Exhibit I

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MEMORANDUM

DATE: **Revised July 6, 2022** **Project No. 4409**

TO: **Juan Hernandez, Monterey County Public Works**

FROM: **Nathaniel Milam, PE, QSD**

Cc: **Jeff Nohr, Avila Construction**

SUBJECT: **Susan Street Agricultural Employee Housing, PLN#210152**

Supplemental Drainage Study

Purpose

This Memorandum provides an analysis of the existing county-owned storm drain system, with focus on the Susan Street Pump Station and Pond located near the Project Site's northeasterly property corner, and how the Proposed Project (the Susan Street Agricultural Employee Housing project, PLN#21052) affects said system.

This Memorandum is prepared to satisfy the following project Condition of Approval:

> *15. MM USS-2 DRAINAGE STUDY*
>
> *The Owner/Applicant may be able to connect to the storm drain system provided certain conditions are met by the development. A stormwater downstream conveyance and lift station capacity analysis is required. The downstream capacity study shall include, but not be limited to:*
>
> - *An evaluation of the impact of the proposed development on the storm drain system and identification of any system improvements necessary to accommodate the proposed project.*
> - *If the lift station or any impacted storm drain lines are determined to be undersized to serve the proposed development, the study shall include recommendations for necessary upgrades.*

In addition, County staff has stated that they are concerned about sending additional runoff to the Susan Street Pump Station due to existing drainage management challenges. They noted that significant runoff from agricultural land is directed to the pump station, resulting in year-round pumping. Also, sediment and trash tend to accumulate in the pump station wetwell.

The Proposed Project

The Project occurs on Assessor's Parcel Number (APN) 117-361-016, a 5.95-acre undeveloped parcel located immediately north of Susan Street. Currently the site is used for row crops, and elevations vary from approximately 29.5' NAVD88[1] at the northwest corner to approximately 32' at the southeast corner of the site. The site drains from the south and east to the northwest, where runoff is collected into a ditch that runs along the toe of the river levee and the northerly boundary of adjacent parcel APN 117-361-017 (Nicola). This ditch outfalls to the Pajaro River via a 12"-diameter corrugated metal pipe (CMP) culvert through the levee. Backflow from the river to the ditch is minimized by a flap gate on the end of the CMP. When the river is high enough to prevent discharge through the 12" CMP outfall, stormwater runoff accumulates in the low-lying areas on the Project Site and on the Nicola parcel until the river water level recedes.

The Proposed Project includes construction of four agricultural employee apartment buildings, and associated site work such as utilities, parking and outdoor spaces. Runoff from the Project Site is proposed to be mitigated by a series of on-site bioretention ponds that are sized to 1) retain (infiltrate) all runoff up to the 85th percentile storm event, and 2) reduce the site's peak runoff rate to less than or equal to the site's existing peak runoff rate, for the 2- through 100-year storm events.[2]

The Project proposes to change the discharge point for the site from the northwest corner of the site, and instead connect the proposed on-site facilities to the existing County-owned storm drain south and east of the Project Site. The connections are shown on the Project Plans; see sheets C1.2, C1.5 and C1.6. This change in drainage pattern is proposed for three reasons:

First, the *Pajaro Master Drainage Plan* identifies the Project Site as located within the ultimately planned drainage area for the Susan Street Pump Station.

Second, we recommend against the Project Site continuing to drain to the west due to 1) the lack of a pump station at the Gonda Street Outfall, 2) the potential redevelopment of the Nicola parcel. Redevelopment of that parcel would significantly reduce the area that can be flooded; and 3) the reported flooding of the existing apartments west of Gonda Street (which area is also not served by a pump station).

And finally, the project's proposed Stormwater Control Measures (SCMs) must connect to a storm drain due to the depth of the proposed on-site storm drains. There is no storm drain available adjacent to the Project and at sufficient depth, other than the County-owned storm drain.

Background Information and Field Review

We reviewed the documents referenced at the end of this report, obtained publicly available 1-foot contour interval LIDAR mapping for the study area, and performed a field review on February 23, 2022 with Monterey County staff. We used this information

[1] All elevations given herein are in the North American Datum of 1988 (NAVD88), except where specifically noted otherwise.
[2] See the Project's Storm Water Control Plan (SWCP) for detailed description and sizing of the on-site facilities.

to create an Existing Conditions Base Map. The existing storm drainage facilities and watersheds are shown in the Exhibits in Appendix 2.

The existing County-owned storm drain system in the study area consists of the following components:

- San Juan Road Storm Drain (see the Phase 2-A Plans):
    - A 24" to 30"-diameter storm drain running from east to west under San Juan Road, to collect drainage that accumulates on San Juan Road;
    - Area B-5 Outfall: A 30"-diameter RCP with flap gate near the Porter Drive / Main Street bridge.
- Susan Street Storm Drain, Pump Station and Pond (see the Phase 2-B Plans):
    - A 24" to 30"-diameter storm drain running northerly within Susan Street from San Juan Road to approximately 10' north of the southerly property line of the Project Site; then running easterly through the Project Site, within a 20-wide easement along the Project Site's southerly boundary; then running northerly, approximately 10' east of the Project Site's easterly boundary to the Susan Street Pump Station;
    - A storm water pond occupying the majority of County-owned parcel APN 117-381-031, which lies directly east of the Project Site.
    - A pump station located near the Project Site's northeasterly corner (and partially encroaching onto the Project Site), consisting of a wet well and four pumps.
    - Susan Street Pump Station (Area B-1) Outfall: A 30"-diameter RCP pipe with flap gate
- Various culverts, most prominently at the San Juan Road / Allison Road intersection
- Various ditches, most prominently along San Juan Road and Allison Road

In addition to these County-owned facilities, the following outfalls exist within Drainage Area B. We understand these outfalls are owned and operated by Monterey County Water Resources Agency.

- Gonda Street (Area B-2) Outfall: A 12"-diameter CMP pipe with flap gate
- Area B-3 Outfall: A 15"-diameter CMP pipe with flap gate (broken). The outfall is connected to a catch basin located in the parking lot of the apartment buildings west of Gonda Street. Because the flap gate is broken, and the low point on the site occurs in the parking lot adjacent to the apartment buildings, flooding is a problem when the river rises above 30' elevation (which is less than the 10-year river flood elevation per the FEMA Flood Insurance Study).

Pajaro Master Drainage Plan

The design basis outlined in the *Pajaro Master Drainage Plan* is as follows (ref. page 7):

> *The storm drain system planned for the community of Pajaro is expected to protect the community from damage caused by runoff from local rainfall. Various levels of protection are proposed, based on cost/benefit considerations. The system should be sized so that the runoff from a 2-year storm is carried entirely in the ditches and pipes which are part of the storm drain system. The runoff from the 10-year storm is to be carried in the combination of pipes, ditches, and gutters with no ponding that would prohibit passage of motor vehicles. Runoff from the 25-year rainfall should be stored and conveyed away from the community with no inundation of private property or damage to public facilities. Streets and undeveloped property may be flooded for some period of time, but permanent damage should be minimized.*

In the discussion on pages 17 – 19 the Master Plan gives the 100-year storm as the basis for sizing the pump station.

The Master Plan identifies the Project Site as lying within Tributary Area B, which is highlighted in Figure 1, below. The Master Plan describes Area B as follows (ref. pg. 5):

> *Area B which is 135 acres is located between the Pajaro River and San Juan Road and is bounded on the east by the northeasterly projection of Allison Road. A culvert crosses San Juan Road at Allison Road and carries the flows from the area north of San Juan Road and east of Allison Road to the ditch which continues south along the west side of Allison Road. (See Area D for further discussion of this portion of the system.) Runoff in Area B is concentrated in the gutters along both sides of San Juan Road and drains to the Pajaro River through a flap gate located a short way upstream from the Porter Street Bridge and culvert with flap gate (12-inch CMP) located near the end of Gonda Street. This provides some drainage relief for Elsa Street and the northern portion of Gonda Street which does not flow to San Juan Road. The majority of Area B is agricultural land which drains to a low area with no positive means of relief. This low area is located beyond the northern end of Susan Street, near the Pajaro River levee.*

The Master Plan also notes that Tributary Area D-1 spills over into Tributary Area B during storm events larger than the 2-year event (ref. pg 14). As discussed later in this Study, however, the Susan Street Storm Drain is undersized to convey the drainage that accumulates along San Juan Road, therefore the amount of runoff that actually arrives at the pump station from watersheds B and D is limited by the capacity of the Susan Street Storm Drain.

The Master Plan improvements are shown in Figure 2, below. The Master Plan's proposed storm drain system is intended to capture Tributary Area B primarily via catch basins along San Juan Road, and be served by both the 30" RCP gravity outfall adjacent to the Porter Drive / Main Street Bridge, as well as the Susan Street Pump Station. When the river stage is low, the San Juan Road Storm Drain would gravity flow into the river via the 30" RCP outfall. When the river stage is high, the Susan Street Pump Station would allow the Susan Street / San Juan Road storm drain system to be pumped. The San Juan Road Storm

Drain would, in this case, "run backward" to the Pump Station, from Porter Drive to Susan Street.

Several sizing options are presented in the Master Plan for the pump station and pond. The Phase 2B contruction drawings indicate the existing pump station has a capacity of 30 cfs with all pumps 'on', and 18 cfs with one of the two larger pumps offline.

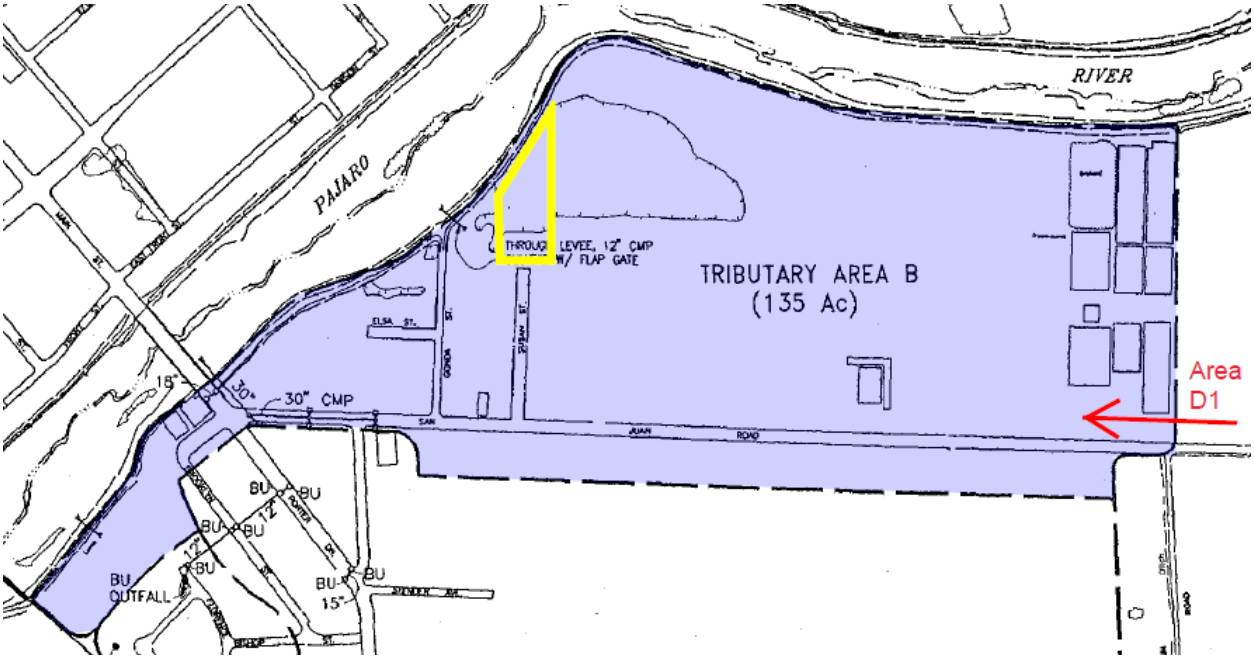


Figure 1. Excerpt from Figure 5, Pajaro Master Drainage Plan

The Master Plan's drainage improvements within Tributary Area B that have been constructed to date are:

- The San Juan Road Storm Drain (Phase 2A) and
- The Susan Street Storm Drain, Pond, and Pump Station (Phase 2B)

The Master Plan's drainage improvements that have not been constructed to date are:

- A storm drain extension from San Juan Road up Gonda Street and Elsa Street
- A storm drain extension east along San Juan Road to 500' east of Allison Road
- A storm drain extension from Gonda Street to the Susan Street Pump Station. This extension is identified later in this Study as Project #1.

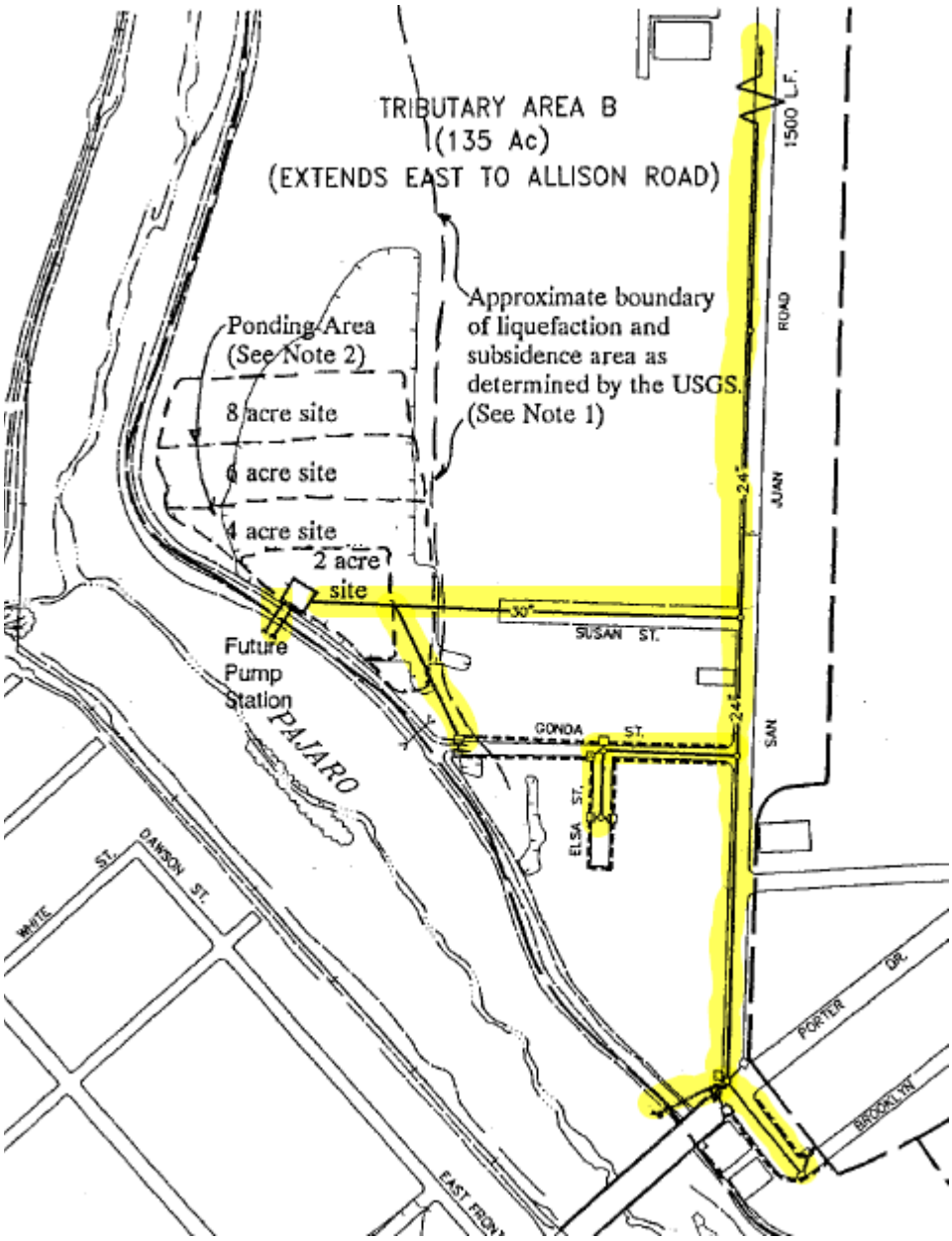


Figure 2. Excerpt from Figure 8, Pajaro Master Drainage Plan

Drainage Area B and Sub-Areas

For purposes of this study, we broke Drainage Area B into five sub-areas for analysis:

Area B-1 (47 acres) is directly tributary to the County Pond. Area B-1 does not have a gravity outfall to the Pajaro River, therefore all accumulated runoff must be infiltrated or pumped.

Because Area B-1 is not dependent on the capacity of the Susan Street Storm Drain, runoff from Area B-1 (and from Area B-2, post-project) is the primary determinant of the County Pond volume during large storm events. This is because the Susan Street Storm

Drain very significantly limits the peak inflow to the pond and pump station from the drainage areas that rely on the storm drain.

Area B-2 (5.7 acres) encompasses the Project Site and adjacent Nicola parcel. Area B-2 currently drains to a ditch located along the toe of the levee and discharges to the Pajaro River via a 12" CMP culvert with flap gate. In existing conditions, when the river stage is high, runoff accumulates in the low-lying areas within Area B-2 until the river level recedes. Per the *Pajaro Master Drainage Plan*, runoff from Area B-2 is planned to be directed to the County Pond.

Area B-3 (2.8 acres) encompasses the apartments northwest of Gonda Street and surrounding residences. Area B-3 relies on a 15" CMP culvert (with a broken flap gate) for drainage. Unlike Area B-2, Area B-3 has very limited stormwater storage capacity prior to flooding of improvements because the low point is located in the parking lot adjacent to the apartment buildings. Per the *Pajaro Master Drainage Plan*, runoff from Area B-3 is planned to be directed to the County Pond.

Area B-4 (51 acres) lies south of Area B-1 and east of Susan Street and drains south to San Juan Road. Runoff from Area B-4 is collected in the northerly San Juan Road curb and gutter, and then primarily into two catch basins located on the north side of San Juan Road, at Susan Street and approximately 500' east of Susan Street. In the event runoff exceeds the drain inlet capacity, runoff would continue flowing along San Juan Road to other catch basins located further west along San Juan Road, eventually overtopping the street curb and gutter, flowing out to the south, to Drainage Area A.

Due to the way the connection was made between the Susan Street Storm Drain and the San Juan Road Storm Drain, "low flows" from Area B-4 (e.g., agricultural runoff) are routed to the Susan Street Pump Station rather than to the 30" gravity outfall, even when river stage is low, thereby requiring runoff to be pumped.

The conveyance and capture capacity of the San Juan Road street and storm drain and Susan Street Storm Drain are limited. Modeling indicates runoff from Areas B-4 and D-1 creates flooding on San Juan Road during the 2-year and larger storm events. This flooding exits over-land to Drainage Area A.

Area B-5 (15 acres) is the remainder of Area B, and lies north of San Juan Road and west of Susan Street. Area B-5 is fully developed. Drainage is collected by catch basins located along San Juan Road. The San Juan Road Storm Drain conveys runoff east to the 30"-diameter gravity outfall located adjacent to the Porter Drive / Main Street Bridge when river stage is low; and west to the Susan Street Storm Drain when river stage is high.

Due to the elevation of San Juan Road relative to the Susan Street Pump Station and Pond, and the relatively large flows that enter the San Juan Road Storm Drain from Drainage Area B-4, during 2-year and larger storm events the San Juan Road Storm Drain is anticipated to back up, causing shallow flooding in Area B-5 along San Juan Road.

Area D-1 (300 acres) is upstream (east) of Area B-2. Agricultural runoff and runoff from small rain events drains to the Allison Road Ditch via two CMP culverts that cross under San Juan Road just east of Allison Road. However, these culverts have a combined capacity of only approximately 12 cfs, which is much smaller than the watershed's estimated 2-year runoff. During the 2-year and larger storm events, Area D-1 is

anticipated to overtop San Juan Road and overflow over-land into Areas A, B-4 and D-2.

Hydrologic Analysis

Runoff from Drainage Areas B and D-1 was estimated using the method outlined in NRCS Technical Release 55, commonly known as the "TR-55 Method". This method was developed specifically to estimate runoff volumes based on the 24-hour storm event, and therefore is well suited for evaluation of ponding volumes. The detailed watershed inputs are provided in **Appendix 3**. A summary of the peak runoff rates and total runoff volumes for the analyzed sub-watersheds are presented in Table 1, below.

