J.R. Bonnett Engineering

CIVIL & STRUCTURAL ENGINEERING/CONSULTING 803 E. 3RD AVENUE, SPOKANE, WA. 99202 (509) 534-3929

Drainage Design Calculations

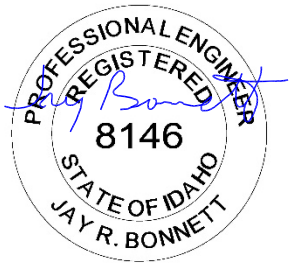
of

Douglass Family Residence

828 N. Steamboat Bay Road
Coolin, ID

for

Harley and Lisa Douglass
5520 N. Florida Street
Spokane , WA 99202



October 3, 2024
JRBE Job No. 21-059.10

JRB

J.R. BONNETT ENGINEERING
CIVIL & STRUCTURAL ENGINEERING / CONSULTING & DESIGN

Douglass Family Residence

Stormwater Management Narrative

PROJECT DESCRIPTION

This project involves the construction of a residential structure along the shores of Priest Lake. The site topography slopes down generally east to west.

The project site is located approximately 3 miles north of Coolin, Idaho within the SW ¼ of Section 27, Township 60 N, Range 04 W. Boise Meridian, Bonner County, ID.

PURPOSE

The purpose of this drainage report is to determine the extent of storm drainage facilities, which will be required to dispose of stormwater runoff from the proposed project. The storm drainage facilities on this project will be designed to dispose of runoff from a 25-year design storm. For this project the Idaho Transportation Department Zone "C" Intensity, Duration, and Frequency (IDF) curve was used.

GEOTECHNICAL INFORMATION

The underlying soils are loamy coarse sands, as identified by the NRCS Web Soil Survey and have a very low potential for erosion and sediment runoff.

PRE-DEVELOPMENT BASIN INFORMATION

Surface runoff is expected to be contained on-site. Off-site surface runoff is not expected to significantly contribute to the on-site basin.

POST-DEVELOPMENT BASIN INFORMATION

The project site consists of 3 onsite drainage basins – Basin A, Basin B and Basin C. Each Basin is created by the proposed site improvements where surface runoff is directed to their respective swales as shown on the Post Developed Basin Map provided.

The attached Bowstring calculations summarize the impervious and pervious areas for the drainage basins and the pollutant-generating impervious surfaces.

METHODOLOGY

The proposed onsite basins have been sized and analyzed using the Rational Method and Bowstring Method to accommodate a 25-year design frequency storm event per starting with a 10 minute time of concentration. For this project the Idaho Transportation Department Zone "C" Intensity, Duration, and Frequency (IDF) curve was used.

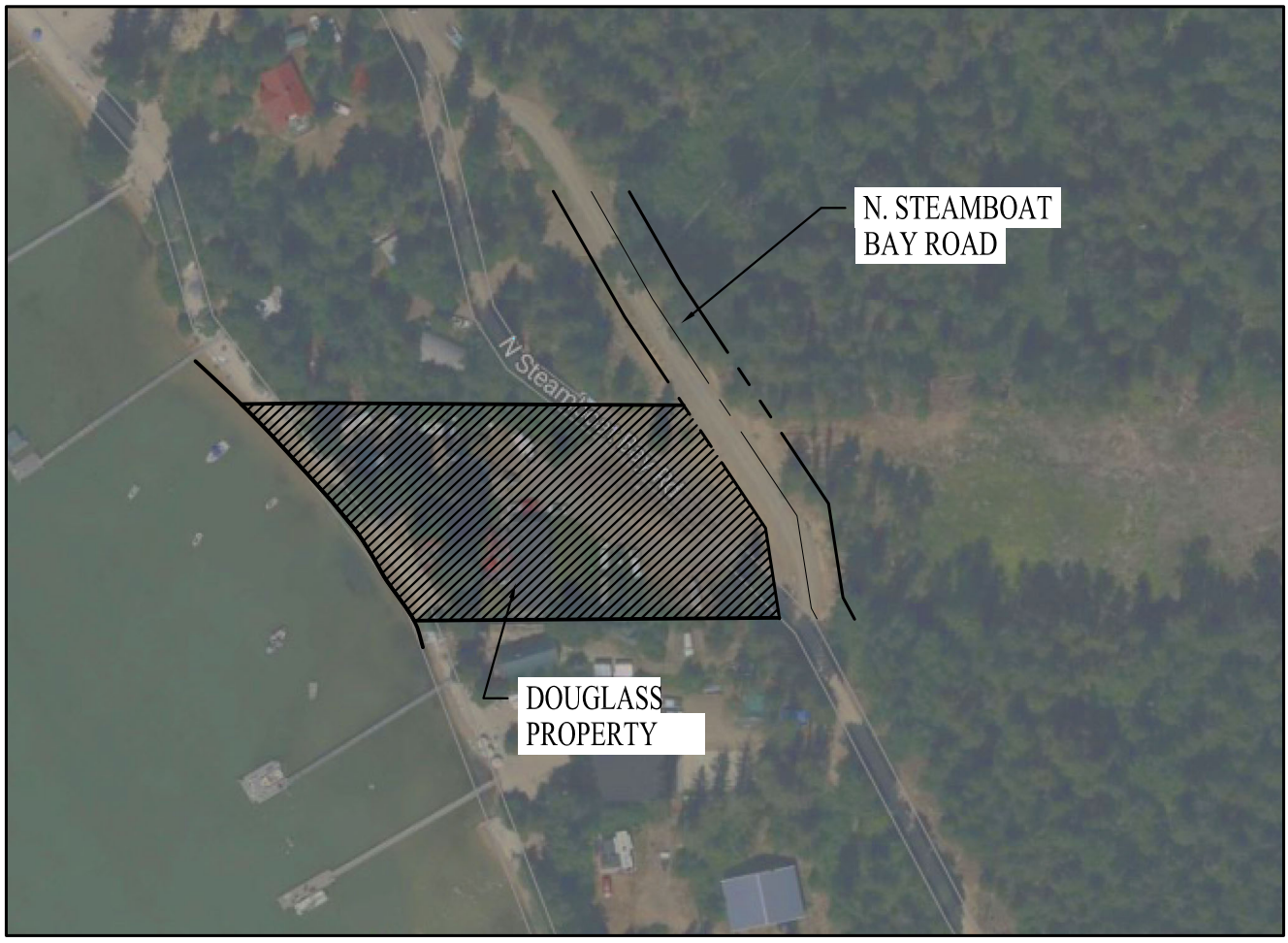
CONCLUSION

As demonstrated by the calculations and body of this report, the storm drainage facilities provided in the design, will adequately dispose of the storm water from the site. Mitigating drainage facilities for all of the impervious surfaces have been provided.

As required by Bonner County, a Grading & Drainage Plan and Erosion and Sedimentation Control Plan have been prepared and submitted along with this drainage report for review and comment. It shall be noted that the design engineer takes no responsibility or obligation in the maintenance activities of the stormwater facilities. It shall be the sole responsibility and obligation of the Owner to maintain all stormwater facilities. Maintenance activities of the stormwater facilities shall include, but not be limited to, watering, mowing, and fertilizing of GIA's, sod renovation of GIA's, sediment and debris removal from detention basins, debris removal and cleaning of all inlets, and piping.

