma_H(z)$ is the horizontal pressure at depth z, Θ is the angle between a line perpendicular to the excavation/wall and a line from the point-load to location on the excavation/wall where the surcharge is being evaluated, and $\sigma_H(z)$ is the horizontal pressure at depth z.

8.10.12 In addition to the recommended earth pressure, the upper 10 feet of the retaining wall adjacent to the street or driveway areas should be designed to resist a uniform lateral pressure of 100 psf, acting as a result of an assumed 300 psf surcharge behind the shoring due to normal street traffic. If the traffic is kept back at least 10 feet from the wall, the traffic surcharge may be neglected.

8.11 Elevator Pit Design

8.11.1 If used, the elevator pit slab and retaining wall should be designed by the project structural engineer. Elevator pit foundation and walls may be designed in accordance with the recommendations in the *Conventional Foundation Design* and *Conventional Retaining Walls* sections of this report.

8.11.2 Additional pressure should be added for a surcharge condition due to sloping ground, vehicular traffic or adjacent foundations and should be designed for each condition as the project progresses.

8.11.3 If retaining wall drainage is to be provided, the drainage system should be designed in accordance with the *Conventional Retaining Walls* section of this report.

8.11.4 We recommend that the exterior walls and slab be waterproofed to prevent excessive moisture inside of the elevator pit. Waterproofing design and installation are not the responsibility of the Geotechnical Engineer.

8.12 Elevator Piston

8.12.1 If a plunger-type elevator piston is installed for this project, a deep drilled excavation will be required. It is important to verify that the drilled excavation is not situated immediately adjacent to a foundation, or the drilled excavation could compromise the existing foundation support, especially if the drilling is performed subsequent to the foundation construction. In addition, boulders and cobbles may be encountered in the existing fill or alluvial soils, and some of the site soils have little to no cohesion and are prone to excessive caving. The contractor should be prepared for difficult drilling conditions.

8.12.2 Caving is expected, and the contractor should be prepared to use casing and should have it readily available at the commencement of drilling activities. Continuous observation of the drilling and installation of the elevator piston by the Geotechnical Engineer should be performed.

8.12.3 The annular space between the piston casing and drilled excavation wall should be filled with a minimum of 1½-sack slurry pumped from the bottom up. As an alternative, pea gravel may be utilized. The use of soil to backfill the annular space is not acceptable.

8.13 Swimming Pools

8.13.1 For the proposed pools, the shell bottoms should be designed as a free-standing structure and may derive support on a minimum of 2 feet of engineered fill compacted to a dry density of at least 90 percent of the laboratory maximum dry density at or slightly above optimum moisture content as determined by ASTM D1557.

8.13.2 Swimming pool foundations and walls may be designed in accordance with the recommendations in the *Conventional Foundation Design* and *Conventional Retaining Walls* sections of this report. A hydrostatic relief valve should be considered as part of the swimming pool design unless a gravity drain system can be placed beneath the pool shell.

8.13.3 Based on the soil overburden load that will be removed during excavation of the swimming pool, anticipated settlements are expected to be small. Static differential settlement of the pool is not expected to exceed ¼ inch over a horizontal distance of 40 feet.

8.13.4 Surface drainage around the pool/spa should be designed to prevent water from ponding and seeping into the ground. Surface water should be collected and conducted through non-erosive devices to the street, storm drain or other approved water course or disposal area. Leakage from the proposed pool/spa could create an artificial groundwater condition that will likely create instability problems. Therefore, all plumbing and the pool/spa should be leak free.

8.13.5 The deck for the swimming pool/spa should be cast separately from the swimming pool/spa, and water stops should be provided between the bond beam and the deck. Jointing for concrete flatwork should be provided in accordance with the recommendations of the American Concrete Institute. The joints should be sealed with an approved flexible sealant to reduce the potential for introduction of surface water into the underlying soil.

8.13.6 To mitigate the potential for moisture infiltration into the subgrade soils beneath the pool deck, we recommend the construction of a deepened footing along the outside edge of the pool deck flatwork. A subdrain consisting of 4-inch diameter perforated PVC pipe should be installed inside the deepened footing and sloped to drain into an approved outlet. The pipe should be surrounded by ¾ inch open-graded gravel and wrapped with filter fabric.

8.13.7 If the proposed pools are in proximity to a proposed or existing structure, consideration should be given to the construction sequence. If the proposed pool is to be constructed near an existing structure, or a proposed structure that is constructed before the pool construction, the excavation required for the pool could remove a critical component of lateral support from the foundations of the structure and would therefore require shoring to safeguard the foundations. Once information regarding the pool locations and depth becomes available, this information should be provided to Geocon for review and possible revision of these recommendations.

8.14 Lateral Design

8.14.1 To resist lateral loads, a passive pressure exerted by an equivalent fluid weight of 270 pounds per cubic foot (pcf) with a maximum earth pressure of 2,700 pcf should be used for the design of footings or shear keys poured neat against properly compacted fill. The allowable passive pressure assumes a horizontal surface extending at least 5 feet, or three times the surface generating the passive pressure, whichever is greater. The upper 12 inches of material in areas not protected by floor slabs or pavement should not be included in design for passive resistance.

8.14.2 If friction is to be used to resist lateral loads, an allowable coefficient of friction between soil and concrete of 0.4 should be used for design.

8.14.3 The passive and frictional resistant loads can be combined for design purposes. When combining passive and friction for lateral resistance, the passive component should be reduced by one-third. The lateral passive pressures may be increased by one-third when considering transient loads due to wind or seismic forces.

8.15 Exterior Concrete Flatwork

8.15.1 Exterior concrete flatwork not subject to vehicular traffic should be constructed in accordance with the recommendations presented in the following table. The recommended steel reinforcement would help reduce the potential for cracking.

MINIMUM CONCRETE FLATWORK RECOMMENDATIONS

Expansion Index, EI	Minimum Reinforcing Steel* Options	Minimum Thickness
EI $\leq$ 20	6x6-W2.9/W2.9 (6x6-6/6) welded wire mesh	4 Inches
	No. 3 Bars 18 inches on center, Both Directions	

*In excess of 8 feet square.

8.15.2 The subgrade soil should be properly moisturized and compacted prior to the placement of steel and concrete. The subgrade soil should be compacted to a dry density of at least 90 percent of the laboratory maximum dry density at or slightly above optimum moisture content in accordance with ASTM D1557.

8.15.3 Even with the incorporation of the recommendations of this report. The reinforcing steel should overlap continuously in flatwork to reduce the potential for vertical offsets within flatwork. Additionally, flatwork should be structurally connected to the curbs, where possible, to reduce the potential for offsets between the curbs and the flatwork.

8.15.4 Concrete flatwork should be provided with crack control joints to reduce and/or control shrinkage cracking. Crack control spacing should be determined by the project Structural Engineer based upon the slab thickness and intended usage. Criteria of the American Concrete Institute (ACI) should be taken into consideration when establishing crack control spacing. Subgrade soil for exterior slabs not subjected to vehicle loads should be compacted in accordance with criteria presented in the grading section prior to concrete placement. Subgrade soil should be properly compacted and the moisture content of subgrade soil should be verified prior to placing concrete. Base materials will not be required below concrete improvements.

8.15.5 Where exterior flatwork abuts the structure at entrant or exit points, the exterior slab should be dowelled into the structure's foundation stemwall. This recommendation is intended to reduce the potential for differential elevations that could result from differential settlement or minor heave of the flatwork. Dowelling details should be designed by the project structural engineer.

8.15.6 The recommendations presented herein are intended to reduce the potential for cracking of exterior slabs as a result of differential movement. However, even with the incorporation of the recommendations presented herein, slabs-on-grade will still crack. The occurrence of concrete shrinkage cracks is independent of the soil supporting characteristics. Their occurrence may be reduced and/or controlled by limiting the slump of the concrete, the use of crack control joints and proper concrete placement and curing. Crack control joints should be spaced at intervals no greater than 12 feet. Literature provided by the Portland Concrete Association (PCA) and American Concrete Institute (ACI) present recommendations for proper concrete mix, construction, and curing practices, and should be incorporated into project construction.

8.16 Preliminary Pavement Design

8.16.1 Where new paving is to be placed, we recommend that undocumented fill or soft/loose soils be excavated and properly compacted for paving support in accordance with the recommendations provided in the *Grading* section of this report. The client should be aware that excavation and compaction of undocumented fill or soft/loose soils in the area of new paving is not required; however, paving constructed over existing uncertified fill or unsuitable soils may experience increased settlement and/or cracking, and may therefore have a shorter design life and increased maintenance costs. As a minimum, the upper 12 inches of paving subgrade should be scarified, moisture conditioned at or slightly above optimum moisture content, and properly compacted to at least 95 percent relative compaction, as determined by ASTM D1557.

8.16.2 The final pavement design should be based on R-value testing of soils at roadway subgrade elevation. Roadways should be designed in accordance with the City of Desert Hot Springs *Standard Plans & Specifications* when final Traffic Indices (TI) and R-Value test results of subgrade soils are completed. The roadway classifications and TI's selected for our preliminary evaluation are in accordance with those specified in *Section III.C., Street Standards* of the City of Desert Hot Springs *Standard Plans & Specifications*. Based on our observation and experience with site soils, we used an assumed R-value of 50 for our preliminary evaluation of pavements. Preliminary flexible pavement sections are presented in the following table. Geocon should be contacted if other roadway classifications and traffic indices are appropriate for the project.

PRELIMINARY FLEXIBLE PAVEMENT SECTIONS

Road Classification	Assumed Traffic Index	Assumed Subgrade R-Value	Asphalt Concrete (inches)	Crushed Aggregate Base (inches)
Alley/Cul-de-Sac	3.5	50	3	4
Local Collector	4.0		3	6
Collector	5.5		3	8

8.16.3 The crushed aggregated base and asphalt concrete materials should conform to Section 200-2.2 and Section 203-6, respectively, of the *Greenbook*. Base materials should be moisture conditioned at or slightly above optimum moisture content and properly compacted to at least 95 percent relative compaction, as determined by ASTM D1557. Asphalt concrete should be compacted to a density of 95 percent of the laboratory Hveem density in accordance with ASTM D1561.

8.16.4 A rigid Portland cement concrete (PCC) pavement section should be placed in roadway aprons and cross gutters. We calculated the rigid pavement section in general conformance with the procedure recommended by the American Concrete Institute report ACI 330-21 Commercial Concrete Parking Lots and Site Paving Design and Construction – Guide. The following table provides the traffic categories and design parameters used for the calculations for 20-year design life.

TRAFFIC CATEGORIES

Traffic Category	Description	Reliability (%)	Slabs Cracked at End of Design Life (%)
A	Car Parking Areas and Access Lanes	60	15
B	Entrance and Truck Service Lanes	60	15
C	School or City Buses (Excluding Large Articulated Buses)	75	15
D	Heavy Duty Trucks (Gross Weight of 80 Kips)	75	15
E	Garbage or Fire Truck Lane	75	15

8.16.5 We used the parameters presented in the following table to calculate the pavement design sections. We should be contacted to provide updated design sections, if necessary.

RIGID PAVEMENT DESIGN PARAMETERS

Design Parameter	Design Value
Modulus of subgrade reaction, k	100 pci
Modulus of rupture for concrete, M_R	500 psi
Concrete Compressive Strength	3,000 psi
Concrete Modulus of Elasticity, E	3,150,000

8.16.6 Based on the criteria presented herein, the PCC pavement sections should have a minimum thickness as presented in the following table.

RIGID VEHICULAR PAVEMENT RECOMMENDATIONS

Traffic Category	Trucks Per Day	Portland Cement Concrete, T (Inches)
A = Car Parking Areas and Access Lanes	10	5½
B = Entrance and Truck Service Lanes	10	6
	50	6½
	100	6½
C = School or City Buses	50	9½
	100	9½
D = Heavy Duty Trucks	50	6½
	100	7
E = Garbage or Fire Truck Lanes	5	6½
	10	7

8.16.7 The PCC vehicular pavement should be placed over subgrade soil that is compacted to a dry density of at least 95 percent of the laboratory maximum dry density, at or slightly above optimum moisture content, as determined by ASTM D1557.

8.16.8 Adequate joint spacing should be incorporated into the design and construction of the rigid pavement in accordance with the following table.

MAXIMUM JOINT SPACING

Pavement Thickness, T (Inches)	Maximum Joint Spacing (Feet)
4<T<5	10
5≤T<6	12.5
6≤T	15

8.16.9 The rigid pavement should also be designed and constructed incorporating the parameters presented in the following table.

ADDITIONAL RIGID PAVEMENT RECOMMENDATIONS

Subject	Value
Thickened Edge	1.2 Times Slab Thickness Adjacent to Structures
	1.5 Times Slab Thickness Adjacent to Soil
	Minimum Increase of 2 Inches
	4 Feet Wide
Crack Control Joint Depth	Early Entry Sawn = T/6 to T/5, 1.25 Inch Minimum
	Conventional (Tooled or Conventional Sawing) = T/4 to T/3
Crack Control Joint Width	¼-Inch for Sealed Joints and Per Sealer Manufacturer's Recommendations
	$^{1}/_{16}$- to $^{1}/_{4}$-Inch is Common for Unsealed Joints

8.16.10 Reinforcing steel will not be necessary within the concrete for geotechnical purposes with the possible exception of dowels at construction joints as discussed herein.

8.16.11 To control the location and spread of concrete shrinkage cracks, crack-control joints (weakened plane joints) should be included in the design of the concrete pavement slab. Crack-control joints should be sealed with an appropriate sealant to prevent the migration of water through the control joint to the subgrade materials. The depth of the crack-control joints should be in accordance with the referenced ACI guide.

8.16.12 To provide load transfer between adjacent pavement slab sections, a butt-type construction joint should be constructed. The butt-type joint should be thickened by at least 20 percent at the edge and taper back at least 4 feet from the face of the slab.

8.16.13 Concrete curb and gutter should be placed on soil subgrade compacted to a dry density of at least 95 percent of the laboratory maximum dry density at or slightly above optimum moisture content. Cross-gutters that receive vehicular traffic should be placed on subgrade soil compacted to a dry density of at least 95 percent of the laboratory maximum dry density at or slightly above optimum moisture content. Base materials should not be placed below the curb and gutter, or cross-gutters so water is not able to migrate from the adjacent parkways to the pavement sections. Where flatwork is located directly adjacent to the curb and gutter, the concrete flatwork should be structurally connected to the curbs to help reduce the potential for offsets between the curbs and the flatwork.

8.17 Temporary Excavations

8.17.1 Excavations of up to 10 feet in height may be required during earthwork and utility installation operations. The excavations are expected to expose engineered fill or alluvial soils that are highly susceptible to caving. Vertical excavations up to 5 feet in height may be attempted where not surcharged by adjacent foundations or traffic; however, the contractor should be prepared for caving sands to be present in open excavations and formwork may be required in foundation excavations. Sloping measures will likely be required to provide a stable excavation. Excavations should be observed for the presence of cobbles and boulders to determine if further safety measures are required.

8.17.2 Vertical excavations greater than 5 feet or where surcharged by existing structures will require sloping or shoring measures in order to provide a stable excavation. The contractor’s competent person should evaluate the appropriate slope based on soil type, per Cal-OSHA regulations. We anticipate that sufficient space is available to complete the required earthwork for this project using sloping measures.

8.17.3 Where there is insufficient space for sloped excavations, shoring or trench shields should be used to support excavations. Shoring may also be necessary where sloped excavation could remove vertical or lateral support of existing improvements, including existing utilities and adjacent structures. The contractor’s competent person should evaluate the appropriate shoring system to provide per Cal-OSHA regulations.

8.17.4 Where temporary construction slopes are utilized, the top of the slope should be barricaded to prevent vehicles and storage loads at the top of the slope within a horizontal distance equal to the height of the slope. If the temporary construction slopes are to be maintained during the rainy season, berms are suggested along the tops of the slopes where necessary to prevent runoff water from entering the excavation and eroding the slope faces. The contractor's competent person should inspect the soils exposed in the cut slopes during excavation in accordance with Cal-OSHA regulations so that modifications of the slopes can be made if variations in the soil conditions occur.

8.17.5 It is difficult to accurately predict the amount of deflection of a shored embankment, but some deflection will occur. We recommend that the deflection be minimized to prevent damage to existing structures and adjacent improvements. Where a public right-of-way is present or adjacent offsite structures do not surcharge the shoring excavation, the shoring deflection should be limited to less than 1 inch at the top of the shored embankment. Where offsite structures are within the shoring surcharge area it is recommended that the beam deflection be limited to less than ½ inch at the elevation of the adjacent offsite foundation, and no deflection at all if deflections will damage existing structures. The allowable deflection is dependent on many factors, such as the presence of structures and utilities near the top of the embankment and will be assessed and designed by the project shoring engineer.

8.18 Site Drainage and Moisture Protection

8.18.1 Adequate site drainage is critical to reduce the potential for differential soil movement, erosion and subsurface seepage. Under no circumstances should water be allowed to pond adjacent to footings. The site should be graded and maintained such that surface drainage is directed away from structures in accordance with 2022 CBC 1804.4 or other applicable standards. In addition, surface drainage should be directed away from the top of slopes into swales or other controlled drainage devices. Roof and pavement drainage should be directed into conduits that carry runoff away from the proposed structure.

8.18.2 Underground utilities should be leak free. Utility and irrigation lines should be checked periodically for leaks and detected leaks should be repaired promptly. Detrimental soil movement could occur if water can infiltrate the soil for prolonged periods of time.

8.18.3 Landscaping planters adjacent to paved areas are not recommended due to the potential for surface or irrigation water to infiltrate the pavement's subgrade and base course. We recommend area drains to collect excess irrigation water and transmit it to drainage structures or impervious above-grade planter boxes be used. In addition, where landscaping is planned adjacent to the pavement, we recommend construction of a cutoff wall or the use of an impermeable geosynthetic along the edge of the pavement that extends at least 6 inches below the bottom of the base material.

8.18.4 Proposed infiltration systems should be offset from the outside edge of planned foundations a minimum lateral distance of 20 feet to reduce the occurrence of water migrating below the load projection of planned structures, and a minimum lateral distance of 15 feet from site improvements. These minimum offsets will reduce the potential for settlements induced by migrating water that could adversely impact the proposed structures and improvements.

8.18.5 If not properly constructed, there is a potential for distress to improvements and properties located hydrologically down gradient or adjacent to infiltration areas. Factors such as the amount of water to be detained, its residence time, and soil permeability have an important effect on seepage transmission and the potential adverse impacts that may occur if the storm water management features are not properly designed and constructed. We have not performed a hydrogeology study at the site. Downgradient and adjacent structures may be subjected to seeps, movement of foundations and slabs, or other impacts as a result of water infiltration.

8.19 Plan Review

8.19.1 Grading and structural/foundation plans should be reviewed by Geocon prior to finalization of design to check that the plans have been prepared in substantial conformance with the recommendations of this report, and to provide additional analyses or recommendations, if necessary.

LIMITATIONS AND UNIFORMITY OF CONDITIONS

The recommendations of this report pertain only to the site investigated and are based upon the assumption that the soil conditions do not deviate from those disclosed in this investigation. If any variations or undesirable conditions are encountered during construction, or if the proposed construction will differ from that expected herein, Geocon West, Inc., should be notified so that supplemental recommendations can be given. The evaluation or identification of the potential presence of hazardous materials was not part of the scope of services provided by Geocon West, Inc.

This report is issued with the understanding that it is the responsibility of the owner, or of their representative, to ensure that the information and recommendations contained herein are brought to the attention of the architect and engineer for the project and incorporated into the plans, and the necessary steps are taken to see that the contractor and subcontractors carry out such recommendations in the field.

The requirements for concrete and reinforcing steel presented in this report are preliminary recommendations from a geotechnical perspective. The Structural Engineer should provide the final recommendations for structural design of concrete and reinforcing steel for foundation systems, floor slabs, exterior concrete, or other systems where concrete and reinforcing steel are utilized, in accordance with the latest version of applicable codes.

The findings of this report are valid as of the date of this report. However, changes in the conditions of a property can occur with the passage of time, whether they are due to natural processes or the works of man on this or adjacent properties. In addition, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and should not be relied upon after a period of three years.

The firm that performed the geotechnical investigation for the project should be retained to provide testing and observation services during construction to provide continuity of geotechnical interpretation and to check that the recommendations presented for geotechnical aspects of site development are incorporated during site grading, construction of improvements, and excavation of foundations. If another geotechnical firm is selected to perform the testing and observation services during construction operations, that firm should prepare a letter indicating their intent to assume the responsibilities of project Geotechnical Engineer of Record. A copy of the letter should be provided to the regulatory agency for their records. In addition, that firm should provide revised recommendations concerning the geotechnical aspects of the proposed development, or a written acknowledgement of their concurrence with the recommendations presented in our report. They should also perform additional analyses deemed necessary to assume the role of Geotechnical Engineer of Record.

LIST OF REFERENCES

1. Abode Communities Architecture Studio, *Site Plan*, Desert Hot Springs RFQ, dated October 17, 2023.

2. American Concrete Institute, 2019, *Building Code Requirements for Structural Concrete*, Report by ACI Committee 318.

3. ACI 330-21, *Commercial Concrete Parking Lots and Site Paving Design and Construction,* prepared by the American Concrete Institute, dated May 2021.

4. ASCE 7-16, 2019, *Minimum Design Loads for Buildings and Other Structures*.

5. Boore, D. M. and G. M Atkinson, *Ground-Motion Prediction for the Average Horizontal Component of PGA, PGV, and 5%-Damped PSA at Spectral Periods Between 0.01 and 10.0 S*, Earthquake Spectra, Volume 24, Issue 1, pages 99-138, February 2008.

6. California Building Standards Commission, 2022, *California Building Code (CBC)*, California Code of Regulations Title 24, Part 2.

7. California Geological Survey (CGS), *Earthquake Shaking Potential for California*, from USGS/CGS Seismic Hazards Model, CSSC No. 03-02, 2003.

8. California Geological Survey (CGS), *Probabilistic Seismic Hazards Mapping-Ground Motion Page*, 2003, CGS Website: www.conserv.ca.gov/cgs/rghm/pshamap.

9. California Geological Survey, *Seismic Shaking Hazards in California,* Based on the USGS/*CGS Probabilistic* Seismic Hazards Assessment (PSHA) Model, 2002 (revised April 2003). 10% probability of being exceeded in 50 years;

   http://redirect.conservation.ca.gov/cgs/rghm/pshamap/pshamain.html.

10. California Department of Transportation (Caltrans), Division of Engineering Services, Materials Engineering and Testing Services, 2021, *Corrosion Guidelines, Version 3.2,* dated March.

11. California Department of Transportation (Caltrans), 2020, *Highway Design Manual*, 7th Edition, dated July 1.

12. California Department of Water Resources (DWR), *Water Data Library* online database, www.water.ca.gov/waterdatalibrary/, accessed August 2024.

13. Campbell, K. W. and Y. Bozorgnia, *NGA Ground Motion Model for the Geometric Mean Horizontal Component of PGA, PGV, PGD and 5% Damped Linear Elastic Response Spectra for Periods Ranging from 0.01 to 10 s*, Preprint of version submitted for publication in the NGA Special Volume of Earthquake Spectra, Volume 24, Issue 1, pages 139-171, February 2008.

14. Chiou, Brian S. J. and Robert R. Youngs, *A NGA Model for the Average Horizontal Component of Peak Ground Motion and Response Spectra*, preprint for article to be published in NGA Special Edition for Earthquake Spectra, Spring 2008.

LIST OF REFERENCES (CONTINUED)

15. Thomas W. Dibblee Jr., 2008, *Geologic Map of the Thousand Palms and Lost Horse Mountain 15 Minute Quadrangles, Riverside County, California*, Dibblee Foundation Map DF-372.

16. Jennings, Charles W. and Bryant, William A., 2010, *Fault Activity Map of California,* California Division of Mines and Geology Map No. 6.

17. Legg*,* M. R., J. C. Borrero, and C. E. Synolakis*, Evaluation of Tsunami Risk to Southern California Coastal Cities*, 2002 NEHRP Professional Fellowship Report, dated January 2003.

18. Desert Hot Springs Public Works & Engineering Department, 2008, *Street Pavement Requirements*, dated January 30.

19. Public Works Standards, Inc., 2022, *Standard Specifications for Public Works Construction "Greenbook,"* Published by BNi Building News.

20. Riverside County GIS (RC GIS), *Map My County* website, http://mmc.rivcoit.org/MMC_Public/Custom/disclaimer/Default.htm; accessed August 2024.