At the time of the preparation of the *Pajaro Master Drainage Plan* (1996), the majority of Drainage Areas B and D was characterized by traditional row crops. Today, the drainage area is primarily characterized by berry production (strawberry and raspberry/blackberry) utilizing plastic soil cover to reduce weed growth and retain soil moisture; as well as temporary "hoop" style greenhouses. The use of plastic cover and greenhouses significantly increases the drainage area's runoff potential, and was likely not anticipated in the Master Plan.[3]

For purpose of this Study we have assumed an approximate impervious coverage of 50% to account for the plastic soil cover and greenhouses.

[3] Watershed characterisstics are not provided for Area B, however, on Page 22 of the Pajaro Master Drainage Plan it states: "*The calculated runoff* [for Area D] *is based on an assumed runoff coefficient of 0.2 which the City of Watsonville Drainage Master Plan uses as a minimum coefficient' for all agricultural land.*"

Figure 3. Photo of berry vines, temporary greenhouses, and plastic soil cover.

Figure 4. Photo of strawberry field with plastic soil cover

Table 1. Estimated runoff, with 50% plastic cover on agricultural lands

I.D.	Area (ac)	2-Yr Peak Runoff (c.f.s.)	2-Yr Total Runoff (ac-ft)	100-Yr Peak Runoff (c.f.s.)	100-Yr Total Runoff (ac-ft)	Notes
B-1	47	34	5.7	120	18	Directly tributary to County Pond
B-2	5.7	0.45	0.2	11	1.5	Project Site and Nicola parcel
B-3	2.8	2.8	0.4	8.2	1.1	Apartments west of Gonda St
B-4	51	43	7.0	160	22	Ag fields north of San Juan Rd, west of Allison St
B-5	15	18	2.5	50	6.8	Developed area north of San Juan Rd, west of Susan St
D-1	300	170	44	550	130	Partially runs on to Area B-4

As will be seen, these watershed runoff values far exceed the conveyance capacity of the Susan Street Storm Drain. As a result, the amount of runoff that is actually routed to the Susan Street Pump Station is only a fraction of the total watershed runoff. The excess runoff accumulates along San Juan Road, causing shallow flooding until it overflows over-land to Watersheds A and D-2.

Hydraulic Analysis

We performed a hydraulic analysis of the Susan Street Storm Drain, Pump Station and Pond. A plan, profile and typical section are provided in **Appendix 2** showing several hydraulic grade lines (HGLs) which are used for discussion.

The storm drain, pump station and pond response during large storm events is complex due to the relatively large tributary drainage areas, the over-land flow splits between the watersheds, and the limited conveyance capacity of the Susan Street Storm Drain. The system response is also dependent on whether the 30"-diameter gravity outfall to the Pajaro River is open. For analysis purposes, we have assumed the gravity outfall is closed.

The maximum conveyance of the existing Susan Street Storm Drain, with system hydraulic grade line (HGL) at the gutter elevation of San Juan Road (i.e., San Juan Road beginning to flood), is approximately 11 cfs. Losses are primarily driven by losses in the 24"-diameter portion of the storm drain. When the pond is at elevation 28.5' (pond just beginning to fill) the storm drain conveyance is reduced to approximately 8 cfs. Storm drain conveyance reaches zero at approximately pond elevation 30'; at this elevation the pond is at the same level as San Juan Road.

The pump "on" levels and the storm drain HGL's are shown on the Plan and Profile of the Project Site and County Storm Drain System in **Appendix 2**.

Table 2. Existing Pond Stage-Storage Table

Stage (elev, ft)	Area (ac)	Volume (ac-ft)[2]	Notes
28	0	0.35[1]	Pond empty; storm drain submerged
28.5	0.3	0.4	Pond beginning to fill
29	1.1	0.8	Between elev. 29' and 30' the pond begins to inundate adjacent ag fields (Miller parcel)
30	6.1	4.0	Approx. gutter elevation at San Juan Rd.
31	12.2	13	
31.5	14.5	20	Approx. elevation of the access road between the Project Site and County Pond parcel, and the high point at the north end of Susan Street

[1] Volume represents storage in the storm drain upstream of the pond

[2] Volumes are calculated by the Conic Method.

Table 3. Susan Street Pump Station Levels

Pump	Motor Horsepower	Design Capacity (cfs)	"On" Elev (ft)	"Off" Elev (ft)
P-1	10	2.8	24.3	23.8
P-2	10	2.8	24.7	24.2
P-3	45	12	24.9	24.0
P-4	45	12	25.1	23.9

[1] Horsepower and capacity are per the facility construction drawings. Pump "on" and "off" levels are based on the levels noted on the pump control panel, which are higher than shown on the construction drawings.

We created a model using the HEC-HMS computer program to estimate the required pond volume for both pre- and post-project conditions, and assuming either three pumps (17.6 cfs) or four pumps (29.6 cfs) are in operation. The results are provided in the table below. Detailed model information is provided in **Appendix 3**.

Table 4. Comparison of Calculated Pond Volumes

Scenario	2-Yr Pond Volume (ac-ft)	100-Yr Pond Volume (ac-ft)	100-Yr Pond Stage (ft)
At 29.6 cfs pump rate			
Existing	0.5	3.4	29.9
Proposed, without Project #2	0.5	3.8	30.0
At 17.6 cfs pump rate			
Existing	1.0	4.7	30.1
Proposed, without Project #2	1.0	5.3	30.2
Proposed, with Project #2	1.4	5.6	29.3

The model indicates the peak runoff from Watersheds B-4 and B-5 quickly overwhelms the Susan Street Storm Drain, and as a result the runoff that arrive at the pump station via the storm drain is limited to 11 cfs. Since this is less than the pumping rate, the runoff arriving via the storm drain does not significantly effect the total pond volume. Rather, runoff from Area B-1, which flows over-land to the pond and pump station, determines the required ponding volume, despite only accounting for only about one third of the total Area B runoff.

In proposed post-project conditions (without implementation of Project #2), the 100-year pond stage (elevation) is calculated in all scenarios to increase by approximately 0.1' relative ot existing conditions . This is due to the proposed redirection of Area B-2 to the County Pond. With implemenetation of Project #2, and assuming the use of only three pumps 'on' (one pump in standby), the 100-year pond stage would decrease by approximately 0.8' relative to existing conditions.

In all cases (existing, Proposed without Project #2, and Proposed with Project #2), the calculated 100-year pond stage (elevation) is estimated to be below an elevation that would flood existing adjacent or proposed structures, or overflow to the Subject Parcel, or overflow to the developed neighborhood to the south west. In both Existing and Proposed without Project #2 conditions, the 100-year pond stage would inundate the adjacent agricultural fields (Miller parcel) to less than 1 foot depth. In Proposed with Project #2 conditions, the 100-year pond stage (29.3') would not inundate the adjacent agricultural fields.

The increase in pond elevation resulting from the redirection of Area B-2 to the County Pond is therefore reduced to a less than significant level by implementation of Project #2.

Proposed Storm Drain Improvements

Project #1

In addition to the storm drain connections the Project proposes to make to the county's storm drain, the Project proposes to construct an 18"-diameter storm drain along the Project Site's southerly boundary, stubbing the line at the Project Site's west boundary. This will allow future development within Area B-2 to extend the storm drain to Gonda Street. With this storm drain extension, the Nicola parcel and the north end of Gonda Street can drain to the Susan Street Pump Station when the river stage prevents drainage through the existing 12" culvert. This would be especially beneficial in the event the Nicola parcel is developed, as local flooding would not easily be able to be accommodated on the Nicola parcel after that site is developed.

An easement would be needed for the storm drain extension through the Project Site.

Project #2

The Susan Street Pond, as currently exists, is significantly higher in elevation than the storm drain: the 30" storm drain invert at the pump station is at elevation 23.5', and the P-3 pump "on" elevation is 24.9'; whereas the pond does not begin to fill until approximately elevation 28'. This limits the conveyance capacity of the Susan Street Storm Drain during larger storms, and increases the cycling frequency of the pumps during smaller storms.

Project #2 entails excavating the existing pond to a bottom elevation of approximately 24', and modifying the adjacent 30"-diameter storm drain so that it outlets into the pond beginning at elevation 24'. This would allow storm water to be infiltrated in the pond when flows are small (e.g. agricultural runoff and runoff from small storm events); and would allow the pond to act as a sedimentation bay and trash capture area. This project would also increase the pond volume by approximately 4 ac-ft, which would significantly reduce pump cycle times.

Other Potential Projects

Based on this analysis, we have identified several other projects that the County may wish to pursue, separately from the Proposed Project. These would address storm water management concerns stated by County staff during preparation of this Study.

Project #3

The Phase 2A Storm Drain, prior to construction of Phase 2B, collected drainage from Areas B-4 and B-5 and discharged by gravity to the Pajaro River. With construction of the

Phase 2B Storm Drain, however, runoff from the two most upstream drain inlets on San Juan Road (which collect runoff from Drainage Area B-4) now are primarily conveyed to the Susan Street Storm Drain, even when the river stage is low enough to allow gravity discharge.

Project #3 entails adding a low-flow weir in the manhole at the intersection of San Juan Road and Susan Street to keep low-flows from Area B-4 from entering the Susan Street Storm Drain. This would significantly reduce the total annual volume of drainage that is routed to and pumped by the Susan Street Pump Station.

Further analysis would be needed to ensure the weir is designed in such a way that it does not significantly impact the storm drain's function during the 100-year event.

Conclusion

Runoff from Drainage Areas B-2 and B-3 was identified as tributary to the Susan Street Storm Drain and Pond in the *Pajaro Master Drainage Plan*; this included runoff from the undeveloped Project Site.

The Project will implement on-site mitigation measures (bioretention ponds and underground storage) to reduce the rate of the Project Site's runoff post-project to less than or equal to the rate of the undeveloped site. The Proposed Project therefore is within the design criteria outlined in the *Pajaro Master Drainage Plan*.

The redirection of Drainage Area B-2 to the Susan Street Pump Station will increase the estimated 100-year pond volume by 0.4 to 0.6 ac-ft, which is a difference of 0.1 feet vertically. This is not considered a significant impact, and connecting Drainage Area B-2 to the pump station would avoid flooding the Project Site and the adjacent Nicola parcel when the river stage is high.

One storm drain system improvement is proposed: construction of an 18"-diameter storm drain through the Project Site, toward Gonda Street. This storm drain would be of benefit to all parcels within Area B-2, as it would reduce flooding when the river stage is high.

The Proposed Project would not impact flood elevations for properties located in Drainage Areas B-3, B-4 or B-5.

We believe this Memorandum addresses the County condition MM USS-2. As always, please feel free to reach out to us if you need additional information.

References

Creegan + D'Angelo Consulting Engineers (1996). "Pajaro Master Drainage Plan", prepared for Monterey County Redevelopment Agency.

Creegan + D'Angelo Consulting Engineers (1998). "Plans for the Pajaro Drainage Project – Phase 2A", Contract No. C99002-D014, prepared for Monterey County Public Works.

Creegan + D'Angelo Consulting Engineers (2000). "Plans for the Pajaro Drainage Project – Phase 2B", Contract No. C 00018-BG, prepared for Monterey County Public Works.

Monterey County (1954). Single plan sheet titled "Road Dist. No. 1, Allison Road", County Serial Number 00008378.

US Army Corps of Engineers (1949). "Plans for Construction of Pajaro River Levees and Corralitos Creek Levees".

Appendices

1. Photos of Existing Drainage Facilities
2. Exhibits
   - Existing Storm Drain System and Topography
   - Map of Watersheds B and D
   - Plan and Profile of Project Site and County Storm Drain System
   - Cross-Section of Project Site and County Storm Drain System
   - Over-Land Overflow Conditions
   - Potential Projects
3. HEC-HMS Model Inputs and Results

Appendix 1

Selected Drainage Facility Photos

Photo 1. Susan Street Storm Drain Pump Station

Photo 2. Pump station inlet bay with trash pump suction pipe in foreground

Photo 3. Area B-5 Gravity Outfall near Porter Ave. (30" RCP with flap gate)

Photo 4. Area B-2 Outfall (12" CMP with flap gate)

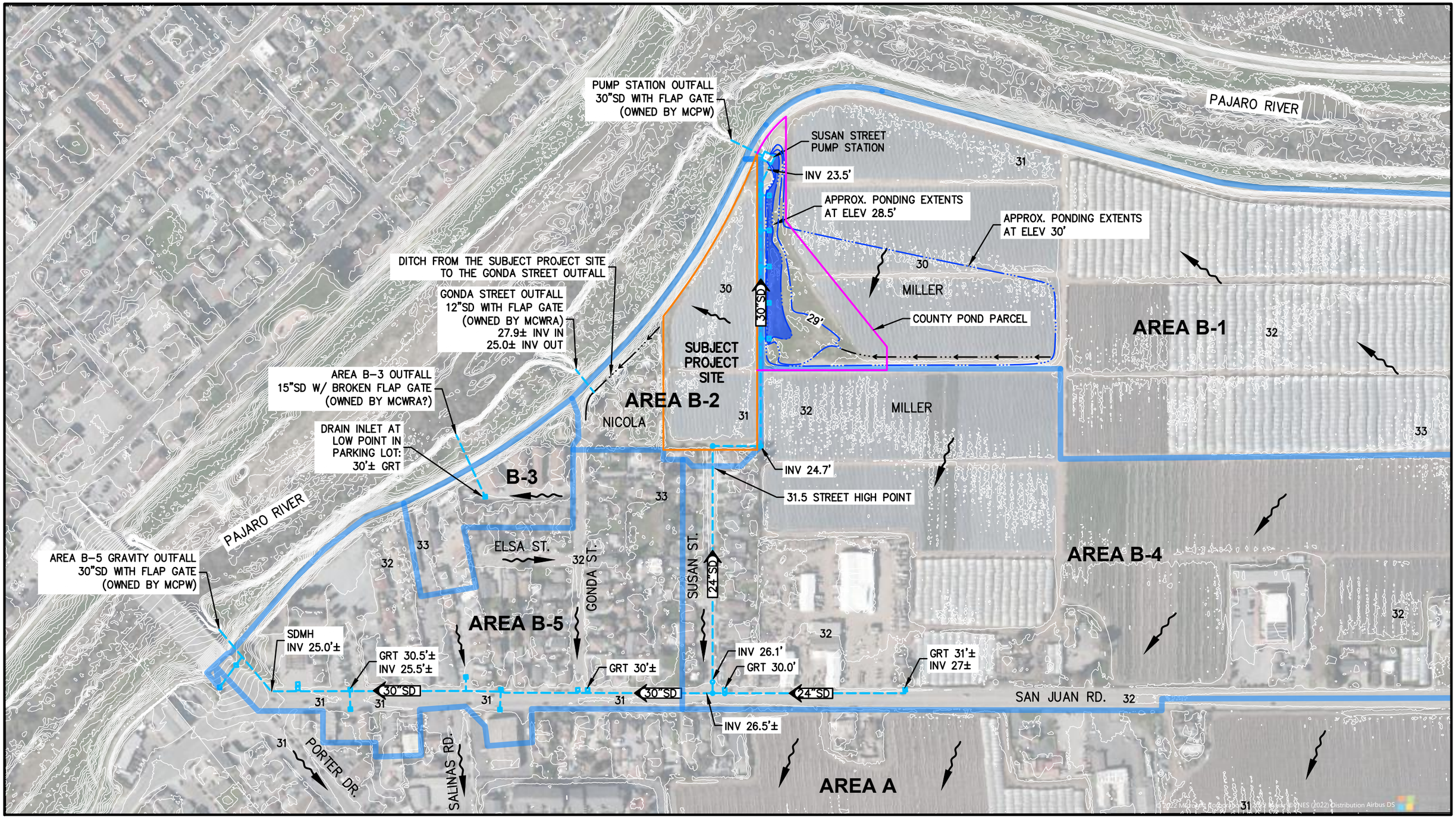
Photo 5. Area B-3 Outfall (15" CMP with broken flap gate)

Photo 6. Inlet side of double 22"x12" CMP culvert crossing San Juan Road at Allison Street. These CMP pipes have a capacity of approximately 12 cfs prior to road overtopping.

Photo 7. Inlet side of 4.5'W x 1.5'H box culvert crossing Allison Street at San Juan Road. Culvert has a capacity of approximately 22 cfs prior to road overtopping.

Appendix 2

Exhibits



Susan Street Agricultural Employee Housing, PLN#210152

EXISTING STORM DRAIN SYSTEM AND TOPOGRAPHY

PAJARO, CALIFORNIA

2 / 15 / 2022

Project No.: 4409.00

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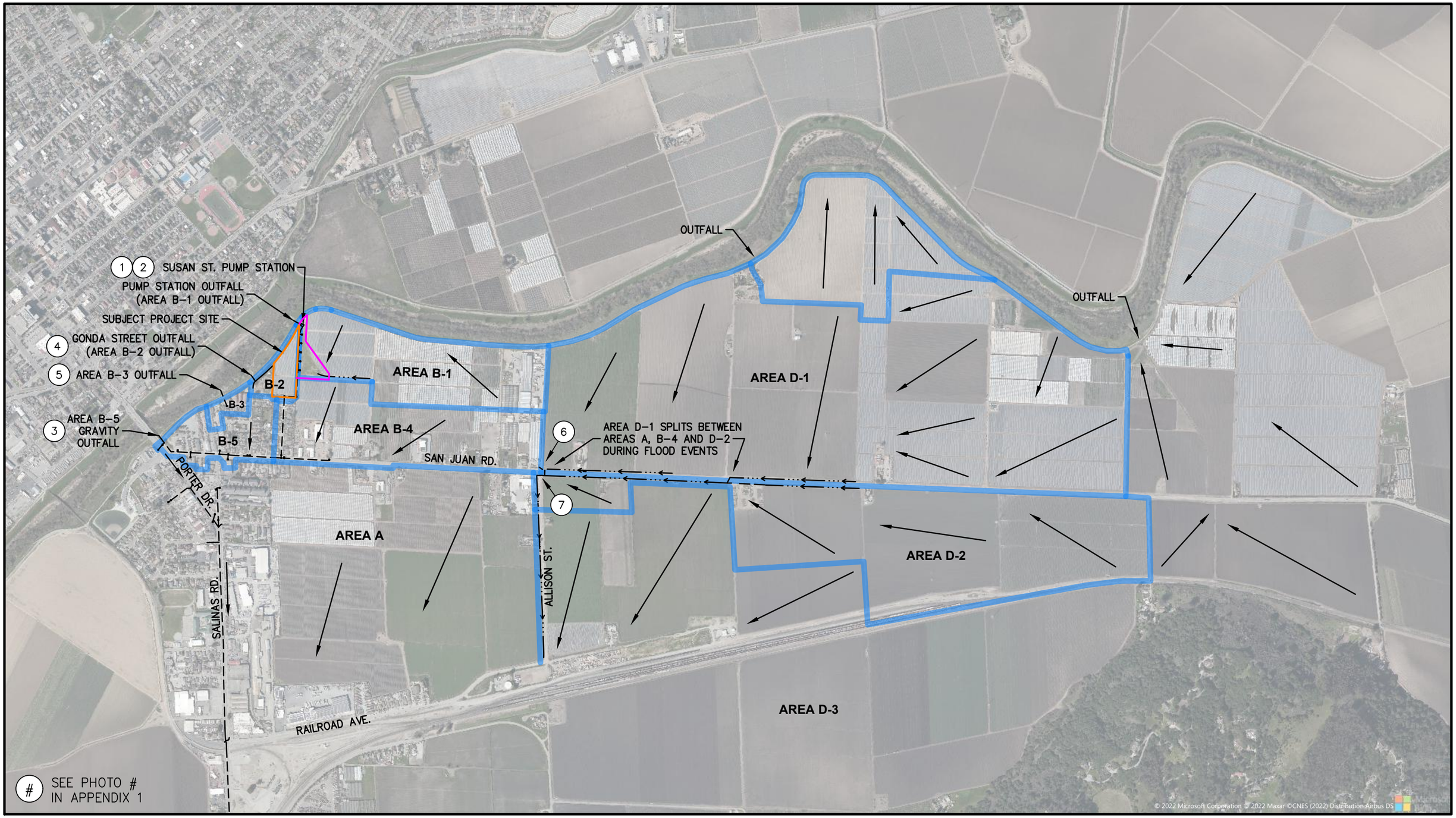
1" = 250'