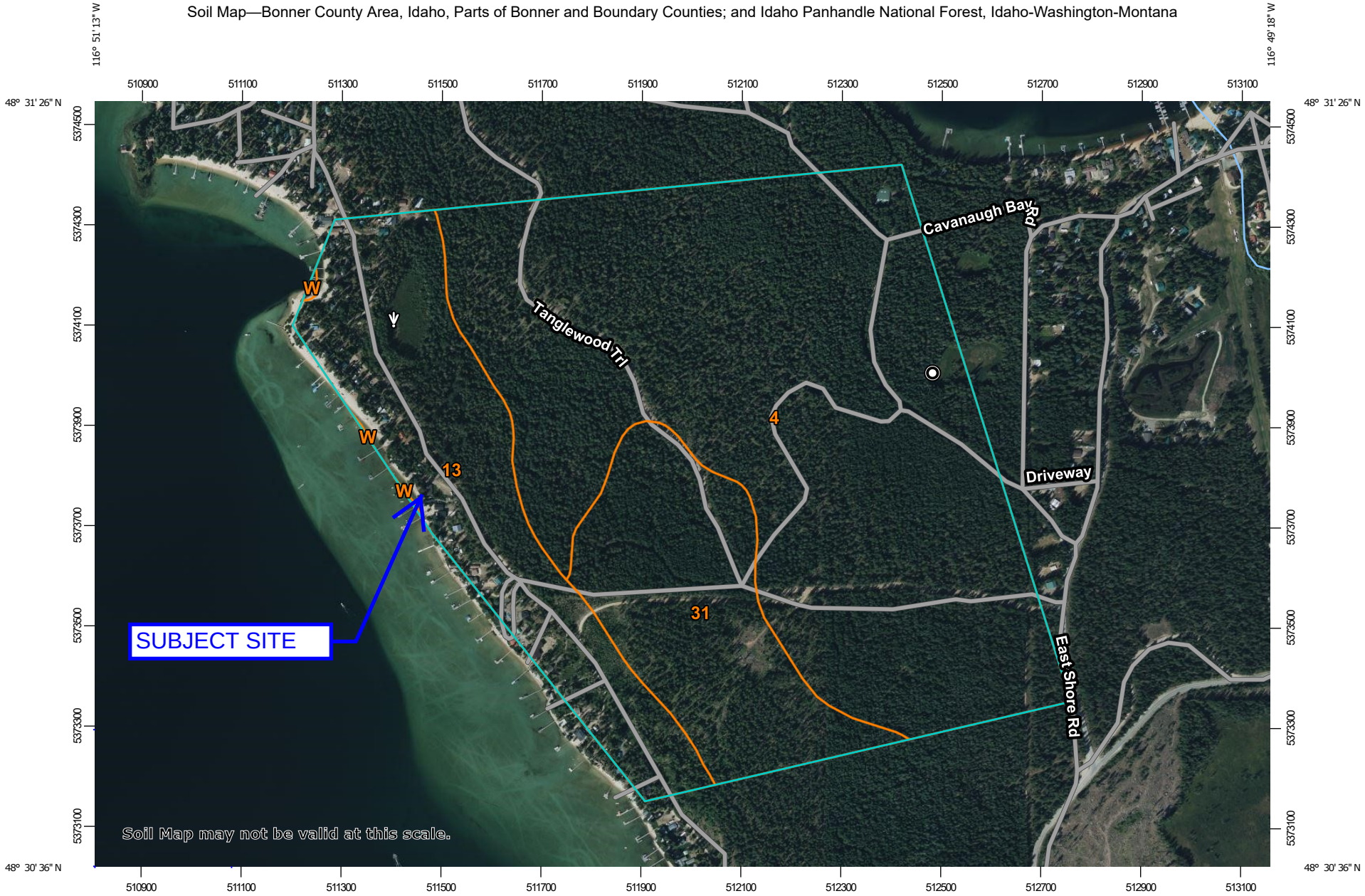
Drainage calculations with supporting basin maps and literature are attached for review and comment as required.

MAPS



VICINITY MAP

NTS



Map Scale: 1:10,700 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 150 300 600 900

Feet: 0 500 1000 2000 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Bonner County Area, Idaho, Parts of Bonner and Boundary Counties
Survey Area Data: Version 18, Sep 2, 2022

Soil Survey Area: Idaho Panhandle National Forest, Idaho-Washington-Montana
Survey Area Data: Version 9, Sep 2, 2022

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 16, 2021—Oct 18, 2021

MAP LEGEND

MAP INFORMATION

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

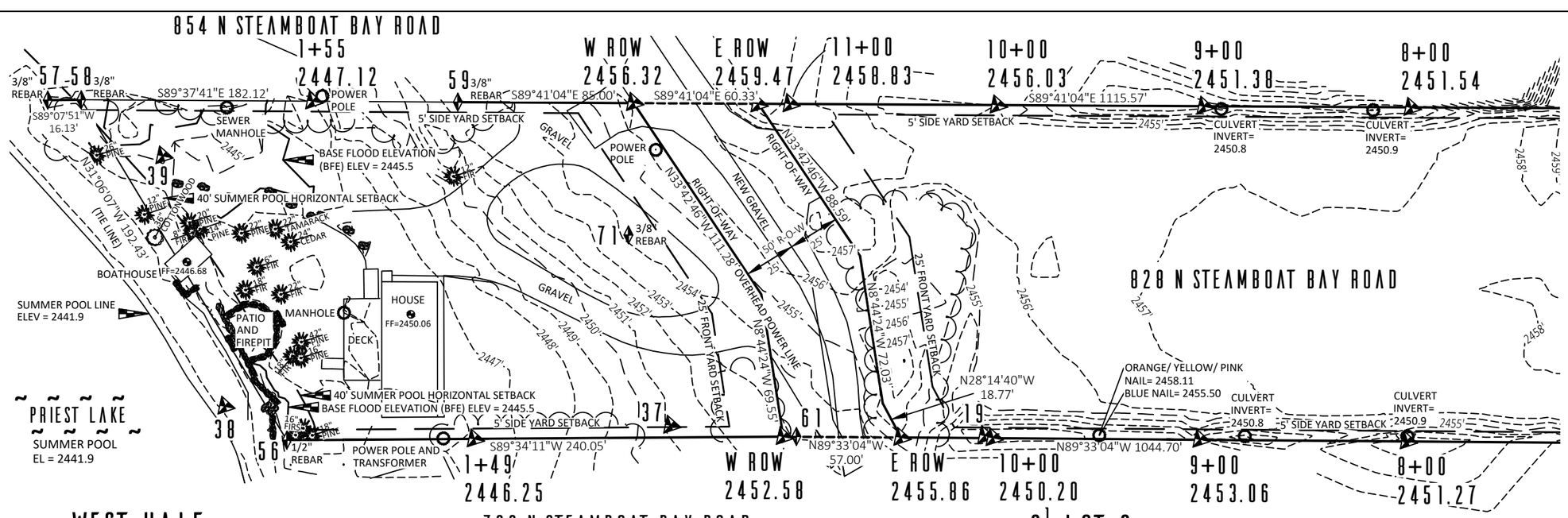
Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
4	Bonner silt loam, cool, 0 to 4 percent slopes	204.1	62.8%
13	Elmira variant loamy coarse sand, 0 to 2 percent slopes	67.3	20.7%
31	Mission silt loam, 0 to 2 percent slopes	53.6	16.5%
Subtotals for Soil Survey Area		**324.9**	**99.9%**
Totals for Area of Interest		**325.2**	**100.0%**

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
W	Water	0.3	0.1%
Subtotals for Soil Survey Area		**0.3**	**0.1%**
Totals for Area of Interest		**325.2**	**100.0%**

TOPOGRAPHIC SURVEY

IN THE SOUTHWEST 1/4 OF SECTION 27, TOWNSHIP 60 NORTH, RANGE 04 WEST, BOISE MERIDIAN, BONNER COUNTY, IDAHO



LEGEND

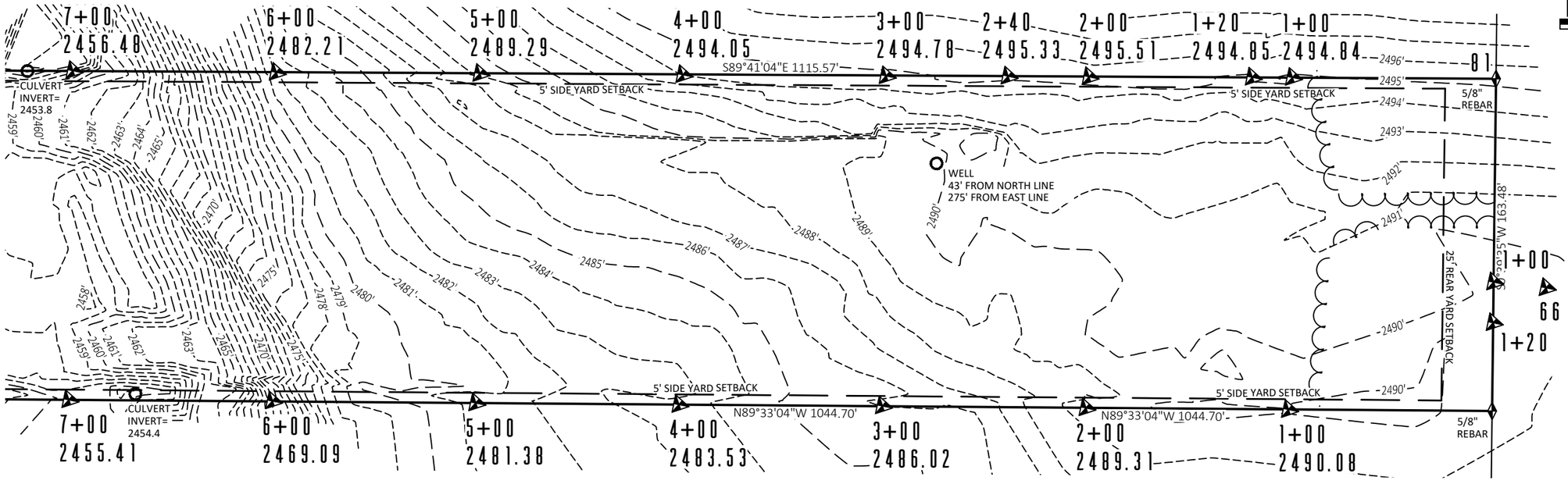
- BOUNDARY- SURVEY MONUMENT
- CONTROL- RANDOM SURVEY POINT- 60d NAIL AND WHISKER OR WOOD HUB WITH STAKE
- 13 BENCH MARK- SEE TABLE, NUMBER OR STATION IS MARKED ON STAKE
- MAILBOX — UTILITY AND MISCELLANEOUS FEATURES- AS NOTED
- MAJOR CONTOURS (5')
- MINOR CONTOURS (1')
- BOUNDARY- PROPERTY LINES
- BOUNDARY- SETBACKS (AS NOTED)
- EDGE OF TREES
- LANDSCAPE AND RETAINING WALL BOULDERS
- 4" ASPEN — TREE- DECIDUOUS (DBH SIZE AND SPECIES NOTED)
- 6" CEDAR — TREE- CONIFEROUS (DBH SIZE AND SPECIES NOTED)

