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ENGINEERING REPORT

SAGEBRUSH RANCH CALF YARD
MABTON, WASHINGTON

October 10, 2025

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Prepared For:

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Grandview, Washington 98930

**ENGINEERING REPORT
SAGEBRUSH RANCH CALF YARD
MABTON, WASHINGTON**

Reference:

IES Project No.

Date:

October 10, 2025



INLAND EARTH SCIENCES CORPORATION

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DISTRIBUTION LIST

<u>NAME</u>	<u>ORGANIZATION</u>
Ruurd Veldhuis	FRH Enterprises LLC

ac	acre or acres
ASTM	American Society for Testing and Materials
cm/s	centimeters per second
cfs	cubic feet per second
DNMP	Dairy Nutrient Management Plan
ft	feet
ft amsl	feet above mean sea level
GCL	geosynthetic clay liner
HDPE	high density polyethylene
in	inches
in/hr	inches per hour
mil	millionth of an inch
lbs	pounds
pcf	pounds per cubic foot



1 INTRODUCTION

Inland Earth Sciences Corporation (IES), on behalf of FRH Enterprises LLC (FRH), presents this Engineering Report (the "Report") for the Sagebrush Ranch Calf Yard facility (the "Calf Yard") located near Mabton, Washington (Sheet T-01; Appendix A). The Calf Yard is a confined animal feeding operation (CAFO) designed for the rearing of young stock for FRH Enterprises' dairy and beef operations.

This Engineering Report presents a description of the current Calf Yard facility and planned expansion activities, a hydrologic assessment of the site, and major design components developed to address operational needs and conditions for the expanded facility. The facility design sheets are referenced as Appendix A of this Report.

1.1 Site Description

The Calf Yard is the primary young stock rearing operation for FRH and is the result of consolidation of other young stock rearing operations previously located at other stock rearing locations and dairies located in Yakima County. The current configuration of the Calf Yard is shown on Design Sheet C-02. The site is divided into two areas. The western portion of the site is approximately XXX acres and contains an operations area, hutch area, and elementary corral area. The eastern portion of the site is approximately XXX acres and contains an operations area, compost area, and corral area.

The western portion of the site is focused mainly on young stock rearing. The western operations area covers approximately 15 acres and consists of nursery and hospital barns and other maintenance buildings, and feed and bedding material storage areas. The hutch area covers approximately 133 acres and consists of individual hutches for rearing zero- to three-month old calves. The hutch area layout allows room for individual hutches to be moved to a new area between calf rotations for animal health reasons. The elementary corral area currently covers approximately 48 acres and houses three- to five-month old calves. A 26 acre expansion of the corral area in the western portion of the Calf Ranch is included in the design.

The eastern portion of the site is focused on older stock rearing. The northern portion of the eastern site contains a 6-acre operations area and a 59-acre compost area. The southern portion of the eastern site contains 72 acres of corrals. An approximately 101 acre expansion of the corral area is included in the design.

2 HYDROLOGIC ANALYSIS

A hydrologic analysis of the area was performed to support the design and to ensure that appropriate surface water and stormwater controls are included in the design. A review of available topographic information was used to identify drainage basins beginning at the topographic high in Horse Heaven Hills located south of the site and extending north to the site. Based on available topographic information, three drainages (east, central, and west) were identified for analysis and are shown on Figure 1.

The hydrologic analyses were performed using Version 2.0 of the WinTR-55 Small Watershed Hydrology computer model (Natural Resource Conservation Service [NRCS], June 2022). For each drainage, anticipated runoff conditions in each drainage where they intersect the project were evaluated under a range of storm event conditions. While the design storm event for project is the 25-year/24-hour storm



event, runoff conditions under the 2-year, 5-year, 10-year, 50-year, and 100-year/24-hour storm events were also evaluated. Precipitation amounts for each storm event were obtained using the National Oceanic and Atmospheric Administration (NOAA) Atlas 2 – Precipitation Frequency Atlas of the Western United States, Volume IX – Washington.

For all three drainages a site land use of arid rangeland and a cover type of Sagebrush with grass understory in fair condition was used. The land use and cover type result in a curve number of 51 which was employed as the curve number for the hydrologic analysis of all drainages.

The input and output files for the hydrologic analysis of each drainage are included in Appendix B and are summarized below.

2.1 Eastern Drainage

The eastern drainage is shown on Figure 1. The eastern drainage is approximately 1,595 acres in size. A Type V drainage is identified in the drainage area adjacent to the eastern site corral expansion area. It should be noted that in the area identified as a Type V channel, no visible channel or water course is present. In addition, no flowing or standing water and not wet or saturated soil conditions have been observed over the past 10 years.

The eastern drainage was subdivided into 5 sub-basins and 3 stream reaches. In the two uppermost sub-basins (East_SB1 and East_SB2), side drainage channels were embedded into the sub-basins. The drainage was divided into three reaches and the outlet is located where the Type V channel intersects the gravel road at the site. A 24-inch culvert is present under the road at this location.

The results of the hydrologic analysis show that no runoff from the eastern drainage occurs under any of the modeled storm event conditions with the exception of the 100-year/24-hour storm event. This is consistent with physical observations of the drainage over the past 10 years where no runoff, standing or flowing water, or saturated conditions have been observed.

