## RECOMMENDATIONS OF CONDITIONS OF APPROVAL

**Suggested motion: I move to approve the preliminary plat of Arcadian Heights Master Plan, the variance from MSB 43.20.300(A), and the variance request from MSB 43.20.300(E)(3)(a) Lot and Block Design Section 17, Township 17 North, Range 01 West, Seward Meridian, Alaska, contingent on staff recommendations:**

1. Taxes and special assessments must be paid in full for the year of recording, pursuant to MSB 43.15.053(F) and AS 40.15.020. Pay taxes and special assessments (LIDs), by CERTIFIED FUNDS OR CASH.
2. Provide updated Certificate to Plat executed within seven (7) days of recording of each phase plat and submit Beneficiary Affidavit for any holders of a beneficial interest.
3. Overlay the flag pole portions of Lot 2 & Lot 3, Block 2 with either a common access easement or a public use easement.
4. Provide City of Wasilla final road approval for each phase plat.
5. Provide an updated soils report once the regrading of Lot 17, Block 2 has been completed. Alternatively, combine Lot 17, Block 2 with an adjoining lot.
6. Relocate the proposed temporary cul-de-sac on S. Braxton Drive to the end of the proposed S. Braxton Drive at the edge of the southern property boundary.
7. Pay postage and advertising fees.
8. Show all easements of record on each phase plat.
9. Submit recording fees for each phase, payable to Department of Natural Resources (DNR).
10. Submit each phase plat in full compliance with Title 43.



HANDOUT #1
ARCADIAN HEIGTS MSP
CASE # 2023-070/071
MEETING DATE: August 3, 2023

## Jesse Curlin

**From:** Percy, Colton T (DFG) <colton.percy@alaska.gov>
**Sent:** Wednesday, July 12, 2023 7:46 AM
**To:** Jesse Curlin
**Subject:** RE: RFC Legacy Hills Estates #2023-064

[EXTERNAL EMAIL - CAUTION: Do not open unexpected attachments or links.]
Hi Chris,

No objections from Access Defense. Thanks for getting this out to us.


**Colton Percy**
**Habitat Biologist**
**Access Defense Program**
Alaska Department of Fish and Game
Division of Wildlife Conservation
333 Raspberry Rd
Anchorage, AK 99518
907-267-2118


---

**From:** Jesse Curlin <Jesse.Curlin@matsugov.us>
**Sent:** Monday, July 10, 2023 10:33 AM
**To:** Myers, Sarah E E (DFG) <sarah.myers@alaska.gov>; Percy, Colton T (DFG) <colton.percy@alaska.gov>
**Subject:** RFC Legacy Hills Estates #2023-064



Please ignore the due date. I realized you were left out of the original email. Any comments you have time to send would be appreciated.
The following link contains a Request for Comments to subdivide 217N02W14D005. Comments are due by June 9, 2023. Please let me know if you have any questions.

Legacy Hills Estates

Sincerely,


Jesse C. "Chris" Curlin
Platting Technician
Matanuska-Susitna Borough
(907) 861-7873


HANDOUT #2
LEGACY HILLS EST
CASE #2023-064
MEETING DATE: AUGUST 3, 2023

## Jesse Curlin

**From:** Moenaert, Crystal L (DFG) <crystal.moenaert@alaska.gov>
**Sent:** Monday, July 10, 2023 3:31 PM
**To:** Jesse Curlin
**Subject:** RE: RFC Legacy Hills Estates #2023-064

[EXTERNAL EMAIL - CAUTION: Do not open unexpected attachments or links.]
Good Afternoon,

The ADF&G Habitat Section has reviewed the request to create 12 lots and construct an interior road for access to all lots. The subject location does not contain any documented resident or anadromous waterbodies therefore a permit from the ADF&G Habitat Section is not required. Should fish bearing water bodies be discovered please contact the ADF&G Habitat Section at (907) 861-3200.

Thank you for the opportunity to comment.

Sincerely,

*Crystal Moenaert*
*Habitat Biologist 2*
*ADF&G Habitat Section*
*1801 S Margaret Drive, Suite 6*
*Palmer AK 99645*
*Ph: 907-861-3204*
ADF&G Habitat Section Permits Link

---

**From:** Jesse Curlin <Jesse.Curlin@matsugov.us>
**Sent:** Monday, July 10, 2023 10:33 AM
**To:** Myers, Sarah E E (DFG) <sarah.myers@alaska.gov>; Percy, Colton T (DFG) <colton.percy@alaska.gov>
**Subject:** RFC Legacy Hills Estates #2023-064

CAUTION: This email originated from outside the State of Alaska mail system. Do not click links or open attachments unless you recognize the sender and know the content is safe.

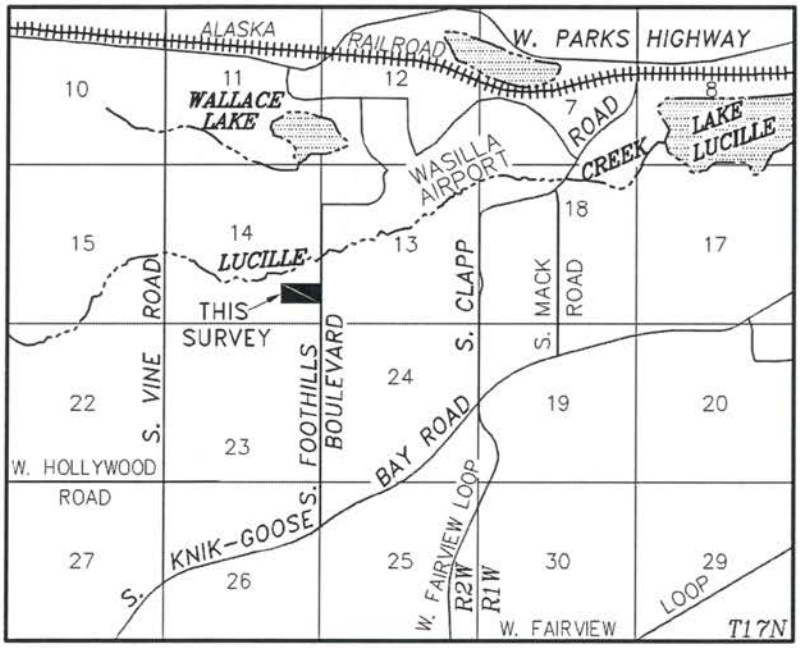
Please ignore the due date. I realized you were left out of the original email. Any comments you have time to send would be appreciated.
The following link contains a Request for Comments to subdivide 217N02W14D005. Comments are due by June 9, 2023. Please let me know if you have any questions.

HANDOUT #1
LEGACY HILLS EST
CASE #2023-064
MEETING DATE: AUGUST 3, 2023

# Legacy Hills

# DRAINAGE REPORT

Legacy Hills Subdivision
Account Number: 217N02W14D005 Parcel ID: 38442
TRS: TOWNSHIP 17N RANGE 2W SECTION 14 LOT D5
Site Address: 2180 S Foothills Blvd
Ownership: ALASKA ROYAL HOLDINGS LLC
Primary Owner's Address: 3950 E WICKERSHAM WAY WASILLA AK 99654




*Civil Resources, LLC*
*3001 W Stonebridge Dr.*
*Wasilla, AK 99654*
*CRLLC Job No. 230428*
August 2, 2023

STATE OF ALASKA
49 TH
BRUCE J. FRIEDHOFF
No. CE 13163
8/2/23
REGISTERED PROFESSIONAL ENGINEER



HANDOUT #3
LEGACY HILLS EST
CASE # 2023-064
MEETING DATE: August 3, 2023

# Table of Contents



# Introduction

Owner will develop a residential subdivision with 12 Lots on 20 acres and 1,270 feet of public road improvement. The site is on a hill having ten separate outfalls in all directions. There are two natural depressions that keep post development peak flow less than pre-development. There is no runoff from the 1-Year 24-Hour storm event. Flows from the 10-Year 24-Hour storm event for most of the outfalls are negligibly small (less than 0.05 CFS). Post-development flow increases are also negligibly small. There are two culverts, one at each end of the road. All ditches are stable for the 100-year 24-hour storm event. Culverts are designed for the 100-year 24-hour storm event in order to maintain pre-development flow pattern.

Land development activities increase runoff and requires responsible stormwater management facilities consisting of treatment, retention, detention, infiltration, and conveyance of stormwater to avoid adverse impact of adjoining, nearby, and downstream properties receiving water. The purpose of this report is to document those improvements will follow the following criteria in Table D-1[1]:

1. Conveyance: Drainage ditches and non-regulated streams shall be designed for the 10-year storm 24-hour storm event. Regulated streams shall be designed for the 100-year 24-hour storm event.
    a. All ditches and culverts must convey the peak flow from the 10-Year Storm Event with a minimum of 12-Inches (1-foot) freeboard below the top of fore slope (structural section hinge point) or maximum flow depth of 18" in a 30" deep ditch.
    b. Flow capacity must be a minimum of 10% greater than the design flow.
2. Wetlands. Preserve the pre-development function of wetlands. For jurisdictional wetland areas, comply with United States Army Corps of Engineers wetlands development retention requirements.
3. Water Quality. Treat runoff generated by 0.50 inch of rainfall in a 24-hour period.
4. Erosion and Sediment Control. Control flows in conveyance channels so that transport of particles sized D50 and greater will not occur for the post-development peak flow.
5. Extended Detention. Provide 12 to 24 hours of detention for the post-development project runoff in excess of pre-development runoff volume for the 1-year, 24-hour storm.
6. Flood Hazard. Control peak flow to minimize downstream impacts.
    a. Maintain the post-development project runoff peak flows from the 10-year, 24-hour storm to less than or equal to pre-development runoff peak flow at all project discharge points. Or,
    b. Maintain the post-development project runoff peak flows to less than 1.10 times pre-development runoff peak flow at all project discharge points. Evaluate downstream until the project site area is less than 10% of the total upstream basin area and mitigate adverse impacts.

[1] Matanuska-Susitna Borough, Public Works Department, Subdivision Construction Manual, July 19, 2022.

7. Flood Bypass. Compute post-development peak flow and delineate an unobstructed, overland flow path for runoff to overtop or bypass project conveyance routes for the post-development 100-year, 24-hour storm.
8. Drainage Easements. Easements are required for drainage facilities located outside of dedication right-of-way. Easements shall connect to right-of-way and be a minimum of 20' wide and 20' long. Easement for detention basins shall be 5' outside top of basin.
9. Utility Easements. Avoid locating drainage facilities in adjacent utility easements. Obtain approval from utilities when co-location is required.
10. Other Agency Requirement may include the following:
    a. Floodplain Use Permit from MSB;
    b. 404 Permit from U.S. Army Corps of Engineers;
    c. Alaska Department of Fish and Game (ADFG) for fish/stream crossings; or
    d. Storm Water Pollution Prevention Permit (SWPPP) from the Alaska Department of Environmental Control.

Maps and calculations supporting the findings and recommendations can be found in Appendices A and B. All storm events referenced herein have a 24-hour duration except those used in the Rational Method.

# Site Conditions

## *FEMA Flood Zone*

Flood Insurance Rate Map 02170C8065F Effective Date 09/27/2019 designates the project site area outside the 0.2% annual chance floodplain (Zone 'X') or area with undetermined, but possible flooding (Zone 'D'). The site is adjacent to and 100 feet above Lucille Creek Flood Zone 'A'.


## *Waters of the United States*

There are no wetland or Jurisdictional Waters of the United States (WOTUS) on site. A 404 Permit is not required from the United States Army Corps of Engineers prior to performing any disturbance or development in this area.

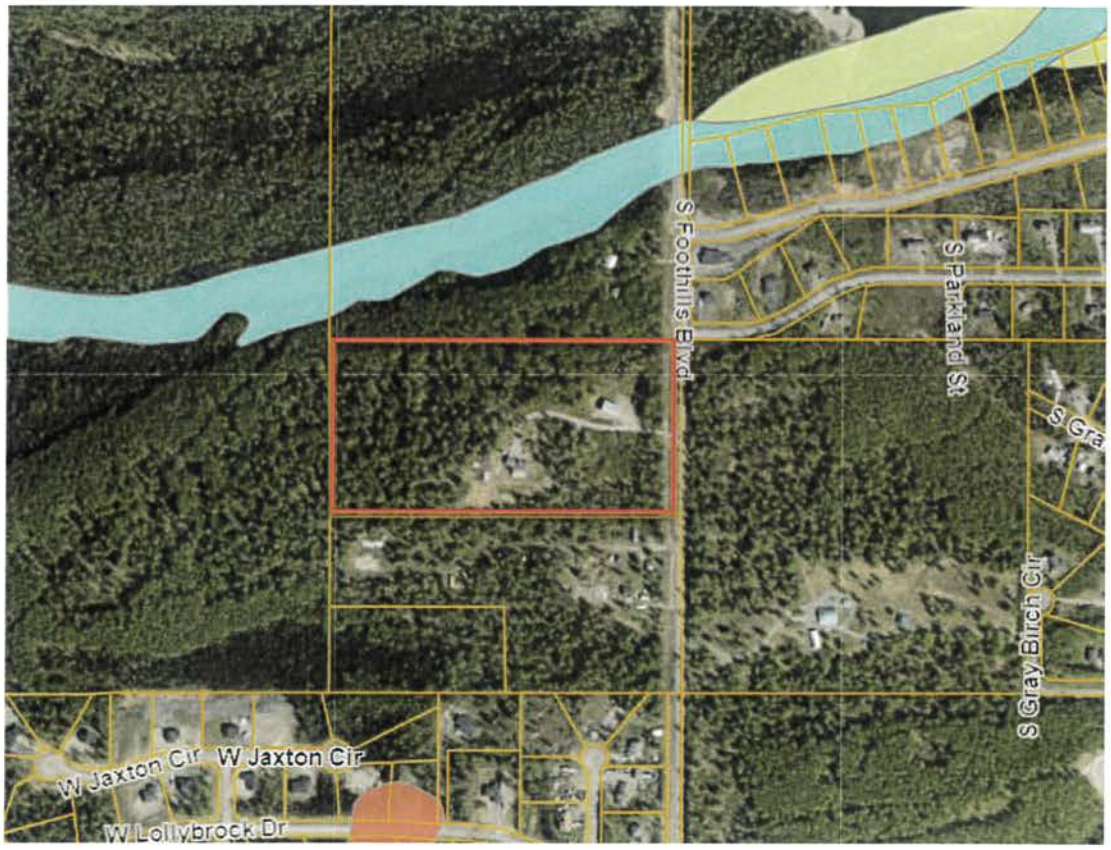



**Figure 1 – Wetlands and Waters of the United States**

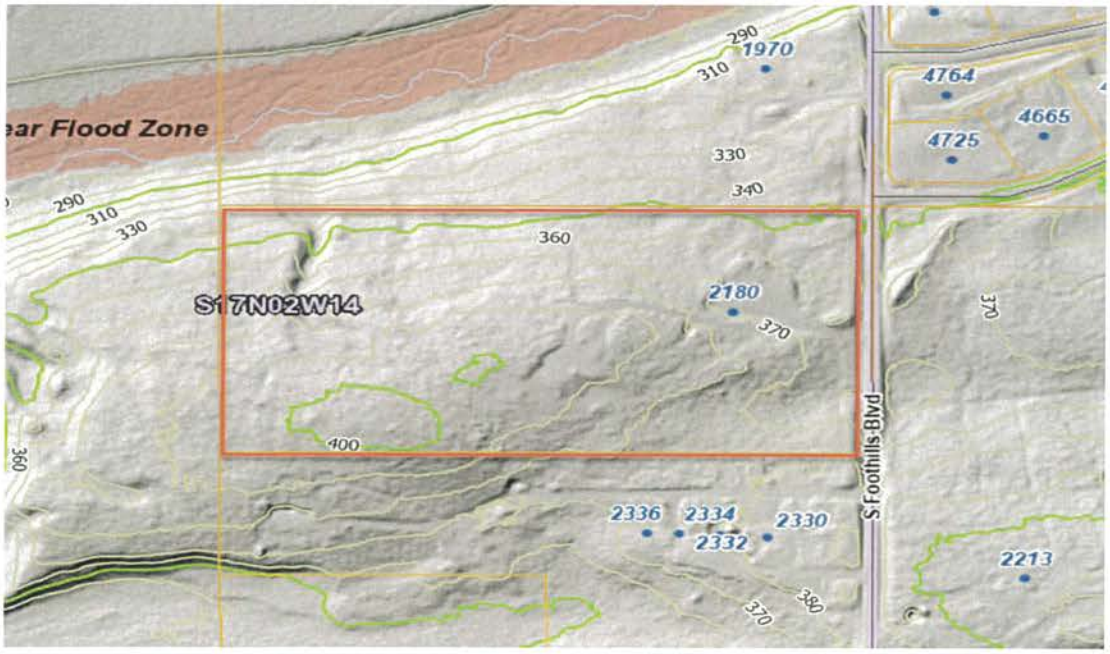



**Figure 2 – Hillside Topography**

## *Storm Water Pollution Prevention Plan (SWPPP)*

Runoff from the site travels to Crocker Creek and Cook Inlet (WOTUS). A storm water pollution prevention plan and notice of intent are REQUIRED.

