505 VERMEER DRIVE
COMMERCIAL SITE PLAN DESIGN REPORT
2020

NOVEMBER 6

7B ENGINEERING
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DESIGN REPORT

SITE, GRADING, STORMWATER & EROSION CONTROL PLAN

For

RPP36990010060A aka **505 Vermeer Drive**, Ponderay, ID 83852
Ponderay Business Park Blk 1 Lot 6 Section 2, Township 57 North, Range 2 West,
Boise Meridian, Bonner County, Ponderay, Idaho

Figure 1: Vicinity Map

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Soils Information and Map
Modified Rational Calculations for Stormwater
Owner Information/Building Floor Plan – supplied by owner
Engineers Cost Estimate for Sidewalk

Introduction

This report has been prepared to address design required by the City of Ponderay for a site plan application on 0.322 acres at 505 Vermeer Drive in Ponderay, Idaho for Burnett Electric Inc. More specifically, this Site, Grading, Stormwater, and Erosion Control Plan addresses site requirements to construct a new commercial/industrial building.

Approximately a 4,000 SF building and a 6,470 SF parking lot will be constructed. Stormwater runoff ,after treatment and detention, will be directed to existing stormwater swale along the west side of the property This report, calculations, and drawings are for review by the City of Ponderay and shall become the property of the Owner when approved for construction. All other requirements for any future building permits must be met by the Owner. This report addresses design requirements of the City.

Project Location

The site is located on the west side of Vermeer Drive close to Vermeer Court (see Figure 1). Property Identification Numbers: RPP36990010060A aka Ponderay Business Park Block 1 Lot 6 in Section 2, Township 57 North, Range 2 West, Boise Meridian, Bonner County, City of Ponderay, Idaho.

Location:	**Property owner:**	**Size of Lot:**
Section 2, T57N, R2W	Burnett Electric Inc	0.322 Acres

Geotechnical

The USDA NRCS Web Soil Survey was used to categorize the soil characteristics at this site. A site visit confirmed the findings of the NRCS and the soils appeared to be consistent with the Survey. In general, the site consists of Odenson silt loams, soils in Hydrologic group B/D. These soils have a low infiltration rate (high runoff potential), are very deep and very poorly drained. These consist chiefly of volcanic ash and loess.

Soil amendment and underdrains (where feasible) are recommended for any infiltration treatment design. All required testing and inspections will be coordinated by the Owner and Contractor and/or his representative and will be submitted to the Engineer if required at the completion of construction.

Water System

The city of Sandpoint supplies water to the site.

Sewer System

The site is currently served by the Kootenai-Ponderay Sewer District.

Road Specifications

Vermeer Drive is a publicly owned and maintained roadway.

Stormwater Facility Description and Calculations

In general, this project disturbs a very small amount of area sloping less than 5 percent. All new impervious surface areas are required to be treated by grassed infiltration areas per the City of Ponderay. No other Best Management Practices from the DEQ Stormwater Catalog (Catalog, 2005) are considered. To treat the impervious runoff from the parking lot and building, only grassed infiltration and detention areas are proposed. The GIAs shown are sized to capture the first ½" of runoff from the site for treatment and detention requirements.

Hydrology and Hydraulics

To protect the drainage and downstream properties from hazardous runoff flooding, the Rational method was used for stormwater calculations. The peak runoff for the pre-developed design storms using the Idaho Intensity/Duration/Frequency curves for the 25-year and 50-year storms were compared to the post-developed peak runoff rates.

Contributing runoff to the site was determined by a site visit and topographical survey. Rainfall amounts were taken from the NOAA Isopluvial precipitation maps for Idaho and the IDF curve for a 25-year and 50-year design events. Downstream of this basin, is existing stormwater system that empties into a wetland/pond area north of this property.

The GIAs are sized for treatment as well as detention of all new on-site impervious areas for the 25-Year and 50-Year runoff events. However, the swale must accommodate off-site flow, so it is primarily sized for the 50-Year, 24-Hour peak storm event. A summary of the stormwater calculations are presented in Table 1.

Table 1: Stormwater Basin Summary

Stormwater Basin Summary				
Basin	**Area (SF)**	**CN**	**24-Hr Peak Flow (CFS)**	**Required Detention Volume (CF)**
50-Year (Existing)	108,900	87	0.16	N/a
50-Year (Proposed)	108,900	94	0.18	1,190
25-Year (Existing)	28,955	83	0.03	N/a
25-Year (Proposed)	28,955	91	0.05	1,022

All stormwater discharges through swale on the property.

Treatment Calculations

In general, more treatment volume is provided in the design than is required for the improvements shown. Table 2 below summarizes the treatment design calculations for the required first ½ inch of runoff from new impervious surface areas created by the project.

Table 2: Treatment Volume Summary

Treatment Summary			
Facility	**Impervious Area (SF)**	**Volume Required (CF)**	**Volume Proposed (CF)**
Existing	11,779	491	643
Proposed	11,867	474	557
Total	**23,646**	**965**	**1200**

Existing site impervious area is the neighbor's driveway and roof shed. The proposed stormwater treatment combined area is about 1800 SF at 8" depth.

The treatment volumes were found using the following calculations:

- **Treatment Volume** was calculated with the following equation:

$$(V_{treatment}\ cf) = (A_{impervious}\ sf) \times \left[\left(\frac{1}{2} in \text{ of runoff}\right) \times \left(\frac{1ft}{12in}\right)\right]$$

- **Treatment Area** was calculated with the following equation:

$$(A_{treatment}\ sf) = (V_{swale}\ cf) \div [\text{Depth of Swale in } ft]$$

*Note: Maximum treatment depth is 6" from the bottom of Swale/Grassed Infiltration Area for residential and **8" for Commercial or Industrial**. However, Swales or GIAs may be deeper where additional detention is required.*

- **Infiltration Disposal Rate** was calculated with the following equation:

$$(Q_{infiltrate}\ CFS) = (A_{swale}\ sf) \times (f_{swale}\ \frac{in}{hr}) \times \left(\frac{1\ ft}{12\ in}\right) \times \left(\frac{1\ hr}{360\ sec}\right)$$

where f_{swale} is the Infiltration Rate assumed or proposed for a given soil.

- **Manning's Equations**:

$$Q = VA \qquad V = \frac{k}{n}\left(\frac{A}{P}\right)^{2/3} S^{1/2}$$

Where:

k is a unit conversion factor:
k=1.49 for English units (feet and seconds).
k=1.0 for SI units (meters and seconds).
A = Flow area of the pipe, culvert, or channel.
P = Wetted perimeter (the portion of the circumference that is in contact with water).
Q = Discharge (flow rate).
S = Downward (longitudinal) slope of the culvert, pipe, or channel.
V = Average velocity in the pipe, culvert, or channel.

