FOR STAFF USE ONLY
Date Received: 6/12/2023 Received By: VRS Application No. ENC2023-020
Bldg. Official ______ Date ______ PWD Director DJG Date 08-25-2023
Attached Additional Conditions Apply (see attached list if checked) Inspection Required Yes (yes/no)

APPLICATION FOR ENCROACHMENT PERMIT

CITY OF PIEDMONT, DEPARTMENT OF PUBLIC WORKS

120 Vista Avenue, Piedmont, CA 94611
Tel: 510-420-3050 Fax: 510-658-3167

Email application to: enchroachments@piedmont.ca.gov

WORK ADDRESS: 800 Magnolia Avenue, Piedmont CA 94611 -Witter Field
(list street(s) and address range if more than one property/location)

UTILITY COMPANY OR CONTRACTOR REFERENCE/JOB NO.: ______

Company Name: Robert A Bothman Construction

Contact Name: Tyler Hutchings E-Mail: thutchings@bothman.com

Address: 2690 Scott Blvd City: Santa Clara Zip: 95050

Office Phone: 408.279.2281 Cell Phone: 408.309.3491

SITUS ADDRESS OWNER INFORMATION:

Name(s): Piedmont Unified School District

Address: 760 Magnolia City: Piedmont Zip: 94611

Home Phone: ______ Work or Cell Phone: (510)594-26

E-Mail: ppalmer@piedmont.k12.ca.us

Application is hereby made for a permit to perform:

- ☐ Traffic control
- ☐ Utility Work
- ☐ Sidewalk
- ☐ Driveway curb cut
- ☒ Drainage
- ☐ Other (explain below)

For the purpose of: Per Daniel Gonzales & John Wenger, City Engineer request, we are submitting this permit application to tie into the City storm drain system as shown in the attached plans and drawings.

x I have enclosed the appropriate drawings, plans, maps, and traffic control information.

The undersigned hereby applies for permission to perform the above described work and/or otherwise encroach on City of Piedmont right-of-way or property. Permittee agrees to accept all responsibility for loss or damage to any person or entity and to indemnify, hold harmless, and defend and release the City of Piedmont, its agents, volunteers and employees from and against any and all liability actions, claims, damages, costs, or expenses including, but not limited to, attorneys' fees and court costs, which may be asserted by any person or entity, including Permittee, arising out of or in connection with the willful act or negligence of Permittee performing the work associated with this Permit, whether or not there is concurrent negligence on the part of the City, but excluding liability due to the sole active negligence or sole willful misconduct of the City. The fees associated with this permit are considered a deposit only. The applicant understands that if actual costs for inspections, City administration or legal fees are more than the deposit, the applicant shall pay any additional costs prior to acceptance of the improvements and release of surety. Any unused portions of monies paid shall be refunded to the applicant.

SIGNATURE OF APPLICANT: [signature] 6/8/23

PRINT NAME & TITLE: Pete Palmer, Director of Facilities, PUSD

Revised: 2.10.2022

CITY OF PIEDMONT
ENCROACHMENT PERMIT CONDITIONS
Application No. ENC2023-020

Note: The following standard and checked (X) conditions apply to this permit.

1. APPENDING LIST OF CONDITIONS: In the event that these following conditions conflict with the conditional notes and language found in the Permit Application, the following conditions and special conditions will supersede and prevail.

2. ACCEPTANCE OF THE PROVISIONS: It is understood and agreed by the Permittee that all conditions have been read, and understood. The Permittee agrees to comply with all conditions.

3. KEEP PERMIT ON WORK SITE: This permit, or a complete copy, shall be kept at the site of the work and upon request must be shown to any representative of the City or any law enforcement officer.

4. PERMITS FROM OTHER AGENCIES: Permittee must obtain all other permits required by other public or private agencies or individuals necessary in order to perform the intended work.

5. FINAL INSPECTION NOTIFICATION: Upon completion of all work, including final surface restoration, the Permittee shall contact the City Public Works Department (510-420-3050) a minimum of two (2) working days prior to the requested inspection date.

6. ___X____ PRE-CONSTRUCTION MEETING with City representatives and inspector will be required scheduled. Contact the City Public Works Department to schedule the meeting.

7. ___X___ PERIODIC INSPECTION REQUIRED by a City-assigned inspector. All work must be inspected prior, during and after backfill or re-excavation and will be at Permittee's expense. The Permittee shall notify the assigned inspector a minimum of two (2) working days prior to the performance of any work. Additionally, depending on the scope of the project, traffic control may be reviewed/inspected. <Inspections shall be called for:
   a) Excavation mark-out
   b) Connection to the City's storm drain system (pipe placement and grouting)
   c) Backfill – verification of compaction
   d) Raising of all manholes, valve boxes, monument vaults and other "iron" in the street.

8. CONSTRUCTION METHODS: Any work performed without inspection or contrary to approved plans, City Standards and Specifications, Caltrans Standard Plans (latest edition) or direction by the City or City inspector shall be deemed non-complying and will not be accepted by the City. Attention is called to the following special provisions:

   a) Permittee shall hire a soils engineer to test for compaction in all trenches associated with the connection to the City's storm drain system. Trench compaction reports shall be provided to the City showing tests conducted on all trenches. Any failing compaction tests shall be addressed and repaired until compaction meeting City Standards.

   b) Temporary repairs to existing grades, backfilling, and making the work site safe are required.

   c) Permit conditions address information shown on plans submitted with this application. Paving and/or trench restoration required herein are subject to change based on field conditions. If field conditions warrant a change, additional paving restoration or trench repairs may be required.

   d) Other Conditions:
      - **Connection to the City's storm drain system shall be per the attached detail to this permit showing the 8-inch storm drain pipe.**
      - **Breaking concrete out of the existing manhole to accommodate the new 8-inch pipe shall be**

minimized and grout shall be require around the pipe to provide a water tight connection.

- **The new 8-inch pipe connection shall be solid pipe (HDPE, PVC or concrete) and shall have a wall thickness necessary to withstand project loading over the pipe.**
- **Backfill around city culvert and manholes shall be performed in accordance with City Standard Detail 502**

9. PLANS: All work shall comply with City of Piedmont standards and specifications and conditions attached hereto and mentioned herein and the approved project plans and specifications.

10. WORK HOURS: All work shall be restricted to 8:00am to 5:00pm Monday-Friday (excluding holidays) or as directed by the Engineer. Work at times other than regular workdays requires additional compensation for overtime inspection and written approval from the City.

11. UNDERGROUND SERVICE ALERT: Permittee must notify Underground Service Alert (USA-North 811) at least 48 hours in advance of start of work for location of underground utilities.

12. GUARANTEE: The Permittee shall guarantee all public facility restoration performed under this permit for a period of one (1) year from the date of final inspection. Any failure or settlement caused by defective materials or workmanship shall be promptly repaired or replaced at Permittee's expense.

13. STORAGE OF MATERIAL: Excavated material, sand, gravel or any construction materials and debris shall not be stockpiled or stored with the City right-of-way, except as approved by the City.

14. PUBLIC CONVENIENCE:

    a) The Permittee shall conduct his operations as to offer the least possible obstruction and inconvenience to the public and abutting property owners, and he shall have under construction no greater amount of work than he can prosecute properly with due regard to the rights of the public.

15. EROSION AND SEDIMENT CONTROL MEASURES: The Permittee is obligated to insure compliance with all applicable stormwater regulations at all times. BMPs (Best Management Practices) per Alameda County Clean Water Standards and California Stormwater Quality Association (CASQA) handbook shall be implemented and maintained to effectively prevent the potentially negative impacts on this project's construction activities on stormwater quality. Stockpiles of soil, material, and wastes shall be properly contained and covered to minimize sediment transport from the site to streets, drainage facilities or adjacent properties via runoff, vehicle tracking, or wind.

16. DISPOSAL OF MATERIAL: The contractor shall be responsible to suitably dispose of any excavated material to the satisfaction of the City and Regional Water Quality Control Board. Disposal of any excavated material will not be allowed on any city-owned property.

17. CLEAN UP: Upon completion of daily work, the Permittee shall clean the right-of-way of all rubbish, sediment and gravel, construction debris, trees, brush, excess materials, temporary structures and equipment.

18. SAFETY:

    a) The Permittee is completely responsible for the conditions of the job site, including safety, and shall not be limited to normal working hours. Work and Safety provisions shall conform to all applicable Federal, State, and local laws, ordinances, and codes, and to the rules and regulations established by the California Division of Industrial Safety applicable to the work.

    b) The services of the Inspector in conducting construction review of the Permittee's performance is not intended to include review of the adequacy of the Permittee's work methods or safety measures, in, on, or near the construction site, and shall not be construed as supervision of the actual construction nor make the Inspector or the City responsible for providing a safe place for the performance of work by the Permittee, or subcontractors; or for access, visits, use work, travel or occupancy by any person.

    c) The Permittee shall carefully instruct all personnel working in potentially hazardous work areas as to potential dangers and shall provide such necessary safety equipment and instruction as is necessary to prevent injury to personnel and damage to property.

    d) Shoring and Trench Safety Plan - Attention is directed to the Civil Code of the State of California, the State Labor Code, and the State of California Division of Industrial Safety.

19. PROTECTION OF PERSON AND PROPERTY: The Permittee shall take whatever precautions are necessary to prevent damage to all existing improvements, including above ground and underground utilities. If such improvements or property are damaged by reason of the Permittee's operations, they shall be replaced or restored to a condition equal to or greater than what existed prior, at the Permittee's expense, without delay.

20. RESPONSIBILITY FOR REPAIR OF FACILITIES: All public or private facilities and improvements to remain, including but not limited to structures, utilities, and storm drains disturbed during construction of the work shall be repaired and/or replaced by the Permittee to match facilities existing prior to construction. In addition, the Permittee shall be responsible for any settlement damage to such facilities or adjoining areas for a period mentioned in the "Guarantee" section of this permit after acceptance of such required facilities. In the event the Permittee refuses or neglects to make good any loss or damage for which he is responsible under this Permit, the City may itself, or by the employment of others, make good any such loss or damage, and all cost and expense of doing so shall be charged to the Permittee.

21. CONTRACTOR'S LICENSE NOTICE: Contractors are required by law to be licensed and regulated by the Contractor's State License Board.

22. PRIVATE IMPROVEMENTS: Any private improvements to be installed within the City right-of-way as part of this permit shall be continuously maintained to a safe, clean, and serviceable level, and that the Permittee agrees to remove said improvements at the Permittee's expense in the event that the City requests such removal at its discretion.

23. NO PRECEDENT ESTABLISHED: This permit is granted with the understanding that this action is not to be considered as establishing any precedent on the question of the expediency of permitting any certain kind of encroachment. All excavation permits are revocable at any time by the City.

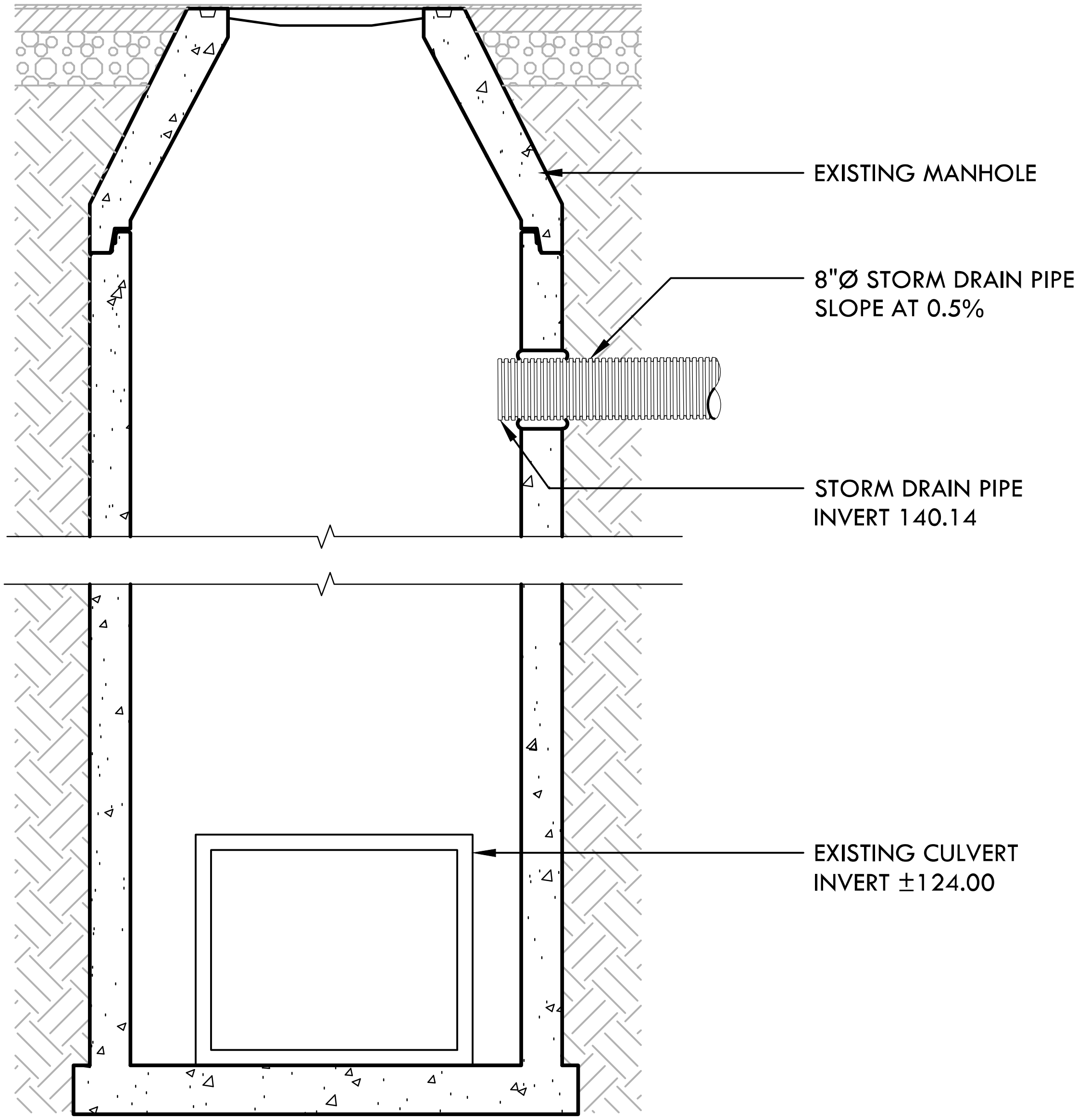
24. PERMIT AND INSPECTION FEES: The applicant shall be responsible to reimburse the City for all expenses in processing issuing, inspecting, enforcing, finalizing and other expenses that may arise specifically due to this permit. By signing the permit, the applicant accepts responsibility for payment of all fees, costs and expenses that arise from this permit.

By signing the encroachment permit, Permittee agrees to the following indemnification language:

Neither City nor any City officers, officials, employees, agents or designated volunteers shall be liable for any injury to persons or property occasioned by reason of the acts or omissions of Permittee, or any person or entity acting on the Permittee's behalf, including, without limitation, the agents, employees, contractors or subcontractors of the Permittee. Permittee further agrees to indemnify, hold harmless, and defend with counsel approved by the City, the City and its officers, officials, employees, agents and designated volunteers from any and all claims, demands, causes of action, liability or loss of any sort (including, but not limited to, attorney's fees and costs and fees of litigation) (collectively, "Liability"), because of, or arising out of, acts or omissions of Permittee, its agents, employees, contractors, subcontractors or any others acting pursuant to this Permit, including, without limitation, Liability because of, or arising out of, in whole or in part, the design or construction of the project, injuries to persons or damages or taking of property resulting from the design or construction of the project, and restoration of the Property and any improvements on the Property. Permittee further agrees to indemnify, hold harmless and defend with counsel approved by the City, the City and its officers, officials, employees, agents and designated volunteers from any and all Liability because of, or arising out of any discharge or other impact on City property caused by Permittee or any person or entity acting on Permittee's behalf or on whose behalf Permittee acted, regardless of whether such discharge or other impact occurred pursuant to or during the time the Permit is in effect, prior to the time the Permit is in effect, or after the time the Permit is in effect. Acceptance by the City of the restoration of the Property shall not constitute an assumption of any responsibility for any damage or taking covered by this paragraph. The Permittee shall be responsible for all of the Permittee's activities pursuant to the Permit and related restoration, including, without limitation, design and construction of the project. City shall not be liable for any negligence, nonfeasance, misfeasance or malfeasance in approving, reviewing, checking, or correcting any plans or specifications or in approving, reviewing or inspecting any aspect of the Permittee's activities pursuant to the Permit or any related restoration of the Property. The rights and obligations that accrue pursuant to this provision shall survive the expiration or termination of the Permit.

Permittee(s): ______________________________ ________
Print name Initial

Permittee(s): ______________________________ ________
Print name Initial

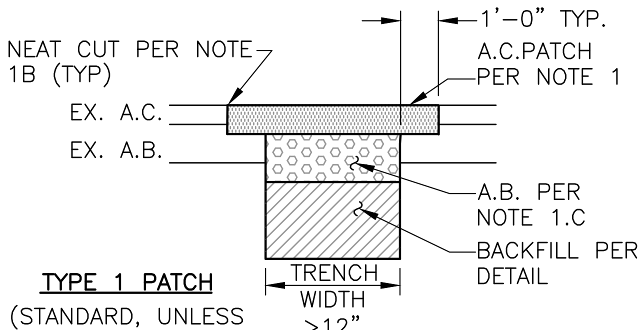


EXISTING MANHOLE CONNECTION NTS

CITY OF PIEDMONT

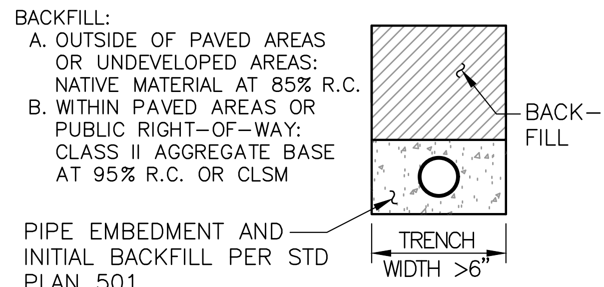
PUBLIC WORKS DEPARTMENT

FINAL BACKFILL & TRENCH STRUCTURAL SECTION REQUIREMENTS

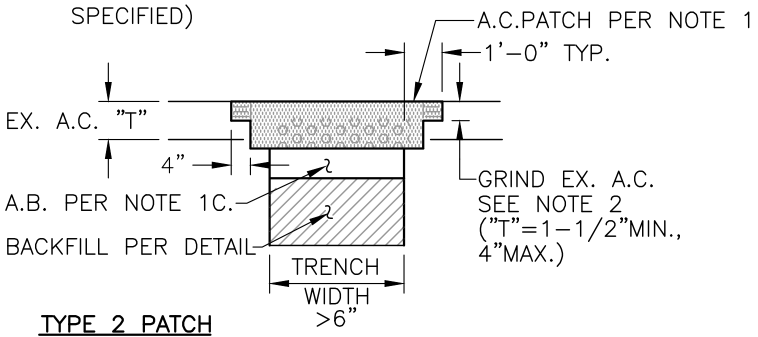


TYPE 1 PATCH

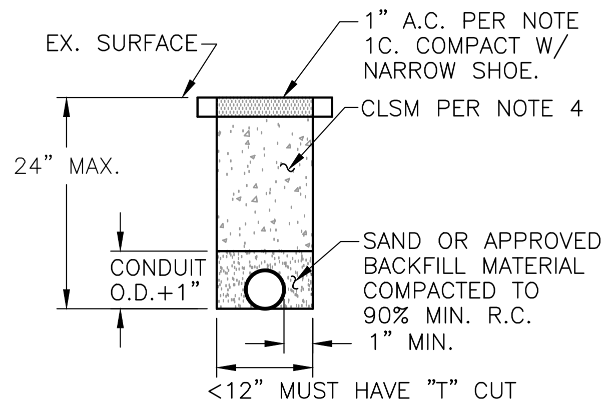
(STANDARD, UNLESS TYPE 2 OR 3 IS SPECIFIED)



BACKFILL DETAIL

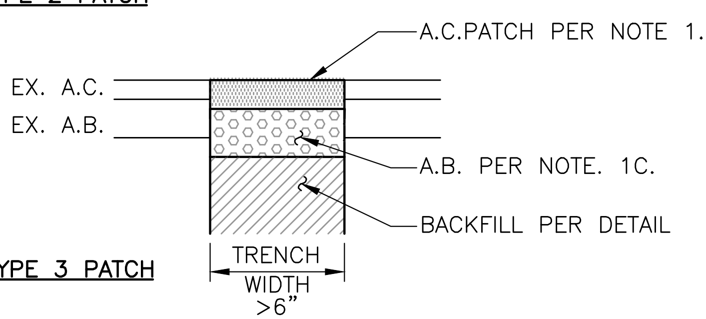


TYPE 2 PATCH



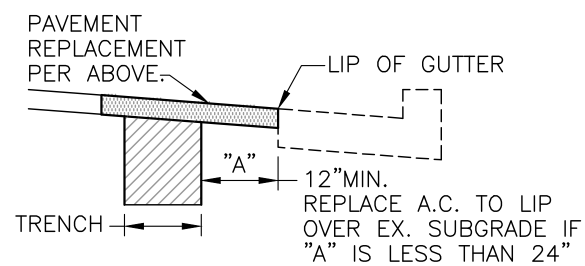
3" & SMALLER CONDUIT

(WHEEL CUT TRENCH)



TYPE 3 PATCH

PAVEMENT REPLACEMENT



ADJACENT TO GUTTER SPECIAL CASES

NOTES:

1. TYPE 1 PATCH:
   A) TOTAL AC THICKNESS TO MATCH EXISTING PLUS 1", 3" MINIMUM APPLIED IN TWO LIFTS.
   B) DROP HAMMER OR OTHER ROUGH CUT ALLOWED FOR INITIAL CUT ALONG TRENCH WALL. FINAL AC EDGE SHALL BE SAWCUT AND TACK COATED PRIOR TO NEW AC PLACEMENT.
   C) AB THICKNESS PER PLANS. AB MAY BE REPLACED BY ADDITIONAL AC (50% OF REQ'D AB THICKNESS).