Susan Street Agricultural Employee Housing, PLN#210152

MAP OF WATERSHEDS B AND D

PAJARO, CALIFORNIA

2/15/2022

Project No.: 4409.00

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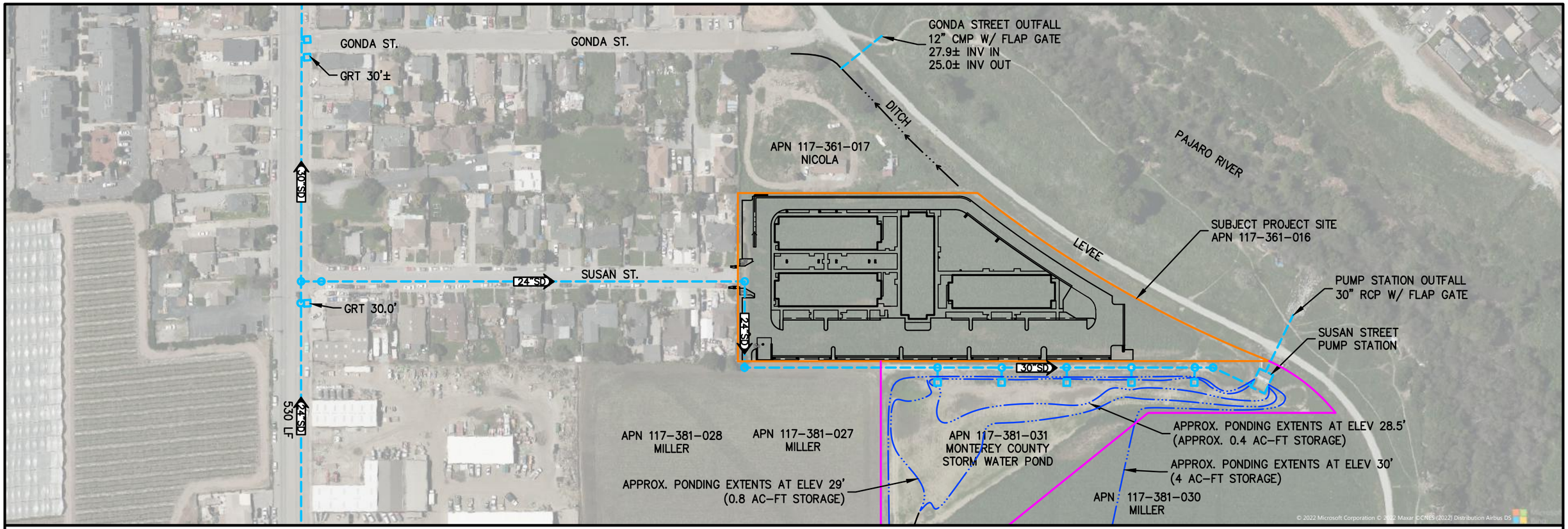
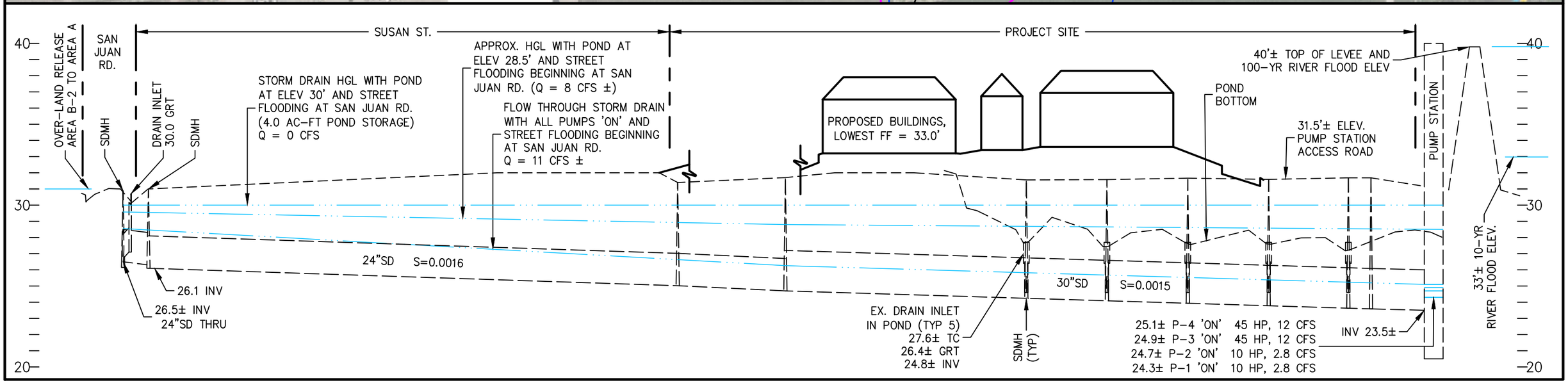
whitsonengineers.com

1" = 1000'





Susan Street Agricultural Employee Housing, PLN#210152

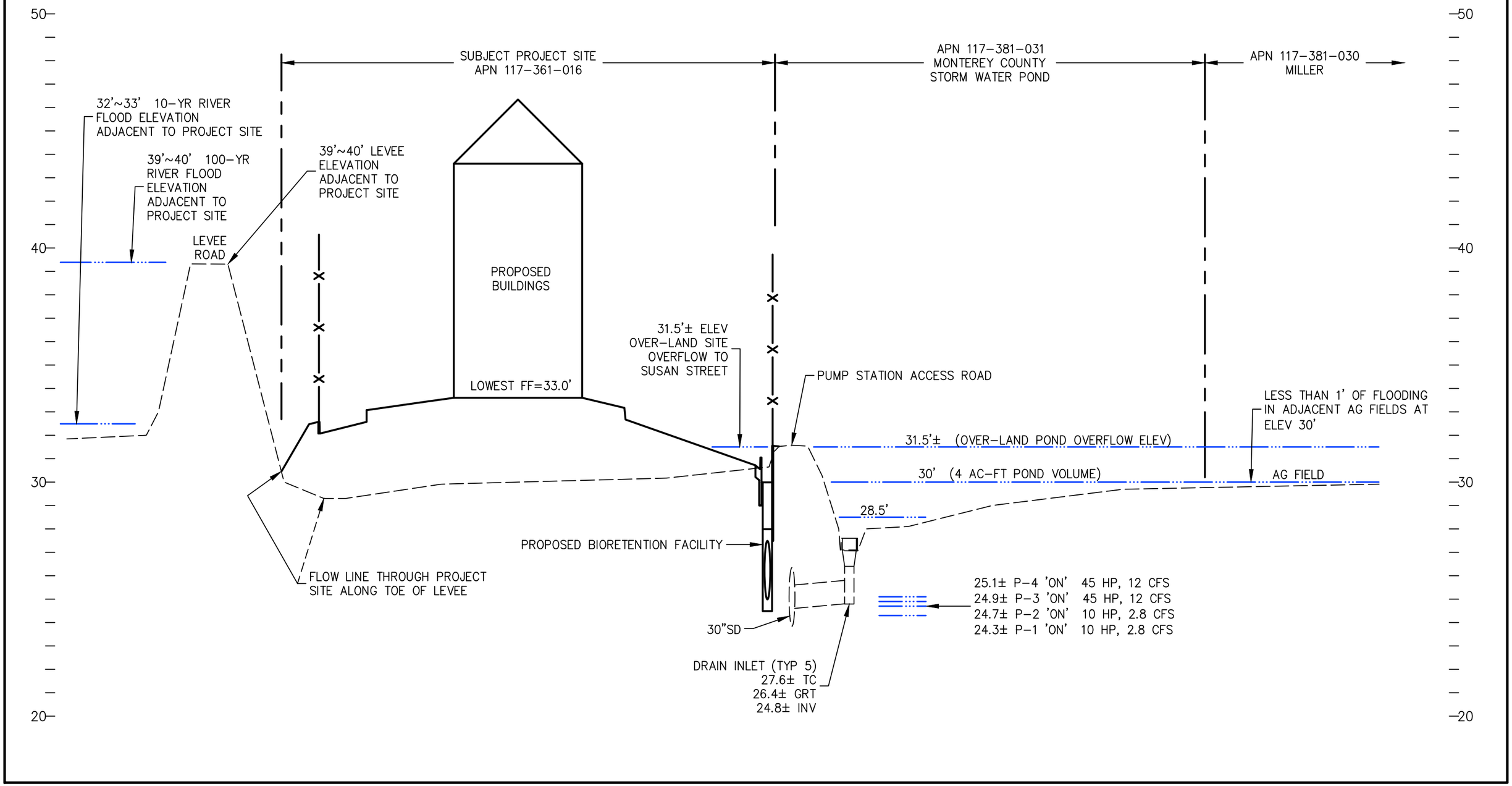
PLAN AND PROFILE OF PROJECT SITE AND COUNTY STORM DRAIN SYSTEM

PAJARO, CALIFORNIA

2/15/2022
Project No.: 4409.00

Whitson ENGINEERS
Civil Engineering
Land Surveying
6 Harris Court
Monterey, California
831.649.5225
whitsonengineers.com

NO SCALE



Susan Street Agricultural Employee Housing, PLN#210152

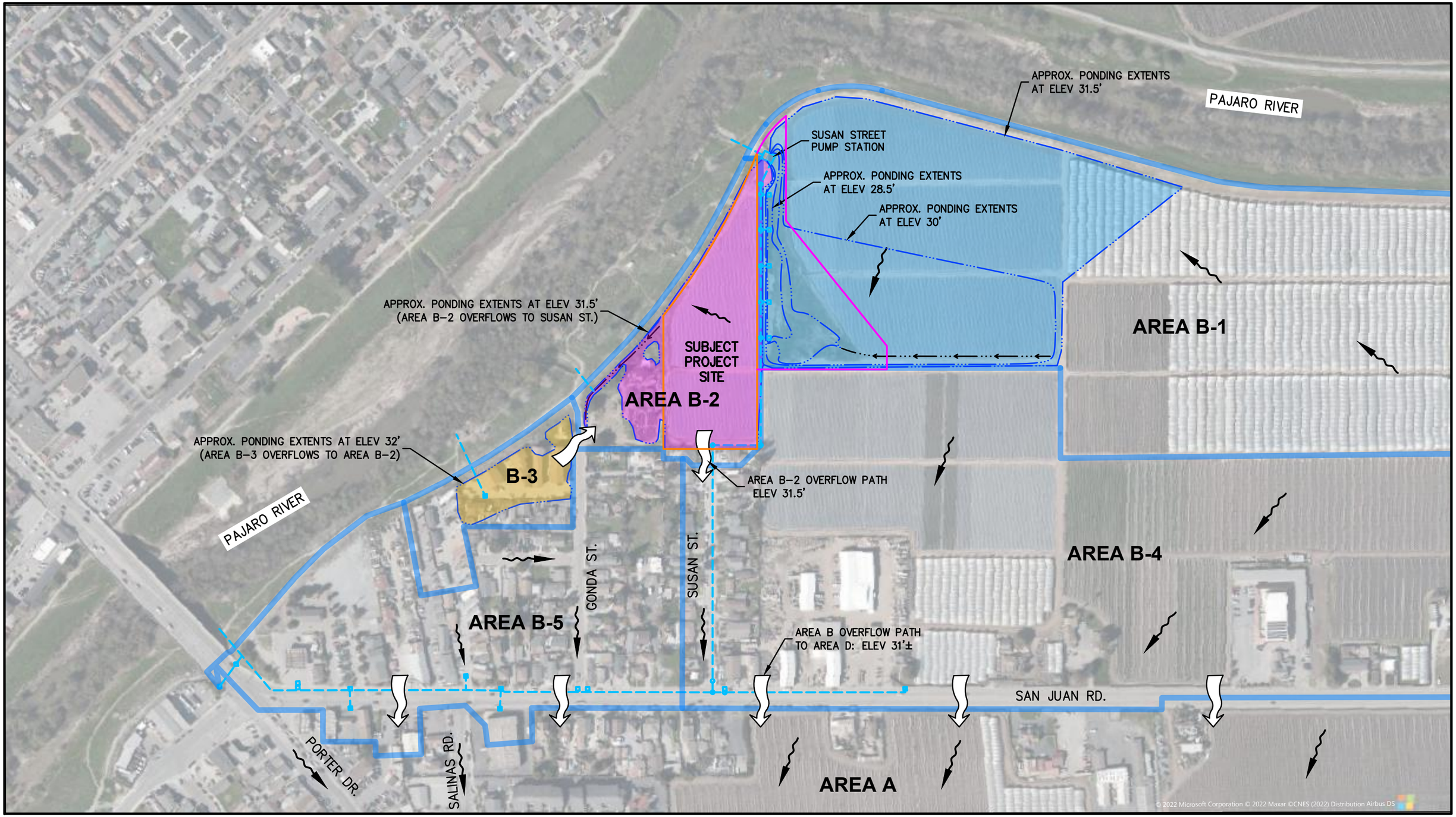
CROSS-SECTION OF PROJECT SITE AND COUNTY STORM DRAIN SYSTEM

PAJARO, CALIFORNIA

2/25/2022
Project No.: 4409.00

Whitson ENGINEERS
Civil Engineering
Land Surveying
6 Harris Court
Monterey, California
831.649.5225
whitsonengineers.com

NO SCALE



Susan Street Agricultural Employee Housing, PLN#210152

OVER-LAND OVERFLOW CONDITIONS

PAJARO, CALIFORNIA

2/15/2022
Project No.: 4409.00

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Civil Engineering
Land Surveying
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Monterey, California
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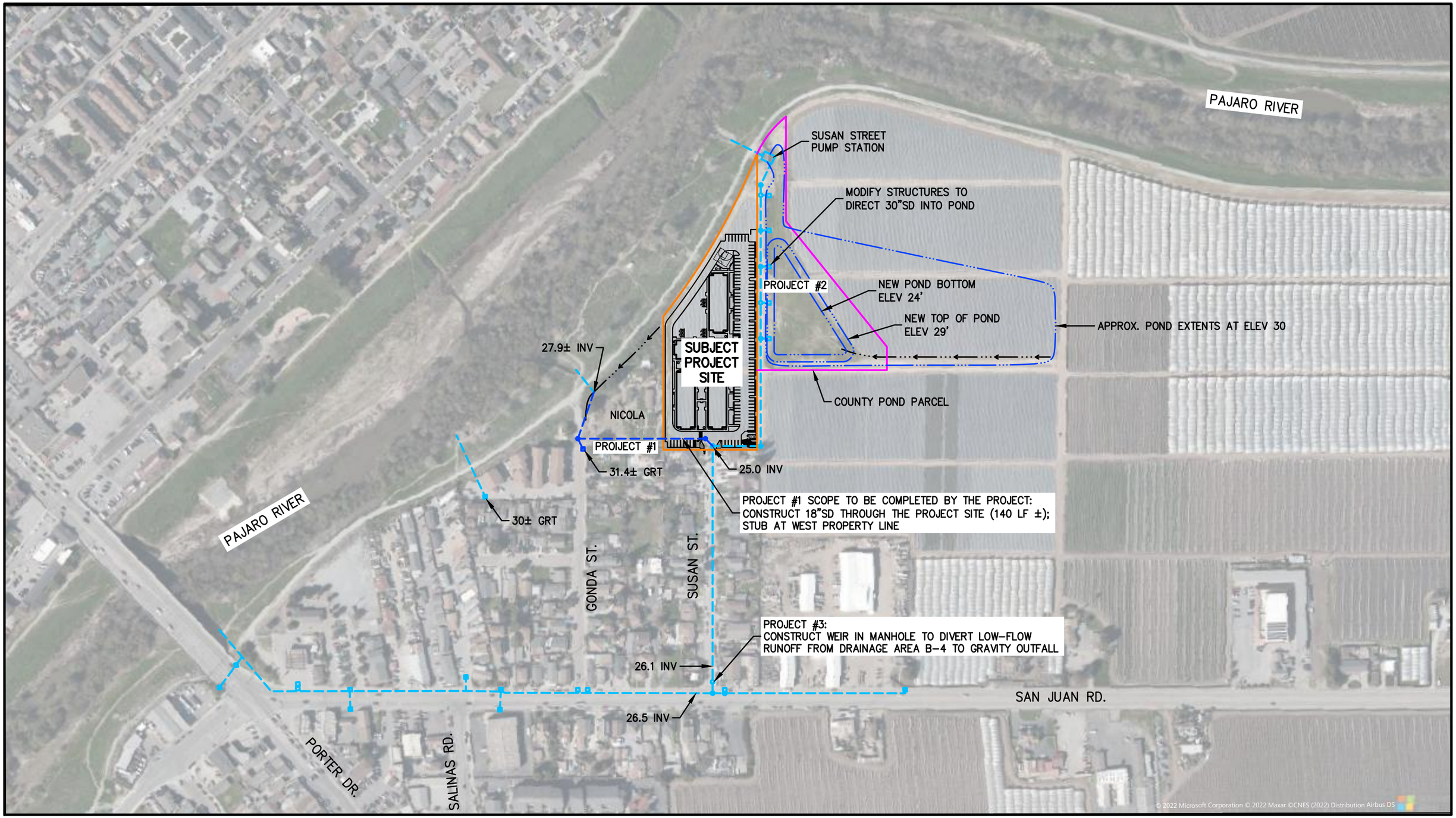
whitsonengineers.com

1" = 250'



Susan Street Agricultural Employee Housing, PLN#210152

POTENTIAL STORM DRAIN IMPROVEMENT PROJECTS

PAJARO, CALIFORNIA

2/15/2022

Project No.: 4409.00

Whitson ENGINEERS

Civil Engineering
Land Surveying
6 Harris Court
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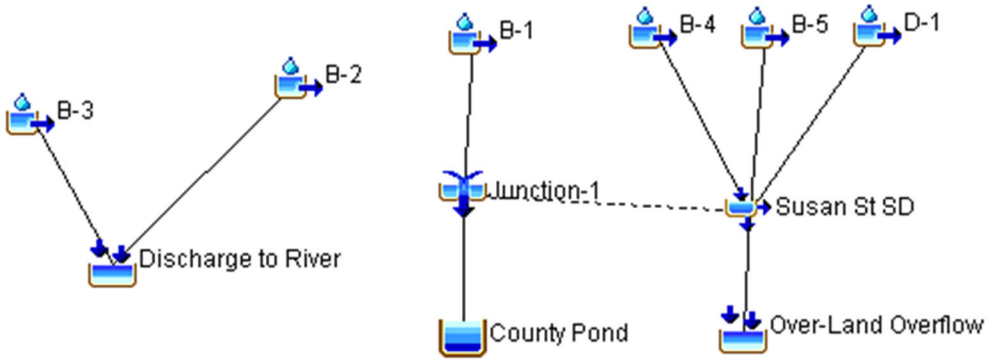
831.649.5225
whitsonengineers.com

1" = 250'

Appendix 2

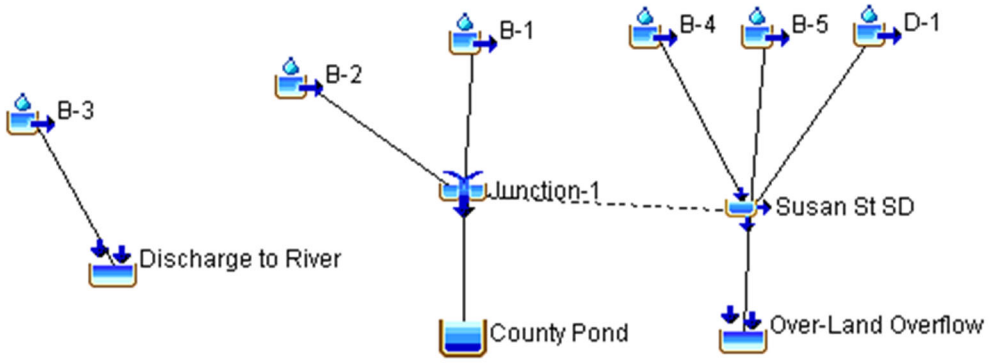
HEC-HMS Model, Inputs and Results

HEC-HMS Model: Existing Conditions



HEC-HMS Model: Post-Project Conditions

(note that DMA B-2 is connected to the County Pond)



Model Notes

The functioning of the existing storm drain system is complex due to flow splits and over-land overflow. The following simplifications were made for modeling purposes:

1. Drainage Area B-1 (and B-2 in the post-project condition) are directly tributary to the pond.
2. Drainage Areas B-4, B-5 and D-1 are connected to the pond by the Susan Steet Storm Drain, which has limited capacity. With the pond empty the storm drain can convey 11 cfs to the pond; with the pond at elevation 28.5 the rate drops to 8 cfs, and the rate is 0 cfs when the pond reaches 30' elevation. Such backwater effects are not able to be directly modeled in HEC-HMS. We have modeled this by:
    - Constant maximum "diversion" of 11 cfs from element "Susan St SD" to "Junction 1".
    - Modeled the reduction in storm drain capacity at high pond levels as an additional "discharge" in element "County Pond". For example, at elevation 28.5', the pond discharge is equal to the pump discharge plus 3 cfs (11 cfs "diversion" less 8 cfs actual calculated storm drain inflow).
3. Because of the very flat slopes within the drainage area (on average approximately 0.15%), we increased the Initial Abstraction from 0.2 S to 0.4 S, which is approximately the upper limit of Initial Abstraction.
4. Pond infiltration is ignored.