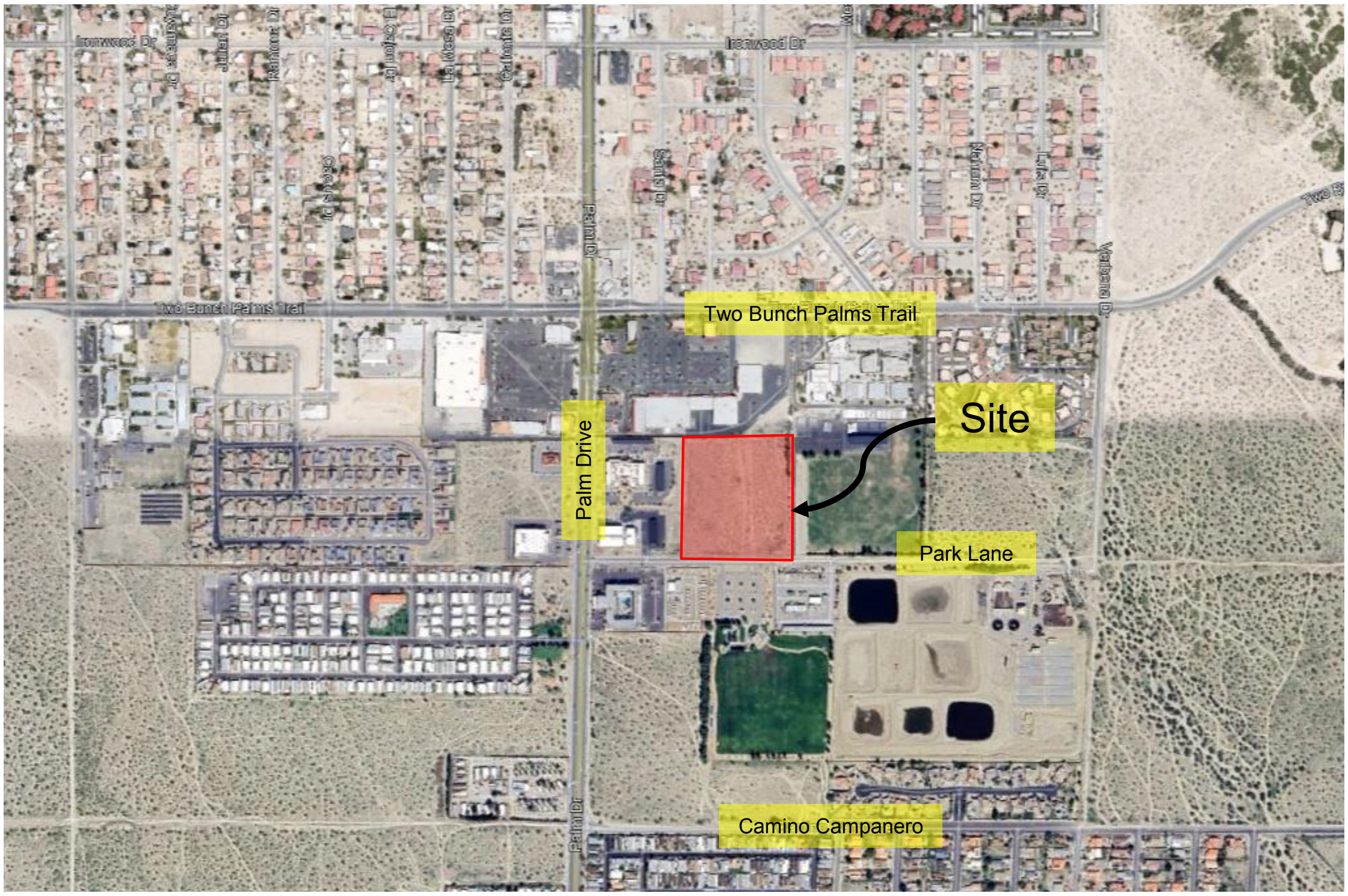
21. Riverside County Flood Control and Water Conservation District, 2011, *Design Handbook for Low Impact Development Best Management Practices,* dated September.

22. Riverside County, 2013, *General Plan Amendment No. 960, Section 4.11 Flood and Dam Inundation Hazards.*

23. Sneed, 2013, *Hydrogeology of the Thermal Springs in The Palm Springs Area – Indian Canyons & Agua Caliente Hot Springs*, AEG Inland Empire, March 14

24. U.S. Geological Survey (USGS), *Deaggregation of Seismic Hazard for PGA and 2 Periods of Spectral Acceleration*, 2002, USGS Website: www.earthquake.usgs.gov/research/hazmaps.

25. U.S. Geological Survey (USGS), *U.S. Seismic Design Maps* online database, http://earthquake.usgs.gov/designmaps/us/application.php, accessed August 2024.



SOURCE: Google Earth, 2024

VICINITY MAP

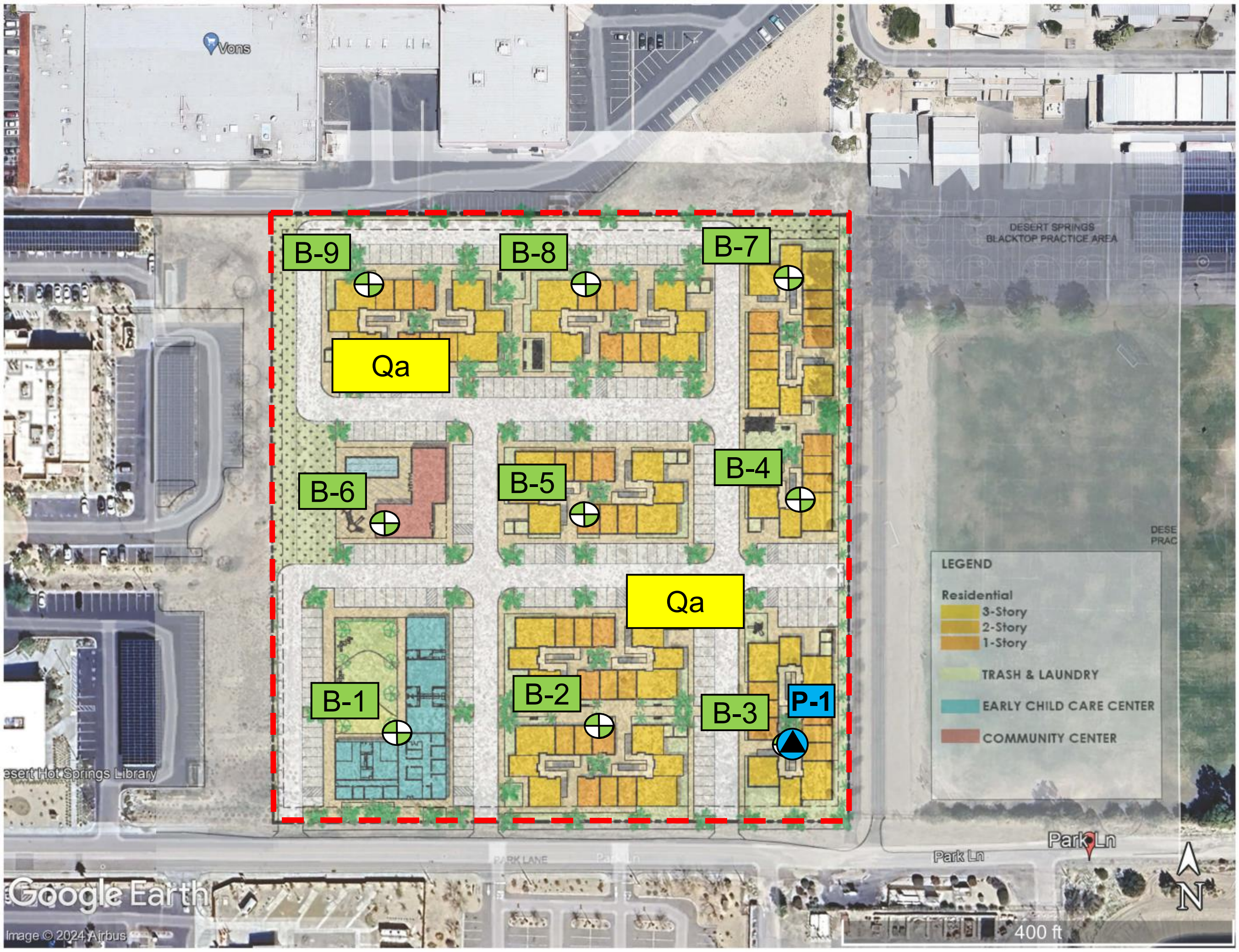
GEOCON
W E S T, I N C.

GEOTECHNICAL, ENVIRONMENTAL, MATERIALS
78-075 Main Street #G-203, La Quinta, California 92253
PHONE 951-304-2300 www.geoconinc.com

DRAFT BY: KD | CHECKED BY: ATS

MULTI-FAMILY RESIDENTIAL DEVELOPMENT
14320 PALM DRIVE
DESERT HOT SPRINGS, CALIFORNIA

SEPTEMBER 2024 | PROJECT NO. T3082-22-01 | FIG. 1



GEOCON LEGEND

Locations are approximate

B-9 ⊕ .... BORING LOCATION

P-1 ▲ .... PERCOLATION TEST LOCATION

- - - .... PROJECT LIMITS

Qa .... ALLUVIAL SAND AND GRAVEL OF THE VALLEY AREAS

0' 165' 330'

SCALE: 1" = 165'

N

SOURCE: Google Earth, 2024

GEOLOGIC MAP AND SITE PLAN

GEOCON
WEST, INC.
GEOTECHNICAL, ENVIRONMENTAL, MATERIALS
78-075 Main Street #G-203, La Quinta, California 92253
PHONE 951-304-2300 www.geoconinc.com

MULTI-FAMILY RESIDENTIAL DEVELOPMENT
14320 PALM DRIVE
DESERT HOT SPRINGS, CALIFORNIA

DRAFT BY: KD | CHECKED BY: ATS | SEPTEMBER 2024 | PROJECT NO. T3082-22-01 | FIG. 2

GEOCON

Project Name : Multi-Family Residential Deve
Project No : T3033-22-01
Boring : B-5

EMPIRICAL ESTIMATION OF LIQUEFACTION POTENTIAL
MAXIMUM CONSIDERED EARTHQUAKE

NCEER (1996) METHOD W 2001 UPDATES

EARTHQUAKE INFORMATION:

Earthquake Magnitude:	7.50
Peak Horiz. Acceleration PGA_M (g):	1.080
Magnitude Scaling Factor:	1.000
Historic High Groundwater:	176.0
Groundwater Depth During Exploration:	51.5

ENERGY & ROD CORRECTIONS:

Energy Correction (CE) for N60:	1.25
Rod Len.Corr.(CR) (0-no or 1-yes):	1
Bore Dia. Corr. (CB):	1.00
Sampler Corr. (CS):	1.20
Use Ksigma (0-no or 1-yes):	1

LIQUEFACTION CALCULATIONS:

Unit Wt. Water (pcf): 62.4

Depth to Base (ft)	Total Unit Wt. (pcf)	Water (0 or 1)	Field SPT (N)	Depth of SPT (ft)	Liq.Sus. (0 or 1)	-200 (%)		Est. Dr (%)	CN Factor	Corrected (N1)60cs	Eff. Unit Wt. (psf)	Resist. CRR 7.5	rd Factor	Induced CSR	Liquefac. Safe.Fact.
1.0	100.7	0	10.0	2.5	1	5		73	1.700	19.1	100.7	0.205	1.000	0.702	--
2.0	100.7	0	10.0	2.5	1	5		73	1.700	19.1	100.7	0.205	0.998	0.701	--
3.0	100.7	0	10.0	2.5	1	5		73	1.700	19.1	100.7	0.205	0.996	0.699	--
4.0	100.7	0	10.0	2.5	1	5		73	1.700	19.1	100.7	0.205	0.994	0.698	--
5.0	113.4	0	9.0	5.0	1	5		66	1.700	17.2	113.4	0.183	0.991	0.696	--
6.0	113.4	0	9.0	5.0	1	5		66	1.700	17.2	113.4	0.183	0.989	0.694	--
7.0	113.4	0	9.0	5.0	1	5		66	1.700	17.2	113.4	0.183	0.987	0.693	--
8.0	109.7	0	11.0	7.5	1	4		69	1.618	20.0	109.7	0.216	0.985	0.691	--
9.0	109.7	0	11.0	7.5	1	4		69	1.517	18.8	109.7	0.201	0.982	0.690	--
10.0	121.5	0	18.0	10.0	1	4		85	1.429	28.9	121.5	0.407	0.980	0.688	--
11.0	121.5	0	18.0	10.0	1	4		85	1.351	27.3	121.5	0.348	0.978	0.687	--
12.5	121.5	0	18.0	10.0	1	4		85	1.269	25.7	121.5	0.306	0.975	0.685	--
13.0	125.9	0	19.0	12.5	1	9		83	1.240	27.3	125.9	0.348	0.973	0.683	--
14.0	125.9	0	19.0	12.5	1	9		83	1.174	25.9	125.9	0.311	0.972	0.682	--
15.0	116.6	0	29.0	15.0	1	9		98	1.129	40.7	116.6	Infin.	0.970	0.681	--
16.0	116.6	0	29.0	15.0	1	9		98	1.091	39.3	116.6	Infin.	0.967	0.679	--
17.0	116.6	0	29.0	15.0	1	9		98	1.057	38.1	116.6	Infin.	0.965	0.678	--
18.0	125.9	0	23.0	17.5	1	6		83	1.024	30.4	125.9	Infin.	0.963	0.676	--
19.0	125.9	0	23.0	17.5	1	6		83	0.993	29.5	125.9	0.434	0.961	0.674	--
20.0	125.9	0	65.0	20.0	1	6		136	0.965	84.6	125.9	Infin.	0.958	0.673	--
21.0	125.9	0	65.0	20.0	1	6		136	0.939	82.3	125.9	Infin.	0.956	0.671	--
22.0	125.9	0	65.0	20.0	1	6		136	0.915	80.2	125.9	Infin.	0.953	0.669	--
23.0	125.9	0	65.0	20.0	1	6		136	0.893	78.2	125.9	Infin.	0.950	0.667	--
24.0	125.9	0	65.0	20.0	1	6		136	0.872	76.4	125.9	Infin.	0.947	0.665	--
25.0	125.9	0	41.0	25.0	1	6		101	0.853	50.3	125.9	Infin.	0.944	0.662	--
26.0	125.9	0	41.0	25.0	1	6		101	0.834	49.3	125.9	Infin.	0.940	0.660	--
27.0	125.9	0	41.0	25.0	1	6		101	0.817	48.3	125.9	Infin.	0.936	0.657	--
28.0	125.9	0	41.0	25.0	1	6		101	0.801	47.3	125.9	Infin.	0.932	0.654	--
29.0	125.9	0	41.0	25.0	1	6		101	0.786	46.4	125.9	Infin.	0.928	0.651	--
30.0	125.9	0	63.0	30.0	1	6		118	0.772	73.3	125.9	Infin.	0.923	0.648	--
31.0	125.9	0	63.0	30.0	1	6		118	0.759	72.0	125.9	Infin.	0.918	0.644	--
32.0	125.9	0	63.0	30.0	1	15	*	118	0.746	76.4	125.9	Infin.	0.912	0.641	--
33.0	125.9	0	63.0	30.0	1	15	*	118	0.734	75.2	125.9	Infin.	0.907	0.636	--
34.0	125.9	0	63.0	30.0	1	15	*	118	0.722	74.0	125.9	Infin.	0.900	0.632	--
35.0	125.9	0	63.0	30.0	1	15	*	118	0.711	72.9	125.9	Infin.	0.894	0.628	--
36.0	125.9	0	37.0	35.0	1	6	*	85	0.700	39.1	125.9	Infin.	0.887	0.623	--
37.0	125.9	0	37.0	35.0	1	6	*	85	0.690	38.5	125.9	Infin.	0.880	0.617	--
38.0	125.9	0	37.0	35.0	1	6	*	85	0.680	38.0	125.9	Infin.	0.872	0.612	--
39.0	125.9	0	37.0	35.0	1	6	*	85	0.671	37.5	125.9	Infin.	0.864	0.606	--
40.0	125.9	0	37.0	35.0	1	6	*	85	0.662	37.0	125.9	Infin.	0.855	0.600	--
41.0	108.2	0	27.0	40.0	1	15	*	69	0.654	30.3	108.2	Infin.	0.846	0.594	--
42.0	108.2	0	27.0	40.0	1	4	*	69	0.647	26.2	108.2	0.318	0.837	0.588	--
43.0	108.2	0	27.0	40.0	1	4	*	69	0.640	25.9	108.2	0.311	0.828	0.581	--
44.0	108.2	0	27.0	40.0	1	4	*	69	0.633	25.7	108.2	0.305	0.818	0.574	--
45.0	108.2	0	27.0	40.0	1	4	*	69	0.627	25.4	108.2	0.300	0.808	0.567	--
46.0	108.2	0	27.0	45.0	1	15	*	67	0.621	28.8	108.2	0.403	0.798	0.560	--
47.0	108.2	0	27.0	45.0	1	15	*	67	0.615	28.6	108.2	0.392	0.788	0.553	--
48.0	108.2	0	27.0	45.0	1	15	*	67	0.609	28.3	108.2	0.382	0.778	0.546	--
49.0	108.2	0	27.0	45.0	1	15	*	67	0.603	28.1	108.2	0.373	0.768	0.539	--
50.5	108.2	0	63.0	50.0	1	15	*	195	0.596	61.5	108.2	Infin.	0.755	0.530	--

* Indicates Assumed Value

GEOCON

Project Name : Multi-Family Residential Development, Desert Hot Spr
Project No : T3033-22-01
Boring : B-5

TECHNICAL ENGINEERING AND DESIGN GUIDES AS ADAPTED FROM THE US ARMY CORPS OF ENGINEERS, NO. 9

EVALUATION OF EARTHQUAKE-INDUCED SETTLEMENTS IN DRY SANDY SOILS

MAXIMUM CONSIDERED EARTHQUAKE

MCE EARTHQUAKE INFORMATION:

Earthquake Magnitude:	7.50
Peak Horiz. Acceleration (g):	1.080

Fig 4.1 Fig 4.2 Fig 4.4

Depth of Base of Strata (ft)	Thickness of Layer (ft)	Depth of Mid-point of Layer (ft)	Soil Unit Weight (pcf)	Overburden Pressure at Mid-point (tsf)	Mean Effective Pressure at Mid-point (tsf)	Average Cyclic Shear Stress [Tav]	Field SPT [N]	Correction Factor [Cer]	Relative Density [Dr] (%)	Correction Factor [Cn]	Corrected [N1]60	rd Factor	Maximum Shear Mod. [Gmax] (tsf)	[yeff]*[Geff] [Gmax]	yeff Shear Strain	[yeff]*100%	Volumetric Strain M7.5 [E15} (%)	Number of Strain Cycles [Nc]	Corrected Vol. Strains [Ec]	Estimated Settlement [S] (inches)
1.0	1.0	0.5	100.7	0.03	0.02	0.018	10	1.25	73.3	1.7	19.1	1.0	155.2	1.13E-04	2.30E-04	0.023	2.43E-02	15.0	2.43E-02	Grading
2.0	1.0	1.5	100.7	0.08	0.05	0.053	10	1.25	73.3	1.7	19.1	1.0	268.9	1.91E-04	2.30E-04	0.023	2.43E-02	15.0	2.43E-02	Grading
3.0	1.0	2.5	100.7	0.13	0.08	0.088	10	1.25	73.3	1.7	19.1	1.0	347.1	2.42E-04	3.00E-03	0.300	3.17E-01	15.0	3.17E-01	Grading
4.0	1.0	3.5	100.7	0.18	0.12	0.124	10	1.25	73.3	1.7	19.1	1.0	410.8	2.81E-04	8.10E-04	0.081	8.55E-02	15.0	8.55E-02	Grading
5.0	1.0	4.5	113.4	0.23	0.15	0.161	9	1.25	66.5	1.7	17.2	1.0	452.8	3.26E-04	5.00E-03	0.500	5.99E-01	15.0	5.99E-01	Grading
6.0	1.0	5.5	113.4	0.29	0.19	0.200	9	1.25	66.5	1.7	17.2	1.0	505.6	3.57E-04	5.00E-03	0.500	5.99E-01	15.0	5.99E-01	0.14
7.0	1.0	6.5	113.4	0.34	0.23	0.240	9	1.25	66.5	1.7	17.2	1.0	553.4	3.84E-04	1.00E-03	0.100	1.20E-01	15.0	1.20E-01	0.03
8.0	1.0	7.5	109.7	0.40	0.27	0.278	11	1.25	68.9	1.6	20.0	1.0	627.5	3.86E-04	1.00E-03	0.100	9.99E-02	15.0	9.99E-02	0.02
9.0	1.0	8.5	109.7	0.45	0.30	0.316	11	1.25	68.9	1.5	18.8	1.0	655.0	4.13E-04	2.70E-03	0.270	2.91E-01	15.0	2.91E-01	0.07
10.0	1.0	9.5	121.5	0.51	0.34	0.356	18	1.25	84.8	1.4	28.9	1.0	803.4	3.73E-04	1.00E-03	0.100	6.42E-02	15.0	6.42E-02	0.02
11.0	1.0	10.5	121.5	0.57	0.38	0.397	18	1.25	84.8	1.4	27.3	1.0	834.0	3.95E-04	1.00E-03	0.100	6.87E-02	15.0	6.87E-02	0.02
12.5	1.5	11.8	121.5	0.65	0.43	0.449	18	1.25	84.8	1.3	25.7	1.0	869.3	4.19E-04	2.70E-03	0.270	2.00E-01	15.0	2.00E-01	0.07
13.0	0.5	12.8	125.9	0.71	0.48	0.490	19	1.25	83.5	1.2	27.3	1.0	928.6	4.22E-04	2.70E-03	0.270	1.85E-01	15.0	1.85E-01	0.02
14.0	1.0	13.5	125.9	0.76	0.51	0.522	19	1.25	83.5	1.2	25.9	1.0	941.9	4.38E-04	1.20E-03	0.120	8.79E-02	15.0	8.79E-02	0.02
15.0	1.0	14.5	116.6	0.82	0.55	0.562	29	1.25	98.2	1.1	40.7	1.0	1137.6	3.85E-04	7.10E-04	0.071	3.03E-02	15.0	3.03E-02	0.01
16.0	1.0	15.5	116.6	0.88	0.59	0.600	29	1.25	98.2	1.1	39.3	1.0	1164.2	3.96E-04	7.10E-04	0.071	3.16E-02	15.0	3.16E-02	0.01
17.0	1.0	16.5	116.6	0.93	0.63	0.638	29	1.25	98.2	1.1	38.1	1.0	1189.7	4.06E-04	1.20E-03	0.120	5.54E-02	15.0	5.54E-02	0.01
18.0	1.0	17.5	125.9	0.99	0.67	0.677	23	1.25	83.4	1.0	30.4	1.0	1138.6	4.44E-04	1.20E-03	0.120	7.27E-02	15.0	7.27E-02	0.02
19.0	1.0	18.5	125.9	1.06	0.71	0.718	23	1.25	83.4	1.0	29.5	1.0	1162.1	4.55E-04	1.20E-03	0.120	7.54E-02	15.0	7.54E-02	0.02
20.0	1.0	19.5	125.9	1.12	0.75	0.758	65	1.25	136.0	1.0	84.6	1.0	1700.1	3.24E-04	7.10E-04	0.071	1.26E-02	15.0	1.26E-02	0.00
21.0	1.0	20.5	125.9	1.18	0.79	0.797	65	1.25	136.0	0.9	82.3	1.0	1731.4	3.30E-04	7.10E-04	0.071	1.30E-02	15.0	1.30E-02	0.00
22.0	1.0	21.5	125.9	1.25	0.84	0.836	65	1.25	136.0	0.9	80.2	1.0	1761.5	3.36E-04	7.10E-04	0.071	1.34E-02	15.0	1.34E-02	0.00
23.0	1.0	22.5	125.9	1.31	0.88	0.875	65	1.25	136.0	0.9	78.2	0.9	1790.7	3.42E-04	7.10E-04	0.071	1.38E-02	15.0	1.38E-02	0.00
24.0	1.0	23.5	125.9	1.37	0.92	0.913	65	1.25	136.0	0.9	76.4	0.9	1819.0	3.47E-04	7.10E-04	0.071	1.42E-02	15.0	1.42E-02	0.00
25.0	1.0	24.5	125.9	1.44	0.96	0.951	41	1.25	100.8	0.9	50.3	0.9	1618.4	4.02E-04	1.20E-03	0.120	3.96E-02	15.0	3.96E-02	0.01
26.0	1.0	25.5	125.9	1.50	1.00	0.988	41	1.25	100.8	0.8	49.3	0.9	1641.7	4.07E-04	8.10E-04	0.081	2.75E-02	15.0	2.75E-02	0.01
27.0	1.0	26.5	125.9	1.56	1.05	1.024	41	1.25	100.8	0.8	48.3	0.9	1664.4	4.11E-04	8.10E-04	0.081	2.81E-02	15.0	2.81E-02	0.01
28.0	1.0	27.5	125.9	1.62	1.09	1.060	41	1.25	100.8	0.8	47.3	0.9	1686.5	4.16E-04	8.10E-04	0.081	2.88E-02	15.0	2.88E-02	0.01
29.0	1.0	28.5	125.9	1.69	1.13	1.095	41	1.25	100.8	0.8	46.4	0.9	1708.1	4.20E-04	8.10E-04	0.081	2.95E-02	15.0	2.95E-02	0.01
30.0	1.0	29.5	125.9	1.75	1.17	1.130	63	1.25	117.6	0.8	73.3	0.9	2025.7	3.62E-04	5.20E-04	0.052	1.09E-02	15.0	1.09E-02	0.00
31.0	1.0	30.5	125.9	1.81	1.21	1.164	63	1.25	117.6	0.8	72.0	0.9	2049.8	3.65E-04	5.20E-04	0.052	1.12E-02	15.0	1.12E-02	0.00
32.0	1.0	31.5	125.9	1.88	1.26	1.198	63	1.25	117.6	0.7	76.4	0.9	2126.1	3.58E-04	5.20E-04	0.052	1.04E-02	15.0	1.04E-02	0.00
33.0	1.0	32.5	125.9	1.94	1.30	1.231	63	1.25	117.6	0.7	75.2	0.9	2150.0	3.61E-04	5.20E-04	0.052	1.06E-02	15.0	1.06E-02	0.00
34.0	1.0	33.5	125.9	2.00	1.34	1.263	63	1.25	117.6	0.7	74.0	0.9	2173.4	3.63E-04	5.20E-04	0.052	1.08E-02	15.0	1.08E-02	0.00
35.0	1.0	34.5	125.9	2.06	1.38	1.295	63	1.25	117.6	0.7	72.9	0.9	2196.4	3.65E-04	5.20E-04	0.052	1.10E-02	15.0	1.10E-02	0.00
36.0	1.0	35.5	125.9	2.13	1.43	1.326	37	1.25	85.4	0.7	39.1	0.9	1811.1	4.49E-04	8.10E-04	0.081	3.63E-02	15.0	3.63E-02	0.01
37.0	1.0	36.5	125.9	2.19	1.47	1.357	37	1.25	85.4	0.7	38.5	0.9	1828.8	4.51E-04	8.10E-04	0.081	3.69E-02	15.0	3.69E-02	0.01
38.0	1.0	37.5	125.9	2.25	1.51	1.387	37	1.25	85.4	0.7	38.0	0.9	1846.2	4.53E-04	8.10E-04	0.081	3.75E-02	15.0	3.75E-02	0.01
39.0	1.0	38.5	125.9	2.32	1.55	1.416	37	1.25	85.4	0.7	37.5	0.9	1863.2	4.55E-04	8.10E-04	0.081	3.82E-02	15.0	3.82E-02	0.01
40.0	1.0	39.5	125.9	2.38	1.59	1.445	37	1.25	85.4	0.7	37.0	0.9	1880.0	4.57E-04	8.10E-04	0.081	3.88E-02	15.0	3.88E-02	0.01
41.0	1.0	40.5	108.2	2.44	1.63	1.470	27	1.25	69.5	0.7	30.3	0.8	1780.5	4.87E-04	8.10E-04	0.081	4.93E-02	15.0	4.93E-02	0.01
42.0	1.0	41.5	108.2	2.49	1.67	1.492	27	1.25	69.5	0.6	26.2	0.8	1715.7	5.09E-04	1.30E-03	0.130	9.40E-02	15.0	9.40E-02	0.02
43.0	1.0	42.5	108.2	2.55	1.71	1.514	27	1.25	69.5	0.6	25.9	0.8	1728.0	5.09E-04	1.30E-03	0.130	9.52E-02	15.0	9.52E-02	0.02
44.0	1.0	43.5	108.2	2.60	1.74	1.535	27	1.25	69.5	0.6	25.7	0.8	1740.2	5.09E-04	1.30E-03	0.130	9.64E-02	15.0	9.64E-02	0.02
45.0	1.0	44.5	108.2	2.65	1.78	1.555	27	1.25	69.5	0.6	25.4	0.8	1752.2	5.09E-04	1.30E-03	0.130	9.76E-02	15.0	9.76E-02	0.02
46.0	1.0	45.5	108.2	2.71	1.81	1.575	27	1.25	66.8	0.6	28.8	0.8	1846.8	4.86E-04	8.10E-04	0.081	5.22E-02	15.0	5.22E-02	0.01
47.0	1.0	46.5	108.2	2.76	1.85	1.595	27	1.25	66.8	0.6	28.6	0.8	1859.5	4.86E-04	8.10E-04	0.081	5.28E-02	15.0	5.28E-02	0.01
48.0	1.0	47.5	108.2	2.82	1.89	1.613	27	1.25	66.8	0.6	28.3	0.8	1872.1	4.85E-04	8.10E-04	0.081	5.33E-02	15.0	5.33E-02	0.01
49.0	1.0	48.5	108.2	2.87	1.92	1.632	27	1.25	66.8	0.6	28.1	0.8	1884.5	4.85E-04	8.10E-04	0.081	5.39E-02	15.0	5.39E-02	0.01
50.5	1.5	49.8	108.2	2.94	1.97	1.654	63	1.25	195.1	0.6	61.5	0.8	2476.0	3.72E-04	5.20E-04	0.052	1.35E-02	15.0	1.35E-02	0.00