## *Alaska Department of Fish and Game*

There are no active streams or fish crossings for this site.

# Hydrology

## *Drainage Areas*

Drainage areas and streams were delineated using HEC-HMS GIS tools[2] and the MSB 2019 Digital Elevation Model (DEM)[3]. Areas and streams were then adjusted based on review of contour maps and field observation.

## *Rainfall*

Rainfall depths and intensities were taken from NOAA 14 Data Server[4] and are summarized in the following table. No aerial reduction is applied. SCS Type I Rainfall Distribution is recommended by NOAA 14, TR-55, and MOA for use in this area of Alaska.

NOAA14 uses a regional influence approach for a variety of probability distribution functions and durations that is most suitable for the region. Distribution parameters and precipitation frequency estimates were analyzed for each duration based on the mean of the annual maximum series at each station and then regionally smoothed across durations to ensure consistency in precipitation frequency estimates.

Storms vary spatially having differing effects within the same region. One storm could produce a 2-inch rainfall in Palmer and 1-inch at the project site. But the next storm could reverse having 2-inches at the project site and 1-inch in Palmer. Both sites within the same region have similar probabilities even though the effects could be different for any one event. The precipitation frequency duration data published by NOAA is the best available information available for this site.

**Table 1**

| Wasilla | | | | | | | |
|---|---|---|---|---|---|---|---|
| 24-Hour Depths in Inches | | | | 10-YR Intensity in Inches per Hour | | | |
| Frequency | 1 | 10 | 100 | 5 | 10 | 15 | 30 |
| Inches | 1.09 | 1.98 | 3.02 | 2.11 | 1.42 | 1.10 | 0.73 |

## *Losses*

Hydrologic Soil Groups (HSG) were given by the USDA/NRCS Data Server[5]. SCS Curve Numbers (CN) were taken from TR-55[6] Tables 2-2a and 2c and MOA[7] Table 4.4-3 and adjusted for non-

[2] Hydrologic Modeling System (HEC-HMS) Version 4.7.1, January 14, 2021.
[3] 2019 LiDAR & Imagery Project, Matanuska-Susitna Borough.
[4] NOAA Atlas 14 Volume 7 Version 2.0, Precipitation-Frequency Atlas of the United States, Alaska. NOAA, National Weather Service, Silver Spring, MD.
[5] Custom Soil Resource Report for Matanuska-Susitna Valley Area, Alaska, USDA/NRCS, February 2, 2021.
[6] Urban Hydrology for Small Watersheds, USDA/NRCS, Technical Release 55 (TR-55), June 1986, Update January 1999.
[7] Anchorage Stormwater Manual, Volume 1, Chapter 4, December 2017.

connected impervious area. The following tables summarize CN'S by hydrologic soil group and weighted CN'S for each type of land use.

Runoff is based on maximum future development for current zoning. It is reasonable to expect future runoff events to be greater than those in the past. For example, commercial properties could replace pervious gravel with impervious pavement having significantly greater runoff. Likewise, residential properties can replace forest with grass having greater runoff. Initial abstraction of rainfall and small depression storage are incorporated into calculations.

**Table 2**

| Rural SCS Runoff Curve Numbers (CN) (Imp Not Connected) | | | | | | |
|---|---|---|---|---|---|---|
| **HSG** | **IMP** | **A** | **B** | **C** | **D** | **TR-55** |
| Infiltration (in/hr) | | 1.42 | 0.57 | 0.06 | 0.00 | NRCS, Part 630 Tbl 7-2 |
| Forrest | | 30 | 55 | 70 | 77 | MOA Tbl 4.4-3 |
| Grass/Pasture | | 39 | 61 | 74 | 80 | Table 2-2c |
| R1 (1DU/AC) | 20% | 45 | 65 | 76 | 82 | (1) and (4) |
| R2 (2DU/AC) | 25% | 47 | 66 | 77 | 82 | (1) and (4) |
| R3 (3DU/AC) | 30% | 49 | 67 | 78 | 83 | (1) and (4) |
| R4 (4DU/AC) | 42% | 53 | 70 | 80 | 84 | (1) and (4) |
| COM | 85% | 89 | 92 | 94 | 95 | (1) |
| IND | 72% | 81 | 88 | 91 | 93 | (1) |
| Bare Ground | | 77 | 86 | 91 | 94 | MOA Tbl 4.4-3 |
| Pavement/IMP | | 98 | 98 | 98 | 98 | MOA Tbl 4.4-3 |
| Gravel | | 76 | 85 | 89 | 91 | MOA Tbl 4.4-3 |
| ROW | 33% | 58 | 73 | 82 | 86 | (2) |
| (1) Compute using %IMP * Pavement + (1-%IMP) * Grass. | | | | | | |
| (2) Compute using 10/30= 33% Pavement and 60% grass/pasture. | | | | | | |
| (3) Use 42% IMP for R4 (WSDOT HRM M31-16.04) | | | | | | |
| (4) Unconnected Impervious area (90%). (NRCS Part 630 Chp. 9 Tbl 9-2) | | | | | | |

*Note: Hydrologic Soil Group 'C' is not found in this watershed/site.*

**Table 3**

| PRE LOSS SUMMARY | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| OUTFALL | SUB-AREA | HYDROLOGIC SOIL GROUP IN ACRES | | | | TOTAL | CN X DA | CN |
| | | B-FORREST | B-R1 | ROW | IMP | | | |
| | | 55 | 65 | 73 | 98 | | | |
| | 1 | 2.0 | 1.0 | | | 3.0 | 175.0 | 58.3 |
| | 2 | 1.2 | 1.0 | | | 2.2 | 131.0 | 59.5 |
| | 3 | 3.4 | | | | 3.4 | 185.4 | 55.0 |
| | 4 | 2.4 | | | | 2.4 | 133.4 | 55.0 |
| | 5 | 1.6 | | | | 1.6 | 89.5 | 55.0 |
| | 6 | 0.4 | | | | 0.4 | 24.0 | 55.0 |
| | 7 | 0.5 | | | | 0.5 | 25.9 | 55.0 |
| | 8 | 1.0 | 0.6 | | | 1.6 | 94.0 | 58.8 |
| | 9 | 4.8 | 1.0 | | | 5.8 | 329.0 | 56.7 |
| | 10 | 6.9 | | | | 6.9 | 377.2 | 55.0 |
| | 11 | | | 0.6 | | 0.6 | 43.8 | 73.0 |
| **Total** | | **24.2** | **3.6** | **0.6** | **0.0** | **28.4** | **1,608.2** | **56.6** |

| POST LOSS SUMMARY | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| OUTFALL | SUB-AREA | HYDROLOGIC SOIL GROUP IN ACRES | | | | TOTAL | CN X DA | CN |
| | | B-FORREST | B-R1 | ROW | IMP | | | |
| | | 55 | 65 | 73 | 98 | | | |
| | 1 | | | 0.5 | | 0.5 | 36.5 | 73.0 |
| | 2 | | 2.5 | | | 2.5 | 162.7 | 65.0 |
| | 3 | | 1.5 | | | 1.5 | 98.8 | 65.0 |
| | 4 | | 2.3 | | | 2.3 | 149.7 | 65.0 |
| | 5 | | 0.9 | | | 0.9 | 56.7 | 65.0 |
| | 6 | | 0.8 | | | 0.8 | 51.9 | 65.0 |
| | 7 | | 0.6 | | | 0.6 | 39.2 | 65.0 |
| | 8 | | 2.0 | | | 2.0 | 130.0 | 65.0 |
| | 9 | | 0.4 | | | 0.4 | 28.4 | 65.0 |
| | 10 | | 0.5 | | | 0.5 | 30.6 | 65.0 |
| | 11 | | 1.6 | | | 1.6 | 101.8 | 65.0 |
| | 12 | | 5.6 | | | 5.6 | 365.9 | 65.0 |
| | 13 | 6.9 | | | | 6.9 | 379.5 | 55.0 |
| | 14 | | | 0.8 | | 0.8 | 58.4 | 73.0 |
| | 15 | | | 0.8 | | 0.8 | 58.4 | 73.0 |
| | 16 | | 0.7 | | | 0.7 | 45.5 | 65.0 |
| **Total** | | **6.9** | **19.4** | **2.1** | **0.0** | **28.4** | **1,794.0** | **63.2** |

## *Time of Concentration*

Time of concentration was computed using four different methods (Kirpich, NRCS Upland, NRCS Lag, and Manning's Equation). Manning's, Upland, and Kirpich all give comparable results. NRCS Lag gives a much higher travel time than the other three and will not be used. Kirpich gives a slightly shorter time than the other two and produces realistic slightly conservative results. Kirpich Equation is given as,

$$Tc = 0.0078\ L^{0.77}\ S^{-0.385}\ \text{in Minutes} \qquad EQ.\ 1$$

*Where:*

*L = Stream Length in feet;*

*S = Watercourse Slope in feet/feet.*

**Table 4 – Pre-Development Input Data**

| PRE-DEVELOPMENT DRAINAGE DATA | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| BASIN | | Stream | | Acres | Length | Slope | Tc | V | CN |
| OUTFALL | SUB | UP | DN | | 1.1 | | | | |
| 2 | 1 | 20 | 26 | 3.0 | 304 | 0.065 | 5.0 | 1.0 | 58.3 |
| 3 | 2 | 9 | 24 | 2.2 | 435 | 0.108 | 5.0 | 1.4 | 59.5 |
| 4 | 3 | 6 | 28 | 3.4 | 443 | 0.144 | 5.0 | 1.5 | 55.0 |
| 5 | 4 | 3 | 29 | 2.4 | 613 | 0.118 | 5.0 | 2.0 | 55.0 |
| 6 | 5 | 8 | 27 | 1.6 | 476 | 0.111 | 5.0 | 1.6 | 55.0 |
| 7 | 6 | 5 | 11 | 0.4 | 121 | 0.036 | 5.0 | 0.4 | 55.0 |
| 8 | 7 | 5 | 11 | 0.5 | 121 | 0.036 | 5.0 | 0.4 | 55.0 |
| 9 | 8 | 4 | 13 | 1.6 | 203 | 0.057 | 5.0 | 0.7 | 58.8 |
| 10 | 9 | 7 | 21 | 5.8 | 718 | 0.049 | 5.0 | 2.4 | 56.7 |
| 10 | 10 | 2 | 23 | 6.9 | 539 | 0.080 | 5.0 | 1.8 | 55.0 |
| 1 | 11 | 20 | 25 | 0.6 | 319 | 0.060 | 5.0 | 1.1 | 73.0 |
| Total | | | | 28.4 | 4,292 | | | | |
| Max | | | | 6.9 | 718 | 0.1440 | 5.0 | 2.4 | 73.0 |
| Min | | | | 0.4 | 121 | 0.0364 | 5.0 | 0.4 | 55.0 |
| Note: Minimum Tc is 5 minutes. | | | | | | | | | |

**Table 5. Post-Development Input Data**

| POST-DEVELOPMENT DRAINAGE DATA | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| BASIN | | Stream | | Acres | Length | Slope | Tc | V | CN |
| OUTFALL | SUB | UP | DN | | 1.1 | | | | |
| 1 | 1 | 20 | 25 | 0.5 | 319 | 0.060 | 5.0 | 1.1 | 73.0 |
| 2 | 2 | 20 | 26 | 2.5 | 304 | 0.065 | 5.0 | 1.0 | 65.0 |
| 3 | 3 | | 24 | 1.5 | 300 | 0.065 | 5.0 | 1.0 | 65.0 |
| 4 | 4 | | 28 | 2.3 | 300 | 0.065 | 5.0 | 1.0 | 65.0 |
| 5 | 5 | | 15 | 0.9 | 300 | 0.065 | 5.0 | 1.0 | 65.0 |
| 6 | 6 | 18 | 27 | 0.8 | 80 | 0.005 | 5.0 | 0.3 | 65.0 |
| 6 | 7 | 12 | 16 | 0.6 | 603 | 0.030 | 5.0 | 2.0 | 65.0 |
| 4 | 8 | 8 | 14 | 2.0 | 216 | 0.084 | 5.0 | 0.7 | 65.0 |
| 7 | 9 | 5 | 11 | 0.4 | 121 | 0.036 | 5.0 | 0.4 | 65.0 |
| 8 | 10 | 5 | 11 | 0.5 | 121 | 0.036 | 5.0 | 0.4 | 65.0 |
| 9 | 11 | 4 | 13 | 1.6 | 203 | 0.057 | 5.0 | 0.7 | 65.0 |
| 10 | 12 | 7 | 21 | 5.6 | 718 | 0.049 | 5.0 | 2.4 | 65.0 |
| 10 | 13 | 2 | 23 | 6.9 | 539 | 0.080 | 5.0 | 1.8 | 55.0 |
| 10 | 14 | 12 | 17 | 0.8 | 730 | 0.027 | 5.0 | 2.4 | 73.0 |
| 10 | 15 | 10 | 19 | 0.8 | 730 | 0.040 | 5.0 | 2.4 | 73.0 |
| 5 | 16 | 8 | 14 | 0.7 | 216 | 0.084 | 5.0 | 0.7 | 65.0 |
| Total | | | | 28.3 | 5,800 | | | | |
| Max | | | | 6.9 | 730 | 0.0845 | 5.0 | 2.4 | 73.0 |
| Min | | | | 0.4 | 80 | 0.0050 | 5.0 | 0.3 | 55.0 |
| Note: Minimum Tc is 5 minutes. | | | | | | | | | |

**Table 6. Road Hydrology**

| Road Hydrology | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **BASINS** | **From Node** | **To Node** | **Feature** | **Grade** | **REF HYD** | **STORM** | **Q** | **Qd** |
| | 10 | 14 | Ditch | 1.0 | 8 | 100 | 0.5 | 0.5 |
| | 12 | 16 | Ditch | 1.0 | 7 | 100 | 0.1 | 0.2 |
| | 10 | 19 | Ditch | 1.0 | 15 | 100 | 0.5 | 0.5 |
| | 12 | 17 | Ditch | 1.0 | 14 | 100 | 0.5 | 0.5 |
| | 17 | 19 | CUL1 | 1.0 | 14 | 100 | 0.5 | 0.5 |
| | 14 | 16 | CUL2 | 1.0 | 8 | 100 | 0.5 | 0.5 |
| | Min | | | | | | 0.5 | 0.5 |
| | Avg | | | | | | 0.5 | 0.5 |
| | Max | | | | | | 0.5 | 0.5 |
| | NODE COUNT | | | See Appendix for detail calculations. | | | | |

## *Transformation - Routing*

Autodesk Hydraflow[8] model is used to transform the Type I Hyetograph into runoff using the SCS Method. Basin area, curve number (CN), and time of concentration are entered for each area and routed to their respective outfalls. Results are summarized in the following figures and table.