Analysis Results – Existing Conditions at 30 cfs pump rate

Project: 4409_Off_Site_R1 Simulation Run: 2-Year

Start of Run: 01Jan2000, 00:00
End of Run: 02Jan2000, 00:00
Compute Time: 07Mar2022, 10:02:29

Basin Model: Drainage Area
Meteorologic Model: 2-Year
Control Specifications: Control 1

Show Elements: All Elements | Volume Units: IN / ACRE-FT | Sorting: Alphabetic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (ACRE-FT)
B-1	0.073	33.79711	01Jan2000, 10:04	5.67568
B-2	0.009	0.44872	01Jan2000, 10:02	0.21692
B-3	0.004	1.54874	01Jan2000, 10:03	0.21689
B-4	0.080	43.14258	01Jan2000, 10:02	7.02718
B-5	0.023	11.75637	01Jan2000, 10:02	1.54713
County Pond	0.073	32.88299	01Jan2000, 10:13	26.09429
Discharge to River	0.013	1.99263	01Jan2000, 10:03	0.43381
D-1	0.470	166.79068	01Jan2000, 10:23	43.62668
Junction-1	0.073	44.79711	01Jan2000, 10:04	26.23899
Over-Land Overflow	0.573	174.24411	01Jan2000, 10:22	31.63769
Susan St SD	0.573	174.24411	01Jan2000, 10:22	31.63769

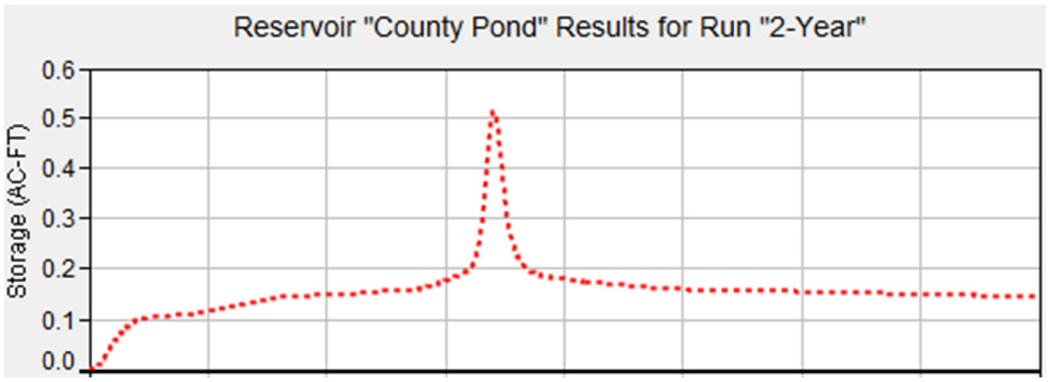
Project: 4409_Off_Site_R1 Simulation Run: 100-yR

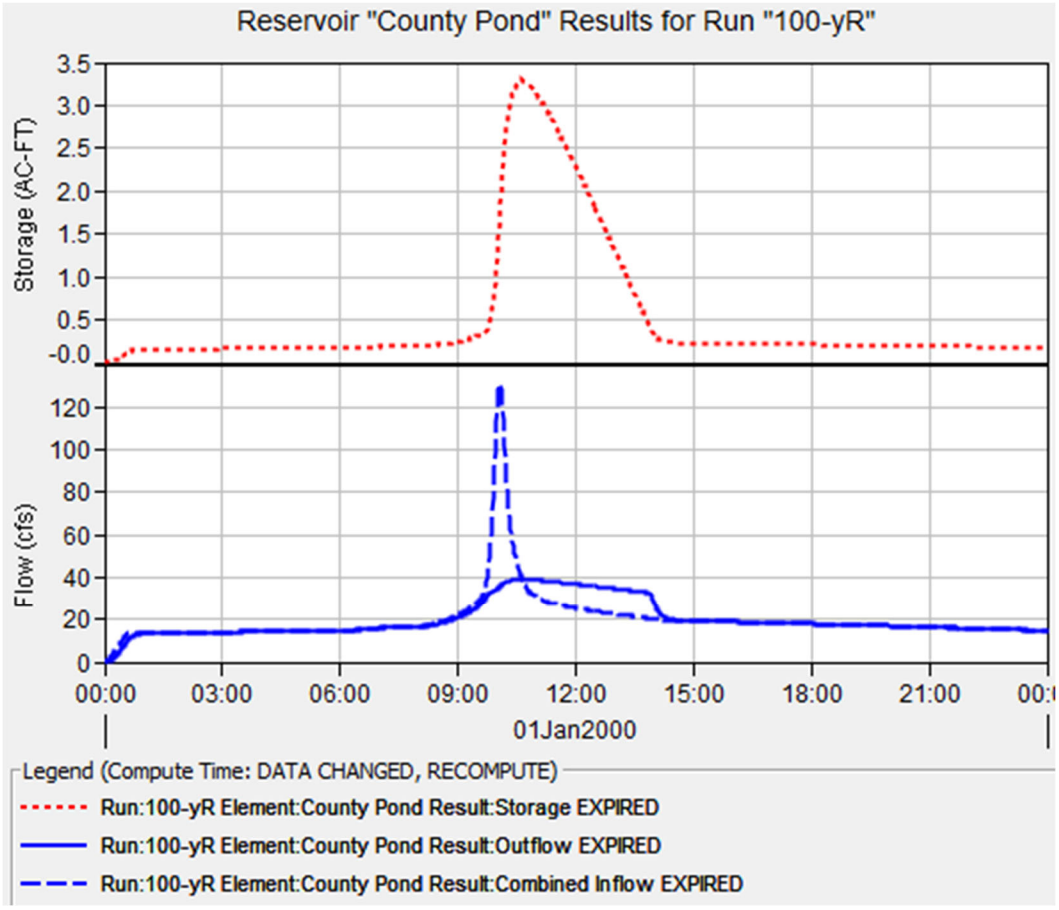
Start of Run: 01Jan2000, 00:00
End of Run: 02Jan2000, 00:00
Compute Time: DATA CHANGED, RECOMPUTE

Basin Model: Drainage Area
Meteorologic Model: 100-Year
Control Specifications: Control 1

Show Elements: All Elements | Volume Units: IN / ACRE-FT | Sorting: Alphabetic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (ACRE-FT)
B-1	0.073	120.34114	01Jan2000, 10:04	17.85328
B-2	0.009	10.99874	01Jan2000, 10:03	1.47237
B-3	0.004	7.07724	01Jan2000, 10:02	0.88388
B-4	0.080	164.20240	01Jan2000, 10:02	21.57155
B-5	0.023	45.02622	01Jan2000, 10:02	5.60680
County Pond	0.073	39.04754	01Jan2000, 10:38	39.18356
Discharge to River	0.013	18.04221	01Jan2000, 10:02	2.35625
D-1	0.470	552.70428	01Jan2000, 10:22	129.26301
Junction-1	0.073	131.34114	01Jan2000, 10:04	39.35811
Over-Land Overflow	0.573	607.70017	01Jan2000, 10:20	134.93653
Susan St SD	0.573	607.70017	01Jan2000, 10:20	134.93653


Reservoir "County Pond" Results for Run "2-Year"
Storage (AC-FT)
0.6
0.5
0.4
0.3
0.2
0.1
0.0


Reservoir "County Pond" Results for Run "100-yR"
Storage (AC-FT)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
-0.0
Flow (cfs)
120
100
80
60
40
20
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
01Jan2000
Legend (Compute Time: DATA CHANGED, RECOMPUTE)
Run:100-yR Element:County Pond Result:Storage EXPIRED
Run:100-yR Element:County Pond Result:Outflow EXPIRED
Run:100-yR Element:County Pond Result:Combined Inflow EXPIRED

Analysis Results – Existing Conditions at 17.6 cfs pump rate

Project: 4409_Off_Site_R1 Simulation Run: 2-Year

Start of Run: 01Jan2000, 00:00
End of Run: 02Jan2000, 00:00
Compute Time: 07Mar2022, 09:59:00

Basin Model: Drainage Area
Meteorologic Model: 2-Year
Control Specifications: Control 1

Show Elements: All Elements | Volume Units: IN / ACRE-FT | Sorting: Alphabetic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (ACRE-FT)
B-1	0.073	33.79711	01Jan2000, 10:04	5.67568
B-2	0.009	0.44872	01Jan2000, 10:02	0.21692
B-3	0.004	1.54874	01Jan2000, 10:03	0.21689
B-4	0.080	43.14258	01Jan2000, 10:02	7.02718
B-5	0.023	11.75637	01Jan2000, 10:02	1.54713
County Pond	0.073	21.98907	01Jan2000, 10:25	25.99534
Discharge to River	0.013	1.99263	01Jan2000, 10:03	0.43381
D-1	0.470	166.79068	01Jan2000, 10:23	43.62668
Junction-1	0.073	44.79711	01Jan2000, 10:04	26.23899
Over-Land Overflow	0.573	174.24411	01Jan2000, 10:22	31.63769
Susan St SD	0.573	174.24411	01Jan2000, 10:22	31.63769

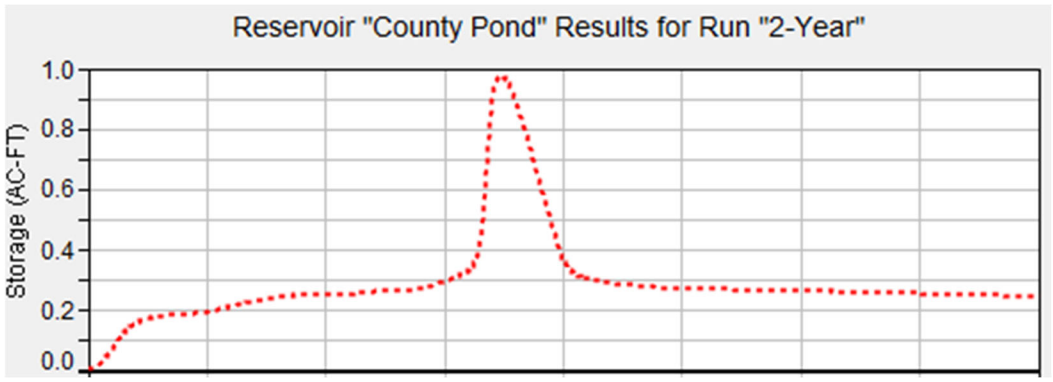
Project: 4409_Off_Site_R1 Simulation Run: 100-yR

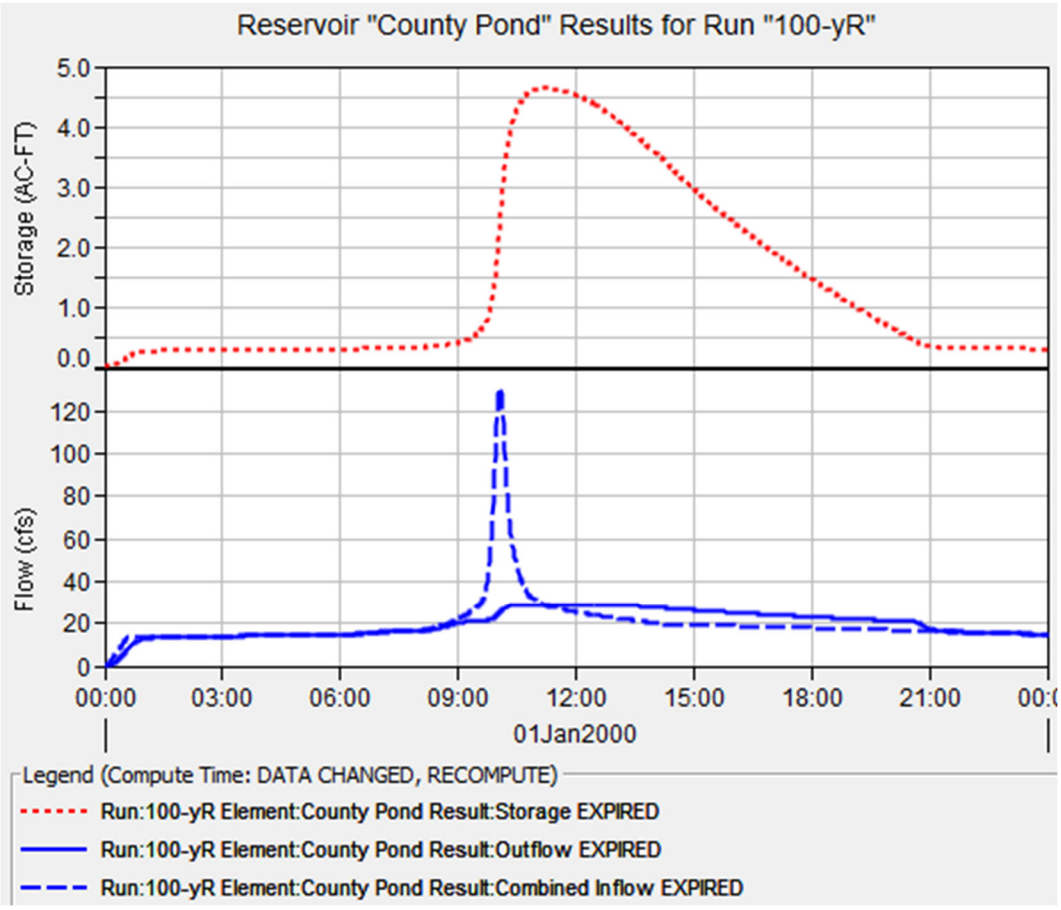
Start of Run: 01Jan2000, 00:00
End of Run: 02Jan2000, 00:00
Compute Time: DATA CHANGED, RECOMPUTE

Basin Model: Drainage Area
Meteorologic Model: 100-Year
Control Specifications: Control 1

Show Elements: All Elements | Volume Units: IN / ACRE-FT | Sorting: Alphabetic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (ACRE-FT)
B-1	0.073	120.34114	01Jan2000, 10:04	17.85328
B-2	0.009	10.99874	01Jan2000, 10:03	1.47237
B-3	0.004	7.07724	01Jan2000, 10:02	0.88388
B-4	0.080	164.20240	01Jan2000, 10:02	21.57155
B-5	0.023	45.02622	01Jan2000, 10:02	5.60680
County Pond	0.073	28.60000	01Jan2000, 10:21	39.06362
Discharge to River	0.013	18.04221	01Jan2000, 10:02	2.35625
D-1	0.470	552.70428	01Jan2000, 10:22	129.26301
Junction-1	0.073	131.34114	01Jan2000, 10:04	39.35811
Over-Land Overflow	0.573	607.70017	01Jan2000, 10:20	134.93653
Susan St SD	0.573	607.70017	01Jan2000, 10:20	134.93653


Reservoir "County Pond" Results for Run "2-Year"
Storage (AC-FT)
1.0
0.8
0.6
0.4
0.2
0.0


Reservoir "County Pond" Results for Run "100-yR"
Storage (AC-FT)
5.0
4.0
3.0
2.0
1.0
0.0
Flow (cfs)
120
100
80
60
40
20
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
01Jan2000
Legend (Compute Time: DATA CHANGED, RECOMPUTE)
Run:100-yR Element:County Pond Result:Storage EXPIRED
Run:100-yR Element:County Pond Result:Outflow EXPIRED
Run:100-yR Element:County Pond Result:Combined Inflow EXPIRED

Analysis Results – Proposed Conditions, 30 cfs pump rate

Project: 4409_Off_Site_R1 Simulation Run: 2-Year

Start of Run: 01Jan2000, 00:00
End of Run: 02Jan2000, 00:00
Compute Time: 07Mar2022, 10:03:52

Basin Model: Drainage Area
Meteorologic Model: 2-Year
Control Specifications: Control 1

Show Elements: All Elements | Volume Units: IN / ACRE-FT | Sorting: Alphabetic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (ACRE-FT)
B-1	0.073	33.79711	01Jan2000, 10:04	5.67568
B-2	0.009	0.44872	01Jan2000, 10:02	0.21692
B-3	0.004	1.54874	01Jan2000, 10:03	0.21689
B-4	0.080	43.14258	01Jan2000, 10:02	7.02718
B-5	0.023	11.75637	01Jan2000, 10:02	1.54713
County Pond	0.082	32.90566	01Jan2000, 10:13	26.31001
Discharge to River	0.004	1.54874	01Jan2000, 10:03	0.21689
D-1	0.470	166.79068	01Jan2000, 10:23	43.62668
Junction-1	0.082	45.23040	01Jan2000, 10:04	26.45591
Over-Land Overflow	0.573	174.24411	01Jan2000, 10:22	31.63769
Susan St SD	0.573	174.24411	01Jan2000, 10:22	31.63769

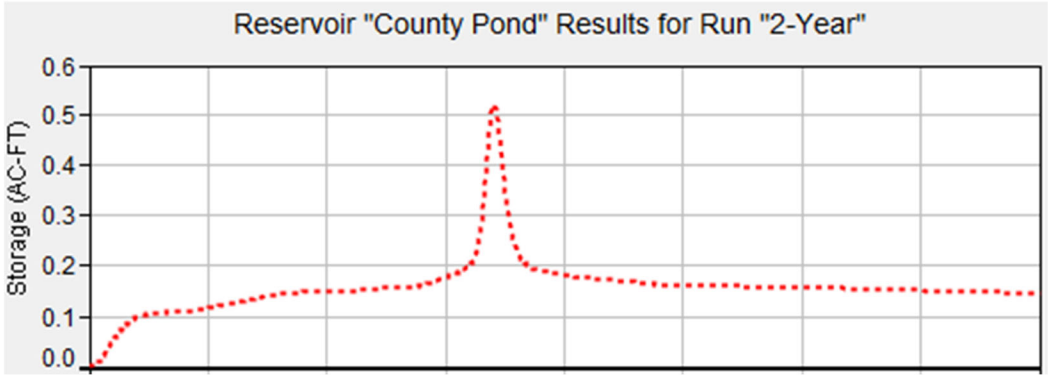
Project: 4409_Off_Site_R1 Simulation Run: 100-yR

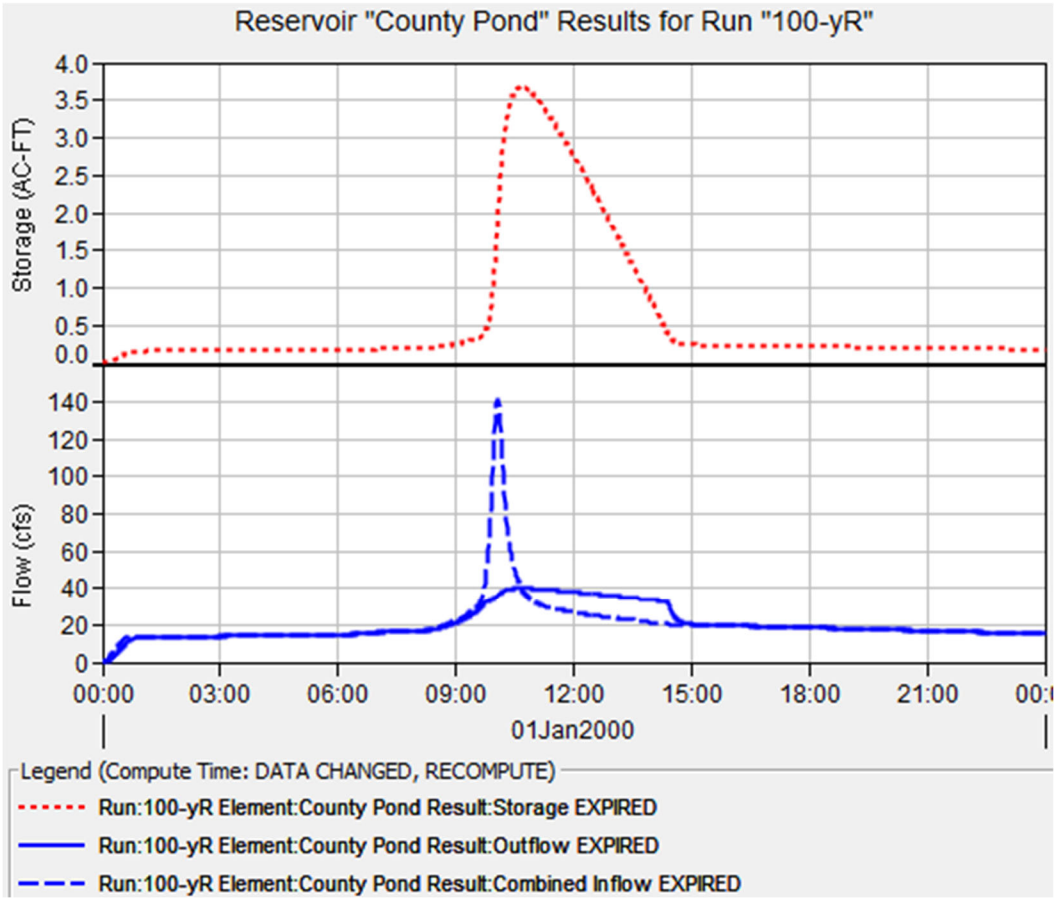
Start of Run: 01Jan2000, 00:00
End of Run: 02Jan2000, 00:00
Compute Time: DATA CHANGED, RECOMPUTE