NOTES

1) ZONING: CURRENT ZONING FOR THIS PARCEL IS "RECREATIONAL" WITH 25' FRONT AND REAR AND 5' SIDE YARD SETBACKS.
2) VERTICAL DATUM = NAVD88, ESTABLISHED BY SUMMER POOL ELEVATION STUDY AND GPS OPUS SOLUTION.
3) THIS IS NOT A BOUNDARY SURVEY. BOUNDARY AS SHOWN IS BASED ON "RECORD OF SURVEY" BOUNDARY SURVEY FILED AS INSTRUMENT NUMBER 1000187.
4) THIS DRAWING IS BEST UTILIZED AT 1:2 SCALE ON 11X17 PAPER.
5) POWERLINE EASEMENT (INSTRUMENT NUMBER 758679) CALLS OUT LOCATION TO BE "...ACROSS A PORTION OF..." PARCEL AND DOES NOT INDICATE WIDTH.
6) TELEPHONE EASEMENT (INSTRUMENT NUMBERS 117014, 117016, 117017, AND 117018) CALL OUT LOCATION OF EASEMENT AS, "...ALONG EXISTING ROADWAY." NOT SHOWN ON THIS SURVEY.

BENCH MARKS

▲37	2451.20	♦58	2445.19
▲38	2442.25	♦59	2454.10
▲39	2445.28	♦61	2453.06
▲19	2450.08	▲66	2489.47
♦56	2445.52	♦71	2454.26
♦57	2445.41	♦81	2495.20



SCALE
N 1"=30'
30 60
(SEE NOTE 4)

SIGNED ORIGINAL ON FILE AT STEARNS SURVEYING

JOHN STEARNS, PLS

DATE

PROFESSIONAL LAND SURVEYOR REGISTERED 8798 STATE OF IDAHO JOHN STEARNS

ADDRESS
828 N STEAMBOAT BAY ROAD
COOLIN, IDAHO

PARCEL
RP 60N04W27 6700A

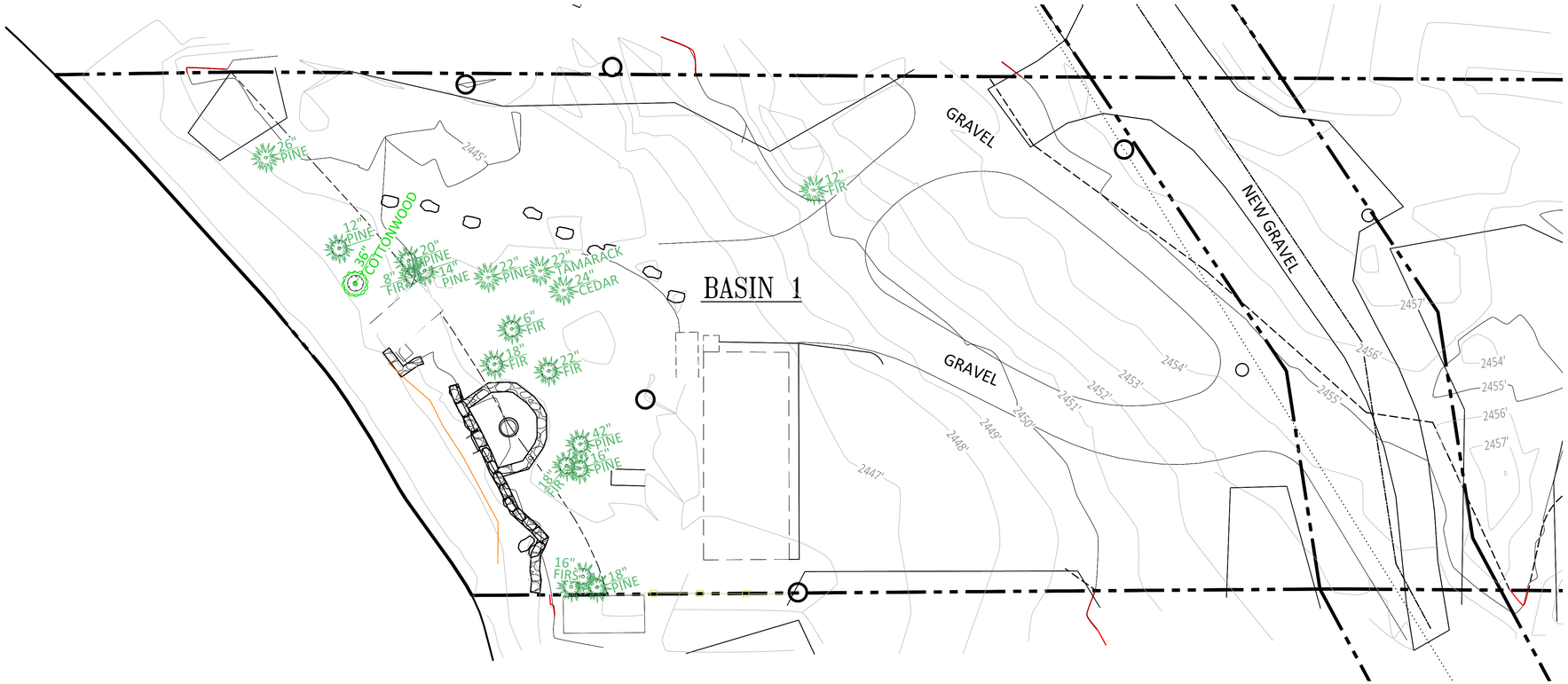
CLIENT
DOUGLASS

FILE
23.063

DATE
NOVEMBER, 2023

PHONE
208.696.2017

STEARNS SURVEYING
WWW.STEARNSSURVEYING.COM



PRE-DEVELOPED BASIN MAP

GRAPHIC SCALE

30 0 15 30 60

(IN FEET)
1 inch = 30 ft.

UNDERGROUND SERVICE ALERT
ONE-CALL NUMBER
811
CALL TWO BUSINESS DAYS BEFORE YOU DIG

REV.	DATE	BY	DESCRIPTION

J.R. BONNETT ENGINEERING
CIVIL AND STRUCTURAL CONSULTING AND DESIGN
803 E. 3RD AVENUE
SPOKANE, WASHINGTON 99202
(509) 534-3929 / FAX (509) 534-4014