2.2 Central Drainage

The central drainage is shown on Figure 1. The central drainage is approximately 1,167 acres in size. A Type V drainage is identified in the central drainage, but mapping shows the drainage ending in the relatively flat area south of the western portion of the site. For the purposes of the hydrologic analysis, the drainage flow path was extended along the topographic low area between the existing corrals and the corral expansion area in the western portion of the site.

The central drainage was subdivided into 7 sub-basins and 4 stream reaches. No embedded channels were included in any of the subareas. The drainage outlet was located at the point where the topographic low area extended from the mapped Type V drainage intersects with the site between the existing corrals and the planned corral expansion in the western portion of the site.

The results of the hydrologic analysis show that no runoff from the central drainage occurs under any of the modeled storm event conditions with the exception of the 100-year/24-hour storm event. This is consistent with physical observations at the site over the past 10 years and end of the Type V drainage mapping in the flat area south of the site.



2.3 West Drainage

The western drainage is shown on Figure 1. The west drainage is approximately 1,647 acres in size. No Type V or larger drainages are identified in the central drainage adjacent to the site. A Type V drainage is identified in the western drainage, but mapping shows the drainage ending in the relatively flat area south of the western portion of the site. For the purposes of the hydrologic analysis, the drainage flow path was extended along the topographic low area between the western edge of the hutch area and Glade Road.

The western drainage was subdivided into 5 sub-basins and 5 stream reaches. The headwaters of the drainage are represented by the 3 upper sub-basins and reaches. An embedded channel is included in each of the lower sub-basins to represent lower topographic areas within the sub-basins that connect with the main reach. The drainage outlet is located in the northwest corner of the mapped drainage shown on Figure 1 between the hutch area and Glade Road.

The results of the hydrologic analysis show that no runoff from the central drainage occurs under any of the modeled storm event conditions with the exception of the 100-year/24-hour storm event. This is consistent with physical observations at the site over the past 10 years and end of the Type V drainage mapping in the flat area south of the site.

3 EXCAVATION AND GRADING PLAN

The design of the Sagebrush Ranch Calf Yard is provided as Appendix A. The design includes the following design sheets:

- T-01 Title Page
- T-02 Notes and Legend
- C-01 Sagebrush Ranch Site
- C-02 Compost Area Existing Conditions
- C-03 Compost Area WSP #4
- C-04 WSP #4 Grading Plan
- C-05 East Side Corral Existing Conditions
- C-06 East Side Corral Expansion Grading Plan
- C-07 East Side Corral WSP #5
- C-08 West Side Corral and Hutches Existing Conditions
- C-09 West Side Corral and Hutches Grading Plan
- C-10 WSP #6 Retrofit Grading Plan
- C-11 WSP #7 Grading Plan
- C-12 WSP #8 Grading Plan
- C-13 West Side Stormwater Control
- D-01 WSP Liner Details
- D-02 Stormwater Collection Sump Details
- D-03 Run on/off Control Berm Details
- SWPPP-01 East Side Stormwater Plan
- SWPPP-02 West Side Stormwater Plan

A summary of the major design components is presented below.



3.1 General Grading

In areas where grading is to occur, grading has been designed to use existing topography to the extent practicable to slope the areas to promote stormwater runoff to waste storage ponds (WSPs) and collection areas. Cut and fill balances for areas where grading is to occur are shown on Sheets C-06 and C-09. Additional stormwater collection ponds (WSPs) and collection points have been included to supplement existing stormwater controls. All grading has been designed to incorporate existing site conditions and ensure that all stormwater generated on site remains on site.

The design calls for the installation of run on/runoff control berms surrounding the site. Berm details are shown on Sheet D-03. Berms will be matched to the adjacent operating surface. Earth berms will be used where earth or gravel are the operating surface, asphalt will be used where the operating surface is asphalt, and concrete will be used where the operating surface is concrete. As shown in the hydrologic analysis presented in Section 2, it is unlikely that run on from upstream areas will impact the southern boundary from south to north. The design grade for flat areas that will be used for operations ranges from one to two percent. Sheet C-03 shows areas of cut and fill at the site. As shown on Sheet C-03, the swale in the eastern portion of the site will be filled and a stormwater pond will be located in the northeastern portion of the site. The access road will act as the divide between the northern and southern portions of the site with the northern portion of the site sloping to the stormwater pond in the northwest corner of the site and the southern portion of the site sloping to the northeast.

The design calls for a combination of run-on/runoff control berms surrounding the site. Berm details are shown on Sheet D-03. Berms will be matched to the adjacent operating surface. Earth berms will be used where earth or gravel are the operating surface, asphalt will be used where the operating surface is asphalt, and concrete will be used where the operating surface is concrete.

3.2 Waste Storage Ponds

There are currently 4 WSPs at the Sagebrush Ranch site, three are located on the eastern portion of the site and one is located in the western portion of the site. The three WSPs located in the eastern portion of the site are lined with a 60-mil textured high density polyethylene (HDPE) liner and have underlying leak detection systems. The existing WSP in the western portion of the site is a compacted earth lined pond and will be reconfigured and lined as part of this design.

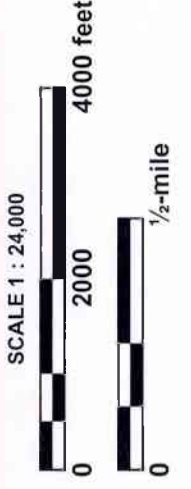
As part of the design, water storage needs were estimated to determine the water storage requirements for Sagebrush Ranch in accordance with the facility's Manure Pollution Prevention Plan (MPPP) required as part of the facility's concentrated animal feeding operation (CAFO) discharge permit. On a site wide basis, a water storage need of 30.5 million gallons was estimated. The design water storage for the Sagebrush Ranch WSPs is 34.6 million gallons. Water storage calculations are included in Appendix C.