2. TYPE 2 PATCH OPTIONAL, EXCEPT WHEN REQUIRED BY THE CITY. GRIND DEPTH "T" SHALL BE ADJUSTED TO MATCH EXISTING OVERLAY THICKNESS.

3. TYPE 3 PATCH TO BE USED WHEN SHOWN ON THE PLANS OR AS APPROVED BY THE ENGINEER, GENERALLY ON STREETS TO BE OVERLAYED.

4. CONTROLLED LOW STRENGTH MATERIAL (CLSM) MAY BE USED FOR BACKFILL WITH THE PRIOR APPROVAL OF THE ENGINEER. CLSM SHALL BE IN ACCORDANCE WITH CALTRANS STANDARD SPECIFICATIONS SECTION 19–3.02F.

Dwn: CLG	No.	Date	Revision	Appr.
Chk: MNO				
JAN 2017				

Approved By: [signature]

Chester Nakahara
Director of Public Works
Date 1/17/17

STD DETAIL 502

Images: CN darker.jpg;Piedmont 2015.jpg; Xrefs:
Path: C:\Users\gooler\appdata\local\temp\AcPublish_6300\Piedmont Std 501-503.dwg Layout Name: 502 Plot Date: Feb 09, 2017 at 09:49 am

Piedmont Unified School District

Witter Track and Field Stormwater Management Report

Revised: August 24, 2023

PREPARED BY:

VERDE DESIGN

REGISTERED PROFESSIONAL ENGINEER
DEVIN CONWAY
NO. C56494
EXP. 6/30/25
CIVIL
STATE OF CALIFORNIA

LANDSCAPE ARCHITECTURE I CIVIL ENGINEERING I SPORT PLANNING & DESIGN

1. Introduction:

This technical report provides a comprehensive analysis of the stormwater management aspects for the Piedmont High School Track and Field Reconstruction Project. The project aims to enhance the existing track and field facility at Piedmont High School, while addressing previous drainage challenges experienced within the synthetic turf playing field. The purpose of this document and its attachments is to assess the stormwater capture capabilities of the existing and proposed surfaces, and propose a storm drainage system to ensure effective storm water management.

2. Existing Conditions/ Site Drainage Patterns:

The Piedmont High School campus has an overall area of approximately 20.6 acres, of which roughly 8.35 acres currently drains into the area contributing stormwater collection and discharge to the manhole that exists inside the existing all-weather track oval. Of the 8.35 acres, 4.96 acres (or 216,080 square feet of area) remains unchanged as a part of this project, and will not be considered as a part of this report. The existing track and field is comprised of a combination of synthetic turf and all-weather track surfaces that make up 147,719 sf of area. Although a portion of the existing synthetic turf is to be converted into all-weather track surfacing as a part of this project, the overall footprint of the new track and field surfaces is to remain the same as the existing condition.

The existing track and field area at Piedmont High School features a distinct topography, resembling a slight bowl shape. The adjacent areas to the north, east, and south of the track are at higher elevations. The area to the west has a gentle ridge at the outer edge of the track and then slopes downhill to the west towards the existing baseball field and adjacent neighboring properties.

Stormwater runoff from the existing track drains onto the synthetic turf field. The existing synthetic turf field is graded such that there is a low point/ swale line at the center of the field. Storm water permeates through the synthetic turf and is collected within a 12" diameter storm drain line underneath the field. The 12" storm drain line discharges to the existing box culvert at the southern edge of the field. This box culvert is regulated and owned by the City, and is an underground portion of the Bushy Dell creek.

3. Proposed Stormwater Management Approach/ Goals:

Considering the existing conditions and challenges, the proposed stormwater management strategy takes into account the historic flow patterns and aims to mitigate flooding and runoff issues from the field surfaces (all-weather track surface runoff and synthetic turf runoff) for storm events with recurrence intervals of up to 25 years. By introducing a well-designed storm drainage system, the reconstruction project intends to allow a maximum peak flow rate out of the field into the existing box culvert at a rate that is equal to or less than the existing peak flow rates out of the 12" storm drain line, while also alleviating the flooding and sheet flow concerns to the areas west of the track by storing the excess runoff within the renovated field's subsurface drainage system and permeable rock base profile.

4. Pre-Development Conditions – Track & Field:

4.1 Rational Method for Peak Flow

Using the Rational Method, as prescribed by the City to ulitize the coefficients, factors and formulas within the Alameda County Hydrology & Hydraulics manual (ACHHM), the pre-development peak flows for the existing track and field area were calculated for the 5-, 15-, and 25-year recurrence interval storms. The methodology for the calculations, the data obtained from ACHHM's data tables and attachments, and the calculated results are summarized below.

4.1A. Time of Concentration

The initial step for calculating peak flows is determining the time of concentration for the site. The time of concentration (T_C) is a critical parameter in hydrological calculations, as it represents the time taken for a drop of water to travel from the furthest point of a drainage area to the point of collection or discharge.

For the pre-development conditions, the longest flow path was determined to be overland flow from the outer edge of the track to the low point/ swale line at the center of the field, plus the conduit flow path within the existing 12" storm drain line to the existing box culvert. See attachment B for a pre-development site map with the longest flow path identified.

Per the ACHHM, the overland time of concentration is either to be calculated using equation 3 or 4. Given that equation 4 is for developed watersheds, equation 4 was used in our calculations as it is more applicable to the existing site conditions.

The variables for the overland time of concentration formula are the overland flow time and the gutter flow time. The gutter flow time is not applicable to the project because the sheet flow is collected within subsurface pipes, rather than flowing via gutter flow to a storm drain catchment point. The overland flow time is based on the initial time in from attachment 4 in the ACHHM. Per this attachment, the overland time of concentration for secondary facilities, which is the category that this site falls under, is 5 minutes.

The conduit / pipe flow time is calculated using Manning's equation to determine the flow velocity within the existing 12" storm drain line with a slope of 0.5% (or 0.005), a roughness coefficient of 0.012 for HDPE pipes, and the assumption that the pipe is flowing half full, and the overall conduit length.

Conduit flow length: 380 LF (see attachment B)
Conduit flow velocity: 3.47 fps (see attachment A, part 1)
Conduit time of concentration: 1.83 minutes (see attachment A, part 1)

The total time of concentration is equal to the sum of the overland time of concentration and the conduit time of concentration, per equation 2 of the ACHHM.

Total time of concentration: 6.83 minutes.

Given that the existing synthetic turf has a lower permeability that what is typical or expected of a synthetic turf field, we have elected to add a factor of safety of 1.3 to the calculated time of concentration to account for the longer time that is needed for the water to permeate thru the synthetic turf profile and be collected within the storm drain line below the field.

Pre-Development time of concentration = 6.83 minutes x 1.3 FS = 8.88 minutes.

4.1.B. Rainfall intensity

The rainfall intensity is calculated for each of the design storm events (5-yr, 15-yr, and 25-yr) using equation 5 from the ACHHM. The rainfall intensity is based on time of concentration (discussed in section 4.1.A.), the mean annual precipitation for the site, the frequency factor (attachment 12 of the ACHHM), and the coefficient of variation (attachment 12 of the ACHHM).

Mean annual precipitation (MAP): 25
Frequency Factor (K_i):
- 5-year recurrence: 0.719
- 15-year recurrence: 1.684
- 25-year recurrence: 2.108

Coefficient of variation (CV): 0.404

See attachment A, part 4, for the calculations for rainfall intensity for each design storm:
- 5-year recurrence rainfall intensity: 2.53 in/hr
- 15-year recurrence rainfall intensity: 3.30 in/hr
- 25-year recurrence rainfall intensity: 3.63 in/hr

4.1.B. Runoff Coefficient

The runoff coefficient (C) is a dimensionless value that quantifies the portion of rainfall or precipitation that becomes surface runoff. It reflects the influence of various factors such as land use, soil type, surface cover, and topography on the rate of runoff generated during storm events. For the purposes of this study, the runoff coefficient has been calculated using equation 7 of the ACHHM. Per this formula, the runoff coefficient is dependent upon the land use and hydrologic soil group of the site, the slope of the site from attachment 10 of the ACHHM, and the rainfall intensity factor per equation 9 of the ACHHM.

The land use description that best applies to the project site is a large open school space. The existing soils at the site are silty clay soils per the geotechnical investigation, therefore the hydrologic soil group for the site is group D. Using Table 2 from the ACHHM, the basic runoff coefficient for the site (C) is determined to be 0.39. Note that neither the land use nor hydrologic soil group differ between various storm recurrence intervals or the pre-development vs. post-development conditions.

The slope of the site is used to calculate a ground slope adjustment factor (equation 8) to be added to the basic runoff coefficient. Per the ACHHM, the slope is to be selected based on the project location from the map in attachment 10 of the ACHHM. The site is located in an area of the map that indicates the slope value to be used as being between 2 and 5 percent. Although the track and field have surface slopes of less than one percent (1%), a design slope for this calculation was selected at 3 percent to fall within the range provided by attachment 10 of the ACHHM, and to be conservative in our calculations. Given a slope value of 3 and a basic runoff coefficient value of 0.39, the ground slope adjustment factor is calculated to be 0.492 (see attachment A, part 3). Again, these values will not differ between various storm recurrence intervals or the pre-development vs. post-development conditions.

Per equation 9 of the ACHHM, if the sum of the basic runoff coefficient and the ground slope adjustment factor is greater than or equal to 0.8, the rainfall intensity factor is zero.

Per equation 7 of the ACHHM, the project's runoff coefficient is the sum of the basic runoff coefficient, the ground slope adjustment factor, and the rainfall intensity factor, which equals 0.882 for the track and field site. This value applies to the 5-, 15-, and 25-year recurrence intervals for both the pre-development and post-development conditions.

4.1C. Flow Discharge Rate (Q)

Using the calculated rainfall intensities for the various storm events (5-, 15-, and 25-year recurrence intervals), the project's runoff coefficient, and the overall drainage area for the site, the max peak flow discharge rate can be calculated from equation 1 of the ACHHM.

The pre-development peak flows as calculated using the ACHHM's prescribed methodology for the design storms are as follows:

5-year recurrence: 7.57 cfs
15-year recurrence: 9.87 cfs
25-year recurrence: 10.86 cfs

4.2 Hydraulic Flow

The pre-development peak flows as determined by the ACHHM's rational method, discussed in section 4.1, exceed the capacity of the existing 12" diameter storm drain line that connects to the existing box culvert under the field. One of the design goals is not to exceed the existing flow rate out of the field into the existing box culvert, therefore we must determine what the maximum existing peak flow is into the box culvert from the 12" storm drain line. This is achieved by using manning's equation for maximum flow rate within a pipe (see calculation on attachment A, part 5)

The maximum flow rate within the existing 12" pipe is calculated as being 3.34 cfs. This will be the design control flow rate out of the field in the post development conditions.

5. Post-Project Condition:

The finish surface elements of the post-development project conditions are to be very similar to the existing conditions, with the same overall footprint. There are three key components that will impact the hydrology and hydraulics of the post-development project conditions. The first component is that 11,995 square feet of existing synthetic turf is proposed to be converted into an all-weather track surfaced (impermeable) area. The second component is that the synthetic turf field profile will be renovated with a new permeable base rock system below the surface of the playing field, thus allowing stormwater to infiltrate into the field base rock and travel laterally thru the permeable base rock layer, mimicking aquifer flow, to the low points of the field at the field edges, and be collected within the proposed drainage system. The third component is that the track and field's overall drainage system will be much more significant than the existing drainage system, with longer overall pipe runs at the field edges and more storage volume within the field subgrade drainage trenches.

5.1 Rational Method for Peak Flow

Using the Rational Method as prescribed within the ACHHM, the post-development peak flows for the existing track and field area were calculated for the 5-, 15-, and 25-year recurrence interval storms. The methodology for the calculations, the data obtained from the ACHHM's data tables and attachments, and the calculated results are summarized below.

5.1A. Time of Concentration

The change in drainage patterns between the pre-development and post-development conditions results in different times of concentration. For the post-development conditions, the longest flow path was determined to be overland flow from the synthetic turf ridge line at the center of the field to the drainage system at the edge of the field, plus the conduit /storm drain pipe's flow path within the field's storm drain system to the point of connection at the existing box culvert under the field. See attachment C for a post-development site map with the longest flow path identified.

Per the ACHHM, the overland time of concentration for developed watersheds is to be calculated using equation 4. Given that equation 4 assumes a gutter flow takes place, equation 3 was used in our calculations as it is more applicable to the site conditions.

The variables for the overland time of concentration formula are the overland flow time and the gutter flow time. The gutter flow time is not applicable to the project because the sheet flow is collected within conduits rather than flowing via gutter flow to a storm drain catchment point. The overland flow time is based on the initial time in from attachment 4 in the ACHHM. Per this attachment, the overland time of concentration for secondary facilities, which is the category that this site falls under, is 5 minutes.

The conduit flow time is calculated using Manning's equation to determine the flow velocity within the proposed 8" storm drain line with a slope of 0.5% (or 0.005), a roughness coefficient of 0.012 for HDPE pipes, and the assumption that the pipe is flowing half full, and the overall conduit length.

Conduit flow length: 437 LF (see attachment C)
Conduit flow velocity: 2.63 fps (see attachment A, part 6)
Conduit time of concentration: 2.77 minutes (see attachment A, part 6)

The total time of concentration is equal to the sum of the overland time of concentration and the conduit time of concentration, per equation 2 of the ACHHM.

Total time of concentration: 7.77 minutes.

5.1.B. Rainfall intensity

The rainfall intensity is calculated for each of the design storm events (5-yr, 15-yr, and 25-yr) using equation 5 from the ACHHM. The rainfall intensity is based on time of concentration (discussed in section 5.1.A.), the mean annual precipitation for the site, the frequency factor (attachment 12 of the ACHHM), and the coefficient of variation (attachment 12 of the ACHHM).

Mean annual precipitation (MAP): 25
Frequency Factor (K_i):
- 5-year recurrence: 0.719
- 15-year recurrence: 1.684
- 25-year recurrence: 2.108

Coefficient of variation (CV): 0.404

See attachment A, part 7, for the calculations for rainfall intensity for each design storm:

5-year recurrence rainfall intensity: 2.69 in/hr
15-year recurrence rainfall intensity: 3.51 in/hr
25-year recurrence rainfall intensity: 3.87 in/hr

5.1.B. Runoff Coefficient

The runoff coefficient (C) is a dimensionless value that quantifies the portion of rainfall or precipitation that becomes surface runoff. It reflects the influence of various factors such as land use, soil type, surface cover, and topography on the rate of runoff generated during storm events. For the purposes of this study, the runoff coefficient has been calculated using equation 7 of the ACHHM.

As discussed in section 4.1.B of this report, the runoff coefficient does not differ between pre- and post-development conditions per the ACHHM's methodology for calculating runoff coefficients. The runoff coefficient is equal to 0.882 for the site for the 5-, 15-, and 25-year recurrence interval storm events. See section 4.1.B and attachment A, part 7.

5.1C. Flow Discharge Rate (Q)

Using the calculated rainfall intensities for the various storm events (5-, 15-, and 25-year recurrence intervals), the runoff coefficient, and the overall drainage area for the site, the post-development peak flow discharge rates can be calculated from equation 1 of the ACHHM.

The post-development peak flows as calculated using the ACHHM's prescribed methodology for the design storms are as follows:

5-year recurrence: 8.04 cfs
15-year recurrence: 10.50 cfs
25-year recurrence: 11.57 cfs

6. Stormwater Management Strategy:

The proposed approach aims to ensure that peak flows during rainfall events do not exceed the existing pre-development peak flows into the City's box culvert, and to effectively store excess runoff within the site's stormwater infrastructure.

6.1 Post-Development Peak Flow Control:
The stormwater management strategy focuses on controlling peak flow rates for design storm events, specifically for the 5-, 15-, and 25-year recurrence interval storms with unmitigated post-development peak flow rates of 8.04, 10.50, and 11.57 cubic feet per second (cfs) respectively. The design goal is to maintain a controlled flow rate leaving the

site at the point of connection to the City's box culvert, ensuring it does not exceed the existing controlled flow rate of 3.34 cfs.

6.1A. Flow Control Mechanism:

To achieve the desired flow control, the size of the outlet pipe from the track and field drainage system is sized to act as a restricted flow device.

The proposed storm drain system outlets via one proposed storm drainage pipe into the existing storm drain manhole, that is designed to not exceed the pre-project net flow rate of 3.34 CFS in full pipe conditions. The proposed size and slope of this pipe is as follows:

- 8-inch CHDPE @ 0.5% slope

The maximum outlet discharge rate thru this pipe in full pipe flow conditions was calculated as 2.66 CFS when acting as an orifice with upgradient storage (see section 6.2A), effectively managing stormwater outflow below the pre-project condition (3.34 cfs).

This approach prevents the site from contributing excessive runoff into the City's box culvert and ensures that downstream systems are not overwhelmed.

6.2 Excess Runoff Management:

While the flow control mechanism ensures that the controlled flow rate does not exceed the allowed limit, the stormwater management strategy also addresses excess runoff that cannot be accommodated within the controlled flow. Instead of allowing this excess runoff to sheet flow offsite, as in the existing conditions, a more sustainable approach is adopted to store the excess runoff within the track and field limits.

6.2.A. Excess Runoff Storage Volume Required for Detention:

While the project site is less than 25 acres, the ACHHM dictates that a synthetic unit hydrograph method be utilized to determine peak discharge and associated runoff volume to be detained within the project site for the 25-year, 24 hour storm. Design runoff hydrographs were developed using the Autodesk Hydraflow Hydrograph extension for this project; process described below. Since this program does not readily contain a Snyder Unit Hydrograph, a Type 1A Unit Hydrograph was used for temporal storm distribution.

First, the precipitation data in the Event Manager for the model were input for the 6-hour and 24-hour duration storm depths for the 5, 10, and 25 year frequency. These depths were derived from NOAA Atlas 14 Point Precipitation Frequency Estimates (see Attachment D). For the purposes of this report, only the 25-year, 24-hour storm outputs (most conservative) are provided.

Then, pre and post-construction hydrographs were created (see Attachment E for Hydrographs No. 3 pre-construction and No. 1 post-construction). Input data is shown at the top of the hydrographs in the attachment. Important notes for these hydrograph inputs:

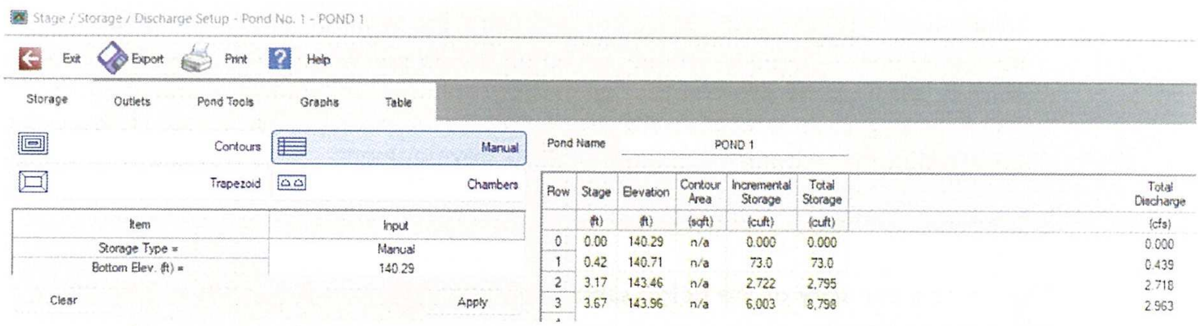
- Time of concentration for both pre and post scenarios were manually input and derived from Tc calculations shown previously in this report
- The curve number (CN) for the pre-construction hydrograph assumes a CN of 80 for the field area – this condition assumes a natural grass condition, predating the prior conversion of the field to synthetic turf, but allows for modeling of the increased runoff that likely occurred when the field was originally converted.
- Post-construction CN for the synthetic field area assumes a value of 90. Pre and post-construction CN for the track area is consistent at 95 for both conditions.

Peak discharge from the pre-construction hydrograph is stated at 2.918 CFS. This value becomes the target peak discharge rate for the post-construction hydrograph routed through the onsite detention facility.

