Appendix C
Site Specific Data

Map Unit Description

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this report, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. All the soils of a series have major horizons that are similar in composition, thickness, and arrangement. Soils of a given series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Additional information about the map units described in this report is available in other soil reports, which give properties of the soils and the limitations, capabilities, and potentials for many uses. Also, the narratives that accompany the soil reports define some of the properties included in the map unit descriptions.

Report—Map Unit Description

Upper Flathead Valley Area, Montana

Sg—Somers silty clay loam, 0 to 3 percent slopes

Map Unit Setting

Mean annual precipitation: 15 to 18 inches
Mean annual air temperature: 39 to 45 degrees F
Frost-free period: 105 to 125 days

Map Unit Composition

Somers and similar soils: 90 percent
Minor components: 10 percent

Description of Somers

Setting

Landform: Terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 48 to 72 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 20 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 3.0 mmhos/cm)
Available water capacity: Moderate (about 7.8 inches)

Interpretive groups

Farmland classification: Prime farmland if irrigated
Land capability classification (irrigated): 2e
Land capability (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: Clayey (Cy) 15-19" p.z. (R044XW181MT)

Typical profile

0 to 8 inches: Silty clay loam
8 to 12 inches: Silty clay loam
12 to 22 inches: Silty clay loam
22 to 30 inches: Stratified loam to silty clay loam
30 to 60 inches: Loamy fine sand

Minor Components

Nonhydric

Percent of map unit: 10 percent

Th—Tuffit-Somers silty clay loams, 0 to 5 percent slopes

Map Unit Setting

Elevation: 2,600 to 3,400 feet
Mean annual precipitation: 15 to 19 inches
Mean annual air temperature: 39 to 45 degrees F
Frost-free period: 105 to 125 days

Map Unit Composition

Tuffit and similar soils: 50 percent
Somers and similar soils: 35 percent

Minor components: 15 percent

Description of Tuffit

Setting

Landform: Terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Slightly saline to strongly saline (8.0 to 32.0 mmhos/cm)
Sodium adsorption ratio, maximum: 30.0
Available water capacity: Moderate (about 7.0 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 6s
Hydrologic Soil Group: C
Ecological site: Claypan (Cp) 15-19" p.z. (R044XW147MT)

Typical profile

0 to 4 inches: Silty clay loam
4 to 12 inches: Silty clay
12 to 29 inches: Silty clay loam
29 to 60 inches: Stratified very fine sandy loam to silty clay loam

Description of Somers

Setting

Landform: Terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 48 to 72 inches
Frequency of flooding: None
Frequency of ponding: None

Calcium carbonate, maximum content: 20 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 3.0 mmhos/cm)
Available water capacity: Moderate (about 7.8 inches)

Interpretive groups
Farmland classification: Not prime farmland
Land capability classification (irrigated): 2e
Land capability (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: Clayey (Cy) 15-19" p.z. (R044XW181MT)

Typical profile
0 to 8 inches: Silty clay loam
8 to 12 inches: Silty clay loam
12 to 22 inches: Silty clay loam
22 to 30 inches: Stratified loam to silty clay loam
30 to 60 inches: Loamy fine sand

Minor Components

Nonhydric
Percent of map unit: 15 percent

Data Source Information

Soil Survey Area: Upper Flathead Valley Area, Montana
Survey Area Data: Version 10, Jan 5, 2012

Property Record Card

Summary

Primary Information

Property Category: RP
Subcategory: Real Property
Geocode: 07-3835-07-3-01-01-0000
Assessment Code: 0000246800
Primary Owner:
INTERMOUTAIN DEACONESS HOME FOR CHILDREN
500 S LAMBORN ST
HELENA, MT 59601-5417
NOTE: See the Owner tab for all owner information
PropertyAddress: RIVERSIDE RD
KALISPELL, MT 59901
COS Parcel:
Certificate of Survey:
Subdivision:
Legal Description:
S07, T27 N, R20 W, TR 2 IN L 3 & NE4SW4
Last Modified: 6/15/2013 12:18:14 AM

General Property Information

Neighborhood: 160.0
Property Type: AR - Agricultural Rural
Living Units: 0
Levy District: 07-032702-29 - F
Zoning:
Ownership %: 100
Linked Property:
No linked properties exist for this property
Exemptions:
No exemptions exist for this property
Condo Ownership:
General: 0
Limited: 0

Property Factors

Topography: 8
Fronting: 0 - None
Utilities: 0
Parking Type:
Access: 1
Parking Quantity:
Location: 0 - Rural Land
Parking Proximity:

Land Summary

Land Type	Acres	Value
Grazing	0.000	00.00
Fallow	0.000	00.00
Irrigated	0.000	00.00
Continuous Crop	0.000	00.00
Wild Hay	75.720	00.00
Farmsite	0.000	00.00
ROW	0.000	00.00
NonQual Land	0.000	00.00
Total Ag Land	75.720	00.00
Total Forest Land	0.000	00.00
Total Market Land	0.000	00.00

Deed Information:

Deed Date	Book	Page	Recorded Date	Document Number	Document Type

6/9/2011			6/9/2011	201100011886	Warranty Deed

Owners

Party #1

Default Information: INTERMOUTAIN DEACONESS HOME FOR CHILDREN
500 S LAMBORN ST
Ownership %: 100
Primary Owner: "Yes"
Interest Type: Conversion
Last Modified: 1/18/2012 3:33:52 PM

Other Names

Name **Type**

Other Addresses

Appraisals

Appraisal History

Tax Year	Land Value	Building Value	Total Value	Method
2013	37292	0	37292	COST
2012	37292	0	37292	COST

Market Land

Market Land Info

No market land info exists for this parcel

Dwellings

Existing Dwellings

No dwellings exist for this parcel

Other Buildings/Improvements

Outbuilding/Yard Improvements

No other buildings or yard improvements exist for this parcel

Commercial

Existing Commercial Buildings

No commercial buildings exist for this parcel

Ag/Forest Land

Ag/Forest Land Item #1

Acre Type: W - Non-Irrigated Hayland
Irrigation Type:
Class Code: 1801
Timber Zone:

Productivity

Quantity: 2
Commodity: Alfalfa
Units: Tons/Acre

Valuation

Acres: 75.72 **Per Acre Value:** 0

Value: 0

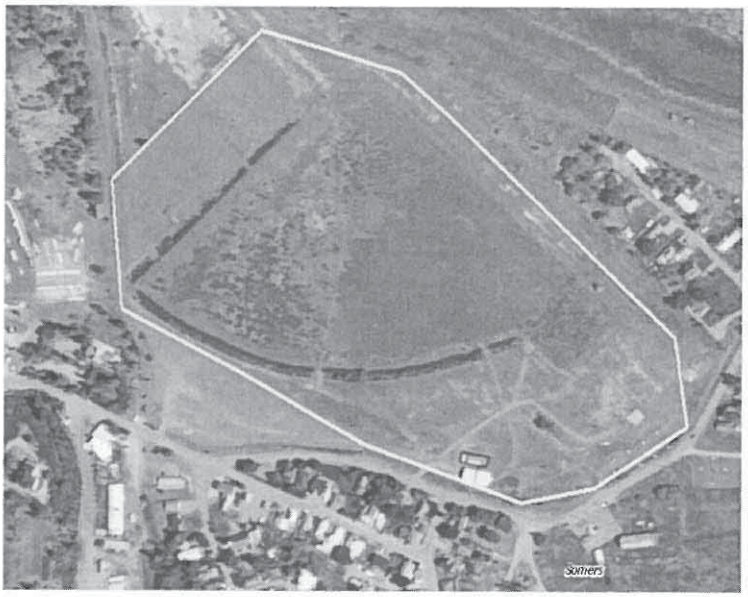
MONTANA.GOV
OFFICIAL STATE WEBSITE

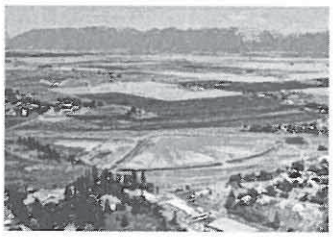
mt.gov
Montana's Official State Website
(http://mt.gov/)

DEPARTMENT OF ENVIRONMENTAL QUALITY (/)

(#ctl00_SiteMapPath1_SkipLink) Home (/default.mcpx) » Federal Superfund (/fedsuperfund/default.mcpx) » BN Somers

BN Somers





Aerial view of BN Somers Site.

Closure of Land Treatment Unit

The tabs below provide a variety of links to information under the BN Somers. Included are links to other web site that have information related to BN Somers. The purpose of this website is to provide information and news about BN Somers and activities.

Information

Located on the northwest shore of Flathead Lake in the Town of Somers in Northwestern Montana's Flathead County, this site was used by Burlington Northern-Santa Fe (BNSF) Railroad from 1901 to 1986 to treat railroad ties. Creosote (wood preservative) wastes contaminated

soils and groundwater at the 80-acre site. Contaminants of concern included Polynuclear/Polycyclic Aromatic Hydrocarbon (PAH) compounds, phenols and zinc chloride.

Located on the northwest short of Flathead Lake in the Town of Somers in Northwestern Montana's Flathead County, this site was used by Burlington Northern (later renamed BNSF Railway) from 1901 to 1986 to treat railroad ties. Creosote (wood preservative) wastes contaminated soils and groundwater at the 80-acre site. Contaminants of concern include polynuclear aromatic hydrocarbon (PAH) compounds, phenols, and zinc chloride. Following soil and groundwater sampling in the 1980s, the Record of Decision was signed in 1989, and in 1991, the Environmental Protection Agency (EPA) entered into a Consent Decree with BNSF for design and performance of the selected remedy. Cleanup began in 1993. Soils were excavated and removed to a Land Treatment Unit (LTU) for bioremediation. In 2003, EPA and DEQ certified cleanup of the soils was complete.

Groundwater cleanup began in 1995, and included pumping and treating through a groundwater treatment system (GWTS) as well as in-situ bioremediation. Sampling of the municipal well has shown that no contaminants of concern are present in the municipal water system.

In 2008, the Agencies approved the Interim Monitoring Plan and allowed BNSF to temporarily shut down the GWTS. Based on data obtained during the Interim Monitoring Period, the Agencies required an Additional Groundwater Investigation to more completely define the nature and extent of groundwater contamination and to assess whether or not the groundwater contaminant plume is stable. The Fourth Five-Year Review for the BN Somers site was completed in 2012.

Developments

EPA Superfund Cleanup Process (http://www.epa.gov/superfund/cleanup/index.htm)	PA/SI	NPL Listing	RI/FS	ROD	RD/RA	Construction Completion	Post Construction Completion	NPL Delete	Reuse
BN Somers	C	NA	C	C	O	NA	NA	NA	TBD

Table Legend

Symbol	Symbol Id
C	Complete
O	Ongoing
I	Interim
N	Negotiations
D	Deferred
NA	Not Applicable
TBD	To Be Determined

UpComing Activities

No activities are scheduled at this time.

Documents & Reports

Documents & Reports Name	Date
Fall Meeting Powerpoint Presentation (/FedSuperfund/bns/PDFs/2012 Fall Public Meeting 092012.pdf)	September, 2012
Final BN Somers Five Year Review (/FedSuperfund/bns/PDFs/Final BN Somers Five Year Review 022012.pdf)	February, 2(
BNSomers Final BNSF Somers 2011 Work Plan (/FedSuperfund/bns/PDFs/BNSomers Final BNSF somers 2011 Work Plan 090911.pdf)	September :
Vapor Intrusion Investigation Final Work Plan (/FedSuperfund/bns/PDFs/VaporInstrusionInvestigationWorkPlanOPT.pdf)	January 201
Work Plan Addendum (/FedSuperfund/bns/PDFs/WorkPlanAddendum.pdf)	October 1, 2
Letter to BNSF re Final Work Plan (/FedSuperfund/bns/PDFs/Ltr-090910.pdf)	September ! 2010
Final Work Plan for Additional Data Collection (/FedSuperfund/bns/PDFs/2010 Work Plan_Final_Complete for CD.pdf)	August 201(

Memo-Review of Interim Groundwater Monitoring Plan (/FedSuperfund/bns/PDFs/Somers_Memo_FNL_03_09.pdf)	February 6,:
BNSF Response to Technical Review (http://BNSomers/BNSF'sresponsetoGSI_GeoTransReports.pdf)	March 2009
Letter to BN (/FedSuperfund/bns/PDFs/LettertoBN33009.pdf)	March 30, 2
BNSF response to EPA letter (/FedSuperfund/bns/PDFs/BNSF's response to Agencies'3_29request.pdf)	April 13, 20
Annual Report (/FedSuperfund/bns/PDFs/BN Somers_web-workpl_blurb9-2010_2_.pdf)	2008
5 Year Review FAQs (/FedSuperfund/bns/PDFs/Final - Five Year Review FAQs 090909.pdf)	
Five-Year Review (/FedSuperfund/bns/PDFs/5yrreviewsept2006.pdf)	2006
Five-Year Review Photographs (http://BNSomers/20065yrReviewPhotos1.pdf)	2006
Flathead Beacon Newspaper Article BNSF Inquires About Land Purchases Near Superfund Sites (http://www.flatheadbeacon.com/articles/article/bnsf_inquires_about_land_purchases_near_superfund_sites_in_somers_whitefish/9274/)	
Flathead Beacon Newspaper Article - Environmental Review Process begins for Submerged Somers Bay Logs (http://www.flatheadbeacon.com/articles/article/20_million_boardfeet_under_the_sea/8165/)	
Explanation of Significant Differences (/FedSuperfund/bns/PDFs/significantdifferences1998.pdf)	1998
Explanation of Significant Differences (/FedSuperfund/bns/PDFs/significantdifferences1992.pdf)	1992
Concept Review Related to Discontinuing Active Remediation BN Somers (/FedSuperfund/bns/PDFs/final somers technical assistance 020309.pdf)	February 3,:
Record of Decision (/FedSuperfund/bns/PDFs/ROD.pdf)	September :
Geo-GIS Recommendations (/FedSuperfund/bns/PDFs/Geo_GSIRecommendations.pdf)	
BN Somers Chronology of Events (/FedSuperfund/bns/PDFs/BNSomersChronologyofEvents.pdf)	
BN Somers Site Description and History (/FedSuperfund/bns/PDFs/BNSomersSiteDescriptionandHistory.pdf)	

Fact Sheets	Date
BN Somers Fact Sheet (/FedSuperfund/bns/PDFs/BNSomersFactSheetAug2012.pdf)	August 2012
Fact Sheet (/FedSuperfund/bns/PDFs/Fact Sheet 10-15-09-final_2_.pdf)	October 10, 2009

Related Links

Montana Department of Environmental Quality (/default.mcpx)

Remediation Division

(/rem/default.mcpx)

EPA United States Environmental Protection Agency
(http://www.epa.gov/nscep/index.html)

Download Adobe Reader
(http://www.adobe.com/products/acrobat/readstep2.html)

Contacts

EPA
(http://www.epa.gov/region8/superfund/)

Diana Hammer

Remedial Project Manager
U.S. Environmental Protection Agency
Region 8, Montana Office
Federal Building
10 West 15th Street, Suite 3200
Helena, MT 59626
406-457-5040 (#)
hammer.diana@epa.gov
(mailto:hammer.diana@epa.gov)

Montana Department of Environmental Quality
(http://deq.mt.gov/default.mcpx)

Lisa DeWitt

Project Officer
Montana Department of Environmental Quality
1100 North Last Chance Gulch
P.O. Box 200901
Helena MT 59620-0901
406-841-5037 (#)
1-800-246-8198 (#) (in-state only)
lidewitt@mt.gov (mailto:lidewitt@mt.gov)

Environmental Justice

The Environmental Justice program, established by Presidential Executive Order 12898, requires Federal agencies to ensure that all environmental policies and the disposal of toxic waste do not adversely impact minority and low-income communities. The common concern is that these communities are exposed to unfair levels of environmental risk arising from multiple sources, often coupled with inadequate government response.

The goal of environmental justice is to ensure that all people, regardless of race, national origin or income, are protected from disproportionate impacts of environmental hazards. To be classified as an environmental justice community, residents must be a minority and/or low income group; excluded from the environmental policy setting and/or decision-making process; subject to a disproportionate impact from one or more environmental hazards; and experience a disparate implementation of environmental regulations, requirements, practices and activities in their communities.

Montana's Environmental Justice Communities

The following is a listing of some of the communities and other areas in Montana with Environmental Justice issues:

Anaconda (Deer Lodge County) - Superfund site, mining contamination
Libby (Lincoln County) - Superfund site, asbestos contamination and exposure
Zortman-Landusky Area (Phillips and Blaine Counties) - pollution from mine tailings
Butte/Silver Bow Creek (Silver Bow County) - mining contamination
Blackfeet Reservation (Glacier Homes - HUD housing) - contaminated building materials
Milltown Dam (Missoula County) - Superfund site, polluted reservoir sediments
Lockwood Solvent Plume (Yellowstone County) - Superfund site, groundwater contamination

Web Sites with More Information

There are also many resources on the Internet that provide timely and relevant information on Environmental Justice issues in Montana. The following are just a few:

Montana Water Center
Montana DEQ (Federal Superfund Section)

MONTANA.GOV
OFFICIAL STATE WEBSITE

mt.gov
Montana's Official State Website
(http://mt.gov/)

DEPARTMENT OF ENVIRONMENTAL QUALITY (/)

Storm Water Discharges Associated with Construction Activity

Construction activities can play a major role in the degradation of water quality. Construction activities impact water quality by contributing discharges of sediment to streams, rivers, lakes, and other water bodies throughout the state. Sediment runoff rates from construction sites are 10 to 20 times greater than those from agricultural lands, and 1,000 to 2,000 times greater than those of forestlands. Discharges of sediment can degrade aquatic habitats, alter channel dynamics, and release high levels of nutrients and metals. Other pollutant sources associated with construction activities pose additional threats to water quality. These pollutant sources include chemicals, fuel, lubricants, and other toxic substances.

Upcoming Training Events

Please see Compliance and Technical Support (/wqinfo/ctss/default.mcpx) for upcoming training information.

Permit Information

Storm Water Construction General Information (/wqinfo/WPBForms/pdf/SWCinfo.pdf)

2013 General Permit for Storm Water Discharges Associated with Construction Activity (/wqinfo/WPBForms/pdf/SW_CONST_PER.pdf)

- Response to Comments (/wqinfo/MPDES/StormWater/pdf/MTR100000ResponseComments.pdf)
- Environmental Assessment (/wqinfo/MPDES/StormWater/pdf/MTR100000EA.pdf)
- Fact Sheet (/wqinfo/MPDES/StormWater/pdf/MTR100000FactSheet.pdf)

Permit Fee Schedule for Applications and Annual Fees (/wqinfo/MPDES/RULES09/pdf/FeeSummarySched10.pdf)

Application Package for Storm Water Construction General Permit

- Notice of Intent (NOI) (/wqinfo/WPBForms/pdf/SWC_NOI.pdf)
- Storm Water Pollution Prevention Plan (SWPPP) (/wqinfo/WPBForms/pdf/MTR100000_SWPPP.pdf)
- Attachment A for SWPPP (/wqinfo/WPBForms/pdf/ATTACHMENT_A.pdf)
- Attachment B for SWPPP (/wqinfo/WPBForms/pdf/ATTACHMENT_B.pdf)
- Attachment C for SWPPP (/wqinfo/WPBForms/pdf/ATTACHMENT_C.pdf)
- Attachment D for SWPPP (/wqinfo/WPBForms/pdf/ATTACHMENT_D.pdf)
- Attachment E for SWPPP (/wqinfo/WPBForms/pdf/ATTACHMENT_E.pdf)
- Notice of Termination (NOT) (/wqinfo/WPBForms/pdf/NOT.pdf)
- Permit Transfer Notification (PTN) (/wqinfo/WPBForms/pdf/PTN.pdf)
- Storm Water Rainfall Erosivity Waiver (/wqinfo/WPBForms/pdf/RAINFALLEROSIVITYFORM.pdf)

Rules and Regulations

- MCA Title 75, Chapter 5 - Water Quality (http://leg.mt.gov/bills/mca_toc/75_5.htm)
- ARM Title 17.30.1101 - Storm Water (/dir/legal/chapters/ch30-11.pdf)

EPA Guidance

- Storm Water Discharges From Construction Activities (http://cfpub.epa.gov/npdes/stormwater/const.cfm)
- Storm water Pollution Prevention Plans for Construction Activities (http://cfpub.epa.gov/npdes/stormwater/swppp.cfm#report)
- National Menu of Storm water Best Management Practices (http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm)

Effective, Terminated, MPDES Storm Water Construction Permit Authorizations

These reports will be updated at the beginning of each month

SW Construction Effective Permits by County (/wqinfo/WPBForms/pdf/SW Construction Effective By County.pdf)

SW Construction Terminated Permits by County (/wqinfo/WPBForms/pdf/SW Construction By County Terminations.pdf)

Compliance Information

Noncompliance Reporting (#NCR)
Useful Resources (#UsefulRes)

Compliance Evaluation Inspections

Entry/Introduction (#swEntry)
Records Review (#swRecRev)
Facility Site Evaluation (#swSiteEval)
Conclusion/Preliminary Findings (#swConclusion)
Inspection Report Package (#swReportPackage)

Permittees operating under the General Permit for Storm water Discharges Associated with Construction Activity (General Permit) are subject to Compliance Evaluation Inspections (CEIs). The purpose of a storm water construction CEI is to assess the adequacy of the Storm water Pollution Prevention Plan (SWPPP) by ensuring the SWPPP meets the requirements of the General Permit, reviewing how pollutants are being managed, and determining whether pollutants are being discharged from the construction site and to state waters.

Storm water construction CEIs conducted by a Water Protection Bureau Compliance Inspector (inspector) are typically completed during and/or immediately following precipitation events as an announced or unannounced CEI. An announced CEI is when the inspector contacts the permittee and establishes a meeting date, time, and location to complete the CEI. An unannounced CEI is when an inspector does not contact the permittee ahead of time and arrives on-site during normal business hours to complete the CEI.

Please note that the authority to conduct an inspection at a construction site is defined in section 402 of the Clean Water Act. The State of Montana establishes its inspection authority of the delegated federal program in Section 75-5-603 of the Montana Code Annotated.

CEIs consist of the following components: Entry/Introduction, Records Review, Facility Site Evaluation, and Conclusion/Preliminary Findings. Factual information and observations made by the inspector are presented in the Inspection Report Package.

Entry/Introduction

The purpose of the Entry/Introduction portion of the CEI is to provide the necessary identification to appropriate on-site personnel, state the reason for the CEI, and review the components of the CEI. Examples of information discussed during this portion of the CEI include:

Identification of the Owner/Operator
Description of the Construction Project
Date Construction Started
Estimated Time for Construction Project Completion
Phase of Construction Project
Issues / Areas of Noncompliance Experienced during Construction Activities

Records Review

The purpose of the Records Review portion of the CEI is to review the General Permit and SWPPP to ensure the SWPPP meets the requirements of the General Permit. In order to complete this portion of the CEI, the inspector will request copies of the following information:

Copy of the General Permit
Copy of the Department's Confirmation Letter
Copy of the completed and signed Notice of Intent (NOI) form
Copy of the completed, signed, and up-to-date SWPPP
Up-to-date SWPPP Site Map
BMP installation and design standards
Inspection Records
Annual Inspection Reports, if applicable
Reports of Noncompliance

The inspector will review the SWPPP and SWPPP Site Map to ensure the most current version of these documents contain the minimum elements defined in the General Permit. Additionally, the inspector will review any updates to the SWPPP to ensure the SWPPP reflects current conditions. Inspection records will be reviewed to ensure they are being completed at the required frequency and documenting, at minimum, the required elements defined in the General Permit and the SWPPP.

Facility Site Evaluation

The purpose of the Facility Site Evaluation is to assess site conditions, determine if the SWPPP is being followed by verifying that Best Management Practices (BMPs) are installed as specified in the SWPPP, assess the condition and adequacy of installed BMPs, and determine areas of noncompliance. Specific questions the inspector will focus on when evaluating BMPs include:

What is the pollutant source?
Is there a BMP present?
Is the BMP installed correctly?
Is the BMP being maintained?
Is the BMP appropriate for the pollutant source and/or area?

During the Facility Site Evaluation, the inspector will take photos and take notes to provide supporting evidence for areas of noncompliance.

Conclusion/Preliminary Findings

The purpose of the Conclusion/Preliminary Findings portion of the CEI is to provide preliminary findings and explain the Inspection Report process. Additionally, this portion allows the permittee to ask questions and allows both parties to clarify issues which arose during the CEI. If

additional information is required from the permittee to complete the CEI, the inspector will provide a list of information and specify a date for submittal. Finally, if there are immediate areas of concern, the inspector will identify the problems and what the expectations are of the permittee.

Please note: Any information presented during the Conclusion/Preliminary Findings is preliminary. The final factual findings and observations will be documented in the Inspection Report Package.

Final Inspection Report Package

The purpose of the Inspection Report Package is to document areas of noncompliance identified during the CEI and require the permittee to complete corrective actions to return to compliance. Additional information included in the Inspection Report Package may include areas of potential noncompliance. The Final Inspection Report Package will include:

Cover Letter
MPDES 3560 Form
Narrative Inspection Report
Photo Report

If the Cover Letter is a Letter of Violation, the permittee is required to compose a written response addressing each one of the factual findings and observations presented in the Narrative Inspection Report. The Letter of Violation will specify a date the written response is due.

If the Cover Letter is a Letter of Compliance, the permittee is required to read through the Narrative Inspection Report and address any areas of potential noncompliance. A written response may be required dependent upon the identified areas of potential noncompliance.

Please note: It is the expectation of the Department that the permittee address each of the factual findings presented in the Narrative Inspection Report. Please contact the inspector if there are questions regarding the content of the Narrative Inspection Report or if assistance is needed in composing a required response.

For further information, contact the Water Protection Bureau at (406) 444-3080 (#).

Noncompliance Reporting

Noncompliance reporting is required when a permittee identifies condition(s) that are not in compliance with or when a permittee determines they will not be able to comply with a condition(s) of the General Permit for Storm Water Discharges Associated with Construction Activity (General Permit). Examples of noncompliance associated with permittees operating under the General Permit include: any noncompliance that may endanger health or the environment, a discharge of pollutants from the construction project site and/or to state waters, failure of installed Best Management Practices (BMPs), and failure to conduct inspections.

The noncompliance reporting condition of the General Permit requires an oral report be provided within 24-hours of becoming aware of the noncompliance followed by a written report within five days. The following information is required to be reported to the Department in an event of noncompliance:

MPDES Permit Authorization Number
Facility or Site Name
Name and Phone Number of Individual Reporting Noncompliance
A description of the noncompliance and its cause
The period of noncompliance, including exact dates and times; or if not identified, the anticipated time the noncompliance is expected to continue
Additional measures being taken to reduce, eliminate, and prevent recurrences of the noncompliance

It is the responsibility of the permittee to contact a Compliance Inspector in the Water Protection Bureau within 24 hours of first identifying the noncompliance. If the event of noncompliance occurs on a weekend, leave a message on the Water Protection Bureau's main number: (406) 444-3080 (#).

After receipt of the 24 hour report of noncompliance, the Compliance Inspector will specify a date to submit the five day written report. The five day written report is to be mailed to:

Department of Environmental Quality
Water Protection Bureau
c/o (Name of Compliance Inspector)
PO Box 200901
Helena, MT 59620-0901

The Compliance Inspector will review the submitted material and draft a Department response. It is the expectation of the Department that the permittee address and complete any required corrective actions unless otherwise specified.

The form below (Form NCR) can be filled out online, printed, and mailed to the Department. It will fulfill the five day written report requirement if it is completely filled out and if it is received by the Department within five days of the 24-hour oral report.

Noncompliance Reporting Form (/wqinfo/WPBForms/pdf/NCR_form.pdf)

For further information contact the Water Protection Bureau at (406) 444-3080 (#).

Useful Resources

Montana Department of Environmental Quality Best Management Practice Field Guide (/wqinfo/MPDES/pdfs/MT_BMP_FieldGuide.pdf)

Montana Department of Environmental Quality Oil and Gas BMP Field Guide (/wqinfo/WPBForms/pdf/MT Oil and Gas BMP Field Guide.pdf)

Montana Department of Transportation Erosion and Sediment Control Best Management Practices Manual (http://www.mdt.mt.gov/research/projects/env/erosion.shtml)

United States Environmental Protection Agency - Storm water Pollution Prevention Plans for Construction Activities (http://cfpub.epa.gov/npdes/stormwater/swppp.cfm#report)

United States Environmental Protection Agency – National Menu of Storm water Best Management Practices (http://cfpub.epa.gov/npdes/stormwater/menuofbmps/)

Upcoming Storm Water Trainings - MCA (http://www.mtagc.org/training/)

Upcoming Storm Water Trainings - DEQ (/wqinfo/ctss/default.mcpx)

(/wqinfo/MPDES/MTR10_Auths/Beaverhead.xlsx)

FLATHEAD RIVER, MONTANA

Managing Agency:

National Park Service, Glacier National Park
U.S. Forest Service, Flathead National Forest

Designated Reach:

October 12, 1976. The North Fork from the Canadian border downstream to its confluence with the Middle Fork. The Middle Fork from its headwaters to its confluence with the South Fork. The South Fork from its origin to the Hungry Horse Reservoir.

Classification/Mileage:

Wild — 97.9 miles; Scenic — 40.7 miles; Recreational — 80.4 miles; Total — 219.0 miles.

Salmon, Native American culture, history, whitewater boating, unmatched beauty, world-renowned fishing, solitude, what don't Northwest rivers offer in abundance?

RELATED LINKS

Glacier National Park

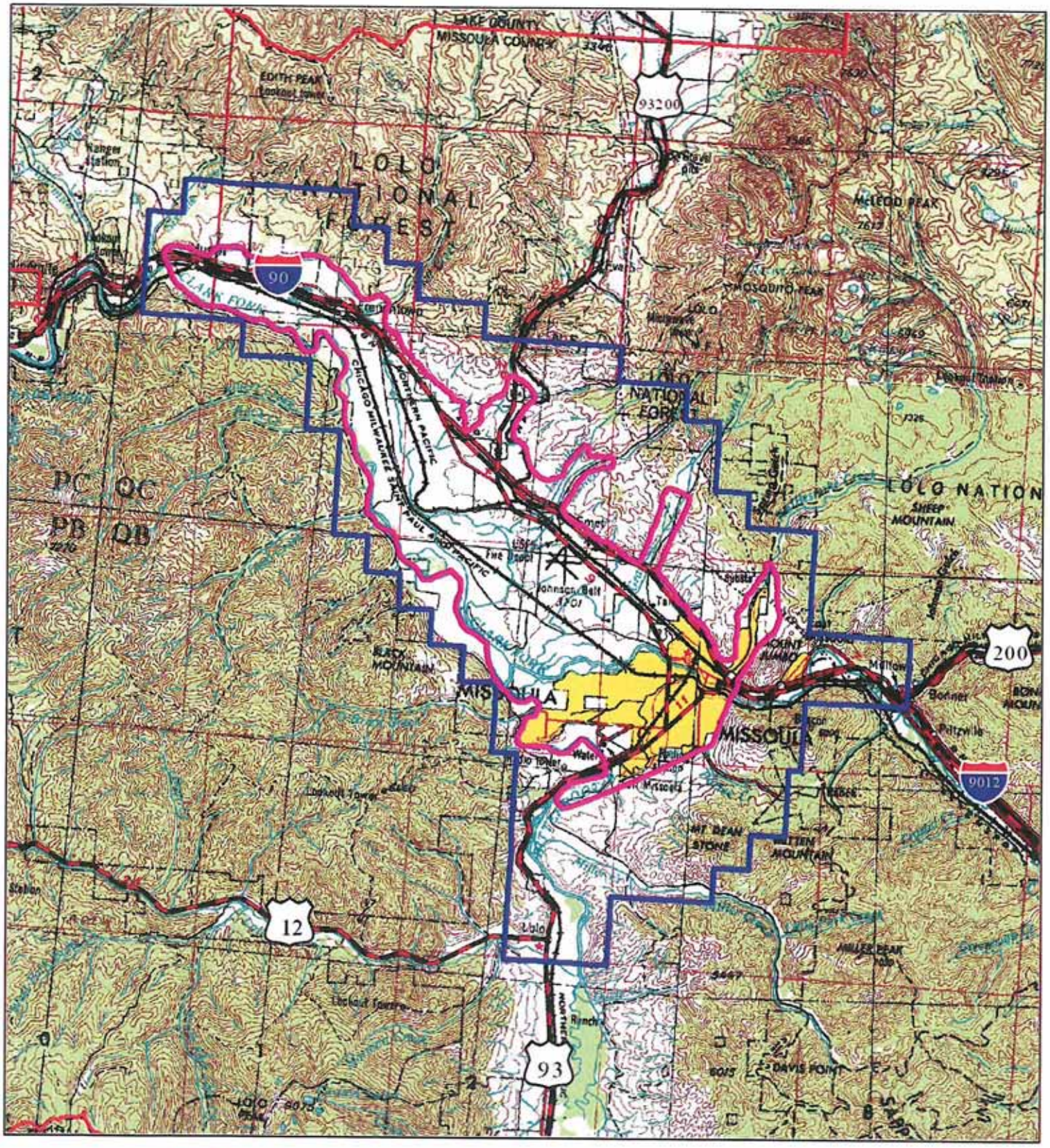
Photo Credit: Unknown

Flathead River

The designation includes the North Fork, Middle Fork and South Fork above Hungry Horse Reservoir and features recreation, scenery, historic sites, unique fisheries, and wildlife such as grizzly bears and wolves. The rugged area includes the landscapes of Glacier National Park and the Bob Marshall and Great Bear Wilderness areas.

No permits are required for floating use. There are several commercial outfitters that offer float

Location Map
Missoula Valley Water Quality District
Missoula County, Montana



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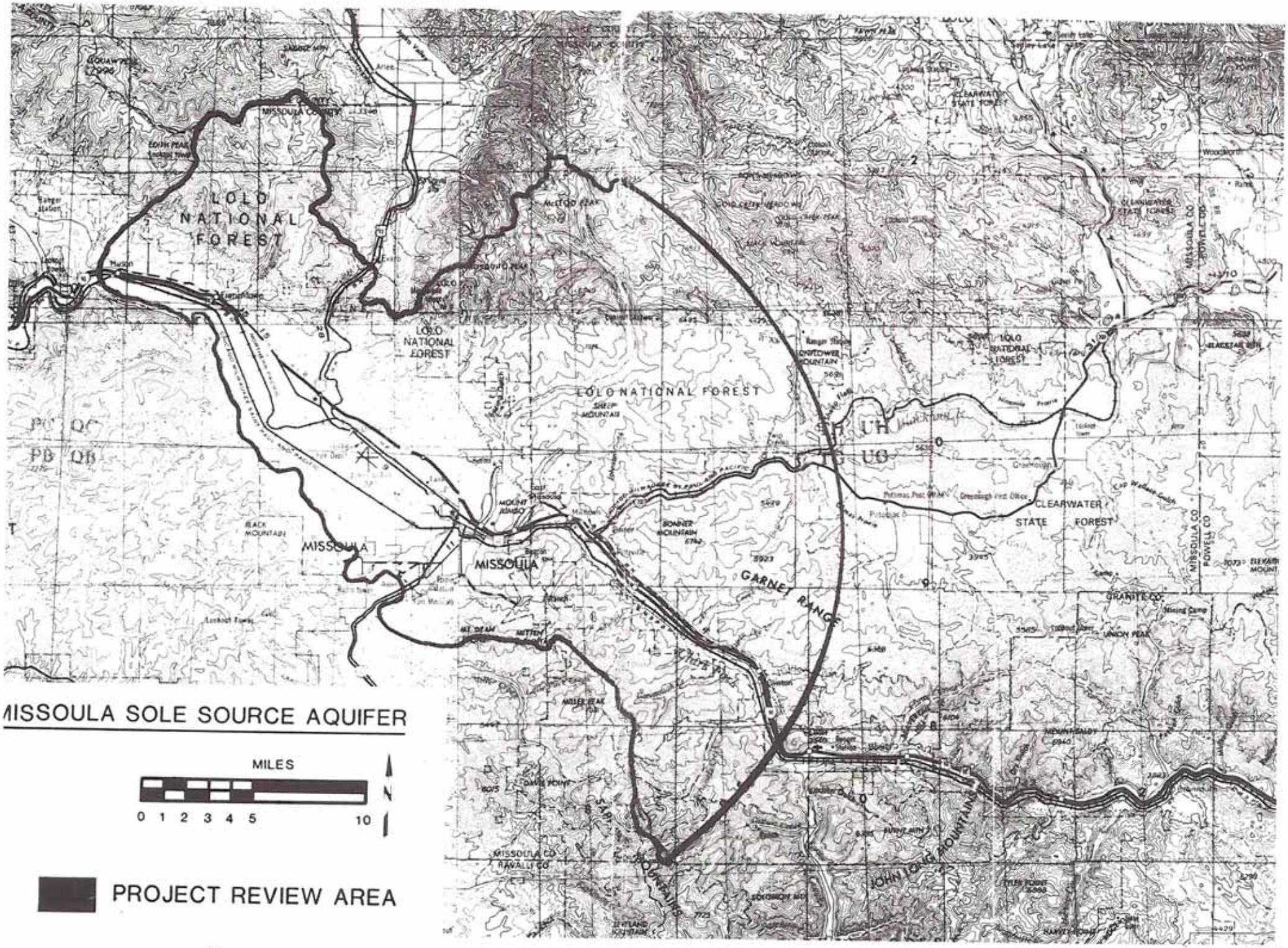
EPA Designated Sole Source Aquifer Boundary

Missoula Valley Water Quality District

Missoula County

2 0 2 4 6 8 Miles


LOLO NATIONAL FOREST
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CLEARWATER STATE FOREST
MISSOULA
MISSOULA
GARNET RANGE
JOHN LONG MOUNTAINS
MISSOULA SOLE SOURCE AQUIFER
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PROJECT REVIEW AREA

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Geotechnical Engineering Report

Providence Home – Intermountain Flathead

Somers, Montana

October 28, 2013

Terracon Project No. C5135908

Prepared for:

Intermountain Deaconess Children's Services, Inc.

Helena, Montana

Prepared by:

Terracon Consultants, Inc.

Kalispell, Montana

Offices Nationwide
Employee-Owned
Established in 1965
terracon.com

Terracon

Geotechnical ■ Environmental ■ Construction Materials ■ Facilities

October 28, 2013

Intermountain Deaconess Children's Services
500 South Lamborn Street
Helena, MT 59601

Attn: Mr. Jim Fitzgerald, CEO

Re: Geotechnical Engineering Report
Providence Home – Intermountain Flathead
Somers, Montana
Terracon Project Number: C5135908

Dear Mr. Fitzgerald:

Terracon Consultants, Inc. (Terracon) has completed the geotechnical engineering services for the above referenced project. This study was performed in accordance with our proposal dated September 27, 2013, and signed Agreement for Services dated October 7, 2013. This report presents the findings of the subsurface exploration and provides geotechnical recommendations regarding the design and construction of foundations, floor slabs, parking areas/access roads, and associated earthwork for the proposed development.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, or if we may be of further service, please contact us.

Sincerely,
Terracon Consultants, Inc.

