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MANITOBA Parks

Moose Lake Provincial Park

ENVIRONMENT ACT PROPOSAL

Manitoba Water Services Board & Parks and Protected Spaces

Moose Lake Campground
Water Treatment Plant Upgrades

February 2017

AE# 2012-4123.000

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

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March 30, 2017
File: 2012-4123.000

Ms. Tracey Braun, M. Sc.
Director, Environmental Approvals
Sustainable Development
123 Main Street, Suite 160
Winnipeg Manitoba, R3C 1A5

Re: MANITOBA SUSTAINABLE DEVELOPMENT - PARKS AND PROTECTED SPACES
MOOSE LAKE WATER TREATMENT PLANT UPGRADES
ENVIRONMENT ACT PROPOSAL SUBMISSION FOR A CLASS 1 DEVELOPMENT

Dear Ms. Braun:

On behalf of Parks and Protected Spaces and The Manitoba Water Services Board, please find attached our Environment Act Proposal submission for the above-mentioned project.

This application is for the seasonal surface discharge of residuals from the upgraded water treatment plant in the campground. The existing facility was not operating under any Environment Act Licence, thus one is being applied for as part of the upgrades.

We trust that the enclosed application contains sufficient information for your staff to complete the new Licence. Should the reviewer require any additional information or require any clarifications, please do not hesitate to contact myself.

Yours truly,

Ken Anderson, P.Eng.
Manager, Water

KA

Environment Act Proposal Form

Manitoba
Sustainable Development

Name of the development: Moose Lake Campground Water Treatment Plant Upgrades	
Type of development per Classes of Development Regulation (Manitoba Regulation 164/88): Class 1 Development - Waste Treatment and Disposal from a Water Treatment Plant	
Legal name of the applicant: Manitoba Sustainable Development - Parks and Protected Spaces Branch	
Mailing address of the applicant: 200 Saulteaux Cres., Winnipeg, MB R3J 3W3 Contact Person: Rebecca Lauhn-Jensen, CSLA City: Winnipeg Province: MB Postal Code: R3J 3W3 Phone Number: 204-945-4410 Fax: 204-945-0012 email: rebecca.lauhn-jensen@gov.mb.ca	
Location of the development: Moose Lake Provincial Park Campground Contact Person: Rebecca Lauhn-Jensen, CSLA Street Address: 200 Saulteaux Cres., Winnipeg, MB R3J 3W3 Legal Description: Section 12 - Twp 3 - Rge 16E City/Town: Winnipeg Province: Manitoba Postal Code: R3J 3W3 Phone Number: 204-945-4410 Fax: 204-945-0012 email: rebecca.lauhn-jensen@gov.mb.ca	
Name of proponent contact person for purposes of the environmental assessment: Ken Anderson - Associated Engineering (Sask) Ltd.	
Phone: 204-942-6391 Fax:	Mailing address: 203 - Five Donald Street Winnipeg, MB R3L 2T4
Email address: andersonk@ae.ca	
Webpage address:	
Date: February 15, 2017	Signature of proponent, or corporate principal of corporate proponent: Printed name: Ken Anderson

A complete **Environment Act Proposal (EAP)** consists of the following components:

- **Cover letter**
- **Environment Act Proposal Form**
- **Reports/plans supporting the EAP** (see "Information Bulletin - Environment Act Proposal Report Guidelines" for required information and number of copies)
- **Application fee** (Cheque, payable to Minister of Finance, for the appropriate fee)

Per Environment Act Fees Regulation (Manitoba Regulation 168/96):

Class 1 Developments	$1,000
Class 2 Developments	$7,500
Class 3 Developments:	
Transportation and Transmission Lines	$10,000
Water Developments	$60,000
Energy and Mining	$120,000

Submit the complete EAP to:

Director
Environmental Approvals Branch
Manitoba Conservation and Water Stewardship
Suite 160, 123 Main Street
Winnipeg, Manitoba R3C 1A5

For more information:
Phone: (204) 945-8321
Fax: (204) 945-5229
http://www.gov.mb.ca/conservation/eal

Executive Summary

The following Environment Act Proposal (EAP) is submitted on behalf of Sustainable Development Parks and Protected Spaces (Parks) and The Manitoba Water Services Board (MWSB). The EAP is for a Class 1 Development License under the Manitoba's *Environment Act* for the construction of a water treatment plant (WTP) at the Moose Lake Campground. This document provides the information required from Sustainable Development's Environment Act Proposal Report Guidelines and Supplementary Guidelines for Municipal Water Supply Systems.

This EAP describes the components of a new WTP, and associated work, which includes a plant residuals discharge line. The Moose Lake Campground is approximately 160 km southeast of Winnipeg, Manitoba and 11 km north of the border with the United States. The campground consists of 95 campsites (24 are serviced with electricity), five non-modern washrooms with no running water, and one modern washroom facility with two water closets and two showers. Treated water is provided to six stand pipes within the campground and the one modern washroom facility. The Moose Lake Campground operates seasonally from May to September.

The proposed project includes construction of a new semi-public water system that is capable of providing 0.35 L/s of treated water. This new water treatment system includes a two-step ion exchange process, UV primary disinfection, chlorine feed for secondary disinfection, potable water storage tanks, and distribution pumping. An existing building was used to house the new treatment equipment. The new treatment system will target the reduction of ammonia, iron, manganese, and organics.

An assessment of the environmental effects of the proposed WTP upgrade concluded that standard construction best management practices would be effective to mitigate any potential environmental impacts. The expected concentration of regeneration residuals entering the nearby marshlands is anticipated to have negligible if any impacts to water quality and the environment. Several environmental management measures are described herein to address other potential impacts to the environment.

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1 Introduction

On behalf of the Manitoba Water Services Board, Associated Engineering (Sask.) Ltd. (AE) has prepared the following Environmental Act Proposal (EAP) for the Moose Lake Campground Water Treatment Plant (WTP) Project (the Project). The EAP is based on detailed design prepared by AE.

The final user of the system is Manitoba Sustainable Development's department of Parks and Protected Spaces (The Parks).

This application is for the surface disposal of the plant residuals stream from the new water treatment plant in the campground.

1.1 BACKGROUND INFORMATION

The Moose Lake Campground can be found within the Moose Lake Provincial Park located approximately 160 km southeast of Winnipeg, MB and 11 km north of the border with the United States. The campground consists of approximately 95 campsites (24 that have electricity) and currently has five non-modern washrooms with no running water. These washroom facilities are connected to holding tanks that are emptied as required. The wastewater is hauled to nearby lagoons by contracted haulers at the end of each season. There is a modern washroom facility with two water closets and two showers; potable water is provided by the new water treatment plant. Wastewater from the modern washroom is collected and pumped to an onsite wastewater management system (Ecoflo Biofilter).

Prior to 2014, the Parks was providing an untreated water supply to the standpipes located throughout the campground. Then in 2014, the Parks completed the installation of a new water treatment plant inside an existing building on site. However, the new plant was not fully used until the new onsite wastewater management system was placed into service at the end of 2015.

With both systems fully operational in late 2015, it was determined that the regeneration residuals from the new WTP could not be directed to the new wastewater system. The onsite wastewater system supplier could not guarantee the performance of their system with these residuals due to the elevated mineral content.

Given the location of the campground, the option to store and haul the plant residuals is cost prohibitive, thus, this application is for the surface disposal of regeneration water. Although the water quality is high in mineral content similar to that of reverse osmosis concentrate (that is regularly disposed of to surface), the volume is relatively small given the small size of the system and low to zero use throughout most of the year. The system experiences peak use in July/August with lesser use in June/September, and no use from October to May.

1.1.1 Previous Studies

A predesign study for the new water system was prepared by AE in 2013. The study reviewed historic and projected water use as the raw well water quality. The report provides a summary of design considerations, water quality, and options for upgrades.

1.1.2 Population

The Moose Lake Campground has 95 sites and for design purposes, the serviced population was estimated to be 195 individuals assuming there is an average of two people per campsite and five campground staff. The nearest community is Sprague, MB, located 35 km to the southeast.

1.1.3 Projected Water Use

Treated water will be provided to the modern washroom facility as well as seven standpipes located throughout the campground. The modern washroom facility includes two toilets, two sinks, and two showers. The toilets will be low flow fixtures and the showers will also be low flow but will also be coin operated. Water demand will be based on this serviced population as well as the development of the new modern washroom facility. Considerations will also be given for a future modern washroom facility in the design.

Average Day use during the peak months is estimated to be approximately 30 L/c/day, thus 195 users x 30 L/c/d = **5,850 L/day**. The Peak Day use was based on estimating the maximum use of the two washrooms and two showers in a heavy use day; this was calculated to be **10,450 L/day**. The anticipated volume of 10,450 litres per day is assumed to be sufficient to provide each individual with 20 litres of water on site and the use of each toilet, sink and shower up to 100 times in a day.

The target for the new treatment system is therefore to produce 10,450 L over an eight-hour period. Thus, the treatment flow rate is designed to be **0.35 L/sec**.

1.1.4 Raw Water Source

Moose Lake Provincial Park Campground obtains their water from two ground water wells, installed near the existing WTP building. A pumping test for these wells yielded 1.14 L/sec and 1.36 L/sec and recommended pumping rate of 0.75 L/sec. The intakes for these pumps are located approximately 5.8 m and 6.4 m below grade when they were installed in 2005.

1.1.5 Water Rights Act

Moose Lake Provincial Park Campground will not require a Water Right Act licence as its annual average water use is under 25,000 L/day.

1.1.6 Water Quality

The Office of Drinking Water (ODW) performs annual audits of all public water systems which include sampling and chemistry analysis of raw water once every year for surface water sources. A raw water quality sample from 2010 is summarized in the following Table along with the water quality objectives set forth in Health Canada's Guidelines for Canadian Drinking Water Quality (GCDWQ) (Health Canada, 2014).

Testing in July of 2012 also shows relatively similar levels for Iron, Manganese and UVT. The sample data shows that with the exception of turbidity, the raw water meets the health based quality parameters. The elevated turbidity is typically a result of oxidized iron and manganese during the sampling procedure. Also, manganese and iron are the two main parameters that exceed the aesthetic guidelines. The levels are high enough to result in discoloured water and staining of fixtures and laundry. The ammonia levels are also slightly elevated, enough so to complicate primary disinfection using only chlorine.

Since the raw water wells are quite shallow in an unconfined aquifer, they are considered as potentially under the direct influence of surface water (GUDI) and the treatment process should account for turbidity reduction and primary disinfection using UV for added protection, and primary disinfection strategy with ammonia.

Table 1-1 Raw Water Quality Summary

Parameter	Units	Raw Water Well #1	Raw Water Well #2	Current Limits (GCDWQ)	Treatment Objective
pH		7.94	7.92	6.5 – 8.5(AO)	6.5 – 8.5
Alkalinity	mg/L	168	171		
Hardness ($CaCO_3$)	mg/L	170	179	200 (PO)	
TDS	mg/L	180	186	500 (AO)	< 500
UV Transmittance	%T	**66.1**	**65.8**		**> 80%**
Ammonia, Total (N)	mg/L	**0.549**	**0.758**		
TKN	mg/L	0.89	1.13		
Total Organic Carbon (TOC)		**7.2**	**7.7**		**< 2.0**
Arsenic	ug/L	0.55	0.43	10	
Chloride	mg/L	1.85	1.79	250 (AO)	
Colour	TCU	10	10	< 15 TCU	< 5
Fluoride	mg/L	0.19	0.20	1.5	0.80
Iron	mg/L	**0.898**	**0.780**	< 0.3 (AO)	**< 0.10**
Manganese	mg/l	**0.106**	**0.176**	< 0.05 (AO)	**< 0.05**
Turbidity	NTU	**2.45**	**1.17**		**< 0.3, 95% of the time**

Abbreviations:
AO *= aesthetic objective*
GCDWQ *= guidelines for Canadian drinking water quality*
PO *= practical objective*
IMAC *= interim maximum acceptable concentration*
MAC *= maximum acceptable concentration*
SMCL *= secondary maximum contaminant level*

The level of UV transmittance was concerning for a groundwater source, as it can impact the operation of the UV system. The treatment strategy would need to address the elevated TOC levels in order to increase the UVT values.

2 Description of Proposed Development

2.1 PROJECT DESCRIPTION

The proposed project was to install a water treatment Plant (WTP) that is capable of producing 0.35 L/s of treated water.

The projected included the following scope of works:

- The installation of two new well pumps in the existing wells;
- Miscellaneous retrofits to the existing building to accommodate the new plant equipment;
- Installation of new treatment equipment, potable water storage tanks, and distribution pumps;
- Upgrades to the existing standpipes in the campground; and
- Plant residuals collection to a manhole and pumping to the nearby slough.

2.1.1 Proposed Water Treatment Process

The original treatment system that was proposed was greensand filtration, granular activated carbon, UV disinfection and final chlorination.

However, during initial phases of construction, the process was revised through discussions with the selected treatment supplier. The supplier proposed a two-step ion exchange system that would greatly simplify the process and eliminate a significant amount of operational efforts. AE and the Owner accepted the revision as the new process would only require salt for ion exchange process as opposed to a potassium permanganate system, frequent replacement of the carbon media, and regular monitoring of chloramine levels.

The proposed treatment process is as follows:

- One ∅450mm x 1500mm ion exchange vessel for iron and manganese removal;
- One ∅450mm x 1500mm ion exchange vessel for ammonia and organics removal;
- One ∅450mm x 1500mm standby ion exchange vessel for any breakthrough of ammonia;
- Two UV reactors for primary disinfection;
- One chlorination system using sodium hypochlorite for secondary disinfection; and
- Potable storage tanks and distribution pumps.

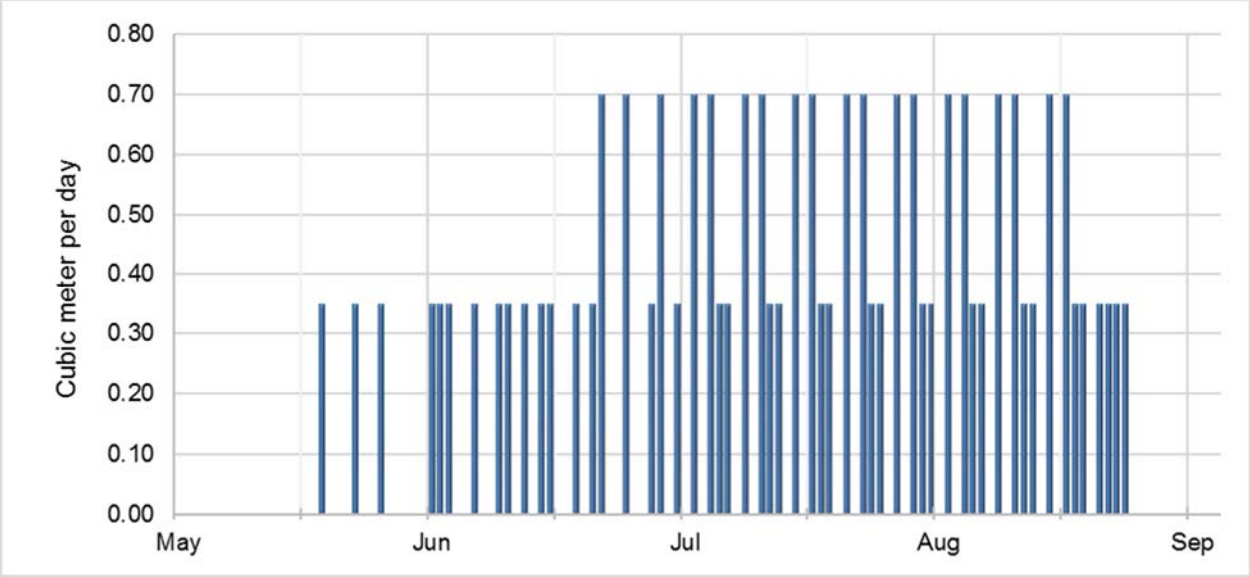
2.1.2 Regeneration Water Disposal

As previously mentioned, the original intent was to direct the plant residuals to the new onsite wastewater management system, however, this practice was not recommended by the onsite system supplier. The option to store and haul the residuals from site was also found to be very costly due to the remoteness of the campground.

Thus, it is proposed that the plant's regeneration water is discharged to the surface for disposal. Residuals from the new treatment process consists of the regeneration water from the ion exchange regeneration process. This flow is to be directed to a manhole outside the plant and then pumped to the slough 30m southwest of the WTP.

Regeneration cycles on the ion exchange units are triggered on volume use; vessel #1 will regenerate after 17,000 L of treated flow; vessel #2 after 10,000 L; and vessel #3 after 30,000 L. Based on the trends in campground use over the season, the frequency and daily volume of regenerations are calculated in **Figure 2-1** below. The chart shows the prediction of the units regenerating one to two times per week in the shoulder season, then peaking upwards of 0.35 to 0.70 m^3/day every second day in July and August. There is no flow from mid-September to late-May.

Figure 2-1: Regeneration Cycles and Regeneration Volume per Day



The chart predicts in a given peak year, with full occupancy, the total annual regeneration water discharged could be upwards of 27m^3/year. A relatively minor volume over only part of the year.

Table 2-1 is a summary of regeneration water quality from sampling facilities with similar ion exchange processes.

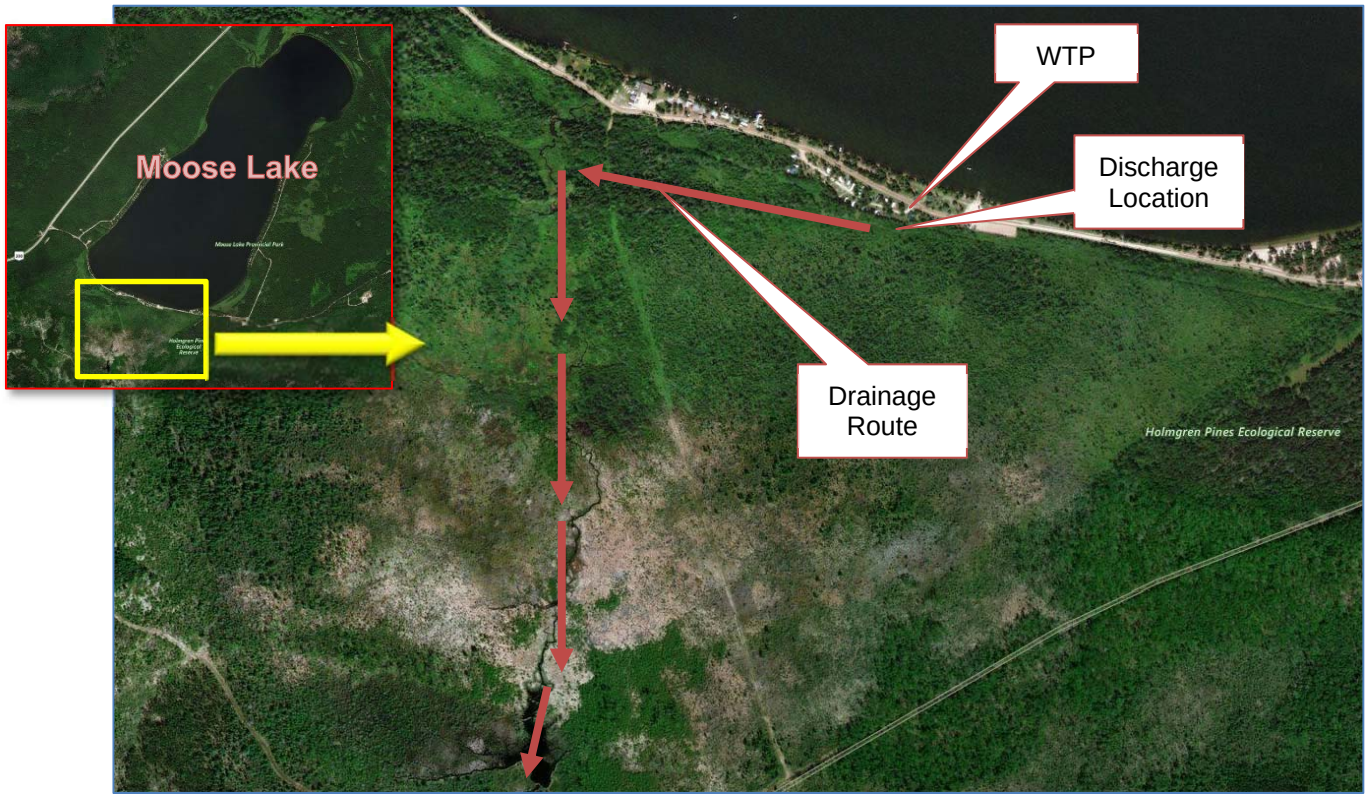
Table 2-1 Projected Regeneration Water Quality

Parameter	Units	Raw Water	Reject Water
pH		7.95	**7.95**
Alkalinity	mg/L	170	**50**
Hardness ($CaCO_3$)	mg/L	180	**1400**
Chloride	mg/L	2.0	**9000**
Colour	TCU	10	**20**
Sodium	mg/L	2.0	**6000**
TDS	mg/L	190	**15000**
Turbidity	NTU	-	**10**

The plant residuals are to be discharged to the nearby slough that drains into a small creek that drains into a nearby creek that itself drains into a larger wetland to the south.

Figure 2-2 is a map of the discharge point and drainage route.

Figure 2-2: Discharge and Drainage Route



Since the volume of discharge is relatively small and only occurs in summer when the slough and marshlands are flowing, there is a large dilution factor to be expected. The water quality is not that different from concentrate streams from membrane treatment plants, and those types of plants regularly discharge to surface water bodies without having significant adverse effects. Thus, it is anticipated that the residuals stream from this new facility will have negligible effects on the water quality in the marshlands.

2.1.3 Operations and Maintenance

Manitoba Sustainable Development, Parks and Protected Spaces will be responsible for operation and maintenance of the WTP. Moose Lake campground has a water treatment plant operator who will be responsible for plant operation in accordance with their Licence and Regulations.

2.2 CERTIFICATE OF TITLE

The WTP will be located on provincially owned Crown land within the Moose Lake Provincial Park. The land is registered under Her Majesty The Queen.

2.3 EXISTING AND ADJACENT LAND USE

The WTP is located within the camping area. No change to the existing and adjacent lands is planned to occur as a result of this project. The existing lands are used for camping and recreational activities.

2.4 LAND USE DESIGNATION AND ZONING

All of the land comprising Moose Lake Provincial Park has been categorized as a Recreational Development. The main purpose of this land use category is to accommodate recreational development. Zoning for water pipelines on municipal owned land does not apply.

2.5 PROJECT SCHEDULE

The WTP project was completed in 2015, however, it was not in full operation until 2016 with the construction of the new onsite wastewater management system.

2.6 PROJECT FUNDING

The project is funded by Manitoba Sustainable Development, and managed through the Manitoba Water Services Board.

2.7 REGULATORY APPROVALS

The following departments will receive copies of the specifications and plans, for review and approval:

- Office of Drinking Water

2.8 PUBLIC CONSULTATION

Public consultation will not be required as the project does not involve private funding or property.

2.9 STORAGE OF PETROLEUM PRODUCTS AND OTHER CHEMICALS

The contractors will be required to ensure all equipment is to be maintained free of fluid leaks, and in proper operating condition. The contractor shall wash, refuel and service machinery, store fuel and other materials for the equipment away from the water to prevent deleterious substances from entering the water. No fuelling of equipment shall occur within 100 m of the watercourse during construction. If fueling of large equipment does occur onsite, fuel should be provided by fueling trucks. Logs of refueling volumes should be recorded and spill kits and an emergency response plan shall be prepared for the site which involves spill prevention, notification and response procedures.

During operation of the WTP, no petroleum products are planned to be stored within the building. Sodium hypochlorite and salt will be required to be onsite for the water treatment process and will be stored in a designated area with suitable spill containment.

3 Physical Environment

3.1 PHYSIOGRAPHIC SETTING AND CLIMATE

Moose Lake Campground is located in the southeast corner of Manitoba off of Provincial Highway 308 and near Lake of the Woods and the American border. The project area is a part of the Precambrian Shield physiographic region. The Precambrian Shield stretches from northwestern to southeastern Manitoba and consists of a hummocky terrain of eroded crystalline bedrock, partly to mostly covered by Quaternary deposits (National Ecological Framework for Canada, 2013). Surface elevation generally does not exceed 350 m above sea level with relief seldom exceeding 30 m. Much of the land surface is occupied by swamp and muskeg as drainage is generally poor.

More specifically, the area is underlain by massive, crystalline, acidic, Archean bedrock, forming hummocky, broadly sloping uplands and lowlands (National Ecological Framework for Canada, 2013). Lowlands have lacustrine deposits forming level to undulating clay plains. The area is also interspersed with areas of fluvioglacial outwash deposits. Bare rock outcrops are common, and Dystric Brunisols are the dominant soil on sandy morainal veneers and blankets. Mesisolic and Fibrisolic Organic soils can dominate areas while Gray Luvisolic soils are found on exposed clay deposits.

The climate in this ecoregion is more closely identified with the warmer, more humid southeastern mixed forest region, rather than with the colder, drier boreal regions to the north (National Ecological Framework for Canada, 2013). The climatic data was taking from an Environment Canada Weather Station (2014) located in Sprague, MB from 1996 to 2007. This station is the closest active station to Moose Lake Provincial Park.

Table 3-1 Climatic Averages for the Region (1996-2007)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Yearly Average
TEMPERATURE (ºC)													
Monthly Average	-14.6	-12.3	-5.9	3.9	10.3	16.0	18.9	17.3	12.5	4.9	-3.6	-11.1	3.3
Average Max	-2.7	-0.2	6.1	15	19.1	23.9	28.7	26.5	20.8	12.7	6.1	-1.6	n/a
Average Min	-26.8	-23.4	-17.7	-7.1	0.4	7.5	11.5	8.9	4.1	-4.4	-15	-22.8	n/a
PRECIPITATION (mm)													
Monthly Average	23.0	18.4	23.3	27.9	83.8	121	84.3	77.5	51.4	61.4	30.2	20.0	52.2

* *Environment Canada (http://climate.weather.gc.ca/climateData/monthlydata_e.html?timeframe=3&Prov=MB&StationID=10196&mlyRange=1996-02-01|2007-11-01&Year=2007&Month=01&Day=01*

3.2 HYDROGEOLOGY

A summary of the hydrogeology in the Precambrian Shield has been completed by Betcher, Groove and Pupp (1995). They have noted that hydraulic conductivity is typically very low in unfractured crystalline igneous and metamorphic rock. Most ground water movement occurs through secondary features consisting of joints, shears, or faults. There are large variations in the frequency of these secondary features on both a local and a regional scale, making a prediction of their location very difficult. In general, groundwater development from Precambrian rocks is quite limited in Manitoba, because of the small demand for groundwater in this region and the uncertainty, low yield and considerable expense of drilling into igneous and metamorphic rocks.

Most groundwater development in the Precambrian Shield has occurred in cottage areas of southeastern Manitoba, where sand and gravel aquifers are sparsely distributed (Betcher, Groove and Pupp, 1995). Several hundred wells have been completed into these units in this area with reported well yields ranging from “dry” holes to more than 14 L/s. Generally, though, well yields are low, often below 1.0 L/s and ranging from 0.01 to 0.001 L/s/m. Water producing zones can be found at depths in excess of 60 m and often depths of 100 m or more below the bedrock surface.

No information is available on hydrogeology located directly within Moose Lake Provincial Park.

3.3 HYDROLOGY

Lakes, ponds, and sloughs are present throughout the region and occupy shallow depressions. These wetlands appear to be interconnected but there is no drain index information available for Moose Lake Provincial Park to confirm their connectivity. Water from Moose Lake appears to flow northward into a large wetland complex that eventually flows eastward into Lake of the Woods. This large lake straddles the borders of Manitoba, Ontario and Minnesota.

Portions of Moose Lake are a part of a nutrient management zone which has been designated to protect water quality by encouraging responsible nutrient planning. Setback distances from the shoreline of the receiving water body have been set by the Province to regulate the application of materials containing nutrients. The location of the WTP does not fall within these management zones and is therefore not subject to its regulations. Moose Lake is also not considered as vulnerable in the Nutrient Management Regulation (MB SD, date unknown).

There is no running water to the non-modern washrooms at Moose Lake Campground. Wastewater from these washroom facilities is stored in underground tanks and then hauled away from site to the closest wastewater treatment facilities. Treated water is supplied to the modern washroom, and the wastewater from this facility is directed to an onsite wastewater management system (Ecoflo Biofilter).

The WTP is located at the south end of Moose Lake, in the campground area.

3.4 FISH AND FISH HABITAT

Fish habitat is present within Moose Lake with the presence of walleye, northern pike and yellow perch. Moose Lake is quite shallow, with a maximum depth of 5.5 metres (MB Conservation, 2012). The south end of the lake is aerated to help prevent winter-kill of fish in that area. Water level on the lake is maintained through the use of a water control structure that is operated by Manitoba Infrastructure.

3.5 VEGETATION AND WILDLIFE

Moose Lake Campground is within the Lake of the Woods Ecoregion of the Boreal Shield Ecozone (National Ecological Framework for Canada, 2013). Characteristic vegetation in the ecoregion includes trembling aspen, paper birch, and jack pine forests that transition to white spruce, black spruce, and balsam fir dominated stands. Warmer portions of the ecoregion support red and eastern white pine while cooler and wetter sites have black spruce and tamarack. The western limit for red and eastern white pine in Canada is found with this ecoregion.

The extent of wetlands is variable, being most extensive in the vicinity of Lake of the Woods. Treed bowl bogs and peat margin swamps are the predominant wetland types. Characteristic wildlife includes moose, black bear, wolf, lynx, snowshoe hare, and woodchuck. Bird species include ruffed grouse, hooded merganser, pileated woodpecker, bald eagle, turkey vulture, herring gull, and waterfowl.

3.6 SOCIOECONOMIC

The project is located within Moose Lake Provincial Park. The park is funded by the Province of Manitoba and provides recreation, camping, and day use areas to the public. As previously stated, the campground can have a peak of 195 individuals with five campground staff when it is operation from May to September. Fluctuations on the number of people staying at the campground occur from year to year and through the season.

Within the Park, there are also two cottage subdivisions, with 90 road-accessible leased cottage lots, can be found on the east and west sides of Moose Lake along with a resort and outfitting establishment (Silver Birch) along the south end of the lake.

3.7 HERITAGE RESOURCES

The project activities all occur within Moose Lake Provincial Park and primarily occur within previously disturbed or developed areas. The owner would work with Heritage Resources Branch to mitigate any concerns as required.

4 Potential Environmental Effects

An environmental effect includes a change that a project or development may cause to the environment. They may include, but are not limited to effects to:

- Air Quality;
- Soils;
- Surface Water, Fish and Fish Habitat;
- Water Quality;
- Ground Water Levels;
- Vegetation;
- Wildlife Habitat and Vegetation; and
- Socioeconomics aspects of the area.

4.1 AIR QUALITY

Construction activities will create dust and emissions from construction machinery. Dust suppression using water sprays or mists will be used to alleviate potential dust from being raised. Air quality effects from any dust generation during construction would be localized and temporary and is considered to have a low or negligible environmental effect. Emissions from construction equipment will be temporary and minimized by having machinery operating within normal limits and outfitted with mufflers (where application) to reduce air emissions. It is anticipated that during the operation of the WTP there would not be any release of pollutants to the air.

4.2 SOILS

A risk exists, during the construction of the facility, for a spill to occur from construction machinery and vehicle equipment. To reduce this risk storage of fuel, other petroleum products and lubricants will not be permitted within the area of the water supply. Therefore, the risk of occurrence is small based and additionally standard construction best practices for managing clean-up and removal of any impacted soils will be used to prevent any impacts.

During WTP operation activities are limited to regular maintenance activities. Daily checks of the WTP would involve recording readings, making minor adjustments to the plant treatment process, such as regeneration rates and disinfection dosing rates. These activities would have a minimal impact to soils in the area. Potential adverse impacts to soil quality are assessed to be minor.

4.3 SURFACE WATER AND FISH HABITAT

Any potential environmental impacts to surface water and fish habitat are expected to be minor and short term during construction. The majority of the work will take place in a new structure which will house the

water treatment plant. The installation of the residuals discharge line could temporarily increase erosion and sedimentation into a nearby wetland. Standard construction best management practices for sedimentation and erosion control will be implemented during construction to reduce potential effects to aquatic life.

Best management practices for sedimentation and erosion control will be implemented during construction to reduce sediment from entering Moose Lake. No work is expected to take place in proximity to the Lake.

4.4 WATER QUALITY

Impacts to the water quality of Moose Lake will be reduced during construction by using the proper mitigation measures (e.g. following best practices), as previously described.