It is assumed that the topsoil layer of facility will be properly modified for infiltration and plant growth as detailed in the section below. An infiltration rate of 1 to 3 inches is desirable. For this analysis, a rate of 2 in/hr is assumed. An underdrain is included so that the stormwater facility could meet the required infiltration rate.

- **Underdrain Pipe Capacity Calculation:**

$$(A_{swale}\ sf) = (1800\ sf)$$

$$(Q_{infiltrate}\ cfs) = (1{,}800\ sf) \times (2_{swale}\ \tfrac{in}{hr}) \times \left(\tfrac{1\ ft}{12\ in}\right) \times \left(\tfrac{1\ hr}{3600\ sec}\right) = \mathbf{0.0833\ cfs}$$

From commonly available nomographs for smooth interior pipe (Manning's "n" of 0.012), a 8" pipe at 0.27% slope **has a capacity of 0.75 cfs at a velocity of 2 fps**. This capacity chart is included in the Appendices but is based on Manning's Equation.

Using classic Rational Method, a 25-Year, 5-minute storm event would produce the following runoff to be collected by the 8" underdrain pipe.

$$(Q_{peak}) = CiA$$

$$(Q_{peak}) = 0.90(2.8)(\tfrac{11{,}370sf}{43560\ sf/ac}) = \mathbf{0.66\ cfs}$$

This is below the capacity of a 8" smooth interior pipe installed at 0.27% slope. However, combined with the treatment flow rate, the desired flushing velocity of 2fps within the pipe might be achieved. Otherwise, inlets are provided in the design to allow flushing and cleaning of the system (if needed).

Stormwater Facility Construction and Maintenance

The facilities shown on these plans are intended to be constructed as a bioinfiltration facility (Grassed Infiltration Area or Raingarden). Two options are presented here but are not intended to be exhaustive. The Owner should choose to construct either a GIA (grassed and requires regular maintenance) or a Raingarden (requires more plantings but little maintenance).

Constructions considerations

Grassed Infiltration Area (Common GIA):

GIA's are commonly seen as depressed grassy areas or swales free of invasive weeds, shrubs, or trees. They use soils and a compact root zone (typically from grass) to remove stormwater pollutants. They require frequent mowing and light maintenance (see below).

1) Grass or sod may be used but should be a species adapted to permeable soils. Avoid grass intended for clay soils or sod grown on clay.
2) Soil should be less than 25% clay, 3 to 5% organic material, and at least 60% sand.
3) Apply compost at a depth of 3 inches over area and till to 8-inch depth.
4) Scarify facility subgrade to 12-inch depth before planting. DO NOT COMPACT.
5) Grass height should be kept at 3 inches to 9 inches and all grass clippings removed.
6) Sediment should be removed when it begins to inhibit the growth of grass.

Bioretention (Raingarden):

Bioretention facilities (or Raingardens) use soils and both woody and herbaceous plants to remove pollutants. They require little or no maintenance (unless obvious failure occurs) but are more expensive to construct. Raingardens are ½ to 1/3 the area of a GIA to treat the same volume. This does not change the required stormwater detention volume shown above.

1) Scarify native soil at subgrade and place 18-inches of sand at the bottom of the facility.

2) Topsoil should be less than 25% clay, 8-9% organic material, and at least 60% sand 2 ft to 4 ft thick.
3) Place a 3-inch layer of mulch over the topsoil to line the pond before planting.
4) A mixture of trees, shrubs, and grass is preferred.
5) Water-loving plantings should be chosen (Alder, Willow, Ash, Dogwood, Sedges, etc.) or ponding depth should be limited to 6 inches.
6) Infiltration rates should not exceed 9 inches per hour.
7) Undesirable ponding may occur on some native soils and underdrains may be required.

Maintenance Requirements

Inspect the constructed facility monthly and between large storm events for the first year. After the facility is established and working as designed, inspect in the spring and fall. Remove any dead or diseased vegetation and replant as needed. Mulch any bare spots at inspection and the entire facility every 2 to 3 years.

Water standing for more than 4 days after a storm when temperatures are above 50 degrees Fahrenheit may indicate a problem with the facility. Sediment removal and scarification of the topsoil or subgrade may be required. In extreme cases, soils may need to be replaced.

In addition to the treatment/filtration facility required to treat the driving surfaces, the treatment swale must be kept clean and clear to allow snow storage and stormwater floaters.

Erosion and Sediment Control BMP's

In general, this project disturbs 0.322 acres with an average slope of 2 percent. By constructing through the summer month, much of the maintenance needed on slopes with these soils can be avoided. A simple erosion control plan is presented here and shown on the plans, consisting primarily of fiber rolls, compost berms, and maintaining existing vegetation. Care must be taken by the Contractor to practice additional erosion control measures if needed.

To properly construct this project, approximately 0.322 Acres will be disturbed, including:

- Site Grading (Parking lot) and Utility Construction
- Building Pad
- Fine grading of landscape and stormwater facilities

All disturbed exposed areas will be covered with suitable topsoil, mulched, and either landscaped or re-vegetated on slopes 3:1 or less. Slopes steeper than 2:1 will be stabilized with stone mulch, riprap or boulders.

Temporary Erosion and Sediment Controls

All temporary erosion control features shall be installed and maintained as detailed and shall prevent stormwater runoff or sediment migration off-site. Barriers shall be placed perpendicular to the direction of flow and shall be deployed before construction begins. Leave all temporary stormwater and erosion control measures in place until vegetation has been re-established. Construct silt fence, compost berms, or fiber rolls where overland flow may allow runoff to leave the construction site or enter the neighboring properties. Mulching of disturbed, final graded areas can be done with hay, straw, wood chips, or grass clippings (8-10 pounds per 100 sf).

Timing of Construction

Construction activities for this site grading will proceed as follows:

Construction Schedule	Timing
Excavation and grading	Apr-21
Utility Construction	Apr-21
Finish grade bioswales and landscape areas	May-21
Reseed slopes and distrubed areas	May-21
Building Construction	May-21

By constructing in the dry season, the risk of sediment laden runoff is minimized and the sequence of construction will occur during optimal conditions. The Owner and Contractor shall continually monitor the site conditions and progress of the work, keeping erosion control measures in good repair.

Staging Areas

Equipment will be staged on the property and adjacent to the right-of-way that is undeveloped, ensuring any runoff from equipment or vehicles has adequate time for treatment. No dikes, berms or grading of staging areas is warranted or proposed.

Preservation of Existing Vegetation

Preserve all vegetation (trees and grass) not within the areas to be graded and minimize bare soil exposure. Grading activity areas shall be limited to those shown on the Plan. Keep all construction equipment, materials, and waste within the areas designated on the Plan and out of areas to be preserved.