In addition to the existing WSPs, 4 new WSPs will be constructed and the existing WSP in the western portion of the site will be reconfigured. The new and reconfigured WSPs will be lined with a geosynthetic clay liner (GCL) with a puncture resistant HDPE geomembrane as shown on Sheet D-01. Prior to entering the WSPs, stormwater will pass through stormwater collection sumps (Sheet D-02) that will remove large solids prior to entering the WSP. The existing WSP in the western portion of the site has a settling basin located to the west of the WSP that allows for solids to settle out prior to being pumped to the WSP. Water from the WSPs will be used for irrigation and will be sampled and applied to cropping fields in accordance with the Sagebrush Ranch MPPP.



Path: C:\Users\kmf\OneDrive\Documents\IES\PROJECTS\FRH Enterprises\Sagebrush Ranch\Figures\

Publish Date: 10/1/2025



DRAINAGE AREAS
ENGINEERING REPORT
Conditional Use Permit
Sagebrush Ranch Calf Ranch
Mabton, Washington

FIGURE 1

WinTR-55 Current Data Description

--- Identification Data ---

User: IES-SLH Date: 10/8/2025
 Project: Sagebrush Ranch Units: English
 SubTitle: Center Drainage Areal Units: Acres
 State: Washington
 County: Yakima - Type II
 Filename: C:\Users\Steve Hicks\Documents\veldhuis calf yard\2025\HydroAnalysis\TR55CenterDrainage.w55

--- Sub-Area Data ---

Name	Description	Reach	Area (ac)	RCN	Tc
Cent_SB1	Headwaters subarea	Headwater	60	51	0.348
Cent_SB2	Headwaters subarea	Headwater	95	51	.376
Cent_SB3	Headwaters subarea	Headwater	135	51	0.157
Cent_SB4	Headwaters subarea	Headwater	111	51	0.404
Cent_SB5		Upper	142	51	0.100
Cent_SB6		Mid	444	51	0.100
Cent_SB7		Flats	180	51	0.139

Total area: 1167 (ac)

--- Storm Data ---

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	-Yr (in)
.8	1.1	1.3	1.6	1.8	2.0	.0

Storm Data Source: User-provided custom storm data
 Rainfall Distribution Type: Type II
 Dimensionless Unit Hydrograph: <standard>

IES-SLH

Sagebrush Ranch
Center Drainage
Yakima - Type II County, Washington

Storm Data

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	-Yr (in)
.8	1.1	1.3	1.6	1.8	2.0	.0

Storm Data Source: User-provided custom storm data
Rainfall Distribution Type: Type II
Dimensionless Unit Hydrograph: <standard>

IES-SLH

Sagebrush Ranch
Center Drainage
Yakima - Type II County, Washington

Watershed Peak Table

Sub-Area or Reach Identifier	Peak Flow by Rainfall Return Period					
	2-Yr (cfs)	5-Yr (cfs)	10-Yr (cfs)	25-Yr (cfs)	50-Yr (cfs)	100-Yr (cfs)

SUBAREAS						
Cent_SB1	.00	.00	.00	.00	.00	0.02
Cent_SB2	.00	.00	.00	.00	.00	0.03
Cent_SB3	.00	.00	.00	.00	.00	0.05
Cent_SB4	.00	.00	.00	.00	.00	0.04
Cent_SB5	.00	.00	.00	.00	.00	0.05
Cent_SB6	.00	.00	.00	.00	.00	0.15
Cent_SB7	.00	.00	.00	.00	.00	0.06
REACHES						
Headwater	.00	.00	.00	.00	.00	0.13
Down	.00	.00	.00	.00	.00	0.13
Upper	.00	.00	.00	.00	.00	0.18
Down	.00	.00	.00	.00	.00	0.18
Mid	.00	.00	.00	.00	.00	0.32
Down	.00	.00	.00	.00	.00	0.32
Flats	.00	.00	.00	.00	.00	0.33
Down	.00	.00	.00	.00	.00	0.33
OUTLET	.00	.00	.00	.00	.00	0.33

IES-SLH

Sagebrush Ranch
Center Drainage
Yakima - Type II County, Washington

Hydrograph Peak/Peak Time Table

Sub-Area or Reach Identifier	Peak 2-Yr (cfs) (hr)	Flow 5-Yr (cfs) (hr)	and Peak Time (hr) 10-Yr (cfs) (hr)	by Rainfall 25-Yr (cfs) (hr)	Return 50-Yr (cfs) (hr)	Period 100-Yr (cfs) (hr)