Kagan M. Rutz, P.E.
Kalispell Office Manager

Gary A. Quinn, P.E.
Great Falls Office Manager

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Exhibit C-4	Portland Cement Concrete Pavement Materials

EXECUTIVE SUMMARY

Terracon Consultants, Inc. has completed a geotechnical exploration for the proposed Providence Home north of Somers, Montana. The structure is to be located in the southwest portion of a large tract of land southeast of North Somers Road. Eight (8) borings, designated B-1 through B-8, were drilled to depths ranging from 4.5 to 21.5 feet below the existing ground surface within the proposed building area, as well as proposed parking and access road areas.

Based on the information obtained from our subsurface exploration, the site can be developed for the proposed project in accordance with the recommendations contained in this report. The following geotechnical considerations were identified:

- Organic silt topsoil was encountered in borings up to 1.3 feet thick. In our opinion, this material should be completely removed from the proposed building footprint, as we consider these materials to be unsuitable.

- The proposed building may be supported on shallow footings bearing on undisturbed, native silt. Recommendations for the subgrade preparation are included in the Foundations section of this report.

- Assuming proper site preparation, total and differential settlement should be within anticipated client/owner tolerances as discussed herein.

- From the 2012 International Building Code Section 1613.3.2, and ASCE 7-10 Table 20.3-1, the seismic site classification for this site is F due to the presence of liquefiable sands during the design seismic event.

- Close monitoring of the construction operations discussed herein will be critical in achieving the design foundation/subgrade support. We therefore recommend that Terracon be retained to provide observation/testing during this portion of the work.

This summary should be used in conjunction with the entire report for design purposes. It should be recognized that details were not included or fully developed in this section, and the report must be read in its entirety for a comprehensive understanding of the items contained herein. The section titled **GENERAL COMMENTS** should be read for an understanding of the report limitations.

GEOTECHNICAL ENGINEERING REPORT
PROVIDENCE HOME - INTERMOUNTAIN FLATHEAD
SOMERS, MONTANA

Terracon Project No. C5135908
October 28, 2013

1.0 INTRODUCTION

Terracon Consultants, Inc.(Terracon) has completed a geotechnical exploration for the proposed Providence Home at the Intermountain Flathead property north of Somers, Montana. The structure is to be located in the southwest portion of a large, undeveloped parcel of land south and east of North Somers Road. Subsurface exploration took place on October 8, 2013, and included eight(8) borings, designated B-1 through B-8, that were drilled to depths ranging from 4.5 to 21.5 feet below the existing ground surface in the areas of proposed development. Logs of the borings and a boring location diagram are included in Appendix A of this report.

The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- subsurface soil conditions
- groundwater conditions
- earthwork
- foundation design and construction
- floor slab design and construction
- seismic considerations
- lateral earth pressures
- pavement recommendations

2.0 PROJECT INFORMATION

2.1 Project Description

Item	Description
Site layout	See Appendix A, Exhibit A-2: Boring Location Diagram
Structure	Single story, with slab-on-grade and footprint of +/- 7,500 ft^2.
Building construction	Wood-frame on perimeter strip foundations
Finished floor elevation	Project elevation 2904 = 100.0' (Terracon Datum)
Maximum loads	Columns: 50 kips (assumed) Walls: 2 klf (assumed) Floor slab: 125 psf max (assumed)
Maximum allowable settlement	Columns: 1 inch (assumed) Walls: ¾ inch over 40 feet (assumed)

Item	Description
Grading	Based on the topographic site plan provided by the client, we anticipate that site grading will require 1 to 2 feet of fill on the south side and nominal cut on the north side to achieve final grades.

2.2 Site Location and Description

Item	Description
Location	This project will be located at the northwest portion of the existing camp near the access road
Existing improvements	Currently the site and undeveloped and used for agriculture
Current ground cover	Alfalfa hay
Existing topography	The site slopes gently downward to the southeast in the immediate area of the proposed building. There is a depression of 4 to 5 feet +/- in the central portion of the property, and elevations on the northern portion are near those on the south portion (based on visual assessment)

3.0 SUBSURFACE CONDITIONS

3.1 Geology/Typical Profile

The project site is located north of Somers, and about 2 miles north of Montana Highway 82, where dominant subsurface conditions are glacial outwash or glacio-fluvial silts and sands underlain by glacial till at depths presumed well beyond those explored for this investigation. Based on the results of the borings, subsurface conditions on the project site can be generalized as follows:

Stratum	Approximate Depth to Bottom of Stratum (feet)	Material Description	Consistency/Density
1	0.6 to 1.3 feet	Organic Silt topsoil and roots	Soft to medium stiff
2a	6.0 to 8.0 feet (B-1 through B-5)	Silt	Medium stiff to very stiff
2b	Termination depths of 6.5 feet (B-6 through B-8)	Silty Clay	Medium stiff to very stiff
3	13.0 to 17.0 feet (Termination depths of 11.5 and 16.5 feet in Borings B-3 and B-5)	Silty Sand	Very loose to loose

Stratum	Approximate Depth to Bottom of Stratum (feet)	Material Description	Consistency/Density
4	Termination depths of 16.5 and 21.5 feet (Borings B-1 and B-2)	Poorly Graded Sand (Borings B-1 and B-2 only)	Very loose to loose

Conditions encountered at each boring location are indicated on the individual boring logs. Stratification boundaries on the boring logs represent the approximate location of changes in soil types; in situ, the transition between materials may be gradual. Complete details for each of the borings can be found on the boring logs in Appendix A of this report.

Under the topsoil layer, native soils consisted of silt/silty clay that extended to depths ranging from 6.0 to 8.0 feet below existing grade. These native fine-grained glacial outwash soils were generally medium stiff to very stiff with SPT values typically ranging from 6 to 27, having been stiffened by post-glacial drying. Natural moisture contents ranged from 2 to 10 percent, but were typically on the order of 2 to 6 percent. Liquid Limits measured 29 and 26 percent, while the Plasticity Index value was 5 for two samples taken in this layer.

Borings B-4 and B-6 through B-8 terminated in this silt/silty clay layer. Silty sand was encountered below the silt/silty clay and extended from 13.0 to 17.0 feet below existing grade in the area of the proposed building. Particle size analysis indicated approximately 58 to 75 percent sand, and the remainder primarily silt. Atterberg Limits were shown to be non-plastic on the fraction passing the No. 40 sieve. Borings B-1 and B-2 contained poorly graded sand below the silty sand that extended to the total exploration depth.

A sample taken from Boring B-2 at a depth of 5 to 7 feet was tested for consolidation/swell by ASTM D2435 and direct shear strength (consolidated undrained) by ASTM D3080. Consolidation testing recorded about 0.8 percent axial strain at field moisture content and a normal stress of 2,000 psf, after which the normal stress was reduced to 1,000 psf and the sample inundated. The sample showed minor collapse upon inundation of about 0.3 percent with no increase in normal stress. The resulting total axial strains were about 1.4 percent and 2.5 percent at 2,000 psf and 4,000 psf, respectively. If the sample had not been inundated, anticipated axial strain would have been on the order of 2 percent at 4,000 psf. The direct shear failure stress was 2,390 psf which occurred at 3 percent horizontal strain. These test results indicate generally moderate shear strength and compressibility for the native outwash soils that exist in the upper 8 feet of the soil profile. Please refer to Appendix B for a laboratory test summary and complete test results.

3.2 Water Level Observations

The borings were observed while drilling and immediately after completion for the presence and level of groundwater. Groundwater was encountered at 16.1 feet in Boring B-1 during the field investigation, and was not encountered in any other borings.

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. In addition, perched or trapped water can develop over low permeability soils such as those on this site. Therefore, groundwater may be encountered randomly during construction or at other times in the life of the structure. The possibility of groundwater presence should be considered when developing the design and construction plans for the project.

4.0 RECOMMENDATIONS FOR DESIGN AND CONSTRUCTION

4.1 Geotechnical Considerations

From our review of provided site topographic mapping, it appears that the finished floor in the northern portion will be near existing grade and approximately 1 to 2 feet above existing grade in the southern portion. We understand that the proposed structure will have a perimeter foundation wall extending below frost depth. We have assumed maximum loads of 50 kips and 2 kips per lineal foot for columns and line loads, respectively.

Foundation conditions at the site consist of 7 to 8 feet of stiff silt below the topsoil layer. This material will provide a natural “rafting” effect to distribute footing loads provided the silt is not disturbed by construction activity. Our settlement calculations have been based on direct bearing on undisturbed native silt, prepared as will be discussed in detail in Section 4.3 Foundations. Below the silt, loose to very loose, saturated sand was encountered. This material is liquefiable during the design seismic event as further discussed in Section 4.4.

The silt showed minor collapse potential upon inundation with water during our consolidation test, as previously discussed. Given this moisture sensitivity, our recommendations include a perimeter foundation drain to reduce the risk for adverse differential performance of foundations and floor slab from water infiltration/saturation. As discussed above, finished floor elevation will be variable across the proposed building area, with cut on the north and fill required on the south. Fill required to establish design grades should meet the requirements for Structural Fill or engineered fill (ML) as presented in Section 4.2.2. The native silt subgrade is highly frost susceptible, and foundation plans should reflect this potential by frost-depth embedment along exterior building lines, or by using foundation insulation. Structures that incorporate thickened-edge slabs (such as unheated storage buildings) or exterior columns that are structurally tied to

the main building(s) are particularly susceptible to frost damage. Exterior subgrade insulation is appropriate for some instances where differential movements are undesirable.

All organic silt soils and roots should be completely removed from the building footprint during initial site preparation, which will be discussed in detail in Section 4.2 Earthwork. We recommend that the exposed subgrade be thoroughly evaluated after removing existing organic silt material within the upper 1.3 feet +/-, but prior to the start of any Structural Fill/engineered fill placement. We recommend that our geotechnical engineer be retained to evaluate the bearing material for the foundations and floor slab subgrade soils.

Preparation for exterior stoops and walkways should be carefully considered given the presence of the highly frost susceptible silts near surface. Based upon the preliminary site plan provided, there appears to be significant exterior concrete around the building, including a sidewalk that extends to the northwest to the island/turnaround area. Depending on the desired level of performance, we suggest consideration be given for a minimum 12 inch subexcavation and replacement with a granular, low-frost susceptible material to minimize the detrimental effects of long-term cyclical frost heave, which can produce increased risk for both cosmetic imperfections and potential tripping/safety hazards.

Subsurface conditions, as identified by the field and laboratory testing programs, have been reviewed and evaluated with respect to the proposed building information known to us at this time. Our recommendations for earthwork and the design and construction of shallow foundations, floor slabs, and drainage for the proposed development are presented in the following sections.

4.2 Earthwork

Earthwork on this project should be observed and evaluated by Terracon, as our recommendations have been developed based on our further involvement during construction. Recommendations for site preparation, excavation, subgrade preparation, and placement of engineered fill for the project are provided in the following sections.

4.2.1 Site Preparation

The following preparation and evaluation sequence is recommended for the building area and should be performed with a Terracon representative present before any foundation excavation/preparation begins:

- Site preparation should begin with the removal of all topsoil, vegetation, organic materials and any loose, soft, or otherwise unsuitable materials. Organic soils removed during site preparation could be utilized as fill for landscaped areas, but these materials should not be used as fill beneath the proposed building or road areas.

- The exposed native soils that will serve as slab and pavement support materials should be observed and tested by Terracon following stripping and prior to placing new engineered fill. The subgrade should be moistened and compacted to a minimum of 95% of standard Proctor maximum dry density (ASTM D698). The subgrade should not deflect or rut excessively under the compaction and construction equipment. Preparation for foundations is discussed in Section 4.3.

4.2.2 Engineered Fill Material Requirements

Engineered fill materials that require placement under engineering control are listed below:

Fill Type	USCS Classification	Acceptable Location for Placement
Structural Fill[1,3]	GW, GP, SW, SP and dual classifications thereof	All required fill/backfill within building footprint
On-site soils[1,2]	ML	Exterior foundation backfill, utility trench backfill outside building limits

1. Frozen material should not be used, and fill should not be placed on a frozen subgrade. A sample of each material type should be submitted to Terracon for evaluation prior to use on this site.
2. Based on visual examination of recovered soil samples and the results of the laboratory tests, the native silt is acceptable for use as fill only at the indicated locations. However, any organic materials, uncontrolled fill, and other unsuitable materials should be removed prior to use in new fill sections.
3. Structural Fill should have 100% passing 2-inch size, 85-100% passing 1-1/2 inch size, 30-60% passing the No. 4 screen, and not more than 10% passing the No. 200 screen. The fines portion should have a maximum Liquid Limit and Plasticity Index of 25 and 10 percent respectively.

4.2.3 Fill Placement and Compaction Requirements

Item	Description
Fill Lift Thickness	9 inches or less in loose thickness when heavy, self-propelled compaction equipment is used. 6 inches or less in loose thickness when hand-guided equipment (i.e., a jumping jack or plate compactor) is used.
Minimum Compaction Requirement [1, 2] **Structural Fill**	98% of the material's standard Proctor maximum dry density (ASTM D698).
Minimum Compaction Requirement [1, 2] **Foundation backfill, slab subgrade**	95% of the material's maximum standard Proctor dry density (ASTM D698)

Moisture Content of Cohesive Soil	-2% to +2% of standard Proctor optimum (ASTM D698)
Moisture Content of Granular Material [3]	Workable moisture levels

1. We recommend that each lift of fill be tested by Terracon for moisture content and compaction prior to the placement of additional fill or concrete. If the results of the in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested as required until the specified moisture and compaction requirements are achieved.
2. If the granular material is a coarse sand or gravel, is of a uniform size, or has a low fines content, compaction comparison to relative density (ASTM D 4253/4254) may be more appropriate. In this case, granular materials should be compacted to at least 60% relative density.
3. The gradation of a granular material affects its stability and the moisture content required for proper compaction. Moisture levels should be maintained to achieve compaction without bulking during placement or pumping under compactive effort.

4.2.4 Grading and Drainage

Due to the presence of silt soils with some moisture sensitivity, it is particularly important that moisture sources around the building be eliminated to the extent practical. During construction, grades should be developed to direct surface water flow away from or around the site. Exposed subgrades should be sloped to provide positive drainage so that the potential for saturation of subgrades is reduced. Surface water should not be permitted to accumulate on the site.

Final surrounding grades should be sloped away from the structure on all sides to prevent ponding of water and irrigation migration into the building backfill zones. Gutters and downspouts that drain water should be extended a minimum of 10 feet beyond the building limits. This can be accomplished through the use of downspout extensions and flexible pipes that are designed to attach to the end of the downspout. Flexible pipe should only be used if it is daylighted in such a manner that it gravity-drains collected water. Splash-blocks should also be considered below hose bibs and water spigots. If water is permitted to pond adjacent to the structure, the foundation performance estimates provided cannot be relied upon due to the adverse effects that moisture may induce in terms of clay volume change or strength. Irrigation in the building backfill zone should be avoided, or plantings limited to strictly managed containers.

To limit the potential problems associated with moisture infiltration around the building, it is recommended that a perimeter underdrain system be installed. A general detail is provided in Appendix A. It is recommended that our geotechnical engineer provide final design input in this regard along with observation during installation.

4.2.5 Earthwork Construction Considerations

Care should be taken to avoid disturbance of prepared subgrades. Unstable subgrade conditions could develop during general construction operations, particularly if the soils are wetted and/ or

subjected to repetitive construction traffic. New fill compacted above optimum moisture content or that accumulates water during construction can also become disturbed by construction equipment. Construction traffic over the completed subgrade should be minimized to the extent practical. If the subgrade becomes saturated, desiccated, or disturbed, the affected materials should either be scarified and compacted, or be removed and replaced. Subgrades should be observed and tested by Terracon prior to construction of foundations and slabs.

As a minimum, excavations should be performed in accordance with OSHA 29 CFR, Part 1926, Subpart P, "Excavations" and its appendices, and in accordance with any applicable local, state, and federal safety regulations. The contractor should be aware that slope height, slope inclination, and excavation depth should in no instance exceed those specified by these safety regulations. Flatter slopes than those dictated by these regulations may be required depending upon the soil/groundwater conditions encountered and other external factors. These regulations are strictly enforced and if they are not followed, the owner, contractor, and/or earthwork and utility subcontractor could be liable and subject to substantial penalties. Under no circumstances should the information provided in this report be interpreted to mean that Terracon is responsible for construction site safety or the contractor's activities. Construction site safety is the sole responsibility of the contractor who shall also be solely responsible for the means, methods, and sequencing of the construction operations.

4.3 Foundations

In our opinion, the proposed building can be supported by conventional spread footing foundations bearing on undisturbed native, medium stiff to very stiff silt. Excavations for foundations should be conducted using smooth-lipped buckets and cut neatly to minimize disturbance to the bearing subgrade. This native silt soils are anticipated to be sufficiently homogenous at planned foundation depth, but our engineer should be contacted to verify subgrade conditions during excavation. Where other unsuitable conditions are encountered at design footing bearing depth, the remedial methods recommended in Section 4.3.2 should be implemented. Design recommendations for shallow foundations to support the proposed building are presented below.

4.3.1 Foundation Design Recommendations

Description	Value
Allowable bearing pressure [1]	2,000 psf
Minimum footing dimensions	Isolated footings: 30 inches Continuous footings: 18 inches
Minimum embedment below finished grade for frost protection [2]	3.5 feet
Approximate total settlement from foundation loads [3]	< 1 inch

Estimated differential settlement from foundation loads [3]	1/2 to 2/3 of the total settlement

1. The recommended allowable bearing pressure is the pressure including surrounding overburden pressure at the footing base elevation. This pressure assumes that any existing fill or lower strength soils, if encountered, will be undercut and replaced with engineered fill.
2. For perimeter footings, footings beneath unheated areas, and footings that will be exposed to freezing conditions during construction.
3. Foundation settlement will depend upon the variations within the subsurface soil profile, the structural loading conditions, the embedment depth of the footings, the thickness of engineered fill, and the quality of the earthwork operations and footing construction.

These recommendations have been based on assumed maximum columns and wall loads of 50 kips and 2 kips per lineal foot, respectively, as indicated in Sections 2.1 and 4.1. Design loading in excess will increase the stress applied to the supporting soils, and require additional geotechnical analysis to ensure estimated settlement will meet engineer/owner expectations.

4.3.2 Foundation Construction Considerations

The base of each foundation excavation should be free of water and any loose or soft soil prior to placing concrete. The foundation excavations should be cut neatly with smooth-lipped buckets as described above in Section 4.3. Concrete should be placed as soon after foundation preparation as possible to reduce bearing soil disturbance. If the subgrade should become become excessively dry, disturbed, saturated, or frozen, the affected soil should be removed to an undisturbed surface and replaced under geotechnical observation prior to placing concrete.

Footings should bear on properly prepared native soils as described in Section 4.3. If unsuitable bearing soils are encountered in footing excavations, the excavation should be extended deeper to suitable soils under the direction of our geotechnical engineer. Any required subexcavations below foundation level should be replaced with a lean concrete fill with compressive strength on the order of 500 pounds per square inch or other methods as directed by our geotechnical engineer.

4.4 Seismic Considerations

The site is located in the seismically active Intermountain Seismic Belt. Probabilistic ground motion studies developed by the USGS 2008 indicate a Peak Ground Accelerations (PGA) of 0.36g on a 2475-year return interval, or a 2% probability of exceedence in a given 50-year period. Based on this information and the presence of loose to very loose saturated sand soils, calculations by conventional, semi-empirical methods indicate the site to be liquefaction-prone. Therefore, the following Site Classification has been applied:

Code Used	Site Classification
2012 International Building Code (IBC) [1]	F [2]

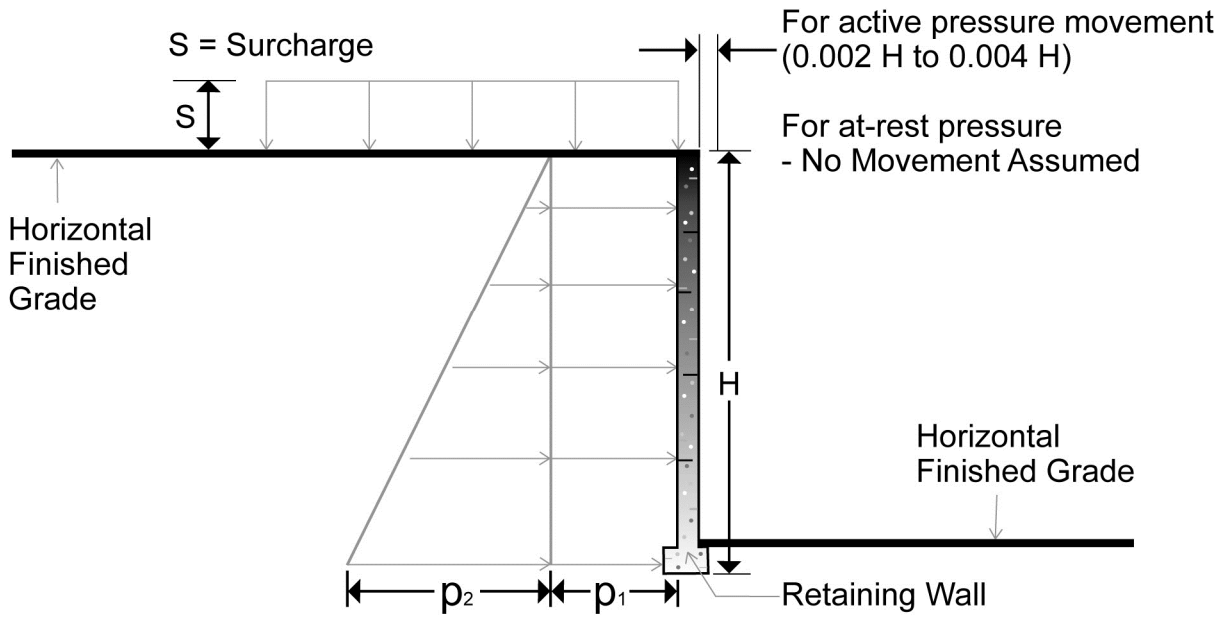
1. 1. In general accordance with the *2012 International Building Code,* Section 1613.3.2, and ASCE 7-10 Table 20.3-1

2. The 2012 International Building Code and ASCE 7-10 require a site soil profile determination extending a depth of 100 feet for seismic site classification. The current scope requested does not include the required 100 foot soil profile determination. Borings for this report extended to a maximum depth of 21.5 feet. Additional exploration to greater depths could be considered to confirm the conditions below the current depth of exploration. Alternatively, a geophysical exploration could be utilized in order to attempt to justify a more favorable seismic site class.

Although further analysis with respect to this condition is beyond the current scope of project services, we are available to work with the project structural engineer to evaluate possible mitigating options. It appears that the stiff silt crust at the site along with a rigid, cross-tied foundation system, possibly integral with the slab, would be a first option to consider in efforts to maintain structural integrity during an extreme seismic event.

4.5 Lateral Earth Pressures

Foundation or retaining walls with unbalanced backfill levels on opposite sides should be designed for earth pressures at least equal to those indicated in the following table. Earth pressures will be influenced by structural design of the walls, conditions of wall restraint, methods of construction and/or compaction and the strength of the materials being restrained. Two wall restraint conditions are shown. Active earth pressure is commonly used for design of free-standing cantilever retaining walls and assumes wall movement. The "at-rest" condition assumes no wall movement. The recommended design lateral earth pressures do not include a factor of safety and do not provide for possible hydrostatic pressure on the walls.



EARTH PRESSURE COEFFICIENTS

Earth Pressure Conditions	Coefficient For Backfill Type	Equivalent Fluid Density (pcf)	Surcharge Pressure, p_1 (psf)	Earth Pressure, p_2 (psf)
Active (Ka)	Structural Fill – 0.26	35	(0.26)S	(35)H
	Site Silt Fill – 0.49	60	(0.49)S	(60)H
At-Rest (Ko)	Structural Fill - 0.41	55	(0.41)S	(55)H
	Site Silt Fill – 0.66	81	(0.66)S	(81)H
Passive (Kp)	Structural Fill – 3.85	500	---	(500)H
	Site Silt Fill – 2.0	245	---	(245)H

Applicable conditions to the above include:

- For active earth pressure, wall must rotate about base, with top lateral movements of about 0.002 **H** to 0.004 **H**, where **H** is wall height
- For passive earth pressure to develop, wall must move horizontally to mobilize resistance.
- Uniform surcharge, where S is surcharge pressure
- Horizontal backfill, compacted between 95 and 98 percent of Standard Proctor maximum dry density
- Loading from heavy compaction equipment not included
- Compaction within 4' of walls using hand operated equipment only
- No hydrostatic pressures acting on wall (underdrainage provided)

- No dynamic loading; seismic thrust must be added as required by IBC
- All table values are ultimate and do not include factors of safety that must be applied by the structural engineer.

Backfill placed against structure on the exterior should consist of either sorted on-site silt or imported Structural Fill described in Section 4.2. Structural Fill should be used for interior foundation backfill. The on-site silt will require some moisture adjustment (either drying or moistening). For the Structural Fill values to be valid, the granular backfill must extend out from the base of the wall at an angle of at least 45 and 60 degrees from vertical for the active and passive cases, respectively. Additional geotechnical design input will be necessary for your designer if retaining walls are intended for the site; we can provide these parameters once additional information is provided for a specific retention feature.

4.6 Floor Slab

4.6.1 Design Recommendations

Item	Description
Floor slab support[1]	Native soils or Structural Fill material that have been prepared in accordance with section 4.2 and tested/observed by Terracon
Modulus of subgrade reaction	200 pounds per square inch per inch (psi/in) for point loading conditions
Crushed aggregate base course [2]	Nominal 4 inches of ¾" minus gravel material

1. Floor slabs should be structurally independent of any building footings or walls to reduce the severity of floor slab cracking caused by differential movement between the slab and foundation.
2. The floor slab should be placed on a leveling course comprised of well-graded granular material (e.g., Montana Public Works Standard Specifications – ¾" crushed base course) compacted to at least 98% of the material's standard Proctor maximum dry density (ASTM D698)

Joints should be constructed at regular intervals as recommended by the American Concrete Institute (ACI) to help control the location of cracking. It should be understood that differential settlement between the floor slabs and foundation could occur.

The use of a vapor retarder should be considered beneath concrete slabs on grade that will be covered with wood, tile, carpet or other moisture sensitive or impervious coverings, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer should refer to ACI 302 and/or ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder.

4.6.2 Floor Slab Construction Considerations

On most project sites, the site grading is generally accomplished early in the construction phase. However as construction proceeds, the subgrade may be disturbed due to utility excavations, construction traffic, desiccation, rainfall, etc. As a result, the floor slab subgrade may not be suitable for placement of crushed aggregate base course and concrete and corrective action will be required.

Terracon should review the condition of the floor slab subgrades immediately prior to placement of the granular leveling course and construction of the slabs. Particular attention should be paid to high traffic areas that were rutted and disturbed earlier and to areas containing backfilled trenches. Areas where unsuitable conditions are located should be repaired by removing and replacing the affected material with properly compacted engineered fill. The use of geotextile and/or geogrid may also be required based on engineering observation.

4.7 Pavements

4.7.1 Pavement Design Recommendations

The design approach used to develop the following tables for the flexible surfacing was based on the American Association of State Highway and Transportation Officials (AASHTO) 1993 Guide for Design of Pavement Structures, Chapter 4 Low Volume Road Design. We used structural coefficients of the Montana Department of Transportation and our local experience. We also consulted the National Asphalt Pavement Association (NAPA) methodology, which is specific to low-volume pavements. For the pavement designs for these sites, we have assumed a maximum of 27,000 total ESAL's over the design period. Pavement sections have been developed based upon a minimum Structural Number of 2.6.

The design of pavement thickness was based on this traffic data and the following:

- Subgrade is prepared in accordance with the **Earthwork** section of this report.
- Anticipated traffic loading and volume
- Climate conditions at the project site
- A design period of 20 years.

As a minimum, we suggest the following typical pavement sections be considered:

Typical Pavement Section Thickness

Traffic Area	Asphalt Concrete Surface Course	Portland Cement Concrete	Crushed Aggregate Base Course[1]	Uncrushed Aggregate Subbase[2]	Total Thickness
Parking Lot/Access Roads Option #1	3 inches	--	10 inches	--	13 inches
Parking Lot/Access Roads Option #2	3 inches	--	4 inches	8 inches	15 inches
Delivery/Loading Areas/Dumpster	--	6 inches	4 inches		10 inches

The pavement design has been predicated on complete removal of the organic silt topsoil. It also assumes all recommendations for subgrade improvement and evaluation have been implemented from Section 4.2.1 Site Preparation.

Specific information regarding anticipated vehicle types, axle loads and traffic volumes was not provided. In developing our recommendations, we have considered that traffic will consist primarily of automobile traffic and a limited number of small busses, delivery trucks and trash removal trucks. If heavier vehicle types or higher traffic volumes are expected, Terracon should review these recommendations. Recommended specifications for flexible and Portland cement concrete pavement materials are included in Appendix C as Exhibits C-3 and C-4.

Pavements and subgrades will be subject to freeze-thaw cycles and seasonal fluctuations in moisture content. The pavement sections provided in the table above were developed based on local soil and climate conditions.

The pavement sections provided above assume that the subgrade soils will not experience significant increases in moisture content. Paved areas should be sloped to provide rapid drainage of surface water and to drain water away from the pavement edges. Water should not be allowed to accumulate on or adjacent to the pavement, since this could saturate and soften the subgrade soils and subsequently accelerate pavement deterioration. Periodic maintenance of the pavements will be required. Cracks should be sealed, and areas exhibiting distress should be repaired promptly to help prevent further deterioration. Even with periodic maintenance, some movement and related cracking may still occur and repairs may be required.

4.7.2 Pavement Construction Considerations

Pavement subgrades should be prepared in accordance with the recommendations presented in Sections 4.1 and 4.2 of this geotechnical engineering report. Grading and paving are commonly performed by separate contractors and there is often a time lapse between the end

of grading operations and the commencement of paving. Subgrades prepared early in the construction process may become disturbed by construction traffic. Non-uniform subgrades often result in poor pavement performance and local failures relatively soon after pavements are constructed. Depending on the paving equipment used by the contractor, measures may be required to improve subgrade strength to greater depths for support of heavily loaded concrete/asphalt trucks.

5.0 GENERAL COMMENTS

Terracon should be retained to review the final design plans and specifications so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications. Terracon also should be retained to provide observation and testing services during grading, excavation, and foundation construction phases of the project. It is particularly important that our geotechnical engineer observe subgrade preparation for foundations and slabs; without such observation and approval, the recommendations contained herein for development of the site for the described use are not valid.

The analysis and recommendations presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between borings, across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.

APPENDIX A
FIELD EXPLORATION

Field Exploration Description

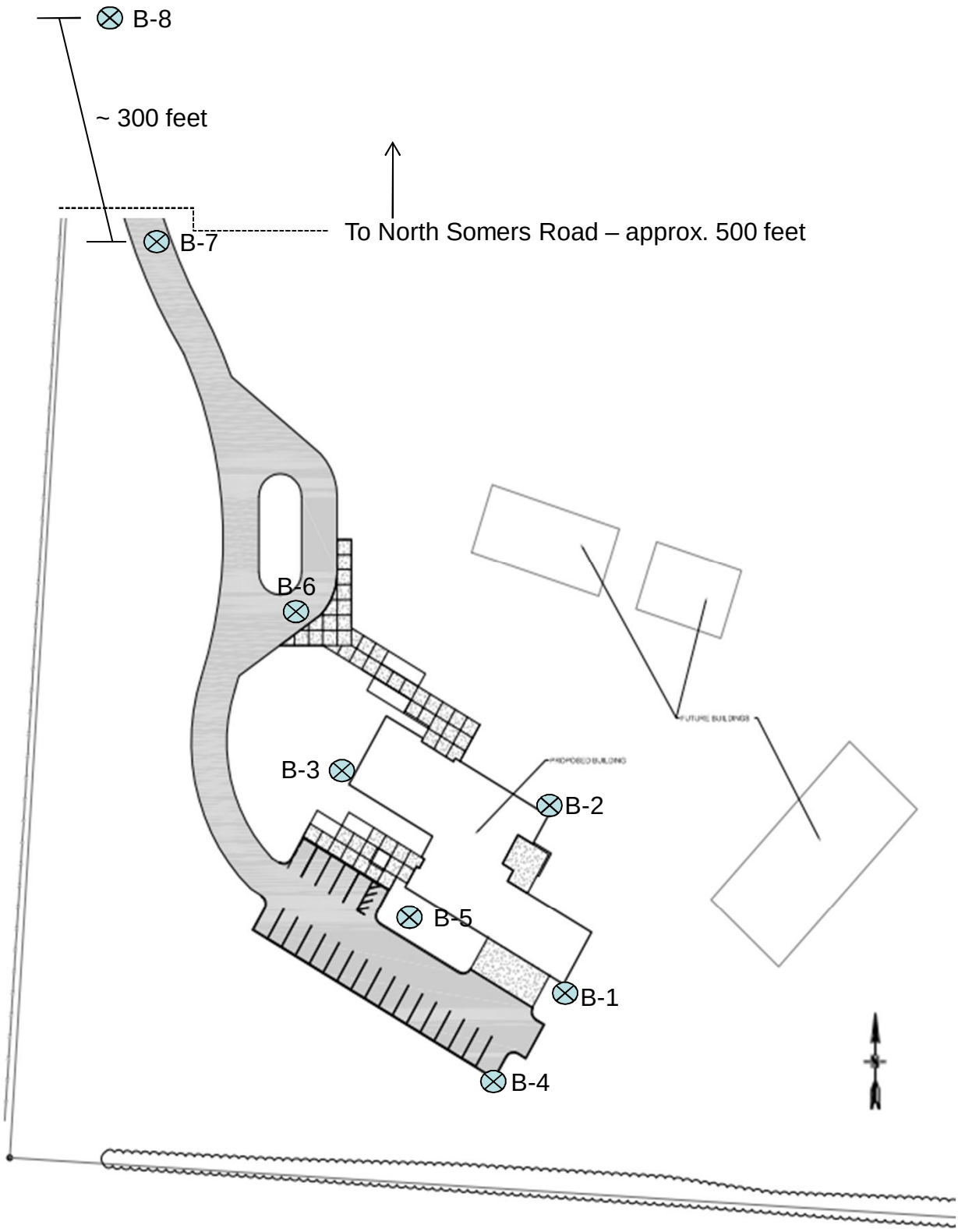
The boring locations were laid out at the site by a Terracon representative utilizing a site plan provided by the client. Ground surface elevations indicated on the boring logs were interpolated from a topographic site plan provided by the client and are rounded to the nearest 1 foot. Differences could occur from interpolation and from superimposing approximate boring locations on the topographic plan. The locations and elevations of the borings should be considered accurate only to the degree implied by the means and methods used to define them.

The borings were drilled with a truck-mounted, rotary drill rig (Mobile B-59) using continuous flight augers to advance the boreholes. Soil samples were obtained using split-barrel and thin-walled tube sampling procedures.

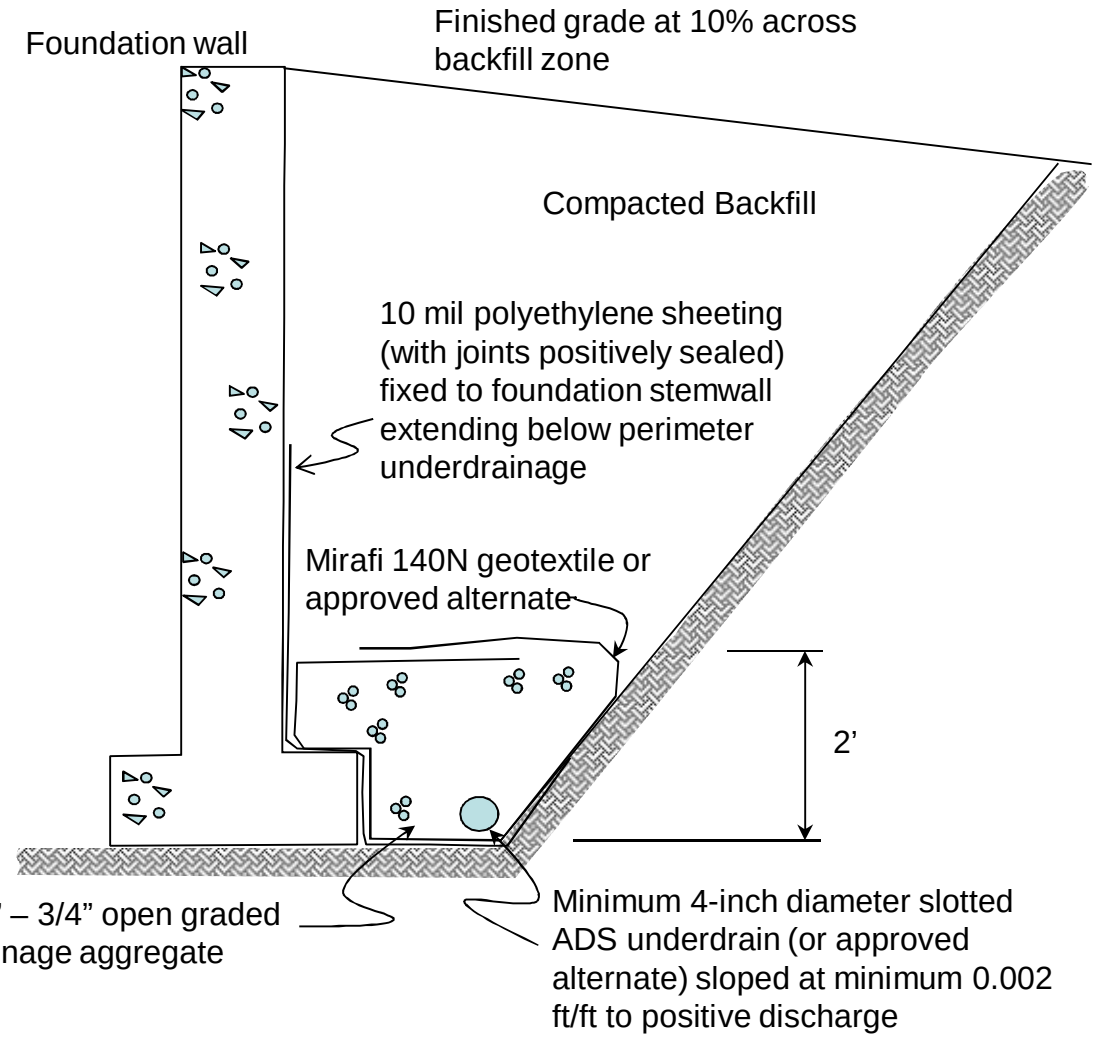
In the split-barrel sampling procedure, the number of blows required to advance a standard 2-inch O.D. split-barrel sampler the last 12 inches of the typical total 18-inch penetration by means of a 140-pound hammer with a free fall of 30 inches, is the standard penetration resistance value (SPT-N). This value is used to estimate the in-situ relative density of cohesionless soils and consistency of cohesive soils.

In the thin-walled tube sampling procedure, a thin-walled, seamless steel tube with a sharp cutting edge is pushed hydraulically into the soil to obtain a relatively undisturbed sample. The samples were tagged for identification, sealed to reduce moisture loss, and taken to our laboratory for further examination, testing, and classification. Information provided on the boring logs attached to this report includes soil descriptions, consistency evaluations, boring depths, sampling intervals, and groundwater conditions. The borings were backfilled with auger cuttings prior to the drill crew leaving the site.