Clearing Limits

Minimize the total area of bare soil exposed to 1 acre and cover with straw or stone mulch within 14 days of disturbance. Mulch slopes and cover exposed driveway surfaces with rock as grading progresses to reduce dust and erosion potential. Do not disturb areas outside of the grading limits established by the Plan. At the end of construction, prepare all slopes and landscape areas for seeding or include seed in the erosion control mulch used.

Mulching

Apply straw, grass, grass hay, compost, wood chips, or wood fibers onto exposed soils leaving no more than 1 acre exposed for no more than 14 days. Driveway graded surfaces should be mulched or covered by aggregate as soon as practical to prevent erosion and reduce dust. Slopes steeper than 2:1 may require netting or tacking agents to hold mulch in place.

If wood chips or fibers are used, especially if obtained by chipping trees or stumps on the site, limit use to slopes under 6%. If vegetation is desired, treat chipped areas with a nitrogen fertilizer to aid plant germination and growth – otherwise wood chips tent to reduce growth of undesirable plants.

Use wood or stone mulches in areas that are not desirable to mowed or maintain. Bark chips in particular should not be used on sloped areas as they tend to be carried away by spring runoff.

Gravel or crushed rock placed as mulch should be placed at 10 tons / 0.10 acre (4,400 sf) at a depth of 3 inches (average). Use where subject to traffic or on slopes where maintenance of vegetation is not desired.

Hay or straw mulch should be free of unwanted seeds and applied at 2 or 3 bales per 1,100 sf of exposed soil at a depth of 2 to 3 inches in a uniform mat. No more than 40% of the original ground or exposed soils should be visible through the mat. Netting or tacking agents may be needed on slopes exposed to wind or steeper than 2:1.

Wood fiber mulches should be used where plant growth is to be inhibited, particularly on slopes steeper than 3:1 where mowing or maintenance of vegetation is not desired. If used in areas where growth is to be encouraged, nitrogen treatment will be needed. Apply to an average depth of 3 inches or about 25 lbs per 1,000 sf.

Compost used as mulching should be applied to the Grassed Infiltration Area and any other areas where growth (grasses) is desired. Apply compost at a depth of 3 inches over areas where seeding is to be done.

Inspect all mulched areas weekly and repair any damaged or exposed soils immediately. Mulching should cease once vegetation is re-established.

Fiber Rolls

A fiber roll (wattle/compost-filled socks) consists of straw, flax, or other similar materials bound into a biodegradable tubular plastic or similar encasing material. Fibers rolls should be placed along a contour unless otherwise shown in plans. For slope inclinations 2:1 or greater, fiber rolls should be placed a maximum interval of 10 ft. When placing, turn the ends of the fiber roll up slope to prevent runoff from going around the roll. If more than one wattle is placed in a row, the rolls shall be overlapped a minimum of 12 inches. Maintain rolls daily during extended rain events, after rain events, and two-week intervals during dry season. Sediment shall be removed when sediment accumulation reaches one-half of the exposed height of the roll.

Temporary Berms

A berm or ridge of compacted soil, compost, or sandbags which is created to intercept and divert runoff from small construction areas. They are often constructed along the top edge of a fill slope but may also be constructed along a roadway, across a roadway (a transverse berm) at an angle with the centerline.

Temporary berms are used to direct or divert runoff flow from newly constructed slopes until vegetation is established or other permanent measures are in place. They intercept the stormwater flow from the construction area and direct it to temporary slopes drains or protected outlets for safe discharge. They can also be used as barriers to collect and store runoff. They can be used at storm drain inlets, across minor ditches or swales, or other areas where the structure is temporary.

Soil berms have an approximate height of 12 to 20 inches with a minimum top width of 2 to 3 feet and side slopes of 2:1 or flatter. Berms should be high enough to prevent flow from overtopping and are normally constructed of embankment materials. Grade to drain to a slope or drain inlet. Compact the entire width of the berm with a bulldozer or loader/grader wheels.

Compost berms act as filter berms and are most effective when constructed 1 foot high by 2 feet wide or 1.5 feet high and 3 feet wide. Construct with 25-100% organic matter with particles not to exceed 3-inches thick or 6-inches long. Particle gradation should also be 90-100% passing a 1-in. filter, 70-100% passing the ¾ inch filter, and 30%-75% passing the ¼ inch filter.

Sandbag berms have the following dimensions

- Height: 20 in. minimum
- Top Width: 20 in. minimum
- Bottom Width: 4-1/4 to 5 feet
- Sandbag size – length 2 -2.6 ft, width 16-20 in., depth or thickness 6-8 inches. and weight 88 to 132 lbs.

Install so that flow between bags is prevented. Stack bags in an interlocking fashion but no more than 3 bags high without widening the base. Can be used to impound the volume of the design storm.

Permanent Erosion Controls
After construction is complete, all exposed soils shall be covered by a minimum of 3-inches topsoil or mulch. Areas to be vegetated will be seeded, planted, or landscaped. Slopes in excess of 2:1 shall be armored with rip-rap or covered with topsoil, seeding, mulch, and matt.

Seeding and mulching shall not be applied to areas of standing water. Mulch shall be applied at a rate of 8-10 pounds per 100 square feet (2" – 3" thick when loose) with a maximum of 20% of original ground noticeable. Slopes in excess of 3:1 which are not rip-rapped shall be covered with Jute matting or hydro-seeded for stability of seed bed.

Plant List
Refer to Bonner County Code Title 12, Appendix B - North Idaho Native and Beneficial Plant List.

Proposed Supplementary Conditions

The following are proposed & recommend conditions to help achieve site approval by the City of Ponderay.

Sidewalk
The owner requests to pay a fee in lieu for sidewalk construction because there are no sidewalks adjacent of the project. A stormwater drainage ditch and public utilities also makes the installation of the sidewalk unreasonable on the property. Please see the attached engineers estimated value.

Setback
A proposed sideyard setback reduction of five feet is requested by owner. A letter of support from both owners has been suggested.

Operation and Maintenance Plan

Temporary and Permanent Erosion and Stormwater control measures will be the responsibility of the Owner:

Inspection Schedule & Maintenance Activities

As described above, both temporary and permanent erosion and sediment control measures should be inspected by the Owner and/or Contractor. Below is an inspection schedule table for convenience.

Stormwater Feature or Erosion Control Measure	Inspection Frequency	Maintenance Activities
Mulching	Weekly & following major rain event	Mulch exposed soil
Fiber Rolls	Weekly & following major rain event	Repair and remove sediment
Temporary Berms	Weekly & following major rain event	Repair or Replace as needed.
Treatment and Detention Facility	Monthly the first year and bi-annually thereafter	Mulch exposed soil and mulch cell every 2 to 3 years

In conclusion, I find that the proposed permanent improvements if properly constructed and maintained as described herein and shown on the Plans, will treat and detain the additional runoff to be generated with the future construction of the roadway and buildings on these properties.