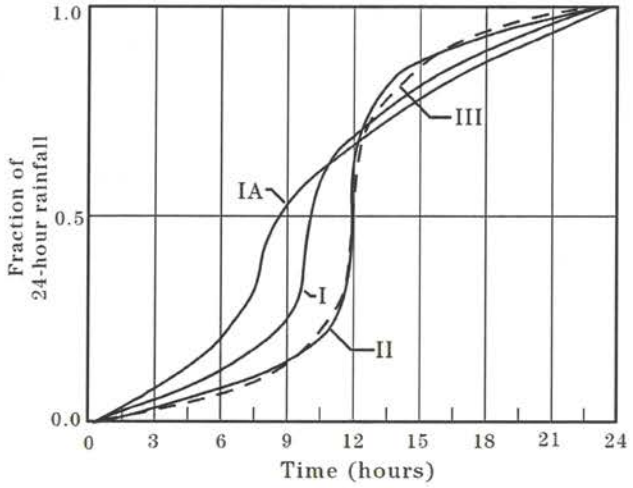



**Figure 3. SCS 24-Hour Rainfall Distributions**

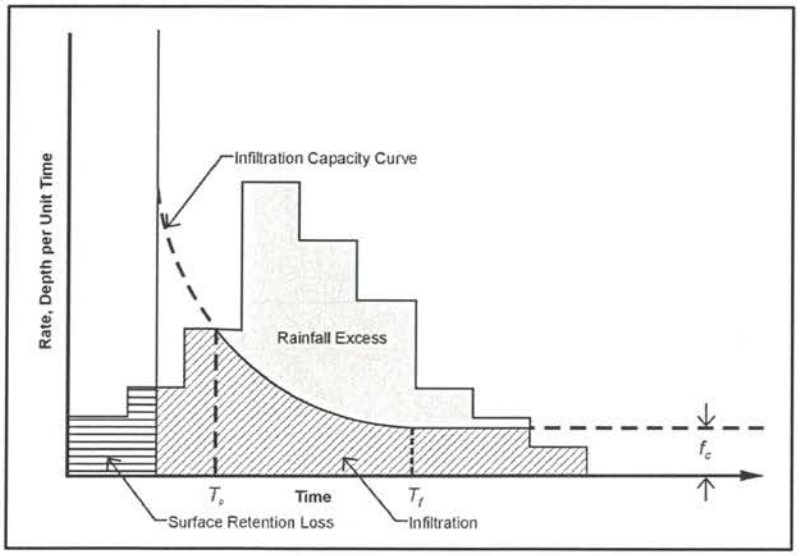



**Figure 4. Rainfall – Runoff - Infiltration Relationship**

[8] Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 is an application for urban hydro systems engineering. It creates hyetographs from rainfall data, computes losses, and creates runoff hydrographs that can be added together at junctions, routed through channels, diverted at junctions, and routed through ponds. Pond sizing and routing is interactive within the application.

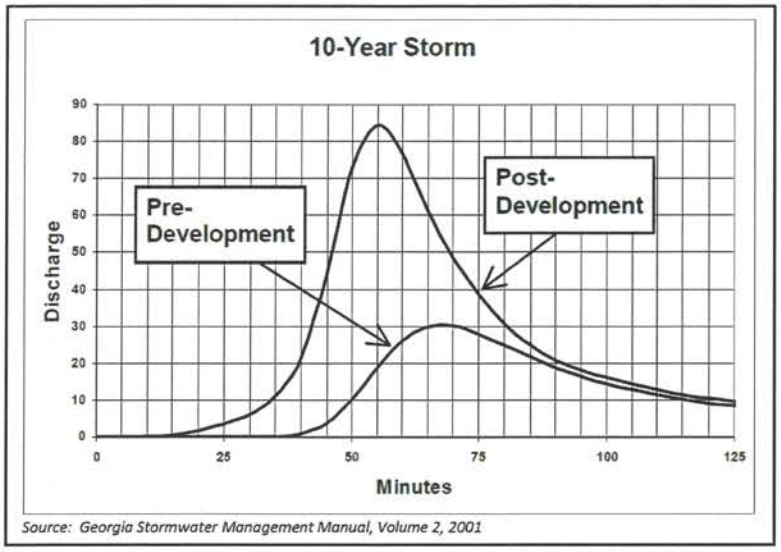



**Figure 5. Comparison of Pre- and Post-Development Runoff Hydrographs (Example)**

**Table 7**

**Pre- and Post- Development Flows and Volumes**

| PRE FLOW IN CFS | | | | |
|---|---|---|---|---|
| OUTFALL | HYD | 1YR | 10YR | 100YR |
| 1 | 1 | 0.0 | 0.0 | 0.1 |
| 2 | 2 | 0.0 | 0.0 | 0.1 |
| 3 | 3 | 0.0 | 0.0 | 0.1 |
| 4 | 4 | 0.0 | 0.0 | 0.0 |
| 5 | 5 | 0.0 | 0.0 | 0.0 |
| 6 | 6 | 0.0 | 0.0 | 0.0 |
| 7 | 7 | 0.0 | 0.0 | 0.0 |
| 8 | 8 | 0.0 | 0.0 | 0.1 |
| 9 | 14 | 0.0 | 0.0 | 0.0 |
| 10 | 11 | 0.0 | 0.1 | 0.4 |

| PRE VOLUME IN CU-FT | | | |
|---|---|---|---|
| OUTFALL | 1YR | 10YR | 100YR |
| 1 | 0 | 440 | 3,245 |
| 2 | 0 | 424 | 2,676 |
| 3 | 0 | 176 | 2,547 |
| 4 | 0 | 124 | 1,798 |
| 5 | 0 | 83 | 1,199 |
| 6 | 0 | 21 | 300 |
| 7 | 0 | 26 | 375 |
| 8 | 0 | 264 | 1,819 |
| 9 | 0 | 0 | 0.000 |
| 10 | 68 | 700 | 1,953 |

| POST FLOW IN CFS | | | | |
|---|---|---|---|---|
| OUTFALL | HYD | 1YR | 10YR | 100YR |
| 1 | 2 | 0.0 | 0.0 | 0.6 |
| 2 | 3 | 0.0 | 0.0 | 0.4 |
| 3 | 4 | 0.0 | 0.0 | 0.5 |
| 4 | 24 | 0.0 | 0.0 | 0.8 |
| 5 | 19 | 0.0 | 0.0 | 0.4 |
| 6 | 9 | 0.0 | 0.0 | 0.1 |
| 7 | 10 | 0.0 | 0.0 | 0.1 |
| 8 | 11 | 0.0 | 0.0 | 0.4 |
| 9 | 23 | 0.0 | 0.0 | 0.0 |
| 10 | 1 | 0.0 | 0.1 | 0.3 |

| POST VOLUME IN CU-FT | | | |
|---|---|---|---|
| OUTFALL | 1YR | 10YR | 100YR |
| 1 | 0 | 1214 | 4822 |
| 2 | 0 | 728 | 2893 |
| 3 | 0 | 1117 | 4436 |
| 4 | 0 | 1699 | 6751 |
| 5 | 0 | 728 | 2893 |
| 6 | 0 | 194 | 772 |
| 7 | 0 | 243 | 964 |
| 8 | 0 | 777 | 3086 |
| 9 | 0 | 0 | 0 |
| 10 | 57 | 583 | 1628 |

| POST FLOW INCREASE IN CFS | | | | |
|---|---|---|---|---|
| OUTFALL | | 1YR | 10YR | 100YR |
| 1 | | 0.0 | 0.0 | 0.5 |
| 2 | | 0.0 | 0.0 | 0.3 |
| 3 | | 0.0 | 0.0 | 0.5 |
| 4 | | 0.0 | 0.0 | 0.8 |
| 5 | | 0.0 | 0.0 | 0.3 |
| 6 | | 0.0 | 0.0 | 0.1 |
| 7 | | 0.0 | 0.0 | 0.1 |
| 8 | | 0.0 | 0.0 | 0.3 |
| 9 | | 0.0 | 0.0 | 0.0 |
| 10 | | 0.0 | 0.0 | -0.1 |

*Note: Values are rounded to nearest 0.1 CFS.*
*Zero flows are less than 0.005 CFS.*

| POST VOLUME INCREASE CU-FT | | | |
|---|---|---|---|
| OUTFALL | 1YR | 10YR | 100YR |
| 1 | 0 | 774 | 1577 |
| 2 | 0 | 304 | 217 |
| 3 | 0 | 941 | 1889 |
| 4 | 0 | 1575 | 4953 |
| 5 | 0 | 645 | 1694 |
| 6 | 0 | 173 | 472 |
| 7 | 0 | 217 | 589 |
| 8 | 0 | 513 | 1267 |
| 9 | 0 | 0 | 0 |
| 10 | -11 | -117 | -325 |

*Note: Values are rounded to nearest 1.0 Cu-Ft.*

## *Snow Melt*

Spring snow melt is an event that occurs every year with a daily runoff volume that could exceed the 10-year 24-hour rainfall volume when "ice-sealing" occurs. Ice sealing takes place when snow melts at a rate exceeding soil infiltration causing a saturated soil condition. The saturated soil then freezes at night forming an impervious ice layer that reduces the amount of snow melt that can infiltrate into the ground. The phenomenon could last a few hours to two days until night freezing temperature hours are less than daytime warming hours. Even if it only occurs for one or two days, there is a real risk of property damage and traffic interruption if not properly addressed. The Municipality of Anchorage estimates this type of event occurs every five years and design for the 10-Year storm event is adequate to address snow melt[9]. The estimated snow melt during spring break-up is 0.5 inches per day[10]. The project has 10- and 100-year daily runoff amounts of 0.05 and 0.3 inches. In other words, it is likely the site will experience a greater and more frequent amount of runoff from snow melting than rainfall. Providing stormwater detention basins will help mitigate snow melt runoff.

[9] Anchorage Stormwater Manual, Volume 1, December 2017, Section 8.1.
[10] NEH Part 630, Chapter 630.1103, Eq. 11-5 for mean daily temperature of 40 Degree-F. Assumes minimum of 2' depth of snow. MOA has recorded 0.9 inches in 40 hours (Appendix D-6).

# Hydraulic and Stability Analyses

## *Ditches*

Ditches were analyzed using Manning's Equation for a 30" deep V-Ditch having 3:1 gravel fore slope and 2:1 turf back slope. Results of detailed calculations for the 100-Year design flow are summarized in the following table.

Manning's Equation is,

$V = (1.486R^{2/3}S^{1/2})/N$ *EQ. 3*

$Q = VA$

*Where;*

*V = Velocity, ft/s*

*A =area of flow, $ft^2$*

*Q= quantity of flow, $ft^3/s$*

*N = Manning friction coefficient*

*R = Hydraulic Radius, feet*

*S = Energy Slope (ft/ft)*

Standard ditch consists of turf and Class II sub-base fill ($D_{50}$ = 1.5-inches). Ditches with $D_{50}$-Incipient Motion diameters greater than 1.5-inches risk erosion. These were designed for stabilized gravel/rock lining using the Isbash Equation[11] for channel banks on straight reach. Rock stabilization with diameters and gradation is shown in the following table. Turf Reinforcement Matt (TRM) is an acceptable alternative if approved by the Borough for use in right-of-way.

The Isbash Equation for critical incipient motion is,

$D_{50} = 0.0191\ Va^2\ [\gamma w/(\gamma s-\gamma w)]/\cos\varphi$ *EQ. 5*

*Where:*

*Va = Average velocity in feet per second,*

*$\gamma w$ = Specific weight of water in pounds per cubic feet = 62.4,*

*$\gamma s$ = Specific weight of stone in pound per cubic feet = 156, and*

*$\Phi$ = Bank Angle with horizontal*

[11] Drainage Design Manual for Maricopa County, Hydraulic Open Channels, Pg. 6-51, EQ 6.34, December 14, 2018.

**Table 8 – Hydraulic Design Results**

| BASIN | FROM NODE | TO NODE | FEATURE | Storm | Qd (CFS) | S (%) | D (FT) | B (FT) | z1 | z2 | Y (FT) | FB (FT) | N | V (FPS) | D50 | Lining |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 10 | 14 | Ditch | 100 | 0.5 | 4.0 | 0.2 | 1 | 3 | 2 | 2.5 | 2.3 | 0.035 | 2.1 | 0.7 | A |
| | 12 | 16 | Ditch | 100 | 0.2 | 4.0 | 0.1 | 1 | 3 | 2 | 2.5 | 2.4 | 0.035 | 1.5 | 0.3 | A |
| | 10 | 19 | Ditch | 100 | 0.5 | 6.0 | 0.2 | 1 | 3 | 2 | 2.5 | 2.3 | 0.035 | 2.5 | 1.0 | A |
| | 12 | 17 | Ditch | 100 | 0.5 | 6.0 | 0.2 | 1 | 3 | 2 | 2.5 | 2.3 | 0.035 | 2.5 | 1.0 | A |
| | MAX | | | | 0.5 | 6.0 | 0.2 | 1.0 | 3 | 2 | 2.5 | 2.4 | 0.035 | 2.5 | 1.0 | |
| | MIN | | | | 0.2 | 4.0 | 0.1 | 1.0 | 3 | 2 | 2.5 | 2.3 | 0.035 | 1.5 | 0.3 | |
| | AVG | 4 | NODE COUNT | | 0.4 | 5.0 | 0.1 | 1.0 | 3 | 2 | 2.5 | 2.4 | 0.035 | 2.2 | 0.7 | |

**Table 9**

| DITCH / CHANNEL LINING STABILIZATION | | | | | |
|---|---|---|---|---|---|
| TYPE | D50 | DMAX | DMIN | T | MATERIAL |
| UNITS | INCHES | | | | |
| A | NATIVE GRASS/TURF/GRAVEL | | | | |
| B | 3.0 | 4.5 | 1.5 | 6.0 | RIPRAP |
| C | 6.0 | 9.0 | 3.0 | 12.0 | RIPRAP |
| D | 9.0 | 13.5 | 4.5 | 18.0 | RIPRAP |
| E | 12.0 | 18.0 | 6.0 | 24.0 | RIPRAP |

## *Culverts*

Culvert crossings were analyzed using Autodesk Hydraflow[12] for HW/D = 1.0, a minimum grade of 1.0%, and are summarized in the following table.

[12] Hydraflow Express Extension for Autodesk Civil 3D Version 12 by Autodesk, Inc. Http://www.autodesk.com/civil3d-stormwater.

# Hydraflow Rainfall Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Wednesday, 08 / 2 / 2023

| Return Period (Yrs) | Intensity-Duration-Frequency Equation Coefficients (FHA) | | | |
|---|---|---|---|---|
| | B | D | E | (N/A) |
| 1 | 0.0000 | 0.0000 | 0.0000 | -------- |
| 2 | 0.0000 | 0.0000 | 0.0000 | -------- |
| 3 | 0.0000 | 0.0000 | 0.0000 | -------- |
| 5 | 0.0000 | 0.0000 | 0.0000 | -------- |
| 10 | 0.0000 | 0.0000 | 0.0000 | -------- |
| 25 | 0.0000 | 0.0000 | 0.0000 | -------- |
| 50 | 0.0000 | 0.0000 | 0.0000 | -------- |
| 100 | 0.0000 | 0.0000 | 0.0000 | -------- |

File name: WASILLA.IDF

**Intensity = B / (Tc + D)^E**

| Return Period (Yrs) | Intensity Values (in/hr) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 5 min | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 |
| 1 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 5 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 100 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Tc = time in minutes. Values may exceed 60.