Next, the detention facility for the site is modeled as "Pond-1". The detention facility for this project is primarily the subsurface drainage system beneath the field and its corresponding void space in underground piping and permeable rock trenches. A discussion regarding the storage capacity of this system is included in section 6.2B, below, and detailed calculations for the storage are included in Attachment A, Part 8, of this report. The pond storage data was manually input in the model (see screenshot of model below). The base elevation at stage 0.00 ft represents the site elevation at the junction of two (2) 8" storm drain pipes that combine before the final discharge outlet pipe/culvert into the existing City system. The location of this junction is shown in Attachment C. There is some storage capacity within those 8" pipes before they outlet at elevation 140.29, or Stage 0.00 for the detention facility. The next stage of the detention facility represents the bottom of the subsurface drainage trenches at the east and west edges of the synthetic turf field. These trenches are an average of 2.75' in height, which is represented in the incremental storage stage height between rows 1 and 2. The corresponding cubic feet of incremental storage which was input for that stage is derived from the Attachment A, Part 8 calculations in this report.

The upper/final storage stage is represented by the 6" permeable rock base portion of the field that contributes to the subsurface overall storage volume as described in the Attachment A, Part 8 calculations. The incremental storage for this 6" section (6,003 cft) was input into the model to produce the total storage of 8,798 cft.

POND 1 STORAGE INPUT TABLE SCREENSHOT – HYDRAFLOW MODEL

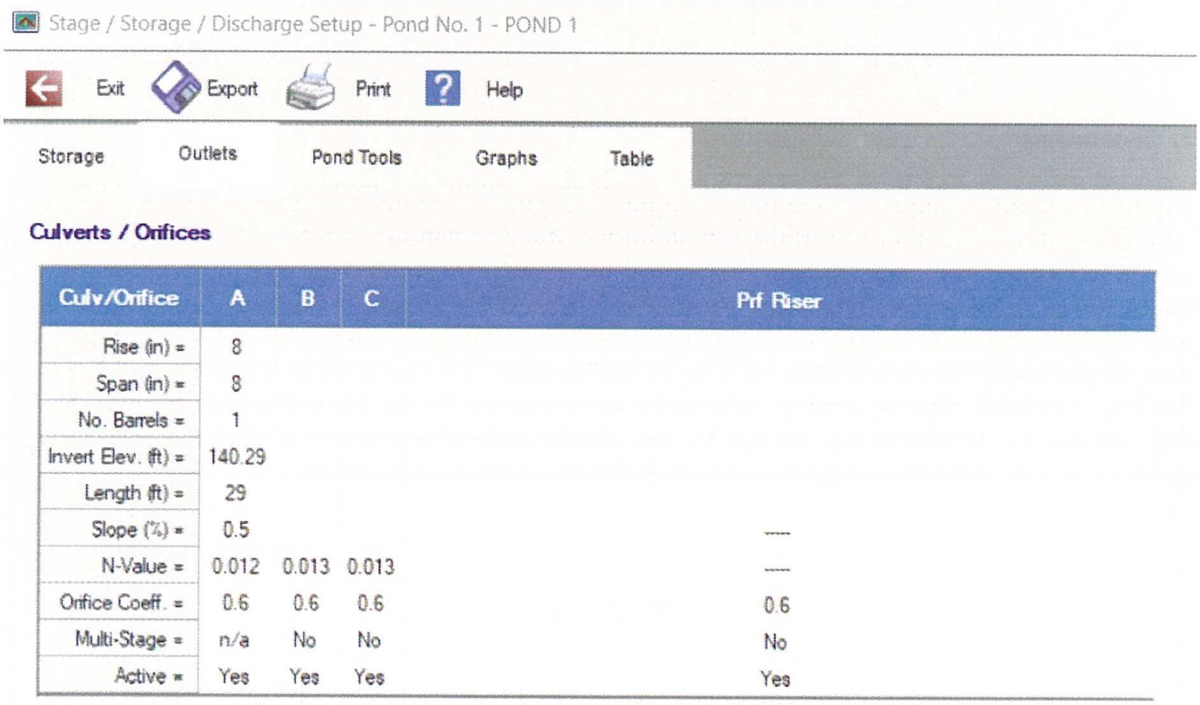


Item	Input
Storage Type =	Manual
Bottom Elev. (ft) =	140.29

Row	Stage (ft)	Elevation (ft)	Contour Area (sqft)	Incremental Storage (cuft)	Total Storage (cuft)	Total Discharge (cfs)
0	0.00	140.29	n/a	0.000	0.000	0.000
1	0.42	140.71	n/a	73.0	73.0	0.439
2	3.17	143.46	n/a	2,722	2,795	2.718
3	3.67	143.96	n/a	6,003	8,798	2.963

The subsurface detention facility for the track and field combine into a junction box and exit to the box culvert beneath the field using an 8" pipe from both sideline collector trenches. This overall 8" pipe length was input into the model as the Pond-1 outlet, shown as a culvert/orifice (see location in Attachment C).

POND 1 OUTLET INPUT TABLE SCREENSHOT – HYDRAFLOW MODEL



Culv/Orifice	A	B	C	Prf Riser
Rise (in) =	8			
Span (in) =	8			
No. Barrels =	1			
Invert Elev. (ft) =	140.29			
Length (ft) =	29			
Slope (%) =	0.5			-----
N-Value =	0.012	0.013	0.013	-----
Orifice Coeff. =	0.6	0.6	0.6	0.6
Multi-Stage =	n/a	No	No	No
Active =	Yes	Yes	Yes	Yes

The Pond output graphs for stage storage and stage discharge are shown in Attachment F.

Finally, the post construction Hydrograph (No. 1) was then routed through the detention facility, Pond-1. The hydrograph output for this simulation is shown in Attachment G (Hydrograph No. 2). In summary, the resultant of this model shows the site allows a peak discharge of 2.662 cfs when routed through the detention facility, which is less than the pre-construction hydrograph peak discharge. In this 25-year, 24 hour scenario, a total of 2,690 cft of storage was used, which is well beneath the maximum 8, 798 cft provided in the project development.

6.2.B Storage Capacity Calculation:

The storage capacity of the field's subbase drainage system is comprised of storage within the perforated drain lines, storage within the void space volume of the perforated drain line rock trenches, storage within the solid storm drain lines, and finally, storage within the permeable base rock profile. See storage calculations in attachment A, part 8).

The total storage capacity that can take place within the track and field limits, prior to allowing sheet flow to discharge off of the site, is 8,725 cubic feet (see calculations in Attachment A). This storage capacity is greater than the storage volume required for the peak runoff event from a 25-year recurrence storm event.

7. Conclusion:

The Piedmont High School Track and Field Reconstruction Project includes a stormwater management strategy to address the historical drainage challenges. The proposed storm drainage system, including appropriately sized pipes and stormwater storage underneath the synthetic turf field, ensures that stormwater inflow rates are managed effectively and do not exceed pre-project conditions, while also sufficiently managing excess runoff volume. This project design approach aims to enhance the overall functionality and resilience of the track and field facility, while also ensuring proper stormwater management. By storing excess runoff within the site's stormwater infrastructure, the project contributes to flood prevention and results in an overall design that will not have a negative impact to the neighboring properties.

End of Report

PIEDMONT HS - STORMWATER MANAGEMENT REPORT

-ATTACHMENT A-

HYDROLOGY AND HYDRAULIC CALCULATIONS

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PART 1 - PRE-DEVELOPMENT TIME OF CONCENTRATION

APPLICABLE EQUATIONS FROM ALAMEDA COUNTY HYDROLOGY AND HYDRAULICS MANUAL

EQUATION 2 TIME OF CONCENTRATION

$$T_c = t_o + t_{cond} \tag{2}$$

where:

T_c = *time of concentration (min)*
t_o = *initial and/or overland time of concentration (min, from **Equation 3** or **4**)*
t_{cond} = *conduit time (min)*

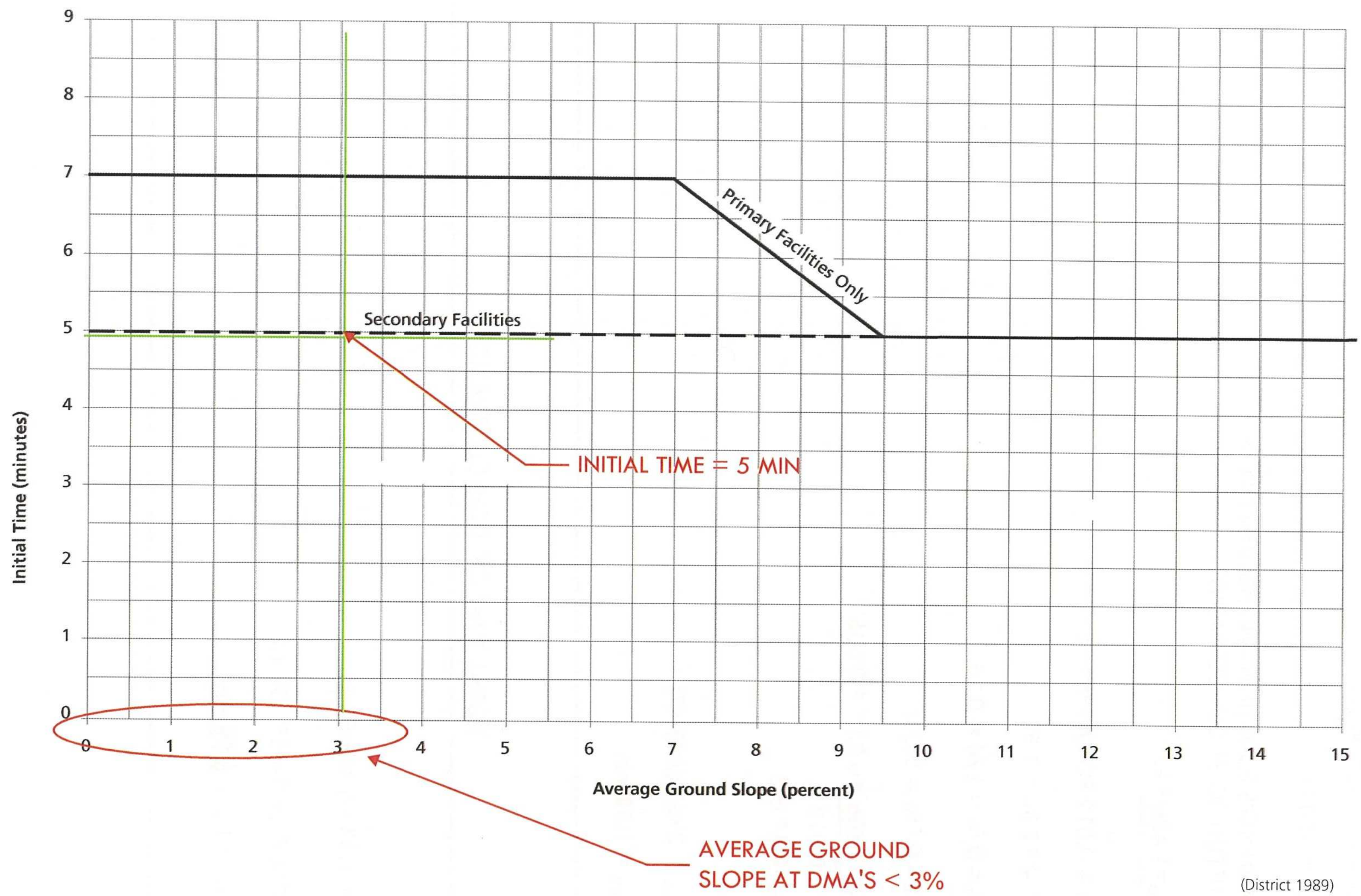
EQUATION 4 OVERLAND TIME OF CONCENTRATION — DEVELOPED WATERSHEDS

$$t_o = t_i + \frac{L_g}{60V_g} \tag{4}$$

where:

t_o = *initial and/or overland time of concentration (min)*
t_i = *initial time (min from **Attachment 4**)*
L_g = *gutter flow length (ft)*
V_g = *gutter flow velocity (ft/sec from **Attachment 5**)*

INITIAL TIME OF CONCENTRATION SELECTION FROM ALAMEDA COUNTY HYDROLOGY AND HYDRAULICS MANUAL - ATTACHMENT 4



(District 1989)

Flood Control & Water Conservation DISTRICT	Alameda County Hydrology & Hydraulics Manual 2016 Initial Time	Attachment 4

CONDUIT TIME OF CONCENTRATION

CONDUIT TIME

$t_{COND} = L_{COND}/(60*V_{COND})$

$L_{COND} = 380$ FT

V_{COND} - USE MANNING'S EQUATION AND ASSUME PIPE IS FLOWING HALF FULL TO BE CONSERVATIVE

$$V_{COND} = \frac{1.486}{n} * R_h^{2/3} * S^{1/2}$$

n = 0.012 FOR HDPE PIPE

D = 12 in. = 1 FT

$R_h = D/4 = 1/4 = 0.25$

S = 0.5% = 0.005

$$V_{COND} = \frac{1.486}{0.012} * 0.25^{2/3} * 0.005^{1/2}$$

$V_{COND} = 3.47$ FPS

CONDUIT TIME

$t_{COND} = 380/(60*3.47)$

$t_{COND} = 1.83$ min

TOTAL TIME OF CONCENTRATION

$T_C = t_0 + t_{cond}$

$T_C = 5$ min + 1.83 min = 6.83 min

ADDED FACTOR OF SAFETY OF 1.3

$T_C = 6.83$ min * 1.3 = <u>8.88 min</u>

PART 3 - DISTRICT'S RUNOFF COEFFICIENT

APPLICABLE EQUATIONS FROM ALAMEDA COUNTY HYDROLOGY AND HYDRAULICS MANUAL

EQUATION 7 DISTRICT'S RUNOFF COEFFICIENT

$$C' = C + C_s + C_i \tag{7}$$

where:

C' = *District's runoff coefficient*
C = *basic runoff coefficient (from **Table 2**)*
C_s = *ground slope adjustment factor (from **Equation 8**)*
C_i = *rainfall intensity factor (from **Equation 9**)*

EQUATION 8 GROUND SLOPE ADJUSTMENT FACTOR

$$C_s = \frac{(0.8 - C)[ln(S-1)]S^{0.5}}{56} \tag{8}$$

$$C_s = 0 \text{ for } C \geq 0.8$$

where:

C_s = *ground slope adjustment factor*
C = *basic runoff coefficient*
S = *slope (percent from **Attachment 10**)*

EQUATION 9 RAINFALL INTENSITY FACTOR

$$C_i = \left(0.8 - (C + C_s)\right)\left(1 - \frac{1}{\frac{1}{e^i} + ln(i+1)}\right) \tag{9}$$

$$C_i = 0 \text{ for } C + C_s \geq 0.8$$

where:

C_i = *rainfall intensity factor*
C = *basic runoff coefficient*
C_s = *ground slope adjustment factor*
i = *rainfall intensity (inches / hr from **Equation 5** or **Attachment 7**)*

BASIC RUNOFF COEFFICIENT SELECTION FROM ALAMEDA COUNTY HYDROLOGY AND HYDRAULICS MANUAL - TABLE 2

TABLE 2 BASIC RUNOFF COEFFICIENTS FOR PARTICULAR LAND USE AND SOIL TYPE

Land Use Description	Hydrologic Soil Group			
	A	B	C	D
Undeveloped land, parks, and golf courses	0.10	0.15	0.20	0.25
Rural Residential (larger than 1 ac lot)	0.13	0.18	0.23	0.28
Residential 10,000 - 1 ac lot	0.20	0.25	0.30	0.35
Residential 1/4 ac (8,000 - 10,000 sf lot)	0.25	0.30	0.35	0.40
Residential 1/8 ac (5,000 - 8,000 sf lot)	0.27	0.32	0.37	0.42
Residential (3600 - 5000 sf lot)	0.28	0.33	0.38	0.43
Residential (2700 - 3600 sf lot)	0.29	0.34	0.39	0.44
Zero Lot Line Residential & Less than 2700 sf	0.34	0.39	0.44	0.49
Townhouse	0.44	0.49	0.54	0.59
Condominium	0.51	0.56	0.61	0.66
Industrials	0.58	0.63	0.68	0.73
Apartment	0.65	0.70	0.75	0.80
Commercial	0.69	0.74	0.79	0.84
Freeway*	0.72	0.77	0.82	0.87
Mobile Home Park*	0.34	0.39	0.44	0.49
School (large open space)	0.24	0.29	0.34	0.39
School (small open space)	0.44	0.49	0.54	0.59

* For freeways, use aerial imagery to estimate percent impervious area.
** For mobile home parks, a minimum of 50% of the NCIA roof area should be counted as DCIA; for example, DCIA = 17+(37/2) = 35.5

C = 0.39

GROUND SLOPE ADJUSTMENT FACTOR

$C_s = (0.8 - C)[\ln(S-1)]S^{0.5}$

S = 3% from Alameda County Hydrology and Hydraulics Manual attachment 10

$C_s = (0.8 - 0.39)[\ln(3-1)]3^{0.5}$

$C_s = 0.492$

RAINFALL INTENSITY FACTOR

$C + C_s = 0.882$; $C_i = 0$

DISTRICT'S RUNOFF COEFFICIENT

$C' = C + C_s + C_i$

$C' = 0.39 + 0.492 + 0$

$\underline{C' = 0.882}$

APPLICABLE EQUATIONS FROM ALAMEDA COUNTY HYDROLOGY AND HYDRAULICS MANUAL

EQUATION 1 DISTRICT'S RATIONAL FORMULA

$$Q = C'iA \qquad (1)$$

where:

Q = *discharge (cfs)*
C' = *District's runoff coefficient (from **Equation 7)***
i = *rainfall intensity (inches/hr from **Equation 5)***
A = *drainage area (acres)*

EQUATION 5 RAINFALL INTENSITY

$$i_{ij} = \frac{D_{ij}}{t_d} \qquad (5)$$

where:

i_{ij} = *rainfall intensity (inches/hr) for recurrence interval j and storm duration i*
D_{ij} = *design rainfall depth (inches) for recurrence interval j and storm duration i (from **Equation 6)***
t_d = *storm duration (hr) = $T_c/60$*
T_c = *time of concentration (min)*

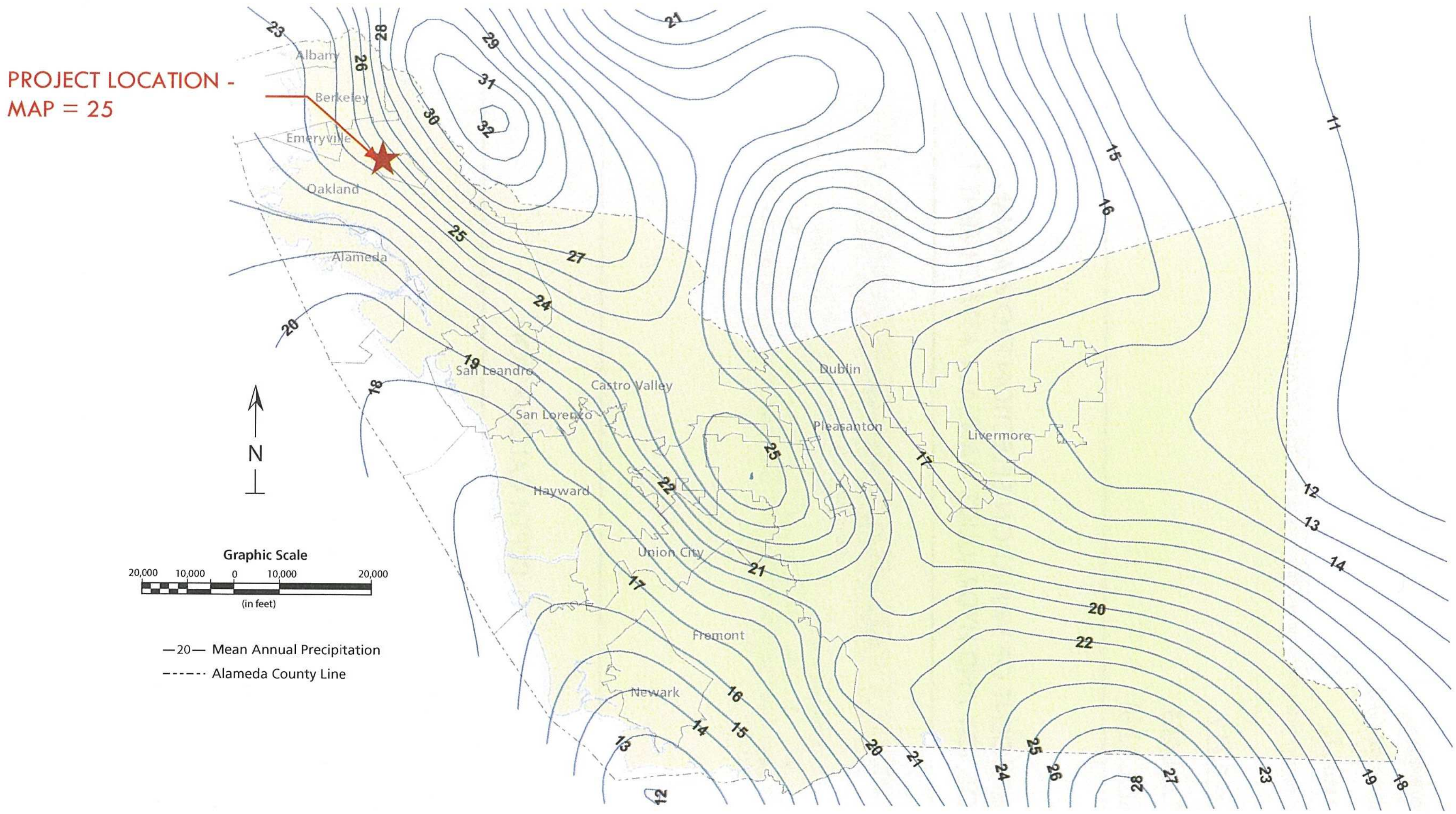
EQUATION 6 RAINFALL DEPTH

$$D_{ij} = (0.32665 + 0.091144\overline{P})(1 + K_j CV)t_i^{0.43287} \qquad (6)$$

where:

D_{ij} = *design rainfall depth (inches) for recurrence interval j and storm duration i*
$\overline{P}$ = *mean annual precipitation (inches)*
K_j = *frequency factor for recurrence interval j (from **Table 1** for storm durations up to 24 hours or **Attachment 12** for storm durations greater than 24 hours)*
CV = *coefficient of variation (from **Attachment 12)***
t_i = *consecutive time (days)*

MEAN ANNUAL PRECIPITATION SELECTION FROM ALAMEDA COUNTY HYDROLOGY AND HYDRAULICS MANUAL - ATTACHMENT 6



Attachment 6 available for download as a GIS file from the Alameda County Flood Control District website.