Moose Lake has an approximate surface area of 639 ha (Google Maps). The plant's residuals discharge is to be directed to a nearby slough that drains into a large marchland to the south. The relatively minor amount of plant residuals water compared to the large volume of water in the marshland is expected to create a large dilution factor. Thus, any impact to water quality in the marshland is expected to be negligible with no expected adverse effects.

4.5 GROUNDWATER LEVELS

The supply of raw water to the WTP will come from two existing nearby groundwater wells. These wells are expected to continue to operate as they have in the past from May to September of each year. The proposed pumping rates for the new WTP are less than the recommended maximum pumping rates for the wells, thus, the potential environmental effects to groundwater resources are assumed to be negligible.

4.6 VEGETATION

The proposed development area at Moose Lake Provincial Park has previously been disturbed and is regularly managed. Best management construction practices were implemented to manage sedimentation and erosion control. The area of disturbance for the installation of the discharge line is minimal. Any areas which were disturbed have been restored to their natural state.

The operating and maintenance activities of the proposed development are minimal and will be restricted to established areas within the park. Potential impacts to vegetation are considered to be negligible.

4.7 WILDLIFE HABITAT AND VEGETATION

The potential effects to wildlife habitat loss were assessed to be negligible as all activities are occurring in areas previously developed.

4.8 NOISE AND VIBRATION

The construction equipment will create noise emissions. Predominately, machinery engines and powered hand tools are expected to be the sources of noise. The noise will be in addition to regular maintenance and park activities, and are expected to be short term and are considered to be minor.

4.9 HUMAN HEALTH AND WELL BEING

Potential adverse effects on the overall human health are considered to be negligible to minor. During construction, short term increases to dust and noise will occur. The construction and operation of the water treatment plant designed to produce treated water to meet current water quality standards is considered to have a positive effect on human health and wellbeing.

4.10 CLIMATE CHANGE

No climate change impacts are expected from the proposed development.

5 Environmental Management Measures

5.1 AIR QUALITY

Well maintained vehicles and equipment and reduction of unnecessarily transportation and idling of vehicles will assist in mitigating air quality impacts.

The control of dust with water sprays or an approved dust suppressant will limit the impact of dust to the air quality. Prompt re-establishment of vegetation disturbed during construction and also limiting certain work to periods of low winds will also help mitigate air quality impacts.

5.2 SOILS

Preparation of an emergency response plan to mitigate potential impacts to soil by contaminants from petroleum products as well as use and availability of on-site spill clean-up equipment and materials, using properly maintained equipment and fuelling procedures.

Minimal ground disturbance is anticipated during the construction phase. The reestablishment of vegetation and backfill of any short trenches or excavations will occur as soon as possible after any disturbance to reduce the loss of soil due to wind or water erosion.

5.3 SURFACE WATER

Surface water issues may be mitigated during construction by redirecting surface run-off, pumping accumulated water to adjacent ditches and installing proper erosion control practices such as silt fences and erosion control blankets.

Properly maintained, operated and fueled equipment will assist with the mitigation of potential fuel or petroleum spills. Regulatory authorities will be notified through the emergency response line and appropriate measures will be taken according to Provincial requirements.

Setback distances of 100m will be used for fueling and refueling purposes from any water courses. Vehicles will stay on established roads and not unnecessarily disturb riparian zones. Any disturbed vegetation will be re-established as soon as possible.

Chlorinated water used to disinfect the water treatment plant or distribution system will be neutralized prior to discharge.

5.4 GROUNDWATER

The same mitigation efforts as described for surface water can be applied to as mitigation measures to reduce potential impact to any groundwater

5.5 VEGETATION AND WILDLIFE

The establishment of re-vegetation will occur as soon as practically possible for disturbed areas. Minimizing laydown areas and construction activities will act as a measure to reduce disturbance to soils, and vegetation. Proper noise control and dust control as previously discussed will be implemented to mitigate potential impacts.

5.6 FISHERIES

Fisheries impacts will be mitigated by controlling run-off and any construction related discharge to the watercourse to reduce potential harmful effects. The work area will be set back from riparian zones. Proper erosion and sedimentation control measures for working near water will be implemented. These measures will limit any short term temporary impact to fisheries.

5.7 NOISE AND VIBRATION

Unnecessary operation of equipment, properly muffled vehicles and equipment on site and properly maintained equipment will be assist in mitigating noise and vibration issues.

5.8 WATER CONSERVATION

Coin operated showers and low flush fixtures will assist in water conservation measures related to the treatment and production of water at Moose Lake Provincial Park.

5.9 RESIDUAL ENVIRONMENTAL EFFECTS

Long-term residual effects are not anticipated, but short term residual effects are considered local, minor in magnitude, short term in duration, and reversible over time after environmental protection and mitigation measures are applied.

6 References

"Betcher, Groove and Pupp, 1995. Groundwater in Manitoba: Hydrogeology, Quality Concerns, Management." Environment Canada, National Hydrology Research Institute Contribution No. CS-93017. Obtained from https://gov.mb.ca/waterstewardship/reports/groundwater/hg_of_manitoba.pdf

"Bruederlin, Bruno, 2015. Personal communication (email)." Regional Fisheries Biologist. Manitoba Conservation and Water Stewardship, Fisheries Branch. Brandon, MB.

"Environment Canada, Canadian Climate Normals" http://climate.weather.gc.ca/climate_normals

"National Ecological Framework for Canada, 2013." Ecoregions of Canada, Lake of the Woods Ecoregion. http://ecozones.ca/english/region/91.html

MB Conservation, 2012. Moose Lake Provincial Park – Draft Management Plan.
https://www.gov.mb.ca/.../pdf/moose_lake_draft_management_plan.pdf

MB Conservation, date unknown. Vulnerable Water Bodies.
http://www.gov.mb.ca/waterstewardship/wqmz/vulnerable.html

Appendix A – Drawings

MANITOBA CONSERVATION &
MANITOBA WATER SERVICES BOARD

Manitoba

Moose Lake Campground Water Treatment Plant & Facility Upgrades

AE Project No. 2012-4123-01

M.W.S.B. Tender # 1093

Issued for Tender

Sheet List Table

Sheet No.	Drawing No.	Revision No.	Drawing Title
GENERAL			
1	000	0	COVER
CIVIL			
2	101	0	SITE PLAN & DETAIL
3	102	0	CAMPGROUND PLAN & DETAILS
ARCHITECTURAL			
4	201	0	SCHEDULES & CODE ANALYSIS
5	202	0	MAIN FLOOR PLAN
6	203	0	ELEVATIONS
7	204	0	SECTIONS
8	205	0	DETAILS
STRUCTURAL			
9	301	0	MAIN FLOOR PLAN
10	302	0	NOTES & DETAILS
PROCESS MECHANICAL			
11	401	0	LEGEND
12	402	0	PROCESS FLOW DIAGRAM
13	403	0	WTP MAIN FLOOR PLAN - 3D ISOMETRIC
14	404	0	WTP MAIN FLOOR PLAN
15	405	0	DETAILS
BUILDING MECHANICAL			
16	501	0	MAIN FLOOR PLAN - DRAINAGE
17	502	0	MAIN FLOOR PLAN - PLUMBING
18	503	0	MAIN FLOOR PLAN - HEATING & VENTILATION
19	504	0	DETAILS & SCHEDULES
20	505	0	PRE-ENGINEERED IN FLOOR HEAT
ELECTRICAL			
21	601	0	SITE PLAN
22	602	0	LIGHTING PLAN
23	603	0	POWER & SYSTEMS PLAN
24	604	0	SCHEDULES

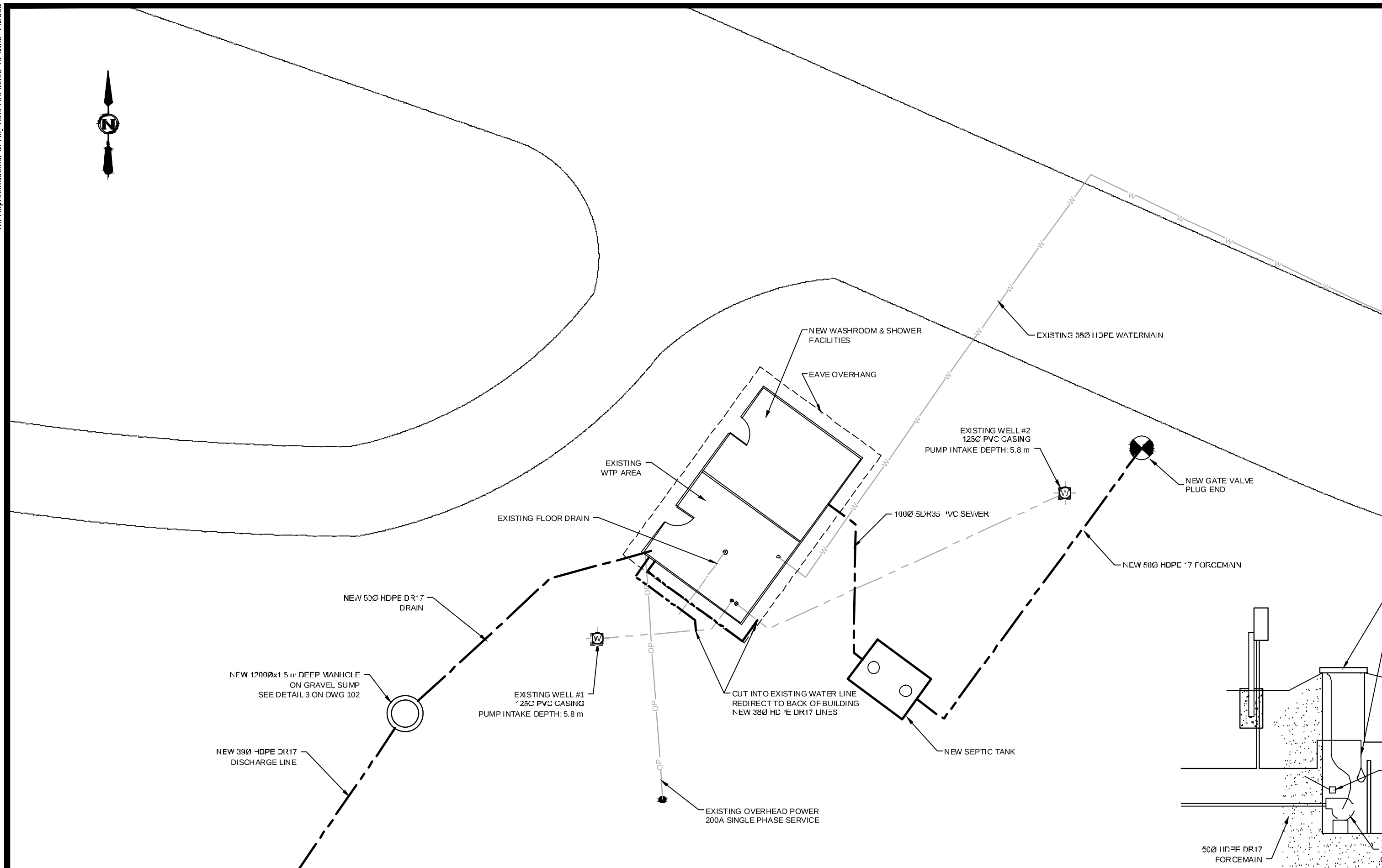
PROJECT MANAGER

OCT 1, 2012
DATE

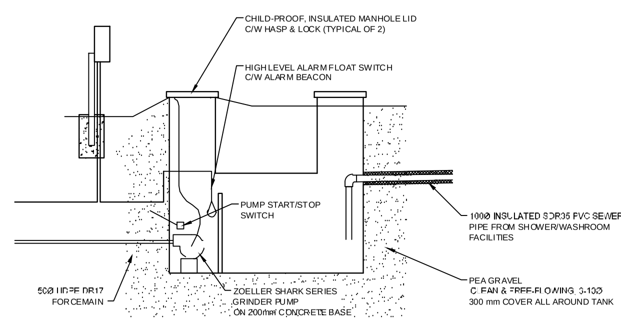
Associated Engineering

GLOBAL PERSPECTIVE.
LOCAL FOCUS.

DRAWING NUMBER	REV. NO.	SHEET
4123-01-000	0	1/24


NEW WASHROOM & SHOWER FACILITIES
EAVE OVERHANG
EXISTING 38Ø HDPE WATERMAIN
EXISTING WELL #2
125Ø PVC CASING
PUMP INTAKE DEPTH: 5.8 m
EXISTING WTP AREA
NEW GATE VALVE
PLUG END
EXISTING FLOOR DRAIN
100Ø SDR35 PVC SEWER
NEW 50Ø HDPE 17 FORCEMAIN
NEW 50Ø HDPE DR17
DRAIN
NEW 1200Ø x1.5 m DEEP MANHOLE
ON GRAVEL SUMP
SEE DETAIL 3 ON DWG 102
EXISTING WELL #1
125Ø PVC CASING
PUMP INTAKE DEPTH: 5.8 m
CUT INTO EXISTING WATER LINE
REDIRECT TO BACK OF BUILDING
NEW 38Ø HDPE DR17 LINES
NEW SEPTIC TANK
NEW 38Ø HDPE DR17
DISCHARGE LINE
EXISTING OVERHEAD POWER
200A SINGLE PHASE SERVICE

1 PLAN 1:100
WTP SITE


CHILD-PROOF, INSULATED MANHOLE LID
C/W HASP & LOCK (TYPICAL OF 2)
HIGH LEVEL ALARM FLOAT SWITCH
C/W ALARM BEACON
PUMP START/STOP
SWITCH
100Ø INSULATED SDR35 PVC SEWER
PIPE FROM SHOWER/WASHROOM
FACILITIES
PEA GRAVEL
CLEAN & FREE-FLOWING 3-13Ø
300 mm COVER ALL AROUND TANK
50Ø HDPE DR17
FORCEMAIN
ZOELLER SHARK SERIES
GRINDER PUMP
ON 200mm CONCRETE BASE

MINIMUM 4500 L, TWO CHAMBER, SHALLOW BURY SEPTIC TANK

TANK SHALL CONFORM TO CSA B66-0 & INSTALLATION PER MANUFACTURER'S SPECIFICATIONS

2 PLAN NTS
SEPTIC TANK INSTALLATION

DRAWING REDUCED TO HALF SIZE

NO.	DATE	ENG.	BY	SUBJECT
0	20120928	K.A.	D.Y.	ISSUED FOR TENDER

REVISIONS

Associated Engineering

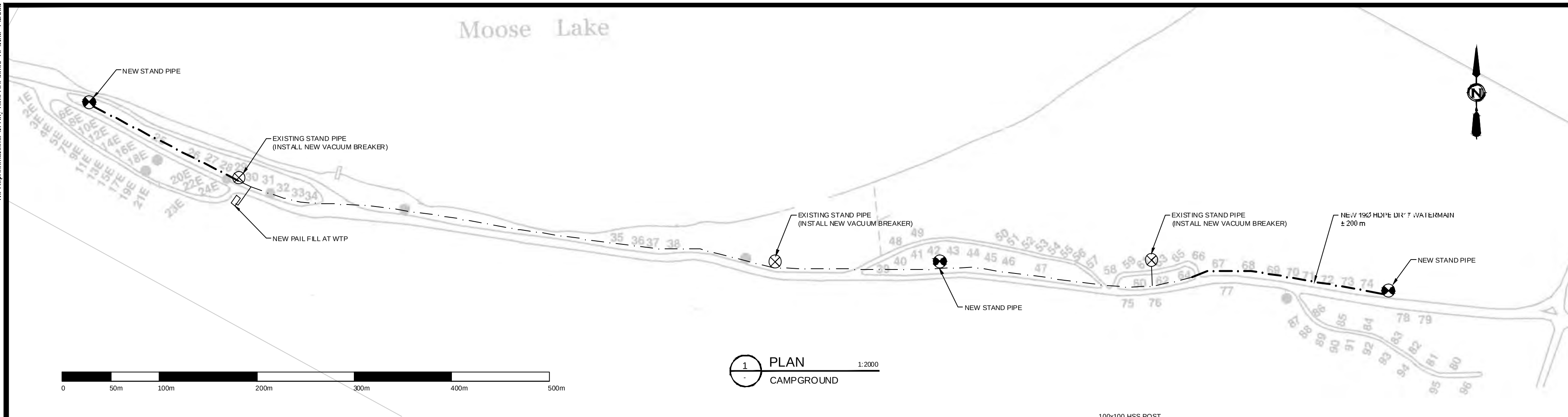
PROJECT No.	2012-4123-01
SCALE	AS SHOWN
DRAWN	K. ANDERSON
DESIGNED	K. ANDERSON

MANITOBA CONSERVATION & M.W.S.B.

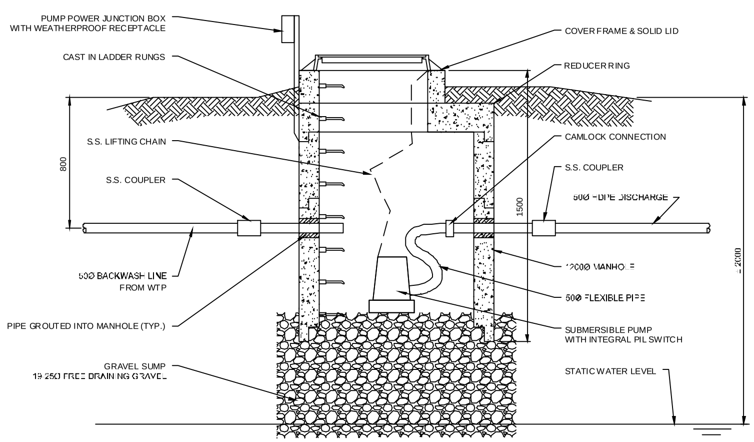
CIVIL
SITE PLAN & DETAIL

M.W.S.B. NO. 1093
MOOSE LAKE CAMPGROUND
WTP & FACILITY UPGRADES

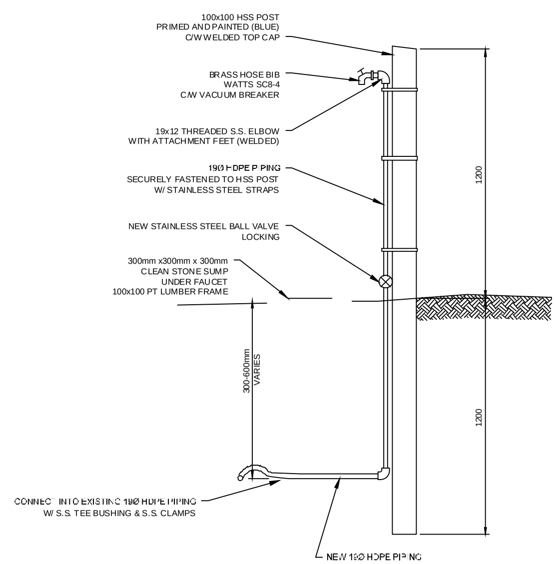
DRAWING NUMBER	REV. NO.	SHEET
4123-01-101	0	2 / 24


Moose Lake
NEW STAND PIPE
EXISTING STAND PIPE (INSTALL NEW VACUUM BREAKER)
NEW PAIL FILL AT WTP
EXISTING STAND PIPE (INSTALL NEW VACUUM BREAKER)
NEW STAND PIPE
EXISTING STAND PIPE (INSTALL NEW VACUUM BREAKER)
± 200 m
NEW STAND PIPE
0
50m
100m
200m
300m
400m
500m

1 PLAN 1:2000
CAMPGROUND


PUMP POWER JUNCTION BOX WITH WEATHERPROOF RECEPTACLE
CAST IN LADDER RUNGS
S.S. LIFTING CHAIN
S.S. COUPLER
FROM WTP
PIPE GROUTED INTO MANHOLE (TYP.)
GRAVEL SUMP
COVER FRAME & SOLID LID
REDUCER RING
CAMLOCK CONNECTION
S.S. COUPLER
SUBMERSIBLE PUMP WITH INTEGRAL PIL SWITCH
STATIC WATER LEVEL
800
1500

2 DETAIL 1:15
MANHOLE SUMP


100x100 HSS POST PRIMED AND PAINTED (BLUE) C/W WELDED TOP CAP
BRASS HOSE BIB WATTS SC8-4 C/W VACUUM BREAKER
19x12 THREADED S.S. ELBOW WITH ATTACHMENT FEET (WELDED)
SECURELY FASTENED TO HSS POST W/ STAINLESS STEEL STRAPS
NEW STAINLESS STEEL BALL VALVE LOCKING
300mm x300mm x 300mm CLEAN STONE SUMP UNDER FAUCET 100x100 PT LUMBER FRAME
W/ S.S. TEE BUSHING & S.S. CLAMPS
300-600mm VARIES
1200
1200

3 DETAIL 1:10
NEW STAND PIPE

DRAWING REDUCED TO HALF SIZE

NO.	DATE	ENG.	BY	SUBJECT
0	20120928	K.A.	D.Y.	ISSUED FOR TENDER

REVISIONS

Associated Engineering

PROJECT No.	2012-4123-01
SCALE	AS SHOWN
DRAWN	K. ANDERSON
DESIGNED	K. ANDERSON

MANITOBA CONSERVATION & M.W.S.B.

CIVIL
CAMPGROUND PLAN & DETAILS

M.W.S.B. NO. 1093
MOOSE LAKE CAMPGROUND
WTP & FACILITY UPGRADES

DRAWING NUMBER	REV. NO.	SHEET
4123-01-102	0	3/24

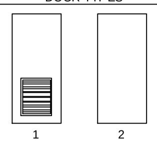
ROOM FINISH SCHEDULE

TAG	ROOM	FLOOR MATERIAL	FLOOR FINISH	WALL MATERIAL	WALL FINISH	CEILING HEIGHT	CEILING MATERIAL	CEILING FINISH
101	TREATMENT AREA	CONCRETE	EPOXY PAINT	NEW WOOD SHEATHING	FRP PANELS	2425	EXISTING PLYWOOD	PAINT
102	SHOWER STALL 1	CONCRETE	CERAMIC TILE	WOOD SHEATHING	FRP PANELS	2425	WOOD SHEATHING	FRP PANELS
103	SHOWER STALL 2	CONCRETE	CERAMIC TILE	WOOD SHEATHING	FRP PANELS	2425	WOOD SHEATHING	FRP PANELS
104	WASHROOM 1	CONCRETE	CERAMIC TILE	WOOD SHEATHING	FRP PANELS	2425	WOOD SHEATHING	FRP PANELS
105	WASHROOM 2	CONCRETE	CERAMIC TILE	WOOD SHEATHING	FRP PANELS	2425	WOOD SHEATHING	FRP PANELS

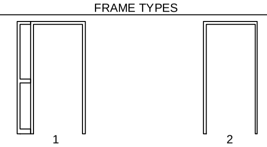
DOOR SCHEDULE

TAG	LOCATION FROM	LOCATION TO	DOORS SIZE	DOORS TYPE	DOORS F.R.R.	DOORS CORE	DOORS MATERIAL	DOORS FINISH	FRAMES TYPE	FRAMES F.R.R.	FRAMES MATERIAL	FRAMES FINISH	HARDWARE F.R.R.	PANIC.	KEYED LOCKSET	THRESHD.	CLOSER	WEATHER STRIP	KICK PLATE
101	TREATMENT AREA	EXTERIOR	900x2150x45	2	-	INSUL	STEEL	PAINT	2	-	P.S.	PAINT		•	•	•	•	•	•
102	SHOWER STALL 1	EXTERIOR	900x2150x45	1	-	INSUL	STEEL	PAINT	1	-	P.S.	PAINT			•	•	•	•	•
103	SHOWER STALL 2	EXTERIOR	900x2150x45	1	-	INSUL	STEEL	PAINT	1	-	P.S.	PAINT			•	•	•	•	•
104	WASHROOM 1	EXTERIOR	900x2150x45	1	-	INSUL	STEEL	PAINT	1	-	P.S.	PAINT			•	•	•	•	•
105	WASHROOM 2	EXTERIOR	900x2150x45	1	-	INSUL	STEEL	PAINT	1	-	P.S.	PAINT			•	•	•	•	•

DOOR TYPES



FRAME TYPES

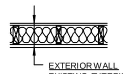


NOTES:

1. ALL DOORS TO HAVE 1.5 PAIRS OF BUTT HINGES.
2. ALL HARDWARE TO BE MEDIUM DUTY, COMMERCIAL GRADE. SEE SPECIFICATIONS.
3. ALL HARDWARE TO BE KEYED TO MASTER KEYING SYSTEM.
4. ALL CLOSERS TO HAVE 90° HOLD OPEN DEVICE.
5. ALL EXTERIOR DOORS TO HAVE STOP CHAINS.

ABBREVIATIONS:
INSUL. = INSULATED
P.S. = PRESSED STEEL
F.R.R. = FIRE RESISTANCE RATING

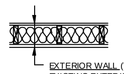
WALL TYPES



EXTERIOR WALL
EXISTING EXTERIOR SIDING
EXISTING 19 mm PLYWOOD
R-20 BATT INSULATION
NEW 38x89 mm WOOD STUDS 400 mm o/c
NEW 6 MIL CGSB POLY VAPOUR BARRIER
NEW 19 mm WOOD SHEATHING
NEW FIBRE REINFORCED PLASTIC PANEL

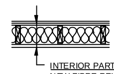
AT OPEN AREAS AT ROOF:
* NEW WOOD SIDING TO MATCH
* NEW 19 mm EXTERIOR SHEATHING

1



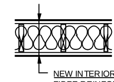
EXTERIOR WALL (WTP)
EXISTING EXTERIOR SIDING
EXISTING 19 mm PLYWOOD
EXISTING R-20 BATT INSULATION
EXISTING 38x89 mm WOOD STUDS
EXISTING 10 mm PLYWOOD SHEATHING
NEW 13 mm PLYWOOD SHEATHING
FIBRE REINFORCED PLASTIC PANEL

2



INTERIOR PARTITION
NEW FIBRE REINFORCED PLASTIC PANEL
NEW 6 mm PLYWOOD
NEW 12 mm W.R. GYPSUM BOARD
NEW R-20 BATT INSULATION
EXISTING 38x89 mm WOOD STUDS
NEW 6 MIL CGSB POLY VAPOUR BARRIER
NEW 19 mm PLYWOOD SHEATHING
FIBRE REINFORCED PLASTIC PANEL

3

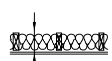


NEW INTERIOR PARTITION
FIBRE REINFORCED PLASTIC PANEL
6 mm PLYWOOD
12 mm W.R. GYPSUM BOARD
R-20 BATT INSULATION
38x190 mm WOOD STUDS 400mm o/c
12 mm W.R. GYPSUM BOARD
6 mm PLYWOOD
FIBRE REINFORCED PLASTIC PANEL

4

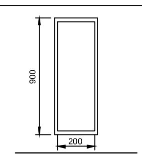
NOTE:
ALL FIBRE REINFORCED PLASTIC PANEL SYSTEMS TO BE WATER TIGHT

CEILING TYPES



NEW CEILINGS
R-40 BATT INSULATION
38x140 mm WOOD JOISTS 600 o/c
6 MIL CGSB POLY VAPOUR BARRIER
19 mm WOOD SHEATHING
FIBRE REINFORCED PLASTIC PANEL

WINDOW TYPES



W1
OBSCURED (FROSTED) GEORGIAN PLATE 6 mm LOCATED IN DOOR SIDELITE

BUILDING CODE ANALYSIS

THE BUILDING HAS BEEN DESIGNED IN ACCORDANCE WITH THE 2011 MANITOBA BUILDING CODE, PART 3, FIRE PROTECTION, OCCUPANT SAFETY AND ACCESSIBILITY.

A. OCCUPANCY CLASSIFICATION (NBC ARTICLE 3.1.2) MAJOR OCCUPANCY GROUP F, DIVISION 3, 'LOW HAZARD INDUSTRIAL'.
BUILDING AREA = 48 SQ.M. (517 SQ.FT.)
ONE-STOREY, NON-SPRINKLERED

B. OCCUPANT LOAD (NBC ARTICLE 3.1.17): 2 PERSONS PROCESS AREA: IT CAN BE SHOWN THAT NO MORE THAN 2 PERSONS WILL OCCUPY THIS BUILDING AT ANY GIVEN TIME.

C. BARRIER-FREE DESIGN (NBC ARTICLE 3.8.1.1.1(C)) NOT REQUIRED DUE TO NATURE OF OCCUPANCY.

D. NUMBER AND SPACING OF EGRESS DOORS (NBC ARTICLE 3.3.1.5.1.c) AT LEAST 2 EGRESS DOORS SHALL BE PROVIDED WHEN THE AREA OF A ROOM OR SUITE, OR DISTANCE MEASURED WITHIN THE ROOM OR SUITE TO THE NEAREST EGRESS DOOR, EXCEEDS THE VALUES IN TABLE 3.3.1.5.A)

TABLE 3.3.1.5.A

OCCUPANCY OF ROOM	MAX. AREA OF ROOM	MAX. DISTANCE TO EGRESS DOOR
GROUP F, DIVISION 3	200 SQ.M.	15 M

GREATEST FLOOR AREA (WTP AREA) = 23 SQ.M.
GREATEST TRAVEL DISTANCE (WTP AREA) = 6 M

NOTE: 1 EXIT FROM THE BUILDING IS PROVIDED.

E. NUMBER OF REQUIRED EXITS (NBC ARTICLE 3.4.2.1 (2)) ACCORDING TO TABLE 3.4.2.1.A, FOR AN OCCUPANCY F3 LESS THAN 200 SQ.M. AND TRAVEL DISTANCE LESS THAN 15 M, ONE EXIT IS TO BE PROVIDED.

F. FIRE RESISTANCE RATINGS FOR FLOORS AND ROOFS (NBC ARTICLE 9.10.8.1) ACCORDING TO TABLE 9.10.8.1., FIRE RESISTANCE RATINGS ARE NOT REQUIRED FOR THE MAIN FLOOR AND ROOF.

G. FIRE ALARM SYSTEM (NBC ARTICLE 3.2.4.1) A FIRE ALARM IS NOT REQUIRED FOR A LOW HAZARD INDUSTRIAL OCCUPANCY WITH A OCCUPANT LOAD LESS THAN 75.

DRAWING REDUCED TO HALF SIZE

NO.	DATE	ENG.	BY	SUBJECT
0	2012/09/28	K.A.	D.Y.	ISSUED FOR TENDER

REVISIONS

Associated Engineering

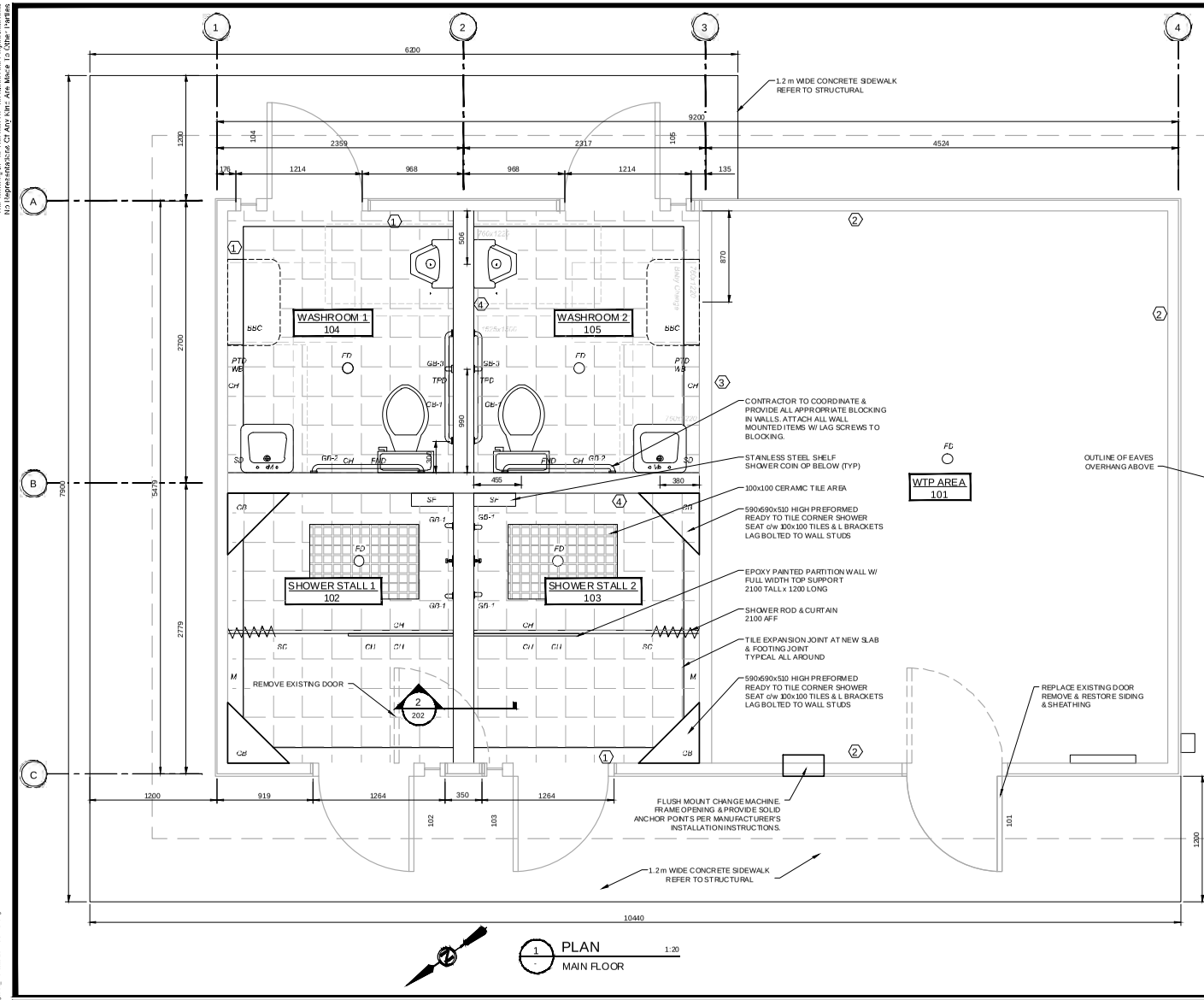
PROJECT No.	2012-4123-01
SCALE	AS SHOWN
DRAWN	D. YANKECH
DESIGNED	K. ANDERSON

MANITOBA CONSERVATION & M.W.S.B.