Precip. file name: C:\Users\bfrie\CRLLC\Projects\WORK2023\Legacy Hills\CALC\WASILLA.pcp

| Storm Distribution | Rainfall Precipitation Table (in) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1-yr | 2-yr | 3-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr |
| SCS 24-hour | 1.09 | 0.00 | 0.00 | 0.00 | 1.98 | 0.00 | 0.00 | 3.02 |
| SCS 6-Hr | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Huff-1st | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Huff-2nd | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Huff-3rd | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Huff-4th | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Huff-Indy | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Custom | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

# Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

| Hyd. No. | Hydrograph type (origin) | Peak flow (cfs) | Time interval (min) | Time to Peak (min) | Hyd. volume (cuft) | Inflow hyd(s) | Maximum elevation (ft) | Total strge used (cuft) | Hydrograph Description |
|---|---|---|---|---|---|---|---|---|---|
| 1 | SCS Runoff | 0.304 | 1 | 598 | 1,628 | ------ | ------ | ------ | SUB1, OUT-10 |
| 2 | SCS Runoff | 0.596 | 1 | 599 | 4,822 | ------ | ------ | ------ | SUB2, OUT-1 |
| 3 | SCS Runoff | 0.358 | 1 | 599 | 2,893 | ------ | ------ | ------ | SUB3, OUT-2 |
| 4 | SCS Runoff | 0.548 | 1 | 599 | 4,436 | ------ | ------ | ------ | SUB4, OUT-3 |
| 5 | SCS Runoff | 0.215 | 1 | 599 | 1,736 | ------ | ------ | ------ | SUB5, OUT-4 |
| 6 | SCS Runoff | 0.191 | 1 | 599 | 1,543 | ------ | ------ | ------ | SUB6, 18>27 |
| 7 | SCS Runoff | 0.143 | 1 | 599 | 1,157 | ------ | ------ | ------ | SUB7, 12>16 |
| 8 | SCS Runoff | 0.477 | 1 | 599 | 3,858 | ------ | ------ | ------ | SUB8, 8>14 |
| 9 | SCS Runoff | 0.095 | 1 | 599 | 772 | ------ | ------ | ------ | SUB9, OUT-6 |
| 10 | SCS Runoff | 0.119 | 1 | 599 | 964 | ------ | ------ | ------ | SUB10, OUT-7 |
| 11 | SCS Runoff | 0.382 | 1 | 599 | 3,086 | ------ | ------ | ------ | SUB11, OUT-8 |
| 12 | SCS Runoff | 1.335 | 1 | 599 | 10,801 | ------ | ------ | ------ | SUB12, 7>21 |
| 13 | SCS Runoff | 0.119 | 1 | 774 | 5,170 | ------ | ------ | ------ | SUB13, 2>23 |
| 14 | SCS Runoff | 0.487 | 1 | 598 | 2,604 | ------ | ------ | ------ | SUB14, 12>17 |
| 15 | SCS Runoff | 0.487 | 1 | 598 | 2,604 | ------ | ------ | ------ | SUB15, 10>19 |
| 16 | Combine | 0.620 | 1 | 599 | 5,015 | 7, 8, | ------ | ------ | RET1 IN |
| 17 | SCS Runoff | 0.167 | 1 | 599 | 1,350 | ------ | ------ | ------ | SUB16, >OUT5 |
| 18 | Combine | 0.358 | 1 | 599 | 2,893 | 6, 17 | ------ | ------ | OUT-5 |
| 19 | Combine | 2.303 | 1 | 599 | 16,010 | 12, 14, 15, | ------ | ------ | DEP1 IN |
| 20 | Reservoir | 0.273 | 1 | 954 | 10,467 | 19 | 362.24 | 7,078 | DEP1, 21 |
| 21 | Combine | 0.388 | 1 | 965 | 15,637 | 13, 20 | ------ | ------ | DEP2 IN |
| 22 | Reservoir | 0.000 | 1 | n/a | 0 | 21 | 359.66 | 15,637 | DEP2, OUT-9 |
| 23 | Combine | 0.835 | 1 | 599 | 6,751 | 5, 16, | ------ | ------ | OUT4 |

# Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

| Hyd. No. | Hydrograph type (origin) | Peak flow (cfs) | Time interval (min) | Time to Peak (min) | Hyd. volume (cuft) | Inflow hyd(s) | Maximum elevation (ft) | Total strge used (cuft) | Hydrograph Description |
|---|---|---|---|---|---|---|---|---|---|
| 1 | SCS Runoff | 0.064 | 1 | 599 | 583 | ------ | ------ | ------ | SUB1, OUT-10 |
| 2 | SCS Runoff | 0.028 | 1 | 775 | 1,214 | ------ | ------ | ------ | SUB2, OUT-1 |
| 3 | SCS Runoff | 0.017 | 1 | 775 | 728 | ------ | ------ | ------ | SUB3, OUT-2 |
| 4 | SCS Runoff | 0.026 | 1 | 775 | 1,117 | ------ | ------ | ------ | SUB4, OUT-3 |
| 5 | SCS Runoff | 0.010 | 1 | 775 | 437 | ------ | ------ | ------ | SUB5, OUT-4 |
| 6 | SCS Runoff | 0.009 | 1 | 775 | 388 | ------ | ------ | ------ | SUB6, 18>27 |
| 7 | SCS Runoff | 0.007 | 1 | 775 | 291 | ------ | ------ | ------ | SUB7, 12>16 |
| 8 | SCS Runoff | 0.022 | 1 | 775 | 971 | ------ | ------ | ------ | SUB8, 8>14 |
| 9 | SCS Runoff | 0.004 | 1 | 775 | 194 | ------ | ------ | ------ | SUB9, OUT-6 |
| 10 | SCS Runoff | 0.006 | 1 | 775 | 243 | ------ | ------ | ------ | SUB10, OUT-7 |
| 11 | SCS Runoff | 0.018 | 1 | 775 | 777 | ------ | ------ | ------ | SUB11, OUT-8 |
| 12 | SCS Runoff | 0.062 | 1 | 775 | 2,719 | ------ | ------ | ------ | SUB12, 7>21 |
| 13 | SCS Runoff | 0.016 | 1 | 1318 | 358 | ------ | ------ | ------ | SUB13, 2>23 |
| 14 | SCS Runoff | 0.102 | 1 | 599 | 933 | ------ | ------ | ------ | SUB14, 12>17 |
| 15 | SCS Runoff | 0.102 | 1 | 599 | 933 | ------ | ------ | ------ | SUB15, 10>19 |
| 16 | Combine | 0.029 | 1 | 775 | 1,262 | 7, 8, | ------ | ------ | RET1 IN |
| 17 | SCS Runoff | 0.008 | 1 | 775 | 340 | ------ | ------ | ------ | SUB16, >OUT5 |
| 18 | Combine | 0.017 | 1 | 775 | 728 | 6, 17 | ------ | ------ | OUT-5 |
| 19 | Combine | 0.204 | 1 | 599 | 4,584 | 12, 14, 15, | ------ | ------ | DEP1 IN |
| 20 | Reservoir | 0.000 | 1 | n/a | 0 | 19 | 361.66 | 4,584 | DEP1, 21 |
| 21 | Combine | 0.016 | 1 | 1318 | 358 | 13, 20 | ------ | ------ | DEP2 IN |
| 22 | Reservoir | 0.000 | 1 | n/a | 0 | 21 | 358.04 | 358 | DEP2, OUT-9 |
| 23 | Combine | 0.039 | 1 | 775 | 1,699 | 5, 16, | ------ | ------ | OUT4 |

# Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

| Hyd. No. | Hydrograph type (origin) | Peak flow (cfs) | Time interval (min) | Time to Peak (min) | Hyd. volume (cuft) | Inflow hyd(s) | Maximum elevation (ft) | Total strge used (cuft) | Hydrograph Description |
|---|---|---|---|---|---|---|---|---|---|
| 1 | SCS Runoff | 0.002 | 1 | 1153 | 57 | ------ | ------ | ------ | SUB1, OUT-10 |
| 2 | SCS Runoff | 0.000 | 1 | 1440 | 0 | ------ | ------ | ------ | SUB2, OUT-1 |
| 3 | SCS Runoff | 0.000 | 1 | 1440 | 0 | ------ | ------ | ------ | SUB3, OUT-2 |
| 4 | SCS Runoff | 0.000 | 1 | 1440 | 0 | ------ | ------ | ------ | SUB4, OUT-3 |
| 5 | SCS Runoff | 0.000 | 1 | 1440 | 0 | ------ | ------ | ------ | SUB5, OUT-4 |
| 6 | SCS Runoff | 0.000 | 1 | 1440 | 0 | ------ | ------ | ------ | SUB6, 18>27 |
| 7 | SCS Runoff | 0.000 | 1 | 1440 | 0 | ------ | ------ | ------ | SUB7, 12>16 |
| 8 | SCS Runoff | 0.000 | 1 | 1440 | 0 | ------ | ------ | ------ | SUB8, 8>14 |
| 9 | SCS Runoff | 0.000 | 1 | 1440 | 0 | ------ | ------ | ------ | SUB9, OUT-6 |
| 10 | SCS Runoff | 0.000 | 1 | 1440 | 0 | ------ | ------ | ------ | SUB10, OUT-7 |
| 11 | SCS Runoff | 0.000 | 1 | 1440 | 0 | ------ | ------ | ------ | SUB11, OUT-8 |
| 12 | SCS Runoff | 0.000 | 1 | 1440 | 1 | ------ | ------ | ------ | SUB12, 7>21 |
| 13 | SCS Runoff | 0.000 | 1 | n/a | 0 | ------ | ------ | ------ | SUB13, 2>23 |
| 14 | SCS Runoff | 0.003 | 1 | 1153 | 91 | ------ | ------ | ------ | SUB14, 12>17 |
| 15 | SCS Runoff | 0.003 | 1 | 1153 | 91 | ------ | ------ | ------ | SUB15, 10>19 |
| 16 | Combine | 0.000 | 1 | 1440 | 0 | 7, 8, | ------ | ------ | RET1 IN |
| 17 | SCS Runoff | 0.000 | 1 | 1440 | 0 | ------ | ------ | ------ | SUB16, >OUT5 |
| 18 | Combine | 0.000 | 1 | 1440 | 0 | 6, 17 | ------ | ------ | OUT-5 |
| 19 | Combine | 0.005 | 1 | 1153 | 182 | 12, 14, 15, | ------ | ------ | DEP1 IN |
| 20 | Reservoir | 0.000 | 1 | n/a | 0 | 19 | 360.07 | 182 | DEP1, 21 |
| 21 | Combine | 0.000 | 1 | n/a | 0 | 13, 20 | ------ | ------ | DEP2 IN |
| 22 | Reservoir | 0.000 | 1 | n/a | 0 | 21 | 358.00 | 0.000 | DEP2, OUT-9 |
| 23 | Combine | 0.000 | 1 | 1440 | 0 | 5, 16, | ------ | ------ | OUT4 |