(District 2011)

Flood Control & Water Conservation District	Alameda County Hydrology & Hydraulics Manual 2016 Mean Annual Precipitation	Attachment 6

FREQUENCY FACTOR SELECTION FROM ALAMEDA COUNTY HYDROLOGY AND HYDRAULICS MANUAL - TABLE 2

TABLE 1 FREQUENCY FACTORS FOR SELECT RECURRENCE INTERVALS*

Recurrence interval *(yrs)*	2	5	10	15	25	100	200	500	1000
Frequency Factor, K_j	-0.210	0.719	1.339	1.684	2.108	3.211	3.745	4.417	4.955

*Table 1 presents frequency factors (K_j) for storm durations (t_d) up to 24 hours. See *Attachment 12* for storm durations greater than 24 hours.

K_j (5-YR RECURRENCE) = 0.719

K_j (15-YR RECURRENCE) = 1.684

K_j (25-YR RECURRENCE) = 2.108

REGIONAL COEFFICIENT OF VARIATION SELECTION FROM ALAMEDA COUNTY HYDROLOGY AND HYDRAULICS MANUAL - ATTACHMENT 12

Regional Coefficient of Variation, *CV*

Storm Duration (t_d)

Consecutive Minutes				Consecutive Hours						Consecutive Days											
5	10	15	30	1	2	3	6	12	24	2	3	4	5	6	8	10	15	20	30	60	365
0.404	0.404	0.404	0.404	0.404	0.404	0.404	0.404	0.404	0.404	0.431	0.426	0.424	0.141	4.414	0.404	0.398	0.395	0.390	0.386	0.385	0.336

CV = 0.404

RAINFALL DEPTH CALCULATION

$$D_{ij} = (0.32665 + 0.091144\overline{P})(1 + K_j CV)t_i^{0.43287}$$

t_i = 8.88 min * 1 day/ 1440 min = .0062 days

D_{ij} = (0.32665 + 0.091144*25)*(1+K_j*.404)*.0062$^{.43287}$

D_{ij} (5-YR RECURRENCE) = 0.372 in

D_{ij} (15-YR RECURRENCE) = 0.485 in

D_{ij} (25-YR RECURRENCE) = 0.534 in

RAINFALL INTENSITY CALCULATION

$$i_{ij} = \frac{D_{ij}}{t_d}$$

t_d = 8.88 min * 1 hr/ 60 min = .147 hrs

i_{ij} (5-YR RECURRENCE) = 2.53 in/hr

i_{ij} (15-YR RECURRENCE) = 3.30 in/hr

i_{ij} (25-YR RECURRENCE) = 3.63 in/hr

DISTRICT'S RATIONAL METHOD CALCULATION FOR PEAK FLOW

Q = C' * i * A

C' = 0.882

A = 147719 SF * 1 acre/ 43560 SF

A = 3.391 acres

5-YR RECURRENCE: i_{ij} = 2.53 in/hr

Q = 0.882 * 2.53 * 3.391

Q = 7.57 cfs

15-YR RECURRENCE: i_{ij} = 3.30 in/hr

Q = 0.882 * 3.30 * 3.391

Q = 9.87 cfs

25-YR RECURRENCE: i_{ij} = 3.63 in/hr

Q = 0.882 * 3.63 * 3.391

Q = 10.86 cfs

PART 5 - PRE-DEVELOPMENT PEAK FLOW RATES (HYDRAULICS)

MANNING'S EQUATION FOR FLOW RATE (Q) WITHIN A PIPE

$$Q_p = \frac{1.486}{n} * R_h^{2/3} * S^{1/2} * A$$

n= 0.012 FOR HDPE PIPE

D = 12 in. = 1 FT

R_h= D/4 = 1/4 = 0.25

S= 0.5% = 0.005

A= pi*$(D/2)^2$

A= 0.785

$$Q_p = \frac{1.486}{0.012} * 0.25^{2/3} * 0.005^{1/2} * 0.785$$

Q_p=3.34 cfs

PART 6 - POST-DEVELOPMENT TIME OF CONCENTRATION

APPLICABLE EQUATIONS FROM ALAMEDA COUNTY HYDROLOGY AND HYDRAULICS MANUAL

EQUATION 2 TIME OF CONCENTRATION

$$T_c = t_o + t_{cond} \tag{2}$$

where:

T_c = *time of concentration (min)*

t_o = *initial and/or overland time of concentration (min, from* ***Equation 3*** *or* ***4****)*

t_{cond} = *conduit time (min)*

EQUATION 4 OVERLAND TIME OF CONCENTRATION — DEVELOPED WATERSHEDS

$$t_o = t_i + \frac{L_g}{60V_g} \tag{4}$$

where:

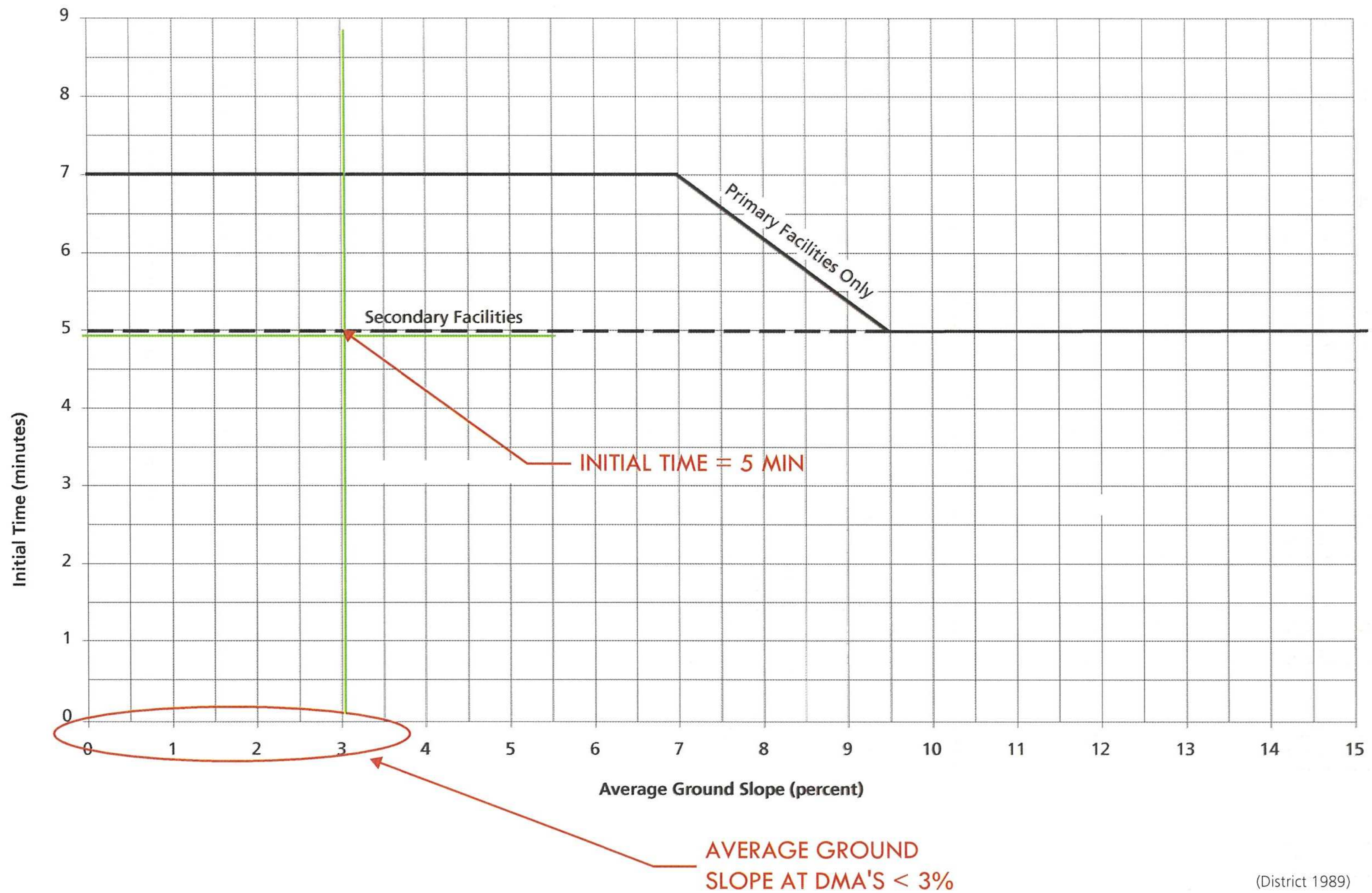
t_o = *initial and/or overland time of concentration (min)*

t_i = *initial time (min from* ***Attachment 4****)*

L_g = *gutter flow length (ft)*

V_g = *gutter flow velocity (ft/sec from* ***Attachment 5****)*

INITIAL TIME OF CONCENTRATION SELECTION FROM ALAMEDA COUNTY HYDROLOGY AND HYDRAULICS MANUAL - ATTACHMENT 4



(District 1989)

Flood Control & Water Conservation DISTRICT	Alameda County Hydrology & Hydraulics Manual 2016 Initial Time	Attachment 4

CONDUIT TIME OF CONCENTRATION

CONDUIT TIME

$t_{COND} = L_{COND}/(60*V_{COND})$

$L_{COND} = 437$ FT

V_{COND} - USE MANNING'S EQUATION AND ASSUME PIPE IS FLOWING HALF FULL TO BE CONSERVATIVE

$$V_{COND} = \frac{1.486}{n} * R_h^{2/3} * S^{1/2}$$

n = 0.012 FOR HDPE PIPE

D = 8 in. = .66 FT

$R_h = D/4 = .66/4 = 0.165$

S= 0.5% = 0.005

$$V_{COND} = \frac{1.486}{0.012} * 0.165^{2/3} * 0.005^{1/2}$$

$V_{COND} = 2.63$ FPS

CONDUIT TIME

$t_{COND} = 437/(60*2.63)$

$t_{COND} = 2.77$ min

TOTAL TIME OF CONCENTRATION

$T_C = t_0 + t_{cond}$

$T_C = 5\text{ min} + 2.77\text{ min} = 7.77\text{ min}$

APPLICABLE EQUATIONS FROM ALAMEDA COUNTY HYDROLOGY AND HYDRAULICS MANUAL

EQUATION 1 DISTRICT'S RATIONAL FORMULA

$$Q = C'iA \qquad (1)$$

where:

Q = *discharge (cfs)*
C' = *District's runoff coefficient (from **Equation 7**)*
i = *rainfall intensity (inches/hr from **Equation 5**)*
A = *drainage area (acres)*

EQUATION 5 RAINFALL INTENSITY

$$i_{ij} = \frac{D_{ij}}{t_d} \qquad (5)$$

where:

i_{ij} = *rainfall intensity (inches/hr) for recurrence interval j and storm duration i*
D_{ij} = *design rainfall depth (inches) for recurrence interval j and storm duration i (from **Equation 6**)*
t_d = *storm duration (hr)* $= T_c/60$
T_c = *time of concentration (min)*

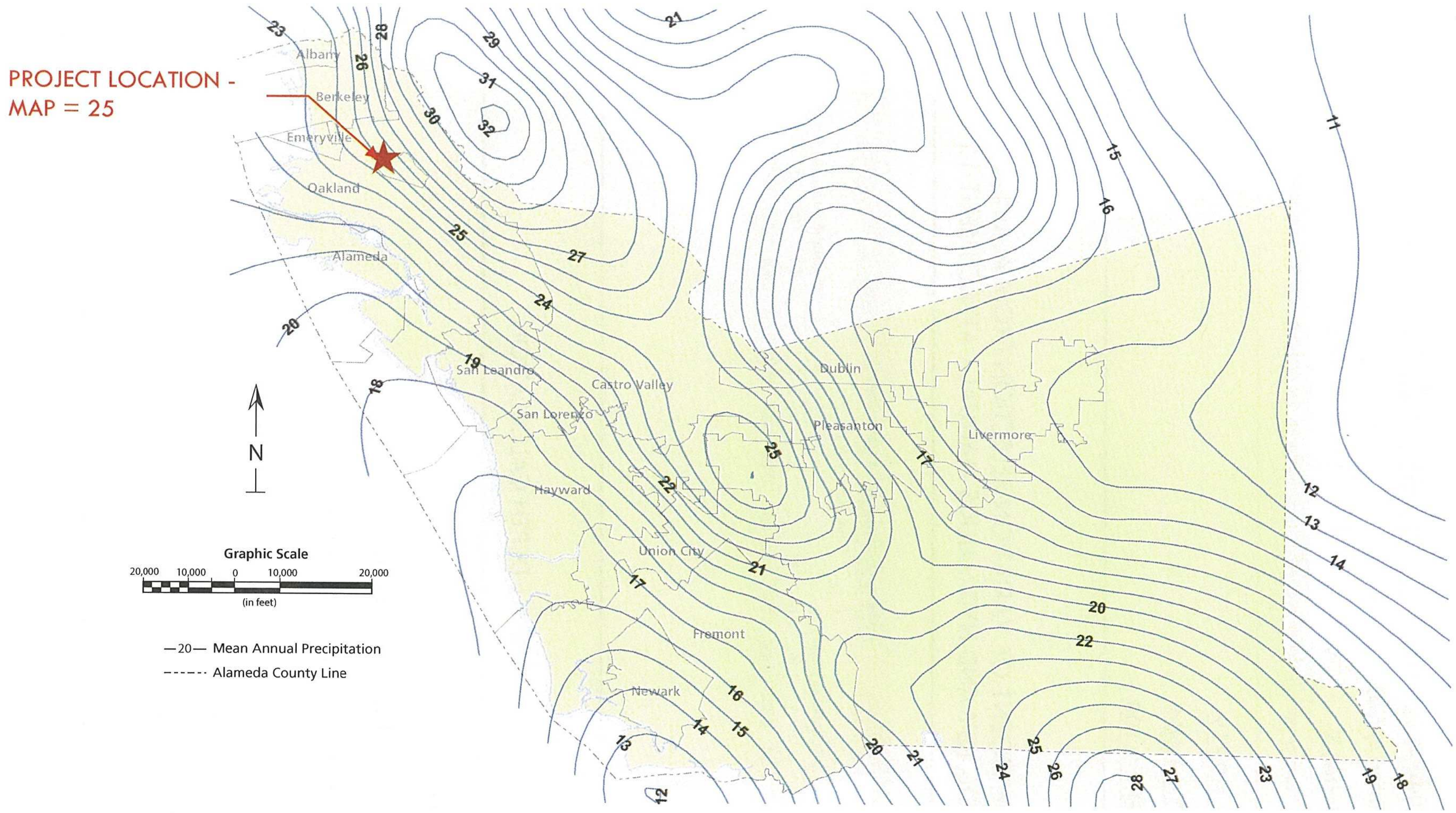
EQUATION 6 RAINFALL DEPTH

$$D_{ij} = (0.32665 + 0.091144\overline{P})(1 + K_j CV)t_i^{0.43287} \qquad (6)$$

where:

D_{ij} = *design rainfall depth (inches) for recurrence interval j and storm duration i*
$\overline{P}$ = *mean annual precipitation (inches)*
K_j = *frequency factor for recurrence interval j (from **Table 1** for storm durations up to 24 hours or **Attachment 12** for storm durations greater than 24 hours)*
CV = *coefficient of variation (from **Attachment 12**)*
t_i = *consecutive time (days)*

MEAN ANNUAL PRECIPITATION SELECTION FROM ALAMEDA COUNTY HYDROLOGY AND HYDRAULICS MANUAL - ATTACHMENT 6



Attachment 6 available for download as a GIS file from the Alameda County Flood Control District website.

(District 2011)

Flood Control & Water Conservation District	Alameda County Hydrology & Hydraulics Manual 2016 Mean Annual Precipitation	Attachment 6

FREQUENCY FACTOR SELECTION FROM ALAMEDA COUNTY HYDROLOGY AND HYDRAULICS MANUAL - TABLE 2

TABLE 1 FREQUENCY FACTORS FOR SELECT RECURRENCE INTERVALS*

Recurrence interval *(yrs)*	2	5	10	15	25	100	200	500	1000
Frequency Factor, K_j	-0.210	0.719	1.339	1.684	2.108	3.211	3.745	4.417	4.955

*Table 1 presents frequency factors (K_j) for storm durations (t_d) up to 24 hours. See *Attachment 12* for storm durations greater than 24 hours.

K_i (5-YR RECURRENCE) = 0.719

K_i (15-YR RECURRENCE) = 1.684

K_i (25-YR RECURRENCE) = 2.108

REGIONAL COEFFICIENT OF VARIATION SELECTION FROM ALAMEDA COUNTY HYDROLOGY AND HYDRAULICS MANUAL - ATTACHMENT 12

Regional Coefficient of Variation, CV

Storm Duration (t_d)

Consecutive Minutes				Consecutive Hours						Consecutive Days											
5	10	15	30	1	2	3	6	12	24	2	3	4	5	6	8	10	15	20	30	60	365
0.404	0.404	0.404	0.404	0.404	0.404	0.404	0.404	0.404	0.404	0.431	0.426	0.424	0.141	4.414	0.404	0.398	0.395	0.390	0.386	0.385	0.336

CV = 0.404

RAINFALL DEPTH CALCULATION

$$D_{ij} = (0.32665 + 0.091144\overline{P})(1 + K_j CV) t_i^{0.43287}$$

t_i = 7.77 min * 1 day/ 1440 min = .00539 days

D_{ij} = (0.32665 + 0.091144*25)*(1+K_i*.404)*$.0062^{.43287}$

D_{ij} (5-YR RECURRENCE) = 0.350 in

D_{ij} (15-YR RECURRENCE) = 0.456 in

D_{ij} (25-YR RECURRENCE) = 0.503 in

RAINFALL INTENSITY CALCULATION

$$i_{I} = \frac{D_{I}}{t_d}$$

t_d = 7.77 min * 1 hr/ 60 min = .130 hrs

i_{I} (5-YR RECURRENCE) = 2.69 in/hr

i_{I} (15-YR RECURRENCE) = 3.51 in/hr

i_{I} (25-YR RECURRENCE) = 3.87 in/hr

DISTRICT'S RATIONAL METHOD CALCULATION FOR PEAK FLOW

Q = C' * i * A

C' = 0.882

A = 147719 SF * 1 acre/ 43560 SF

A = 3.391 acres

5-YR RECURRENCE: i_{I} = 2.69 in/hr

Q = 0.882 * 2.69 * 3.391

Q = 8.04 cfs

15-YR RECURRENCE: i_{I} = 3.51 in/hr

Q = 0.882 * 3.51 * 3.391

Q = 10.50 cfs

25-YR RECURRENCE: i_{I} = 3.87 in/hr

Q = 0.882 * 3.87 * 3.391

Q = 11.57 cfs

PART 8 - PROPOSED STORAGE CAPACITY CALCULATIONS

ASSUMPTIONS: - POROSITY / VOID RATIO IN PERMEABLE FIELD ROCK IS MIN 25%
- POROSITY / VOID RATIO IN SUDRAIN TRENCH DRAIN ROCK IS 35%

(ABOVE ASSUMPTIONS BASED ON PROJECT TEST DATA)

THE SOLID WALL STORM DRIANAGE PIPING IN THE RENOVATED FIELD HOLDS ROUGHLY 232 CUBIC FEET OF STORMWATER, WHICH IS A RELATIVELY SMALL STORAGE VOLUME, SO IT IS NOT FACTORED INTO THE STORAGE CALCULATIONS.