A field log of each boring was prepared by our engineer. These logs included visual classifications of the materials encountered during drilling as well as the driller's interpretation of the subsurface conditions between samples. Final boring logs included with this report represent the engineer's interpretation of the field logs and include modifications based on laboratory observation and tests of the samples.



Project No. C5135908 Scale: N.T.S. Date: 10/28/13	Terracon 1075 Trumble Creek Rd, Unit A Kalispell, MT PH. (406) 257-6479 FAX. (406) 257-6479	Boring Location Diagram Providence Home Intermountain Flathead	Exhibit A-2



Project No. C5135908 Scale: N.T.S. Date: 10/28/13	Terracon 1075 Trumble Creek Rd, Unit A Kalispell, MT PH. (406) 257-6479 FAX. (406) 257-6479	Underdrainage Detail Providence Home Somers, MT	Exhibit A-3

BORING LOG NO. B-1

PROJECT: Providence Home - Intermountain Flathead

CLIENT: Intermountain Deaconess Children's Services Helena, Montana

SITE: North Somers Road Somers, MT

Schlenker & McKittrick Architects, PC Helena, Montana

LOCATION See Exhibit A-2

DEPTH	Description	FIELD TEST RESULTS	TEST TYPE	COMPRESSIVE STRENGTH	STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI
0.7	**ORGANIC SILT (OL)**, dark brown, soft to medium stiff							
	SILT (ML), light brown, very stiff							
		5-9-12 N=21				3		29-24-5
5		6-10-7 N=17				4		
8.0	**SILTY SAND (SM)**, brown to orange-brown, very loose to loose							
10		2-2-3 N=5				4		
15		1-2-1 N=3				35		
17.0	Groundwater at 16.1' while drilling							
	POORLY GRADED SAND (SP), grayish-brown, very loose							
20	6 inches of heave at 20'	0-0-0 N=0				28		
21.5	***Boring Terminated at 21.5 Feet***							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method: 3.25" HSA

Abandonment Method:

See Exhibit for description of field procedures.

See Appendix B for description of laboratory procedures and additional data, (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

while drilling

Terracon

Boring Started: 10/8/2013 | Boring Completed: 10/8/2013

Drill Rig: CME 75 | Driller: R. Guedesse

Project No.: C5135908 | Exhibit A-4

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. TERRACON SMART LOG-NO WELL PROVIDENCE HOME.GPJ TERRACON2012.GDT 10/25/13

BORING LOG NO. B-2

PROJECT: Providence Home - Intermountain Flathead

CLIENT: Intermountain Deaconess Children's Services Helena, Montana

SITE: North Somers Road Somers, MT

Schlenker & McKittrick Architects, PC Helena, Montana

LOCATION See Exhibit A-2

GRAPHIC LOG	DEPTH	DEPTH (ft)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (%)	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI
	0.6 **ORGANIC SILT (OL)**, dark brown, soft to medium stiff											
	SILT (ML), light brown, stiff											
				X	1.5	7-5-6 N=11				5		
		5										
				■	2		UC			4	91	
	8.0			X	1.5	5-5-6 N=11				4		
	SILTY SAND (SM), brown to orange-brown, loose											
		10		X	1.5	3-4-5 N=9				3		
	13.0											
	POORLY GRADED SAND (SP), grayish-brown, very loose to loose											
		15		X	1.5	2-2-3 N=5				10		
	16.5											
	Boring Terminated at 16.5 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method: 3.25" HSA

Abandonment Method:

See Exhibit for description of field procedures.

See Appendix B for description of laboratory procedures and additional data, (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Terracon

Boring Started: 10/8/2013 | Boring Completed: 10/8/2013

Drill Rig: CME 75 | Driller: R. Guedesse

Project No.: C5135908 | Exhibit A-5

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. TERRACON SMART LOG-NO WELL PROVIDENCE HOME.GPJ TERRACON2012.GDT 10/25/13

BORING LOG NO. B-3

PROJECT: Providence Home - Intermountain Flathead

CLIENT: Intermountain Deaconess Children's Services Helena, Montana

SITE: North Somers Road Somers, MT

Schlenker & McKittrick Architects, PC Helena, Montana

LOCATION See Exhibit A-2

GRAPHIC LOG	DEPTH		DEPTH (ft)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (%)	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI
	0.8	**ORGANIC SILT (OL)**, dark brown, soft to medium stiff											
		SILT (ML), light brown, medium stiff			X	1.5	4-4-3 N=7				6		
			5										
					X	1.5	3-4-4 N=8				8		
	7.0												
		SILTY SAND (SM), brown to orange-brown, loose, with some clayey sand lenses											
			10		X	1.5	2-4-3 N=7				6		
			15		X	1.5	2-3-2 N=5				11		
	16.5												
		Boring Terminated at 16.5 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3.25" HSA

Abandonment Method:

See Exhibit for description of field procedures.

See Appendix B for description of laboratory procedures and additional data, (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Terracon

Boring Started: 10/8/2013 | Boring Completed: 10/8/2013

Drill Rig: CME 75 | Driller: R. Guedesse

Project No.: C5135908 | Exhibit A-6

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. TERRACON SMART LOG-NO WELL PROVIDENCE HOME.GPJ TERRACON2012.GDT 10/25/13

BORING LOG NO. B-4

PROJECT: Providence Home - Intermountain Flathead

CLIENT: Intermountain Deaconess Children's Services Helena, Montana

SITE: North Somers Road Somers, MT

Schlenker & McKittrick Architects, PC Helena, Montana

GRAPHIC LOG	LOCATION See Exhibit A-2 DEPTH	DEPTH (ft)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI
	ORGANIC SILT (OL), dark brown, soft to medium stiff 1.0										
	SILT (ML), light brown, stiff to very stiff			X	4-8-8 N=16				10		
				X	6-7-8 N=15				8		
	4.5										
	Boring Terminated at 4.5 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method: 3.25" HSA

Abandonment Method:

See Exhibit for description of field procedures.

See Appendix B for description of laboratory procedures and additional data, (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Terracon

Boring Started: 10/8/2013 | Boring Completed: 10/8/2013

Drill Rig: CME 75 | Driller: R. Guedesse

Project No.: C5135908 | Exhibit A-7

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. TERRACON SMART LOG-NO WELL PROVIDENCE HOME.GPJ TERRACON2012.GDT 10/25/13

BORING LOG NO. B-5

PROJECT: Providence Home - Intermountain Flathead

CLIENT: Intermountain Deaconess Children's Services Helena, Montana

SITE: North Somers Road Somers, MT

Schlenker & McKittrick Architects, PC Helena, Montana

GRAPHIC LOG	LOCATION See Exhibit A-2 / DEPTH	DEPTH (ft)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (%)	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI
	0.8 **ORGANIC SILT (OL)**, dark brown											
	SILT (ML), light brown, stiff to very stiff											
				X	1.5	6-13-14 N=27				5		
		5		X	1.5	6-7-8 N=15				4		
	7.0 **SILTY SAND (SM)**, brown to orange-brown, loose			X	1.2	3-5-5 N=10				2		NP
		10		X	1.3	3-4-5 N=9				2		
	11.5 ***Boring Terminated at 11.5 Feet***											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method: 3.25" HSA

Abandonment Method:

See Exhibit for description of field procedures.

See Appendix B for description of laboratory procedures and additional data, (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Terracon

Boring Started: 10/8/2013 | Boring Completed: 10/8/2013

Drill Rig: CME 75 | Driller: R. Guedesse

Project No.: C5135908 | Exhibit A-8

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. TERRACON SMART LOG-NO WELL PROVIDENCE HOME.GPJ TERRACON2012.GDT 10/25/13

BORING LOG NO. B-6

PROJECT: Providence Home - Intermountain Flathead

CLIENT: Intermountain Deaconess Children's Services Helena, Montana

SITE: North Somers Road Somers, MT

Schlenker & McKittrick Architects, PC Helena, Montana

LOCATION See Exhibit A-2

GRAPHIC LOG	DEPTH	DEPTH (ft)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI
	ORGANIC SILT (OL), dark brown, soft to medium stiff 1.3										
	SILTY CLAY (CL-ML), light brown, very stiff Combined bulk sample from B-6, B-7, & B-8 approximately 2-4 feet depth				3-6-10 N=16				5 5		26-21-5
					5-8-10 N=18				5		
		5			6-10-10 N=20				3		
	6.5 ***Boring Terminated at 6.5 Feet***										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3.25" HSA

Abandonment Method:

See Exhibit for description of field procedures.

See Appendix B for description of laboratory procedures and additional data, (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Terracon

Boring Started: 10/8/2013 | Boring Completed: 10/8/2013

Drill Rig: CME 75 | Driller: R. Guedesse

Project No.: C5135908 | Exhibit A-9

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. TERRACON SMART LOG-NO WELL PROVIDENCE HOME.GPJ TERRACON2012.GDT 10/25/13

BORING LOG NO. B-7

PROJECT: Providence Home - Intermountain Flathead

CLIENT: Intermountain Deaconess Children's Services Helena, Montana

SITE: North Somers Road Somers, MT

Schlenker & McKittrick Architects, PC Helena, Montana

GRAPHIC LOG	LOCATION See Exhibit A-2 / DEPTH	DEPTH (ft)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI
	ORGANIC SILT (OL), dark brown, soft to medium stiff (1.3)										
	SILTY CLAY (CL-ML), light brown, medium stiff to stiff			X	2-5-5 N=10				5		
				X	4-9-11 N=20				1		
		5									
				X	7-8-8 N=16				0		
	6.5 Minor roots extending to approximately 6.5'										
	Boring Terminated at 6.5 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method: 3.25" HSA

Abandonment Method:

See Exhibit for description of field procedures.

See Appendix B for description of laboratory procedures and additional data, (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Terracon

Boring Started: 10/8/2013 | Boring Completed: 10/8/2013

Drill Rig: CME 75 | Driller: R. Guedesse

Project No.: C5135908 | Exhibit A-10

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. TERRACON SMART LOG-NO WELL PROVIDENCE HOME.GPJ TERRACON2012.GDT 10/25/13

BORING LOG NO. B-8

PROJECT: Providence Home - Intermountain Flathead

CLIENT: Intermountain Deaconess Children's Services Helena, Montana

SITE: North Somers Road Somers, MT

Schlenker & McKittrick Architects, PC Helena, Montana

LOCATION See Exhibit A-2

GRAPHIC LOG	DEPTH	DEPTH (ft)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (%)	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI
	ORGANIC SILT (OL), dark brown, soft to medium stiff											
	1.3											
	SILTY CLAY (CL-ML), light brown, medium stiff to stiff											
				X	1.5	6-8-6 N=14				2		
				X	1.5	4-3-3 N=6				2		
		5										
				X	1.5	3-4-4 N=8				1		
	6.5											
	Boring Terminated at 6.5 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method: 3.25" HSA

Abandonment Method:

See Exhibit for description of field procedures.

See Appendix B for description of laboratory procedures and additional data, (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Terracon

Boring Started: 10/8/2013 | Boring Completed: 10/8/2013

Drill Rig: CME 75 | Driller: R. Guedesse

Project No.: C5135908 | Exhibit A-11

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. TERRACON SMART LOG-NO WELL PROVIDENCE HOME.GPJ TERRACON2012.GDT 10/25/13

APPENDIX B
SUPPORTING INFORMATION

Laboratory Testing

The soil samples obtained from the borings were tested in the laboratory to measure their natural water contents. A pocket penetrometer was used to help estimate the approximate unconfined compressive strength of selected native cohesive samples. The test results are provided on the boring logs in Appendix A.

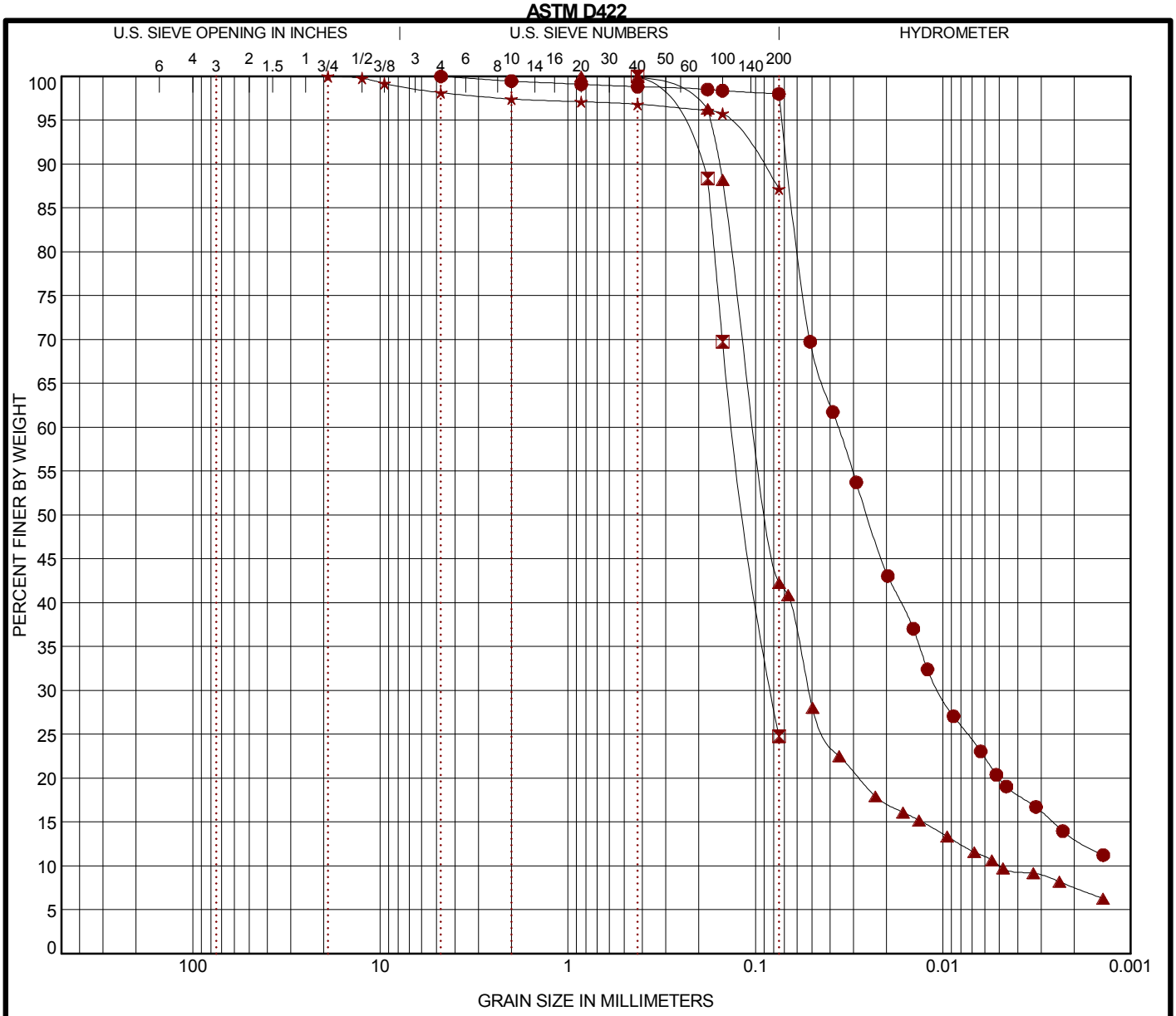
The soil samples were classified in the laboratory based on visual observation, texture, plasticity, and the limited laboratory testing described above. The soil descriptions presented on the boring logs for native soils are in accordance with the enclosed General Notes and Unified Soil Classification System (USCS). The estimated USCS group symbols for native soils are shown on the boring logs, and a brief description of the USCS is included in this report.

Consolidation is the process of time-dependent settlement of clayey soil when subjected to an increased loading. This testing is conducted in a fixed-ring consolidometer in general accordance with the procedures of ASTM D2435-90. The test measures sample strain (settlement) with time for a series of increasing loads applied on the sample surface area; pressure versus strain relations are thereby determined. Specimens for the testing are trimmed from “undisturbed” samples retrieved commonly by Shelby tube or California ring sampler. Specimen dimensions for testing are typically 2.5 inches in diameter by 1.0 inch in height. During the test, specimens may be inundated at a selected normal pressure to simulate field conditions. Test data is generally reduced using the square root of time fitting method to determine specimen strain at 100 percent of primary consolidation for each load increment. This strain at progressive load increments is plotted to construct the consolidation curve for which field soil deformation can be approximated.

Direct shear testing was conducted by consolidated undrained procedures. The first phase of the testing involved consolidating test specimens at normal pressures typically exceeding the existing overburden pressure. At these consolidation pressures, the specimens were in a normally consolidated state for which undrained shear strength can be established. The testing was conducted in a Wykeham-Parrance shear box apparatus at a constant, quick strain rate to limit drainage of water within the sample.

GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Classification	LL	PL	PI	Cc	Cu
●	B-1	1.3	SILT(ML)	29	24	5		
⊠	B-3	15.0	SILTY SAND					
▲	B-5	7.0	SILTY SAND(SM)	NP	NP	NP	5.53	19.64
★	B-6	2.0	SILTY CLAY(CL-ML)	26	21	5		

	Specimen Identification		D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Clay
●	B-1	1.3	4.75	0.036	0.01		0.0	2.0	78.0	20.0
⊠	B-3	15.0	0.425	0.129	0.081		0.0	75.2	24.8	
▲	B-5	7.0	0.85	0.098	0.052	0.005	0.0	57.8	32.2	10.0
★	B-6	2.0	19				1.9	11.0	87.2	

PROJECT: Providence Home - Intermountain Flathead

SITE: North Somers Road
Somers, MT

Terracon

PROJECT NUMBER: C5135908

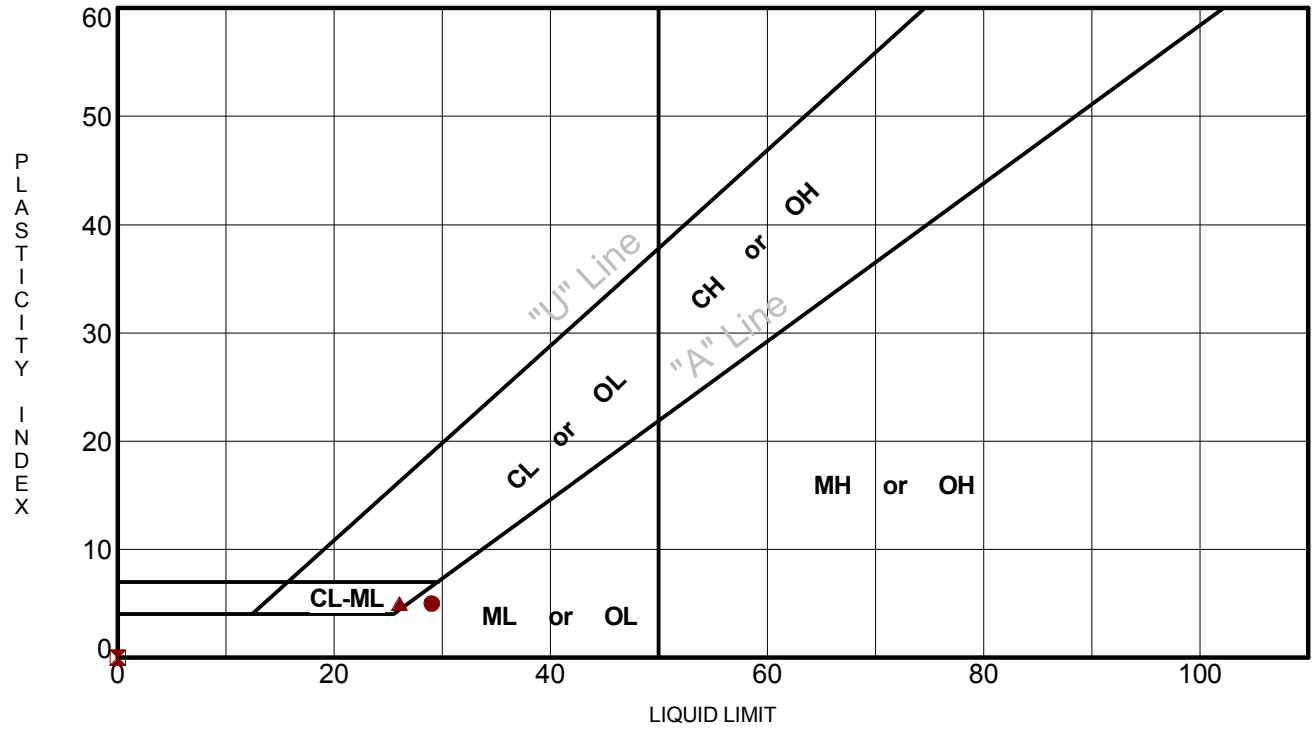
CLIENT: Intermountain Deaconess Children's Services
Helena, Montana

EXHIBIT: B-2

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS-2 PROVIDENCE HOME.GPJ TERRACON2012.GDT 10/25/13

ATTERBERG LIMITS RESULTS

ASTM D4318



	Boring ID	Depth	LL	PL	PI	Fines	USCS	Description
●	**B-1**	**1.3**	**29**	**24**	**5**	**98**	**ML**	**SILT**
⧗	**B-5**	**7.0**	**NP**	**NP**	**NP**	**42**	**SM**	**SILTY SAND**
▲	**B-6**	**2.0**	**26**	**21**	**5**	**87**	**CL-ML**	**SILTY CLAY**

PROJECT: Providence Home - Intermountain Flathead

SITE: North Somers Road
Somers, MT

Terracon

PROJECT NUMBER: C5135908

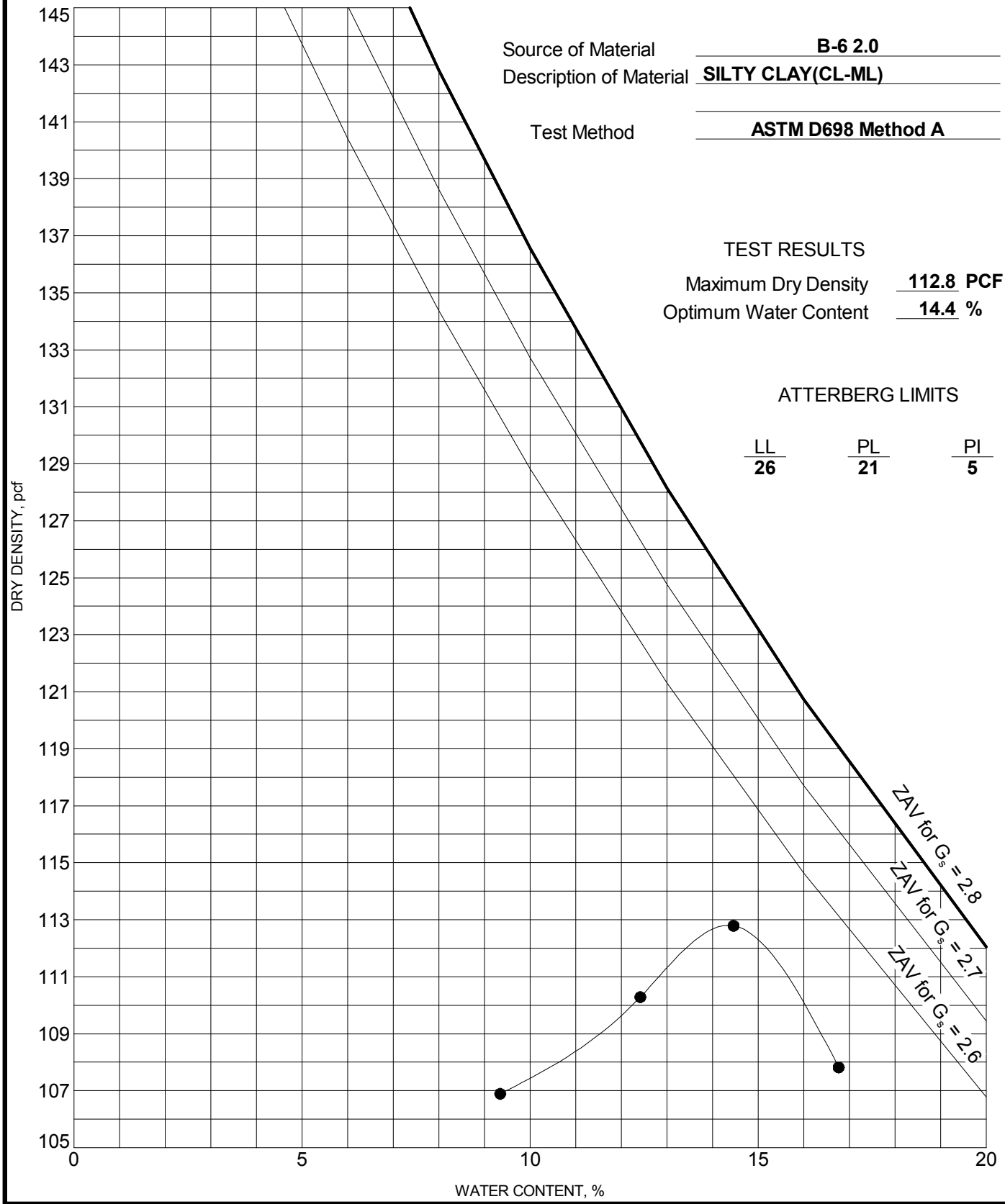
CLIENT: Intermountain Deaconess Children's Services
Helena, Montana

EXHIBIT: B-3

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. ATTERBERG LIMITS PROVIDENCE HOME.GPJ TERRACON2012.GDT 10/25/13

MOISTURE-DENSITY RELATIONSHIP

ASTM D698/D1557



Source of Material: **B-6 2.0**

Description of Material: **SILTY CLAY(CL-ML)**

Test Method: **ASTM D698 Method A**

TEST RESULTS

Maximum Dry Density: **112.8** PCF

Optimum Water Content: **14.4** %

ATTERBERG LIMITS

LL	PL	PI
26	**21**	**5**

PROJECT: Providence Home - Intermountain Flathead

SITE: North Somers Road
Somers, MT

Terracon

PROJECT NUMBER: C5135908

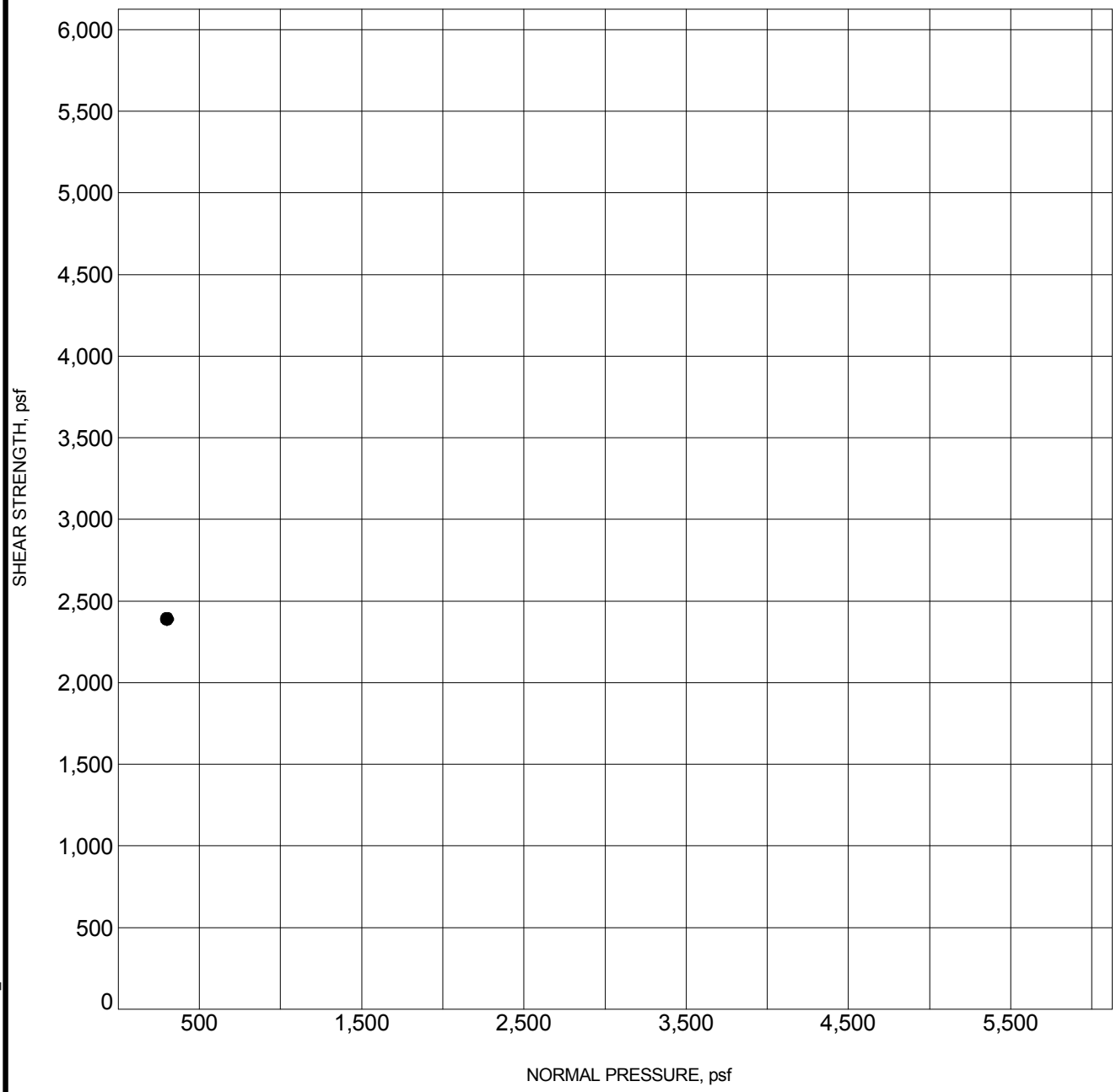
CLIENT: Intermountain Deaconess Children's Services
Helena, Montana

EXHIBIT: B-4

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. COMPACTION - V1 PROVIDENCE HOME.GPJ TERRACON2012.GDT 10/25/13

DIRECT SHEAR TEST

ASTM D3080



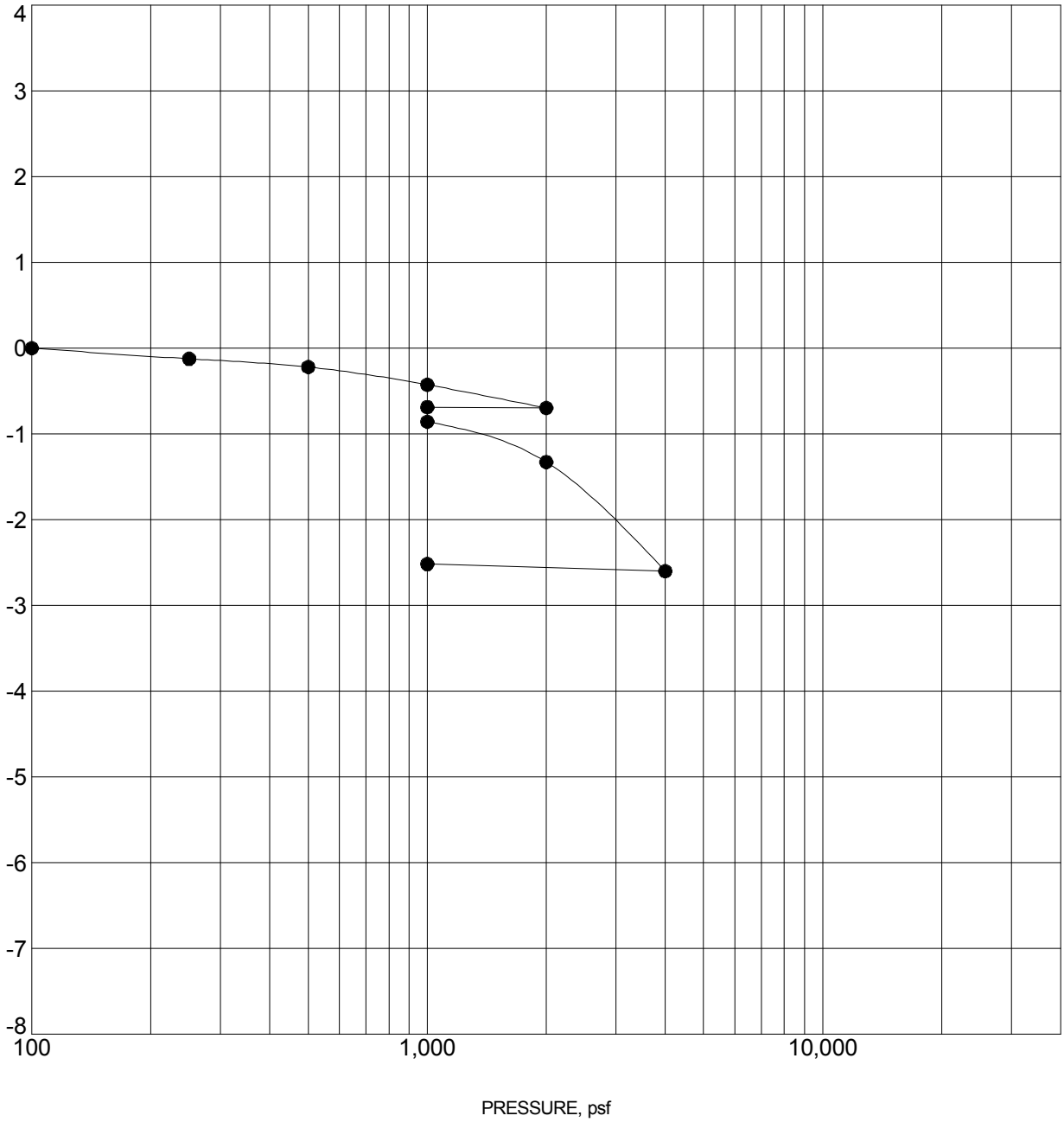
Specimen Identification			Classification	DD	MC%
●	**B-2**	**5.0**	**Silt**	**93**	**2**

PROJECT: Providence Home - Intermountain Flathead	Terracon 1392 13th Ave. SW Great Falls, Montana	PROJECT NUMBER: C5135908
SITE: North Somers Road Somers, MT		CLIENT: Intermountain Deaconess Children's Services Helena, Montana
		EXHIBIT: B-5

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. DIRECT_SHEAR PROVIDENCE HOME.GPJ 10/24/13

SWELL CONSOLIDATION TEST

ASTM D2435



Specimen Identification			Classification	γ_d, pcf	WC, %
●	B-2	5.0 ft	Silt	91	5

NOTES:

PROJECT: Providence Home - Intermountain Flathead
SITE: North Somers Road
Somers, MT

Terracon

PROJECT NUMBER: C5135908
CLIENT: Intermountain Deaconess Children's Services
Helena, Montana

EXHIBIT: B-6

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. TC_CONSOL_STRAIN-USCS PROVIDENCE HOME.GPJ TERRACON2012.GDT 10/25/13

APPENDIX C
SUPPORTING DOCUMENTS

GENERAL NOTES

DRILLING & SAMPLING SYMBOLS:

SS:	Split Spoon - 1-$^{3}/_{8}$" I.D., 2" O.D., unless otherwise noted	HS:	Hollow Stem Auger
ST:	Thin-Walled Tube – 2" O.D., 3" O.D., unless otherwise noted	PA:	Power Auger (Solid Stem)
RS:	Ring Sampler - 2.42" I.D., 3" O.D., unless otherwise noted	HA:	Hand Auger
DB:	Diamond Bit Coring - 4", N, B	RB:	Rock Bit
BS:	Bulk Sample or Auger Sample	WB	Wash Boring or Mud Rotary

The number of blows required to advance a standard 2-inch O.D. split-spoon sampler (SS) the last 12 inches of the total 18-inch penetration with a 140-pound hammer falling 30 inches is considered the "Standard Penetration" or "N-value".

WATER LEVEL MEASUREMENT SYMBOLS:

WL:	Water Level	WS:	While Sampling	BCR:	Before Casing Removal
WCI:	Wet Cave in	WD:	While Drilling	ACR:	After Casing Removal
DCI:	Dry Cave in	AB:	After Boring	N/E:	Not Encountered

Water levels indicated on the boring logs are the levels measured in the borings at the times indicated. Groundwater levels at other times and other locations across the site could vary. In pervious soils, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of groundwater levels may not be possible with only short-term observations.

DESCRIPTIVE SOIL CLASSIFICATION: Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

CONSISTENCY OF FINE-GRAINED SOILS

Unconfined Compressive Strength, Qu, psf	Standard Penetration or N-value (SS) Blows/Ft.	Consistency
< 500	0 - 1	Very Soft
500 – 1,000	2 - 4	Soft
1,000 – 2,000	4 - 8	Medium Stiff
2,000 – 4,000	8 - 15	Stiff
4,000 – 8,000	15 - 30	Very Stiff
8,000+	> 30	Hard

RELATIVE DENSITY OF COARSE-GRAINED SOILS

Standard Penetration or N-value (SS) Blows/Ft.	Relative Density
0 – 3	Very Loose
4 – 9	Loose
10 – 29	Medium Dense
30 – 50	Dense
> 50	Very Dense

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 15
With	15 – 29
Modifier	≥ 30

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75mm)
Sand	#4 to #200 sieve (4.75 to 0.075mm)
Silt or Clay	Passing #200 Sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 5
With	5 – 12
Modifier	> 12

PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1-10
Medium	11-30
High	> 30

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					Soil Classification	
					Group Symbol	Group Name [B]
Coarse Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$ [E]		GW	Well-graded gravel [F]
			$Cu < 4$ and/or $1 > Cc > 3$ [E]		GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH		GM	Silty gravel [F,G, H]
			Fines classify as CL or CH		GC	Clayey gravel [F,G,H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$ [E]		SW	Well-graded sand [I]
			$Cu < 6$ and/or $1 > Cc > 3$ [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G,H,I]
			Fines Classify as CL or CH		SC	Clayey sand [G,H,I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots on or above "A" line [J]		CL	Lean clay [K,L,M]
			PI < 4 or plots below "A" line [J]		ML	Silt [K,L,M]
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay [K,L,M,N]
			Liquid limit - not dried			Organic silt [K,L,M,O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line		CH	Fat clay [K,L,M]
			PI plots below "A" line		MH	Elastic Silt [K,L,M]
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay [K,L,M,P]
			Liquid limit - not dried			Organic silt [K,L,M,Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-in. (75-mm) sieve
[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.
[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.
[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.
[H] If fines are organic, add "with organic fines" to group name.
[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.
[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.
[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.
[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.
[N] PI ≥ 4 and plots on or above "A" line.
[O] PI < 4 or plots below "A" line.
[P] PI plots on or above "A" line.
[Q] PI plots below "A" line.