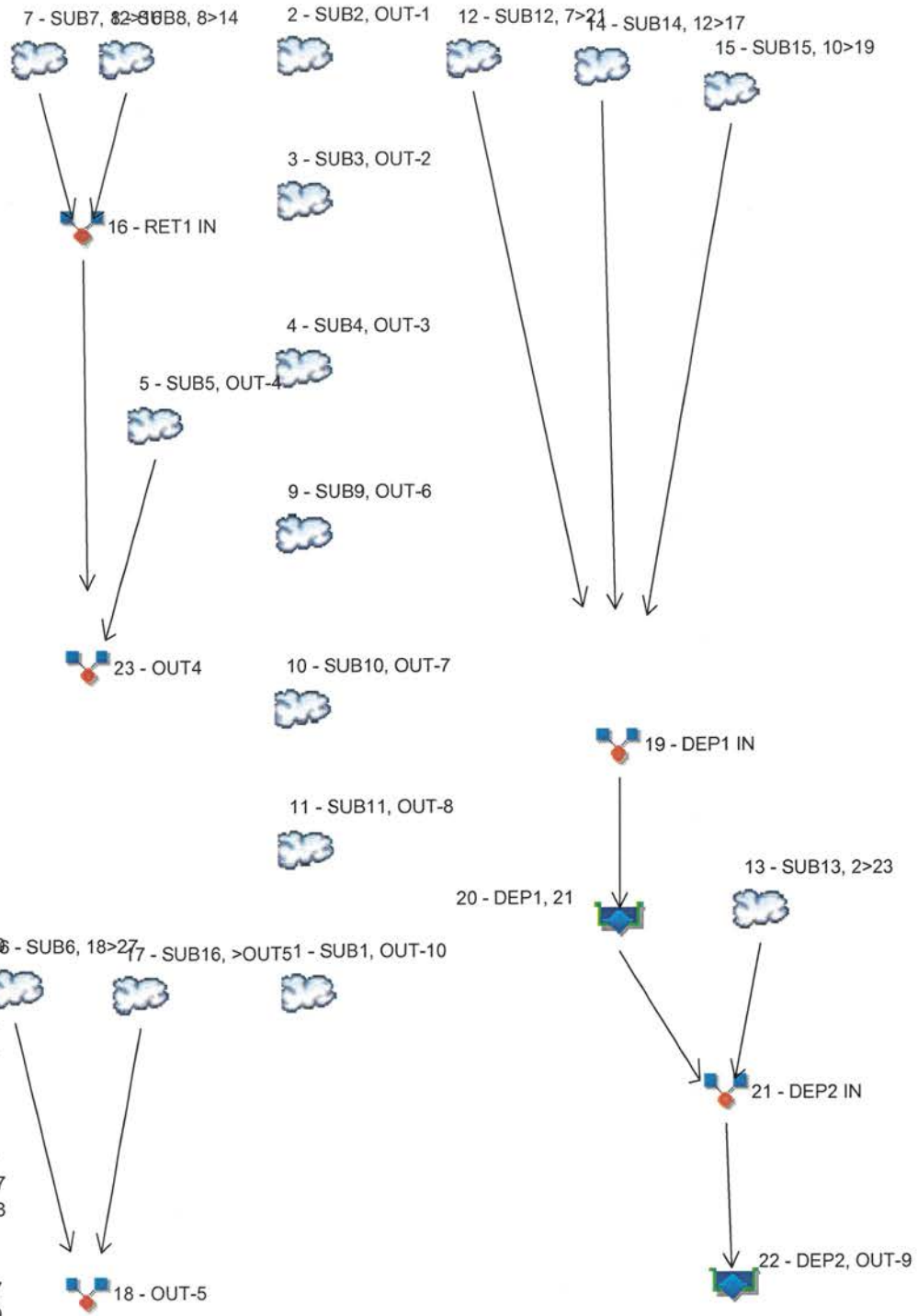
# Hydrograph Return Period Recap

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

| Hyd. No. | Hydrograph type (origin) | Inflow hyd(s) | Peak Outflow (cfs) | | | | | | | | Hydrograph Description |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1-yr | 2-yr | 3-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr | |
| 1 | SCS Runoff | ------ | 0.002 | ------- | ------- | ------- | 0.064 | ------- | ------- | 0.304 | SUB1, OUT-10 |
| 2 | SCS Runoff | ------ | 0.000 | ------- | ------- | ------- | 0.028 | ------- | ------- | 0.596 | SUB2, OUT-1 |
| 3 | SCS Runoff | ------ | 0.000 | ------- | ------- | ------- | 0.017 | ------- | ------- | 0.358 | SUB3, OUT-2 |
| 4 | SCS Runoff | ------ | 0.000 | ------- | ------- | ------- | 0.026 | ------- | ------- | 0.548 | SUB4, OUT-3 |
| 5 | SCS Runoff | ------ | 0.000 | ------- | ------- | ------- | 0.010 | ------- | ------- | 0.215 | SUB5, OUT-4 |
| 6 | SCS Runoff | ------ | 0.000 | ------- | ------- | ------- | 0.009 | ------- | ------- | 0.191 | SUB6, 18>27 |
| 7 | SCS Runoff | ------ | 0.000 | ------- | ------- | ------- | 0.007 | ------- | ------- | 0.143 | SUB7, 12>16 |
| 8 | SCS Runoff | ------ | 0.000 | ------- | ------- | ------- | 0.022 | ------- | ------- | 0.477 | SUB8, 8>14 |
| 9 | SCS Runoff | ------ | 0.000 | ------- | ------- | ------- | 0.004 | ------- | ------- | 0.095 | SUB9, OUT-6 |
| 10 | SCS Runoff | ------ | 0.000 | ------- | ------- | ------- | 0.006 | ------- | ------- | 0.119 | SUB10, OUT-7 |
| 11 | SCS Runoff | ------ | 0.000 | ------- | ------- | ------- | 0.018 | ------- | ------- | 0.382 | SUB11, OUT-8 |
| 12 | SCS Runoff | ------ | 0.000 | ------- | ------- | ------- | 0.062 | ------- | ------- | 1.335 | SUB12, 7>21 |
| 13 | SCS Runoff | ------ | 0.000 | ------- | ------- | ------- | 0.016 | ------- | ------- | 0.119 | SUB13, 2>23 |
| 14 | SCS Runoff | ------ | 0.003 | ------- | ------- | ------- | 0.102 | ------- | ------- | 0.487 | SUB14, 12>17 |
| 15 | SCS Runoff | ------ | 0.003 | ------- | ------- | ------- | 0.102 | ------- | ------- | 0.487 | SUB15, 10>19 |
| 16 | Combine | 7, 8, | 0.000 | ------- | ------- | ------- | 0.029 | ------- | ------- | 0.620 | RET1 IN |
| 17 | SCS Runoff | ------ | 0.000 | ------- | ------- | ------- | 0.008 | ------- | ------- | 0.167 | SUB16, >OUT5 |
| 18 | Combine | 6, 17 | 0.000 | ------- | ------- | ------- | 0.017 | ------- | ------- | 0.358 | OUT-5 |
| 19 | Combine | 12, 14, 15, | 0.005 | ------- | ------- | ------- | 0.204 | ------- | ------- | 2.303 | DEP1 IN |
| 20 | Reservoir | 19 | 0.000 | ------- | ------- | ------- | 0.000 | ------- | ------- | 0.273 | DEP1, 21 |
| 21 | Combine | 13, 20 | 0.000 | ------- | ------- | ------- | 0.016 | ------- | ------- | 0.388 | DEP2 IN |
| 22 | Reservoir | 21 | 0.000 | ------- | ------- | ------- | 0.000 | ------- | ------- | 0.000 | DEP2, OUT-9 |
| 23 | Combine | 5, 16, | 0.000 | ------- | ------- | ------- | 0.039 | ------- | ------- | 0.835 | OUT4 |

# Watershed Model Schematic

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020




## Legend

| Hyd. | Origin | Description |
|---|---|---|
| 1 | SCS Runoff | SUB1, OUT-10 |
| 2 | SCS Runoff | SUB2, OUT-1 |
| 3 | SCS Runoff | SUB3, OUT-2 |
| 4 | SCS Runoff | SUB4, OUT-3 |
| 5 | SCS Runoff | SUB5, OUT-4 |
| 6 | SCS Runoff | SUB6, 18>27 |
| 7 | SCS Runoff | SUB7, 12>16 |
| 8 | SCS Runoff | SUB8, 8>14 |
| 9 | SCS Runoff | SUB9, OUT-6 |
| 10 | SCS Runoff | SUB10, OUT-7 |
| 11 | SCS Runoff | SUB11, OUT-8 |
| 12 | SCS Runoff | SUB12, 7>21 |
| 13 | SCS Runoff | SUB13, 2>23 |
| 14 | SCS Runoff | SUB14, 12>17 |
| 15 | SCS Runoff | SUB15, 10>19 |
| 16 | Combine | RET1 IN |
| 17 | SCS Runoff | SUB16, >OUT5 |
| 18 | Combine | OUT-5 |
| 19 | Combine | DEP1 IN |
| 20 | Reservoir | DEP1, 21 |
| 21 | Combine | DEP2 IN |
| 22 | Reservoir | DEP2, OUT-9 |
| 23 | Combine | OUT4 |

# Hydraflow Rainfall Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

Monday, 05 / 22 / 2023

| Return Period (Yrs) | Intensity-Duration-Frequency Equation Coefficients (FHA) | | | |
|---|---|---|---|---|
| | B | D | E | (N/A) |
| 1 | 0.0000 | 0.0000 | 0.0000 | -------- |
| 2 | 0.0000 | 0.0000 | 0.0000 | -------- |
| 3 | 0.0000 | 0.0000 | 0.0000 | -------- |
| 5 | 0.0000 | 0.0000 | 0.0000 | -------- |
| 10 | 0.0000 | 0.0000 | 0.0000 | -------- |
| 25 | 0.0000 | 0.0000 | 0.0000 | -------- |
| 50 | 0.0000 | 0.0000 | 0.0000 | -------- |
| 100 | 0.0000 | 0.0000 | 0.0000 | -------- |

File name: WASILLA.IDF

**Intensity = B / (Tc + D)^E**

| Return Period (Yrs) | Intensity Values (in/hr) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 5 min | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 |
| 1 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 5 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 100 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Tc = time in minutes. Values may exceed 60.

Precip. file name: C:\Users\bfrie\CRLLC\Projects\WORK2023\Legacy Hills\CALC\WASILLA.pcp

| Storm Distribution | Rainfall Precipitation Table (in) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1-yr | 2-yr | 3-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr |
| SCS 24-hour | 1.09 | 0.00 | 0.00 | 0.00 | 1.98 | 0.00 | 0.00 | 3.02 |
| SCS 6-Hr | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Huff-1st | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Huff-2nd | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Huff-3rd | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Huff-4th | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Huff-Indy | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Custom | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

# Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

| Hyd. No. | Hydrograph type (origin) | Peak flow (cfs) | Time interval (min) | Time to Peak (min) | Hyd. volume (cuft) | Inflow hyd(s) | Maximum elevation (ft) | Total strge used (cuft) | Hydrograph Description |
|---|---|---|---|---|---|---|---|---|---|
| 1 | SCS Runoff | 0.083 | 1 | 622 | 3,245 | ------ | ------ | ------ | SUB1, OUT-1 |
| 2 | SCS Runoff | 0.106 | 1 | 602 | 2,676 | ------ | ------ | ------ | SUB2, OUT-3 |
| 3 | SCS Runoff | 0.058 | 1 | 774 | 2,547 | ------ | ------ | ------ | SUB3, OUT-3 |
| 4 | SCS Runoff | 0.041 | 1 | 774 | 1,798 | ------ | ------ | ------ | SUB4, OUT-4 |
| 5 | SCS Runoff | 0.027 | 1 | 774 | 1,199 | ------ | ------ | ------ | SUB5, OUT-5 |
| 6 | SCS Runoff | 0.007 | 1 | 774 | 300 | ------ | ------ | ------ | SUB6, OUT-6 |
| 7 | SCS Runoff | 0.009 | 1 | 774 | 375 | ------ | ------ | ------ | SUB7, OUT-7 |
| 8 | SCS Runoff | 0.052 | 1 | 602 | 1,819 | ------ | ------ | ------ | SUB8, OUT-8 |
| 9 | SCS Runoff | 0.125 | 1 | 755 | 5,299 | ------ | ------ | ------ | SUB9, 7>21 |
| 10 | SCS Runoff | 0.119 | 1 | 774 | 5,170 | ------ | ------ | ------ | SUB10 |
| 11 | SCS Runoff | 0.365 | 1 | 598 | 1,953 | ------ | ------ | ------ | SUB11, OUT-10 |
| 12 | Reservoir | 0.000 | 1 | n/a | 0 | 9 | 361.91 | 5,299 | DEP1, 21 |
| 13 | Combine | 0.119 | 1 | 774 | 5,170 | 10, 12 | ------ | ------ | DEP2 IN |
| 14 | Reservoir | 0.000 | 1 | n/a | 0 | 13 | 358.55 | 5,170 | DEP2, 23>OUT-9 |

# Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

| Hyd. No. | Hydrograph type (origin) | Peak flow (cfs) | Time interval (min) | Time to Peak (min) | Hyd. volume (cuft) | Inflow hyd(s) | Maximum elevation (ft) | Total strge used (cuft) | Hydrograph Description |
|---|---|---|---|---|---|---|---|---|---|
| 1 | SCS Runoff | 0.014 | 1 | 1199 | 440 | ------ | ------ | ------ | SUB1, OUT-1 |
| 2 | SCS Runoff | 0.012 | 1 | 1162 | 424 | ------ | ------ | ------ | SUB2, OUT-3 |
| 3 | SCS Runoff | 0.008 | 1 | 1318 | 176 | ------ | ------ | ------ | SUB3, OUT-3 |
| 4 | SCS Runoff | 0.006 | 1 | 1318 | 124 | ------ | ------ | ------ | SUB4, OUT-4 |
| 5 | SCS Runoff | 0.004 | 1 | 1318 | 83 | ------ | ------ | ------ | SUB5, OUT-5 |
| 6 | SCS Runoff | 0.001 | 1 | 1318 | 21 | ------ | ------ | ------ | SUB6, OUT-6 |
| 7 | SCS Runoff | 0.001 | 1 | 1318 | 26 | ------ | ------ | ------ | SUB7, OUT-7 |
| 8 | SCS Runoff | 0.008 | 1 | 1182 | 264 | ------ | ------ | ------ | SUB8, OUT-8 |
| 9 | SCS Runoff | 0.020 | 1 | 1252 | 550 | ------ | ------ | ------ | SUB9, 7>21 |
| 10 | SCS Runoff | 0.016 | 1 | 1318 | 358 | ------ | ------ | ------ | SUB10 |
| 11 | SCS Runoff | 0.077 | 1 | 599 | 700 | ------ | ------ | ------ | SUB11, OUT-10 |
| 12 | Reservoir | 0.000 | 1 | n/a | 0 | 9 | 360.20 | 550 | DEP1, 21 |
| 13 | Combine | 0.016 | 1 | 1318 | 358 | 10, 12 | ------ | ------ | DEP2 IN |
| 14 | Reservoir | 0.000 | 1 | n/a | 0 | 13 | 358.04 | 358 | DEP2, 23>OUT-9 |

# Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

| Hyd. No. | Hydrograph type (origin) | Peak flow (cfs) | Time interval (min) | Time to Peak (min) | Hyd. volume (cuft) | Inflow hyd(s) | Maximum elevation (ft) | Total strge used (cuft) | Hydrograph Description |
|---|---|---|---|---|---|---|---|---|---|
| 1 | SCS Runoff | 0.000 | 1 | n/a | 0 | ------ | ------ | ------ | SUB1, OUT-1 |
| 2 | SCS Runoff | 0.000 | 1 | n/a | 0 | ------ | ------ | ------ | SUB2, OUT-3 |
| 3 | SCS Runoff | 0.000 | 1 | n/a | 0 | ------ | ------ | ------ | SUB3, OUT-3 |
| 4 | SCS Runoff | 0.000 | 1 | n/a | 0 | ------ | ------ | ------ | SUB4, OUT-4 |
| 5 | SCS Runoff | 0.000 | 1 | n/a | 0 | ------ | ------ | ------ | SUB5, OUT-5 |
| 6 | SCS Runoff | 0.000 | 1 | n/a | 0 | ------ | ------ | ------ | SUB6, OUT-6 |
| 7 | SCS Runoff | 0.000 | 1 | n/a | 0 | ------ | ------ | ------ | SUB7, OUT-7 |
| 8 | SCS Runoff | 0.000 | 1 | n/a | 0 | ------ | ------ | ------ | SUB8, OUT-8 |
| 9 | SCS Runoff | 0.000 | 1 | n/a | 0 | ------ | ------ | ------ | SUB9, 7>21 |
| 10 | SCS Runoff | 0.000 | 1 | n/a | 0 | ------ | ------ | ------ | SUB10 |
| 11 | SCS Runoff | 0.002 | 1 | 1153 | 68 | ------ | ------ | ------ | SUB11, OUT-10 |
| 12 | Reservoir | 0.000 | 1 | n/a | 0 | 9 | 360.00 | 0.000 | DEP1, 21 |
| 13 | Combine | 0.000 | 1 | n/a | 0 | 10, 12 | ------ | ------ | DEP2 IN |
| 14 | Reservoir | 0.000 | 1 | n/a | 0 | 13 | 358.00 | 0.000 | DEP2, 23>OUT-9 |