THERE ARE TWO SUBSURFACE SUBDRAIN TRENCHES, ONE ALONG EACH SIDELINE (EAST AND WEST). EACH TRENCH IS A MINIMUM OF THREE FEET WIDE, AND HAS AN EIGHT INCH (8") PERFORATED HDPE PIPE IN THE DRAINAGE TRENCH, TO COLLECT STORMWATER. THE 8" PIPE HAS A VOLUME OF 0.342 CUBIC FEET (CF) PER LINEAL FOOT.

THE EASTERN TRENCH HAS AN AVERAGE TRENCH DEPTH OF 2.75 FEET, AND IS 523 LINEAL FEET IN LENGTH.

THE WESTERN TRENSH HAS AN AVERAGE DEPTH OF 2.55 FEET, AND IS 378 LINEAL FEET IN LENGTH.

THE MINIMUM STORMWATER STORAGE VOLUME IN EACH TRENCH IS CALCULATED WITH THE FOLLOWING FOLMUL: TRENCH WIDTH (3 FT MIN.) BY TRENCH DEPTH (2.75 FT OR 2.55 FT) LESS THE PIPE DIAMETER (0.342 SF) TIMES THE DRAIN ROCK VOID RATIO (0.35), AND THEN MULTIPLIED BY THE TRENCH LENGTH (523 OR 378 LF).

<u>EASTERN SUBDRAINAGE TRENCH</u>

(2.75) * (3.0) - 0.342 = 7.91 CF ROCK PER LF OF TRENCH
7.91 * 0.35 = 2.77 CF STORMWATER STORAGE PER LF OF TRENCH
2.77 CF (ROCK) + 0.342 CF (PIPE) PER LF OF TRENCH = 3.11 CF OF STORMWATER STORAGE PER LF OF TRENCH

3.11 * 523 = <u>1,626 CF STORMWATER STOAGE IN EASTERN SUBDRAINAGE TRENCH</u>

<u>WESTERN SUBDRAINAGE TRENCH</u>

(2.55) * (3.0) - 0.342 = 7.31 CF ROCK PER LF OF TRENCH
7.31 * 0.35 = 2.558 CF STORMWATER STORAGE PER LF OF TRENCH
2.558 CF (ROCK) + 0.342 CF (PIPE) PER LF OF TRENCH = 2.9 CF OF STORMWATER STORAGE PER LF OF TRENCH

2.9 * 378 = <u>1,096 CF STORMWATER STORAGE IN WESTERN SUBDRAINAGE TRENCH</u>

FOR SYNTHETIC TURF FIELD PERMEABLE BASE

SYNTHETIC TURF FIELD AREA IS 84,950 SF

SUBTRACT AREA OF FIELD ALREADY TAKEN INTO ACCOUNT WITH THE SUBDRAINAGE TRENCHES, WHICH IS 2,703 SF

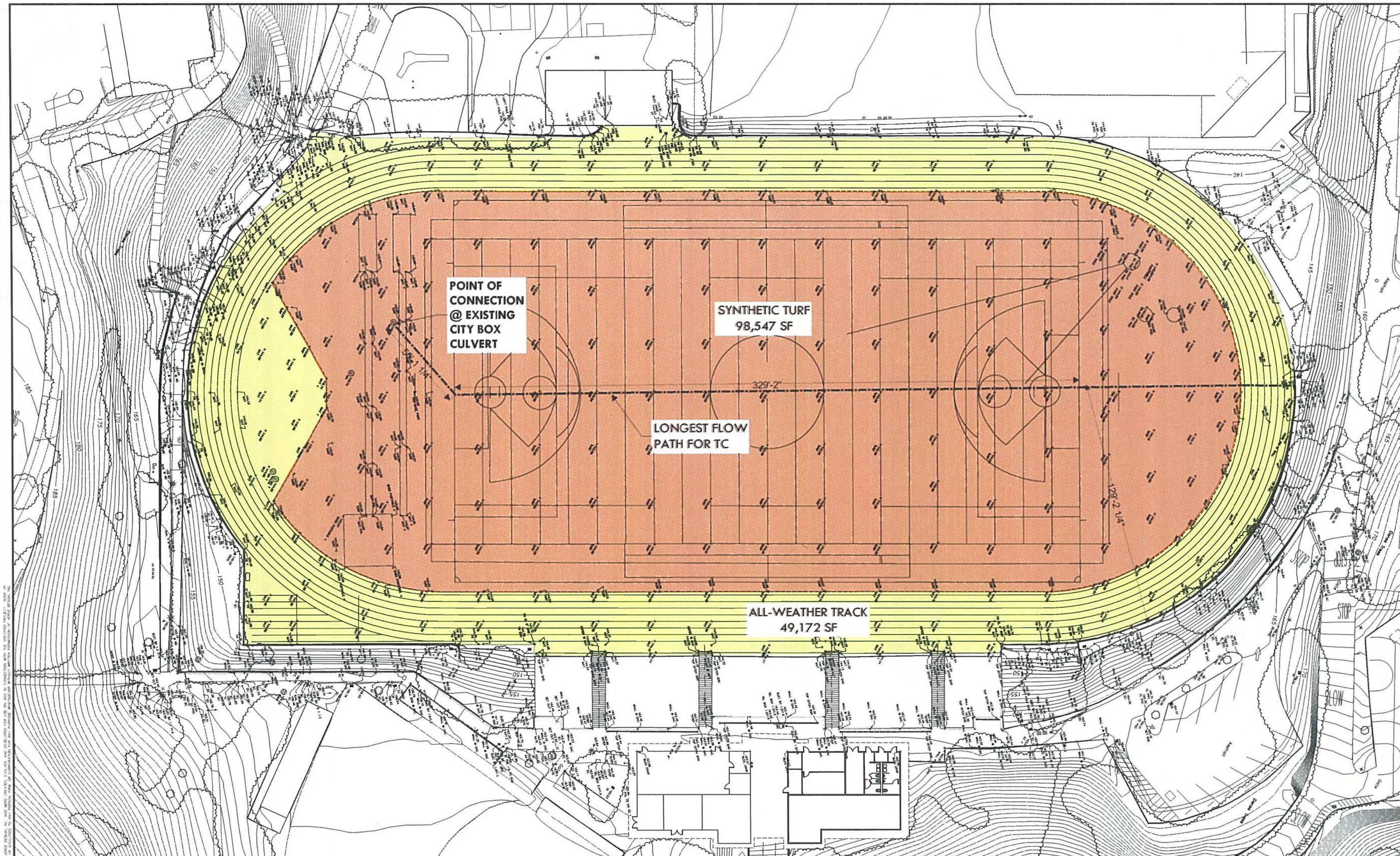
84,950 - 2,703 = 82,247 SF

SUBTRACT AREA OF FIELD ALONG THE CROWN OF THE FIELD WHERE THE FIELD ROCK STORAGE CANNOT BE CONSIDERED DETENTION VOLUME DUE TO ROP OF ROCK ELEVATION BEING HIGHER THAN TRACK ELEVATION: 380 LF X ROUGHLY 90 FT WIDTH = 34,200 SF

82,247 - 34,200 - 48,027 SF

48,027 SF * 0.5 FT (6" THICK LAYER OF NEW PERMEABLE FIELD ROCK) * 0.25 (VOID RATIO OF PERMEABLE FIELD ROCK) = 6,003 CF STORMWATER STORAGE IN PERMEABLE ROCK FIELD BASE

TOTAL MINIMUM STORMWATER STORAGE IN SUBSURFACE FIELD ROCK IS 1,096 CF + 1,626 CF + 6003 CF = 8,725 CF



PIEDMONT HS - STORMWATER MANAGEMENT REPORT

ATTACHMENT B

PRE-DEVELOPMENT CONDITIONS

AERIAL SURVEY INFORMATION:

AERIAL TOPOGRAPHY SHOWN UPON THIS MAP WAS PREPARED USING COMPUTER ASSISTED, PHOTOGRAMMETRIC METHODS BY 360 AERIAL SURVEYS IN FAIRFAX, CALIFORNIA.

IN AREAS OF DENSE VEGETATION, ACCURACY OF CONTOURS MAY DEVIATE FROM ACCEPTED ACCURACY STANDARDS.

DATE OF PHOTOGRAPHY 06-22-17

CONTOUR INTERVAL 1 FOOT

DATUM NOTE:

HORIZONTAL AND VERTICAL CONTROL DATA IS BASED ON THE CALIFORNIA COORDINATE SYSTEM ZONE III, NAD83, NAVD88 DATUM PER THE REAL-TIME GNSS REFERENCE STATION NETWORK. THE CALIFORNIA SURVEYING VIRTUAL SURVEY NETWORK (CSVSN) MAINTAINED BY CALIFORNIA SURVEY AND DRAFTING SUPPLY. THE PROJECT REFERENCE POINTS AND DATUM INFORMATION ARE AS FOLLOWS.

Point#	Northing	Easting	Elevation	Description
004	2126164.90'	6059829.32'	147.49'	MAG NAIL
006	2126465.88'	6060797.22'	225.78'	MAG NAIL
007	2126806.93'	6061222.62'	289.89'	60 NAIL
008	2127346.89'	061207.99'	338.77'	MAG NAIL

DISTANCES ARE IN US SURVEY FEET AND/OR DECIMALS THEREOF.

THIS TOPOGRAPHIC SURVEY WAS DONE BY A FIELD CREW UNDER THE SUPERVISION OF ALEXANDER FONG, DURING THE MONTH OF JULY, 2017.

BOUNDARY INFORMATION:

THE BOUNDARY INFORMATION SHOWN WITHIN THIS TOPOGRAPHIC SURVEY WAS PROVIDED BY THE PIEDMONT UNIFIED SCHOOL DISTRICT. THE LINEWORK AND BEARING AND DISTANCE INFORMATION SHOWN HEREON WAS CALCULATED AND COMPILED FROM UNKNOWN SOURCES AND IS SHOWN FOR INFORMATIONAL PURPOSES ONLY. BELLECCI & ASSOCIATES., INC CANNOT VERIFY THE COMPLETENESS AND ACCURACY OF THE BOUNDARY INFORMATION PROVIDED.

LEGEND

- FOUND STANDARD CITY STREET MONUMENT
- FOUND IRON PIPE
- CONTROL POINT CUT X
- CONTROL POINT NAIL & TAG
- CONTROL POINT SET
- BOUNDARY
- PARCEL DIVISIONS
- SHEET DIVISIONS

NORTH

0 10' 20' 40' 60'

VERDE DESIGN
LANDSCAPE ARCHITECTURE
CIVIL ENGINEERING
SPORT PLANNING & DESIGN
2455 The Alameda
Santa Clara, CA 95050
tel: 408.985.7200
fax: 408.985.7260
www.VerdeDesigninc.com

STAMP

CONSULTANT

360 Aerial Surveys
415-450-5008

SHEET TITLE
EXISTING CONDITIONS SURVEY PLAN (FOR REFERENCE ONLY)

PROJECT NAME
PIEDMONT HIGH SCHOOL TRACK AND FIELD REPLACEMENT

PROJECT ADDRESS
760 MAGNOLIA AVENUE
PIEDMONT, CA
94611

SUBMITTAL	DATE
95% SUBMITTAL	04-26-18
DSA SUBMITTAL	05-10-18
DSA SUBMITTAL	06-01-18
DSA BACKCHECK	08-09-18
BID SUBMITTAL	10-28-22

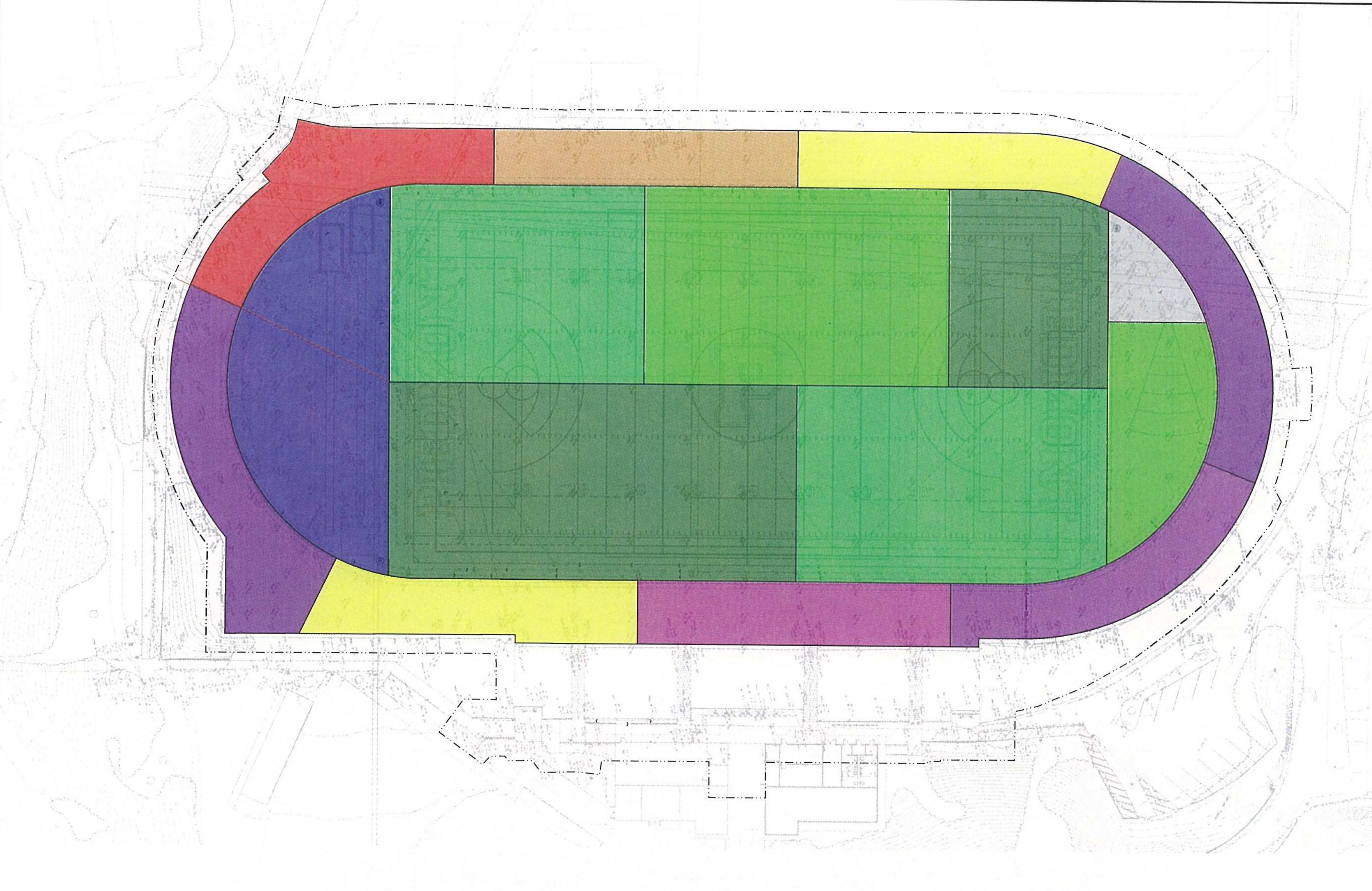
NO.	REVISIONS	DATE
△		
△		
△		
△		
△		
△		

DRAWN BY	CHECKED BY
360 AERIAL	DM
DATE ISSUED 10/28/2022	SCALE 1"= 20'

PROJ. NO. 1711600

SHEET NO. L2.0

EXISTING CONDITIONS SURVEY PLAN



PIEDMONT HS - STORMWATER MANAGEMENT REPORT
ATTACHMENT C
POST-DEVELOPMENT CONDITIONS

VERDE DESIGN
LANDSCAPE ARCHITECTURE
CIVIL ENGINEERING
SPORT PLANNING & DESIGN
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Santa Clara, CA 95050
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fax: 408.985.7260
www.VerdeDesignInc.com

STAMP

CONSULTANT

SHEET TITLE
DMA PLAN

PROJECT NAME
PIEDMONT HIGH SCHOOL TRACK AND FIELD REPLACEMENT

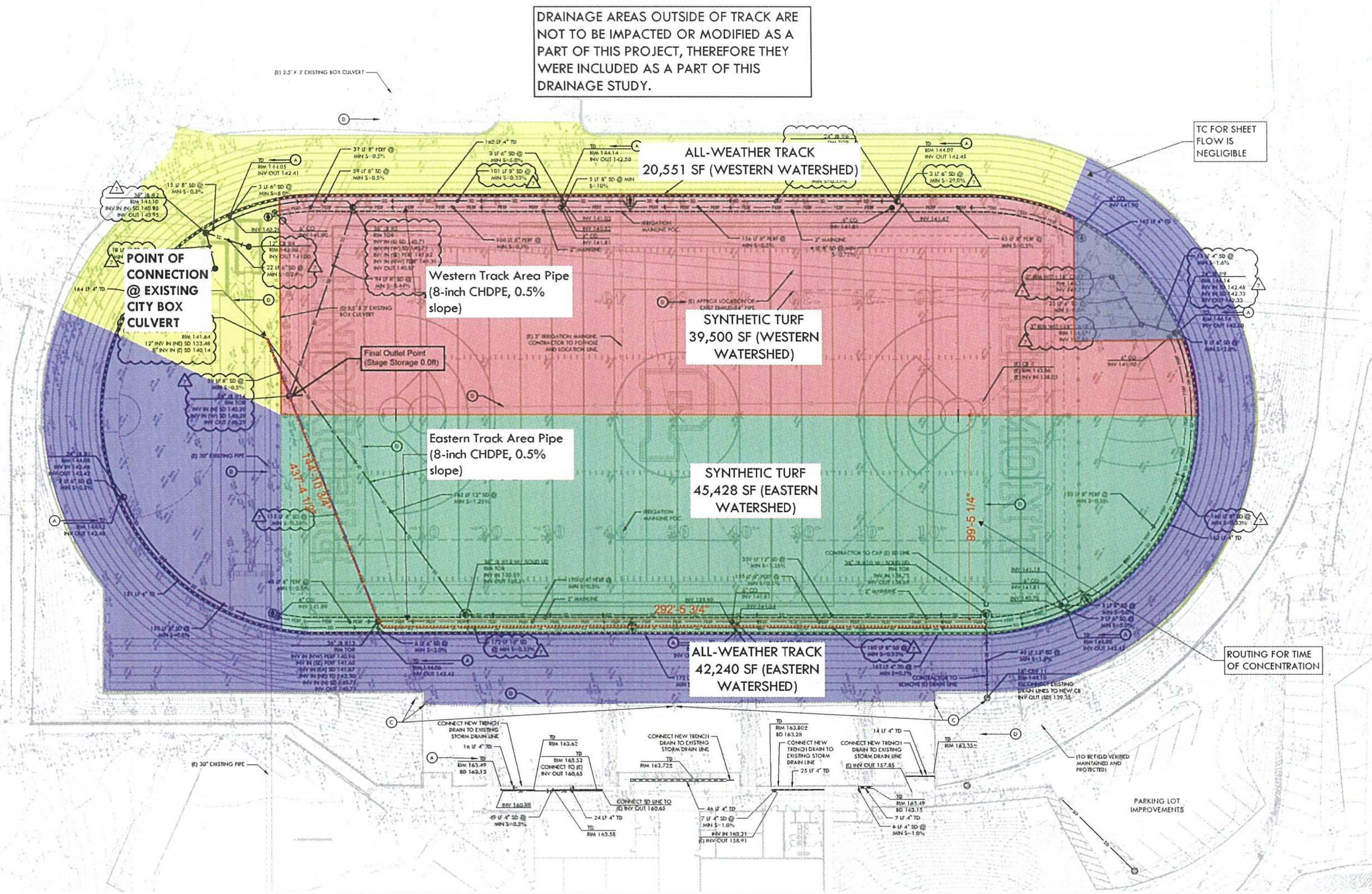
PROJECT ADDRESS
760 MAGNOLIA AVENUE
PIEDMONT, CA
94611

SUBMITTAL	DATE
95% SUBMITTAL	04-26-18
DSA SUBMITTAL	05-10-18
DSA SUBMITTAL	06-01-18
DSA BACKCHECK	08-09-18
BID SUBMITTAL	10-28-22

NO.	REVISIONS	DATE
2	FIELD DIRECTIVE #2 GRADE AND DRAINAGE REVISIONS	07/13/23
4	RFI #10 PAVING REALIGNMENT	07/24/23

DRAWN BY: CD	CHECKED BY: DM
DATE ISSUED: 10/28/2022	SCALE: 1"=20'-0"
PROJ. NO.: 1711600	
SHEET NO.: DMA	

DMA PLAN



DRAINAGE & UTILITY LEGEND

SYM.	DESCRIPTION	DETAIL NUMBER / SHEET NUMBER
A	TRACK TRENCH DRAIN CONNECTION	H / D1.0
B	REPLACE GRATE TO ADA TRAFFIC RATED GRADE.	
C	CONTRACTOR TO CONFIRM EXISTING TRENCH DRAINS CONNECT TO THE EXISTING CATCH BASINS. REPORT THE PIPE SIZE AND INVERTS IN THIS SYSTEM BACK TO THE OWNERS REPRESENTATIVE.	
D	CONTRACTOR TO CLEAN OUT AND VIDEO ALL EXISTING STORM DRAIN LINES WITHIN THE LIMIT OF WORK.	

