DEVELOPMENT PERMIT

NO. **DP- 2019-02**

TO: **Waterline Resources Inc.**

ADDRESS: **2430 Jingle Pot Rd.**
Nanaimo, B.C. V9R6W2
(Permittee)

1) This Development Permit is issued subject to compliance with all of the Bylaws of the Town of Gibsons applicable thereto, except those specifically varied or supplemented by this Permit.

2) The Development Permit applies to those "lands" within the Town of Gibsons described below:

Parcel Identifier:	**007-897-103**
Legal Description:	**Lot 3, Block B, Plan 14197**
Civic Address:	**464 South Fletcher Road**
Parcel Identifier:	**007-897-090**
Legal Description:	**Lot 2, Block B, Plan 14197**
Civic Address:	**351 Gower Point Road**
Parcel Identifier:	**011-944-072**
Legal Description:	**Lot 11, Plan 4060**
Civic Address:	**540 Gower Point Road**

3) These lands are within Development Permit Area No. 9 for the purpose of the protection of the Gibsons Aquifer.

4) The "lands" described herein shall be developed strictly in accordance with the terms and conditions and provisions of this Permit, and any plans and specifications attached to and forming part of this Permit; specifically:

- Letter from Waterline Resources Inc., *RE: Drilling of Monitoring Wells and Water Supply Well, Town of Gibsons, BC,* dated January 18, 2019 and stamped by Simon Wing, P.Geo. Hydrologist.
- *Proposed Drilling Program for the Gibsons Area Expansion*, prepared by Waterline Resources and issued January 15, 2019.

5) Minor changes to the aforesaid drawings that do not affect the intent of this Development Permit are permitted only with the approval of the Town of Gibsons and a hydrogeological professional.

6) If the Permittee does not commence the development permitted by this Permit within twenty-four months of the date of this Permit, this Permit shall lapse.

7) Upon completion of the works, a letter from a qualified professional is required to provide all drill well logs and to ensure all conditions of this permit were met.

8) This Permit is NOT a Building Permit.

ISSUED THIS 28th DAY OF FEBRUARY, 2019.

Lesley-Ann Staats, MCIP, RPP
Director of Planning

Copy of permit to Waterline Resources

2430 Jingle Pot Rd
Nanaimo, British Columbia
Canada V9R 6W2
Tel: 250.585.0800
Toll Free: 1.888.585.0802
www.waterlineresources.com

January 18, 2019
2550-18-001

Town of Gibsons
474 South Fletcher Rd
Box 340, Gibsons, BC

Attention: Dave Newman (Director of Infrastructure Services)

Dear Mr. Newman,

RE: Drilling of Monitoring Wells and Water Supply Well, Town of Gibsons, BC

1.0 INTRODUCTION

The enclosed letter is intended to support the Town of Gibsons (the Town) Development Permit Area (DPA) #9 application requirements for the proposed drilling locations provided in Waterline Resources Inc.'s technical specification document (Appendix A of the Proposed Drilling Program for the Gibsons Area Expansion). This letter specifically addresses Section 16.10 of the Town's Official Community Plan (OCP; Town of Gibsons 2015) which requires that work involving drilling (excavation >1.5 m) within the Town boundary and more specifically the Lower Gibsons Subarea, considered all the hazards associated to flowing artesian conditions prior to commencing work activities.

This letter should be read in conjunction with the following:

- *Develop Permit 1, 2 and 9 Application Form*;
- *Proposed Drilling Program* for the Gibsons Area Expansion (as per Bylaw 1192-01); *Schedule F* – Gibsons Aquifer Development Permit Area No. 9 of the OCP (included in Attachments); and
- *Email Letter Report* for the DPA-1 Considerations (Provided by Thurber Engineering; included in Attachments).

2.0 SCOPE OF WORK

It is understood this permit can be updated and amended as development plans are finalized. Details of the current scope of work, including the proposed drilling site locations are included in the technical specifications document *(*Appendix A of the *Proposed Drilling Program* for the Gibsons Area Expansion). Proposed in this application are the:

- Drilling of two monitoring wells (MW18-01 and MW18-02) in the Holland and Winegarden park areas, to monitor aquifer pressure and water quality at various depths in the Gibsons aquifer;

- Drilling of one water supply well (TW5) in the Dougall park area, to provide added capacity to the existing water supply network and replace aging infrastructure; and

- Construction of road access to TW5. Construction will be completed under the supervision of the Town's Infrastructure Services team and will involve minor changes to the land surface (leveling and grading). It is expected that gravel material will be laid in areas where soft and wet ground conditions are encountered. The road access material will be staying in place after the work is complete and organics stripped from the access alignment will be redistributed in adjacent areas of the park.

3.0 REGULATOR CONSIDERATIONS

3.1 Geotechnical Hazard Development Permit Area No.1 (DPA-1)

All regulatory consideration for construction of the access road have been discussed with and review by Thurber Engineering. A response to the DPA-1 guidelines is included as an *Email Letter Report*.

3.2 Gibsons Aquifer Development Permit Area No.9 (DPA-9)

The sustainability and overall health of the Gibsons Aquifer is important for the Town and the local ecosystem, as stated in the OCP (Town of Gibsons 2015). As our work area is in the Lower Gibsons Subarea (*Schedule F* of the OCP; Town of Gibsons 2015), flowing artesian conditions are expected during the planned drilling activities. The BC MOE Flowing Artesian document and the BC Groundwater Protection Regulations (2016) were consulted during the creation of the technical specifications for the Service Area Expansion work, which is included in the *Proposed Drilling Program* as Appendix A. The water well driller contracted to complete all drilling related activities is registered in the province of British Columbia and all certification are provided in the *Proposed Drilling Program* as Appendix C.

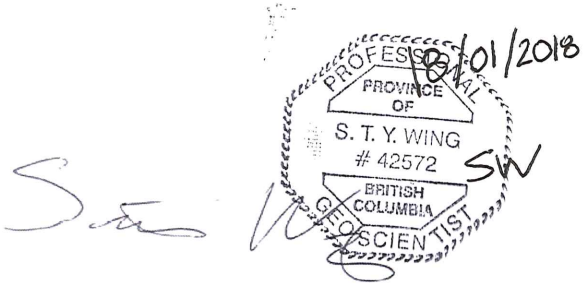
4.0 CERTIFICATION

This document was prepared under the direction of a professional geologist, geoscientist or engineer registered in the Province of British Columbia.

Waterline Resources Inc. trusts that the information provided in this document is sufficient for your requirements. Should you have any questions or concerns, please do not hesitate to contact the undersigned.

Respectfully submitted,

Waterline Resources Inc.

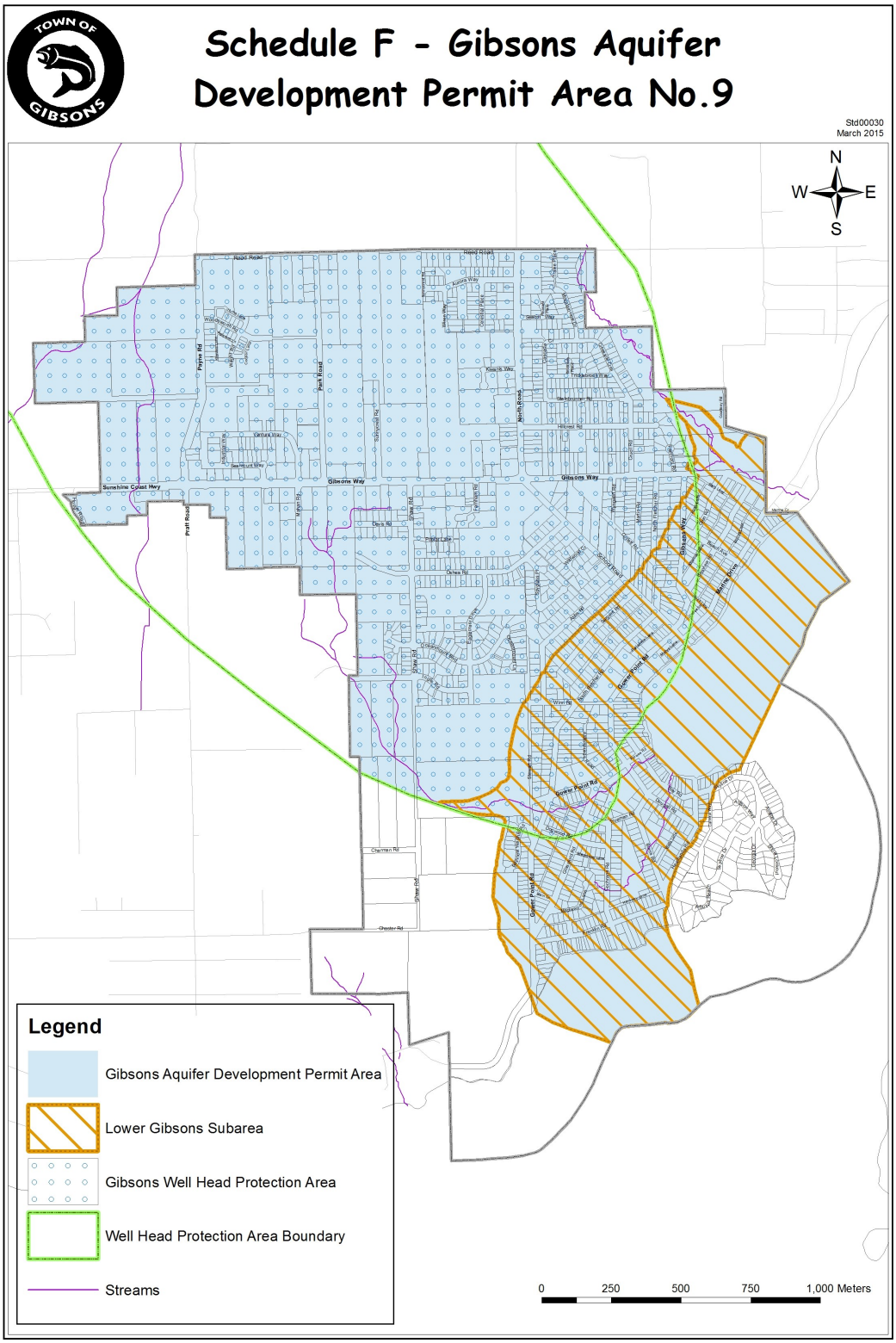


Simon Wing, B.Sc., P.Geo.
Hydrogeologist

5.0 REFERENCES

Town of Gibsons, 2015. SMART PLAN – Gibsons Official Community Plan (Schedule A:" Town of Gibsons Official Community Plan Bylaw No. 985, 2005"). Published for the Town of Gibsons March 2015.

ATTACHEMENTS


Schedule F - Gibsons Aquifer Development Permit Area No.9
Std00030
March 2015
N
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Legend
Gibsons Aquifer Development Permit Area
Lower Gibsons Subarea
Gibsons Well Head Protection Area
Well Head Protection Area Boundary
Streams
0 250 500 750 1,000 Meters

Simon Wing

From: Marc Bosse <mbosse@thurber.ca>
Sent: 21-Jan-19 9:20 AM
To: Simon Wing
Cc: David Tara; Dave Newman; Steve Brubacher
Subject: Gibson Well DPA-1/9_23443
Attachments: 2018 DP 1, 2, 9 Guide & Application.pdf

Good day Simon,

We understand that a gravel access road and drilling platform have been constructed by the Town of Gibsons in Dougall Park. The road and platform comprise about 300 mm of granular material and were placed after stripping the topsoil. The topsoil will be spread back over the road and working surface when the work is completed. Dougall Park is located in a low geotechnical hazard area on Town of Gibsons map Development Permit Area #1.

It is our opinion that no significant flooding hazard is associated with construction of the road and platform in the context of DPA #1. From an operations and maintenance standpoint, the raised ground may obstruct surface drainage and lead to the formation of new, wet, soft spots in the park. We understand that this was the reason for the road and platform in the first place. The Town should review the fill placed and should consider placing additional fill to eliminate low spots and facilitate surface drainage to reduce water impoundment.

It is also our opinion that no significant risk is associated with construction of the road and platform in the context of DPA #9. The minor excavation work required (< 0.3 m) for construction would not be expected to compromise the integrity of the shallow cap confining Gibsons aquifer.

We trust this is sufficient for your needs. Please call if you have any questions.

Regards,

Marc C. Bossé, M.Sc., P.Eng.
Geotechnical Engineer

Thurber Engineering Ltd.
#900 – 1281 West Georgia Street
Vancouver, British Columbia V6E 3J7

T. 604 684 4384 | F. 604 684 5124 | M. 778 899-8055
thurber.ca

Reviewed by: David Tara, P.Eng.

Proposed Drilling Program for The *Gibsons Area Expansion*

Submitted to: The Town of Gibsons

Date Issued: ***January 15, 2019***

PREPARED BY: *Waterline Resources Inc.*

CC:	Town of Gibsons representative	Dave Newman and Daniel Tardif
	Town's hydrogeology consultant	Waterline Resources Inc.
	Drilling contractor	Drillwell Enterprises Inc.

CONTACT LIST

EMERGENCY NUMBERS

Town of Gibsons Representative: Dave Newman(604) 741-8370 *and or Daniel Tardif (604) 841-7491*
Drilling Contractor Owner/Principal: *Shawn Slade, (250) 746-5268 , (250) 510-9253*

Ambulance/Hospital **911**

Town Hydrogeology Consultant

Principal Hydrogeologist: D*arren David, (250) 585-0800 , (250) 741-4851*
Field Hydrogeologist: *Gage Nordstrom, (250) 741-6189 and Simon Wing, (403) 478-1405*

OTHER CONTACT INFORMATION

Registered Driller: [*Scott Burrows, (250) 710-4484*]

Registered Pump Installer: [*Monashee Aquifer Testing*]

TO BE POSTED ON SITE

1 OVERVIEW

1.1 The purpose of subject the drilling program is to:

- *Please review the technical specifications: Service Area Expansion (Appendix A)*

1.2 As outlined in the Town of Gibsons Development Permit Area Guidelines, the proposed drilling area is underlain by a known artesian aquifer (the Gibson Aquifer) and therefore an increased standard of care is needed to protect the aquifer.

- *Drilling will be completed in Holland/Winegarden and Dougall Parks as outlined in the technical specification: Service Area Expansion (Appendix A; Figure 1 and 2)*

1.3 Waterline understands there are some risks associated with the proposed drilling program in the lower Gibsons aquifer (planned installation of 2 monitoring wells and 1 water supply well). Flowing artesian conditions are known and expected and present the following hazards:

- *Uncontrolled artesian flow when aquitard is breached*
- *Erosion of Surface sediments if artesian flow is left unattended or site worker are unprepared to mitigate the flow*
- *Impact on the Town of Gibsons' water wells if the aquifer is breached and left unsealed*
- *Potential loss of aquifer pressure if the aquifer is breached and not sealed properly*

1.4 The proposed borehole *locations, anticipated depth, well completion information and best practices are included in the technical specifications: Service Area Expansion (Appendix A)*

Table 1: Example table of proposed borehole details

Borehole Name	***Location***	***Planned Depth***	***Well Completion***
[see Tech Spec]	*[see Tech Spec]*	*[see Tech Spec]*	*[see Tech Spec]*

2 PRE-DRILLING REQUIREMENTS

2.1 The following must be established prior to drilling commencement:

- Knowledge and understanding of British Columbia's Groundwater Protection Regulation (GWPR 2016)
  - *(http://www.bclaws.ca/Recon/document/ID/freeside/11_299_2004)*
- WorkSafe BC program:
  - *Waterline and Drillwell will provide the relevant Safe Job Procedures (SJP), Safe Work Practices (SWPs) for activities taking place on site (Appendix B)*
- Permit Requirements:
  - *Work is being completed for the town of Gibsons and the DPA-9 permitting application is required. See seperate application form*
- Driller certification:
  - *Provided in the Drilling Contractor Material, Appendix C*
- All rig lifting equipment, and overhead equipment must be certified to the Original Equipment Manufacturers Specifications (OEM).
  - *A Dual Rotary Rig (either a DR24 or DR12) will be used for the this scope of work. The rigs were bought new in 2018 and 2011 respectively. All equipment is original from the manufacturer*
- Casing handling and running procedures:
  - *Provided in Drillwell's H&S 2018 document, Appendix B*
- Certificates of Insurance and WorkSafe BC letters for Waterline and Drillwell
  - *Provided in Appendix D*
- Drill rig specifications
  - *Provided in the Drilling Contractor Material, Appendix C*
- Additional pre-drilling requirements:
  - *The BC MoE Flowing Artesian Wells document is included in Appendix E and a valid BC one call with utility clearance is included in Appendix F*

3 RIG MOVE, RIG UP AND SITE SAFETY

3.1 The following procedures site safety provisions must be followed in mobilizing, set up and operation of the drilling rig:

- *Drilling contractor to confirm with Waterline the day before mobilization to site that the drill and equipment is ready. Waterline will confirm with the Town that all utility locates are complete*
- *Move in and rig up drilling rig and auxiliary equipment on site (first drilling location will be determined during the site inspection). Prior to initiating drilling, carry out detailed rig inspection and report any unsafe conditions to consultant*
- *Properly define the exclusion zone around all equipment to ensure that no public or unauthorized personel can walk through the working area. The drilling set up will be consistent with the drawing included in Appendix C*
- *Hold a pre-drilling safety meeting with the rig crew and all consultants on site to discuss the Hazardous Operations and drilling program*
- *Certified driller to be onsite at all times during drilling*

4 GENERAL DRILLING PROCEDURES

4.1 Roles and responsibilities:

- *Waterline will be onsite to observe the drilling and testing activites and will report all condtions to the Town*
- *Drillwell will drill and install the MWs and WSW. Pump contractor (TBD) will complete the aquifer testing.*

4.2 Methodology of data and sample collection:

- *All relevant procedures are included in the technical specifications: Service Area Expansion (Appendix A)*

4.3 Drilling and Testing Details

- *Details of the proposed drilling activities are included in the technical specifications: Service Area Expansion (Appendix A), including mitigative measures for encountering artesian conditions. The BC MoE Flowing Artesian Wells document was used for guidance (Appendix E)*
- *Details of the proposed well construction are also included in the technical specifications: Service Area Expansion (Appendix A). The well installation will be supervised by Waterline and will comply with the GWPR 2016*

5 FIELD PACKAGE

- The following documents are attached:

  - *Proposed borehole/well location plan (Appendix A)*
  - *Site specific Health and Safety Plan including SJPs and SWPs for Waterline and Drillwell (Appendix B)*
  - *Drilling Contractor Materials (Waterwell driller identification, rig equipment/set up diagram and operation; Appendix C)*
  - *Certificate of Insurance and WorkSafe BC letter (Appendix D)*
  - *BC MoE Flowing Artesian Well Document (Appendix E)*
  - *BC One-call and Utility clearances (Appendix F)*

APPENDIX A

2430 Jingle Pot Road
Nanaimo, British Columbia
Canada V9R 6W2
Tel: 250.585.0800
Toll Free: 1.844.585.0800
www.waterlineresources.com

Technical Memorandum

Prepared For:	Urban Systems and the Town of Gibsons.	**Date:**	October 04, 2018
Prepared By:	Simon Wing, P.Geo, Hydrogeologist	**File No.:**	2550-18-001
Subject:	Technical Specifications for the Gibsons Aquifer Service Area Expansion		

1.0 INTRODUCTION AND BACKGROUND

1. These technical specifications apply for the work related to drilling, installation and testing of new wells for the Town of Gibsons. Two tasks are being recommended at two pre-determined locations within lower Gibsons (Figure 1 and Figure 2), with a third (optional) task being proposed at a pre-determined location in upper Gibsons (Figure 3). The work related to these tasks include:

    - Task 1 – Drilling and installing three monitoring wells (2-inch diameter) in Holland and Winegarden parks (Figure 1). The monitoring wells would be instrumented with packers to control artesian flow and downhole pressure transducers;
    - Task 2 – Drilling and installing one water supply well (Town Well #5 [TW5]; 12-inch diameter) in Dougall Park (Figure 2). Conducting a 72-hour constant rate pump test with recovery period once the well is developed; and
    - Task 3 (Optional - based on the testing results of Task 2) – Drilling and installing a test well (TW18-01; 8-inch diameter) on Oceanmount Blvd (Figure 3). Conducting a 48-hour constant rate pump test with recovery period once the well is developed.

2. The contractor should provide complete, fully tested and operational process components and materials to meet requirements described herein. All rig lifting equipment, and overhead equipment must be certified to the Original Equipment Manufacturers Specifications (OEM).

3. The Town will supply a vacuum truck to take away drill cutting during the drilling activities, however the contractor should provide some containment for times when no services are available.

4. The contractor's methods for each task (drilling, well installation, development and testing) should be outlined in their proposal for review by the hydrogeological consultant and client representative.

5. A registered well driller (contractor), as defined under the BC Water Sustainability Act, will complete the drilling, well installation, development, testing (contractor also registered as a pump installer or has a qualified staff member) and instrumentation of the monitoring wells, the water supply well and the test well. A copy of the Qualified Well Driller certification will be provided to the hydrogeological consultant prior to starting work. It will also be the responsibility of the contractor to ensure this work will be completed in accordance to the Groundwater Protection Regulation (GWPR, 2016).

6. The site is known to be underlain by an artesian aquifer (the Gibson Aquifer) and therefore an increased standard of care is needed to protect the aquifer during subsurface investigations. Based on Waterline's Gibsons Aquifer mapping program (Waterline 2013; https://gibsons.ca/), we understand that piezometric heads of over 10 m above sea level are possible (14.2 psi). We envisage that the following risks would be involved in the proposed drilling program:

    a) Uncontrolled artesian flow if the aquitard is breached;
    b) Potential for ground settlement and internal erosion if artesian flow is encountered and left unsealed;
    c) Impact on the Town's nearby water supply wells if the aquifer is breached and left unsealed and;
    d) Potential loss of aquifer pressure if the aquifer is breached and not sealed properly.

7. More information about the extent and area of lower and upper Gibsons aquifer can be referenced online under Schedule F – Gibsons Aquifer DPA 9 of the Town of Gibsons Official Community Plan page (https://gibsons.ca/).

8. Due to potential risks of artesian conditions, the contractor must demonstrate their competency in controlling or stopping artesian flow. Documentation of specific training, experience, knowledge or skill should be provided in the contractor's proposal to be reviewed prior to engaging in any work. The use of a proper annular diversion system for managing flowing conditions at surface will be instrumental in the success of the project. Alternative measures for overcoming the natural hydrostatic pressure of the formation such as the use of drilling with mud (mud weight should be greater than 1000 kg/m^3) should also be considered and presented in the contractor's proposal.

9. Artesian flow to surface from the Gibsons aquifer has been measured between 45 to 203 m^3/day (8-33 USGPM). Therefore, water should be re-directed to the stormwater outfall system when flowing conditions are encountered. The discharge pipe/hose should extend to the base of the stormwater outfall points where the storm drain outlet is located. Locations of the stormwater outfall points are indicated on Figures 1-3.

10. More details for managing artesian conditions are outline under the Groundwater Protection Regulation (GWPR 2016; Section 15), the Groundwater Protection Regulation handbook (GWPR 2017) and the Flowing Artesian Wells Guidance document (MOE; ISBN 978-0-7726-7034-2).

2.0 SAFETY

1. A WorkSafe BC program will be developed by the contractor with site specific H&S requirements and special considerations for working within an urban environment. All local by-laws will be discussed with a client representative prior to starting any work.

2. Permitting will be completed prior to the start of the job and the proper permits will be obtained by the Town of Gibsons Development Permit group.

3. A review of the ground disturbance package with the hydrogeological consultant will be completed prior to starting any work. All line locating documents (sketches and communications) for the area around the proposed drilling locations will be reviewed in full and the exact drilling locations may change depending on the location of any underground facilities (Figures 1-3).

4. Safety barriers and signage indicating the “no go zone” will be properly marked prior to spotting the drilling equipment on a new location. Prior to initiating drilling, a detailed rig inspection will be completed, and any unsafe conditions will be reported to hydrogeological consultant and client representative.

5. At the start of every morning and before each new task, a pre-job safety meeting with the rig crew and site personnel will be completed to discuss the hazardous operations being performed.

6. Driller certification (Training courses) will be reviewed at the start of the project by both the hydrogeological consultant and the client representative. The certified driller must always be onsite during drilling.

3.0 TASK 1 – MONITORING WELL DRILLING IN HOLLAND AND WINEGARDEN PARKS

The monitoring wells to be drilled as apart of task 1 are being completed to monitor aquifer pressure and water quality over time, while pumping at existing Town Well #1 (TW1) and Town Well #4 (TW4) completed in the lower Gibsons aquifer, is ongoing. The proposed drilling locations, depths and installation requirements are summarized below in Table 1.

Table 1: Proposed Monitoring Well Details

Monitoring Well Name	Proposed Location	Steel Surface Casing Diameter (mm)	Well Casing Diameter (mm)	Casing Type	Expected Depth (m)	Expected Water Level (mbgl)	Instrumentation (Y/N)
MW18-01	Northwest of TW1	152	50	PVC	15 - 25	Artesian	Y
MW18-02	Midway point of TW1 and TW4	152	50	PVC	15 - 20	Artesian	Y
MW18-03	Northwest of TW4	152	50	PVC	10 - 20	Artesian	Y

Notes: 'mm' means milometer; 'PVC' means polyvinyl chloride tubing; 'mbgl' means meters below ground level

Specific tasks related to drilling, installation, development and instrumentation of the proposed three monitoring wells will include:

1. Ensuring proper well control is in place prior to starting any drilling activities. The contractor should be capable of diverting artesian flow (range of 45 to 203 m^3/day) to the nearest stormwater outfall system. There are multiple stormwater outfall points (>10) within a 100 m radius of the Holland and Winegarden parks (Figure 1).

2. Setting surface casing into the upper confining layer (aquitard) above the Gibsons aquifer. This aquitard layer is very thin in places and therefore a review of the drilling logs should be completed prior to starting any drilling activities (reference drilling logs for TW1 and TW4; Appendix A). Suggested best practices for securing surface casing are included in Groundwater Protection Regulations (GWPR 2016) and may involve:

    a) A minimum of 6.0 m of surface casing to be cemented in place within the interbedded aquitard layer;
    b) Using a high-density grout such as neat cement or concrete grout with bentonite;
    c) Pressure cementing the casing in place using a cement plug (shoe), ensuring cement returns are noted in the annular space between the formation wall and the outer wall of the casing; and
    d) Allowing for adequate time for the cement to set before proceeding with drilling.

3. Drilling vertically to the estimated total depth (TD) as noted in Table 1. All three monitoring wells will be logged by the hydrogeological consultant and the actual TD will be determined in the field based on observed geology.

4. Measuring the hydraulic head when the aquifer is penetrated, and the artesian flow is detected. This should be completed at surface by placing a cap with a pressure gauge onto the top of the casing. Once the hydraulic pressure is recorded, the cap should then be removed.

5. Depending on the well construction method as determined by the contractor:
    a) The screen assembly should be lowered to TD. Either a 1.5 or 3.0 m screen section will be installed at each of the locations based on the observed drill cuttings;
    b) A natural pack or a gravel pack will be placed adjacent to the screened section (Using a tremie pipe to place gravel pack if needed) based on formation conditions. The gravel pack should extend from the base of the screen to approximately 0.5 m above the top of the screen;
    c) A bentonite seal should be placed above gravel pack or natural pack, with a thickness >1.0 m (Using a tremie line to place the bentonite pellets if necessary) and;
    d) A surface seal (neat cement or concrete grout with bentonite) should be placed by tremie into the annular space above the bentonite seal to the top of the surface casing. The weight and volume of cement or grout should be calculated to balance the formation artesian pressure.

6. The flow at surface should be properly diverted away from the well while the grout mixture is setting up.

7. Following drilling and installation, each monitoring well will be developed through airlifting using the rig air compressor. The minimum air-compressor size (example 350 CFM or 150 psi) will be determined by the contractor based on the well diameter and necessary lifting velocity. Well development will be completed for a minimum of 60 minutes or until field parameters (pH, temperature, conductivity and turbidity) have stabilized. Despite the expected artesian conditions, the goal of airlifting will be to remove any drilling fluids and fines from around the well screen and to ensure a direct hydraulic connection between the well and the formation.

8. The water produced during the development task should be diverted to the nearest stormwater outfall point (Figure 1). Sediment from the development water should be removed prior to entering the storm drain outlet. This could be achieved using a settling tank (e.g. roll off bin etc.) and pumping the water off the top of the tank. Also, sediments pads (e.g. hay bails etc.) could be laid near the discharge point as a second approach to filtering the water.

9. The well configuration at surface should meet the standards and guidelines outline in the GWPR (2016) including proper surface seals and wellhead securement.

10. The contractor should also budget time and effort for sourcing a packer system (e.g.: RST Instruments, Wellbusters, etc.) that can pass a direct read cable/data logger (provided by the hydrogeological consultant) to allow for long term measurements of downhole parameters. Further discussion with the hydrogeological consultant should be completed in advance of mobilizing to site to allow for adequate lead up time for sourcing this equipment. Other specific requirements for the packer system would include:
    a) Minimum length of 3.0 m to prevent freezing of groundwater at surface; and
    b) Is capable of being removed from the well if needed to allow for groundwater sampling or replacement of the downhole instrumentation.

4.0 TASK 2 – WATER SUPPLY WELL DRILLING AND TESTING IN DOUGAL PARK

The water supply well (TW5) is intended to be a high capacity well which would be added to the existing well network that supplies potable drinking water to the Town. Town Well #5 (TW5) is being drilled in a proven location within the lower Gibsons aquifer near existing TW2 and TW3 and will target a similar depth interval. The proposed drilling location, depths and installation requirements are summarized below in Table 2.

Table 2: Proposed Water Supply Well Details

Well Name	Proposed Location	Steel Surface Casing Diameter (mm)	Well Casing Diameter (mm)	Casing Type	Expected Depth (m)	Expected Water Level (mbgl)	Aquifer Testing Type and duration
TW5	Northwest of TW3	406	298	Steel	20 - 40	Artesian	Step Rate test and 72-hour constant rate test with recovery period

Notes: ‘mm’ means milometer; ‘mbgl’ means meters below ground level

Specific tasks related to the drilling, installation, development and testing of the proposed TW5 in lower Gibsons will include:

1. Ensuring proper well control is in place prior to starting any drilling activities. The contractor should be capable of diverting artesian flow (range of 45 to 203 m^3/day) to the nearest stormwater outfall system. There are multiple stormwater outfall points (>10) within a 100 m radius of Dougall park (Figure 2).

2. Setting surface casing into the upper confining layer (aquitard) above the Gibsons aquifer. This aquitard layer is very thin in places and therefore a review of the drilling logs should be completed prior to starting any drilling activities (reference drilling logs for TW2 and TW3; Appendix A). Suggested best practices for securing surface casing are included in the reference material (GWPR 2016) and may involve:
    a) A minimum of 6.0 m of surface casing to be cemented in place within the interbedded aquitard layer;
    b) Using a high-density grout such as neat cement or concrete grout with bentonite;
    c) Pressure cementing the casing in place using a cement plug (shoe), ensuring cement returns are noted in the annular space between the formation wall and the outer wall of the casing and;
    d) Allowing for adequate time for the cement to set before proceeding with drilling.

3. Drilling vertically to TD as noted in Table 2. Waterline's wellsite hydrogeologist will be on site to log samples, collect field water chemistry and complete sieve analysis. Grain-size analysis will be completed across the most productive water-bearing sand and gravel unit to provide the basis for selecting the screen slot size. An aggressive slot size (D60 or greater) will be recommend for achieving the highest well yield.

4. Once a slot size and screen length has been determined, the contractor will source the stainless-steel screen through a third-party vendor with a quick turn around time, so that standby time is minimized.

5. Measuring the hydraulic head when the aquifer is penetrated, and the artesian flow is detected. This should be completed at surface by placing a cap with a pressure gauge onto the top of the casing. Once the hydraulic pressure is recorded, the cap should then be removed.

6. Depending on the construction method determined by the contractor:
    a) The production casing should be cemented in place so that the annular space between the surface casing is sealed off. The weight and volume of cement or grout should be calculated to balance the formation artesian pressure;
    b) The screen assembly should be lowered to TD; and
    c) The well would be completed with either a naturally developed filter pack or an artificial gravel pack based on the contractor's chosen drilling method and the encountered formation conditions.

7. The flow at surface should be properly diverted away from the well while the grout mixture is setting up.

8. The well configuration at surface should meet the standards and guidelines outline in the Groundwater Protection Regulation (GWPR 2016) and included proper surface seal, stickup, and locking well cap.

9. Following the drilling and well installation, a combination of air surging and jetting should be used to promote the migration of the fine-grained material, capable of passing the slot opening, to enter the well and to be removed during the development process. Other methods such as surging and bailing with a cable tool rig should be considered as a second approach to development to promote the highest well yields. Field parameters including pH, temperature, conductivity, turbidity and sand production will be monitored by the hydrogeological consultant to ensure adequate development is completed. The intended purpose of TW5 is to provide the Town with potable drinking water at the highest yields. As such, turbidity will need to remain stable below 10 Nephelometric Turbidity unit (NTU) to deem the development complete. The contractor should budget enough time (3 to 6 hours per meter of screen or as seen fit) and effort for this portion of the project.

10. The water produced during the development task should be diverted to the nearest stormwater outfall point (Figure 2). Sediment from the development water should be removed prior to entering the storm drain outlet. This could be achieved using a settling tank (e.g. roll off bin etc.) and pumping the water off the top of the tank. Also, sediments pads (e.g. hay bails etc.) could be laid near the discharge point as a second approach to filtering the water.

11. The testing program will be completed directly after the development and will consist of a step-rate test (5 steps of 1 hour) and a 72-hour constant-rate aquifer test. Recovery time should also be budgeted between the step rate and constant rate tests (minimum 1-2 hours or to 90% of pre-pumping water level) and after the constant rate test is completed (water level must recover to 95% of the non-pumping level before the pump can be removed from the well).

    As a note, other wells (8-inch diameter) in the lower Gibsons aquifer have been previously tested at 1200 to 1500 m^3/day and the goal is to achieve a higher rate for TW5.

12. The aquifer testing program will be designed to meet the licensing requirements under the Water Sustainability Act (WSA) and therefore all relevant tasks related to section 4 of the Guidance for Technical Assessment Requirements in Support of an Application for Groundwater use in British Columbia (2016) and the Guide to Conducting Well pumping Tests (MOE ISBN 978-0-7726-7033-5) will need to be completed or addressed.

    As such, the contractor should include all materials related to the aquifer testing requirements and should budget time and efforts for 24-hour coverage during the testing period. Tasks to be completed by the contractor during testing will include:

    a) Installing all pump testing equipment downhole and on surface (power supply, electrical submersible pump(s), drop tubing, flow meters, flow control valve, lay flat hose and all fittings needed to take water chemistry samples etc.);
    b) Activating the pump and confirming and recording the rate of flow;
    c) Maintaining the appropriate setting on the flow control valve for constant backpressure and pumping rate (within +/- 5%) as determined by the hydrogeological consultant;
    d) Collecting flow and water level response data in the pumped well. The static water level (referenced below top of casing) in the well should be measured using an electronic water level tape through an access tube. Please note that the water level meter should be thoroughly clean with a chlorine solution prior to deployment into the well. Measurement frequencies are outlined in the reference material (MOE ISBN 978-0-7726-7033-5);
    e) Monitor water quality parameters including pH, temperature, electrical conductivity, and turbidity. The hydrogeological consultant will be onsite during daytime hours (06:00 to 18:00) to help with data collection; and
    f) Managing the discharge water to the nearest stormwater outfall point in compliance with the Town's requirements.

13. An electronic copy of the data must be provided to hydrogeological consultant after the well testing is complete and before moving onto the next task.

5.0 TASK 3 (OPTIONAL) - TEST WELL DRILLING AND TESTING ON OCEANMOUNT BOULAVARD

This task should be included as **optional** and will be based on the testing results of TW5. The completion and testing of this test well (TW18-01) in the upper Gibsons watershed will be to explore other potential aquifer locations. As such, limited information about the deliverability of the aquifer is known. The proposed test well will be drilled near existing water observation well WL10-02 and will have a similar target depth interval. The proposed drilling location, depths and installation requirements are summarized below in Table 3.

Table 3: Proposed Test Well Details

Well Name	Proposed Location	Steel surface Casing Diameter (mm)	Well Casing Diameter (mm)	Casing Type	Expected Depth (m)	Expected Water Level (mbgl)	Aquifer Testing Type and duration
TW18-01	>15m East of WL10-02	251	203	Steel	110 - 150	85	Step Rate test and 48-hour constant rate test with recovery period

Notes: 'mm' means milometer; 'mbgl' means meters below ground level

Specific tasks related to the drilling, installation, development and testing of the proposed test well (TW18-01) in upper Gibsons will include:

1. Ensuring proper well control is in place prior to starting any drilling activities. Artesian conditions are not expected in the upper Gibsons aquifer at the Oceanmount drilling location, however surface casing should be cemented in place as part of the best practices outlined in the GWPR (2016).