JOB TITLE
DOUGLASS FAMILY RESIDENCE
BONNER COUNTY IDAHO

SHEET TITLE
PRE-DEVELOPMENT DRAINAGE BASIN MAP

PROFESSIONAL ENGINEER
REGISTERED
8146
STATE OF IDAHO
JAY R. BONNETT

10/3/24

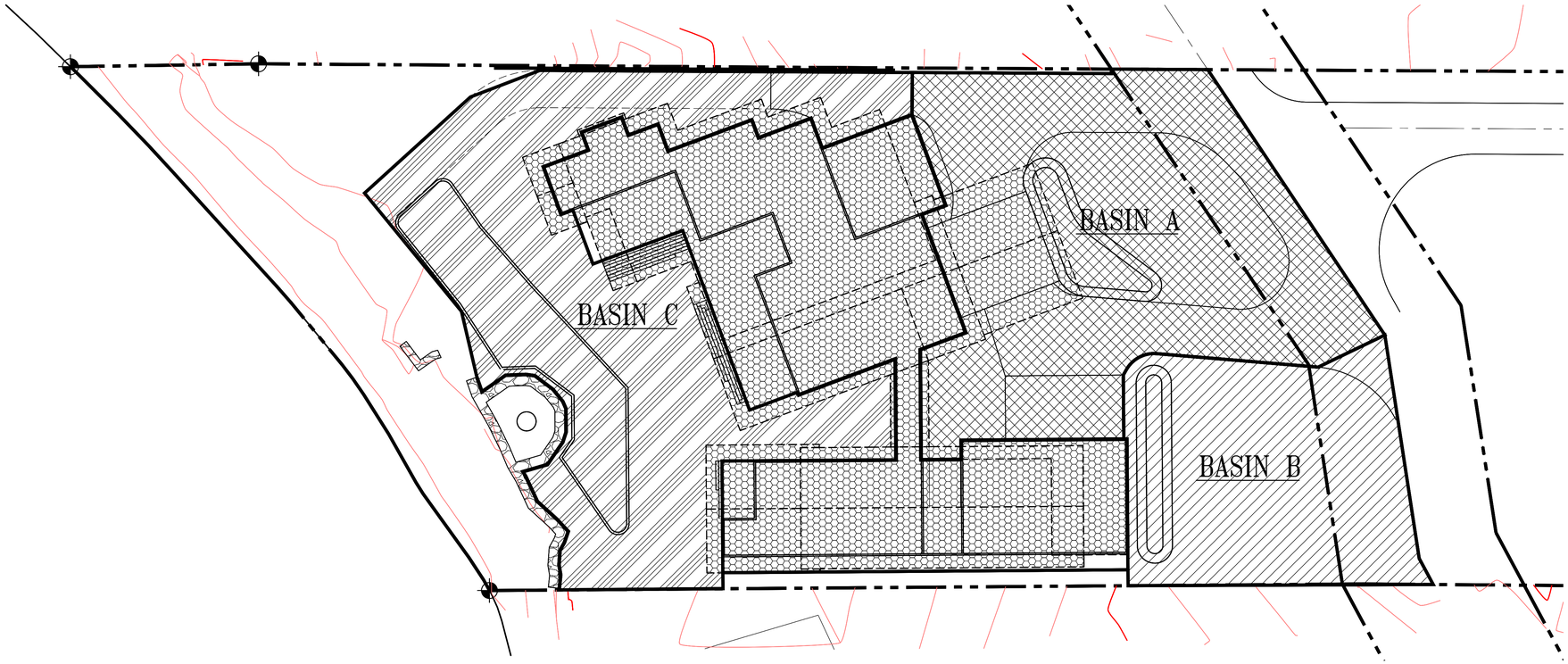
DATE
OCT, 2024

DRAWN BY
JRB

DESIGN BY
JRB

JOB NO.
21-059.10

SHEET NO.
B1



POST-DEVELOPED BASIN MAP

GRAPHIC SCALE

30 0 15 30 60

(IN FEET)
1 inch = 30 ft.

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POST-DEVELOPED DRAINAGE BASIN MAP

PROFESSIONAL ENGINEER
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8146
STATE OF IDAHO
JAY R. BONNETT

10/3/24

DATE
OCT, 2024

DRAWN BY
JRB

DESIGN BY
JRB

JOB NO.
21-059.10

SHEET NO.
B2

POND 'A'
POLLUTION GENERATING IMPERVIOUS SURFACE = 6769 S.F.
TREATMENT VOL. REQ'D = 0.50" * 6769 S.F./12 = 282 CF
TREATMENT VOL. PROVIDED = 298 CF
25 YR STORM VOL. REQUIRED = 255 CF
25 YR STORM VOL. PROVIDED = 862 CF

POND 'B'
POLLUTION GENERATING IMPERVIOUS SURFACE = 1329 S.F.
TREATMENT VOL. REQ'D = 0.50" * 1329 S.F./12 = 55 CF
TREATMENT VOL. PROVIDED = 183 CF
25 YR STORM REQUIRED = 76 CF
25 YR STORM PROVIDED = 650 CF

POND 'C'
POLLUTION GENERATING IMPERVIOUS SURFACE = 13600 S.F.
TREATMENT VOL. REQ'D = 0.50" * 13600 S.F./12 = 567 CF
TREATMENT VOL. PROVIDED = 581 CF
25 YR STORM REQUIRED = 682 CF
25 YR STORM PROVIDED = 801 CF

GRADING KEY NOTES

(A) **GRASSY INFILTRATION POND 'A'**
BOT DIM PER DETAIL @ S.G. EL. 2' BELOW F.G. (F.G. PER PLAN) (FLR A=504 S.F. MIN.) DEPTH=1.0' MIN., 3H:1V MAX. SIDE SLOPES. INSTALL (1) CATCH BASIN W/ METAL FRAME & GRATE. SET DW GRATE 0.50' ABOVE F.G. (TG PER PLAN). INSTALL CONTINUOUS 2'-WIDE X 4'-DEEP GRAVEL INFILTRATION TRENCH W/ 6"ø PVC PERF PIPE BNTH POND FLOOR PER PLAN.

(B) **GRASSY INFILTRATION POND 'B'**
BOT DIM PER DETAIL @ S.G. EL. 2' BELOW F.G. (F.G. PER PLAN) (FLR A=275 S.F. MIN.) DEPTH=1.0' MIN., 3H:1V MAX. SIDE SLOPES. INSTALL (1) CATCH BASIN W/ METAL FRAME & GRATE. SET DW GRATE 0.50' ABOVE F.G. (TG PER PLAN). INSTALL CONTINUOUS 2'-WIDE X 4'-DEEP GRAVEL INFILTRATION TRENCH W/ 6"ø PVC PERF PIPE BNTH POND FLOOR PER PLAN.

(C) **GRASSY INFILTRATION POND 'C'**
BOT DIM PER DETAIL @ S.G. EL. 2' BELOW F.G. (F.G. PER PLAN) (FLR A=2,215 S.F. MIN.) DEPTH=0.25' MIN., 3H:1V MAX. SIDE SLOPES. INSTALL CONTINUOUS 1'-DEEP GRAVEL INFILTRATION GALLERY W/ 6"ø PVC PERF PIPE BNTH POND FLOOR PER PLAN.

GRADING/DRAINAGE KEY NOTES

(1A) INFILTRATION TRENCH BELOW POND FLOOR & DRIVEWAY (2'-WIDE X 4'-DEEP X 143' LONG). TRENCH TO BE LINED W/ FILTER FABRIC ON BOTTOM, SIDES AND TOP & FILLED W/ 2" MINUS DRAINFIELD ROCK W/ 6"ø PERFORATED PVC PIPE. (SEE DTL 1/C3.1 & 2/C3.1).

(1B) INFILTRATION GALLERY BELOW POND FLOOR. (A=735 SF X 1'-DEEP). TRENCH TO BE LINED W/ FILTER FABRIC ON BOTTOM, SIDES AND TOP & FILLED W/ 2" MINUS DRAINFIELD ROCK W/ 6"ø PERFORATED PVC PIPE. (SEE DTL 3/C3.1)

(2) SLOPE FINISHED GRADE SURFACE DOWN AT STRAIGHT GRADE (1% MIN.) TO POND.

(3) SLOPE SUBSURFACE INFILTRATION TRENCH & PERF. PIPE TO THE NORTH AT 1% MIN. GRADE.

(4) 4'-DIAM PRECAST CONC. CATCH BASIN SIM. TO CITY OF SPOKANE TYPE 1 W/ METAL FRAME AND GRATE (SOLID COVER WHERE SHOWN). EXTEND DRAINAGE PIPE INTO CB BARREL 4" MIN. MEASURED FROM INSIDE FACE.

(5) SLOPE FINISHED GRADES AWAY FROM BUILDING AT 1% MIN. SLOPE, TYP.