TOTAL SETTLEMENT = **0.75**

Figure 4

APPENDIX A

APPENDIX A
FIELD EXPLORATION

Our field investigation was conducted on August 9 and 12, 2024, and included:

- Drilling of nine (9) exploratory borings (Borings B-1 through B-9) to depths ranging between approximately 16½ feet and 50½ feet, to observe the subsurface geological conditions at the site, collect relatively undisturbed in-situ and disturbed bulk samples for laboratory testing, and evaluate the depth to static groundwater, if encountered.
- Backfilling and performing percolation testing in one (1) geotechnical boring (Boring B-3), at a depth of approximately 10 feet, to provide a preliminary evaluation of the subsurface infiltration rate in areas where storm water infiltration systems are expected. The percolation test is identified as Test P-1. A bentonite plug was installed at 10 feet of depth, after backfilling and prior to performing percolation testing. Additional percolation testing should be performed when the exact location and depth of the proposed storm water infiltration system is known.

We collected bulk and relatively undisturbed samples from the borings by driving a 3-inch O. D., California Modified Sampler into the “undisturbed” soil mass with blows from a 140-pound hammer falling 30 inches. The California Modified Sampler was equipped with 1-inch high by 2$^{3}/_{8}$-inch inside diameter brass sampler rings to facilitate removal and testing. Relatively undisturbed samples and bulk samples of disturbed soils were transported to our laboratory for testing.

The soil conditions encountered in the borings were visually examined, classified and logged in general accordance with the Unified Soil Classification System (USCS). Logs of the borings are presented on Figures A-1 through A-9. The logs depict the soil and geologic conditions encountered and the depth at which samples were obtained. The approximate locations of the borings are depicted on the *Geologic Map and Site Plan*, Figure 2.

Preliminary percolation testing was performed in accordance with *Riverside County Flood Control and Water Conservation District, LID BMP Manual, Appendix A.* The percolation test data is presented on Figure A-10.

PROJECT NO. T3082-22-01

BORING B-1

ELEV. (MSL.) 910 DATE COMPLETED 8/9/2024

EQUIPMENT CME-75 BY: KD

DEPTH IN FT	SAMPLE NO.	BULK	DR/SPT	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B-1@0-5'	☒				SP-SM	**ALLUVIAL SAND AND GRAVEL OF VALLEY AREAS (Qa)** Poorly-graded SAND with silt, medium dense, dry, pale brown, fine to coarse			
2		☒								
	B-1@2.5'	☒	■					22	106.2	1.1
4		☒								
	B-1@5'		■					26	116.4	0.5
6										
8	B-1@7.5'		■					31	107.8	0.8
10	B-1@10'		■			SM	Silty SAND, medium dense, slightly moist, light brown, fine to medium	28	117.6	0.3
12										
14										
	B-1@15'		■					40	106.4	0.6
16						SP	Poorly-graded SAND, medium dense, slightly moist, pale brown, fine to coarse			
18										
20	B-1@20'		■					42	116.1	1.3
22										
24										
	B-1@25'		■				- Becomes dense	58	118.8	0.9
26										

Total Depth = 26 1/2 feet
Groundwater not encountered
Penetration resistance for 140-lb hammer falling 30 inches by auto hammer
Backfilled with cuttings 8/9/2024

Figure A-1,
Log of Boring B-1, Page 1 of 1

T3082-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS

☐ ... SAMPLING UNSUCCESSFUL	◧ ... STANDARD PENETRATION TEST	■ ... DRIVE SAMPLE (UNDISTURBED)
☒ ... DISTURBED OR BAG SAMPLE	◪ ... CHUNK SAMPLE	▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. T3082-22-01

BORING B-2

ELEV. (MSL.) **908** DATE COMPLETED **8/9/2024**

EQUIPMENT **CME-75** BY: **KD**

DEPTH IN FT	SAMPLE NO.	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0		SP-SM	**ALLUVIAL SAND AND GRAVEL OF VALLEY AREAS (Qa)** Poorly-graded SAND with silt, dense, dry, pale brown, fine to coarse			
2						
			- Cobbles encountered			
4						
	B-2@5'			53	118.1	0.5
6						
8						
		SM	Silty SAND, medium dense, slightly moist, light brown, fine to medium			
10	B-2@10'			31	104.0	0.7
12						
14						
	B-2@15'		- Becomes dense	49	123.3	1.1
16						

Total Depth = 16 1/2 feet
Groundwater not encountered
Penetration resistance for 140-lb hammer falling 30 inches by auto hammer
Backfilled with cuttings 8/9/2024

Figure A-2,
Log of Boring B-2, Page 1 of 1

SAMPLE SYMBOLS

☐ ... SAMPLING UNSUCCESSFUL
◧ ... STANDARD PENETRATION TEST
■ ... DRIVE SAMPLE (UNDISTURBED)
☒ ... DISTURBED OR BAG SAMPLE
◪ ... CHUNK SAMPLE
▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. T3082-22-01

BORING B-3

ELEV. (MSL.) **906** DATE COMPLETED **8/9/2024**

EQUIPMENT **CME-75** BY: **KD**

SAMPLE NO.	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
B-3@0-5'		SP	**ALLUVIAL SAND AND GRAVEL OF VALLEY AREAS (Qa)** Poorly-graded SAND, loose, dry, pale gray, fine to medium with few coarse; coarsening downward			
B-3@2.5'				12	98.2	4.4
B-3@5'			- Becomes slightly moist	16	110.6	1.3
B-3@7.5'			- Becomes light brown	15	107.0	0.9
			- Thin silt layer			
B-3@10'		SP-SM	Poorly-graded SAND with silt, medium dense, slightly moist, light brown; fine to coarse	22	118.5	0.7
B-3@15'			- Becomes pale brown	40	113.8	2.2
B-3@20'			- Becomes dense; increase in fine sand	53	96.6	0.5
B-3@25'			- Becomes very dense; NO RECOVERY	50/6"		

Total Depth = 26 1/2 feet
Groundwater not encountered
Penetration resistance for 140-lb hammer falling 30 inches by auto hammer
Backfilled with cuttings to 10'
Percolation Test Equipment Set on 8/9/2024
Presaturated with 5 gallons of water
Backfilled with cuttings 8/12/2024

Figure A-3,
Log of Boring B-3, Page 1 of 1

T3082-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS			
	☐ ... SAMPLING UNSUCCESSFUL	◧ ... STANDARD PENETRATION TEST	■ ... DRIVE SAMPLE (UNDISTURBED)
	⊠ ... DISTURBED OR BAG SAMPLE	◪ ... CHUNK SAMPLE	▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. T3082-22-01

BORING B-4

ELEV. (MSL.) **910** DATE COMPLETED **8/9/2024**

EQUIPMENT **CME-75** BY: **KD**

DEPTH IN FT	SAMPLE NO. (BULK / DR/SPT)	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SP	**ALLUVIAL SAND AND GRAVEL OF VALLEY AREAS (Qa)** Poorly-graded SAND, medium dense, dry, pale brown; fine to medium with few coarse sand; coarsening downward			
2								
4								
	B-4@5'					22	103.0	3.1
6								
8								
10	B-4@10'				-Becomes dense	53	112.3	1.0
12								
14								
	B-4@15'				NO RECOVERY	50/2"		
16								

Total Depth = 16 1/2 feet
Groundwater not encountered
Penetration resistance for 140-lb hammer falling 30 inches by auto hammer
Backfilled with cuttings 8/9/2024

Figure A-4,
Log of Boring B-4, Page 1 of 1

T3082-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS			
	☐ ... SAMPLING UNSUCCESSFUL	◧ ... STANDARD PENETRATION TEST	■ ... DRIVE SAMPLE (UNDISTURBED)
	⊠ ... DISTURBED OR BAG SAMPLE	◪ ... CHUNK SAMPLE	▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. T3082-22-01

BORING B-5

ELEV. (MSL.) **914** DATE COMPLETED **8/9/2024**

EQUIPMENT **CME-75** BY: **KD**

DEPTH IN FT	SAMPLE NO.	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B-5@0-5'	SP	**ALLUVIAL SAND AND GRAVEL OF VALLEY AREAS (Qa)** Poorly-graded SAND, loose, dry, pale brown; fine to coarse sand			
	B-5@2.5'			10		
	B-5@5'		- Fining downward; NO RECOVERY	14		
8	B-5@7.5'		- Thin silt lens	11		
			- Increase in medium to coarse sand			
10	B-5@10'		- Becomes medium dense; NO RECOVERY	28		
	B-5@12.5'	SP-SM	Poorly-graded SAND with Silt, medium dense, dry, pale brown; fine to medium sand with few coarse sand; few large gravel	19		
	B-5@15'		- Increase in coarse sand	46	122.8	0.5
18	B-5@17.5'			23		
20	B-5@20'		- Becomes very dense; NO RECOVERY	77/9"		
22			- Large cobbes encountered			
	B-5@25'		- Becomes dense	41		
30	B-5@30'		- Becomes very dense; large gravels (6-8') encountered	50/6"	154.4	0.4
32		SM	Silty SAND, very dense, slightly moist, light brown; fine to medium with few coarse sand			

Figure A-5,
Log of Boring B-5, Page 1 of 2

SAMPLE SYMBOLS			
	☐ ... SAMPLING UNSUCCESSFUL	◧ ... STANDARD PENETRATION TEST	■ ... DRIVE SAMPLE (UNDISTURBED)
	⊠ ... DISTURBED OR BAG SAMPLE	◪ ... CHUNK SAMPLE	▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. T3082-22-01

BORING B-5

ELEV. (MSL.) **914** DATE COMPLETED **8/9/2024**

EQUIPMENT **CME-75** BY: **KD**

DEPTH IN FT	SAMPLE NO.	BULK	DR/SPT	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
36	B-5@35'		■			SP-SM	Poorly-graded SAND with silt, dense, slightly moist, pale brown; medium to coarse sand	37		
38										
40	B-5@40'		■			SM	Silty SAND, medium dense, slightly moist, light brown; fine sand	43	105.6	1.9
						SP	Poorly-graded SAND, medium dense, slightly moist, pale brown; fine to coarse sand			
42										
44										
46	B-5@45'		■			SM	Silty SAND, medium dense, slightly moist, pale brown; fine sand	27		
48										
50	B-5@50'		○					50/6"		

Total Depth = 50 1/2 feet
Groundwater not encountered
Penetration resistance for 140-lb hammer falling 30 inches by auto hammer
Backfilled with cuttings 8/9/2024

Figure A-5,
Log of Boring B-5, Page 2 of 2

T3082-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS			
	☐ ... SAMPLING UNSUCCESSFUL	◧ ... STANDARD PENETRATION TEST	■ ... DRIVE SAMPLE (UNDISTURBED)
	☒ ... DISTURBED OR BAG SAMPLE	◣ ... CHUNK SAMPLE	▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. T3082-22-01

BORING B-6

ELEV. (MSL.) **910** DATE COMPLETED **8/9/2024**

EQUIPMENT **CME-75** BY: **KD**

DEPTH IN FT	SAMPLE NO.	BULK	DR/SPT	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0						SP	**ALLUVIAL SAND AND GRAVEL OF VALLEY AREAS (Qa)** Poorly-graded SAND, medium dense, slightly moist, pale gray; fine to medium with few coarse sand			
2										
4										
	B-6@5'		○				- NO RECOVERY	20		
6										
8										
10	B-6@10'		■					37	104.1	6.1
12										
14										
	B-6@15'		■				- Becomes dense	72	124.1	0.5
16										

Total Depth = 16 1/2 feet
Groundwater not encountered
Penetration resistance for 140-lb hammer falling 30 inches by auto hammer
Backfilled with cuttings 8/9/2024

Figure A-6,
Log of Boring B-6, Page 1 of 1

T3082-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS

☐ ... SAMPLING UNSUCCESSFUL
◧ ... STANDARD PENETRATION TEST
■ ... DRIVE SAMPLE (UNDISTURBED)
☒ ... DISTURBED OR BAG SAMPLE
◪ ... CHUNK SAMPLE
▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. T3082-22-01

BORING B-7

ELEV. (MSL.) **913** DATE COMPLETED **8/9/2024**

EQUIPMENT **CME-75** BY: **KD**

DEPTH IN FT	SAMPLE NO.	BULK	DR/SPT	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B-7@0-5'	☒				SP-SM	**ALLUVIAL SAND AND GRAVEL OF VALLEY AREAS (Qa)** Poorly-graded SAND with silt, medium dense, dry, pale brown; fine to coarse sand			
2										
	B-7@2.5'	☒	■					38	115.0	1.8
4		☒					- Rootlets			
	B-7@5'		■					29	107.2	1.1
6										
	B-7@7.5'		■					38	100.3	0.7
8							- Increase in coarse sand			
10	B-7@10'		■					43	109.2	0.4
12										
14										
	B-7@15'		○				NO RECOVERY	50/2"		
16										

REFUSAL, LARGE COBBLES ENCOUNTERED
Total Depth = 17 feet
Groundwater not encountered
Penetration resistance for 140-lb hammer falling 30 inches by auto hammer
Backfilled with cuttings 8/9/2024

Figure A-7,
Log of Boring B-7, Page 1 of 1

T3082-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS

☐ ... SAMPLING UNSUCCESSFUL
◧ ... STANDARD PENETRATION TEST
■ ... DRIVE SAMPLE (UNDISTURBED)
☒ ... DISTURBED OR BAG SAMPLE
◪ ... CHUNK SAMPLE
▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. T3082-22-01

BORING B-8

ELEV. (MSL.) **915** DATE COMPLETED **8/9/2024**

EQUIPMENT **CME-75** BY: **KD**

DEPTH IN FT	SAMPLE NO.	BULK	DR/SPT	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0						SP	**ALLUVIAL SAND AND GRAVEL OF VALLEY AREAS (Qa)** Poorly-graded SAND, medium dense, dry, pale brown, fine to coarse sand			
2										
4										
6	B-8@5'		■					33	114.1	0.6
8										
10	B-8@10'		■				- Becomes very dense; NO RECOVERY	50/3"		
12										
14							- Large cobbles encountered			
16	B-8@15'		■					43	111.8	0.7

Total Depth = 16 1/2 feet
Groundwater not encountered
Penetration resistance for 140-lb hammer falling 30 inches by auto hammer
Backfilled with cuttings 8/9/2024

Figure A-8,
Log of Boring B-8, Page 1 of 1

SAMPLE SYMBOLS			
	☐ ... SAMPLING UNSUCCESSFUL	◧ ... STANDARD PENETRATION TEST	■ ... DRIVE SAMPLE (UNDISTURBED)
	⊠ ... DISTURBED OR BAG SAMPLE	◩ ... CHUNK SAMPLE	▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. T3082-22-01

BORING B-9

ELEV. (MSL.) **910** DATE COMPLETED **8/9/2024**

EQUIPMENT **CME-75** BY: **KD**

DEPTH IN FT	SAMPLE NO.	BULK	DR/SPT	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B-9@0-5'	☒				SP	**ALLUVIAL SAND AND GRAVEL OF VALLEY AREAS (Qa)** Poorly-graded SAND, medium dense, dry, pale brown; medium to coarse sand			
2		☒								
	B-9@2.5'	☒	■					19	113.3	0.9
4		☒								
	B-9@5'		■				- Increase in fine and medium sand	24	107.0	0.8
6										
8	B-9@7.5'		■					44	107.0	0.4
10	B-9@10'		■					27	117.2	1.4
12										
14										
	B-9@15'		■					41	137.7	0.9
16										
18										
20	B-9@20'		☐				- Becomes very dense; NO RECOVERY	50/3"		
22										
24										
	B-9@25'		☐				NO RECOVERY	50/3"		
26										

Total Depth = 26 1/2 feet
Groundwater not encountered
Penetration resistance for 140-lb hammer falling 30 inches by auto hammer
Backfilled with cuttings 8/9/2024

Figure A-9,
Log of Boring B-9, Page 1 of 1

SAMPLE SYMBOLS

☐ ... SAMPLING UNSUCCESSFUL
◧ ... STANDARD PENETRATION TEST
■ ... DRIVE SAMPLE (UNDISTURBED)
☒ ... DISTURBED OR BAG SAMPLE
◪ ... CHUNK SAMPLE
▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PERCOLATION TEST REPORT

Project Name:	DHS	**Project No.:**	T3082-22-01
Test Hole No.:	B-3	**Date Excavated:**	8/9/2024
Length of Test Pipe:	126.0 inches	**Soil Classification:**	SP
Height of Pipe above Ground:	6.0 inches	**Presoak Date:**	8/9/2024
Depth of Test Hole:	120.0 inches	**Perc Test Date:**	8/13/2024
Check for Sandy Soil Criteria Tested by:		**Percolation Tested by:**	KD

Water level measured from BOTTOM of hole

Sandy Soil Criteria Test

Trial No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Head (in)	Final Water Head (in)	Δ in Water Level (in)	Percolation Rate (min/inch)
1							
2							

Soil Criteria: Sandy

Percolation Test

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Head (in)	Final Water Head (in)	Δ in Water Level (in)	Percolation Rate (min/inch)
1	8:16 AM 8:26 AM	10	10	30.0	0.0	30.0	0.3
2	8:26 AM 8:36 AM	10	20	46.2	0.7	45.5	0.2
3	8:36 AM 8:46 AM	10	30	43.8	1.8	42.0	0.2
4	8:46 AM 8:56 AM	10	40	52.2	1.3	50.9	0.2
5	8:56 AM 9:06 AM	10	50	49.2	0.6	48.6	0.2
6	9:06 AM 9:16 AM	10	60	43.1	0.2	42.8	0.2

Infiltration Rate (in/hr):	21.7
Radius of test hole (in):	4
Average Head (in):	21.7

Figure A-10

APPENDIX B

APPENDIX B

LABORATORY TESTING

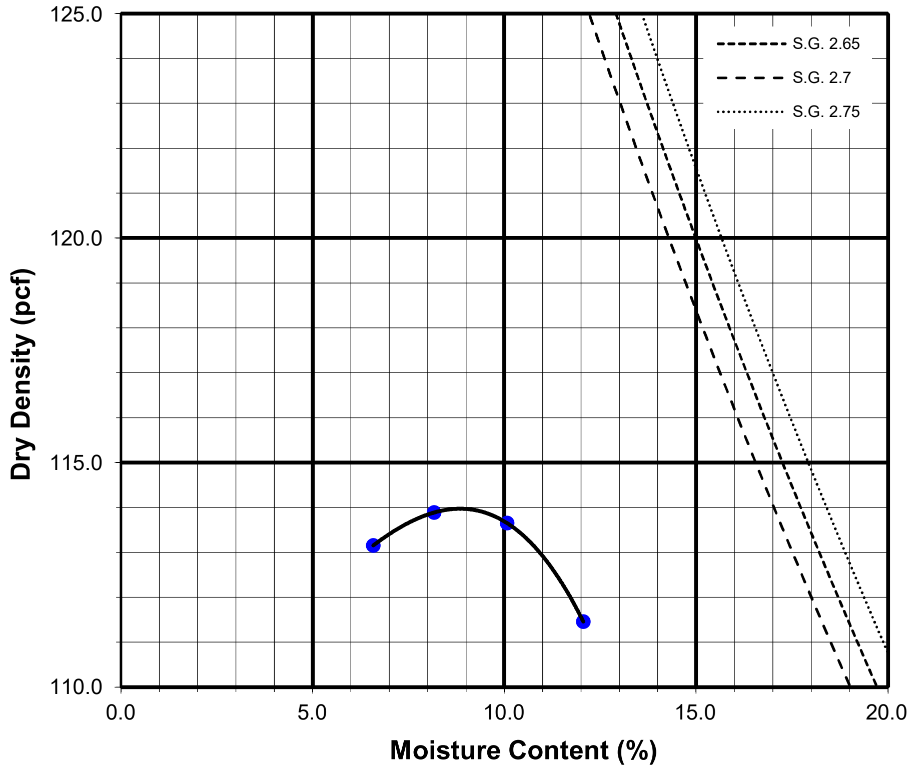
We performed laboratory tests in accordance with current, generally accepted test methods of ASTM International (ASTM) or other suggested procedures. We analyzed selected soil samples for in-situ density and moisture content, maximum dry density and optimum moisture content, corrosivity, expansion, grain size distribution, consolidation characteristics, and direct shear strength. The results of the laboratory tests are presented in Figures B-1 through B-23. The in-place dry density and moisture content of the samples tested are presented on the boring logs in Appendix A.