2. Drilling vertically to TD as noted in Table 3. Waterline's wellsite hydrogeologist will be on site to log samples, collect field water chemistry and complete sieve analysis. Grain-size analysis will be completed across the most productive water-bearing sand and gravel unit to provide the basis for selecting the slot size. An aggressive slot size (D60 or higher) will be recommend for achieving the highest well yield.

3. Once a slot size and screen length has been determined, the contractor will source the stainless-steel screen through a third-party vendor with a quick turn around time, so that standby time is minimized.

4. Measuring the depth to water using an electronic water level tape. Please note that the water level tape should be thoroughly clean with a chlorine solution prior to deployment into the well.

5. Depending on the construction method determined by the contractor:
    a) The production casing should be cemented in place so that the annular space between the surface casing is sealed off;
    b) The screen assembly should be lowered to TD; and
    c) The well would be completed with either a naturally developed filter pack or an artificial gravel pack based on the contractor's chosen drilling method and the encountered formation conditions.

6. The well configuration at surface should meet the standards and guidelines outline in the GWPR (2016) and included proper surface seal, well stickup, and locking cap.

7. Following the drilling and well installation, a combination of air surging and jetting should be used to promote the migration of the fine-grained material, capable of passing the slot opening, to enter the well and to be removed during the development process. Other methods such as surging and bailing with a cable tool rig should be considered as a second approach to development to promote the highest well yields. Field parameters including pH, temperature, conductivity, turbidity and sand production will be monitored by the hydrogeological consultant to ensure adequate development is completed. The intended purpose of TW18-01 is to provide the Town with potable drinking water at the highest yields. As such, turbidity will need to remain stable below 10 Nephelometric Turbidity unit (NTU) to deem the development complete. The contractor should budget enough time (3 to 6 hours per meter of screen or as seen fit) and effort for this portion of the project.

8. The water produced during the development task should be diverted to the nearest stormwater outfall point (Figure 3). Sediment from the development water should be removed prior to entering the storm drain outlet. This could be achieved using a settling tank (e.g. roll off bin etc.) and pumping the water off the top of the tank. Also, sediments pads (e.g. hay bails etc.) could be laid near the discharge point as a second approach to filtering the water.

9. The testing program will be completed directly after the development and will consist of a step-rate test (5 steps of 1-hour) and a 48-hour constant-rate aquifer test. Recovery time should also be budgeted between the step rate and constant rate tests (minimum 1-2 hours or to 90% of pre-pumping water level) and after the constant rate test is completed (water level must recover to 95% of the non-pumping level before the pump can be removed from the well).

   As a note, other wells (8-inch diameter) in the lower Gibsons aquifer have been previously tested at 1200 to 1500 m^3/day and the goal is to achieve a rate that is equal or higher for TW18-01.

10. The aquifer testing program will be designed to meet the licensing requirements under the Water Sustainability Act (WSA) and therefore all relevant tasks related to section 4 of the Guidance for Technical Assessment Requirements in Support of an Application for Groundwater use in British Columbia (2016) and the Guide to Conducting Well pumping Tests (MOE ISBN 978-0-7726-7033-5) will need to be completed or addressed.

    As such, the contractor should include all materials related to the aquifer testing requirements and should budget time and efforts for 24-hour coverage during the testing period. Tasks to be completed by the contractor during testing will include:

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    b) Activating the pump and confirming and recording the rate of flow;
    c) Maintaining the appropriate setting on the flow control valve for constant backpressure and pumping rate (within +/- 5%) as determined by the hydrogeological consultant;
    d) Collecting flow and water level response data in the pumped well. The static water level (referenced below top of casing) in the well should be measured using an electronic water level tape through an access tube. Please note that the water level meter should be thoroughly clean with a chlorine solution prior to deployment into the well. Measurement frequencies are outlined in the reference material (MOE ISBN 978-0-7726-7033-5);
    e) Monitor water quality parameters including pH, temperature, electrical conductivity, and turbidity. The hydrogeological consultant will be onsite during daytime hours (06:00 to 18:00) to help with data collection; and
    f) Managing the discharge water to the nearest stormwater outfall point in compliance with the Town's requirements.

11. An electronic copy of the data must be provided to hydrogeological consultant after the well testing is complete and before moving onto the next task.

Figures

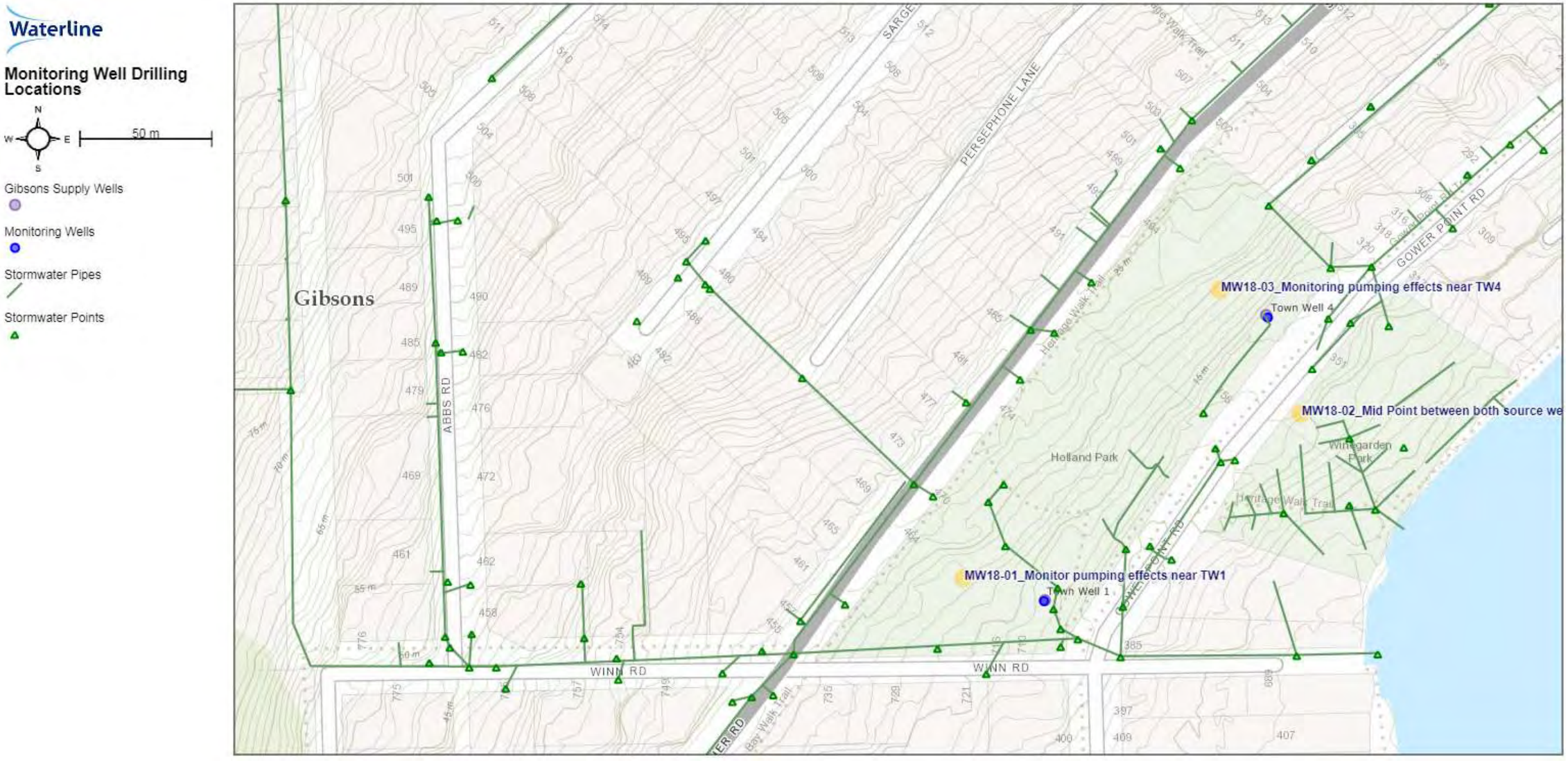


Figure 1: Monitoring Well Drilling Locations (Holland and Winegarden Parks)

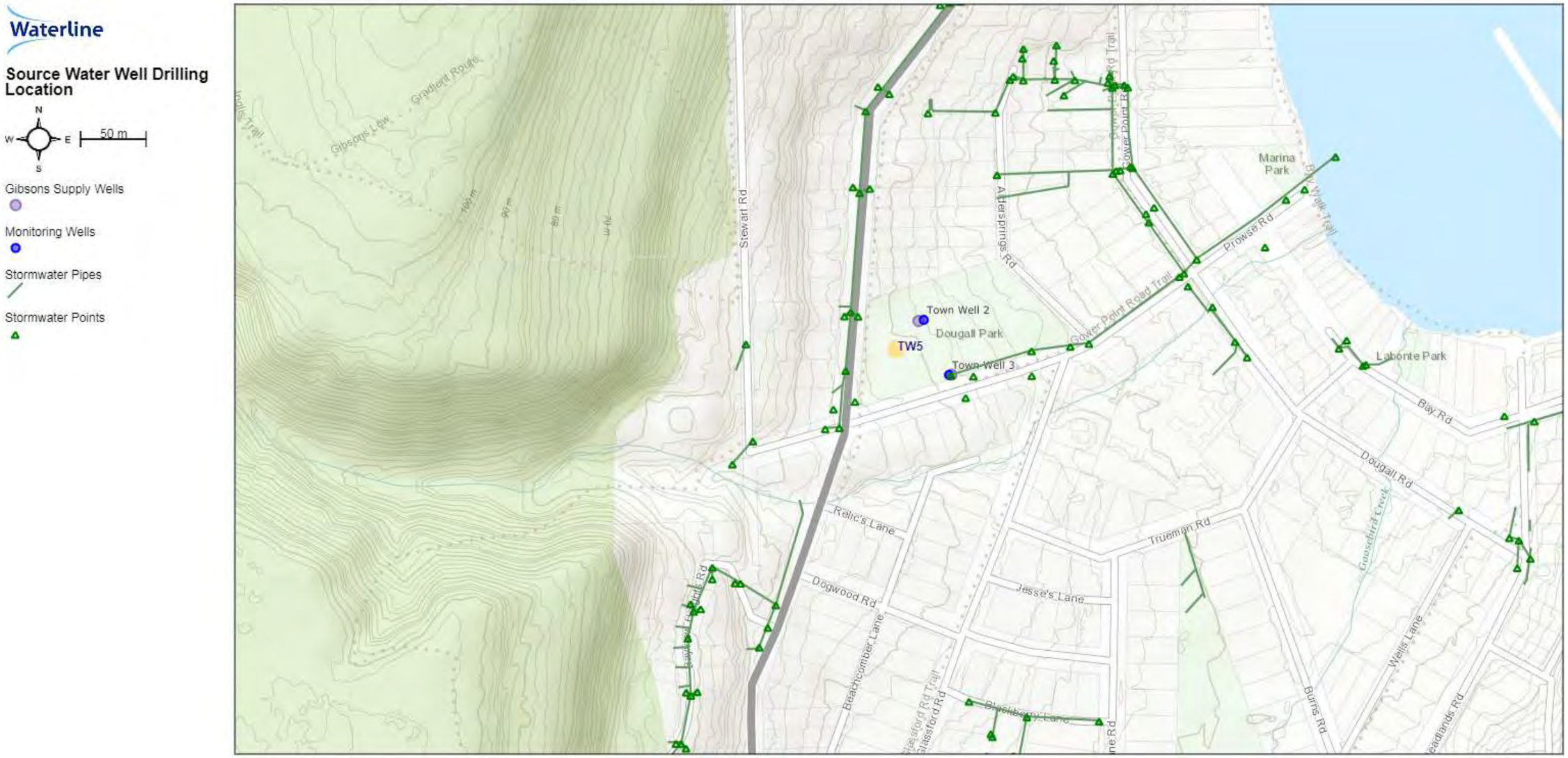


Figure 2: Town Well #5 Drilling Location (Dougall Park)

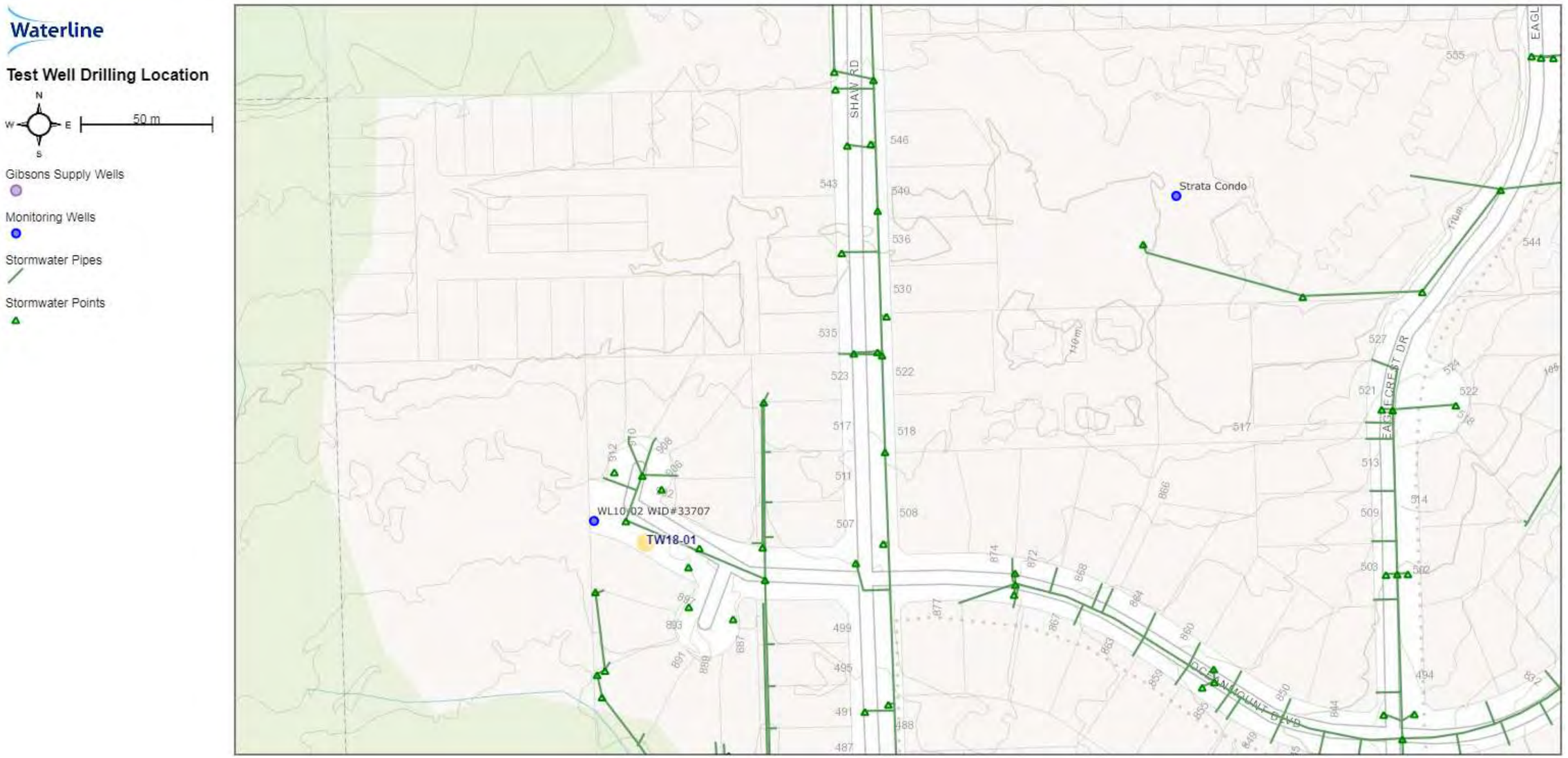


Figure 3: Test Well (Optional) Drilling Location (Oceanmount Blvd)

Appendix A: Well Logs

	Gibsons, British Columbia	BOREHOLE: Town Well 1
INSTALLED BY: Piteau Associates	ATS:	SITE: WL09-1578
DRILL TYPE:	EAST: 463057 NORTH: 5472034	ELEVATION: 12.72 (masl)

FILL TYPE: Slough | Bentonite | Grout | Backfill | Sand | Peltonite | Open Hole | Fill

SAMPLE TYPE: Shelby Tube | No Recovery | Split Spoon | Disturbed | Dynamic Cone | Core | Grab Sample

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	WELL INSTALLATION (Casing diam. = 0.254 m)
0	Fill			
	0.61 mbgl			
	Soft organic top soil			
	1.219 mbgl			
2	Cobbles interfilled with silty fine sand			
	Boulders - interspaced with compact			
4				
6	Sandy gravel medium to coarse, few			
8	Sandy gravel (medium to coarse) W.B.			
10	10.058 mbgl			
	Coarse sand and gravel. 2" to 4" and			
12	Coarse sand and fine gravel mostly sand			
	Sand, medium to coarse with occasional			
14				
16				
18				
20	Medium to coarse sand (W.B.)			
22				
	23.165 mbgl			
24	Coarse sand some fine gravel			
	25.298 mbgl			
26	Silty sand fine to medium compact			
28				
30	Sand fine to medium (W.B.)			
	Compact silty sand			
	30.785 mbgl			
32	Compact silt with peat stringers			
	32.918 mbgl			
34	Sand fine to med., some silt			
	Compact silty sand			
	Silty sand medium			
36	Light grey fine silty sand			
	Fine grey sand (very little silt) W.B.			
38				
40	Fine grey sand with a little silt			
42				
	END OF HOLE AT 42.06 m			
44				
46				
48				

	TYPE: Supply	COMPLETION DEPTH: 22.9 (m)
	LOGGED BY: VILLAGE OF GIBSONS	COMPLETION DATE:
	CHECKED BY:	Date printed: 20-Oct-2016

	Gibsons, British Columbia	BOREHOLE: Town Well 4
INSTALLED BY: Piteau Associates	ATS:	SITE: WL09-1578
DRILL TYPE:	EAST: 463143 NORTH: 5472141	ELEVATION: 13.00 (masl)

FILL TYPE: Slough | Bentonite | Grout | Backfill | Sand | Peltonite | Open Hole | Fill

SAMPLE TYPE: Shelby Tube | No Recovery | Split Spoon | Disturbed | Dynamic Cone | Core | Grab Sample

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	WELL INSTALLATION
0	Grey, silty, coarse gravel and cobbles			Steel surface Casing
2				
	3.0 mbgl			
	Grey, tight silty sand and silty fine gravel			
	3.66 mbgl			
4	Grey silty coarse sand. seams of fine sand and silt			no annular fill
	5.49 mbgl			
	Brown, silty coarse sand			
6	6.09 mbgl			Steel ID=311mm; OD=324 mm
	Silty fine to medium gravel and coarse sand			
	7.01 mbgl			
	Brown silty, fine to coarse sand with stones			
8	Fine to coarse sand and fine gravel			
	Brown, silty, fine to coarse sand with stones (flowing)			
10	Fine to coarse sand with sone stones			
	10.97 mbgl			
	Silty, coarse gravel with cobbles (no water)			K-packer
12	Coarse gravel and coarse sand			Blank riser Drive shoe
	Fine to coarse gravel and coarse sand			Sand pack (no details)
14				
	Fine to coarse gravel and coarse sand			
16				Tail pipe
	Fine to coarse gravel and coarse sand. Seams: grey packed silt with fine to medium gravel. Less flow.			
	Fine to coarse gravel and coarse sand			Backfilled with sand and gravel
18	Fine to coarse gravel and coarse sand, some fine sand			
	18.59 mbgl			
	Compact, fine sand and grey silt with some coarse gravel seams			
20	END OF HOLE AT 19.5 m			
	Other wells in nest: TW00-01			

	TYPE: Supply	COMPLETION DEPTH: 16.2 (m)
	LOGGED BY:	COMPLETION DATE: 2000-Sep-30
	CHECKED BY:	Date printed: 20-Oct-2016

WELL LOG CONSTRUCTION RECORD

OWNER Village of Gibsons

Address P. O. Box 340, Gibsons B.C.

Well Location Municipal Park, Gibsons B.C.

Date Started December 4, 1975 Date Completed December 11, 1975

RURAL WELLS LTD.
13117-116th AVE.
SURREY, B. C.
V3R 2S8

Drilling Method Air-rotary

Driller L. J. Desilets Helper W. Hendy

File 7557 Folio

Signed By

LOG OF FORMATIONS

Depth			Descriptions
0	to	7'	Silty gravel, some dark
	to		organics
7	to	14	Bouldery organic silty
	to		gravel
14	to	15	Silty medium sand with
	to		little gravel
15	to	17	Organic silty medium
	to		sand
17	to	21 &	Organic silt with few
	to		boulders
21	to	36	Compact claey silt with
	to		thin sand interbeds and
	to		small amount of gravel
36	to	42	Compact silty gravel
	to		water bearing, flow
	to		noted at 42 feet, flow
	to		about 40 gpm
42	to	48	Coarse gravel up to 4"
	to		sand fraction 10 - 15%
	to		
	to		
	to		
	to		
	to		
	to		
	to		
	to		

GENERAL REMARKS

CASING RECORD

Dia. 10 ins. Wt. ___ #/ft. From 1 to 15

Dia. 8 ins. Wt 28.4 #/ft. From 1 to 42

Dia. ___ ins. Wt. ___ #/ft. From ___ to ___

Shoe Yes Welded Yes Cemented Yes

SCREEN RECORD

Make Johnson Material Stainless

Slot opening #100 Length 5'

Top 43' ft. Bottom 48' ft.

Fittings Top Type "K" Fittings Bottom Bail

Gravel Pack ___ Natural ___

Development Method Air-surge

ROCK WELL DATA

Open Bore Hole ___ Dia. ___ ins.

From ___ ft. to ___ ft.

PRODUCTION DATA

Static Level Flowing well ft.

Measured from

Pumping Level ___ ft. at ___ GPM

___ ft. at ___ GPM

Bail Test ___ ft. at ___ GPH

___ ft. at ___ GPH

Recommended Pump Setting ___ ft.

Recommended Max. Pump Output 275 GPM ~~GPH~~

Duration of Test 24 Hrs.

PUMP DATA

Make ___ Type ___

Model ___ Serial No. ___

Size ___ HP ___ Drop Pipe ___ ins.

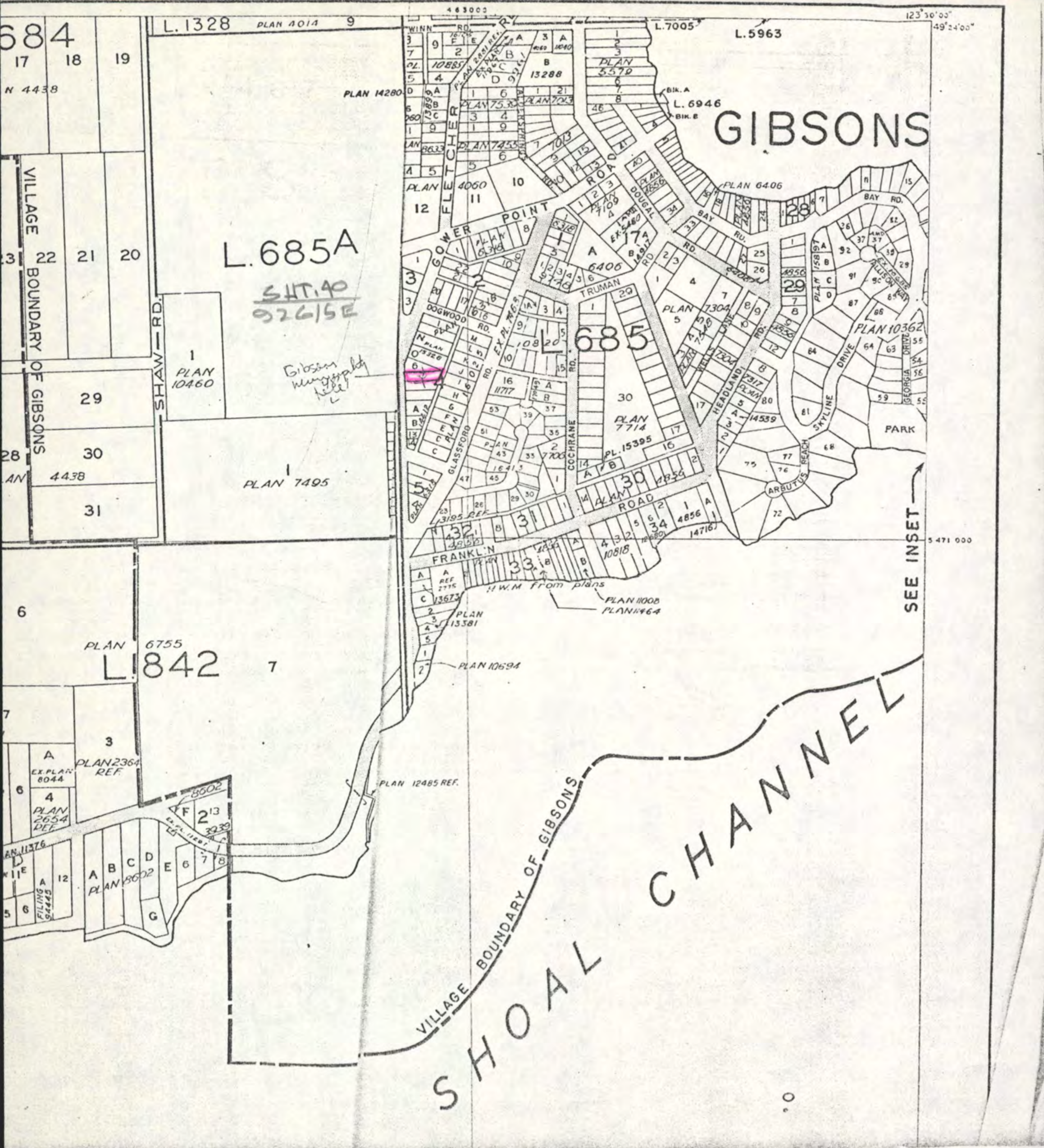
GPM ___ Head ___ ft. ___ RPM

Motor ___ Volts ___ PH ___

Well Seal ___

Water Analysis — Hardness ___ PPM

PH ___ Iron ___ PPM



GIBSONS
L.684
L.1328
L.7005
L.5963
L.6946
L.685A
SHT. 40
92G/5E
L.685
L.842
VILLAGE BOUNDARY OF GIBSONS
SHAW RD.
FLETCHER RD.
GOWER POINT ROAD
DOUGAL RD.
BAY RD.
TRUMAN
DOGWOOD RD.
COCHRANE RD.
GLASSFORD RD.
HEADLAND RD.
SKYLINE DRIVE
GEORGIA DRIVE
ARBUTUS REACH
FRANKLIN ROAD
PARK
SEE INSET
H.W.M. from plans
PLAN 11008
PLAN 11464
PLAN 13381
PLAN 10694
PLAN 12485 REF.
PLAN 10460
PLAN 7495
PLAN 6755
PLAN 7714
PLAN 10362
PLAN 6406
PLAN 4060
PLAN 8602
SHOAL CHANNEL
Gibsons Municipality Hall

92G.033.3.4.4 WTN 33950 #4

WATER WELL RECORD

DEPT. OF ENVIRONMENT, WATER RESOURCES SERVICE, WATER INVESTIGATIONS BRANCH VICTORIA, BRITISH COLUMBIA

LEGAL DESCRIPTION: LOT 7 SEC. 4 TP. ___ R. ___ D.L. 685 LAND DISTRICT NEW WEST PLAN 14412

DESCRIPTIVE LOCATION MUNICIPAL PARK GIBSONS B.C. LICENCE NO. ___ DATE ___

Z ___ WELL NO. ___

___ E

___ N

Z x71 Y28 NO. 4

SHT 40

NAT. TOPO. SHEET NO. 92G/5E

OWNER'S NAME VILLAGE OF GIBSON ADDRESS P.O. BOX 340 GIBSONS

DRILLER'S NAME RURAL W.D. ADDRESS SURREY DATE COMPLETED Dec 11/73

DEPTH 48 ELEVATION OF (120) ☐ ESTIMATED ☐ SURVEYED CASING DIAM. 10" LENGTH 1'-15'

METHOD OF CONSTRUCTION Air rotary CASING DIAM 8" LENGTH 1'-48'

SCREEN LOCATION 43'-48' SCREEN ☒ SIZE #100 LENGTH 5' TYPE S.S Johnson.

SANITARY SEAL YES ☒ NO ☐ SCREEN ☐ SIZE ___ LENGTH ___ TYPE ___

PERFORATED CASING ☐ LENGTH ___ PERFORATIONS FROM ___ TO ___

GRAVEL PACK ☐ LENGTH ___ DIAM. ___ SIZE GRAVEL, ETC. ___

DISTANCE TO WATER flowing ☐ ESTIMATED WATER LEVEL DEVELOP - AIR SURGE

FROM ___ ☐ MEASURED ELEVATION ___ ARTESIAN PRESSURE ___

DATE OF WATER LEVEL MEASUREMENT ___ WATER USE ___

PRODUCTION TEST SUMMARY

DATE ___

TEST BY ___

BAIL TEST ☐ PUMP TEST ☐ DURATION OF TEST 24h.

RATE ___ DRAWDOWN ___

WATER LEVEL AT COMPLETION OF TEST ___

AVAILABLE DRAWDOWN ___ SPECIFIC CAPACITY ___

PERMEABILITY ___ STORAGE COEFF. ___

TRANSMISSIVITY ___

RECOMMENDED PUMPING RATE 275 GPM

RECOMMENDED PUMP SETTING ___

CHEMISTRY

TEST BY ___ DATE ___

TOTAL DISSOLVED SOLIDS ___ mg/l TEMPERATURE ___ °C pH ___ SILICA (SiO_2) ___ mg/l

CONDUCTANCE ___ μmhos/cm AT 25°C TOTAL IRON (Fe) ___ mg/l TOTAL HARDNESS ($CaCO_3$) ___ mg/l

TOTAL ALKALINITY ($CaCO_3$) ___ mg/l PHEN. ALKALINITY ($Ca\ CO_3$) ___ mg/l MANGANESE (Mn) ___ mg/l

COLOUR ___ ODOUR ___ TURBIDITY ___

ANIONS	mg/l	epm	CATIONS	mg/l	epm
CARBONATE (CO_3)			CALCIUM (Ca)		
BICARBONATE (HCO_3)			MAGNESIUM (Mg)		
SULPHATE (SO_4)			SODIUM (Na)		
CHLORIDE (Cl)			POTASSIUM (K)		
$NO_2 + NO_3$ (NITROGEN)			IRON (DISSOLVED)		
* TKN. (NITROGEN)					
PHOSPHORUS (P)					

* TKN = TOTAL KJELDAHL NITROGEN CHEMISTRY SITE NO. ___

NO_2 = NITRITE NO_3 = NITRATE

CHEMISTRY FIELD TESTS

TEST BY ___ DATE ___ EQUIPMENT USED ___

LITHOLOGY

FROM	TO	DESCRIPTION
0	7	silty gravel, some dark organics
7	14	bouldery organic silty gravel
14	15	silty med sand with little gravel
15	17	Organic silty medium sand
17	21	" silt with few boulders
21	36	compact clayey silt with thin sand interbeds & small amount of gravel
36	42	compact silty gravel WB flow noted at 42' about 40 GPM.
42	48	Coarse gravel up to 4" sand fraction 10-15%

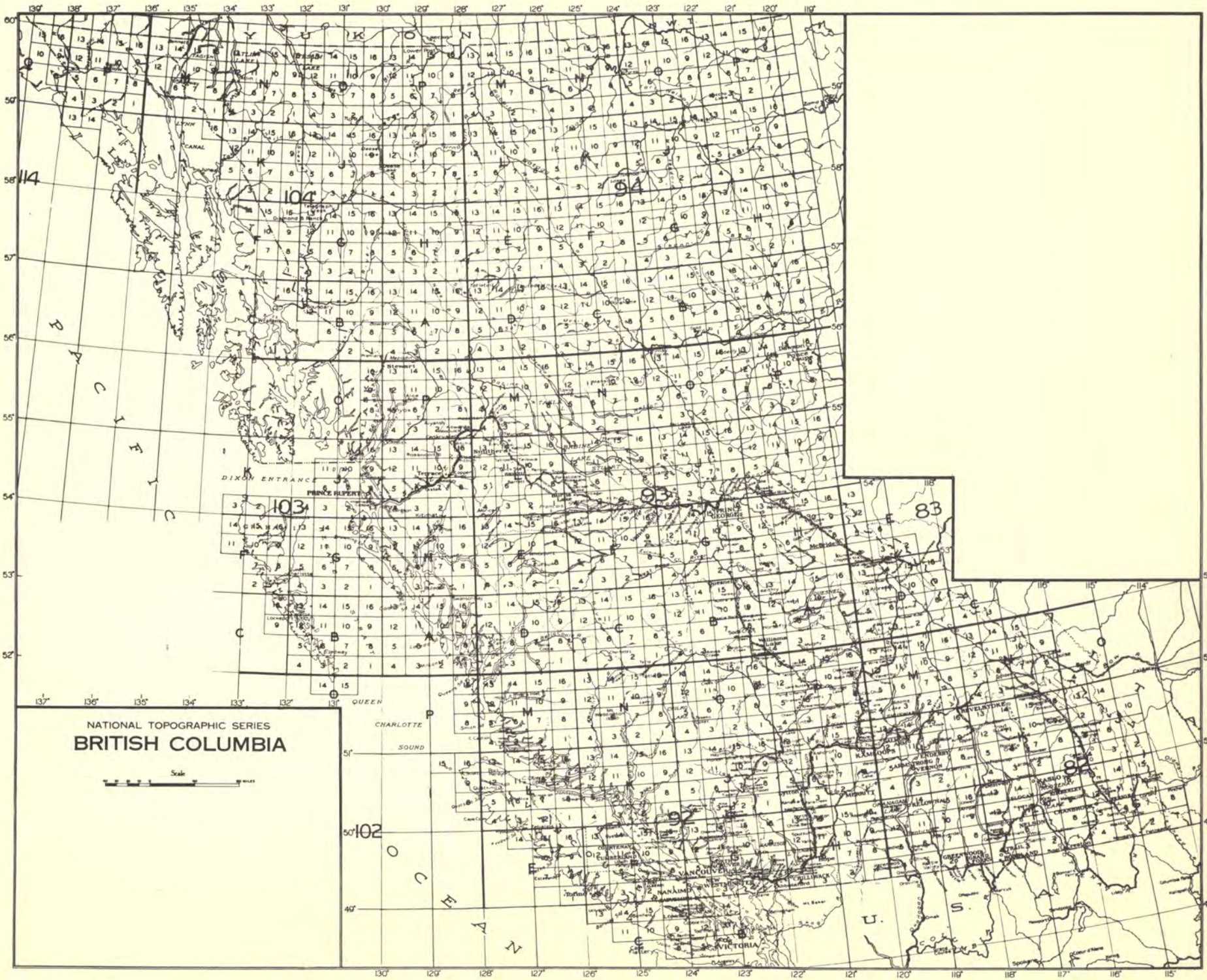
CONTENTS OF FOLDER

☒ DRILL LOG ☐ PUMP TEST DATA ☐ CHEMICAL ANALYSIS

☐ SIEVE ANALYSIS ☐ GEOPHYSICAL LOGS ☐ REPORT

OTHER Field

SOURCES OF INFORMATION Drillers


NATIONAL TOPOGRAPHIC SERIES
BRITISH COLUMBIA
Scale
PACIFIC OCEAN
DIXON ENTRANCE
QUEEN CHARLOTTE SOUND
PRINCE RUPERT
VANCOUVER
VICTORIA
NANAIMO
KAMLOOPS
U. S.
114
104
94
103
93
83
102
92
82


LAND DISTRICTS
N.W.T.
YUKON
ALASKA
Atlin
Cassiar
Liard R.
Stikine R.
CASSIAR
PEACE RIVER
Finlay R.
Fort St. John
Peace R.
Dawson Creek
Parsnip R.
Stewart
Nass R.
Smithers
Babine Lake
Terrace
Skeena R.
Prince Rupert
COAST RANGE 5
Kitimat
PRINCE GEORGE
CARIBOO
ALBERTA
PACIFIC OCEAN
QUEEN CHARLOTTE
COAST RANGE 4
Quesnel
COAST RANGE 3
Williams Lake
Columbia R.
Queen Charlotte Sound
COAST RANGE 2
LILLOOET
Fraser R.
KAMLOOPS DIV. OF YALE
Thompson R.
Kamloops
OSOYOOS DIV. OF YALE
Vernon
Kelowna
KOOTENAY
Kootenay Lake
Kootenay R.
Nelson
Cranbrook
Trail
Port Hardy
RUPERT
COAST RANGE 1
NEW WESTMINSTER
YALE DIV. OF YALE
SIMILKAMEEN DIV. OF YALE
Penticton
VANCOUVER
NANAIMO
VICTORIA
50 0 50 100 150 Miles
LAND DISTRICTS IN THIS AREA NOT SHOWN DUE TO SMALL AREA OF MAP.