References

Catalog, I. S. (2005). *http://www.deq.idaho.gov/media/622263-Stormwater.pdf.* Retrieved from deq.idaho.gov: http://www.deq.idaho.gov/media/622263-Stormwater.pdf

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NOAA Atlas 2. (1973). *Precipitation Frequency Isopluvials.* NOAA.

Thomas J. Glover and Richard A. Young. (2001-2017). *Handyman In-Your-Pocket.* Anchorage, Alaska, U.S.A.: Sequoia Publishing, Inc.

U.S. Environmental Protection Agency. (September, 2004). *Stormwater Best Management Practice Design Guide: Volume 1 General Considerations.* Washington DC: Office of Research and Development.

Soil Map—Bonner County Area, Idaho, Parts of Bonner and Boundary Counties

Map Scale: 1:260 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 3 7 14 21

Feet: 0 10 20 40 60

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 16, Jun 4, 2020

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

Date(s) aerial images were photographed: Aug 15, 2010—Aug 23, 2016

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
34	Odenson silt loam, 0 to 2 percent slopes	0.3	100.0%
Totals for Area of Interest		**0.3**	**100.0%**

Bonner County Area, Idaho, Parts of Bonner and Boundary Counties

34—Odenson silt loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 5465
Elevation: 2,000 to 3,000 feet
Mean annual precipitation: 25 to 38 inches
Mean annual air temperature: 43 to 46 degrees F
Frost-free period: 80 to 120 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Odenson and similar soils: 70 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Odenson

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Volcanic ash and loess over silty glaciolacustrine deposits

Typical profile

A - 0 to 9 inches: silt loam
2Bg - 9 to 18 inches: silty clay loam
2Bgk - 18 to 35 inches: silty clay loam
3Cg - 35 to 46 inches: silt loam
4Cgk - 46 to 57 inches: silty clay
5Cg - 57 to 60 inches: very fine sandy loam
6Cgk - 60 to 62 inches: silty clay
7Cg - 62 to 65 inches: silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: About 6 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Available water storage in profile: High (about 11.0 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Hydric soil rating: Yes

Minor Components

Pywell

Percent of map unit: 5 percent
Landform: Basin floors
Hydric soil rating: Yes

Wrencoe

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Hoodoo

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Bonner County Area, Idaho, Parts of Bonner and Boundary Counties
Survey Area Data: Version 14, Sep 13, 2018

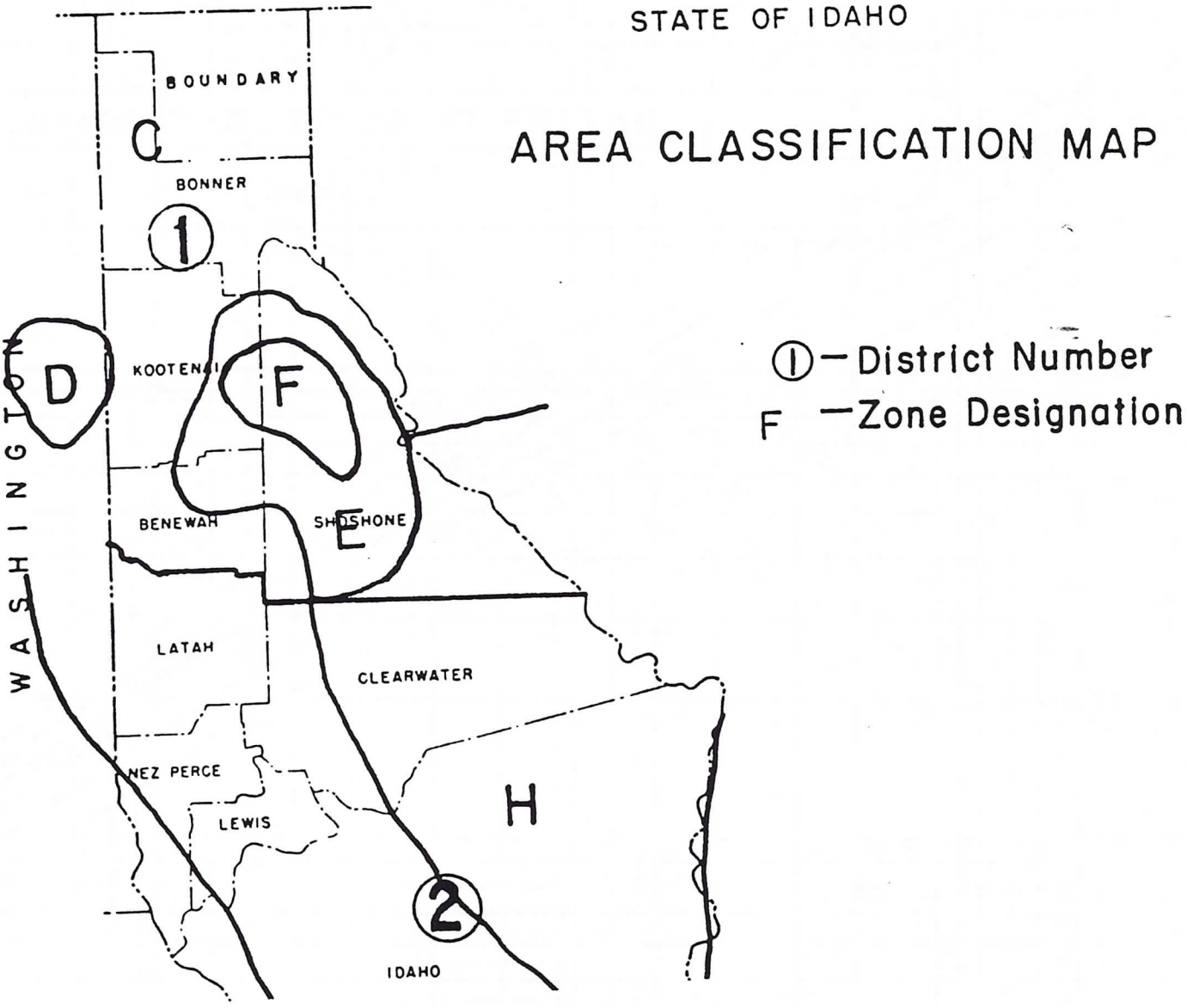


FIGURE 6-3 AREA CLASSIFICATION MAP FOR IDF CURVES - IDAHO
(IDAHO TRANSPORTATION DEPARTMENT)

FIGURE 6-4 ZONE C, INTENSITY-DURATION-FREQUENCY CURVE
(IDAHO TRANSPORTATION DEPARTMENT)