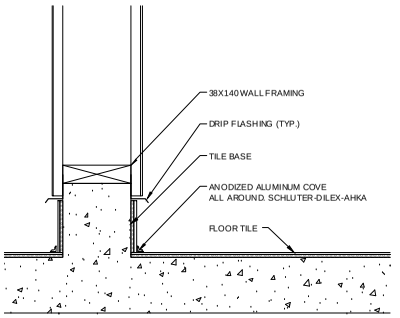
ARCHITECTURAL
SCHEDULES & CODE ANALYSIS

M.W.S.B. NO. 1093
MOOSE LAKE CAMPGROUND
WTP & FACILITY UPGRADES

DRAWING NUMBER	REV. NO.	SHEET
4123-01-201	0	4 / 24



1 PLAN 1:20
MAIN FLOOR



2 SECTION 1:5
FLOOR TILE

FIXTURE & ACCESSORY SCHEDULE

TAG	TYPE	MODEL	NOTES
CB	CORNER BENCH		REFER TO SPECIAL PROVISIONS
CH	COAT HOOK		REFER TO SPECIAL PROVISIONS
BBC	BABY CHANGE STATION		REFER TO SPECIAL PROVISIONS
FD	FLOOR DRAIN		REFER TO SPECIAL PROVISIONS
GB	S.S. GRAB BAR	GB-1: 42" ; GB-2: 36" ; GB-3: 18"	REFER TO SPECIAL PROVISIONS
M	MIRROR		REFER TO SPECIAL PROVISIONS
PT	S.S. PARTITION		REFER TO SPECIAL PROVISIONS
PTD	PAPER TOWEL DISPENSER		REFER TO SPECIAL PROVISIONS
WB	WASTE BIN		REFER TO SPECIAL PROVISIONS
SC	SHOWER CURTAIN & ROD		REFER TO SPECIAL PROVISIONS
SF	S.S. SHELF		REFER TO SPECIAL PROVISIONS
SH	SHOWER HEAD		REFER TO SPECIAL PROVISIONS
	SINK		REFER TO SPECIAL PROVISIONS
SD	SOAP DISPENSER		REFER TO SPECIAL PROVISIONS
	TOILET		REFER TO SPECIAL PROVISIONS
TPD	TOILET PAPER DISPENSER		REFER TO SPECIAL PROVISIONS
FND	FEMININE NAPKIN DISPOSAL		REFER TO SPECIAL PROVISIONS
	URINAL		REFER TO SPECIAL PROVISIONS

CONTRACTOR SHALL PERFORM LEVELNESS SURVEY OF SITE PRIOR TO CONSTRUCTION

DRAWING REDUCED TO HALF SIZE

NO.	DATE	ENG.	BY	SUBJECT
0	20120809	K.A	D.Y.	ISSUED FOR TENDER

REVISIONS

Associated Engineering

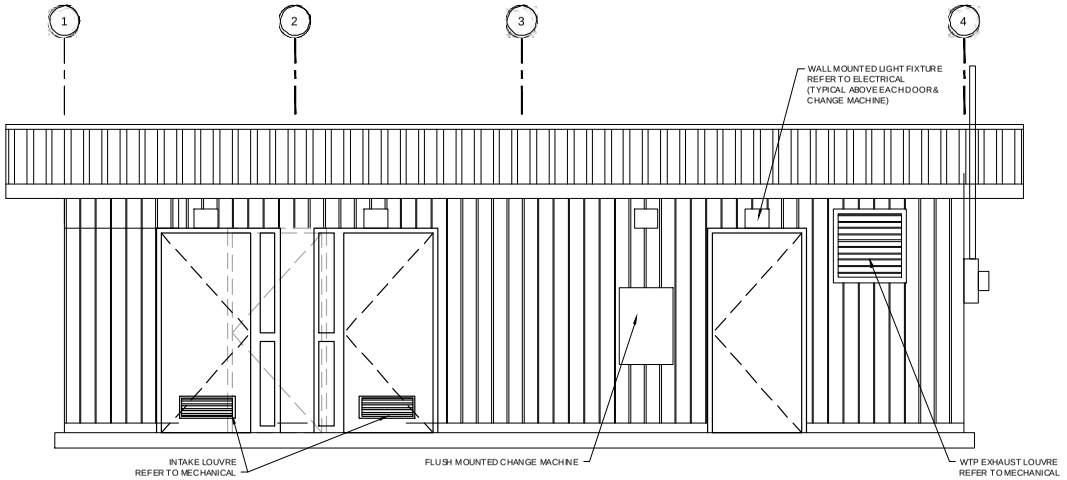
PROJECT No.	2012-4123-01
SCALE	AS SHOWN
DRAWN	D. YANKECH
DESIGNED	K. ANDERSON

MANITOBA CONSERVATION & M.W.S.B.

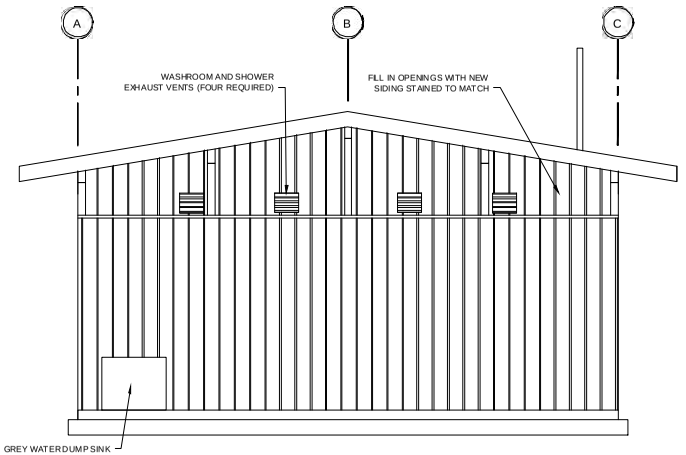
ARCHITECTURAL
MAIN FLOOR PLAN

M.W.S.B. NO. 1093
MOOSE LAKE CAMPGROUND
WTP & FACILITY UPGRADES

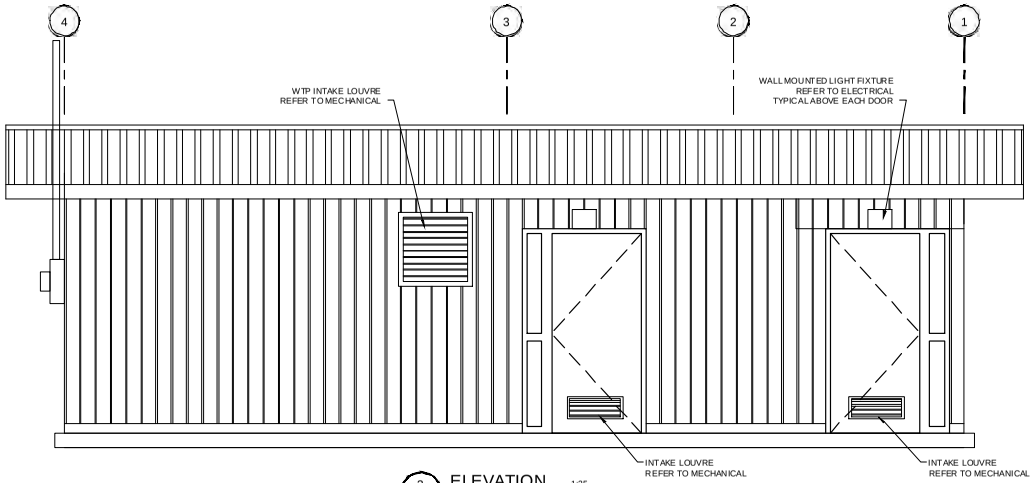
DRAWING NUMBER	REV. NO.	SHEET
4123-01-202	0	5 / 24



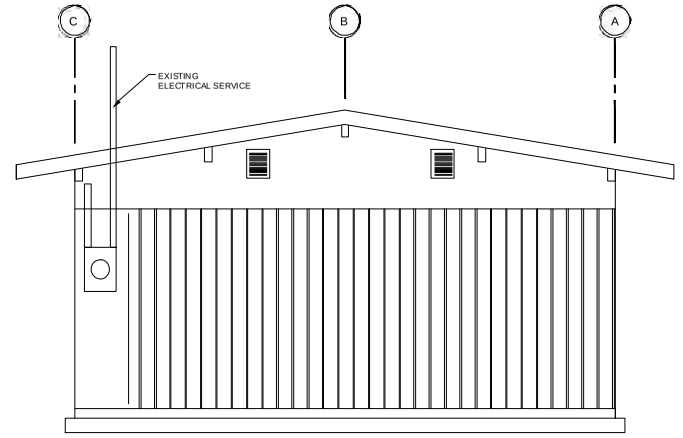
1 ELEVATION 1:25
NORTH



2 ELEVATION 1:25
EAST



3 ELEVATION 1:25
SOUTH



4 ELEVATION 1:25
NORTH

DRAWING
REDUCED TO
HALF SIZE

NO.	DATE	ENG.	BY	SUBJECT
0	2012/08/09	K.A	D.Y.	ISSUED FOR TENDER

REVISIONS

Associated Engineering

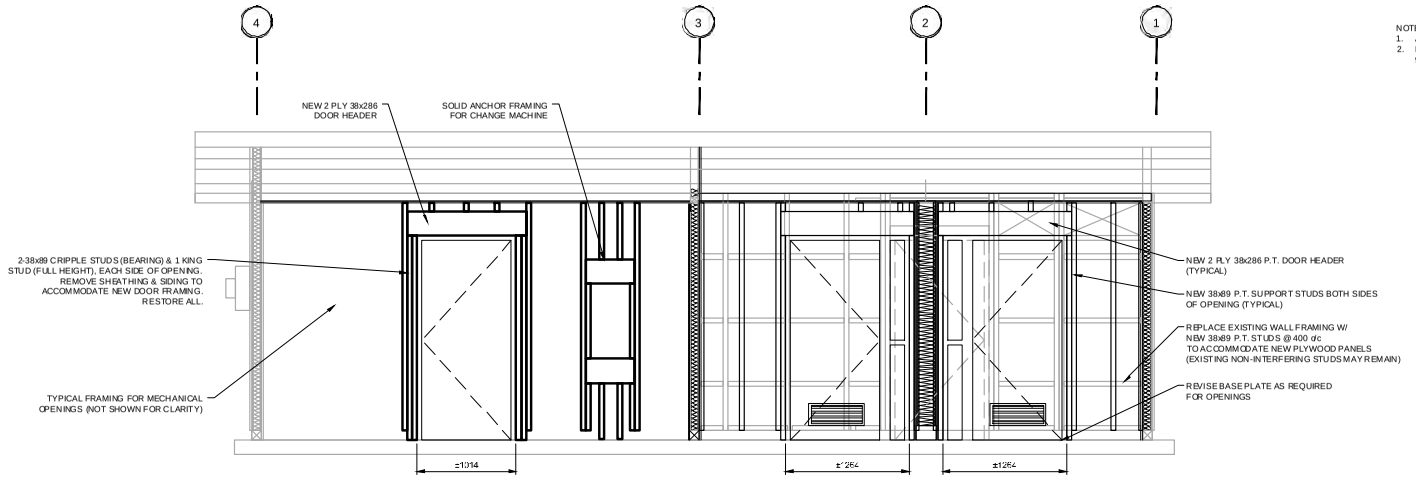
PROJECT No.	2012-4123-01
SCALE	AS SHOWN
DRAWN	D. YANKECH
DESIGNED	K. ANDERSON

MANITOBA CONSERVATION &
M.W.S.B.

ARCHITECTURAL
ELEVATIONS

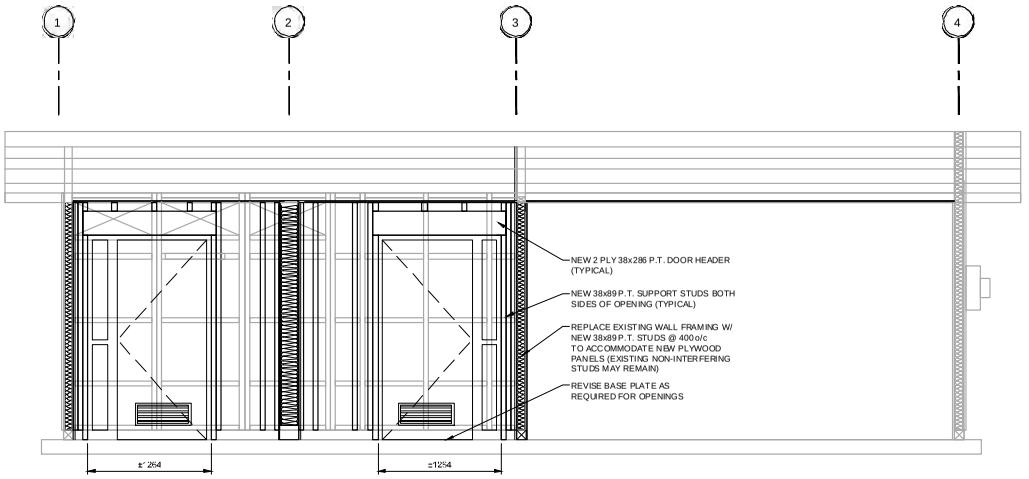
M.W.S.B. NO. 1093
MOOSE LAKE CAMPGROUND
WTP & FACILITY UPGRADES

DRAWING NUMBER	REV. NO.	SHEET
4123-01-203	0	6 / 24



1 ELEVATION 1:25
INTERIOR WEST WALL

NOTES:
1. ALL LUMBER SHALL BE PRESSURE TREATED (P.T.).
2. NAILING PATTERNS TO COMPLY WITH TABLE 9.23.3.4 IN PART 9 OF THE 2011 MANITOBA BUILDING CODE.



2 ELEVATION 1:25
INTERIOR EAST WALL

DRAWING REDUCED TO HALF SIZE

NO.	DATE	ENG.	BY	SUBJECT
0	2012/08/09	K.A	D.Y.	ISSUED FOR TENDER

REVISIONS

Associated Engineering

PROJECT No.	2012-4123-01
SCALE	AS SHOWN
DRAWN	D. YANKECH
DESIGNED	K. ANDERSON

MANITOBA CONSERVATION & M.W.S.B.

ARCHITECTURAL SECTIONS

M.W.S.B. NO. 1093
MOOSE LAKE CAMPGROUND
WTP & FACILITY UPGRADES

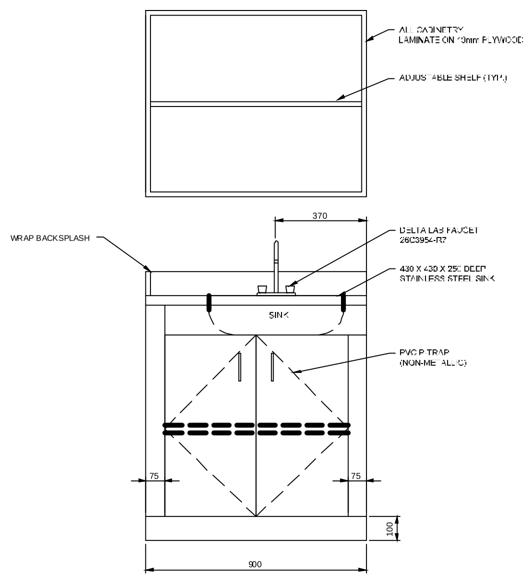
DRAWING NUMBER	REV. NO.	SHEET
4123-01-204	0	7/24

LAB COUNTER CONSTRUCTION

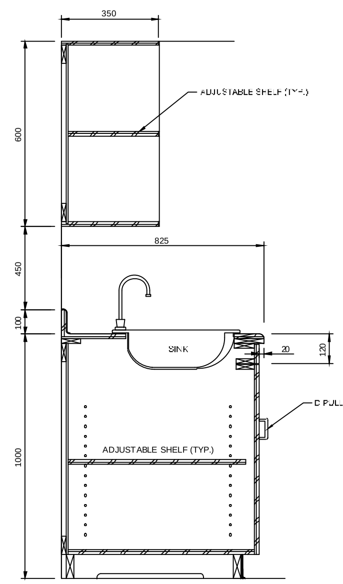
1. ALL CONSTRUCTION IS 19 mm PLYWOOD S4S WITH LAMINATE BOTH SIDES END LAMINATE EDGING - COLOUR: LIGHT GREY
2. CONCEALED GABLES AND SHELVES 19 mm PLYWOOD C/W LAMINATE EDGING
3. COUNTER TOP, FASCIA AND BACKSPLASH: 19 mm PLYWOOD C/W CHEMICAL RESISTANT PLASTIC LAMINATE SURFACE
4. 6 mm MASONITE BACKS ON 19x75 SPRUCE FRAMING
5. 19x75 SPRUCE FRAMING WHERE REQUIRED

TYPICAL HARDWARE

1. DOOR & DRAWER PULLS "RICHELIEU" No. 33206 METAL FINISH 195
2. HINGES: AMEROCK SYSTEM 2000, CONCEALED ALL METAL, ADJUSTABLE IN ALL DIRECTIONS, SELF CLOSING
3. SHELF SUPPORTS: K+V No.255ZC STANDARDS C/W No.239ZC SUPPORTS



1 ELEVATION NTS
LAB COUNTER



2 PROFILE NTS
LAB COUNTER

DRAWING REDUCED TO HALF SIZE

NO.	DATE	ENG.	BY	SUBJECT
0	2012/09/28	K.A.	D.Y.	ISSUED FOR TENDER

REVISIONS

Associated Engineering

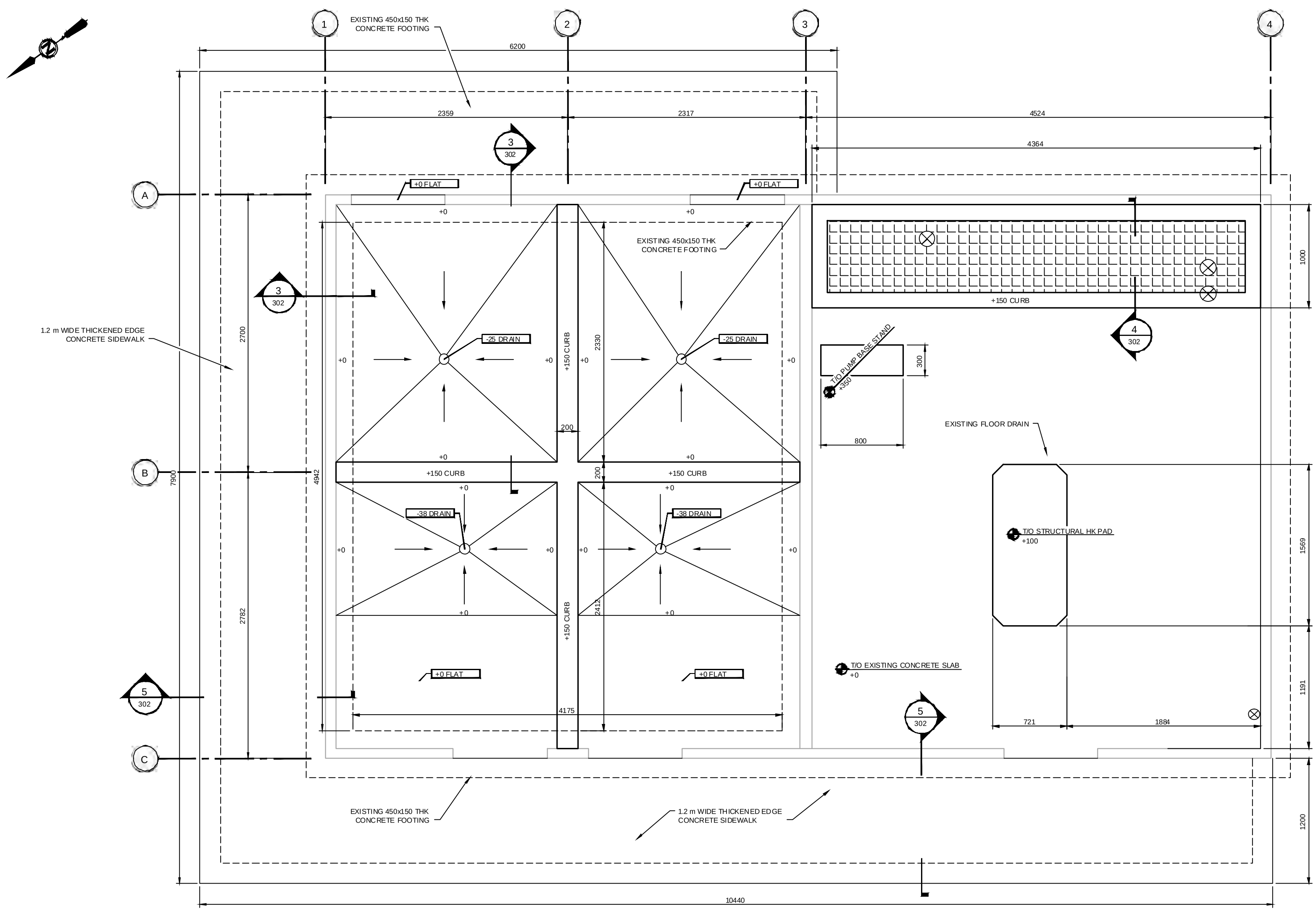
PROJECT No.	2012-4123-01
SCALE	AS SHOWN
DRAWN	K. ANDERSON
DESIGNED	K. ANDERSON

MANITOBA CONSERVATION & M.W.S.B.

ARCHITECTURAL DETAILS

M.W.S.B. NO. 1093
MOOSE LAKE CAMPGROUND
WTP & FACILITY UPGRADES

DRAWING NUMBER	REV. NO.	SHEET
4123-01-205	0	8 / 24



PLAN 1:20
MAIN FLOOR

DRAWING REDUCED TO HALF SIZE

NO.	DATE	ENG.	BY	SUBJECT
0	20120928	K.A.	D.Y.	ISSUED FOR TENDER

REVISIONS

Associated Engineering

PROJECT No.	2012-4123-01
SCALE	AS SHOWN
DRAWN	D. YANKECH
DESIGNED	D. TOWELLS

MANITOBA CONSERVATION & M.W.S.B.

STRUCTURAL
MAIN FLOOR PLAN

M.W.S.B. NO. 1093
MOOSE LAKE CAMPGROUND
WTP & FACILITY UPGRADES

DRAWING NUMBER	REV. NO.	SHEET
4123-01-301	0	9 / 24

GENERAL NOTES:

1. SITE CONFIRM DIMENSIONS. REPORT DISCREPANCIES TO ENGINEER.

REINFORCING STEEL NOTES:

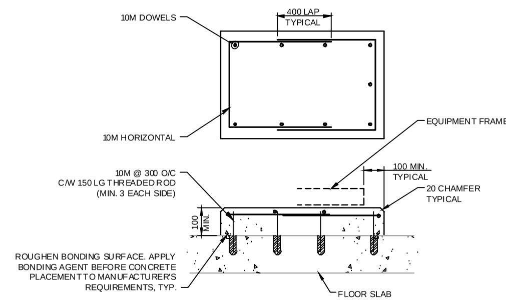
1. ALL REINFORCING STEEL TO BE CSA G30.18M GRADE 400R DEFORMED BARS EXCEPT COLUMN TIES AND BEAM STIRRUPS WHICH MAY BE GRADE 400W STEEL. ALL REINFORCING IS TO BE DETAILED IN ACCORDANCE WITH THE LATEST EDITION OF THE RSIC DETAILING MANUAL, EXCEPT OTHERWISE NOTED.
2. ALL REINFORCING TO BE EPOXY COATED.
3. ENSURE COVER TO REINFORCEMENT IS MAINTAINED DURING CONCRETE POUR.
4. ALL REINFORCING TO BE HELD IN PLACE, AND TIED BY THE USE OF PROPER ACCESSORIES, SUCH AS HI-CHAIRS, SPACERS, ETC. TO BE SUPPLIED BY THE REINFORCING STEEL FABRICATOR. HI-CHAIRS TO HAVE FOUR LEGS AND BE STAPLED OR NAILED TO THE FORMWORK.
5. SUBMIT SHOP DRAWINGS FOR REVIEW.
6. PLAIN ROUND BARS TO: CAN/CSA-G40.21.
7. DO NOT FIELD BEND OR FIELD WELD REINFORCEMENT EXCEPT WHERE INDICATED ON DRAWINGS OR AS AUTHORIZED BY ENGINEER.
8. REPLACE BARS WHICH DEVELOP CRACKS OR SPLITS.
9. CLEAN BARS FREE FROM LOOSE RUST, MUD, OIL, OR OTHER BOND REDUCING COATINGS.

FORMWORK NOTES:

1. VERIFY LINES, LEVELS AND CENTERS BEFORE PROCEEDING WITH FRAMEWORK/FALSEWORK AND ENSURE DIMENSIONS AGREE WITH DRAWINGS
2. INSPECT FORMWORK PRIOR TO PLACING CONCRETE TO ENDURE THAT IT IS PROPERLY PLACED, SUFFICIENTLY RIGID AND TIGHT, THOROUGHLY CLEANED, PROPERLY SURFACE TREATED AND FREE FROM SNOW, ICE, WATER OR OTHER FOREIGN MATERIALS.

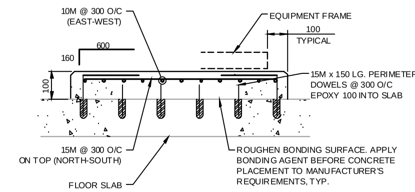
CONCRETE NOTES:

1. ALL CONCRETE IS TO BE MANUFACTURED AND INSTALLED IN ACCORDANCE WITH THE LATEST EDITION OF CAN/CSA-A23.1 "CONCRETE MATERIALS AND METHODS OF CONCRETE CONSTRUCTION" AND CAN3-CSA A23.2 "METHOD OF TEST FOR CONCRETE."
2. PROPORTION NORMAL DENSITY CONCRETE IN ACCORDANCE WITH CAN/CSA-A23.1, ALTERNATIVE 1 TO GIVE FOLLOWING QUALITY FOR ALL CONCRETE:
   - 2.1. CEMENT: TYPE GU PORTLAND CEMENT.
   - 2.2. MINIMUM COMPRESSIVE STRENGTH AT 28 DAYS: 30 MPa.
   - 2.3. TEMPERATURE: CONCRETE WHEN PLACED AT LEAST 10°C BUT NOT ABOVE 30°C.
   - 2.4. MIX DESIGN TO MINIMIZE SHRINKAGE AND TO MAXIMIZE WATER TIGHTNESS.
3. PROVIDE HEATED ENCLOSURE FOR THE CONCRETE WHENEVER AIR TEMPERATURE IS BELOW OR IS LIKELY TO FALL BELOW 5°C. MAINTAIN TEMPERATURE WITHIN HEATED ENCLOSURE FOR PLACED CONCRETE AT NOT LESS THAN 10°C FOR 5 DAYS.
4. SUBMIT CONCRETE MIX DESIGN FOR REVIEW.
5. MOIST CURE CONCRETE WORK FOR 7 DAYS MINIMUM, IN ACCORDANCE WITH CAN/CSA-23.1.
6. FINISH CONCRETE IN ACCORDANCE WITH CAN/CSA-23.1.

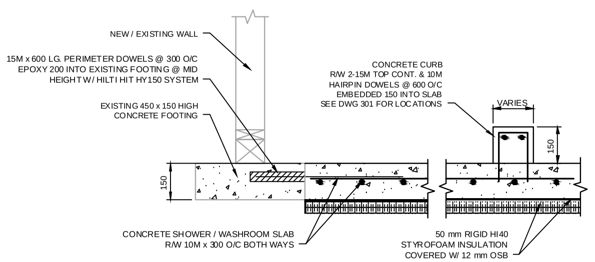

10M DOWELS
400 LAP
TYPICAL
10M HORIZONTAL
EQUIPMENT FRAME
10M @ 300 O/C
C/W 150 LG THREADED ROD
(MIN. 3 EACH SIDE)
100 MIN.
TYPICAL
20 CHAMFER
TYPICAL
100
MIN.
ROUGHEN BONDING SURFACE. APPLY
BONDING AGENT BEFORE CONCRETE
PLACEMENT TO MANUFACTURER'S
REQUIREMENTS, TYP.
FLOOR SLAB

CONTRACTOR TO COORDINATE LAYOUT, DIMENSIONS AND ANCHORAGE OF HOUSEKEEPING PADS FOR EACH PIECE OF EQUIPMENT

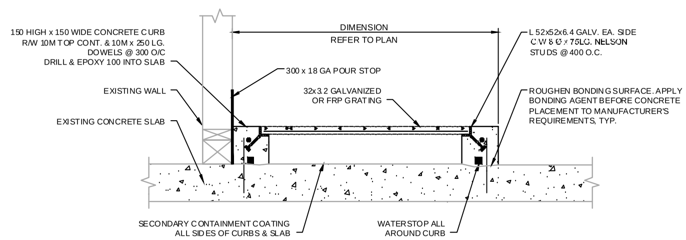
1 DETAIL — NTS
STANDARD HOUSEKEEPING PAD


10M @ 300 O/C
(EAST-WEST)
600
160
100
EQUIPMENT FRAME
100
TYPICAL
15M x 150 LG. PERIMETER
DOWELS @ 300 O/C
EPOXY 100 INTO SLAB
15M @ 300 O/C
ON TOP (NORTH-SOUTH)
FLOOR SLAB
ROUGHEN BONDING SURFACE. APPLY
BONDING AGENT BEFORE CONCRETE
PLACEMENT TO MANUFACTURER'S
REQUIREMENTS, TYP.