SYM	DESCRIPTION	DETAIL NUMBER / SHEET NUMBER
CO	CLEANOUT	
JB	JUNCTION BOX	
S=0.5%	SLOPE	
MIN.	MINIMUM	
N, S, W EA.	NORTH, SOUTH, WEST, EAST	
P.O.C	POINT OF CONNECTION	
	TRENCH DRAIN INSIDE TRACK - REFER TO DETAIL F, SHEET D1.0 TRENCH DRAIN OUTSIDE TRACK - REFER TO DETAIL G, SHEET D1.0	F,G / D1.0
	[illegible] OF WORK	
	[illegible]NLINE - CLASS 200 PVC WITH RING - TITE CONNECTIONS. LINE [illegible]LL BE 6" UNLESS NOTED OTHERWISE.	I / D3.0
	[illegible]CK COUPLER (IN SYNTHETIC TURF) [illegible]O - 100-SL-VLC QUICK COUPLER VALVE WITH 100-AK KEY AND [illegible] MHS HOSE SWIVEL KEY	K / D3.0
	[illegible]CK COUPLER (IN ALL WEATHER) [illegible]O - 100-SL-VLC QUICK COUPLER VALVE WITH 100-AK KEY AND [illegible] MHS HOSE SWIVEL KEY	J / D3.0
	[illegible] IN ALL WEATHER SURFACING	N / D1.0

SYM	DESCRIPTION	DETAIL NUMBER / SHEET NUMBER
◐	JUNCTION BOX, SIZE PER PLAN	C,D / D1.0
⊜	CATCH BASIN, SIZE PER PLAN	A / D1.0
●	CLEANOUT IN SYNTHETIC TURF	L / D1.0
●	SHOT PUT / DISCUS DRAIN	M / D1.0
●	SAND PIT CATCH BASIN	B / D1.0
—SD—	SOLID WALL STORM DRAIN	E / D1.0
—PERF—	PERFORATED SUBDRAIN LINE	I / D1.0
CB	CATCH BASIN	
BD	BOTTOM OF DRAIN	
INV	INVERT	
RIM	RIM ELEVATION	
TOR	TOP OF ROCK ELEVATION	
LF	LINEAR FEET	

DRAINAGE & UTILITY NOTES

1. THE CONTRACTOR SHALL VERIFY THE LOCATIONS OF ALL EXISTING UTILITIES, STRUCTURES, AND SERVICES BEFORE COMMENCING WORK. THE LOCATIONS OF UTILITIES, STRUCTURES, AND SERVICES SHOWN IN THE CONTRACT DOCUMENTS SHALL BE DEEMED TO BE APPROXIMATIONS ONLY. ALL DISCREPANCIES BETWEEN WHAT IS SHOWN AND THE ACTUAL FIELD CONDITIONS SHALL BE REPORTED TO THE DISTRICT REPRESENTATIVE. THE CONTRACTOR SHALL CONTACT UNDER GROUND SERVICE ALERT (USA) AT (800) 227-2600 PRIOR TO ANY DEMOLITION OR EXCAVATION. UPON COMPLETION OF USA MARKING OPERATIONS, CONTRACTOR SHALL RECORD ALL UTILITY MARKINGS ON A SEPARATE SET OF DRAWINGS. THIS SET SHALL BE KEPT ON-SITE FOR REFERENCE FOR DURATION OF CONTRACT.
2. ALL EXISTING DRAINAGE STRUCTURES, BOXES, UTILITY VAULTS ETC. TO REMAIN, SHALL BE BROUGHT TO FINAL FINISH GRADE PRIOR TO FINAL SURFACE TREATMENT.
3. THE CONTRACTOR IS TO PROTECT DRAINAGE SYSTEM FROM DEBRIS, INCLUDING SOIL, ROCK MATERIAL, AND TRASH FROM ENTERING THE PIPE DURING CONSTRUCTION. CONTRACTOR SHALL AVOID PLACING CONSTRUCTION VEHICLES OVER INSTALLED DRAINAGE TRENCHES TO PREVENT CRUSHING OF PIPE.
4. COORDINATE ALL SLEEVING AND UTILITY LOCATIONS AS SHOWN ON THE PLANS AND DETAILS CONTAINED WITHIN THESE CONTRACT DOCUMENTS.
5. THE CONTRACTOR IS TO ENSURE THAT ALL REMAINING ACTIVE AND NEW DRAINAGE AND UTILITY LINES ARE PROTECTED AND UNDAMAGED FROM TRENCHING AND FOOTING EXCAVATIONS FOR NEW FOOTINGS, PARTICULARLY FOR NEW FENCING AND WALLS.
6. ALL ABANDONED STORM LINES SHALL REMAIN IN PLACE UNLESS IN CONFLICT WITH PROPOSED DRAINAGE, UTILITY, OR SUBGRADING OPERATIONS, IN WHICH CASE ABANDONED PIPE IN CONFLICT SHALL BE REMOVED. REMAINING ABANDONED STORM PIPE SHALL BE SEALED WITH APPROPRIATELY SIZED CONCRETE CAP (3 SACK MIX) 6" ENVELOPE OUTSIDE AND INSIDE DIAMETER OF PIPE.
7. PRIOR TO ALL DRAINAGE AND UTILITY WORK, CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING ALL POTENTIAL DRAINAGE CONNECTIONS AND EXISTING UTILITY BY POTHOLING. IN ADDITION, ALL DOWNSTREAM CONNECTIONS TO EXISTING STRUCTURES SHALL BE THE START OF THESE OPERATIONS, AND GRADES SHALL BE VERIFIED.
8. WHEN WORK HAS TO OCCUR UNDER THE DRIPLINE OF EXISTING TREES NOT SCHEDULED FOR REMOVAL, THE CONTRACTOR SHALL USE ALL POSSIBLE CARE TO AVOID INJURY TO THE TREES AND TREE ROOTS. GRADE IN LINES RADIAL TO THE EXISTING TREES RATHER THAN TANGENTIAL. ALL PARTIAL CUTS OR TEARS THROUGH ROOTS TWO INCHES IN DIAMETER AND LARGER SHALL BE CUT CLEAN. TRENCHES ADJACENT TO TREES SHALL BE FILLED WITHIN 24 HOURS AFTER EXCAVATION, BUT WHERE THIS IS NOT POSSIBLE, THE SIDE OF THE TRENCH ADJACENT TO THE TREE, AND ANY EXPOSED ROOTS SHALL BE KEPT SHADED AND MOIST WITH DAMPENED BURLAP OR CANVAS.

PIEDMONT HS - STORMWATER MANAGEMENT REPORT
ATTACHMENT C
POST-DEVELOPMENT CONDITIONS

VERDE DESIGN
LANDSCAPE ARCHITECTURE
CIVIL ENGINEERING
SPORT PLANNING & DESIGN
2455 The Alameda
Santa Clara, CA 95050
tel: 408.985.7200
fax: 408.985.7260
www.VerdeDesigninc.com

SHEET TITLE: DRAINAGE AND UTILITY PLAN

PROJECT NAME: PIEDMONT HIGH SCHOOL TRACK AND FIELD REPLACEMENT

PROJECT ADDRESS: 760 MAGNOLIA AVENUE PIEDMONT, CA 94611

SUBMITTAL	DATE
95% SUBMITTAL	04-26-18
DSA SUBMITTAL	05-10-18
DSA SUBMITTAL	06-01-18
DSA BACKCHECK	08-09-18
BID SUBMITTAL	10-28-22

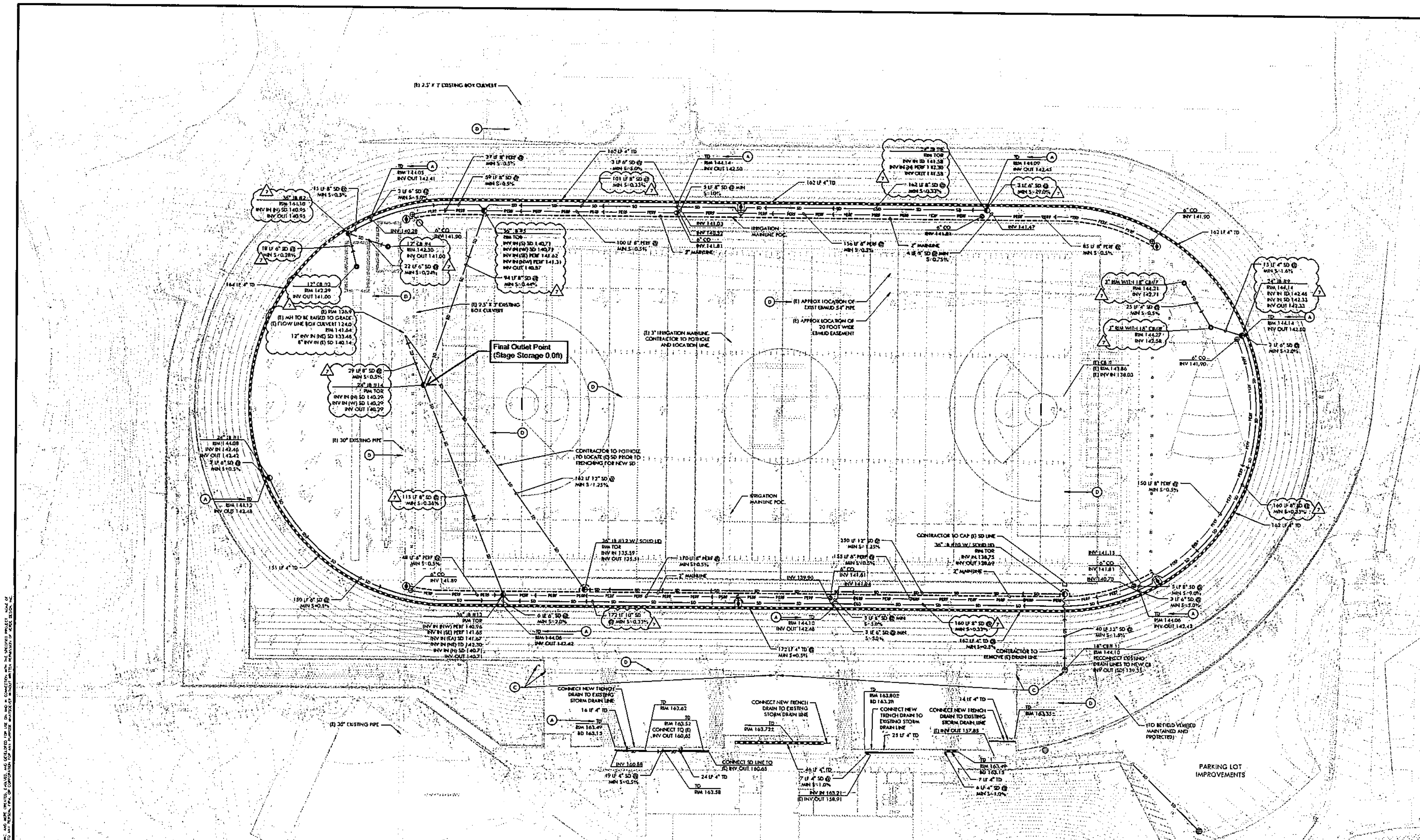
NO.	REVISIONS	DATE
1	RFI #3 TRENCH DRAIN SLOPE	07/11/23
2	FIELD DIRECTIVE #2 GRADE AND DRAINAGE REVISIONS	07/13/23
5	FIELD DIRECTIVE #3 SYN TURF DRAINAGE REVISIONS	07/31/23
4	FIELD DIRECTIVE #4 EXISTING STAIRS REVISOINS	08/21/23
7	FIELD DIRECTIVE #5 DRAINAGE REVISIONS - CITY PERMIT	08/23/23

DRAWN BY	CHECKED BY
CD	DM
DATE ISSUED: 08/14/2023	SCALE: 1"=20'-0"

PROJ. NO. 1711600

SHEET NO. L6.0

DRAINAGE AND UTILITY PLAN



DRAINAGE & UTILITY LEGEND

SYM	DESCRIPTION	DETAIL NUMBER / SHEET NUMBER
(A)	TRACK TRENCH DRAIN CONNECTION	H / D1.0
(B)	REPLACE GRATE TO ADA TRAFFIC RATED GRADE.	
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(D)	CONTRACTOR TO CLEAN OUT AND VIDEO ALL EXISTING STORM DRAIN LINES WITHIN THE LIMIT OF WORK.	

SYM	DESCRIPTION	DETAIL NUMBER / SHEET NUMBER
CO	CLEANOUT	
JB	JUNCTION BOX	
S=0.5%	SLOPE	
MIN.	MINIMUM	
N, S, W, EA.	NORTH, SOUTH, WEST, EAST	
P.O.C	POINT OF CONNECTION	
	TRENCH DRAIN INSIDE TRACK - REFER TO DETAIL F, SHEET D1.0 TRENCH DRAIN OUTSIDE TRACK - REFER TO DETAIL G, SHEET D1.0	F,G / D1.0
	… OF WORK	
	…LINE - CLASS 200 PVC WITH RING - TITE CONNECTIONS. LINE …L BE 6" UNLESS NOTED OTHERWISE.	I / D3.0
	…CK COUPLER (IN SYNTHETIC TURF) …O - 100-SL-VLC QUICK COUPLER VALVE WITH 100-AK KEY AND …MHS HOSE SWIVEL KEY	K / D3.0
	…CK COUPLER (IN ALL WEATHER) …O - 100-SL-VLC QUICK COUPLER VALVE WITH 100-AK KEY AND …MHS HOSE SWIVEL KEY	J / D3.0
	…NOUT IN ALL WEATHER SURFACING	N / D1.0

SYM	DESCRIPTION	DETAIL NUMBER / SHEET NUMBER
	JUNCTION BOX, SIZE PER PLAN	C,D / D1.0
	CATCH BASIN, SIZE PER PLAN	A / D1.0
	CLEANOUT IN SYNTHETIC TURF	L / D1.0
	SHOT PUT / DISCUS DRAIN	M / D1.0
	SAND PIT CATCH BASIN	B / D1.0
SD	SOLID WALL STORM DRAIN	E / D1.0
PERF	PERFORATED SUBDRAIN LINE	I / D1.0
CB	CATCH BASIN	
BD	BOTTOM OF DRAIN	
INV	INVERT	
RIM	RIM ELEVATION	
TOR	TOP OF ROCK ELEVATION	
LF	LINEAR FEET	

DRAINAGE & UTILITY NOTES

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NORTH

PIEDMONT HS - STORMWATER MANAGEMENT REPORT
ATTACHMENT C
POST-DEVELOPMENT CONDITIONS

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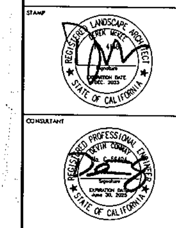

SHEET TITLE
DRAINAGE AND UTILITY PLAN

PROJECT NAME
PIEDMONT HIGH SCHOOL TRACK AND FIELD REPLACEMENT

PROJECT ADDRESS
760 MAGNOLIA AVENUE
PIEDMONT, CA
94611

SUBMITTAL	DATE
95% SUBMITTAL	04-26-18
DSA SUBMITTAL	05-10-18
DSA SUBMITTAL	06-01-18
DSA BACKCHECK	08-09-18
BID SUBMITTAL	10-28-22

NO.	REVISIONS	DATE
1	RFI #3 TRENCH DRAIN SLOPE	07/11/23
2	FIELD DIRECTIVE #2 GRADE AND DRAINAGE REVISIONS	07/13/23
5	FIELD DIRECTIVE #3 SYN TURF DRAINAGE REVISIONS	07/31/23
4	FIELD DIRECTIVE #4 EXISTING STAIRS REVISOINS	08/21/23
7	FIELD DIRECTIVE #5 DRAINAGE REVISIONS - CITY PERMIT	08/23/23

DRAWN BY: CD
CHECKED BY: DM
DATE ISSUED: 08/14/2023
SCALE: 1"=20'-0"
PROJ. NO.: 1711600
SHEET NO.: L6.0

DRAINAGE AND UTILITY PLAN

ATTACHMENT D - PROJECT SITE PRECIPITATION DEPTHS

25-Year Storm for Alameda County

Mean Annual Precipitation	Minutes 5	Minutes 10	Minutes 15	Minutes 30	Hours 1	Hours 2	Hours 3	Hours 6	Hours 12	Hours 24	Days 2	Days 3	Days 4	Days 5	Days 6	Days 8	Days 10	Days 15	Days 20	Days 30	Days 60
10	0.20	0.27	0.32	0.43	0.58	0.78	0.93	1.26	1.70	2.29	3.20	3.80	4.27	4.63	5.01	5.61	6.08	7.15	8.05	9.60	12.72
11	0.21	0.29	0.34	0.46	0.62	0.84	1.00	1.35	1.82	2.46	3.44	4.08	4.59	4.97	5.38	6.03	6.53	7.67	8.64	10.31	13.66
12	0.23	0.31	0.36	0.49	0.66	0.90	1.07	1.44	1.95	2.63	3.68	4.36	4.90	5.32	5.75	6.44	6.98	8.20	9.23	11.01	14.60
13	0.24	0.33	0.39	0.52	0.71	0.95	1.14	1.54	2.07	2.80	3.91	4.64	5.22	5.66	6.12	6.85	7.43	8.72	9.83	11.72	15.53
14	0.26	0.35	0.41	0.56	0.75	1.01	1.21	1.63	2.20	2.97	4.15	4.92	5.53	6.00	6.49	7.27	7.87	9.25	10.42	12.43	16.47
15	0.27	0.36	0.43	0.59	0.79	1.07	1.27	1.72	2.32	3.14	4.38	5.20	5.85	6.34	6.86	7.68	8.32	9.78	11.01	13.13	17.41
16	0.28	0.38	0.46	0.62	0.84	1.13	1.34	1.81	2.45	3.31	4.62	5.48	6.16	6.68	7.23	8.09	8.77	10.30	11.60	13.84	18.34
17	0.30	0.40	0.48	0.65	0.88	1.18	1.41	1.91	2.57	3.47	4.86	5.75	6.47	7.02	7.60	8.51	9.22	10.83	12.20	14.55	19.28
18	0.31	0.42	0.51	0.68	0.92	1.24	1.48	2.00	2.70	3.64	5.09	6.03	6.79	7.36	7.97	8.92	9.66	11.35	12.79	15.26	20.22
19	0.33	0.44	0.53	0.71	0.96	1.30	1.55	2.09	2.82	3.81	5.33	6.31	7.10	7.70	8.34	9.33	10.11	11.88	13.38	15.96	21.15
20	0.34	0.46	0.55	0.74	1.01	1.36	1.62	2.18	2.95	3.98	5.56	6.59	7.42	8.04	8.70	9.75	10.56	12.41	13.97	16.67	22.09
21	0.36	0.48	0.58	0.78	1.05	1.42	1.69	2.28	3.07	4.15	5.80	6.87	7.73	8.38	9.07	10.16	11.01	12.93	14.56	17.38	23.03
22	0.37	0.50	0.60	0.81	1.09	1.47	1.76	2.37	3.20	4.32	6.03	7.15	8.05	8.73	9.44	10.57	11.45	13.46	15.16	18.08	23.96
23	0.39	0.52	0.62	0.84	1.13	1.53	1.82	2.46	3.32	4.49	6.27	7.43	8.36	9.07	9.81	10.99	11.90	13.98	15.75	18.79	24.90
24	0.40	0.54	0.65	0.87	1.18	1.59	1.89	2.55	3.45	4.66	6.51	7.71	8.68	9.41	10.18	11.40	12.35	14.51	16.34	19.50	25.84
25	0.42	0.56	0.67	0.90	1.22	1.65	1.96	2.65	3.57	4.82	6.74	7.99	8.99	9.75	10.55	11.81	12.80	15.04	16.93	20.20	26.78
26	0.43	0.58	0.69	0.93	1.26	1.70	2.03	2.74	3.70	4.99	6.98	8.27	9.31	10.09	10.92	12.23	13.25	15.56	17.53	20.91	27.71
27	0.44	0.60	0.72	0.97	1.30	1.76	2.10	2.83	3.82	5.16	7.21	8.55	9.62	10.43	11.29	12.64	13.69	16.09	18.12	21.62	28.65
28	0.46	0.62	0.74	1.00	1.35	1.82	2.17	2.93	3.95	5.33	7.45	8.83	9.93	10.77	11.66	13.05	14.14	16.61	18.71	22.32	29.59
29	0.47	0.64	0.76	1.03	1.39	1.88	2.24	3.02	4.07	5.50	7.69	9.11	10.25	11.11	12.03	13.47	14.59	17.14	19.30	23.03	30.52
30	0.49	0.66	0.79	1.06	1.43	1.93	2.30	3.11	4.20	5.67	7.92	9.39	10.56	11.45	12.39	13.88	15.04	17.67	19.90	23.74	31.46
31	0.50	0.68	0.81	1.09	1.47	1.99	2.37	3.20	4.32	5.84	8.16	9.67	10.88	11.80	12.76	14.29	15.48	18.19	20.49	24.44	32.40
32	0.52	0.70	0.83	1.12	1.52	2.05	2.44	3.30	4.45	6.01	8.39	9.95	11.19	12.14	13.13	14.71	15.93	18.72	21.08	25.15	33.33
33	0.53	0.72	0.86	1.16	1.56	2.11	2.51	3.39	4.57	6.17	8.63	10.23	11.51	12.48	13.50	15.12	16.38	19.24	21.67	25.86	34.27
34	0.55	0.74	0.88	1.19	1.60	2.16	2.58	3.48	4.70	6.34	8.87	10.51	11.82	12.82	13.87	15.53	16.83	19.77	22.27	26.56	35.21
35	0.56	0.76	0.90	1.22	1.65	2.22	2.65	3.57	4.82	6.51	9.10	10.79	12.14	13.16	14.24	15.95	17.28	20.30	22.86	27.27	36.14
36	0.58	0.78	0.93	1.25	1.69	2.28	2.72	3.67	4.95	6.68	9.34	11.07	12.45	13.50	14.61	16.36	17.72	20.82	23.45	27.98	37.08