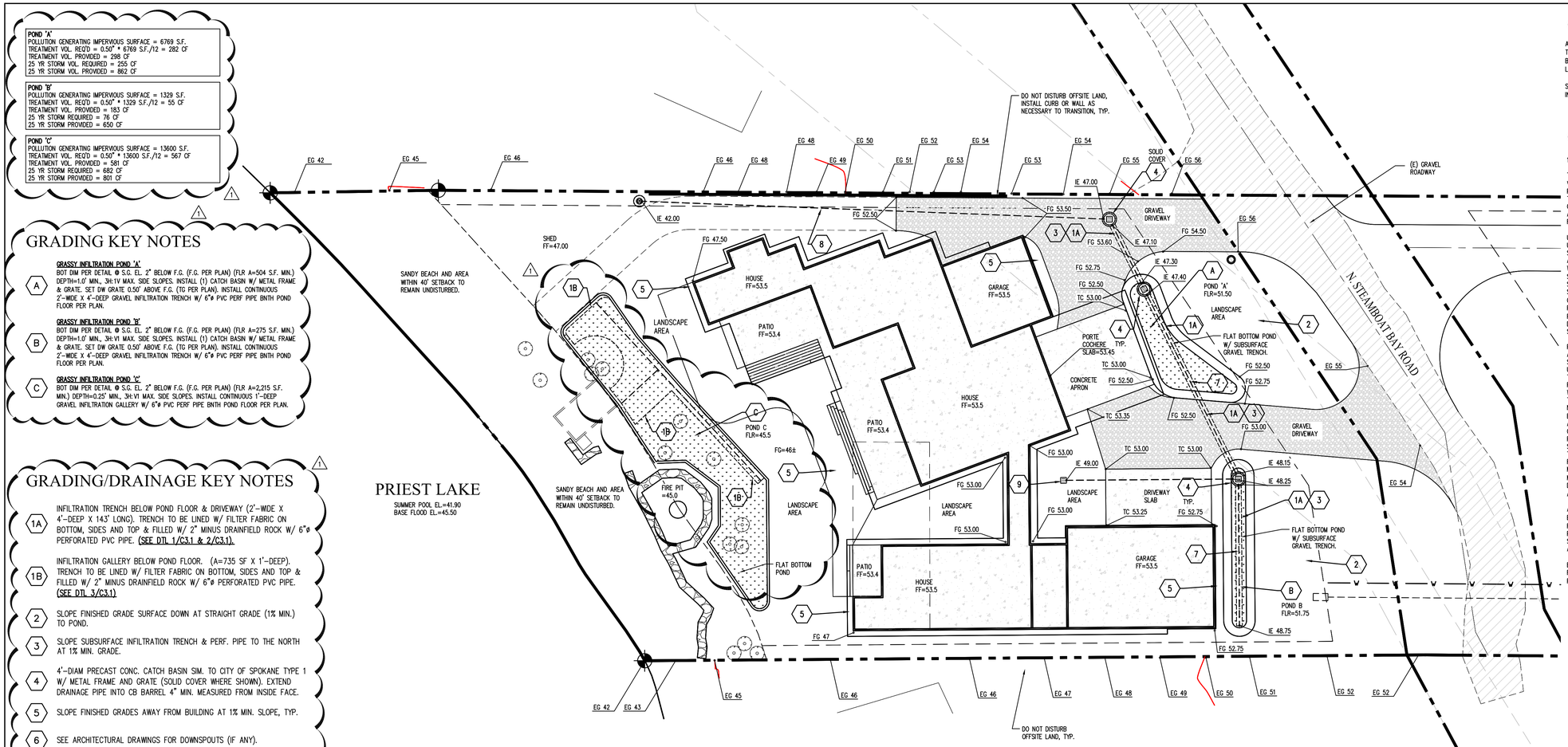
(6) SEE ARCHITECTURAL DRAWINGS FOR DOWNSPOUTS (IF ANY).

(7) 6"ø SDR35 PVC PERF. PIPE W/ 1% MIN SLOPE CENTERED IN INFILTRATION TRENCH. SEE DTLS 1/C3.1 & 2/C3.1.

(8) 8"ø SDR35 PVC OVERFLOW PIPE TIGHTLINED TO (E) CONC. SUMP TANK W/ 1% MIN SLOPE.

(9) PVC OR CONC. YARD DRAIN BASIN W/ 6"ø PVC PIPE SLOPED TO CATCH BASIN.

(10) EXISTING 4'-DIAM CONC SUMP TANK TO REMAIN IN USE.



GRAPHIC SCALE
20 0 10 20 40
(IN FEET)
1 inch = 20 ft.

GRADING/DRAINAGE PLAN - WEST

1" = 20'

GENERAL NOTES

ALL METHODS AND MATERIALS SHALL COMPLY WITH THE LATEST EDITIONS OF THE INTERNATIONAL BUILDING CODE; THE IDAHO TRANSPORTATION DEPARTMENT; BONNER COUNTY ENVIRONMENTAL STANDARDS; AND ALL OTHER APPLICABLE LOCAL, STATE AND FEDERAL CODES, RULES, AND REGULATIONS.

SEE SHEET C1.1 & C1.2 FOR TEMPORARY EROSION AND SEDIMENT CONTROL INFORMATION AND OPERATIONS AND MAINTENANCE BMP'S FOR DRAINAGE FACILITIES.

GRADING & DRAINAGE NOTES

12-723.1: GRADING STANDARDS:

A. THE SLOPE OF CUT SURFACES SHALL BE NO STEEPER THAN IS SAFE FOR THE INTENDED USE AND SHALL BE NO STEEPER THAN TWO HORIZONTAL TO ONE VERTICAL (2:1), UNLESS A DESIGN PROFESSIONAL CAN DEMONSTRATE TO THE PLANNING DIRECTOR SUBSTANTIAL EVIDENCE THAT STEEPER SLOPES ARE FEASIBLE, TAKING INTO ACCOUNT SAFETY, STABILITY, EROSION CONTROL, REVEGETATION AND OVERALL WATER QUALITY IMPACTS. SUBSURFACE DRAINAGE SHALL BE PROVIDED AS NECESSARY FOR STABILITY. ALL ENGINEERING REPORTS ARE SUBJECT TO REVIEW BY THE PLANNING DIRECTOR OR DESIGNEE.

B. FILL SLOPES SHALL BE NO STEEPER THAN IS SAFE FOR THE INTENDED USE AND SHALL BE NO STEEPER THAN TWO HORIZONTAL TO ONE VERTICAL (2:1), UNLESS A DESIGN PROFESSIONAL CAN DEMONSTRATE TO THE PLANNING DIRECTOR SUBSTANTIAL EVIDENCE THAT STEEPER SLOPES ARE FEASIBLE, TAKING INTO ACCOUNT SAFETY, STABILITY, EROSION CONTROL, REVEGETATION AND OVERALL WATER QUALITY IMPACTS. FILL SLOPES SHALL NOT BE CONSTRUCTED ON NATURAL SLOPES OF FORTY PERCENT (40%) (21/2 HORIZONTAL TO 1 VERTICAL) OR STEEPER, WITHOUT SPECIAL TREATMENT OR DESIGN. IN ADDITION, THE TOE OF FILL SLOPES SHALL NOT BE CLOSER TO THE TOP OF EXISTING OR PLANNED DOWNHILL CUT SLOPES THAN THE HEIGHT OF THAT CUT (E.G., IF AN 8 FOOT CUT IS PLANNED, THE TOE OF THE UPHILL FILL SLOPE SHALL NOT BE CLOSER THAN 8 FEET TO THE TOP OF THAT CUT), UNLESS THE DESIGN PROFESSIONAL HAS DEMONSTRATED THAT COMPARABLE STABILITY CAN BE ACHIEVED WITH LESSER SETBACKS.

C. PRIOR TO PLACEMENT OF FILL, THE GROUND SURFACE SHALL BE PREPARED TO RECEIVE FILL BY REMOVING VEGETATION, TOPSOIL, FOREST DUFF AND ANY OTHER UNSUITABLE MATERIAL. THE AREA TO RECEIVE FILL SHALL BE SCARIFIED TO PROVIDE A BOND WITH THE NEW FILL. FILL SHALL NOT BE PLACED UNTIL THE AREA IS PREPARED BY CONSTRUCTING A LEVEL OR SLIGHTLY INSLOPED TOE BENCH INTO COMPETENT MATERIAL AT THE BASE OF THE NEW FILL. THE PLANNING DIRECTOR MAY WAIVE THE BENCHING REQUIREMENT FOR MINOR FILLS WHICH ARE NOT INTENDED TO SUPPORT A ROAD, DRIVEWAY OR STRUCTURE WHERE THE PROJECT DESIGN PROFESSIONAL PROVIDES ADEQUATE EVIDENCE THE FILL IS NOT AT RISK FOR SLIPPAGE OR MOVEMENT. IN HIGH RISK AREAS WHERE SLOPES EXCEED FIFTEEN PERCENT (15%), OR WHERE HIGHLY EROSIVE SOILS, SEEPAGE AREAS OR KNOWN AREAS OF SUBSIDENCE EXIST, THE POSITION, WIDTH AND CONFIGURATION OF THE BENCH SHALL BE DETERMINED BY A DESIGN PROFESSIONAL. FILL SLOPES AND THE TRANSITION ZONE INTO NATURAL TERRAIN SHALL BE CONFIGURED TO A GENERALLY SMOOTH, PLANAR CONFIGURATION SO THAT RUNOFF TRAVERSES THE AREA AS SHEET FLOW AND IS NOT CONCENTRATED. FILL MATERIAL SHALL BE COMPOSED OF MINERAL SOIL THAT IS FREE OF ORGANIC MATERIAL. ROADWAY FILLS SHALL BE PLACED IN LIFTS AND COMPACTED TO A MINIMUM OF NINETY FIVE PERCENT (95%) OF THE MAXIMUM DENSITY AS DETERMINED BY THE AASHTO T-99 OR ASTM D-698 COMPACTION PROCEDURE, OR AS SPECIFIED IN THE DESIGN PROFESSIONAL'S REPORT.