NORTH

WEST

EAST

SOUTH

see inside

CARD BY CB DATE May 16 '78

ADDITIONAL DATA ADDED BY _____

REMARKS

Note: during x-referencing of gw licence application - applicant indicated this well was incorrectly mapped.

Map in file contradicts what was provided, however, I'm not sure of the accuracy of this map. UTSA indicates this parcel not currently or in past Municipal property. Nor does the property match the Town's Port Plan/map. Therefore, assuming updated coordinates correct.

OCT 16 1984

X 71, Y 28
sheet 40
Map well #005

WATER WELL LOCATION DESCRIPTION FORM

NAME OF WELL OWNER : TOWN OF GIBSONS

ADDRESS : P.O Box 340 Gibsons B.C Phone No. 886-2274

DRILLING CONTRACTOR: A & H CONSTRUCTION LTD

DATE WELL DRILLING COMMENCED: Aug 29, 1984

LEGAL DESCRIPTION OF PROPERTY WHERE THE WELL IS LOCATED
(fill in applicable items)

LAND DISTRICT: 37 NEW WESTMINSTER

DISTRICT LOT (DL): 685

TOWNSHIP (TP): ———

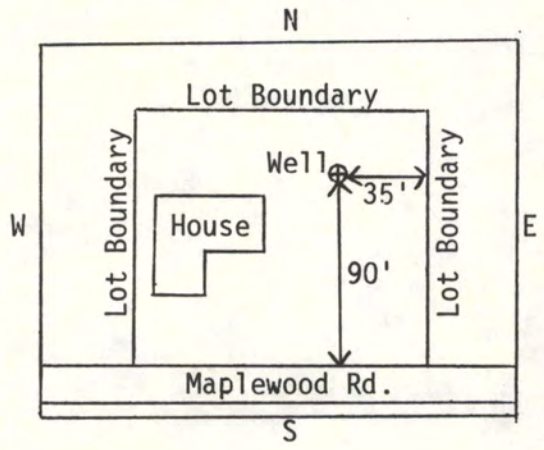
RANGE (R): ———

SECTION (SEC): ———

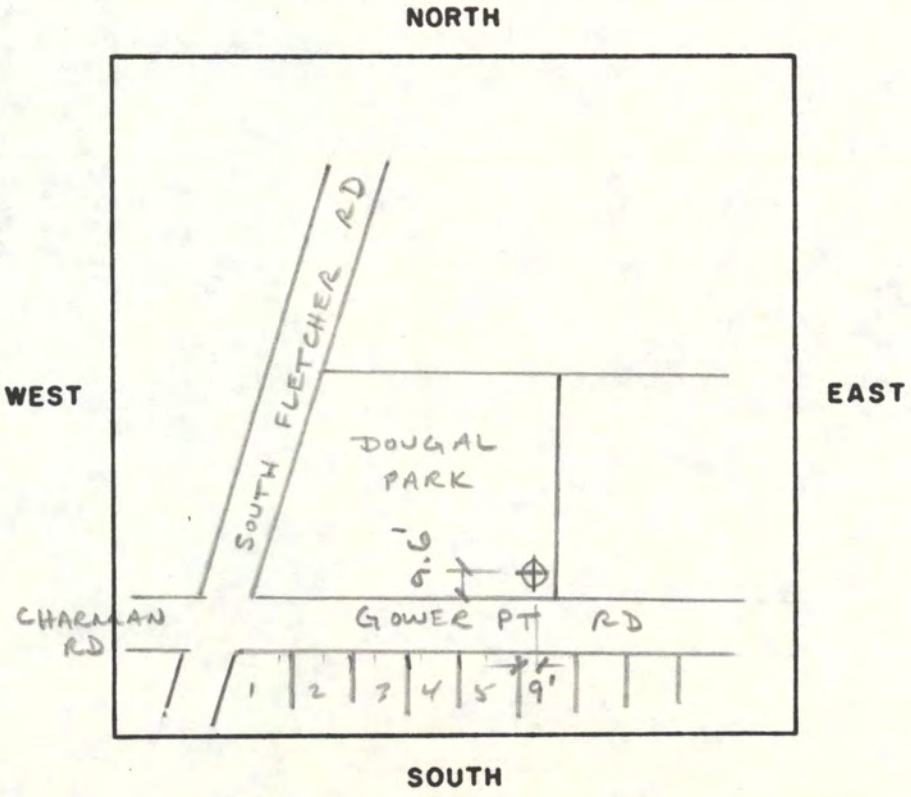
PLAN NO. : 4060

LOT NO. : Block 10

WELL LOCATION SKETCH EXAMPLE



WELL LOCATION SKETCH MAP



1984/84

Static water 15"

Drilled well Aug. 29,30,31. Sept.4th & 5th. 1984.
Well site: Same as below.

Town of Gibsons,
1490 S. Fletcher Road,
Gibsons, B.C.

DAILY REPORT

A & H CONSTRUCTION LIMITED WELL DRILLERS

1681 SALTON ROAD, P.O. BOX 38, ABBOTSFORD, B.C. V2S 4N7 - PHONE 853-2513

Location TOWN OF GIBSON Date Aug 30 1984

Hole No. Shift from 630 to

42.8½
20.2½
21.2½
85.1½

Depth at end of shift 84
Depth at start of shift 20

1. Size of Casing inserted 8 in
2. Feet of Casing inserted
3. Machine Hours
4. Chargeable Machine Hours 1 hr. TEST WELL
4 hr standby

FROM	TO	AMOUNT	GEOLOGY
20	82		silty sand + GRAVEL
82	84		SAND

Remarks @ 11:30-1230 clean well up so as to test water G.P.M.
4 standby
~~14 ft of~~ 8

Driller R.D FAIRCLOUGH Hours
Helper M. McDONALD Hours
Supt.
Drill No. 4 № 4846

DAILY REPORT

A & H CONSTRUCTION LIMITED WELL DRILLERS

1681 SALTON ROAD, P.O. BOX 38, ABBOTSFORD, B.C. V2S 4N7 - PHONE 853-2513

Location TOWN OF GIBSON Date Aug 29 1984

Hole No. Shift from 530 to 430

21.6
21.2½
42.8½

Depth at end of shift 20
Depth at start of shift 0
20

1. Size of Casing inserted 20 ft.
2. Feet of Casing inserted
3. Machine Hours
4. Chargeable Machine Hours

FROM	TO	AMOUNT	GEOLOGY
0	15		TILL + Boulders
15	20		Silty SAND + GRAVEL

Remarks SURFACE 10 in casing + Drive shoe 22
8 in casing + Drive shoe 21.6
2 hr GROUT + Grout 10 in pipe in
~~4 hr standby waiting for Grout to set~~

Driller R.D FAIRCLOUGH Hours 11½
Helper M McDONALD Hours 11½
Supt.
Drill No. 4 № 4845

DAILY REPORT

A & H CONSTRUCTION LIMITED WELL DRILLERS

1681 SALTON ROAD, P.O. BOX 38, ABBOTSFORD, B.C. V2S 4N7 - PHONE 853-2513

Location TOWN OF GIBSONS Date Sept 5 1984

Hole No. .... Shift from 700 to 200

Depth at end of shift —

Depth at start of shift —

—

1. Size of Casing inserted 8 in
2. Feet of Casing inserted
3. Machine Hours
4. Chargeable Machine Hours 2 Hr Developing

FROM	TO	AMOUNT	GEOLOGY
14	ft	of	8 in casing pull out.

Remarks 700 to 900 Developing
Screen set at Top @ 68.7
SCREEN BOTTEM 81.1
clean site up and Load Rod
move Back to abbotsford

Driller RD FAIRCLOUGH Hours 7.

Helper M MCDONALD Hours 7

Supt.

Drill No. 4

№ 4849

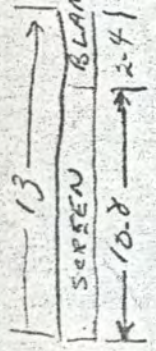
DAILY REPORT

A & H CONSTRUCTION LIMITED WELL DRILLERS

1681 SALTON ROAD, P.O. BOX 38, ABBOTSFORD, B.C. V2S 4N7 - PHONE 853-2513

Location Town of Gibson Date Aug 31 19 84

Hole No. ..... Shift from 8 00 to 4 30



Depth at end of shift .....

Depth at start of shift 84

8 in

1. Size of Casing inserted .....
2. Feet of Casing inserted .....
3. Machine Hours .....
4. Chargeable Machine Hours .....

FROM	TO	AMOUNT	GEOLOGY
10 ft	84 ft	open screen	

Remarks 8 hr standby waiting for screen

Driller R D FAIRCLOUGH Hours 8

Helper M McDONALD Hours 8

Supt. .....

Drill No. 4

№ 4847

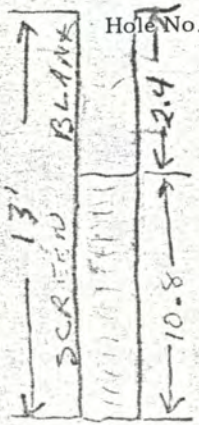
DAILY REPORT

A & H CONSTRUCTION LIMITED WELL DRILLERS

1681 SALTON ROAD, P.O. BOX 38, ABBOTSFORD, B.C. V2S 4N7 - PHONE 853-2513

Location TOWN OF GIBSON Date Sept 4 19 84

Hole No. ..... Shift from 5 30 to 4 30



Depth at end of shift .....

Depth at start of shift .....

85.1½
10.11
74 2 ½

8 in

1. Size of Casing inserted .....
2. Feet of Casing inserted .....
3. Machine Hours .....
4. Chargeable Machine Hours 2 HR INSTALLING SCR
6 HR Developing

FROM	TO	AMOUNT	GEOLOGY
JOHNSON "X"		55	SCREEN 150 SCST WITH PACKER + BALL BOTTOM + 5' RISER
			install screen from 68 ft to 81 ft

Remarks 8.30 to 10:30 install screen
static water level 2 in above 10' surface casi
10.30 to 4.30 Developing

Driller K D FAIRCLOUGH Hours 11

Helper K Hopkins Hours 11

Supt. .....

Drill No. 4

№ 4848


GIBSONS
L.685A
L.685
L.5963
L.7005
L.6946
FL 15764
FL 52898
PLAN 7495
PLAN 7714
PLAN 10362
PLAN 6406
PLAN 11008
PLAN 11464
PLAN 13381
PLAN 4014
PLAN 14260
From D.E.F.G
463000
123°30'00"
49°24'00"
5 471 000
GOWER POINT ROAD
FLETCHER
STEWART
TRUMAN
BAY RD.
DOGWOOD RD.
GLASSFORD
COCHRANE
FRANKLIN
ROAD
SKYLINE
DRIVE
GEORGIA DRIVE
ARBUTUS
REACH
HEADLANDS
WINN RD.
PARK
H.W.M. from plans
SEE INSET
Town of Gibson
84'

	INT
A	McCallu
B	Casserl
C	Carthop
D	Prentic
G	Kulland
H	George
J	Gower
K	Mainwa
L	Mainwa
M	Metcalf
N	Easthop
P	Burritt
Q	Russell
R	Swallow
S	Kenneth
T	Tom Sp
U	8th St
V	Chaste
W	Stubbs
X	Thorn S
Y	Oswald
Z	Schulst
AA	McCanc
BB	Anderso
CC	Cummin
DD	Seargan
EE	Hazel S
FF	Crompto
GG	Crompto
HH	Crompto
JJ	Byfield

92G.033.3.4.4

WTN 53237

WATER WELL RECORD

DEPT. OF ENVIRONMENT, WATER RESOURCES SERVICE, WATER INVESTIGATIONS BRANCH VICTORIA, BRITISH COLUMBIA

Z WELL NO. 005

LEGAL DESCRIPTION: LOT ____ SEC. ____ TP. ____ R. BL 10 D.L. 685 LAND DISTRICT NWD PLAN 4060

DESCRIPTIVE LOCATION DOUGAL PARK. LICENCE NO. ____ DATE ____

Z 71 X Y 28 NO.

OWNER'S NAME TOWN OF GIBSON'S ADDRESS P.O. BOX 340 GIBSON'S B.C.

DRILLER'S NAME A+H WELL DRILLERS ADDRESS ABBOTSFORD DATE COMPLETED ____

NAT. TOPO. SHEET NO. 40

DEPTH 84' ELEVATION OF ____ (DL) ☐ ESTIMATED ☐ SURVEYED CASING DIAM. 8" LENGTH ____

METHOD OF CONSTRUCTION ____ CASING DIAM ____ LENGTH ____

SCREEN LOCATION 68' TO 81' SCREEN ☑ SIZE 150 LENGTH 17'-0" TYPE JOHNSON S/S

SANITARY SEAL YES ☐ NO ☐ SCREEN ☐ SIZE ____ LENGTH ____ TYPE ____

PERFORATED CASING ☐ LENGTH ____ PERFORATIONS FROM ____ TO ____

GRAVEL PACK ☐ LENGTH ____ DIAM. ____ SIZE GRAVEL, ETC. ____

DISTANCE TO WATER 13' ☐ ESTIMATED WATER LEVEL

FROM ____ ☐ MEASURED ELEVATION ____ ARTESIAN PRESSURE ____

DATE OF WATER LEVEL MEASUREMENT ____ WATER USE ____

PRODUCTION TEST SUMMARY

DATE ____

TEST BY ____

BAIL TEST ☐ PUMP TEST ☐ DURATION OF TEST ____

RATE ____ DRAWDOWN ____

WATER LEVEL AT COMPLETION OF TEST ____

AVAILABLE DRAWDOWN ____ SPECIFIC CAPACITY ____

PERMEABILITY ____ STORAGE COEFF. ____

TRANSMISSIVITY ____

RECOMMENDED PUMPING RATE ____

RECOMMENDED PUMP SETTING ____

CHEMISTRY

TEST BY ____ DATE ____

TOTAL DISSOLVED SOLIDS ____ mg/l TEMPERATURE ____ °C pH ____ SILICA (SiO_2) ____ mg/l

CONDUCTANCE ____ μmhos/cm AT 25°C TOTAL IRON (Fe) ____ mg/l TOTAL HARDNESS ($CaCO_3$) ____ mg/l

TOTAL ALKALINITY ($CaCO_3$) ____ mg/l PHEN. ALKALINITY ($Ca\ CO_3$) ____ mg/l MANGANESE (Mn) ____ mg/l

COLOUR ____ ODOUR ____ TURBIDITY ____

ANIONS	mg/l	epm	CATIONS	mg/l	epm
CARBONATE (CO_3)			CALCIUM (Ca)		
BICARBONATE (HCO_3)			MAGNESIUM (Mg)		
SULPHATE (SO_4)			SODIUM (Na)		
CHLORIDE (Cl)			POTASSIUM (K)		
$NO_2 + NO_3$ (NITROGEN)			IRON (DISSOLVED)		
* TKN. (NITROGEN)					
PHOSPHORUS (P)					

* TKN = TOTAL KJELDAHL NITROGEN CHEMISTRY SITE NO. ____

NO_2 = NITRITE NO_3 = NITRATE

CHEMISTRY FIELD TESTS

TEST BY ____ DATE ____ EQUIPMENT USED ____

LITHOLOGY

FROM	TO	DESCRIPTION
0	15	TILL & BOULDERS
15	20	SILTY SAND & GRAVEL
20	82	SILTY SAND & GRAVEL
82	84	SAND
		Casing
		Screen installed between 68 and 81 ft
		(PROBABLY A very good well!)
		62' of casing natural? → 15-82

CONTENTS OF FOLDER

☑ DRILL LOG ☐ PUMP TEST DATA ☐ CHEMICAL ANALYSIS

☐ SIEVE ANALYSIS ☐ GEOPHYSICAL LOGS ☐ REPORT

OTHER WATERWELL LOCATION DESCRIPTION FORM / SKETCH

SOURCES OF INFORMATION DRILLER

NORTH

WEST

EAST

SEE SKETCH
INSIDE

SOUTH

CARD BY DL DATE November 85

ADDITIONAL DATA ADDED BY _____

REMARKS

Well located on property, boundaries Lots 10 & 11

ENV 1995

Aquifer Mapping Program	Town of Gibsons	BOREHOLE: WL10-02 WID#33707
INSTALLED BY: Drillwell Enterprises Ltd.		PROJECT: WL09-1578
DRILL TYPE: Air Rotary	EAST: 462263.0 NORTH: 5472238.0	ELEVATION: 108.102 (masl)

FILL TYPE: Slough | Bentonite | Grout | Backfill | Sand | Peltonite | Open Hole | Fill

SAMPLE TYPE: Shelby Tube | No Recovery | Split Spoon | Disturbed | Dynamic Cone | Core | Grab Sample

Depth (ft)	Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	WELL INSTALLATION
		CLAY, trace to some gravel, grey-brown, damp			Casing Stickup = 0.6 m
10	2			5	Bentonite Seal
	4			10	
				15	
20	6	... wet @ 6.1 m		20	
	8			25	
30		... damp @ 9.1 m		30	
	10				
		GRAVEL, some clay, trace silt, grey (producing water)		35	
40	12			40	
	14			45	
50		GRAVEL, some sand, trace silt and clay, grey, damp		50	
	16			55	
		SAND, trace to some gravel, grey, damp		57	
60	18			60	
	20	GRAVEL, some sand, trace silt, well graded, grey damp		65	
70	22			70	
				75	
80	24			80	
	26			85	
90		SAND, trace to some gravel, trace silt, brown-grey, moist		90	
	28			95	
100	30			100	152 mm Diameter Steel Casing
	32			105	
110		GRAVEL (TILL?), some sand, trace silt and clay, grey-brown		110	
	34			115	Grout
120	36			120	
	38			125	
130				130	
	40			135	
	42				
140		SAND (TILL?), some gravel, trace silt, grey-brown, damp		140GS	
	44			145	
		GRAVEL (TILL?), some sand, trace silt, grey-brown, damp		150	
150	46	... boulder @ 45.7 m		155	
		... lense, some gravel, grey-brown, damp @ 47.2 m		160	
	48				
160					

Waterline Resources Inc.	TYPE:	COMPLETION DEPTH: 123.40 (m)
	LOGGED BY: Byron Molloy	COMPLETION DATE: 8-Apr-2010
	CHECKED BY:	Page 1 of 4 Date printed: 31-May-2010

Aquifer Mapping Program	Town of Gibsons	BOREHOLE: WL10-02 WID#33707
INSTALLED BY: Drillwell Enterprises Ltd.		PROJECT: WL09-1578
DRILL TYPE: Air Rotary	EAST: 462263.0 NORTH: 5472238.0	ELEVATION: 108.102 (masl)

FILL TYPE: Slough | Bentonite | Grout | Backfill | Sand | Peltonite | Open Hole | Fill

SAMPLE TYPE: Shelby Tube | No Recovery | Split Spoon | Disturbed | Dynamic Cone | Core | Grab Sample

Depth (ft)	Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	WELL INSTALLATION
170	52	SAND, fine grained, trace to some gravel, grey-brown, damp		165	75 mm Diameter Schedule 80 Solid PVC Pipe
	54			170	
180	56			175	
				180	
190	58	... gravel lense, trace sand and silt, damp @ 57.9 m		185	
	60			190	
200	62			195	
				200	
210	64			205	
	66			210	
220	68			215	
				220	
230	70			225	
	72			230	
240	74			235	
				240	
250	76			245	
	78			250	
260	80	GRAVEL, some sand, trace silt, grey-brown, damp		255	
				260	
270	82	SAND, fine grained, some silt, dense, grey, dry		265	
	84	▽		270	
280				275	Static Water Level @ 84.43 m bgl
	86	SAND, coarse grained, trace gravel, wet		280	
290	88			285	
	90			290	
300				295GS	
	92			300	
				302	
310	94			305	
	96			310	
320	98			315	
				320	
				325	

Waterline Resources Inc.	TYPE:	COMPLETION DEPTH: 123.40 (m)
	LOGGED BY: Byron Molloy	COMPLETION DATE: 8-Apr-2010
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Aquifer Mapping Program	Town of Gibsons	BOREHOLE: WL10-02 WID#33707
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FILL TYPE: Slough | Bentonite | Grout | Backfill | Sand | Peltonite | Open Hole | Fill

SAMPLE TYPE: Shelby Tube | No Recovery | Split Spoon | Disturbed | Dynamic Cone | Core | Grab Sample

Depth (ft)	Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	WELL INSTALLATION
330	102	... well graded sand, some silt, trace gravel, producing water (~5 gpm) @ 102.1 m		330	Slough
340	104	... fine to medium sand and sone silt @ 103.4 m		335	
	106			340	
350	108			345	
				350	
				353	
360	110	GRAVEL, some sand (~5 gpm)		355	
		SAND, some gravel (~5 gpm)		360	
	112	GRAVEL, some sand (~10 gpm)		365	
370	114	SAND, fine grained, some silt (~10 gpm)		370	
				375	
380	116	... gravel lense, some sand @ 115.8 m		380	
		... trace gravel @ 117.3 m		385	
	118			390	
390	120	... some gravel @ 118.9 m		395	Top of Casing @ 120.4 m bgl 75 mm Diameter Schedule 80 Slotted PVC Screen
		GRAVEL, some sand, trace silt and clay (10 gpm)		400	Bottom of Casing @ 123.4 m bgl
400	122				
	124	SAND, well graded, trace silt and gravel		405	
410	126			410	
				415	
420	128			420	
	130	... fine to medium sand @ 131.1 m		425	
430				430	
	132	... fine grained, some sand, organics @ 132.6 m		435	
440	134			440	Slough
	136			445	
450	138			450	
				455	
460	140			460	
	142			465	
470	144			470	
				475	
480	146			480	
	148			485	
490					

Waterline Resources Inc.	TYPE:	COMPLETION DEPTH: 123.40 (m)
	LOGGED BY: Byron Molloy	COMPLETION DATE: 8-Apr-2010
	CHECKED BY:	Page 3 of 4 Date printed: 31-May-2010

Aquifer Mapping Program	Town of Gibsons	BOREHOLE: WL10-02 WID#33707
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SAMPLE TYPE: Shelby Tube | No Recovery | Split Spoon | Disturbed | Dynamic Cone | Core | Grab Sample

Depth (ft)	Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	WELL INSTALLATION
500	152	... no further organics @ 150.9 m		495	
	154			500	
510	156			505	
	158			510	
520				515	
	160	END OF HOLE AT 157.0 m Water Level Date 12-Apr-2010			
530	162				
	164				
540					
	166				
550	168				
	170				
560					
	172				
570	174				
	176				
580					
	178				
590	180				
	182				
600					
	184				
610	186				
	188				
620					
	190				
630	192				
	194				
640					
	196				
650	198				

Waterline Resources Inc.	TYPE:	COMPLETION DEPTH: 123.40 (m)
	LOGGED BY: Byron Molloy	COMPLETION DATE: 8-Apr-2010
	CHECKED BY:	Page 4 of 4 Date printed: 31-May-2010

APPENDIX B

SAFE JOB PROCEDURE
ON-SITE HYDROGEOLOGICAL SUPPORT DURING DRILLING AND LOGGING

Tools/Equipment Required	Material Required	Personal Protective Equipment
Drilling rig & supplies with operator & helper; sampling trowel, spatula or knife; vehicle; measuring tape; GPS or survey equipment; sieve kit, wire strainer for air/water return sampling: means of communication (cellular or satellite phone, radio); camera	Sampling jars & bags; distilled water; paper towels; notebook and/or blank logs; pencils; labels; permanent marker; map of area; tarps/blankets for diesel/lube protection (from Hammer Rig); field parameter kit (Temp., pH, EC) and water level tape; project safety information (Hazard Assessment, client/site safety requirements)	First aid kit; standard PPE (hard hat, safety glasses and boots); coveralls; leather gloves; additional PPE as established by hazard assessment (e.g., nitrile gloves, respirator with particulate and organic vapour cartridge, personal gas monitor); appropriate outdoor gear (for weather and other conditions); hearing protection

Steps	Sequence of Steps	Potential Accidents or Hazards	Recommended Safe Job Procedure
1	Pre-job hazard assessment		Pre-job hazard assessment to establish appropriate controls, procedures, emergency response, necessary equipment, materials and PPE. Assess the potential for contaminated drill cuttings or fluids at the site and the need for a site-specific disposal procedure. Review the pre-job hazard assessment with supervisor.
2	Ground disturbance planning	Damaging buried infrastructure, electrocution, gas release, hydrocarbon release, water release, chemical release, explosion, fire	Initiate ground disturbance planning and clearance activities (see SJP for Buried Utility Search – Initiating a Ground Disturbance Program, Waterline Ground Disturbance Guideline and Permit). Complete the Waterline Ground Disturbance Permit (and client Ground Disturbance permits, if required). Conduct utility locates: file BC or AB One-Call request; search available client, municipal or other government records to identify other facilities and owners in the area and notify other facility owners of planned activities; and coordinate any necessary private locates. Evaluate the need for daylighting with the client and all workers involved on the project. Consider other restrictions (e.g., overhead power lines, or active facilities) that may constrain drilling. Establish emergency response plans. Review ground disturbance planning with supervisor.
3	Mobilize to site	Driving, vehicle use, getting lost, weather hazards, site hazards	Plan the trip, check ahead for the predicted weather forecast and highway conditions, drive according to conditions, use maps, compass or GPS, and drive defensively (see SWPs for Motor Vehicle Operation, Driving (Winter), Journey Management, and Fatigue Management).
4	Prepare for work		Inspect and wear PPE, and bump test personal gas monitor, if it is required. Inspect and prepare all tools. Perform a visual inspection of the site. Check wind direction if at an H_2S site. Make sure a spill kit is available.
5	Conduct Tailgate Hazard Assessment		Include site representatives, drillers, and all on-site workers in tailgate meeting. Review work area and ensure work will be undertaken safely. Review relevant safe job procedures and policies (e.g., Waterline, client and/or subcontractor requirements, ground disturbance, etc.). Confirm locates/clearance are acceptable, and all ground disturbance requirements have been satisfied. Inspect work area for any other indications of buried facilities (e.g., manholes, light poles, conduits entering the ground). Discuss signals or establish effective communication between the driller, driller's helper and Waterline field staff to apply to drilling activity. Identify muster area and who to report to in the event of an emergency. Identify actively hazardous areas around rig (e.g., area where crane is moving pipe, or air/water or sample return areas) and arrange, with the support of the driller and driller's helper, appropriate areas for Waterline to work and park the Waterline vehicle. Discuss how to manage site traffic and tape off work area, if appropriate (See SWP for Control of Traffic Flow on Work Sites). Make sure the ERP and emergency contact list is available.
6	Set up drilling rig and drilling	Heavy equipment, pinch or crush points, moving	Adhere to all ground disturbance requirements (e.g., crossing/proximity agreements, activities near overhead power lines). Ensure ground conditions (e.g., slopes, soft ground) won't affect stability of drill rig. Be aware

		equipment around other workers or public, overhead dangers, proximity to power lines, crossing underground facilities, ground conditions	of potential damage by hydraulic jacks of drill rig to property (e.g., roadways, sidewalks, etc.). Keep staff, vehicles and equipment away from the rig, particularly while rig is being maneuvered into a drilling location (may require control of traffic). Good practice to keep support vehicles and equipment well away from the rig (i.e., create a work area based on a radius equivalent to the mast height) to ensure area is clear of unnecessary obstructions. Keep staff, vehicles and equipment safe from overhead dangers associated with the rig. Ensure good communication between all workers when setting up and before approaching the rig.
7	Drilling and logging	Pinch and crush points, overhead equipment, chemical exposure from unidentified substances in the ground, chemical exposure from rig fuels or lubricants, buried facility strike, ignition source, fire/explosion, excessive noise, electrical shock, snapped winch cable, flailing pressure hose, blowing particulates, pedestrians, slips/trips/falls	Drilling rigs can rely on a variety of techniques and the power and size of equipment can vary. All rigs are potentially dangerous. Maintain distance from the rig and equipment wherever practical (e.g., approach the rig to log soils only after augers have been removed from the ground, ensure that augers are not rotating during sample collection, and the driller has signaled the area safe to approach). Maintain eye contact and communication with the driller and helper. Avoid water and air outlets and areas during drilling to avoid high pressure discharges, splashes, particulate streams, slips and trips, etc. Sample water or air returns with a sieve or shovel rather than by hand to minimize risks associated with high pressure discharges from water and air outlets. If cutting cohesive soil samples off augers, take care when using trowels or knives. Avoid handling auger flights, as metal splinters or burrs often form along the edges. Keep an eye out for bystanders and prevent them from approaching the rig.
8	Backfill and abandon, or install other instrumentation	Pedestrians, workers, livestock or animals catching foot in open hole	Backfill test holes with excavated soil, bentonite, monitoring well completion materials, etc., as required for the site or the project. If not done immediately, barricade, mark, and/or cover boreholes in interim. Be sure to re-visit backfilled holes on your next site visit to verify that the backfill has not sloughed in or subsided to create tripping or other hazards.
9	Handling, storing, shipping soil samples	Strain injuries, chemical exposure	Plan and ensure proper lifting. Depending on the quantity and character of samples, transport may fall under the jurisdiction of Transportation of Dangerous Goods; handle accordingly.

Rev.	Date	Description	Authored / Reviewed by	Approved by
0	Sep. 19, 2008	Developed	Eric Pringle	Jamie Wills
1	Jan. 14, 2009	Reviewed	Jamie Wills	
2	May 27, 2009	Reviewed	David van Everdingen	
3	Aug. 11, 2011	Reviewed	Shelley Bayne	
4	Oct. 16, 2012	Reviewed and updated formatting	Ryan Bjornsen	
5	Aug. 27, 2013	Reviewed and additions as noted	Bonnie Derksen	Kiran Arshi
6	Oct. 22, 2014	Reviewed and additions as noted	Yannick Bouet	
7	Sep. 17, 2015	Reviewed	Brent Lennox	Jamie Wills
8	Oct. 24, 2016	Reviewed and additions as noted	Ben McCafferty	Eric Pringle
9	Nov. 15, 2017	Annual review – minor edits	Jamie Wills	Eric Pringle
10	Jan. 10, 2019	Annual review	Michelle Taylor	Eric Pringle

* The above information is intended for general use and may not apply to every circumstance. It is not a definitive guide to government regulations and does not relieve persons using this publication from their responsibilities under applicable legislation.

SAFE JOB PROCEDURE BURIED UTILITY SEARCH - INITIATING A GROUND DISTURBANCE PROGRAM			
Tools/Equipment Required		**Material Required** Ground Disturbance Permit, and Guideline	**Personal Protective Equipment**
Steps	**Sequence of Steps**	**Potential Accidents or Hazards**	**Recommended Safe Job Procedure**
1	Review Ground Disturbance Guidelines		There are a variety of significant safety and legal implications associated with ground disturbance. A person supervising a ground disturbance must have valid ground disturbance certification that meets IRP 17 standards. Do not commence a ground disturbance without a Waterline and any client specific ground disturbance permit(s) and proper training/certification.
2	Identify all buried facilities within a 30 m radius of the ground disturbance site(s)	Failure to identify a facility and notify a facility owner of a ground disturbance, could lead to a potential strike or other legal implications.	For Alberta, contact Alberta One-Call at 1-800-242-3447 or www.alberta1call.com; and allow at least two full working days for utility locates to be completed. Registration with Alberta One-Call is voluntary and buried facilities of unregistered owners may not be identified. For Saskatchewan, contact Sask 1st Call at 1-866-828-4888 or www.sask1stcall.com and allow two full working days. For British Columbia, contact BC One Call at 1-800-474-6886 or www.bconecall.bc.ca and allow three business days. If possible, provide additional notice (e.g., five business days) to allow sufficient time for facility owners to respond. If any facility owners do not respond by the expected response date, follow up with the provincial One-Call/1st Call centre.
		The presence or potential presence of buried facilities may not be identified.	Search title certificates and survey plans. For Alberta, complete an online search for land title certificates and survey plans at http://alta.registries.gov.ab.ca/SpinII/welcomeguest.aspx or complete your search at the Service Alberta Building (710-4 Avenue S.W., Calgary). Other commercial services can be used (e.g., AbaData), or may be accessed by private locate contractors to provide the same results. Land titles for British Columbia can be accessed at https://ltsa.ca/ and land titles for Saskatchewan can be accessed at https://www.isc.ca/LandTitles/Pages/default.aspx.
		Note that only pipelines with an operating pressure over 700 kPa must be registered and licensed with the Alberta Energy Regulator (AER).	Acquire and review a utilities map from the AER. All pipelines registered with the AER are provided on a facility baseline map by township. Ensure you have an up-to-date map. If any registered pipelines are identified within 30 m of the proposed ground disturbance, or if equipment will be crossing a registered pipeline, the facility owner may require that a proximity and/or crossing agreement be established.
			Complete a search of the municipal facilities (gas, water, power, sewer, cable, telephone). Contact each municipal authority and find out how their facility may impact your ground disturbance.
			Contact the landowner and/or facility operations personnel. The landowner/operator may have information on buried facilities located on their property.
3	Contact facility owners and arrange for any facility owner locates	Poor or inadequate communication of proposed ground disturbance locations could lead to confusion and misjudgement of the proximity of buried facilities.	Registering with One-Call will result in notification of One-Call registered owners automatically. You must directly contact all buried facility owners that are not registered with One-Call to arrange for clearance/locate of their facilities. Arrange meet times or communicate effectively to determine the need for site meeting(s) and appropriate clearances for all facility owners in the vicinity of the ground disturbance.
4	Complete a visual inspection of the site		Inspect the site for any signage (e.g., pipeline fence line crossings) or other visual evidence (e.g., risers, hydrants, conduit on poles, etc.) that suggests a buried facility may be present on the site. Confirm that available plans match any visible surface facilities.

5	Complete a private buried facility locate sweep of the site.		Hiring a locate contractor to do a sweep of the ground disturbance site should be considered. For many clients and facilities, private locates are required. Private locates should include the proposed work area and a 30 m controlled area around the proposed ground disturbance. Sweeping all areas that may be of interest for ground disturbance provides an additional level of diligence to identify otherwise unidentified buried facilities.
6	Record keeping and Ground Disturbance Permit		Document all steps taken to locate buried facilities. Acquire documentation of all locate requests and receipt of locate requests and clearances from buried facility owners. Maintain a written record of any verbal conversations with facility owners. Fill out the Waterline Ground Disturbance Permit and any client specific permits/authorizations and ensure they are appropriately authorized. Keep a copy of the permit(s) at the work site during all ground disturbance work and ensure that it is retained in project files after completion of the work.

There are companies that specialize in ground disturbance locate services and may be contracted to complete portions of this work (e.g., AccuTech Ground Disturbance Ltd., Alberta Ground Control Inc., Alberta Pipefinders Inc., Red-Alta Utility Location Ltd., Safety Dig Ltd., and Ridgeline Energy Service Inc.).