Basin Model: Drainage Area
Meteorologic Model: 100-Year
Control Specifications: Control 1

Show Elements: All Elements | Volume Units: IN / ACRE-FT | Sorting: Alphabetic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (ACRE-FT)
B-1	0.073	120.34114	01Jan2000, 10:04	17.85328
B-2	0.009	10.99874	01Jan2000, 10:03	1.47237
B-3	0.004	7.07724	01Jan2000, 10:02	0.88388
B-4	0.080	164.20240	01Jan2000, 10:02	21.57155
B-5	0.023	45.02622	01Jan2000, 10:02	5.60680
County Pond	0.082	39.90294	01Jan2000, 10:40	40.65096
Discharge to River	0.004	7.07724	01Jan2000, 10:02	0.88388
D-1	0.470	552.70428	01Jan2000, 10:22	129.26301
Junction-1	0.082	142.19513	01Jan2000, 10:04	40.83049
Over-Land Overflow	0.573	607.70017	01Jan2000, 10:20	134.93653
Susan St SD	0.573	607.70017	01Jan2000, 10:20	134.93653


Reservoir "County Pond" Results for Run "2-Year"
Storage (AC-FT)
0.6
0.5
0.4
0.3
0.2
0.1
0.0


Reservoir "County Pond" Results for Run "100-yR"
Storage (AC-FT)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Flow (cfs)
140
120
100
80
60
40
20
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
01Jan2000
Legend (Compute Time: DATA CHANGED, RECOMPUTE)
Run:100-yR Element:County Pond Result:Storage EXPIRED
Run:100-yR Element:County Pond Result:Outflow EXPIRED
Run:100-yR Element:County Pond Result:Combined Inflow EXPIRED

Analysis Results – Proposed Conditions without Project #2, 17.6 cfs pump rate

Project: 4409_Off_Site_R1 Simulation Run: 2-Year

Start of Run: 01Jan2000, 00:00
End of Run: 02Jan2000, 00:00
Compute Time: 07Mar2022, 10:05:39

Basin Model: Drainage Area
Meteorologic Model: 2-Year
Control Specifications: Control 1

Show Elements: All Elements | Volume Units: IN / ACRE-FT | Sorting: Alphabetic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (ACRE-FT)
B-1	0.073	33.79711	01Jan2000, 10:04	5.67568
B-2	0.009	0.44872	01Jan2000, 10:02	0.21692
B-3	0.004	1.54874	01Jan2000, 10:03	0.21689
B-4	0.080	43.14258	01Jan2000, 10:02	7.02718
B-5	0.023	11.75637	01Jan2000, 10:02	1.54713
County Pond	0.082	22.02413	01Jan2000, 10:26	26.21022
Discharge to River	0.004	1.54874	01Jan2000, 10:03	0.21689
D-1	0.470	166.79068	01Jan2000, 10:23	43.62668
Junction-1	0.082	45.23040	01Jan2000, 10:04	26.45591
Over-Land Overflow	0.573	174.24411	01Jan2000, 10:22	31.63769
Susan St SD	0.573	174.24411	01Jan2000, 10:22	31.63769

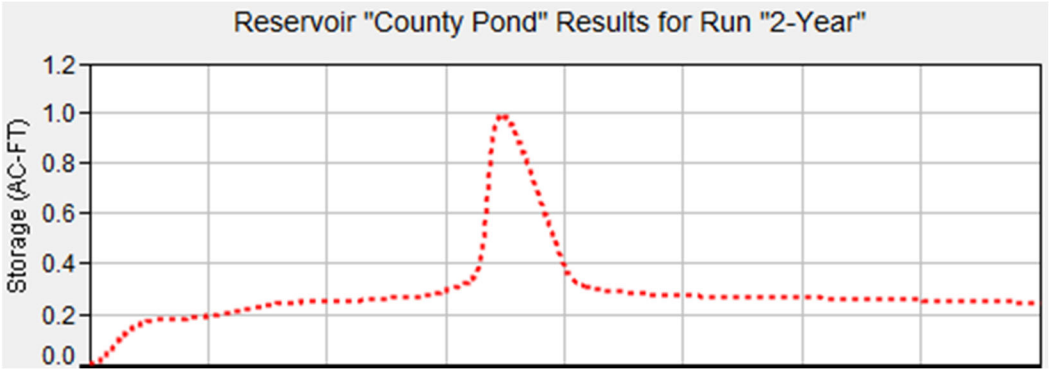
Project: 4409_Off_Site_R1 Simulation Run: 100-yR

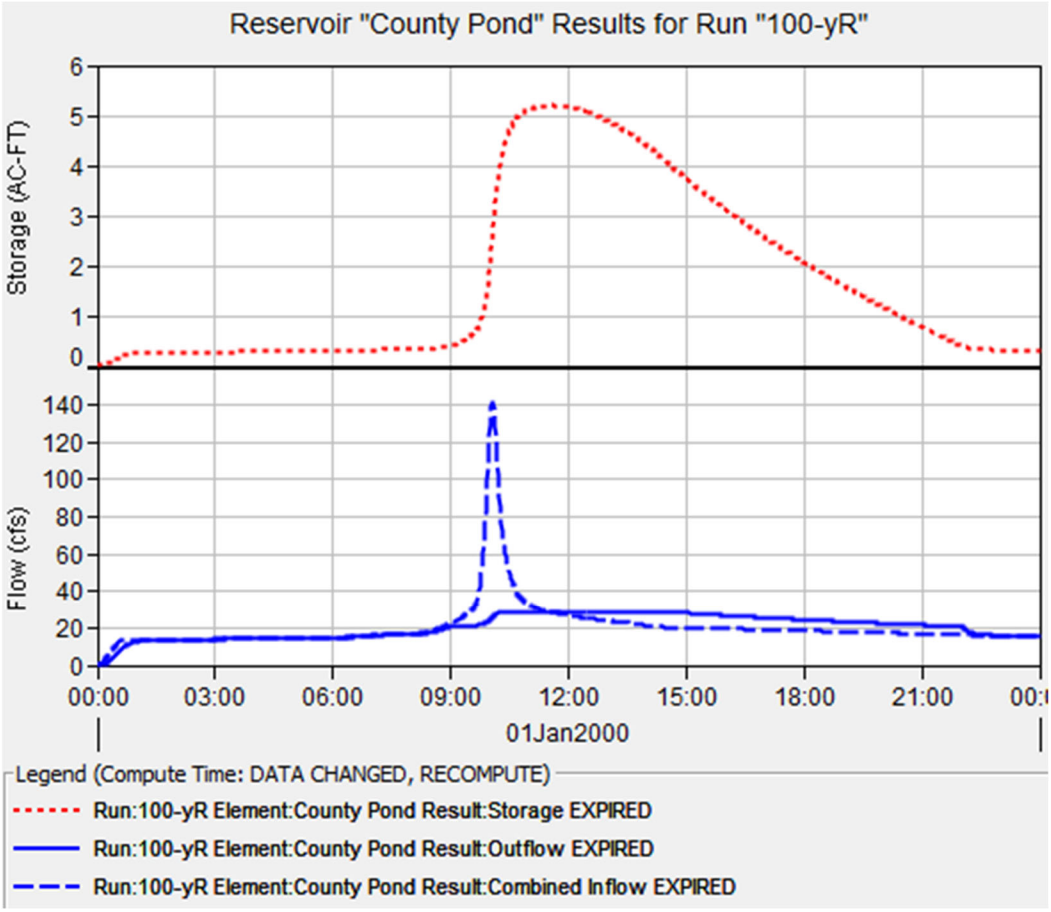
Start of Run: 01Jan2000, 00:00
End of Run: 02Jan2000, 00:00
Compute Time: DATA CHANGED, RECOMPUTE

Basin Model: Drainage Area
Meteorologic Model: 100-Year
Control Specifications: Control 1

Show Elements: All Elements | Volume Units: IN / ACRE-FT | Sorting: Alphabetic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (ACRE-FT)
B-1	0.073	120.34114	01Jan2000, 10:04	17.85328
B-2	0.009	10.99874	01Jan2000, 10:03	1.47237
B-3	0.004	7.07724	01Jan2000, 10:02	0.88388
B-4	0.080	164.20240	01Jan2000, 10:02	21.57155
B-5	0.023	45.02622	01Jan2000, 10:02	5.60680
County Pond	0.082	28.60000	01Jan2000, 10:15	40.52752
Discharge to River	0.004	7.07724	01Jan2000, 10:02	0.88388
D-1	0.470	552.70428	01Jan2000, 10:22	129.26301
Junction-1	0.082	142.19513	01Jan2000, 10:04	40.83049
Over-Land Overflow	0.573	607.70017	01Jan2000, 10:20	134.93653
Susan St SD	0.573	607.70017	01Jan2000, 10:20	134.93653


Reservoir "County Pond" Results for Run "2-Year"
Storage (AC-FT)
1.2
1.0
0.8
0.6
0.4
0.2
0.0


Reservoir "County Pond" Results for Run "100-yR"
Storage (AC-FT)
6
5
4
3
2
1
0
Flow (cfs)
140
120
100
80
60
40
20
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
01Jan2000
Legend (Compute Time: DATA CHANGED, RECOMPUTE)
Run:100-yR Element:County Pond Result:Storage EXPIRED
Run:100-yR Element:County Pond Result:Outflow EXPIRED
Run:100-yR Element:County Pond Result:Combined Inflow EXPIRED

Analysis Results – Proposed Conditions with Project #2, 17.6 cfs pump rate

Project: 4409_Off_Site_R1 Simulation Run: 2-Year

Start of Run: 01Jan2000, 00:00
End of Run: 02Jan2000, 00:00
Compute Time: 06Jul2022, 09:49:23

Basin Model: Drainage Area
Meteorologic Model: 2-Year
Control Specifications: Control 1

Show Elements: All Elements Volume Units: ○ IN ◉ ACRE-FT Sorting: Alphabetic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (ACRE-FT)
B-1	0.073	33.79711	01Jan2000, 10:04	5.67568
B-2	0.009	0.44872	01Jan2000, 10:02	0.21692
B-3	0.004	1.54874	01Jan2000, 10:03	0.21689
B-4	0.080	43.14258	01Jan2000, 10:02	7.02718
B-5	0.023	11.75637	01Jan2000, 10:02	1.54713
County Pond	0.082	17.60000	01Jan2000, 09:40	26.00080
Discharge to River	0.004	1.54874	01Jan2000, 10:03	0.21689
D-1	0.470	166.79068	01Jan2000, 10:23	43.62668
Junction-1	0.082	45.23040	01Jan2000, 10:04	26.45591
Over-Land Overflow	0.573	174.24411	01Jan2000, 10:22	31.63769
Susan St SD	0.573	174.24411	01Jan2000, 10:22	31.63769

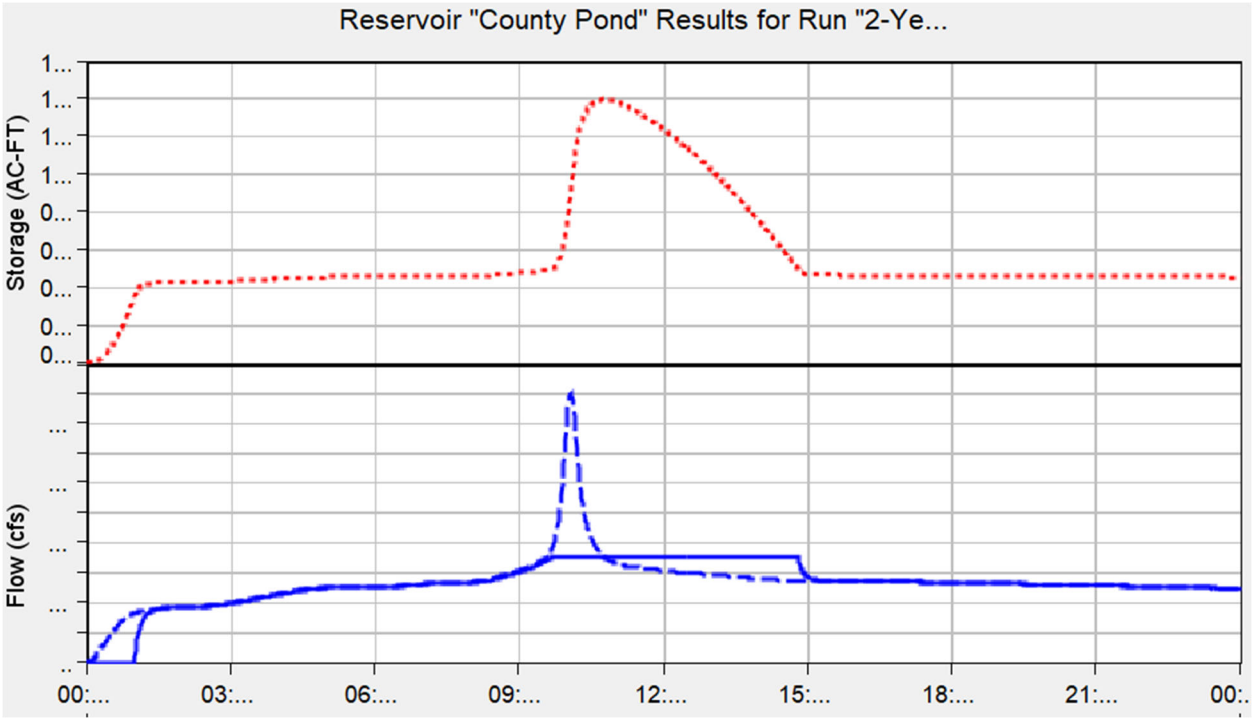
Project: 4409_Off_Site_R1 Simulation Run: 100-yR

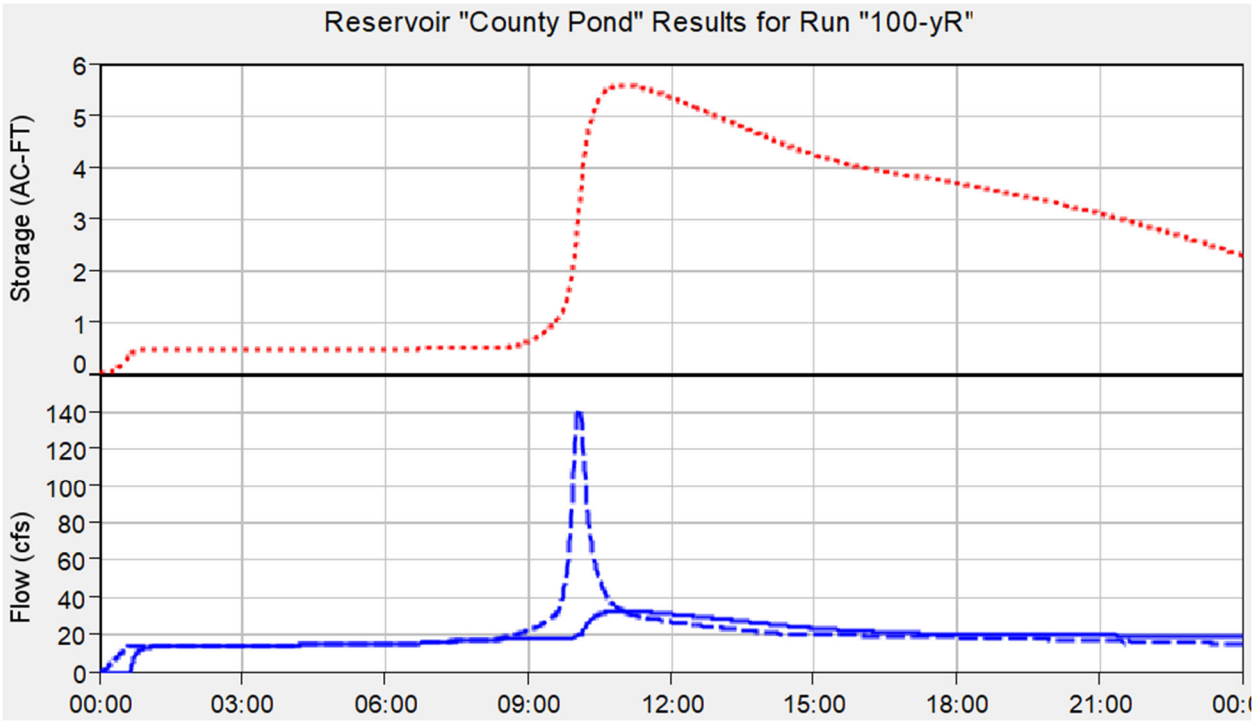
Start of Run: 01Jan2000, 00:00
End of Run: 02Jan2000, 00:00
Compute Time: DATA CHANGED, RECOMPUTE

Basin Model: Drainage Area
Meteorologic Model: 100-Year
Control Specifications: Control 1

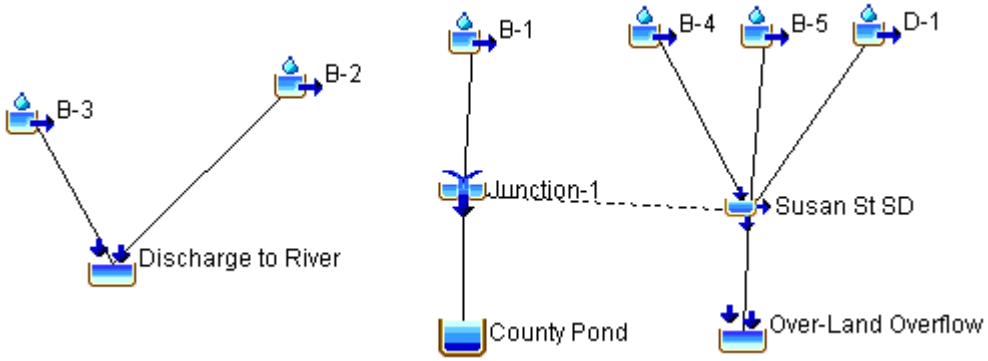
Show Elements: All Elements Volume Units: ○ IN ◉ ACRE-FT Sorting: Alphabetic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (ACRE-FT)
B-1	0.073	120.34114	01Jan2000, 10:04	17.85328
B-2	0.009	10.99874	01Jan2000, 10:03	1.47237
B-3	0.004	7.07724	01Jan2000, 10:02	0.88388
B-4	0.080	164.20240	01Jan2000, 10:02	21.57155
B-5	0.023	45.02622	01Jan2000, 10:02	5.60680
County Pond	0.082	32.72812	01Jan2000, 11:00	38.54453
Discharge to River	0.004	7.07724	01Jan2000, 10:02	0.88388
D-1	0.470	552.70428	01Jan2000, 10:22	129.26301
Junction-1	0.082	142.19513	01Jan2000, 10:04	40.83049
Over-Land Overflow	0.573	607.70017	01Jan2000, 10:20	134.93653
Susan St SD	0.573	607.70017	01Jan2000, 10:20	134.93653


Reservoir "County Pond" Results for Run "2-Ye...
Storage (AC-FT)
1...
1...
1...
1...
0...
0...
0...
0...
0...
Flow (cfs)
...
...
...
...
..
00:...
03:...
06:...
09:...
12:...
15:...
18:...
21:...
00:.