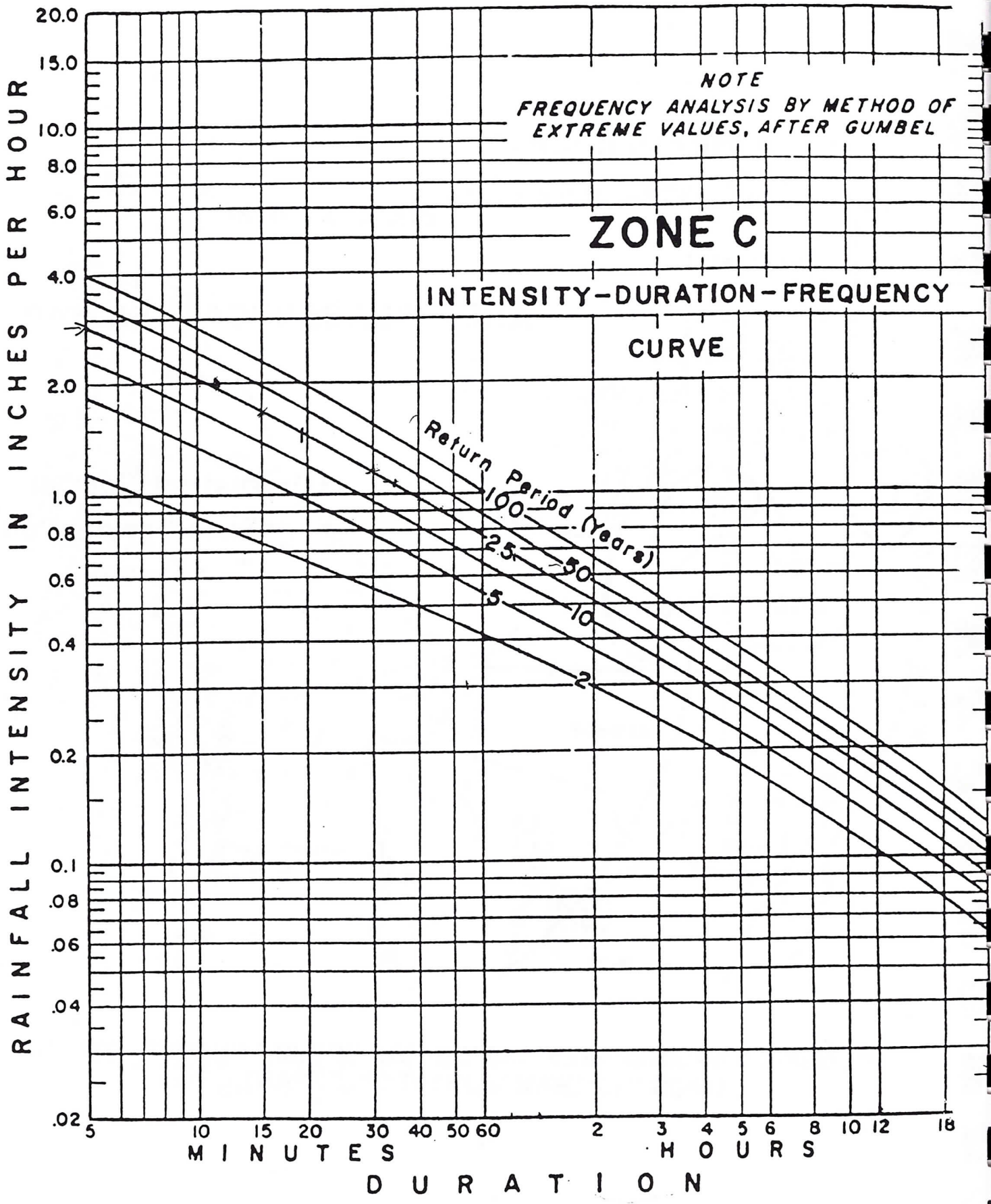


TABLE 6-2 RUNOFF COEFFICIENTS FOR THE RATIONAL METHOD FOR DETERMINING PEAK DISCHARGE

Type of Cover	Flat	Rolling 2%-10%	Hilly Over 10%
Pavement and Roofs	0.90	0.90	0.90
Earth Shoulders	0.50	0.50	0.50
Drives and Walks	0.75	0.80	0.85
Gravel Pavement	0.50	0.55	0.60
City Business Areas	0.80	0.85	0.85
Suburban Residential	0.25	0.35	0.40
Single Family Residential	0.30	0.40	0.50
Multi Units, Detached	0.40	0.50	0.60
Multi Units, Attached	0.60	0.65	0.70
Lawns, Very Sandy Soil	0.05	0.07	0.10
Lawns, Sandy Soil	0.10	0.15	0.20
Lawns, Heavy Soil	0.17	0.22	0.35
Grass Shoulders	0.25	0.25	0.25
Side Slopes, Earth	0.60	0.60	0.60
Side Slopes, Turf	0.30	0.30	0.30
Median Areas, Turf	0.25	0.30	0.30
Cultivated Land, Clay and Loam	0.50	0.55	0.60
Cultivated Land, Sand and Gravel	0.25	0.30	0.35
Industrial Areas, Light	0.50	0.70	0.80
Industrial Areas, Heavy	0.60	0.80	0.90
Parks and Cemetaries	0.10	0.15	0.25
Playgrounds	0.20	0.25	0.30
Woodland and Forests	0.10	0.15	0.20
Meadows and Pasture Land	0.25	0.30	0.35
Pasture with Frozen Ground	0.40	0.45	0.50
Unimproved Areas	0.10	0.20	0.30