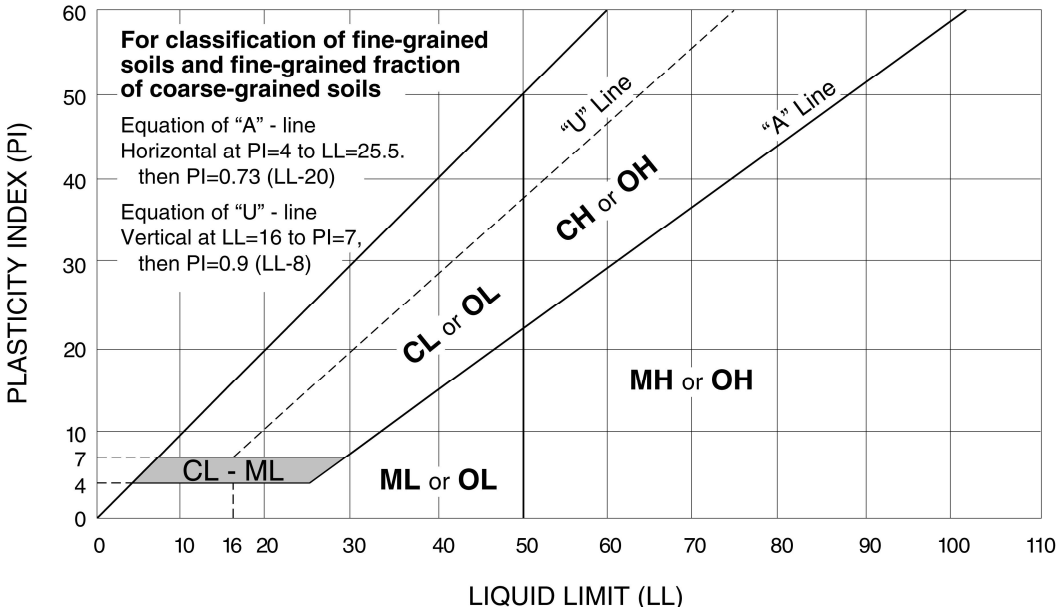


Exhibit C-2

RECOMMENDED SPECIFICATIONS FOR FLEXIBLE PAVEMENT MATERIALS

1. Aggregate Base Course (MT Public Works Specification)

Screen or Sieve Size	3/4-Inch Percent Passing	1-1/2-Inch Percent Passing
1-1/2"		100
1"		95 - 100
3/4"	100	
1/2"	—	45 - 80
No. 4	40 - 70	25 - 60
No. 10	25 - 55	25 - 55
No. 200	2 - 10	0 - 8*
Mechanically Fractured Faces, one or more on plus No. 4 aggregate, % minimum	50*	50*

*Deviates from the MT Public Works Specification

In addition to the gradation presented above, aggregate base course quality should conform to the MT Public Works Specification, Crushed Base Course, Section 02235, Subsection 02.

2. Asphaltic Concrete Aggregate (MT Public Works Specification 02503)

Screen or Sieve Size	Asphalt Concrete Surfacing Percent Passing Type B Grading Requirements
3/4"	100
1/2"	80 - 100
3/8"	70 - 90
No. 4	45 - 65
No. 10	32 - 45
No. 40	15 - 25
No. 200	4 - 10

In addition to the grading requirements shown, the aggregate quality should conform to the applicable portions of the MT Public Works Specifications, Section 02232, Aggregates for Surfacing and Asphalt Plant Mixes and the requirements of MT Public Works Specification 02503, Hot Plant Mix Asphalt Concrete

Asphalt Concrete Mix Designs

Asphalt concrete mix designs should be provided by the contractor, or materials supplier, and should meet the following requirements, consistent with the MT Public Works Specification Section 02503, Hot Plant Mix Asphalt Concrete:

Property	Test Method	Specifications
Stability, pounds, minimum	ASTM D6927	1200 min.
Flow, 1/100 Inch Units	ASTM D6927	8 - 18
Air Voids, percent	ASTM D3203	3 - 5
Voids in Mineral Aggregate (VMA), Percent Minimum	Asphalt Institute Manual MS-2	14 Minimum

*50 blows each end of specimen

Minimum Density Requirements

Material	Test Method	Percent of Maximum
Asphaltic Concrete Surfacing	ASTM D2041	93
Crushed or Uncrushed Granular Base/Subbase Course	ASTM D698	95
Subgrade (top 12 inches)**	ASTM D698	95

**For all pavement types, Clay subgrades should be compacted at moisture contents within ±3 percent of optimum, or above as recommended specifically in the report.

Maximum compacted lift thickness should be 12 inches for granular base/subbase courses. Also, minimum lift thickness for gravel should be twice the maximum size of the aggregate.

RECOMMENDED SPECIFICATIONS FOR PORTLAND CEMENT CONCRETE PAVEMENT MATERIALS

Subgrade Preparation & Density

Subgrade bases (when employed) should be prepared and compacted in accordance with Minimum Density Requirements of the guidelines for Asphalt Concrete Pavements.

Portland Cement Concrete

Pavement concrete should conform to the requirements of ASTM C94 and have the following properties:

Property	Specification Limits	Test Method
Water/Cement Ratio	Maximum 0.45	—
Slump, inches	1 to 3	C143
Air content, percent	5 to 7	C231
Compressive Strength, 28 days, psi	4000 minimum	C39

Aggregates

Aggregates should meet the requirements of ASTM C33, with a maximum aggregate size of not more than 1 ½-inches.

Aggregate suitability test results and a concrete mix design should be prepared by a qualified independent laboratory and submitted to the engineer for approval, prior to placement.

Concrete Placement and Curing

Pavement concrete should be placed and cured in accordance with ACI 316, “Recommended Practice for Construction of Concrete Pavements and Concrete Bases”.

MORRISON MAIERLE, INC.

design memo

TO: Jeff Cicon

COPIES:

FROM: Mike Kaczmarek

DATE: October 17, 2013

JOB **2096012**

RE: Providence Home Water Well – Basis for Well Design

☐ **Urgent** ☐ **For Review** ☐ **Please Comment** ☐ **Please Reply** ☒ **For Your Use**

Jeff:

The subject well requires an essentially private domestic well design.

CASING

The design yield of 35 gpm at 60 psi requires a 4-inch nominal diameter pump and motor. Accordingly, the recommended minimum well casing diameter is 6-inch nominal diameter steel casing, which is large enough to accept the pumping equipment with sufficient clearance for pump wire and ease of installation.

Steel 6-inch casing has an O.D. of 6.625 inches. Montana Board of Water Well Contractor Standards requires a minimum wall thickness of 0.250 inches for 6-inch steel casing, thus giving the casing a maximum I.D. of 6.125 inches and a weight of 17.02 pounds per foot (lb/ft).

The drilling contractor will likely elect to use thicker wall casing for drilling and driving. Typically, drillers will select steel pipe for drilling and driving with a wall thickness of 0.312 inches, an I.D. of 6.001 inches and a weight of 21.06 lb/ft. Our letter spec will make the casing wall thickness the Contractor's choice, but he will also be responsible for replacing the casing if it deforms at the drive shoe, bends excessively for pump installation, breaks or splits, or otherwise is not an acceptable installation for a water well under the Montana Board of Water Well Contractors regulations.

WELL SCREEN

Most domestic wells do not include well screen. That is why many of them have limited yields, large amounts of drawdown relative to their yield and, in some cases, excessive production of sand. The Providence Home well should be equipped with a well screen. Considering the relatively small design yield, a total of 5 to 10 feet of well screen installed in the production zone will be more than enough. The well screen will provide the benefit of allowing development of the well to clean up the formation so produced water will not contain suspended sediment such as sand. The well screen will also reduce the amount of drawdown that the well will experience at any given pumping rate

relative to drawdown that would occur without the well screen. This will result in a long-terms energy savings for operation of the well.

The disadvantage (if you want to call it that) of using well screen is that:

1. The well must penetrate a thick enough gravel lens for installation of the screen length plus about three feet of gravel above the top of the well screen. Well screen length can be tailored to the gravel thickness, within practical limits.

2. Samples of the sand and gravel must be collected and sieved for particle size gradation analysis to provide the basis for selecting the correct slot size for the well screen. This means sending the samples to our lab or to a well screen manufacturer for sieve analysis.

3. If an off-the-shelf screen length and slot size is not selected (2M, Northwest Pipe and Steel and other companies keep a few 5 or 10-foot well screens in stock), there may be a delay of up to 10 days waiting for manufacture, shipment and delivery of the specified well screen.

DEPTH

The target aquifer is the upper part of the so-called deep alluvial aquifer of the Kalispell valley. The deep alluvial aquifer is confined by several hundred feet of silty sand and clay that is not suitable for water well completion. Therefore, the well for Providence Home must penetrate through the confining overburden until sand and gravel lenses with sufficient thickness to develop a well are penetrated. Typically, the uppermost 100 feet or more of the deep alluvial aquifer is a mixture of mostly fine-grained sediment in which coarse-grained sand and gravel lenses are embedded. The sand and gravel lenses are the target for the Providence Home well, rather than the deeper and cleaner, thick layer of coarse sand and gravel of the lower part of the deep alluvial aquifer. This strategy (completing in the upper and dirtier part of the deep aquifer) will hopefully save 100 to 200 feet of drilling depth.

Montana Bureau of Mines and Geology (MBMG) records report 83 wells in sections 7 and 8 of T27N, R20W. The wells have an average depth of 355 feet with the maximum reported depth 820 feet. The average static water level is 8 feet below land surface and the average yield is 91 gpm with a low yield of 5 gpm. Section 12, T27N, R21W records include 14 wells with an average depth of 201 feet, a maximum depth of 480 feet, an average static water level of 10 feet below ground surface, and an average yield of 45 gpm. One of the two closest wells is 360 feet deep with a static water level of 36 feet. The other closest well is 400 feet deep with a static level of 8 feet.

Based on the foregoing information, it is recommended that a budget adequate to drill to 500 feet be set aside for the well and the specifications sent to the well driller indicate an anticipated depth of 450 feet. If favorable conditions are found, the total well depth may be less than 450 feet.

PUMP AND MOTOR REQUIREMENT

Static Water Level -The data from the MBMG records indicate generally shallow depths to water in the vicinity of the Providence Home project. An estimate of the depth to static water level below the land surface is 17 feet, based on a land surface elevation of 2,900 feet and a minimum pool elevation in Flathead Lake of 2,883 feet. Records of static water levels in a nearby well include seasonal static water levels to 36 feet, perhaps as affected by pumping. Based on the reported static level in that nearby well, a conservatively worst-case estimate of static water level is 35 feet below land surface.

Pumping Water Level -The elevation lift out of the well is the sum of the static water level and the drawdown of the water level in the well during pumping. The sum of the static level and the drawdown is the pumping water level. With a well screen installed in a good, coarse-grained sand and gravel lens, a yield of 1 gallon per minute per foot of drawdown (gpm/ft-dd) is a reasonable expectation and would provide 35 feet of drawdown at a 35 gpm production rate. This is referred to as a "*specific* capacity" of 1.0 gpm/ft-dd. The drawdown added to the static level provides a maximum pumping water level depth of 70 feet. This is the total elevation lift out of the well.

Friction Loss in Pump Column – A 2-inch nominal diameter pump column is recommended for the 35-gpm design yield. Head loss for flow through galvanized pipe is estimated to be 6.12 feet per hundred feet with a C value of 100. Adjusting to a C value of 130 provides 4.71 feet per hundred of friction loss. A value of 5.00 feet of head loss per hundred feet of pump column is selected for this design process.

The pump inlet should be set at approximately 50 feet below the pumping water level to provide for 10 feet of pump inlet submergence and 40 feet of additional drawdown if the well screen fills with sand over long-term operation or if iron incrustation partially plugs the well screen, causing a decrease in specific capacity. Pump column pipe comes in pieces that are 21-feet long; therefore, six pieces of pump column will provide 126 feet of pipe. At a loss of 5.0 ft/100 ft, the pump column head loss at 35 gpm will be 6.3 feet.

Friction Loss in Service Line – The outside diameter of DR11, 160-psi HDPE pipe is 2.375 inches and the I.D. is 1.917 inches. Application of the Hazen-Williams equation to these dimensions for a 35-gpm flow with a C value of 150 results in 3.41 feet of head loss per 100 feet or 6.82 feet for 200 feet of service line at 35 gpm.

Total Dynamic Head – The design pressure at the home inlet is 138.5 feet of head (60 psi). The components of total dynamic head for the pump are summarized as follows:

Maximum Elevation Lift to Top of Well:	70.0 feet
Operating Pressure at House Inlet:	138.5 feet
Pump Column Friction Loss:	6.3 feet
Service Line Friction Loss:	6.8 feet
Total Dynamic Head:	**221.6 feet**

Horsepower Requirement – Rounding the total dynamic head (TDH) to 220 feet provides a TDH operating range for the pump of 185 feet TDH starting with the pumping water level at the static level of 35 feet, and increasing to the total of approximately 220 feet of TDH.

This range of TDH straddles a requirement for a 3- to 5-horsepower pump. For price quoting purposes, I would indicate we need a 3-hp pump capable of delivering 35 gpm at a TDH of 190 feet. If subsequent testing of the completed well indicates that the pumping water level is significantly less than 70 feet, a 3-hp motor equipped with a VFD will be a good choice and if drawdown is negligible, we may be able to install a 2-hp permanent pump. The 3-hp pump will let us have about 190 feet TDH with a typical Goulds or Grundfos pump and jumping up to 5-hp will let us pump 35 gpm with 350 feet of TDH. The 5-hp is excessive. If we get good hydraulic performance out of the well by installing a well screen, the 3-hp pump with a VFD will be the best choice.

Technical Memorandum

INTERMOUNTAIN PROVIDENCE HOME SEPTIC SYSTEM BASIS OF DESIGN

PREPARED BY: Jeff Cicon, PE

REVIEWED BY: Ryan Jones, PE

DATE: February 17, 2014

1. INTRODUCTION

The Intermountain Providence Home is located northeast of Somers, MT in Flathead County. The properties physical and legal address are as follows:

Physical:
905 North Somers Road
Kalispell, MT

Legal:
Tract 2, CA # 0000246800
Gov't Lot 3 & the NE1/4SW1/4 of Section 7, T27N, R20W, P.M.M.
Deed # 201100011886

The purpose of this report is to present the design criteria used to design the septic system. This report and subsequent plans will comply with the applicable design standards as set forth in the *Flathead County Sewage Treatment System Design and Construction Standards* and the *Montana Department of Environmental (MDEQ) Design Circular 4*.

2. WASTEWATER FLOWS

This septic system will serve the proposed Intermountain Providence Home, a youth home for children. The projected flows have been developed using Tables 5-1 and 5-2 from MDEQ Circular 4. Table 1 outlines the assumptions made based on discussions with Flathead City-County Health Department.

Table 1 Daily Sewage Volume				
Source	**Unit**	**Number of Units**	**Flow Per Unit (gpd)**	**Total Flow (gpd)**
School, Boarding	Student	10	75	750
Hospital Staff (Overnight)	Employee	1	75	75
Hospital Staff (Shift)	Employee	5	20	100
			Total=	**925**

Although this is considered a commercial building, the proposed use of the building is similar to a residential application. Therefore, for the purposes of design, the strength of the wastewater will be considered residential.

3. BASIC SYSTEM DATA

The following design information can be found in the Site Evaluation and Design Report from the Flathead City-County Health Department, found in Appendix A.

- Daily sewage volume: 925 gal/day
- Minimum septic volume: 1,500 gal
- Allowable soil loading rate: 0.4 gal/day/sq.ft.
- Required absorption area: 2313 sq.ft.
- Minimum drainfield length: 400 ft. (East-West)

The 400-foot drainfield length is needed to meet non-degradation standards. To reduce the footprint of the septic system, the owner has elected to install a Level II Treatment System. This system will consist of the installation of an AdvanTex® Treatment System manufactured by Orenco Systems, Inc (OSI). The basis of design for the primary (septic) tank, recirculation tank, dose tank, and filter units is based on the AdvanTex® Design Manual provided by OSI.

4. TREATMENT SYSTEM

4.1. Primary (Septic) Tank

The AdvanTex® Design Manual recommends a hydraulic retention time (HRT) of 3 days assuming the facility is a “multiple dwelling unit.” Therefore, the required septic volume is 2,775 gallons. The septic tank specified is a 3,000 gallon precast concrete tank.

The primary tank also has an 8-inch Biotube effluent filter before discharging into the recirculation tank. The Biotube is used to improve the quality of the effluent exiting the septic tank. The filter specified (OSI FT-08-54-36) meets Flathead County Design Standards. A riser and fiberglass lid are provided for maintenance.

4.2. Recirculation/Dose Tank

MDEQ Circular 4 requires a HRT of 1.5 days. Therefore, the required recirculation volume is 1,388 gallons. The recirculation tank specified is a 1,500 gallon precast concrete tank. The floats in the recirculation tank will be set as follows based on OSI recommendations, measured from the bottom of the tank:

1. Low water alarm/redundant off: 38”
2. Override timer: 50”
3. High water alarm: 53”

Duplex pumps are selected for the recirculation side of the system, OSI Model 2-PF500712. These pumps are a high head effluent pump rated for 50 gpm.

The dose volume was calculated using the Pump Design Worksheet from the Flathead County Website. The minimum required dose volume is 243 gallons assuming five times the volume in the laterals and one times the volume in the force main. Therefore, a 500 gallon precast concrete tank was specified for the dose tank. The floats will be set as follows, measured from the bottom of the tank:

1. Redundant off: 24” [minimum water level for pumps]
2. Pump off: 27” [+3” above redundant off]
3. Pump on: 46” [213 gallons = 19 vertical inches of tank]
4. High water alarm: 49” [+3” above pump on]

Duplex pumps are selected for the dose side of the system, OSI Model 2-PF500712. These pumps are a high head effluent pump rated for 50 gpm as will meet the head and flow requirements to dose the drainfield as outlined in the Pump Design Worksheet included in Appendix B.

4.3. Treatment Filters

The AdvanTex® Design Manual recommends loading rate of 25 gpd/sq.ft assuming the facility is a “multiple dwelling unit.” Therefore, the required treatment area is 37 sq.ft. Two AX20 pods are specified for a total treatment area of 40 sq.ft.

5. DRAINFIELD

The transport pipe will consist of a 2” Sch 40 PVC pipe in accordance with Flathead County Standards. The pipe is approximately 226 feet long as has an estimated head loss of 12 feet as outlined in the Pump Design Worksheet.

The required absorption area outlined previously is 2,313 sq.ft. for a conventional drainfield. However, Flathead County Standards allow a drainfield reduction of 50% for a Level II Treatment System. Therefore, the required infiltration area is 1,156 sq.ft. Assuming a 3-foot trench width, the total required length of laterals is 385 feet. Six laterals 75 feet long are specified for a total length of 450 feet and a treatment area of 1,350 sq.ft.

The laterals consist of 1.25” Sch 40 PVC pipe with 5/32” orifices spaced at 5 feet as shown in the drawings. The drainfield will be installed in accordance with Flathead County Standards. The drainfield is located on a relatively flat spot on the site, allowing all five laterals to be

installed at the same 2901.70' elevation and still meet depth requirements. A replacement drainfield, of equal area, has also been set aside to the north.

6. APPENDIX A – SITE EVALUATION

Flathead City-County Health Department

1035 First Ave. West Kalispell, MT 59901
(406) 751-8101 FAX 751-8102
www.flatheadhealth.org

Community Health Services
751-8110 FAX 751-8111
Environmental Health Services
751-8130 FAX 751-8131
Family Planning Services
751-8150 FAX 751-8151
Home Health Services
751-6800 FAX 751-6807
WIC Services
751-8170 FAX 751-8171
Animal Shelter
752-1310 FAX 752-1546

Dear septic permit applicant,

Enclosed is a copy of the Site Evaluation and Design Report for the property described in your septic permit application. You should provide this information, along with the enclosed hydraulic design worksheets, to an engineer or certified designer who will design your sewage treatment and disposal system. Please return the appropriate completed hydraulic design worksheet to this office, along with a drawing of the proposed system. The drawing should include such items as:

1. Lot boundaries & prominent features
2. Existing and proposed structures
3. Water supply and distribution
4. Plan and profile of sewage system, (pipelines, tanks, drainfield, etc.)
5. Driveways and parking areas
6. Utility service lines
7. Wells, drainfields, structures, etc. on adjacent properties within 100 ft. of property line

Upon receipt of the completed design and layout drawing, we will prepare a permit. You will be notified by phone when you may pick up and pay for the permit.

H:\HE\EH\!Shared\SEPTIC\Applications\Applicantletter2012.doc

SITE EVALUATION AND DESIGN REPORT

DATE: ____/____/____

PROPERTY DESCRIPTION: Tract 2, CA# 0000246800, COS Deed 2011000 11886

LEGAL OWNER: Intermountain Deaconess Home

SITE EVALUATION DATA:

Soil profile:

		Description
0	to 3"	Duff topsoil
3"	to 3'	Silt Loam
3'	to 9'	Clay silt loam

Depth to:Groundwater: >84" ft. (unknown > 8 ft)

Ground surface slope in drainfield area: 0 %

Proposed water supply (Source) well

REQUIRED SETBACKS	FROM TANK	FROM DRAINFIELD
Well [a]	50	100
100-year Floodplain	5	100
Surface Water [b]	50	100[a]
Foundation Wall	10	10
Water Lines	10	10
Property Lines [c]	10	10
Absorption System	10	---
Slopes in excess of 25%	10	25
Groundwater Table [d]	(e)	4 [a][f]
Bedrock [d]	(e)	4 [a][f]
Impermeable or Impervious Layer [d]	(e)	4 [a][f]
Subsoil Drains	10	10
Cisterns [a]	25	50

BASIC SYSTEM DESIGN DATA:

Wastewater strength: (residential) (BOD < 300 mg/l, TSS < 150 mg/l, FOG < 25 mg/l)
high strength, commercial, industrial, etc

Daily sewage volume: 925 gal/day (- Bedrooms)

Min. septic chamber vol. 1500 gal. **(DOES NOT INCLUDE DOSING CHAMBER VOLUME)**

Allowable soil loading rate: 0.4 gal/day/sq. ft. Reqd. sq. ft.: gravel 2313, chambers 1735

Lin. Feet: G) 771 C) 788

Treatment facility:
- ✓ Standard septic tank 3 Foot Wide 2.2 Foot Wide
- Package treatment plant (requires design by P.E.)
- Intermittent sand filter (requires design by P.E.)
- Other ____

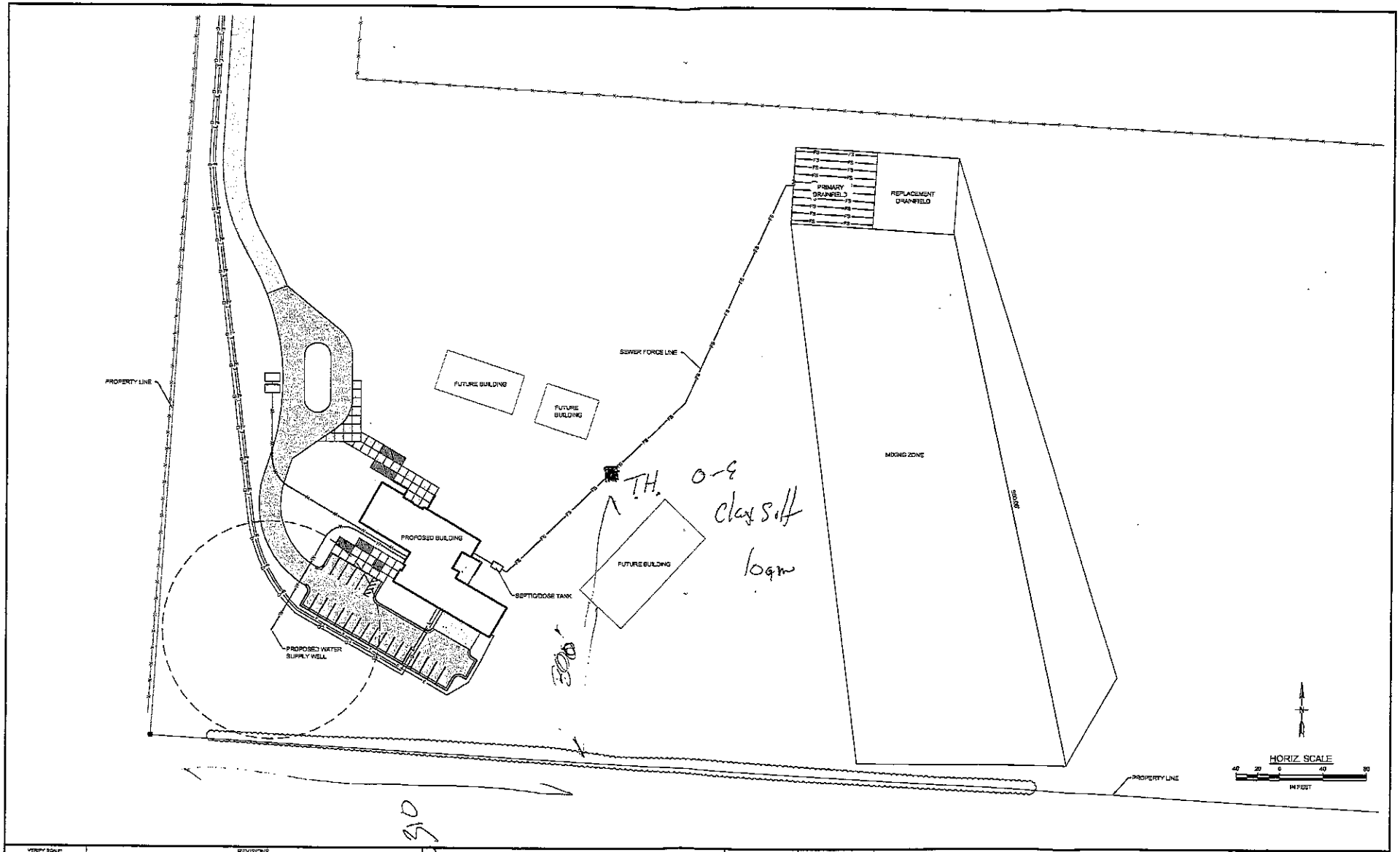
Disposal system:
- ✓ Standard pressure distribution drainfield (certified designer)
- Elevated sand mound (requires design by P.E.)
- Other ____

Minimum Drainfield length: 400 ft.

Drainfield orientation: N-S, (E-W), NE-SW, NW-SE

Maximum trench depth: 36 inches

PREPARED BY: R Montgomery (name), Engineer (position title)



VERIFY SCALE
THESE PRINTS MAY BE REDUCED. LINE BELOW MEASURES ONE INCH ON ORIGINAL DRAWING.
MODIFY SCALE ACCORDINGLY

REVISIONS			
NO.	DESCRIPTION	DATE	BY

DRAWING LOCATION: PLOTTED BY: JEFF DODD ON Oct 15/2013

MORRISON MAIERLE, INC.
An Employee-Owned Company
Engineers Surveyors Scientists Planners
125 Schoolhouse Loop
Kalispell, MT 59901
Phone: (406) 752-2218
Fax: (406) 752-2291
COPYRIGHT © MORRISON-MAIERLE, INC. 2013

DRAWN BY: JJC
DSGN. BY:
APPR. BY:
DATE: 10/2013
Q.C. REVIEW BY:
DATE:

INTERMOUNTAIN PROVIDENCE HOME
SOMERS MONTANA

FLATHEAD SEPTIC PERMIT
SITE PLAN

PROJECT NUMBER 2056.012
SHEET NUMBER -
DRAWING NUMBER -

7. APPENDIX B – PUMP DESIGN WORKSHEET

PUMP DESIGN WORKSHEET - 5/5/08

Recd. Date Stamp (FCCHD)

Owner:	Intermountain Deaconess	Designer	Jeff Cicon, PE
Address:	500 S. Lamborn St	Tel:	(406) 751-5863
Legal :	905 N. Somers Rd	Installer	
		Tel:	

Design Data Required

Orifice Diameter (OD)	5/32	inch	(minimum 1/8th inch)
Orifice Spacing (OS)	5	ft	on centers (maximum 5 feet)
Pressure head, first orifice (HO)	5	ft	(> 2.3 ft for 3/16 in. or larger orifices, > 5 ft for orifices< 3/16 in.)
Orifice Discharge Rate (QO)	0.66	gal/min	(from orifice flow chart)

Length of Force Main (LFM)	**LFM**	226	ft.	
Diameter of Force Main	**DFM**	2.047	inches	
Pump Chamber Low-Level (pump "off") elevation	**E1**	2895.5	ft.	
Elevation of Upper Lateral	**E2**	2902.8	ft.	
Daily Sewage Volume	**QS/**	925	gal / day	Level Two treatment
Allowable Soil Loading Rate	**QL**	0.4	gpd/sq.ft.	x for yes x

Trench type:	ROCK (x for yes)	x	CHAMBER			
Trench width:	select 2 or 3 ft	3	Effective width	2.2	*Infiltrator = 2.20 ft.	
					*ADS	= 2.20 ft.

Design calculations

Required infiltration Area (sq.ft.)	Rock	1156	Chamber	867
Total length of laterals		385		394

Number of Orifices	**NO**	=	**LL/OS**	77	
Total Discharge Rate	**Qt**	=	**QO x NO**	51	gal/min
Forcemain Fricton Factor			F	5.03	ft/100 ft
Forcemain Headloss	**(F x LFM/100)**			11.36	ft.
Elevation Head (gravity)	HG	=	E2-E1	7.3	ft.
Total Dynamic Head (HG + HFM + HO),				23.66	

Required Pump

Capable of pumping at least	51	gal/min	against a head of	24	feet	
	Pump make	Orenco	Model	PF500712		

Actual Drainfield Design:

			L1	L2	L3	L4	L5	L6
Number of Laterals	6	Length each Lateral	75	75	75	75	75	75
		Lateral elevation	2902.8	2902.8	2902.8	2902.8	2902.8	2902.8
			L7	L8	L9	L10	L11	L12
Control Float Settings		Length						
Dose Volume		Elevation						

Laterals-	1.25"					
Pipe type/clas	SCH 40	Int. Dia.	1.38	in.	Pipe Vol.	0.078 gal/ ft
Total length of laterals (L)			450	ft.		
Total vol in laterals (VL)			34.96			
Forcemain						
Pipe type/clas	SCH 40	Int. Dia.	2.047	in.	Pipe Vol.	0.171 gal/ ft
Total length forcemain			226	ft		
Total vol. in forcemain			38.64	gal, (VFM)		

(5x VL) + VFM = 175 + 39 = 213 gal

Pump Chamber Volume (V)	132	gal / ft		
MinimumDose Volume (D)	213	gal		
Upper (pump on) float should be	1.62	ft (D/V)	=	19 in. above "pump off" float
Control & Alarm (make & model)	Orenco MF4A			

PLEASE PROVIDE A SKETCH OF SYSTEM LAYOUT AND PROFILE ON BACK OF THIS SHEET

file: Pump hyd design wksht 5-5-08-computer.xls

8. APPENDIX C – DESIGN CALCULATIONS

MORRISON MAIERLE, INC.	PROJECT: PROVIDENCE HOME SEPTIC		
	BY: JJC	DATE 11/2013	PROJ. NO. 2096.012
	CHK:	DATE	PAGE: 1 OF 3

SEPTIC DESIGN:

* DISCUSSED W/ TOM ANDERSON, GLACIER PRECAST

1) SIZE PRIMARY (SEPTIC) TANK

HRT = 3 DAYS [ORENCO DESIGN MANUAL]

925 GPD x 3 DAYS = 2,775 GAL

USE 3,000 GAL PRECAST

2) SIZE RECIRC TANK

HRT = 1.5 DAYS [DEQ 4]

925 GPD x 1.5 DAYS = 1,388 GAL

USE 1,500 GAL / 500 DOSE

3) DETERMINE PODS

APPLICATION RATE (MIN) = 25 GPD/SF

925 GPD / 25 GPD/SF = 37 S.F.

2 AY 20 PODS = 40 S.F.

4) PUMPS

USE DUPLEX 2-PF500712 FOR RECIRC & DOSE

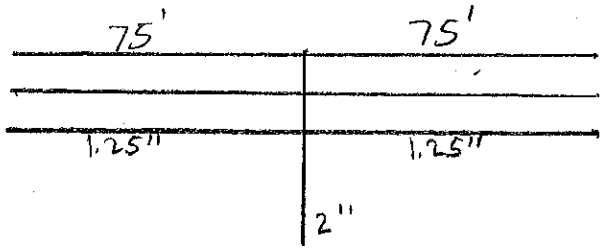
5) CONTROL PANEL

USE MVP-DAX-DAY-PTROHT

MORRISON MAIERLE, INC.	PROJECT: Intermountain Youth Home		
	BY: CRL	DATE 2/2014	PROJ. NO. 2096.012
	CHK: JJC	DATE 2/2014	PAGE: OF

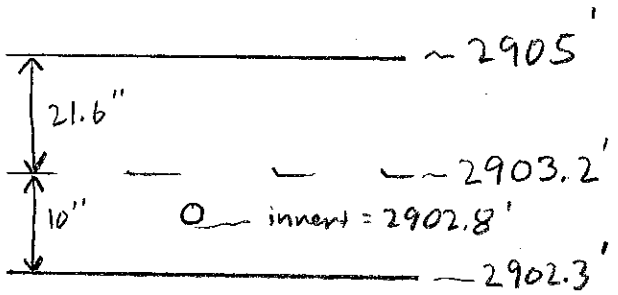
6) Drainfield Configuration

- Required total length per to GW = 150'
- Use 6 laterals @ 75' EA



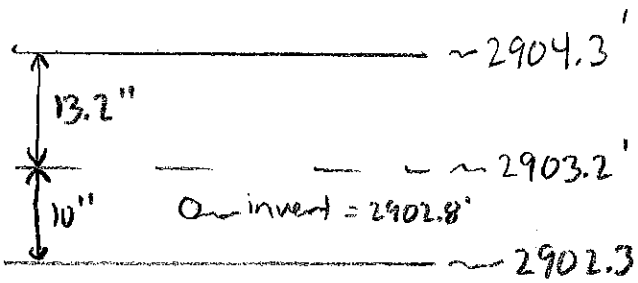
Worst Case scenerios (see fig 1-A)

Deepest:



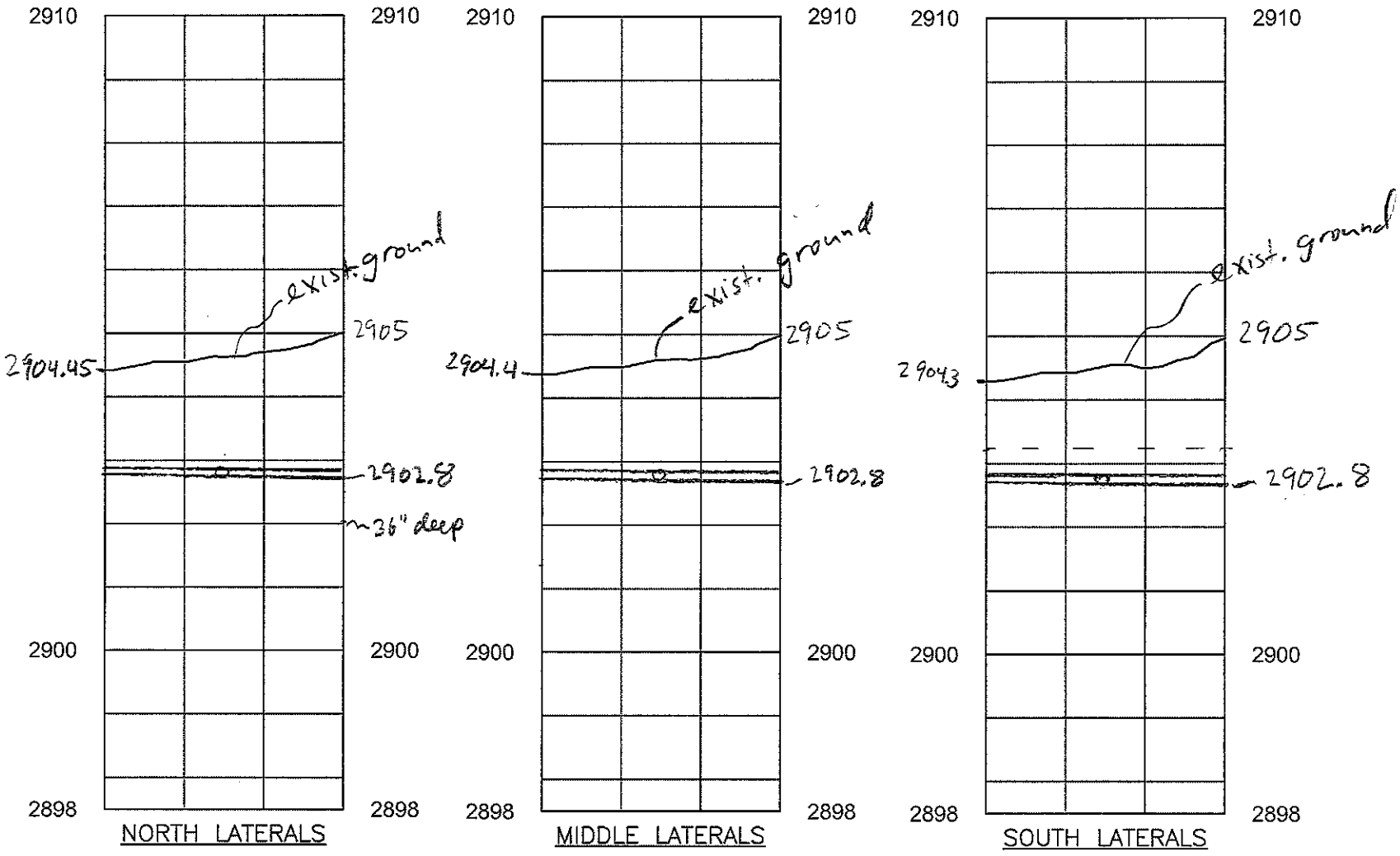
On fig 1-A, 36" (max depth) is at 2902.0'
2902.3' > 2902.0'
therefore depth is OK.