Sample No:

B1,B3@0-5	Poorly Graded SAND with Silt (SP-SM), light gray

TEST NO.		1	2	3	4	5	6
Wt. Compacted Soil + Mold	(g)	6113	6142	6139	6074		
Weight of Mold	(g)	4252	4252	4252	4252		
Net Weight of Soil	(g)	1861	1890	1887	1822		
Wet Weight of Soil + Cont.	(g)	895.9	764.4	824.6	937.5		
Dry Weight of Soil + Cont.	(g)	847.7	718.2	763.8	895.6		
Weight of Container	(g)	257.7	259.5	259.5	258.7		
Moisture Content	(%)	8.2	10.1	12.1	6.6		
Wet Density	(pcf)	123.2	125.1	124.9	120.6		
Dry Density	(pcf)	113.9	113.7	111.5	113.2		

Maximum Dry Density (pcf)	**114.0**	**Optimum Moisture Content (%)**	**9.0**



Preparation Method: A

COMPACTION CHARACTERISTICS USING MODIFIED EFFORT TEST RESULTS

ASTM D-1557

Checked by: ATS

GEOCON

Project No.: T3082-22-01

Multi-Family Residential Development
14320 Palm Drive
Desert Hot Springs

September 2024

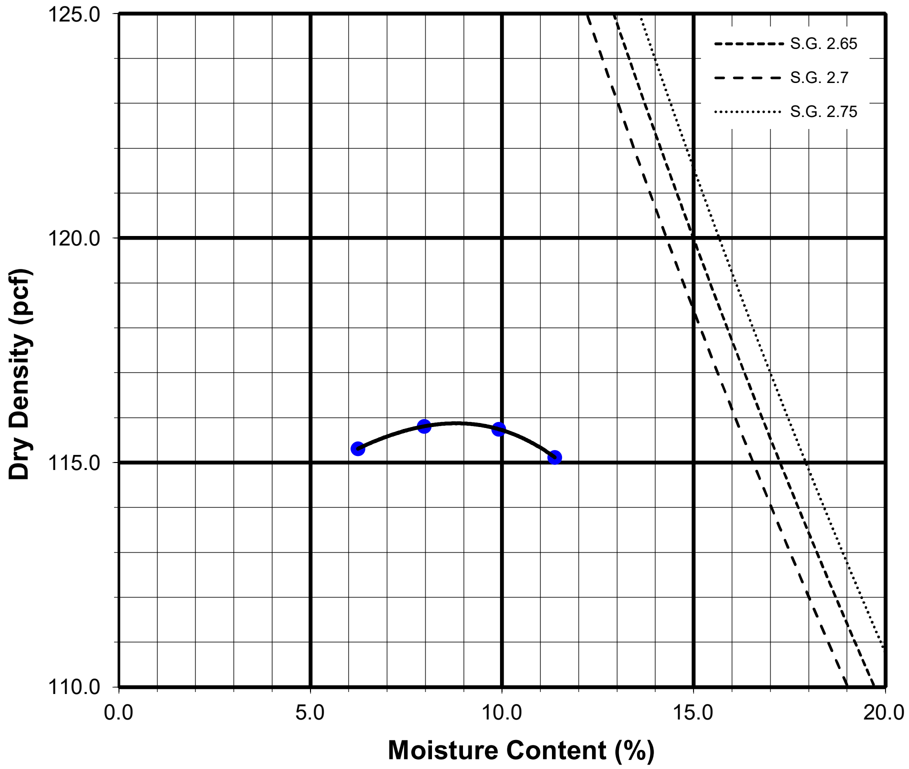
Figure B-1

Sample No:

B7,B9@0-5	Poorly Graded SAND with Silt (SP-SM), pale brown

TEST NO.		1	2	3	4	5	6
Wt. Compacted Soil + Mold	(g)	6103	6141	6174	6189		
Weight of Mold	(g)	4252	4252	4252	4252		
Net Weight of Soil	(g)	1850	1889	1922	1937		
Wet Weight of Soil + Cont.	(g)	835.7	868.0	900.2	886.0		
Dry Weight of Soil + Cont.	(g)	801.7	822.8	842.2	821.5		
Weight of Container	(g)	256.7	255.4	257.1	254.4		
Moisture Content	(%)	6.2	8.0	9.9	11.4		
Wet Density	(pcf)	122.5	125.0	127.2	128.2		
Dry Density	(pcf)	115.3	115.8	115.7	115.1		

Maximum Dry Density (pcf)	**116.0**	**Optimum Moisture Content (%)**	**9.0**



Preparation Method: A

GEOCON

COMPACTION CHARACTERISTICS USING MODIFIED EFFORT TEST RESULTS

ASTM D-1557

Checked by: ATS

Project No.: T3082-22-01

Multi-Family Residential Development
14320 Palm Drive
Desert Hot Springs

September 2024

Figure B-2

B1,B3@0-5

MOLDED SPECIMEN		BEFORE TEST	AFTER TEST
Specimen Diameter	(in.)	4.0	4.0
Specimen Height	(in.)	1.0	1.0
Wt. Comp. Soil + Mold	(gm)	599.6	615.1
Wt. of Mold	(gm)	196.8	196.8
Specific Gravity	(Assumed)	2.7	2.7
Wet Wt. of Soil + Cont.	(gm)	473.2	615.1
Dry Wt. of Soil + Cont.	(gm)	445.7	365.8
Wt. of Container	(gm)	173.2	196.8
Moisture Content	(%)	10.1	14.3
Wet Density	(pcf)	121.5	126.0
Dry Density	(pcf)	110.4	110.2
Void Ratio		0.5	0.5
Total Porosity		0.3	0.3
Pore Volume	(cc)	71.5	71.2
Degree of Saturation	(%) [S_{meas}]	52.1	73.6

Date	Time	Pressure (psi)	Elapsed Time (min)	Dial Readings (in.)
8/20/2024	10:00	1.0	0	0.3573
8/20/2024	10:10	1.0	10	0.3573
Add Distilled Water to the Specimen				
8/21/2024	10:00	1.0	1430	0.3561
8/21/2024	11:00	1.0	1490	0.3561

Expansion Index (EI meas) =	-1.2
Expansion Index (Report) =	**0**

Expansion Index, EI_{50}	CBC CLASSIFICATION *	UBC CLASSIFICATION **
0-20	Non-Expansive	Very Low
21-50	Expansive	Low
51-90	Expansive	Medium
91-130	Expansive	High
>130	Expansive	Very High

* Reference: 2022 California Building Code, Section 1803.5.3

** Reference: 1997 Uniform Building Code, Table 18-I-B.

GEOCON

EXPANSION INDEX TEST RESULTS

ASTM D-4829

Checked by: ATS

Project No.: T3082-22-01

Multi-Family Residential Development
14320 Palm Drive
Desert Hot Springs

September 2024

Figure B-3

B7,B9@0-5

MOLDED SPECIMEN		BEFORE TEST	AFTER TEST
Specimen Diameter	(in.)	4.0	4.0
Specimen Height	(in.)	1.0	1.0
Wt. Comp. Soil + Mold	(gm)	605.0	626.3
Wt. of Mold	(gm)	201.6	201.6
Specific Gravity	(Assumed)	2.7	2.7
Wet Wt. of Soil + Cont.	(gm)	473.2	626.3
Dry Wt. of Soil + Cont.	(gm)	447.2	368.4
Wt. of Container	(gm)	173.2	201.6
Moisture Content	(%)	9.5	15.3
Wet Density	(pcf)	121.7	127.9
Dry Density	(pcf)	111.1	111.0
Void Ratio		0.5	0.5
Total Porosity		0.3	0.3
Pore Volume	(cc)	70.5	69.7
Degree of Saturation	(%) [S_{meas}]	50.0	80.7

Date	Time	Pressure (psi)	Elapsed Time (min)	Dial Readings (in.)
8/20/2024	10:00	1.0	0	0.3395
8/20/2024	10:10	1.0	10	0.3396
Add Distilled Water to the Specimen				
8/21/2024	10:00	1.0	1430	0.3356
8/21/2024	11:00	1.0	1490	0.3356

Expansion Index (EI meas) =	-4
Expansion Index (Report) =	**0**

Expansion Index, EI_{50}	CBC CLASSIFICATION *	UBC CLASSIFICATION **
0-20	Non-Expansive	Very Low
21-50	Expansive	Low
51-90	Expansive	Medium
91-130	Expansive	High
>130	Expansive	Very High

* Reference: 2022 California Building Code, Section 1803.5.3

** Reference: 1997 Uniform Building Code, Table 18-I-B.

GEOCON

EXPANSION INDEX TEST RESULTS

ASTM D-4829

Checked by: ATS

Project No.: T3082-22-01

Multi-Family Residential Development
14320 Palm Drive
Desert Hot Springs

September 2024

Figure B-4

SUMMARY OF LABORATORY
POTENTIAL OF HYDROGEN (pH) AND RESISTIVITY TEST RESULTS
AASHTO T289 ASTM D4972 and AASHTO T288 ASTM G187

Sample No.	pH	Resistivity (ohm centimeters)
B1,B3@0-5	8.8	13000
B7,B9@0-5	9.2	15000

SUMMARY OF LABORATORY CHLORIDE CONTENT TEST RESULTS
AASHTO T291 ASTM C1218

Sample No.	Chloride Ion Content (%)
B1,B3@0-5	0.009
B7,B9@0-5	0.015

SUMMARY OF LABORATORY WATER SOLUBLE SULFATE TEST RESULTS
AASHTO T290 ASTM C1580

Sample No.	Water Soluble Sulfate (% SO_4)	Sulfate Exposure
B1,B3@0-5	0.001	S0
B7,B9@0-5	0.000	S0

GEOCON

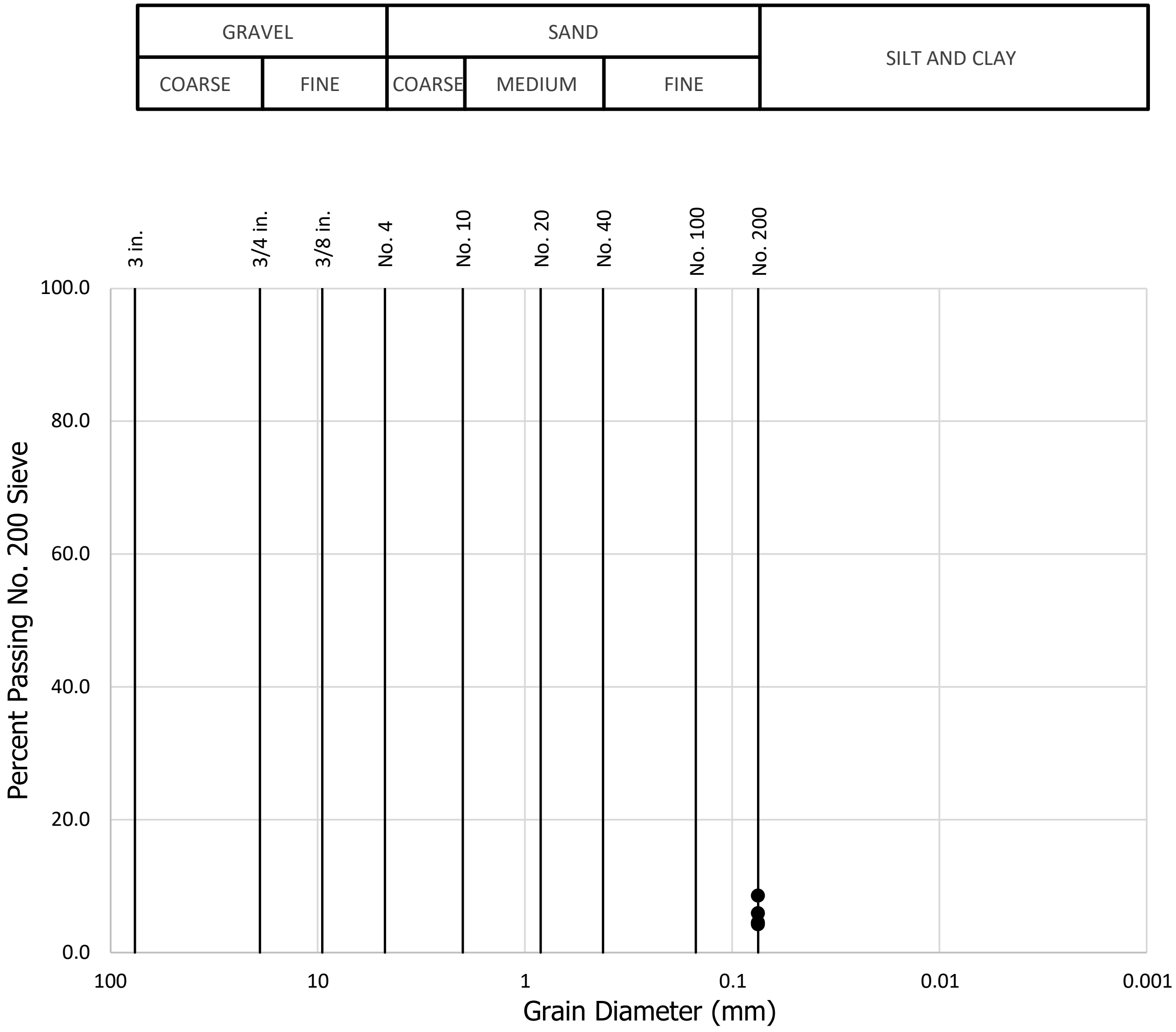
CORROSIVITY TEST RESULTS

Checked by: ATS

Project No.: T3082-22-01

Multi-Family Residential Development
14320 Palm Drive
Desert Hot Springs

September 2024



Sample No.	Percent Passing No. 200 Sieve
B5 @ 2.5'	4.5
B5 @ 7.5'	4.3
B5 @ 12.5'	8.6
B5 @ 17.5'	5.9

GEOCON

GRAIN SIZE ANALYSIS

ASTM D-1140

Checked by: ATS

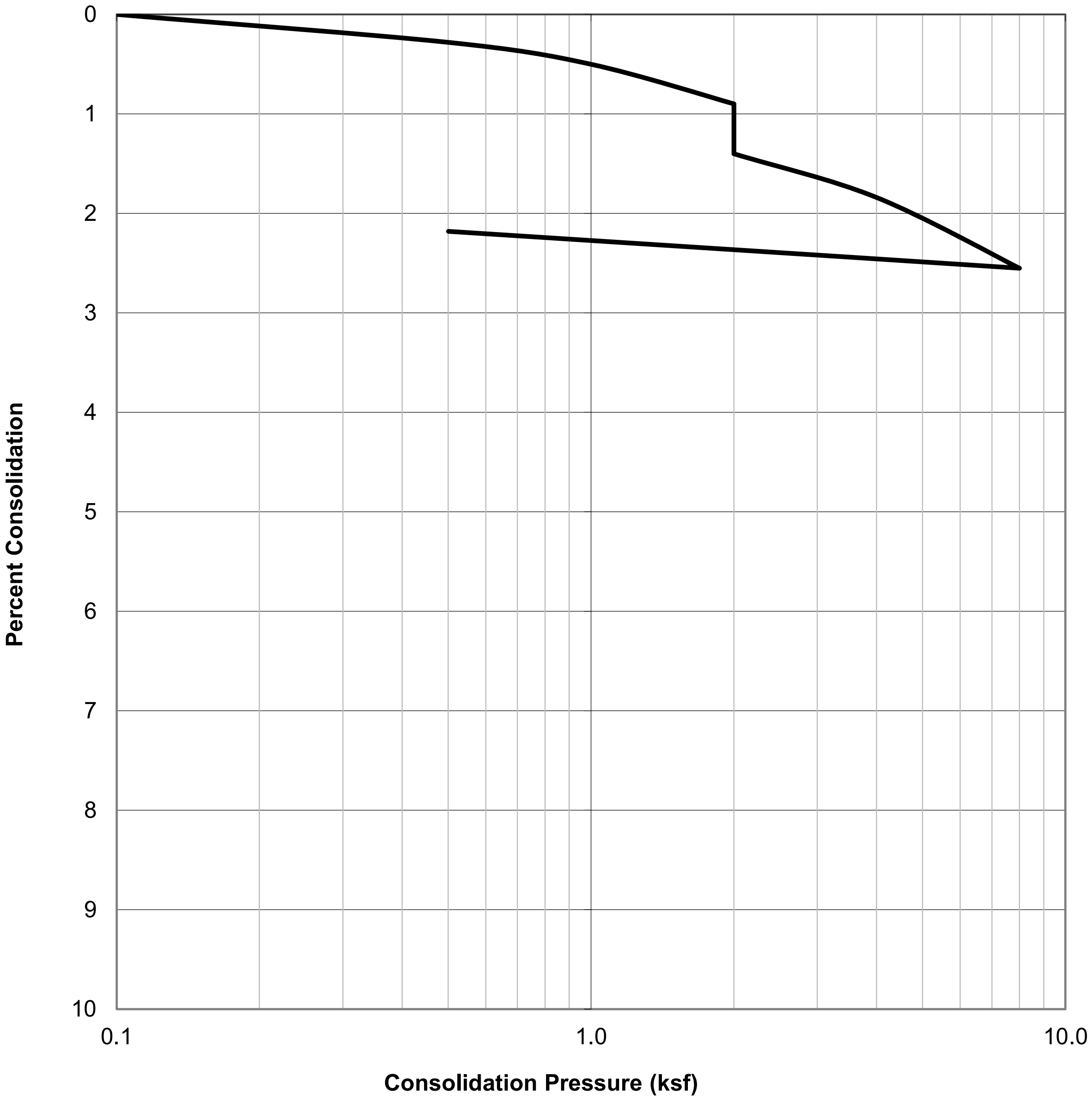
Project No.: T3082-22-01

Multi-Family Residential Development
14320 Palm Drive
Desert Hot Springs

September 2024

Figure B-6

WATER ADDED AT 2.0 KSF



SAMPLE ID.	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B1@2.5	Poorly Graded SAND with Silt (SP-SM), pale brown	110.2	1.1	14.5

GEOCON

CONSOLIDATION TEST RESULTS

ASTM D-2435

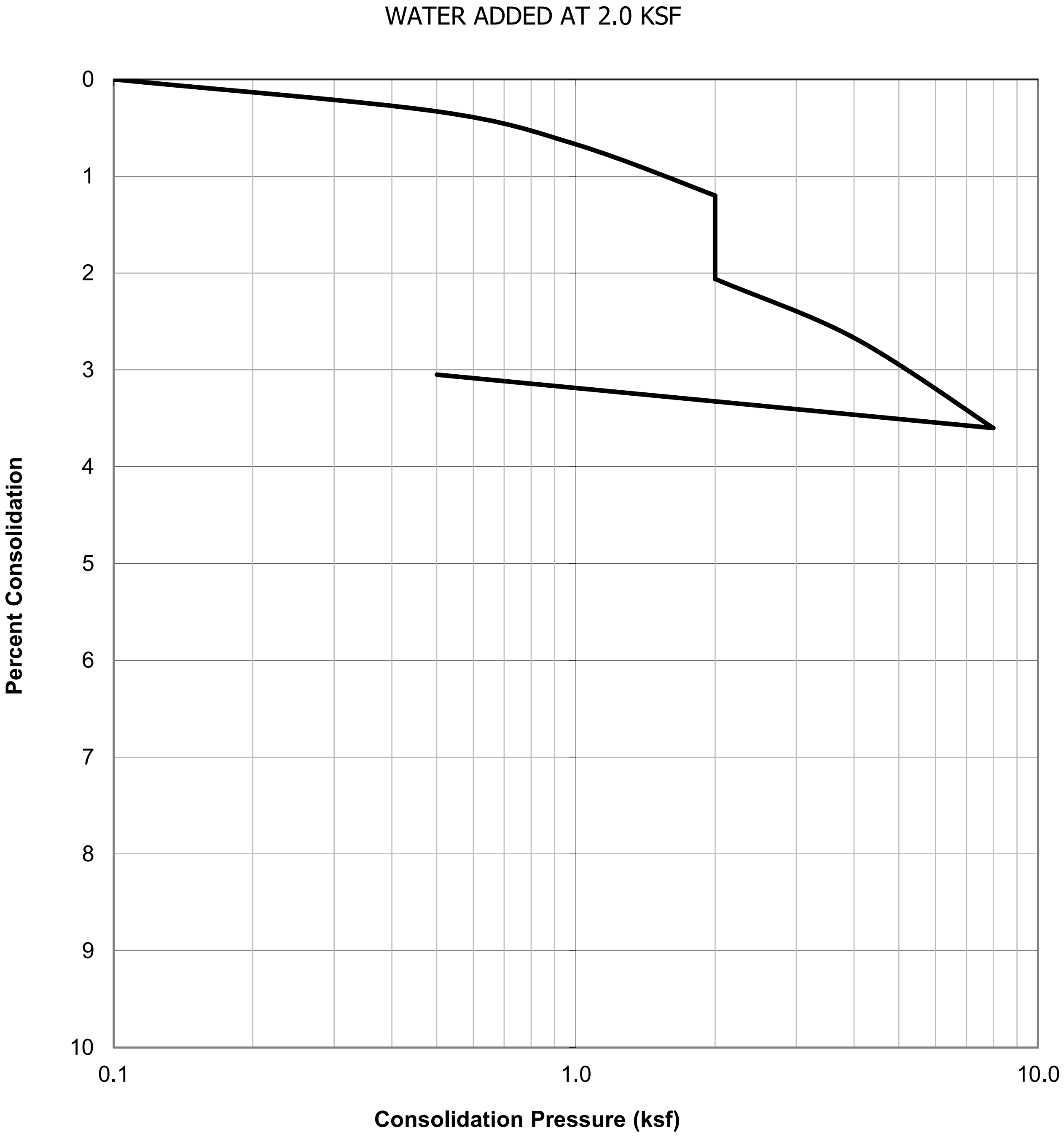
Checked by: ATS

Project No.: T3082-22-01

Multi-Family Residential Development
14320 Palm Drive
Desert Hot Springs

September 2024

Figure B-7



SAMPLE ID.	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B1@5	Poorly Graded SAND with Silt (SP-SM), pale brown	112.8	0.5	14.2