SUBAREAS						
Cent_SB1	.00 n/a	.00 n/a	.00 n/a	.00 n/a	.00 n/a	0.02 23.92
Cent_SB2	.00 n/a	.00 n/a	.00 n/a	.00 n/a	.00 n/a	0.03 23.94
Cent_SB3	.00 n/a	.00 n/a	.00 n/a	.00 n/a	.00 n/a	0.05 23.91
Cent_SB4	.00 n/a	.00 n/a	.00 n/a	.00 n/a	.00 n/a	0.04 23.93
Cent_SB5	.00 n/a	.00 n/a	.00 n/a	.00 n/a	.00 n/a	0.05 23.90
Cent_SB6	.00 n/a	.00 n/a	.00 n/a	.00 n/a	.00 n/a	0.15 23.90
Cent_SB7	.00 n/a	.00 n/a	.00 n/a	.00 n/a	.00 n/a	0.06 23.91
REACHES						
Headwater	.00 n/a	.00 n/a	.00 n/a	.00 n/a	.00 n/a	0.13 23.91
Down	.00 n/a	.00 n/a	.00 n/a	.00 n/a	.00 n/a	0.13 24.06
Upper	.00 n/a	.00 n/a	.00 n/a	.00 n/a	.00 n/a	0.18 23.91
Down	.00 n/a	.00 n/a	.00 n/a	.00 n/a	.00 n/a	0.18 24.12
Mid	.00 n/a	.00 n/a	.00 n/a	.00 n/a	.00 n/a	0.32 23.91
Down	.00 n/a	.00 n/a	.00 n/a	.00 n/a	.00 n/a	0.32 24.42
Flats	.00 n/a	.00 n/a	.00 n/a	.00 n/a	.00 n/a	0.33 23.14
Down	.00 n/a	.00 n/a	.00 n/a	.00 n/a	.00 n/a	0.33 24.01
OUTLET	.00	.00	.00	.00	.00	0.33

IES-SLH

Sagebrush Ranch
Center Drainage
Yakima - Type II County, Washington

Sub-Area Summary Table

Sub-Area Identifier	Drainage Area (ac)	Time of Concentration (hr)	Curve Number	Receiving Reach	Sub-Area Description
Cent_SB1	60.00	0.348	51	Headwater	Headwaters subarea
Cent_SB2	95.00	0.376	51	Headwater	Headwaters subarea
Cent_SB3	135.00	0.157	51	Headwater	Headwaters subarea
Cent_SB4	111.00	0.404	51	Headwater	Headwaters subarea
Cent_SB5	142.00	0.100	51	Upper	
Cent_SB6	444.00	0.100	51	Mid	
Cent_SB7	180.00	0.139	51	Flats	

Total Area: 1167 (ac)

IES-SLH

Sagebrush Ranch
Center Drainage
Yakima - Type II County, Washington

Reach Summary Table

Reach Identifier	Receiving Reach Identifier	Reach Length (ft)	Routing Method
Headwater	Upper	4830	CHANNEL
Upper	Mid	4825	CHANNEL
Mid	Flats	9145	CHANNEL
Flats	Outlet	1430	CHANNEL

IES-SLH

Sagebrush Ranch
Center Drainage
Yakima - Type II County, Washington

Sub-Area Time of Concentration Details

Sub-Area Identifier/	Flow Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)
Cent_SB1							
SHEET	100	0.0300	0.130				0.248
SHALLOW	500	0.3000	0.050				0.016
CHANNEL	2180	0.1960	0.050	5.25	13.10	7.209	0.084
							Time of Concentration 0.348
							=====
Cent_SB2							
SHEET	100	0.0400	0.130				0.221
SHALLOW	1025	0.2700	0.050				0.034
CHANNEL	2660	0.1420	0.050	5.25	13.10	6.107	0.121
							Time of Concentration .376
							=====
Cent_SB3							
SHEET	100	0.1500	0.130				0.130
SHALLOW	720	0.2083	0.050				0.027
							Time of Concentration 0.157
							=====
Cent_SB4							
SHEET	100	0.1500	0.130				0.130
SHALLOW	915	0.1690	0.050				0.038
CHANNEL	4690	0.1166	0.050	5.25	13.10	5.520	0.236
							Time of Concentration 0.404
							=====
Cent_SB5							
SHALLOW	654	0.1770	0.050				0.027
							Time of Concentration 0.100
							=====
Cent_SB6							
SHALLOW	950	0.0320	0.050				0.091
							Time of Concentration 0.100
							=====
Cent_SB7							
SHALLOW	1200	0.0220	0.050				0.139
							Time of Concentration 0.139
							=====

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Sagebrush Ranch
Center Drainage
Yakima - Type II County, Washington

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use	Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
Cent_SB1	CN directly entered by user	-	60	51
	Total Area / Weighted Curve Number		60 ==	51 ==
Cent_SB2	CN directly entered by user	-	95	51
	Total Area / Weighted Curve Number		95 ==	51 ==
Cent_SB3	CN directly entered by user	-	135	51
	Total Area / Weighted Curve Number		135 ===	51 ==
Cent_SB4	Sagebrush (w/ grass understory) (fair)	B	111	51
	Total Area / Weighted Curve Number		111 ===	51 ==
Cent_SB5	CN directly entered by user	-	142	51
	Total Area / Weighted Curve Number		142 ===	51 ==
Cent_SB6	CN directly entered by user	-	444	51
	Total Area / Weighted Curve Number		444 ===	51 ==
Cent_SB7	Sagebrush (w/ grass understory) (fair)	B	180	51
	Total Area / Weighted Curve Number		180 ===	51 ==

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Sagebrush Ranch
Center Drainage
Yakima - Type II County, Washington

Reach Channel Rating Details

Reach Identifier	Reach Length (ft)	Reach Manning's n	Friction Slope (ft/ft)	Bottom Width (ft)	Side Slope
Headwater	4830	0.05	0.117	8	5 :1
Upper	4825	0.05	0.045	20	10 :1
Mid	9145	0.05	0.0238	20	10 :1
Flats	1430	0.05	0.007	50	20 :1