Shallow:



On fig 1-A, 12" (min depth) is at 2903.3'
2903.2' < 2903.3'
therefore depth is OK.

fig 1-A


2910
2910
2904.45
exist. ground
2905
2902.8
36" deep
2900
2900
2898
2898
NORTH LATERALS
2910
2910
2904.4
exist. ground
2905
2902.8
2900
2900
2898
2898
MIDDLE LATERALS
2910
2910
2904.3
exist. ground
2905
2902.8
2900
2900
2898
2898
SOUTH LATERALS

MORRISON MAIERLE, INC.	PROJECT:		
	BY:	DATE	PROJ. NO.
	CHK:	DATE	PAGE: 3 OF 3

7) FLOAT SETTINGS

1) DOSE PUMP FLOATS

FLOOR = 2893.50'

REDUNDANT OFF	=	24"		[MIN WATER FOR PUMPS]
PUMP OFF	=	27"	(+3")	[TOM A, GLACIER PRECAST]
PUMP ON	=	46"	(+19")	[FLATHEAD COUNTY]
HIGH WATER	=	49"	(+3")	[TOM A]

2) RECIRC PUMP FLOATS

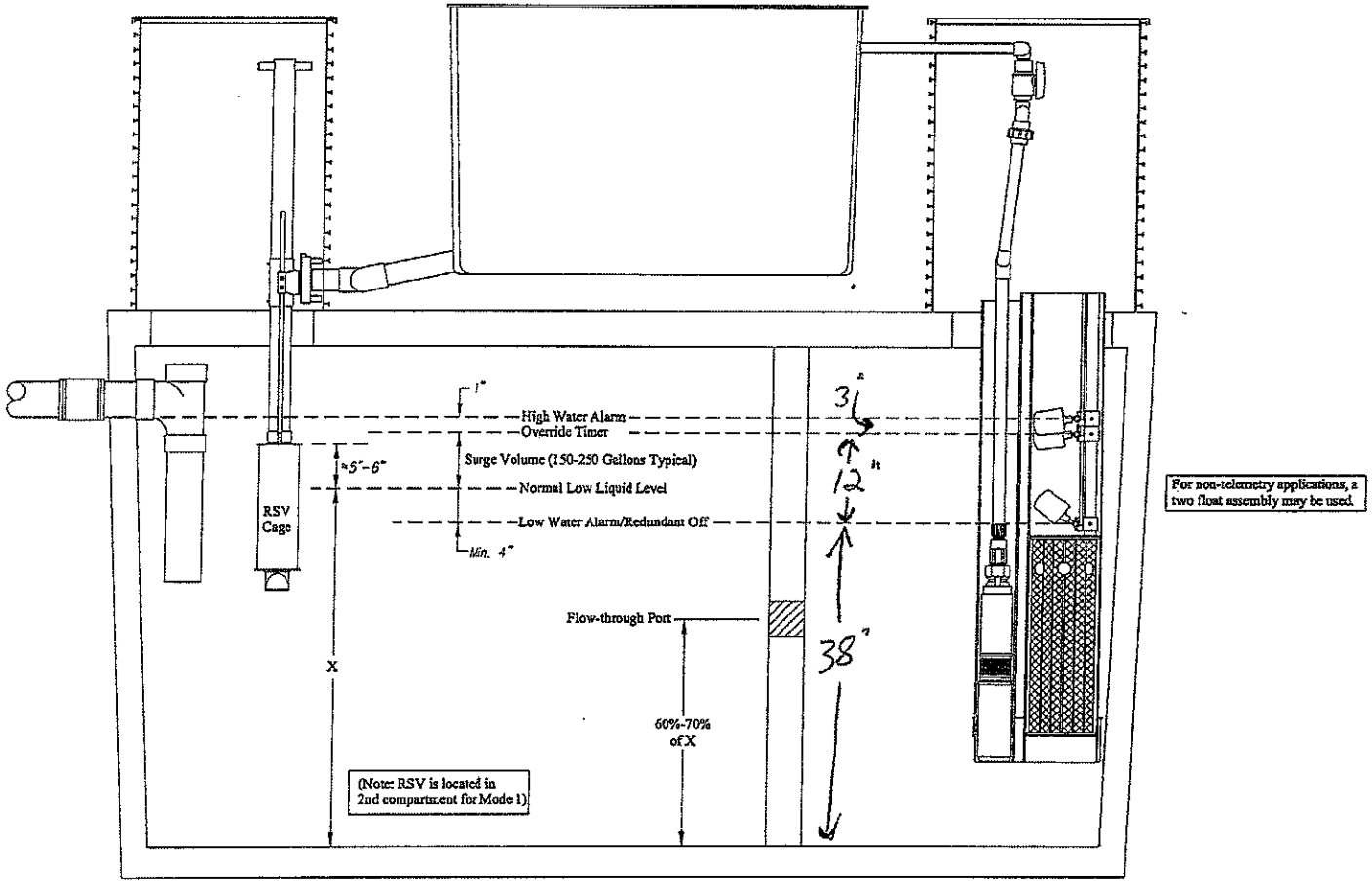
FLOOR = 2893.50

LOW WATER ALARM / REDUNDANT OFF	=	38"	
OVERIDE TIMER	=	50"	(+12")
HIGH WATER ALARM	=	53"	(+3")

* SEE DRAWING FROM GLACIER PRECAST.

jcicon@m-m.net

Typical Liquid Level Positions for Residential AdvanTex™ Treatment System with VeriComm™ Telemetry Control Panel



Orenco Systems® Incorporated

Title: Typical Liquid Level Positions for Residential AdvanTex™ Treatment System with VeriComm™ Telemetry Control Panel

Drawing No.

Scale: 1" = 1'-0"

Date: 6/27/01

Drawn By: CHRIS JORDAN

Drawing: 1 OF 1

Revision:

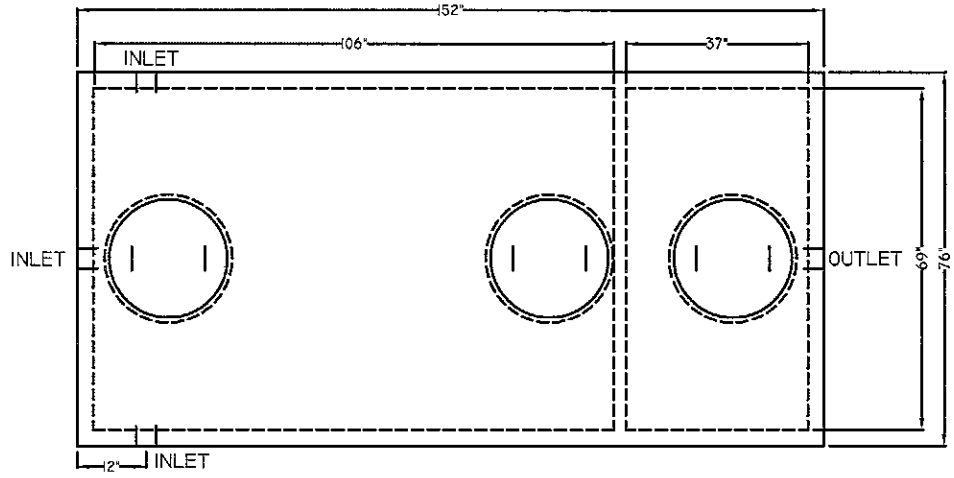
Designed By: EB

Approved By:

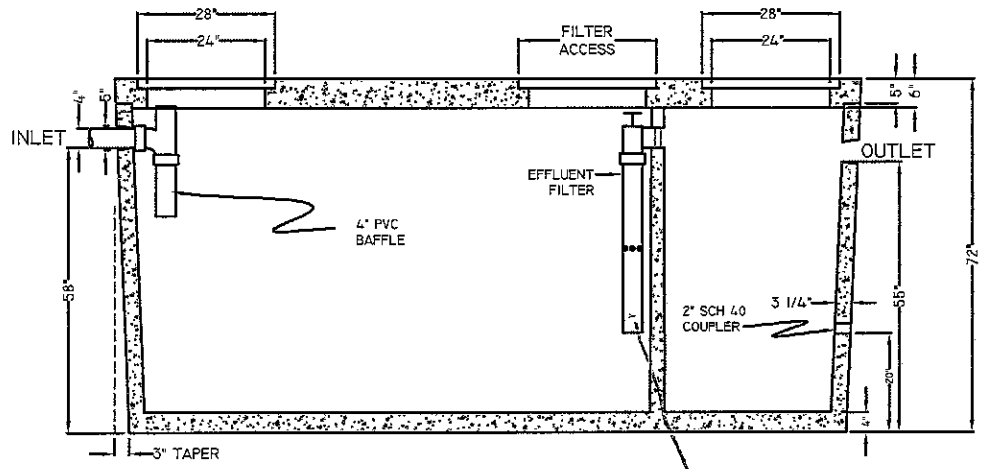
Date Approved:

U.S. Patents 5,531,894 and 5,480,561 4,439,323 and 5,492,635 Other Patents Pending

© 1998 Orenco Systems® Inc.



TOP VIEW

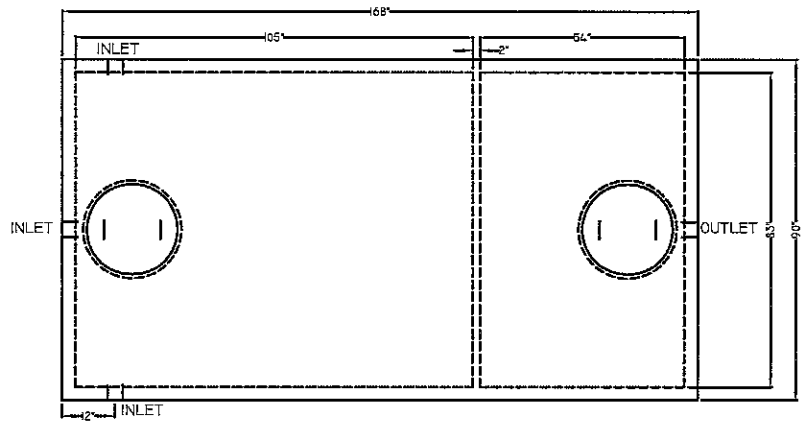


SIDE VIEW

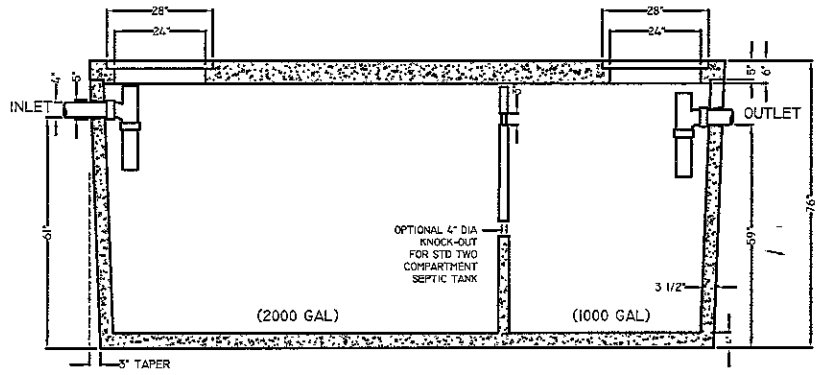
RECIRCULATING SPLITTER VALVE

DOSE CHAMBER
37" X 69"
17.73 S.F.
17.73 CF/FT
= 132.61 GAL/FT

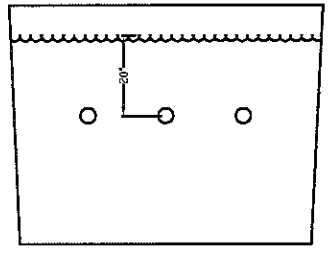
1500/500 GAL SEPTIC/PUMP CHAMBER



TOP VIEW



SIDE VIEW



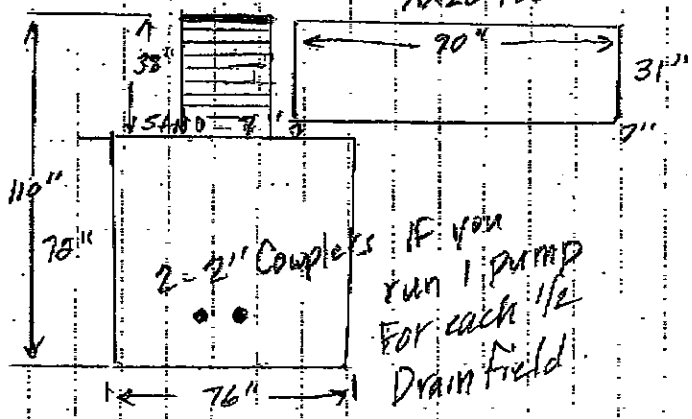
CENTER WALL DETAIL

3000 GAL
2-COMP. SEPTIC TANK

Fax to: JEFF 752-2391
Morrison Maierle

FROM DAVID GPC.

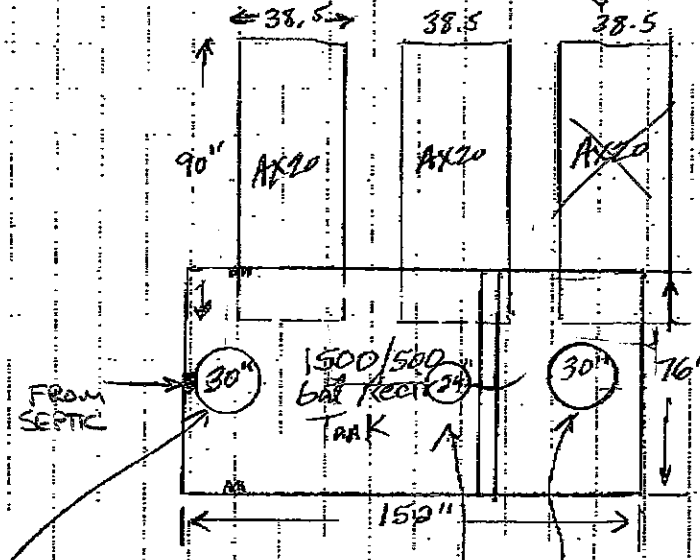
End View



IF you run 1 pump For each 1/2 Drain Field

Top View

ONLY NEED 2 AX20 = 40 SF



Orenco Recirculating Pumps
Duplex 2-PF500712
1-MF4A FLOAT STEM
1-PVU6818 Pump Vault

1-PVU6818 Pump Vault
2-PF500712 Duplex Orenco Dose Pumps
1-MF4A FLOAT STEM

1-RECIRCULATING SPLITTER VALVE

LIDS: 2-FL30612 Fiberglass lids
1-FL04612 "

RISERS 2-RR3038 PVC RISERS
1-RR2438 " "

EFFLUENT FILTER ON SEPTIC = ORENCO
FT-08-54-36
11/8/13 DAVID HOLST

Control Panel
MVP DAX DAXPT RO HT
2-SB4 Splice Boxes
2-SB2 " "

LAFARGE
bringing materials to life™

11/08/2013 08:39 LAFARGE PRECAST CONCRETE www.lafargenorthamerica.com P.001/001

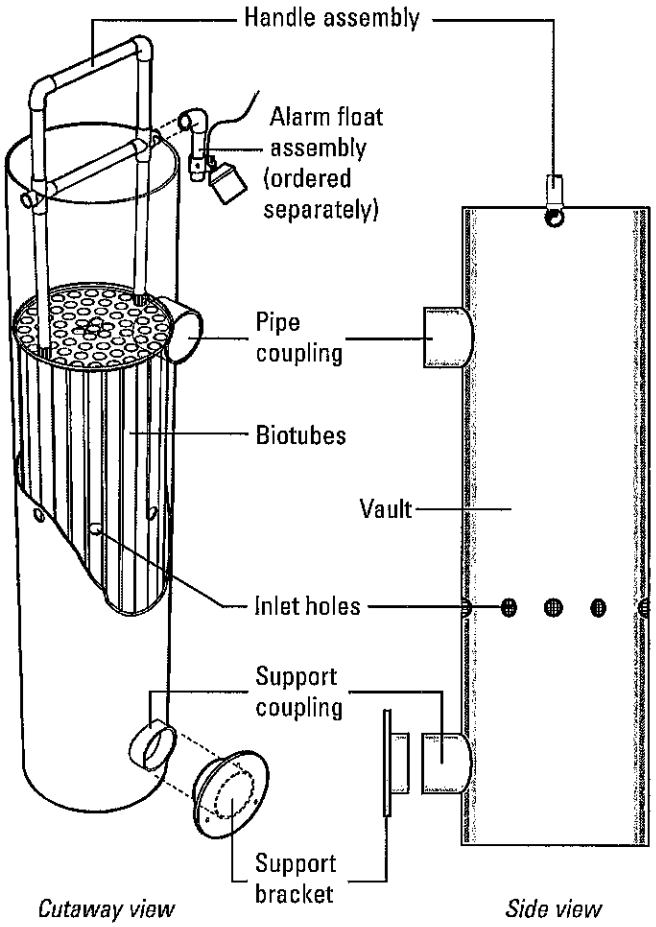
9. APPENDIX D – EQUIPEMENT DATA

8"-15" Dia. Biotube® Effluent Filters

Orenco Systems® Incorporated
800-348-9843

Applications

Orenco® 8"-15" Biotube® Effluent Filters are designed to remove solids from effluent leaving commercial septic tanks. They can be used in new and existing tanks.



Note: Support coupling and support bracket are available on 12" and 15" filters only.

General

Orenco® 8"-15" Biotube® Effluent Filters* are used to improve the quality of effluent exiting a commercial septic tank. The Biotube cartridge fits snugly in the vault and is removable for maintenance, the handle assembly snaps into the notches in the top of the vault, and the tee handle can be extended for easy removal of the cartridge. A "base inlet" model (see p. 2) is available for low-profile tanks.

An optional slide rail system, available on larger models, simplifies installation and provides tank access for servicing.

Standard Models

FT0854-36, FT1254-36, FT1554-36, FT0822-14B, FT1254-36AR

Nomenclature

FT [ ] [08] [54] [36] [ ]

Options:
Blank = standard series
A = float bracket*
B = base inlet series
R = slide rail series (12" and 15" only)†

Cartridge height (inches):
14 = 14" (base inlet)
36 = 36" (standard height)

Housing height (inches):
22 = base inlet model
48 = when minimum liquid level is 37"-46" (8" dia.only)‡
54 = when minimum liquid level is 46"-63" ‡
60 = when minimum liquid level is 64"-84" ‡
66 = when minimum liquid level is 85"-112" ‡

Filter diameter:
08 = 8"
12 = 12"
15 = 15"

Blank = 1/8" filtration
P = 1/16" filtration

Biotube™ effluent filter series

* Indicates bracket is epoxied to housing (add-on alarm also available)
† Use the slide rail when only one access is available for the filter chamber
‡ Minimum liquid level is measured from the invert of the outlet to the tank floor

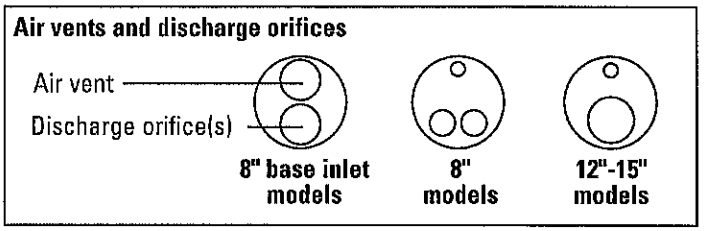
Materials of Construction

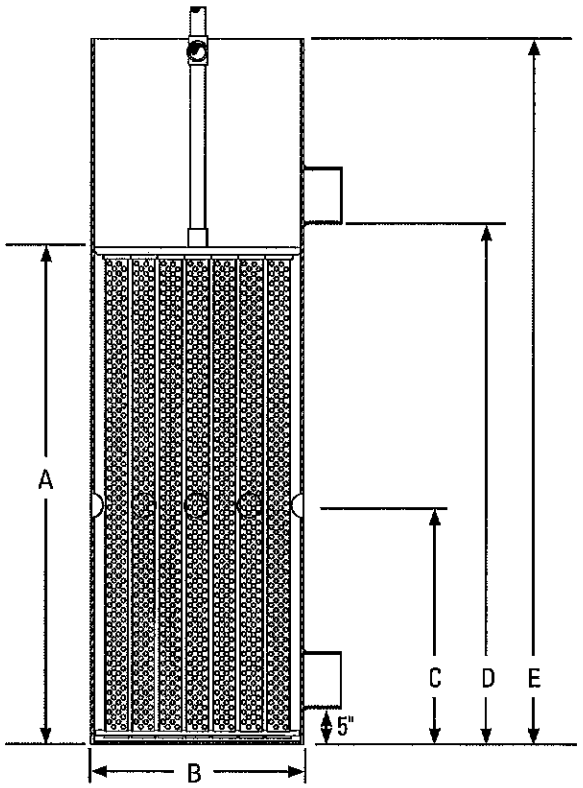
Vault, pipe coupling, handle components, support coupling and bracket	PVC
Biotube® cartridge	Polypropylene and polyethylene

** Orenco® Biotube® Effluent Filters are covered under multiple U.S. and international patents.*

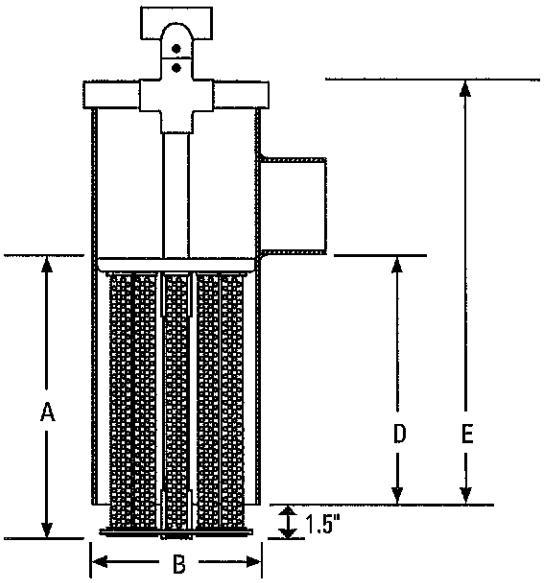
© 2010 Orenco Systems® Inc.

8"-15" Diameter Biotube® Effluent Filters (continued)





Standard model



Base inlet model

Specifications

Model	FT0854-36	FT0822-14B	FT1254-36	FT1254-36AR	FT1554-36
A - Cartridge height, in.	36	14	36	36	36
B - Nominal diameter, in.	8	8	12	12	15
C - Inlet hole height*, in.	22	n/a†	22	22	22
D - Vault base to invert height, in.	38	13	38	38	38
E - Vault height	54	22	54	54	54
Number of inlet holes	8	n/a	8	8	8
Inlet hole diameter, in.	1.375	n/a	1.375	1.375	1.375
Number of discharge orifices	2	1	1	1	1
Discharge orifice diameter, in.	1.125	1.750	2	2	2
Pipe coupling diameter, in.	4	4	4	4	4
Number of air vents	1	1	1	1	1
Air vent diameter, in.	0.75	1.750	0.75	0.75	0.75
Filter surface area‡, ft^2	14.6	6.0	30.0	30.0	50.5
Flow area**, ft^2	4.4	1.8	9.0	9.0	15.2

** Inlet hole height can vary depending on the configuration of the tank. Optimum hole height is 65-75% of the minimum liquid level.*
† No inlet holes required, because influent enters between the vault base and the bottom of the filter cartridge.
‡ Filter area is defined as the total surface area of all individual Biotubes® within the filter cartridge.
*** Flow area is defined as the total open area (area of the mesh openings) of all the individual Biotubes within the filter cartridge.*

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Technical Data Sheet

AdvanTex® – AX20 Filter

Orenco Systems® Incorporated
800-348-9843

Applications

Orenco's AdvanTex® Treatment System* is an innovative technology for onsite treatment of residential wastewater. The heart of the System is the AdvanTex® Filter, a sturdy, watertight fiberglass basin filled with an engineered textile material. This lightweight, highly absorbent textile material treats a tremendous amount of wastewater in a small space. The AdvanTex® Treatment System is ideal for:

- Small sites
- System upgrades and repairs
- New construction
- Poor soils
- Nitrogen reduction
- Price-sensitive markets
- Pretreatment

For sizing, see "AdvanTex® Design Criteria," NDA-ATX-2.

The heart of the AdvanTex® Treatment System is this sturdy, watertight fiberglass basin filled with an engineered textile material.

**Covered by U.S. patent numbers 5,980,748; 5,531,894; 5,480,561; 5,360,556; 5,492,635; and 4,439,323. Additional patents pending.*

Features/Specifications

To specify this product, require the following:

- Wastewater treatment to better than secondary treatment standards
- Consistent treatment, even during peak flows
- Timer operation for flow monitoring, flow modulation, and surge control
- Fixed film textile media (a polyester plastic), operated in an unsaturated condition
- Consistent media quality
- Low maintenance beyond annual servicing
- Low energy consumption (under $1.45-4.86/month power cost at national average electric rate of $.10 kWh)
- Complete pre-manufactured package, ready-to-install
- Watertight construction, corrosion-proof materials, tamper-proof lid bolts
- Anti-flotation flanges
- Quiet operation

Standard Models

AX20, AX20N

(AX20 units carrying the NSF logomark are labeled AX20N, per NSF protocol.)

Physical Specifications

*Approximate Dimensions***

Filter Basin Length in. (mm)	91 (2311)
Width in. (mm)	40 (1016)
Height in. (mm)	31 (787)
Area (footprint) in. (m^2)	20 ft^2 (1.86)
Filter Dry Weight lb (kg)	400 (181)

*** See AdvanTex® Treatment System drawings for exact dimensions*

AdvanTex® Treatment System AXN Models meet the requirements of NSF-ANSI Standard 40 for Class I Systems.

© 2011 Orenco Systems® Inc.

Orenco PF500712 High Head Effluent Pump 50 GPM 0.75 HP 240V 1PH

$701.70

SKU: ONCPF500712

Brand: Orenco Systems, Inc.

Weight: 31.00 LBS

Quantity: 1

Add to Cart

Shipping: Calculated at checkout

Usually ships within 2 weeks. Need it sooner? Call

Description | Reviews | Also Viewed | Warranty

Orenco high-head effluent pumps are manufactured specifically for wastewater applications, to transport filtered effluent from septic tanks. High-head capabilities make them the ideal choice for STEP effluent sewer systems. Steep pump curves provide high-pressure capacity to clear plugged orifices in pressurized distribution systems. Orenco high-head effluent pumps possess a high cycling capability (up to 300 cycles/day on most models), which is needed for optimum treatment in many of today's high performance onsite systems. 60-Hz 1/2 hp to 1-1/2 hp pumps are UL and CSA listed for use in effluent. 5-year extended warranty included with all PF series pumps. PF pumps include an SOOW type cable, suitable for Class I, Division 1 and 2 applications (check local codes).

Orenco PF500712 High Head Effluent Pump Typical Application

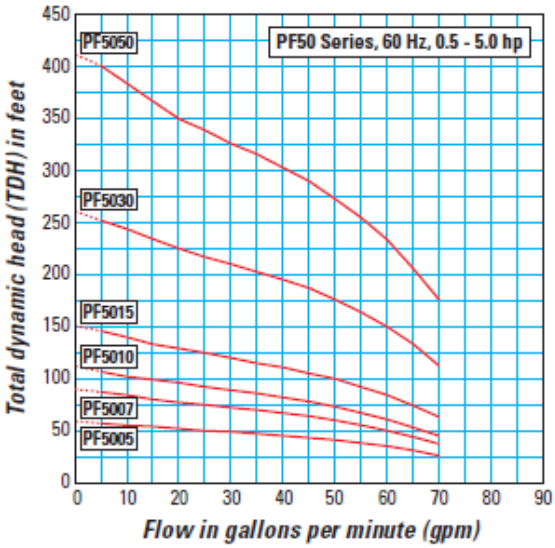
- Residential septic tank effluent
- Disposal system dosing
- Treatment system dosing

Orenco PF500712 High Head Effluent Pump Technical Details

- Minimum 24-hour run-dry capability with no deterioration inpump life or performance
- 1⁄8-inch (3-mm) bypass orifice (patent pending) to ensure flowrecirculation for motor cooling and to prevent air bind
- Liquid end repair kits available for better long-term cost ofownership
- TRI-SEAL™ floating impeller design on 10, 20, and 30 gpm(0.6, 1.3, and 1.9 L/sec) models; floating stack design on 50 and75 gpm (3.2 and 4.7 L/sec) models
- Super stainless Franklin Electric motor, rated for continuoususe and frequent cycling
- Type SOOW 600-V motor cable (suitable for Class I, Division 1and Division 2 applications)
- Five-year warranty on pump or retrofit liquid end from date ofmanufacture against defects in materials or workmanship
- 50 GPM nominal flow (see pump curve)

- 0.75 HP, 240 VAC, single phase, 6.8 FLA
- 2" FPT discharge

Orenco PF50 Series High Head Effluent Pump Curve



Orenco PF Series High Head Effluent Pump Product Resources

PDF Format

Orenco PF Series High Head Effluent Pump Technical Data Sheet - Orenco Document: NTD-PU-PF-1

Orenco PF100512 High Head Effluent Pump 10 GPM 0.5 HP 240V 1PH

$547.60

Orenco PF200512 High Head Effluent Pump 20 GPM 0.5 HP 240V 1PH

$549.70

Orenco PF300512 High Head Effluent Pump 30 GPM 0.5 HP 240V 1PH

$552.70

Orenco PF500512 High Head Effluent Pump 50 GPM 0.5 HP 240V 1PH

$554.80

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625 Best Avenue, Coeur d'Alene, ID 83814 | 4101 E. Broadway, Spokane, WA 99202

R.C. Worst & Co Inc. is Upfront

Called 1-17-14

Septic System Permit

Flathead City-County Health Department

Environmental Health Services

1035 1st Avenue West, Kalispell, MT 59901

Phone: (406) 751-8130 / Fax: (406) 751-8131

Permit Number: 14- 6371-N

Site Eval Receipt 13-3455

Date Issued: 3-17-14

Zone: 4

Date Recorded: 10/21/2013

1. Legal Description: Co. Assess. Tr.# 2 **Sec** 07 **Twp** 27 **Rng** 20

Subdiv. Name: **Lot:** **Block:**

COS #: **Parcel Size:** ~ 80 **acres**

Name/EQ:

Property Address: 905 N SOMERS RD KALISPELL MT 59901

2. Legal Property Owner **Intermountain Deaconess Home for Children**

Address and Phone 500 S Lamborn St, Helena, MT 59601-5417

3. Authorized for: New **Existing Structure:**

4. Structure: Proposed Structure Commercial **Specify:** Group Home for Youth

5. System Use: Individual

6. Occupancy Type: No. of Bedrooms **#:** 16 **Other Permits:**

7. Water Supply: Individual **Public:**

8. Nitrates: **Source:** WELL

9. Soil Type: Silt loam over silty clay loam **How Determined:** T.H.

10. Depth to Groundwater Table/Bedrock: > 84 **inches** **How Determined:** T.H.

11. Classification: 1 **Septic Tank Size (gal- min):** 3000 **Absorption Area (sq ft):** 2313

Permit Fee: $ 235.00

12. Drainfield Description:

Follow the plans and specifications prepared by Jeff Cicon Engineering, dated 1/2/14. Any changes must be approved by the engineer and Flathead City/County Health Department (FCCHD).

The engineer and a representative from FCCHD must be present for the inspection and a clear-water pump test.

Within 10 days after inspection and prior to final approval of the project by FCCHD, the engineer shall provide one complete set of as-built drawings and written certification that the project was completed as shown therein.

Follow plans carefully and be sure of all County septic system regulations prior to installation. NOTE: Minimum well separations = 50 feet to solid lines and septic tank and 100 feet to drainfield.

01/07/2014 Wendee Jacobs. R.S. Wendee Jacobs RS

Date **Signature Authorizing Approval of Permit**

* These requirements establish the MINIMUM STANDARDS for this septic system installation. The permit will be voided and declared invalid if the system is not installed within 12 months. The issuance of this permit authorizes construction of the septic system and requires the installation comply with the FLATHEAD COUNTY REGULATIONS FOR SEWAGE TREATMENT SYSTEMS (FCRSTS). The permit will be void if the system is not utilized as intended within three (3) years of installation. The property owner is responsible for operating and maintaining the system in accordance with FCRSTS. Failure to comply with these regulations may result in revocation of this permit. This permit does not constitute a design and does not bind or obligate this office to guarantee the performance of the system. This permit shall be given to the installer prior to construction. The owner shall give 48 hours advance notice for the required inspection of the system. Please call 751-8130.

PUMP DESIGN WORKSHEET - 5/5/08

RECEIVED
Recd. Date Stamp (FCCHD)
JAN - 2 2014
FLATHEAD CITY-COUNTY HEALTH DEPARTMENT

Owner:	Intermountain Deaconess	Designer	Jeff Cicon, PE
Address:	500 S. Lamborn St	Tel:	(406) 751-5863
Legal :	905 N. Somers Rd	Installer	
		Tel:	

Design Data Required

Orifice Diameter (OD)	5/32	inch	(minimum 1/8th inch)
Orifice Spacing (OS)	5	ft	on centers (maximum 5 feet)
Pressure head, first orifice (HO)	5	ft	(> 2.3 ft for 3/16 in. or larger orifices, > 5 ft for orifices< 3/16 in.)
Orifice Discharge Rate (QO)	0.66	gal/min	(from orifice flow chart)

Length of Force Main (LFM)	LFM	400	ft.	
Diameter of Force Main	DFM	2.047	inches	
Pump Chamber Low-Level (pump "off") elevation	E1	2895.5	ft.	
Elevation of Upper Lateral	E2	2901.7	ft.	
Daily Sewage Volume	QS/	925	gal / day	Level Two treatment
Allowable Soil Loading Rate	QL	0.4	gpd/sq.ft.	x for yes x

Trench type:	ROCK (x for yes)	x	CHAMBER		
Trench width:	select 2 or 3 ft	3	Effective width	2.2	*Infiltrator = 2.20 ft.
					*ADS = 2.20 ft.

Design calculations

Required infiltration Area (sq.ft.)	Rock	1156	Chamber 867
Total length of laterals		385	394

Number of Orifices	NO	=	LL/OS	77	
Total Discharge Rate	Qt	=	QO x NO	51	gal/min
Forcemain Fricton Factor			F	5.03	ft/100 ft
Forcemain Headloss	(F x LFM/100)			20.11	ft.
Elevation Head (gravity)	HG	=	E2-E1	6.2	ft.
Total Dynamic Head (HG + HFM + HO),				31.31	

Required Pump

Capable of pumping at least 51 gal/min against a head of 31 feet

Pump make Orenco Model PF500712

Actual Drainfield Design:

Number of Laterals 6 Length each Latera

	L1	L2	L3	L4	L5	L6
Length each Latera	75	75	75	75	75	75
Lateral elevation	2901.7	2901.7	2901.7	2901.7	2901.7	2901.7

	L7	L8	L9	L10	L11	L12
Length						
Elevation						

Control Float Settings

Dose Volume

Laterals- 1.25"

Pipe type/clas SCH 40 Int. Dia. 1.38 in. Pipe Vol. 0.078 gal/ ft

Total length of laterals (L) 450 ft.

Total vol in laterals (VL) 34.96

Forcemain

Pipe type/clas SCH 40 Int. Dia. 2.047 in. Pipe Vol. 0.171 gal/ ft

Total length forcemain 400 ft

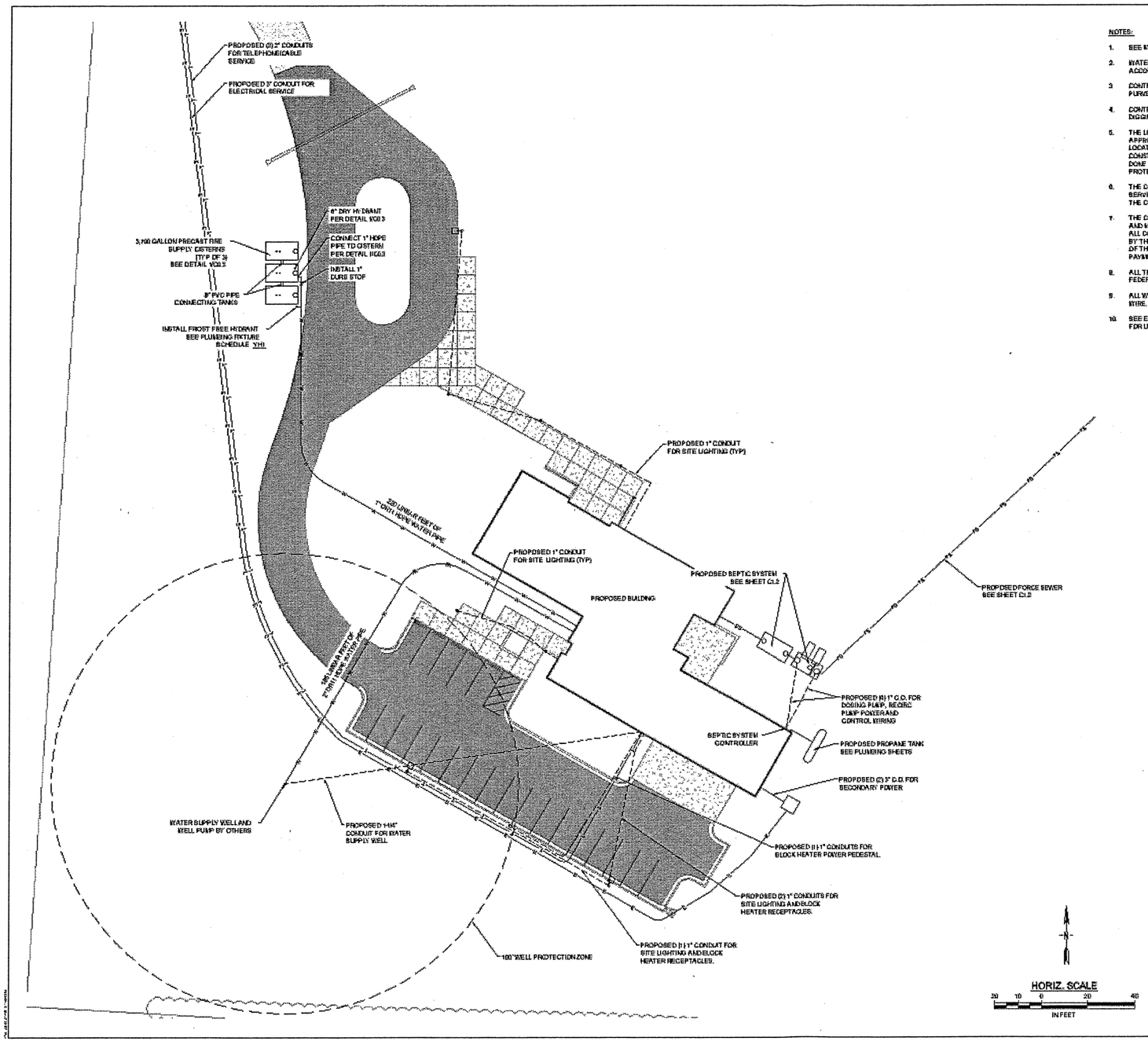
Total vol. in forcemain 68.38 gal, (VFM)

(5x VL) + VFM = 175 + 68 = 243 gal

Pump Chamber Volume (V)	132	gal / ft	
MinimumDose Volume (D)	243	gal	
Upper (pump on) float should be	1.84	ft (D/V)	= 22 in. above "pump off" float
Control & Alarm (make & model)	Orenco MF4A		

PLEASE PROVIDE A SKETCH OF SYSTEM LAYOUT AND PROFILE ON BACK OF THIS SHEET

file: Pump hyd design wksht 5-5-08-computer.xls



NOTES:

1. SEE MPWES STANDARD DRAWING NO 02221-1 FOR TYPICAL UTILITY TRENCH DETAIL.
2. WATER LINES SHALL HAVE A MINIMUM COVER OF 6.5 FEET AND SHALL BE IN ACCORDANCE WITH MONTANA PUBLIC WORKS STANDARD SPECIFICATIONS.
3. CONTRACTOR TO COORDINATE CONNECTIONS TO EXISTING UTILITIES WITH GOVERNING PURVEYORS.
4. CONTRACTOR SHALL NOTIFY ONE CALL AND MARK ALL EXISTING UTILITIES PRIOR TO DIGGING.
5. THE LOCATION, DEPTH AND SIZE OF EXISTING UTILITIES SHOWN ON THESE PLANS IS APPROXIMATE. THE CONTRACTOR SHALL FIELD VERIFY THE EXISTENCE, EXTENTS, LOCATION, DEPTH, SIZE, LINE AND GRADE OF EXISTING UTILITY CONNECTIONS PRIOR TO CONSTRUCTION. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR ANY DAMAGE DONE TO THE EXISTING FACILITIES DUE TO FAILURE TO LOCATE OR PROVIDE PROPER PROTECTION WHEN LOCATION IS KNOWN.
6. THE CONTRACTOR SHALL MAINTAIN SERVICE OF ALL EXISTING UTILITIES. IF BAD SERVICE IS DAMAGED, THE CONTRACTOR SHALL IMMEDIATELY REPAIR THE DAMAGE AT THE CONTRACTOR'S EXPENSE.
7. THE CONTRACTOR SHALL ADJUST ALL NEW AND EXISTING VALVE BOXES, CURB BOXES, AND MANHOLES TO THE FINAL ELEVATION SHOWN ON THE PLANS UPON COMPLETION OF ALL CONSTRUCTION. ANY BOXES OR MANHOLES DAMAGED OR OTHERWISE DISTURBED BY THE CONTRACTOR OR ANY SUBCONTRACTOR SHALL BE REPAIRED AT THE EXPENSE OF THE CONTRACTOR. THIS WORK SHALL BE INCIDENTAL TO THE PROJECT, SEPARATE PAYMENT WILL NOT BE MADE.
8. ALL TRENCHING, PIPE LAYING, AND BACKFILLING SHALL BE IN ACCORDANCE WITH FEDERAL OSHA REGULATIONS.
9. ALL WATER AND SEWER LINES MUST BE INSTALLED WITH 14 GAUGE COPPER TRACER WIRE. THE WIRE MUST BE ACCESSIBLE AT ALL VALVES, HYDRANTS, AND CLEANOUTS.
10. SEE ELECTRICAL SHEETS FOR SITE LIGHTING LUMINAIRE SCHEDULE. SEE SHEET E1.1 FOR LIGHT POLE BASE DETAIL.