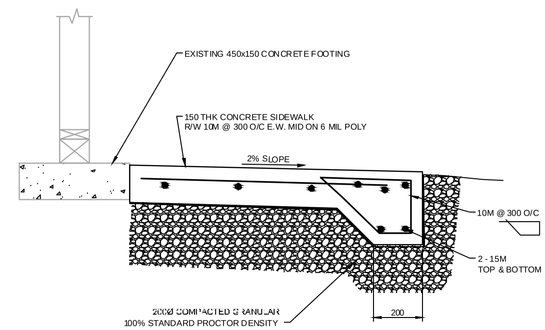
2 DETAIL — NTS
STRUCTURAL HOUSEKEEPING PAD


NEW / EXISTING WALL
15M x 600 LG. PERIMETER DOWELS @ 300 O/C
EPOXY 200 INTO EXISTING FOOTING @ MID
HEIGHT W/ HILTI HIT HY150 SYSTEM
EXISTING 450 x 150 HIGH
CONCRETE FOOTING
CONCRETE CURB
R/W 2-15M TOP CONT. & 10M
HAIRPIN DOWELS @ 600 O/C
EMBEDDED 150 INTO SLAB
SEE DWG 301 FOR LOCATIONS
VARIES
150
150
CONCRETE SHOWER / WASHROOM SLAB
R/W 10M x 300 O/C BOTH WAYS
50 mm RIGID HI40
STYROFOAM INSULATION
COVERED W/ 12 mm OSB

3 DETAIL — NTS
CONCRETE SLAB & CURB


150 HIGH x 150 WIDE CONCRETE CURB
R/W 10M TOP CONT. & 10M x 250 LG.
DOWELS @ 300 O/C
DRILL & EPOXY 100 INTO SLAB
EXISTING WALL
EXISTING CONCRETE SLAB
DIMENSION
REFER TO PLAN
300 x 18 GA POUR STOP
32x3.2 GALVANIZED
OR FRP GRATING
L 52x52x6.4 GALV. EA. SIDE
C/W 6 Ø x 75LG. NELSON
STUDS @ 400 O.C.
ROUGHEN BONDING SURFACE. APPLY
BONDING AGENT BEFORE CONCRETE
PLACEMENT TO MANUFACTURER'S
REQUIREMENTS, TYP.
SECONDARY CONTAINMENT COATING
ALL SIDES OF CURBS & SLAB
WATERSTOP ALL
AROUND CURB

4 DETAIL — NTS
CONCRETE CONTAINMENT



5 DETAIL — NTS
SIDEWALK

DRAWING REDUCED TO HALF SIZE

NO.	DATE	ENG.	BY	SUBJECT
0	2012/09/28	K.A.	D.Y.	ISSUED FOR TENDER

REVISIONS

Associated Engineering

PROJECT No.	2012-4123-01
SCALE	AS SHOWN
DRAWN	D. YANKECH
DESIGNED	D. TOWELLS

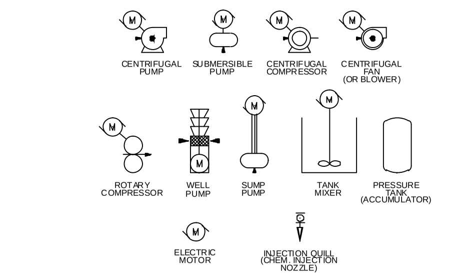
MANITOBA CONSERVATION & M.W.S.B.

STRUCTURAL NOTES & DETAILS

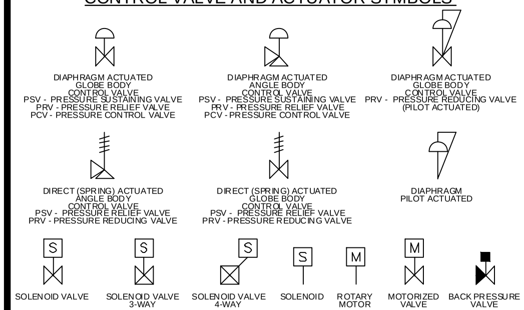
M.W.S.B. NO. 1093
MOOSE LAKE CAMPGROUND
WTP & FACILITY UPGRADES

DRAWING NUMBER	REV. NO.	SHEET
4123-01-302	0	10 / 24

EQUIPMENT SYMBOLS

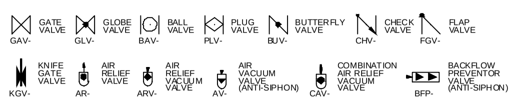


CONTROL VALVE AND ACTUATOR SYMBOLS



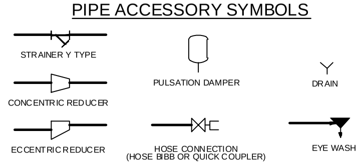
DIAPHRAGM ACTUATED GLOBE BODY CONTROL VALVE
PSV - PRESSURE SUSTAINING VALVE
PRV - PRESSURE RELIEF VALVE
PCV - PRESSURE CONTROL VALVE
DIAPHRAGM ACTUATED ANGLE BODY CONTROL VALVE
PSV - PRESSURE SUSTAINING VALVE
PRV - PRESSURE RELIEF VALVE
PCV - PRESSURE CONTROL VALVE
DIAPHRAGM ACTUATED GLOBE BODY CONTROL VALVE
PRV - PRESSURE REDUCING VALVE (PILOT ACTUATED)
DIRECT (SPRING) ACTUATED ANGLE BODY CONTROL VALVE
PSV - PRESSURE RELIEF VALVE
PRV - PRESSURE REDUCING VALVE
DIRECT (SPRING) ACTUATED GLOBE BODY CONTROL VALVE
PSV - PRESSURE RELIEF VALVE
PRV - PRESSURE REDUCING VALVE
DIAPHRAGM PILOT ACTUATED
SOLENOID VALVE
SOLENOID VALVE 3-WAY
SOLENOID VALVE 4-WAY
SOLENOID
ROTARY MOTOR
MOTORIZED VALVE
BACK PRESSURE VALVE

VALVE SYMBOLS AND IDENTIFICATION TAGS

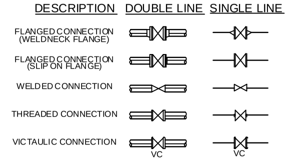


GATE VALVE GAV-
GLOBE VALVE GLV-
BALL VALVE BAV-
PLUG VALVE PLV-
BUTTERFLY VALVE BUV-
CHECK VALVE CHV-
FLAP VALVE FGV-
KNIFE GATE VALVE KGV-
AIR RELIEF VALVE AR-
AIR RELIEF VACUUM VALVE ARV-
AIR VACUUM VALVE (ANTI-SIPHON) AV-
COMBINATION AIR RELIEF VACUUM VALVE CAV-
BACKFLOW PREVENTOR VALVE (ANTI-SIPHON) BFP-

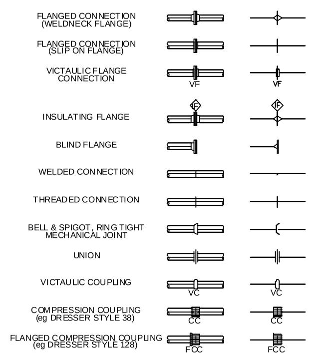
PIPE ACCESSORY SYMBOLS



PIPE TO VALVE CONNECTIONS

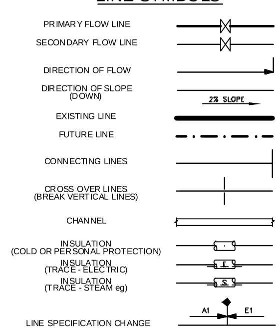


PIPE TO PIPE (OR FITTINGS) CONNECTIONS



DESCRIPTION
DOUBLE LINE
SINGLE LINE
FLANGED CONNECTION (WELDNECK FLANGE)
FLANGED CONNECTION (SLIP ON FLANGE)
VICTAULIC FLANGE CONNECTION
VF
VF
INSULATING FLANGE
BLIND FLANGE
WELDED CONNECTION
THREADED CONNECTION
BELL & SPIGOT, RING TIGHT MECHANICAL JOINT
UNION
VICTAULIC COUPLING
VC
VC
COMPRESSION COUPLING (eg DRESSER STYLE 38)
CC
CC
FLANGED COMPRESSION COUPLING (eg DRESSER STYLE 128)
FCC
FCC

LINE SYMBOLS



PRIMARY FLOW LINE
SECONDARY FLOW LINE
DIRECTION OF FLOW
DIRECTION OF SLOPE (DOWN)
2% SLOPE
EXISTING LINE
FUTURE LINE
CONNECTING LINES
CROSS OVER LINES (BREAK VERTICAL LINES)
CHANNEL
INSULATION (COLD OR PERSONAL PROTECTION)
INSULATION (TRACE - ELECTRIC)
INSULATION (TRACE - STEAM eg)
LINE SPECIFICATION CHANGE
A1
E1

PROCESS MECHANICAL - COMMODITY SYMBOLS

SYMBOL	COMMODITY
ASW	ALUM SOLUTION WASTE
AWS	AIR WASH SUPPLY
BWS	BACKWASH SUPPLY WATER
BWW	BACKWASH WASTE WATER
CLL	CHLORINE LIQUID
CLS	CHLORINE SOLUTION
DCW	DOMESTIC COLD WATER
DHW	DOMESTIC HOT WATER
DR	DRAIN
FEF	FILTER EFFLUENT WATER
FIL	FILTERED WATER
FIN	FILTER INFLUENT WATER
FTW	FILTER TO WASTE
FWD	FILTER TO WASTE DRAIN
NGH	NATURAL GAS HIGH PRESSURE
NGL	NATURAL GAS LOW PRESSURE
PW	POTABLE WATER (SAFE FOR HUMAN CONSUMPTION)
RW	RAW WATER (NOT SAFE FOR HUMAN CONSUMPTION)
SD	STORM DRAIN
SHS	SODIUM HYPOCHLORITE SOLUTION
SW	SANITARY WASTE

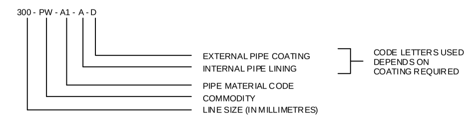
PIPE MATERIAL CODE

CODE	MATERIAL AND FLANGE RATING
A1	STEEL PIPE 900mmØ & SMALLER - 40°C 150 POUND FLANGE RATING
A2	STEEL PIPE 900mmØ & SMALLER - 40°C 300 POUND FLANGE RATING
A3	STEEL PIPE 1050mmØ & LARGER - 40°C 150 POUND FLANGE RATING PIPE & FLANGE SPEC TO AWWA STANDARDS
A4	STEEL PIPE 1050mmØ & LARGER - 40°C 300 POUND FLANGE RATING PIPE & FLANGE SPEC TO AWWA STANDARDS
A5	STEEL PIPE 600mmØ & SMALLER - 130°C 150 POUND FLANGE RATING
A6	STEEL PIPE 600mmØ & SMALLER - 130°C 300 POUND FLANGE RATING
A7	STEEL PIPE 300Ø & SMALLER - 40°C AI PIPE CODE VICTAULIC COUPLED
A8	STEEL PIPE 100Ø & SMALLER - 40°C A2 PIPE CODE CHLORINE GAS, CARBON DIOXIDE GAS
A1A	STEEL PIPE 200Ø & SMALLER - 40°C 150 POUND FLANGE RATING GAS SERVICE ONLY
A1G	GALVANIZED STEEL PIPE 100Ø & SMALLER - 40°C 150 POUND FLANGE RATING
B1	CONCRETE PIPE STEEL REINFORCED (HYPRESCON TYPE)
C1	CONCRETE PIPE - GRAVITY SERVICE
D1	-
E1	PVC PIPE (PRESSURE PIPE)
E2	PVC PIPE - GRAVITY SERVICE
E3	POLYETHYLENE PIPE
E4	
E5	PLASTIC FLEXIBLE TUBING IN PVC CONDUIT (DOUBLE CONTAINMENT)
E6	RUBBER HOSE
E7	PLASTIC WEEPING TILE PIPE
F1	CAST IRON PRESSURE PIPE
F2	CAST IRON DRAINAGE PIPE
F3	DUCTILE IRON PIPE - PRESSURE SERVICE
G1	COPPER PIPE - TYPE K
G2	COPPER PIPE - TYPE L
H1	STAINLESS STEEL PIPE HIA-SS Sch 10
H2	STAINLESS STEEL PIPE HIB-SS Sch 40
H3	STAINLESS STEEL TUBING - Sch 40
P1	PLASTIC DWV, COPPER DWV, CAST IRON DWV PLUMBING SERVICE

VALVE SYMBOLS

SYMBOL	VALVE
AR	AIR RELEASE VALVE
ARV	AIR RELEASE / VACUUM VALVE
AV	AIR VACUUM VALVE (ANTI-SYPHON)
BAV	BALL VALVE
BBV	BLOCK & BLEED VALVE
BUV	BUTTERFLY VALVE
BWV	BACK WATER VALVE
CHV	CHECK VALVE
FGV	FLAP GATE VALVE
GAV	GATE VALVE
GLV	GLOBE VALVE
KGV	KNIFE GATE VALVE
PLV	PLUG VALVE
SG	SLUICE GATE VALVE
SGV	SLIDE GATE VALVE
SV	SOLENOID VALVE
TWSV	THREE WAY SOLENOID VALVE
TWBV	THREE WAY BALL VALVE

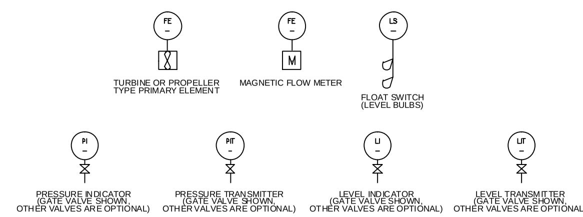
LINE IDENTIFICATION



PIPE TREATMENT CODE

CODE	DESCRIPTION
A	CEMENT MORTAR LINED (40 TO 900mmØ PIPE)
B	INTERNAL HOT COAL TAR ENAMEL
C	INTERNAL EPOXY LINED
D	YELLOW JACKET (20 TO 600mmØ PIPE)
E	EXTERNAL COAL TAR ENAMEL
F	EXTERNAL EPOXY
G	INSULATION
I	INSULATION c/w JACKET (HIGH TEMP)

FLOW AND METERING SYMBOLS



FE
TURBINE OR PROPELLER TYPE PRIMARY ELEMENT
FE
M
MAGNETIC FLOW METER
LS
FLOAT SWITCH (LEVEL BULBS)
PI
PRESSURE INDICATOR (GATE VALVE SHOWN, OTHER VALVES ARE OPTIONAL)
PIT
PRESSURE TRANSMITTER (GATE VALVE SHOWN, OTHER VALVES ARE OPTIONAL)
LI
LEVEL INDICATOR (GATE VALVE SHOWN, OTHER VALVES ARE OPTIONAL)
LIT
LEVEL TRANSMITTER (GATE VALVE SHOWN, OTHER VALVES ARE OPTIONAL)

DRAWING REDUCED TO HALF SIZE

NO.	DATE	ENG.	BY	SUBJECT
0	2012/09/28	K.A.	D.Y.	ISSUED FOR TENDER

REVISIONS

Associated Engineering

PROJECT No.	2012-4123-01
SCALE	NA
DRAWN	NA
DESIGNED	NA

MANITOBA CONSERVATION & M.W.S.B.

PROCESS MECHANICAL LEGEND

M.W.S.B. NO. 1093
MOOSE LAKE CAMPGROUND
WTP & FACILITY UPGRADES

DRAWING NUMBER	REV. NO.	SHEET
4123-01-401	0	11 / 24

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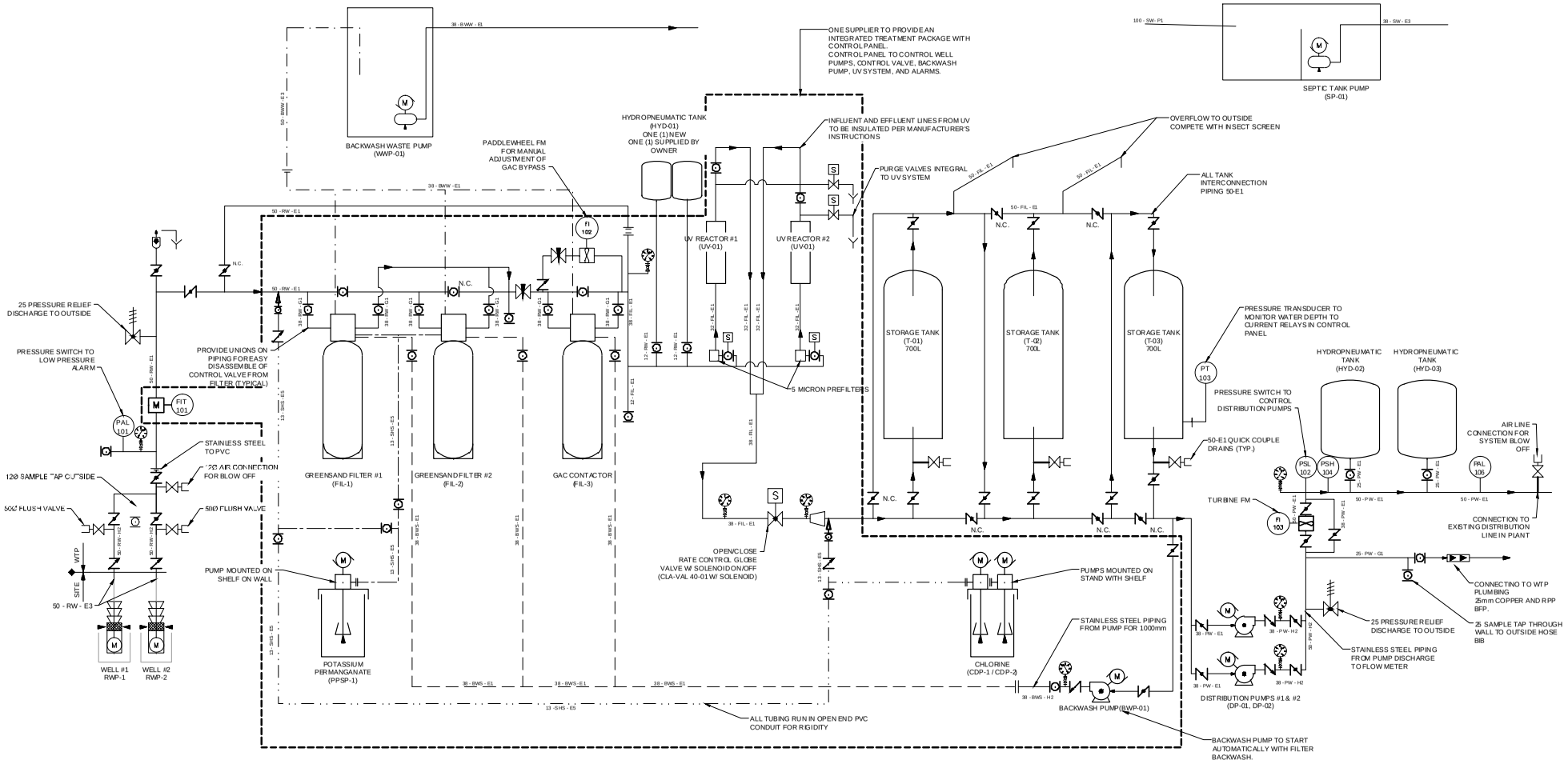
DATE: 2012-09-28, Desiree Yamada



DRAWING REDUCED TO HALF SIZE

NO.	DATE	ENG.	BY	SUBJECT
0	20120809	K.A	G.Y.	ISSUED FOR TENDER

REVISIONS

Associated Engineering

PROJECT No.	2012-4123-01
SCALE	AS SHOWN
DRAWN	K. ANDERSON
DESIGNED	K. ANDERSON

MANITOBA CONSERVATION & M.W.S.B.

PROCESS MECHANICAL
PROCESS FLOW DIAGRAM

M.W.S.B. NO. 1093
MOOSE LAKE CAMPGROUND
WTP & FACILITY UPGRADES

DRAWING NUMBER	REV. NO.	SHEET
4123-01-402	0	12 / 24

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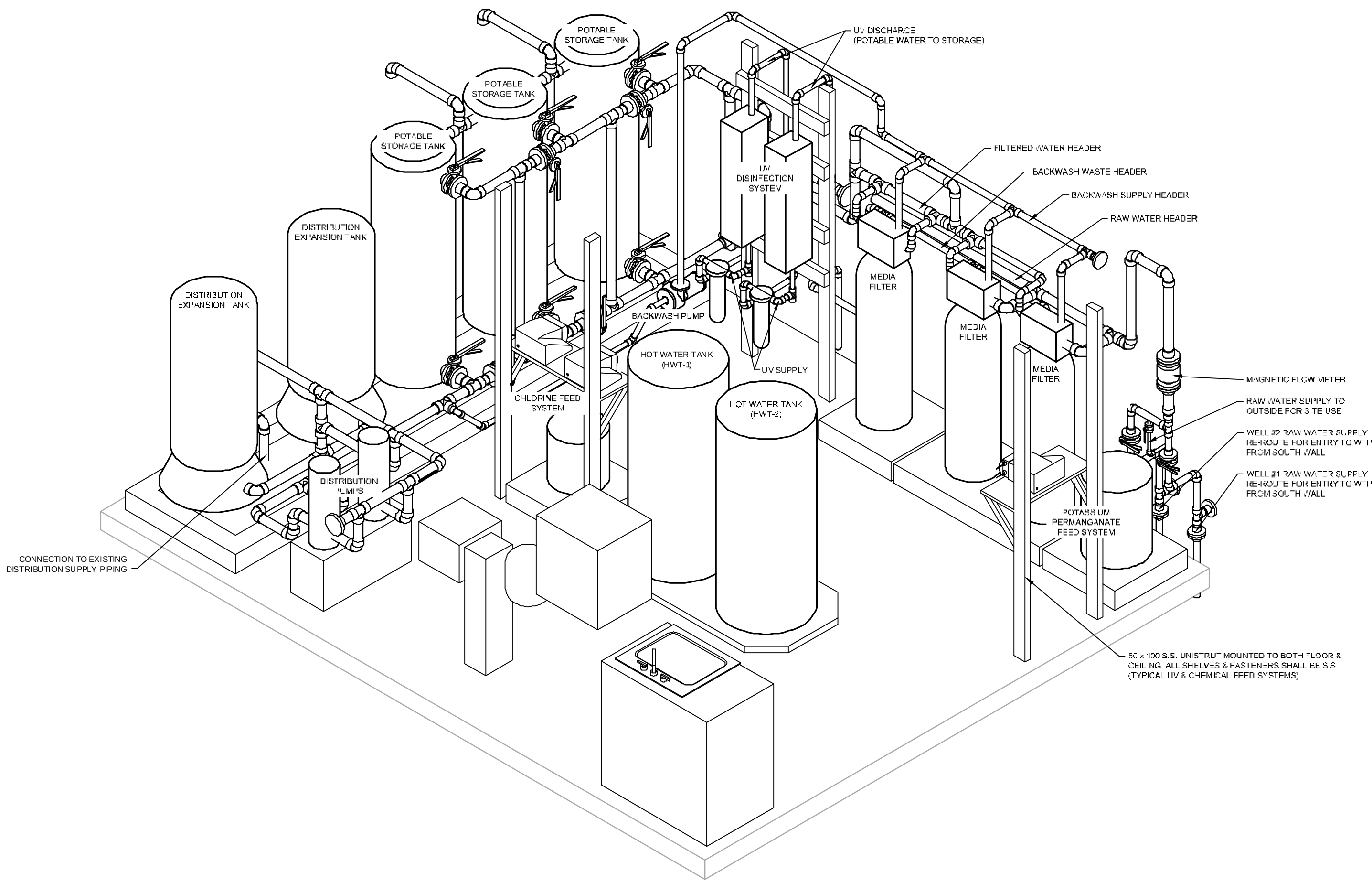
DATE: 2012-08-27 Dominik Tuerkes

NOTES:

1. PIPING TO/FROM TREATMENT EQUIPMENT MAY NOT BE EXACTLY AS ILLUSTRATED.
2. PROCESS DRAWINGS TO BE USED IN CONJUNCTION WITH EQUIPMENT MANUFACTURER INSTALLATION REQUIREMENTS.


POTABLE STORAGE TANK
POTABLE STORAGE TANK
POTABLE STORAGE TANK
DISTRIBUTION EXPANSION TANK
DISTRIBUTION EXPANSION TANK
UV DISCHARGE (POTABLE WATER TO STORAGE)
UV DISINFECTION SYSTEM
FILTERED WATER HEADER
BACKWASH WASTE HEADER
BACKWASH SUPPLY HEADER
RAW WATER HEADER
MEDIA FILTER
MEDIA FILTER
MEDIA FILTER
BACKWASH PUMP
HOT WATER TANK (HWT-1)
HOT WATER TANK (HWT-2)
UV SUPPLY
CHLORINE FEED SYSTEM
DISTRIBUTION PUMPS
MAGNETIC FLOW METER
RAW WATER SUPPLY TO OUTSIDE FOR SITE USE
WELL #2 RAW WATER SUPPLY RE-ROUTE FOR ENTRY TO WTP FROM SOUTH WALL
WELL #1 RAW WATER SUPPLY RE-ROUTE FOR ENTRY TO WTP FROM SOUTH WALL
POTASSIUM PERMANGANATE FEED SYSTEM
CONNECTION TO EXISTING DISTRIBUTION SUPPLY PIPING
50 x 100 S.S. UNISTRUT MOUNTED TO BOTH FLOOR & CEILING. ALL SHELVES & FASTENERS SHALL BE S.S. (TYPICAL UV & CHEMICAL FEED SYSTEMS)

1 VIEW 1:15
WTP MAIN FLOOR

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NO.	DATE	ENG.	BY	SUBJECT
0	2012/09/28	K.A.	D.Y.	ISSUED FOR TENDER

REVISIONS

Associated Engineering

PROJECT No.	2012-4123-01
SCALE	AS SHOWN
DRAWN	D. YANKECH
DESIGNED	K. ANDERSON

MANITOBA CONSERVATION & M.W.S.B.

PROCESS MECHANICAL
WTP MAIN FLOOR PLAN - 3D ISOMETRIC

M.W.S.B. NO. 1093
MOOSE LAKE CAMPGROUND
WTP & FACILITY UPGRADES

DRAWING NUMBER	REV. NO.	SHEET
4123-01-403	0	13 / 24

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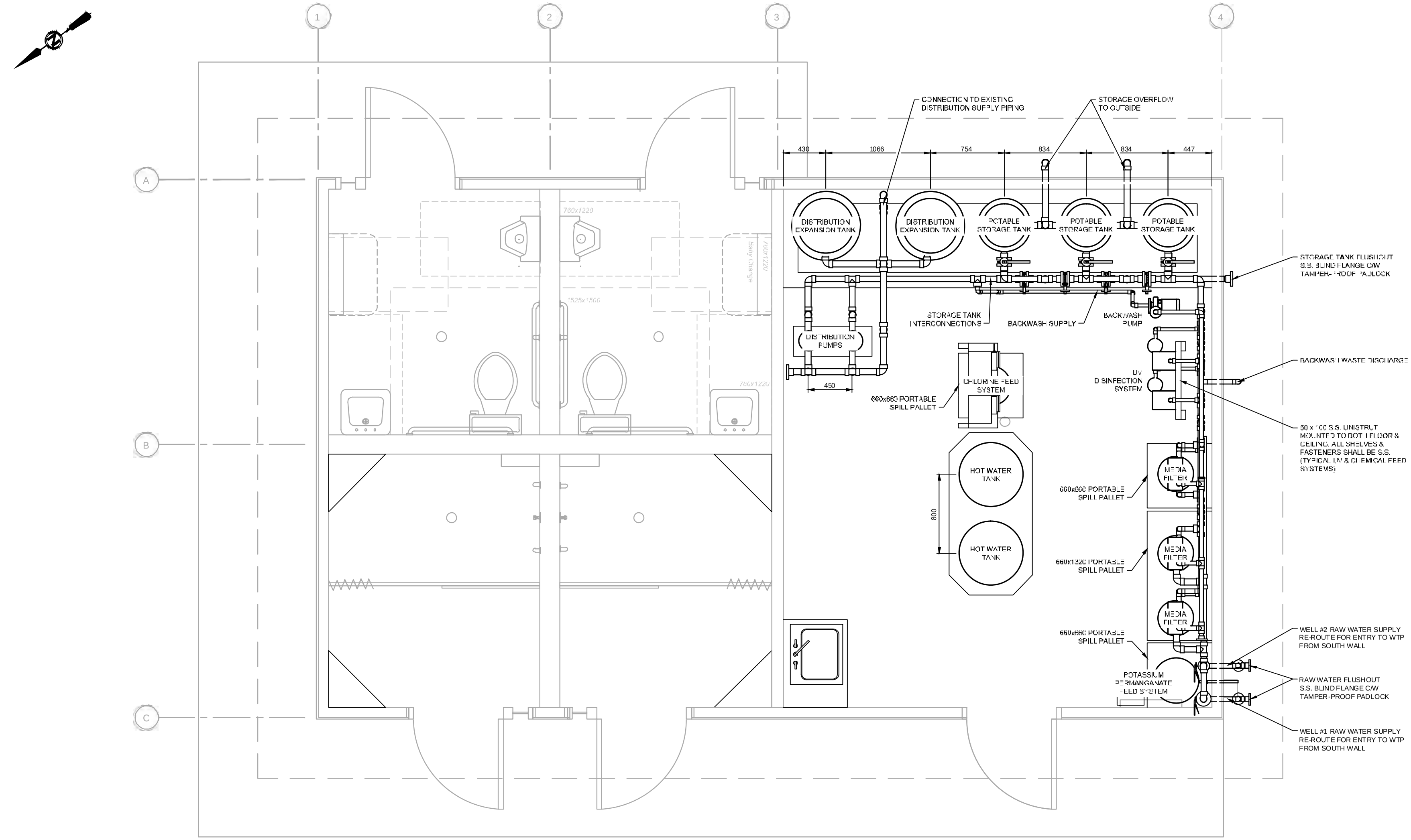
DATE: 2012-09-25 , Dwayne Yankech



CONNECTION TO EXISTING DISTRIBUTION SUPPLY PIPING
STORAGE OVERFLOW TO OUTSIDE
430
1066
754
834
834
447
DISTRIBUTION EXPANSION TANK
DISTRIBUTION EXPANSION TANK
POTABLE STORAGE TANK
POTABLE STORAGE TANK
POTABLE STORAGE TANK
STORAGE TANK FLUSHOUT S.S. BLIND FLANGE C/W TAMPER-PROOF PADLOCK
STORAGE TANK INTERCONNECTIONS
BACKWASH SUPPLY
BACKWASH PUMP
DISTRIBUTION PUMPS
450
660x660 PORTABLE SPILL PALLET
BACKWASH WASTE DISCHARGE
UV DISINFECTION SYSTEM
50 x 100 S.S. UNISTRUT MOUNTED TO BOTH FLOOR & CEILING. ALL SHELVES & FASTENERS SHALL BE S.S. (TYPICAL UV & CHEMICAL FEED SYSTEMS)
HOT WATER TANK
HOT WATER TANK
800
MEDIA FILTER
660x660 PORTABLE SPILL PALLET
660x1320 PORTABLE SPILL PALLET
660x660 PORTABLE SPILL PALLET
POTASSIUM PERMANGANATE FEED SYSTEM
WELL #2 RAW WATER SUPPLY RE-ROUTE FOR ENTRY TO WTP FROM SOUTH WALL
RAW WATER FLUSHOUT S.S. BLIND FLANGE C/W TAMPER-PROOF PADLOCK
WELL #1 RAW WATER SUPPLY RE-ROUTE FOR ENTRY TO WTP FROM SOUTH WALL
700x1220
Baby Change
1525x1560
1
2
3
4
A
B
C
N

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DESIGNED	K. ANDERSON

MANITOBA CONSERVATION & M.W.S.B.