Reach Identifier	Stage (ft)	Flow (cfs)	End Area (sq ft)	Top Width (ft)	Friction Slope (ft/ft)
Headwater	0.0	0.000	0	8	0.117
	0.5	23.682	4	8	
	1.0	70.085	8	8	
	2.0	197.040	16	8	
	5.0	692.458	40	8	
	10.0	1637.519	80	8	
	20.0	3629.506	160	8	
Upper	0.0	0.000	0	20	0.045
	0.5	38.445	10	20	
	1.0	118.329	20	20	
	2.0	354.498	40	20	
	5.0	1406.828	100	20	
	10.0	3686.931	200	20	
	20.0	8932.799	400	20	
Mid	0.0	0.000	0	20	0.0238
	0.5	27.959	10	20	
	1.0	86.054	20	20	
	2.0	257.808	40	20	
	5.0	1023.112	100	20	
	10.0	2681.312	200	20	
	20.0	6496.355	400	20	
Flats	0.0	0.000	0	50	0.007
	0.5	38.647	25	50	
	1.0	121.119	50	50	
	2.0	374.975	100	50	
	5.0	1609.646	250	50	
	10.0	4611.220	500	50	
	20.0	12381.392	1000	50	

WinTR-55 Current Data Description

--- Identification Data ---

User: IES-SLH Date: 10/8/2025
 Project: Sagebrush Ranch Units: English
 SubTitle: Eastern Drainage Areal Units: Acres
 State: Washington
 County: Yakima - Type II
 Filename: C:\Users\Steve Hicks\Documents\veldhuis calf yard\2025\HydroAnalysis\TR55EastDrainage.w55

--- Sub-Area Data ---

Name	Description	Reach	Area (ac)	RCN	Tc
East_SB1	Channel embedded	Reach 2	180	51	.468
East_SB2	Channel embedded	Reach 2	93	51	.326
East_SB3	No Channel	Reach 1	568	51	.146
East_SB4	No Channel	Reach 2	506	51	0.1
East_SB5	No Channel	Reach 3	248	51	.396

Total area: 1595 (ac)

--- Storm Data ---

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	-Yr (in)
.8	1.1	1.3	1.6	1.8	2.0	.0

Storm Data Source: User-provided custom storm data
 Rainfall Distribution Type: Type II
 Dimensionless Unit Hydrograph: <standard>

IES-SLH

Sagebrush Ranch
Eastern Drainage
Yakima - Type II County, Washington

Storm Data

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	-Yr (in)
.8	1.1	1.3	1.6	1.8	2.0	.0

Storm Data Source: User-provided custom storm data
Rainfall Distribution Type: Type II
Dimensionless Unit Hydrograph: <standard>

IES-SLH

Sagebrush Ranch
Eastern Drainage
Yakima - Type II County, Washington

Watershed Peak Table

Sub-Area or Reach Identifier	Peak Flow by Rainfall Return Period					
	2-Yr (cfs)	5-Yr (cfs)	10-Yr (cfs)	25-Yr (cfs)	50-Yr (cfs)	100-Yr (cfs)

SUBAREAS						
East_SB1	.00	.00	.00	.00	.00	0.06
East_SB2	.00	.00	.00	.00	.00	0.03
East_SB3	.00	.00	.00	.00	.00	0.19
East_SB4	.00	.00	.00	.00	.00	0.17
East_SB5	.00	.00	.00	.00	.00	0.08
REACHES						
Reach 2	.00	.00	.00	.00	.00	0.26
Down	.00	.00	.00	.00	.00	0.26
Reach 1	.00	.00	.00	.00	.00	0.19
Down	.00	.00	.00	.00	.00	0.19
Reach 3	.00	.00	.00	.00	.00	0.51
Down	.00	.00	.00	.00	.00	0.44
OUTLET	.00	.00	.00	.00	.00	0.44

IES-SLH

Sagebrush Ranch
Eastern Drainage
Yakima - Type II County, Washington

Hydrograph Peak/Peak Time Table

Sub-Area or Reach Identifier	Peak Flow and Peak Time (hr) by Rainfall Return Period					
	2-Yr (cfs) (hr)	5-Yr (cfs) (hr)	10-Yr (cfs) (hr)	25-Yr (cfs) (hr)	50-Yr (cfs) (hr)	100-Yr (cfs) (hr)

SUBAREAS						
East_SB1	.00	.00	.00	.00	.00	0.06
	n/a	n/a	n/a	n/a	n/a	23.94
East_SB2	.00	.00	.00	.00	.00	0.03
	n/a	n/a	n/a	n/a	n/a	23.92
East_SB3	.00	.00	.00	.00	.00	0.19
	n/a	n/a	n/a	n/a	n/a	23.90
East_SB4	.00	.00	.00	.00	.00	0.17
	n/a	n/a	n/a	n/a	n/a	23.90
East_SB5	.00	.00	.00	.00	.00	0.08
	n/a	n/a	n/a	n/a	n/a	23.94
REACHES						
Reach 2	.00	.00	.00	.00	.00	0.26
	n/a	n/a	n/a	n/a	n/a	23.91
Down	.00	.00	.00	.00	.00	0.26
	n/a	n/a	n/a	n/a	n/a	24.68
Reach 1	.00	.00	.00	.00	.00	0.19
	n/a	n/a	n/a	n/a	n/a	23.90
Down	.00	.00	.00	.00	.00	0.19
	n/a	n/a	n/a	n/a	n/a	23.65
Reach 3	.00	.00	.00	.00	.00	0.51
	n/a	n/a	n/a	n/a	n/a	23.91
Down	.00	.00	.00	.00	.00	0.44
	n/a	n/a	n/a	n/a	n/a	24.89
OUTLET	.00	.00	.00	.00	.00	0.44