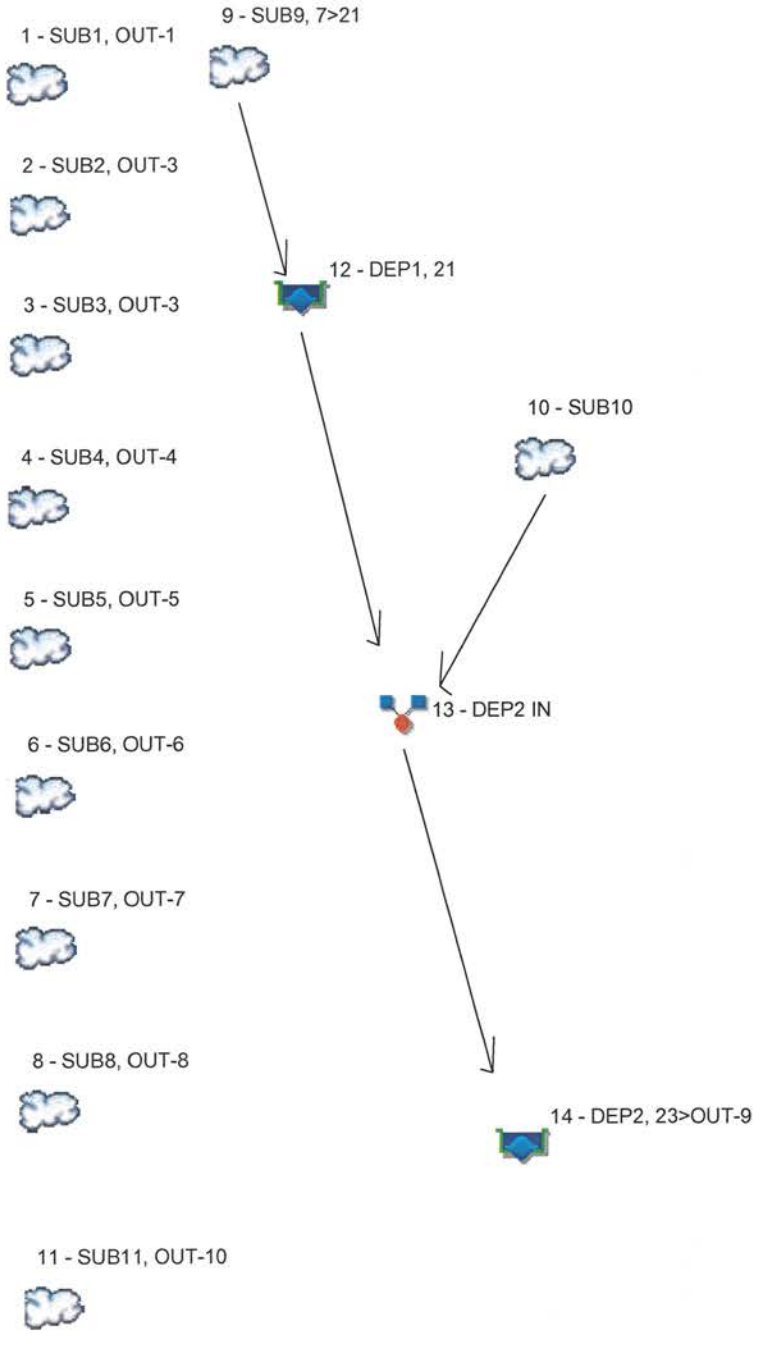
# Hydrograph Return Period Recap

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020

| Hyd. No. | Hydrograph type (origin) | Inflow hyd(s) | Peak Outflow (cfs) | | | | | | | | Hydrograph Description |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1-yr | 2-yr | 3-yr | 5-yr | 10-yr | 25-yr | 50-yr | 100-yr | |
| 1 | SCS Runoff | ------ | 0.000 | ------- | ------- | ------- | 0.014 | ------- | ------- | 0.083 | SUB1, OUT-1 |
| 2 | SCS Runoff | ------ | 0.000 | ------- | ------- | ------- | 0.012 | ------- | ------- | 0.106 | SUB2, OUT-3 |
| 3 | SCS Runoff | ------ | 0.000 | ------- | ------- | ------- | 0.008 | ------- | ------- | 0.058 | SUB3, OUT-3 |
| 4 | SCS Runoff | ------ | 0.000 | ------- | ------- | ------- | 0.006 | ------- | ------- | 0.041 | SUB4, OUT-4 |
| 5 | SCS Runoff | ------ | 0.000 | ------- | ------- | ------- | 0.004 | ------- | ------- | 0.027 | SUB5, OUT-5 |
| 6 | SCS Runoff | ------ | 0.000 | ------- | ------- | ------- | 0.001 | ------- | ------- | 0.007 | SUB6, OUT-6 |
| 7 | SCS Runoff | ------ | 0.000 | ------- | ------- | ------- | 0.001 | ------- | ------- | 0.009 | SUB7, OUT-7 |
| 8 | SCS Runoff | ------ | 0.000 | ------- | ------- | ------- | 0.008 | ------- | ------- | 0.052 | SUB8, OUT-8 |
| 9 | SCS Runoff | ------ | 0.000 | ------- | ------- | ------- | 0.020 | ------- | ------- | 0.125 | SUB9, 7>21 |
| 10 | SCS Runoff | ------ | 0.000 | ------- | ------- | ------- | 0.016 | ------- | ------- | 0.119 | SUB10 |
| 11 | SCS Runoff | ------ | 0.002 | ------- | ------- | ------- | 0.077 | ------- | ------- | 0.365 | SUB11, OUT-10 |
| 12 | Reservoir | 9 | 0.000 | ------- | ------- | ------- | 0.000 | ------- | ------- | 0.000 | DEP1, 21 |
| 13 | Combine | 10, 12 | 0.000 | ------- | ------- | ------- | 0.016 | ------- | ------- | 0.119 | DEP2 IN |
| 14 | Reservoir | 13 | 0.000 | ------- | ------- | ------- | 0.000 | ------- | ------- | 0.000 | DEP2, 23>OUT-9 |

# Watershed Model Schematic

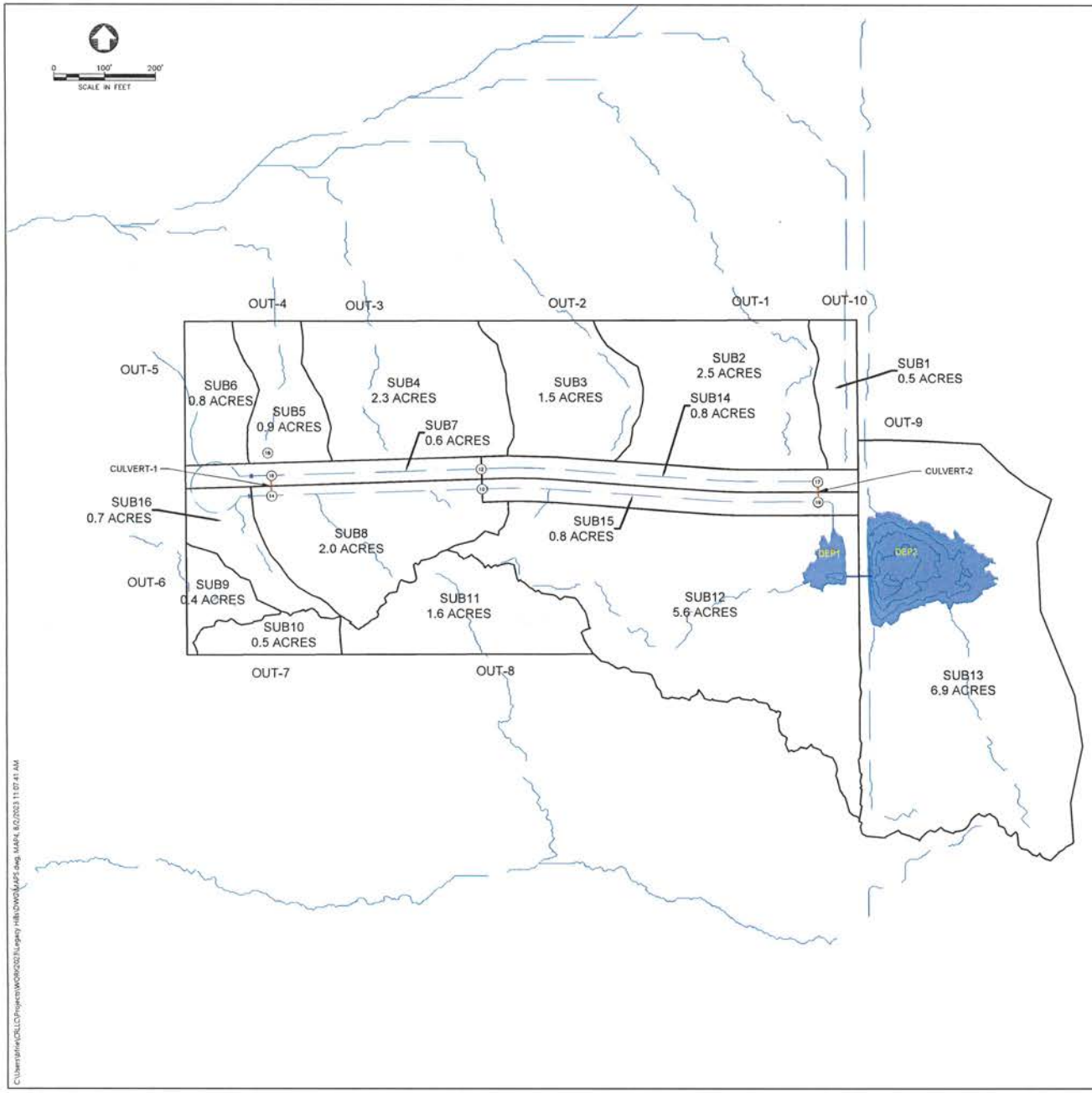
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® 2019 by Autodesk, Inc. v2020




## Legend

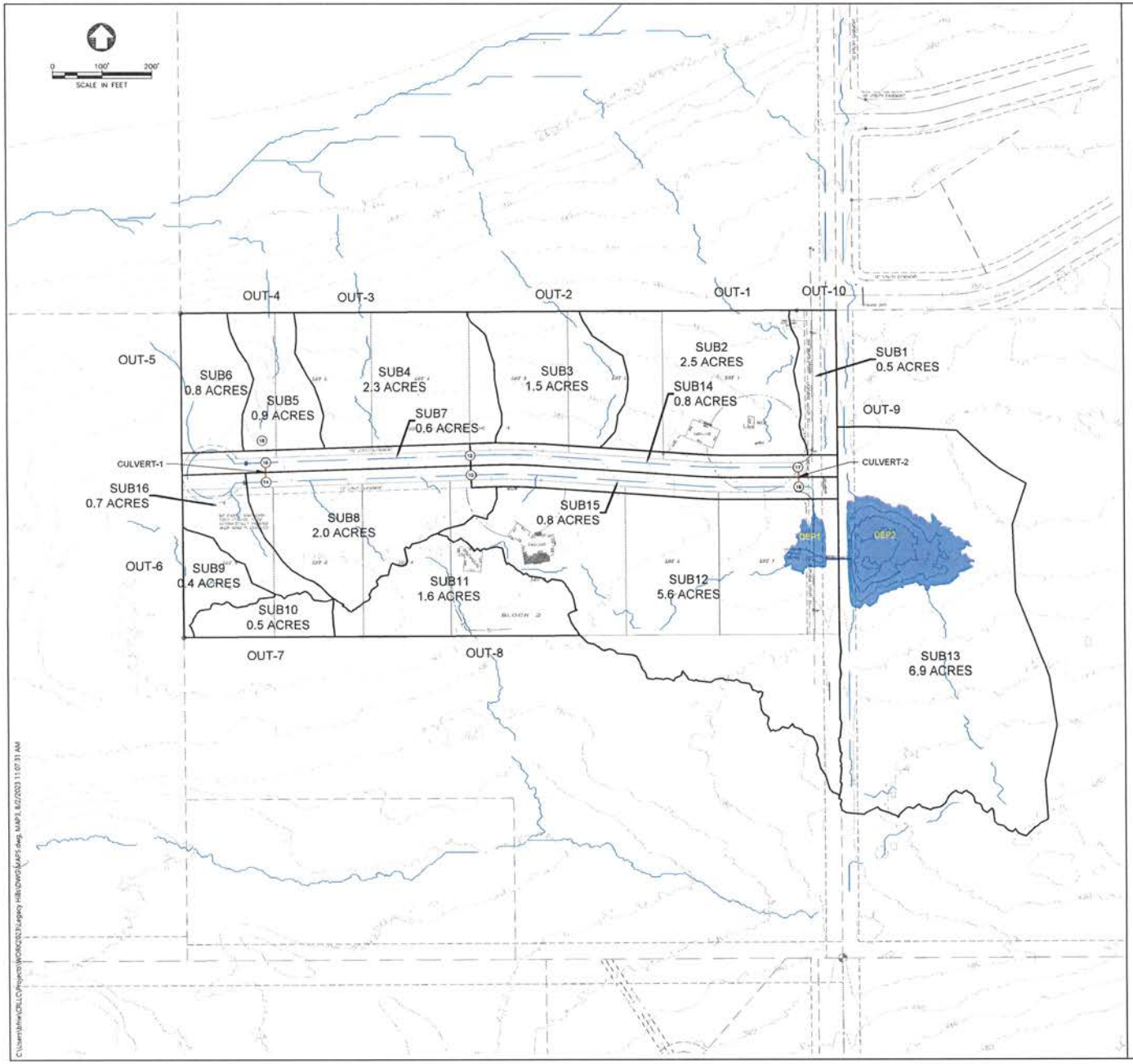
| Hyd. | Origin | Description |
|---|---|---|
| 1 | SCS Runoff | SUB1, OUT-1 |
| 2 | SCS Runoff | SUB2, OUT-3 |
| 3 | SCS Runoff | SUB3, OUT-3 |
| 4 | SCS Runoff | SUB4, OUT-4 |
| 5 | SCS Runoff | SUB5, OUT-5 |
| 6 | SCS Runoff | SUB6, OUT-6 |
| 7 | SCS Runoff | SUB7, OUT-7 |
| 8 | SCS Runoff | SUB8, OUT-8 |
| 9 | SCS Runoff | SUB9, 7>21 |
| 10 | SCS Runoff | SUB10 |
| 11 | SCS Runoff | SUB11, OUT-10 |
| 12 | Reservoir | DEP1, 21 |
| 13 | Combine | DEP2 IN |
| 14 | Reservoir | DEP2, 23>OUT-9 |