50-Year Storm for Alameda County

Mean Annual Precipitation	Minutes 5	Minutes 10	Minutes 15	Minutes 30	Hours 1	Hours 2	Hours 3	Hours 6	Hours 12	Hours 24	Days 2	Days 3	Days 4	Days 5	Days 6	Days 8	Days 10	Days 15	Days 20	Days 30	Days 60
10	0.22	0.30	0.36	0.48	0.65	0.88	1.05	1.41	1.91	2.57	3.62	4.29	4.81	5.19	5.61	6.28	6.75	7.87	8.86	10.60	13.90
11	0.24	0.32	0.38	0.52	0.70	0.94	1.12	1.52	2.05	2.76	3.89	4.60	5.16	5.57	6.03	6.74	7.24	8.45	9.51	11.38	14.93
12	0.25	0.34	0.41	0.55	0.75	1.01	1.20	1.62	2.19	2.95	4.15	4.92	5.52	5.95	6.44	7.20	7.74	9.03	10.16	12.16	15.95
13	0.27	0.37	0.44	0.59	0.79	1.07	1.28	1.72	2.33	3.14	4.42	5.24	5.87	6.33	6.85	7.66	8.24	9.61	10.82	12.94	16.97
14	0.29	0.39	0.46	0.62	0.84	1.14	1.35	1.83	2.47	3.33	4.69	5.55	6.22	6.71	7.27	8.12	8.74	10.19	11.47	13.72	18.00
15	0.30	0.41	0.49	0.66	0.89	1.20	1.43	1.93	2.61	3.52	4.95	5.87	6.58	7.10	7.68	8.59	9.23	10.77	12.12	14.50	19.02
16	0.32	0.43	0.51	0.69	0.94	1.26	1.51	2.03	2.75	3.71	5.22	6.18	6.93	7.48	8.09	9.05	9.73	11.35	12.77	15.28	20.04
17	0.34	0.45	0.54	0.73	0.98	1.33	1.58	2.14	2.89	3.90	5.49	6.50	7.28	7.86	8.50	9.51	10.23	11.93	13.43	16.06	21.07
18	0.35	0.48	0.57	0.76	1.03	1.39	1.66	2.24	3.03	4.09	5.75	6.81	7.64	8.24	8.92	9.97	10.72	12.51	14.08	16.84	22.09
19	0.37	0.50	0.59	0.80	1.08	1.46	1.74	2.35	3.17	4.28	6.02	7.13	7.99	8.62	9.33	10.44	11.22	13.09	14.73	17.62	23.11
20	0.38	0.52	0.62	0.84	1.13	1.52	1.82	2.45	3.31	4.47	6.29	7.45	8.35	9.00	9.74	10.90	11.72	13.67	15.38	18.41	24.14
21	0.40	0.54	0.65	0.87	1.18	1.59	1.89	2.55	3.45	4.65	6.55	7.76	8.70	9.39	10.16	11.36	12.21	14.25	16.04	19.19	25.16
22	0.42	0.56	0.67	0.91	1.22	1.65	1.97	2.66	3.59	4.84	6.82	8.08	9.05	9.77	10.57	11.82	12.71	14.83	16.69	19.97	26.18
23	0.43	0.59	0.70	0.94	1.27	1.72	2.05	2.76	3.73	5.03	7.09	8.39	9.41	10.15	10.98	12.28	13.21	15.41	17.34	20.75	27.21
24	0.45	0.61	0.72	0.98	1.32	1.78	2.12	2.87	3.87	5.22	7.35	8.71	9.76	10.53	11.40	12.75	13.70	15.98	17.99	21.53	28.23
25	0.47	0.63	0.75	1.01	1.37	1.85	2.20	2.97	4.01	5.41	7.62	9.02	10.12	10.91	11.81	13.21	14.20	16.56	18.64	22.31	29.25
26	0.48	0.65	0.78	1.05	1.42	1.91	2.28	3.07	4.15	5.60	7.89	9.34	10.47	11.30	12.22	13.67	14.70	17.14	19.30	23.09	30.28
27	0.50	0.67	0.80	1.08	1.46	1.98	2.35	3.18	4.29	5.79	8.15	9.65	10.82	11.68	12.64	14.13	15.19	17.72	19.95	23.87	31.30
28	0.52	0.70	0.83	1.12	1.51	2.04	2.43	3.28	4.43	5.98	8.42	9.97	11.18	12.06	13.05	14.59	15.69	18.30	20.60	24.65	32.32
29	0.53	0.72	0.86	1.15	1.56	2.10	2.51	3.39	4.57	6.17	8.68	10.29	11.53	12.44	13.46	15.06	16.19	18.88	21.25	25.43	33.35
30	0.55	0.74	0.88	1.19	1.61	2.17	2.59	3.49	4.71	6.36	8.95	10.60	11.89	12.82	13.88	15.52	16.68	19.46	21.91	26.21	34.37
31	0.56	0.76	0.91	1.23	1.65	2.23	2.66	3.59	4.85	6.55	9.22	10.92	12.24	13.20	14.29	15.98	17.18	20.04	22.56	26.99	35.39
32	0.58	0.78	0.93	1.26	1.70	2.30	2.74	3.70	4.99	6.74	9.48	11.23	12.59	13.59	14.70	16.44	17.68	20.62	23.21	27.77	36.42
33	0.60	0.81	0.96	1.30	1.75	2.36	2.82	3.80	5.13	6.93	9.75	11.55	12.95	13.97	15.12	16.90	18.17	21.20	23.86	28.55	37.44
34	0.61	0.83	0.99	1.33	1.80	2.43	2.89	3.91	5.27	7.12	10.02	11.86	13.30	14.35	15.53	17.37	18.67	21.78	24.51	29.33	38.46
35	0.63	0.85	1.01	1.37	1.85	2.49	2.97	4.01	5.41	7.31	10.28	12.18	13.66	14.73	15.94	17.83	19.17	22.36	25.17	30.11	39.49
36	0.65	0.87	1.04	1.40	1.89	2.56	3.05	4.11	5.55	7.50	10.55	12.50	14.01	15.11	16.35	18.29	19.66	22.94	25.82	30.89	40.51

ATTACHMENT D - PROJECT SITE PRECIPITATION DEPTHS

NOAA Atlas 14, Volume 6, Version 2
Location name: Oakland, California, USA*
Latitude: 37.8236°, Longitude: -122.2331°
Elevation: 304 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	0.138 (0.121-0.159)	0.175 (0.153-0.202)	0.223 (0.195-0.258)	0.262 (0.226-0.306)	0.314 (0.259-0.383)	0.353 (0.284-0.443)	0.393 (0.307-0.510)	0.435 (0.327-0.584)	0.491 (0.351-0.694)	0.535 (0.366-0.789)
10-min	0.198 (0.174-0.228)	0.251 (0.220-0.290)	0.320 (0.279-0.370)	0.375 (0.324-0.439)	0.449 (0.372-0.549)	0.506 (0.407-0.636)	0.564 (0.440-0.730)	0.623 (0.469-0.836)	0.704 (0.503-0.995)	0.766 (0.524-1.13)
15-min	0.240 (0.210-0.276)	0.304 (0.266-0.351)	0.387 (0.337-0.448)	0.454 (0.392-0.531)	0.544 (0.449-0.664)	0.612 (0.493-0.769)	0.682 (0.532-0.883)	0.754 (0.567-1.01)	0.851 (0.608-1.20)	0.927 (0.634-1.37)
30-min	0.330 (0.289-0.380)	0.418 (0.366-0.482)	0.532 (0.464-0.616)	0.624 (0.539-0.730)	0.748 (0.618-0.914)	0.842 (0.678-1.06)	0.938 (0.732-1.22)	1.04 (0.781-1.39)	1.17 (0.837-1.66)	1.28 (0.872-1.88)
60-min	0.466 (0.409-0.537)	0.591 (0.517-0.681)	0.752 (0.656-0.870)	0.882 (0.761-1.03)	1.06 (0.874-1.29)	1.19 (0.958-1.49)	1.33 (1.03-1.72)	1.46 (1.10-1.97)	1.66 (1.18-2.34)	1.80 (1.23-2.66)
2-hr	0.679 (0.595-0.782)	0.857 (0.750-0.989)	1.09 (0.948-1.26)	1.27 (1.10-1.49)	1.52 (1.26-1.86)	1.71 (1.38-2.15)	1.91 (1.49-2.47)	2.10 (1.58-2.82)	2.37 (1.70-3.36)	2.58 (1.77-3.81)
3-hr	0.853 (0.748-0.983)	1.08 (0.943-1.24)	1.37 (1.19-1.58)	1.60 (1.38-1.87)	1.92 (1.58-2.34)	2.16 (1.73-2.71)	2.40 (1.87-3.11)	2.65 (1.99-3.55)	2.99 (2.13-4.22)	3.25 (2.23-4.80)
6-hr	1.22 (1.07-1.40)	1.54 (1.35-1.78)	1.97 (1.72-2.28)	2.31 (1.99-2.70)	2.77 (2.29-3.38)	3.12 (2.51-3.92)	3.47 (2.71-4.50)	3.84 (2.89-5.15)	4.33 (3.10-6.13)	4.72 (3.23-6.97)
12-hr	1.60 (1.40-1.84)	2.05 (1.80-2.37)	2.64 (2.30-3.06)	3.12 (2.69-3.65)	3.76 (3.11-4.60)	4.25 (3.42-5.34)	4.75 (3.71-6.15)	5.26 (3.96-7.06)	5.96 (4.26-8.43)	6.51 (4.46-9.61)
24-hr	2.10 (1.91-2.35)	2.72 (2.47-3.06)	3.54 (3.21-3.99)	4.20 (3.77-4.77)	5.09 (4.42-5.98)	5.78 (4.91-6.94)	6.47 (5.37-7.97)	7.19 (5.80-9.11)	8.17 (6.31-10.8)	8.93 (6.66-12.2)
2-day	2.67 (2.43-3.00)	3.47 (3.15-3.90)	4.51 (4.08-5.08)	5.34 (4.80-6.07)	6.47 (5.62-7.60)	7.34 (6.24-8.80)	8.21 (6.81-10.1)	9.11 (7.34-11.5)	10.3 (7.97-13.6)	11.3 (8.40-15.4)
3-day	3.06 (2.78-3.43)	3.96 (3.60-4.45)	5.13 (4.65-5.78)	6.08 (5.46-6.90)	7.35 (6.38-8.64)	8.32 (7.07-9.99)	9.30 (7.71-11.4)	10.3 (8.31-13.1)	11.7 (9.02-15.4)	12.7 (9.49-17.4)
4-day	3.39 (3.08-3.80)	4.38 (3.98-4.92)	5.66 (5.13-6.38)	6.69 (6.01-7.60)	8.08 (7.02-9.50)	9.14 (7.77-11.0)	10.2 (8.47-12.6)	11.3 (9.11-14.3)	12.8 (9.88-16.9)	13.9 (10.4-19.1)
7-day	4.20 (3.82-4.71)	5.40 (4.91-6.07)	6.95 (6.30-7.83)	8.19 (7.36-9.30)	9.86 (8.56-11.6)	11.1 (9.45-13.4)	12.4 (10.3-15.3)	13.7 (11.0-17.3)	15.4 (11.9-20.4)	16.8 (12.5-23.0)
10-day	4.77 (4.34-5.35)	6.13 (5.57-6.89)	7.87 (7.12-8.86)	9.25 (8.31-10.5)	11.1 (9.64-13.0)	12.5 (10.6-15.0)	13.9 (11.5-17.1)	15.3 (12.4-19.4)	17.2 (13.3-22.8)	18.7 (13.9-25.6)
20-day	6.33 (5.76-7.10)	8.14 (7.39-9.14)	10.4 (9.43-11.7)	12.2 (11.0-13.9)	14.5 (12.6-17.1)	16.3 (13.8-19.5)	18.0 (14.9-22.1)	19.7 (15.9-24.9)	21.9 (17.0-29.0)	23.7 (17.6-32.4)
30-day	7.72 (7.02-8.66)	9.92 (9.01-11.1)	12.6 (11.5-14.2)	14.8 (13.3-16.8)	17.5 (15.2-20.6)	19.5 (16.6-23.4)	21.5 (17.8-26.4)	23.4 (18.9-29.6)	25.9 (20.0-34.3)	27.8 (20.8-38.1)
45-day	9.46 (8.61-10.6)	12.1 (11.0-13.6)	15.3 (13.9-17.3)	17.8 (16.0-20.2)	21.0 (18.2-24.6)	23.2 (19.8-27.9)	25.4 (21.1-31.3)	27.6 (22.2-34.9)	30.4 (23.4-40.1)	32.4 (24.2-44.3)
60-day	11.3 (10.3-12.7)	14.4 (13.1-16.2)	18.1 (16.4-20.4)	20.9 (18.8-23.8)	24.5 (21.3-28.8)	27.0 (23.0-32.4)	29.4 (24.4-36.2)	31.8 (25.6-40.3)	34.8 (26.9-46.0)	37.0 (27.6-50.6)

[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.

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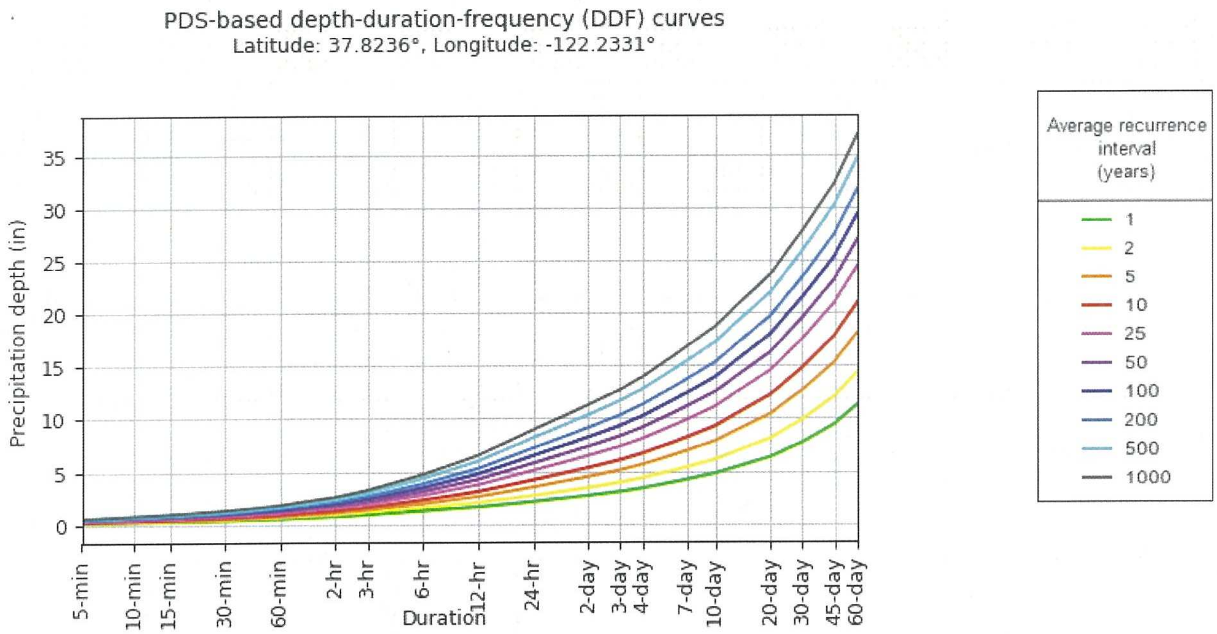
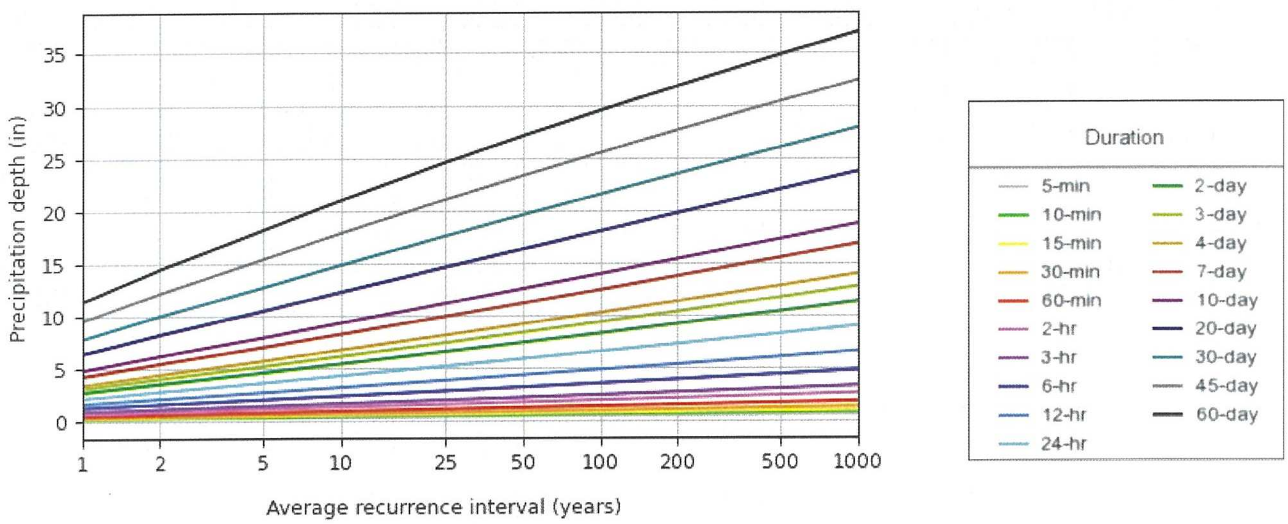
USED TOTAL DEPTH OF 5.09 FROM NOAA OUTPUT FOR SPECIFIC SITE ADDRESS FOR HYDROGRAPH MODEL IN LIEU OF 4.82 FROM COUNTY MANUAL IN ORDER TO BE CONSERVATIVE FOR OUR DESIGN

PF graphical





NOAA Atlas 14, Volume 6, Version 2

Created (GMT): Wed Aug 23 18:34:02 2023

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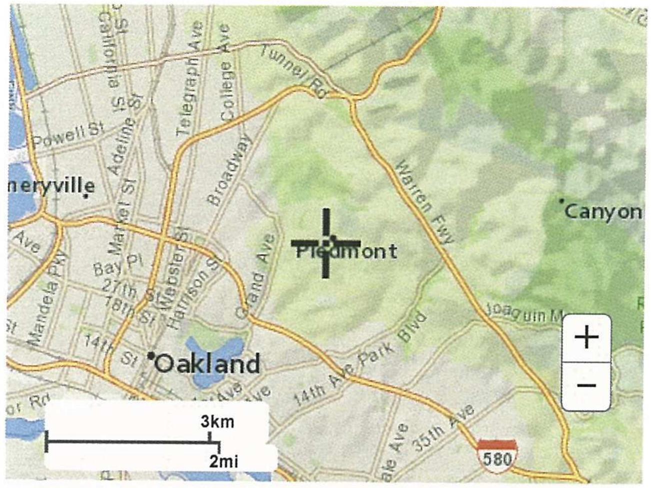
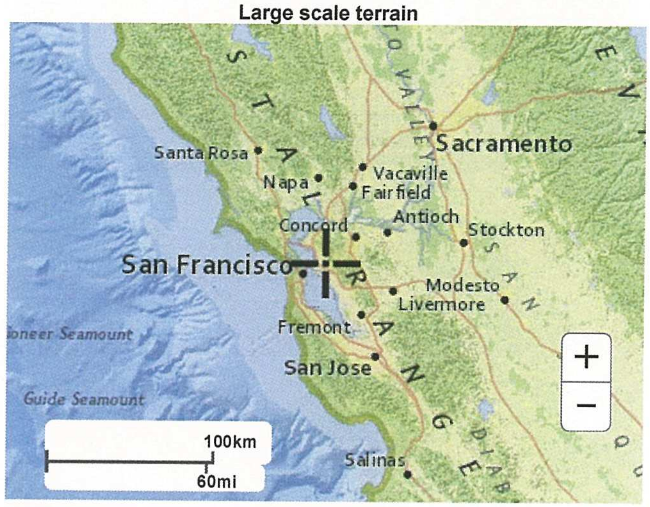
Maps & aerials