IES-SLH

Sagebrush Ranch
Eastern Drainage
Yakima - Type II County, Washington

Sub-Area Summary Table

Sub-Area Identifier	Drainage Area (ac)	Time of Concentration (hr)	Curve Number	Receiving Reach	Sub-Area Description
East_SB1	180.00	0.468	51	Reach 2	Channel embedded
East_SB2	93.00	0.326	51	Reach 2	Channel embedded
East_SB3	568.00	0.146	51	Reach 1	No Channel
East_SB4	506.00	0.100	51	Reach 2	No Channel
East_SB5	248.00	0.396	51	Reach 3	No Channel
Total Area:	1595 (ac)				

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Sagebrush Ranch
Eastern Drainage
Yakima - Type II County, Washington

Reach Summary Table

Reach Identifier	Receiving Reach Identifier	Reach Length (ft)	Routing Method
Reach 2	Reach 3	10225	CHANNEL
Reach 1	Reach 3	13963	CHANNEL
Reach 3	Outlet	1977	CHANNEL

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Sagebrush Ranch
Eastern Drainage
Yakima - Type II County, Washington

Sub-Area Time of Concentration Details

Sub-Area Identifier/	Flow Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)
East_SB1							
SHEET	100	0.2100	0.130				0.114
SHALLOW	1400	0.1830	0.050				0.056
CHANNEL	5652	0.1060	0.050	5.25	13.10	5.268	0.298
						Time of Concentration	.468
							=====
East_SB2							
SHEET	100	0.1900	0.130				0.118
SHALLOW	765	0.2130	0.050				0.029
CHANNEL	3473	0.1110	0.050	5.25	13.10	5.390	0.179
						Time of Concentration	.326
							=====
East_SB3							
SHEET	100	0.1700	0.130				0.124
SHALLOW	635	0.2410	0.050				0.022
						Time of Concentration	.146
							=====
East_SB4							
SHALLOW	1170	0.0920	0.050				0.066
						Time of Concentration	0.1
							=====
East_SB5							
SHALLOW	706	0.0425	0.050				0.059
CHANNEL	1977	0.0101	0.050	5.25	13.10	1.630	0.337
						Time of Concentration	.396
							=====

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Sagebrush Ranch
Eastern Drainage
Yakima - Type II County, Washington

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use		Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
East_SB1	Sagebrush (w/ grass understory)	(fair)	B	180	51
	Total Area / Weighted Curve Number			180 ===	51 ==
East_SB2	Sagebrush (w/ grass understory)	(fair)	B	93	51
	Total Area / Weighted Curve Number			93 ==	51 ==
East_SB3	Sagebrush (w/ grass understory)	(fair)	B	568	51
	Total Area / Weighted Curve Number			568 ===	51 ==
East_SB4	Sagebrush (w/ grass understory)	(fair)	B	506	51
	Total Area / Weighted Curve Number			506 ===	51 ==
East_SB5	Sagebrush (w/ grass understory)	(fair)	B	248	51
	Total Area / Weighted Curve Number			248 ===	51 ==

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Sagebrush Ranch
Eastern Drainage
Yakima - Type II County, Washington

Reach Channel Rating Details

Reach Identifier	Reach Length (ft)	Reach Manning's n	Friction Slope (ft/ft)	Bottom Width (ft)	Side Slope
Reach 2	10225	0.05	0.0298	8	10 :1
Reach 1	13963	0.05	0.0408	8	10 :1
Reach 3	1977	0.05	0.0101	20	10 :1

Reach Identifier	Stage (ft)	Flow (cfs)	End Area (sq ft)	Top Width (ft)	Friction Slope (ft/ft)
Reach 2	0.0	0.000	0	8	0.0298
	0.5	16.880	6.5	18	
	1.0	68.624	18	28	
	2.0	317.523	56	48	
	5.0	2865.522	290	108	
	10.0	16561.606	1080	208	
	20.0	100029.193	4160	408	
Reach 1	0.0	0.000	0	8	0.0408
	0.5	19.751	6.5	18	
	1.0	80.297	18	28	
	2.0	371.533	56	48	
	5.0	3352.939	290	108	
	10.0	19378.689	1080	208	
	20.0	117043.881	4160	408	
Reach 3	0.0	0.000	0	20	0.0101
	0.5	20.805	12.5	30	
	1.0	73.844	30	40	
	2.0	288.822	80	60	
	5.0	2128.145	350	120	
	10.0	11072.694	1200	220	
	20.0	62722.843	4400	420	

WinTR-55 Current Data Description

--- Identification Data ---

User: IES-SLH Date: 10/8/2025
 Project: Sagebrush Ranch Units: English
 SubTitle: West Drainage Areal Units: Acres
 State: Washington
 County: Yakima - Type II
 Filename: C:\Users\Steve Hicks\Documents\veldhuis calf yard\2025\HydroAnalysis\TR55WestDrainage.w55

--- Sub-Area Data ---

Name	Description	Reach	Area (ac)	RCN	Tc
West_SB1		W Reach 1	488	51	0.199
West_SB2		W Reach 2	167	51	0.237
West_SB3		W Reach 3	539	51	0.151
West_SB4		Main Reach	312	51	0.800
West_SB5		Flats Rch	130	51	0.578