LEGEND

—W—	PROPOSED WATER LINE
—SG—	PROPOSED GRAVITY SEWER
—FS—	PROPOSED FORCE SEWER
—E—	PROPOSED ELECTRICAL SERVICE
—T—	PROPOSED TELEPHONE SERVICE
—G—	PROPOSED GAS SERVICE
- - - - -	PROPOSED CONDUIT

INCOMING ELECTRICAL SERVICE
DIVISION OF RESPONSIBILITY

	ELEC. CONTR.	UTILITY CO.
PRIMARY CONDUIT	X	
PRIMARY CONDUCTORS		X
TRANSFORMER		X
TRANSFORMER PAD/ VAULT	X	
TRANSFORMER CONNECTIONS		X
SECONDARY CONDUIT	X	
SECONDARY CONDUCTORS		X
CT ENCLOSURE	X	
DISCONNECT	X	
METER BASE	X	
METER		X

AVAILABLE FAULT CURRENT AT SERVICE POINT: 13.001A @ 120/240V 1P, 5W XFMR

NOTES:

1. CONTACT AND COORDINATE ALL REQUIREMENTS AND RESPONSIBILITIES WITH SERVING UTILITY COMPANIES PRIOR TO SUBMITTING BID
2. ALL SERVICE INSTALLATION WORK SHALL BE IN STRICT COMPLIANCE WITH THE REQUIREMENTS OF THE SERVING UTILITIES. COORDINATE TRENCH INSPECTIONS AND FINAL VAULT LOCATIONS WITH UTILITY PRIOR TO INSTALLATION.

POWER CONTACT:
CHAD BESSETTE
FLATHEAD ELECTRIC
KALISPELL, MT

TELEPHONE CONTACT:
COREY HILLS
CENTURYLINK
KALISPELL, MT

MORRISON MAIERLE, INC HAS CONTACTED THE UTILITIES BUT HAS NOT RECEIVED IN WRITING THE FINAL REQUIREMENTS FROM THE POWER UTILITY. THESE DRAWINGS INDICATE OUR BEST ESTIMATION OF THEIR REQUIREMENTS. PRIOR TO BID CONTACT THE UTILITIES AND OBTAIN IN WRITING THEIR REQUIREMENTS.

SMA
SCHLEMER & McKITTRICK
PO BOX 1 KALISPELL, MT 59903
PH: (406) 752-5500
FAX: (406) 752-5501

MONTANA JEFFREY L. UNCH No. 23987 PE LICENSED PROFESSIONAL ENGINEER

Intermountain Providence Home

1316

Bozeman, Montana

Intermountain Deaconess Children's Services, Inc.

intermountain
restoring hope for children

MORRISON MAIERLE, INC.
An Employee-Owned Company
135 SCHOOLHOUSE LOOP
P.O. BOX 1257
KALISPELL, MT 59904
PHONE (406) 752-5221
FAX (406) 752-2217

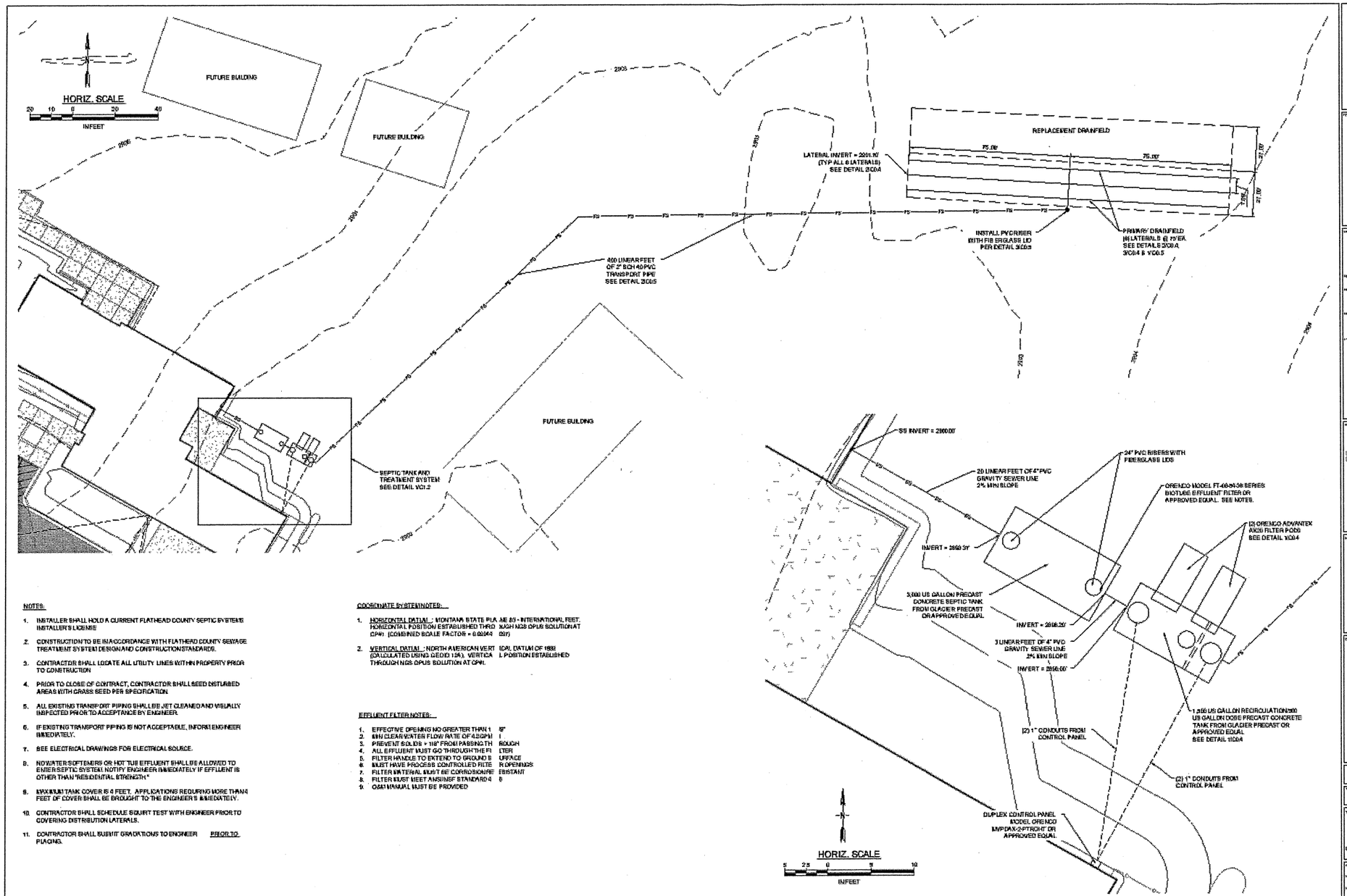
Overall Utility Plan

Construction Documents

11.01.2013

1316

C1.1



1 SEPTIC TANK AND TREATMENT SYSTEM DETAIL

C1.2 SCALE: 1"=5

NOTES:

1. INSTALLER SHALL HOLD A CURRENT FLATHEAD COUNTY SEPTIC SYSTEMS INSTALLER'S LICENSE
2. CONSTRUCTION TO BE IN ACCORDANCE WITH FLATHEAD COUNTY SEWAGE TREATMENT SYSTEM DESIGN AND CONSTRUCTION STANDARDS.
3. CONTRACTOR SHALL LOCATE ALL UTILITY LINES WITHIN PROPERTY PRIOR TO CONSTRUCTION
4. PRIOR TO CLOSE OF CONTRACT, CONTRACTOR SHALL SEED DISTURBED AREAS WITH GRASS SEED PER SPECIFICATION.
5. ALL EXISTING TRANSPORT PIPING SHALL BE JET CLEANED AND VISUALLY INSPECTED PRIOR TO ACCEPTANCE BY ENGINEER.
6. IF EXISTING TRANSPORT PIPING IS NOT ACCEPTABLE, INFORM ENGINEER IMMEDIATELY.
7. SEE ELECTRICAL DRAWINGS FOR ELECTRICAL SOURCE.
8. NO WATER SOFTENERS OR HOT TUB EFFLUENT SHALL BE ALLOWED TO ENTER SEPTIC SYSTEM. NOTIFY ENGINEER IMMEDIATELY IF EFFLUENT IS OTHER THAN "RESIDENTIAL STRENGTH."
9. MAX MUM TANK COVER IS 4 FEET. APPLICATIONS REQUIRING MORE THAN 4 FEET OF COVER SHALL BE BROUGHT TO THE ENGINEER'S IMMEDIATELY.
10. CONTRACTOR SHALL SCHEDULE SQUIRT TEST WITH ENGINEER PRIOR TO COVERING DISTRIBUTION LATERALS.
11. CONTRACTOR SHALL SUBMIT GRADATIONS TO ENGINEER PRIOR TO PLACING.

COORDINATE SYSTEM NOTES:

1. HORIZONTAL DATUM : MONTANA STATE PLA NE 83 - INTERNATIONAL FEET, HORIZONTAL POSITION ESTABLISHED THRO UGH NGS OPUS SOLUTION AT CPH. (COMBINED SCALE FACTOR = 0.00044 007)
2. VERTICAL DATUM : NORTH AMERICAN VERT ICAL DATUM OF 1988 (CALCULATED USING GEOID 12A). VERTICA L POSITION ESTABLISHED THROUGH NGS OPUS SOLUTION AT CPH.

EFFLUENT FILTER NOTES:

1. EFFECTIVE OPENING NO GREATER THAN 1 6"
2. MIN CLEAR WATER FLOW RATE OF 4.2 GPM
3. PREVENT SCUBS = 110" FROM PASSING TH ROUGH
4. ALL EFFLUENT MUST GO THROUGH THE FI LTER
5. FILTER HANDLE TO EXTEND TO GROUND S URFACE
6. MUST HAVE PROCESS CONTROLLED FILTE R DEPENDING
7. FILTER MATERIAL MUST BE CORROSION/RE SISTANT
8. FILTER MUST MEET ANSI/NSF STANDARD 4 0
9. O&M MANUAL MUST BE PROVIDED

SMA
SCHLENKER & MCKITTRICK

MONTANA PETER J. DIXON No. 23187 PE LICENSED PROFESSIONAL ENGINEER

Intermountain Providence Home

1316
Sonara, Montana

Intermountain Deaconess Children's Services, Inc.

intermountain
restoring hope for children

MORRISON MAIERLE, INC.
An Employee-Owned Company
125 SCHOOLHOUSE LOOP
P.O. BOX 1307
KALISPELL, MT 59904
PHONE (406) 752-2218
FAX (406) 752-2281

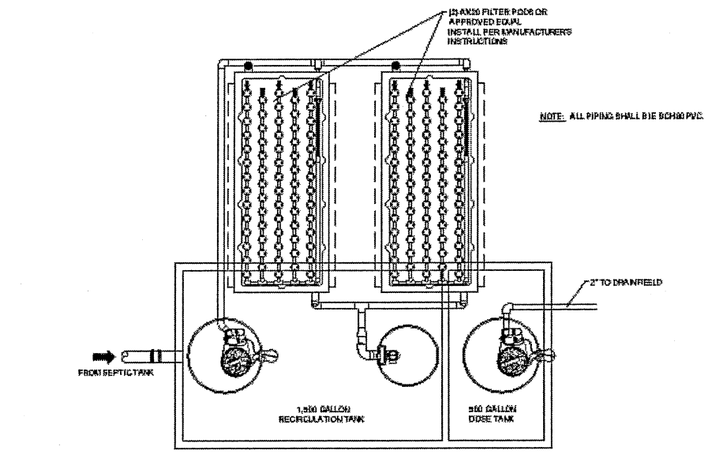
1. Modify Drainfield Laterals

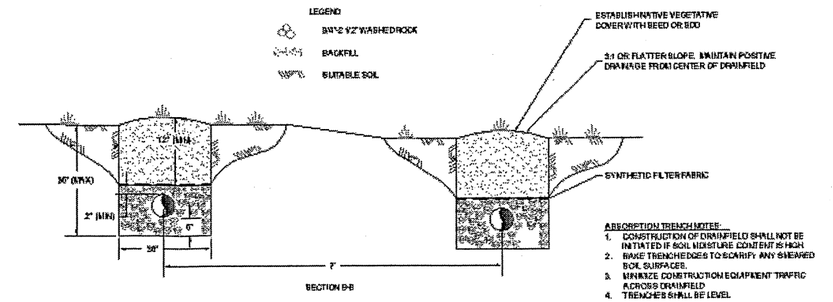
DRAWN BY: AM
CHECKED BY: MJ

Septic System Plan

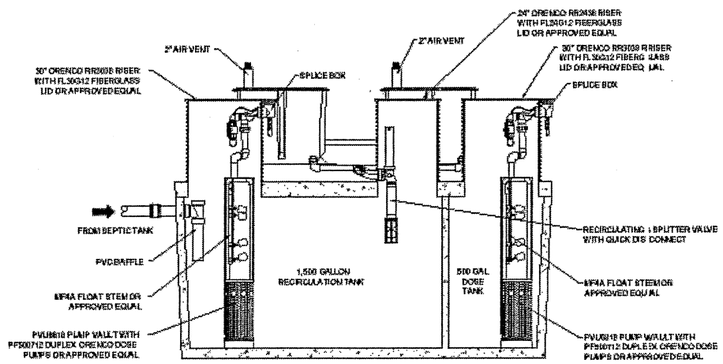
Construction Documents
11.01.2013
1316

C1.2

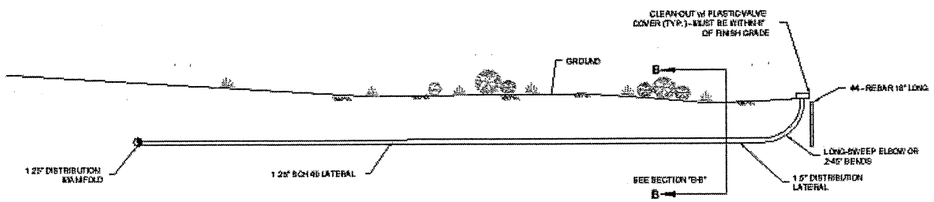




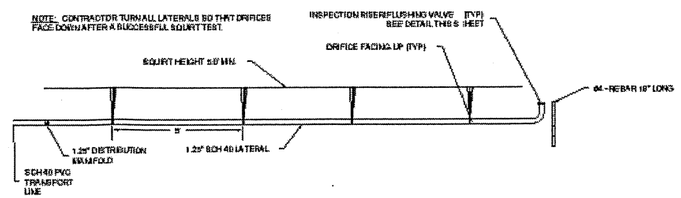
2 TYPICAL PRESSURE DOSED TRENCH DETAIL
C1.2 SCALE: NTS



1 PACKAGE ADVANTEX SYSTEM DETAIL
C1.2 SCALE: NTS



3 PRESSURE DOSED DRAINFIELD PROFILE
C1.2 SCALE: NTS



4 DRAINFIELD SQUIRT TEST DETAIL
C1.2 SCALE: NTS

SCHLEINER & McKITTRICK

MONTANA REGISTERED PROFESSIONAL ENGINEER

Intermountain Providence Home

1316

Sonoma, Montana

Intermountain Deaconess Children's Services, Inc.

intermountain
restoring hope for children

MORRISON MAIERLE, INC.
An Employee Owned Company
115 SCHOOLHOUSE LOOP
P.O. BOX 1357
KALISPELL, MT 59904
PHONE: (406) 752-2278
FAX: (406) 752-2291

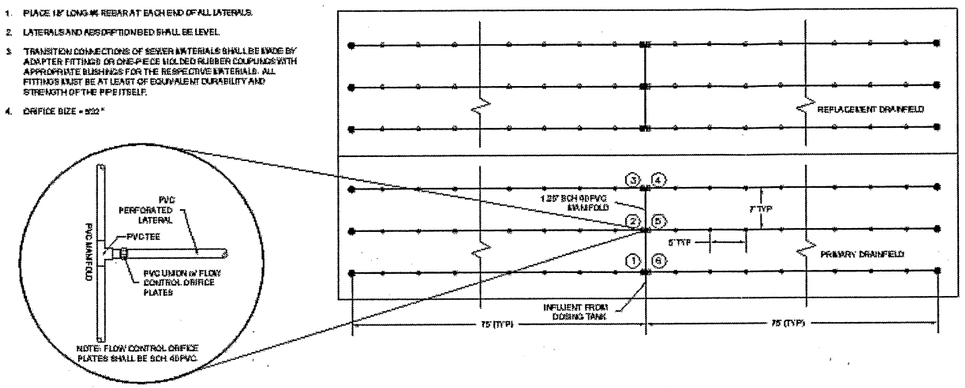
Septic System Details

Construction Documents
11.01.2013
1316

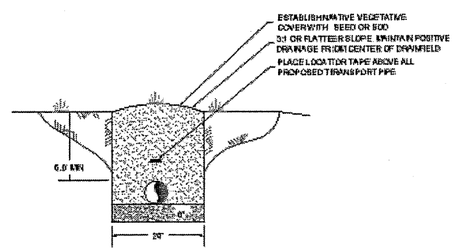
C0.4

PRESSURE DISTRIBUTED LATERAL NOTES:

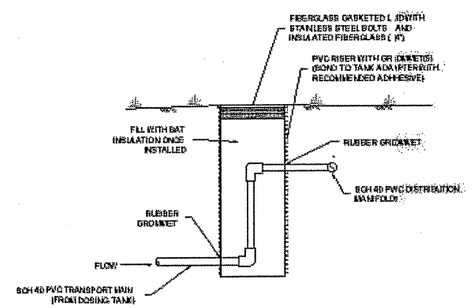
1. PLACE 18" LONG #4 REBAR AT EACH END OF ALL LATERALS.
2. LATERALS AND ABSORPTION BED SHALL BE LEVEL.
3. TRANSITION CONNECTIONS OF SEWER MATERIALS SHALL BE MADE BY ADAPTER FITTINGS OR ONE-PIECE MOLDED RUBBER COUPLINGS WITH APPROPRIATE BUSHINGS FOR THE RESPECTIVE MATERIALS. ALL FITTINGS MUST BE AT LEAST OF EQUIVALENT DURABILITY AND STRENGTH OF THE PIPE ITSELF.
4. ORIFICE SIZE = 0.22"



1 DOSED PRIMARY AND REPLACEMENT DRAINFIELD DETAIL
1/C1.2 SCALE: NTS



2 PROPOSED TRANSPORT PIPE TRENCH DETAIL
C1.2 SCALE: NTS



3 TRANSPORT PIPE TO DISTRIBUTION MANIFOLD DETAIL
C1.2 SCALE: NTS

SCHLENKER & MUKOTTRICK ENGINEERING

MONTANA
DICON
No. 23187 PE
LICENSED
PROFESSIONAL ENGINEER

Intermountain Providence Home

1316
Sunburst, Montana

Intermountain Deaconess Children's Services, Inc.

intermountain
exceeding hope for children

MORRISON MAIERLE, INC.
An Employee Owned Company
115 SCHOOLHOUSE LOOP
P.O. BOX 1001
KALISPELL, MT 59903
PHONE: (406) 752-22-1
FAX: (406) 752-2083

Septic System Details

Construction Documents
11.01.2013
1316

C0.5

Christine Pearcy

From: Wendee Jacobs <wjacobs@flathead.mt.gov>
Sent: Thursday, February 27, 2014 12:02 PM
To: Jeff Cicon
Subject: RE: Providence Home Septic

Hi Jeff,
I finally had a chance to take a look at the changes. Everything looks good and probably better as the new version doesn't deptict any turns or angles in the forcemain. Setbacks are all maintained. I will just include the new layout with a current date in the file. Thanks for your patience!

Wendee Jacobs, RS
Flathead County Sanitarian
Environmental Health Service
Flathead City-County Health Department
1035 1st Avenue West
Kalispell MT 59901
(406)751-8130
FAX 751-8131

From: Jeff Cicon [mailto:jcicon@m-m.net]
Sent: Tuesday, February 25, 2014 2:56 PM
To: Wendee Jacobs
Subject: RE: Providence Home Septic

Wendee - were you able to review this change?

Jeff Cicon, PE, LSI, LEED AP BD+C
MORRISON-MAIERLE, INC.
Direct: 406.751.5863

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From: Jeff Cicon
Sent: Tuesday, February 18, 2014 10:16 AM
To: Wendy Jacobs (wjacobs@flathead.mt.gov)
Subject: Providence Home Septic

Wendee,

The location of the building envelope of the Providence Home has been moved approximately 270 feet to the north and 250 feet to the east based on comments received on the project. This will require the location of the drainfield to be modified as shown on the attached plans. The length and configuration of the drainfield has remained the same. I also attached the updated Pump Design Worksheet based on the new length of the transport pipe.

Please let me know if you have any questions. Thanks,

Jeff Cicon, PE, LSI, LEED AP BD+C
Civil Engineer

MORRISON MAIERLE, INC.
ENGINEERS·SURVEYORS·PLANNERS·SCIENTISTS

125 Schoolhouse Loop
Kalispell, MT 59901
Main: 406.752.2216
Direct: 406.751.5863

Date: 12/19/2013 **Number:** 2013-BLDG-MTN-000918

BUILDING PERMIT

STATE OF MONTANA
BUILDING CODES BUREAU
301 S. PARK, PO BOX 200517
HELENA, MT 59620-0517

DEC 23 2013

Intermoutain Deaconess Home For Children
500 S Lamborn St
Helena, MT 59601-5417

County: Flathead

Project Name: INTERMOUNTAIN DEACONESS TBS NEW **Expires:** 6/19/2015

Contractor:

Owner: Intermoutain Deaconess Home For Children **Phone:** 4064424933

Inspector: Robert Morris **Phone:** 406-202-1324

Location: 905 North Somers Rd Rd Kalispell, Mt 59901 **Plan Reviewer:** Keith Fletcher

Bureau Chief, Building Codes Bureau

For all work done under this permit number the permitee accepts full responsibility for compliance with the National Electrical Code or Montana State Plumbing/Mechanical Code as amended and other applicable State codes and Statutes.

Granted in accordance with Title 50, Chapter 60, Part 2, MCA, and all other administrative rules promulgated there under.

Granting of this provisional permit does not implicitly or expressly preempt or authorize violation of the provisions of any other state or local law relating to or regulating building construction. It remains the responsibility of the permit holder to comply with the State Building Codes regardless of whether non-complying items were identified during plan review or during inpection.

Check local zoning requirements. State licensing laws require that only properly licensed personnel be used to install electrical or plumbing systems on commercial or public projects.

DISABILITY ACCESS NOTICE

Compliance with the requirements of the state building code for physical accessibilty to persons with disabilities does not necessarily guarantee compliance with the Americans with Disabilities Act of 1990, the Rehabilitation Act of 1972, the Fair Housing Amendments Act of 1988, Title 49, Chapter 2, commonly known as the Montana Human Rights Act, or other similiar federal, state, or local laws that mandate accessibility to commercial construction or multifamily housing.

MORRISON MAIERLE, INC.

Technical Memorandum

INTERMOUNTAIN PROVIDENCE HOME STORMWATER SYSTEM BASIS OF DESIGN

PREPARED BY: Jeff Cicon, PE

REVIEWED BY: Paul Burnham, PE

DATE: March 6, 2014

1. INTRODUCTION

The Intermountain Providence Home is located northeast of Somers, MT in Flathead County. The purpose of this technical memorandum is to present the design criteria used to design the stormwater system. This memo and subsequent plans will comply with the applicable design standards as set forth in the *Flathead County Subdivision Regulations and Montana Department of Environmental Quality (MDEQ) Design Circular 8 – Montana Standards for Subdivision Storm Drainage (2002 Edition)*.

2. PRE-DEVELOPMENT FLOW

The pre-development flow was analyzed by creating a stormwater model in HydroCAD stormwater modeling software. The model was set to use NRCS Type I 24-hour storm to predict flow conditions. The 24-hour precipitation data was set as follows:

- 2-year: 1.4 inches
- 10-year: 2.0 inches
- 25-year: 2.4 inches
- 50-year: 2.8 inches
- 100-year: 3.0 inches

There are two natural discharge points for the stormwater as shown in Figure 1. For analysis, these have been separated into two drainage basins, North and South. A summary of both basins is provided below.

South Basin:

- Area = 1.22 acres
- Soil Type = C
- CN = 79 (Pasture, Fair)
- Tc = 46.1 min

North Basin:

- Area = 1.08 acres
- Soil Type = C
- CN = 79 (Pasture, Fair)
- Tc = 38.2 min

The model predicted the following pre-development flow conditions, presented in Table 1.

TABLE 1
PRE-DEVELOPMENT FLOW

Basin	2-year Flow (cfs)	10-year Flow (cfs)	100-year Flow (cfs)
South Basin	0.04	0.16	0.46
North Basin	0.04	0.16	0.46

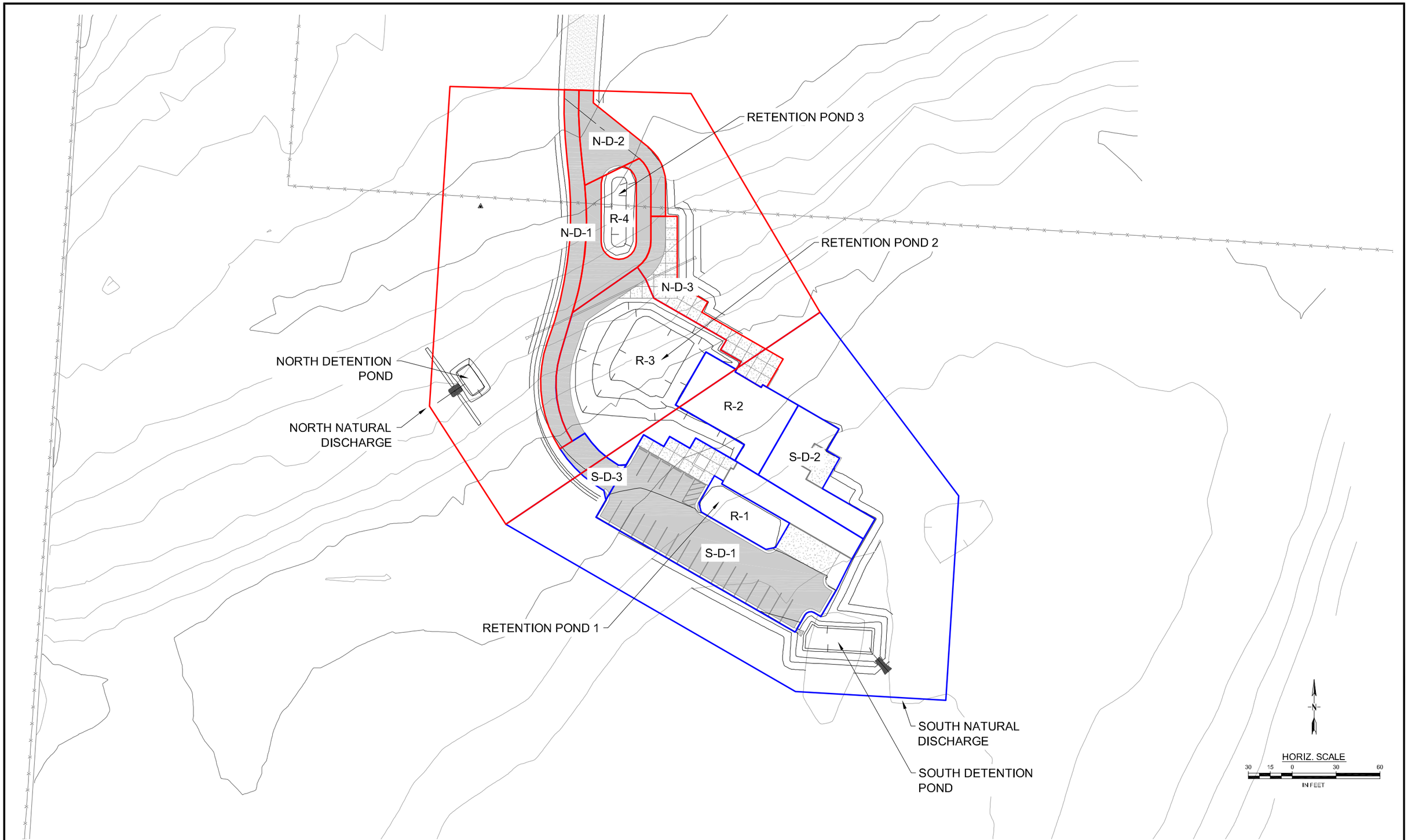
3. POST-DEVELOPMENT FLOW

There are two detention facilities proposed for each natural discharge point. There are also three retention facilities proposed for the project. Although MDEQ Circular 8 requires these ponds to be designed for the 2-year event, these ponds are designed for the 10-year event to provide an additional level of treatment and flow control beyond MDEQ standards. The 100-year event was also analyzed to ensure the improvements would not be inundated during this event.

Figure 1 outlines the various sub-basins that were entered into the model. Figure 2 shows the configuration of the model. A summary of the drainage basins in provided in Table 2.

TABLE 2
DRAINAGE BASIN ASSUMPTIONS

Basin	Area (sf)	Curve Number Assumption	Curve Number	Time-to-Concentration (min)
R-1	1,429	>75% Grass cover, Good	74	n/a
R-2	3,235	Roof	98	n/a
R-3	9,399	>75% Grass cover, Good	74	n/a
R-4	1,412 2,054	>75% Grass cover, Good Paved Parking	74 98	n/a
S-D-1	11,383	Roof/Paved Parking	98	4.0
S-D-2	2,817	Roof	98	5.1
S-D-3	845	Paved Parking	98	10.2
S-D-Remainder	27,448	Pasture, Fair	79	46.1
N-D-1	2,584	Paved Parking	98	5.0
N-D-2	2,107	Paved Parking	98	31.7
N-D-3	2,528	Paved Parking	98	38.1
N-D-Remainder	33,214	Pasture, Fair	79	38.2



VERIFY SCALE!

THESE PRINTS MAY BE REDUCED. LINE BELOW MEASURES ONE INCH ON ORIGINAL DRAWING.

MODIFY SCALE ACCORDINGLY!

REVISIONS

NO.	DESCRIPTION	DATE	BY

U:\2096 SMA\012 INTERMOUNTAIN YOUTH GROUP HOME\ACAD\EXHIBITS\DRAINAGE BASIN EXHIBIT.DWG PLOTTED BY: JEFF CICON ON Mar/06/2014

MORRISON MAIERLE, INC.
An Employee-Owned Company
Engineers
Surveyors
Scientists
Planners
125 Schoolhouse Loop
Kalispell, MT 59901
Phone: (406) 752-2216
Fax: (406) 752-2391

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NOT FOR CONSTRUCTION

DRAWN BY: JJC
DSGN. BY: JJC
APPR. BY:
DATE: 03/2014
Q.C. REVIEW BY:
DATE:

INTERMOUNTAIN PROVIDENCE HOME

SOMERS MONTANA

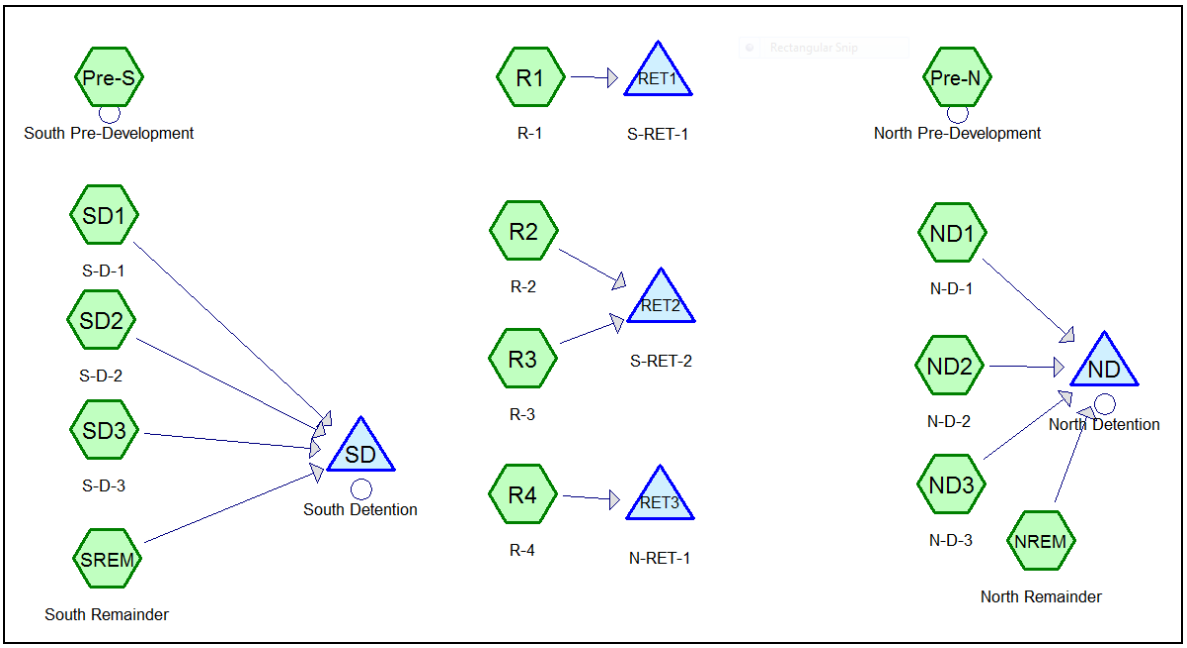
STORMWATER BASIN MAP

PROJECT NUMBER 2096.012

SHEET NUMBER -

DRAWING NUMBER FIG 1

FIGURE 2
STORMWATER MODEL CONFIGURATION



3.1 Detention Ponds

The model predicted the following flow conditions at the two detention ponds, presented in Tables 3 and 4. The results show the 10-year post development peak flow rate is less than the predevelopment peak flow rate for both ponds. The results also show the ponds will safely pass the 100-year storm event without inundating any structures or drainfields.

TABLE 3
SOUTH DETENTION POND RESULTS

Basin	2-year Flow (cfs)	10-year Flow (cfs)	100-year Flow (cfs)
S-D-1	0.26	0.38	0.58
S-D-2	0.06	0.09	0.14
S-D-3	0.02	0.02	0.04
S-D-Remainder	0.02	0.08	0.24
Peak Pond Inflow[1]	**0.33**	**0.50**	**0.80**
Peak Pond Outflow	**0.04**	**0.15**	**0.66**
Peak Pond Volume (cf)	899	966	1,138
Peak Elevation (feet)	2903.55	2903.61	2903.75
Maximum Elevation (feet)	2904.30	2904.30	2904.30

1. Accounts for time to concentration of individual drainage basins.

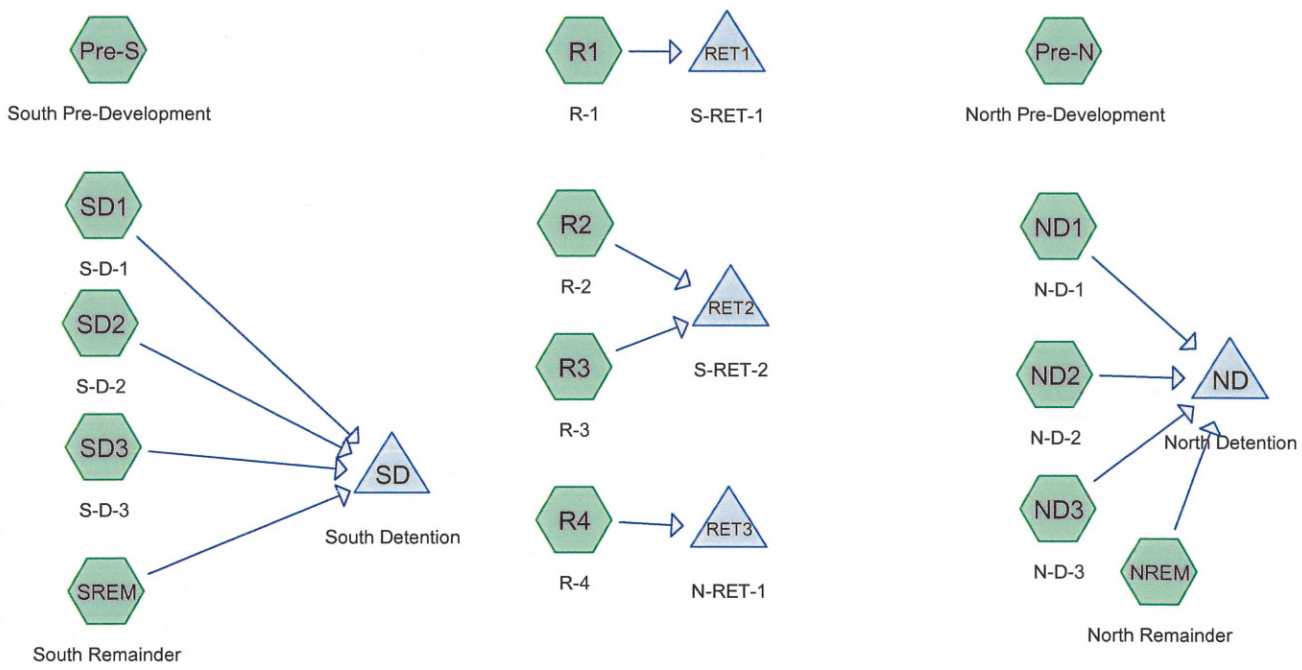
TABLE 4 NORTH DETENTION POND RESULTS			
Basin	**2-year Flow (cfs)**	**10-year Flow (cfs)**	**100-year Flow (cfs)**
N-D-1	0.06	0.08	0.13
N-D-2	0.03	0.04	0.06
N-D-3	0.03	0.04	0.06
N-D-Remainder	0.03	0.11	0.32
Peak Pond Inflow[1]	**0.08**	**0.20**	**0.46**
Peak Pond Outflow	**0.02**	**0.11**	**0.42**
Peak Pond Volume (cf)	646	712	862
Peak Elevation (feet)	2902.03	2902.09	2902.20
Maximum Elevation (feet)	2903.00	2903.00	2903.00
1. Accounts for time to concentration of individual basins.			