GEOCON

CONSOLIDATION TEST RESULTS

ASTM D-2435

Checked by: ATS

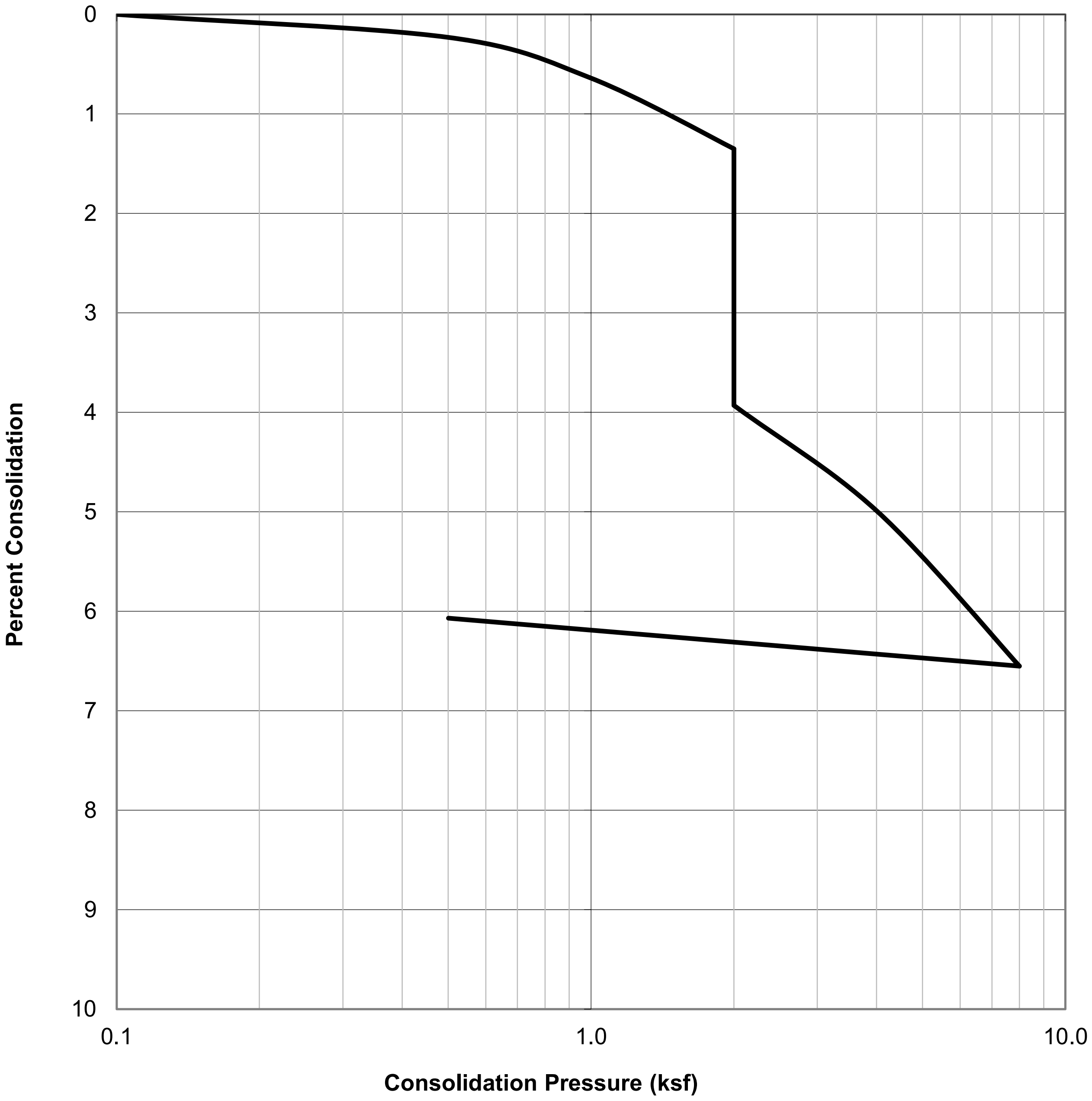
Project No.: T3082-22-01

Multi-Family Residential Development
14320 Palm Drive
Desert Hot Springs

September 2024

Figure B-8

WATER ADDED AT 2.0 KSF



SAMPLE ID.	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B1@10	Silty SAND (SM), light brown	113.9	0.2	7.0

GEOCON

CONSOLIDATION TEST RESULTS

ASTM D-2435

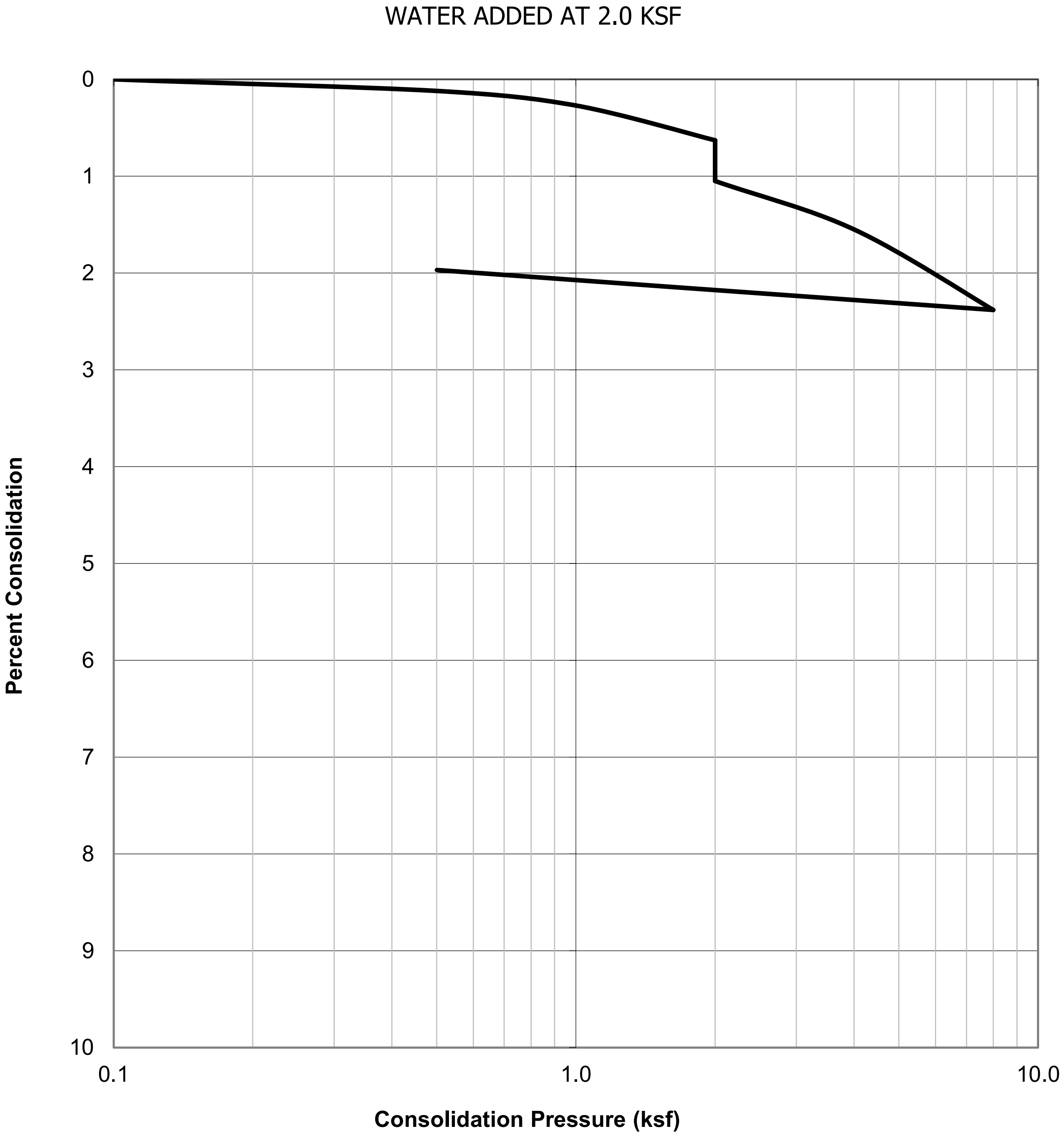
Checked by: ATS

Project No.: T3082-22-01

Multi-Family Residential Development
14320 Palm Drive
Desert Hot Springs

September 2024

Figure B-9



SAMPLE ID.	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B1@20	Poorly Graded SAND (SP), pale brown	109.3	1.3	15.3

GEOCON

CONSOLIDATION TEST RESULTS

ASTM D-2435

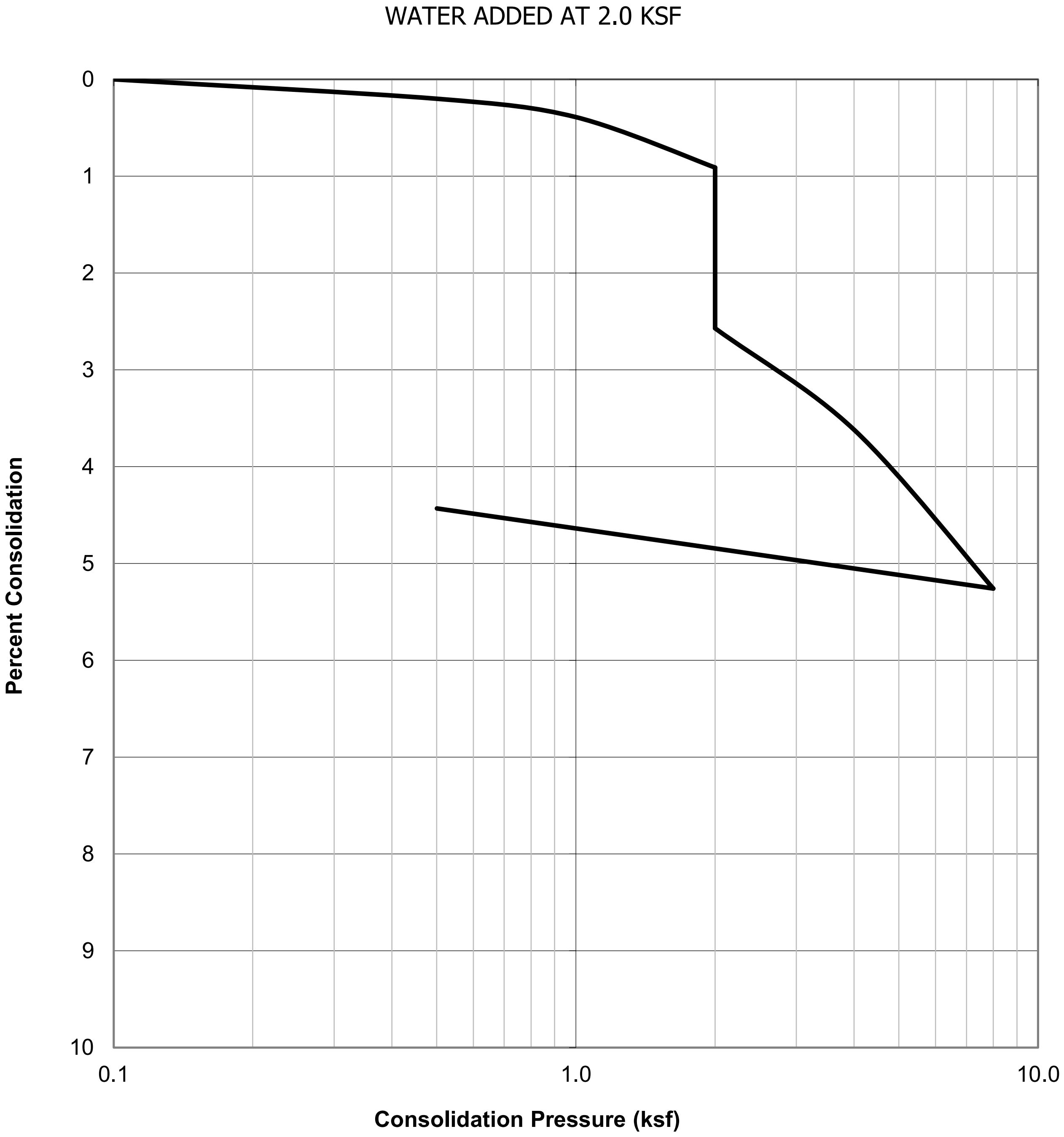
Checked by: ATS

Project No.: T3082-22-01

Multi-Family Residential Development
14320 Palm Drive
Desert Hot Springs

September 2024

Figure B-10



SAMPLE ID.	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B4@5	Poorly graded SAND (SP), pale brown	101.5	3.1	19.4

GEOCON

CONSOLIDATION TEST RESULTS

ASTM D-2435

Checked by: ATS

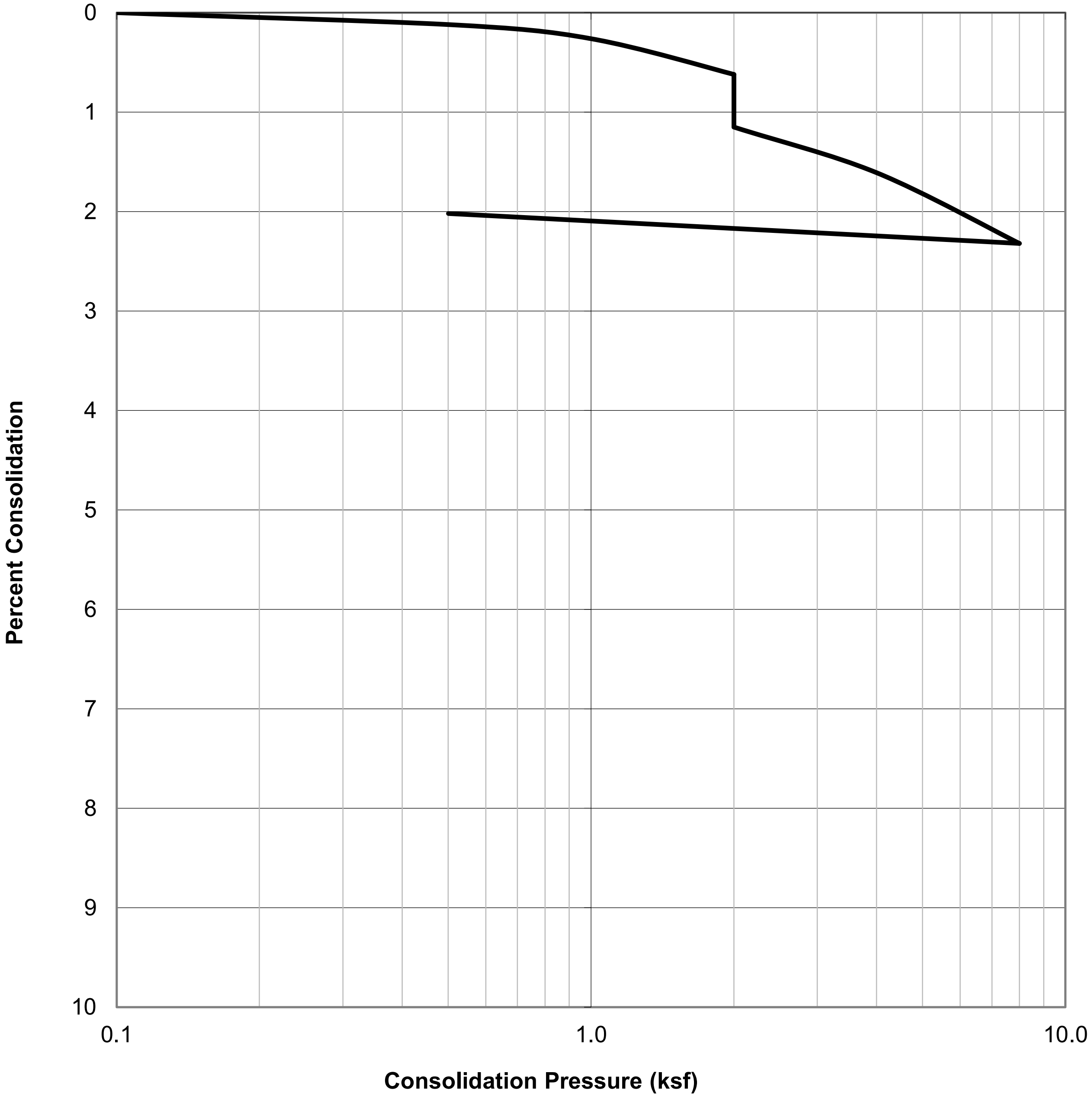
Project No.: T3082-22-01

Multi-Family Residential Development
14320 Palm Drive
Desert Hot Springs

September 2024

Figure B-11

WATER ADDED AT 2.0 KSF



SAMPLE ID.	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B4@10	Poorly graded SAND (SP), pale brown	113.1	1.0	13.1

GEOCON

CONSOLIDATION TEST RESULTS

ASTM D-2435

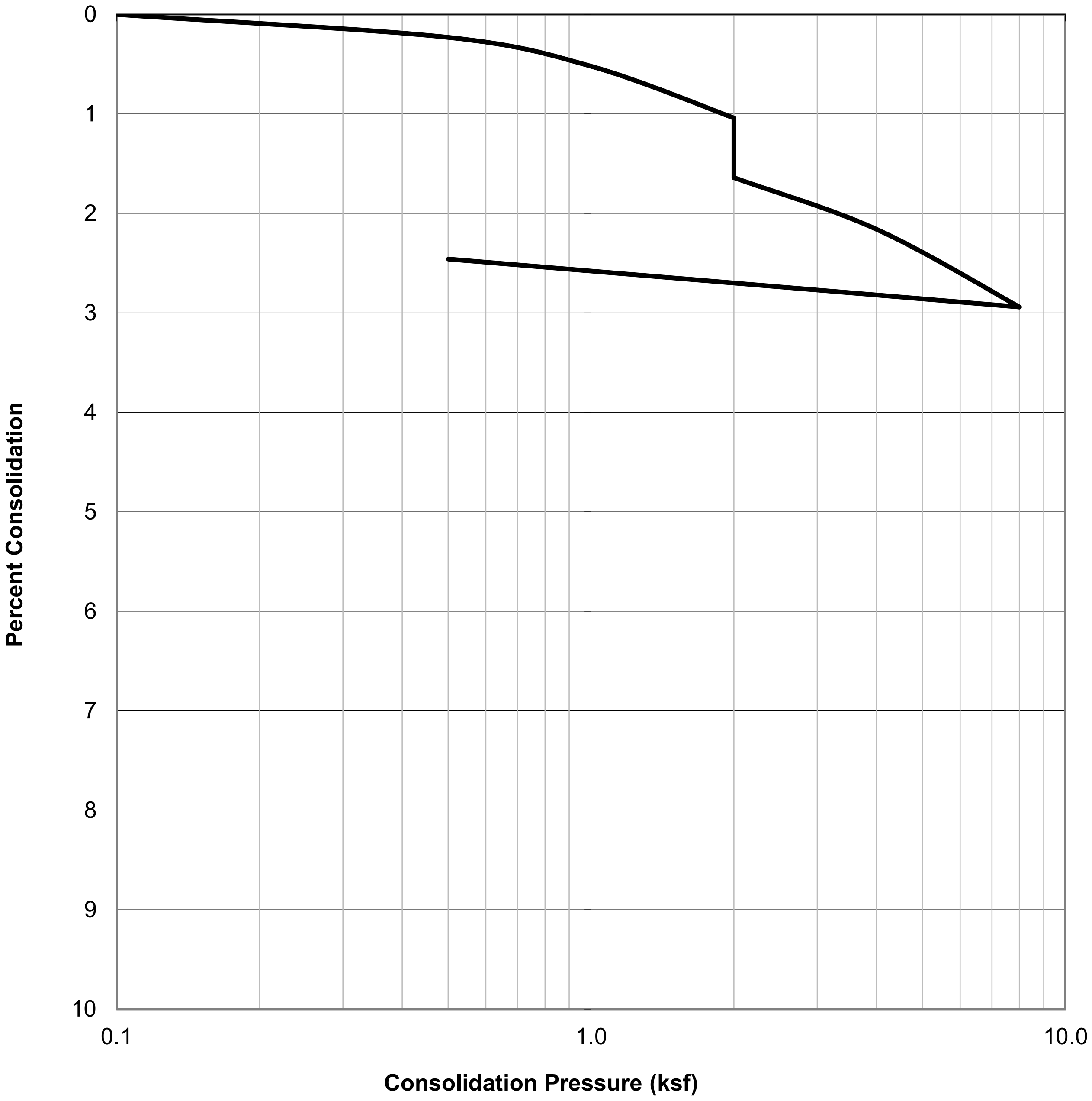
Checked by: ATS

Project No.: T3082-22-01

Multi-Family Residential Development
14320 Palm Drive
Desert Hot Springs

September 2024

WATER ADDED AT 2.0 KSF



SAMPLE ID.	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B7@2.5	Poorly graded SAND with Silt (SP-SM), pale brown	111.7	1.8	14.8

GEOCON

CONSOLIDATION TEST RESULTS

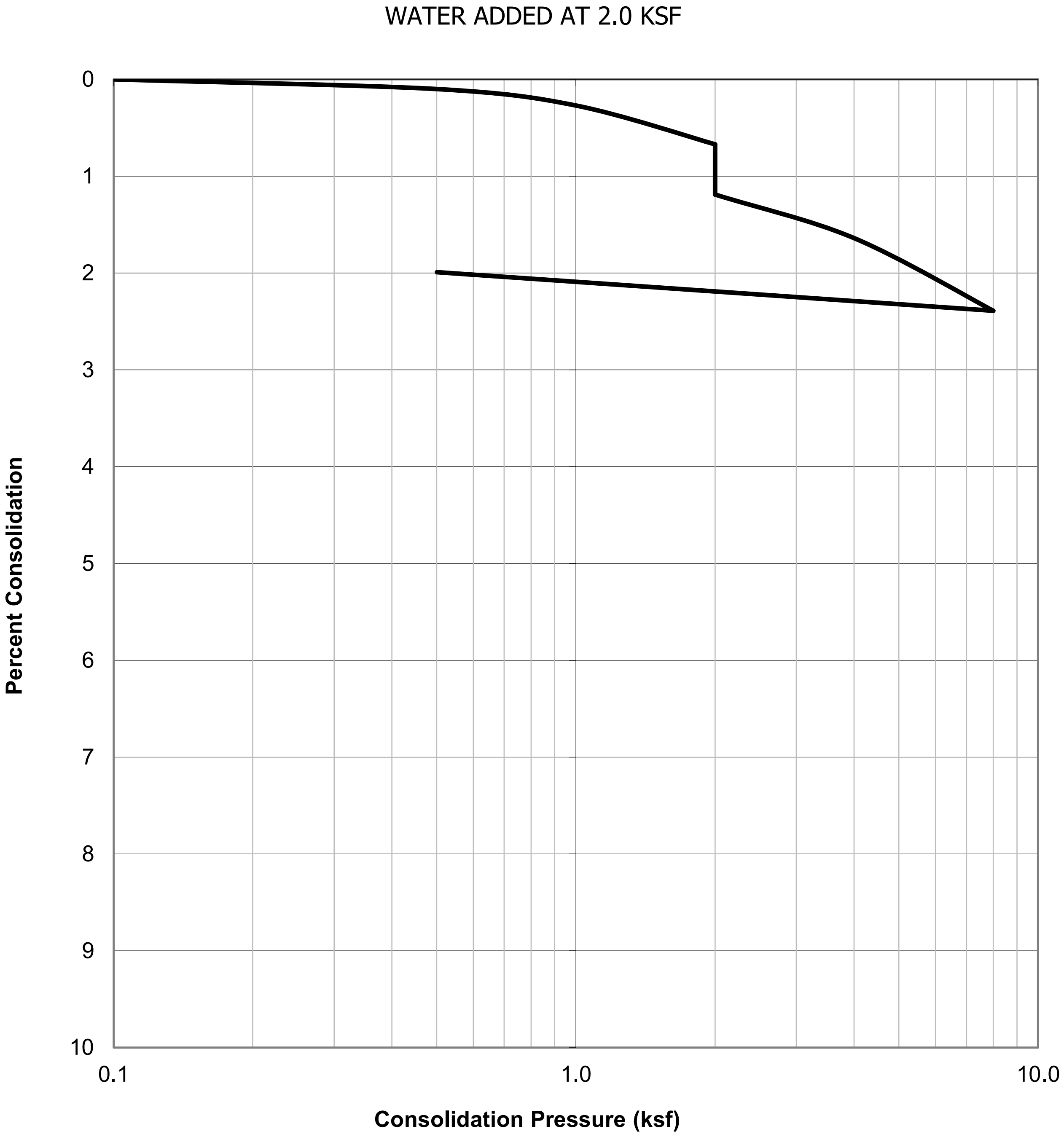
ASTM D-2435

Checked by: ATS

Project No.: T3082-22-01

Multi-Family Residential Development
14320 Palm Drive
Desert Hot Springs

September 2024



SAMPLE ID.	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B7@5	Poorly graded SAND with Silt (SP-SM), pale brown	110.0	1.1	15.9