PROCESS MECHANICAL
WTP MAIN FLOOR PLAN

M.W.S.B. NO. 1093
MOOSE LAKE CAMPGROUND
WTP & FACILITY UPGRADES

DRAWING NUMBER	REV. NO.	SHEET
4123-01-404	0	14 / 24

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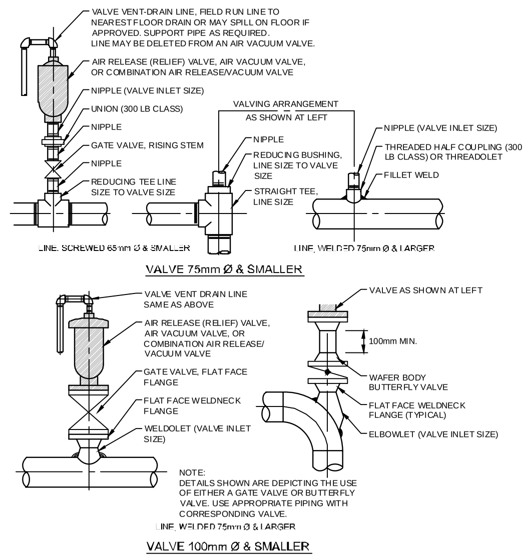
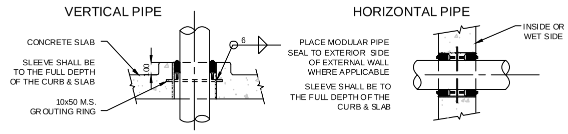
DATE: 2012-09-28, Desiree Yankech



VALVE VENT-DRAIN LINE, FIELD RUN LINE TO NEAREST FLOOR DRAIN OR MAY SPILL ON FLOOR IF APPROVED. SUPPORT PIPE AS REQUIRED. LINE MAY BE DELETED FROM AN AIR VACUUM VALVE.
AIR RELEASE (RELIEF) VALVE, AIR VACUUM VALVE, OR COMBINATION AIR RELEASE/VACUUM VALVE
NIPPLE (VALVE INLET SIZE)
UNION (300 LB CLASS)
NIPPLE
GATE VALVE, RISING STEM
NIPPLE
REDUCING TEE LINE SIZE TO VALVE SIZE
LINE SCREWED 65mm Ø & SMALLER
VALVING ARRANGEMENT AS SHOWN AT LEFT
NIPPLE
REDUCING BUSHING, LINE SIZE TO VALVE SIZE
STRAIGHT TEE, LINE SIZE
NIPPLE (VALVE INLET SIZE)
THREADED HALF COUPLING (300 LB CLASS) OR THREADOLET
FILLET WELD
LINE WELDED 75mm Ø & LARGER
VALVE 75mm Ø & SMALLER
VALVE VENT DRAIN LINE SAME AS ABOVE
AIR RELEASE (RELIEF) VALVE, AIR VACUUM VALVE, OR COMBINATION AIR RELEASE/ VACUUM VALVE
GATE VALVE, FLAT FACE FLANGE
FLAT FACE WELDNECK FLANGE
WELDOLET (VALVE INLET SIZE)
VALVE AS SHOWN AT LEFT
100mm MIN.
WAFER BODY BUTTERFLY VALVE
FLAT FACE WELDNECK FLANGE (TYPICAL)
ELBOWLET (VALVE INLET SIZE)
NOTE: DETAILS SHOWN ARE DEPICTING THE USE OF EITHER A GATE VALVE OR BUTTERFLY VALVE. USE APPROPRIATE PIPING WITH CORRESPONDING VALVE.
LINE WELDED 75mm Ø & LARGER
VALVE 100mm Ø & SMALLER

1 - DETAIL NTS
AIR VALVE CONNECTION



VERTICAL PIPE
HORIZONTAL PIPE
CONCRETE SLAB
SLEEVE SHALL BE TO THE FULL DEPTH OF THE CURB & SLAB
10x50 M.S. GROUTING RING
100
6
PLACE MODULAR PIPE SEAL TO EXTERIOR SIDE OF EXTERNAL WALL WHERE APPLICABLE
SLEEVE SHALL BE TO THE FULL DEPTH OF THE CURB & SLAB
INSIDE OR WET SIDE

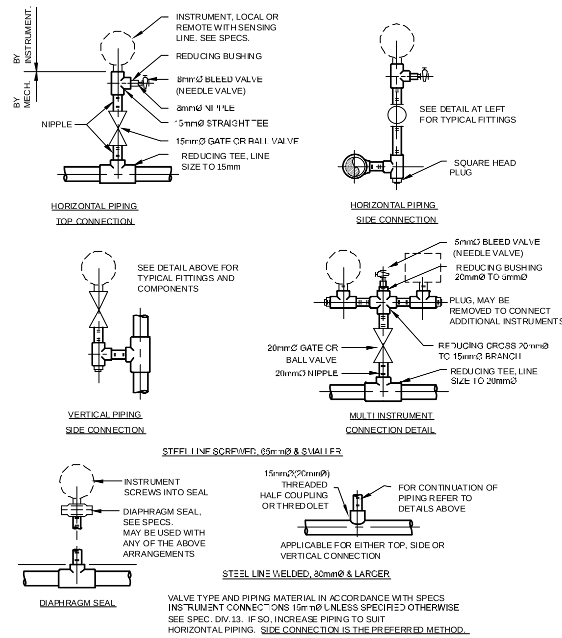
TABLE OF "LINK-SEAL" SERIES FOR STEEL PIPE
FOR OTHER SIZES AND MATERIALS SEE SUPPLIER'S TABLES*

STEEL PIPE		WALL SLEEVE	LINK-SEAL		STEEL PIPE		WALL SLEEVE	LINK-SEAL	
SIZE	ACTUAL O.D.	I.D.	LINKS / SEAL	MODEL NO.*	SIZE	ACTUAL O.D.	I.D.	LINKS PER SEAL	MODEL NO.*
13	21.3	52.5	4	LS-200-C	250	273.1	336.6	10	LS-425-C
20	26.7	62.7	5	LS-275-C	300	323.9	387.4	12	LS-425-C
25	33.4	62.7	5	LS-200-C	350	355.6	438.2	13	LS-400-C
32	42.2	77.9	7	LS-275-C	400	406.4	489.0	15	LS-400-C
38	48.3	90.1	5	LS-300-C	450	457.2	590.6	16	LS-500-C
50	60.3	102.3	6	LS-300-C	500	508.0	590.6	18	LS-400-C
75	89.0	128.2	8	LS-300-C	600	609.6	743	21	LS-500-C
100	114.3	154.1	10	LS-300-C	750	762.0	895	26	LS-500-C
125	141.3	202.7	6	LS-425-C	900	914.4	1048	30	LS-500-C
150	168.3	254.5	7	LS-400-C	1050	1066.8	1200	36	LS-500-C
200	219.1	304.8	12	LS-475-C	1200	1219.2	1353	41	LS-500-C

* USE FD OR FS MODEL FOR FIRE RATED SERVICE, REFER TO SUPPLIER FOR DETAIL.

APPLICATION NOTES:
1. CONCRETE WALL
2. STEEL, DUCTILE IRON, PVC OR FRP PIPE; NON-INSULATED
3. CONDITION
a) DRY TO DRY
b) WET TO DRY
c) DRY TO BELOW GRADE
4. GROUT RING REQ'D ONLY FOR PENETRATION IN WET AREAS OR BELOW GRADE.
5. LIQUID SIDE MUST PASS LEAKAGE TEST UNDER PRESSURE TO WHICH STRUCTURE IS SUBJECTED.
6. MODULAR "LINK-SEAL" PIPE SEAL SLEEVE TYPE SHALL BE AS PER MANUFACTURER'S RECOMMENDATION.
7. FOR BOTH DETAILS ALL PIPES SHALL BE SUPPORTED ON BOTH SIDES OF THE WALL OR FLOOR

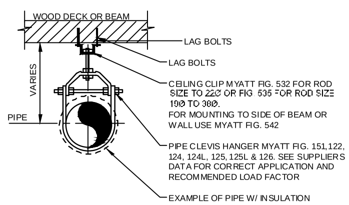
2 - DETAIL NTS
PIPES THROUGH CONCRETE



BY INSTRUMENT.
BY MECH.
INSTRUMENT, LOCAL OR REMOTE WITH SENSING LINE. SEE SPECS.
REDUCING BUSHING
8mmØ BLEED VALVE (NEEDLE VALVE)
8mmØ NIPPLE
15mmØ STRAIGHT TEE
15mmØ GATE OR BALL VALVE
REDUCING TEE, LINE SIZE TO 15mm
NIPPLE
HORIZONTAL PIPING TOP CONNECTION
SEE DETAIL AT LEFT FOR TYPICAL FITTINGS
SQUARE HEAD PLUG
HORIZONTAL PIPING SIDE CONNECTION
SEE DETAIL ABOVE FOR TYPICAL FITTINGS AND COMPONENTS
VERTICAL PIPING SIDE CONNECTION
5mmØ BLEED VALVE (NEEDLE VALVE)
REDUCING BUSHING 20mmØ TO 5mmØ
PLUG, MAY BE REMOVED TO CONNECT ADDITIONAL INSTRUMENTS
REDUCING CROSS 20mmØ TO 15mmØ BRANCH
20mmØ GATE OR BALL VALVE
20mmØ NIPPLE
REDUCING TEE, LINE SIZE TO 20mmØ
MULTI INSTRUMENT CONNECTION DETAIL
STEEL LINE SCREWED, 65mmØ & SMALLER
INSTRUMENT SCREWS INTO SEAL
DIAPHRAGM SEAL, SEE SPECS. MAY BE USED WITH ANY OF THE ABOVE ARRANGEMENTS
DIAPHRAGM SEAL
15mmØ(20mmØ) THREADED HALF COUPLING OR THREDOLET
FOR CONTINUATION OF PIPING REFER TO DETAILS ABOVE
APPLICABLE FOR EITHER TOP, SIDE OR VERTICAL CONNECTION
STEEL LINE WELDED, 80mmØ & LARGER

VALVE TYPE AND PIPING MATERIAL IN ACCORDANCE WITH SPECS.
INSTRUMENT CONNECTIONS 15mmØ UNLESS SPECIFIED OTHERWISE
SEE SPEC. DIV.13. IF SO, INCREASE PIPING TO SUIT
HORIZONTAL PIPING. SIDE CONNECTION IS THE PREFERRED METHOD.

3 - DETAIL NTS
INSTRUMENTATION CONNECTION



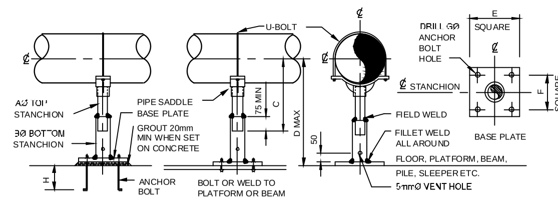
WOOD DECK OR BEAM
LAG BOLTS
LAG BOLTS
VARIES
PIPE
CEILING CLIP MYATT FIG. 532 FOR ROD SIZE TO 22Ø OR FIG. 535 FOR ROD SIZE 19Ø TO 30Ø.
FOR MOUNTING TO SIDE OF BEAM OR WALL USE MYATT FIG. 542
PIPE CLEVIS HANGER MYATT FIG. 151,122, 124, 124L, 125, 125L & 126. SEE SUPPLIERS DATA FOR CORRECT APPLICATION AND RECOMMENDED LOAD FACTOR
EXAMPLE OF PIPE W/ INSULATION

PIPE SIZE	10	15	20	25	30	40	50	65	80	100	150
CLEVIS No.	ROD Ø										
MYATT 122	10	10	10	10	10	10	10	13	13	13	
MYATT 124			10	10	10	10	10	13	13	16	19
MYATT 125									19	22	25
MYATT 126										19	19
MYATT 151		10	10	10	10	10	10	13	13	13	19

ANGLE	80x60x6	90x75x6	100x90x8	125x90x10
CHANNEL				
SPAN (mm)	S.L.	S.L.	S.L.	S.L.
600	1680kg	2364kg	3955kg	5455kg
900	1136kg	1590kg	2636kg	3818kg
1200	864kg	1182kg	1951kg	2864kg
1500	682kg	954kg	1590kg	2318kg
1800	545kg	772kg	1318kg	1909kg
2100		682kg	1136kg	1636kg
2400			1000kg	1455kg
2700			863kg	1272kg

NOTES:
MANUFACTURED COMPONENTS MAY BE ORDERED FROM MYATT OR MUELLER OR AS APPROVED.
S.L. IS THE SAFE TOTAL UNIFORMLY DISTRIBUTED LOAD IN KILOGRAMS W/ A MAXIMUM DEFLECTION OF 6 mm.
FABRICATED COMPONENTS SHALL BE SHOP PRIMED WITH 2 COATS RED OXIDE PRIMER OR GALVANIZED AS PER SPECS.

4 - DETAIL NTS
PIPE HANGERS

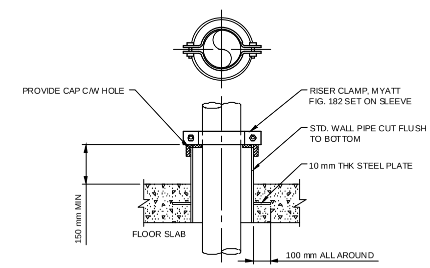


AS TOP STANCHION
30 BOTTOM STANCHION
PIPE SADDLE
BASE PLATE
GROUT 20mm MIN WHEN SET ON CONCRETE
ANCHOR BOLT
H
U-BOLT
75 MIN
C
D MAX
50
BOLT OR WELD TO PLATFORM OR BEAM
DRILL GØ ANCHOR BOLT HOLE
E SQUARE
F SQUARE
STANCHION
FIELD WELD
FILLET WELD ALL AROUND
BASE PLATE
FLOOR, PLATFORM, BEAM, PILE, SLEEPER ETC.
5mmØ VENT HOLE

NOTES: STANCHION MATERIAL SCH. 40 PIPE, OR AS PER SPECIFICATIONS.
BASE PLATE - CARBON STEEL
SHOP PRIME - 2 COATS RED OXIDE PRIMER OR GALVANIZED AS PER SPECIFICATIONS
TOUCH UP FIELD WELDS WITH PRIMER OR GALVICON
PIPE STANCHION SADDLE - MAY BE MYATT FIG. 306/306S OR MUELLER (ANVIL) FIG. 259/265

PIPE SIZE	100	125	150	200	250	300	350	400	450	500	600	750	900	-
A	80	80	80	80	80	80	80	80	90	90	100	100	100	-
B	100	100	100	100	100	100	100	100	150	150	150	150	150	-
C MIN	240	255	270	310	350	370	380	425	485	510	590	670	745	-
C MAX	350	370	390	425	460	485	515	540	600	625	705	785	860	-
D MAX	1200	1200	1200	1200	1200	1200	1200	1200	1850	1850	1850	1850	1850	-
THICK x E SQUARE	10mm x 250	10mm x 250	10mm x 250	10mm x 250	10mm x 250	10mm x 250	10mm x 250	10mm x 250	10mm x 250	10mm x 250	10mm x 250	10mm x 250	10mm x 250	-
F SQUARE	200	200	200	200	200	200	200	200	200	200	200	200	200	-
G DIAM. x No. HOLES	20 DIAMETER x 4													
BOLT DIAM. x H	M16x100 GALVANIZED OR AS APPROVED EXIST. CONCRETE USE M16 HSL HILTI													

5 - DETAIL NTS
PIPE STANDS



NOTE:
REFER TO CLAMP MANUFACTURERS DATA FOR CORRECT SIZE AND RECOMMENDED LOAD.
LUG PLATES MAY BE REPLACED BY TACK WELDING (EQUAL STRENGTH) CLAMP TO PIPE, IF APPROVED BY ENGINEER.
GRINNEL CLAMPS MAY BE USED AS AN APPROVED ALTERNATE.
TURN CLAMPS SO THAT ENDS EXTENDING OVER SLEEVE DO NOT PROJECT INTO WALKWAYS.
IF THIS IS NOT POSSIBLE, CUT END BACK 25 mm PROJECTION PASSED SLEEVE.

6 - DETAIL NTS
PIPES THROUGH CONCRETE

DRAWING REDUCED TO HALF SIZE

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0	20120928	K.A.	D.Y.	ISSUED FOR TENDER

REVISIONS

Associated Engineering

PROJECT No.	2012-4123-01
SCALE	AS SHOWN
DRAWN	D. YANKECH
DESIGNED	K. ANDERSON

MANITOBA CONSERVATION & M.W.S.B.

PROCESS MECHANICAL DETAILS

M.W.S.B. NO. 1093
MOOSE LAKE CAMPGROUND
WTP & FACILITY UPGRADES

DRAWING NUMBER	REV. NO.	SHEET
4123-01-405	0	15 / 24

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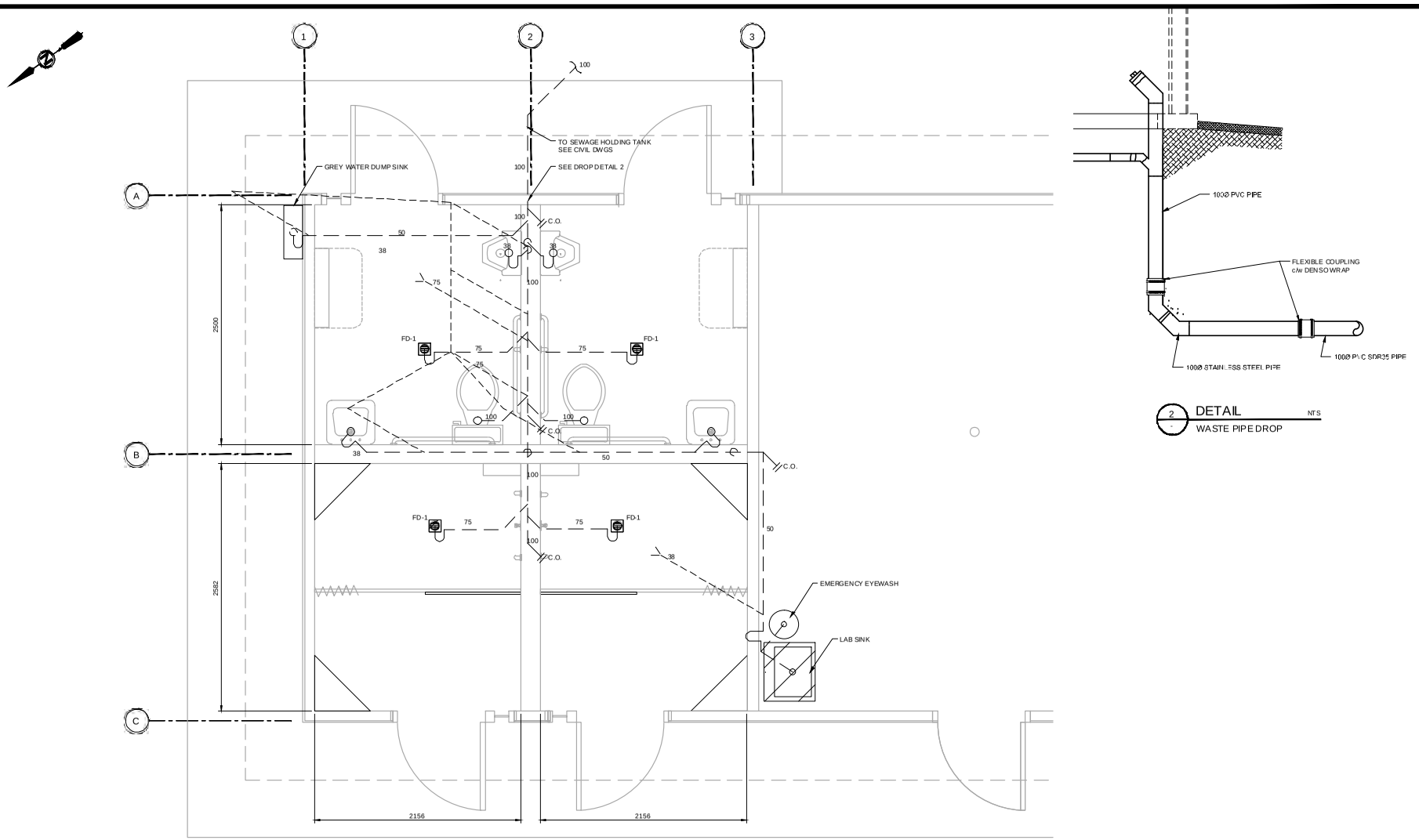
DATE: 2012-09-28, Drawn: Yankech



1 PLAN 1:20
MAIN FLOOR DRAINAGE

2 DETAIL NTS
WASTE PIPE DROP

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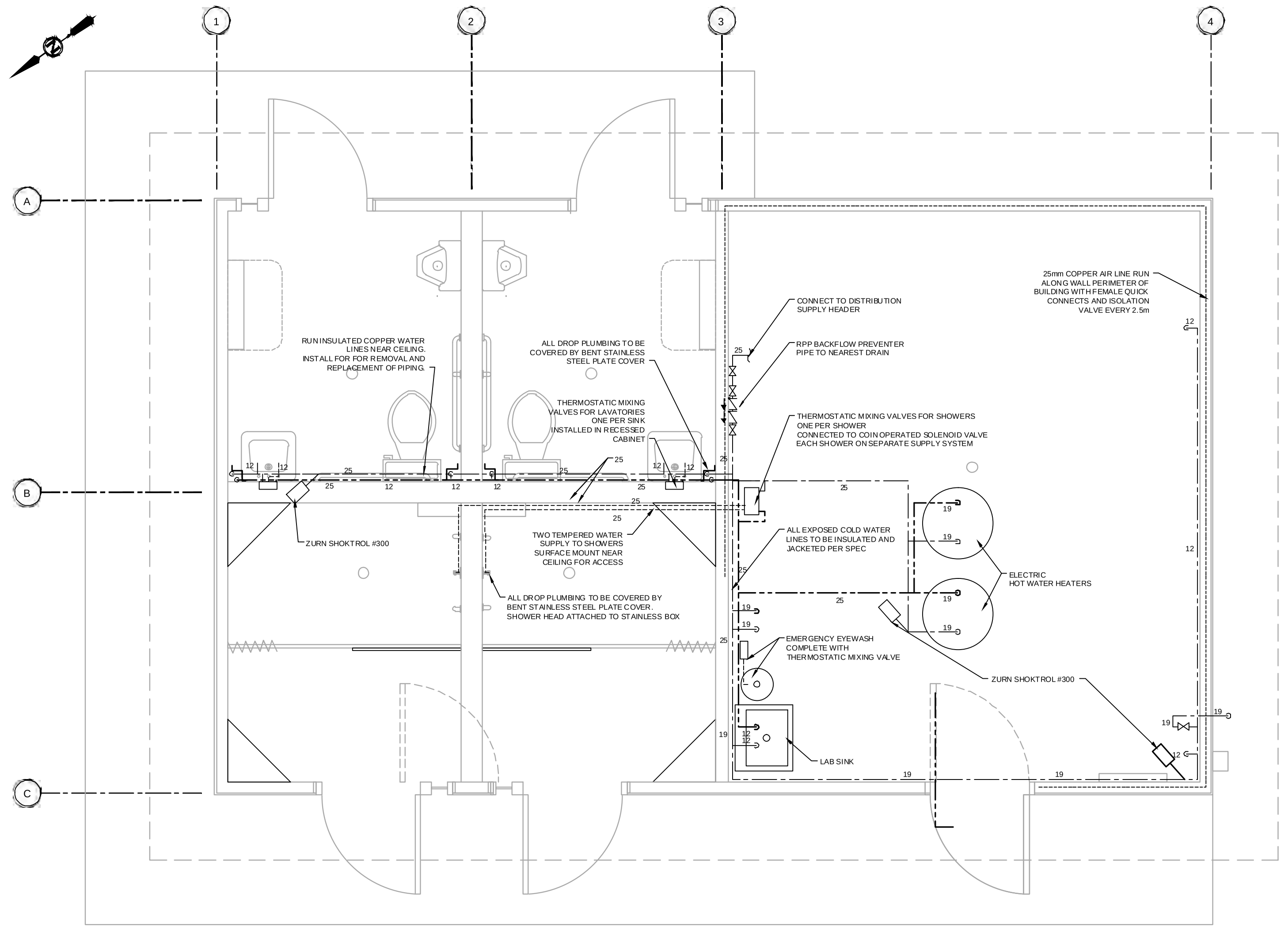
MANITOBA CONSERVATION & M.W.S.B.

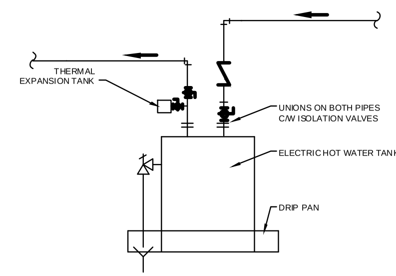
BUILDING MECHANICAL
MAIN FLOOR PLAN - DRAINAGE

M.W.S.B. NO. 1093
MOOSE LAKE CAMPGROUND
WTP & FACILITY UPGRADES

DRAWING NUMBER	REV. NO.	SHEET
4123-01-501	0	16 / 24


1
2
3
4
A
B
C
RUN INSULATED COPPER WATER LINES NEAR CEILING. INSTALL FOR FOR REMOVAL AND REPLACEMENT OF PIPING.
ALL DROP PLUMBING TO BE COVERED BY BENT STAINLESS STEEL PLATE COVER
THERMOSTATIC MIXING VALVES FOR LAVATORIES ONE PER SINK INSTALLED IN RECESSED CABINET
ZURN SHOKTROL #300
TWO TEMPERED WATER SUPPLY TO SHOWERS SURFACE MOUNT NEAR CEILING FOR ACCESS
ALL DROP PLUMBING TO BE COVERED BY BENT STAINLESS STEEL PLATE COVER. SHOWER HEAD ATTACHED TO STAINLESS BOX
CONNECT TO DISTRIBUTION SUPPLY HEADER
RPP BACKFLOW PREVENTER PIPE TO NEAREST DRAIN
THERMOSTATIC MIXING VALVES FOR SHOWERS ONE PER SHOWER CONNECTED TO COIN OPERATED SOLENOID VALVE EACH SHOWER ON SEPARATE SUPPLY SYSTEM
ALL EXPOSED COLD WATER LINES TO BE INSULATED AND JACKETED PER SPEC
ELECTRIC HOT WATER HEATERS
EMERGENCY EYEWASH COMPLETE WITH THERMOSTATIC MIXING VALVE
LAB SINK
ZURN SHOKTROL #300
25mm COPPER AIR LINE RUN ALONG WALL PERIMETER OF BUILDING WITH FEMALE QUICK CONNECTS AND ISOLATION VALVE EVERY 2.5m

1 PLAN 1:20
MAIN FLOOR PLUMBING



2 DETAIL NTS
HOT WATER HEATER PIPING

NOTES:

1. BUILDING IS SEASONAL IT IS CLOSED OCTOBER-MAY. ALL PLUMBING AND DRAIN LINES TO BE DESIGNED FOR EASY DRAINING, ACCESS, AND BLOW OUT. AIR LINE CONNECTIONS AND BLEED VALVES ARE TO BE PROVIDED AT KEY LOCATIONS.

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BUILDING MECHANICAL
MAIN FLOOR PLAN - PLUMBING

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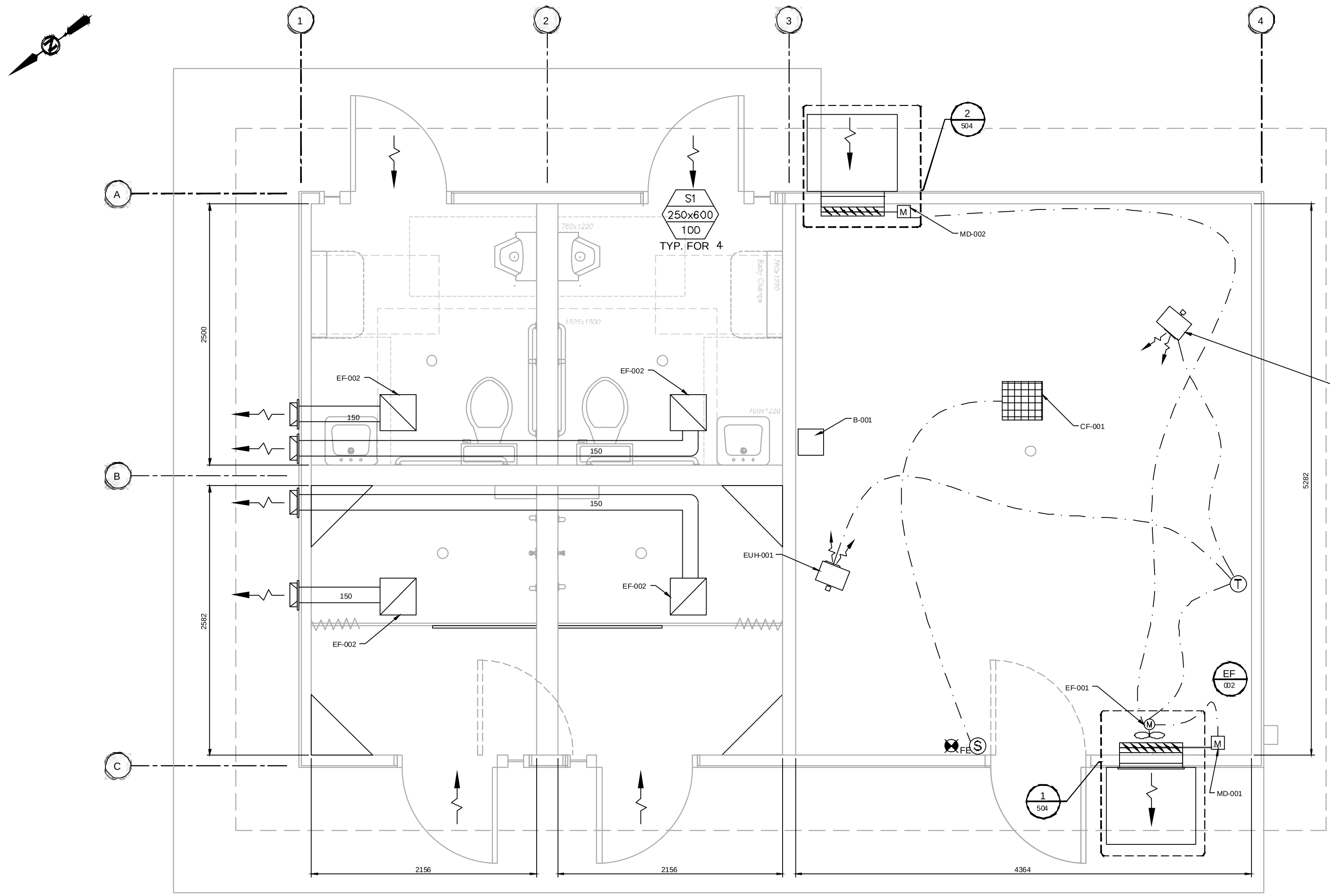

1 PLAN 1:20
MAIN FLOOR VENTILATION

SYMBOL	DESCRIPTION
	SQUARE TO ROUND REDUCER
	INSULATED DUCT
S1 500X500 100	TYPE OF DIFFUSER/GRILLE/LOUVER SIZE (mm x mm) VOLUME (L/SEC)
	LOUVRE
M	MOTORIZED DAMPER
	ELBOW DOWN
	ELBOW UP
	UNIT HEATER
	PROPELLER/AVIAL FAN
	INTERLOCK
	THERMOSTAT
	SWITCH
	CONTROL WIRING
FE	FIRE EXTINGUISHER

DRAWING REDUCED TO HALF SIZE

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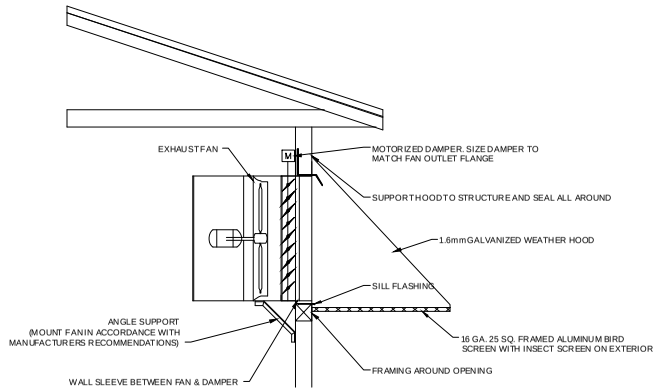
DESIGNED	K. ANDERSON

MANITOBA CONSERVATION &
M.W.S.B.