Rev.	Date	Description	Authored/Reviewed by	Approved by
0	Jan. 14, 2009	Developed	Roger Reynolds	Eric Pringle
1	May 25, 2009	Reviewed	Chris Dobson	Eric Pringle
2	Aug. 15, 2011	Reviewed	Steve Sturrock	
3	Sep. 26, 2012	Reviewed	Justin Buis	
4	Jul. 23, 2013	Revised to reflect ERCB transition to AER	Graham Stonebridge	Kiran Arshi
5	Oct. 22, 2014	Modified as noted	Yannick Bouet	
6	Sep. 22, 2015	Annual review – no new changes	Bonnie Derksen	
7	Oct. 4, 2016	Annual review – no changes	Philip Low	Eric Pringle
8	Nov. 16, 2017	Annual review	Eric Pringle	
9	Jan. 3, 2019	Added additional detail re: crossing agreements, private locates; other edits as noted	Philip Low	Eric Pringle

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SAFE WORK PRACTICE CELL PHONE AND HAND HELD ELECTRONIC DEVICE USE WHILE DRIVING	
GENERAL	Protecting workers from injuries associated with the improper use of cell phones or hand held electronic devices while operating a motor vehicle.
APPLICATION	Using a cell phone or hand held electronic device while operating a motor vehicle may be hazardous to the worker and general public due to the potential for distraction.
PROTECTIVE MECHANISMS	Safe work practice, Highway Traffic Act, local regulations, manufacturer's recommendations.
SELECTION AND USE	Safe work practice, manufacturer's recommendations.
SUPERVISOR RESPONSIBILITY	Supervisors are responsible to facilitate and/or provide proper instruction to their workers on expectations, requirements, and training regarding the use of cell phones and hand held electronic devices while driving. Supervisors should ensure that both they and the worker(s) are complying with this safe work practice.
WORKER RESPONSIBILITY	• Familiarize yourself with and follow Alberta's Distracted Driving Law (http://www.transportation.alberta.ca/distracteddriving.htm), British Columbia's distracted driving law (http://www2.gov.bc.ca/gov/content/transportation/driving-and-cycling/road-safety-rules-and-consequences/distractions), and/or other jurisdictions where you will be driving. • Hand held devices are not to be used while driving. • Be aware that many clients prohibit the use of cell phones while driving on their property whether hand held or hands-free. While driving on client property, use of cell phones in any capacity is prohibited. • Make driving your first priority and avoid distractions. Keep your eyes on the road and maintain awareness of your immediate surroundings at all times. • Ensure cell phones/electronic devices are stored in a safe and secure place inside the vehicle while driving in order to minimize potential for damage/distraction/injury in case of a sudden stop. • If safe to do so, answer phone using a hands-free set (i.e., Bluetooth) only, or safely pull over to a safe location to use a cell phone. • Keep phone conversations to a minimum. • If there is a passenger in the vehicle, have the passenger make any required cell phone calls instead of the driver. • Let your voice mail take your incoming calls when required. • Do not engage in stressful or emotional conversations while driving. • Do not use cell phones when refueling or when near other combustible gas sources (i.e., wellheads, above ground storage tanks, etc.).

Rev.	Date	Description	Authored/ Reviewed by	Approved by
0	Oct. 31, 2007	Based on ACSA SWP	Eric Pringle	Steve Foley
1	May 5, 2008		Jamie Wills	
2	May 20, 2009	Reviewed and Revised	Brent Morin	Eric Pringle
3	Aug. 10, 2011	Reviewed and Revised (added point 2 & 3)	James Musulak	Kiran Arshi
4	Sep. 12, 2012	Reviewed and Revised	Brent Lennox	James Musulak
5	Jan. 24, 2013	Added point re: cell phone use on client property	Shannon Rooke	Eric Pringle
6	Oct. 20, 2014	Reviewed	Chris Dyck	
7	Sep. 21, 2015	Reviewed	Shermin Negari	Eric Pringle
8	Oct. 4, 2016	Reviewed, updated link for B.C.	Joel Defoe	Eric Pringle
9	Nov. 16, 2017	Reviewed	Chris Dyck	Eric Pringle
10	Jan. 10, 2019	Reviewed and Revised	Jan Michaelian	Eric Pringle

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SAFE WORK PRACTICE FIRST AID	
GENERAL	Ensures appropriate training and supplies are in place for first aid needs.
APPLICATION	Supply of first aid relies on appropriately trained and certified first aiders, first aid equip. and supplies.
PROTECTIVE MECHANISMS	• Safe work practices (SWP) • Training • Available First Aid Supplies • Emergency Response Plan (ERP) • Pre-Job Hazard Assessment
SELECTION AND USE	As per job and Occupational Health and Safety (OH&S) requirements
SUPERVISOR RESPONSIBILITY	• Ensure that first aid training for staff is appropriate and/or provide instruction to workers on requirements, confirming that project details and legislated requirements are satisfied. Ensure workers certified in first aid are readily available to assist injured workers. The number, qualifications and training of first aiders in Alberta and B.C. are shown in Tables 1 and 2 below, respectively. In other jurisdictions, these needs may vary. • Carefully consider Waterline's project specific responsibilities regarding crew size (i.e., including or excluding contractor worker numbers) when judging first aid needs and required equipment. If Waterline is a prime contractor, all workers on site must be considered for first aid OH&S requirements. • Ensure that first aid services, equipment, supplies or a first aid room that may be required are located at or near the work site they are intended to serve, and are readily available and accessible during working hours. • First aid equipment and supplies must be maintained in a clean, dry and serviceable condition contained in a material that protects the contents from the environment and clearly identified as first aid equipment and supplies. • Appropriate signs must be clearly posted indicating the location of first aid service, equipment and supplies; or, if posting signs is not practical, ensure that workers know the location of first aid services, equipment and supplies. • Suitable means of emergency communication must be available for workers to summon first aid or emergency services. • Planning before workers are sent to a work site must include arrangements to transport injured or ill workers from the work site to the nearest health care facility. Registering with STARS Air Ambulance for remote Alberta sites, contracting private medivac services for B.C., or identifying local emergency contacts and incorporating these in ERPs are common approaches. • Ensure that company records of worker training and designation as first aiders at a work site are maintained. • Ensure that company records of first aid incidents and work related illnesses are completed and maintained, so the employer can satisfy the requirement to maintain these records for at least three years following the recording of a first aid incident.
WORKER RESPONSIBILITY	• Ensure that a Pre-Job Hazard Assessment is complete including an ERP. This document must be signed by all field staff and the Project Manager. • As a designated first aider on a work site, ensure your training is current and was provided by an approved training agency that satisfies the specific certification needs for the jurisdiction. An Alberta worker who successfully completes training by an approved training agency must meet the standards for a certificate in emergency first aid, standard first aid or advanced first aid that are adopted by the Director of Medical Services in consultation with the Joint First Aid Training Standards Board. • Ensure that all workers and contractors are aware of the location of the ERP, which should be placed in a safe and visible location (e.g., during the tail-gate meeting, identify that the ERP will be on the dashboard of the supervisor's truck). • Document and verbally report all first aid injuries and illnesses to supervisors immediately after they occur. • Be familiar with OH&S regulations regarding First Aid requirements.

Rev.	Date	Description	Authored/ Reviewed by	Approved by
0	Sep. 11, 2008		Eric Pringle	Steve Foley
1	May 22, 2009	Clarified instructions for the use of the ERP	Elizabeth Howard	Eric Pringle
2	Mar. 10, 2011	Review	Christopher Dyck	Elizabeth Howard
3	Sep. 4, 2012		Bonnie Derksen	Eric Pringle
4	Nov. 19, 2012	Rewording in Supervisor responsibility	Kiran Arshi	Steve Foley
5	May 27, 2013	Minor additions and rewording	Shannon Rooke	Eric Pringle
6	Feb. 28, 2014	Added tables from AB OH&S Code & BC OHS Reg	Shannon Rooke	Eric Pringle
7	Sep. 17, 2015	Added crew size and BC medivac detail	Andrea Mellor	Eric Pringle
8	Oct. 11, 2016	Review	Shermin Negari	Eric Pringle
9	Nov. 15, 2017	Annual Review	Taylor Donelon	Eric Pringle
10	Jan. 3, 2019	Annual Review	Brent Lennox	Eric Pringle
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Table 1: First Aid Requirements as specified in Schedule 2, Tables 5, 6, and 7 of the AB OH&S Code

Type of Work	# of workers at site per shift	Close work site (<20 minutes from health care facility)	Distant work site (20 to 40 minutes from health care facility)	Isolated work site (>40 minutes from health care facility)
Low Hazard	1	Type P First Aid Kit	Type P First Aid Kit	Type P First Aid Kit
	2-9	No. 1 First Aid Kit	1 Emergency First Aider & No. 2 First Aid Kit	1 Standard First Aider & No. 2 First Aid Kit
Medium Hazard	1	Type P First Aid Kit	Type P First Aid Kit	Type P First Aid Kit
	2-9	1 Emergency First Aider & No. 1 First Aid Kit	1 Standard First Aider, No. 2 First Aid Kit & 3 blankets	1 Standard First Aider, No. 2 First Aid Kit & 3 blankets
High Hazard	1	Type P First Aid Kit	Type P First Aid Kit	Type P First Aid Kit
	2-4	1 Emergency First Aider & No. 1 First Aid Kit	1 Standard First Aider, No. 2 First Aid Kit & 3 blankets	1 Standard First Aider, No. 2 First Aid Kit & 3 blankets
	5-9	1 Emergency First Aider, 1 Standard First Aider & No. 2 First Aid Kit	2 Standard First Aiders, No. 2 First Aid Kit & 3 blankets	2 Standard First Aiders, No. 2 First Aid Kit & 3 blankets

Note: Number of first aiders indicated is for a shift at all times.

Table 2: Minimum Levels of First Aid as specified in Schedule 3-A BC OHS Regulation

Type of Work	# of workers at site per shift	Work site 20 minutes or less from hospital	Work site more than 20 minutes from hospital
Low Risk	1	None	Personal First Aid Kit
	2-10 (≤20 min.); 2-5 (>20 min.)	Basic First Aid Kit	Basic First Aid Kit
	11-50 (≤20 min.); 6-30 (>20 min.)	Level 1 First Aid Kit & Level 1 Certificate	Level 1 First Aid Kit & Level 1 Certificate
Moderate Risk	1	Personal First Aid Kit	Personal First Aid Kit
	2-5	Basic First Aid Kit	Level 1 First Aid Kit & Level 1 Certificate
	6-25 (≤20 min.); 6-15 (>20 min.)	Level 1 First Aid Kit & Level 1 Certificate	Level 1 First Aid Kit, ETV Equipment & Level 1 Certificate with Transportation Endorsement
High Risk	1	Personal First Aid Kit	Personal First Aid Kit
	2-15 (≤20 min.); 2-5 (>20 min.)	Level 1 First Aid Kit & Level 1 Certificate	Level 1 First Aid Kit & Level 1 Certificate
	16-30 (≤20 min.); 6-10 (>20 min.)	Level 2 First Aid Kit; Dressing Station & Level 2 Certificate	Level 1 First Aid Kit, ETV Equipment, Level 1 Certificate with Transportation Endorsement & ETV

Note: ETV indicates Emergency Transportation Vehicle

SAFE WORK PRACTICE

HEAD PROTECTION

GENERAL	Safety headwear is designed to protect the head from impact from falling objects, bumps, splashes from chemicals or harmful substances, and contact with energized objects and equipment. Head protection is mandatory on all active Waterline work sites unless authorized by the Waterline Project Manager or a Waterline Principal. Workers exposed to head hazards must wear protective headgear.
APPLICATION	Industrial headwear is considered mandatory unless otherwise authorized by the Project Manager or Principal. Industrial headwear is defined as a hard hat that has the required "dielectric strength." There are many designs, but they all must meet CSA requirements for Class G (General Usage) and Class E (Electrical trades). Both the shell (light and rigid to deflect blows) and the suspension (to absorb and distribute the energy of the blow) must be compatible and maintained according to manufacturer's instructions. If attachments are used with headwear, they must be designed specifically for use with the specific headwear used. Other types of head protection may be considered on active Waterline work sites through hazard assessment and approval by the Project Manager or Principal, including OH&S Code approved all-terrain vehicle, snow vehicle, motorcycle head protections, OH&S Code approved bump hats, and OH&S Code bicycle head protection.
PROTECTIVE MECHANISMS	Proper care is required for headgear to perform efficiently. Its service life is affected by many factors including temperature, chemicals, sunlight and ultraviolet radiation (welding). The usual maintenance for headgear is washing with a mild detergent and rinsing thoroughly. Consistent with SWP Equipment Immobilization (Lock-Out / Tag-Out) and SWP Preventative Maintenance requirements, PPE, including hard hats, must be regularly checked before use to ensure they are in good repair and suitable for use. **Do:** • Replace headgear that is pitted, holed, cracked or brittle; • Replace headgear that has been subjected to a blow even though damage cannot be seen; • Remove from service any headgear if its serviceability is in doubt; • Replace headgear and components according to the manufacturer's instructions; and • Consult applicable legislation or your supplier for information on headgear. **Do Not:** • Drill, remove peaks, or alter the shell or suspension in any way; • Use solvents or paints on the shell (makes shell "break down"); • Put chin straps over the brims of certain classes of headgear; • Use any liner that contains metal or conductive material; or • Carry anything in the hard hat while wearing the hard hat. For more information, look at: CSA Standard "Industrial Protective Headwear" and the ANSI Standard.
SELECTION AND USE	As per safe work procedures.
SUPERVISOR RESPONSIBILITY	Supervisors are responsible to facilitate and/or provide proper PPE and associated training to their workers.
WORKER RESPONSIBILITY	Ensure proper head protection is worn as per the safe work practice and hazard assessment.

Rev.	Date	Description	Authored/ Reviewed by	Approved by
0	Oct. 9, 2008	Based on the ACSA head protection information sheet	Steve Foley	Eric Pringle
1	May 22, 2009	Review	Shermin Negari	
2	Mar. 10, 2011	Review	Christopher Dyck	
3	Oct. 17, 2012	Review	Brent Morin	
4	Aug. 12, 2013	Annual Review	Brent Lennox	Kiran Arshi
5	Oct. 15, 2014	Annual Review – no changes	Jessica Doyle	
6	Sep. 21, 2015	Annual Review – no new changes	Maury Scott	Eric Pringle
7	May 13, 2016	Revision to align all PPE guidance and policy	Steve Foley	Eric Pringle
8	Aug. 17, 2016	Addition of req. to check PPE before use, removal of 5-year expiry for headgear	Eric Pringle	Shannon Kuntz

9	Nov. 3, 2016	Added req. for head hazards	Shannon Kuntz	Eric Pringle
10	Nov. 15, 2017	Annual Review – no changes	Joel Defoe	Eric Pringle
11	Jan. 3, 2019	Annual Review – no changes	Christopher Dyck	Eric Pringle
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Printed on: January 3, 2019

SAFE WORK PRACTICE MOTOR VEHICLE OPERATION	
GENERAL	To ensure all employees and contract staff whose work requires operation of a motor vehicle do so safely and are in compliance with all vehicle codes, traffic laws, company procedures, and manufacturer's recommended operating guidelines. Driving represents a predominant hazard in our industry.
APPLICATION	This practice applies to all motor vehicle operation to conduct business matters.
PROTECTIVE MECHANISMS	• Safe Work Practice • Highway Traffic Act, and Applicable Distracted Driving Law • Company Rules • Manufacturer's Recommendations • Journey Management Safe Work Practice • Check www.amaroadreports.ca prior to driving
SELECTION AND USE	• As per safe work procedure • Company Rules • Manufacturer's recommendations
SUPERVISOR RESPONSIBILITY	• Facilitate and/or provide proper instruction to employees on protection requirements and training. Ensure employees utilize equipment according to manufacturer's instructions and legal requirements (e.g., seat belt use). • Compliance. • Enforcement. • Review Journey Management plans and ensure workers check in. • Current driver's abstract, driving oriented training programs, and effective closure of motor vehicle incidents may be requested to manage driving risks. • Diesel engine-powered equipment used within 25 meters of a wellhead or an oil and gas facility will be equipped with a positive air intake shut-off. An automatically activated positive air shut-off is recommended, and may be required on many of our client's sites. • Waterline does not own, operate, or typically utilize powered mobile equipment. However, for powered mobile equipment where rollover is identified as a potential hazard, the employer must: (a) equip the powered mobile equipment with a rollover protective structure (ROP) that is either supplied by the manufacturer or certified by a professional engineer as being suited to that equipment, or (b) institute safe work procedures that eliminate the possibility of rollover. An employer must ensure that powered mobile equipment fitted with a ROP has seat belts for the operator and passengers.
EMPLOYEE RESPONSIBILITY	• Ensure you have a valid operator's license, and are continuously competent to operate vehicles. • Ensure the vehicle has valid registration and insurance. • Complete Waterline's Vehicle Circle Check Procedure on a daily basis, prior to operation. This includes performing a "walk around" and reporting any deficiencies to a supervisor. If deemed unsafe to operate, the vehicle must be tagged out. • Ensure vehicle has an Emergency Road Kit, and that all cargo stored in the vehicle and/or box is properly secured to prevent shifting when travelling. • The operation of any motor vehicle for company business is prohibited when the driver is fatigued, has consumed alcoholic beverages or drugs causing impairment, or when the road authority does not recommend travel. • Refer to the Journey Management and Fatigue Management SWPs. Create a Journey Management plan to detail driving routes and check in times. Check www.amaroadreports.ca and revise Journey Management plan accordingly. • Be familiar with the vehicle and its capabilities. Use good judgment and understand the basic recovery skills appropriate to the vehicle you are driving. If the driver is uncomfortable operating the given vehicle, they should notify their supervisor immediately so that other arrangements can be made. • Drive defensively and according to existing road conditions. Obey all traffic laws and all posted and imposed conditions for roadway use. Our actions on roadways reflect directly on Waterline's and our client's image and reputation with the public and our neighbours. • Drivers and passengers must wear seatbelts at all times when travelling.

	• Refer to SWP Cell Phone and Hand Held Electronic Device Use While Driving. • Refer to Working Alone or Isolated SJP when driving in isolated areas. Maintain a communication schedule appropriate to the situation. • When parking in parking lots, use pull-through parking stalls whenever possible. Otherwise, back in when practical and use a spotter to ensure accuracy. • Always circle the vehicle prior to moving to determine if your path is free of obstructions. If possible, have someone spot you when backing out. • Do not offer rides to hitchhikers or strangers. • When operating your own, Waterline's, or a rental motor vehicle on company business, employees are to notify the project manager or appropriate supervisor of all vehicle incidents and near misses. • Ensure that the vehicle has been properly cleaned and filled with fuel when returning from the field. Complete a post field work vehicle inspection and record the results on the Vehicle Circle Check Procedure form. Notify supervisor of any vehicle damage. Regular maintenance must be performed as per manufacturer's guidelines. If maintenance is required (e.g., oil change every 5,000 km), mark the vehicle as requiring maintenance in the Equipment Database, and the Equipment Manager will schedule the vehicle for an appointment.

Rev.	Date	Description	Authored/ Reviewed by	Approved by
0	Nov. 2, 2007	Based on ACSA SWP	Eric Pringle	Steve Foley
1	May 5, 2008		Jamie Wills	
2	May 23, 2008		Eric Pringle	
3	Jul. 21, 2009	Added points, revised grammar	David van Everdingen	Eric Pringle
4	Apr. 11, 2011	Review- Added point 2.	Elizabeth Howard	David van Everdingen
5	Nov. 15, 2012	Review – added to point 9 and 11, and added points 14-17	Brent Morin	Jamie Wills
6	Aug. 2, 2013	Annual Review – No Changes	Ben McCafferty	Kiran Arshi
7	Oct. 20, 2014	Annual Review – No Changes	Kiran Arshi	
8	Sep. 22, 2015	Annual Review – No Changes	Domi Diaz	Eric Pringle
9	May 19, 2016	Combined Driving SWP with this SWP; and updated	Shannon Kuntz	Eric Pringle
10	July 19, 2017	Annual Review	Bonnie Derksen	Eric Pringle
11	July 18, 2018	Annual Review, added post field work vehicle inspection	Joel Defoe	Eric Pringle

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SAFE WORK PRACTICE PORTABLE FIRE EXTINGUISHERS	
GENERAL	Protecting workers from injuries associated with improper use of fire extinguishers.
APPLICATION	Portable fire extinguishers must be installed, inspected on a monthly basis, and inspected by a certified fire extinguisher inspector annually to ensure proper operation in an emergency.
PROTECTIVE MECHANISMS	• Safe Work Practice • Alberta Fire Code • NFPA 10 – Standard for Portable Fire Extinguishers • Manufacturer's recommendations • PPE
SELECTION AND USE	• As per safe work practice • Alberta Fire Code • NFPA 10 – Standard for Portable Fire Extinguishers • Manufacturer's recommendations • Client health and safety program requirements
SUPERVISOR RESPONSIBILITY	• Supervisors are responsible to facilitate and/or provide proper instruction to their workers on protection requirements and training. • Proper selection of equipment. • Conversant with proper regulations (Alberta Fire Code and NFPA 10).
WORKER RESPONSIBILITY	• Ensure you are trained in the selection of the appropriate type of fire extinguisher for the class of fire you are most likely to encounter. • Ensure you are trained in the operation and maintenance of the fire extinguisher. • Ensure monthly and yearly inspections are up-to-date by checking tag on the fire extinguisher. • Inspect fire extinguisher monthly by checking the following: o The fire extinguisher is in its designated place (truck bracket, wall mount), and the mounting is securely in place and appropriately functioning; o There is no obstruction to access or visibility of the fire extinguisher; o The pressure gauge needle (yellow) is in the operable range (green zone); o Operating instructions are legible and face outward; o Safety seals and tamper indicators are in place, not broken or missing (plastic tag on handle and metal pin); and o There is no obvious physical damage, corrosion, leakage or a clogged hose (unscrew hose and blow through to check for clogs). • Mark initials in appropriate month on tag when monthly inspection complete. • Tag-out any fire extinguisher that does not pass monthly inspection (deficiency in any part of the fourth bullet above) and indicate issue for correction.

Rev.	Date	Description	Authored/ Reviewed by	Approved by
0	Oct. 31, 2007	Based on ACSA SWP	Eric Pringle	Steve Foley
1	May 5, 2008		Jamie Wills	
2	May 19, 2009		Ryan Bjornsen	Steve Foley
3	Nov. 28, 2011	Revisions to Worker Responsibility	Jan Michaelian	Eric Pringle
4	Sep. 6, 2012	Significant revisions	Shannon Rooke	Eric Pringle
5	Jul. 24, 2013	Annual Review – No changes	Genevieve Brown	Kiran Arshi
6	Oct. 20, 2014	Revisions to Selection and Use	Brent Morin	
7	Sep. 22, 2015	Revision to Worker Responsibility	Jan Michaelian	Eric Pringle
8	Sep. 29, 2016	Annual Review – No changes	Brian Cire	Eric Pringle
9	Nov. 16, 2017	Annual Review – No changes	Mattea Pittman	Eric Pringle
10	Jan. 10, 2019	Annual Review – No changes	Joshua Foley	Eric Pringle

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SAFE WORK PRACTICE

SAFEGUARDS FOR TOOLS AND EQUIPMENT USE

GENERAL	All tools and equipment shall be properly maintained to reduce the risk of injury or damage to property. Only tools or equipment in good repair, with guards, safety devices or appropriate personal protective equipment (PPE) specific to the hazard, shall be used.
APPLICATION	Where the potential to encounter: moving parts of machinery; points of machinery at which material is cut/shaped/bored; surfaces with temperatures that may cause skin to freeze/burn/blister; energized cables; debris, material or objects thrown from equipment; material being fed into or removed from process equipment or machinery; equipment that may be hazardous; then safeguards, or equipment-specific PPE that offers equal or greater protection than the safeguard, must be used.
PROTECTIVE MECHANISMS	Workers operating or working near a machine or equipment must ensure the proper protective mechanisms are in place. If machinery or equipment cannot accommodate or operate with a safeguard, the worker must wear PPE that is appropriate to the hazard and offers equal or greater protection than the safeguard.
SELECTION AND USE	As per manufacturer's specifications, job hazard assessment, safe work procedures and OH&S Code.
SUPERVISOR RESPONSIBILITY	• The supervisor must ensure that the design, installation, operation and maintenance of safeguards meet the requirements of CSA Standard Z432, "Safeguarding of Machinery". • Supervisors are responsible to provide Waterline staff and contractors with training in the selection, use and maintenance of safeguards and appropriate PPE as part of the hazard assessment.
WORKER RESPONSIBILITY	• Workers are prohibited from removing a safeguard from a machine that is operating if the safeguard is not designed to be removed when the machine is operating. • Workers are prohibited from removing a safeguard or making it ineffective unless removing it or making it ineffective is necessary, with supervisor permission, to perform maintenance, tests, repairs, adjustments or other tasks on the equipment. • If a worker removes a safeguard or makes it ineffective, the worker must ensure that alternative protection measures are in place, the safeguard is replaced immediately after the task is completed, and the safeguard functions properly once replaced. • Equipment operator must ensure that starting the machinery will not endanger the operator or another worker. While operating machinery, an operator must ensure that its operation will not endanger the operator or another worker. • If contact between moving parts of machinery, electrically energized equipment, or part of the work process and a worker's clothing, jewelry, or hair is likely: (a) the worker's clothing must fit closely to the body, (b) the worker must not wear bracelets, rings, dangling neckwear, a wristwatch, or similar articles, and (c) the worker's head and facial hair must be short or confined and cannot be snagged or caught.

Rev.	Date	Description	Authored/ Reviewed by	Approved by
0	Oct. 10, 2008	Based on the OH & S Code requirements	Steve Foley	Eric Pringle
1	May 20, 2009	Review	Chris Dyck	Eric Pringle
2	Oct. 23, 2009	Added detail start up, clothing & jewelry	Eric Pringle	
3	Sep. 29, 2011	Annual review	Shermin Negari	
4	Oct. 2, 2012	Review	Graham Stonebridge	Shermin Negari
5	May 27, 2013	Minor updates to Worker Responsibility	Shannon Rooke	Eric Pringle
6	Oct. 20, 2014	Annual review – no changes	Philip Low	
7	Sep. 19, 2015	Annual Review – no changes	Shermin Negari	Eric Pringle
8	Oct. 4, 2016	Annual Review – no changes	Brent Lennox	Eric Pringle
9	Nov. 15, 2017	Annual Review – no changes	Joel Defoe	Eric Pringle
10	Jan. 3, 2019	Annual Review – grammatical	Marie-Claude Reid	Eric Pringle

* The above information is intended for general use and may not apply to every circumstance. It is not a definitive guide to government regulations and does not relieve persons using this publication from their responsibilities under applicable legislation.

DRILLWELL

HEALTH & SAFETY POLICY & PROCEDURES

REVISED JANUARY 2018

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Health and Safety Policy

Drillwell Enterprises is committed to providing a safe and healthy work environment in all of our day-to-day operations. A safe and healthy work environment is a right of all workers and this policy extends to our sub-trades, clients, other site personnel and members of the general public. All new employees of Drillwell Enterprises Ltd. will receive a new worker safety orientation detailing their health and safety requirements and responsibilities as well as those of the management and supervisors of the company. Employees will receive a copy of the company safety program and all updates as they become available.

Worksafe BC Occupational Health and Safety Regulations will be considered the minimum standards for work procedures in the shop and in the field. All available employees are required to participate in minimum monthly safety meetings as well as any added safety training that the management of Drillwell Enterprises Ltd. deems necessary for the safe performance of duties.

All employees are required to correct and/or report all unsafe conditions and work procedures without delay. The supervisors and management of Drillwell Enterprises Ltd. will address all workers' concerns, investigate and act without delay to prevent incidents, industrial injury and disease. Documentation of all concerns and incidents will be kept as required by the OH&S Regulations.

It is our objective to eliminate workplace injuries by having well trained, safe and conscientious company employees. A safe and healthy workplace is a basic right of all workers. We will work in the spirit of consultation and cooperation with workers to meet this objective. Drillwell Enterprises Ltd. expects its employees to present a professional and safety first attitude to other trades, clients and the public.

Jan 31, 2018

Colin Slade - Partner

Date

Management and Supervisors Responsibility

The management and supervisors of Drillwell Enterprises Ltd. will enforce the Worksafe BC OH&S Regulations at all times, and on every project, with all workers and sub-trades under our responsibility. Every effort will be made during the planning of work to eliminate potential safety hazards, reduce all hazards to the lowest level of danger, and to utilize specialty equipment and procedures as necessary.

The management of Drillwell Enterprises Ltd. will view the safety of workers as their foremost responsibility and will provide, by means of direction to supervisors, general safety training and specific safety procedures, and all the tools necessary to maintain a safe work place. Regular documented safety inspections, at intervals frequent enough to prevent any hazardous conditions from developing will be conducted. Informal and documented discussions with supervisors and workers will take place whenever and wherever required to ensure the ongoing safety of all. In addition, specialized safety training will be provided to any workers the management or supervisors of Drillwell Enterprises Ltd. identifies as requiring added training to safely perform any specialized task.

Supervisors must ensure that workers are never placed at an undue hazard, and that all tasks will be monitored to ensure that the safest procedures possible are being utilized. Supervisors are responsible for the safety and supervision of the workers in their charge. All supervisors will effectively reduce and control hazards, and will report to management any problematic procedures.

Safety violation forms, new worker safety orientations, investigations, first aid treatment records, injury statistics and other documentation will be kept on file. The recording and documentation of information may be delegated to supervisors or others. Safety warnings that have been issued to workers, sub-trades or others will be enforced without prejudice by the management of Drillwell Enterprises ltd., and appropriate corrective measures will be implemented, including the consultation and involvement of Worksafe BC, as necessary.

Workers Responsibility

All workers employed by Drillwell Enterprises Ltd., either directly, or as a sub-contractor to Drillwell Enterprises Ltd. must abide by the Drillwell Enterprises Ltd. Safety Program while performing all work and duties related to any Drillwell Enterprises ltd. jobsite or contract. Any infraction of Worksafe BC's OH&S Regulations is subject to disciplinary action on behalf of Drillwell Enterprises Ltd. Details are included in Drillwell Enterprises Ltd.'s Worker Disciplinary Policy.

It is a responsibility of every worker to recognize workplace hazards. This includes conditions that may arise from the work processes being performed. Not only to protect themselves from harm, but fellow workers and the public as well. If there is a possibility that the public or an un-authorized worker may enter the work area, these work areas must be effectively cordoned off to prevent incidents and injuries.

Every worker is responsible to correct and/or report to a supervisor all unsafe conditions, acts and procedures. Failure to report unsafe acts and conditions may result in disciplinary action. All workers are reminded of their right to refuse unsafe work. All injuries must be reported to a supervisor, and treatment obtained by a first aid attendant. A record of every injury will be kept on file.

When a site is under the jurisdiction of a prime contractor, all site safety rules and procedures must be followed. In the event that an unsafe act or condition is the result of another contractor's work, the prime contractor's office or safety representative must be notified immediately, and all Drillwell Enterprises Ltd. Employees will stay back a safe distance until the condition or act has been rectified.

Subcontractor Responsibilities

In addition the requirements and responsibilities listed above all subcontractors must have a valid WCB account and be in good standing with WCB.

Violence, Harassment or Abuse in the Workplace

Drillwell is committed to providing a workplace free of verbal or physical abuse or harassment.

Every employee of Drillwell is entitled to be treated with dignity and respect regardless of their age, seniority, race, religion and sexual orientation. The management of Drillwell will not tolerate workers who engage in harassment, or physical or verbal abuse. All persons are expected to treat their fellow employees, their supervisors, and others on the job site with good manners and restrained behavior.

Any incidence of work place violence will result in the immediate suspension of the person or persons engaged in the acts of violence. The minimum suspension will be one week without pay, and the maximum will be termination of employment subject to the discretion of the management.

Any confirmed reports of verbal abuse or harassment will result in a verbal and a written warning, with a permanent entry into the personnel file. Any subsequent instances of verbal

harassment or abuse will result in the suspension or dismissal of the offending employee at the discretion of the management.

Drug and Alcohol

Policy

Drillwell Enterprises acknowledges that the use of illicit drugs and the inappropriate use of alcohol, prescription and over the counter medicine can have serious adverse effects on the safety and well-being of workers, contractors and the public. Drillwell Enterprises is committed to maintaining a safe work environment for all employees and those in the public who may be affected. As such, this commitment includes reasonable cause drug and alcohol testing of all employees.

Requirements

The use, possession, concealment, transportation, promotion or sale of illegal substances or items, by any employee, contractor, subcontractor, their employees and invitees is strictly prohibited. Employees will report for work fit for duty; safely able to perform their required duties without any limitations including those that are due to the use (or after effects) of alcohol, drugs or other substances.

Enforcement

As a condition of employment or continued employment, all employees shall be deemed to have and agreed to cooperate with the implementation of this policy and abide by its terms. In addition, as a condition of employment or continued employment, all employees shall be deemed to have agreed to the following enforcement procedures.

Searches and Inspections - An individual’s entry into, or presence at, company property, or project work sites, is conditional upon such persons consent to the right of the company, its authorized representative, or appropriate law enforcement personnel to search the person, his vehicle and personal effects for the presence of unauthorized, prohibited, illegal, or controlled drugs, chemicals or substances, alcohol, explosives, contraband, or firearms.

Drug and Alcohol Testing - A Pre-employment drug and alcohol screen will be required of all persons, prior to being approved for work on the premises of a customer where required. A Post-accident drug and alcohol screen will be required of any employee involved in an on-the-job accident when the incident could be attributed to substance abuse. A "Reasonable Cause" drug and alcohol screen will be required of all persons who show signs of possible intoxication or using or being under the influence of drugs or alcohol, or when such other circumstances exist that would lead a prudent supervisor to be concerned about the employee's safety and the safety of others.

Testing Procedures

Drillwell Enterprises will designate a testing company (CannAmm or similar) to perform pre-access screening service using provincially recognized standards and detection levels. This pre-access screening includes testing for the following substances: cannabinoid, cocaine, phencyclidine, opiates, amphetamines, ecstasy and alcohol.

Disciplinary Action for Non-Compliance

- No search, inspection or drug test will be conducted without consent. However, any employee who refuses to provide such consent and fully cooperate with this policy will be subject to disciplinary action up to and including discharge from employment.
- Under certain circumstances, disciplinary action may include a mandatory referral to and enrollment in an approved rehabilitation program at the employee's expense. This action may also require an indefinite suspension of regular employment.
- An employee's job is not in jeopardy by reason of his voluntary admission to having a substance problem and request for help and referral to an approved rehabilitation program, provided there has been no prior violation of this policy, and the employee has not previously been through rehabilitation while employed with the company. Employees participating in this rehabilitation program will be subject to follow-up or "maintenance" testing.
- If the final result of a "reasonable cause", "post-accident" or "maintenance" drug screening is positive, the employee will be terminated. No terminated employee can be reconsidered for reemployment sooner than six (6) months following termination.
- Any terminated employee who is subsequently rehired and later fails another drug screen will no longer be eligible to be reconsidered for employment.

Administrative Guidelines:

All employees will be informed regarding this policy at the time of employment. Additionally it will be discussed periodically at "tail gate" safety meetings.

In the event an employee or terminated employee requests a review be conducted regarding his/her positive test result, the laboratory will conduct a retest and will make the results of the retest available to the employee or terminated employee provided the request is made within 12 months following the initial test. In the event that the retest is also positive, the employee or terminated employee will be required to pay for the cost of such retest.

An employee who has a substance problem is encouraged to seek immediate assistance. Drillwell Enterprises will provide the employee with the name and address of local agencies or facilities that are equipped to provide the rehabilitation assistance needed by the employee.

The employee may be eligible for a one-time leave of absence from work for a period of up to 30 days, for the purpose of enrolling in an approved rehabilitation program. As a condition of employment such employee must test negative on a substance test in order to return to work. Such request must be made well in advance of any request by the company to submit reasonable cause substance screen.

Client Requirements

In the event that a client has an Alcohol and Drug Testing Guideline that is more stringent than those outlined above, the client's guidelines will be followed for all work done with that client.

General Rules

- All accidents must be reported immediately to your supervisor/foreman, and prior to leaving the workplace.
- All workers must have proof of training indicating that they are trained in WHMIS.
- Workers must wear appropriate PPE when and where required.
- Workers must perform all work following safe work practices and safe job procedures.
- Workers must maintain good housekeeping.
- No fighting or horseplay is permitted at the workplace.
- No theft or vandalism will be tolerated at the workplace.
- No possession or consumption of alcohol or illegal drugs is permitted while at the workplace.
- You are not permitted to arrive or remain at work if your ability to perform the job safely is impaired.

Worker Disciplinary "Zero Tolerance" Safety Policy

All personnel employed with Drillwell Enterprises Ltd., or sub-trades hired to perform work by Drillwell Enterprises Ltd. must follow established safety protocols, where and when required.

Failure to follow or implement company safety program procedure will result in immediate disciplinary action and possible termination of employment. Only one written warning may be removed from any employee file per calendar year, at the discretion of Drillwell Enterprises Ltd. management.

Safety is everybody's business. Safety is our greatest concern!

In the event of a worker contravening a WorksafeBC regulation or a company safety program policy, the following guidelines shall be implemented:

1. Immediately remove the worker(s) from the hazard in question. Contact the Drillwell Enterprises Ltd. site supervisor and office with the worker's name. Sub-trade personnel may be permanently removed from any or all Drillwell Enterprises Ltd. sites for non-compliance of safety regulations.

2. After review of the facts, the company representative will initiate appropriate disciplinary action. Guidelines for discipline are as follows:

- FIRST OFFENCE: The worker and/or supervisor will receive a written Safety Violation notice, and it will remain in their personal file for the duration of employment, including future employment with Drillwell Enterprises Ltd.
- SECOND OFFENCE: The worker (and supervisor, if appropriate) will receive a written Safety Violation notice, and will be suspended without pay for one (1) working day. Worker and supervisor will sign document.
- THIRD OFFENCE: The worker (and supervisor, if appropriate) will receive a written Safety Violation notice, and will be suspended without pay for five (5) working days. Worker and supervisor will sign document.
- FOURTH OFFENCE: employment will be terminated, effective immediately.