GEOCON

CONSOLIDATION TEST RESULTS

ASTM D-2435

Checked by: ATS

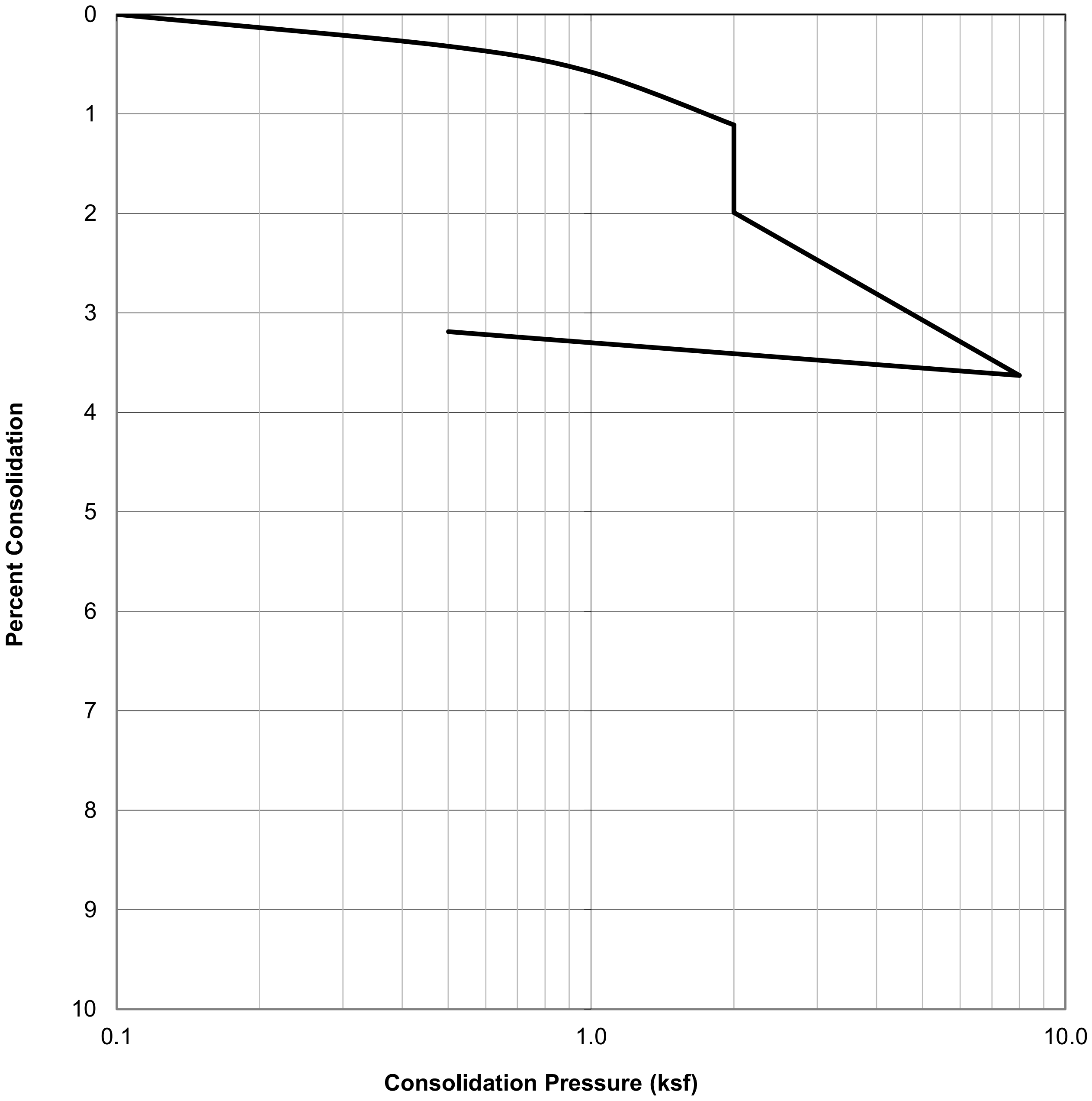
Project No.: T3082-22-01

Multi-Family Residential Development
14320 Palm Drive
Desert Hot Springs

September 2024

Figure B-14

WATER ADDED AT 2.0 KSF



SAMPLE ID.	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B9@2.5	Poorly graded SAND (SP), pale brown	112.7	0.9	14.3

GEOCON

CONSOLIDATION TEST RESULTS

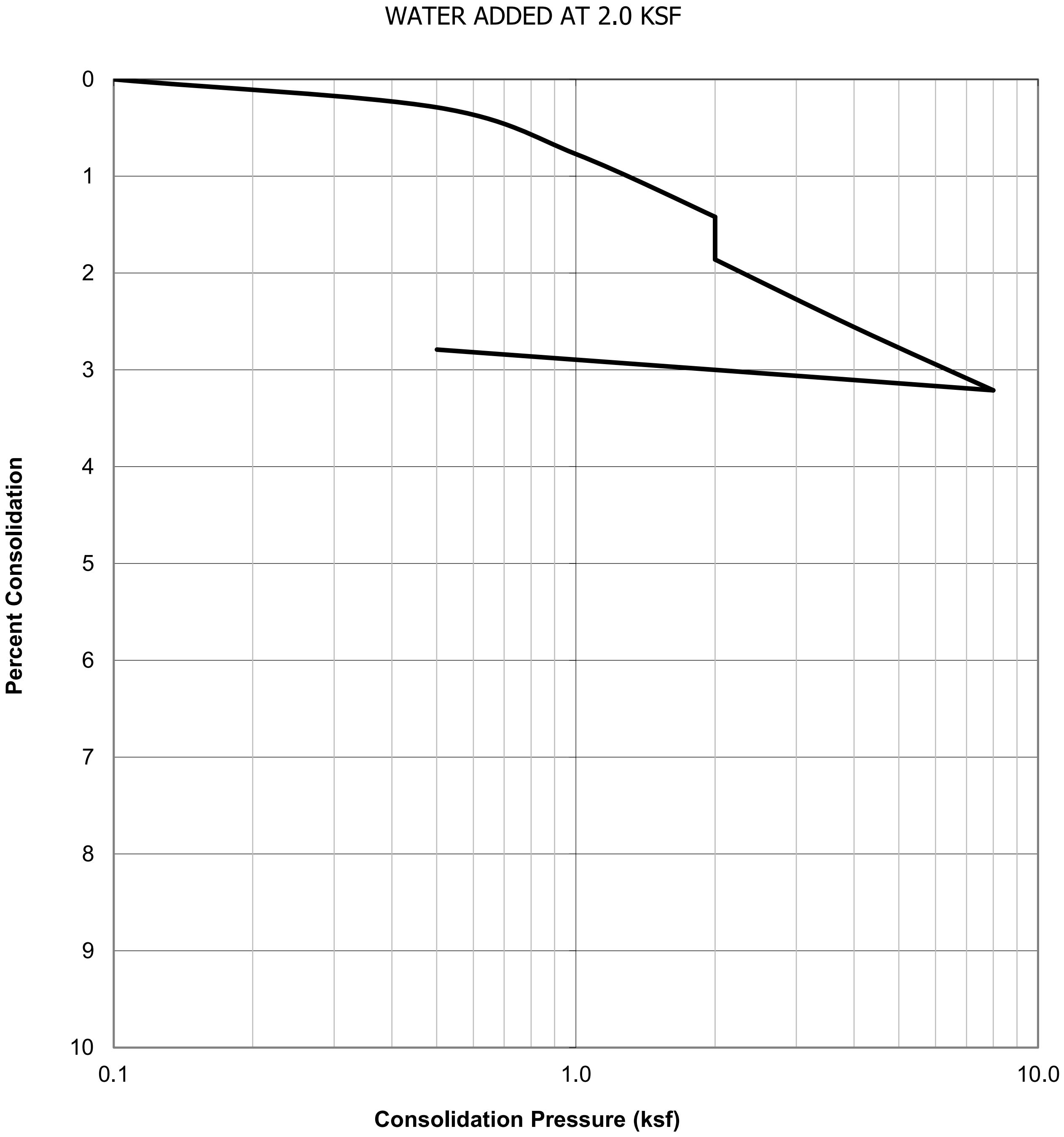
ASTM D-2435

Checked by: ATS

Project No.: T3082-22-01

Multi-Family Residential Development
14320 Palm Drive
Desert Hot Springs

September 2024



SAMPLE ID.	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B9@5	Poorly graded SAND (SP), pale brown	114.3	0.8	14.5

GEOCON

CONSOLIDATION TEST RESULTS

ASTM D-2435

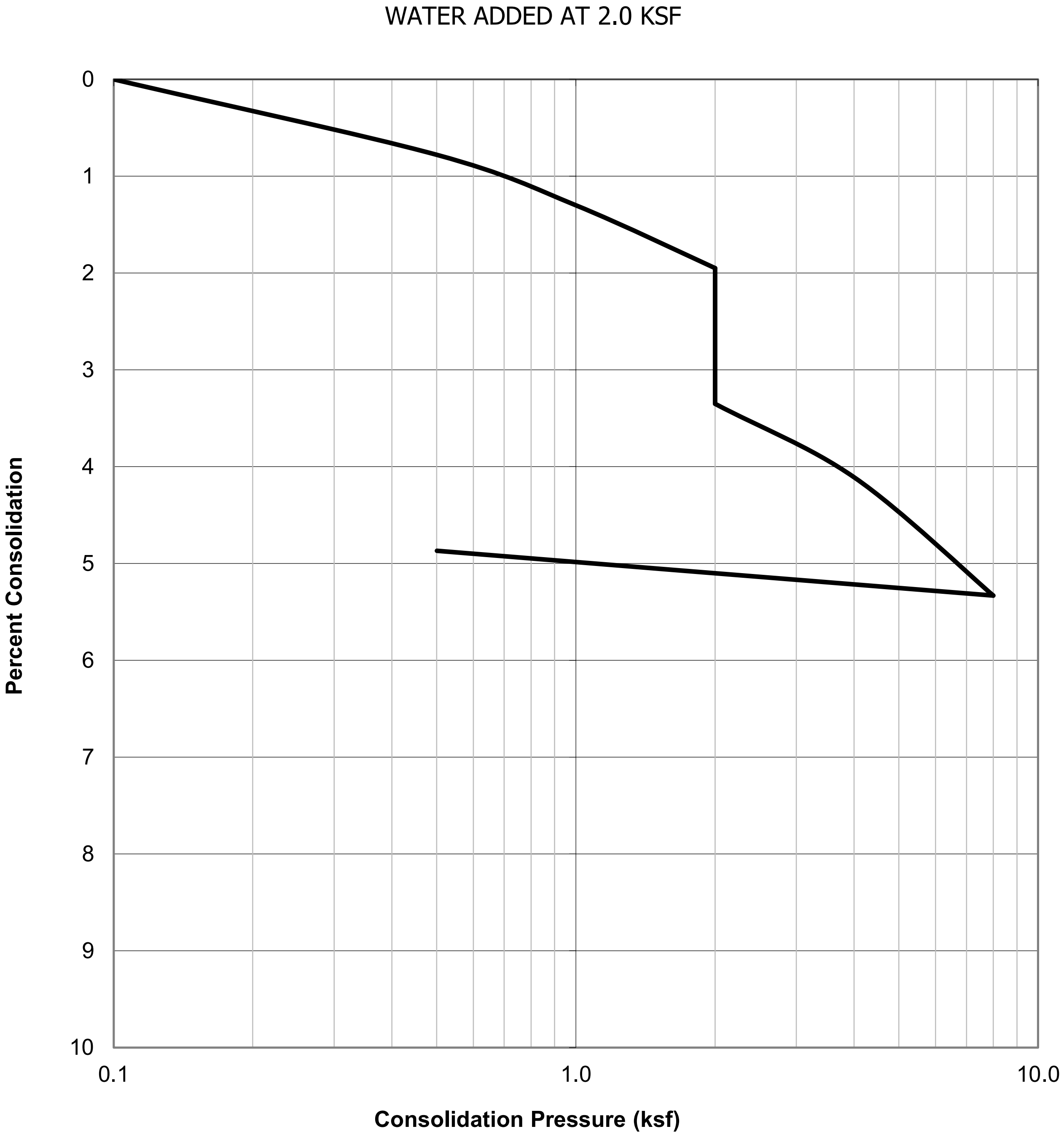
Checked by: ATS

Project No.: T3082-22-01

Multi-Family Residential Development
14320 Palm Drive
Desert Hot Springs

September 2024

Figure B-16



SAMPLE ID.	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B9@10	Poorly graded SAND (SP), pale brown	114.7	1.4	12.9

GEOCON

CONSOLIDATION TEST RESULTS

ASTM D-2435

Checked by: ATS

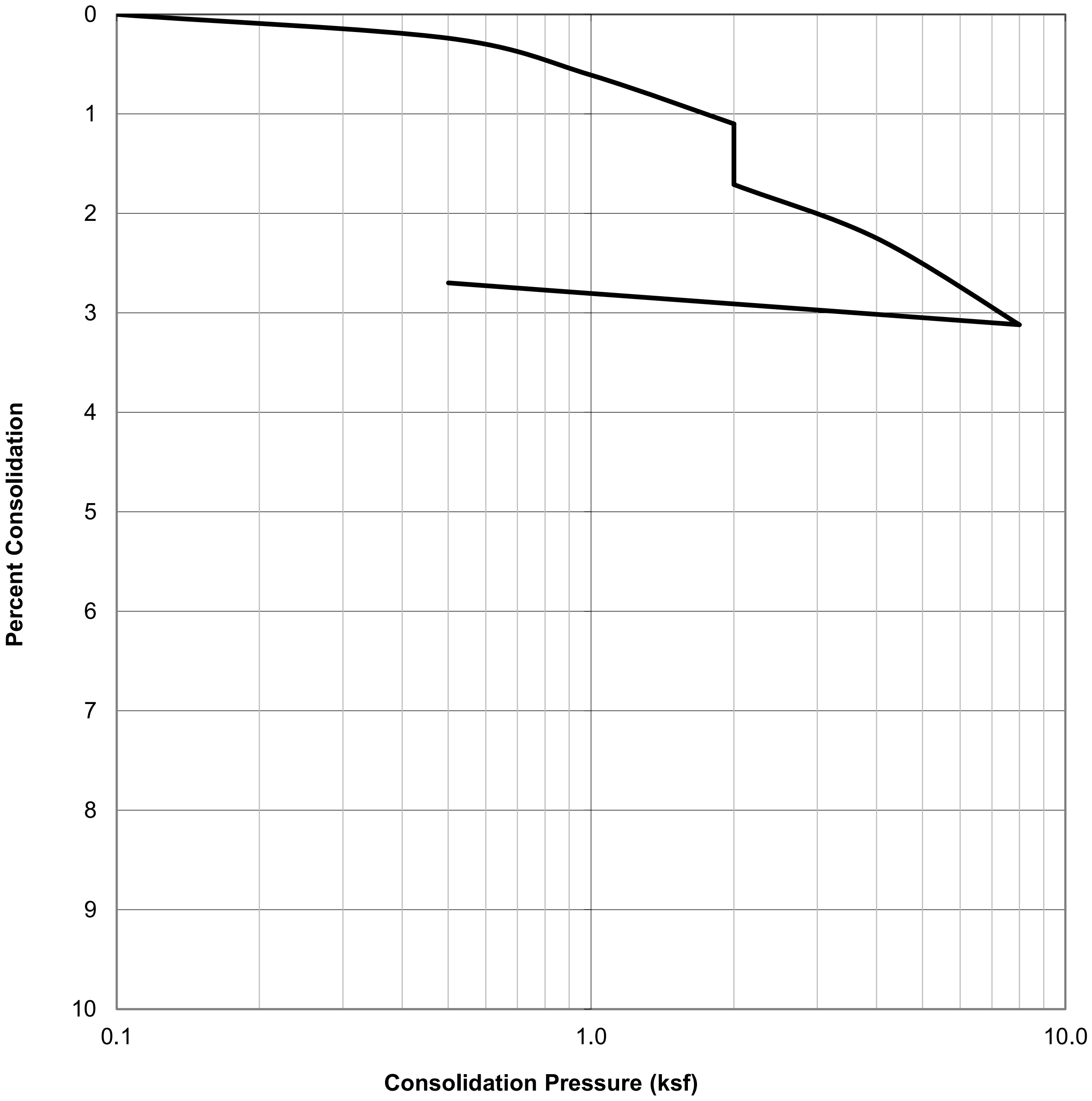
Project No.: T3082-22-01

Multi-Family Residential Development
14320 Palm Drive
Desert Hot Springs

September 2024

Figure B-17

WATER ADDED AT 2.0 KSF



SAMPLE ID.	**SOIL TYPE**	**DRY DENSITY (PCF)**	**INITIAL MOISTURE (%)**	**FINAL MOISTURE (%)**
B9@15	Poorly graded SAND (SP), pale brown	107.9	0.9	25.1

GEOCON

CONSOLIDATION TEST RESULTS

ASTM D-2435

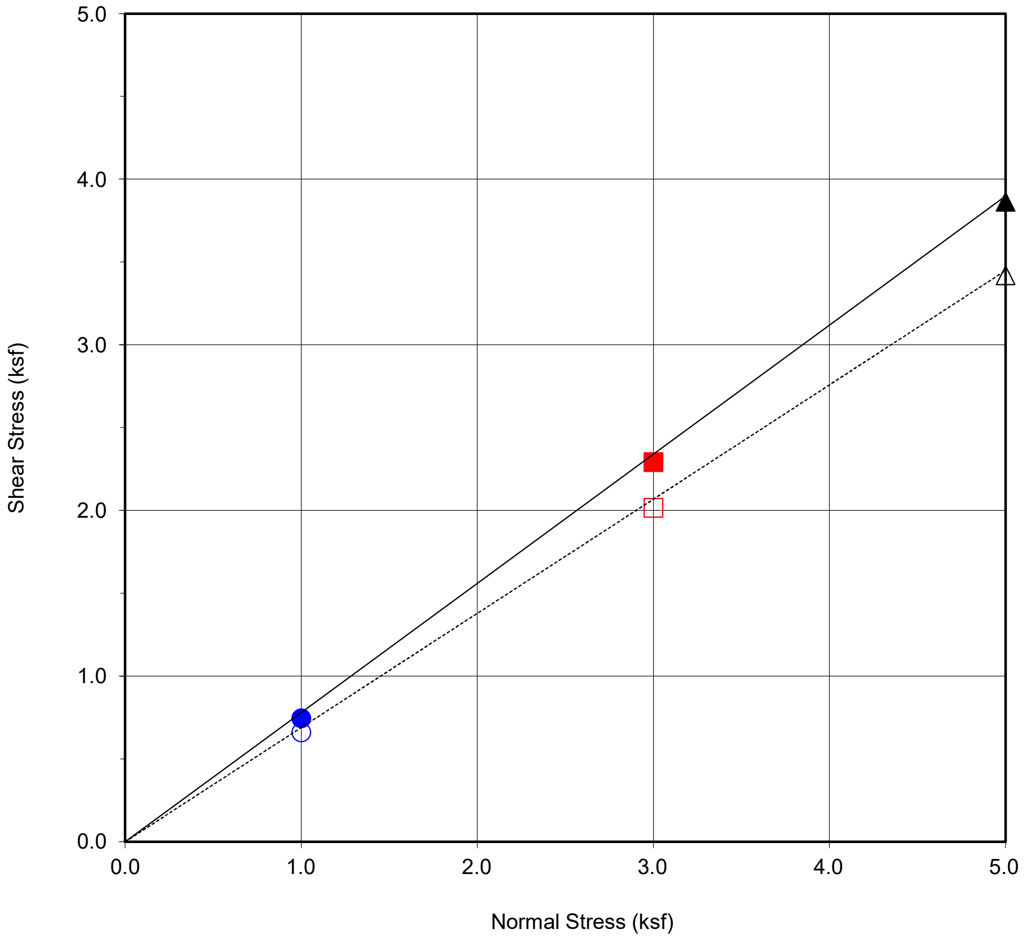
Checked by: ATS

Project No.: T3082-22-01

Multi-Family Residential Development
14320 Palm Drive
Desert Hot Springs

September 2024

Figure B-18



Boring No.	**B1,B3**
Sample No.	**B1,B3@0-5**
Depth (ft)	**0-5**
Sample Type:	Bulk

Soil Identification:

Poorly Graded SAND with Silt (SP-SM), light gray

Strength Parameters

	C (psf)	ϕ (°)
Peak	0	38
Ultimate	0	35

Normal Stress (kip/ft^2)	1	3	5
Peak Shear Stress (kip/ft^2)	● 0.74	■ 2.29	▲ 3.86
Shear Stress @ End of Test (ksf)	○ 0.66	□ 2.02	△ 3.42
Deformation Rate (in./min.)	0.05	0.05	0.05
Initial Sample Height (in.)	1.0	1.0	1.0
Ring Inside Diameter (in.)	2.375	2.375	2.375
Initial Moisture Content (%)	9.1	8.9	9.1
Initial Dry Density (pcf)	103.0	102.9	103.0
Initial Degree of Saturation (%)	38.6	37.7	38.6
Soil Height Before Shearing (in.)	1.2	1.2	1.2
Final Moisture Content (%)	12.6	7.8	13.2

GEOCON

DIRECT SHEAR TEST RESULTS

Consolidated Drained ASTM D-3080

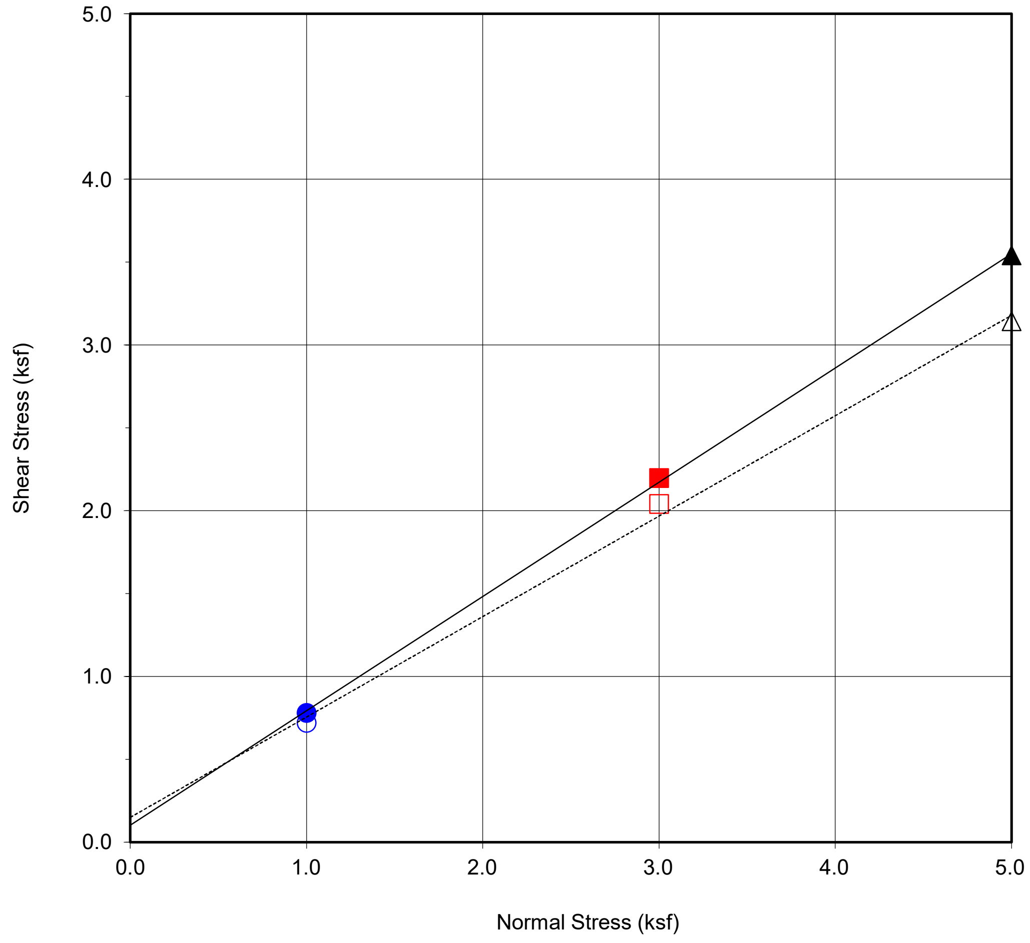
Checked by: ATS

Project No.: T3082-22-01

Multi-Family Residential Development
14320 Palm Drive
Desert Hot Springs

September 2024

Figure B-19



Boring No.	**B3**
Sample No.	**B3@2.5**
Depth (ft)	**2.5**
Sample Type:	Ring

Soil Identification:		
Poorly Graded SAND (SP), pale gray		
Strength Parameters		
	C (psf)	ϕ (°)
Peak	102	35
Ultimate	150	31

Normal Stress (kip/ft²)	1	3	5
Peak Shear Stress (kip/ft²)	● 0.78	■ 2.20	▲ 3.54
Shear Stress @ End of Test (ksf)	○ 0.72	□ 2.04	△ 3.14
Deformation Rate (in./min.)	0.05	0.05	0.05
Initial Sample Height (in.)	1.0	1.0	1.0
Ring Inside Diameter (in.)	2.375	2.375	2.375
Initial Moisture Content (%)	4.5	4.7	4.2
Initial Dry Density (pcf)	98.7	103.0	93.7
Initial Degree of Saturation (%)	17.3	20.0	14.3
Soil Height Before Shearing (in.)	1.2	1.2	1.2
Final Moisture Content (%)	18.7	18.7	15.8