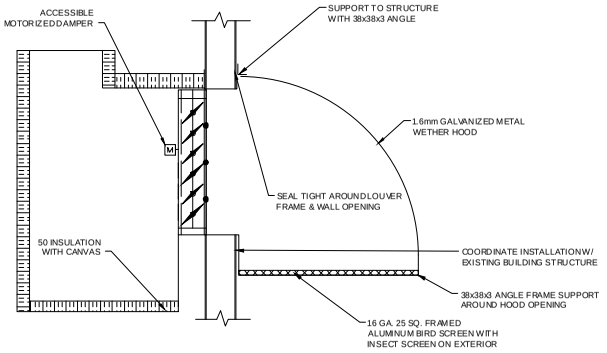
BUILDING MECHANICAL
MAIN FLOOR PLAN - HEATING & VENTILATION

M.W.S.B. NO. 1093
MOOSE LAKE CAMPGROUND
WTP & FACILITY UPGRADES

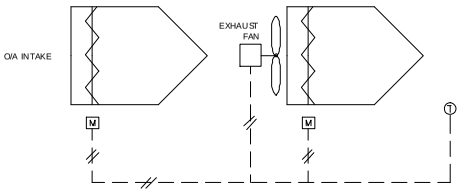
DRAWING NUMBER	REV. NO.	SHEET
4123-01-503	0	18 / 24



1 - DETAIL NTS
EXHAUST WALL PENETRATION



2 - DETAIL NTS
INTAKE WALL PENETRATION



3 - SCHEMATIC NTS
EXHAUST FAN CONTROL

HEATING & VENTILATION EQUIPMENT SCHEDULE

TAG	DESCRIPTION	LOCATION	TYPE	DESIGN BASIS MAKE/MODEL	HEATING INPUT (kW)	FLOW (L/s)	ESP (Pa)	hp	V/Hz/ϕ	NOTES
EF-001	EXHAUST FAN	WTP ROOM	WALL PROPELLOR	SE1-10-440-E	-	200	65	FRAC		DIRECT DRIVE - MOTOR GUARD
EF-002	EXHAUST FAN	WASHROOM /SHOWER	CEILING	GREENHECK SP-A90	-	50	65	FRAC	120/60/1	STAINLESS STEEL GRILLE, EXHAUST WC-6, INTERNAL SPEED CONTROL
UH-001	ELECTRIC UNIT HEATER	WTP ROOM	ELECTRIC		2.500	-	-	FRAC	120/60/1	
CF-001	CEILING FAN	WTP ROOM	CEILING FAN	EQUALIZE-AIR EASI-I-100				FRAC	120/60/1	COMPLETE WITH SPEED CONTROL
B-001	FLOOR HEAT BOILER	WTP ROOM	BOILER	LION LEB-3	3.000				240/60/1	

LOUVRE, DAMPER & GRILLE SCHEDULE

TAG	DESCRIPTION	LOCATION	SERVICE	TYPE	DESIGN BASIS MAKE/MODEL	WxH	NOTES
MD-001	MOTORIZED DAMPER	WTP ROOM	EF-001 EXHAUST	INSUL. PARALLEL	TAMCO 9000 BF	300X300	MOTORIZED DAMPER
MD-002	MOTORIZED DAMPER	WTP ROOM	EF-001 INTAKE	INSUL. PARALLEL	TAMCO 9000 BF	300X300	MOTORIZED DAMPER
S1	DOOR GRILLE	WASHROOM/ SHOWER	EF-002 INTAKE	LOUVRED FACE, ALUM		250X600	PRIVACY - OBSCURED ANODIZED ALUMINUM

DRAWING REDUCED TO HALF SIZE

NO.	DATE	ENG.	BY	SUBJECT
0	2012/08/09	K.A	D.Y.	ISSUED FOR TENDER

REVISIONS

Associated Engineering

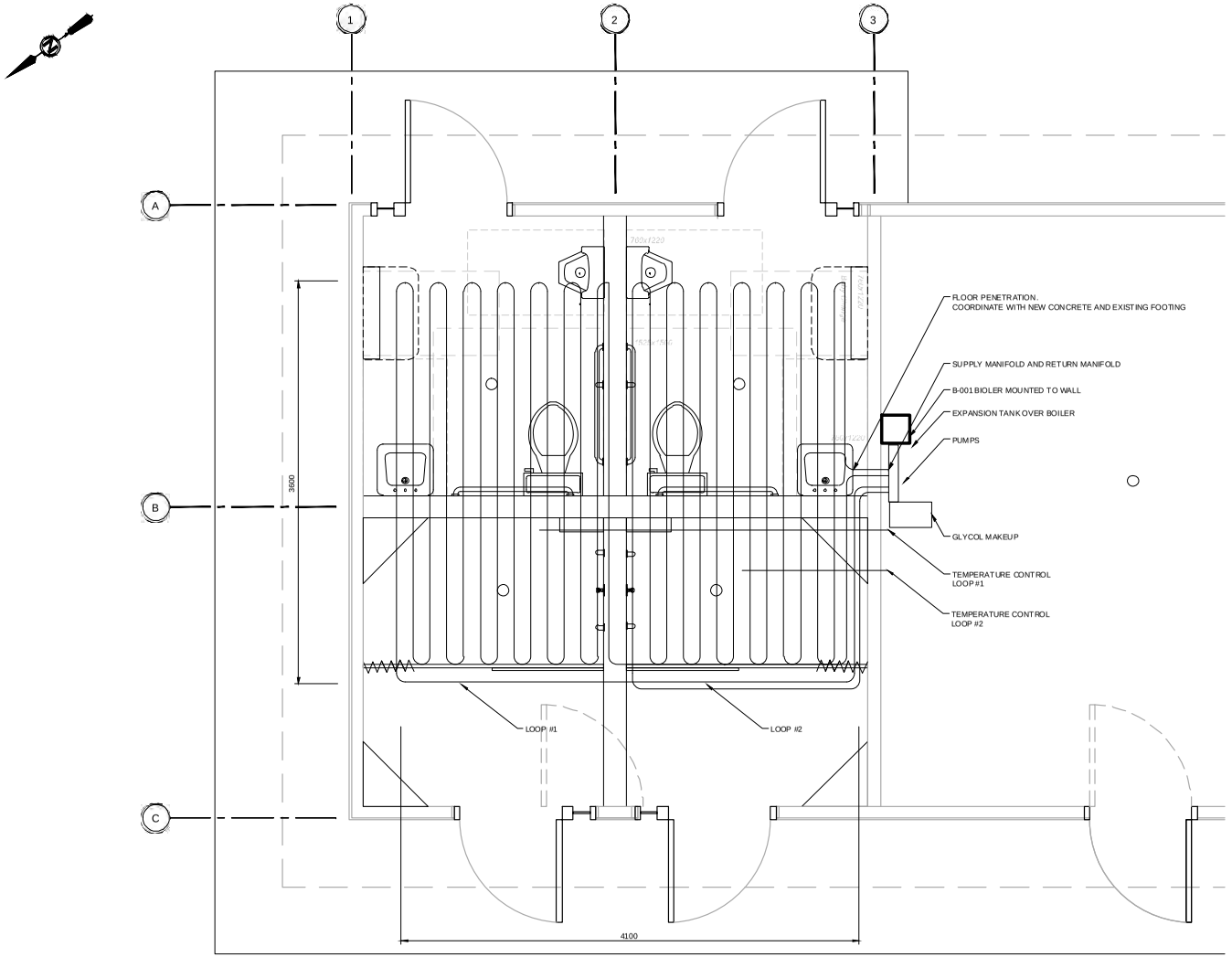
PROJECT No.	2012-4123-01
SCALE	AS SHOWN
DRAWN	D. YANKECH
DESIGNED	K. ANDERSON

MANITOBA CONSERVATION & M.W.S.B.

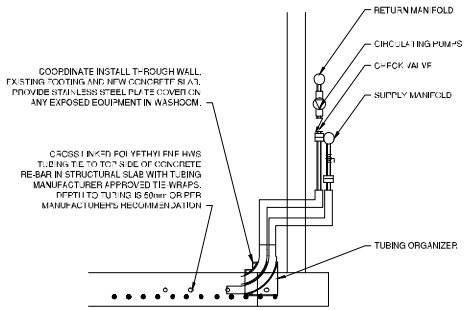
BUILDING MECHANICAL DETAILS & SCHEDULES

M.W.S.B. NO. 1093
MOOSE LAKE CAMPGROUND
WTP & FACILITY UPGRADES

DRAWING NUMBER	REV. NO.	SHEET
4123-01-504	0	19 / 24



1 PLAN 1:20
MAIN FLOOR IN FLOOR HEAT



2 DETAIL NTS
IN FLOOR HEAT DETAIL

NOTES:

1. IN FLOOR HEAT SYSTEM IS PRE-ENGINEERED PACKAGE SUPPLIED BY WOLSELEY.

DRAWING REDUCED TO HALF SIZE

NO.	DATE	ENG.	BY	SUBJECT
0	2012/08/09	K.A	D.Y.	ISSUED FOR TENDER

REVISIONS

Associated Engineering

PROJECT No.	2012-4123-01
SCALE	AS SHOWN
DRAWN	K. ANDERSON
DESIGNED	K. ANDERSON

MANITOBA CONSERVATION & M.W.S.B.

BUILDING MECHANICAL
PRE-ENGINEERED IN FLOOR HEAT

M.W.S.B. NO. 1093
MOOSE LAKE CAMPGROUND
WTP & FACILITY UPGRADES

DRAWING NUMBER	REV. NO.	SHEET
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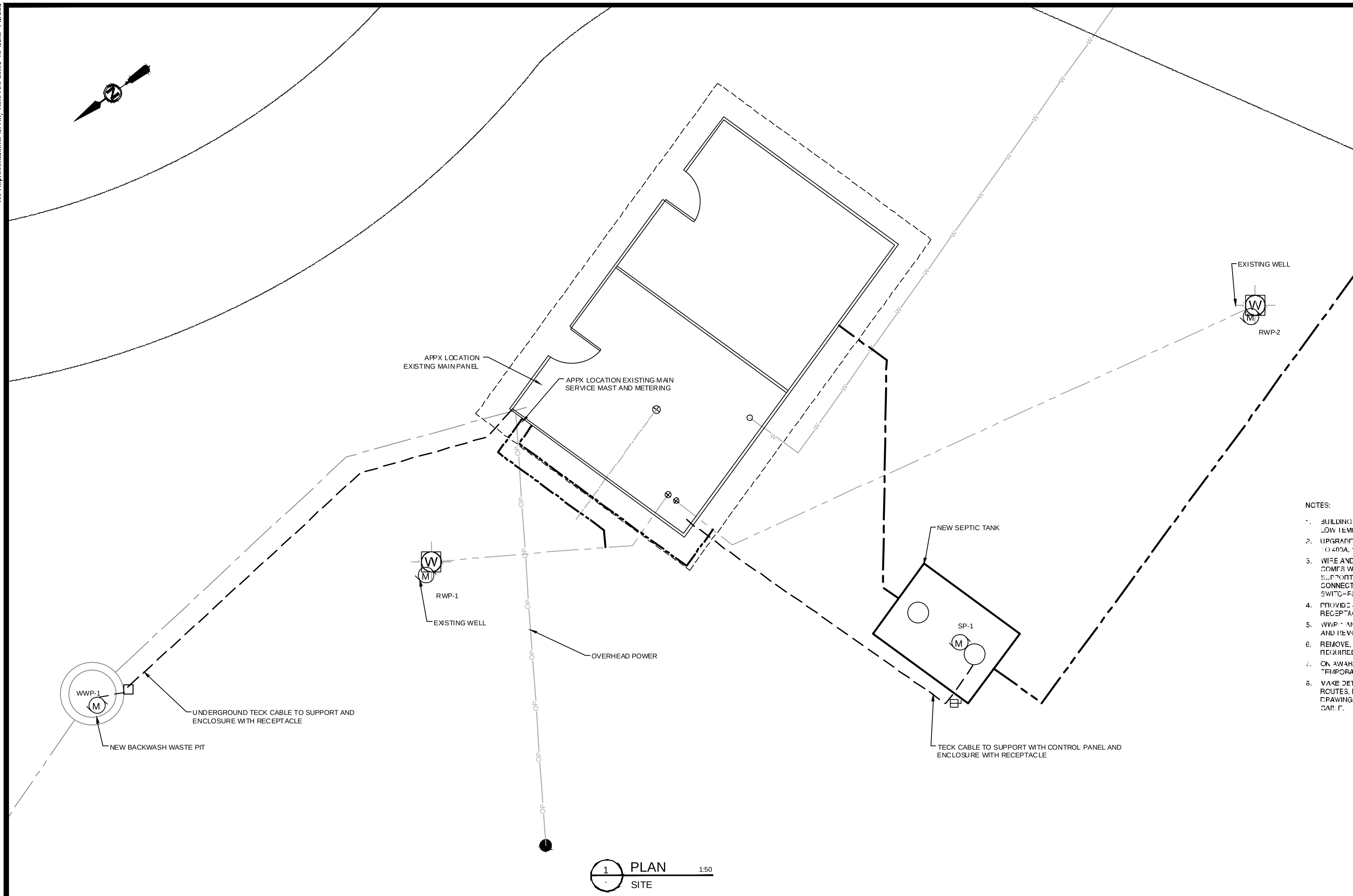

1 PLAN 1:50
SITE

NOTES:

1. BUILDING IS SEASONAL USE. SELECT EQUIPMENT SUITABLE FOR LOW TEMPERATURE STORAGE OVER WINTER.
2. UPGRADE EXISTING 200A, 120/240V OVERHEAD MAST AND SERVICE TO 400A, 120/240V SINGLE PHASE OVERHEAD.
3. WIRE AND CONNECT SEPTIC TANK EQUIPMENT. SEWAGE PUMP COMES WITH CONTROL PANEL (MOUNT NEAR TANK LOCATION ON SUPPORT POST) AND THREE FLOATS FOR AUTOMATIC OPERATION. CONNECT PUMP POWER, PUMP LEAKAGE SENSOR, AND FLOAT SWITCHES TO CONTROL PANEL.
4. PROVIDE SUPPORT AT WWP-1 AND ENCLOSURE WITH RECEPTACLE FOR CONNECTION OF PUMP.
5. WWP-1 AND SP-1 PUMPS ARE TO BE CONNECTED VIA RECEPTACLE AND REMOVABLE FOR WINTER.
6. REMOVE, REINSTALL, REWIRE AND RECONNECT EQUIPMENT AS REQUIRED TO SUIT MODIFICATIONS TO EXISTING BUILDING.
7. ON AWARD OF CONTRACT, COORDINATE WITH UTILITIES. FINALIZE TEMPORARY AND PERMANENT ARRANGEMENTS.
8. MAKE DETAILED RECORD OF BURIED CONDUIT AND CABLE ROUTES, BURIAL DEPTHS, AND OTHER DETAILS ON RECORD DRAWINGS AT THE TIME OF INSTALLATION OF ANY CONDUIT OR CABLE.

DRAWING REDUCED TO HALF SIZE

NO.	DATE	ENG.	BY	SUBJECT
0	20120928	K.A.	D.Y.	ISSUED FOR TENDER

REVISIONS

Associated Engineering

PROJECT No.	2012-4123-01
SCALE	AS SHOWN
DRAWN	D. ROBINSON
DESIGNED	D. ROBINSON

MANITOBA CONSERVATION &
M.W.S.B.

ELECTRICAL
SITE PLAN

M.W.S.B. NO. 1093
MOOSE LAKE CAMPGROUND
WTP & FACILITY UPGRADES

DRAWING NUMBER	REV. NO.	SHEET
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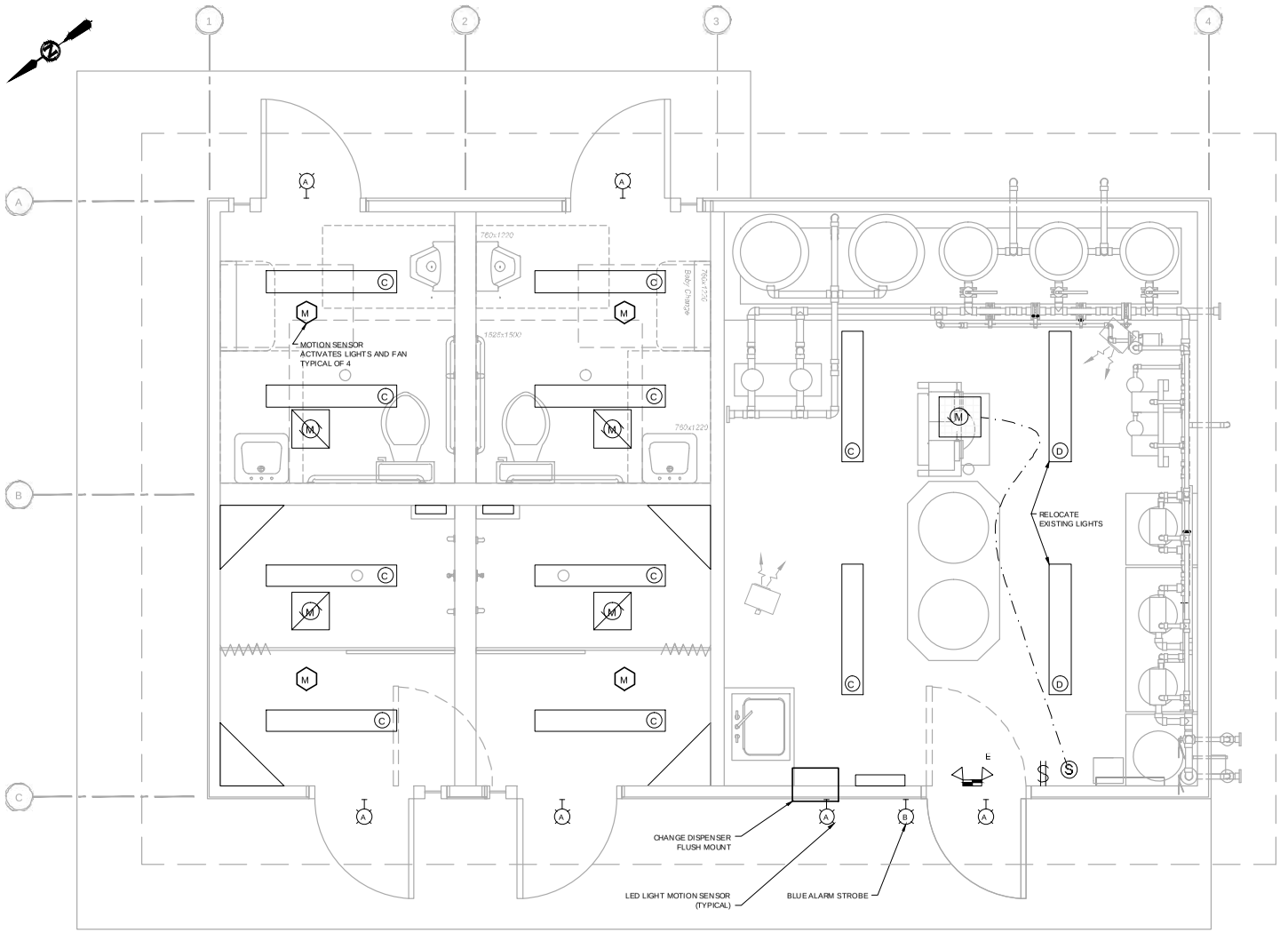


1 PLAN 1:20
MAIN FLOOR LIGHTING

SYMBOL LEGEND

	WALL MOUNT FIXTURE OR BEACON
	DUPLEX RECEPTACLE
	GFCI RECEPTACLE
	SPECIAL RECEPTACLE OR EQUIPMENT CONNECTION
J	JUNCTION BOX
M	MOTOR
	MOTOR STARTER
	MOTOR DISCONNECT
M	MOTORIZED DAMPER
WP	WEATHER PROOF
PLC	PROGRAMMABLE LOGIC CONTROLLER
HMI	HUMAN MACHINE INTERFACE
CP	CONTROL PANEL
ATS	AUTO TRANSFER SWITCH
MCC	MOTOR CONTROL CENTER
PNL	PANELBOARD
E	EXISTING
APPX	APPROXIMATE
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
TYP	TYPICAL

DRAWING REDUCED TO HALF SIZE

NO.	DATE	ENG.	BY	SUBJECT
0	20120809	K.A	D.Y.	ISSUED FOR TENDER

REVISIONS

Associated Engineering

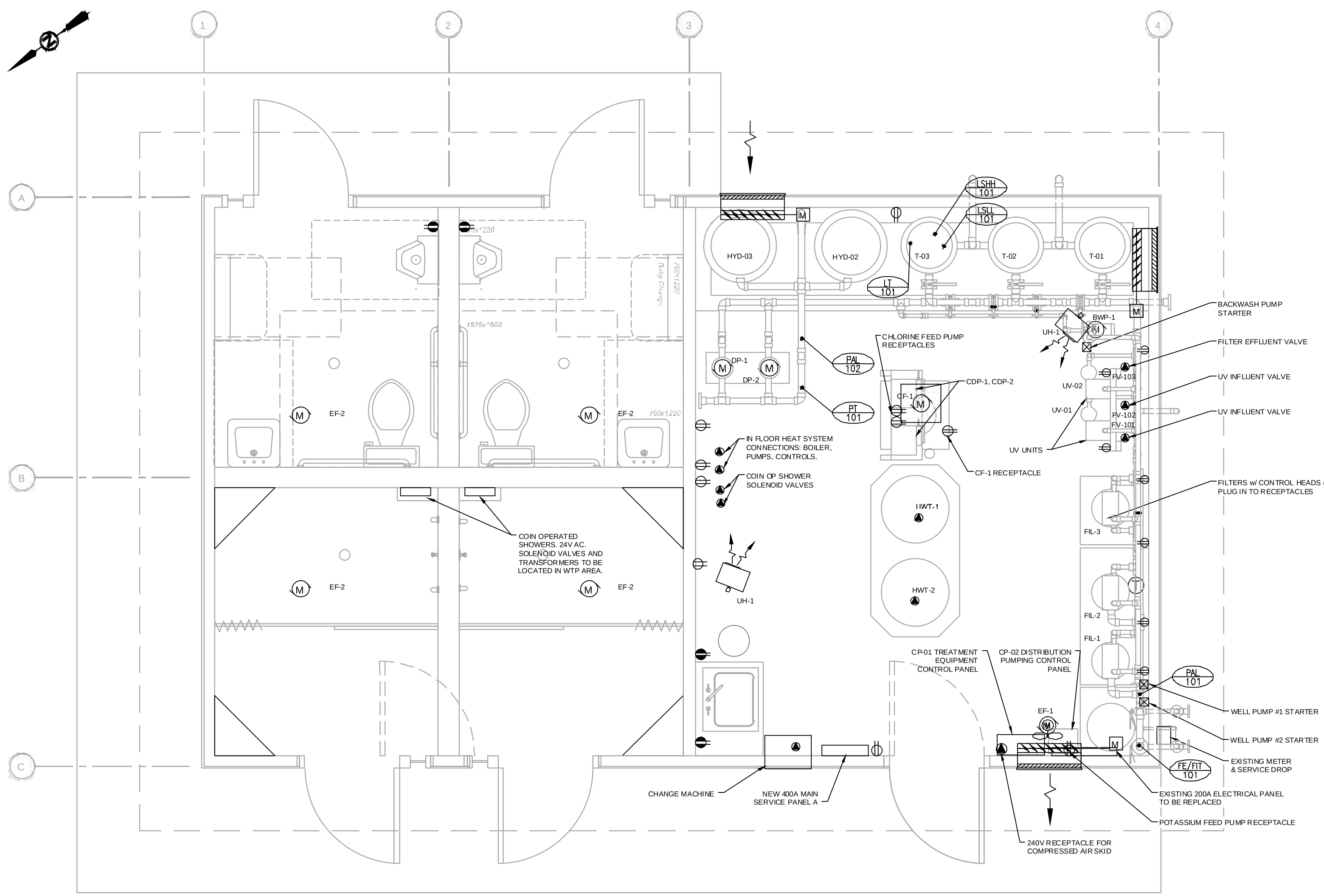
PROJECT No.	2012-4123-01
SCALE	AS SHOWN
DRAWN	D. ROBINSON
DESIGNED	D. ROBINSON

MANITOBA CONSERVATION & M.W.S.B.

ELECTRICAL
LIGHTING PLAN

M.W.S.B. NO. 1093
MOOSE LAKE CAMPGROUND
WTP & FACILITY UPGRADES

DRAWING NUMBER	REV. NO.	SHEET
4123-01-602	0	22 / 24



1 PLAN 1:20
POWER & SYSTEMS

NOTES:

1. DEMOLISH EXISTING ELECTRICAL THAT BECOMES OBSOLETE.
2. UPGRADE ELECTRICAL SERVICE AND CONNECT NEW MAIN SERVICE ENTRANCE PANEL TO GROUND. PANEL SHALL BE NEMA 3, SERVICE ENTRANCE RATED, WITH INTEGRAL OR ADJACENT TVSS RATED 80kA AND PROTECTED BY 30A/2P BREAKER.
3. CONNECT DISCRETE 'RUN' AND 'FAULT' SIGNALS BETWEEN WELL PUMP STARTERS AND CP-01. CONNECT SOLENOID VALVE 'OPEN' SIGNALS BETWEEN VALVES AND CP-01. CONNECT 'RUN' AND 'FAULT' SIGNALS BETWEEN METERING PUMPS AND CP-01. CONNECT 'RUN', 'DRAIN', 'HIGH TEMPERATURE', 'TROUBLE', AND 'FAULT' SIGNALS BETWEEN UV SYSTEMS AND CP-01. PROVIDE MIN TWO SPARE CONDUCTORS PER RUN (TYP.).
4. CONNECT DISTRIBUTION PRESSURE INSTRUMENTS TO CP-02.
5. CONNECT PROCESS, TREATMENT, AND STORAGE TANK INSTRUMENTS TO CP-01.
6. CONNECT DISCRETE STATUS, ALARM, AND INHIBIT SIGNALS BETWEEN CP-01 AND CP-02. CP-01 SHALL BE CAPABLE OF CONTROLLING THE PROCESS, INHIBITING DISTRIBUTION PUMPS, AND ANNUNCIATING STATUSES AND ALARMS.
7. WIRE AND CONNECT CONTROLLERS FOR COIN OPERATED SHOWERS. PROVIDE 24VAC CLASS 2 SUPPLY IN WTP AREA. WIRE AND CONNECT SHOWER SOLENOID VALVES.
8. PROVIDE STARTER FOR EXHAUST FAN EF-1 IN WTP AREA. PROVIDE ADJUSTABLE REVERSE ACTING THERMOSTAT (COOLING TSTAT). CONNECT FAN AND MOTORIZED DAMPERS.
9. WIRE AND CONNECT CEILING FAN CF-1 AND CONTROL SWITCH.
10. COORDINATE WITH OWNER FOR CHARACTERISTICS OF RECEPTACLE FOR AIR COMPRESSOR SKID. PROVIDE BREAKER TO SUIT.
11. WIRE AND CONNECT HVAC EQUIPMENT, FANS, DAMPERS, UNIT HEATERS. PROVIDE NEMA 4X THERMOSTATS AND DEVICES AND CONTROLS. (TYP.). SEE MECHANICAL.
12. COORDINATE SUPPLY OF CONTROL PANELS, INSTRUMENTATION, CONTROL DEVICES, STARTERS, AND MOTOR CAPACITORS WITH TRADES SUPPLYING MECHANICAL EQUIPMENT.
13. PROVIDE WEATHERPROOF, NEMA 3, NEMA 4, OR NEMA 4X EQUIPMENT. RECEPTACLES IN WTP AREA SHALL BE WEATHERPROOF.
14. COORDINATE WITH MANITOBA HYDRO. FINALIZE SERVICE ARRANGEMENTS AND SCHEDULING.
15. COORDINATE WITH TRADES AND EQUIPMENT SUPPLIERS.
16. COORDINATE INSTALLATION OF EQUIPMENT WITH LOCATIONS OF BUILDING FRAMING, CONFIRM ON SITE. (TYP.).

DRAWING REDUCED TO HALF SIZE

NO.	DATE	ENG.	BY	SUBJECT
0	20120928	K.A.	D.Y.	ISSUED FOR TENDER

REVISIONS

Associated Engineering

PROJECT No.	2012-4123-01
SCALE	AS SHOWN
DRAWN	D. ROBINSON
DESIGNED	D. ROBINSON

MANITOBA CONSERVATION & M.W.S.B.

ELECTRICAL
POWER & SYSTEMS PLAN

M.W.S.B. NO. 1093
MOOSE LAKE CAMPGROUND
WTP & FACILITY UPGRADES

DRAWING NUMBER	REV. NO.	SHEET
4123-01-603	0	23 / 24

P:\20124123\00_WIL_Moose_WTP\Working_Dwgs\600_Electrical\4123-01-603.dwg
DATE: 2012-10-01, Desiree Yamach

Tag	Description	LOAD hp	VA	A	Voltage / Phases	PROTECTION OCPD	Disconnect	CONTROL Type	Location	FEEDER Desc	Notes
UH-1	Electric unit heater		2 500		240/1	15/2	x	TSTAT		2-#12	
UH-1	Electric unit heater		2 500		240/1	15/2	x	TSTAT		2-#12	
EF-1	Exhaust fan	frac			120/1	pkg	x	OS		2-#12	
EF-2	Exhaust fan	frac			120/1	pkg		OS		2-#12	
EF-2	Exhaust fan	frac			120/1	pkg		OS		2-#12	
EF-2	Exhaust fan	frac			120/1	pkg		OS		2-#12	
EF-2	Exhaust fan	frac			120/1	pkg		OS		2-#12	
HWT-1	Hot water tank		13 500		240/1	70/2				2-#4	
HWT-2	Hot water tank		13 500		240/1	70/2				2-#4	
RWP-1	Raw Water Pump	1			240/1	20/2	REC	FVNR		2-#12	
RWP-2	Raw Water Pump	1			240/1	20/2	REC	FVNR		2-#12	
UV-01	UV System 1		1 000		240/1	15/2	REC			3-#12	
UV-02	UV System 2		1 000		240/1	15/2	REC			3-#12	
BWP-1	Backwash Pump	1			240/1	20/2	x	FVNR		2-#12	
CP-01	Treatment Control Panel				120/1	15/1				2-#12	
CP-02	Distribution Control Panel	2			240/1	40/2				3-#6	
DP-01	Distribution Pump	1			240/1	(CP-02)	x	FVNR	CP-02	2-#12	
DP-01	Distribution Pump	1			240/1	(CP-02)	x	FVNR	CP-02	2-#12	
PPSP-1	Metering Pump - Potassium Perm			2	120/1	15/1	REC	pkg / CP-01		2-#12	
CDP-1	Metering Pump - Chlorine			2	120/1	15/1	REC	pkg / CP-01		2-#12	
CDP-1	Metering Pump - Chlorine			2	120/1	15/1	REC	pkg / CP-01		2-#12	

OCPD Overcurrent Protective Device (circuit breaker for typical loads, MCP for typical motor starters, fuse where so indicated in Contract Documents)
REC Receptacle
pkg Packaged
FVNR Full voltage non reversing combination magnetic starter
VFD Variable frequency drive
SSSS Solid state soft start / soft stop
MAN Manual starter with thermal overload and pilot light
CON Contactor
OS Occupancy sensor

LUMINAIRE SCHEDULE

TYPE	DESCRIPTION	LAMP	VOLTAGE	MANUFACTURER	NOTES
A	EXTERIOR WALL PACK, LED VAPORTIGHT ; 3500K CARBON BRONZE	LED - 3500K	120V	XTOR CROSSTOUR LED: XTOR2-N-PC1 WIRE GUARD WG/XTOR	ACTIVATED ON MOTION NEAR DOOR
B	ALARM BEACON - BLUE	SOLID STATE	120V	FEDERAL SIGNAL LP3P OR EQUAL	
C	2 LAMP FLUORESCENT 4' VAPORTIGHT, SURFACE MOUNTED, POWERSMART LISTED BALLAST	2-F32T8/841	120V	CFI: VTS232-120SO UTHONIA: DMW 232 120 METALUX: VT2 232DR 120	FIXTURES AND EXHAUST FANS TO BE ACTIVATED ON ENTRY INTO WASHROOMS AND SHOWERS. OCCUPANCY SENSOR: LEVITON OSC05-RMW (ONE PER ROOM)
D	EXISTING LUMINAIRES TO BE RELOCATED		120V		
E	EMERGENCY LIGHTING BATTERY BANK NEMA 4X.	2x20W INC			

DRAWING REDUCED TO HALF SIZE

NO.	DATE	ENG.	BY	SUBJECT
0	20120928	K.A.	D.Y.	ISSUED FOR TENDER

REVISIONS

Associated Engineering

PROJECT No.	2012-4123-01
SCALE	AS SHOWN
DRAWN	D. ROBINSON
DESIGNED	D. ROBINSON

MANITOBA CONSERVATION & M.W.S.B.