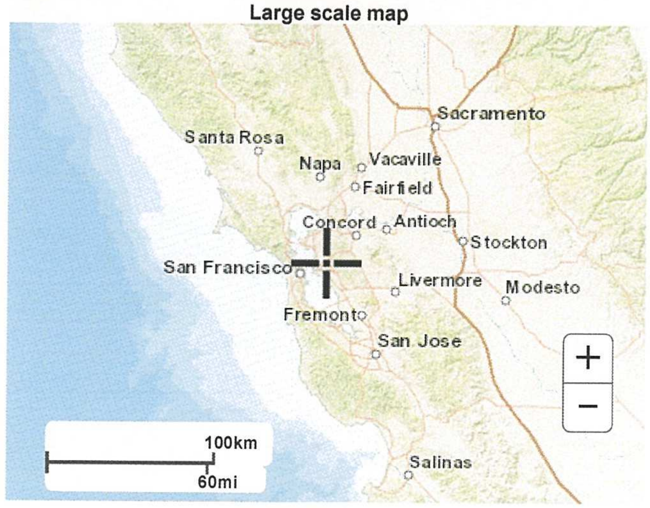
Small scale terrain



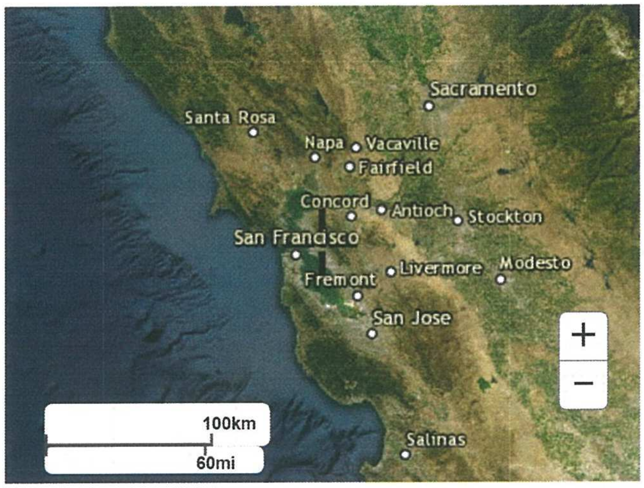
Large scale terrain



Large scale map



Large scale aerial



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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

ATTACHMENT E - POST CONSTRUCTION HYDROGRAPH

Hydrograph Report

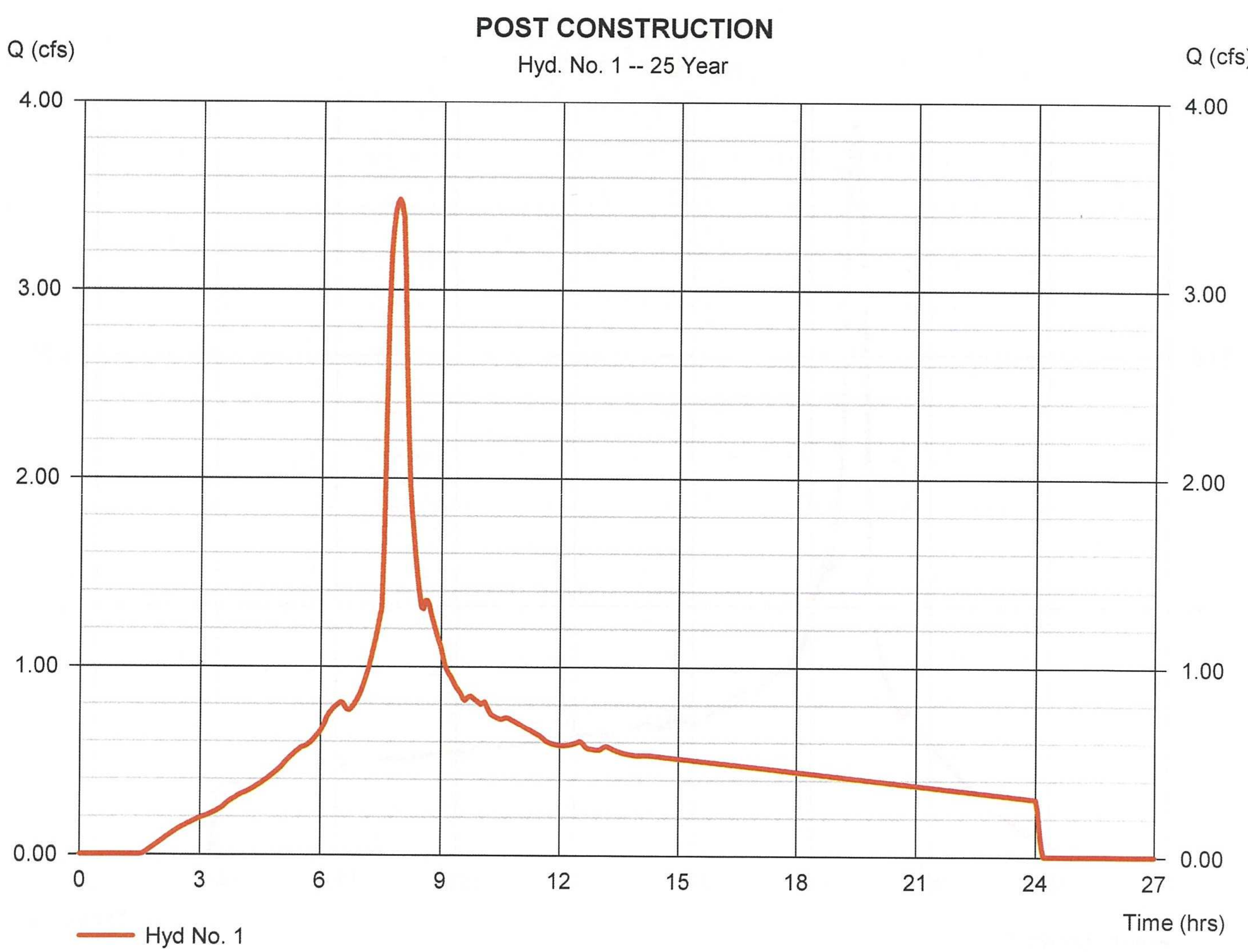
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022 Wednesday, 08 / 23 / 2023

Hyd. No. 1

POST CONSTRUCTION

Hydrograph type	= SCS Runoff	Peak discharge	= 3.479 cfs
Storm frequency	= 25 yrs	Time to peak	= 7.90 hrs
Time interval	= 3 min	Hyd. volume	= 48,191 cuft
Drainage area	= 3.390 ac	Curve number	= 92*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 7.80 min
Total precip.	= 5.09 in	Distribution	= Type IA
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.950 x 90) + (1.440 x 95)] / 3.390



ATTACHMENT E - PRE CONSTRUCTION HYDROGRAPH

Hydrograph Report

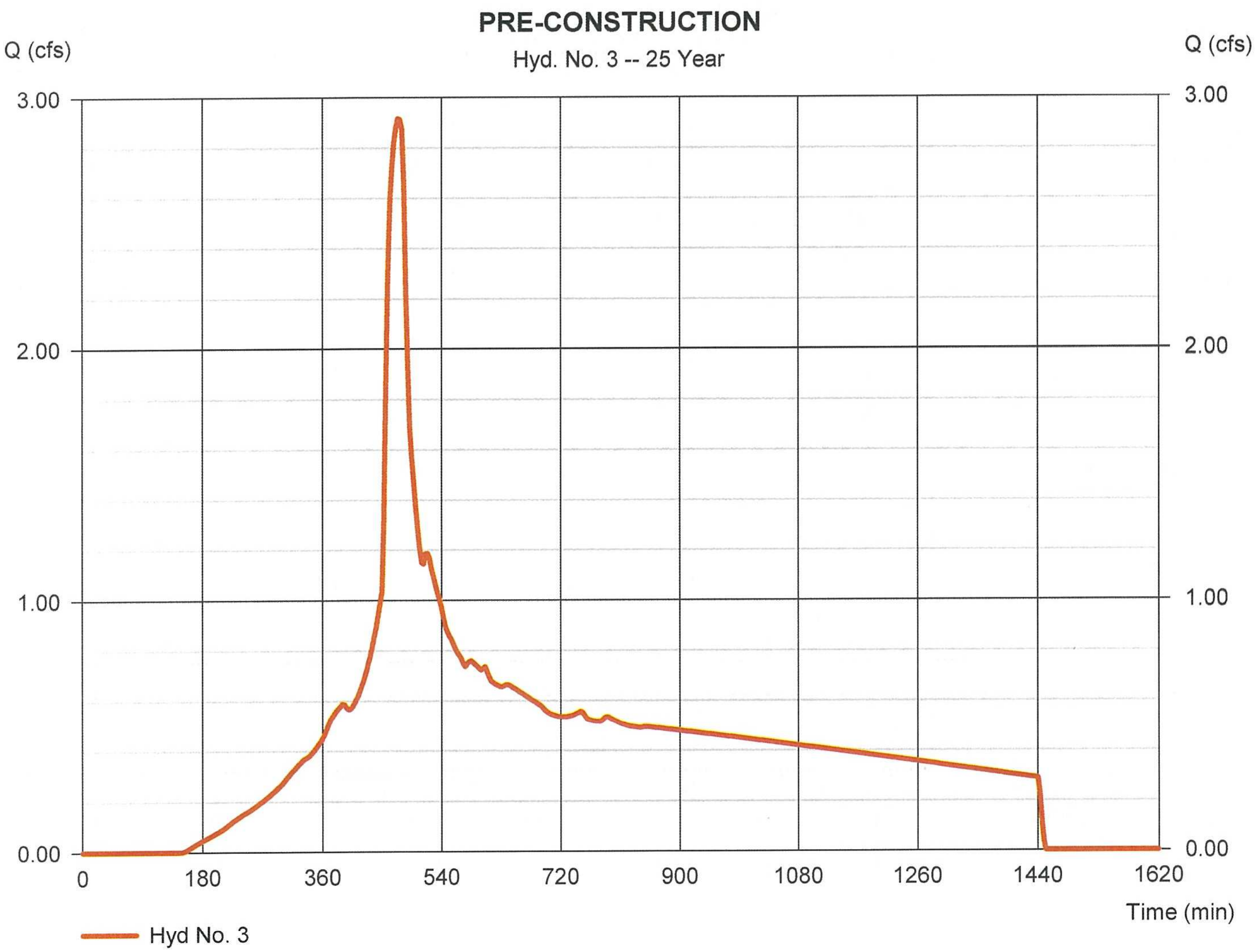
USED AS MAX Q ALLOWABLE IN POST CONSTRUCTION SCENARIO WITH DETENTION ROUTING (SEE ATTACHMENT G)

Hyd. No. 3

PRE-CONSTRUCTION

Hydrograph type	= SCS Runoff	Peak discharge	= 2.918 cfs
Storm frequency	= 25 yrs	Time to peak	= 474 min
Time interval	= 3 min	Hyd. volume	= 40,967 cuft
Drainage area	= 3.390 ac	Curve number	= 86*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 8.90 min
Total precip.	= 5.09 in	Distribution	= Type IA
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(1.950 x 80) + (1.440 x 95)] / 3.390



Pond Report

ATTACHMENT F - DETENTION FACILITY STAGE/DISCHARGE CHART

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022 — Wednesday, 08 / 23 / 2023

Pond No. 1 - POND 1

Pond Data

Pond storage is based on user-defined values.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	140.29	n/a	0	0
0.42	140.71	n/a	73	73
3.17	143.46	n/a	2,722	2,795
3.67	143.96	n/a	6,003	8,798

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 8.00	0.00	0.00	0.00
Span (in)	= 8.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 140.29	0.00	0.00	0.00
Length (ft)	= 29.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	n/a
N-Value	= .012	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

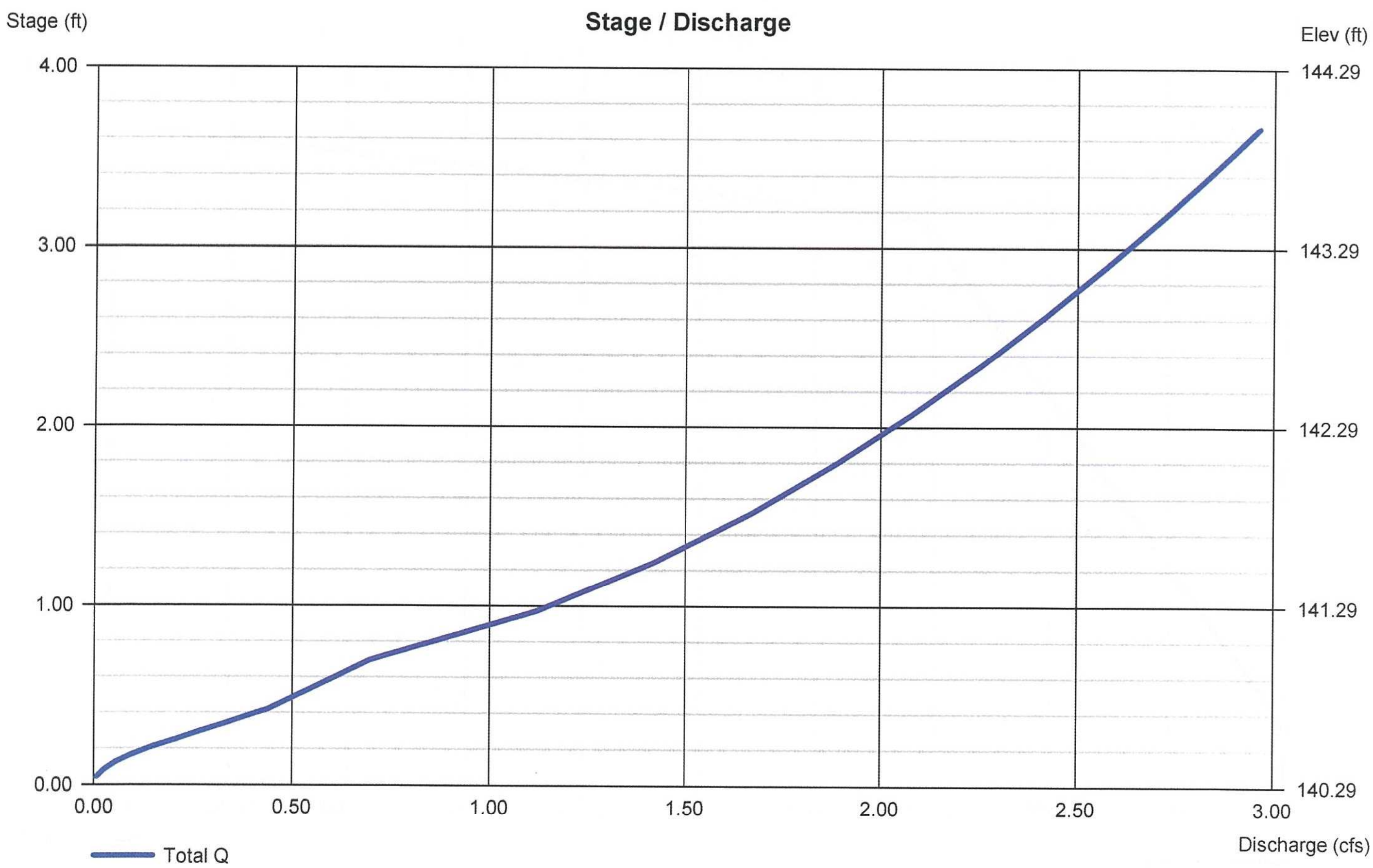
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



Pond Report

ATTACHMENT F - DETENTION FACILITY STAGE/STORAGE CHART

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

Wednesday, 08 / 23 / 2023

Pond No. 1 - POND 1

Pond Data

Pond storage is based on user-defined values.

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	140.29	n/a	0	0
0.42	140.71	n/a	73	73
3.17	143.46	n/a	2,722	2,795
3.67	143.96	n/a	6,003	8,798

Culvert / Orifice Structures

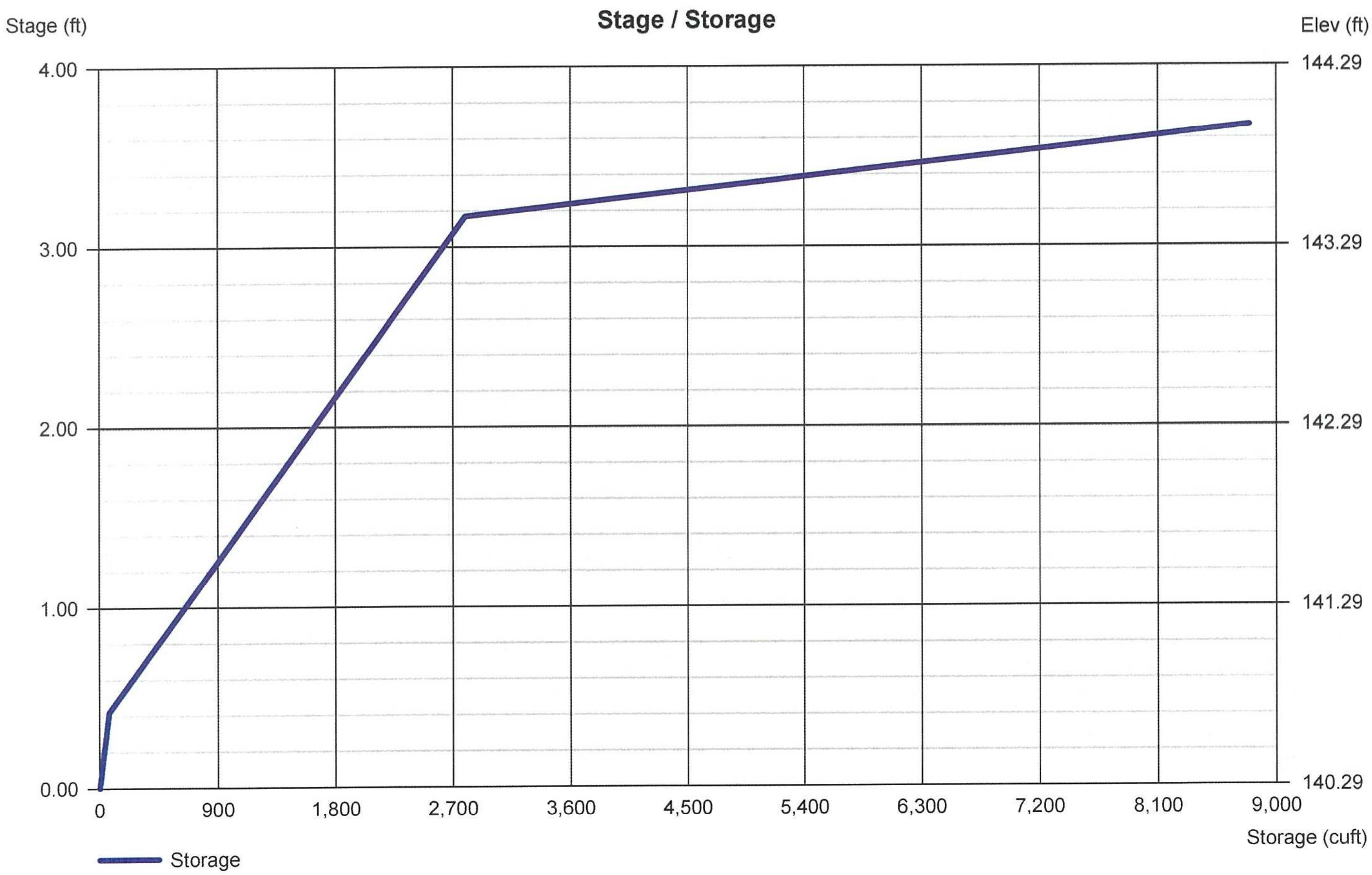
		[A]	[B]	[C]	[PrfRsr]
Rise (in)	=	8.00	0.00	0.00	0.00
Span (in)	=	8.00	0.00	0.00	0.00
No. Barrels	=	1	0	0	0
Invert El. (ft)	=	140.29	0.00	0.00	0.00
Length (ft)	=	29.00	0.00	0.00	0.00
Slope (%)	=	0.50	0.00	0.00	n/a
N-Value	=	.012	.013	.013	n/a
Orifice Coeff.	=	0.60	0.60	0.60	0.60
Multi-Stage	=	n/a	No	No	No

Weir Structures

		[A]	[B]	[C]	[D]
Crest Len (ft)	=	0.00	0.00	0.00	0.00
Crest El. (ft)	=	0.00	0.00	0.00	0.00
Weir Coeff.	=	3.33	3.33	3.33	3.33
Weir Type	=	---	---	---	---
Multi-Stage	=	No	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)
TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022 — Wednesday, 08 / 23 / 2023

Hyd. No. 2

ROUTE TO POND

Hydrograph type	= Reservoir	Peak discharge	= 2.662 cfs
Storm frequency	= 25 yrs	Time to peak	= 8.10 hrs
Time interval	= 3 min	Hyd. volume	= 48,190 cuft
Inflow hyd. No.	= 1 - POST CONSTRUCTION	Max. Elevation	= 143.35 ft
Reservoir name	= POND 1	Max. Storage	= 2,690 cuft

Storage Indication method used.