GEOCON

DIRECT SHEAR TEST RESULTS

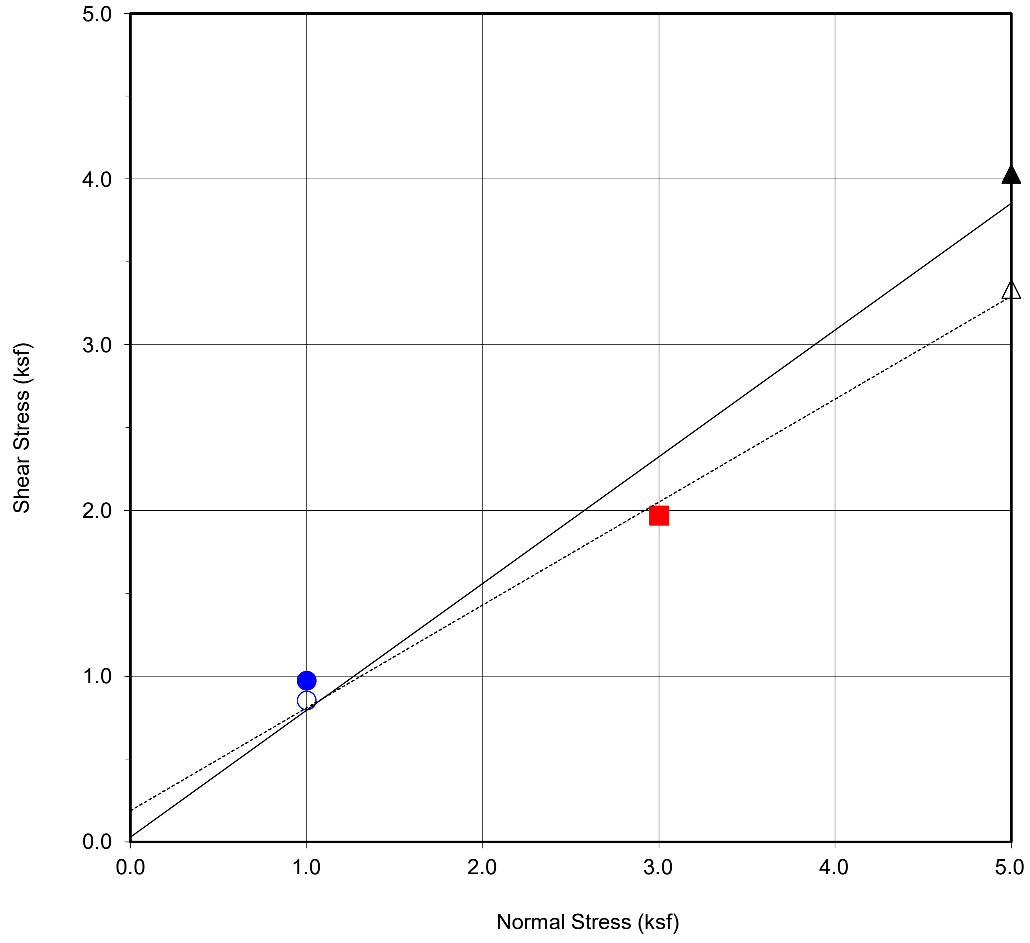
Consolidated Drained ASTM D-3080

Checked by: ATS

Project No.: T3082-22-01

Multi-Family Residential Development
14320 Palm Drive
Desert Hot Springs

September 2024



Boring No.	**B6**
Sample No.	**B6@10**
Depth (ft)	**10**
Sample Type:	Ring

Soil Identification:

Poorly Graded SAND (SP), pale gray

Strength Parameters

	C (psf)	ϕ (°)
Peak	29	37
Ultimate	189	32

Normal Stress (kip/ft²)	1	3	5
Peak Shear Stress (kip/ft²)	● 0.97	■ 1.97	▲ 4.03
Shear Stress @ End of Test (ksf)	○ 0.85	□ 1.97	△ 3.34
Deformation Rate (in./min.)	0.05	0.05	0.05
Initial Sample Height (in.)	1.0	1.0	1.0
Ring Inside Diameter (in.)	2.375	2.375	2.375
Initial Moisture Content (%)	6.1	6.0	7.5
Initial Dry Density (pcf)	105.4	102.4	101.0
Initial Degree of Saturation (%)	27.4	25.0	30.4
Soil Height Before Shearing (in.)	1.2	1.2	1.2
Final Moisture Content (%)	19.2	19.5	19.6

GEOCON

DIRECT SHEAR TEST RESULTS

Consolidated Drained ASTM D-3080

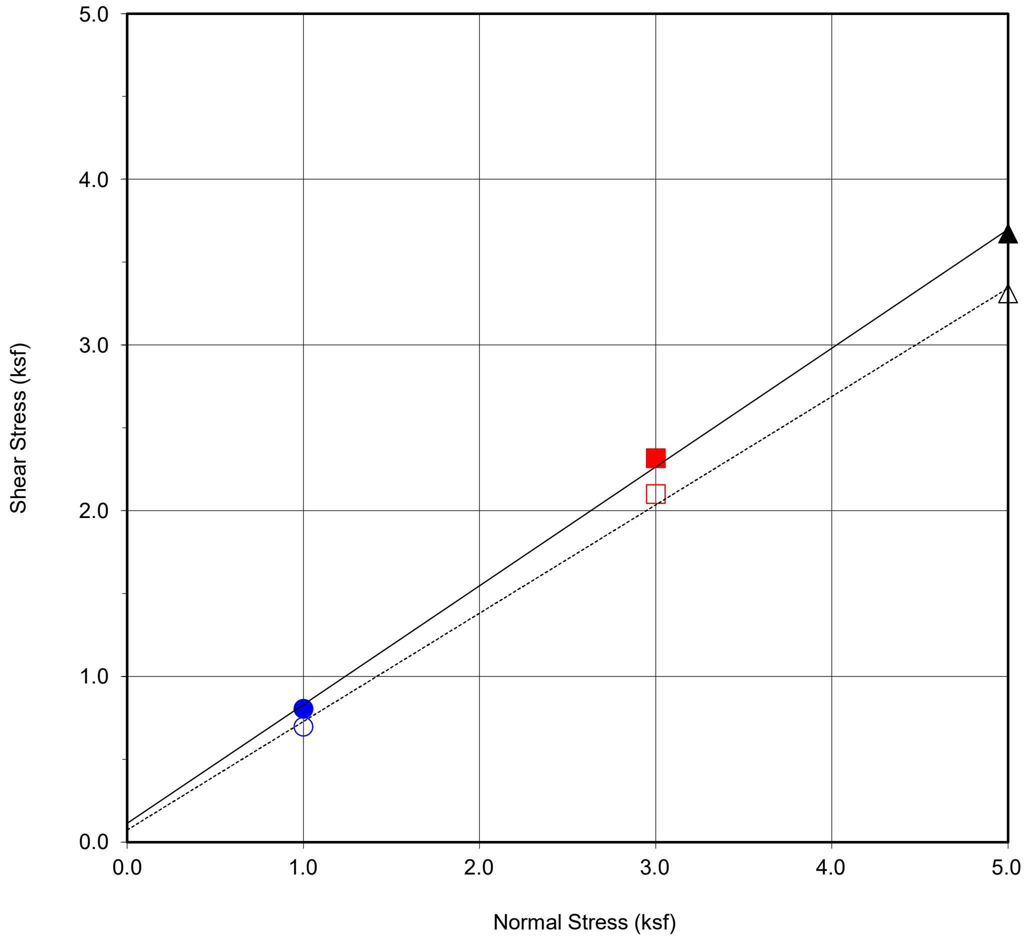
Checked by: ATS

Project No.: T3082-22-01

Multi-Family Residential Development
14320 Palm Drive
Desert Hot Springs

September 2024

Figure B-21



Boring No.	**B7,B9**
Sample No.	**B7,B9@0-5**
Depth (ft)	**0-5**
Sample Type:	Bulk

Soil Identification:

Poorly Graded SAND with Silt (SP-SM), pale brown

Strength Parameters

	C (psf)	ϕ (°)
Peak	113	36
Ultimate	74	33

Normal Stress (kip/ft²)	1	3	5
Peak Shear Stress (kip/ft²)	● 0.80	■ 2.32	▲ 3.67
Shear Stress @ End of Test (ksf)	○ 0.70	□ 2.10	△ 3.31
Deformation Rate (in./min.)	0.05	0.05	0.05
Initial Sample Height (in.)	1.0	1.0	1.0
Ring Inside Diameter (in.)	2.375	2.375	2.375
Initial Moisture Content (%)	8.9	9.0	9.0
Initial Dry Density (pcf)	104.0	104.0	104.0
Initial Degree of Saturation (%)	38.8	39.2	39.4
Soil Height Before Shearing (in.)	1.2	1.2	1.2
Final Moisture Content (%)	12.4	14.4	13.5

GEOCON

DIRECT SHEAR TEST RESULTS

Consolidated Drained ASTM D-3080

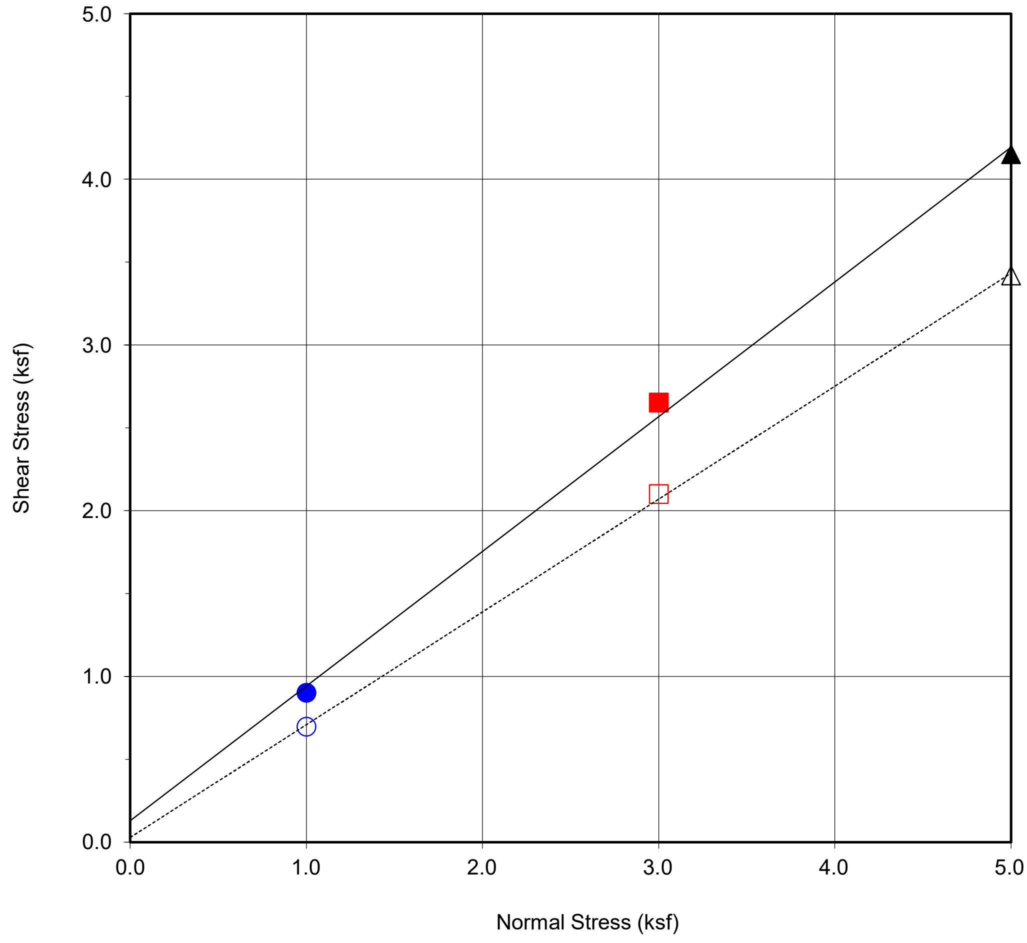
Checked by: ATS

Project No.: T3082-22-01

Multi-Family Residential Development
14320 Palm Drive
Desert Hot Springs

September 2024

Figure B-22



Boring No.	**B7**
Sample No.	**B7@2.5**
Depth (ft)	**2.5**
Sample Type:	Ring

Soil Identification:	
Poorly Graded SAND with Silt (SP-SM), pale brown	

Strength Parameters

	C (psf)	φ (°)
Peak	129	39
Ultimate	29	34

Normal Stress (kip/ft²)	1	3	5
Peak Shear Stress (kip/ft²)	● 0.90	■ 2.65	▲ 4.15
Shear Stress @ End of Test (ksf)	○ 0.70	□ 2.10	△ 3.42
Deformation Rate (in./min.)	0.05	0.05	0.05
Initial Sample Height (in.)	1.0	1.0	1.0
Ring Inside Diameter (in.)	2.375	2.375	2.375
Initial Moisture Content (%)	3.8	3.8	3.7
Initial Dry Density (pcf)	105.3	106.0	108.2
Initial Degree of Saturation (%)	17.1	17.3	17.8
Soil Height Before Shearing (in.)	1.2	1.2	1.2
Final Moisture Content (%)	11.5	17.3	18.3

GEOCON

DIRECT SHEAR TEST RESULTS

Consolidated Drained ASTM D-3080

Checked by: ATS

Project No.: T3082-22-01

Multi-Family Residential Development
14320 Palm Drive
Desert Hot Springs

September 2024

Figure B-23

APPENDIX C

APPENDIX C

RECOMMENDED GRADING SPECIFICATIONS

FOR

PROPOSED MULTI-FAMILY RESIDENTIAL DEVELOPMENT
14320 PALM DRIVE
DESERT HOT SPRINGS, CALIFORNIA

PROJECT NO. T3082-22-01

RECOMMENDED GRADING SPECIFICATIONS

1. GENERAL

1.1 These Recommended Grading Specifications shall be used in conjunction with the Geotechnical Report for the project prepared by Geocon. The recommendations contained in the text of the Geotechnical Report are a part of the earthwork and grading specifications and shall supersede the provisions contained hereinafter in the case of conflict.

1.2 Prior to the commencement of grading, a geotechnical consultant (Consultant) shall be employed for the purpose of observing earthwork procedures and testing the fills for substantial conformance with the recommendations of the Geotechnical Report and these specifications. The Consultant should provide adequate testing and observation services so that they may assess whether, in their opinion, the work was performed in substantial conformance with these specifications. It shall be the responsibility of the Contractor to assist the Consultant and keep them apprised of work schedules and changes so that personnel may be scheduled accordingly.

1.3 It shall be the sole responsibility of the Contractor to provide adequate equipment and methods to accomplish the work in accordance with applicable grading codes or agency ordinances, these specifications and the approved grading plans. If, in the opinion of the Consultant, unsatisfactory conditions such as questionable soil materials, poor moisture condition, inadequate compaction, and/or adverse weather result in a quality of work not in conformance with these specifications, the Consultant will be empowered to reject the work and recommend to the Owner that grading be stopped until the unacceptable conditions are corrected.

2. DEFINITIONS

2.1 **Owner** shall refer to the owner of the property or the entity on whose behalf the grading work is being performed and who has contracted with the Contractor to have grading performed.

2.2 **Contractor** shall refer to the Contractor performing the site grading work.

2.3 **Civil Engineer** or **Engineer of Work** shall refer to the California licensed Civil Engineer or consulting firm responsible for preparation of the grading plans, surveying and verifying as-graded topography.

2.4 **Consultant** shall refer to the soil engineering and engineering geology consulting firm retained to provide geotechnical services for the project.

2.5 **Soil Engineer** shall refer to a California licensed Civil Engineer retained by the Owner, who is experienced in the practice of geotechnical engineering. The Soil Engineer shall be responsible for having qualified representatives on-site to observe and test the Contractor's work for conformance with these specifications.

2.6 **Engineering Geologist** shall refer to a California licensed Engineering Geologist retained by the Owner to provide geologic observations and recommendations during the site grading.

2.7 **Geotechnical Report** shall refer to a soil report (including all addenda) which may include a geologic reconnaissance or geologic investigation that was prepared specifically for the development of the project for which these Recommended Grading Specifications are intended to apply.

3. MATERIALS

3.1 Materials for compacted fill shall consist of any soil excavated from the cut areas or imported to the site that, in the opinion of the Consultant, is suitable for use in construction of fills. In general, fill materials can be classified as *soil* fills, *soil-rock* fills or *rock* fills, as defined below.

3.1.1 **Soil fills** are defined as fills containing no rocks or hard lumps greater than 12 inches in maximum dimension and containing at least 40 percent by weight of material smaller than ¾ inch in size.

3.1.2 **Soil-rock fills** are defined as fills containing no rocks or hard lumps larger than 4 feet in maximum dimension and containing a sufficient matrix of soil fill to allow for proper compaction of soil fill around the rock fragments or hard lumps as specified in Paragraph 6.2. **Oversize rock** is defined as material greater than 12 inches.

3.1.3 **Rock fills** are defined as fills containing no rocks or hard lumps larger than 3 feet in maximum dimension and containing little or no fines. Fines are defined as material smaller than ¾ inch in maximum dimension. The quantity of fines shall be less than approximately 20 percent of the rock fill quantity.

3.2 Material of a perishable, spongy, or otherwise unsuitable nature as determined by the Consultant shall not be used in fills.

3.3 Materials used for fill, either imported or on-site, shall not contain hazardous materials as defined by the California Code of Regulations, Title 22, Division 4, Chapter 30, Articles 9 and 10; 40CFR; and any other applicable local, state or federal laws. The Consultant shall not be responsible for the identification or analysis of the potential presence of hazardous materials. However, if observations, odors or soil discoloration cause Consultant to suspect the presence of hazardous materials, the Consultant may request from the Owner the termination of grading operations within the affected area. Prior to resuming grading operations, the Owner shall provide a written report to the Consultant indicating that the suspected materials are not hazardous as defined by applicable laws and regulations.

3.4 The outer 15 feet of *soil-rock* fill slopes, measured horizontally, should be composed of properly compacted *soil* fill materials approved by the Consultant. *Rock* fill may extend to the slope face, provided that the slope is not steeper than 2:1 (horizontal:vertical) and a soil layer no thicker than 12 inches is track-walked onto the face for landscaping purposes. This procedure may be utilized provided it is acceptable to the governing agency, Owner and Consultant.

3.5 Samples of soil materials to be used for fill should be tested in the laboratory by the Consultant to determine the maximum density, optimum moisture content, and, where appropriate, shear strength, expansion, and gradation characteristics of the soil.

3.6 During grading, soil or groundwater conditions other than those identified in the Geotechnical Report may be encountered by the Contractor. The Consultant shall be notified immediately to evaluate the significance of the unanticipated condition

4. CLEARING AND PREPARING AREAS TO BE FILLED

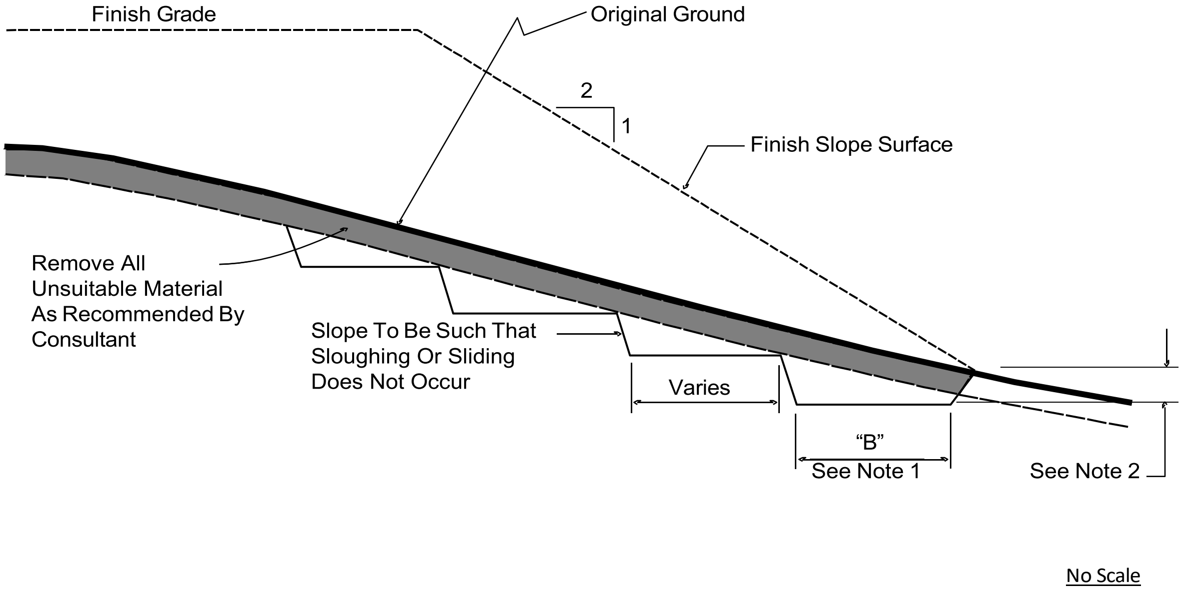
4.1 Areas to be excavated and filled shall be cleared and grubbed. Clearing shall consist of complete removal above the ground surface of trees, stumps, brush, vegetation, man-made structures, and similar debris. Grubbing shall consist of removal of stumps, roots, buried logs and other unsuitable material and shall be performed in areas to be graded. Roots and other projections exceeding 1½ inches in diameter shall be removed to a depth of 3 feet below the surface of the ground. Borrow areas shall be grubbed to the extent necessary to provide suitable fill materials.

4.2 Asphalt pavement material removed during clearing operations should be properly disposed at an approved off-site facility or in an acceptable area of the project evaluated by Geocon and the property owner. Concrete fragments that are free of reinforcing steel may be placed in fills, provided they are placed in accordance with Section 6.2 or 6.3 of this document.

4.3 After clearing and grubbing of organic matter and other unsuitable material, loose or porous soils shall be removed to the depth recommended in the Geotechnical Report. The depth of removal and compaction should be observed and approved by a representative of the Consultant. The exposed surface shall then be plowed or scarified to a minimum depth of 6 inches and until the surface is free from uneven features that would tend to prevent uniform compaction by the equipment to be used.

4.4 Where the slope ratio of the original ground is steeper than 5:1 (horizontal:vertical), or where recommended by the Consultant, the original ground should be benched in accordance with the following illustration.

TYPICAL BENCHING DETAIL



DETAIL NOTES: (1) Key width "B" should be a minimum of 10 feet, or sufficiently wide to permit complete coverage with the compaction equipment used. The base of the key should be graded horizontal, or inclined slightly into the natural slope.

(2) The outside of the key should be below the topsoil or unsuitable surficial material and at least 2 feet into dense formational material. Where hard rock is exposed in the bottom of the key, the depth and configuration of the key may be modified as approved by the Consultant.

4.5 After areas to receive fill have been cleared and scarified, the surface should be moisture conditioned to achieve the proper moisture content, and compacted as recommended in Section 6 of these specifications.

5. COMPACTION EQUIPMENT

5.1 Compaction of *soil* or *soil-rock* fill shall be accomplished by sheepsfoot or segmented-steel wheeled rollers, vibratory rollers, multiple-wheel pneumatic-tired rollers, or other types of acceptable compaction equipment. Equipment shall be of such a design that it will be capable of compacting the *soil* or *soil-rock* fill to the specified relative compaction at the specified moisture content.

5.2 Compaction of *rock* fills shall be performed in accordance with Section 6.3.

6. PLACING, SPREADING AND COMPACTION OF FILL MATERIAL

6.1 *Soil* fill, as defined in Paragraph 3.1.1, shall be placed by the Contractor in accordance with the following recommendations:

6.1.1 *Soil* fill shall be placed by the Contractor in layers that, when compacted, should generally not exceed 8 inches. Each layer shall be spread evenly and shall be thoroughly mixed during spreading to obtain uniformity of material and moisture in each layer. The entire fill shall be constructed as a unit in nearly level lifts. Rock materials greater than 12 inches in maximum dimension shall be placed in accordance with Section 6.2 or 6.3 of these specifications.

6.1.2 In general, the *soil* fill shall be compacted at a moisture content at or above the optimum moisture content as determined by ASTM D 1557.

6.1.3 When the moisture content of *soil* fill is below that specified by the Consultant, water shall be added by the Contractor until the moisture content is in the range specified.

6.1.4 When the moisture content of the *soil* fill is above the range specified by the Consultant or too wet to achieve proper compaction, the *soil* fill shall be aerated by the Contractor by blading/mixing, or other satisfactory methods until the moisture content is within the range specified.