# APPENDIX B - CALCULATIONS




LEGACY HILLS SUBDIVISION
MAP 4
POST-SCHEMATIC

CIVIL RESOURCES, LLC
8/2/2023



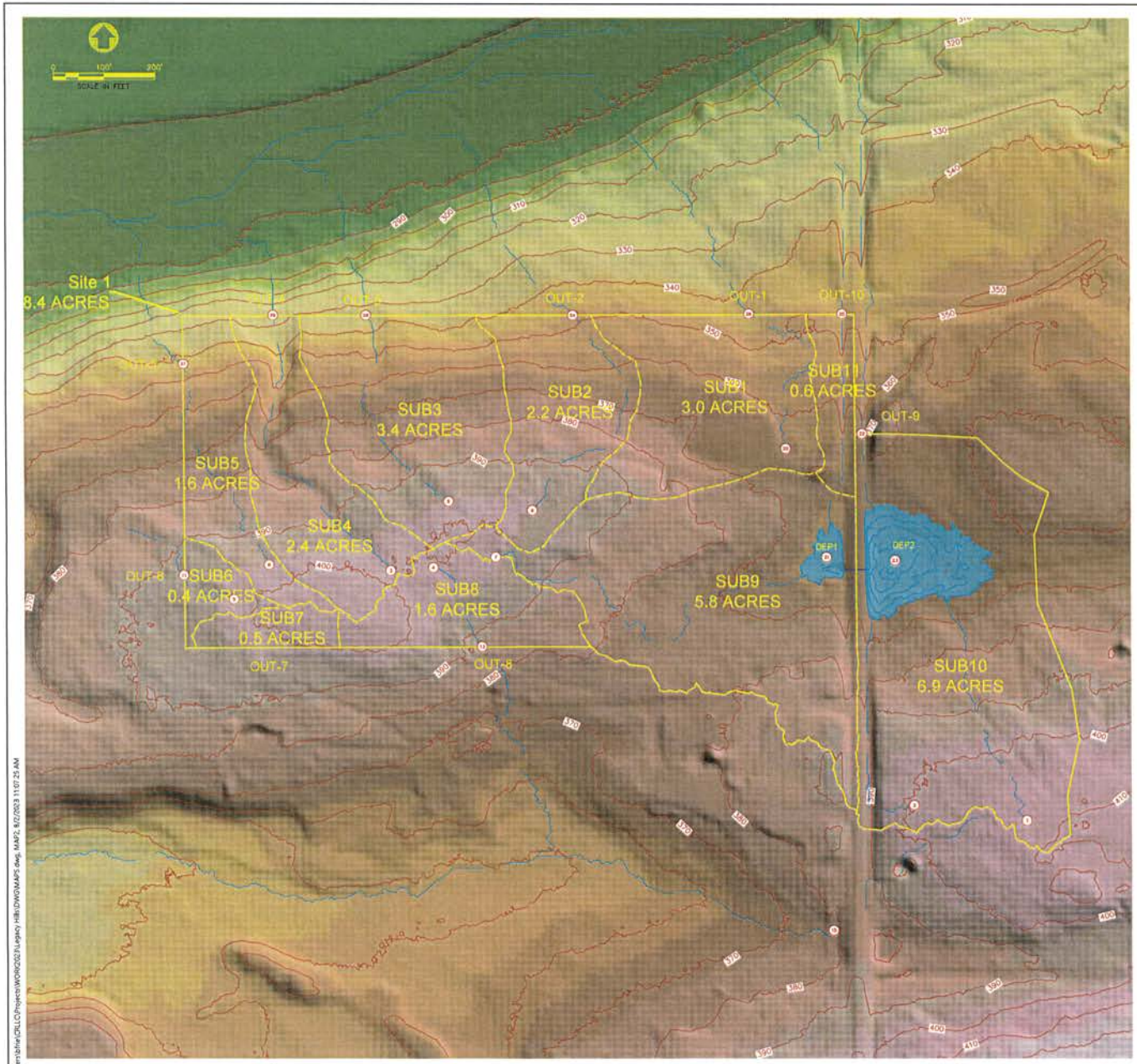

LEGACY HILLS SUBDIVISION

MAP 3

POST-IMPROVEMENTS

CIVIL RESOURCES, LLC

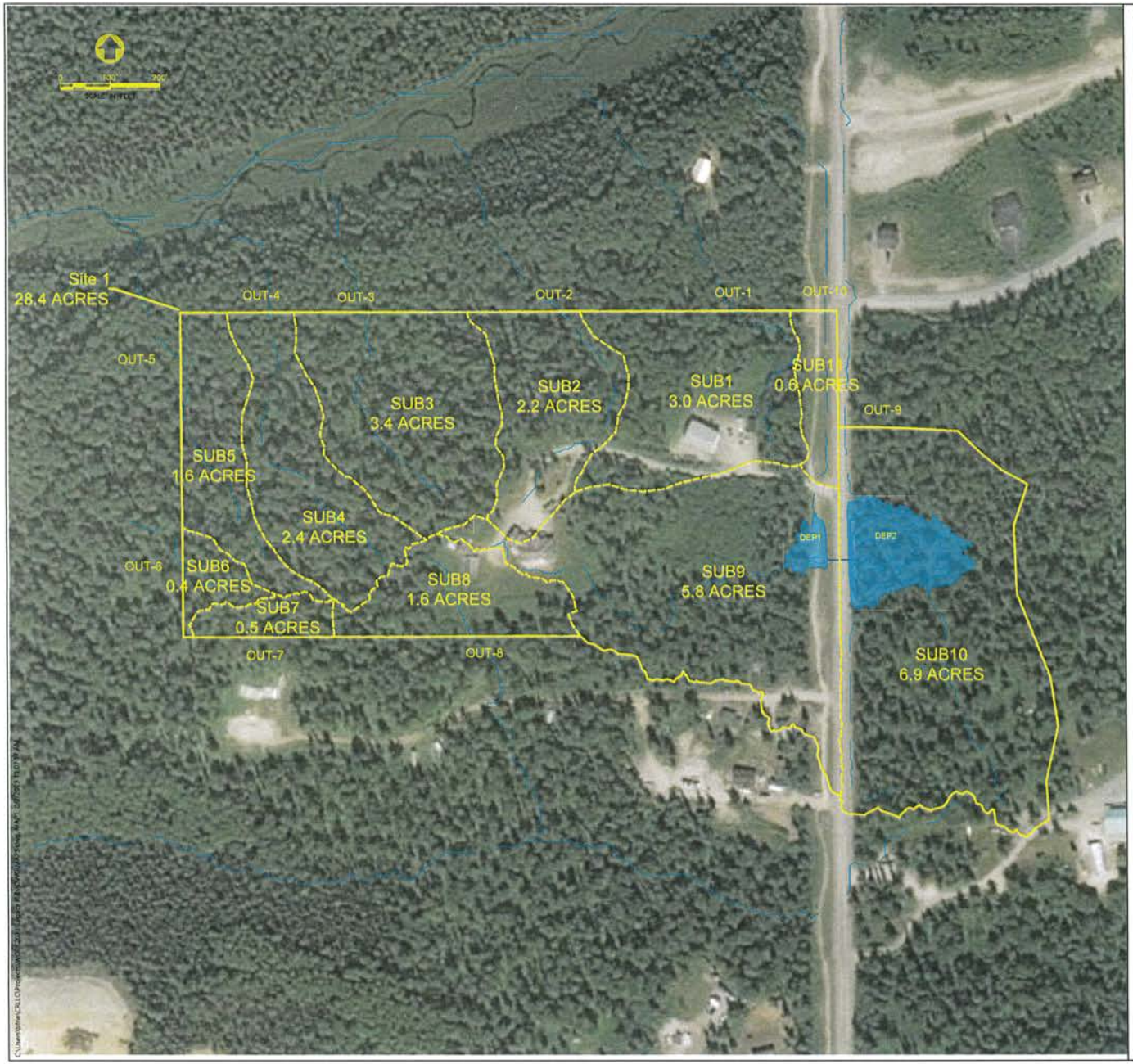
8/2/2023

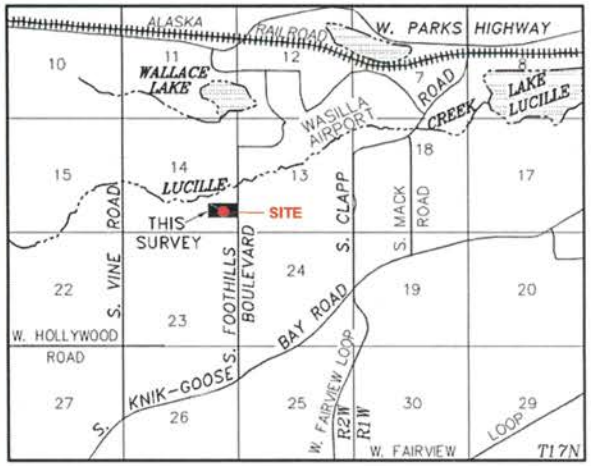



LEGACY HILLS SUBDIVISION

MAP 2
PRE-TERRAIN

CIVIL RESOURCES, LLC
8/2/2023




VICINITY MAP

LEGACY HILLS SUBDIVISION

MAP 1
PRE-AERIAL PHOTO

CIVIL RESOURCES, LLC
8/2/2023

# APPENDIX A – MAPS

# Conclusions and Recommendations

1. Culverts shall be 18" diameter minimum. Ditches should be 30" deep below road hinge point. Cut and fill slopes should not be steeper than 2H:1V.
2. Runoff from the first-flush storm soaks into ground. There is no need for water quality treatment facilities.
3. Road sided ditches are stable for turf or gravel subbase material.
4. The post runoff from the 1-year 24-hour storm infiltrates into the ground. Extended detention storage is not needed.
5. There is no significant-net increase for the 10-Year 24-Hour post development storm. Downstream adverse impact analysis is not required.
6. Runoff from the 100-Year 24-Hour storm event will pass unobstructed through the site.
7. Other Agency Requirements:
    a. Floodplain Use Permit is not needed.
    b. 404 Permit from U.S. Army Corps of Engineers is not required.
    c. Verification from the Alaska Department of Fish and Game is not needed.
    d. A Storm Water Pollution Prevention Plan is required for this project if disturbed area is greater than one acre.
8. Ditches will require periodic removal of sediment and vegetation. It is recommended they be inspected every five years and following major storm events.
9. Rock riprap shall be laid on graded filter material or filter fabric to prevent erosion of underlying soils. Filter is not needed for gravel mulch.
10. Building pad elevations shall be a minimum of 12" above adjacent ground within 10-feet of the building. Finished floor and all openings shall be a minimum of 6" above building pad.
11. As-Built drawings and certification may be required for drainage improvements prior to final acceptance by Borough.

*(7) Construct a concrete washout site next to stabilized entrance. Clean as needed and remove at end of project.*

*(8) Cover all stockpiles and landscape material and berm properly with straw wattles or sandbags. Keep behind silt fence, away from water bodies. Hazardous materials and refuse must be kept in closed containers that are covered and use secondary containment, not directly on soil.*

*(9) Use pea-gravel bags, (or similar product) around drain inlets found both onsite and in gutter as a last line of defense.*

*(10) Place port-a-potty with secondary containment near stabilized site entrance, behind the curb and away from gutters, storm drain inlets, and water bodies.*

*(11) Cover all exposed soil with straw mulch and tackifier (or equivalent).*

*(12) Existing vegetation should be preserved as much as possible. Areas of disturbed soil/vegetation should be revegetated as soon as practical.*

*(13) Prevent equipment fluid leaks onto ground by placing drip pans or plastic tarps under equipment. Repair equipment, as necessary.*

*(14) Maintain all landscaping to ensure that vegetation is healthy and working as designed to prevent erosion and provide treatment to runoff.*

*(15) Keep the site clear of debris and trash to prevent these items from entering roadside ditches.*

*(16) Maintain channel/trail to facilitate drainage and access.*

*(17) Clear all ditches, culverts, and down-chutes of ice prior to Spring break-up.*

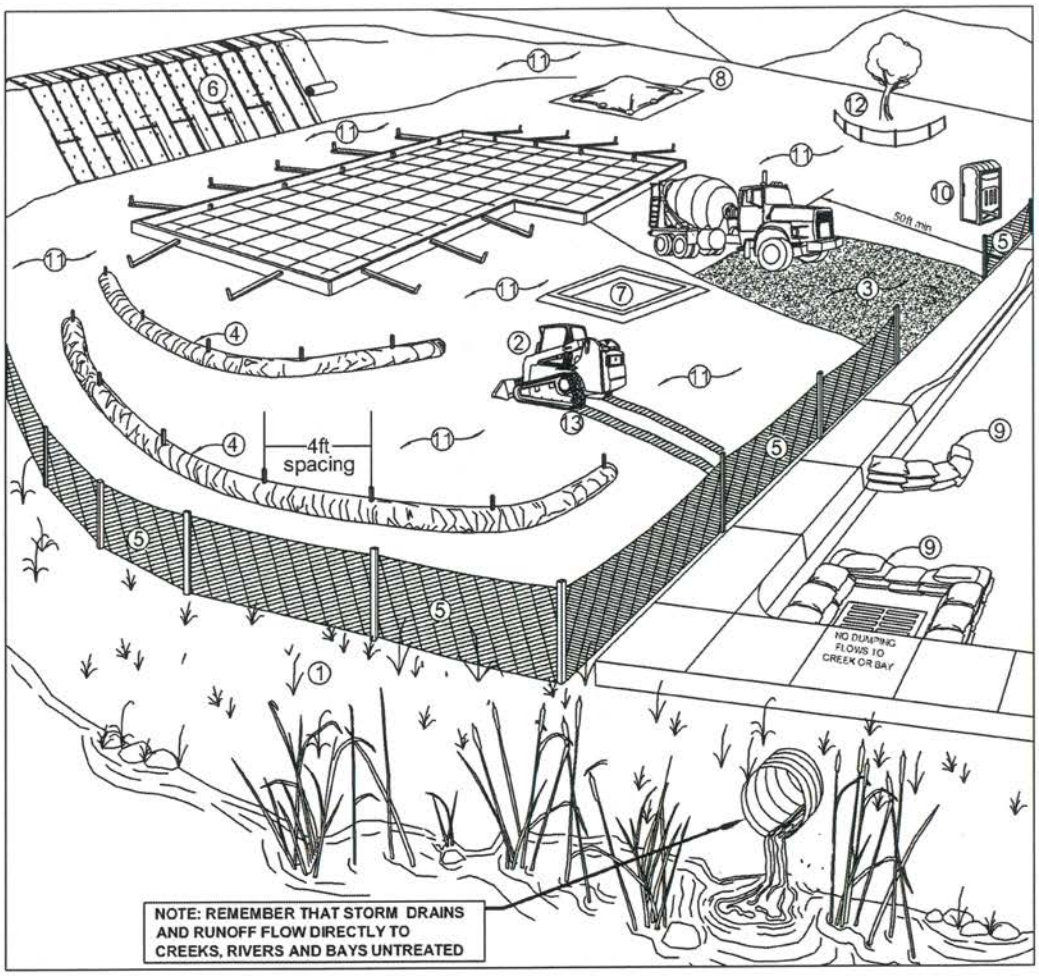



**Figure 6. Best Management Practices**

*(1) Check with your local planning and public works departments for creek setback requirements. Grading and/or building may be limited within Creekside buffers.*

*(2) During grading phase, track-walk up and down slopes (not parallel to them).*

*(3) Stabilize site entrance and temporary driveway – use 3-4" crushed rock for a minimum of 50' (or as far as possible) to prevent tracking soil offsite. This can be used in conjunction with a tire wash or rumble plates.*

*(4) Use straw wattles along contours of short slopes or slopes 3:1 or flatter, keyed into ground at least 3" deep (typically 25' apart).*

*(5) Install silt fence along contours as secondary measure to keep sediment onsite and to minimize vehicle and foot traffic beyond limits of site disturbance. Silt fencing must be keyed in.*

*(6) Install erosion control blankets (or equivalent) on any disturbed site with 3:1 slope or steeper, keyed into the ground at least 3".*

- The permit is an unfunded mandate by the Federal Government.

.

Given that clearing and grading over a site and constructing impervious surfaces causes increased runoff, property owners need to ensure that their individual activities do not injure their property, downstream neighbors, or pollute local waterways or ground water. Runoff controls aim to reduce the total amount of water that runs off and to reduce the pollutants in the runoff. Runoff controls include temporary measures during construction and permanent measures to improve water quality and control drainage. Groundwater recharge feeds many wells in the region, which could introduce above-ground pollutants into groundwater. Construct stormwater systems so contaminants are removed before they pollute surface water or groundwater.

Stormwater runoff from construction activities can have a significant impact on water quality. As stormwater flows over a construction site, it can pick up pollutants such as sediment, debris, and chemicals and transport these to a nearby storm sewer system or directly to a water body. Polluted stormwater runoff and sedimentation can harm or kill fish and other wildlife, destroy aquatic habitat, and cause stream bank erosion. It is the responsibility of the project owner, Homeowner's Association, or the Matanuska-Susitna Borough to keep and service all temporary and permanent erosion and sediment control facilities.

Table 10

| Minimum Culvert Diameters | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| CULVERT NO. | YEAR | FLOW (CFS) | Number | FLOW/PIPE (CFS) | HW/D | DIAMETER CALC | DIAMETER USE | TYPE RIPRAP |
| CUL1 | 100 | 0.5 | 1 | 0.5 | 1.0 | 12 | **18** | B |
| CUL2 | 100 | 0.5 | 1 | 0.5 | 1.0 | 12 | **18** | B |
| *Note: Use 18" diameter when less than 18" for MSB and 24" for DOT.* | | | | | | | | |

### *First Flush Treatment*

The term "first flush" has become common nomenclature in the stormwater management field. The concept behind this term is that pollutants that have collected on impervious surfaces will wash off during the first part of a storm event. The first portion of a given rain event will "flush" the impervious surface of its pollutants, resulting in stormwater runoff that contains more pollutants than runoff produced later in the storm. If the 24-hour 90th percentile historic rainfall event is selected, then capturing/treating the runoff associated with this amount for every rainfall event will prevent 90% of all pollutants from leaving the site. The first flush rainfall amount is 0.52-inches. Treating the runoff from this event by filtering or trapping will prevent 90% of all pollutants from entering Waters of the United States or public water supplies. All polluted runoff from impervious roads, roof tops, patios, walks, and drives will be filtered when flowing through turf and native vegetation before soaking into ground. There is no runoff from the first-flush rainfall event. Therefore, water quality treatment facilities are not needed. All runoffs including the first 0.25" of the 1-, 10-, and 100-year rainfall events are treated by turf filtration/soil infiltration prior to entering storage basins or leaving the site.

### *Down Stream Impact Analysis*

A downstream impact analysis is needed when the net increase in Post Development flow leaving the site is between 0 and 10 percent. There is no-net increase in post-development flow. Therefore, there are no adverse downstream impacts.