ELECTRICAL SCHEDULES

M.W.S.B. NO. 1093
MOOSE LAKE CAMPGROUND
WTP & FACILITY UPGRADES

DRAWING NUMBER	REV. NO.	SHEET
4123-01-604	0	24 / 24

Appendix B – WTP Predesign Report

Predesign Report

MB Conservation

Manitoba Water Services Board

Moose Lake Campground Water Treatment Plant

August 2012

BEST MANAGED COMPANIES

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

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1 Introduction

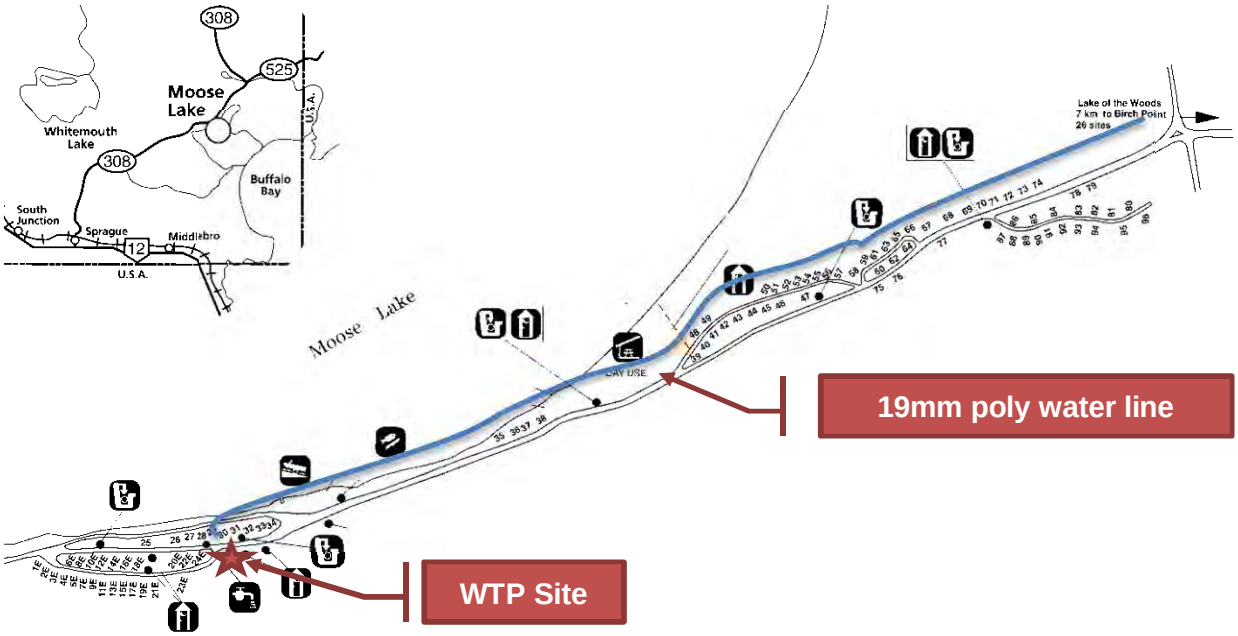
The Moose Lake Campground is located approximately 160 km south east of Winnipeg. The campground consists of 95 sites, 24 of which are serviced with electricity. The campground is currently serviced with five non-modern washrooms with no running water. These washrooms are all connected to holding tanks that are emptied as required. Untreated water is provided at three standpipes throughout the campground that are connected to a groundwater well.

It is MB Conservation's intent to upgrade this campground with a treated water supply and also to provide at least one modern washroom with shower facilities. A second modern washroom with showers shall be a future consideration.

In 2005, a 9.1 m x 5.5 m building was relocated to the campground to be used as a washroom facility and water treatment facility. Two wells were also drilled next to the facility which will provide the source water.

Figure 1.1 – Moose Lake Campground Location Map

Figure 1.2 – Moose Lake Campground



2 Design Considerations

2.1 DESIGN POPULATION AND WATER DEMAND

The Moose Lake campground population will be based on 71 basic and 24 electrified campsites, as well as five campground staff individuals. In discussions with MB Conservation, there are no immediate plans to expand the campground and add more sites. The service population for the design will be based on 95 sites and 5 staff.

Water demand will be based on this serviced population as well as the development of the new modern washroom facility. Considerations will also be given for a future modern washroom facility in the design.

Treated water will be provided to the modern washroom facility as well as seven stand pipes located throughout the campground. The modern washroom facility will include two toilets, two sinks, and two showers. The toilets will be low flow fixtures and the showers will also be low flow but will also be coin operated.

Based on this level of service is it estimated that the average day use will be **55** litres per person per day (L/p/d). Assuming on average **two** individuals per campsite and five staff members, the serviced population is assumed to be **195** individuals.

Daily Demand: 195 persons x 55 L/p/d **= 10,450 litres per day demand.**

This number can also be equated in terms of "usage". 10,450 litres per day is sufficient to provide each individual with 20 litres of water on site and the use of each toilet, sink and shower up to 100 times per day.

Fixture	Consumption	Frequency of use Per Day	Total Volume Consumed Per Day
Individual Use	20 litres per individual	195 individuals	3,900 L
Showers (2)	25 litres per use	100 uses per day per unit	5,000 L
Toilets (2)	6 litres per flush	100 uses per day per unit	1,200 L
Sinks (2)	2 litres per use	100 uses per day per unit	400 L
		TOTAL:	**10,500 L**

2.2 PROPOSED WATER TREATMENT PLANT CAPACITY

The treatment equipment should then be able to produce **10,450 L** in a day. The design will also be based on being able to produce this volume over an **eight hour** period. Implementing an eight hour production day will allow the park staff to more easily monitor the equipment during regular hours, allow for some peaking factor, as well as provide a production rate that can keep up with full time shower use.

Production rate: 10,450 L ÷ 8 hours x (3,600 seconds per hour) = **0.35 L/s (6 usgpm)**

Table 2.1 demonstrates that the proposed treatment should be able to meet the demands of the proposed new modern shower facility. However, further improvements to the WTP may be required in the future if a second shower facility is installed (eg. More storage and greater distribution pumping). The Table also shows that the recommended pumping rate per well is sufficient for the anticipated needs.

Table 2.1 – Water Production Rate Comparison

Proposed Equipment Production Rate	0.35 L/s	5.5 usgpm
Recommended pumping rate per well	0.76 L/s	12 usgpm
Two showers operating at 7.6 litres per minute each	0.26 L/s	4 usgpm
Future (four showers operating at once)	0.52 L/s	8 usgpm

2.2.1 Distribution Pumping

The proposed distribution pumping will be two (2) end suction pumps on variable frequency drives (VFD); one duty and one standby. The existing pump on site is too large for the system (0.4 - 1.4 L/s); it would cycle much too frequently on average demand flows. It is proposed to install two smaller (0.1 – 0.7 L/s) pumps that are more suited to the demand flows. A hydro pneumatic tank will also be installed to accommodate the very low flow periods; approximately six toilet flushes in the night before the pump starts. The variable frequency drives will maintain a set pressure in the system and modulate flow from the distribution pumps to suit demands.

2.2.2 Storage Requirements

The on-site storage requirements should be based on providing a minimum **20 minutes** of chlorine contact time. The number of poly tanks that can fit into the existing space will also limit the maximum amount of storage. For poly tanks in series there is a baffling factor of **0.2** to account for short circuiting. Peak usage is assumed to be when both showers are running and some taps are being used. This is assumed to be similar to the production rate of 0.35 L/s.

Storage Requirement: 0.35 L/s x 20 min. x (60 sec / min.) ÷ 0.2 baffling factor **= 2,100 Litres**

There are two 750 L poly tanks on site, a third will be added to provide a total of 2,250 L of storage.

It is worth noting that this volume of storage is also sufficient to provide 0.5 log inactivation for Giardia at 10^0C, pH 8.0 and chlorine dosage at 1.5 mg/L. This is a consideration since the source may be Ground Water Under the Direct Influent (GUDI) of surface water.

2.2.3 Well Pumping

There are currently three pairs of pumps of various sizes on site ranging from 0.3 L/s to 0.6 L/s. One of these pairs will be used for the new process. The flows will have to be verified based on pump set depth and piping. It is expected that the existing ½ HP pumps will have to be removed from the wells and replaced with the ¾ HP pumps on site.

2.2.4 Process Waste Pumping

Backwash waste will be directed to a gravel sump south of the building. Based on the equipment selection, it is likely that the backwash feed pump will provide sufficient head to pump the waste stream to the sump. If the system requires additional pumping, a small submersible pump may be provided.

2.3 WATER RIGHTS LICENCING

Since water consumption does not exceed 25,000 litres per day, a Water Rights Licence is not required.

2.4 ENVIRONMENT ACT LICENCE

An Environment Act Licence may not be required based on the size of the system. In discussion with MB Conservation, AE will submit a process description and they will decide if a full Environment Act Proposal will be required. The contact at MB Conservation does not believe an Environment Act Licence will be difficult to acquire for this facility.

2.5 EXISTING WTP EQUIPMENT

There is currently some process equipment on site in the WTP facility that was purchased in 2005/06 but never put into use. The intent will be to incorporate this equipment into the design if they are suitable. In addition to miscellaneous small diameter PVC valves and fittings, the following is a list of the more significant equipment that will be reutilized:

Table 2.2 – Existing Equipment List

Quantity	Item	Model Description	Rating
(1)	Distribution Pump	Grundfos CR3-8 / 1.5 HP 3Ø	1.0 L/s @ 56m (80 psi)
(1)	VFD for Dist. Pump	Aquavar / 1.5 HP 1Ø	-
(1)	Chemical Feed Pump	LMI AA171-450BI	1.6 Lph @ 9.7 bar (140 psi)
(1)	Hydro Tank	Goulds V45	15 L draw down
(2)	Poly Tanks	-	750 L each
(2)	Well Pump	½ HP- 1Ø (in the wells now)	0.30 L/s
(2)	Well Pump	¾ HP- 1Ø c/w control box	0.44 L/s
(2)	Well Pump	1 HP- 1Ø c/w control box	0.63 L/s

2.5.1 Electrical Service

The current electrical service is 200 Amp single phase power. The circuit panel has 64 circuits with only ten in use at this time. Based on projected loads, the 200 Amp service appears to be adequate and there is also sufficient spares in the panel to accommodate the new systems.

2.6 BUILDING MECHANICAL

The WTP side of the building currently has no ventilation equipment or permanent heat. The upgrades will incorporate an intake louver and exhaust fan in the building as well as two small electric unit heaters.

2.7 DESIGN SUMMARY

The following is a summary of the current system demands, the projected demands, and the capacities of the proposed new equipment.

Table 2.3 – System Summary

Equipment	Comments	Flow Rate
Design Daily Demand	10,450 L/d	0.12 L/s
Peak Instantaneous Flow	Showers and taps running	0.70 L/s
Proposed Treatment Rate	Based on 8 hour operation	0.35 L/s
Well Pumps – Two Existing	2 x ¾ HP 1Ø	0.35 L/s each
Distribution Pumps - Two New Pumps	2 x 1.0-HP, 1Ø on VFD	0.1 to 0.7 L/s each
Two existing and one New Poly Storage Tank	3 x 750 L	2,250 L
Hydro pneumatic Tank on Distribution	1 x 120 L	30 L draw down

3 Water Quality

3.1 RAW WATER QUALITY

The Raw Water Quality from a 2010 sample is summarized in the Table below along with the water quality objectives set forth in the Guidelines for Canadian Drinking Water Quality.

Table 3.1 – Raw Water Quality Summary

Parameter	Units	Raw Water Well #1	Raw Water Well #2	Current Limits (2010 GCDWQ)	Treatment Objective
pH		7.94	7.92	6.5-8.5(AO)	6.5 - 8.5
Alkalinity	mg/L	168	171		
Hardness ($CaCO_3$)	mg/L	170	179	200 (PO)	
TDS	mg/L	180	186	500 (AO)	< 500
UV Transmittance	%T	**66.1**	**65.8**		**> 80**
Ammonia, Total (N)	mg/L	0.549	0.758		
Nitrate +Nitrite	mg/L	-	-	45	
TKN	mg/L	0.89	1.13		
Total Organic Carbon	mg/L	**7.2**	**7.7**		**< 2.0**
Arsenic	ug/L	0.55	0.43	10	
Chloride	mg/L	1.85	1.79	250 (AO)	
Colour	TCU	10	10	< 15 TCU	< 5
Fluoride	mg/L	0.19	0.20	1.5	0.80
Iron	mg/L	**0.898**	**0.780**	< 0.3 (AO)	**< 0.10**
Manganese	mg/L	**0.106**	**0.176**	< 0.05 (AO)	**< 0.05**
Turbidity	NTU	**2.45**	**1.17**		**< 0.3 95% of the time**

Abbreviations:
AO = aesthetic objective
SMCL = secondary maximum contaminant level
PO = practical objective
MAC = maximum acceptable concentration
IMAC = interim maximum acceptable concentration

Recent testing in July of 2012 shows relatively similar levels for Iron, Manganese and UVT. The sample data shows that with the exception of turbidity, the raw water meets the health based quality parameters. The elevated turbidity is typically a result of oxidized iron and manganese during the sampling procedure.

UV transmittance is of some concern as it can impact the operation of the UV system. Typically, when the UVT is below 70, many UV systems may tend to alarm as full dosage is not achievable. The low UVT is expected to be the result of the elevated TOC in the source water. Not only can the high TOC levels impact UV performance, they may also present a problem with disinfection by products in the distribution if they are not sufficiently removed through the treatment.

Manganese and iron are the two main parameters that exceed the aesthetic guidelines. The levels are high enough to result in discoloured water and staining of fixtures and laundry. The new treatment process will target these two parameters specifically.

Since the wells are quite shallow and in an unconfined aquifer, they should be considered potentially GUDI and the treatment process should account for turbidity reduction and primary disinfection (UV) for added protection.

3.2 TREATED WATER QUALITY OBJECTIVES

Based on the water quality data, it is recommended that the proposed treatment system address iron and manganese removal, complimented by organics reduction and UV disinfection.

With the assumption that the regulators could classify this aquifer as GUDI, it is recommended that the proposed treatment process include UV disinfection for multi barrier treatment, and to achieve the minimum 3-log credit for Giardia and Cryptosporidium inactivation. The process will target organics reduction prior to UV in order to increase UVT to at least 75%.

Table 3.2 summarizes the treatment objectives for the proposed new process equipment.

Table 3.2 – Treatment Objectives

Parameter	Units	Raw Water	Treatment Objective
pH		7.9	6.5 - 8.5
Iron	mg/L	~ 1.0	< 0.10
Manganese	mg/L	~ 0.20	< 0.05
TOC	mg/L	~7.0	< 3.0
Turbidity*	NTU	1.05	<0.3 95% of the time
UV Disinfection		65% UVT	40 mJ/cm2 RED @ 0.35 L/s UVT objective > 75%

4 Treatment Plant Technologies

4.1 IRON AND MANGANESE REMOVAL

The most common method of removing iron and manganese from municipal drinking water supplies is chemical oxidation followed by filtration. Iron out of groundwater supplies is typically in its soluble form (Fe^{2+}) and needs to be oxidized to the insoluble form (Fe^{3+}) in order to be filtered out. Similarly, manganese in its soluble form (Mn^{2+}) needs to be oxidized to the insoluble form (Mn^{4+}) to be filterable.

Commonly used chemical oxidants in water treatment include oxygen, chlorine, and potassium permanganate. Chlorine dioxide and ozone can also be used as oxidants, but require more complex systems to use.

The ability and effectiveness of an oxidant to convert the soluble forms of iron and manganese to their insoluble forms depends on a variety of factors including overall water chemistry. The selection of the oxidant is also dependant on the filter media selected; many “coated” types of media require potassium permanganate for regeneration.

Table 4.1 is a summary of the pros and cons of the three most common forms of chemical oxidant.

Table 4.1 – Chemical Oxidant Summary

Oxidant	Pros	Cons
Oxygen (Aeration)	✓ No chemicals ✓ Effective for iron removal ✓ Can be effective at stripping other contaminants in the water	× Not effective for manganese oxidation (requires long detention time prior to filtration) × Larger power requirement for blower
Chlorine (sodium Hypochlorite)	✓ Simplifies chemical supply. Residual can be retained after filtration for final disinfection. ✓ Effective for iron removal	× Requires higher dosage for manganese oxidation. Also could be complexed by other constituents in the water. The result is the potential for too high of a residual after filtration. × **Not recommended if GAC filters are downstream.**

Oxidant	Pros	Cons
Potassium Permanganate	✓ Effective and rapid oxidation of both iron and manganese ✓ Can be used to regenerate greensand media and Manganese oxide coated media	× Need to pay attention to dosing rate. Underfeed and removal efficiency is reduced – Overfeed and the water could be tinted pink. × Regulated chemical. × Messy to work with.

Since the Moose Lake system will be designed to remove iron as well as manganese, the recommended oxidant will be potassium permanganate. It not only will be the oxidant, but will also be used to regenerate the proposed filter media.

During operation of the plant, it will be determined if the system can switch to intermittent regeneration without impacts to manganese removal efficiency. This is essentially stopping the continuous permanganate feed and only uses it during backwashing to regenerate the media. The oxidation and adsorption process then occurs simultaneously in the filter, referred to as contact oxidation. The effectiveness of this is dependent on water chemistry. If feasible, it can simplify operations and chemical use.

Once the iron and manganese is oxidized into a soluble (filterable) form it must be removed by a physical separation process; a filter. Manganese removal below the treated objective of 0.05 mg/L is typically unreliable with standard anthracite and sand media filters. As a result, most manganese removal processes prefer to use a combination of adsorption and physical separation. For the adsorptive process, the filter media needs to be conditioned with potassium permanganate to create a manganese oxide coating on the surface to allow the Fe^{2+} and Mn^{2+} to readily adsorb onto the media. Regular backwashing is required to remove the adsorbed iron and manganese, thus freeing up the media for more adsorption surfaces.

For Moose Lake, it is proposed to use either Green Sand (coated glauconite) or Green Sand Plus (coated anthracite) media for manganese adsorption. The filters would also have an anthracite cap to capture the oxidized iron.

4.2 ORGANICS REMOVAL

Following the greensand filters will be a granular activated carbon (GAC) filter for organic carbon adsorption. The filter will be equipped with a by pass and pressure regulation in order to provide the ability to send a portion of the water stream through the GAC. Having the flexibility to pass only a portion of the flow (50%-70%) through the GAC may extend the life of the media.

4.3 ULTRAVIOLET DISINFECTION

The regulating bodies would likely consider this source potentially GUDI, as it is a shallow unconfined well close to the Lake. It is recommended that the treatment process include UV for primary disinfection. The reactor will be rated to achieve 3-log inactivation of Giardia and Cryptosporidium; minimum 40 mJ/cm^2 RED @ 0.35 L/s.

4.4 FINAL CHLORINATION

Following UV disinfection, the treated water will then be dosed with chlorine for residual disinfection. Two chemical feed pumps will be provided, one duty and one standby.

4.5 TREATMENT PROCESS RECOMMENDATIONS

Table 4.2 is a summary of the proposed treatment system.

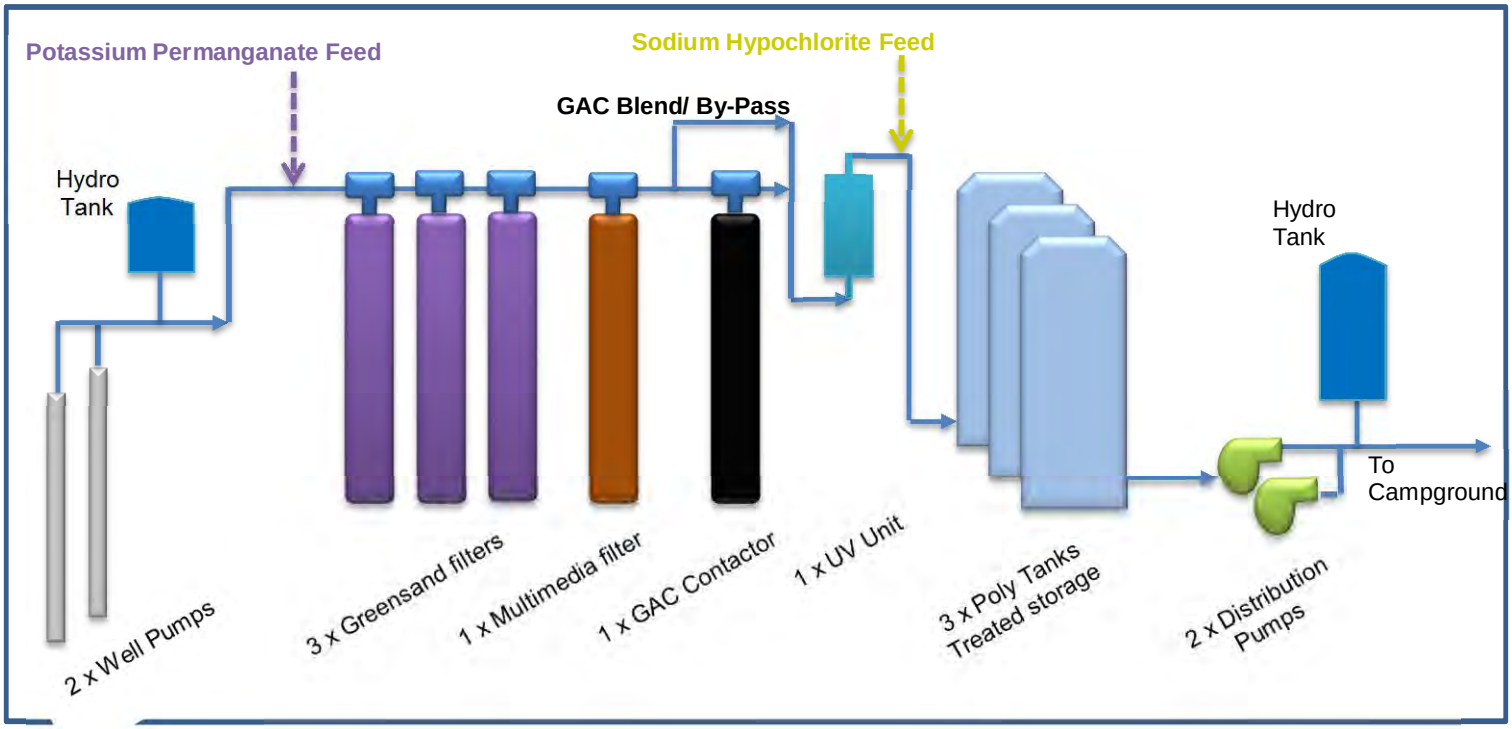
Table 4.2 – Treatment Equipment Summary

Process	Treatment System	Comments
Oxidant	Potassium Permanganate	Will initially be set up as a continuous feed for oxidation and regeneration.
Iron/Manganese Removal Process	Greensand (Plus) Filtration	3 x 325 mm diameter pressure tanks with automatic Fleck control valves. Filtration rate: 5.75 m/hr
Optional Multimedia Filtration	Sand / anthracite filter	If a 150 mm anthracite cap cannot be placed on greensand filters, a polishing filter may be required for turbidity reduction.
Organics Removal	GAC Contactor	1 x 325 mm diameter pressure tank with automatic Fleck control valve. Contact: 3.5 minutes at 100% flow
Primary Disinfection	UV Hallett 15x Crossfire	One unit with spare lamps.
Secondary Disinfection	Chlorine (Sodium Hypochlorite)	Two pumps with degassing heads.

4.6 PROCESS SCHEMATIC

Figure 4.1 is a schematic of the proposed treatment process.

Figure 4.1 – Moose Lake Treatment Process



NOTE: After tender award, the supplier (Aslan) proposed replacing the Greensand and GAC filters with three ion exchange vessels. The ion exchange process was much more effective at removing Ammonia, Manganese, and Organics (improving UVT). Discussions were had with MWSB and Parks and the design change was approved.

4.7 EQUIPMENT SELECTION

The proposed treatment rate is quite small; it is very close to a large residential system, or a small commercial system. As a result, the proposed equipment will be "off the shelf" components that will be assembled by the contractor. All the equipment will be NSF Certified.

4.7.1 Filters

The proposed filters will be structural poly glass vessels. The vessels will either be 0.330 m diameter x 1.37 m tall or 0.355 m x 1.65 m tall re proposed for ease of maintenance and portability.

Top mounted Fleck Control valves (or equal) will be installed on the vessels for feed and backwash control. Backwashing will be manually initiated by the operator.

4.7.2 Chemical Feed Pumps

The proposed chemical feed pumps will be Grundfos ALLDOS DME diaphragm dosing pump. The selection of the pump is based on the low feed rates, simplicity of operation and local support from suppliers. The feed rate is adjustable from 0.0025 to 48 L/h.

4.7.3 UV Reactor

The proposed UV system would be a Hallett 15x. It is rated 55 mJ/cm^2 at 1.0 L/s and 70% UVT. It is NSF certified and simple to maintain and operate.

The reactor is suited for hard water and elevated iron and manganese levels.

4.7.4 Distribution Pumps

The proposed distribution pumps are two (2) Grundfos vertical multistage centrifugal pumps; Model CR1-9, 1 HP 208-230/3/60. Each pump is rated for 0.1 to 0.7 L/s at 450 kPa (65 psi). The pumps are sized for 100% redundancy; one duty and one standby in alternating operation.

The pumps will each be on a variable frequency drive, Aquavar CPC20071. The drives will not only modulate flow maintaining a set system pressure, but they are also required to convert the single phase power source to the pumps.

4.7.5 Well Pumps

The well pumps are currently on site in the WTP building. The ½ HP pumps in the wells will be changed out with the ¾ HP pumps, along with the starter controls.

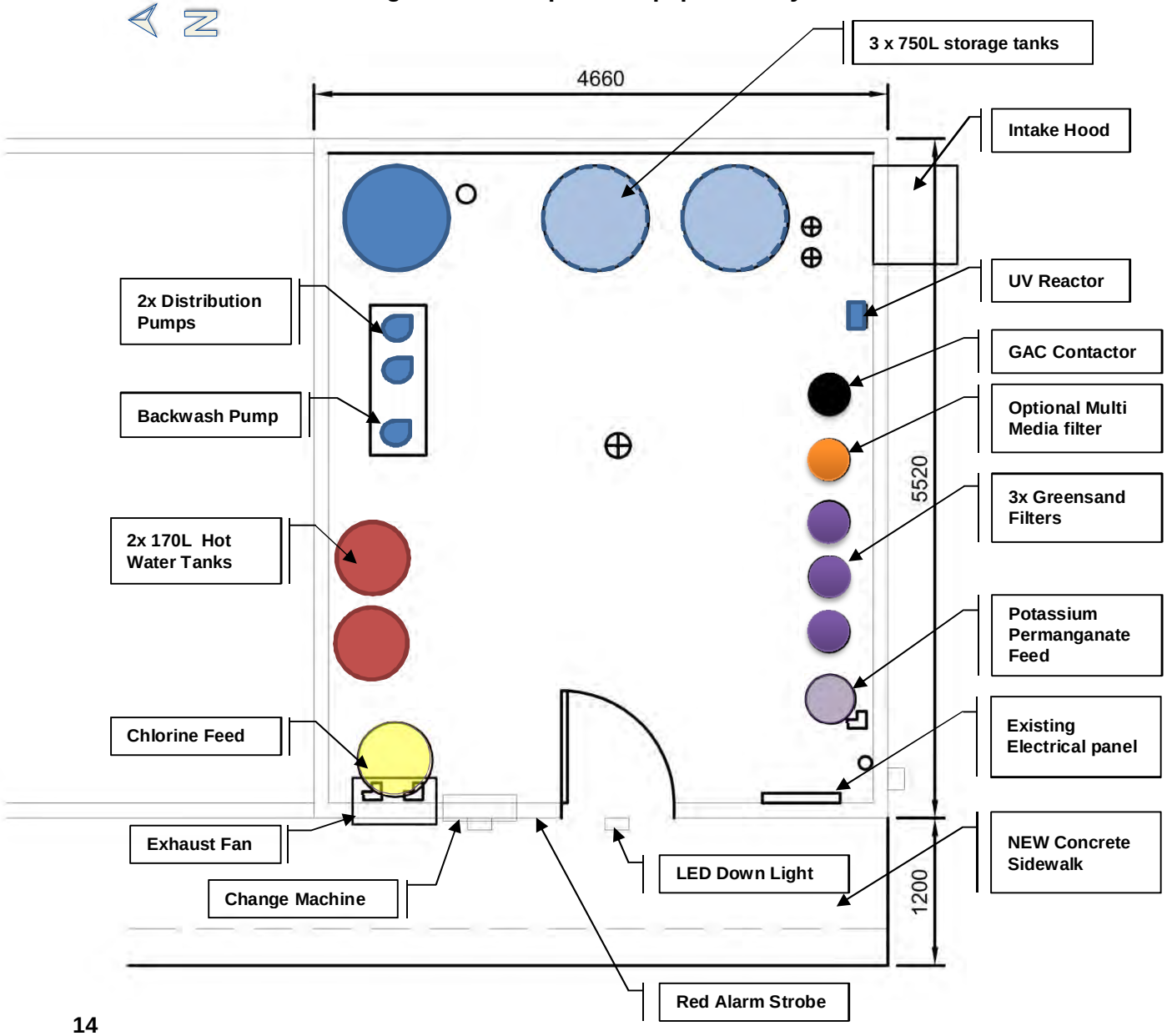
5 Peripheral Facilities

5.1 STRUCTURAL AND BUILDING

The equipment will be situated in an existing building in the campground. Some modifications to the building will be made to accommodate the new ventilation and process equipment.

Figure 5.1 is a sketch of the existing floor plan showing the proposed new equipment.

Figure 5.1 – Proposed Equipment Layout



5.2 HEATING AND VENTILATING

The building area currently has no ventilation equipment installed. The upgrades will incorporate a new intake louver and exhaust fan for proper air changes. Two unit heaters will also be installed in the room to keep the area above freezing over the winter. Some of the equipment, though robust, should not be kept below freezing over the winter. This includes some electrical equipment.

Air conditioning and dehumidification are typically not incorporated into these smaller designs due to costs, however, the owner could request the equipment if they have budget.

It is expected that the tanks and piping will sweat in the summer with the colder groundwater. Spill decks and containment will be incorporated into the design to minimize the amount of water that could pool on the floor.

5.3 CONTROLS AND INSTRUMENTATION

In general the control strategy will be kept simple. The treatment equipment will start and stop based on water levels in the storage tanks. The distribution pumps will operate on VFDs to maintain a consistent pressure in the system.

The filter systems will include an automated backwash system that can either be triggered by timer on the control valve or operator initiated.

Influent flows will be monitored by a magnetic flow meter on the raw water line. Flows to distribution will be monitored by a turbine meter for totalizing.

The client will need to confirm what level of alarming will be required for the system, and what the preferred communication method will be (land line or pager – cel phone coverage is poor). It is assumed that the park staff will regularly be visiting the plant throughout the day, or at least driving by the plant. An alarm strobe will be mounted on the building exterior as a visual notification that there is a problem.

At minimum the system should monitor:

- Low distribution pressure
- Low water level
- High water level
- Intrusion alarm
- Low room temperature
- High room temperature

5.4 HOT WATER TANKS

It is proposed to provide two (2) 170 L (45 gal) high efficiency 208V single phase electric water heaters.

Two showers operating at peak usage may require upwards of 120 litres of hot water per hour. This is based on the showers operating at 7.6 litres/min, 10 uses per hour at three minutes each use. This is also based on a ground water temperature of 15^0C and the showers will be fitted with a mixing valve set to 20^0C. Two high efficiency hot water tanks can recover approximately 140 litres per hour. Thus, during periods of moderate usage, the system should keep up with the hot water demand.

5.5 RESIDUALS MANAGEMENT

Residuals from the plant will be backwash water from the filters. On average, every two to three days the filters may require a backwash. If all filters are backwashed in one day, the total volume of process waste water discharge is approximately 1.5 m^3 to 2.0 m^3. This would be an excessive hydraulic loading to the proposed small wastewater treatment system that the campground is considering.

It would be preferable to send the backwash water back to the environment through a gravel sump or manhole south of the WTP.

We are in discussion with MB Conservation to determine if the volume of discharge is sufficiently low enough to not require a full Environment Act Proposal.

6 Opinion of Probable Costs

The following is a preliminary opinion of probable construction costs based on budget pricing from the suppliers and contractor discussions. A much more detailed

Item	Budget
Hydro Electrical Contribution Allowance (likely not required)	$10,000
Process Treatment Equipment Five (5) polyglass vessels, media, control valves, shipping Backwash pump UV Reactor Shipped loose – assembled by Contractor	$22,000
Two (2) Distribution Pumps Two (2) Aquavar VFDs Two (2) Harmonic Filters (might be required)	$9,000
Building Construction Modifications Concrete Sidewalk Openings	$6,000
HVAC & Mechanical Intake, Exhaust Plumbing Process piping Hot water tanks	$45,000
Electrical Unit Heaters Lighting Power Distribution Controls and Instrumentation	$70,000
Sub-total	$162,000.00
Contingency (~20%)	$35,000
Total	**$197,000**

The following is a preliminary opinion of annual operational costs based on selected equipment and usage rates. It is considered that the treatment equipment will operate only six months of the year.

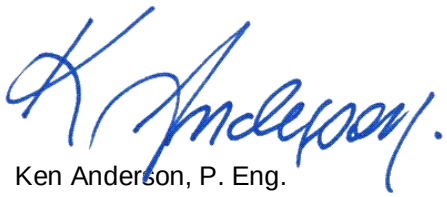
Item	Annual Budget
Media Replacement for filters (annual amortization) Greensand typically replaced every four years at ~$2,000. GAC may be replaced every year or two at ~$350 Multimedia filters typically replace d every five years at ~$250	$1,000
Treatment Chemicals Potassium Permanganate Sodium Hypochlorite	$1,000
Miscellaneous Consumables UV Lamps Pump maintenance kits Chemical feed pump maintenance kits	$500
Asset Amortization (Depreciation over 10 years)	$3,000
Hydro for treatment equipment and pumps only	*~$4,000*
Hydro for building and Hot Water Tanks	*~$2,000*
Sub-total	$11,500.00
Contingency (~20%)	$2,000
Total	**$13,500 / year**

7 Closure

This report was prepared for the MB Conservation Manitoba Water Services Board to provide a conceptual design for upgrades to their existing WTP.