6.1.5 After each layer has been placed, mixed, and spread evenly, it shall be thoroughly compacted by the Contractor to a relative compaction of at least 90 percent. Relative compaction is defined as the ratio (expressed in percent) of the in-place dry density of the compacted fill to the maximum laboratory dry density as determined in accordance with ASTM D 1557. Compaction shall be continuous over the entire area, and compaction equipment shall make sufficient passes so that the specified minimum relative compaction has been achieved throughout the entire fill.

6.1.6 Where practical, soils having an Expansion Index greater than 50 should be placed at least 3 feet below finish pad grade and should be compacted at a moisture content generally 2 to 4 percent greater than the optimum moisture content for the material.

6.1.7 Properly compacted *soil* fill shall extend to the design surface of fill slopes. To achieve proper compaction, it is recommended that fill slopes be over-built by at least 3 feet and then cut to the design grade. This procedure is considered preferable to track-walking of slopes, as described in the following paragraph.

6.1.8 As an alternative to over-building of slopes, slope faces may be back-rolled with a heavy-duty loaded sheepsfoot or vibratory roller at maximum 4-foot fill height intervals. Upon completion, slopes should then be track-walked with a D-8 dozer or similar equipment, such that a dozer track covers all slope surfaces at least twice.

6.2 *Soil-rock* fill, as defined in Paragraph 3.1.2, shall be placed by the Contractor in accordance with the following recommendations:

6.2.1 Rocks larger than 12 inches but less than 4 feet in maximum dimension may be incorporated into the compacted *soil* fill, but shall be limited to the area measured 15 feet minimum horizontally from the slope face and 5 feet below finish grade or 3 feet below the deepest utility, whichever is deeper.

6.2.2 Rocks or rock fragments up to 4 feet in maximum dimension may either be individually placed or placed in windrows. Under certain conditions, rocks or rock fragments up to 10 feet in maximum dimension may be placed using similar methods. The acceptability of placing rock materials greater than 4 feet in maximum dimension shall be evaluated during grading as specific cases arise and shall be approved by the Consultant prior to placement.

6.2.3 For individual placement, sufficient space shall be provided between rocks to allow for passage of compaction equipment.

6.2.4 For windrow placement, the rocks should be placed in trenches excavated in properly compacted *soil* fill. Trenches should be approximately 5 feet wide and 4 feet deep in maximum dimension. The voids around and beneath rocks should be filled with approved granular soil having a Sand Equivalent of 30 or greater and should be compacted by flooding. Windrows may also be placed utilizing an "open-face" method in lieu of the trench procedure, however, this method should first be approved by the Consultant.

6.2.5 Windrows should generally be parallel to each other and may be placed either parallel to or perpendicular to the face of the slope depending on the site geometry. The minimum horizontal spacing for windrows shall be 12 feet center-to-center with a 5-foot stagger or offset from lower courses to next overlying course. The minimum vertical spacing between windrow courses shall be 2 feet from the top of a lower windrow to the bottom of the next higher windrow.

6.2.6 Rock placement, fill placement and flooding of approved granular soil in the windrows should be continuously observed by the Consultant.

6.3 *Rock* fills, as defined in Section 3.1.3, shall be placed by the Contractor in accordance with the following recommendations:

6.3.1 The base of the *rock* fill shall be placed on a sloping surface (minimum slope of 2 percent). The surface shall slope toward suitable subdrainage outlet facilities. The *rock* fills shall be provided with subdrains during construction so that a hydrostatic pressure buildup does not develop. The subdrains shall be permanently connected to controlled drainage facilities to control post-construction infiltration of water.

6.3.2 *Rock* fills shall be placed in lifts not exceeding 3 feet. Placement shall be by rock trucks traversing previously placed lifts and dumping at the edge of the currently placed lift. Spreading of the *rock* fill shall be by dozer to facilitate *seating* of the rock. The *rock* fill shall be watered heavily during placement. Watering shall consist of water trucks traversing in front of the current rock lift face and spraying water continuously during rock placement. Compaction equipment with compactive energy comparable to or greater than that of a 20-ton steel vibratory roller or other compaction equipment providing suitable energy to achieve the required compaction or deflection as recommended in Paragraph 6.3.3 shall be utilized. The number of passes to be made should be determined as described in Paragraph 6.3.3. Once a *rock* fill lift has been covered with *soil* fill, no additional *rock* fill lifts will be permitted over the *soil* fill.

6.3.3 Plate bearing tests, in accordance with ASTM D 1196, may be performed in both the compacted *soil* fill and in the *rock* fill to aid in determining the required minimum number of passes of the compaction equipment. If performed, a minimum of three plate bearing tests should be performed in the properly compacted *soil* fill (minimum relative compaction of 90 percent). Plate bearing tests shall then be performed on areas of *rock* fill having two passes, four passes and six passes of the compaction equipment, respectively. The number of passes required for the *rock* fill shall be determined by comparing the results of the plate bearing tests for the *soil* fill and the *rock* fill and by evaluating the deflection variation with number of passes. The required number of passes of the compaction equipment will be performed as necessary until the plate bearing deflections are equal to or less than that determined for the properly compacted *soil* fill. In no case will the required number of passes be less than two.

6.3.4 A representative of the Consultant should be present during *rock* fill operations to observe that the minimum number of "passes" have been obtained, that water is being properly applied and that specified procedures are being followed. The actual number of plate bearing tests will be determined by the Consultant during grading.

6.3.5 Test pits shall be excavated by the Contractor so that the Consultant can state that, in their opinion, sufficient water is present and that voids between large rocks are properly filled with smaller rock material. In-place density testing will not be required in the *rock* fills.

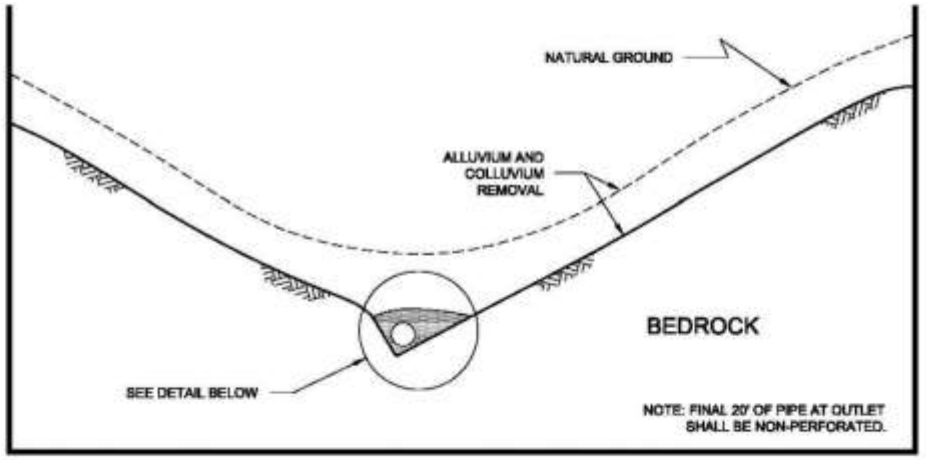
6.3.6 To reduce the potential for "piping" of fines into the *rock* fill from overlying *soil* fill material, a 2-foot layer of graded filter material shall be placed above the uppermost lift of *rock* fill. The need to place graded filter material below the *rock* should be determined by the Consultant prior to commencing grading. The gradation of the graded filter material will be determined at the time the *rock* fill is being excavated. Materials typical of the *rock* fill should be submitted to the Consultant in a timely manner, to allow design of the graded filter prior to the commencement of *rock* fill placement.

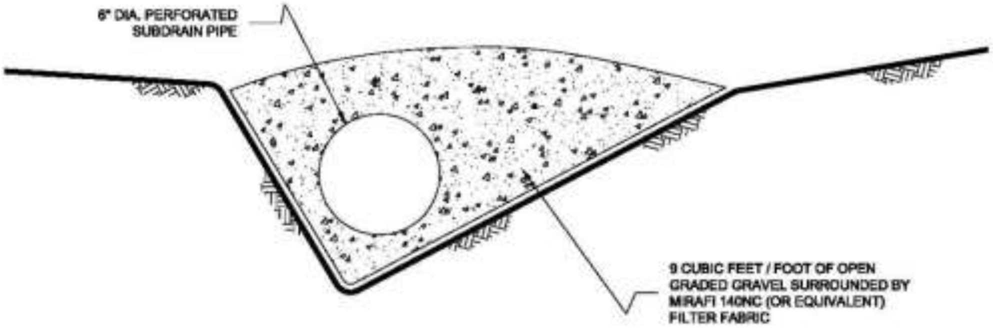
6.3.7 *Rock* fill placement should be continuously observed during placement by the Consultant.

7. SUBDRAINS

7.1 The geologic units on the site may have permeability characteristics and/or fracture systems that could be susceptible under certain conditions to seepage. The use of canyon subdrains may be necessary to mitigate the potential for adverse impacts associated with seepage conditions. Canyon subdrains with lengths in excess of 500 feet or extensions of existing offsite subdrains should use 8-inch-diameter pipes. Canyon subdrains less than 500 feet in length should use 6-inch-diameter pipes.

TYPICAL CANYON DRAIN DETAIL





NOTES:

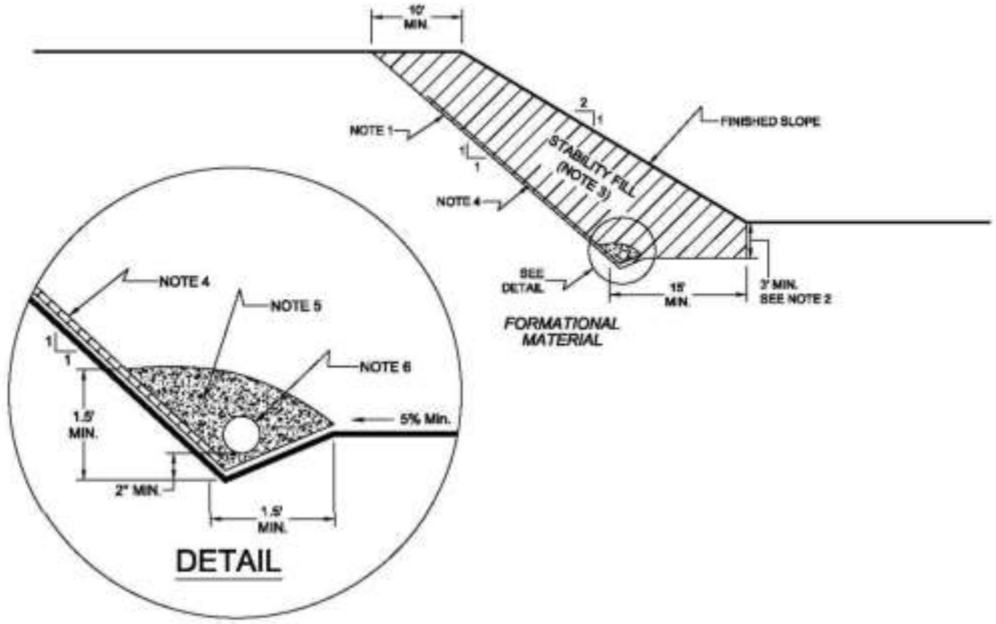
1......6-INCH DIAMETER, SCHEDULE 80 PVC PERFORATED PIPE FOR FILLS IN EXCESS OF 100-FEET IN DEPTH OR A PIPE LENGTH OF LONGER THAN 500 FEET.

2......6-INCH DIAMETER, SCHEDULE 40 PVC PERFORATED PIPE FOR FILLS LESS THAN 100-FEET IN DEPTH OR A PIPE LENGTH SHORTER THAN 500 FEET.

NO SCALE

7.2 Slope drains within stability fill keyways should use 4-inch-diameter (or lager) pipes.

TYPICAL STABILITY FILL DETAIL



NOTES:

1....EXCAVATE BACKCUT AT 1:1 INCLINATION (UNLESS OTHERWISE NOTED).

2....BASE OF STABILITY FILL TO BE 3 FEET INTO FORMATIONAL MATERIAL, SLOPING A MINIMUM 5% INTO SLOPE.

3....STABILITY FILL TO BE COMPOSED OF PROPERLY COMPACTED GRANULAR SOIL.

4....CHIMNEY DRAINS TO BE APPROVED PREFABRICATED CHIMNEY DRAIN PANELS (MIRADRAIN G200N OR EQUIVALENT) SPACED APPROXIMATELY 20 FEET CENTER TO CENTER AND 4 FEET WIDE. CLOSER SPACING MAY BE REQUIRED IF SEEPAGE IS ENCOUNTERED.

5....FILTER MATERIAL TO BE 3/4-INCH, OPEN-GRADED CRUSHED ROCK ENCLOSED IN APPROVED FILTER FABRIC (MIRAFI 140NC).

6....COLLECTOR PIPE TO BE 4-INCH MINIMUM DIAMETER, PERFORATED, THICK-WALLED PVC SCHEDULE 40 OR EQUIVALENT, AND SLOPED TO DRAIN AT 1 PERCENT MINIMUM TO APPROVED OUTLET.

NO SCALE

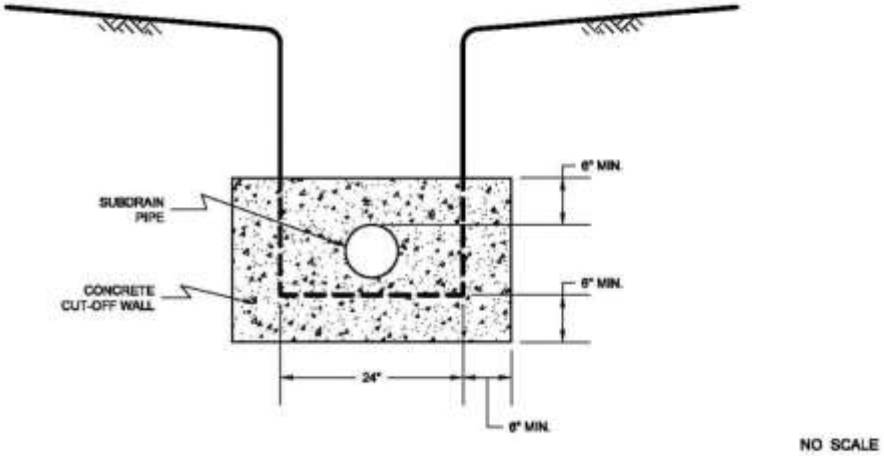
7.3 The actual subdrain locations will be evaluated in the field during the remedial grading operations. Additional drains may be necessary depending on the conditions observed and the requirements of the local regulatory agencies. Appropriate subdrain outlets should be evaluated prior to finalizing 40-scale grading plans.

7.4 *Rock* fill or *soil-rock* fill areas may require subdrains along their down-slope perimeters to mitigate the potential for buildup of water from construction or landscape irrigation. The subdrains should be at least 6-inch-diameter pipes encapsulated in gravel and filter fabric. *Rock* fill drains should be constructed using the same requirements as canyon subdrains.

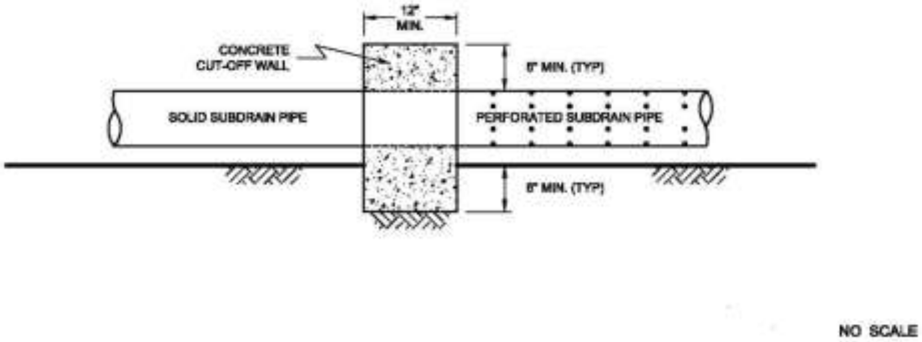
7.5 Prior to outletting, the final 20-foot segment of a subdrain that will not be extended during future development should consist of non-perforated drainpipe. At the non-perforated/ perforated interface, a seepage cutoff wall should be constructed on the downslope side of the pipe.

TYPICAL CUT OFF WALL DETAIL

FRONT VIEW



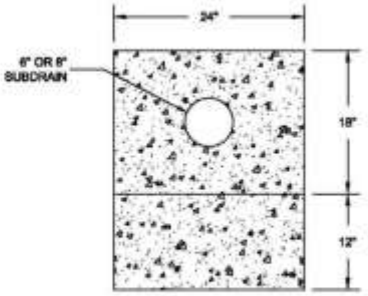
SIDE VIEW



7.6 Subdrains that discharge into a natural drainage course or open space area should be provided with a permanent headwall structure.

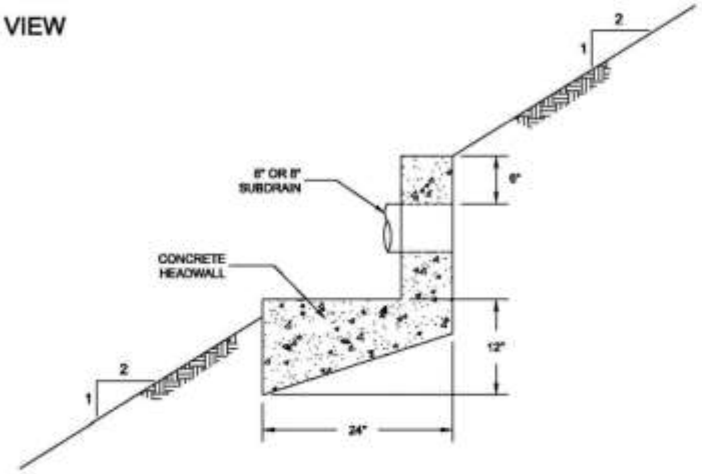
TYPICAL HEADWALL DETAIL

FRONT VIEW



NO SCALE

SIDE VIEW



NOTE: HEADWALL SHOULD OUTLET AT TOE OF FILL SLOPE
OR INTO CONTROLLED SURFACE DRAINAGE

NO SCALE

7.7 The final grading plans should show the location of the proposed subdrains. After completion of remedial excavations and subdrain installation, the project civil engineer should survey the drain locations and prepare an "as-built" map showing the drain locations. The final outlet and connection locations should be determined during grading operations. Subdrains that will be extended on adjacent projects after grading can be placed on formational material and a vertical riser should be placed at the end of the subdrain. The grading contractor should consider videoing the subdrains shortly after burial to check proper installation and functionality. The contractor is responsible for the performance of the drains.

8. OBSERVATION AND TESTING

8.1 The Consultant shall be the Owner's representative to observe and perform tests during clearing, grubbing, filling, and compaction operations. In general, no more than 2 feet in vertical elevation of *soil* or *soil-rock* fill should be placed without at least one field density test being performed within that interval. In addition, a minimum of one field density test should be performed for every 2,000 cubic yards of *soil* or *soil-rock* fill placed and compacted.

8.2 The Consultant should perform a sufficient distribution of field density tests of the compacted *soil* or *soil-rock* fill to provide a basis for expressing an opinion whether the fill material is compacted as specified. Density tests shall be performed in the compacted materials below any disturbed surface. When these tests indicate that the density of any layer of fill or portion thereof is below that specified, the particular layer or areas represented by the test shall be reworked until the specified density has been achieved.

8.3 During placement of *rock* fill, the Consultant should observe that the minimum number of passes have been obtained per the criteria discussed in Section 6.3.3. The Consultant should request the excavation of observation pits and may perform plate bearing tests on the placed *rock* fills. The observation pits will be excavated to provide a basis for expressing an opinion as to whether the *rock* fill is properly seated and sufficient moisture has been applied to the material. When observations indicate that a layer of *rock* fill or any portion thereof is below that specified, the affected layer or area shall be reworked until the *rock* fill has been adequately seated and sufficient moisture applied.

8.4 A settlement monitoring program designed by the Consultant may be conducted in areas of *rock* fill placement. The specific design of the monitoring program shall be as recommended in the Conclusions and Recommendations section of the project Geotechnical Report or in the final report of testing and observation services performed during grading.

8.5 We should observe the placement of subdrains, to check that the drainage devices have been placed and constructed in substantial conformance with project specifications.

8.6 Testing procedures shall conform to the following Standards as appropriate:

8.6.1 **Soil and Soil-Rock Fills:**

8.6.1.1 Field Density Test, ASTM D 1556, *Density of Soil In-Place By the Sand-Cone Method.*

8.6.1.2 Field Density Test, Nuclear Method, ASTM D 6938, *Density of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth).*

8.6.1.3 Laboratory Compaction Test, ASTM D 1557, *Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-Pound Hammer and 18-Inch Drop*.

8.6.1.4 Expansion Index Test, ASTM D 4829, *Expansion Index Test*.

9. PROTECTION OF WORK

9.1 During construction, the Contractor shall properly grade all excavated surfaces to provide positive drainage and prevent ponding of water. Drainage of surface water shall be controlled to avoid damage to adjoining properties or to finished work on the site. The Contractor shall take remedial measures to prevent erosion of freshly graded areas until such time as permanent drainage and erosion control features have been installed. Areas subjected to erosion or sedimentation shall be properly prepared in accordance with the Specifications prior to placing additional fill or structures.

9.2 After completion of grading as observed and tested by the Consultant, no further excavation or filling shall be conducted except in conjunction with the services of the Consultant.

10. CERTIFICATIONS AND FINAL REPORTS

10.1 Upon completion of the work, Contractor shall furnish Owner a certification by the Civil Engineer stating that the lots and/or building pads are graded to within 0.1 foot vertically of elevations shown on the grading plan and that all tops and toes of slopes are within 0.5 foot horizontally of the positions shown on the grading plans. After installation of a section of subdrain, the project Civil Engineer should survey its location and prepare an *as-built* plan of the subdrain location. The project Civil Engineer should verify the proper outlet for the subdrains and the Contractor should ensure that the drain system is free of obstructions.

10.2 The Owner is responsible for furnishing a final as-graded soil and geologic report satisfactory to the appropriate governing or accepting agencies. The as-graded report should be prepared and signed by a California licensed Civil Engineer experienced in geotechnical engineering and by a California Certified Engineering Geologist, indicating that the geotechnical aspects of the grading were performed in substantial conformance with the Specifications or approved changes to the Specifications.

Appendix G

Agreements – CC&Rs, Covenant and Agreements and/or Other Mechanisms for ensuring ongoing Operation, Maintenance, Funding and Transfer of Requirements for the project-specific final WQMP

Appendix H

Phase 1 Environmental Site Assessment – Summary of Site Remediation Conducted and Use Restrictions

Appendix I

Project-Specific PWQMP Summary Data Form

Project-Specific PWQMP Summary Data Form

Applicant Information	
Name and Title	Brendan O' Donnell - Associate Vice President, Development
Company	Abode Communities
Phone	
Email	
Project Information	
Project Name (as shown on project application/project-specific PWQMP)	Park Lane Homes
Street Address	Northeast corner of Palm Drive and Park Lane
Nearest Cross Streets	Palm Drive and Park Lane
Municipality (City or Unincorporated County)	Desert Hot Springs
Zip Code	92240
Tract Number(s) and/or Assessor Parcel Number(s)	APN 656-040-061 (a portion of)
Other (other information to help identify location of project)	Riverside County
Watershed	Whitewater River

Indicate type of project.	**Priority Development Projects (Use an "X" in cell preceding project type):**	
		SF hillside residence; impervious area ≥ 10,000 sq. ft.; Slope ≥ 25%
		SF hillside residence; impervious area ≥ 10,000 sq. ft.; Slope ≥ 10% & erosive soils
		Commercial or Industrial ≥ 100,000 sq. ft.
		Automotive repair shop
		Retail Gasoline Outlet disturbing > 5,000 sq. ft.
		Restaurant disturbing > 5,000 sq. ft.
	x	Home subdivision ≥ 10 housing units
		Parking lot ≥ 5,000 sq. ft. or ≥ 25 parking spaces

Date Project-Specific PWQMP Submitted	
Size of Project Area (nearest 0.1 acre)	7.54 acres
Project Area managed with Site Design or Low Impact Development (LID) BMPs (nearest 0.1 acre)	7.54 acres
Is the project subject to onsite retention by ordinance or policy?	
Are Treatment Control BMPs required?	
Name of the entity that will implement, operate, and maintain the post-construction BMPs	
Contact Name	Brendan O' Donnell
Street or Mailing Address	1149 S Hill Street, Suite 700
City	Los Angeles
Zip Code	90015
Phone	
Space Below for Use by City/County Staff Only	
Preceding Information Verified by (consistent with information in project-specific PWQMP)	**Name:** **Date:**
Date Project-Specific PWQMP Approved:	
Data Entered by	**Name:** **Date:**
Other Comments	