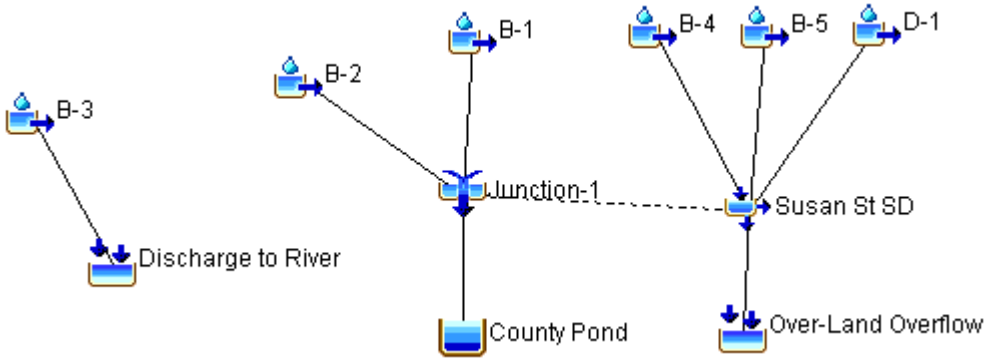

Reservoir "County Pond" Results for Run "100-yR"
Storage (AC-FT)
6
5
4
3
2
1
0
Flow (cfs)
140
120
100
80
60
40
20
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:(

HEC-HMS Model: Existing Conditions



HEC-HMS Model: Post-Project Conditions

(note that DMA B-2 is connected to the County Pond)



Model Notes

The functioning of the existing storm drain system is complex due to flow splits and over-land overflow. The following simplifications were made for modeling purposes:

1. Drainage Area B-1 (and B-2 in the post-project condition) are directly tributary to the pond.
2. Drainage Areas B-4, B-5 and D-1 are connected to the pond by the Susan Steet Storm Drain, which has limited capacity. With the pond empty the storm drain can convey 11 cfs to the pond; with the pond at elevation 28.5 the rate drops to 8 cfs, and the rate is 0 cfs when the pond reaches 30' elevation. Such backwater effects are not able to be directly modeled in HEC-HMS. We have modeled this by:
    - Constant maximum "diversion" of 11 cfs from element "Susan St SD" to "Junction 1".
    - Modeled the reduction in storm drain capacity at high pond levels as an additional "discharge" in element "County Pond". For example, at elevation 28.5', the pond discharge is equal to the pump discharge plus 3 cfs (11 cfs "diversion" less 8 cfs actual calculated storm drain inflow).
3. Because of the very flat slopes within the drainage area (on average approximately 0.15%), we increased the Initial Abstraction from 0.2 S to 0.4 S, which is approximately the upper limit of Initial Abstraction.
4. Pond infiltration is ignored.

Analysis Results – Existing Conditions at 30 cfs pump rate

Project: 4409_Off_Site_R1 Simulation Run: 2-Year

Start of Run: 01Jan2000, 00:00
End of Run: 02Jan2000, 00:00
Compute Time: 07Mar2022, 10:02:29

Basin Model: Drainage Area
Meteorologic Model: 2-Year
Control Specifications: Control 1

Show Elements: All Elements | Volume Units: IN / ACRE-FT | Sorting: Alphabetic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (ACRE-FT)
B-1	0.073	33.79711	01Jan2000, 10:04	5.67568
B-2	0.009	0.44872	01Jan2000, 10:02	0.21692
B-3	0.004	1.54874	01Jan2000, 10:03	0.21689
B-4	0.080	43.14258	01Jan2000, 10:02	7.02718
B-5	0.023	11.75637	01Jan2000, 10:02	1.54713
County Pond	0.073	32.88299	01Jan2000, 10:13	26.09429
Discharge to River	0.013	1.99263	01Jan2000, 10:03	0.43381
D-1	0.470	166.79068	01Jan2000, 10:23	43.62668
Junction-1	0.073	44.79711	01Jan2000, 10:04	26.23899
Over-Land Overflow	0.573	174.24411	01Jan2000, 10:22	31.63769
Susan St SD	0.573	174.24411	01Jan2000, 10:22	31.63769

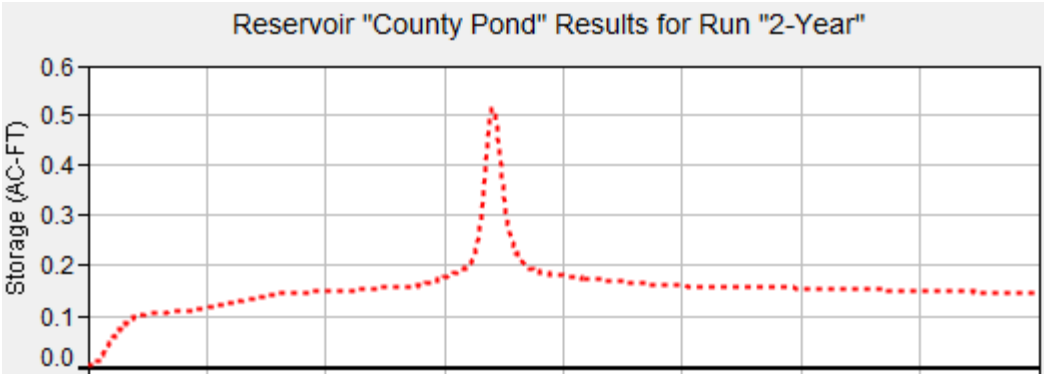
Project: 4409_Off_Site_R1 Simulation Run: 100-yR

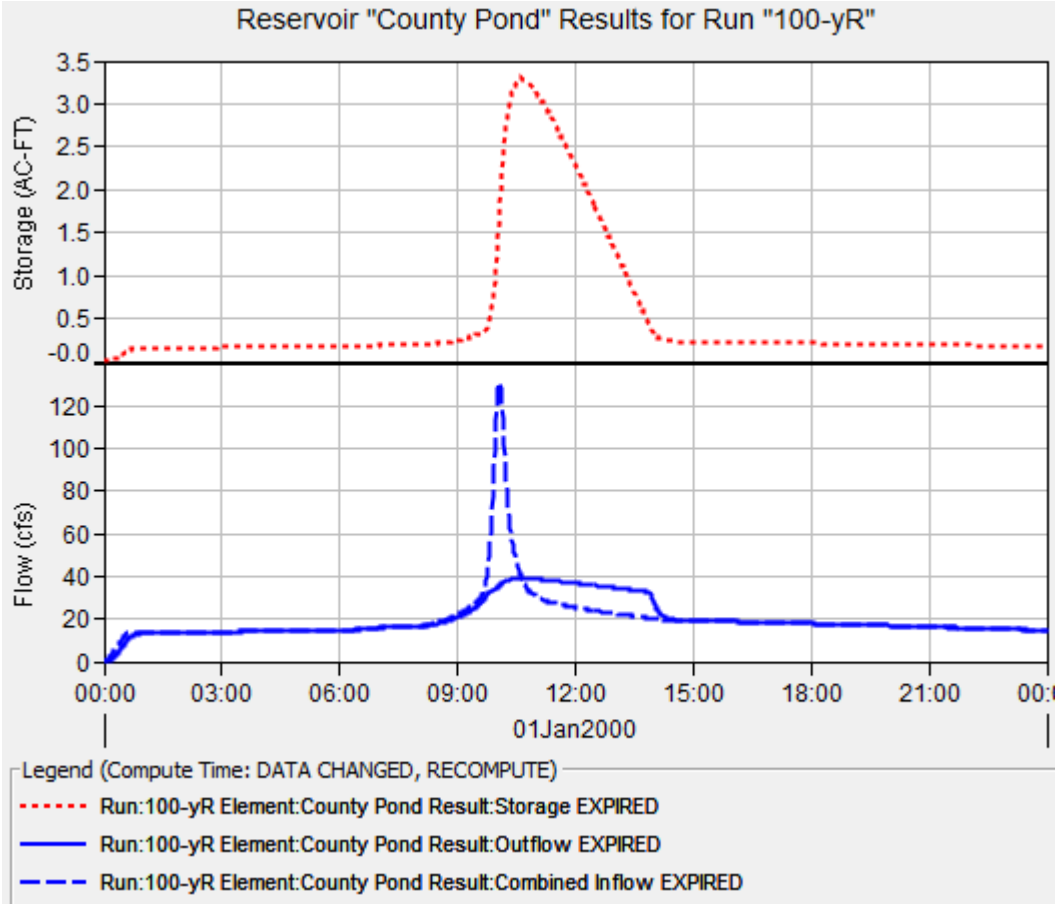
Start of Run: 01Jan2000, 00:00
End of Run: 02Jan2000, 00:00
Compute Time: DATA CHANGED, RECOMPUTE

Basin Model: Drainage Area
Meteorologic Model: 100-Year
Control Specifications: Control 1

Show Elements: All Elements | Volume Units: IN / ACRE-FT | Sorting: Alphabetic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (ACRE-FT)
B-1	0.073	120.34114	01Jan2000, 10:04	17.85328
B-2	0.009	10.99874	01Jan2000, 10:03	1.47237
B-3	0.004	7.07724	01Jan2000, 10:02	0.88388
B-4	0.080	164.20240	01Jan2000, 10:02	21.57155
B-5	0.023	45.02622	01Jan2000, 10:02	5.60680
County Pond	0.073	39.04754	01Jan2000, 10:38	39.18356
Discharge to River	0.013	18.04221	01Jan2000, 10:02	2.35625
D-1	0.470	552.70428	01Jan2000, 10:22	129.26301
Junction-1	0.073	131.34114	01Jan2000, 10:04	39.35811
Over-Land Overflow	0.573	607.70017	01Jan2000, 10:20	134.93653
Susan St SD	0.573	607.70017	01Jan2000, 10:20	134.93653


Reservoir "County Pond" Results for Run "2-Year"
Storage (AC-FT)
0.6
0.5
0.4
0.3
0.2
0.1
0.0


Reservoir "County Pond" Results for Run "100-yR"
Storage (AC-FT)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
-0.0
Flow (cfs)
120
100
80
60
40
20
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
01Jan2000
Legend (Compute Time: DATA CHANGED, RECOMPUTE)
Run:100-yR Element:County Pond Result:Storage EXPIRED
Run:100-yR Element:County Pond Result:Outflow EXPIRED
Run:100-yR Element:County Pond Result:Combined Inflow EXPIRED

Analysis Results – Existing Conditions at 17.6 cfs pump rate

Project: 4409_Off_Site_R1 Simulation Run: 2-Year

Start of Run: 01Jan2000, 00:00
End of Run: 02Jan2000, 00:00
Compute Time: 07Mar2022, 09:59:00

Basin Model: Drainage Area
Meteorologic Model: 2-Year
Control Specifications: Control 1

Show Elements: All Elements | Volume Units: IN / ACRE-FT | Sorting: Alphabetic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (ACRE-FT)
B-1	0.073	33.79711	01Jan2000, 10:04	5.67568
B-2	0.009	0.44872	01Jan2000, 10:02	0.21692
B-3	0.004	1.54874	01Jan2000, 10:03	0.21689
B-4	0.080	43.14258	01Jan2000, 10:02	7.02718
B-5	0.023	11.75637	01Jan2000, 10:02	1.54713
County Pond	0.073	21.98907	01Jan2000, 10:25	25.99534
Discharge to River	0.013	1.99263	01Jan2000, 10:03	0.43381
D-1	0.470	166.79068	01Jan2000, 10:23	43.62668
Junction-1	0.073	44.79711	01Jan2000, 10:04	26.23899
Over-Land Overflow	0.573	174.24411	01Jan2000, 10:22	31.63769
Susan St SD	0.573	174.24411	01Jan2000, 10:22	31.63769

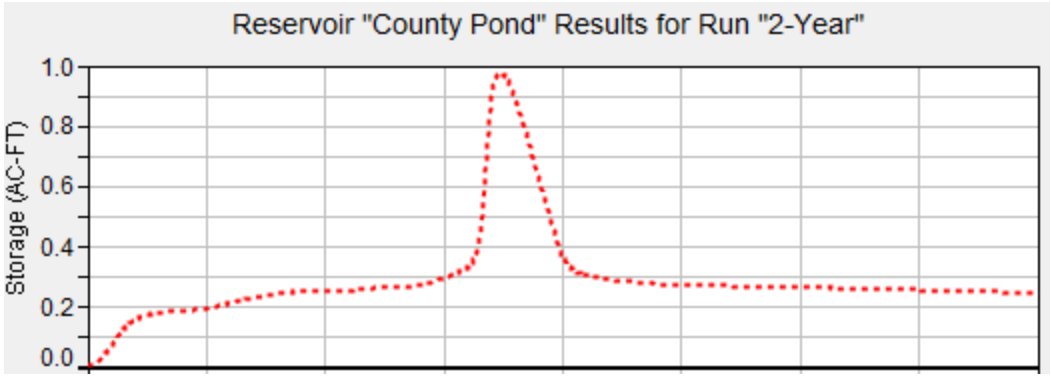
Project: 4409_Off_Site_R1 Simulation Run: 100-yR

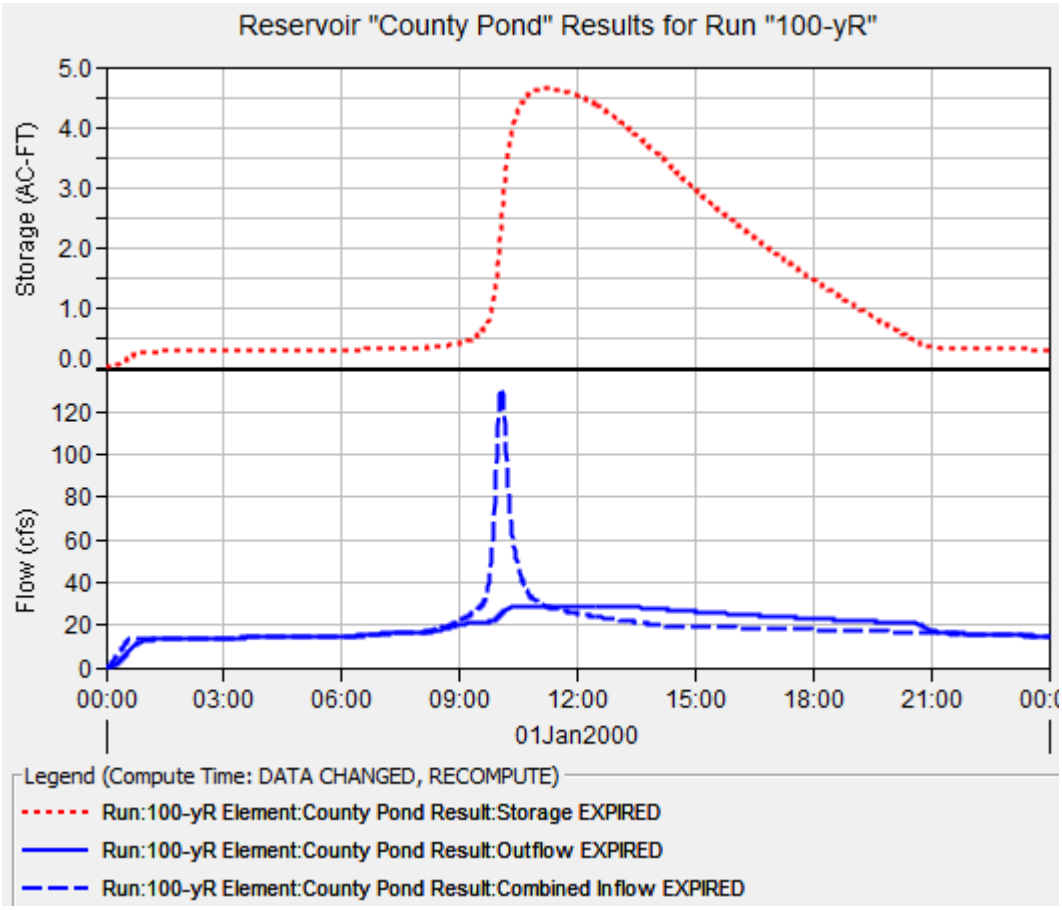
Start of Run: 01Jan2000, 00:00
End of Run: 02Jan2000, 00:00
Compute Time: DATA CHANGED, RECOMPUTE

Basin Model: Drainage Area
Meteorologic Model: 100-Year
Control Specifications: Control 1

Show Elements: All Elements | Volume Units: IN / ACRE-FT | Sorting: Alphabetic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (ACRE-FT)
B-1	0.073	120.34114	01Jan2000, 10:04	17.85328
B-2	0.009	10.99874	01Jan2000, 10:03	1.47237
B-3	0.004	7.07724	01Jan2000, 10:02	0.88388
B-4	0.080	164.20240	01Jan2000, 10:02	21.57155
B-5	0.023	45.02622	01Jan2000, 10:02	5.60680
County Pond	0.073	28.60000	01Jan2000, 10:21	39.06362
Discharge to River	0.013	18.04221	01Jan2000, 10:02	2.35625
D-1	0.470	552.70428	01Jan2000, 10:22	129.26301
Junction-1	0.073	131.34114	01Jan2000, 10:04	39.35811
Over-Land Overflow	0.573	607.70017	01Jan2000, 10:20	134.93653
Susan St SD	0.573	607.70017	01Jan2000, 10:20	134.93653


Reservoir "County Pond" Results for Run "2-Year"
Storage (AC-FT)
1.0
0.8
0.6
0.4
0.2
0.0


Reservoir "County Pond" Results for Run "100-yR"
Storage (AC-FT)
5.0
4.0
3.0
2.0
1.0
0.0
Flow (cfs)
120
100
80
60
40
20
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
01Jan2000
Legend (Compute Time: DATA CHANGED, RECOMPUTE)
Run:100-yR Element:County Pond Result:Storage EXPIRED
Run:100-yR Element:County Pond Result:Outflow EXPIRED
Run:100-yR Element:County Pond Result:Combined Inflow EXPIRED

Analysis Results – Proposed Conditions, 30 cfs pump rate

Project: 4409_Off_Site_R1 Simulation Run: 2-Year

Start of Run: 01Jan2000, 00:00
End of Run: 02Jan2000, 00:00
Compute Time: 07Mar2022, 10:03:52

Basin Model: Drainage Area
Meteorologic Model: 2-Year
Control Specifications: Control 1

Show Elements: All Elements | Volume Units: IN / ACRE-FT | Sorting: Alphabetic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (ACRE-FT)
B-1	0.073	33.79711	01Jan2000, 10:04	5.67568
B-2	0.009	0.44872	01Jan2000, 10:02	0.21692
B-3	0.004	1.54874	01Jan2000, 10:03	0.21689
B-4	0.080	43.14258	01Jan2000, 10:02	7.02718
B-5	0.023	11.75637	01Jan2000, 10:02	1.54713
County Pond	0.082	32.90566	01Jan2000, 10:13	26.31001
Discharge to River	0.004	1.54874	01Jan2000, 10:03	0.21689
D-1	0.470	166.79068	01Jan2000, 10:23	43.62668
Junction-1	0.082	45.23040	01Jan2000, 10:04	26.45591
Over-Land Overflow	0.573	174.24411	01Jan2000, 10:22	31.63769
Susan St SD	0.573	174.24411	01Jan2000, 10:22	31.63769

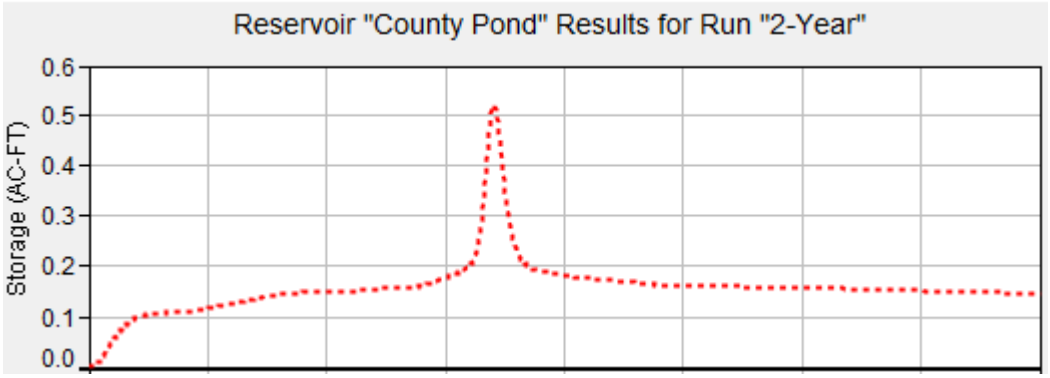
Project: 4409_Off_Site_R1 Simulation Run: 100-yR