There will be no exceptions to this zero tolerance policy!

Hazard Assessment

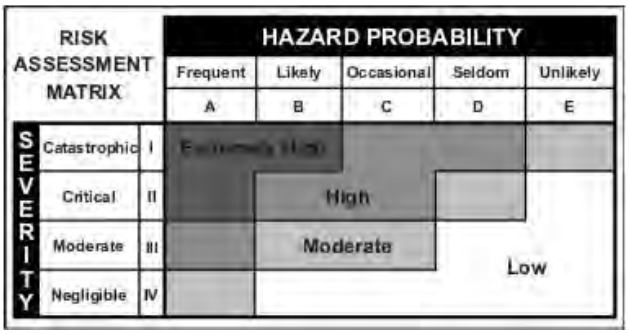
JSA

Written pre-job safety assessments (JSA) shall be performed to determine if hazards are present, or are likely to be present, which necessitate the use of PPE. These exercises are done during morning tailgate meetings and updated during the day as the work or site conditions

change. Drillwell will provide the JSA form unless the client or consultant's shared written JSA meeting includes the following:

- the job to be analyzed
- break down of the job into a sequence of steps
- identification of potential hazards prioritized
- list of identified critical tasks
- determination of preventive measures to overcome these hazards

Assessment of risks will use the following matrix.



LMRA

Last minute risk assessments (LMRA's) are informal, individual, mental hazard assessment of a task. It is intended to focus a worker's attention on the task and is performed before and during the work. It helps identify any unsafe behaviours and hazardous conditions that may have been missed in preparation for the work or which may have developed during the job. This process helps guard against rushing, frustration, fatigue, and complacency by forcing an individual to stop and consider the following:

- Understand the task and hazards
- Assess the risks
- Mitigate the risks

PPE and General Safety

Personal protective equipment (PPE) is the last means of protecting workers from injury. PPE is employed when administrative and engineering controls are ineffective or insufficient. Hazards should be minimized by ensuring that all jobs are well planned, workers are properly trained, and safe work practices and safe job procedures are followed. PPE provides an additional degree of protection from injury. All PPE is to be selected in accordance with standards outlined in OHS regulation.

All workers must equip themselves with Basic PPE including suitable clothing, shirts, and long pants for protection against both weather and workplace hazards. Unless otherwise agreed upon workers are also responsible for providing their own gloves and safety footwear.

Drillwell will provide specialized PPE including hardhats, eye, hearing, fall and respiratory protection along with any other specialized protective equipment required by the Occupational Health and Safety Regulations.

Minimum Health & Safety Requirements for all Drillwell Sites

1. Safety of Drillwell staff and of others in proximity to work site is of utmost importance.
2. Cell phone, land line phone, or radio access to emergency services must be verified.
3. Contact information for onsite first aid facilities, and route to hospital to be verified.
4. Normal precautions for pinch points, and rotating equipment.
5. Normal precautions for overhead and underground hazards.
6. Direction of discharge cuttings and water to be positioned to try and minimize detrimental impact to property and/or water courses.
7. Standard PPE (personal protective equipment); Steel toes, Hard hats, Safety glasses, Hearing protection, High vis.
8. At least one WCB Level 1 first aid attendant on drill site.
9. Adherence to all relevant WCB regulations.
10. Adherence to all relevant client and site specific safety standards and regulations.
11. Adherence to all Drillwell Safety Plans, Policies, and Procedures.
12. Do not use cell phones or other wireless hand held devices (excluding radios) while driving.

Basic PPE

Workers requiring PPE will be trained in the following:

- Exposures and how to identify them;
- Types of PPE to wear as protection from each exposure;
- When to wear them and their limitations;
- How to wear PPE properly; and
- How to care for, clean and properly store PPE.

Clothing

- Shirts required
- No excessively loose clothing.

- No large rips or tears.
- No short pants.
- Dress appropriate for the season.

CSA Grade 1 Footware (Green Tag)

- Wear appropriate protective footware at all times.
- Boots are to be CSA Grade 1 approved with toe protection and puncture resistant sole.
- Lace up boots fully. Laces should be appropriate length to avoid catching on things
- Make allowance for extra socks or insoles
- Boots should fit snugly around heel and ankle when laced
- Walk in new footwear to ensure it is comfortable
- Inspect footware regularly for damage
- Replace or repair damaged or defective footware
- Use a protective coating to make footware water-resistant
- C.S.A. runners only when traveling or very light duty work

Specialized PPE

Hard hats:

- Hard hats are to be worn if there is a risk of head injury or the site requires it.
- On some sites a chin strap may be required.
- Hard hats to be replaced every 5 years.
- Suspension should be adjusted so that hardhat fits snugly without causing any discomfort.
- Inspect and replace hard hats that show signs of wear, scratches, cracks or gouges.
- Hard hat that have been struck should be replaced even if no damage is visible
- Suspension should be kept clean and replaced if there are signs of torn adjustment straps or frayed or broken.

Hi-Vis coveralls

- Coveralls are to be worn on all worksites.
- Coveralls are to be hi-vis and fire retardant.
- Fit should allow for extra clothes underneath but not so loose as to cause risk of entanglement
- Legs and sleeves can be hemmed as required
- Coveralls are to be dropped off for washing as required.
- Broken zippers, ripped seams and tears to be tagged before being dropped off.

- Mandatory for all workers in close proximity to moving equipment, in an excavation, during excavation, during traffic control, or during hoisting operations
- Good practice for all workers to wear at all times.

Eye Protection

- CSA certified safety glasses to be worn whenever there is a risk to eyes or as required by site.
- Frames should be adjusted so that the arms fit comfortably over the ears and the frame is close to the face and supported by the bridge of the nose.
- Glasses to be kept clean following manufactures instructions
- Avoid rough handling or storage that can scratch lenses. Scratched lenses impair visibility and can reduce impact resistance.
- Damaged glasses should be replaced as necessary
- Mandatory for all tasks involving flying debris
- Mandatory when working near equipment & rigs
- Mandatory for all workers near torching operations
- No excuses for failure to comply

Face Protection

- Face shields are NOT protective eyewear; they should be worn in conjunction with safety glasses or goggles.
- To be worn when there is a risk of flying projectiles
- Avoid rough handling or storage that can scratch lens. Scratched lens will impair visibility and can reduce impact resistance.
- Damaged face shield should be replaced as necessary

Hearing protection

- Mandatory for all loud tasks
- Annual test mandatory must carry card
- Disposable Foam ear plugs or ear pods are of universal size.
- If neither foam nor pod fit comfortably another form of hearing protection should be considered.
- Disposable plugs should be kept clean and dry.
- Cardboard containers they come in can be used for short term storage
- Should they become dirty or damaged they should be replaced.

Respiratory protection:

- Mandatory for tasks involving moderate to high levels of dust/fumes/vapours/mists. Check OH&S regs for exposure limits.
- Control contaminants at the source whenever possible
- When controls aren't sufficient or during emergency situations with high exposure respiratory protection will be used.
- If in doubt respiratory protection should be employed
- Respiratory protection employed will be suitable for the task and environment.
- Where gas is expected forced ventilation and gas detectors shall be employed.
- Documented Fit testing, proper use and maintenance is required only if respirator is required.
- Fit testing to be performed by 3rd party.
- Respiratory equipment and training to be provided by employer

Fall protection:

- MANDATORY FOR WORK AT 10 FT. OR ABOVE
- Documented training required
- Daily inspection of equipment.
- Proper fit and use
- Work positioning system for derrick work at all times
- Zero tolerance for non-compliance.

General Orientation Topics

W.H.M.I.S. program

- Proof of training (federal law)
- Location of MSDS sheets
- MSDS sheets for all controlled products.
- Transport sheets & Controlled products together
- No decanting of products without proper labels.

Safety Meetings:

- Mandatory for all workers at site
- JSA at the beginning of each job
- Covers current issues, upcoming hazards etc.
- Reviews recent incident and near miss investigations.
- Covers recent safety inspections and written incident or safety violations issued.

Safety inspections:

- Safety checklists must be completed daily, and prior to starting each job.
- Workers are responsible to ensure their machines and the work areas are safe each day.
- Safety coordinator conducts safety inspections on surprise basis.
- Surprise inspections could include WorksafeBC

Personal medical conditions:

- First Aid attendants need to be aware of conditions like heart disease, epilepsy, diabetes, high blood pressure, etc.
- Medical alert bracelet
- Strict confidentiality of information.

Fire Hazards:

- Smoking is prohibited while handling/during refueling operations
- All flammable liquids must be properly stored
- All petroleum must be stored in approved containers
- Sources of ignition must be controlled during re-fueling
- All equipment gas equipment must be shut off during refueling
- Fire extinguishers must be kept clean & in good condition.
- Ensure careful, proper disposal of cigarette & cigar butts.
- Extreme hazard requires 1/2hr fire watch
- Wet ground after hot work

Pointed Hazards:

- Be aware of falling on any vertical point hazards around the rig
- Cover grade stakes with pails or off-set to a safe distance
- Rebar and other points must be bent over or effectively guarded.
- Do not lean or stand shovels, pry-bars etc. near rigs.

Rebar protection:

- Bend rebar to horizontal whenever possible
- Vertical rebars are guarded if unable to bend over.
- Mushroom caps are for horizontal rebar only.

Hole coverings:

- All openings larger than 6 inches must be securely covered with plywood or steel & marked with a circle, with an “X” through the center.
- Guard rails if the opening is too large to cover.

Electrical protection:

- All power cords to be medium or heavy gauge and in good condition.
- All power cords must be grounded. (3 prong plugs)
- All power cords are to be in good repair, or exchanged in shop ASAP and marked as needing repair.
- Power tools are to be double insulated or grounded plugs.
- Electricians or Drillwell Enterprises ltd. designated tool repair technician only to affect any electrical repair to any tools or equipment.

Power tools (including Pneumatic):

- Must be in good operating condition with no alterations.
- Always use the right tool for the task.
- Wear the appropriate PPE
- Guards are not to be removed.
- All manufacturers’ instructions are to be followed.

Transport of personnel & equipment:

- Seatbelt and all M.O.T. laws must be adhered to
- Only authorized personnel may operate vehicles & equipment.
- No workers allowed to ride on equipment except in a proper seat

Power lines:

- Location (underground, overhead).
- Clearances required.
- Locations of temporary power panels.
- Caution for temporary power lines, cords etc.
- Drillwell Policy is 20 ft. from unshielded power lines until voltage is verified

Housekeeping:

- Daily ritual
- Single worker or crew clean-ups.
- Nails and other sharp hazards bent over or removed.

- Awareness of fire hazard associated with the accumulation of debris.

Cranes and rigging:

- Current inspection sticker on crane.
- Qualified operator. (obtain copy of certificate) if required.
- Proper hand signals or dedicated radio frequency.
- Inspected rigging equipment with WLL tags.
- No loads over workers.
- Point/intended loading; be certain landing area can support the load.

Torching Operations:

- No debris or combustibles nearby.
- No petroleum products or batteries nearby.
- Fire extinguishers in close proximity.
- Personal protective equipment utilized.
- Proper signage to protect other workers/public
- Tanks secured, capped and not hoisted without proper cage.
- All components in good condition.
- Flash arrestor required

Forklifts/Bobcats/Manlifts:

- Only properly trained, authorized workers may operate forklifts and bobcats. In addition to training and authorization certification required for manlift operation.

Name of Supervisor:

- Know the name and contact # of supervisor

Instruction & Demonstration:

- Provide instruction and demonstrate the skills for the tasks the worker will be required to perform.
- Document competency of worker's skills after observation.

Health & Safety Representative:

- Provide contact info for the H&S representative

Safety Orientation Signoff

The safety orientation is mandatory for all workers. Each person is required to sign and date the orientation document to show they have received and understood the information. A copy of the orientation document may be provided to the worker.

Inspection & Preventative Maintenance

All tools, equipment, rigs and vehicles will be well maintained in order to minimize down time and prevent damage to person or property. Operators of equipment will be familiar with inspection and maintenance schedule of their equipment and will be responsible for ensuring the recommended maintenance schedule is adhered to.

Pre-trip and post inspections are a requirement of all commercial vehicle drivers. All rigs and cranes will have equipment inspection forms completed before daily operation. All maintenance (scheduled and otherwise) on vehicles and equipment will be recorded and submitted to the office and filed under the unit number.

Lockout Tagout Policy

Maintenance of equipment can be a hazard in itself. Any equipment that is taken out of service must be tagged and or locked out.

This policy applies to equipment such as rigs, cranes, trucks and hoists while greasing, maintenance or other work is being performed whereby individuals could be injured by the unexpected starting, or engaging of engines, clutches or shafts.

Lockout and tagout procedures also apply to power tools, extension cords, fall arrest equipment, hoisting and lifting equipment including slings, hooks, chains and other rigging.

Any equipment that has been taken out of service must be tagged with the date, the reason for tagging, and the name of the person who initiated the tagging.

Tags when used on rigs and large equipment are to be removed only by the equipment operator or with the equipment operators' authorization. Tags when used on power tools, extension cords, fall arrest or rigging and hoisting equipment are to be removed only by the site foreman, or by authorization from the site foreman.

Training and Communication

Safety Orientation

It is critical that all workers and visitors new to a construction site are properly informed of the safety rules and plans for that site. Prior to commencing work, the new worker must be made

aware of any and all hazards, emergency plans and procedures. A site-specific safety orientation should be received from the site Safety Coordinator (Driller or Foreman). This will be the Safety Coordinator's opportunity to explain the rules, how those rules will be enforced, and to collect/request documentation that will be required.

All new workers will be given a safety orientation, which includes, but is not limited to, the following subject matter:

Company policy:

- Workers must comply with all site rules and procedures.
- Review Company Health & Safety Policy
- Review Management & Worker's responsibilities
- Workers must be trained by Drillwell Enterprises ltd. and/or provide documented proof of training.
- Adhere to the minimum WorksafeBC regulations and standards.

General rules:

- Read any posted site rules, site hour's etc. as applicable
- Read any site safety plans as applicable.
- Designated smoking area
- No violence, practical jokes or horseplay.

Employee Responsibilities:

- Adhere to company policy and procedures.
- Take no risks.
- Assist fellow workers.
- Set a good example.
- Do not work in isolation.
- Possible criminal prosecution/ fines for non-compliance

Employee Rights:

- The right to refuse unsafe work (federal and provincial)
- The right to know the hazards
- The right to participate in the safety program

Reporting unsafe acts or conditions:

- Report hazards immediately

- Correct unsafe conditions whenever possible
- Do not expect others to report/correct.

Reporting incidents and injuries:

- Report immediately to supervisor or First Aid Attendant.
- Get treatment from first aid for assessment and to prevent infection.
- Abide by the decision of first aid when advised to seek medical attention.

Location of first aid (as applicable):

- Note the location of first aid trailer/room and equipment.
- Access and treatment with first aid attendant only.
- Locations of air horns, fire extinguishers and eye wash stations.
- Note personnel with O.F.A. qualifications.

Evacuation procedures:

- In regards to fire, gas leak, explosion or bomb threat, etc.
- Explain why an accurate head count is important to eliminate searches

Location of marshaling area:

- Front gate at shop, or as directed on site.
- In the absence of other directions or when in doubt, workers are to return to the company vehicle, if safe to do so. They should not leave the immediate jobsite area, greater than a reasonable safe distance from hazards.

How to contact first aid:

- Company policy
- Site procedures if applicable

Training

Safe work practices are developed through a combination of training and experience. A safe workforce requires a safe attitude. This attitude is developed with proper training, education, and the understanding that all incidents are preventable. Taking unnecessary risks significantly increases the chances of an incident occurring.

Drillwell Enterprises Ltd. will provide the appropriate safety education, training and equipment to their workers. Documents proving that workers have received specific training should be obtained and kept on file. Commencement of project safety meetings are a way of continuing

the safety training and education of the workers, and documented proof of these meetings must be kept on file.

WHMIS training is mandatory for all workers in Canada that may come in contact with any controlled substance. Proof of WHMIS training is required for all workers.

Short Service Worker (SSW) Program

Workers new to a job or task are at greater risk of injury to themselves and others than more knowledgeable and skilled workers. Our SSW program provides a structured approach to training orienting and mentoring new workers.

SSW Requirements

Drillwell will enroll new workers in our SSW program, they will be identified by wearing a green hard hat and remain enrolled until they:

- Have the basic skills and knowledge to perform their tasks safely
- Fully understand and participates in our safety culture
- Have accumulated a minimum of 2 weeks steady work

Trainers

Drillwell trainers will:

- Provide a positive safety attitude and complete understanding of our safety culture
- Demonstrate training skills and a solid understanding of the material they are teaching
- Will be responsible for the safety of SSW while under their supervision
- Not request a SSW to do new tasks they have not been trained for

Monthly Safety Meetings – JOHSC

The goal of regular safety meetings is to provide a consistent method to convey safety related information throughout the workforce. It also provides documented proof that the information is reaching the workers in the field, and that the workers have the opportunity to provide their feedback to management on the issues discussed. This forum also satisfies Joint Occupation Health & Safety Committee (JOHSC) requirements. Both management and workers are required to attend these meetings.

Identifying trends in incidents and injuries is an important step in the process of developing safe work procedures to lower the frequency of incidents that may result in injury. Workers are required to participate in the health and safety program developed by the company. Input from workers is part of a positive safety culture within an organization, and this input is essential to creating an effective and evolving safety program. The safety meeting is the forum where

workers can comment on issues brought forward by the company management, discuss the issues that are affecting their health and safety, and collectively explore ideas to improve conditions and reduce workplace incidents.

Topics for discussion brought forward by the company should be pertinent to the safety issues identified by trends from incidents and injuries. The findings from all incidents and incident investigations are topics for safety meetings, as they directly represent the safety culture and practices of the company. It is important that the workers hear directly from the company what the investigations revealed, and all recommendations that will be implemented. Workers are encouraged to participate in discussions and bring their ideas forward.

Injury statistics reveal trends specific to the workplace. These trends can identify areas that require an increased focus on safety, in order to reduce and eventually eliminate each type of injury.

Topics presented by workers at previous safety meetings are very important. These issues must be carefully thought through, and solutions developed. The front line workers may mention an issue that upon careful consideration may have the potential for serious injury and/or property damage. Workers will expect these issues to be addressed, and a pro-active safety culture begins with leadership from the top of the organization. Employees at all levels are encouraged to participate in the development of solutions including safe work procedures.

These meetings will be held at least monthly and every effort should be made by employees, management and JOHSC committee members alike to attend. At a minimum at least one JOHSC committee member will be present for quorum.

Each member of a joint committee is entitled to an annual educational leave totalling 8 hours, or a longer period if prescribed by regulation, for the purposes of attending occupational health and safety training courses conducted by or with the approval of the Board.

JOHSC duties and functions:

Drillwell will establish and maintain a Joint Occupational health and safety committee (JOHSC). We will take an active role in ensuring the joint committee functions as required. If a situation is identified where the committee is not meeting its obligations Drillwell will take appropriate action to rectify the problem.

As per WCB regulation the joint committee has the following duties and functions:

- to identify situations that may be unhealthy or unsafe for workers and advise on effective systems for responding to those situations;

- to consider and expeditiously deal with complaints relating to the health and safety of workers;
- to consult with workers and the employer on issues related to occupational health and safety and occupational environment;
- to make recommendations to the employer and the workers for the improvement of the occupational health and safety and occupational environment of workers;
- to make recommendations to the employer on educational programs promoting the health and safety of workers and compliance with this part and the regulations and to monitor their effectiveness;
- to advise the employer on programs and policies required under the regulations for the workplace and to monitor their effectiveness;
- to advise the employer on proposed changes to the workplace, including significant proposed changes to equipment and machinery, or the work processes that may affect the health or safety of workers;
- to ensure that accident investigations and regular inspections are carried out as required by this Part and the regulations;
- to participate in inspections, investigations and inquiries as provided in this Part and the regulations;
- to carry out any other duties and functions prescribed by regulation.

Joint Occupational H&S Membership

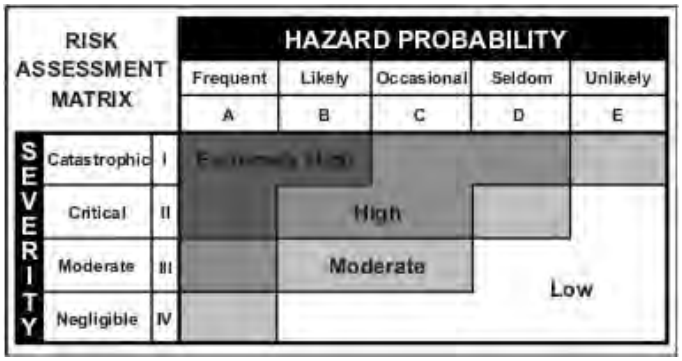
Membership will consist of a minimum of two representatives from both management and employees. Representatives will be roughly split between HVC and Vancouver Island locations. Should employees feel uncomfortable bringing their questions or concerns to the larger safety meeting they can seek out members of the JOHSC to make comments in private.

Management Representation:	Colin Slade (Duncan) 250-381-1990
	Shawn Slade (Duncan) 250-510-9253
	Tiger McGarry (HVC) 778-220-6780
Employee Representation:	Cass Currie (Duncan) 250-858-1253
	Adam Bush (Duncan) 250-709-5811

Inspections

Policy

It is the policy of Drillwell Enterprises Ltd. that regular, effective safety inspections will be performed. All inspections will be performed as frequent as necessary to prevent any hazardous conditions from developing. As determined by the management and supervisors of Drillwell Enterprises Ltd., different requirements may be placed on the inspection of equipment and work processes. Every inspection performed will be documented, and any hazards found will be rated according to the risk assessment matrix below. At any time, if the severity of a hazard is in question, it shall always be considered the more serious of the hazard ratings.



Inspections will be performed on a regular basis, as well as on a surprise basis by the management of Drillwell Enterprises Ltd. or their representative. At a minimum the shops will be inspected semi-annually and every month a worksite inspection will take place. To knowingly operate equipment or perform work related duties with a Class “I” and class “II” hazard present (not eliminated or controlled) will be considered a violation of the company safety policy and will warrant disciplinary action.

The management of Drillwell Enterprises Ltd. will review inspection documents on a regular basis, for the purpose of identifying trends or to identify the need for the development of specific safe work procedures. All Class “I” and class “II” hazards documented will be included as topics for general safety meetings.

Investigation and Reporting

Serious Injury Incidents

All incidents designated as “serious injury incidents” or an incident having the potential of causing serious injury shall be reported immediately to the WorksafeBC’s Incident Prevention Branch. The supervisor will immediately inform the project superintendent and Drillwell Enterprise’s office. The project Superintendent or Drillwell Enterprise’s office shall call the Worker’s Compensation Board office by telephone to report a serious injury incident.

Reportable incidents having the potential of causing serious injury for the purposes of the Industrial Health and Safety Regulations (IHSR) are:

- Incidents resulting in serious injury to, or the death of a worker, or involve a major structural failure or collapse of a building, bridge, tower, crane, hoist, temporary construction support system or excavation, or involve the major release of a toxic or hazardous substance, or
- Involved in a fire or explosion that had a potential for causing serious injury to a worker or was an incident required by Regulation to be reported.

Incident Reporting Procedures

The following is a summary of reporting requirements if an incident occurs.

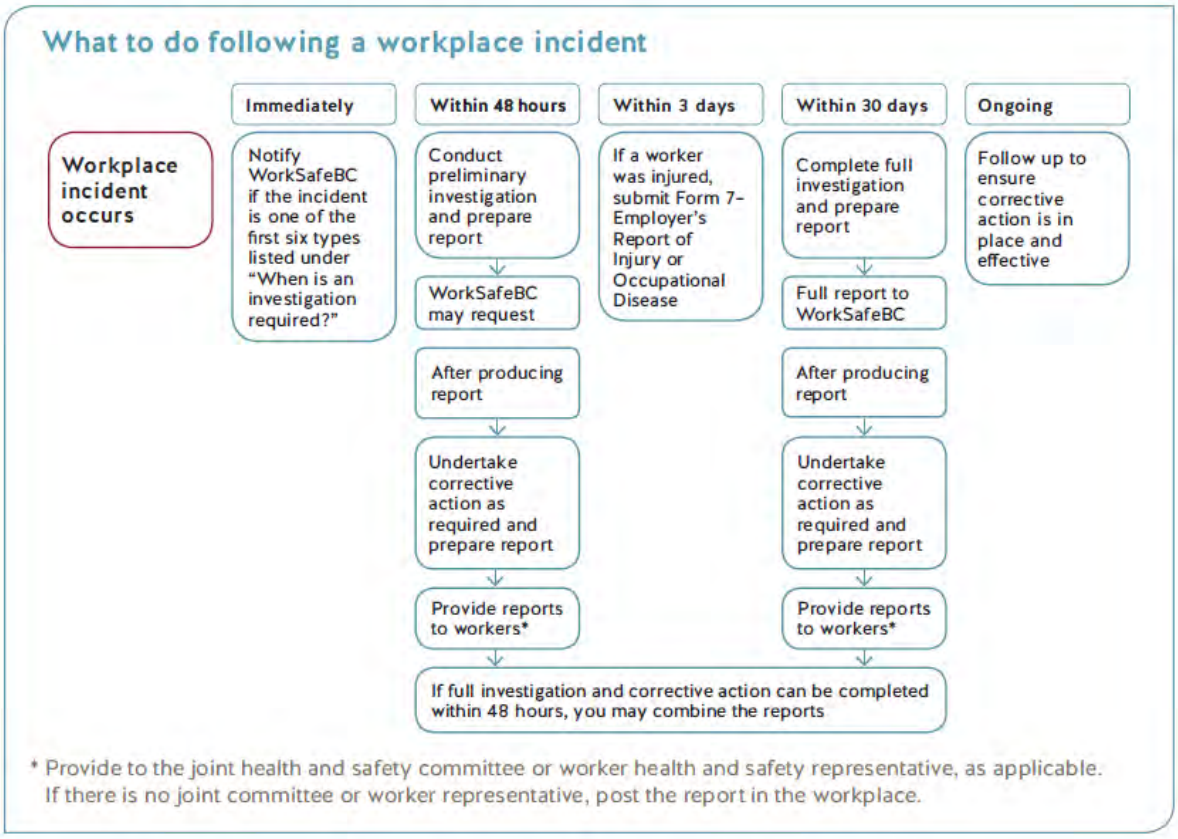


Figure 1 - What to do following a Workplace Incident

Non- Disabling Injury – First Aid Only

The injured worker will:

- Report to immediate Supervisor or First Aid Attendant
- Obtain first aid treatment

- Record incident details in first aid book and return to work

The supervisor or First Aid Attendant will:

- Complete first aid report and advise Drillwell Enterprise's office

Non- Disabling Injury – Medical Aid Required

The injured worker will:

- Report to immediate Supervisor or First Aid Attendant
- Obtain necessary first aid before going to physician
- Advise his immediate Supervisor if any time loss will be involved

The Supervisor or First Aid Attendant will:

- Provide first aid services and treatment recommendations
- Report the incident to Drillwell Enterprise's office
- Complete Workers' Compensation "Form 7A First Aid Report" if advised by the office to do so.
- Maintain contact with employee (and physician if necessary regarding treatment) ensuring the worker gets home after medical aid.
- Follow up to ensure an investigation is conducted. If directed by the office, complete an incident investigation report, send a copy to the Drillwell Enterprise's office.

Drillwell Enterprise's office will:

- Complete Form 7 "Employers Report of Injury or Industrial Disease". Copies of the report are to be given to WorksafeBC Prevention Division.
- Ensure an Employer Incident Investigation Report (EIIR) completed and submitted to WCB within 30 days of the occurrence of the incident.

Disabling Injury

- If able, the worker should report orally to his immediate Supervisor, First Aid Attendant or any other supervisor who is available.
- If unable to report, a fellow worker should report for him.
- Obtain any necessary first aid before going to a physician.

The Supervisor or First Aid Attendant will:

- Provide first aid services and treatment recommendations
- Report the incident to Drillwell Enterprise's office
- Complete Workers' Compensation "Form 7A First Aid Report"

- Maintain contact with employee (and physician if necessary regarding treatment)
- Follow up to ensure an investigation is conducted. If directed by the office, complete an incident investigation report, send a copy to the Drillwell Enterprise's office.

Drillwell Enterprise's office will:

- Complete Form 7 "Employers Report of Injury or Industrial Disease". Copies of the report are to be given to WorksafeBC Prevention Division.
- Ensure an Employer Incident Investigation Report (EIIR) completed and submitted to WCB within 30 days of the occurrence of the incident.

Motor Vehicle Accident (M.V.A)

The driver of a Company vehicle at the scene of an incident shall:

- Render necessary aid to the injured to the extent of training they have.
- Take safety precautions necessary to keep incident from creating a hazard to others.
- Report to immediate supervisor and Drillwell Enterprise's office as soon as possible.
- Contact police/ambulance if damage is extensive or personal injury is involved.
- Obtain all necessary information required for incident reports, such as names and addresses of other vehicle drivers involved, names and addresses of witnesses, etc.

Property Damage Incident – No Injury

Supervisor, workers or person at scene will:

- Report incident to supervisor or Drillwell Enterprise's office.

Near Miss Incident

All incidents which have a potential for serious injury or property damage must be investigated immediately by Drillwell Enterprise's office or delegated supervisor.

Pertinent information is to be gathered and a "near-miss" investigation report must be completed. Any information to be submitted by a subcontractor must be gathered in a timely manner with the report being submitted to Drillwell Enterprise's office no more than two (2) working days following the incident. Near misses of a serious nature are to be submitted to WorkSafe BC within 30 days of the occurrence. Near misses are to be discussed at subsequent safety meetings as a learning opportunity to all.

Absence Investigation and Follow-up

An integral part of good safety management is minimizing the number of lost workdays following an incident by facilitating a worker's return to work as soon as he is physically capable of doing so.

When a worker is absent from work for an extended period of time due to an incident, the Supervisor or Drillwell Enterprise's office will contact the worker to ascertain his physical condition, medical attention received, projected return to work date and offer any reasonable assistance that may be required. A worker is to be encouraged to return to his job as soon as he is physically fit to do so.

Should there be reasonable cause to believe a worker is physically fit to return to work on a job other than his own, Drillwell Enterprise's office will determine whether an alternative meaningful job can be offered to the worker.

First Aid Procedure

Any worker sustaining an injury or illness that is, or may be, job related shall report to the First Aid Attendant for treatment as soon as possible.

The designated First Aid Attendant shall ensure that a record of every injury or illness which requires first aid treatment is kept in a Treatment Record Book. Each record must be duly signed and dated by the designated First Aid Attendant.

A First Aid Treatment book shall be kept for at least ten (10) years following the completion of the project.

The management, in order to determine trends and recommend corrective action, shall review First Aid statistics on a regular basis.

Note: Workers are reminded that all work related injuries are to be reported to the supervisor and/or first aid attendant as soon as possible.

Exposure Control Procedure

Blood-Borne Pathogens

Definition – pathogenic micro organisms that are present in human blood and can cause disease in humans, e.g. Hepatitis B Virus (HBV), Hepatitis C Virus (HCV) and Human Immuno-deficiency Virus (HIV), etc.

1. Injured Worker

- Inform designated First Aid Attendant (O.F.A.A.) that there is an injured worker.

- O.F.A.A. MUST ENSURE ALL HAZARDS HAVE BEEN ELIMINATED OR EFFECTIVELY CONTROLLED PRIOR TO RENDERING AID.
- The O.F.A.A. has complete authority with respect to injured workers, initial treatment, and preservation of the incident scene and treatment recommendations. All workers, supervisors and management personnel will assist the O.F.A.A. in the performance of duties, and all requests made for assistance.
- No worker, O.F.A.A. or other personnel should touch injured workers unless they are wearing Personnel Protective Equipment (PPE). For first aid emergencies, the minimum P.P.E. is medical protective gloves. Face shield or protective eyewear may be necessary if there is a risk of spraying or splashing of bodily fluids.
- Proper glove-up and removal procedures must be adhered to. Gloves and gowns are to be worn for anticipated contact with blood and body fluids (e.g. feces, urine, sputum, saliva, wound drainage and non-intact skin.

Hands are to be washed before and immediately after gloves are removed. Antiseptic or alcohol wipes are to be utilized when proper hand washing is not practicable. Disposal of contaminated gloves, gowns, blankets, dressings or other objects is to be done in a manner, which eliminates future exposure to workers (immediately bagged & sealed).

2. Incidental Exposure:

Any employee who may have been exposed to blood or other potentially infectious materials must report it to the First Aid Attendant.

- Vigorous washing or cleaning must be performed utilizing an anti-bacterial solution, soap or antiseptic/alcohol wipes.
- Then report the incident to the immediate supervisor to obtain medical attention as soon as possible (within 2 hours of the exposure).
- Incidental exposure to possible blood borne pathogens is to be considered an event involving a moderate risk to life and health.

3. Supervisors and Drillwell Enterprises Ltd. management must ensure that all records such as exposure and exposure control training records are maintained. Records of incidental exposure will be kept as part of the first aid record book.

4. Supervisor will complete documentation to include conducting an incident/accident investigation.

Fall Protection Policy

Drillwell Enterprises Ltd. recognizes that falls from heights are a significant hazard to workers. This policy is to outline exactly what workers can expect from management and what will be expected from supervisors and workers with regards to the hazard of working at heights.

It is every employee's responsibility, from junior worker to senior management personnel to recognize and effectively control fall hazards. Every effort will be made in the planning stages of all work to reduce and if possible eliminate all fall hazards wherever they may present. WorksafeBC minimum regulatory standards must be adhered to at all times. Specific Safe Work Procedures will be developed to eliminate or reduce fall hazards. All worker's concerns raised will be addressed by management without delay, and any recommendations made will be transmitted to all company employees either immediately or through the regular safety meeting process.

Field supervisors are responsible to ensure that Fall Protection Procedures and equipment are inspected and utilized whenever required. Unusual hazards such as vertical grade stakes, shovels, pry-bars etc. are to be removed from the perimeter of the drilling rig. Installation of retractable lanyards and all other Fall Protection Equipment must be inspected prior to use and a record kept on the rig safety checklist.

Only trained and authorized workers will be permitted to perform any type of task that involves work being done at a height of 10 feet or greater above safe grade. Any work performed at heights over 10 feet (or some lesser height if required by client or site) will require restraint/arrest equipment to be employed. Any work at or above 25 feet will require a site specific fall protection form. Drillwell Enterprises Ltd. will provide workers with training as required advancing into positions requiring work from heights.

The Hierarchy of fall protection is as follows:

- Hazard elimination – Remove the hazard
- Fall Prevention – Prevent access to the hazard
- Fall Restraint – Restrain user from access the fall hazard
- Fall arrest – Catch the worker in event of fall.

Workers are aware that surprise safety inspections will be conducted by Drillwell Enterprises Ltd. management or designated parties, including the possibility of officers from the Prevention Division of WorksafeBC. Drillwell Enterprises ltd. has a zero tolerance policy with regards to Fall Protection regulatory violations, and all violations will result in disciplinary action.

Fire Prevention

This guideline is intended to provide compliance with all related regulation and standard safe work practice. The goal of these guidelines is to prevent fires and to provide general direction for action in the event that a fire does occur. Drillwell Enterprises employees shall be informed of the proper actions to take in the event of a fire. This includes, but is not limited to; notification and evacuation procedures. It is STRESSED that at no time does the task of fighting fire supersede an employee's primary duties of:

- Ensuring their own personal safety and the safety of others.
- Reporting the incident to the proper authority and ensuring personnel accountability for yourself and all subordinates at the jobsite, in accordance with company and client policy.

Procedure

- All Drillwell Enterprises employees are responsible for good housekeeping practices to enhance fire prevention methods. Supervisors will be held accountable for the housekeeping of their job sites.
- Only approved containers will be used during fueling operations.
- Flammable material shall be kept and stored in compliance with applicable provincial and client regulations. The quantity of flammable/combustible material shall be kept to a minimum on the job site.
- Welding, cutting and grinding sparks shall be regarded as potential sources of ignition.
- Hot work areas shall have a fire extinguisher and hose maintained on each jobsite and where dry conditions present a hazard work area will be kept wetted down.
- Hot Work Permits shall be used where required by client or site.
- Maintain the conditions of the hot work permit at all times
- Know the location of firefighting equipment in the immediate area
- Where dry conditions exist continuously monitor the work area during and for 30 minutes after hot work has finished to ensure no smoldering embers or slag exist
- Report all spills or suspicious odors immediately.
- Fire extinguishers are to be kept in areas easily accessible to employees. Only approved fire extinguishers are to be used. They must have an inspection tag attached. Extinguishers are to be maintained in a fully charged, ready to operate state. Extinguishers are to be inspected monthly and documented annually. Training is provided to all employees who use or may use fire extinguishers.
- NEVER put yourself or others a risk while attempting to extinguish a fire.
- NEVER attempt to extinguish a pressurized-fuel fed fire, including LPG fires

- DO NOT APPLY water to any acid or caustic release as it can cause a violent reaction. Additionally, low concentration acids or caustics become extremely corrosive, causing an increasing leak condition.