The services provided by Associated Engineering Ltd. in the preparation of this report were conducted in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions. No other warranty expressed or implied is made.

Respectfully submitted,
Associated Engineering Ltd.



Ken Anderson, P. Eng.
Project Manager

Driller's Report

Well Location	QTR SEC TWP RGE E [X] W [ ] R. Lot Parish Remarks Moose Lake	GPS Reading N 49° 11' 38" W 95° 19' 42"
Well Owner	Name Manitoba Conservation Address Box 70 Sprague, MB. R0A 1Z0 Phone	Location Sketch of Well
Well Identification	N.E. Side of pump house	
Well Use	Production [X] Test Well [ ] Recharge [ ] Observation [ ]	
Water Use	Domestic [X] Livestock [ ] Industrial [ ] Irrigation [ ] Air-condition [ ] Other [ ] Specify	
Date well completed	September 13 2005	

Depth Below Ground in Feet		DESCRIPTION WELL LOG	Water Record
0	2	Sod and Sandy Brown Till	
2	12	Medium to Course Sand	
12	14	Grey Till	
14	40	Fine Grey Sand	

WELL CONSTRUCTION

Depth Below Ground Level		Casing	Open Hole	Perfor-ations	Gravel Pack	Casing Grout	Inside Diameter	Outside Diameter	Screen Slot size	TYPE	MATERIAL	MAKE
0	21	X					5	5½				
21	26			X						Insert Glued	PVC	
15	30				X				25	Stainless steel screen		
0	15					X				20-40 Grade Silica Sand		
										Enviroplug Grout		

Top of Casing 2 Feet above [X] Below [ ]

REMARKS:

Well must be vented

PUMPING TEST

Date of Test: September 13 2005

Pumping [X] Flowing [ ] Rate 18 I.G.P.M.

Water level before pumping 3 Above [ ] Below [X]

Pumping level at end of test 21 Above [ ] Below [X]

Duration of test ½ HRS Minutes

Recommended pumping rate 10 IGPM ~~15 I.G.P.~~M. (12 usgpm)

With pump intake at 21 Feet below ground level

CONTRACTOR

License Number 594 5

Name Friesen Drillers Ltd.

Address Box 1, Grp. 15, R.R.#1
Steinbach, MB. R5G 1L9

Drill Operator Jim Shoemaker

Driller's Report

Well Location	QTR SEC TWP RGE E [X] W [ ] R. Lot Parish Remarks Moose Lake	GPS Reading N 49° 11' 39" W 95° 19' 43"
Well Owner	Name Manitoba Conservation Address Box 70 Sprague, MB. R0A 1Z0 Phone	Location Sketch of Well
Well Identification	S. W. Corner of pump house	
Well Use	Production [X] Test Well [ ] Recharge [ ] Observation [ ]	
Water Use	Domestic [X] Livestock [ ] Industrial [ ] Irrigation [ ] Air-condition [ ] Other [ ] Specify	
Date well completed	September 13 2005	

Depth Below Ground in Feet		DESCRIPTION WELL LOG	Water Record
0	2	Sandy Brown Till	
2	11	Course Sand	
11	12	Grey Till	
12	30	Fine Grey Sand	

WELL CONSTRUCTION

Depth Below Ground Level		Casing	Open Hole	Perforations	Gravel Pack	Casing Grout	Inside Diameter	Outside Diameter	Screen Slot size	TYPE	MATERIAL	MAKE
0	19	X					5	5½		Insert Glued	PVC	
19	24			X					25	Stainless steel screen		
15	30				X					20-40 Grade Silica Sand		
0	15					X				Enviroplug Grout		

Top of Casing 2 Feet above [X] Below [ ]

REMARKS:

Well must be vented

PUMPING TEST

Date of Test: September 13 2005

Pumping [X] Flowing [ ] Rate 15 I.G.P.M.

Water level before pumping 3 Above [ ] Below [X]

Pumping level at end of test 19 Above [ ] Below [X]

Duration of test 1 HRS Minutes

Recommended pumping rate 10 I.G.P.M. (12 usgpm)

With pump intake at 19 Feet below ground level

CONTRACTOR

License Number 594 5

Name Friesen Drillers Ltd.

Address Box 1, Grp. 15, R.R.#1
Steinbach, MB. R5G 1L9

Drill Operator Jim Shoemaker

PROVINCE OF MANITOBA

THE MANITOBA WATER SERVICES BOARD

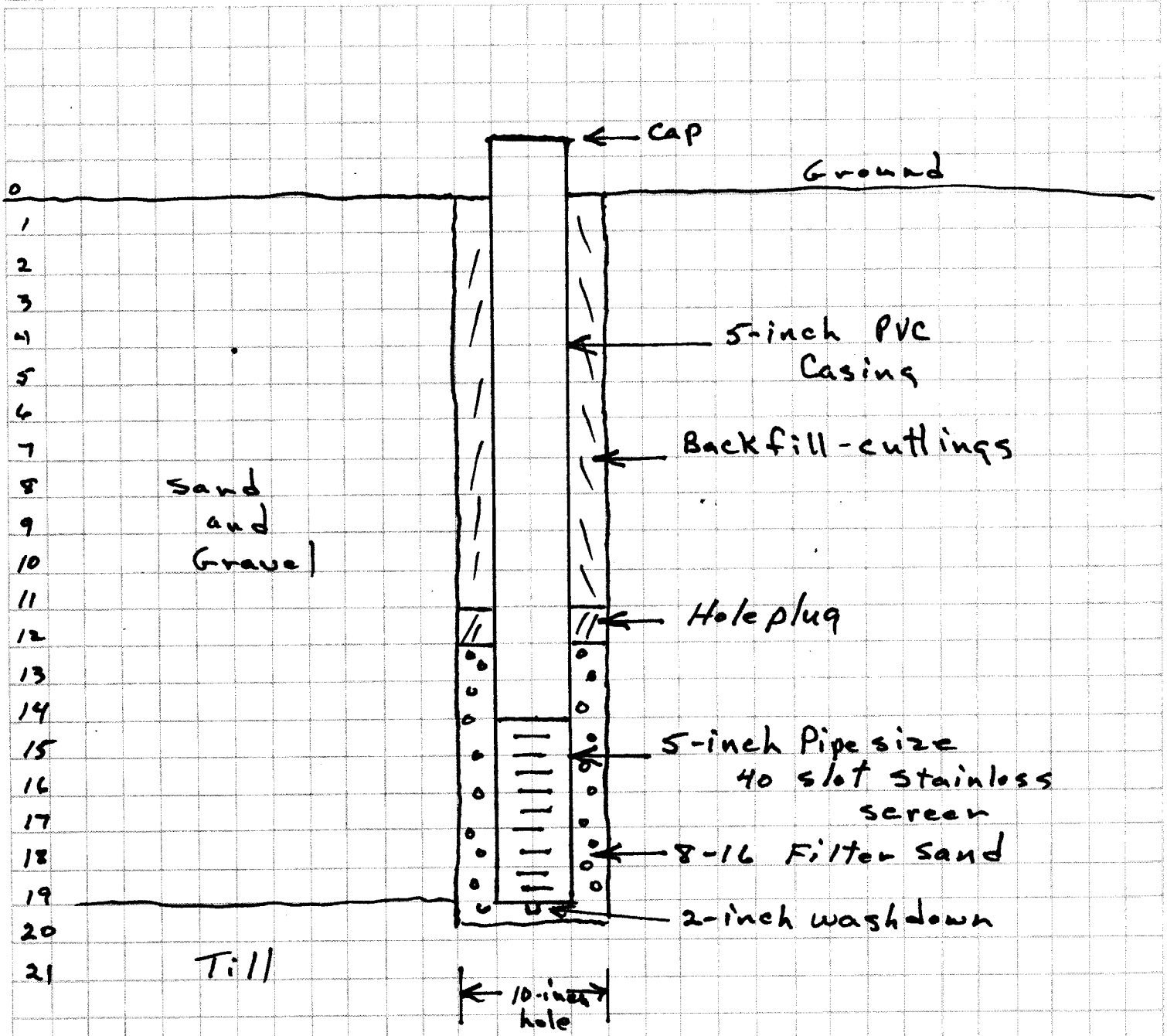
PROJECT No.

ENGINEER A. Pedersen

SCHEME Moose Lake Park
Testing Area ML 78-1

DATE June/05

SHEET OF



SWL ~ 6 feet

Test with 2-inch suction pump for ½ hour

MG-449(a)

MANITOBA Parks

Moose Lake Provincial Park

Campground Tips

- Be sure matches are extinguished. Break them in half before discarding.
- Build no fires except in a designated firepit or use a camp stove. Before leaving make sure your fire is completely out.
- Be careful with your cigarettes, cigars and pipe ashes. Crush them thoroughly before discarding. Never toss them from a vehicle.
- Please! Do not litter.
- Be sensitive to wildlife. Bears can be dangerous and should not be fed. Food must be stored away from your campsite, preferably in a locked vehicle, to avoid attracting hungry animals. Do not store food in your tent.
- Warm clothing is needed for cool nights.
- The use of insect repellent will add to your comfort.
- Learn to recognize and avoid poisonous plants such as poison ivy.
- In case of injury or illness contact a Campground Attendant or Park Patrol Officer. They can assist you to reach medical help.
- Canoeists and hikers travelling in backcountry areas should advise a friend of their intended destination and anticipated length of trip.
- Backcountry camping is only allowed at designated campsites.
- It is illegal to use or transport elm firewood.
- Out of Province Firewood can spread harmful pests and destroy our forests - buy it locally, burn it locally.

Home of a provincially rare stand of white pine trees

A perfect lakeside location, Moose Lake Campground offers 24 electrical sites and 72 regular sites. A picnic shelter and popular play areas make Moose Lake a great place to get away for a weekend with the family. For summertime fun, the campground has many outdoor activities including a horseshoe pitch, two volleyball courts, excellent fishing and watersports.

Take a leisurely stroll along the long beach on the shore of Moose Lake. Bring your tackle box and rod and go fishing off the sand or in a boat. The boat dock and launch are in the campground. The convenience store is located within the park at the Silver Birch Resort.

The park is home to a provincially rare strand of white pine trees. Though common in Ontario, they reach their western limit from here to the southern Whiteshell.

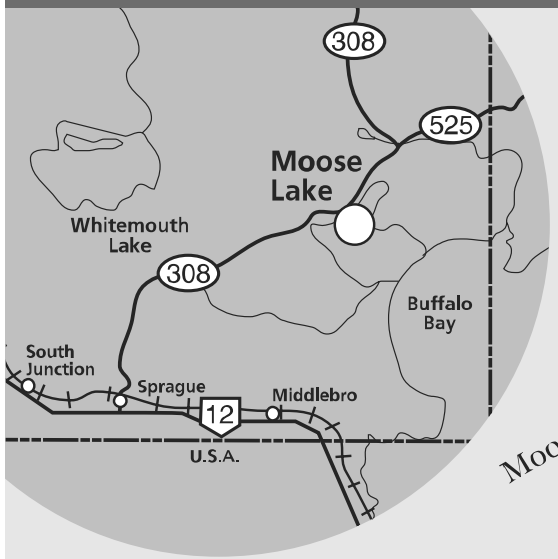
160 kms from Winnipeg. Travel south on highway #12 then turn left onto Provincial Road #308, for 35 kilometers.

More information on Moose Lake Campground and Moose Lake Provincial Park is available on request from the park office.

Manitoba

Moose Lake Campground

Moose Lake Provincial Park



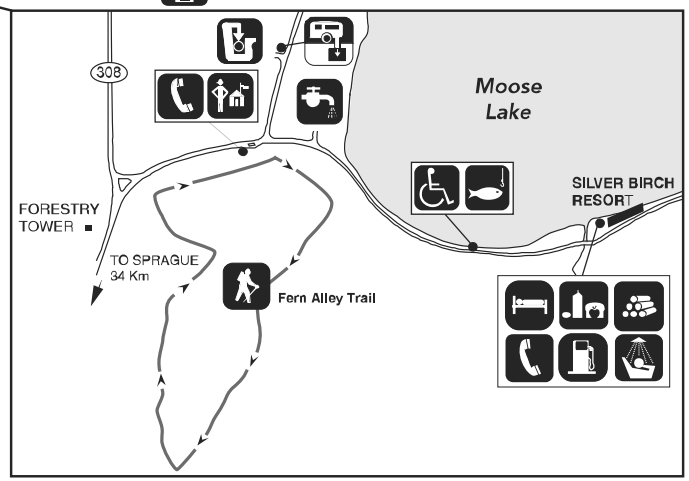
SEASONAL SITES:

Sites #2, 16-24, 42-46, 50-54

Local Weather:
102.1 FM (Roseau)
92.5 FM (Warroad)

NOTE:

- For campsite and group use reservations: www.manitobaparks.com or 1-888-4U2-Camp (1-888-482-2267). In Winnipeg call 204-948-3333.
- Remember, a Park Vehicle Permit is required and must be displayed year round.
- For more information or last minute campsite availability call 1-800-214-6497. In Winnipeg call 204-945-6784 or visit us at: www.manitobaparks.com
- IN CASE OF EMERGENCY, use land line to contact Manitoba 911
(RCMP: 204-437-2135) (Ambulance: 204-425-3222)



LEGEND

- ACCOMMODATION
- BEACH / SWIMMING UNSUPERVISED
- BOAT- LAUNCH
- FIREWOOD (CONCESSIONAIRE)
- FISH CLEANING AREA
- GAS STATION
- GROCERY STORE
- HIKING TRAIL
- HORSESHOE PITCH
- LIFE JACKET LOAN KIOSK
- PARKING
- PUBLIC TELEPHONE
- PICNIC SHELTER
- PLAYGROUND
- REFUSE DISPOSAL
- SHOWER (COIN-OPERATED)
- TRAILER SANITARY STATION
- VOLLEYBALL COURT
- WASHROOMS (NON-MODERN)
- WASHROOMS (MODERN)
- WATER SUPPLY

E ELECTRICAL SERVICE

January 2016

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Environmental Division

Certificate of Analysis

Eastern

ATTN: WILLIAM PREVOST

MOOSE LAKE PROV PARK
BOX 70
SPRAGUE MB R0A 1Z0

Report Date: 04-MAY-10 13:01 (MT)
Version: FINAL

Lab Work Order #: **L879229** **Date Received:** **21-APR-10**

Project P.O. #: NOT SUBMITTED
Job Reference: MOOSE LAKE PROV PARK
Legal Site Desc:
CofC Numbers:

Other Information:

Comments:

Paul Nicolas
Account Manager

Manitoba Technology Centre Ltd.
Part of the ALS Laboratory Group
1329 Niakwa Road East, Unit 12, Winnipeg, MB R2J 3T4
Phone: +1 204 255 9720 Fax: +1 204 255 9721 www.alsglobal.com
A Campbell Brothers Limited Company

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L879229-1 1) MOOSE LAKE PUMP STATION - WELL 1							
Sampled By: BILL PREVOST on 21-APR-10 @ 11:00							
Matrix: WATER - UNTREATED WELL							
MB Conservation test 72D							
Alkalinity							
Alkalinity, Total (as CaCO3)	168		1.0	mg/L		03-MAY-10	R1247297
Bicarbonate (HCO3)	206		2.0	mg/L		03-MAY-10	R1247297
Carbonate (CO3)	<0.60		0.60	mg/L		03-MAY-10	R1247297
Hydroxide (OH)	<0.40		0.40	mg/L		03-MAY-10	R1247297
Ammonia-N Low Level							
Ammonia-N	0.549		0.0050	mg/L		03-MAY-10	R1246714
Chloride Dissolved							
Chloride (Cl) - Dissolved	1.85		0.40	mg/L	21-APR-10	28-APR-10	R1244125
Conductivity							
Conductivity	300		0.40	umhos/cm		22-APR-10	R1240807
Fluoride, Dissolved							
Fluoride (F) - Dissolved	0.19		0.10	mg/L	21-APR-10	27-APR-10	R1243563
Hardness Calculated							
Hardness (as CaCO3)	170		0.30	mg/L		23-APR-10	
Ion Balance Calculation							
Ion Balance	102			%		04-MAY-10	
TDS (Calculated)	166			mg/L		04-MAY-10	
Hardness (as CaCO3)	170			mg/L		04-MAY-10	
Langelier Index 4C							
Langelier Index (4 C)	0.13					04-MAY-10	
Langelier Index 60C							
Langelier Index (60 C)	0.90					04-MAY-10	
Nitrate+Nitrite-N							
Nitrate+Nitrite-N	<0.0060		0.0060	mg/L		23-APR-10	R1242026
Sulphate Dissolved							
Sulphate (SO4) - Dissolved	2.1		2.0	mg/L	21-APR-10	28-APR-10	R1244380
Total Carbon							
Total Carbon	46.5		1.0	mg/L		22-APR-10	R1240472
Total Dissolved Solids							
Total Dissolved Solids	180		5.0	mg/L		23-APR-10	R1242227
Total Inorganic Carbon							
Total Inorganic Carbon	39.3		1.0	mg/L		22-APR-10	R1240472
Total Metals by ICP-MS							
Aluminum (Al)-Total	0.0431		0.0050	mg/L	22-APR-10	22-APR-10	R1240945
Antimony (Sb)-Total	<0.00020		0.00020	mg/L	22-APR-10	22-APR-10	R1240945
Arsenic (As)-Total	0.00055		0.00020	mg/L	22-APR-10	22-APR-10	R1240945
Barium (Ba)-Total	0.0254		0.00020	mg/L	22-APR-10	22-APR-10	R1240945
Beryllium (Be)-Total	<0.00020		0.00020	mg/L	22-APR-10	22-APR-10	R1240945
Bismuth (Bi)-Total	<0.00020		0.00020	mg/L	22-APR-10	22-APR-10	R1240945
Boron (B)-Total	0.015		0.010	mg/L	22-APR-10	22-APR-10	R1240945
Cadmium (Cd)-Total	<0.000010		0.000010	mg/L	22-APR-10	22-APR-10	R1240945
Calcium (Ca)-Total	40.5		0.10	mg/L	22-APR-10	22-APR-10	R1240945
Cesium (Cs)-Total	<0.00010		0.00010	mg/L	22-APR-10	22-APR-10	R1240945
Chromium (Cr)-Total	<0.0010		0.0010	mg/L	22-APR-10	22-APR-10	R1240945
Cobalt (Co)-Total	<0.00020		0.00020	mg/L	22-APR-10	22-APR-10	R1240945
Copper (Cu)-Total	0.00035		0.00020	mg/L	22-APR-10	22-APR-10	R1240945
Iron (Fe)-Total	0.898		0.020	mg/L	22-APR-10	22-APR-10	R1240945
Lead (Pb)-Total	0.000413		0.000090	mg/L	22-APR-10	22-APR-10	R1240945
Lithium (Li)-Total	0.0056		0.0020	mg/L	22-APR-10	22-APR-10	R1240945
Magnesium (Mg)-Total	16.7		0.010	mg/L	22-APR-10	22-APR-10	R1240945
Manganese (Mn)-Total	0.106		0.00030	mg/L	22-APR-10	22-APR-10	R1240945

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L879229-1 1) MOOSE LAKE PUMP STATION - WELL 1							
Sampled By: BILL PREVOST on 21-APR-10 @ 11:00							
Matrix: WATER - UNTREATED WELL							
Total Metals by ICP-MS							
Molybdenum (Mo)-Total	<0.00020		0.00020	mg/L	22-APR-10	22-APR-10	R1240945
Nickel (Ni)-Total	<0.0020		0.0020	mg/L	22-APR-10	22-APR-10	R1240945
Phosphorus (P)-Total	<0.20		0.20	mg/L	22-APR-10	22-APR-10	R1240945
Potassium (K)-Total	1.79		0.020	mg/L	22-APR-10	22-APR-10	R1240945
Rubidium (Rb)-Total	0.00415		0.00020	mg/L	22-APR-10	22-APR-10	R1240945
Selenium (Se)-Total	<0.0010		0.0010	mg/L	22-APR-10	22-APR-10	R1240945
Silicon (Si)-Total	4.81		0.050	mg/L	22-APR-10	22-APR-10	R1240945
Silver (Ag)-Total	<0.00010		0.00010	mg/L	22-APR-10	22-APR-10	R1240945
Sodium (Na)-Total	1.89		0.030	mg/L	22-APR-10	22-APR-10	R1240945
Strontium (Sr)-Total	0.0605		0.00010	mg/L	22-APR-10	22-APR-10	R1240945
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	22-APR-10	22-APR-10	R1240945
Thallium (Tl)-Total	<0.00010		0.00010	mg/L	22-APR-10	22-APR-10	R1240945
Thorium (Th)-Total	<0.00010		0.00010	mg/L	22-APR-10	22-APR-10	R1240945
Tin (Sn)-Total	<0.00020		0.00020	mg/L	22-APR-10	22-APR-10	R1240945
Titanium (Ti)-Total	0.00152		0.00020	mg/L	22-APR-10	22-APR-10	R1240945
Tungsten (W)-Total	<0.0010		0.0010	mg/L	22-APR-10	22-APR-10	R1240945
Uranium (U)-Total	<0.00010		0.00010	mg/L	22-APR-10	22-APR-10	R1240945
Vanadium (V)-Total	0.00055		0.00020	mg/L	22-APR-10	22-APR-10	R1240945
Zinc (Zn)-Total	<0.0050		0.0050	mg/L	22-APR-10	22-APR-10	R1240945
Zirconium (Zr)-Total	<0.00040		0.00040	mg/L	22-APR-10	22-APR-10	R1240945
Total Organic Carbon							
Total Organic Carbon	7.2		1.0	mg/L		22-APR-10	R1240472
True Colour							
Color, True	10.0		5.0	T.C.U.		21-APR-10	R1239943
Turbidity							
Turbidity	2.45		0.10	NTU		21-APR-10	R1239944
pH							
pH	7.94		0.10	pH units		22-APR-10	R1240807
ODW test 695 VOC+BTX							
Volatile Organic Compounds							
1,1,1-Trichloroethane	<0.50	VC:RHS	0.50	ug/L		24-APR-10	R1241626
1,1,2-Trichloroethane	<0.50	VC:RHS	0.50	ug/L		24-APR-10	R1241626
1,1-Dichloroethylene	<0.50	VC:RHS	0.50	ug/L		24-APR-10	R1241626
Benzene	<0.50	VC:RHS	0.50	ug/L		24-APR-10	R1241626
Dichloromethane	<0.50	VC:RHS	0.50	ug/L		24-APR-10	R1241626
Ethyl Benzene	<0.50	VC:RHS	0.50	ug/L		24-APR-10	R1241626
m+p-Xylenes	<1.0	VC:RHS	1.0	ug/L		24-APR-10	R1241626
MTBE	<0.50	VC:RHS	0.50	ug/L		24-APR-10	R1241626
o-Xylene	<0.50	VC:RHS	0.50	ug/L		24-APR-10	R1241626
Tetrachloroethylene	<0.50	VC:RHS	0.50	ug/L		24-APR-10	R1241626
Toluene	<0.50	VC:RHS	0.50	ug/L		24-APR-10	R1241626
Trichloroethylene	<0.50	VC:RHS	0.50	ug/L		24-APR-10	R1241626
Xylenes (Total)	<1.5		1.5	ug/L		24-APR-10	R1241626
Miscellaneous Parameters							
Total Kjeldahl Nitrogen	0.89		0.20	mg/L	21-APR-10	23-APR-10	R1241405
Transmittance, UV (254 nm)	66.1		1.0	% T	26-APR-10	26-APR-10	R1242679
L879229-2 2) MOOSE LAKE PUMP STATION - WELL 2							
Sampled By: BILL PREVOST on 21-APR-10 @ 11:00							
Matrix: WATER - UNTREATED WELL							
MB Conservation test 72D							
Alkalinity							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L879229-2 2) MOOSE LAKE PUMP STATION - WELL 2							
Sampled By: BILL PREVOST on 21-APR-10 @ 11:00							
Matrix: WATER - UNTREATED WELL							
Alkalinity							
Alkalinity, Total (as CaCO3)	171		1.0	mg/L		03-MAY-10	R1247297
Bicarbonate (HCO3)	209		2.0	mg/L		03-MAY-10	R1247297
Carbonate (CO3)	<0.60		0.60	mg/L		03-MAY-10	R1247297
Hydroxide (OH)	<0.40		0.40	mg/L		03-MAY-10	R1247297
Ammonia-N Low Level							
Ammonia-N	0.758		0.0050	mg/L		03-MAY-10	R1246714
Chloride Dissolved							
Chloride (Cl) - Dissolved	1.79		0.40	mg/L	21-APR-10	28-APR-10	R1244125
Conductivity							
Conductivity	304		0.40	umhos/cm		22-APR-10	R1240807
Fluoride, Dissolved							
Fluoride (F) - Dissolved	0.20		0.10	mg/L	21-APR-10	27-APR-10	R1243563
Hardness Calculated							
Hardness (as CaCO3)	179		0.30	mg/L		23-APR-10	
Ion Balance Calculation							
Ion Balance	107			%		04-MAY-10	
TDS (Calculated)	171			mg/L		04-MAY-10	
Hardness (as CaCO3)	179			mg/L		04-MAY-10	
Langelier Index 4C							
Langelier Index (4 C)	0.13					04-MAY-10	
Langelier Index 60C							
Langelier Index (60 C)	0.90					04-MAY-10	
Nitrate+Nitrite-N							
Nitrate+Nitrite-N	<0.0060		0.0060	mg/L		23-APR-10	R1242026
Sulphate Dissolved							
Sulphate (SO4) - Dissolved	2.3		2.0	mg/L	21-APR-10	28-APR-10	R1244380
Total Carbon							
Total Carbon	48.1		1.0	mg/L		22-APR-10	R1240472
Total Dissolved Solids							
Total Dissolved Solids	186		5.0	mg/L		23-APR-10	R1242227
Total Inorganic Carbon							
Total Inorganic Carbon	40.4		1.0	mg/L		22-APR-10	R1240472
Total Metals by ICP-MS							
Aluminum (Al)-Total	0.0263		0.0050	mg/L	22-APR-10	22-APR-10	R1240945
Antimony (Sb)-Total	<0.00020		0.00020	mg/L	22-APR-10	22-APR-10	R1240945
Arsenic (As)-Total	0.00043		0.00020	mg/L	22-APR-10	22-APR-10	R1240945
Barium (Ba)-Total	0.0321		0.00020	mg/L	22-APR-10	22-APR-10	R1240945
Beryllium (Be)-Total	<0.00020		0.00020	mg/L	22-APR-10	22-APR-10	R1240945
Bismuth (Bi)-Total	<0.00020		0.00020	mg/L	22-APR-10	22-APR-10	R1240945
Boron (B)-Total	0.017		0.010	mg/L	22-APR-10	22-APR-10	R1240945
Cadmium (Cd)-Total	<0.000010		0.000010	mg/L	22-APR-10	22-APR-10	R1240945
Calcium (Ca)-Total	42.0		0.10	mg/L	22-APR-10	22-APR-10	R1240945
Cesium (Cs)-Total	<0.00010		0.00010	mg/L	22-APR-10	22-APR-10	R1240945
Chromium (Cr)-Total	<0.0010		0.0010	mg/L	22-APR-10	22-APR-10	R1240945
Cobalt (Co)-Total	<0.00020		0.00020	mg/L	22-APR-10	22-APR-10	R1240945
Copper (Cu)-Total	0.00039		0.00020	mg/L	22-APR-10	22-APR-10	R1240945
Iron (Fe)-Total	0.780		0.020	mg/L	22-APR-10	22-APR-10	R1240945
Lead (Pb)-Total	0.000338		0.000090	mg/L	22-APR-10	22-APR-10	R1240945
Lithium (Li)-Total	0.0053		0.0020	mg/L	22-APR-10	22-APR-10	R1240945
Magnesium (Mg)-Total	17.9		0.010	mg/L	22-APR-10	22-APR-10	R1240945
Manganese (Mn)-Total	0.176		0.00030	mg/L	22-APR-10	22-APR-10	R1240945
Molybdenum (Mo)-Total	<0.00020		0.00020	mg/L	22-APR-10	22-APR-10	R1240945

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ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L879229-2 2) MOOSE LAKE PUMP STATION - WELL 2							
Sampled By: BILL PREVOST on 21-APR-10 @ 11:00							
Matrix: WATER - UNTREATED WELL							
Total Metals by ICP-MS							
Nickel (Ni)-Total	<0.0020		0.0020	mg/L	22-APR-10	22-APR-10	R1240945
Phosphorus (P)-Total	<0.20		0.20	mg/L	22-APR-10	22-APR-10	R1240945
Potassium (K)-Total	2.16		0.020	mg/L	22-APR-10	22-APR-10	R1240945
Rubidium (Rb)-Total	0.00408		0.00020	mg/L	22-APR-10	22-APR-10	R1240945
Selenium (Se)-Total	<0.0010		0.0010	mg/L	22-APR-10	22-APR-10	R1240945
Silicon (Si)-Total	5.47		0.050	mg/L	22-APR-10	22-APR-10	R1240945
Silver (Ag)-Total	<0.00010		0.00010	mg/L	22-APR-10	22-APR-10	R1240945
Sodium (Na)-Total	2.09		0.030	mg/L	22-APR-10	22-APR-10	R1240945
Strontium (Sr)-Total	0.0655		0.00010	mg/L	22-APR-10	22-APR-10	R1240945
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	22-APR-10	22-APR-10	R1240945
Thallium (Tl)-Total	<0.00010		0.00010	mg/L	22-APR-10	22-APR-10	R1240945
Thorium (Th)-Total	<0.00010		0.00010	mg/L	22-APR-10	22-APR-10	R1240945
Tin (Sn)-Total	<0.00020		0.00020	mg/L	22-APR-10	22-APR-10	R1240945
Titanium (Ti)-Total	0.00096		0.00020	mg/L	22-APR-10	22-APR-10	R1240945
Tungsten (W)-Total	<0.0010		0.0010	mg/L	22-APR-10	22-APR-10	R1240945
Uranium (U)-Total	<0.00010		0.00010	mg/L	22-APR-10	22-APR-10	R1240945
Vanadium (V)-Total	0.00037		0.00020	mg/L	22-APR-10	22-APR-10	R1240945
Zinc (Zn)-Total	<0.0050		0.0050	mg/L	22-APR-10	22-APR-10	R1240945
Zirconium (Zr)-Total	<0.00040		0.00040	mg/L	22-APR-10	22-APR-10	R1240945
Total Organic Carbon							
Total Organic Carbon	7.7		1.0	mg/L		22-APR-10	R1240472
True Colour							
Color, True	10.0		5.0	T.C.U.		21-APR-10	R1239943
Turbidity							
Turbidity	1.17		0.10	NTU		21-APR-10	R1239944
pH							
pH	7.92		0.10	pH units		22-APR-10	R1240807
ODW test 695 VOC+BTX							
Volatile Organic Compounds							
1,1,1-Trichloroethane	<0.50		0.50	ug/L		24-APR-10	R1241626
1,1,2-Trichloroethane	<0.50		0.50	ug/L		24-APR-10	R1241626
1,1-Dichloroethylene	<0.50		0.50	ug/L		24-APR-10	R1241626
Benzene	<0.50		0.50	ug/L		24-APR-10	R1241626
Dichloromethane	<0.50		0.50	ug/L		24-APR-10	R1241626
Ethyl Benzene	<0.50		0.50	ug/L		24-APR-10	R1241626
m+p-Xylenes	<1.0		1.0	ug/L		24-APR-10	R1241626
MTBE	<0.50		0.50	ug/L		24-APR-10	R1241626
o-Xylene	<0.50		0.50	ug/L		24-APR-10	R1241626
Tetrachloroethylene	<0.50		0.50	ug/L		24-APR-10	R1241626
Toluene	<0.50		0.50	ug/L		24-APR-10	R1241626
Trichloroethylene	<0.50		0.50	ug/L		24-APR-10	R1241626
Xylenes (Total)	<1.5		1.5	ug/L		24-APR-10	R1241626
Miscellaneous Parameters							
Total Kjeldahl Nitrogen	1.13		0.20	mg/L	21-APR-10	23-APR-10	R1241405
Transmittance, UV (254 nm)	65.8		1.0	% T	26-APR-10	26-APR-10	R1242679

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