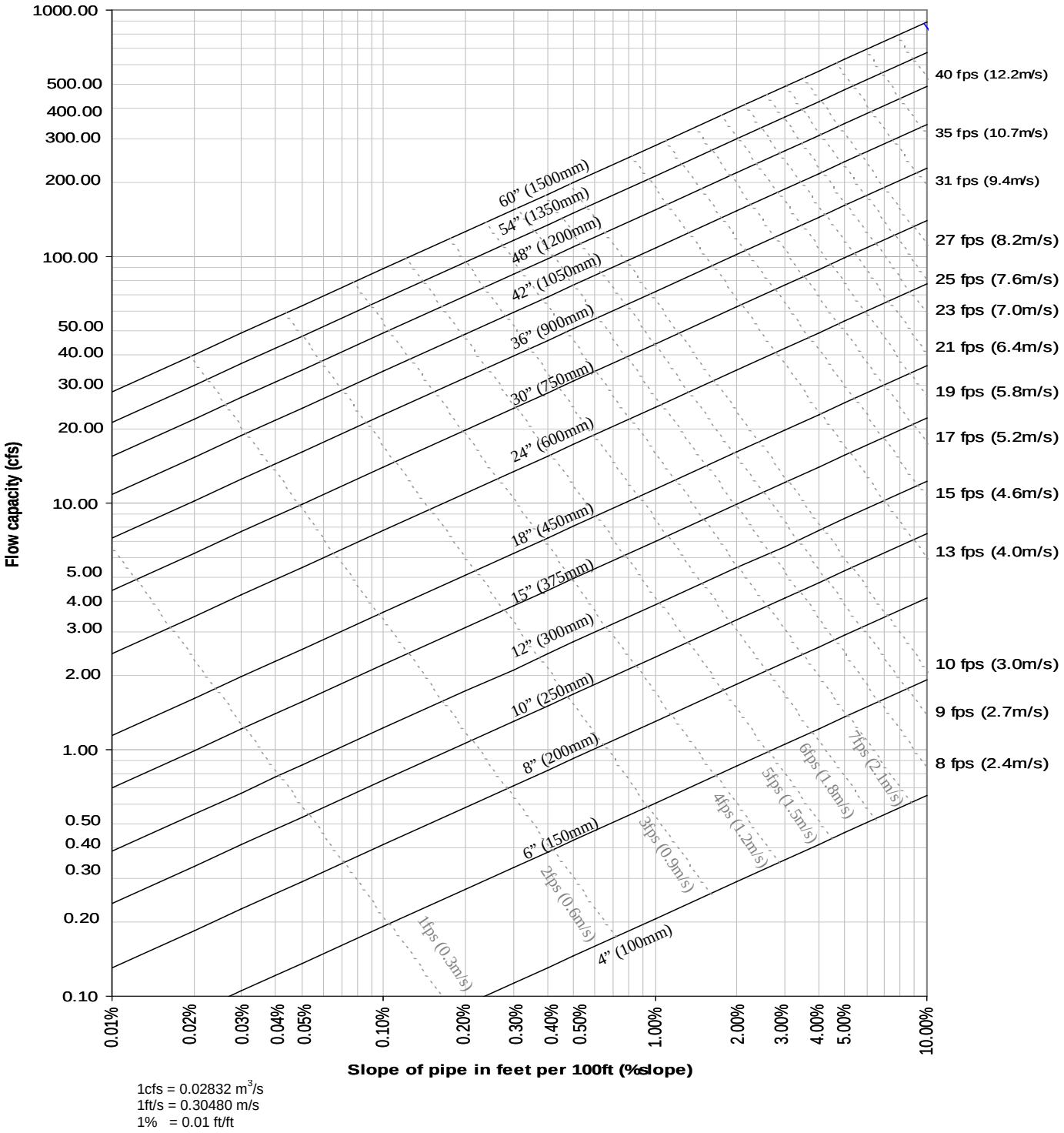
TABLE 6-3 GROUND COVER COEFFICENTS

Type of Cover		K (ground cover coefficient)
Forest with heavy ground cover		150
Minimum tillage cultivation		280
Short pasture grass or lawn		420
Nearly bare ground		600
Grassed waterway or small roadside ditch		900
Paved area		1,200
Gutter flow	0.25 feet deep	1,500
	0.50 feet deep	2,400
	0.75 feet deep	3,100

		Concrete (n = 0.012)	CMP (n = 0.024)
Storm Sewers (Concrete)	12 inch diameter	3,000	1,500
	18 inch diameter	3,900	1,950
	24 inch diameter	4,700	2,350

		Narrow W/D = 1	Medium W/D = 2	Wide W/D = 9
Open Channel Flow (n = 0.040)	1 foot deep	1,100	1,500	2,000
	2 feet deep	1,800	2,300	3,100
	4 feet deep	2,800	3,700	5,000

Figure 3-1
Discharge Rates for ADS Corrugated Pipe with Smooth Interior Liner[1]



1cfs = 0.02832 m^3/s
1ft/s = 0.30480 m/s
1% = 0.01 ft/ft

1. Applicable products: N-12®, MEGA GREEN®, N-12 STIB, N-12 WTIB, HP STORM, SaniTIte®, SaniTite HP, N-12 Low Head

Note: Based on a design Manning's "n" of 0.012.
Solid lines indicate pipe diameters. Dashed lines indicate approximate flow velocity.
Redeveloped from FHWA HDS 3 – Design Charts for Open-Channel Flow[2]

Stormwater Management Calculations
Rational Method
Pre-Developed 25 Year

Pre-Developed Runoff from Table 6-2 kennedy report

		Area(ft^2)	Area(acres)	CN	Runoff	
Pavement		3607	0.09	98	0.90	0.08
Gravel		4255	0.10	91	0.60	0.06
Building		3917	0.09	98	0.90	0.08
Woodland		3150	0.08	55	0.20	0.02
Grass-Lawns		14026	0.33	80	0.25	0.08
	Totals	28955	0.6900	83	2.85	0.32

	Developed "C"	0.46	
Time increment	5	min	
Time of concentration	**5.394600729**	min	
Outflow	0.0032	cfs	1) input outflow (0.3 cfs 600 gal drywell,
Design year	25		1.0 cfs 1000 gal drywell)
Area (sqft)	28955	sqft	2) input surface area for basin (in sqft)
Area (acres)	0.66		3) input the basins "C" factor
Area x "C"	0.31		
Developed "C" factor	0.46		

Time Inc. (min)	Time Inc. (sec)	Intensity (in / hr)	Q (cfs)	Volume (cf)	
5	300	2.80	0.86	348	
10	600	2.10	0.65	460	
11	660	2.00	0.62	476	
12	720	1.90	0.59	487	
13	780	1.85	0.57	508	
14	840	1.75	0.54	513	
15	900	1.70	0.52	530	
20	1200	1.60	0.49	647	
25	1500	1.40	0.43	696	
30	1800	1.20	0.37	708	
35	2100	1.10	0.34	751	
40	2400	0.95	0.29	736	
45	2700	0.90	0.28	781	
50	3000	0.87	0.27	835	
55	3300	0.85	0.26	895	
60	3600	0.78	0.24	893	
65	3900	0.75	0.23	929	
70	4200	0.70	0.22	932	
75	4500	0.69	0.21	982	
80	4800	0.67	0.21	1016	
85	5100	0.65	0.20	1046	
90	5400	0.63	0.19	1072	
95	5700	0.60	0.19	1076	
100	6000	0.59	0.18	1113	
105	6300	0.58	0.18	1148	
110	6600	0.55	0.17	1139	
115	6900	0.52	0.16	1125	
120	7200	0.5	0.15	1129	
125	7500	0.49	0.15	1140	
130	7800	0.48	0.15	1161	
135	8100	0.48	0.15	1205	
140	8400	0.46	0.14	1199	
145	8700	0.45	0.14	1215	
150	9000	0.44	0.13	1229	
155	9300	0.43	0.13	1241	
160	9600	0.42	0.13	1252	
165	9900	0.41	0.13	1261	
170	10200	0.40	0.12	1268	
175	10500	0.39	0.12	1273	
180	10800	0.38	0.12	1277	
360	21600	0.25	0.08	1676	
720	43200	0.17	0.05	2284	
1440	86400	0.11	0.03	2894	24 Hr Storm