In the Event of a Fire

- Remain calm
- Only extinguish a fire when it is clearly within your abilities and the equipment available
- Know the location of the nearest alarm and how to activate the emergency system
- Know the evacuation routes and collection points
- If the fire cannot be extinguished, leave the area immediately and report to your evacuation area
- Await further instructions from the supervisor, or designated responsible personnel

Classes of Fire

- Class A - Ordinary combustibles (wood/paper/textiles)
- Class B - Flammable liquids (gasoline/oils/grease)
- Class C - Live electric (wiring/generators/motors)
- Class D - Combustible metals (finely divided form/chips, turnings)

Types of Fire Extinguishers

- Water - extinguisher for ordinary combustible fires
- Dry Chemical or CO2 - extinguisher for electrical equipment fires and for flammable liquid fires
- Multipurpose Dry Chemical - extinguisher for ordinary combustible fires, liquid fires, and electrical equipment fires
- Foam - extinguishing agent for hydrocarbon fire

Workplace Hazardous Materials Information System (WHMIS)

Policy

It is the policy of Drillwell Enterprises Ltd. to promote and sustain the efficient application of a program for WHMIS to ensure that workers receive the fullest knowledge and protection in the handling of products, which could be harmful to their health as per WCB H&S Regulations Section 5.l - 5.8.

Pursuant to the attainment of this goal, responsibilities for administration of the WHMIS program shall include, but not be limited to, the following:

The Site Supervisors will ensure that all controlled products entering the jobsite will have proper labels and identifying symbols attached to each container and that Safety Data Sheets

(SDS) are available and circulated to the proper personnel. The management of Drillwell Enterprises ltd. will also ensure that adequate information and training is provided for all personnel.

The management of Drillwell Enterprises Ltd. or their designate will coordinate the activities of WHMIS for the company. Duties will include the compiling of a list of hazardous products; requesting SDS sheets and labels for controlled products; keeping SDS sheets current and available at the site; and ensuring that adequate training is given to all workers.

The Site Supervisors will ensure that workers who handle, store or use controlled products are properly trained to identify labels. They must be properly trained to understand risk terminology; to be able to understand applicable sections of SDS`s; to implement emergency procedures should they be necessary and understand problems associated with the handling of controlled products. Supervisors will also ensure that all controlled products received on the jobsite are correctly labeled and that current SDS`s are readily available for these products.

Workers will follow all the established procedures for the use, storage, handling of and disposal of controlled products including, when required, the wearing of proper Personal Protective Equipment.

Cooperation is needed among all levels of the workforce to ensure that our workers receive the necessary information and equipment required for fulfilling our goal of reduced work place injuries. Strict compliance with the WHMIS regulations will ensure that workers have the fullest protection when handling products which could endanger their health now or at a later time in their lives.

Management Responsibilities

Safety Data Sheet

- Obtain up to date supplier Safety Data Sheet before the product is used or handled.
- Ensure that the SDS is less than three years old.
- Update the SDS within 90 days of receiving new information or at least every three years.
- Make sure that the SDS is available to all workers that will come in contact with the substance
- Ensure the workers are informed regarding the content of SDS and the purpose and importance of the information.

Supervisor Responsibilities

WHMIS Labels / SDS

- Ensure that all workers who work with or in proximity to controlled products are instructed in the content, purpose, and significance of supplier and workplace labels and other identifiers. (WCB Section 5.8)
- Ensure that a controlled product or the container of a controlled product has the proper label applied at the time of entry into the workplace.
- Ensure that no controlled product is used or handled in the workplace without the proper label.
- Take measures to ensure that supplier labels are not removed, defaced or altered in the workplace.
- Develop and apply workplace labels to containers of controlled products, when an existing supplier label becomes illegible, or is incidentally removed and a replacement supplier label is not available, or when a controlled product is decanted (transferred from its original container to any other container).
- Provide and apply others means of identification, which need not be workplace labels, but which clearly identify contents for any hazardous product.
- Ensure that SDS are readily available for reference, and that workers have read and understood the information contained within.
- Ensure that all workers who may be exposed to a controlled product are trained in the use of PPE relevant to the use of a controlled product and necessary procedures to be followed.
- Ensure workers are trained in emergency procedures with regard to the controlled products that they handle.

Worker Responsibilities

WHMIS Labels/SDS

It is the Workers responsibility to know and understand:

- The content information which should appear on supplier labels and workplace labels, including the requirements for information on the availability of SDS (Safety Data Sheets).
- The significance for worker health and safety information on labels and other written or symbolic means of identification.

- Procedures for the safe use, storage and handling of controlled products; procedures to be followed when fugitive emissions are present, or in an emergency which involves controlled products.
- How to handle controlled products in accordance with label and identifier alerts.
- How to follow employer directives to avoid removing, defacing or altering labels.
- When to inform employers of the presence of labels and other identifiers which are illegible or have been incidentally removed.
- How to wear and use the appropriate personal protective equipment.
- Know what to do in the event of an unintentional release of a controlled product.
- Understand the proper procedures for disposal of controlled products, obeying all provincial and regional regulations.

Emergency Procedures

For the purposes of worker health and safety and compliance with WorksafeBC OH&S Regulations, Drillwell Enterprises Ltd. has assessed the operations and working conditions, and have deemed all of our field operations as a “High” hazard. This is based upon the general rating for drilling operations, and the fact that our work does not differ greatly from general drilling operations.

This places the requirements for a Level 1 O.F.A. and a LV1 First Aid Kit to be present at all times when there is work being performed by 2 to 15 workers, within 20 minutes surface travel time of medical aid. Medical aid is considered a trauma unit or other medical facility capable of adequately attending to an injured worker. The number of workers is restricted to a maximum of 5 if the surface travel time to medical aid exceeds 20 minutes, or 6 to 10 workers if the level 1 O.F.A. has a transport endorsement and there is an Emergency Transport Vehicle on site at all times work is being performed. Surface travel time to medical aid, the route, and the facility’s ability to deal with an injured worker must be verified and documented prior to work commencing at any location.

Drillwell Enterprises Ltd. shop location will also be rated “High” for the purpose of assessment under the WorksafeBC OH&S Regulations. A Level 1 O.F.A. and LV1 Kit will be maintained whenever work of a hazardous nature may take place at the shop. Every effort will be made to provide this level of first aid support whenever clerical support staff and management staff are working in the building.

All Drillwell Enterprises ltd. workers are encouraged to obtain a minimum Level 1 O.F.A. certification at company expense and to renew this certification every 3 years as required by WorksafeBC OH&S Regulations.

Evacuation

All workers and employees of Drillwell Enterprises Ltd. must make themselves familiar with all exit locations from the office and shop area. As well, all workers will be familiar with the location of all fire extinguishing equipment in and around the building.

In the Event of a Fire or Evacuation:

1. Sound the fire alarm. This may include yelling “fire” loudly. All workers hearing “fire” being announced will themselves yell “fire” to alert all workers to the hazard.

2. All workers must exit the building via the nearest exit, as quickly as possible, closing all doors and windows as they go.

3. Fire extinguishing equipment may be utilized to put a fire out if:

- The fire is small or contained enough to allow the equipment a good chance of being effective.
- The worker has training in the effective use of the equipment.
- There is a clear escape route for the worker from the fire location.
- There are no additional hazards endangering workers (i.e. compressed gas cylinders, petroleum accelerants, explosives, exposed electrical cables etc)
- Other workers are already contacting the fire department.

4. All vehicles must be cleared from around the perimeter of the building.

5. All workers will marshal outside near the front gate or other designated marshal area, and remain a safe distance from the building. A head count should determine any staff that may be trapped in the building and reported to the first responder on scene. Workers will remain outside until fire department officials give clearance to re-enter the building.

APPENDIX 1 – SAFE WORK PRACTICES

Electrical Safety SWP

Drillwell Enterprises ltd. requires all employees to take every precaution to eliminate or reduce any electrical shock hazard. All cords will be 3 prong grounded and must be without any splices or tape. All cords in use must be in good condition, of medium or heavy gauge and inspected prior to use. Damaged cords will be exchanged at the shop ASAP when any damage is found.

Cords will be repaired and tested prior to being returned to service. All problems should be recorded on the safety checklist, and inspections and repairs made by the designated personnel without delay. Only designated personnel may make electrical repairs of any kind. Drillwell Enterprises Ltd. expects all employees to follow B.C. Hydro's 7 steps to electrical safety.

Body Positioning SWP

Conscious evaluation of body positioning is important to guard against injuries resulting from putting oneself in the line of fire, poor lifting techniques, repetitive motion tasks, fatigue and sub-optimal working surfaces.

- Stretch before, during and after work day
- Adjust working position as necessary to avoid strain
- Take turns or breaks when performing repetitive tasks
- Periodically adjust body when holding a position for extended periods of time
- Practice good posture
- Practice good lifting techniques
- Avoid sudden or unexpected movements
- Address poor working surfaces with appropriate measures

Angle Grinders SWP

- Angle grinders must have factory guards in place.
- Factory guards must have 120 degrees of protection.
- Grinding discs must be rated for the speed of the grinder; this includes, but is not limited to abrasive discs, wire wheels and wire cups.
- Adequate eye and face protection must be worn.
- Dispose of damaged disks.

Minimum Requirements:

Safety goggles, or goggle style safety glasses and or safety glasses with face shield.

OR

Safety glasses and welding helmet with flip up tinted lens.

Ground Disturbance SWP

- All ground disturbances must comply with relevant codes and standards.
- Remember to “Dial Before you Dig”.
- If the plans are not adequate to identify the location of underground buried services then appropriate steps to mitigate the potential hazards must be taken. (Locates or daylighting)
- No persons are to enter any excavation over 1.2 meters (4 feet) in depth unless
    - The sides are sloped to a safe angle, not exceeding the ratio of 3 horizontal units to 4 vertical units, or
    - The sides are supported with at least the minimum requirements of the Mine Code, or
- Sloped or supported with the written instructions of a professional engineer.
- You must keep a ladder in the immediate area of the people working in any excavation over 1.2 meters (4feet).
- Excavated material must be kept back at least 1.2meters (4 feet) or at least 0.6m (2 feet) of any trench less than 3.6m wide (12feet).
- Where there is a danger of a person falling into an excavation, standard guardrails or barriers must be placed along the exposed sides or be covered with appropriate material.
- Before an excavation or ground disturbance starts you and your Contract Administrator must review a current plan showing known buried services in the area.

Cement, Concrete, and Masonry Safe Work Practice SWP

Health effects

Cement can cause ill health by skin contact, eye contact, or inhalation. Risk of injury depends on duration and level of exposure and individual sensitivity. Hazardous materials in wet concrete and mortar include:

- alkaline compounds such as lime (calcium oxide) that are corrosive to human tissue
- trace amounts of crystalline silica which is abrasive to the skin and can damage lungs
- trace amounts of chromium that can cause allergic reactions.

Skin contact

The hazards of wet cement are due to its caustic, abrasive, and drying properties. Wet concrete contacting the skin for a short period and then thoroughly washed off causes little irritation. But continuous contact between skin and wet concrete allows alkaline compounds to penetrate and burn the skin.

When wet concrete or mortar is trapped against the skin—for instance, by falling inside a worker's boots or gloves or by soaking through protective clothing—the result may be first, second, or third degree burns or skin ulcers. These injuries can take several months to heal and may involve hospitalization and skin grafts.

Cement dust released during bag dumping or concrete cutting can also irritate the skin. Moisture from sweat or wet clothing reacts with the cement dust to form a caustic solution.

Eye contact

Exposure to airborne dust may cause immediate or delayed irritation of the eyes. Depending on the level of exposure, effects may range from redness to chemical burns and blindness.

Inhalation

Inhaling high levels of dust may occur when workers empty bags of cement. In the short term, such exposure irritates the nose and throat and causes choking and difficult breathing. Sanding, grinding, or cutting concrete can also release large amounts of dust containing high levels of crystalline silica. Prolonged or repeated exposure can lead to a disabling and often fatal lung disease called silicosis.

Personal Protection

To protect skin from cement and cement mixtures, workers should wear:

- Coveralls with long sleeves and full-length trousers
- Suitable respiratory protective equipment when cement dust can't be avoided
- Suitable eye protection where mixing, pouring, or other activities may endanger eyes (minimum—safety glasses with sideshields or goggles, under extremely dusty conditions, tight-fitting unvented or indirectly vented goggles.
- Don't wear contact lenses when handling cement or cement products).

Work Practices

- Work in ways that minimize the amount of cement dust released.
- Mix dry cement in well-ventilated areas.
- Make sure to work upwind from dust sources.
- When kneeling on fresh concrete, use a dry board or waterproof kneepads to protect knees from water that can soak through fabric.
- Remove jewelry such as rings and watches because wet cement can collect under them.

Hearing Loss Prevention SWP

A major long-term problem in the construction industry is hearing loss.

In order to exceed the minimum requirements of the WorksafeBC Industrial Health and Safety Regulations, Drillwell Enterprises Ltd. requires management and supervisors to ensure that:

All employees are provided with appropriate hearing protection whether occasionally or routinely exposed to excessive noise levels.

All employees receive instruction and understand the importance of hearing conservation and utilize hearing protection whenever necessary.

Hearing tests are conducted for all employees as required by WorksafeBC OH&S Regulations at least once per year.

Prolonged exposure to 85 decibels (db) of sound has been proven to cause permanent hearing loss. Examples of noise levels associated with the construction industry are:

Crane Operator	82 – 99 db
Drilling	99 – 103 db
Welding	84 – 97 db
Air Arc Cutting	120 db
Pneumatic Drill	100 db

Hearing Conservation Program

Drillwell Enterprises Ltd. recognizes that noise is a serious problem in the construction industry and is committed to providing a safe work environment for our employees, other trades people and the public.

Noise exposure can vary greatly on a construction site. Therefore, Drillwell Enterprises Ltd. will have an effective noise control and hearing conservation program, which will include:

- Education and training
- Noise control
- Hearing protection
- Hearing tests

Heat and Cold Stress SWP

Heat and cold stress are concerns when working in outdoor environments. These stresses can cause serious injury and need to be guarded against. The following information will help to identify onset of these stresses and mitigation.

Heat Stress

Heat stress takes place when your body's cooling system is overwhelmed. Heat stress can lead to illness or even death. It can happen when heat combines with other factors such as:

- hard physical work;
- fatigue (not enough sleep);
- dehydration (loss of fluids); and
- certain medical conditions.

Precautions when working in hot, humid conditions:

- Increase the frequency and length of rest breaks.
- Drink a cup of water every 1/2 hour.
- Recognize the signs and symptoms of heat stress. Start a "buddy system" because it's unlikely people will notice their own symptoms.
- Wear light summer clothing to allow air to move freely and sweat to evaporate. Always wear shirts for protection from direct sunlight.

Cold Stress

When you're cold, blood vessels in your skin, arms, and legs constrict, decreasing the blood flow to your extremities. This helps your critical organs stay warm, but your extremities are at risk for frostbite. Wind chill accelerates heat loss.

When your core temperature drops, you're at risk for hypothermia. Early signs of hypothermia are shivering, blue lips and fingers, and poor coordination. Soon your breathing and heart rate slow down, and you become disoriented and confused. Hypothermia requires medical help.

Precautions to prevent cold stress:

- Wear several layers of clothing rather than one thick layer.
- Wear gloves if the temperature is below 16°C for non-physical work, below 4°C for light work, and below –7°C for moderate work.
- Take warm, high-calorie drinks and food.
- When clothing gets wet at 2°C or less, change into dry clothes
- If you feel hot, open your jacket but keep your hat and gloves on.

- Take warm-up and rest breaks in a heated shelter. Ensure work is conducted within allowable exposure limits, as per provincial OHS Regulations.

Welding, Cutting and Burning SWP

- Workers not required to be directly involved with welding or cutting operations must remain at a safe distance and must not watch without appropriate PPE.
- Workers must never look down a section of pipe being cut or welded, or position themselves as to have that section of pipe "aiming" at them.
- Whenever possible, screen welding operations to protect other workers from welding flashes.
- Welders must wear gloves, protective clothing, goggles and/or face shields. Always wear goggles or glasses when cleaning off slag.
- Deposit electrode stubs in a waste container. If they are thrown around they may become a sharp, a tripping/slipping hazard or cause damage to tires.
- Always give a warning before striking an arc where others are working.
- Never look at an arc flash, even for an instant. Be sure to turn your head completely away from the arc, and also be careful of reflections especially in water as they may be dangerous.
- Oxygen under high pressure may react violently with grease or oil. Take every precaution to keep oxygen away from grease or oil, and never handle oxygen bottles, valves, regulators, hoses or other fittings with oily hands or gloves. Hoses and regulators should be hung up off the ground to avoid contamination by form oil, etc.
- Oxygen or compressed flammable gas cylinders found to have leaky valves or fittings which cannot be stopped by closing or tightening the valve or fitting, shall be taken to an open area away from sources of ignition and slowly ventilated.
- Compressed gas cylinders must always be stored and used in an upright position. Cylinders must always be secured to prevent tipping or falling.
- Always consider cylinders as full, and handle them carefully. Never move cylinders without the valve protector cap secured unless cylinders are being moved in an approved cart with a retaining chain.
- When cylinders are emptied, replace the protective cap and mark the cylinders "MT."
- Cylinders should never be used for any other purpose than to store gas.
- Cylinders must not be lifted by crane unless they are in a lifting cage specifically designed for hoisting.
- Fumes produced by the cutting or welding of some metals covered with paint/primer/coatings are very dangerous. Ensure that paints or coatings are removed

prior to cutting or welding and means are provided so workers avoid inhaling such fumes. Organic vapour cartridge respirators must be utilized whenever in doubt.

- Never open acetylene cylinder valves more than one (1) full turn and always leave the wrench or handle on the valve in case of emergency.
- Always check the hose lines for signs of wear or splits. Replace defective hoses.
- Never cut or weld on any container that has previously contained any petroleum products unless it has been properly steamed out and inspected by supervisory personnel.
- Always attach electric welding ground cables to the piece being welded and not to some distant part.
- Use only standard fittings on hoses.
- Do not use torches, grinders, or welders near batteries, as batteries may explode when exposed to sparks or flame.
- Flash back protectors are required on all regulators.

Aerial Lifts SWP

Aerial personnel lifts shall be operated, maintained, and controlled in a safe manner. These guidelines define the procedures and standards that apply to the care, control, maintenance, inspection, and operation of aerial personnel lifts. The following applies to all work sites, i.e., Drillwell yards, client job sites, etc., requiring the use of aerial personnel lifts.

General

- Only trained personnel who have been deemed competent and designated by their supervisor are authorized to operate aerial personnel lifts.
- Lift controls shall be tested prior to use to determine that such controls are in safe working condition.
- Personnel shall not be permitted to stand on the rails of aerial devices. A body harness shall be worn and a lanyard appropriately attached.
- Large or excessive amounts of material shall not be transported in an aerial personnel lift. Other material lifts would be necessary for such activities. Load limits specified by the manufacturer shall not be exceeded.
- Aerial personnel lifts that can operate horizontally shall set brakes and outriggers, when used, be positioned on pads or a solid surface, and chock wheels before using on an incline.

Boom Lift Units

Articulating boom and extendible boom platforms, primarily designed as personnel carriers, shall have both platform (upper) and lower controls. Upper controls shall be in or beside the platform within easy reach of the operator. Lower controls shall provide for overriding the upper controls. Controls shall be plainly marked as to their function. Lower level controls shall not be operated unless permission has been obtained from the employee in the lift, except in case of emergency.

Forklift SWP

Forklifts shall be operated, maintained, and controlled in a safe manner. The following procedures and standards apply to the care, control, maintenance, inspection, and operation of forklifts (powered industrial trucks) on Drillwell property and work sites.

Only trained, competent and authorized persons are permitted to operate a forklift. No employees are allowed to operate a forklift without the proper training. The Company Safety Officer or designee will administer the forklift operator certification program and maintain training records.

Training shall occur prior to employee operation of any Drillwell Enterprises forklift, with subsequent training if the observed performance by the operator dictates the need. The following requirements shall be met to become a "Qualified Forklift Operator":

- Completion of Training Course
- Instruction and evaluation of competence

Inspection and Maintenance

Prior to placing a forklift truck into service, the truck operator shall inspect their vehicle. This inspection is not necessary on days when the forklift will not be placed into service.

Forklifts that are defective, in need of repair or are unsafe shall be tagged "Danger – Do Not Operate." and taken out of service until restored to safe operating condition.

A maintenance log shall be maintained for each forklift to determine when required maintenance is due. Only qualified personnel shall perform maintenance and repair.

Maintenance records for each forklift shall be kept on file.

General Safe Operating Rules

- The following safe operating rules apply to employees who operate a forklift. Violations of safe operating rules can, and will result in retraining and/or disciplinary action.

- Only employees trained as per the requirements of this manual section and authorized by a supervisor shall be allowed to operate forklifts
- Stunt driving and horseplay shall not be permitted.
- Personnel are not permitted to ride on forklifts except in designated seats that are part of the equipment design.
- Forklifts shall be equipped with a portable fire extinguisher.
- Under travel conditions, the forklift shall be operated at a speed that will permit it to be brought to a stop in a safe manner.
- Traffic regulations shall be observed, including authorized work site speed limits. A safe distance shall be maintained approximately three forklift lengths from the forklift truck ahead.
- The driver shall be required to look in the direction of, and keep a clear view of the path of travel.
- Copies of the manufacturer's operating instructions for each type of forklift shall be readily available for review by operators and supervisory personnel.
- Lift trucks, stackers, etc., shall have the rated capacity clearly posted on the vehicle so as to be clearly visible to the operator. When the manufacturer provides auxiliary removable counterweights, corresponding alternate rated capacities also shall be clearly shown on the vehicle. These ratings shall not be exceeded.
- No modifications or additions, which affect the capacity or safe operation of the equipment, shall be made without the manufacturer's written approval. If such modifications or changes are made, the capacity, operation, and maintenance instruction plates, tags, or decals shall be changed accordingly. In no case shall the original safety factor of the equipment be reduced.
- Forklifts shall have the manufacturer's nameplate showing its weight with attachments, lifting capacity, lift height maximum and other pertinent data. Nameplates or markings shall be maintained in a legible condition and remain in place.
- Grades shall be ascended or descended slowly.
- When ascending or descending grades in excess of 10 percent, loaded forklifts shall be driven with the load upgrade.
- When travelling forklifts should be operated on all grades with the load engaging means raised only as far as necessary to clear the road surface.
- No person shall pass under the elevated portion of any forklift, whether loaded or empty.
- There shall be sufficient headroom under overhead installations, lights, pipes, sprinkler system, etc.

- Arms or legs are prohibited from being placed between the uprights of the mast or outside the running lines of the forklift.
- When a forklift is left unattended load engaging means shall be fully lowered, controls shall be neutralized, power shall be shut off, and brakes set.
- Wheels shall be blocked if parked on an incline.
- An overhead guard shall be used as protection against falling objects. It should be noted that an overhead guard is intended to offer protection from the impact of small packages, boxes, bagged material. etc. representative of the job application, but not to withstand the impact of a falling capacity load.
- Additional counter weighting of forklifts shall not be allowed unless approved by the manufacturer.
- Forklift operators shall yield to pedestrians.

Ladder Safety SWP

The Ladder Safety guideline is intended to provide employees with safe guidelines for the use of portable ladders, while complying with applicable provincial regulation and client standards.

- Under no circumstances are portable ladders to be used unless conditions are considered safe, secure and in compliance with company procedures and safe work practices.
- The use of ladders with broken or missing rungs or steps, broken or split side rails, or other faulty or defective construction is prohibited. All ladders will be inspected prior to use and when ladders with such defects are discovered they must be immediately removed from service and tagged as such.
- Employees will face the ladder while ascending or descending.
- Ladders will not be loaded beyond the maximum intended load for which they were built or beyond the manufacturer's rated capacity.
- All ladders shall be placed on secure footing, and the area around the top and bottom will be kept clear of work materials, tools and debris.
- Planks will not be used on the top step of stepladders.
- Portable ladders will be placed and used at a pitch that places the horizontal distance, from the top support to the foot of the ladder, at approx. one-quarter of the working length of the ladder. Ladders will not be used in a horizontal position as a platform, runway or scaffold.
- Ladders shall not be spliced together.
- Employees will not stand on the topcap.

- There shall be ample clearance and clear access at the top and bottom of portable ladders.
- Portable metal ladders will not be used for electrical work or where they may contact electrical conductors.
- Ladders shall be maintained in good condition.
- Only one employee is to work on or climb a ladder at the same time.
- All work done from a ladder shall be within an individual's normal reach and with no overextending allowed.

All work done from a ladder that exposes a worker to a fall potential of 10 feet or more requires the worker to wear a harness and be tied off per the Fall Protection Policy. Some clients and sites may require fall protection at less than 10 feet.

Working Alone SWP

There may be situations where personnel sometimes work alone. Examples include;

- Staying late to complete a job that must be done before the next day's work
- Completing a task where there is only room for one worker
- Servicing equipment in a remote area
- Cleaning up scrap and debris when work is done for the day.

A person is "working alone", when he or she is on their own at work; when they cannot be seen or heard by another person; and when emergency assistance is not readily available. The greatest risk in working alone is that no one is available to help a worker who may be injured, trapped, or unconscious. Even if co-workers realize that someone is missing, it may be difficult to locate an injured worker.

Planning

Inspect the jobsite for real and potential hazards and take whatever steps are required to safeguard workers.

If any personal protective equipment or clothing is required in addition to hard hat and safety boots, it should be provided, along with instruction in its proper use.

All safety and work-related procedures should be reviewed with workers to ensure that each procedure is clearly understood. The procedures should also be spelled out in the company's health and safety policy.

In some situations like confined spaces, regulations under the Occupational Health and Safety Act prohibit entry or work without another person standing by outside the area.

Communication

Communication is crucial in accounting for personnel working alone. A system must be established where, at regular intervals, someone checks on the worker or the worker reports to a designated person.

Where hazard exposure is high, intervals should be kept short.

Means of communicating between worker and outside contact must be predetermined and understood by both parties.

Cellular phones, Satellite phones, or two-way radios can provide effective communication. Test the units on-site to ensure that reception is reliable.

Responsibilities

The supervisor shall ensure that any worker working alone is aware of real and potential hazards in the area. The worker should be trained in hazard recognition and in the procedures and equipment required to do the job safely. The supervisor must also ensure that:

- a method of checking in with the worker has been established
- check-in intervals are clearly understood
- the designated contact person is aware of the work schedule
- any communication equipment used is in good working order
- no obstructions or interference may block phone or radio communications.

House Keeping SWP

Hazards in onsite work are everywhere. When natural hazards onsite are compounded with clutter of debris and tools, the hazard level increases, making the likelihood of an incident increase. A worksite with poor housekeeping procedure creates an environment that is unsafe to yourself and your co-workers.

Maintaining good housekeeping onsite can reduce the likelihood of accidents and/or incidents from occurring. The positive effect of good housekeeping practice far outweighs the extra effort. Everyone onsite must do their part to ensure that the jobsite is clean, orderly, and free of potential hazards.

The most common injuries that occur on a jobsite, from poor housekeeping, are Slips, Trips, and falls. Workers may slip, trip, or fall because of;

- Trash and/or debris
- Misplaced tools or equipment
- Hazards that are not properly coned, barricaded, or caution taped

- As a result, workers could suffer cuts, sprains, broken bones, and severe head injuries.

Employees shall take the following steps to maintain safe onsite work environment;

- Remove debris and trash to create a safe work environment.
- Clean as you work to prevent overload of debris, tools, and equipment.
- Place generated waste into containers, in a designated area.
- Keep pathways clear from obstruction.
- Keep worksite neat and orderly.
- Store tools and equipment out of the way.
- Place protective cones, barricades, and caution tape across areas where workers could slip, trip, or fall.
- Use sand or drying agent in wet or slippery areas.
- Only work in areas that have proper lighting.

If everyone does their part and works together to ensure that a worksite is clean and orderly, everyone can feel safer at the workplace. Make good housekeeping practices a habit to protect yourself and others from potential injuries.

Hydrogen Sulfide Awareness Guideline SWP

Hydrogen Sulfide H2S is a very toxic gas. It has no color, but it smells like rotten eggs. In larger amounts, H2S quickly blocks the sense of smell. The gas can irritate the eyes, nose, throat, and lungs.

Employees working on sites where H2S is likely to be encountered during drilling need to have appropriate training, detection equipment and PPE.

TRAINING

Training will be provided prior to working in any job with potential exposure to H2S gas. The purpose of hydrogen sulfide training is to familiarize employees with the provincial OHS regulations affecting H2S operations. Employees will learn the necessary skills to recognize, detect, and use the proper safety equipment in the event of an H2S incident.

Vertical Hoisting, Holding and Lowering of Steel Pipe and Casing SWP

AT NO TIME SHALL A WORKER OR ANY PART OF A WORKERS BODY INCLUDING HANDS AND FEET BE UNDER ANY STATIONARY VERTICAL SUSPENDED LOAD WITHOUT STABLE SECONDARY RESTRAINT OR SUPPORT.

This policy applies to pipe and casing that is not otherwise secured by drill rods or other specialized equipment for lifting and hoisting pipe, rods and casing. I.e.: Casing jacks, lower drives, clamshells, casing grabbers.

- When lifting, lowering, pulling, holding or hoisting steel pipe or casing in vertical or near vertical configuration a positive restraint should be employed at the upper end of the pipe or casing. This could be in the form of a bolted casing runner or other bolted device, threaded lifting bail, elevator or a shackle through a hole in the casing.
- When using a steel choker, strap, or sling, the sling shall be double wrapped and restrained from sliding up the steel pipe by a clamped or welded restraining device.
- A clamp style restraint could be in the form of a split ring of 2" by ¼" steel flat bar, or heavier material, bolted on opposing sides and protruding not less than 1.5 inches past the outside diameter of the pipe.
- A welded restraint (cleat or tab) should be of not less than 3 inch by 3 inch steel of ¼ inch or greater thickness.
- When a choker, strap or sling is attached to the pipe or casing it should be located so that it is in contact with the restraining device in order to prevent the choker from sliding up the pipe.
- If work must be done under a suspended load or structure, a secondary support capable of holding stable and carrying 100% of the weight of the load must be employed. A secondary support could be in the form of a second hoisting line, a strap or chain with a hook secured into the bottom of the pipe, or a metal or wooden block or frame on which the load can rest while still being held from above for the duration required to complete the work.
- Whenever possible work under or around suspended loads should be avoided. In some cases, this could be accomplished by using hand tools or handles, pushing or pulling the load to one side while work is being done, or lowering the load below the point where work must be done.

Tool use and Inspection SWP

How to use and inspect hand tools:

- Ensure that you have been properly trained to use the tool safely.
- Select the right tool for the job. Substitutes increase the chance of having an accident
- Keep tools in good condition at all times.
- Inspect tools for defects before use. Do not put away a defective tool.
- If a tool is defective, remove it from service, and tag it clearly " out of service do not use" and write the date, the defect and your name.

- Replace damaged or defective tools immediately. Do not use even temporarily.
- Replace cracked, splintered, or broken handles on files, hammers, screwdrivers, or sledges.
- Ensure that the handles of tools like hammers and axes fit tightly into the head of the tool.
- Replace worn jaws on wrenches, pipe tools and pliers.
- Redress burred or mushroomed heads of striking tools.
- Inspect pry bars, winch bars or other leverage tools for cracking, or other signs of wear that may cause the tool to break.
- Maintain tools carefully. Keep them clean and dry, and store them properly after each use.
- Wear all PPE, safety glasses or goggles, or face shield, and well-fitting gloves appropriate for the hazards to which you may be exposed when doing various tasks.
- Keep the work environment clean and tidy to avoid clutter which may cause accidents.
- During cold weather ensure tools\tool handles are kept free of snow and ice, defrosted when required, Do not leave unattended while defrosting.

How to use and inspect powered hand tools.

- Wear or use personal protective equipment (PPE) or clothing that is appropriate for the work you are doing; this may include items such as safety glasses or goggles, hearing protection, dust mask, gloves, safety boots or shoes, or rubber boots.
- Ensure that you have been properly trained to use the tool safely.
- Inspect tools for any damage prior to each use. Do not put away a defective tool.
- If a tool is defective, remove it from service, and tag it clearly " out of service do not use" and write the date, the defect and your name.
- Check the handle and body casing of the tool for cracks or other damage.
- If the tool has auxiliary or double handles, check to see that they're installed securely.
- Inspect cords for defects: check the power cord for cracking, fraying, and other signs of wear or faults in the cord insulation.
- Check for damaged switches and ones with faulty trigger locks.
- Inspect the plug for cracks and for missing, loose or faulty prongs. Ensure that the power tool has the correct guard, shield or other attachment that the manufacturer recommends. Prevent shocks. Ensure that the tools are properly grounded.

Inspection and use of cylindrical break out bars and forks SWP

When employing cylindrical style forks and breakout bars, inspect breakout bars and forks carefully before each use, ensure they are clean and can be gripped firmly and safely.

In cold weather defrost as required, ensure they are defrosted and can be gripped firmly and safely. **Do not over heat. Do not leave unattended while defrosting**, bars may become hot and create a burn hazard. **Defrost only**

Before employing cylindrical style forks and breakout bars into the holes on the drill rods, **ensure the receiving holes are clear of mud and debris**, clean as required to prevent cylindrical forks and break out bars from becoming slippery and difficult to grip and control safely. Pay careful attention to hand position and watch for/control pinch points.

***Caution heavy items**

APPENDIX 2 – SAFE JOB PROCEDURES

SJP - Air Brake Adjustment

Written By:	Approved By:	Date Created:
Colin Slade	JOHSC	Dec 2017

Hazards Present:	PPE Required
Other works and/or equipment Machine malfunction	Steel toe boots Safety glasses Gloves Chocks/Blocks

Safe Job Procedure:

1. Wear appropriate PPE
2. Park and apply parking brake on level ground
3. Build air to full system pressure
4. Block/ chock wheels
5. Release brakes and shutoff vehicle
6. Ensure pushrod travel is correct for brake type
7. Adjust slack adjuster if out of spec. If brake is automatic type and out of spec notify supervisor as soon as possible and note condition on pre-trip form.

This Safe Job Procedure will be reviewed and updated if required as the task, equipment or materials change or at a minimum every three years.

Reviewed by:	Date:

SJP - Air Pressure Buildup in Casing Swivel and Discharge

Written By:	Approved By:	Date Created:
Colin Slade	JOHSC	Dec 2017

Hazards Present:	PPE Required
Explosive release of air Flying projectiles Hearing damage	Hard Hat Steel toe boots Eye protection Hearing protection

Safe Job Procedure:

Dangerous amounts of air pressure and volume can build up in casing if long discharge hose becomes plugged with cuttings or frozen mud, water and cuttings. Buildup and sudden release of air pressure can cause swivel and/or discharge hose to move violently and unexpectedly with potential for serious injury and property damage.

1. Prior to use and/or at the end of each shift, discharge hose to be drained to eliminate blockages. In subzero conditions this should be done during any significant work stoppage. Easiest method involves lifting hose vertically to drain.
2. At all times circulation of air through discharge hose must be verified prior to engagement of auxiliary air compressors.
3. If discharge air pressure is building above expected levels shut down compressor input and verify there is no blockage in the swivel or hose.
4. If dangerous buildup of pressure in casing or discharge is suspect ted shut down air, bleed off pressure where possible, remove all persons from immediate “danger area” until pressure has vented prior to finding and removing blockage.

This Safe Job Procedure will be reviewed and updated if required as the task, equipment or materials change or at a minimum every three years.

Reviewed by:	Date:

SJP - Augers

Written By:	Approved By:	Date Created:
Colin Slade	JOHSC	Dec 2017

Hazards Present:	PPE Required
Rotating equipment Burrs Heavy lifting	Steel toed boots Safety glasses Hearing protection Gloves Coveralls

Safe Job Procedure:

1. Only qualified personnel shall work in proximity of drill rig
2. All loose clothing, boot laces, hair, jewelry shall be tied up or otherwise contained
3. Emergency stops shall be tested for functionality on a regular basis
4. If required by site or client auger guard is to be installed
5. All personal will keep clear of rotating augers at all times.
6. Auger will be stopped before any hand, glove, boot or part of person and or clothing makes contact with auger.
7. Two people per auger for lifting and moving augers when required (large diameter, heavily soiled, ect.)