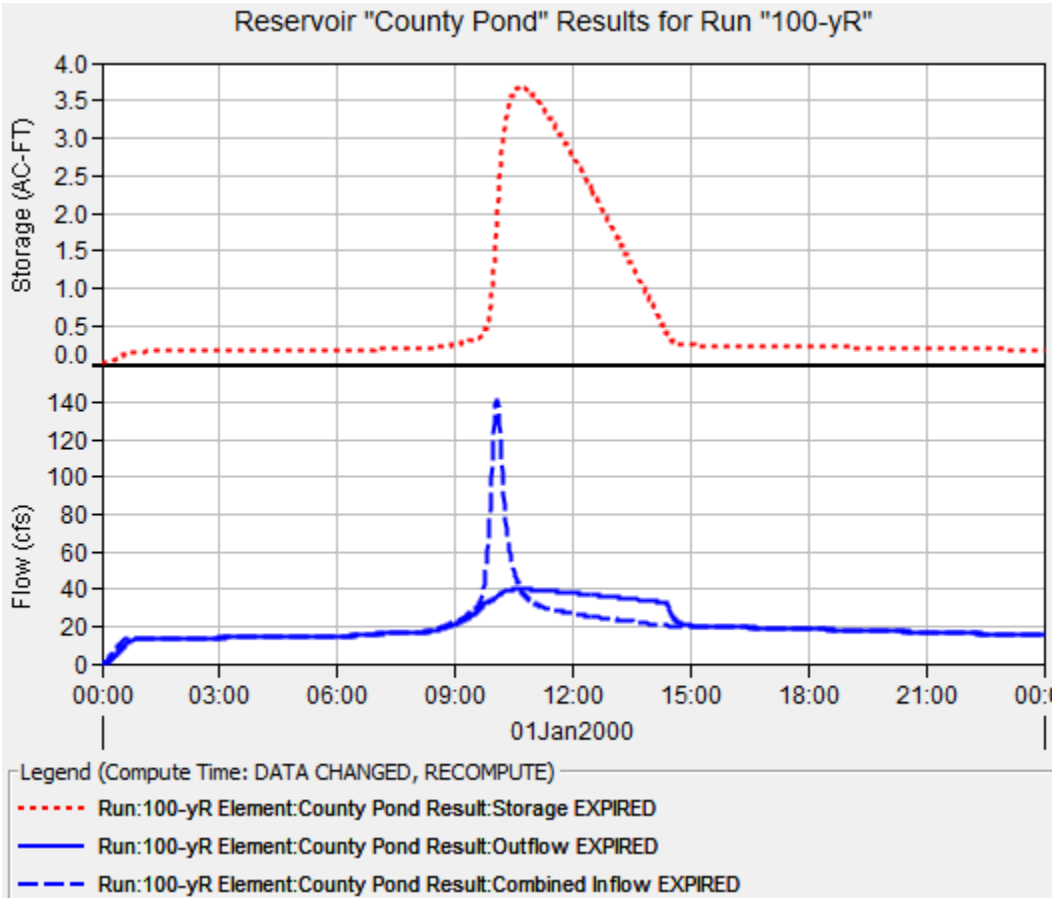
Start of Run: 01Jan2000, 00:00
End of Run: 02Jan2000, 00:00
Compute Time: DATA CHANGED, RECOMPUTE

Basin Model: Drainage Area
Meteorologic Model: 100-Year
Control Specifications: Control 1

Show Elements: All Elements | Volume Units: IN / ACRE-FT | Sorting: Alphabetic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (ACRE-FT)
B-1	0.073	120.34114	01Jan2000, 10:04	17.85328
B-2	0.009	10.99874	01Jan2000, 10:03	1.47237
B-3	0.004	7.07724	01Jan2000, 10:02	0.88388
B-4	0.080	164.20240	01Jan2000, 10:02	21.57155
B-5	0.023	45.02622	01Jan2000, 10:02	5.60680
County Pond	0.082	39.90294	01Jan2000, 10:40	40.65096
Discharge to River	0.004	7.07724	01Jan2000, 10:02	0.88388
D-1	0.470	552.70428	01Jan2000, 10:22	129.26301
Junction-1	0.082	142.19513	01Jan2000, 10:04	40.83049
Over-Land Overflow	0.573	607.70017	01Jan2000, 10:20	134.93653
Susan St SD	0.573	607.70017	01Jan2000, 10:20	134.93653


Reservoir "County Pond" Results for Run "2-Year"
Storage (AC-FT)
0.6
0.5
0.4
0.3
0.2
0.1
0.0


Reservoir "County Pond" Results for Run "100-yR"
Storage (AC-FT)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Flow (cfs)
140
120
100
80
60
40
20
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
01Jan2000
Legend (Compute Time: DATA CHANGED, RECOMPUTE)
Run:100-yR Element:County Pond Result:Storage EXPIRED
Run:100-yR Element:County Pond Result:Outflow EXPIRED
Run:100-yR Element:County Pond Result:Combined Inflow EXPIRED

Analysis Results – Proposed Conditions without Project #2, 17.6 cfs pump rate

Project: 4409_Off_Site_R1 Simulation Run: 2-Year

Start of Run: 01Jan2000, 00:00
End of Run: 02Jan2000, 00:00
Compute Time: 07Mar2022, 10:05:39

Basin Model: Drainage Area
Meteorologic Model: 2-Year
Control Specifications: Control 1

Show Elements: All Elements Volume Units: ○ IN ◉ ACRE-FT Sorting: Alphabetic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (ACRE-FT)
B-1	0.073	33.79711	01Jan2000, 10:04	5.67568
B-2	0.009	0.44872	01Jan2000, 10:02	0.21692
B-3	0.004	1.54874	01Jan2000, 10:03	0.21689
B-4	0.080	43.14258	01Jan2000, 10:02	7.02718
B-5	0.023	11.75637	01Jan2000, 10:02	1.54713
County Pond	0.082	22.02413	01Jan2000, 10:26	26.21022
Discharge to River	0.004	1.54874	01Jan2000, 10:03	0.21689
D-1	0.470	166.79068	01Jan2000, 10:23	43.62668
Junction-1	0.082	45.23040	01Jan2000, 10:04	26.45591
Over-Land Overflow	0.573	174.24411	01Jan2000, 10:22	31.63769
Susan St SD	0.573	174.24411	01Jan2000, 10:22	31.63769

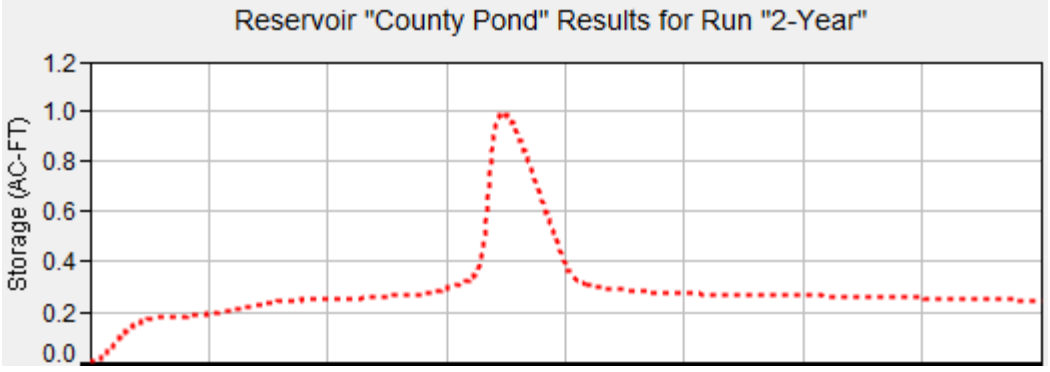
Project: 4409_Off_Site_R1 Simulation Run: 100-yR

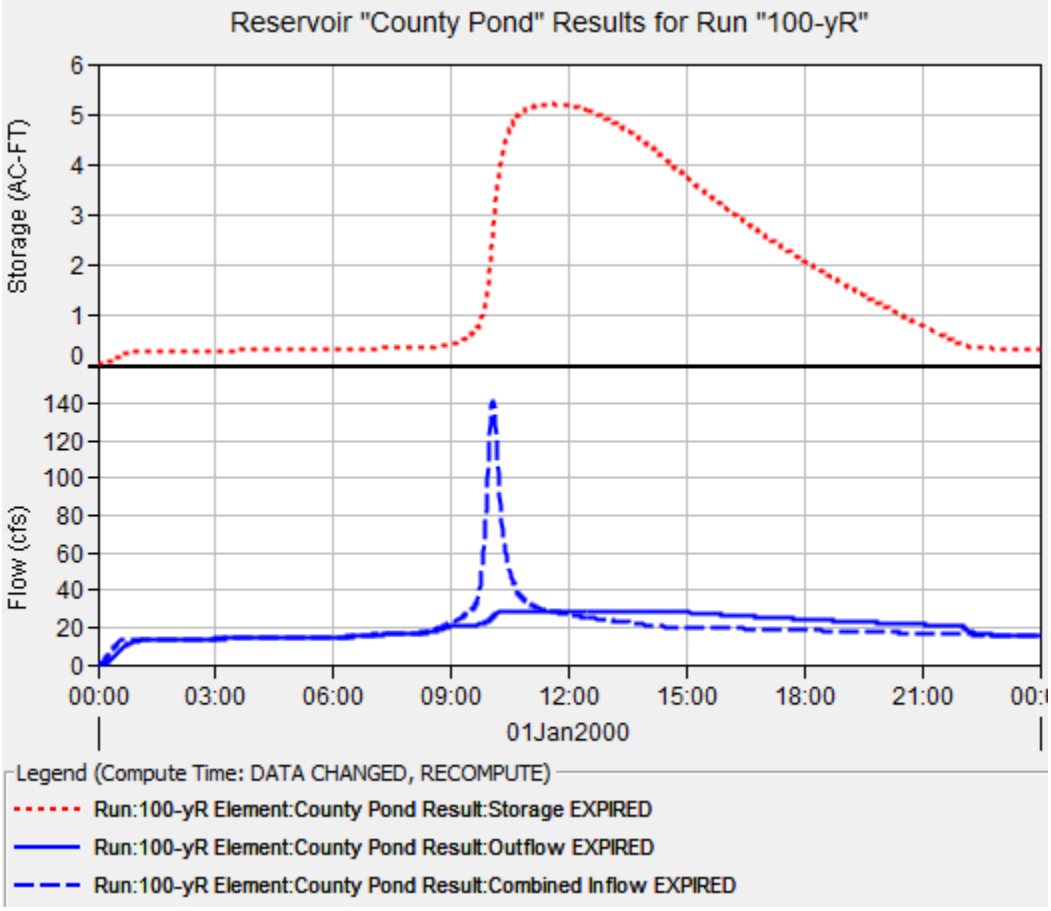
Start of Run: 01Jan2000, 00:00
End of Run: 02Jan2000, 00:00
Compute Time: DATA CHANGED, RECOMPUTE

Basin Model: Drainage Area
Meteorologic Model: 100-Year
Control Specifications: Control 1

Show Elements: All Elements Volume Units: ○ IN ◉ ACRE-FT Sorting: Alphabetic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (ACRE-FT)
B-1	0.073	120.34114	01Jan2000, 10:04	17.85328
B-2	0.009	10.99874	01Jan2000, 10:03	1.47237
B-3	0.004	7.07724	01Jan2000, 10:02	0.88388
B-4	0.080	164.20240	01Jan2000, 10:02	21.57155
B-5	0.023	45.02622	01Jan2000, 10:02	5.60680
County Pond	0.082	28.60000	01Jan2000, 10:15	40.52752
Discharge to River	0.004	7.07724	01Jan2000, 10:02	0.88388
D-1	0.470	552.70428	01Jan2000, 10:22	129.26301
Junction-1	0.082	142.19513	01Jan2000, 10:04	40.83049
Over-Land Overflow	0.573	607.70017	01Jan2000, 10:20	134.93653
Susan St SD	0.573	607.70017	01Jan2000, 10:20	134.93653


Reservoir "County Pond" Results for Run "2-Year"
Storage (AC-FT)
1.2
1.0
0.8
0.6
0.4
0.2
0.0


Reservoir "County Pond" Results for Run "100-yR"
Storage (AC-FT)
6
5
4
3
2
1
0
Flow (cfs)
140
120
100
80
60
40
20
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
01Jan2000
Legend (Compute Time: DATA CHANGED, RECOMPUTE)
Run:100-yR Element:County Pond Result:Storage EXPIRED
Run:100-yR Element:County Pond Result:Outflow EXPIRED
Run:100-yR Element:County Pond Result:Combined Inflow EXPIRED

Analysis Results – Proposed Conditions with Project #2, 17.6 cfs pump rate

Project: 4409_Off_Site_R1 Simulation Run: 2-Year

Start of Run: 01Jan2000, 00:00
End of Run: 02Jan2000, 00:00
Compute Time: 06Jul2022, 09:49:23

Basin Model: Drainage Area
Meteorologic Model: 2-Year
Control Specifications: Control 1

Show Elements: All Elements Volume Units: IN ACRE-FT Sorting: Alphabetic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (ACRE-FT)
B-1	0.073	33.79711	01Jan2000, 10:04	5.67568
B-2	0.009	0.44872	01Jan2000, 10:02	0.21692
B-3	0.004	1.54874	01Jan2000, 10:03	0.21689
B-4	0.080	43.14258	01Jan2000, 10:02	7.02718
B-5	0.023	11.75637	01Jan2000, 10:02	1.54713
County Pond	0.082	17.60000	01Jan2000, 09:40	26.00080
Discharge to River	0.004	1.54874	01Jan2000, 10:03	0.21689
D-1	0.470	166.79068	01Jan2000, 10:23	43.62668
Junction-1	0.082	45.23040	01Jan2000, 10:04	26.45591
Over-Land Overflow	0.573	174.24411	01Jan2000, 10:22	31.63769
Susan St SD	0.573	174.24411	01Jan2000, 10:22	31.63769

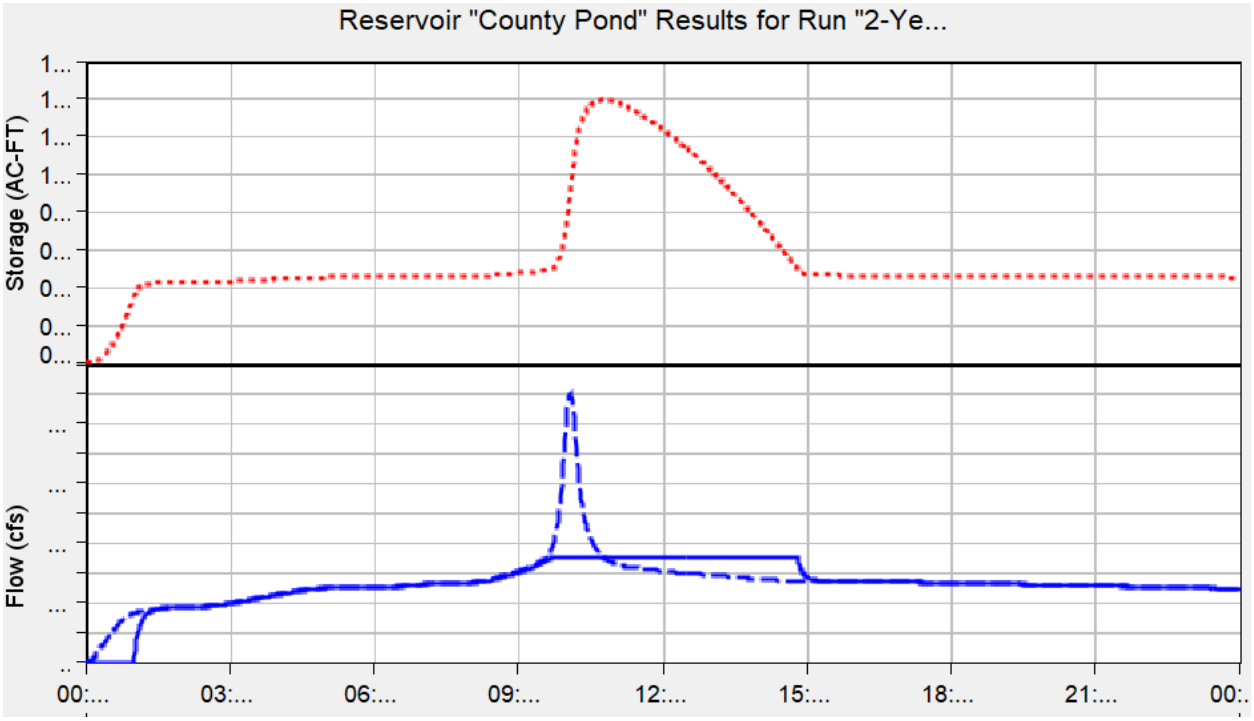
Project: 4409_Off_Site_R1 Simulation Run: 100-yR

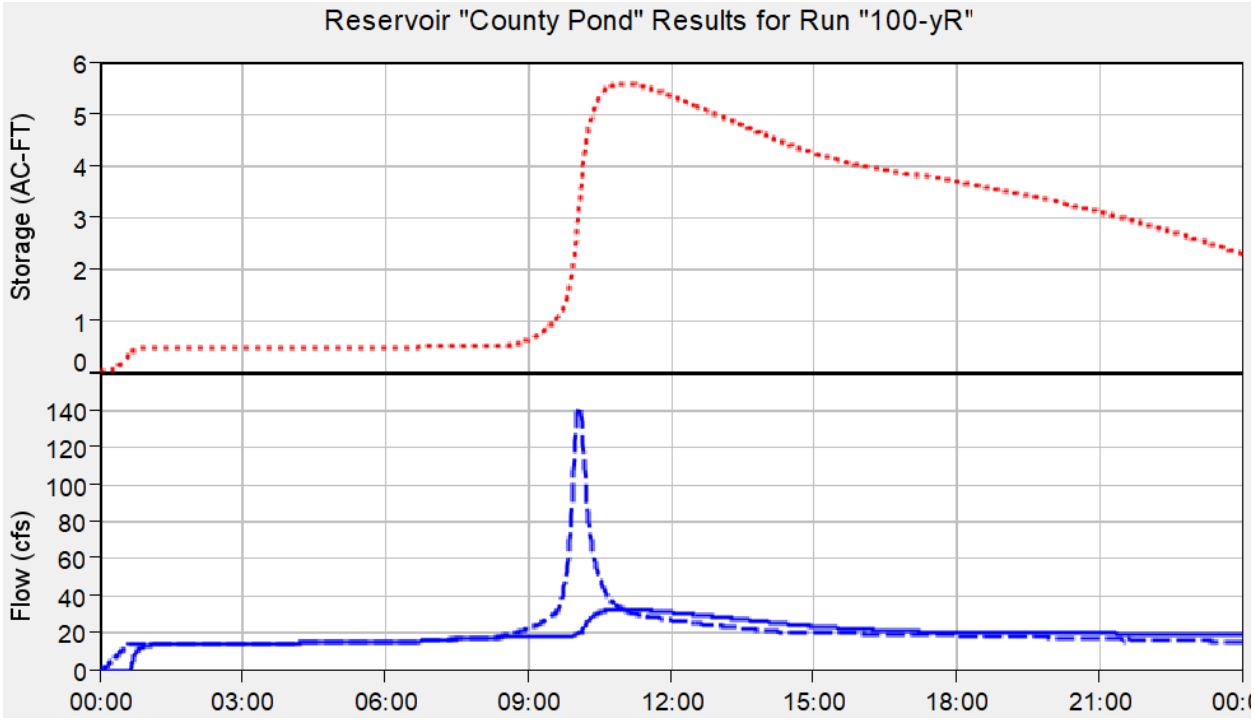
Start of Run: 01Jan2000, 00:00
End of Run: 02Jan2000, 00:00
Compute Time: DATA CHANGED, RECOMPUTE

Basin Model: Drainage Area
Meteorologic Model: 100-Year
Control Specifications: Control 1

Show Elements: All Elements Volume Units: IN ACRE-FT Sorting: Alphabetic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (ACRE-FT)
B-1	0.073	120.34114	01Jan2000, 10:04	17.85328
B-2	0.009	10.99874	01Jan2000, 10:03	1.47237
B-3	0.004	7.07724	01Jan2000, 10:02	0.88388
B-4	0.080	164.20240	01Jan2000, 10:02	21.57155
B-5	0.023	45.02622	01Jan2000, 10:02	5.60680
County Pond	0.082	32.72812	01Jan2000, 11:00	38.54453
Discharge to River	0.004	7.07724	01Jan2000, 10:02	0.88388
D-1	0.470	552.70428	01Jan2000, 10:22	129.26301
Junction-1	0.082	142.19513	01Jan2000, 10:04	40.83049
Over-Land Overflow	0.573	607.70017	01Jan2000, 10:20	134.93653
Susan St SD	0.573	607.70017	01Jan2000, 10:20	134.93653


Reservoir "County Pond" Results for Run "2-Ye...
Storage (AC-FT)
1...
1...
1...
1...
0...
0...
0...
0...
0...
Flow (cfs)
...
...
...
...
..
00:...
03:...
06:...
09:...
12:...
15:...
18:...
21:...
00:.