25 year design (store or discharge 25 year / 2-hour storm event)
24-Hour Volume (pre-developed) 2894 cu ft

Time of concentration calculation

n = manning roughness(Gravel)	0.03		USDA
p=2 year, 24 hour rainfall	2		
Slope (S)	0.04		
Length (L)	250	feet	
Tc=[0.007(nL)^0.8] / (((P)^0.50)*S^0.4))*60	5.39460073	min	

Stormwater Management Calculations
Rational Method

Post-Developed Peak Storm 25 Year

Post-Developed Runoff and Developed "C" Factor

		Area(ft^2)	Area(acres)	CN	Runoff	
Pavement		3607	0.09	98	0.90	0.08
Gravel		10725	0.25	98	0.60	0.15
Building		8817	0.21	98	0.90	0.19
Woodland		3150	0.08	55	0.20	0.02
Grass		2656	0.07	80	0.25	0.02
	Totals	28955	0.7000	91	2.85	0.45

	Developed "C" 0.65	
Time increment	5 min	
Time of concentration	5 min	
Outflow (Infiltration)	0.0833 cfs	Exifiltration through engineered soils
Design year	25	1) input outflow (0.3 cfs 600 gal drywell,
Area (sqft)	28955 sqft	1.0 cfs 1000 gal drywell)
Area (acres)	0.66 Ac	2) input surface area for basin (in sqft)
Area x "C"	0.43	3) input the basins "C" factor
Developed "C" factor	0.65	Weighted value

Time Inc. (min)	Time Inc. (sec)	Intensity (in / hr)	Q dev (cfs)	V in	Q pre (cfs)	V pre	Storage Required
5	300	2.80	1.21	485	0.86	348	137
10	600	2.10	0.90	635	0.65	460	174
11	660	2.00	0.86	656	0.62	476	180
12	720	1.90	0.82	673	0.59	487	185
13	780	1.85	0.80	703	0.57	508	193
14	840	1.75	0.75	710	0.54	513	195
15	900	1.70	0.73	734	0.52	530	202
20	1200	1.60	0.69	897	0.49	647	248
25	1500	1.40	0.60	966	0.43	696	268
30	1800	1.20	0.52	983	0.37	708	273
35	2100	1.10	0.47	1043	0.34	751	290
40	2400	0.95	0.41	1024	0.29	736	284
45	2700	0.90	0.39	1086	0.28	781	301
50	3000	0.87	0.37	1162	0.27	835	323
55	3300	0.85	0.37	1245	0.26	895	346
60	3600	0.78	0.34	1244	0.24	893	345
65	3900	0.75	0.32	1293	0.23	929	359
70	4200	0.70	0.30	1297	0.22	932	359
75	4500	0.69	0.30	1367	0.21	982	379
80	4800	0.67	0.29	1414	0.21	1016	392
85	5100	0.65	0.28	1456	0.20	1046	403
90	5400	0.63	0.27	1493	0.19	1072	413
95	5700	0.60	0.26	1499	0.19	1076	415
100	6000	0.59	0.25	1550	0.18	1113	429
105	6300	0.58	0.25	1599	0.18	1148	442
110	6600	0.55	0.24	1587	0.17	1139	439
115	6900	0.52	0.22	1568	0.16	1125	433
120	7200	0.5	0.22	1572	0.15	1129	434
125	7500	0.49	0.21	1588	0.15	1140	438
130	7800	0.48	0.20	1618	0.15	1161	446
135	8100	0.48	0.20	1680	0.15	1205	463
140	8400	0.46	0.20	1670	0.14	1199	460
145	8700	0.45	0.19	1693	0.14	1215	466
150	9000	0.44	0.19	1713	0.13	1229	471
155	9300	0.43	0.18	1730	0.13	1241	476
160	9600	0.42	0.18	1745	0.13	1252	480
165	9900	0.41	0.18	1757	0.13	1261	483
170	10200	0.40	0.17	1767	0.12	1268	485
175	10500	0.39	0.17	1775	0.12	1273	487
180	10800	0.38	0.16	1780	0.12	1277	488
360	21600	0.25	0.11	2336	0.08	1676	631
720	43200	0.17	0.07	3186	0.05	2284	841
1440	86400	0.11	0.05	4036	0.03	2894	1022

25 year design (store or infiltrate 25 year peak flow and volume)
Peak Storm required storage 1022 cu ft

Overall Treatment Req and Soil Infiltraion Rate		
Site Impervious Area (New + Existing)	23149	SF
Req Treatment	964.541667	CF
Req Treatment Area (8" depth)	1446.8125	SF
Proposed Treatment Area (8" depth)	1800	SF
Treatment soil infiltration	2	in/hr
Soil infiltration of Treatment Area	0.08333333	CFS
Depth of Treatment Area Req'd for Detention	0.57	FT

Stormwater Management Calculations
Rational Method

Pre-Developed 50 Year

Pre-Developed Runoff from Table 6-2 kennedy report

		Area(ft^2)	Area(acres)	CN	Runoff	
Pavement		6534	0.15	98	0.90	0.14
Gravel		74052	1.70	91	0.60	1.02
Building		5660	0.13	98	0.90	0.12
Woodland		8712	0.20	55	0.20	0.04
Grass-Lawns		13942	0.33	80	0.25	0.08
	Totals	108900	2.5100	87	2.85	1.39

	Developed "C" 0.56	
Time increment	5 min	
Time of concentration	**5.394600729** min	
Outflow	0 cfs	1) input outflow (0.3 cfs 600 gal drywell,
Design year	50	1.0 cfs 1000 gal drywell)
Area (sqft)	108900 sqft	2) input surface area for basin (in sqft)
Area (acres)	2.50	3) input the basins "C" factor
Area x "C"	1.39	
Developed "C" factor	0.56	