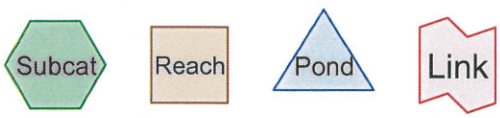
3.2 Retention Ponds

The retention ponds are sized for the 100-year event to ensure the building or other structures are not inundated during this event. Table 5 outlines the conditions predicted by the model for the three retention ponds.

TABLE 5 RETENTION POND RESULTS				
Pond	**Design Volume (cf)**	**100-year Flood Volume (cf)**	**100-year Pond Elevation (ft)**	**Maximum Elevation (ft)**
Retention Pond 1	401	108	2904.82	2905.17
Retention Pond 2	2,018	1,419	2903.29	2903.50
Retention Pond 3	1,256	525	2904.37	2905.00

4. APPENDIX A – STORMWATER MODEL RESULTS





Routing Diagram for SW Model
Prepared by Morrison Maierle Inc, Printed 3/6/2014
HydroCAD® 10.00 s/n 04935 © 2012 HydroCAD Software Solutions LLC

Summary for Subcatchment Pre-N: North Pre-Development

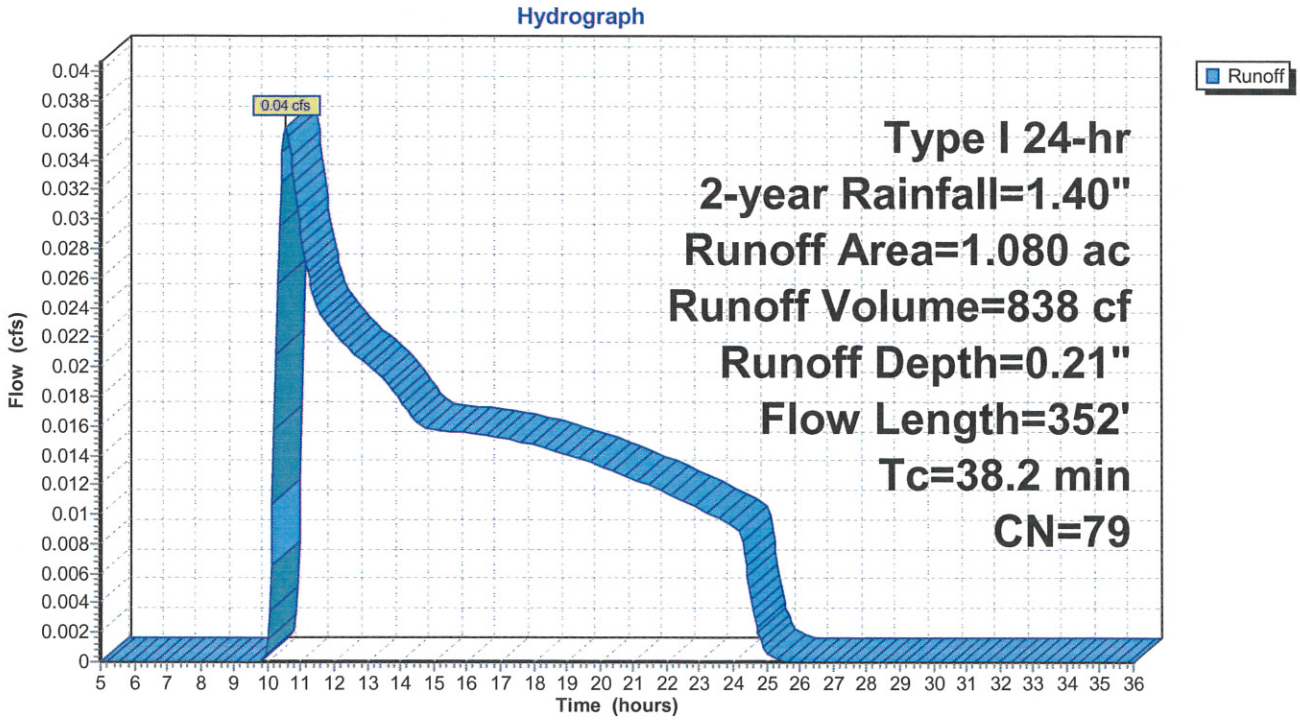
Runoff = 0.04 cfs @ 10.55 hrs, Volume= 838 cf, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Type I 24-hr 2-year Rainfall=1.40"

Area (ac)	CN	Description
1.080	79	Pasture/grassland/range, Fair, HSG C
1.080		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	96	0.0390	0.16		**Sheet Flow,** Range n= 0.130 P2= 1.40"
28.4	256	0.0001	0.15		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
38.2	352	Total			

Subcatchment Pre-N: North Pre-Development



Summary for Subcatchment Pre-S: South Pre-Development

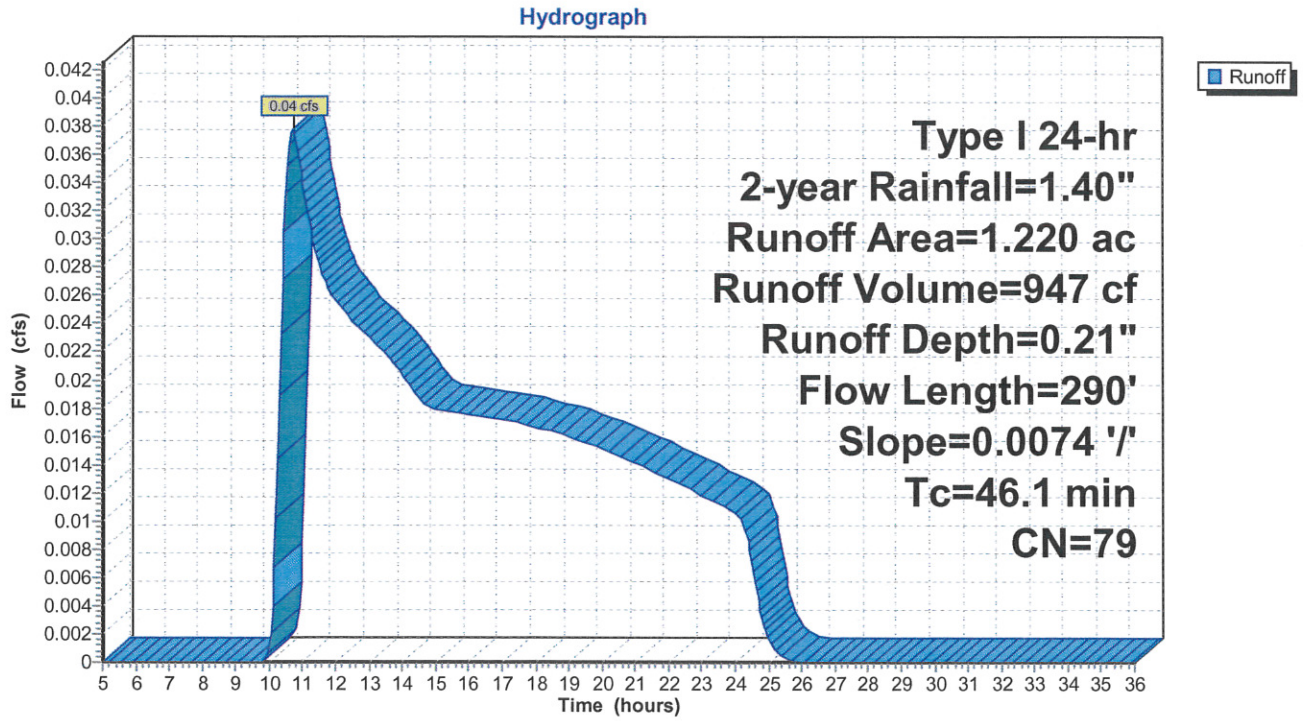
Runoff = 0.04 cfs @ 10.70 hrs, Volume= 947 cf, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Type I 24-hr 2-year Rainfall=1.40"

Area (ac)	CN	Description
1.220	79	Pasture/grassland/range, Fair, HSG C
1.220		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
46.1	290	0.0074	0.10		**Sheet Flow,** Range n= 0.130 P2= 1.40"

Subcatchment Pre-S: South Pre-Development



Summary for Subcatchment Pre-N: North Pre-Development

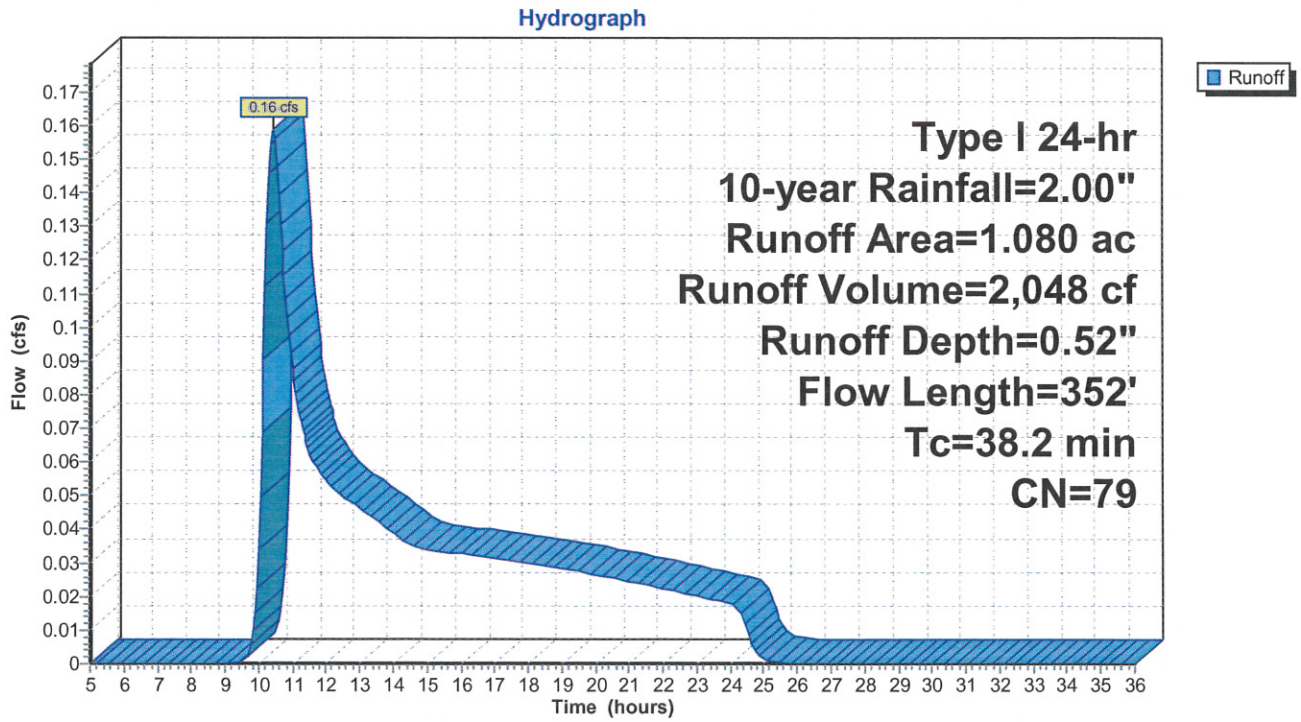
Runoff = 0.16 cfs @ 10.42 hrs, Volume= 2,048 cf, Depth= 0.52"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Type I 24-hr 10-year Rainfall=2.00"

Area (ac)	CN	Description
1.080	79	Pasture/grassland/range, Fair, HSG C
1.080		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	96	0.0390	0.16		**Sheet Flow,** Range n= 0.130 P2= 1.40"
28.4	256	0.0001	0.15		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
38.2	352	Total			

Subcatchment Pre-N: North Pre-Development



Summary for Subcatchment Pre-S: South Pre-Development

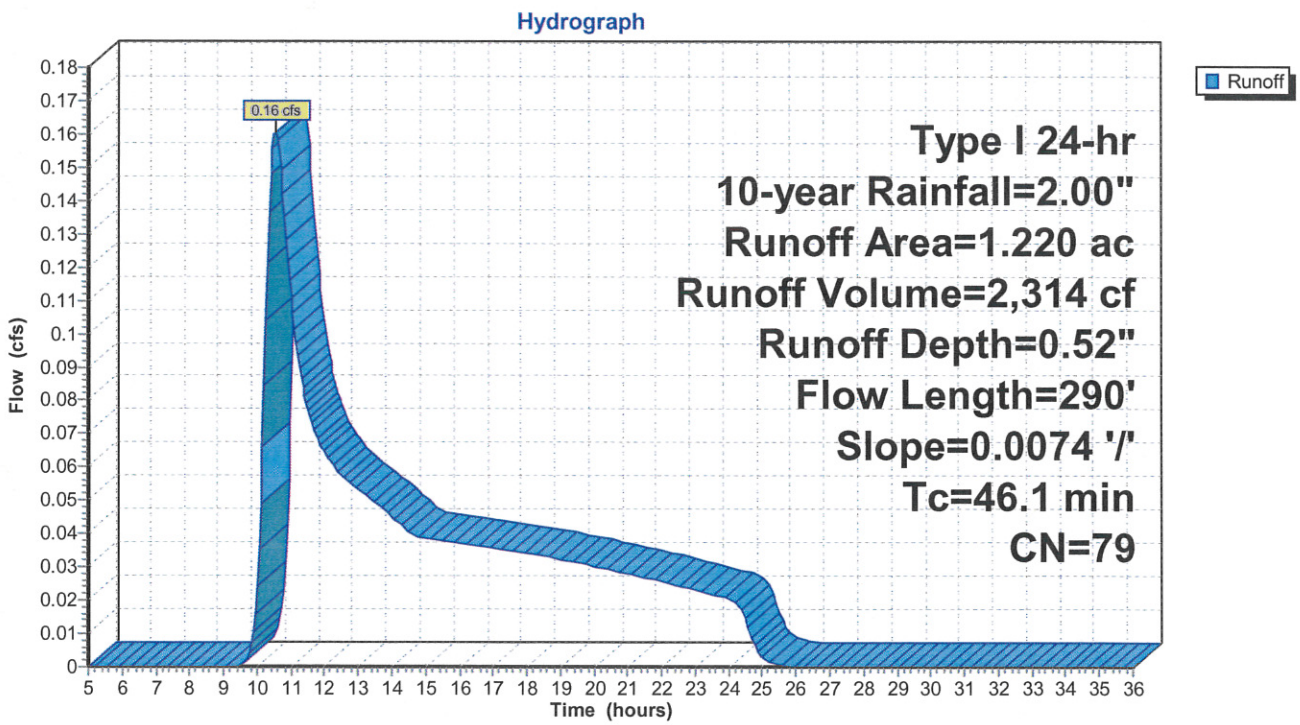
Runoff = 0.16 cfs @ 10.54 hrs, Volume= 2,314 cf, Depth= 0.52"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Type I 24-hr 10-year Rainfall=2.00"

Area (ac)	CN	Description
1.220	79	Pasture/grassland/range, Fair, HSG C
1.220		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
46.1	290	0.0074	0.10		**Sheet Flow,** Range n= 0.130 P2= 1.40"

Subcatchment Pre-S: South Pre-Development



Summary for Subcatchment Pre-N: North Pre-Development

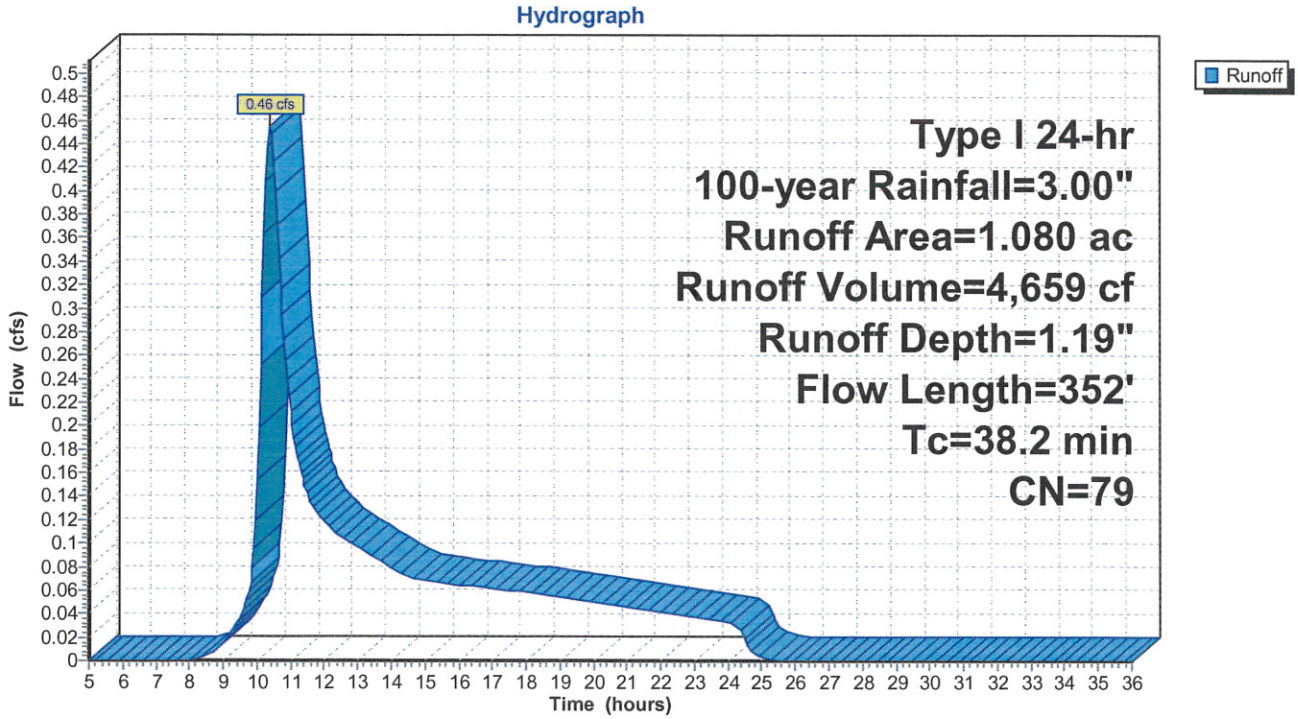
Runoff = 0.46 cfs @ 10.38 hrs, Volume= 4,659 cf, Depth= 1.19"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Type I 24-hr 100-year Rainfall=3.00"

Area (ac)	CN	Description
1.080	79	Pasture/grassland/range, Fair, HSG C
1.080		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.8	96	0.0390	0.16		**Sheet Flow,** Range n= 0.130 P2= 1.40"
28.4	256	0.0001	0.15		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
38.2	352	Total			

Subcatchment Pre-N: North Pre-Development



Summary for Subcatchment Pre-S: South Pre-Development

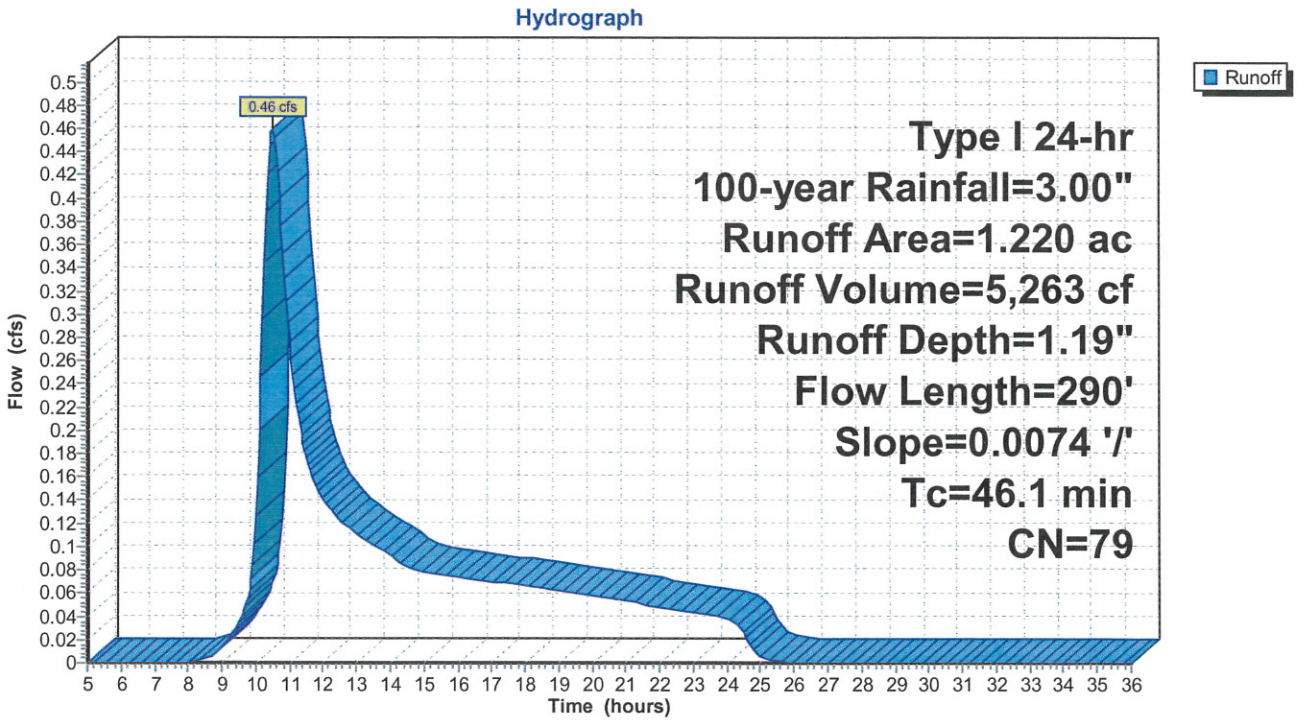
Runoff = 0.46 cfs @ 10.49 hrs, Volume= 5,263 cf, Depth= 1.19"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Type I 24-hr 100-year Rainfall=3.00"

Area (ac)	CN	Description
1.220	79	Pasture/grassland/range, Fair, HSG C
1.220		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
46.1	290	0.0074	0.10		**Sheet Flow,** Range n= 0.130 P2= 1.40"

Subcatchment Pre-S: South Pre-Development



Summary for Pond ND: North Detention

Inflow Area = 40,433 sf, 17.85% Impervious, Inflow Depth > 0.38" for 2-year event
Inflow = 0.08 cfs @ 10.35 hrs, Volume= 1,287 cf
Outflow = 0.02 cfs @ 13.74 hrs, Volume= 677 cf, Atten= 74%, Lag= 203.3 min
Primary = 0.02 cfs @ 13.74 hrs, Volume= 677 cf

Routing by Stor-Ind method, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 2,902.03' @ 13.74 hrs Surf.Area= 1,106 sf Storage= 646 cf

Plug-Flow detention time= 458.4 min calculated for 676 cf (52% of inflow)
Center-of-Mass det. time= 240.7 min (1,093.5 - 852.8)

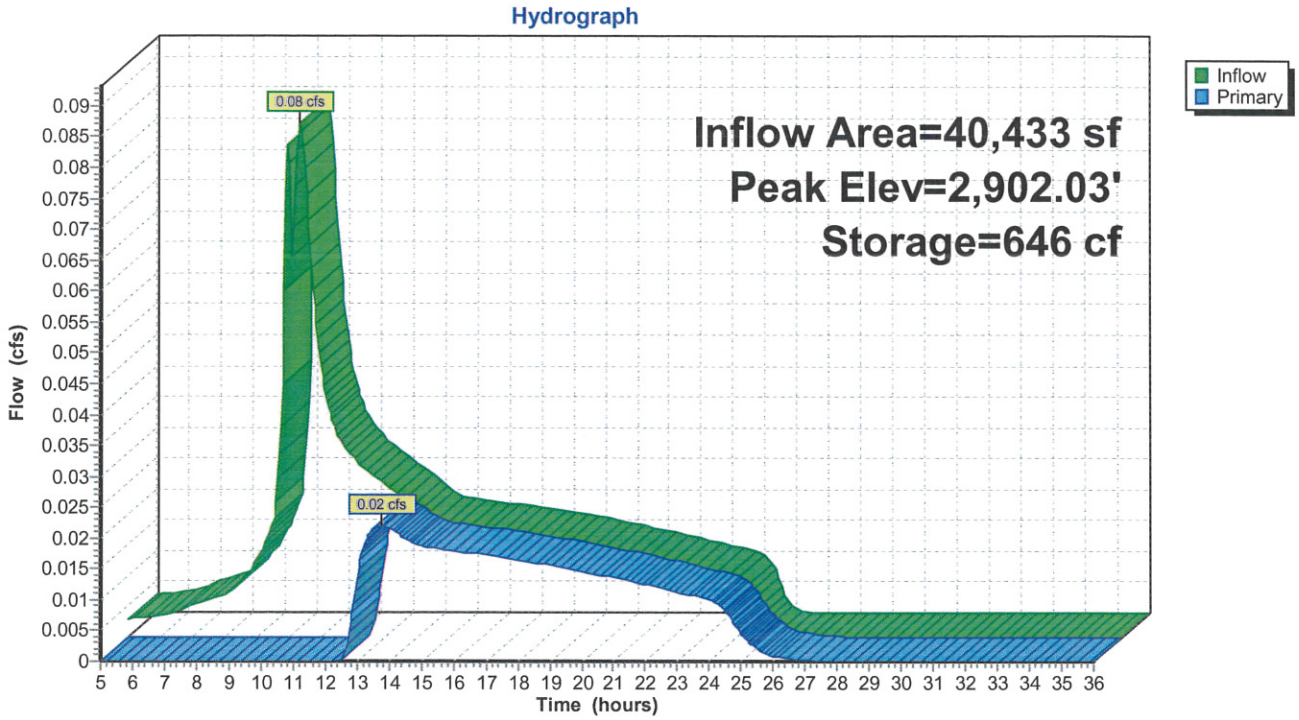
Volume	Invert	Avail.Storage	Storage Description
#1	2,901.00'	2,915 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,901.00	200	0	0
2,902.00	1,021	611	611
2,903.00	3,588	2,305	2,915

Device	Routing	Invert	Outlet Devices
#1	Primary	2,902.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 Width (feet) 1.00 7.00

Primary OutFlow Max=0.02 cfs @ 13.74 hrs HW=2,902.03' (Free Discharge)
└**1=Custom Weir/Orifice** (Weir Controls 0.02 cfs @ 0.58 fps)

Pond ND: North Detention



Summary for Pond RET1: S-RET-1

Inflow Area = 1,429 sf, 0.00% Impervious, Inflow Depth = 0.12" for 2-year event
Inflow = 0.00 cfs @ 12.48 hrs, Volume= 14 cf
Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min

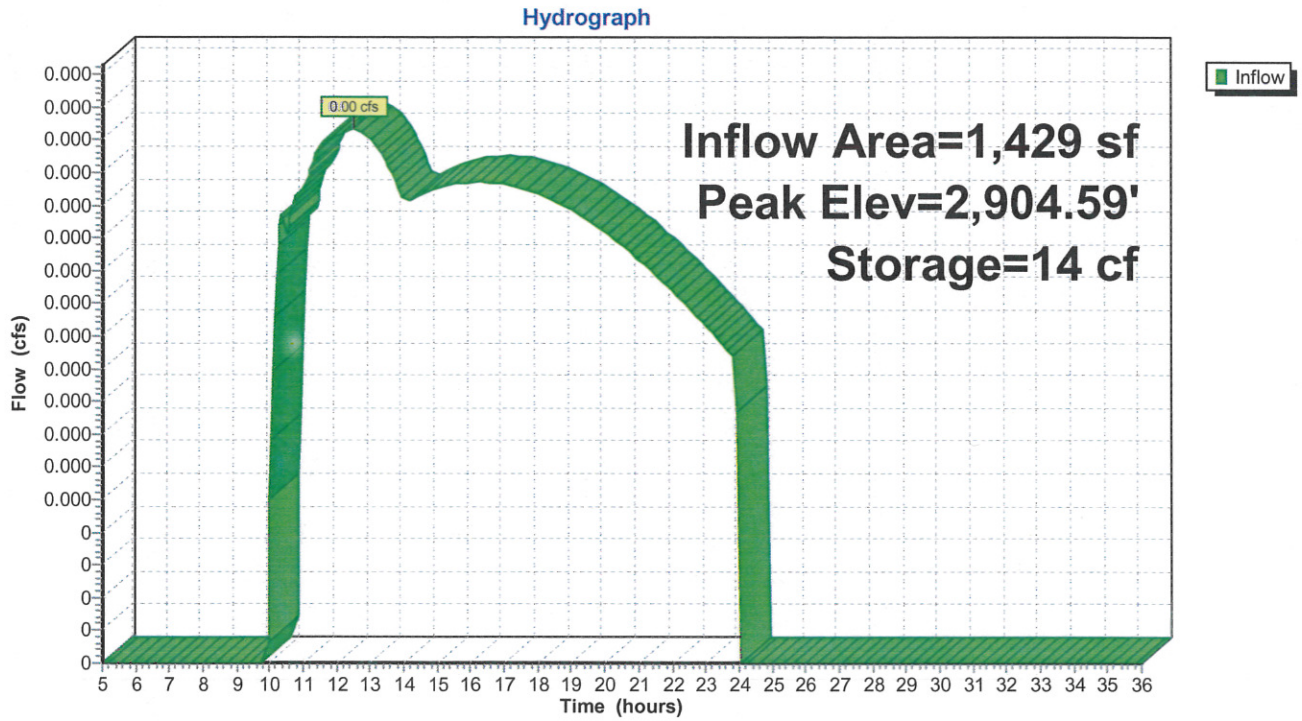
Routing by Stor-Ind method, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 2,904.59' @ 24.05 hrs Surf.Area= 224 sf Storage= 14 cf

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	2,904.50'	412 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,904.50	80	0	0
2,905.17	1,150	412	412

Pond RET1: S-RET-1



Summary for Pond RET2: S-RET-2

Inflow Area = 12,634 sf, 25.61% Impervious, Inflow Depth > 0.38" for 2-year event
Inflow = 0.08 cfs @ 9.87 hrs, Volume= 400 cf
Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min

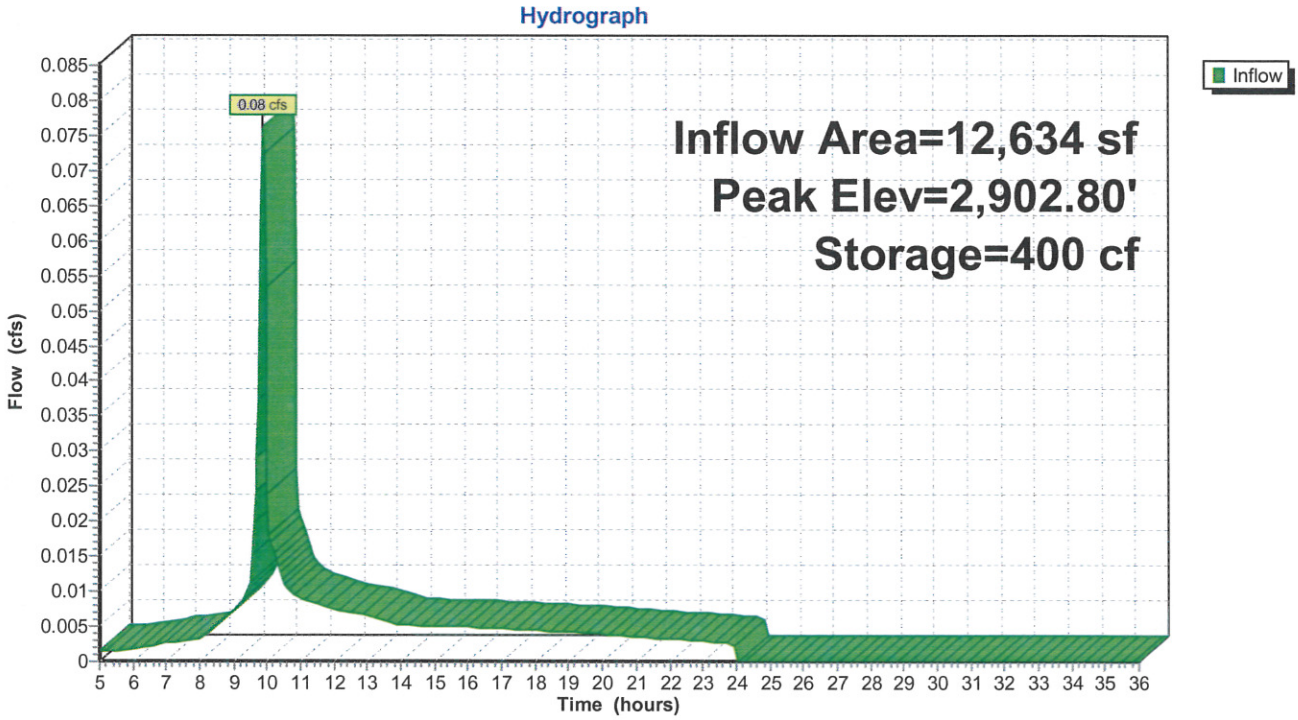
Routing by Stor-Ind method, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 2,902.80' @ 24.05 hrs Surf.Area= 1,626 sf Storage= 400 cf

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	2,902.50'	2,018 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,902.50	1,030	0	0
2,903.50	3,005	2,018	2,018

Pond RET2: S-RET-2



Summary for Pond RET3: N-RET-1

Inflow Area = 3,466 sf, 59.26% Impervious, Inflow Depth = 0.51" for 2-year event
Inflow = 0.03 cfs @ 9.89 hrs, Volume= 147 cf
Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min

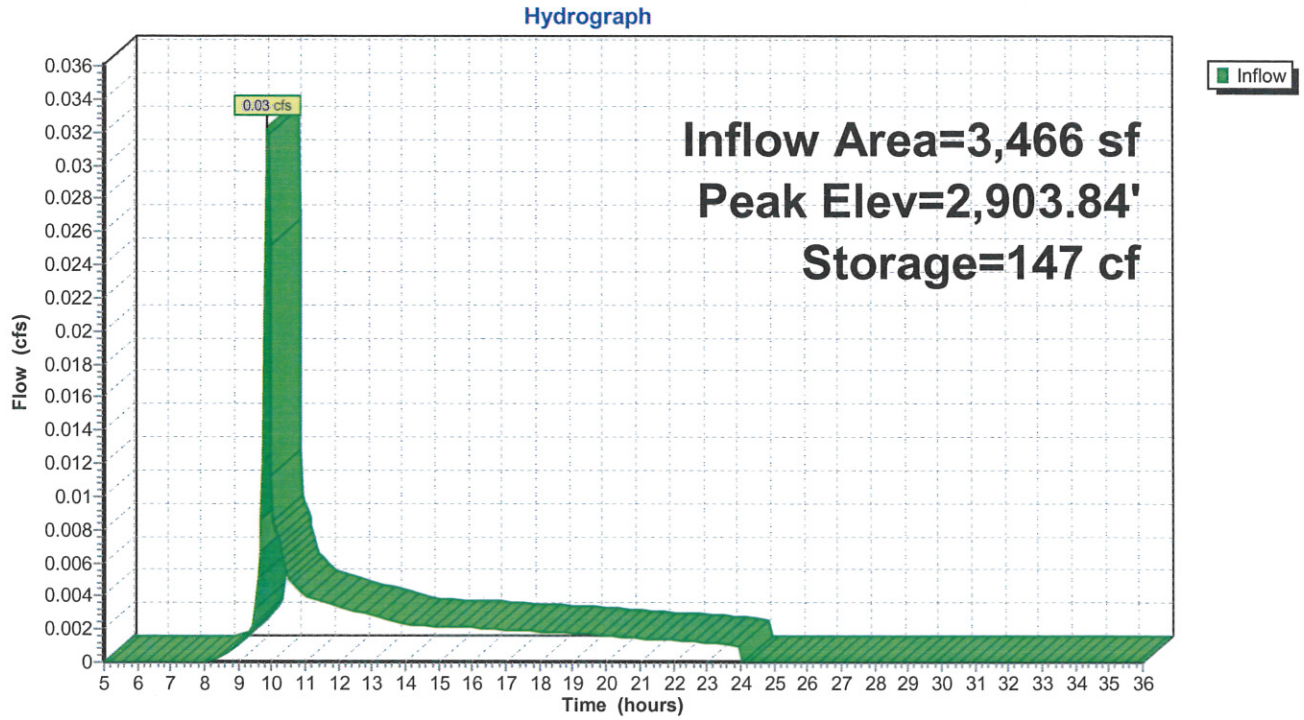
Routing by Stor-Ind method, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 2,903.84' @ 24.05 hrs Surf.Area= 506 sf Storage= 147 cf

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	2,903.40'	1,256 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,903.40	160	0	0
2,905.00	1,410	1,256	1,256

Pond RET3: N-RET-1



Summary for Pond SD: South Detention

Inflow Area = 42,493 sf, 35.41% Impervious, Inflow Depth > 0.55" for 2-year event
Inflow = 0.33 cfs @ 9.93 hrs, Volume= 1,932 cf
Outflow = 0.04 cfs @ 12.03 hrs, Volume= 1,083 cf, Atten= 88%, Lag= 125.6 min
Primary = 0.04 cfs @ 12.03 hrs, Volume= 1,083 cf

Routing by Stor-Ind method, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 2,903.55' @ 12.03 hrs Surf.Area= 1,087 sf Storage= 899 cf

Plug-Flow detention time= 405.2 min calculated for 1,081 cf (56% of inflow)
Center-of-Mass det. time= 203.7 min (1,003.5 - 799.8)

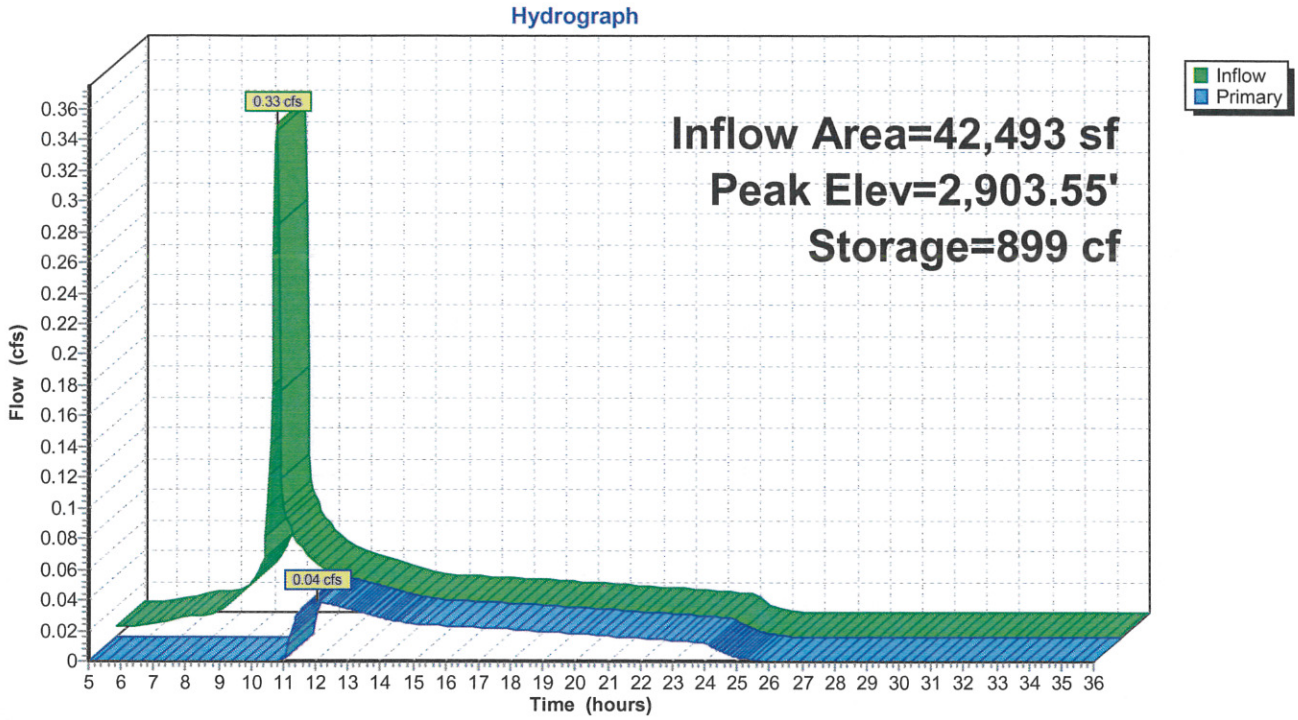
Volume	Invert	Avail.Storage	Storage Description
#1	2,902.50'	12,027 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,902.50	653	0	0
2,903.50	1,045	849	849
2,904.30	1,764	1,124	1,973
2,910.00	1,764	10,055	12,027