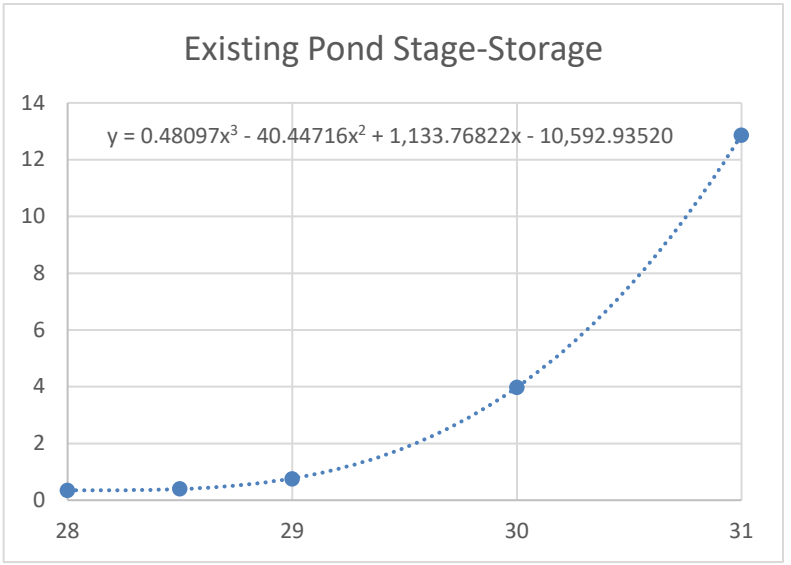

Reservoir "County Pond" Results for Run "100-yR"
Storage (AC-FT)
6
5
4
3
2
1
0
Flow (cfs)
140
120
100
80
60
40
20
0
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:

Watershed Characteristics

Area I.D.	Area (ac)	Area (sq. mi.)	Imperv-ousness w/o plastic cover	Imperv-ousness w/ 50% plastic cover	A	B	C	D	Composite CN	Row L (ft)	Row V (fps)	Ditch L (ft)	Ditch V (fps)	Calc. Tc	Lag Time Used (0.6Tc)	S (in)	Ia (0.4S)
CN (Contoured Row Crop, Poor Condition) ->					**70**	**79**	**84**	**88**									
		CN (High Density Residential.) ->			**77**	**85**	**90**	**92**									
B-1	47	0.073	10	50	65%		35%		**75**	700	0.64	2200	1	18	**11**	3.33	1.33
B-2	5.7	0.009	5	5	70%		30%		**74**					15	**9**	3.51	1.41
B-3	2.8	0.004	included in CN		50%	50%			**81**					15	**9**		
B-4	51	0.080	10	50			100%		**84**	600	0.64	1800	1	16	**9**	1.90	0.76
B-5	15	0.023	included in CN			100%			**85**					15	**9**		
D-1	300	0.47	2	50			100%		**84**	1900	0.64	6300	1	49	**30**	1.90	0.76

Project Name: **Susan Street Agricultural Employee Housing**
Job No.: 4409.00
Date: 2/18/2022
Prepared by: NDM
Facility: Existing Susan Street Pump Station Pond

Elevation	Area		Incremental Volume	Total Volume
feet	sq. ft.	ac	ac-ft.	ac-ft.
28	0	0		0.35
			0.1	
28.5	15,000	0.3		0.4
			0.3	
29	49,000	1.1		0.8
			3.2	
30	260,000	6.0		4.0
			8.9	
31	530,000	12		13



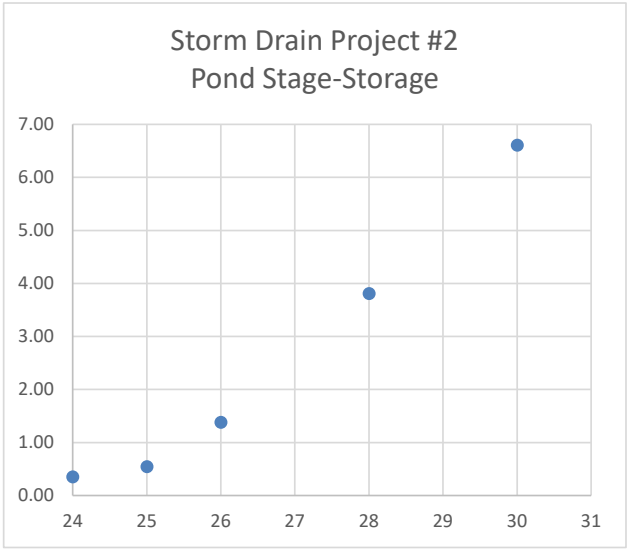
Conic Method:
Incremental Volume = dH/3 x [A1 +A2 +sqrt(A1 x A2)]

The beginning Total Volume is the storage within the storm drain:
2,240 LF 30" SD + 1,360 LF 24" SD = 0.35 ac-ft

Elev	Calc'd Volume (regression equation)
30.00	3.9
30.10	4.4
30.60	8.3
30.70	9.3

Project Name: **Susan Street Agricultural Employee Housing**
Job No.: 4409.00
Date: 6/7/2022
Prepared by: NDM
Facility: Project #2: Expanded Susan Street Pump Station Pond

Elevation	Area		Incremental Volume	Total Volume	SD Capacity Reduction (as discharge)	Pump Discharge (3 pumps)	Total Pond "Discharge" (3 pumps)
feet	sq. ft.	ac	ac-ft.	ac-ft.	cfs	cfs	cfs
24	0	0.0		0.35	0	0.0	0.0
			0.2				
25	25,000	0.6		0.5	0	17.6	17.6
			0.8				
26	49,000	1.1		1.4	0	17.6	17.6
			2.4				
28	57,000	1.3		3.8	3	17.6	20.6
			2.8				
30	65,000	1.5		6.6	11	28.6	39.6



Conic Method:
Incremental Volume = dH/3 x [A1 +A2 +sqrt(A1 x A2)]

The beginning Total Volume is the storage within the storm drain:
2,240 LF 30" SD + 1,360 LF 24" SD = 0.35 ac-ft

USDA NRCS Soil Survey Map for Monterey County (1978)

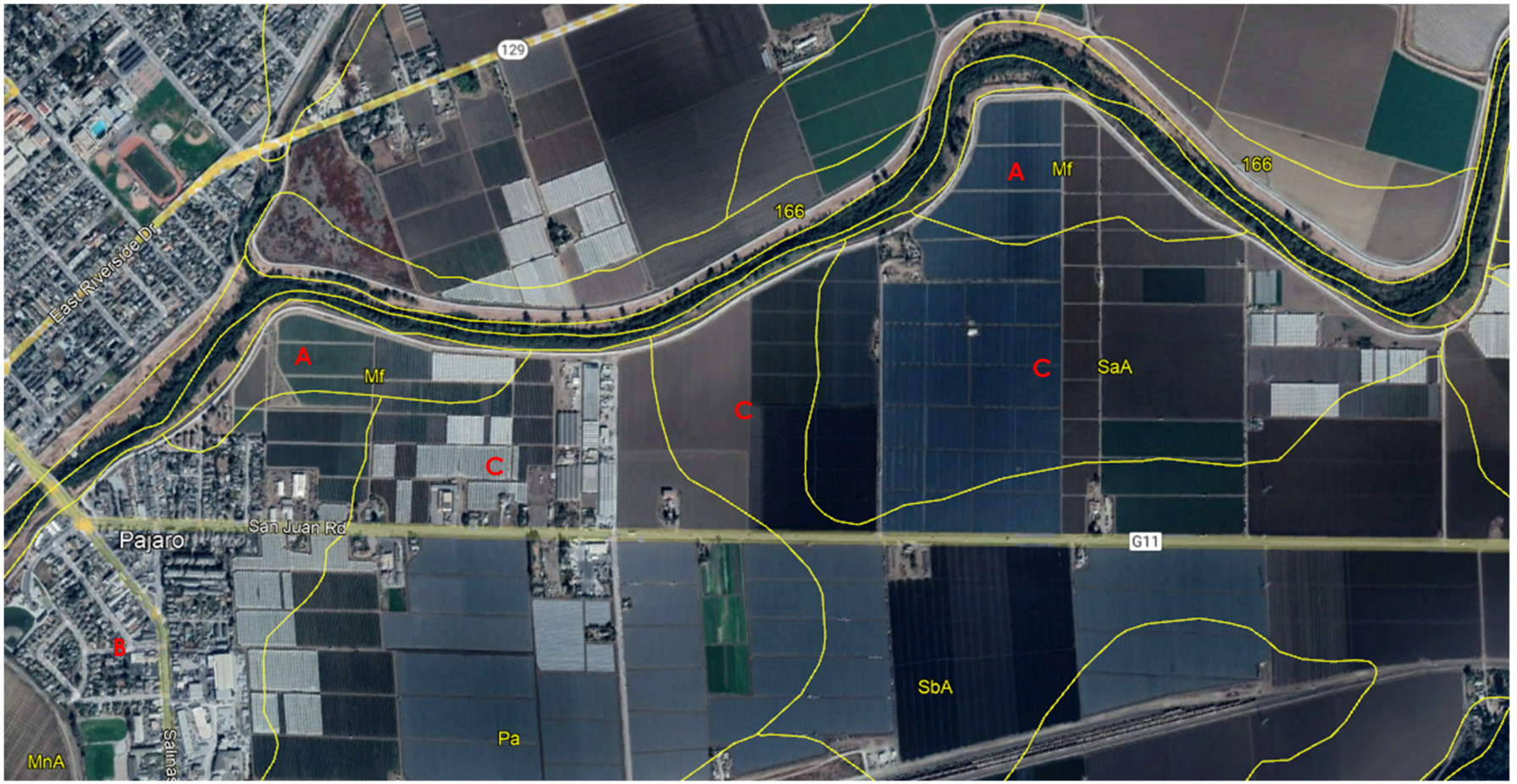


TABLE 7.—*Estimated physical and chemical properties*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil which may have different properties and limitations. For this reason it is necessary to follow carefully the instructions for referring to other series that appear in the first column. The symbol < means less than; > means more than. The erosion tolerance factor (T) is for the entire profile]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion		Erosion factors		
							Uncoated steel	Concrete	K	T	
Metz:											
Me	0–12	6.0–20.0	0.07–0.11	6.6–8.4	<2	Low	High	Low	0.17		5
	12–99	0.6–2.0	0.07–0.10	6.6–8.4	<2	Low	High	Low	0.15		
Mf	0–12	2.0–6.0	0.13–0.17	6.6–8.4	<2	Low	High	Low	0.28		5
	12–99	0.6–2.0	0.07–0.10	6.6–8.4	<2	Low	High	Low	0.15		
Mocho:											
MnA	0–68	0.6–2.0	0.16–0.20	7.4–8.4	<2	Moderate	High	Low	0.43		5
Pacheco:											
Pa	0–65	0.2–0.6	0.18–0.21	6.1–8.4	<15	Moderate	High	Low	0.43		5
Salinas:											
SaA	0–5	0.6–2.0	0.16–0.20	6.6–7.3	<2	Low	High	Low	0.43		5
	5–75	0.2–0.6	0.16–0.20	6.6–8.4	<2	Low	High	Low	0.43		
SbA, SbC	0–5	0.2–0.6	0.18–0.21	6.6–7.3	<2	Moderate	High	Low	0.37		5
	5–75	0.2–0.6	0.16–0.20	6.6–8.4	<2	Low	High	Low	0.43		

TABLE 9.—*Soil and water features*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil which may have different properties and limitations. For this reason it is necessary to follow carefully the instructions for referring to other series that appear in the first column. Absence of an entry indicates the feature is not a concern. See the definitions of "flooding" and "water table" in the Glossary for explanations of such terms as "rare," "brief," and "perched." The symbol > means greater than]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness
Metz: Me, Mf, Mg	A	None			>6.0			>60	
Mocho: MnA, MoA, MoC	B	None			>6.0			>60	
Pacheco: Pa	C	None to rare			3.0–5.0	Apparent	Dec-May	>60	
Salinas: SaA, SbA, SbC	C	None			>6.0			>60	

NOAA Atlas 14, Volume 6, Version 2
Location name: Watsonville, California, USA*
Latitude: 36.907°, Longitude: -121.746°
Elevation: m/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	0.146 (0.125-0.173)	0.174 (0.148-0.206)	0.212 (0.180-0.252)	0.245 (0.206-0.294)	0.292 (0.237-0.365)	0.331 (0.261-0.424)	0.373 (0.286-0.492)	0.418 (0.310-0.570)	0.483 (0.341-0.691)	0.537 (0.364-0.800)
10-min	0.210 (0.179-0.248)	0.249 (0.212-0.295)	0.304 (0.258-0.361)	0.351 (0.295-0.421)	0.419 (0.339-0.524)	0.475 (0.375-0.608)	0.535 (0.410-0.705)	0.599 (0.444-0.817)	0.692 (0.489-0.991)	0.769 (0.522-1.15)
15-min	0.253 (0.216-0.300)	0.301 (0.257-0.357)	0.367 (0.312-0.437)	0.424 (0.357-0.509)	0.507 (0.410-0.633)	0.574 (0.453-0.735)	0.646 (0.495-0.852)	0.725 (0.537-0.988)	0.837 (0.591-1.20)	0.930 (0.631-1.39)
30-min	0.350 (0.299-0.414)	0.416 (0.355-0.493)	0.508 (0.432-0.604)	0.587 (0.494-0.704)	0.701 (0.567-0.875)	0.794 (0.626-1.02)	0.894 (0.685-1.18)	1.00 (0.742-1.37)	1.16 (0.817-1.66)	1.29 (0.872-1.92)
60-min	0.483 (0.412-0.571)	0.574 (0.489-0.680)	0.700 (0.595-0.832)	0.809 (0.681-0.971)	0.966 (0.781-1.21)	1.09 (0.863-1.40)	1.23 (0.944-1.62)	1.38 (1.02-1.88)	1.60 (1.13-2.28)	1.77 (1.20-2.64)
2-hr	0.702 (0.599-0.830)	0.839 (0.715-0.994)	1.03 (0.873-1.22)	1.19 (0.999-1.43)	1.42 (1.14-1.77)	1.60 (1.26-2.05)	1.79 (1.37-2.37)	2.00 (1.48-2.73)	2.30 (1.62-3.29)	2.54 (1.72-3.78)
3-hr	0.873 (0.745-1.03)	1.05 (0.894-1.24)	1.29 (1.10-1.53)	1.49 (1.26-1.79)	1.78 (1.44-2.22)	2.01 (1.59-2.57)	2.25 (1.73-2.97)	2.51 (1.86-3.42)	2.88 (2.03-4.11)	3.17 (2.15-4.72)
6-hr	1.20 (1.02-1.42)	1.46 (1.25-1.73)	1.81 (1.54-2.16)	2.11 (1.78-2.53)	2.53 (2.04-3.16)	2.86 (2.25-3.66)	3.20 (2.46-4.22)	3.57 (2.65-4.87)	4.08 (2.88-5.84)	4.49 (3.05-6.69)
12-hr	1.55 (1.33-1.84)	1.94 (1.65-2.29)	2.46 (2.09-2.92)	2.89 (2.44-3.47)	3.51 (2.84-4.38)	4.00 (3.16-5.12)	4.52 (3.46-5.95)	5.06 (3.75-6.90)	5.83 (4.11-8.34)	6.45 (4.37-9.61)
24-hr	2.05 (1.87-2.29)	2.61 (2.39-2.92)	3.37 (3.07-3.78)	4.00 (3.62-4.51)	4.88 (4.30-5.66)	5.58 (4.82-6.58)	6.30 (5.33-7.59)	7.05 (5.84-8.70)	8.11 (6.48-10.4)	8.95 (6.94-11.8)
2-day	2.61 (2.38-2.91)	3.33 (3.04-3.72)	4.27 (3.89-4.78)	5.03 (4.55-5.67)	6.06 (5.33-7.02)	6.84 (5.91-8.07)	7.63 (6.46-9.20)	8.44 (6.99-10.4)	9.54 (7.62-12.2)	10.4 (8.05-13.7)
3-day	2.95 (2.70-3.30)	3.76 (3.43-4.21)	4.80 (4.37-5.38)	5.63 (5.09-6.35)	6.73 (5.92-7.80)	7.55 (6.53-8.91)	8.38 (7.09-10.1)	9.21 (7.62-11.4)	10.3 (8.23-13.2)	11.1 (8.64-14.7)
4-day	3.27 (2.98-3.65)	4.16 (3.79-4.65)	5.29 (4.81-5.92)	6.18 (5.59-6.97)	7.36 (6.47-8.53)	8.23 (7.11-9.71)	9.09 (7.70-11.0)	9.96 (8.24-12.3)	11.1 (8.86-14.2)	11.9 (9.26-15.7)
7-day	4.01 (3.67-4.48)	5.10 (4.66-5.70)	6.46 (5.89-7.24)	7.52 (6.80-8.48)	8.89 (7.82-10.3)	9.90 (8.56-11.7)	10.9 (9.21-13.1)	11.8 (9.79-14.6)	13.1 (10.4-16.7)	14.0 (10.9-18.4)
10-day	4.48 (4.10-5.01)	5.70 (5.20-6.37)	7.21 (6.56-8.07)	8.37 (7.57-9.44)	9.87 (8.68-11.4)	10.9 (9.47-12.9)	12.0 (10.2-14.5)	13.0 (10.8-16.1)	14.3 (11.4-18.3)	15.3 (11.9-20.1)
20-day	5.85 (5.34-6.53)	7.48 (6.83-8.37)	9.48 (8.63-10.6)	11.0 (9.94-12.4)	12.9 (11.4-15.0)	14.3 (12.3-16.8)	15.6 (13.2-18.7)	16.8 (13.9-20.7)	18.4 (14.7-23.5)	19.5 (15.1-25.6)
30-day	7.17 (6.55-8.01)	9.22 (8.41-10.3)	11.7 (10.6-13.1)	13.5 (12.2-15.3)	15.9 (14.0-18.4)	17.5 (15.1-20.7)	19.0 (16.1-22.9)	20.5 (17.0-25.3)	22.4 (17.9-28.6)	23.7 (18.3-31.1)
45-day	8.79 (8.03-9.82)	11.3 (10.3-12.7)	14.3 (13.1-16.1)	16.6 (15.0-18.7)	19.4 (17.1-22.5)	21.4 (18.5-25.2)	23.2 (19.7-28.0)	25.0 (20.6-30.8)	27.1 (21.6-34.6)	28.6 (22.2-37.6)
60-day	10.3 (9.40-11.5)	13.3 (12.1-14.8)	16.8 (15.3-18.8)	19.4 (17.5-21.9)	22.6 (19.9-26.2)	24.8 (21.5-29.3)	26.9 (22.8-32.4)	28.9 (23.9-35.6)	31.3 (25.0-40.0)	33.0 (25.6-43.4)

[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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PF graphical

Table 2-2a Runoff curve numbers for urban areas [1/]

Cover description: Cover type and hydrologic condition	Average percent impervious area [2/]	Curve numbers for hydrologic soil group: A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) [3/]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) [4/]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation) [5/]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

Drainage Areas B-3 and B-5

[1] Average runoff condition, and $I_a = 0.2S$.

[2] The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.

[3] CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

[4] Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

[5] Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4 based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

Table 2-2b Runoff curve numbers for cultivated agricultural lands [1/]

Cover description			Curve numbers for hydrologic soil group			
Cover type	Treatment [2/]	Hydrologic condition [3/]	A	B	C	D
Fallow	Bare soil	—	77	86	91	94
	Crop residue cover (CR)	Poor	76	85	90	93
		Good	74	83	88	90
Row crops	Straight row (SR)	Poor	72	81	88	91
		Good	67	78	85	89
	SR + CR	Poor	71	80	87	90
		Good	64	75	82	85
	Contoured (C)	Poor	70	79	84	88
		Good	65	75	82	86
	C + CR	Poor	69	78	83	87
		Good	64	74	81	85
	Contoured & terraced (C&T)	Poor	66	74	80	82
		Good	62	71	78	81
	C&T+ CR	Poor	65	73	79	81
		Good	61	70	77	80
Small grain	SR	Poor	65	76	84	88
		Good	63	75	83	87
	SR + CR	Poor	64	75	83	86
		Good	60	72	80	84
	C	Poor	63	74	82	85
		Good	61	73	81	84
	C + CR	Poor	62	73	81	84
		Good	60	72	80	83
	C&T	Poor	61	72	79	82
		Good	59	70	78	81
	C&T+ CR	Poor	60	71	78	81
		Good	58	69	77	80
Close-seeded or broadcast legumes or rotation meadow	SR	Poor	66	77	85	89
		Good	58	72	81	85
	C	Poor	64	75	83	85
		Good	55	69	78	83
	C&T	Poor	63	73	80	83
		Good	51	67	76	80

Drainage Areas B-1, 2, 4 and D-1

[1] Average runoff condition, and I_a=0.2S

[2] Crop residue cover applies only if residue is on at least 5% of the surface throughout the year.

[3] Hydraulic condition is based on combination factors that affect infiltration and runoff, including (a) density and canopy of vegetative areas, (b) amount of year-round cover, (c) amount of grass or close-seeded legumes, (d) percent of residue cover on the land surface (good ≥ 20%), and (e) degree of surface roughness.

Poor: Factors impair infiltration and tend to increase runoff.

Good: Factors encourage average and better than average infiltration and tend to decrease runoff.