This Safe Job Procedure will be reviewed and updated if required as the task, equipment or materials change or at a minimum every three years.

Reviewed by:	Date:

SJP - BC Hydro's 7 Steps to Electrical Safety

Written By:	Approved By:	Date Created:
Colin Slade	JOHSC	Dec 2017

Hazards Present:	PPE Required
Shock Burn	Steel toed boots Safety glasses Hearing protection Gloves Coveralls

Safe Job Procedure:

1. Don't Become a Victim – Always call local emergency personnel when contact is made with an energized line
2. 10 Meters to Safety – Stay back at least 10 meters (33 feet) from any fallen power line or exposed underground cable
3. Look Up and Live – Look up, check and keep equipment clear of overhead power lines
4. Know Your Limits – When using equipment in the vicinity of power lines always maintain the limits of approach: from 3-7 meters (10-20 feet for unshielded lines) depending on the voltage

   DRILLWELL POLICY IS MIN 20 FEET UNLESS CLEARED BY CHECKING WITH BC HYDRO
5. Don't Hang Around Operating Equipment – Stay at least 10 meters (33 feet) from operating equipment, in case it contacts an energized line
6. Shuffle or Hop, Don't Step – If your vehicle makes contact with an energized line remain inside until help arrives. If you must get out due to fire jump with your feet together. Then shuffle or hop away keeping both feet close together. Never contact the ground and your vehicle at the same time.
7. Call Before You Dig – To avoid contacting underground power lines before you dig call B.C. One Call at 1-800-474=6886 or cell *6886.

   BE SURE SERVICE LOCATES HAVE BEEN DONE IN URBAN SETTINGS

This Safe Job Procedure will be reviewed and updated if required as the task, equipment or materials change or at a minimum every three years.

Reviewed by:	Date:

SJP - Casing Jacks, Yoke and Slips

Written By:	Approved By:	Date Created:
Colin Slade	JOHSC	Dec 2017

Hazards Present:	PPE Required
Noise Airborne objects Failure of fittings or hoses Heavy items Crush/pinch points	Steel toe boots Safety glasses Hearing protection Gloves

Safe Job Procedure:

1. Wear appropriate PPE
2. Ensure hoses and fittings are in good repair
3. Foundation for jacks, stands and ladders must be firm and level
4. Setup Jacks and tie or chain to each other and the casing
5. Install yoke keeping hands out of potential pinch points
6. Install slips with all slips at roughly the same insertion depth
7. Stroke out jacks to extract casing
8. Monitoring jacks, jack pads, yolk and slips regularly and continuously for sinking twisting or deviation that may cause a hazard
9. Slightly retract jacks, stop if yolk and slips are stuck
10. If yolk and slips are stuck loosen by striking yolk downward with sledge hammer
11. Sledge hammers must be in good repair and inspected throughout process
12. Keep people out of the line of fire

This Safe Job Procedure will be reviewed and updated if required as the task, equipment or materials change or at a minimum every three years.

Reviewed by:	Date:

SJP - Cranes on Flatdeck Trucks

Written By:	Approved By:	Date Created:
Colin Slade	JOHSC	Dec 2017

Hazards Present:	PPE Required
Noise Suspended loads Failure of fittings or hoses Heavy items Crush/pinch points	Steel toe boots Safety glasses Hearing protection Gloves

Safe Job Procedure:

1. Only qualified operators with certification permitted to use folding cranes
2. All rigging to be inspected, in good condition and sized
3. Outriggers to be set to their maximum practical extension for loads over 500kg
4. Place jack pads or blocking under jacks ensuring ground will support load applied
5. Extend jacks ensuring that both sides begin to take truck load
6. Following specific crane model instructions un-package crane. Ensure knuckle is fully retracted before un-packaging
7. Keep out from under suspended loads at all times
8. Whenever a heavy load is moved away from the truck the load should be keep at close to the ground as practical so that in the case of equipment failure or operator error the load will contact ground limiting damage to load and/or equipment.
9. Keep an adequate distance away from boom and only approach boom after communication with the operator
10. When approaching the boom (i.e. attaching or unhooking a load) the operator will remove hands from controls to prevent accidental movement of crane.
11. In order to avoid accidental engagement of remote control remote unit should be turned around or turned off before bending over to attend rigging or climbing up and down from truck deck
12. Contact supervisor if unfamiliar with considerations for a specific load or rigging

This Safe Job Procedure will be reviewed and updated if required as the task, equipment or materials change or at a minimum every three years.

Reviewed by:	Date:

SJP - Compressed Air (150psi+)

Written By:	Approved By:	Date Created:
Colin Slade	JOHSC	Dec 2017

Hazards Present:	PPE Required
Noise Airborne particles Failure of fittings or hoses	Steel toe boots Safety glasses Hearing protection Gloves Whip-checks

Safe Job Procedure:

1. Wear appropriate PPE
2. Ensure hoses and fittings are in good repair
3. Ensure whip checks are used at the end of hose fittings
4. Check fluid as per compressor recommendations (cold or warm)
5. Keep people out of the line of fire

This Safe Job Procedure will be reviewed and updated if required as the task, equipment or materials change or at a minimum every three years.

Reviewed by:	Date:

SJP - Cutting Torch

Written By:	Approved By:	Date Created:
Colin Slade	JOHSC	Dec 2017

Hazards Present:	PPE Required
Burns Eye Injuries	Eye protection Gloves Coveralls, fire retardant Fire Extinguisher

Safe Job Procedure:

1. Ensure bottles are secure in the upright position
2. Open valves at bottles (1 full turn acetylene, fully open oxygen)
3. Adjust regulator (5-7psi acetylene, 35-45psi oxygen) with torch valves open
4. Close both torch valves. Open acetylene ½ turn at torch and light (oxygen closed when lighting)
5. Turn on and increase oxygen at torch until desired flame is achieved (sharp short blue tip)
6. Cut as required
7. Shutoff oxygen first followed by acetylene at torch
8. Shutoff bottles

This Safe Job Procedure will be reviewed and updated if required as the task, equipment or materials change or at a minimum every three years.

Reviewed by:	Date:

SJP - Equipment Daily Maintenance

Written By:	Approved By:	Date Created:
Colin Slade	JOHSC	Dec 2017

Hazards Present:	PPE Required
Equipment failure Collisions Pinch points	Steel toe boots Eye protection Hand protection Hearing protection

Safe Job Procedure:

1. Check over machine (damage, loose parts, ect) using equipment log checklist if applicable
2. Ensure equipment is within its service interval
3. Check engine for fluid levels, belt condition, leaks, loose hardware
4. Check other fluid levels if applicable (hydraulic, power steering, coolant ect.)
5. Ensure everyone is clear and start engine
6. Check gauges for normal oil pressure, temperature, hydraulic functions
7. Walk around equipment before moving

This Safe Job Procedure will be reviewed and updated if required as the task, equipment or materials change or at a minimum every three years.

Reviewed by:	Date:

SJP - Fall Protection on Drilling Rigs

Written By:	Approved By:	Date Created:
Colin Slade	JOHSC	Dec 2017

Hazards Present:	PPE Required
Falls from more than 10’ Trips Slips	Hard Hat Steel Toed Boots Safety Glasses Fall Arrest Harness Lanyard Self-retracting lifeline (optional)

Safe Job Procedure:

1. Remove any un-necessary objects from worksite that could be hazards in a fall (shovels, pry bars, ect.)
2. Inspect fall arrest harness system which can include (but is not limited to) harness, lanyards, karabiners, retractable lifeline, and tie-off points.
3. Complete fall arrest inspection sheet
4. Complete fall protection plan if work will be performed above 25’.
5. Don fall arrest harness and adjust to fit
6. Climb mast ensuring at least one lanyard (or retractable lifeline) is connected to an anchor point at all times.
7. At working position attach lanyard such that free fall distance will be limited.
8. Descend mast ensuring at least one lanyard (or retractable lifeline) is connected to an anchor point at all times.
9. Remove and inspect fall arrest equipment and put away

This Safe Job Procedure will be reviewed and updated if required as the task, equipment or materials change or at a minimum every three years.

Reviewed by:	Date:

SJP - Fueling Equipment

Written By:	Approved By:	Date Created:
Colin Slade	JOHSC	Dec 2017

Hazards Present:	PPE Required
Eye Injury Fire/Burn Spill	Steel toed boots Eye protection Fire Extinguisher

Safe Job Procedure:

1. All gas equipment must be shut off prior to re-fueling. Diesel equipment to be shut off if practical.
2. All sources of ignition must be controlled prior to re-fueling
3. Ensure adequate ventilation
4. Remove fill cap
5. Fuel equipment allowing some space in tank (do not overfill)
6. Fill nozzles with auto shutoff still need to be attended
7. Securely store fuel source after re-fueling

This Safe Job Procedure will be reviewed and updated if required as the task, equipment or materials change or at a minimum every three years.

Reviewed by:	Date:

SJP - Jump Starting Batteries

Written By:	Approved By:	Date Created:
Colin Slade	JOHSC	Dec 2017

Hazards Present:	PPE Required
Acid Explosive gas Awkward positioning Rotating equipment	Steel toe boots Eye protection

Safe Job Procedure:

1. Check cables for wear, damage to insulation, loose connections
2. Check booster cables for wear, damage to insulation, damaged clamps
3. Connect dead battery positive connection
4. Connect healthy battery positive connection
5. Connect healthy battery negative connection
6. Last connection should be dead battery negative connection but this connection should be made to a good ground (bare metal) away from the battery.
7. Remove cables once uncharged vehicle is started

This Safe Job Procedure will be reviewed and updated if required as the task, equipment or materials change or at a minimum every three years.

Reviewed by:	Date:

SJP - Hoisting Loads with DR Winch

Written By:	Approved By:	Date Created:
Colin Slade	JOHSC	Dec 2017

Hazards Present:	PPE Required
Eye Injury Pinch points Suspended loads	Steel toed boots Eye protection Gloves

Safe Job Procedure:

1. Whenever possible the weak point in a hoisting configuration should be the winch
2. Winch capacity on Dual Rotary rigs are 3000 - 6000lbs; straps and cables with a capacity greater than 6000lbs should be used for all but very small objects.
3. When using chockers or straps on casing double wraps are required. If casing is not restrained by drill rods or other restraints and is longer than 6' a secondary securing device such as a clamp or a cleat is required to prevent strap from slipping.
4. Cloth or rope slings used for hoisting should be in good repair and have rating exceeding the weight of the hoisted object
5. Do not attempt to "finish" cut with winch. If casing is not fully cut, release tension on winch and complete cut with torch/cutting disc.

This Safe Job Procedure will be reviewed and updated if required as the task, equipment or materials change or at a minimum every three years.

Reviewed by:	Date:

SJP - Lifting

Written By:	Approved By:	Date Created:
Colin Slade	JOHSC	Dec 2017

Hazards Present:	PPE Required
Slip/Trip Pinch points Muscle strain	Steel toed boots Gloves

Safe Job Procedure:

1. Assess if object is too heavy by trying to pick up one end. If it is too heavy get additional manpower or equipment to assist.
2. Keep back straight; bend at the hips and knees.
3. Obtain a firm grip
4. Keeping the load close to your body lift with leg muscles in smooth motion
5. Avoid quick or twisting motions
6. Keep hands and feet clear of pinch points when setting down the load

This Safe Job Procedure will be reviewed and updated if required as the task, equipment or materials change or at a minimum every three years.

Reviewed by:	Date:

SJP - Moving Vehicles and Equipment at sites

Written By:	Approved By:	Date Created:
Colin Slade	JOHSC	Dec 2017

Hazards Present:	PPE Required
Collisions with people Collisions with objects	Method of communication Hi-vis clothing

Safe Job Procedure:

1. Walk around vehicle prior to operation
2. Check clearances (left/right, front/back and above/below)
3. Avoid backing up when possible
4. Use spotter if possible
5. If backing up use horn
6. Maneuver at a safe speed
7. If exiting vehicle set brake and leave transmission in appropriate gear

This Safe Job Procedure will be reviewed and updated if required as the task, equipment or materials change or at a minimum every three years.

Reviewed by:	Date:

SJP - Securing Equipment on Decks or Trailers

Written By:	Approved By:	Date Created:
Colin Slade	JOHSC	Dec 2017

Hazards Present:	PPE Required
Slip/Trip Pinch points Muscle strain	Steel toed boots Gloves Eye protection

Safe Job Procedure:

1. Ensure the machine is balanced properly on the trailer and all functions are parked and if equipped blades are resting on deck.
2. Secure the machine with chains and load binders from designated tie down locations
3. Ensure any tooling is secure
4. Any additional chain or strapping is to be secured
5. Double check all chains and tiedowns are tight
6. Check load periodically during trip

This Safe Job Procedure will be reviewed and updated if required as the task, equipment or materials change or at a minimum every three years.

Reviewed by:	Date:

SJP - Securing Tooling or Materials on Decks

Written By:	Approved By:	Date Created:
Colin Slade	JOHSC	Dec 2017

Hazards Present:	PPE Required
Slip/Trip Pinch points Muscle strain	Steel toed boots Gloves Eye protection

Safe Job Procedure:

1. Use load stakes where appropriate
2. Use pallet corner protection where appropriate
3. Inspect straps and chains to ensure in good repair
4. Items longer than 5’ should have two straps
5. Dunnage should be used if required to achieve secure load
6. Tighten straps and/or chains and inspect load to ensure it is secure
7. Secure extra slack in straps and/or chain
8. Periodically check load during trip

This Safe Job Procedure will be reviewed and updated if required as the task, equipment or materials change or at a minimum every three years.

Reviewed by:	Date:

SJP - Welding

Written By:	Approved By:	Date Created:
Colin Slade	JOHSC	Dec 2017

Hazards Present:	PPE Required
Flash Burns Inhalation of gases Shock	Welding helmet Steel toed boots Leather Gloves Eye protection Fire Extinguisher

Safe Job Procedure:

8. Only qualified personnel shall perform welding activities
9. Area is to be well ventilated and clear of combustible materials
10. If extremely dry conditions exist wet down work area
11. Keep area clear of material that will be damaged by slag, heat and sparks
12. Keep area clear of trip and slip hazards
13. Attach ground lead to item to be welded
14. Perform welding activities
15. Be observant of surrounding worksite for ½ hour after welding in case of fire

This Safe Job Procedure will be reviewed and updated if required as the task, equipment or materials change or at a minimum every three years.

Reviewed by:	Date:

SJP - Setting and Removal of Deepwell Pumps

Written By:	Approved By:	Date Created:
Colin Slade	JOHSC	Dec 2017

Hazards Present:	PPE Required
Overhead loads Pinch points Repetitive strain	Hardhat Steel toe boots Safety Glasses Hearing protection

Safe Job Procedure:

1. Ensure adequate site access and preparation prior to setup. Site must be solid, reasonably level and large enough to ensure safe working conditions.
2. Equipment must be able to safely handle weight of pump column, wire, pump and water column. If in doubt request weight calculation from engineering.
3. Consider equipment failure or human error. Emergency escape routes should be discussed at each site. Electrical cable snaking or whipping is can be a major risk if pump is dropped down the hole.
4. Workers are to keep clear of loops and coils of electrical cable
5. Safety of workers is at all times to take precedence over potential damage to electrical cable and/or pump components.
6. Operator and helpers are to ensure all body parts are clear prior to lowering column, especially when lowering column onto fork.
7. Cable banding on last piece of pump column is not to be cut until pump AND motor are secure at surface.
8. During pump installation the same considerations (pinch points, cable loops and coils) must be considered.

This Safe Job Procedure will be reviewed and updated if required as the task, equipment or materials change or at a minimum every three years.

Reviewed by:	Date:

SJP - Lightning

Written By:	Approved By:	Date Created:
Colin Slade	JOHSC	Dec 2017

Hazards Present:	PPE Required
Burns Electrocution	Hardhat Steel toe boots Safety Glasses Hearing protection

Safe Job Procedure:

Every year in North America hundreds of people are struck by lightning and dozens of people are killed by it. When thunderstorms threaten get to a safe place.

1. Cease activities leaving equipment in safe state and alert nearby workers of the danger
2. Relocate to a safe location away from tall metal objects. Safe locations can include inside a vehicle or inside a building complete with plumbing and/or electrical wiring.
3. Wait until at least 20min pass since the most recent thunder or lightening event before returning to work.
4. A worker who is struck by lightning (directly or indirectly) doesn't hold an electrical charge and poses no threat to other workers. CPR may be required. Provide medical aid immediately and call for help. In an isolated situation package patient and provide transport to nearest medical aid.

This Safe Job Procedure will be reviewed and updated if required as the task, equipment or materials change or at a minimum every three years.

Reviewed by:	Date:

SJP - Setup and Teardown of Cable Tool Rigs

Written By:	Approved By:	Date Created:
Colin Slade	JOHSC	Dec 2017

Hazards Present:	PPE Required
Overhead loads Pinch points Repetitive strain Fall from heights	Hardhat Steel toe boots Safety Glasses Hearing protection Fall protection

Safe Job Procedure:

1. Ensure adequate site access and preparation prior to setup. Site must be solid, reasonably level and large enough to ensure safe working conditions
2. Blocking (wood or steel) is to be used. Do not depend on hydraulic outriggers. Blocking must provide support and stability in both side-to-side and front to back directions
3. Mast hoist line to be inspected prior to every use. Must be replaced at first sign of damage or fatigue. Care must be taken to ensure mast hoist line spools neatly on drum
4. Mast hoist clutch must NEVER be left in gear when operator is off stand
5. Stand must be secure and well supported. Safety harness is required when rigging guys
6. Mast is not to be raised or lowered while anyone is on the mast or rig frame
7. When half-masting rig adequate wood or steel blocking must be installed in mast. Do not depend on mast hoist cable to support mast while working
8. Only persons authorized by foreman or management may set up or tear down ANY rig or equipment. No person shall setup or tear down any rig or equipment until they have received instruction, and been supervised by an experienced operator
9. Drill stem to be set in open hole whenever possible
10. Hoist line traveling block must not be secured by ANY means when mast is being raised
11. If mainline is to be secured while raising mast nothing stronger than ½" nylon rope may be used. CABLE CHAIN OR SLINGS ARE NOT TO BE USED
12. Mast hoist clutch will be setup so that it automatically disengages when released

This Safe Job Procedure will be reviewed and updated if required as the task, equipment or materials change or at a minimum every three years.

Reviewed by:	Date:

SJP - Rigging

Written By:	Approved By:	Date Created:
Colin Slade	JOHSC	Dec 2017

Hazards Present:	PPE Required
Overhead loads Pinch points	Hardhat Steel toe boots Safety Glasses Hearing protection

Safe Job Procedure:

1. Prior to each daily use all lifting equipment and rigging will be inspected
2. Chains, slings, chockers, straps, hooks and shackles must be in good condition with no jaggers, burns, cracks, tears, pitting or stretching present.
3. Any lifting equipment showing signs of damage above will be removed from service and tagged, destroyed or disposed of to ensure it isn't reused without being repaired.
4. Crane truck is to be inspected using Equipment inspection form with note indicating the condition of rigging.

This Safe Job Procedure will be reviewed and updated if required as the task, equipment or materials change or at a minimum every three years.

Reviewed by:	Date:

APPENDIX 3 – DRILLWELL SAFETY CARRIER MANUAL

Drillwell Carrier Safety

Rules and Regulations

OBJECTIVES: To have zero accidents, zero tickets, and zero notice and orders; to promote safety throughout the company, particularly in regard to vehicle operations and to ensure compliance with the requirements of the national safety code.

PROFESSIONAL DRIVERS: All employees are professional drivers when operating company vehicles. As professionals, they are required to drive in a safe and courteous fashion, to ensure that their vehicle is safe, secure, and legal, and to comply with "hours of service", inspection, and reporting requirements.

All employees who drive company vehicles must have a valid drivers' license, with the required endorsements, and a good driving record. Also drivers must obey all laws including seat belt, and speed limit, and display good judgment in regards to following distances and speed, especially during poor weather or on bad roads.

Employees must ask for instruction or guidance if unsure about vehicle inspections, hours of service, maintenance, brake adjustments, or load security.

Pre-trip and post-trip inspections are to be turned in daily, or weekly, as it is a finable offence for them to be in the vehicle after 20 days.

Drivers are responsible to do service and maintenance, and/or ensure that maintenance gets done. i.e. Notation in daily inspection report, AND written on shop white board.

Annual drivers' abstracts will be retained on file for all employees for at least 4 years.

Employees are required to report ALL accidents, tickets, and notices, regardless if they are issued while on or off duty, or in company or private vehicles. Copies of all tickets, fines, notices, suspensions, and accident reports are to be turned into the office within 5 days of being received.

Any employee who does not follow the requirements of this policy, and the National Safety Code, will be subject to warnings, fines, and possible suspension or termination.

Each driver is responsible to ensure that the vehicle being operated is equipped with all necessary safety equipment and documentation. This includes operational fire extinguisher charged and checked within the past year, first aid kit, road flares (triangles), and valid insurance, license, and inspection certificates.

Each driller/equipment operator is responsible to make sure that ALL units in his care and control receive all scheduled, and routine maintenance as per operators manuals, and that all units receive at least weekly lubrication, and inspection, and that all minor service gets done in the field. i.e. lights, reflectors, mirrors, wipers etc.

Repairs of ALL known defects are to be done PRIOR to vehicle inspections. Failed inspections go on our safety record. Inspections are NOT for maintenance, they are to verify that all maintenance is being done.

CELL PHONE OR OTHER HANDHELD WIRELESS USE IS FORBIDDEN WHILE DRIVING!

Discipline

Any disciplinary measure whether verbal or written will be recorded in employee file.

Disciplinary action could result from failure to meet the requirements of these policies, from abuse or neglect of equipment, from reports of poor driving, or negative feedback from clients, or from harassing, abusive, or disrespectful treatment of fellow employees.

Discipline would normally start with a verbal warning, followed by a written warning for repeated offences, followed by suspension or termination.

Immediate termination may result from: Theft, willful or deliberate damage to equipment or materials, unauthorized use of equipment, criminal convictions, drivers license suspensions, serious motor vehicle accidents or offences.

The company reserves the right to modify disciplinary action when it deems appropriate.

Use of alcohol or other intoxicating drugs is forbidden while on duty. No one shall work or report for work while under the influence of any intoxicating substance. Use or possession of open alcohol, or other intoxicating substances is forbidden in any Drillwell vehicle.

Regulations and Requirements (70 Hour 7 Day cycle)

1. A pre-trip, AND post-trip inspection are required daily for all vehicles over 14,600 kg GVW when driven on public roads. Drillwell policy is to complete these pre and post-trip inspections on all commercial vehicles other than pickups. Inspection MUST be done, signed, and dated with the time of pre, and post trip. A statement is required, stating defects as noted, or “no defects noted”. Inspection reports must be turned in promptly, as it is a fineable offence to have them in the vehicle for more than 20 days.

2. Drivers hours of service logs are required for all vehicles over 11,795kg if traveling more than 160 km from base, (North of Courtenay, West of Port Alberni, East of Chilliwack from Duncan), or if staying away overnight. Driver's hours of service logs must contain the previous 14 days of on duty time, and days off. They must be fully completed, totaled, signed, dated, and turned in promptly to the office. It is a fineable offence to not have log up to date, or to have log in vehicle for more than 20 days.
3. Inspection and service: Drivers are responsible to know when the vehicle that they are driving is due for CVI (Commercial Vehicle Inspection) or scheduled service, and to help ensure that Inspections and service are done. I.e. Note in daily inspections, and/or note on white board in shop. Lack of a dashboard sticker or illegible dashboard sticker is not an excuse. If you are unsure it is your responsibility to find out.
4. Driver is responsible for all aspects of load security and safety i.e. Brake adjustment, tires, tie down requirements, (number and condition), load security, (including doors, cinch handles, and debris on jack pads, and stands), lights, flags, fire extinguishers, flares, first aid kits.
5. All laws of the road must be followed, including safe passing, speed limits, construction and school zones, seat belts, and safe distances to follow.
6. Do not respond with aggression to the poor or dangerous driving of others. There is no excuse for road rage.
7. Hours of Service:
    - No one shall drive a Commercial Vehicle (over 11,795kg) after 14 hours of on duty time working and driving time combined in one 24 hr. period.
    - No one shall continue to drive a CV after 13 hours of continual driving in one 24 hr. period.
    - No driver shall drive a CV after 16 hours has elapsed from the start of that driver's day, including all off and on duty hours until at least 8 consecutive hours of off duty time has been taken.
    - No one shall drive a commercial vehicle after more than 70 hours of on duty time in 7 consecutive days until taking 36 consecutive hours of off duty time.
    - 24 consecutive off duty hours required in each 14 days to continue cycle.
      Seven day cycle is reset to zero by taking 36 hours off. (a night, a day and a night)

Calculating On-Duty and Off-Duty Hours of Service

Riding as a passenger in a pick-up, plane, etc., to drive a Commercial Vehicle over 11,759kg counts as On Duty hours unless 8 consecutive hours of off duty are taken just prior to driving. You could then deduct those hours spent as a passenger from your total hours in the 7 day cycle.

Waiting for ferries counts as on duty hours.

Time on a ferry is considered off duty hours, (though still chargeable time on your calendar). Show the hours riding the ferry in Remarks and as “Off Duty” on your Hours of Service log sheet.

Drillwell works using the 70 Hour, 7 Day Cycle, (Cycle 1).

DRILLWELL CARRIER SAFETY SIGNOFF

AFTER READING ALL OF THE PRECEDING INFORMATION PLEASE SIGN AND DATE BELOW TO AKNOWLEDGE THAT YOU UNDERSTAND ALL OF THE REQUIRMENTS OF THESE POLICIES, AND THAT YOU AGREE TO ABIDE BY ALL RULES AND REGULATIONS AS SET OUT HEREIN, AND REQUIRED BY THE NATIONAL SAFETY CODE.

A COPY OF THIS AKNOWLEDGEMENT MUST BE RETAINED AT THE OFFICE.

Name:_____

Driver License #_____

Date of expiry_____

Signature:_____

Date Signed:_____

APPENDIX 4 – FORMS

Drillwell Carrier Safety Signoff (Signed Form)

AFTER READING ALL OF THE PRECEDING INFORMATION PLEASE SIGN AND DATE BELOW TO AKNOWLEDGE THAT YOU UNDERSTAND ALL OF THE REQUIRMENTS OF THESE POLICIES, AND THAT YOU AGREE TO ABIDE BY ALL RULES AND REGULATIONS AS SET OUT HEREIN, AND REQUIRED BY THE NATIONAL SAFETY CODE.

A COPY OF THIS AKNOWLEDGEMENT MUST BE RETAINED AT THE OFFICE.

Name:_____

Driver License #_____

Date of expiry_____

Signature:_____

Date Signed:_____

New Worker Safety Orientation (Signed Form)

NAME: _____ DATE: _____

LOCATION: _____ _ POSITION: _____

Emergency contact name and tel. # _____

Topics Covered		Rigging, Slings & Straps	
Company Safety Policy & general rules		Fire Hazards	
Employee safety responsibility		Pointed Hazards	
Reporting unsafe conditions & acts		Rebar protection	
Reporting incidents & injuries		Fall protection	
First aid location & Evacuation procedures		Hole coverings	
Location of marshalling areas		Electrical protection	
How to contact first aid/signal emergency		Power tools	
Personal protective equipment		Transport of Personnel & Equip.	
WHMIS training? (copy) MSDS sheets		Power lines/locates	
Clothing requirements		High visibility vests/Clothing	
Safety meetings & inspections		Housekeeping	
Safety inspections		Lighting requirements	
Workers right to refuse unsafe work		Cranes and rigging	
Personal medical conditions		Torching	
Professional conduct/aggressive behaviour		Forklift	
First aid ticket? (copy)		Issued copy of Safety Program	
Harassment and Abuse		Name & contact info of supervisor	
Hearing test card?		Dual Rotary Hoisting with winch	
Folding Crane Use certification (copy)		Company H&S Representative	
Cable tool Rig Set up and Tear Down		Casing Jack Use	
Summary of Minimum Safety Requirements		Carrier Safety Policy	
Deep Well Pump Sets		Lockout Tagout requirements	
JOHSC Names and contact information		Hoisting Steel Pipe or Casing	

You must **initial each safety topic** discussed and provide copies of documents as indicated above. Your signature indicates that you have understood and agree to follow the procedures as explained.

SAFTEY COORDINATOR: _____ DATE: _____

WORKER'S SIGNATURE: _____

Worker Disciplinary "Zero Tolerance" Policy (Signed Form)

All personnel employed with Drillwell Enterprises Ltd., or sub-trades hired to perform work by Drillwell Enterprises Ltd. must follow established safety protocols, where and when required.

Failure to follow or implement company safety program procedure will result in immediate disciplinary action and possible termination of employment. Only one written warning may be removed from any employee file per calendar year, at the discretion of Drillwell Enterprises Ltd. management.

Safety is everybody's business. Safety is our greatest concern!

In the event of a worker contravening a WorksafeBC regulation or a company safety program policy, the following guidelines shall be implemented:

1. Immediately remove the worker(s) from the hazard in question. Contact the Drillwell Enterprises Ltd. site supervisor and office with the worker's name. Sub-trade personnel may be permanently removed from any or all Drillwell Enterprises Ltd. sites for non-compliance of safety regulations.

2. After review of the facts, the company representative will initiate appropriate disciplinary action. Guidelines for discipline are as follows:

- FIRST OFFENCE: The worker and/or supervisor will receive a written Safety Violation notice, and it will remain in their personal file for the duration of employment, including future employment with Drillwell Enterprises Ltd.
- SECOND OFFENCE: The worker (and supervisor, if appropriate) will receive a written Safety Violation notice, and will be suspended without pay for one (1) working day. Worker and supervisor will sign document.
- THIRD OFFENCE: The worker (and supervisor, if appropriate) will receive a written Safety Violation notice, and will be suspended without pay for five (5) working days. Worker and supervisor will sign document.
- FOURTH OFFENCE: employment will be terminated, effective immediately.

There will be no exceptions to this zero tolerance policy!

I acknowledge, understand and will comply with the company safety program & policy.

NAME: _____ DATE: _____

WORKER'S SIGNATURE: _____

Folding Cranes on Flatdeck Trucks (Signed Form)

- No employee is to use any folding crane without first reading these procedures, AND receiving instruction in crane operation from a senior employee.
- No person shall ever be under a suspended load for any reason.
- No one is to be standing, moving, or working near a boom or in immediate swing radius while crane is being operated. Do not approach boom until operator gives okay signal.
- If a person must be near the boom, i.e.: to attach or unhook a load, the operator will remove hands from controls to prevent accidental pinching or striking of worker by unintended movement of crane.
- Outriggers are to be set to their maximum practical extension any time heavy items (over 500kg.) are loaded or unloaded.
- Jack pads or ground pads are to be used at all times.
- When handling heavy items, the operator must be very aware that as the load moves away from the truck bed, or the boom is extended, the load and leverage acting on the crane and truck increases rapidly.
- Whenever a heavy load is moved away from the truck by swinging or extending the boom, the load should be as close to the ground as possible so that in case of equipment failure or error the load will contact the ground, before it overbalances the truck.
- When handling heavy items use extra caution and time. i.e.: for 16" and 20" casing in lengths 20ft. or over, lift only 2 pieces at one time, for 10" and 12" casing lift only 3 pieces at one time.
- Contact supervisor if unfamiliar with a specific load, or handling.
- All rigging is to be inspected, in good condition and sized appropriately for the intended lift

In order to avoid accidental engagement of remote control, remote unit must be turned off before operator bends over to attend rigging, or climbs up or down from truck deck

All employees who will be operating crane are to sign a copy of these procedures ONLY after they have read them, and received instruction on crane operation from a senior Drillwell Employee. **CERTIFICATION REQUIRED!**

NAME: _____ DATE: _____

WORKER'S SIGNATURE: _____

Crane Inspection (Form)

DRILLWELL

DAILY CRANE TRUCK INSPECTION REPORT

TRUCK: _____ UNIT #: _____ Crane Inspection Expiry: _____

Month: _____ Year: _____ Vehicle Inspection Expiry: _____

Last Service: _____ Fire Extinguisher Expiry: _____

Next Service Due: _____

Day	Site Location Owner / Street	Safety Plan / Precautions Map / Radio / Cell	Stakes & Load Secure	Engine Coolant	Engine Oil Litres Added	Cables / Chains / Slings	Belts / Hoses	Outriggers & Pads	Hyd. Oil	Boom & Frame	Greased Equip. Today	All Guages Working	Site Condition Good	Fluid Leaks	Fuel Level	Remote Checked	Operator init.	Problems / Issues / Hazards Service / Comments
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Additional Comments:

White Copy - submit to office monthly Yellow - retain in vehicle 38617 PrintCraft 1-800-240-7899

Rig/Equipment Inspection (Form)

DRILLWELL

DAILY RIG / EQUIPMENT INSPECTION REPORT

RIG: _____ UNIT #: _____

Month: _____ Year: _____

Last Service: _____

Next Service Due: _____

Vehicle Inspection Expiry: _____

Fire Extinguisher Expiry: _____

Day	Site Location Owner / Street	Safety Plan / Precautions Map / Radio / Cell	Engine Coolant	Engine Oil Litres Added	Cables / Chains / Slings	Belts / Hoses	Comp. Oil	Hyd. Oil	Mast & Frame	Greased Equip. Today	All Guages Working	Site Condition Good	Fluid Leaks	Fuel Level	Driller init.	Helper init.	Problems / Issues / Hazards Service / Comments
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Additional Comments:

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Sonic Inspection (Form)

DRILLWELL

SONIC INSPECTION REPORT

Month: _____ Year: _____

	SERVICED (HRS)	DUE (HRS)
ENGINE		
HEAD		
ROTATION		

Fire Extinguisher Expiry: _____

Day	Site Location Owner / Street	Safety Plan / Precautions Map / Radio / Cell	Engine Coolant	Engine Oil Litres Added	Cables / Chains / Slings	Belts / Hoses	Head Lube Oil	Hyd. Oil	Mast & Frame	Greased Equip. Today	Head / Spindle Bolts	Coolers	Fluid Leaks	Fuel Level	Driller initial	Problems / Issues / Hazards Service / Comments
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23																
24																
25																
26																
27																
28																
29																
30																
31																

Additional Comments:

Pre-trip Inspection (Form)

DRILLWELL TRIP INSPECTION REPORT
as required by the National Safety Code

DATE: _____

UNIT # _____ Odometer Start _____

❑ In pre-trip inspection I have detected no defect or deficiency in this motor vehicle as would be likely to affect the safety of its operation or result in its mechanical breakdown.

TIME: _____ AM/PM SIGNATURE: _____

NAME: _____

TRUCK:

❑ Defect(s) found: (as marked)

❑ Brakes / Brake Adjustment	❑ Steering	❑ Windshield / Wipers
❑ Oil & Fluids	❑ Lights	❑ Horn
❑ Emergency Equipment	❑ Load Security	❑ Mirrors
❑ Tires-Wheels / Nuts / Studs	❑ Parking Brakes	❑ Mud Flaps

❑ TRAILER: (If Applicable) # _____

❑ Defect(s) found: (as marked)

❑ Brake Connections	❑ Lights	❑ Tires
❑ Brakes	❑ Mud Flaps	❑ Wheels
❑ Coupling	❑ Tie Downs	❑ Load Security

❑ In post-trip inspection I have detected no defect or deficiency in this motor vehicle as would be likely to affect the safety of its operation or result in its mechanical breakdown.