Time Inc. (min)	Time Inc. (sec)	Intensity (in / hr)	Q (cfs)	Volume (cf)	
5	300	3.29	4.57	1837	
10	600	2.55	3.55	2517	
15	900	2.16	2.99	3024	
20	1200	1.93	2.69	3521	
25	1500	1.71	2.38	3834	
30	1800	1.49	2.07	3963	
35	2100	1.40	1.95	4305	
40	2400	1.31	1.82	4572	
45	2700	1.22	1.69	4762	
50	3000	1.13	1.57	4876	
55	3300	1.04	1.44	4914	
60	3600	0.95	1.31	4877	
65	3900	0.91	1.27	5089	
70	4200	0.88	1.22	5275	
75	4500	0.85	1.18	5433	
80	4800	0.82	1.13	5564	
85	5100	0.78	1.09	5668	
90	5400	0.75	1.04	5745	
95	5700	0.72	1.00	5794	
100	6000	0.69	0.95	5817	
105	6300	0.65	0.91	5812	
110	6600	0.62	0.86	5780	
115	6900	0.59	0.82	5720	
120	7200	0.55	0.77	5634	
125	7500	0.54	0.75	5744	
130	7800	0.53	0.74	5844	
135	8100	0.53	0.74	6066	
140	8400	0.51	0.71	6016	
145	8700	0.50	0.69	6088	
150	9000	0.49	0.68	6150	
155	9300	0.47	0.66	6203	
160	9600	0.46	0.64	6246	
165	9900	0.45	0.63	6279	
170	10200	0.44	0.61	6303	
175	10500	0.43	0.60	6317	
180	10800	0.42	0.58	6322	
360	21600	0.27	0.37	8041	
720	43200	0.18	0.25	11028	
1440	86400	0.12	0.16	14018	24 Hr Storm

25 year design (store or discharge 50 year / 2-hour storm event)
24-Hour Volume (pre-developed) 14018 cu ft

Time of concentration calculation

n = manning roughness(Gravel)	0.03	USDA
p=2 year, 24 hour rainfall	2	
Slope (S)	0.04	
Length (L)	250 feet	
Tc=[0.007(nL)^0.8] / (((P)^0.50)*S^0.4))*60	5.39460073 min	

Stormwater Management Calculations
Rational Method

Post-Developed Peak Storm 50 Year

Post-Developed Runoff and Developed "C" Factor

		Area(ft^2)	Area(acres)	CN	Runoff	
Pavement		6534	0.15	98	0.90	0.14
Gravel		80522	1.85	98	0.60	1.11
Building		10560	0.25	98	0.90	0.23
Woodland		8712	0.20	55	0.20	0.04
Grass		2572	0.06	80	0.25	0.02
	Totals	108900	2.5100	94	2.85	1.53

	Developed "C"	0.61	
Time increment	5	min	
Time of concentration	5	min	
Outflow (Infiltration)	0.0833	cfs	Exifiltration through engineered soils
Design year	25		1) input outflow (0.3 cfs 600 gal drywell,
Area (sqft)	108900	sqft	1.0 cfs 1000 gal drywell)
Area (acres)	2.50	Ac	2) input surface area for basin (in sqft)
Area x "C"	1.52		3) input the basins "C" factor
Developed "C" factor	0.61		Weighted value

Time Inc. (min)	Time Inc. (sec)	Intensity (in / hr)	Q dev (cfs)	V in	Q pre (cfs)	V pre	Storage Required
5	300	3.29	5.00	2009	4.57	1837	171
10	600	2.55	3.88	2722	3.55	2517	204
15	900	2.16	3.27	3281	2.99	3024	255
20	1200	1.93	2.94	3827	2.69	3521	304
25	1500	1.71	2.60	4171	2.38	3834	336
30	1800	1.49	2.27	4315	2.07	3963	350
35	2100	1.40	2.13	4691	1.95	4305	383
40	2400	1.31	1.99	4983	1.82	4572	408
45	2700	1.22	1.85	5193	1.69	4762	427
50	3000	1.13	1.71	5319	1.57	4876	438
55	3300	1.04	1.58	5362	1.44	4914	443
60	3600	0.95	1.44	5322	1.31	4877	440
65	3900	0.91	1.39	5555	1.27	5089	460
70	4200	0.88	1.34	5758	1.22	5275	477
75	4500	0.85	1.29	5931	1.18	5433	492
80	4800	0.82	1.24	6075	1.13	5564	504
85	5100	0.78	1.19	6189	1.09	5668	514
90	5400	0.75	1.14	6273	1.04	5745	521
95	5700	0.72	1.09	6328	1.00	5794	526
100	6000	0.69	1.04	6353	0.95	5817	528
105	6300	0.65	0.99	6348	0.91	5812	527
110	6600	0.62	0.94	6313	0.86	5780	524
115	6900	0.59	0.89	6249	0.82	5720	519
120	7200	0.55	0.84	6154	0.77	5634	510
125	7500	0.54	0.83	6275	0.75	5744	520
130	7800	0.53	0.81	6385	0.74	5844	530
135	8100	0.53	0.81	6627	0.74	6066	550
140	8400	0.51	0.77	6573	0.71	6016	545
145	8700	0.50	0.76	6652	0.69	6088	552
150	9000	0.49	0.74	6720	0.68	6150	557
155	9300	0.47	0.72	6777	0.66	6203	562
160	9600	0.46	0.70	6825	0.64	6246	565
165	9900	0.45	0.69	6861	0.63	6279	568
170	10200	0.44	0.67	6888	0.61	6303	570
175	10500	0.43	0.65	6903	0.60	6317	571
180	10800	0.42	0.63	6909	0.58	6322	572
360	21600	0.27	0.41	8790	0.37	8041	719
720	43200	0.18	0.28	12058	0.25	11028	970
1440	86400	0.12	0.18	15329	0.16	14018	1190

25 year design (store or infiltrate 25 year peak flow and volume)
Peak Storm required storage 1190 cu ft

Overall Treatment Req and Soil Infiltraion Rate		
New Impervious Area	11370	SF
Additional Req Treatment	473.75	CF
Additional Req Treatment Area (8" depth)	710.625	SF
Proposed Treatment Area (8" depth)	1800	SF
Treatment soil infiltration	2	in/hr
Soil infiltration of Treatment Area	0.08333333	CFS
Added Depth of Treatment Area Req'd for Detention	0.66	FT

414 Church Street, Suite 205I
Sandpoint, ID 83864
(208) 263-0623

Engineers Estimate of Probable Costs

Concrete Sidewalk and Approach

Burnett Electric Inc

Description	Quantity	Units	Unit Price	Cost	
Sidewalk Construction					
GRADING AND EXCAVATION	400	SF	$ 0.60	$ 240.00	
SIDEWALK CONSTRUCTION/ CONCRETE (4 FT X100 FT)	400	SF	$ 5.00	$ 2,000.00	
APPROACH CONSTRUCTION/CONRETE	520	SF	$ 5.00	$ 2,600.00	**$ 4,840.00**

Summary		
Estimated Costs To Construct	$	4,840.00
Contingency (15%)	$	726.00
Total Estimated Costs	**$**	**5,566.00**
Estimated Project Costs	**$**	**6,000.00**

This Engineers Estimate is based upon the 2013 - 2020 Average Unit Price Report Low Bid Average as published by ITD, where available and actual bids received.

The Average Unit prices used are assumed to be relatively accurate.

Design Costs include estimated costs for Survey, Drafting, Engineering,Construction Staking, Inspection, As-Builts, and Estimates including this estimate.

This Estimate is intended to serve as a cost analysis for the Developer