D. EXCEPT WHERE ROADS OR DRIVEWAYS CROSS PROPERTY LINES, THE TOPS AND TOES OF CUT AND FILL SLOPES SHALL BE SET BACK FROM PROPERTY BOUNDARIES ONE-HALF (1/2) OF THE HEIGHT OF THE SLOPE WITH A MINIMUM OF FIVE FEET (5') AND A MAXIMUM OF TWENTY FEET (20'), UNLESS A DESIGN PROFESSIONAL HAS DEMONSTRATED TO THE PLANNING DIRECTOR THAT SMALLER SETBACKS PROVIDE A SUFFICIENT MEASURE OF SAFETY AND STABILITY FOR ACTIVITIES WHICH MAY OCCUR ON ADJACENT PROPERTY.

E. TERRACING SHALL BE REQUIRED ON ALL CUT OR FILL SLOPES WHICH EXCEED FIFTY FEET (50') IN HEIGHT. SPACING, WIDTH AND DRAINAGE REQUIREMENTS OF THE TERRACE SHALL BE DETERMINED BY A DESIGN PROFESSIONAL. (ORD. 501, 11-18-2008)

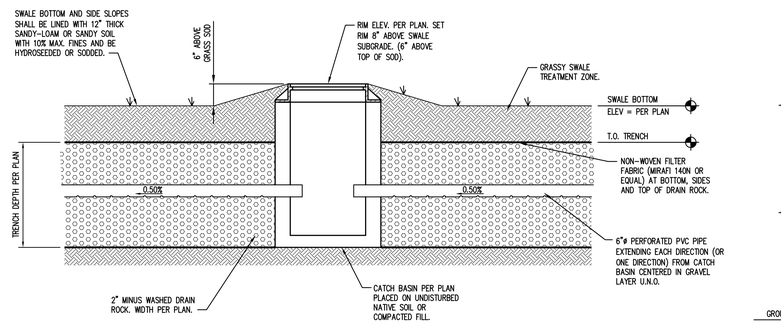
DATUM
ELEVATIONS ARE BASED ON NAVD-88 ESTABLISHED BY SUMMER POOL ELEV. STUDY & GPS OPUS SOLUTION.

SEE TOPOGRAPHIC SURVEY PREPARED BY STEARNS SURVEYING FOR ADDITIONAL INFORMATION.

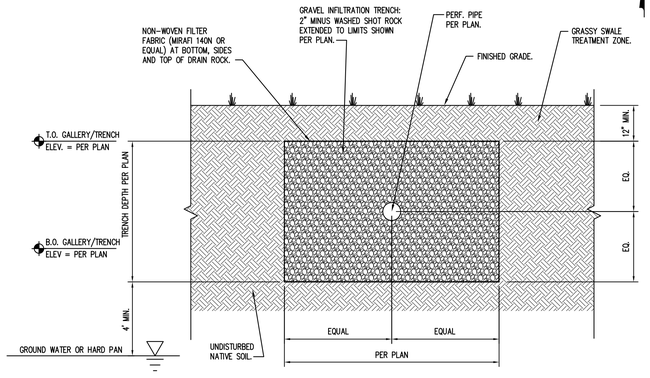
NOTE:
WITH THE EXCEPTION OF EXISTING GRADE CONTOUR ELEVATIONS, ALL ELEVATIONS SHOWN IN THESE DRAWINGS HAVE BEEN TRUNCATED TO TENS OR HUNDREDS VALUES. THE VALUE OF 2400 IS TO BE ADDED TO THE TRUNCATED NUMBERS TO OBTAIN ACTUAL ELEVATIONS.

IMPERVIOUS AREA CALCULATIONS:

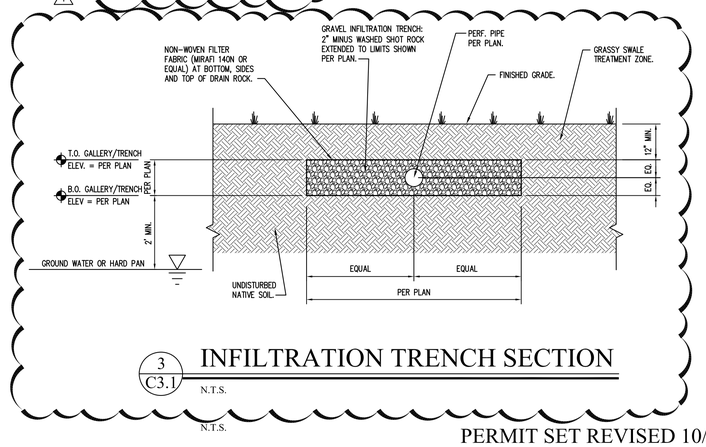
TOTAL ROOF AREA:	14,142 S.F.
TOTAL PAVED DRIVE AREA (NOT UNDER ROOF):	1,730 S.F.
TOTAL GRAVEL DRIVE AREA:	5,100 S.F.
TOTAL CONCRETE AREA (NOT UNDER ROOF):	119 S.F.
TOTAL IMPERVIOUS AREA:	21,091 S.F.



1 C3.1 INFILTRATION TRENCH SECTION
N.T.S.



2 C3.1 INFILTRATION TRENCH SECTION
N.T.S.



3 C3.1 INFILTRATION TRENCH SECTION
N.T.S.

UNDERGROUND SERVICE ALERT
ONE-CALL NUMBER
811
CALL TWO BUSINESS DAYS BEFORE YOU DIG

PERMIT SET REVISED 10/3/24

REV.	DATE	BY	DESCRIPTION
1	10/3/24	JRB	REVISIONS PER PLAN REVIEW COMMENTS

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CIVIL AND STRUCTURAL CONSULTING AND DESIGN
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SPOKANE, WASHINGTON 99202
(509) 534-3929 / FAX (509) 534-4014

JOB TITLE
DOUGLASS FAMILY RESIDENCE
BONNER COUNTY IDAHO

SHEET TITLE
GRADING/DRAINAGE PLAN - WEST

PROFESSIONAL ENGINEER REGISTERED 8146 STATE OF IDAHO JAY R. BONNETT
10/3/24

DATE: OCT, 2024
DRAWN BY: JRB
DESIGN BY: JRB
JOB NO.: 19-059.10
SHEET NO.: C3.1

BIO-INFILTRATION BASINS MAINTENANCE AND OPERATIONS

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance is Performed
General	Trash & Debris	Any trash and debris which exceed 5 cubic feet per 1,000 square feet (this is about equal to the amount of trash it would take to fill up one standard size garbage can). In general, there should be no visual evidence of dumping. If less than threshold, all trash and debris will be removed as part of next scheduled maintenance.	Trash and debris cleared from site.
	Poisonous/Noxious Vegetation	Any poisonous or nuisance vegetation which may constitute a hazard to maintenance personnel or the public. Any evidence of noxious weeds as defined by state or local regulations. (Apply requirements of adopted IPM policies for the use of herbicides).	No danger of poisonous vegetation where maintenance personnel or the public might normally be. (Coordinate with local health department) Complete eradication of noxious weeds may not be possible. Compliance with state or local regulations.
	Contaminants and Pollution	Any evidence of oil, gasoline, contaminants or other pollutants (Coordinate removal/cleanup with local water quality response agency).	No contaminants or pollutants present.
	Rodent Holes	Any evidence of rodent holes if facility is acting as a dam or berm, or any evidence of water piping through dam or berm via rodent holes.	Rodents destroyed, and dam or berm repaired. (Coordinate with local health department.)
Storage Area	Sediment	Water ponding in infiltration pond after rainfall ceases and appropriate time allowed for infiltration. (A percolation test pit or test of facility indicates facility is only working at 90% of its designed capabilities. If two inches or more sediment is present, remove).	Sediment is removed and/or facility is cleaned so that infiltration system works according to design.
Side Slopes of Pond	Erosion	Eroded damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion. Any erosion observed on a compacted berm embankment.	Slopes should be stabilized using appropriate erosion control measure(s); e.g., rock reinforcement, planting of grass, compaction. If erosion is occurring on compacted berms, a licensed civil engineer should be consulted.
Emergency Overflow Spillway	Erosion	Eroded damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion. Any erosion observed on a compacted berm embankment.	Slopes should be stabilized using appropriate erosion control measure(s); e.g., rock reinforcement, planting of grass, compaction. If erosion is occurring on compacted berms, a licensed civil engineer should be consulted.