Total area: 1636 (ac)

--- Storm Data ---

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	-Yr (in)
.8	1.1	1.3	1.6	1.8	2.0	.0

Storm Data Source: User-provided custom storm data
 Rainfall Distribution Type: Type II
 Dimensionless Unit Hydrograph: <standard>

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Sagebrush Ranch
West Drainage
Yakima - Type II County, Washington

Storm Data

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	-Yr (in)
.8	1.1	1.3	1.6	1.8	2.0	.0

Storm Data Source: User-provided custom storm data
Rainfall Distribution Type: Type II
Dimensionless Unit Hydrograph: <standard>

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Sagebrush Ranch
West Drainage
Yakima - Type II County, Washington

Watershed Peak Table

Sub-Area or Reach Identifier	Peak Flow by Rainfall Return Period					100-Yr (cfs)
	2-Yr (cfs)	5-Yr (cfs)	10-Yr (cfs)	25-Yr (cfs)	50-Yr (cfs)	

SUBAREAS						
West_SB1	.00	.00	.00	.00	.00	0.16
West_SB2	.00	.00	.00	.00	.00	0.06
West_SB3	.00	.00	.00	.00	.00	0.18
West_SB4	.00	.00	.00	.00	.00	0.09
West_SB5	.00	.00	.00	.00	.00	0.04
REACHES						
W Reach 1	.00	.00	.00	.00	.00	0.16
Down	.00	.00	.00	.00	.00	0.16
W Reach 2	.00	.00	.00	.00	.00	0.06
Down	.00	.00	.00	.00	.00	0.06
W Reach 3	.00	.00	.00	.00	.00	0.18
Down	.00	.00	.00	.00	.00	0.18
Main Reach	.00	.00	.00	.00	.00	0.46
Down	.00	.00	.00	.00	.00	0.46
Flats Rch	.00	.00	.00	.00	.00	0.46
Down	.00	.00	.00	.00	.00	0.46
OUTLET	.00	.00	.00	.00	.00	0.46

IES-SLH

Sagebrush Ranch
West Drainage
Yakima - Type II County, Washington

Hydrograph Peak/Peak Time Table

Sub-Area or Reach Identifier	Peak 2-Yr (cfs) (hr)	Flow 5-Yr (cfs) (hr)	and Peak 10-Yr (cfs) (hr)	Time (hr) 25-Yr (cfs) (hr)	by Rainfall 50-Yr (cfs) (hr)	Return Period 100-Yr (cfs) (hr)

SUBAREAS						
West_SB1	.00	.00	.00	.00	.00	0.16
	n/a	n/a	n/a	n/a	n/a	23.91
West_SB2	.00	.00	.00	.00	.00	0.06
	n/a	n/a	n/a	n/a	n/a	23.92
West_SB3	.00	.00	.00	.00	.00	0.18
	n/a	n/a	n/a	n/a	n/a	23.91
West_SB4	.00	.00	.00	.00	.00	0.09
	n/a	n/a	n/a	n/a	n/a	24.02
West_SB5	.00	.00	.00	.00	.00	0.04
	n/a	n/a	n/a	n/a	n/a	23.97
REACHES						
W Reach 1	.00	.00	.00	.00	.00	0.16
	n/a	n/a	n/a	n/a	n/a	23.91
Down	.00	.00	.00	.00	.00	0.16
	n/a	n/a	n/a	n/a	n/a	22.98
W Reach 2	.00	.00	.00	.00	.00	0.06
	n/a	n/a	n/a	n/a	n/a	23.92
Down	.00	.00	.00	.00	.00	0.06
	n/a	n/a	n/a	n/a	n/a	23.05
W Reach 3	.00	.00	.00	.00	.00	0.18
	n/a	n/a	n/a	n/a	n/a	23.91
Down	.00	.00	.00	.00	.00	0.18
	n/a	n/a	n/a	n/a	n/a	23.08
Main Reach	.00	.00	.00	.00	.00	0.46
	n/a	n/a	n/a	n/a	n/a	24.22
Down	.00	.00	.00	.00	.00	0.46
	n/a	n/a	n/a	n/a	n/a	24.82
Flats Rch	.00	.00	.00	.00	.00	0.46
	n/a	n/a	n/a	n/a	n/a	24.82
Down	.00	.00	.00	.00	.00	0.46
	n/a	n/a	n/a	n/a	n/a	25.06
OUTLET	.00	.00	.00	.00	.00	0.46

IES-SLH

Sagebrush Ranch
West Drainage
Yakima - Type II County, Washington

Sub-Area Summary Table

Sub-Area Identifier	Drainage Area (ac)	Time of Concentration (hr)	Curve Number	Receiving Reach	Sub-Area Description
West_SB1	488.00	0.199	51	W Reach 1	
West_SB2	167.00	0.237	51	W Reach 2	
West_SB3	539.00	0.151	51	W Reach 3	
West_SB4	312.00	0.800	51	Main Reach	
West_SB5	130.00	0.578	51	Flats Rch	

Total Area:	1636 (ac)				