Device	Routing	Invert	Outlet Devices
#1	Primary	2,903.50'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 Width (feet) 1.00 7.00

Primary OutFlow Max=0.04 cfs @ 12.03 hrs HW=2,903.55' (Free Discharge)
└**1=Custom Weir/Orifice** (Weir Controls 0.04 cfs @ 0.69 fps)

Pond SD: South Detention



Summary for Pond ND: North Detention

Inflow Area =	40,433 sf, 17.85% Impervious, Inflow Depth > 0.74" for 10-year event				
Inflow =	0.20 cfs @	10.36 hrs, Volume=	2,479 cf		
Outflow =	0.11 cfs @	10.90 hrs, Volume=	1,869 cf,	Atten= 46%,	Lag= 32.8 min
Primary =	0.11 cfs @	10.90 hrs, Volume=	1,869 cf		

Routing by Stor-Ind method, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 2,902.09' @ 10.90 hrs Surf.Area= 1,251 sf Storage= 712 cf

Plug-Flow detention time= 241.0 min calculated for 1,868 cf (75% of inflow)
Center-of-Mass det. time= 112.1 min (955.6 - 843.5)

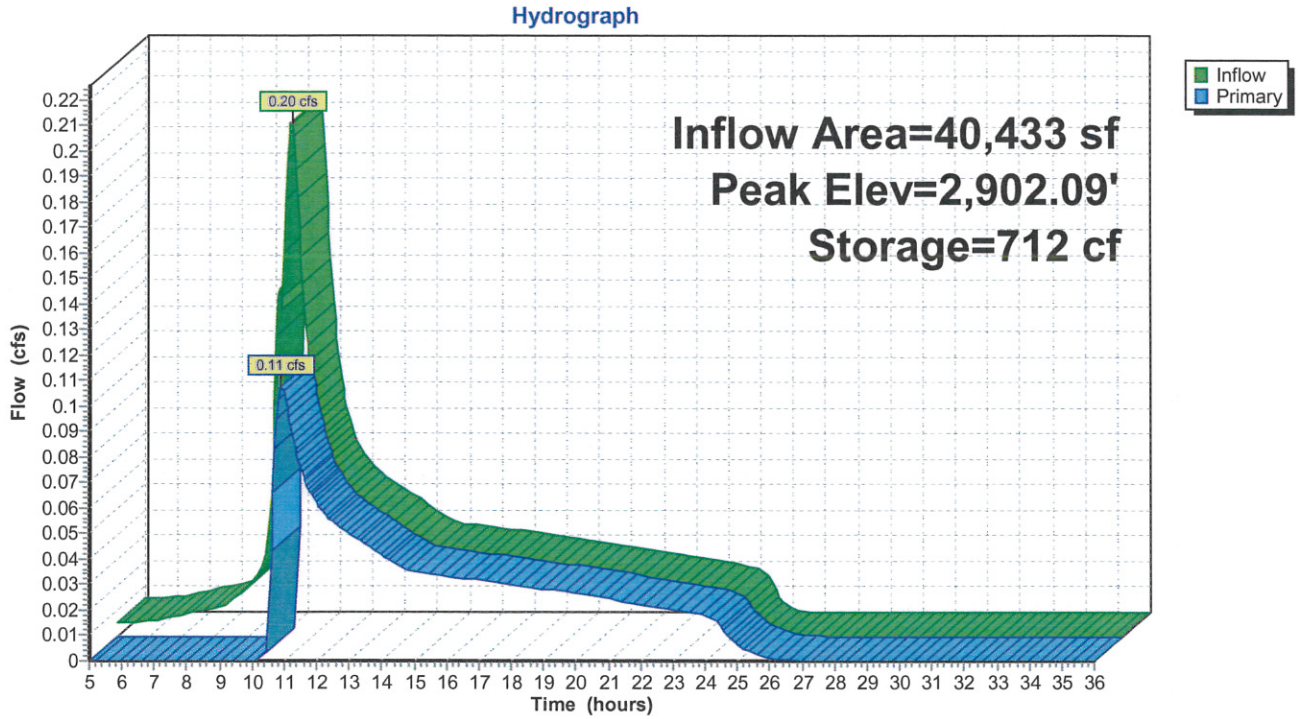
Volume	Invert	Avail.Storage	Storage Description
#1	2,901.00'	2,915 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,901.00	200	0	0
2,902.00	1,021	611	611
2,903.00	3,588	2,305	2,915

Device	Routing	Invert	Outlet Devices
#1	Primary	2,902.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 Width (feet) 1.00 7.00

Primary OutFlow Max=0.11 cfs @ 10.90 hrs HW=2,902.09' (Free Discharge)
↑—**1=Custom Weir/Orifice** (Weir Controls 0.11 cfs @ 0.94 fps)

Pond ND: North Detention



Summary for Pond RET1: S-RET-1

Inflow Area = 1,429 sf, 0.00% Impervious, Inflow Depth = 0.35" for 10-year event
Inflow = 0.01 cfs @ 9.91 hrs, Volume= 42 cf
Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min

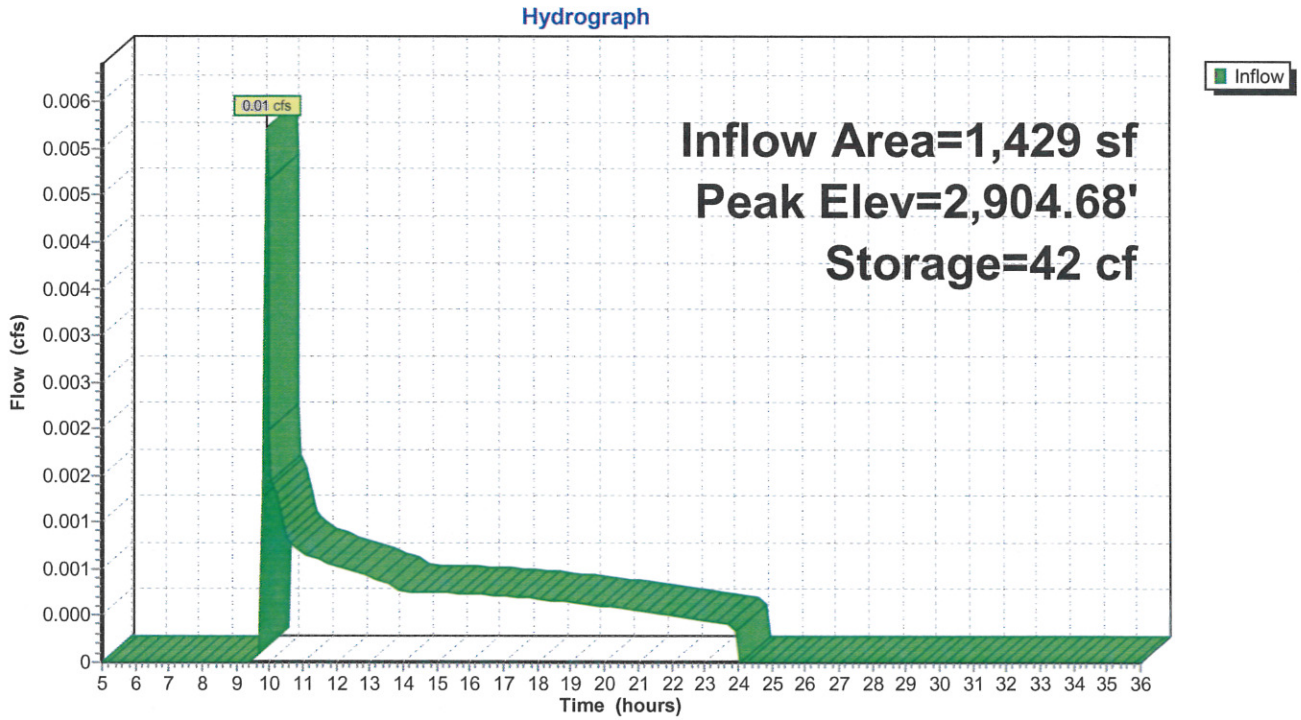
Routing by Stor-Ind method, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 2,904.68' @ 24.05 hrs Surf.Area= 373 sf Storage= 42 cf

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	2,904.50'	412 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,904.50	80	0	0
2,905.17	1,150	412	412

Pond RET1: S-RET-1



Summary for Pond RET2: S-RET-2

Inflow Area = 12,634 sf, 25.61% Impervious, Inflow Depth > 0.70" for 10-year event
Inflow = 0.15 cfs @ 9.88 hrs, Volume= 734 cf
Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min

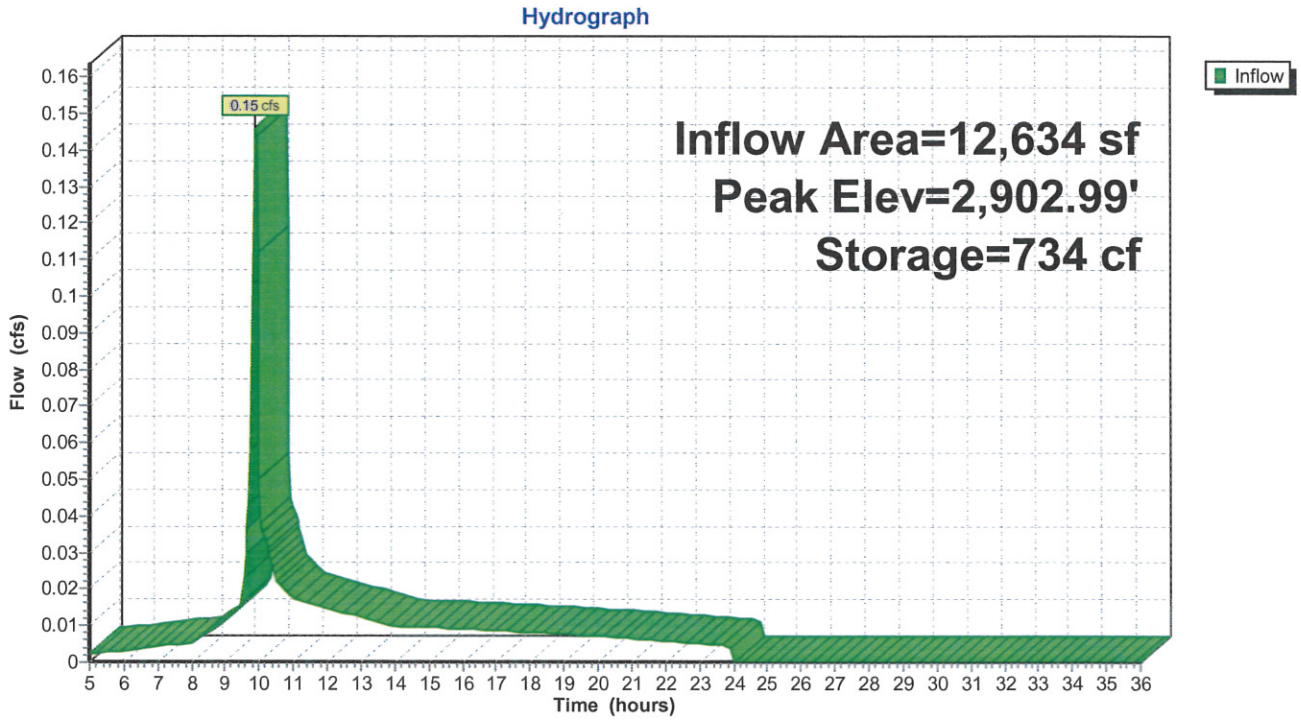
Routing by Stor-Ind method, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 2,902.99' @ 24.05 hrs Surf.Area= 1,990 sf Storage= 734 cf

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	2,902.50'	2,018 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,902.50	1,030	0	0
2,903.50	3,005	2,018	2,018

Pond RET2: S-RET-2



Summary for Pond RET3: N-RET-1

Inflow Area = 3,466 sf, 59.26% Impervious, Inflow Depth = 0.97" for 10-year event
Inflow = 0.07 cfs @ 9.88 hrs, Volume= 279 cf
Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min

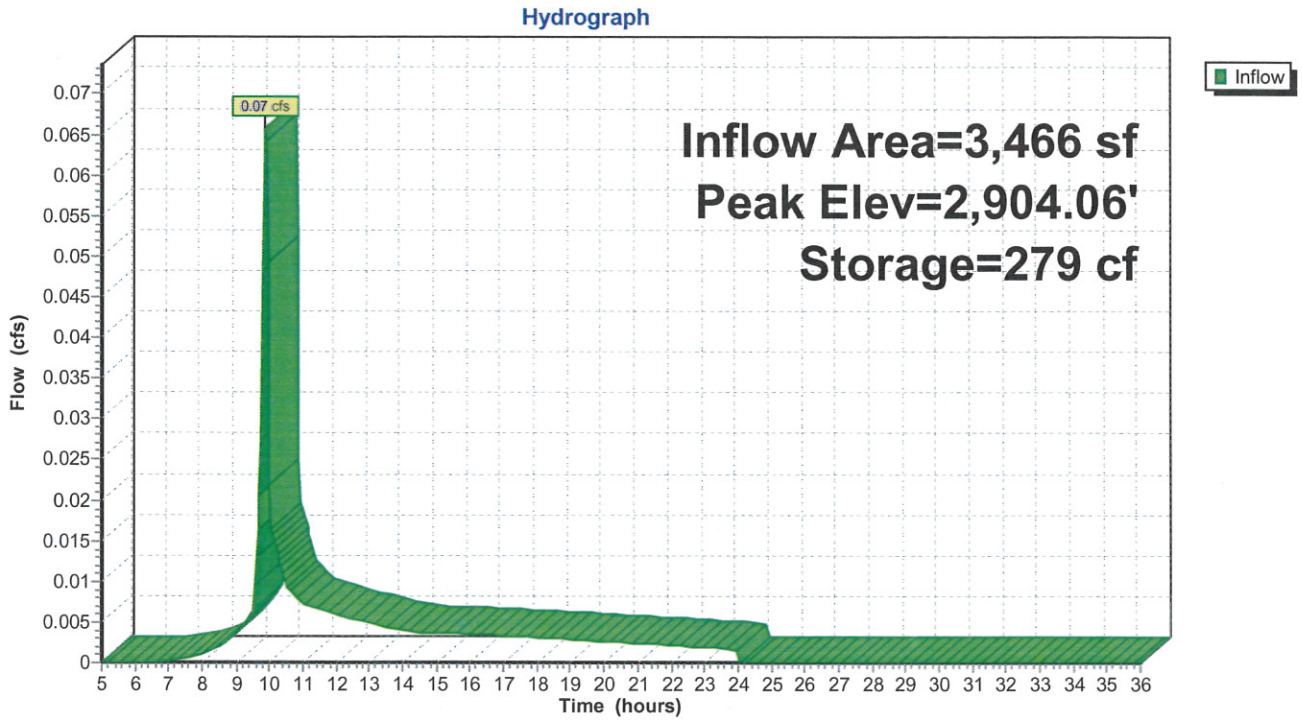
Routing by Stor-Ind method, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 2,904.06' @ 24.05 hrs Surf.Area= 679 sf Storage= 279 cf

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	2,903.40'	1,256 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,903.40	160	0	0
2,905.00	1,410	1,256	1,256

Pond RET3: N-RET-1



Summary for Pond SD: South Detention

Inflow Area = 42,493 sf, 35.41% Impervious, Inflow Depth > 0.94" for 10-year event
Inflow = 0.50 cfs @ 9.93 hrs, Volume= 3,336 cf
Outflow = 0.15 cfs @ 10.50 hrs, Volume= 2,487 cf, Atten= 69%, Lag= 33.9 min
Primary = 0.15 cfs @ 10.50 hrs, Volume= 2,487 cf

Routing by Stor-Ind method, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 2,903.61' @ 10.50 hrs Surf.Area= 1,141 sf Storage= 966 cf

Plug-Flow detention time= 243.8 min calculated for 2,482 cf (74% of inflow)
Center-of-Mass det. time= 109.6 min (909.7 - 800.1)

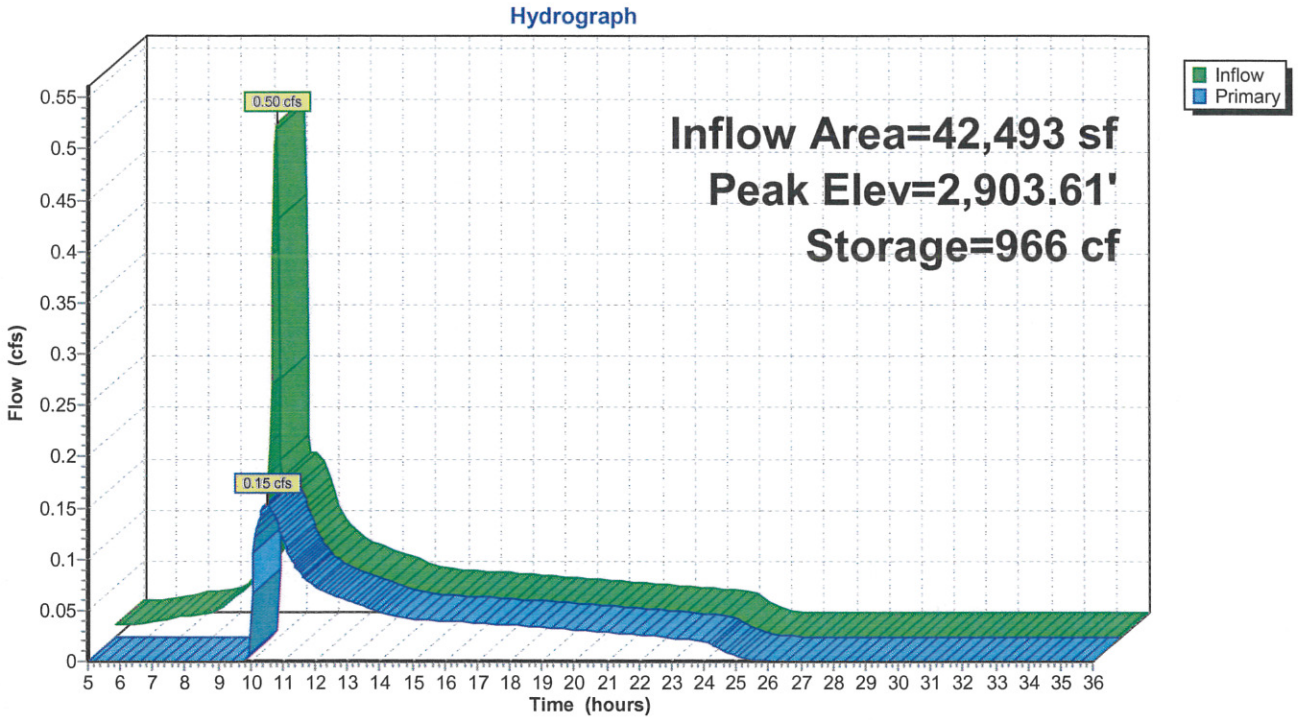
Volume	Invert	Avail.Storage	Storage Description
#1	2,902.50'	12,027 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,902.50	653	0	0
2,903.50	1,045	849	849
2,904.30	1,764	1,124	1,973
2,910.00	1,764	10,055	12,027

Device	Routing	Invert	Outlet Devices
#1	Primary	2,903.50'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 Width (feet) 1.00 7.00

Primary OutFlow Max=0.14 cfs @ 10.50 hrs HW=2,903.61' (Free Discharge)
↑—**1=Custom Weir/Orifice** (Weir Controls 0.14 cfs @ 1.02 fps)

Pond SD: South Detention



Summary for Pond ND: North Detention

Inflow Area =	40,433 sf, 17.85% Impervious, Inflow Depth > 1.45" for 100-year event				
Inflow =	0.46 cfs @	10.35 hrs, Volume=	4,881 cf		
Outflow =	0.42 cfs @	10.48 hrs, Volume=	4,271 cf,	Atten= 8%,	Lag= 8.0 min
Primary =	0.42 cfs @	10.48 hrs, Volume=	4,271 cf		

Routing by Stor-Ind method, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 2,902.20' @ 10.48 hrs Surf.Area= 1,528 sf Storage= 862 cf

Plug-Flow detention time= 130.5 min calculated for 4,263 cf (87% of inflow)
Center-of-Mass det. time= 59.3 min (887.1 - 827.7)

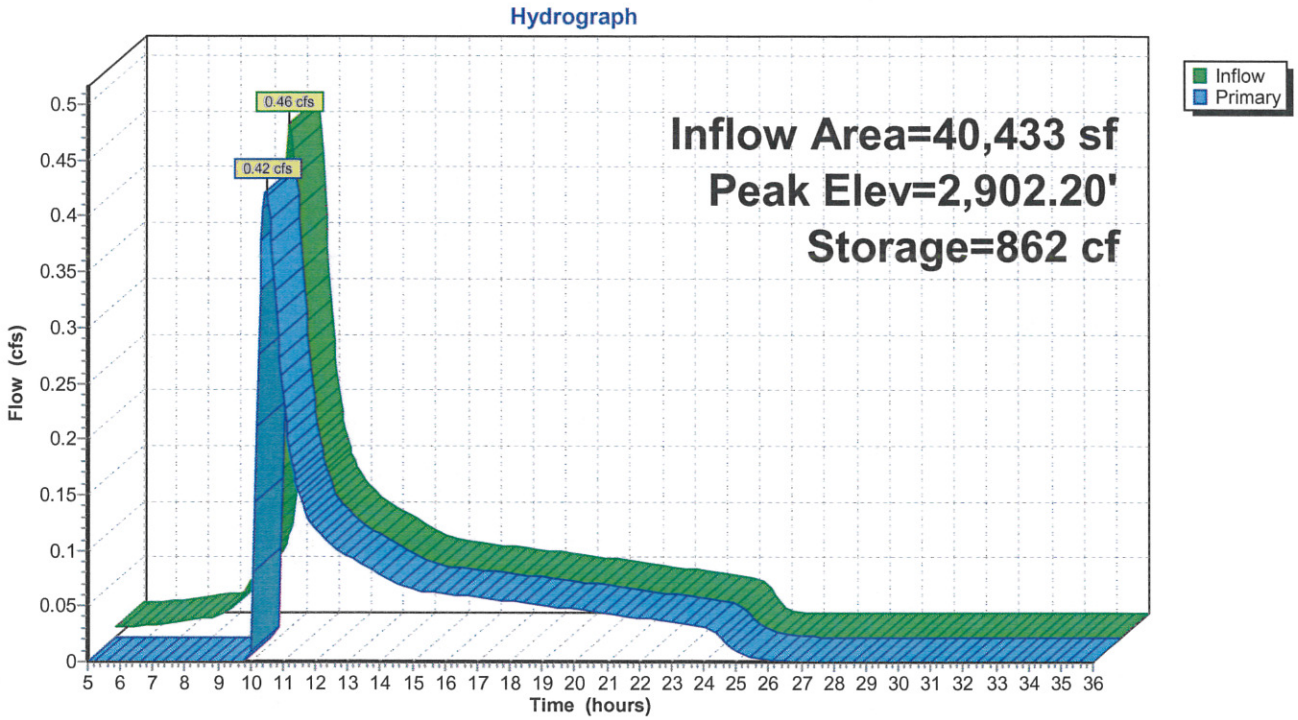
Volume	Invert	Avail.Storage	Storage Description
#1	2,901.00'	2,915 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,901.00	200	0	0
2,902.00	1,021	611	611
2,903.00	3,588	2,305	2,915

Device	Routing	Invert	Outlet Devices
#1	Primary	2,902.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 Width (feet) 1.00 7.00

Primary OutFlow Max=0.42 cfs @ 10.48 hrs HW=2,902.20' (Free Discharge)
└**1=Custom Weir/Orifice** (Weir Controls 0.42 cfs @ 1.35 fps)

Pond ND: North Detention



Summary for Pond RET1: S-RET-1

Inflow Area = 1,429 sf, 0.00% Impervious, Inflow Depth = 0.91" for 100-year event
Inflow = 0.02 cfs @ 9.89 hrs, Volume= 108 cf
Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min

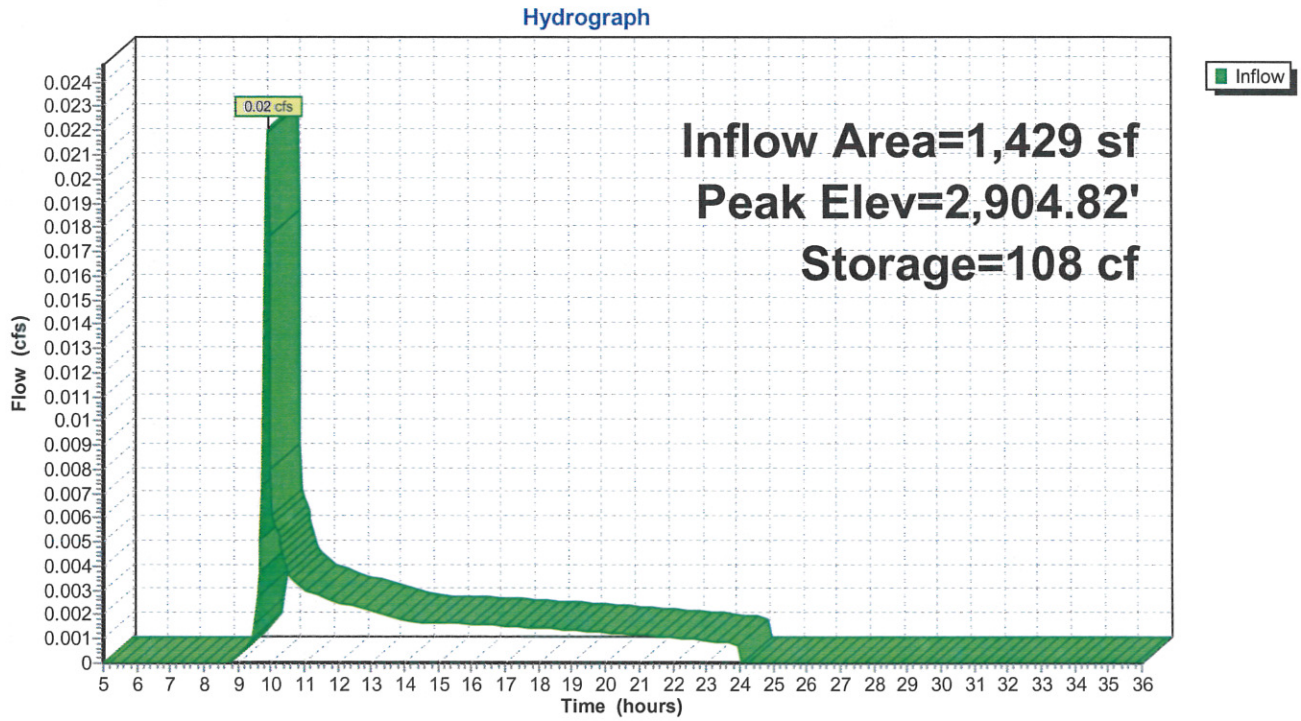
Routing by Stor-Ind method, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 2,904.82' @ 24.05 hrs Surf.Area= 593 sf Storage= 108 cf

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	2,904.50'	412 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,904.50	80	0	0
2,905.17	1,150	412	412

Pond RET1: S-RET-1



Summary for Pond RET2: S-RET-2

Inflow Area = 12,634 sf, 25.61% Impervious, Inflow Depth > 1.35" for 100-year event
Inflow = 0.31 cfs @ 9.88 hrs, Volume= 1,419 cf
Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min

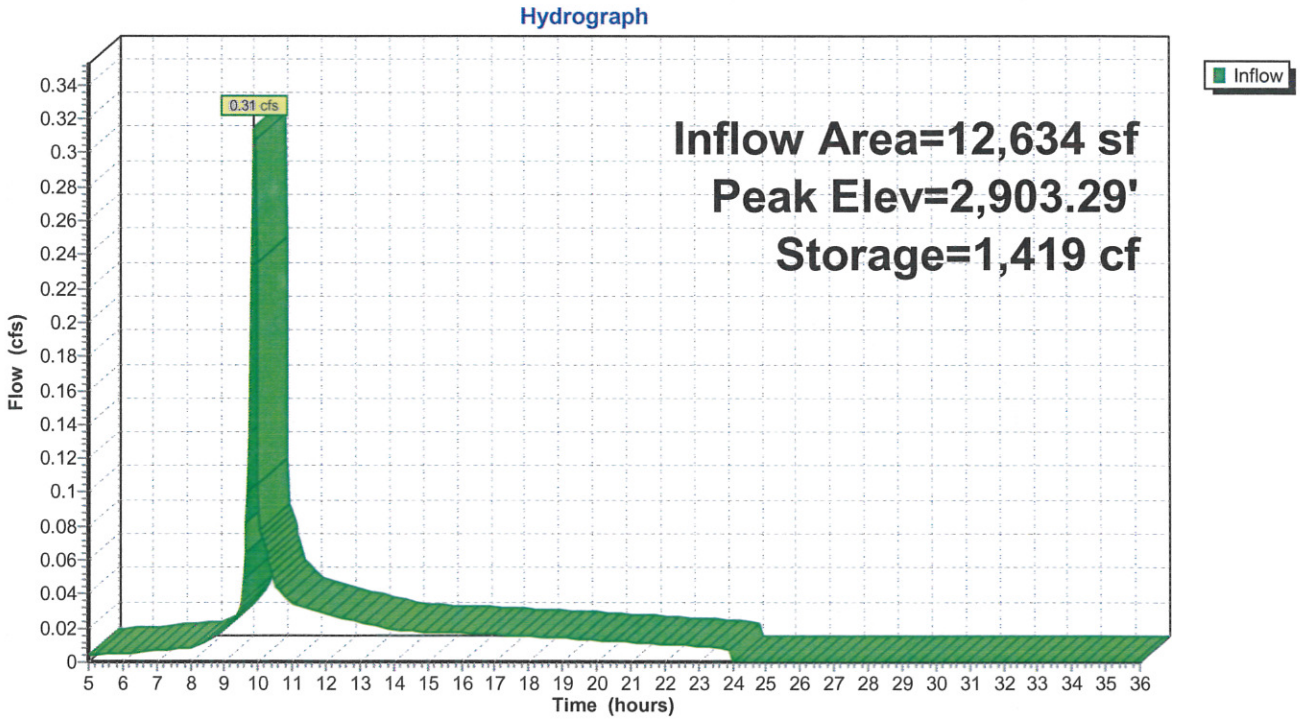
Routing by Stor-Ind method, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 2,903.29' @ 24.05 hrs Surf.Area= 2,582 sf Storage= 1,419 cf

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	2,902.50'	2,018 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,902.50	1,030	0	0
2,903.50	3,005	2,018	2,018

Pond RET2: S-RET-2



Summary for Pond RET3: N-RET-1

Inflow Area = 3,466 sf, 59.26% Impervious, Inflow Depth > 1.82" for 100-year event
Inflow = 0.13 cfs @ 9.87 hrs, Volume= 525 cf
Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min

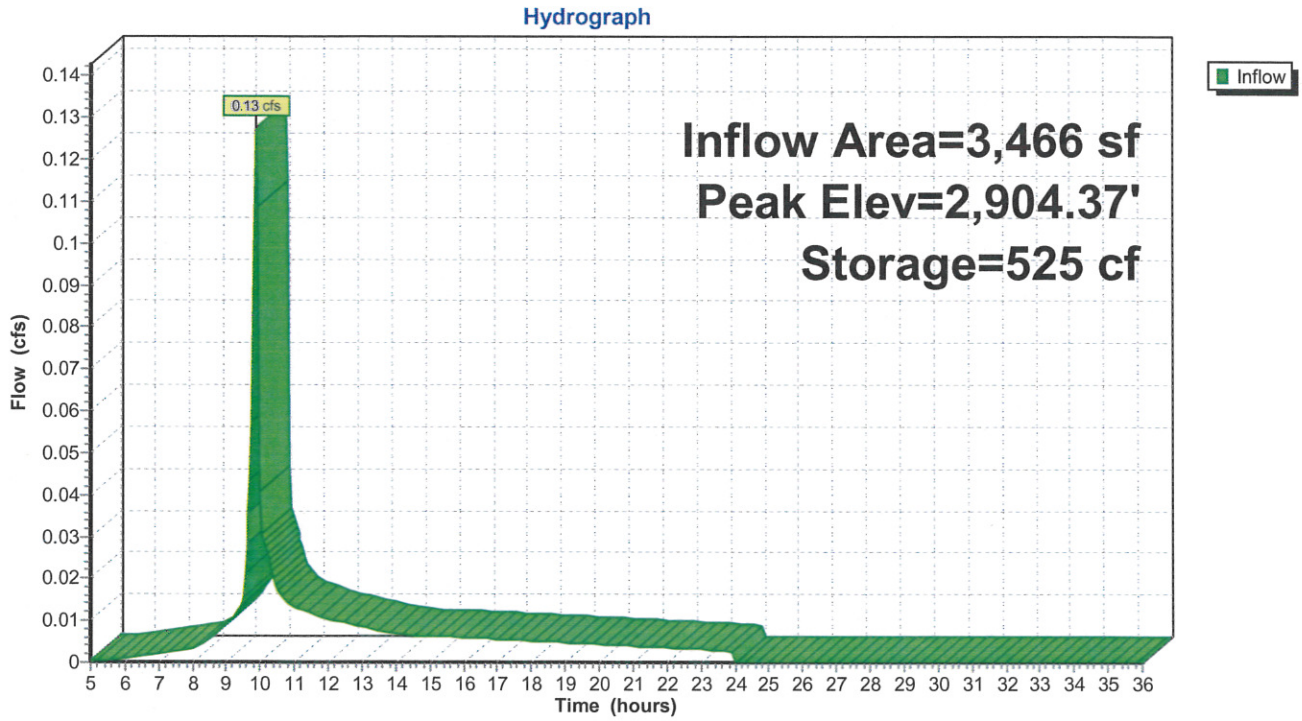
Routing by Stor-Ind method, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 2,904.37' @ 24.05 hrs Surf.Area= 920 sf Storage= 525 cf

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	2,903.40'	1,256 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,903.40	160	0	0
2,905.00	1,410	1,256	1,256

Pond RET3: N-RET-1



Summary for Pond SD: South Detention

Inflow Area = 42,493 sf, 35.41% Impervious, Inflow Depth > 1.70" for 100-year event
Inflow = 0.80 cfs @ 9.93 hrs, Volume= 6,015 cf
Outflow = 0.66 cfs @ 10.00 hrs, Volume= 5,166 cf, Atten= 17%, Lag= 4.1 min
Primary = 0.66 cfs @ 10.00 hrs, Volume= 5,166 cf

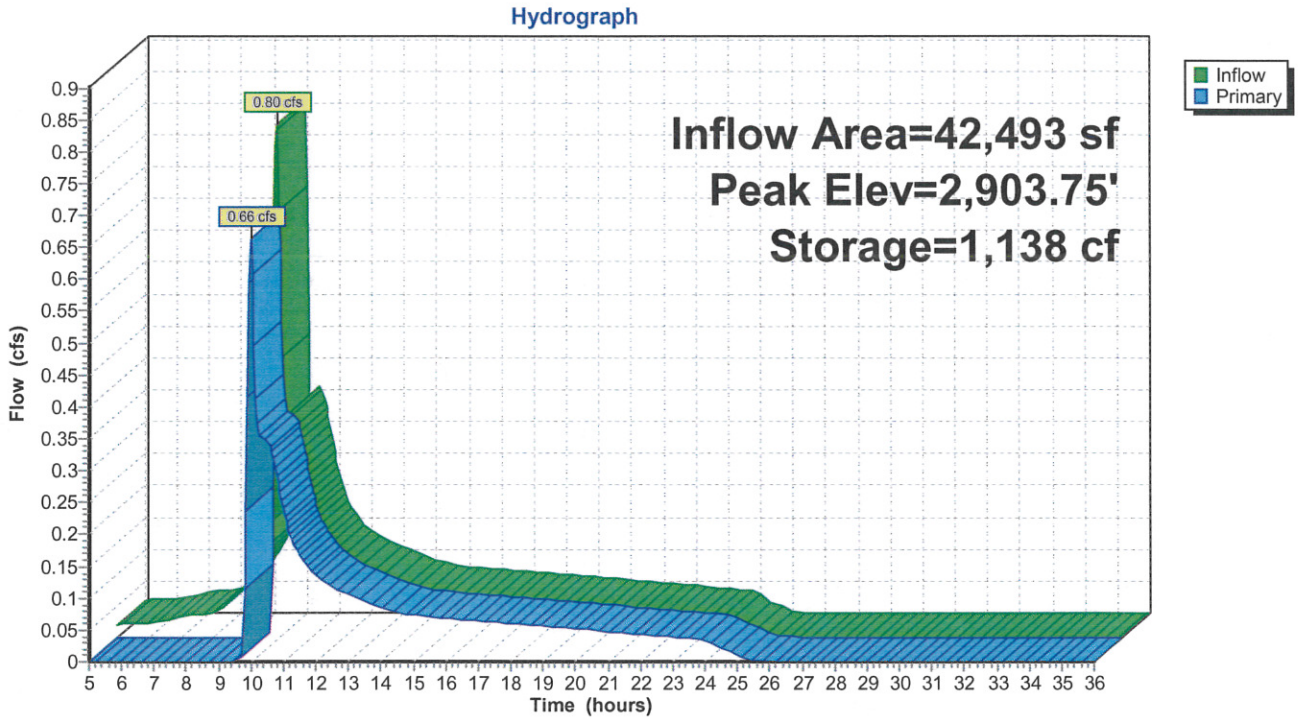
Routing by Stor-Ind method, Time Span= 5.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 2,903.75' @ 10.00 hrs Surf.Area= 1,269 sf Storage= 1,138 cf

Plug-Flow detention time= 146.2 min calculated for 5,164 cf (86% of inflow)
Center-of-Mass det. time= 63.9 min (859.4 - 795.5)

Volume	Invert	Avail.Storage	Storage Description
#1	2,902.50'	12,027 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
2,902.50	653	0	0
2,903.50	1,045	849	849
2,904.30	1,764	1,124	1,973
2,910.00	1,764	10,055	12,027

Device	Routing	Invert	Outlet Devices
#1	Primary	2,903.50'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 Width (feet) 1.00 7.00

Primary OutFlow Max=0.65 cfs @ 10.00 hrs HW=2,903.75' (Free Discharge)
└**1=Custom Weir/Orifice** (Weir Controls 0.65 cfs @ 1.49 fps)

Pond SD: South Detention