DRAINAGE CALCULATIONS

BOWSTRING METHOD **Storm Event** **25**

DETENTION BASIN DESIGN

PROJECT: 21-059.10
BASIN: A
REVIEWER: JRB
DATE: 03-Oct-24

NUMBER OF DRYWELLS PROPOSED

0 Single (type 1) 0 Double (type 2)

Total Area (calc.)	0.28	
Time of Conc. (calc.)	5.00	
Composite "C" (calc.)	0.70	
Time of Conc. (min)		5.00
Area (Acres)		0.28
C' Factor		0.70
Impervious PGIS Area to Pond		**6769** sf
Roof Area		**1673** sf
Other areas		(see above right)
Outflow (cfs)		0.085
Area * C" Factor		0.20

Location: priest lake

m 9.09 n 0.626

#1 Time Inc. (min.)	#2 Time Inc. (sec.) (#1*60)	#3 Intensity (in./hr.)	#4 Q dev. (cfs) (A*C*#3)	#5 V in (cu. ft.)	#6 V out (cu. ft.) (Outf.*#2)	#7 Storage Req'd) (cu. ft.) (#5-#6)
5.00	300.00	3.32	0.65	262	25.42	237
5	300	3.32	0.65	262	25.416	237
10	600	2.15	0.42	297	50.832	246
15	900	1.67	0.33	328	76.248	252
20	1200	1.39	0.27	356	101.664	255
25	1500	1.21	0.24	381	127.08	254
30	1800	1.08	0.21	404	152.496	251
35	2100	0.98	0.19	425	177.912	247
40	2400	0.90	0.18	444	203.328	240
45	2700	0.84	0.16	462	228.744	233
50	3000	0.79	0.15	478	254.16	224
55	3300	0.74	0.15	494	279.576	215
60	3600	0.70	0.14	509	304.992	204
90	5400	0.54	0.11	587	457.488	130
120	7200	0.45	0.09	651	609.984	41
180	10800	0.35	0.07	754	914.976	-161
240	14400	0.29	0.06	838	1219.968	-382
300	18000	0.26	0.05	910	1524.96	-615
360	21600	0.23	0.04	973	1829.952	-857
420	25200	0.21	0.04	1030	2134.944	-1105
480	28800	0.19	0.04	1082	2439.936	-1358
540	32400	0.18	0.03	1130	2744.928	-1615
600	36000	0.17	0.03	1175	3049.92	-1875
660	39600	0.16	0.03	1218	3354.912	-2137
720	43200	0.15	0.03	1258	3659.904	-2402

DRAINAGE POND CALCULATIONS

Required grassy swale treatment volume:
Basic Method: V = A * .5"/12 — **282 cu. ft.** — OK
Provided treatment volume (pond bot. to outlet) = **298 cu. ft.**

INFILTRATION REQUIREMENTS - 25 YEAR DESIGN STORM

Maximum storage required by Bowstring = **255 cu. ft.** — OK
Provided 25-yr total storage volume = **862 cu. ft.**

Number and type of Drywells Required = 0 Single 0 Double

TIME OF CONCENTRATION (minutes)

Tc (sheet flow)		Tc (gutter)	
K (lawn) =	420	K (gutter) =	2400
L(A) =	50	L(gu) =	0.01
S(A) =	0.015	S(gu) =	0.008
Tc (A) =	0.97	Tc (gu) =	0.00
K (ACP) =	1200	Tc (gu) =	0.00
L(B) =	0.01	Tc (A+B) =	0.97
S(B) =	0.015	Tc (total) =	5.00
Tc (B) =	0.00	Intensity =	3.32

Drywell Outflow Rates

A	0.00000
B	0.00000

AREA SUMMARY

	Areas (AC)	Area (SF)	"C"	A*C
SITE	0.281	12245.00	--	--
Asphalt/gravel drive	0.100	4356.00	0.90	0.090
PGIS Roof	0.038	1673.00	0.90	0.035
Attached Concrete	0.017	740.00	0.90	0.015
Detached Concrete	0.000	0.00	0.90	0.000
non-PGIS Roof	0.000	0.00	0.90	0.000
Landscape	0.126	5476.00	0.45	0.057
Undisturbed	0.000	0	0.25	0.000

Total Area		Comp "C"
0.28	24490	0.69875868

Q (total) = C*I*$A_{(total)}$ = 0.65 cfs

Q (imp) = C*I*$A_{(imp)}$ = 0.46 cfs

	AREA			DEPTH		VOLUME	
POND	**BOTTOM**	**208**	**STORM**	**208**	**STORM**	**208**	**STORM**
A	504.2	689.2	888.4	0.5	1	298	696
						0	0
						0	0
					TOTAL	298	696

NOTE: THE TREATMENT AREA LISTED ABOVE IS THE AREA LOCATED ABOVE THE POND FLOOR AT THE "OUTLET ELEV" AND INCLUDES THE POND SIDE SLOPES.
VOL. BELOW OUTLET CALC. = [(BTM AREA + TREATMENT AREA) / 2] X OUTLET ELEV.

INFILTRATION GALLERY

Chambers	L	W	D	BOTTOM AREA	SIDE AREA	END AREA	INFILTRATION RATE	Total Infil. Area	Outflow Rate	FS
1				138	568	0	1.20E-04	706	8.47E-02	1

Volume 552 CF
Void % 0.3
165.6 CF

Gravel Gallery
L = 69
W = 2
D = 4

Bot. Area 138 sf
Side Area 568 sf

Tank needed:
None gal

Rock Volume
20 CY

BOWSTRING METHOD **Storm Event** **25**

DETENTION BASIN DESIGN

PROJECT: 21-059.10
BASIN: B
REVIEWER: JRB
DATE: 03-Oct-24

NUMBER OF DRYWELLS PROPOSED

0 Single (type 1) 0 Double (type 2)

Total Area (calc.)	0.14	
Time of Conc. (calc.)	5.00	
Composite "C" (calc.)	0.55	
Time of Conc. (min)		5.00
Area (Acres)		0.14
C' Factor		0.55
Impervious PGIS Area to Pond		**1329** sf
Roof Area		**1329** sf
Other areas		(see above right)
Outflow (cfs)		0.094
Area * C" Factor		0.08

Location: Priest Lake

m 9.09 n 0.626

#1 Time Inc. (min.)	#2 Time Inc. (sec.) (#1*60)	#3 Intensity (in./hr.)	#4 Q dev. (cfs) (A*C*#3)	#5 V in (cu. ft.)	#6 V out (cu. ft.) (Outf.*#2)	#7 Storage Req'd) (cu. ft.) (#5-#6)
5.00	300.00	3.32	0.26	105	28.30	76
5	300	3.32	0.26	105	28.296	76
10	600	2.15	0.17	118	56.592	62
15	900	1.67	0.13	131	84.888	46
20	1200	1.39	0.11	142	113.184	29
25	1500	1.21	0.09	152	141.48	11
30	1800	1.08	0.08	161	169.776	-9
35	2100	0.98	0.08	169	198.072	-29
40	2400	0.90	0.07	177	226.368	-49
45	2700	0.84	0.07	184	254.664	-71
50	3000	0.79	0.06	191	282.96	-92
55	3300	0.74	0.06	197	311.256	-114
60	3600	0.70	0.05	203	339.552	-136
90	5400	0.54	0.04	234	509.328	-275
120	7200	0.45	0.04	260	679.104	-419
180	10800	0.35	0.03	301	1018.656	-718
240	14400	0.29	0.02	334	1358.208	-1024
300	18000	0.26	0.02	363	1697.76	-1335
360	21600	0.23	0.02	388	2037.312	-1649
420	25200	0.21	0.02	411	2376.864	-1966
480	28800	0.19	0.01	431	2716.416	-2285
540	32400	0.18	0.01	451	3055.968	-2605
600	36000	0.17	0.01	469	3395.52	-2927
660	39600	0.16	0.01	486	3735.072	-3250
720	43200	0.15	0.01	502	4074.624	-3573