IES-SLH

Sagebrush Ranch
West Drainage
Yakima - Type II County, Washington

Reach Summary Table

Reach Identifier	Receiving Reach Identifier	Reach Length (ft)	Routing Method
W Reach 1	Main Reach	12610	CHANNEL
W Reach 2	Main Reach	8850	CHANNEL
W Reach 3	Main Reach	13815	CHANNEL
Main Reach	Flats Rch	5940	CHANNEL
Flats Rch	Outlet	1400	CHANNEL

Sagebrush Ranch
West Drainage
Yakima - Type II County, Washington

Sub-Area Time of Concentration Details

Sub-Area Identifier/	Flow Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)

West_SB1							
SHEET	100	0.0800	0.130				0.167
SHALLOW	875	0.2180	0.050				0.032
					Time of Concentration		0.199
							=====
West_SB2							
SHEET	100	0.0500	0.130				0.202
SHALLOW	450	0.0500	0.050				0.035
					Time of Concentration		0.237
							=====
West_SB3							
SHEET	100	0.1500	0.130				0.130
SHALLOW	565	0.2120	0.050				0.021
					Time of Concentration		0.151
							=====
West_SB4							
SHALLOW	785	0.0242	0.050				0.087
SHALLOW	400	0.0600	0.050				0.028
CHANNEL	6380	0.0255	0.050	5.25	13.10	2.587	0.685
					Time of Concentration		0.800
							=====
West_SB5							
SHALLOW	280	0.0250	0.050				0.030
SHALLOW	590	0.0440	0.050				0.048
CHANNEL	4050	0.0193	0.050	5.25	13.10	2.250	0.500
					Time of Concentration		0.578
							=====

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Sagebrush Ranch
West Drainage
Yakima - Type II County, Washington

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use	Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
West_SB1	CN directly entered by user	-	488	51
	Total Area / Weighted Curve Number		488 ===	51 ==
West_SB2	CN directly entered by user	-	167	51
	Total Area / Weighted Curve Number		167 ===	51 ==
West_SB3	CN directly entered by user	-	539	51
	Total Area / Weighted Curve Number		539 ===	51 ==
West_SB4	CN directly entered by user	-	312	51
	Total Area / Weighted Curve Number		312 ===	51 ==
West_SB5	CN directly entered by user	-	130	51
	Total Area / Weighted Curve Number		130 ===	51 ==

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Sagebrush Ranch
West Drainage
Yakima - Type II County, Washington

Reach Channel Rating Details

Reach Identifier	Reach Length (ft)	Reach Manning's n	Friction Slope (ft/ft)	Bottom Width (ft)	Side Slope
W Reach 1	12610	0.05	0.0738	8	5 :1
W Reach 2	8850	0.05	0.0572	8	5 :1
W Reach 3	13815	0.05	0.0683	8	5 :1
Main Reach	5940	0.05	0.0148	8	5 :1
Flats Rch	1400	0.05	0.0086	20	10 :1

Reach Identifier	Stage (ft)	Flow (cfs)	End Area (sq ft)	Top Width (ft)	Friction Slope (ft/ft)
W Reach 1	0.0	0.000	0	8	0.0738
	0.5	23.042	5.3	13	
	1.0	83.875	13	18	
	2.0	340.467	36	28	
	5.0	2644.622	165	58	
	10.0	14187.748	580	108	
	20.0	81971.503	2160	208	
W Reach 2	0.0	0.000	0	8	0.0572
	0.5	20.286	5.3	13	
	1.0	73.842	13	18	
	2.0	299.740	36	28	
	5.0	2328.271	165	58	
	10.0	12490.600	580	108	
	20.0	72166.016	2160	208	
W Reach 3	0.0	0.000	0	8	0.0683
	0.5	22.167	5.3	13	
	1.0	80.689	13	18	
	2.0	327.535	36	28	
	5.0	2544.168	165	58	
	10.0	13648.837	580	108	
	20.0	78857.875	2160	208	
Main Reach	0.0	0.000	0	8	0.0148
	0.5	10.319	5.3	13	
	1.0	37.561	13	18	
	2.0	152.468	36	28	
	5.0	1184.313	165	58	
	10.0	6353.546	580	108	
	20.0	36708.410	2160	208	
Flats Rch	0.0	0.000	0	20	0.0086
	0.5	19.198	12.5	30	
	1.0	68.141	30	40	
	2.0	266.514	80	60	
	5.0	1963.766	350	120	
	10.0	10217.434	1200	220	
	20.0	57878.101	4400	420	

Appendix C

Water Storage Calculations

Sagebrush Ranch Engineering Report

East Area	Acres	Square Feet
Compost Area	59	
Operations Area	6	
Corrals	173	
Total	238	

West Area	
Hutch Area	133
Operations Area	15
Corrals	74
Total	222

Site Total	460	20,037,600
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Impervious Area (20%)	4,007,520	1.0 Runoff Coeff
Pervious Area (80%)	16,030,080	0.47 Runoff Coeff

	Inches	Feet
120-day storage rainfall	2.64	0.22
25yr/24hr storm event	1.6	0.13

120-day storage

Impervious	6,594,775 gallons
Pervious	12,398,177 gallons

25yr/24hr Storm Event

Impervious	3,996,833 gallons
Pervious	7,514,047 gallons

Storage Required	30,503,832 gallons
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Operating Volume

WSP1	6,090,000 gal	WSP5	10,390,000 gal
WSP2	1,050,000 gal	WSP6	6,970,000 gal
WSP3	805,000 gal	WSP7	5,037,000 gal
WSP4	768,000 gal	WSP8	3,517,000 gal

Total	34,627,000 gallons
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