## Erosion and Sediment Control

With the results of the 2020 Census coming in less than a year, it is expected that the Borough will reach the threshold that will qualify parts of the Borough and Cities of Wasilla and Palmer to apply for an MS4 permit.

- The MS4 permit is a 5-year National Pollutant Discharge Elimination System (NPDES) permit that is renewed every fifth year,
- The permit is governed by the EPA - Through the Alaska Department of Environmental Conservation (ADEC),
- The permit will have defined boundaries set up around Census Designated *"Urbanized Areas,"*
- The permit itself is a Best Management Practices Based Program, and

**MATANUSKA-SUSITNA BOROUGH**
**PLATTING DIVISION**
350 EAST DAHLIA AVENUE
PALMER, ALASKA 99645

RECEIVED
JUL 18 2023
PLATTING

7196000L001 157
STONE JEFFREY S & MARY M
16889 E OUTER SPRINGER LO
PALMER AK 99645

## NOTIFICATION OF PUBLIC HEARING

The Matanuska-Susitna Borough **Platting Board** will consider the following:

**PETITIONER/OWNER: STEFAN K. & YVONNE L. MARTY**

**REQUEST:** The request is to create four lots from Tax Parcels A26, A28 & A29 (Parcel #1 & #2, MSB Waiver 2005-10, recorded at 2005-029658-0) to be known as **ANGUS ACRES,** containing 39 acres +/-. Proposed Lots 1 & 3 are two side-by-side flag lots with 30' wide poles; a Public Use Easement will be granted over the pole portions. Parcels are located south of the Palmer Airport and directly west of E. Outer Springer Loop. Access is from E. Outer Springer Loop (Tax ID#s 17N02E08A026/A028/A029); lying within the NE ¼ Section 09, Township 17 North, Range 02 West, Seward Meridian, Alaska. In the Greater Palmer Community Council and in Assembly District #2.

The Matanuska-Susitna Borough **Platting Board** will hold a public hearing at the **Assembly Chambers** at the **Dorothy Swanda Jones Building**, 350 E. Dahlia Avenue, Palmer, Alaska, on the proposed **Subdivision.** The public hearing is scheduled for **July 20, 2023,** starting at 1:00 p.m. We are sending you this notice as required by State Law and Borough Ordinances.

For comments regarding the proposed action, this form may be used for your convenience by filling in the information below and mail this notice to the MSB Platting Division, 350 E. Dahlia Avenue, Palmer, Alaska 99645 or e-mail: platting@matsugov.us. Comments received from the public after the platting board packet has been written and sent to the Board will be given to the Platting Board in a "Hand-Out" the day of the meeting. Please do not send comments or questions directly to Platting Board members. Board members may not receive or engage in ex-parte contact with the applicant, other parties interested in the application, or members of the public concerning the application or issues presented in the application. **All public comments are due one (1) day prior, by 12:00 p.m**
To request additional information please contact the Platting Technician, ***Amy Otto-Buchanan*** at (907) 861-7872.
To view the agenda or meeting packet please go to the following link: www.matsugov.us/boards/platting.

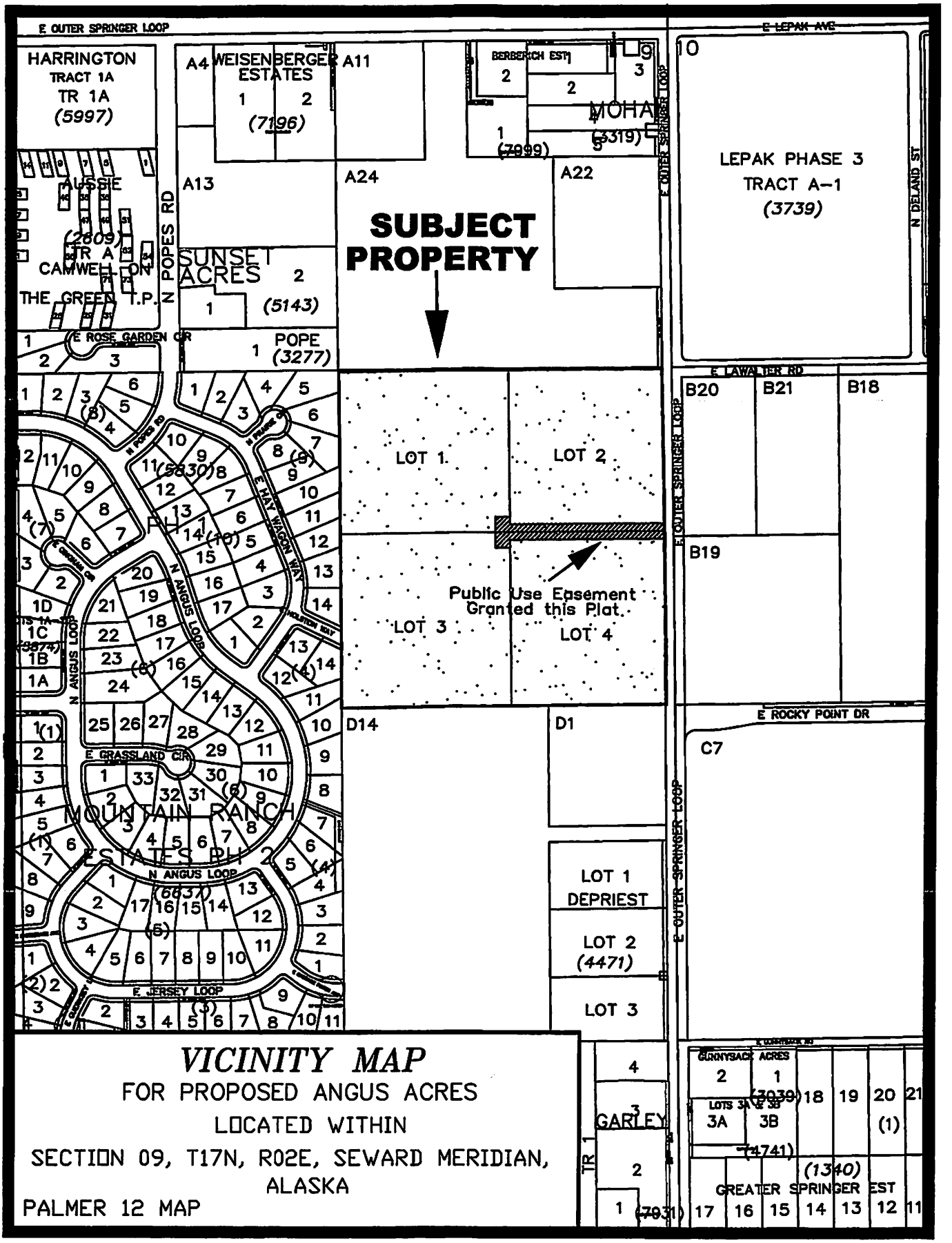
[ ] No Objection [X] Objection [X] Concern

*Name:* Jeffrey & Mary Stone *Address:* 16889 E Outer Springer Loop

*Comments:* Our concerns not build for traffic, noise – these are farm lands not Anchorage subdivisions. Keeping it small! Farmland!

Case # 2023-067 AOB *Note: Vicinity Map Located on Reverse Side*

HANDOUT #1
ANGUS ACRES
CASE #2023-067
MEETING DATE: AUGUST 3, 2023




# *VICINITY MAP*

FOR PROPOSED ANGUS ACRES

LOCATED WITHIN

SECTION 09, T17N, R02E, SEWARD MERIDIAN, ALASKA

PALMER 12 MAP

RECEIVED
JUL 18 2023
PLATTING

6637B05L012 35
PORTER JAMES M
14037 E JERSEY LOOP
PALMER AK 99645

## NOTIFICATION OF PUBLIC HEARING

The Matanuska-Susitna Borough **Platting Board** will consider the following:

**PETITIONER/OWNER: STEFAN K. & YVONNE L. MARTY**

**REQUEST:** The request is to create four lots from Tax Parcels A26, A28 & A29 (Parcel #1 & #2, MSB Waiver 2005-10, recorded at 2005-029658-0) to be known as **ANGUS ACRES,** containing 39 acres +/-. Proposed Lots 1 & 3 are two side-by-side flag lots with 30' wide poles; a Public Use Easement will be granted over the pole portions. Parcels are located south of the Palmer Airport and directly west of E. Outer Springer Loop. Access is from E. Outer Springer Loop (Tax ID#s 17N02E08A026/A028/A029); lying within the NE ¼ Section 09, Township 17 North, Range 02 West, Seward Meridian, Alaska. In the Greater Palmer Community Council and in Assembly District #2.

The Matanuska-Susitna Borough **Platting Board** will hold a public hearing at the **Assembly Chambers** at the **Dorothy Swanda Jones Building**, 350 E. Dahlia Avenue, Palmer, Alaska, on the proposed **Subdivision.** The public hearing is scheduled for **July 20, 2023,** starting at 1:00 p.m. We are sending you this notice as required by State Law and Borough Ordinances.

For comments regarding the proposed action, this form may be used for your convenience by filling in the information below and mail this notice to the MSB Platting Division, 350 E. Dahlia Avenue, Palmer, Alaska 99645 or e-mail: platting@matsugov.us. Comments received from the public after the platting board packet has been written and sent to the Board will be given to the Platting Board in a "Hand-Out" the day of the meeting. Please do not send comments or questions directly to Platting Board members. Board members may not receive or engage in ex-parte contact with the applicant, other parties interested in the application, or members of the public concerning the application or issues presented in the application. **All public comments are due one (1) day prior, by 12:00 p.m**
To request additional information please contact the Platting Technician, ***Amy Otto-Buchanan*** at (907) 861-7872.
To view the agenda or meeting packet please go to the following link: www.matsugov.us/boards/platting.

[ ] No Objection [X] Objection [ ] Concern

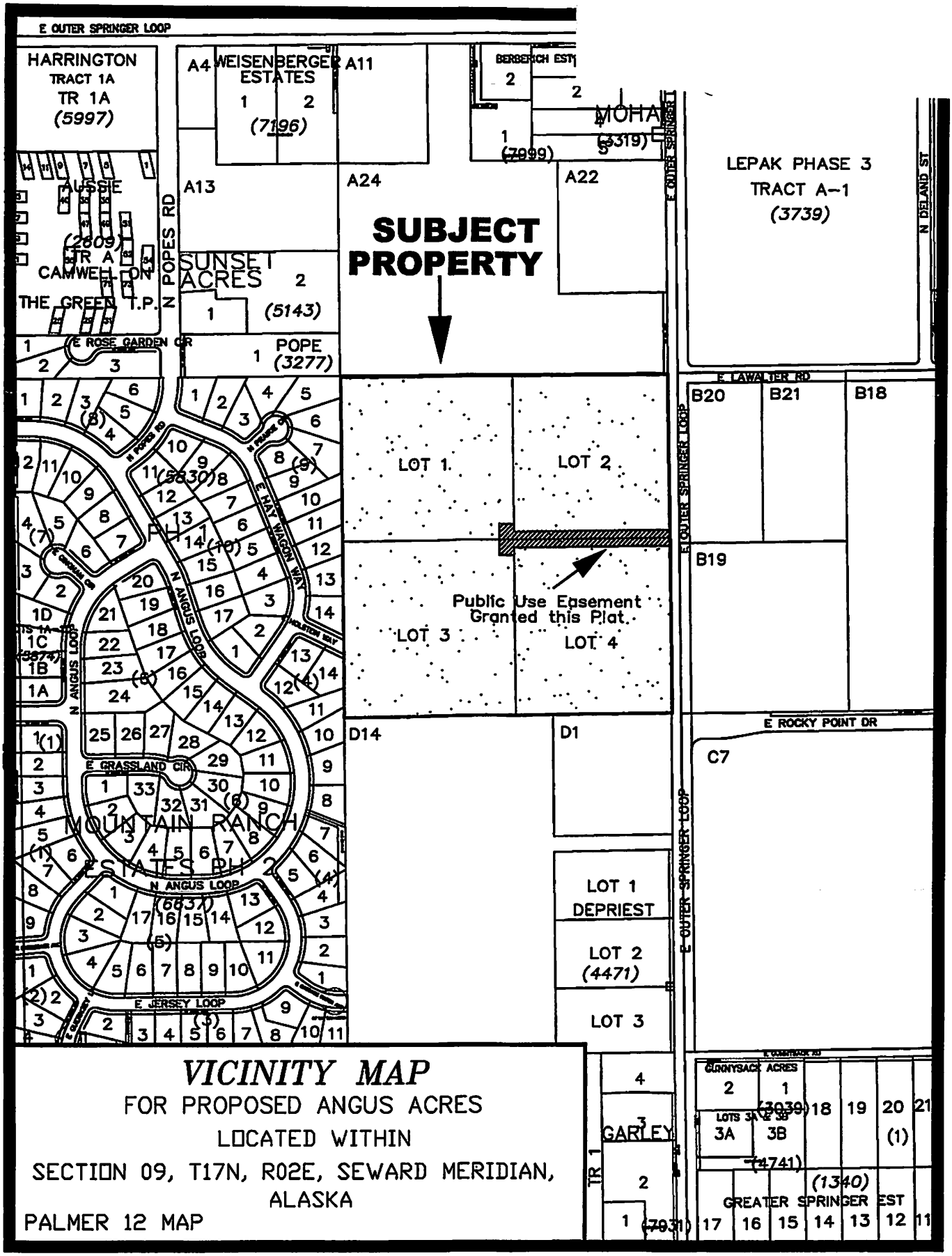
*Name:* _____ *Address:* _____

*Comments:* _____


I do not Agree w/this Development - more hfo
Is needed

Case # 2023-067 AOB *Note: Vicinity Map Located on Reverse Side*

HANDOUT #2
ANGUS ACRES
CASE #2023-067
MEETING DATE: AUGUST 3, 2023




# *VICINITY MAP*

FOR PROPOSED ANGUS ACRES

LOCATED WITHIN

SECTION 09, T17N, R02E, SEWARD MERIDIAN, ALASKA

PALMER 12 MAP

# STAFF REVIEW AND RECOMMENDATIONS
# PUBLIC HEARING
# AUGUST 3, 2023

PRELIMINARY PLAT: ANGUS ACRES

LEGAL DESCRIPTION: SEC 09, T17N, R02E, SEWARD MERIDIAN AK

PETITIONERS: STEFAN K. & YVONNE L. MARTY

SURVEYOR: HANSON LAND SOLUTIONS

ACRES: 39 ± PARCELS: 4

REVIEWED BY: AMY OTTO-BUCHANAN CASE #: 2023-067

---

**REQUEST**: The request is to create four lots from Tax Parcels A26, A28 & A29 (Parcel #1 & #2, MSB Waiver 2005-10, recorded at 2005-029658-0) to be known as **ANGUS ACRES,** containing 39 acres +/-. Proposed Lots 1 & 3 are two side-by-side flag lots with 30' wide poles; a Public Use Easement will be granted over the pole portions. Parcels are located south of the Palmer Airport and directly west of E. Outer Springer Loop. Access is from E. Outer Springer Loop; lying within the NE ¼ Section 09, Township 17 North, Range 02 West, Seward Meridian, Alaska.

**EXHIBITS**

Request for a Continuance to a date uncertain **EXHIBIT A** – 1 pg

Petitioner has requested a continuance to the September 21, 2023 Platting Board meeting to allow for a minor redesign of the request.

**RECOMMENDATIONS OF CONDITIONS OF APPROVAL**

**Suggested motion: I move to approve the continuance to a date uncertain for the preliminary plat of Angus Acres, Section 09, Township 17 North, Range 02 East, Seward Meridian, Alaska.**



HANDOUT #3
ANGUS ACRES
CASE #2023-067
MEETING DATE: AUGUST 3, 2023