DRAINAGE POND CALCULATIONS

Required grassy swale treatment volume:
Basic Method: V = A * .5"/12 — **55 cu. ft.** — OK
Provided treatment volume (pond bot. to outlet) = **183 cu. ft.**

INFILTRATION REQUIREMENTS - 25 YEAR DESIGN STORM

Maximum storage required by Bowstring = **76 cu. ft.** — OK
Provided 25-yr total storage volume = **650 cu. ft.**

Number and type of Drywells Required = 0 Single 0 Double

TIME OF CONCENTRATION (minutes)

Tc (sheet flow)		Tc (gutter)	
K (lawn) =	420	K (gutter) =	2400
L(A) =	50	L(gu) =	0.01
S(A) =	0.015	S(gu) =	0.008
Tc (A) =	0.97	Tc (gu) =	0.00
K (ACP) =	1200	Tc (gu) =	0.00
L(B) =	0.01	Tc (A+B) =	0.97
S(B) =	0.015	Tc (total) =	5.00
Tc (B) =	0.00	Intensity =	3.32

Drywell Outflow Rates

A	0.00000
B	0.00000

AREA SUMMARY

	Areas (AC)	Area (SF)	"C"	A*C
SITE	0.144	6253.00	--	--
Asphalt/gravel drive	0.000	0.00	0.90	0.000
PGIS Roof	0.031	1329.00	0.90	0.027
Attached Concrete	0.000	0.00	0.90	0.000
Detached Concrete	0.000	0.00	0.90	0.000
non-PGIS Roof	0.000	0.00	0.90	0.000
Landscape	0.113	4924.00	0.45	0.051
Undisturbed	0.000	0	0.25	0.000

Total Area		Comp "C"
0.14	12506	0.54564209

Q (total) = C*I*$A_{(total)}$ = 0.26 cfs

Q (imp) = C*I*$A_{(imp)}$ = 0.09 cfs

	AREA			DEPTH		VOLUME	
POND	**BOTTOM**	**208**	**STORM**	**208**	**STORM**	**208**	**STORM**
B	274.6	458.3	656	0.5	1	183	465
						0	0
						0	0
					TOTAL	183	465

NOTE: THE TREATMENT AREA LISTED ABOVE IS THE AREA LOCATED ABOVE THE POND FLOOR AT THE "OUTLET ELEV" AND INCLUDES THE POND SIDE SLOPES.
VOL. BELOW OUTLET CALC. = [(BTM AREA + TREATMENT AREA) / 2] X OUTLET ELEV.

INFILTRATION GALLERY

Chambers	L	W	D	BOTTOM AREA	SIDE AREA	END AREA	INFILTRATION RATE	Total Infil. Area	Outflow Rate	FS
1				154	632	0	1.20E-04	786	9.43E-02	1

Volume 616 CF
Void % 0.3
184.8 CF

Gravel Gallery
L = 77
W = 2
D = 4

Bot. Area 154 sf
Side Area 632 sf

Tank needed:
None gal

Rock Volume
23 CY

BOWSTRING METHOD **Storm Event** **25**

DETENTION BASIN DESIGN

PROJECT: 21-059.10
BASIN: C
REVIEWER: JRB
DATE: 03-Oct-24

NUMBER OF DRYWELLS PROPOSED

0 Single (type 1) 0 Double (type 2)

Total Area (calc.)	0.59	
Time of Conc. (calc.)	5.00	
Composite "C" (calc.)	0.69	
Time of Conc. (min)		5.00
Area (Acres)		0.59
C' Factor		0.69
Impervious PGIS Area to Pond		**13600** sf
Roof Area		**12855** sf
Other areas		(see above right)
Outflow (cfs)		0.102
Area * C" Factor		0.40

Location: Priest Lake

m 9.09 n 0.626

#1 Time Inc. (min.)	#2 Time Inc. (sec.) (#1*60)	#3 Intensity (in./hr.)	#4 Q dev. (cfs) (A*C*#3)	#5 V in (cu. ft.)	#6 V out (cu. ft.) (Outf.*#2)	#7 Storage Req'd) (cu. ft.) (#5-#6)
5.00	300.00	3.32	1.34	539	30.46	509
5	300	3.32	1.34	539	30.456	509
10	600	2.15	0.87	610	60.912	549
15	900	1.67	0.67	675	91.368	584
20	1200	1.39	0.56	733	121.824	611
25	1500	1.21	0.49	784	152.28	632
30	1800	1.08	0.44	831	182.736	648
35	2100	0.98	0.40	873	213.192	660
40	2400	0.90	0.36	913	243.648	669
45	2700	0.84	0.34	949	274.104	675
50	3000	0.79	0.32	984	304.56	679
55	3300	0.74	0.30	1017	335.016	682
60	3600	0.70	0.28	1048	365.472	682
90	5400	0.54	0.22	1208	548.208	660
120	7200	0.45	0.18	1339	730.944	608
180	10800	0.35	0.14	1551	1096.416	455
240	14400	0.29	0.12	1723	1461.888	261
300	18000	0.26	0.10	1871	1827.36	43
360	21600	0.23	0.09	2001	2192.832	-192
420	25200	0.21	0.08	2118	2558.304	-440
480	28800	0.19	0.08	2225	2923.776	-698
540	32400	0.18	0.07	2325	3289.248	-965
600	36000	0.17	0.07	2417	3654.72	-1237
660	39600	0.16	0.06	2504	4020.192	-1516
720	43200	0.15	0.06	2587	4385.664	-1799

DRAINAGE POND CALCULATIONS

Required grassy swale treatment volume:
Basic Method: V = A * .5"/12 = **567 cu. ft.** OK
Provided treatment volume (pond bot. to outlet) = **581 cu. ft.**

INFILTRATION REQUIREMENTS - 25 YEAR DESIGN STORM

Maximum storage required by Bowstring = **682 cu. ft.** OK
Provided 25-yr total storage volume = **801 cu. ft.**

Number and type of Drywells Required = 0 Single 0 Double

TIME OF CONCENTRATION (minutes)

Tc (sheet flow)		Tc (gutter)	
K (lawn) =	420	K (gutter) =	2400
L(A) =	50	L(gu) =	0.01
S(A) =	0.015	S(gu) =	0.008
Tc (A) =	0.97	Tc (gu) =	0.00
K (ACP) =	1200	Tc (gu) =	0.00
L(B) =	0.01	Tc (A+B) =	0.97
S(B) =	0.015	Tc (total) =	5.00
Tc (B) =	0.00	Intensity =	3.32

Drywell Outflow Rates

A	0.00000
B	0.00000

AREA SUMMARY

	Areas (AC)	Area (SF)	"C"	A*C
SITE	0.586	25506.00	--	--
Asphalt/gravel drive	0.017	745.00	0.90	0.015
PGIS Roof	0.295	12855.00	0.90	0.266
Attached Concrete	0.000	0.00	0.90	0.000
Detached Concrete	0.000	0.00	0.90	0.000
non-PGIS Roof	0.000	0.00	0.90	0.000
Landscape	0.273	11906.00	0.45	0.123
Undisturbed	0.000	0	0.25	0.000

Total Area		Comp "C"
0.59	51012	0.68994354

Q (total) = C*I*$A_{(total)}$ = 1.34 cfs

Q (imp) = C*I*$A_{(imp)}$ = 0.93 cfs

	AREA			DEPTH		VOLUME	
POND	**BOTTOM**	**208**	**STORM**	**208**	**STORM**	**208**	**STORM**
C	2215	2430	2430	0.25	0.25	581	581
						0	0
						0	0
					TOTAL	581	581

NOTE: THE TREATMENT AREA LISTED ABOVE IS THE AREA LOCATED ABOVE THE POND FLOOR AT THE "OUTLET ELEV" AND INCLUDES THE POND SIDE SLOPES.
VOL. BELOW OUTLET CALC. = [(BTM AREA + TREATMENT AREA) / 2] X OUTLET ELEV.

INFILTRATION GALLERY

Chambers	L	W	D	BOTTOM AREA	SIDE AREA	END AREA	INFILTRATION RATE	Total Infil. Area	Outflow Rate	FS
1				735	111	0	1.20E-04	846	1.02E-01	1

Volume 735 CF
Void % 0.3
220.5 CF

Gravel Gallery
L = varies
W = varies (average)
D = 1

Bot. Area 735 sf
Side Area 111 sf

Tank needed:
None gal

Rock Volume
27 CY