TIME: _____ AM/PM SIGNATURE: _____

REMARKS / REPAIRS - COMMENT REQUIRED! _____

_____

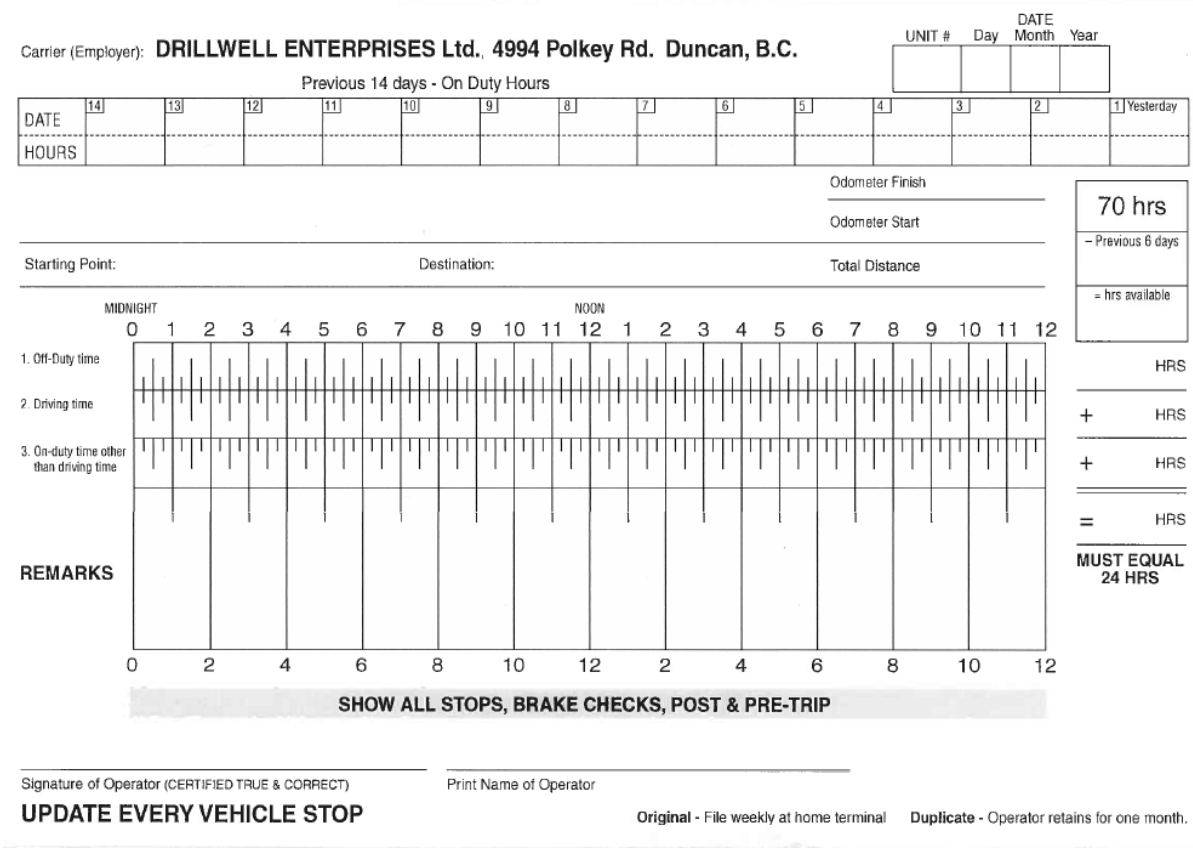
❑ Above defects corrected

❑ Above defects need not be corrected for safe operation

OFFICE REPORT

SIGNATURE: _____ DATE: _____

Driver's Hours of Service (Form)



Carrier (Employer): **DRILLWELL ENTERPRISES Ltd., 4994 Polkey Rd. Duncan, B.C.**

UNIT # | DATE Day Month Year

Previous 14 days - On Duty Hours

	14	13	12	11	10	9	8	7	6	5	4	3	2	1 Yesterday
DATE														
HOURS														

Odometer Finish

Odometer Start

Starting Point: Destination: Total Distance

70 hrs
– Previous 6 days
= hrs available

MIDNIGHT 0 1 2 3 4 5 6 7 8 9 10 11 12 NOON 1 2 3 4 5 6 7 8 9 10 11 12

1. Off-Duty time
2. Driving time
3. On-duty time other than driving time

REMARKS

0 2 4 6 8 10 12 2 4 6 8 10 12

HRS
+ HRS
+ HRS
= HRS

MUST EQUAL 24 HRS

SHOW ALL STOPS, BRAKE CHECKS, POST & PRE-TRIP

Signature of Operator (CERTIFIED TRUE & CORRECT)

Print Name of Operator

UPDATE EVERY VEHICLE STOP

Original - File weekly at home terminal **Duplicate** - Operator retains for one month.

Enviro/Geotech Safety Checklist (Form)

SAFETY CHECK LIST
DRILLWELL ENTERPRISES LTD.

4994 Polkey Road, Duncan, BC V9L 6W3
Email: drill@drillwell.com
Tel: (250) 746-5268 Fax: (250) 746-8404

Rig _____ Date _____

Driller _____

Helper _____

Location _____

Engineering Firm _____

Eng./Tech.Name _____

Cell Number _____

Owner/Client _____

Service Locates By _____

Job Type ☐ Enviro ☐ Geotech

DRILLWELL IS NOT Responsible for damage to underground services

DRILLER SIGNATURE _____

TECH./ENG. SIGNATURE _____

SITE CONDITION

Daylighting	☐ Yes	☐ No
Overhead Hazards	☐ Yes	☐ No
Traffic Hazards	☐ Yes	☐ No
Traffic Control	☐ Yes	☐ No
Environmental Hazards	☐ Yes	☐ No
Site Safety Plan	☐ Yes	☐ No
Drill sites clearly and precisely marked	☐ Yes	☐ No

Other Site Hazards _____

EQUIPMENT

☐ Fire Extinguishers	☐ First Aid Kit	☐ Fuel
☐ Eye Wash Stn.	☐ Hard Hats	☐ Gloves
☐ Safety Glasses	☐ High Vis Vest	☐ Lights
☐ Hydraulic System, leaks/hoses	☐ Lines & Cables	☐ Fluid Levels

Emergency contact #: **911** and/ or _____ Nearest Medical Facility _____

Route to medical facility: _____

Pre-Job Hazard Assessment (Form)

DRILLWELL ENTERPRISES LTD.

Pre-Job Hazard Assessment

Job Site: _____ Planned Activity: _____

Supervisor: _____ Weather Condition: _____

Approved by: _____ Unit # _____ Date: _____

STEPS: Identify the tasks related to the planned activity, identify and determine the Hazards involved to complete the tasks, evaluate the risk and provide the plan to eliminate or control the identified hazards.

NOTE: "High Risk" tasks require a written Safe Job Procedure or Safe Work Practice (refer to Drillwell Safety Manual).

Tasks	Hazards	Risk Rating	Plans to Eliminate / Control Hazards

Potential Hazards Checklist

Ergonomic Hazards
- ☐ Repetitive motion
- ☐ Heavy lifting
- ☐ Awkward positions
- ☐ Over exertion
- ☐ Pinch points
- ☐ Body in line of fire
- ☐ Working above your head

Access/Egress Hazards
- ☐ Aerial lift/man basket (inspected)
- ☐ Scaffold (Inspected)
- ☐ Ladders (tied off)
- ☐ Slips/trips
- ☐ Hoisting (tools/equipment)
- ☐ Excavation/trenching
- ☐ Confined space

Activity Hazards
- ☐ Welding/grinding
- ☐ Burn/heat sources
- ☐ Compressed gases
- ☐ Hoisting/lifting
- ☐ Noise (extreme)
- ☐ Dust/mist/fumes
- ☐ Mobile equipment
- ☐ Traffic and the public
- ☐ Rotating Equipment

Environmental
- ☐ Spill potential
- ☐ Weather conditions
- ☐ MSDS reviewed
- ☐ Ventilation
- ☐ Heat stress/cold exposure
- ☐ Lighting levels
- ☐ Housekeeping
- ☐ Fire Hazard

Procedures Required
- ☐ Lockout
- ☐ Confined Space
- ☐ Fall Protection
- ☐ Craning & Rigging
- ☐ Guarding
- ☐ Excavation
- ☐ Traffic Control
- ☐ Service Locates

Work at Height Hazards
- ☐ Barricading, flagging signs
- ☐ Hole (coverings in place)
- ☐ Falling items
- ☐ Powered platforms
- ☐ Others working overhead/below
- ☐ Fall (100% tie-off)
- ☐ Anchor points identified
- ☐ Ladders

Personal Hazards
- ☐ Working alone
- ☐ Violence
- ☐ First-time performing task
- ☐ Confusing instructions
- ☐ Modified work limitations
- ☐ Teamwork required

Electrical Hazards
- ☐ Shock hazard/GFCIs
- ☐ Working on/near energized eq.
- ☐ Hot work/electrical permit
- ☐ Electrical tools/cords inspected
- ☐ Overhead electrical
- ☐ Explosive hazard

PPE Requirements
- ☐ Safety footwear
- ☐ Safety eyewear
- ☐ Hardhat
- ☐ Hearing protection
- ☐ Respiratory protection
- ☐ Hand/limb/body protection
- ☐ Hi-visiblitiy apparel

Reviewed at Tailboard
- ☐ Fire extinguisher location
- ☐ First Aid room
- ☐ Route to Hospital
- ☐ Muster point
- ☐ Emergency response plan
- ☐ Incident reporting
- ☐ Nearest phone

Initials	Employee Review (print name)	Initials	Employee Review (print name)

Employer Incident Investigation Report – EIIR (Form)

1. Employer's information

Employer's name (legal name and trade name)		
WorkSafeBC account number	Operating location number	
Employer's head office address		
City	Province	Postal code
Employer's representative's name		Phone number (include area code)
Email address		

2. Injured persons

Last name	First name	Job title
a)		
b)		
c)		
d)		

3. Place, date, and time of incident

Location where incident occurred (street address or GPS coordinates)		
City (nearest)	Province	Postal code
Date of incident (yyyy-mm-dd)	Time of incident	☐ a.m. ☐ p.m.

4. Type of occurrence (select all that apply)

- ☐ Death of a worker
- ☐ Serious injury to a worker
- ☐ Major structural failure or collapse
- ☐ Major release of hazardous substance
- ☐ Blasting accident causing personal injury
- ☐ Dangerous incident involving explosives other than blasting incident
- ☐ Diving incident, as defined by regulation
- ☐ Incident of fire or explosion with potential for serious injury
- ☐ Minor injury or no injury but had potential for causing serious injury
- ☐ Injury requiring medical treatment beyond first aid

An incident investigation report is NOT required under the *Workers Compensation Act* if none of the above applies or if this incident is a vehicle accident occurring on a public street or highway.

5. Report type (select all that apply)

If this is a **revised version of a previous report**, please check here ☐

☐ Preliminary Investigation Report	☐ Interim Corrective Action Report	☐ **Full Investigation Report**	☐ Full Corrective Action Report
Report date (yyyy-mm-dd)	Report date (yyyy-mm-dd)	Report date (yyyy-mm-dd)	Report date (yyyy-mm-dd)
Only provide to a WorkSafeBC officer **if requested**		**Must be provided to WorkSafeBC within 30 days* Fax 1.866.240.1434**	
Officer's name		Date sent (yyyy-mm-dd)	

Employer Incident Investigation Report (EIIR)

6. Witnesses

Last name	First name	Job title
a)		
b)		
c)		

7. Other persons whose presence might be necessary for proper investigation

Last name	First name	Job title
a)		
b)		

8. Sequence of events that preceded the incident

Required in Preliminary Report. Update in Full Report if necessary. Describe events earlier that day or even in previous years that led up to the incident. Examples may include events such as training given or changes in equipment, procedures, or company management.

9. Unsafe conditions, acts, or procedures that significantly contributed to the incident

Required in all reports. Describe anything, or the absence of anything, that contributed to the hazard such as poor housekeeping or poor visibility, using equipment without guards, or the lack of safe work procedures.

10. Nature of the serious injury (optional — complete only if there has been an injury)

- ☐ Life threatening or resulting in loss of consciousness
- ☐ Major broken bones in head, spine, pelvis, arms, or legs
- ☐ Major crush injuries
- ☐ Major cut with severe bleeding
- ☐ Amputation of arm, leg, or large part of hand or foot
- ☐ Major penetrating injuries to eye, head, or body
- ☐ Severe (third-degree) burns
- ☐ Punctured lung or other serious respiratory condition
- ☐ Injury to internal organ or internal bleeding
- ☐ Injury likely to result in loss of sight, hearing, or touch
- ☐ Injury requiring CPR or other critical intervention
- ☐ Diving illness such as decompression sickness or near drowning
- ☐ Serious chemical or heat/cold stress exposure
- ☐ Other (specify)

Employer Incident Investigation Report (EIIR)

11. Brief description of the incident

Required in Preliminary Report. Briefly, summarize the sequence of events, the unsafe factors, and the resulting injury, if any.

12. Corrective actions identified and taken to prevent recurrence of similar incidents

Action (Required in Preliminary Report and Interim Corrective Action Report. Update in Full Report, if necessary.)	**Action assigned to** (name and job title)	**Expected completion date** (yyyy-mm-dd)	**Completed date** (yyyy-mm-dd)
a)			
b)			
c)			
d)			
e)			

13. Explanation of blank areas on this Preliminary Report, if any

If there are blank areas, describe the circumstances beyond your control that explain this lack of information.

14. Persons who carried out or participated in the preliminary investigation

Representative	**Name**	**Job title**	**Signature** (optional)	**Date signed** (yyyy-mm-dd)
Employer representative (required)				
Worker representative (required)				
Other				
Other				

End of report

Completing all the sections above satisfies the requirements for a Preliminary Investigation Report and an Interim Corrective Action Report.

Note: If this was a simple investigation and **all needed corrective actions have been completed within 48 hours**, the Preliminary and Full Investigation portions of the report can be completed at the same time. If so, you can check both the Preliminary Investigation Report and the Full Investigation Report boxes in section 5 on page 1.

As of January 1, 2016, copies of **all** reports must also be provided to the joint occupational health and safety committee or worker representative, as applicable.

Employer Incident Investigation Report (EIIR)

15. Determination of causes of incident

Required in Full Report. Analyze the facts and circumstances of the incident to identify underlying factors that led to the incident. Underlying factors include factors that made the unsafe conditions, acts, or procedures in the Preliminary Report possible. Update items from section 9, if needed.

16. Full description of the incident

Required in Full Report. Use the brief description from the Preliminary Report and update it, if necessary.

17. Additional corrective actions necessary to prevent recurrence of similar incidents

Additional corrective action (Required in Full Report and Full Corrective Action Report.)	**Action assigned to** (name and job title)	**Expected completion date** (yyyy-mm-dd)	**Completed date** (yyyy-mm-dd)
a)			
b)			
c)			
d)			

18. Persons who carried out or participated in the full investigation

Representative	**Name**	**Job title**	**Signature** (optional)	**Date signed** (yyyy-mm-dd)
Employer representative (required)				
Worker representative (required)				
Other				

19. Other relevant workplace parties

Company name	**Contact person**	**Contact number or email address**
a)		

End of report

Completing all the sections above satisfies the requirements for a Full Investigation Report and a Full Corrective Action Report.

Employers are required to submit **full** investigation reports to WorkSafeBC **within 30 days* of the incident.** Reports may be submitted by fax to 604.276.3247 (Greater Vancouver), toll-free fax 1.866.240.1434, or by mail to PO Box 5350, Stn Terminal, Vancouver BC V6B 5L5. Do **NOT** submit a preliminary report unless you have been so directed by a WorkSafeBC officer.

* Employers can request an extension from a WorkSafeBC officer, **if the full investigation cannot be completed within 30 days.**

As of January 1, 2016, copies of **all** reports must also be provided to the joint occupational health and safety committee or worker representative, as applicable.

Monthly Safety Meeting (Form)

Joint Health and Safety Meeting Minutes

Date:	

Last Evaluation:	24-May-17
Next Evaluation:	24-May-18

JHS members present:

All others present:

Addressed from Last meeting:

Recent Concerns, Observations, Comments:

Recent Near Misses:

Recent Incidents:

	Number of Time loss Injuries	Days Since last time lost Injury
Year to Date		

Topics For Next Safety Meeting:

Safety Violation – Employee or Subcontractor (Form)

Project name and address: _____

Issued To: _____

Sub-contractor: _____ Trade: _____

Date: _____ Time: _____

Violation:

_____
_____
_____
_____

Workers in violation:

_____

Worker's response:

_____
_____
_____

Action Taken:

_____
_____
_____

Recommendations:

_____
_____
_____

The sub-contractor named above must provide written verification to the site superintendent and safety supervisor within 5 working days of the date of this notice. Verification must address the violations identified and the recommendations set forth.

In the event of a failure to comply a copy of this notice will be forwarded to the WCB prevention division.

_____ _____

Signature of Safety Supervisor Signature of Site Supervisor

Fall Protection Equipment - Inspection Record (Form)

Date: _____ Location: _____ Unit # _____

Date of	Inspected	Equipment	I.D.#	Condition	Replace	Replacement

All equipment listed above has been deemed acceptable for continued service **unless otherwise noted.**

Additional Remarks:

_____

_____

Fall Protection – Site Specific Plan (Form)

Work Site:

Address or Location:

Work to be Performed:

Fall protection system to be used (i.e. guard rails, lanyards, self-retracting lifeline):

Rescue plan (i.e. ladder truck, man basket, high angle rescue team)

Training and Notification:

Have all workers been trained in the safe use of the fall protection equipment? YES NO

Have all affected workers been made aware of this plan? YES NO

Supervisor's Signature:	Date:

Inspection Record (Form)

Inspection Report

Use this report to record the results of your regular workplace inspections.

Company name:_____

Date: _____

Inspectors' Names: _____

_____

Type of hazard *Critical, Urgent, or Important*	Describe hazard and precise location	Recommended corrective action	Person responsible for corrective action	Due Date	Completed *Yes/No*

First Aid Record (Form)

This record must be kept by the employer for three (3) years. This form must be kept at the employer's workplace. Do **NOT** submit to WorkSafeBC.

Sequence number

Name	Occupation
Date of injury or illness (yyyy-mm-dd)	Time of injury or illness (hh:mm) ☐ a.m. ☐ p.m.
Initial reporting date and time (yyyy-mm-dd) (hh:mm) ☐ a.m. ☐ p.m.	Follow-up report date and time (yyyy-mm-dd) (hh:mm) ☐ a.m. ☐ p.m.
Initial report sequence number	Subsequent report sequence number(s)

Description of how the injury, exposure, or illness occurred (What happened?)

Description of the nature of the injury, exposure, or illness (What you see — signs and symptoms)

Description of the treatment given (What did you do?)

Name of witnesses

1.	2.

Arrangement made relating to the worker (return to work/medical aid/ambulance/follow-up)

Provided worker handout ☐ Yes ☐ No Alternate duty options were discussed ☐ Yes ☐ No	A form to assist in return to work and follow-up was sent with the worker to medical aid ☐ Yes ☐ No
First aid attendant's name (please print)	First aid attendant's signature
Patient's signature	

APPENDIX C

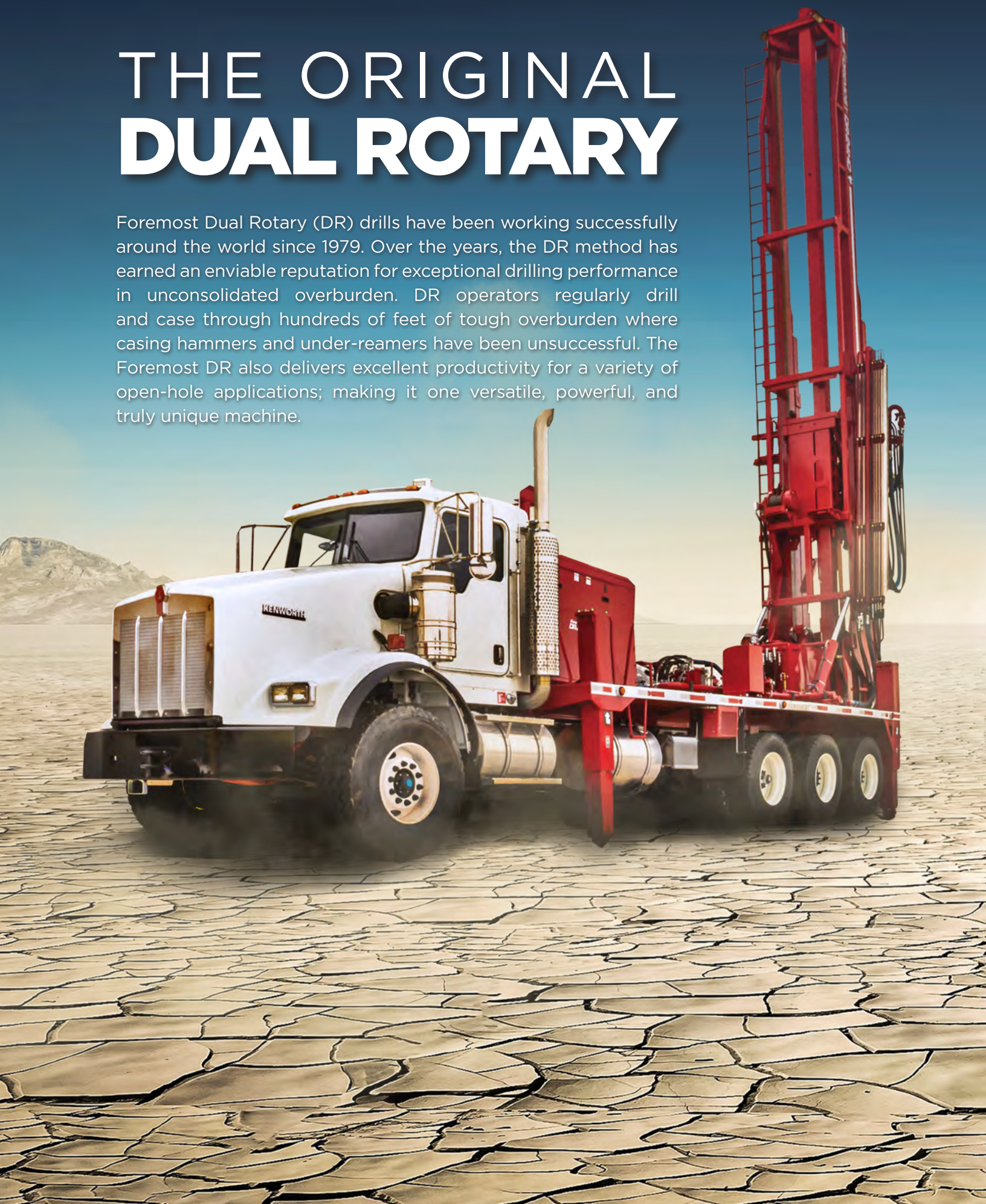
Name	WD Identification
BOURGET, Richard	04121406
BRANCATO, Lou	05041302
BURROWS, Scott	04121407
CURRIE, Cass	16021501
DWYER, Brad	16020901
MCGARRY, Kelly	05041303
SLADE, Calvin	04121405
SLADE, David	04121404
SLADE, Paul	04121403
SLADE, Shawn	15052001

FOREMOST
MOBILE EQUIPMENT

DUAL ROTARY DRILLS

THE ORIGINAL **DUAL ROTARY**

Foremost Dual Rotary (DR) drills have been working successfully around the world since 1979. Over the years, the DR method has earned an enviable reputation for exceptional drilling performance in unconsolidated overburden. DR operators regularly drill and case through hundreds of feet of tough overburden where casing hammers and under-reamers have been unsuccessful. The Foremost DR also delivers excellent productivity for a variety of open-hole applications; making it one versatile, powerful, and truly unique machine.



TOP TEN REASONS TO CONSIDER A FOREMOST DUAL ROTARY RIG

Since 1979, Foremost's Dual Rotary drills have delivered on the promise of better performance. They continue to make significant contributions to the productivity and profitability of operators worldwide. For a growing number of contractors, there's simply no better way to drill. Consider these top DR features:

1. Exceptional Overburden Performance: Foremost DR drills have been proven repeatedly in some of the toughest unconsolidated overburden formations, including sand, gravel, glacial till, and boulders. The DR method minimizes the likelihood of loss circulation and aquifer cross-contamination. Because the DR can drill without fluids, the ability to detect water in low-flow formations is improved.

2. Open-Hole Versatility: In addition to its overburden drilling ability, the DR can be configured for a variety of drilling methods including mud, reverse circulation, and flooded reverse circulation.

3. Straight Holes: The rotation of the casing by the lower drive results in a very straight hole. This minimizes stress on casing and casing welds, and eases the task of installing screens and pumps in water well applications. It also makes the DR ideal for drilling hydraulic elevator shaft holes and foundation piles.

4. Basin Extraction: The lower drive is equally effective at pulling back casing; thereby simplifying the process of exposing a well screen or abandoning a well.

5. Conventional Tools: Foremost DR drills utilize conventional tools. The drill string can be equipped with down-the-hole hammer, roller cone, or drag bit.

6. Control of Discharge: Cuttings are diverted through the discharge swivel and can be directed to a safe and convenient dumping or monitoring point. This is a useful feature when drilling at homeowner sites or when cuttings must be contained for environmental or safety reasons.

7. Ease of Maintenance: Foremost DR rigs feature a directly connected hydraulic feed system – which means no chains, sheaves, or sprockets to maintain. This type of feed system generates zero load on the mast crown, permitting a simple and lightweight mast design that does not sacrifice pullback capability.

8. Reduced Operational Risk: The DR's overburden drilling capability gives you the confidence to go into areas you might once have considered off-limits. Its flexibility allows you to expand into new applications. Knowing that you have the right equipment to get the hole down the first time will help reduce the risk to your company when bidding on projects.

9. Resale Value: There is arguably no drill on the market today that holds its value better than a Foremost DR. Dual Rotary owners tend to hold onto their rigs, making used inventory scarce. Demand for used DR drills remains strong, and consequently, prices favour the seller. Excellent resale potential provides an added level of comfort and financial security for those who might consider investing in a Foremost Dual Rotary drill.

10. Foremost Technical Support: Foremost Dual Rotary rigs are backed by the considerable product and application expertise of its product management team, field technicians, and one of the largest engineering departments in the industry. Foremost is committed to providing superior customer support. Repeat sales are proof of customer satisfaction.

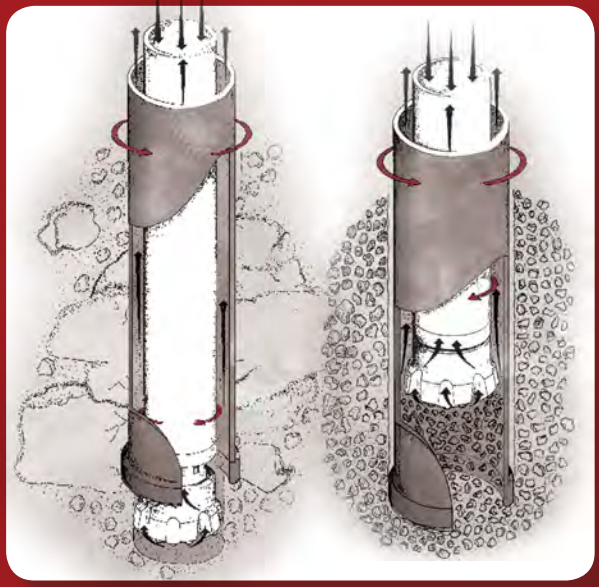
BETTER PRODUCTIVITY THROUGH BETTER TECHNOLOGY

Foremost Dual Rotary drills feature a unique lower rotary drive that is used to advance steel casing through unconsolidated overburden, such as sand, gravel, glacial till, and boulders. Pullback, pulldown, and rotational forces are effectively transmitted to the casing via high-strength steel jaws with carbide inserts.

An independent rotary top drive simultaneously handles a drill string equipped with a down-the-hole hammer, drag bit, or roller cone bit. Cuttings are typically evacuated with air, but Foremost DR drills can also be configured with pumps for mud or flooded reverse circulation drilling.

The top and lower drives feed independently, meaning that the bit position can vary relative to the bottom of the casing. Once the desired casing depth has been achieved, the DR continues drilling open-hole like a conventional top drive drill. With a Foremost DR drill, there is no need to trip out or change tools when transitioning to open-hole drilling.

NORMAL BIT POSITION
In most situations, the drill bit is advanced flush with or slightly ahead of the casing shoe for best penetration rates.



BIT POSITION IN HEAVING FORMATION
In heaving formations, the casing is advanced ahead of the drill bit to create a plug in the casing. This allows drilling to continue in a controlled fashion. This method is also recommended where sample accuracy is important, as it helps to minimize cross-contamination of cuttings.

OVERVIEW OF DR FEATURES

Since acquiring the Dual Rotary technology from Barber Industries in 1993, Foremost has continually updated, refined and expanded the DR line with the goal of enhancing its functionality and extending its range of applications. Today, Foremost offers several DR models, each packed with features that deliver heightened safety, productivity, and profitability across a variety of drilling activities.

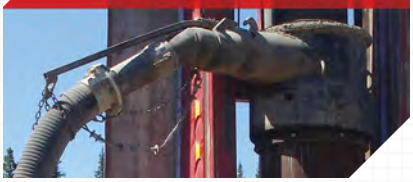
CYCLONE COLLECTOR

The optional cyclone sample collecting system slows discharge velocity to allow accurate and continuous sampling of the formation.

TILTING TOP DRIVE

The independent hydraulic top drive tilts for convenient loading of drill pipe and casing with the operator standing at ground level.

DISCHARGE SWIVEL

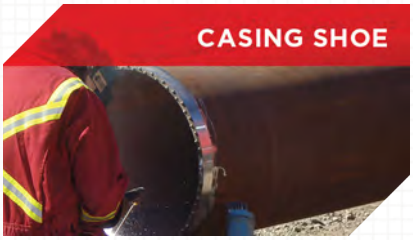


All drill cuttings rise to the surface between the drill pipe and casing, and exit through the discharge swivel attached to the top of the casing. The discharge swivel directs cuttings to a safe dumping point or to an optional cyclone collection system.

CASING JAWS

Rotation and feed forces are effectively transmitted from the lower drive to the casing via a set of three carbide inserts. Casing jaws are available for all common casing sizes and can be changed out quickly in the field.

CASING SHOE



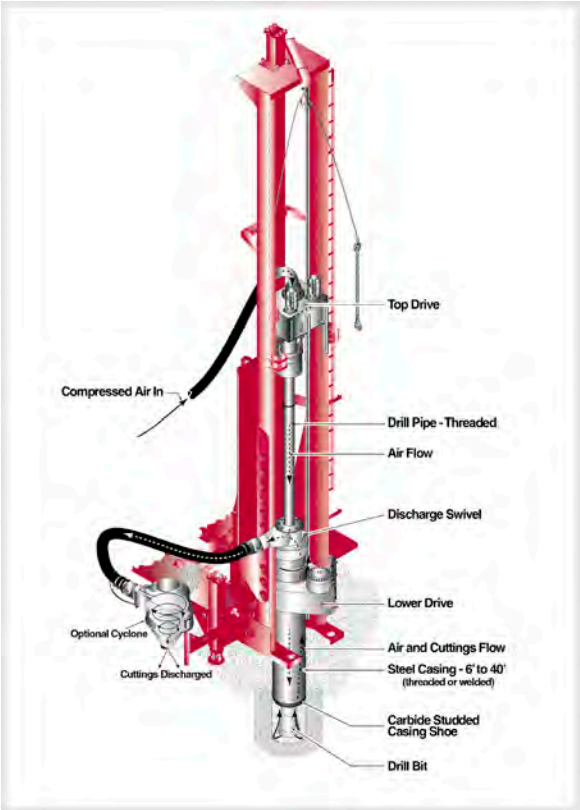
A carbide-studded casing shoe is welded to the casing bottom. The shoe I.D. is flush with the casing I.D. so that there is no reduction in the bore hole diameter when switching to open-hole drilling.

LOWER DRIVE

The lower rotary drive is also used as a powerful breakout and spinner for drill pipe, hammers, bits, and thread casing.

DEPTH RANGES AS REPORTED BY DR OPERATORS

CASING DIAMETER		DEPTH RANGE	
6" - 8"	152 - 203mm	200 - 1300 ft	60 - 400 m
10" - 14"	254 - 356mm	100 - 800 ft	30 - 244 m
16" - 24"	406 - 610mm	100 - 500 ft	30 - 244 m
26" - 40"	660 - 1016mm	50 - 350 ft	15 - 106 m
> 40"	> 1016mm	For surface casing only	



AVAILABLE MODELS

DR-12

The DR-12 is a light, yet powerful PTO rig popular among domestic water well contractors drilling in moderate to severe overburden. It will handle casing up to 12" (305 mm) in diameter, and has been field tested to depths beyond 550 ft (168 m) for a typical 6" (152 mm) cased well. The DR-12 is available with an optional pipe tub, single pipe loader arm and telescopic casing jib. The configuration accommodates diverse site conditions.

DR-24

The DR-24 will set casing up to 24" (610 mm) in diameter. This model is commonly used for domestic and municipal wells, and construction applications such as foundation piling projects and holes for hydraulic elevator jacks. The DR-24 is available in PTO or deck engine configurations and can be mounted on a truck, trailer or self-propelled tracked carrier. Available in a stock tandem or tridem (pictured above) configuration.

DR-24HD

The DR-24HD ('heavy-duty') features a heavy-duty gear-driven lower drive, which generates two and a half times the torque of the standard DR-24. The DR-24HD is also configured with a heavy-duty mast to withstand the additional torque and larger hoist cylinders for increased pullback capabilities. The DR-24HD is most commonly used in deep, large diameter applications such as municipal/industrial wells and mine de-watering.

DR-40

The DR-40 handles casing up to 40" (1,000 mm) in diameter. The DR-40 excels in large diameter construction and industrial water well applications. Standard configurations include tracked undercarriage or crane carrier with deck engine and on-board air compressor.

SPECS & PERFORMANCE

		DR-12	DR-24	DR-24HD	DR-40
TOP DRIVE					
Stroke		25 ft (7.62 m)	26 ft (7.92 m)	26 ft (7.92 m)	29 ft (8.84 m)
Hoist Speed	Up	177 ft/min (54 m/min)	122 ft/min (37 m/min)	78 ft/min (24 m/min)	78 ft/min (24m/min)
Hoist Capacity	Pullback	40,000 lbs (18140 kg)	60,000 lbs (27200 kg)	84,000 lbs (38100 kg)	84,000 lbs (38100 kg)
	Pulldown	12,000lbs (5400 kg)	20,000 lbs (9000 kg)	25,900 lbs (11800 kg)	25,900 lbs (11800 kg)
Torque (stall)		10,000 ft-lbs (13,500 Nm)	10,000 ft-lbs (13,500 Nm)	14,500 ft-lbs (19,600 Nm)	22,000 ft-lbs (30000 Nm)
Rotation Speed		0 - 122 rpm	0 - 122 rpm	0 - 86 rpm	0 - 42 rpm
LOWER DRIVE					
Stroke		12 ft (3.66 m)	12 ft (3.66 m)	12 ft (3.66 m)	12 ft (3.66 m)
Hoist Capacity	Pullback	42,400 lbs (19200 kg)	75,400 lbs (34200 kg)	117,000 lbs (53000 kg)	75,400 lbs (34200 kg)
	Pulldown	18,500 lbs (8400 kg)	33,000 lbs (15000 kg)	42,400 lbs (19200 kg)	33,000 lbs (15000 kg)
Torque		500,000 in-lbs (56500 Nm)	1,000,000 in-lbs (112000 Nm)	2,500,000 in-lbs (282000 Nm)	3,000,000 in-lbs (339000 Nm)
Rotation Speed		0 - 13 rpm	0 - 21 rpm	0 - 6 rpm	0 - 5 rpm
Max. Casing Diameter		12" (305 mm)	24" (609.6 mm)	24" (609.6 mm)	40" (1016 mm)
COMPRESSOR					
Air Flow		900 cfm (25.5 m^3/min)	900-1150 cfm (25.5 m^3/min)		1150 cfm (32.6 m^3/min)
Pressure		350 psi (24.1 bar)	350 psi (24.1 bar)		350 psi (24.1 bar)
Engine Power		525 hp (391 kW)	525 hp (391 kW)		600 hp (447 kW)
DIMENSIONS					
Length		37 ft (11.28 m)	38 ft 9 in (11.81 m)		41 ft 11 in (12.77 m)
Height		13 ft (3.96 m)	13 ft 6 in (4.11 m)		13 ft 6 in (4.11 m)
Width		8 ft (2.44 m)	8 ft (2.44 m)		9 ft 6 in (2.90 m)
Weight		51,600 lbs (23500 kg)	56,000 - 72,000 lbs (25400 - 32650 kg)		105,000 lbs (47600 kg)
JIB BOOM WINCH					
Wire Rope Length		140 ft (42.67 m)	140 ft (42.67 m)		120 ft (36.58 m)
Wire Rope Diameter		1/2" (12.70 mm)	1/2" (12.70 mm)		5/8" (15.88 mm)
Line Pull on Bare Drum		6,000 lbs (2720 kg)	6,000 lbs (2720 kg)		12,000 lbs (5400 kg)
Line Speed on Full Drum		100 ft/min (30 m/min)	100 ft/min (30 m/min)		175 ft/min (53 m/min)
WATER & FOAM INJECTION					
Capacity		12 gpm (45 l/min)	12 - 25 gpm (45 - 75 l/min) 20 gpm (75 l/min)		25 gpm (75 l/min)
Pressure		600 psi (41.4 bar)	600 psi (41.4 bar)		600 psi (41.4 bar)

Performance specifications are theoretical maximums. Actual performance may vary.

Hydraulic Breakout	Lower rotary casing drive is used as a breakout and spinner wrench for drill pipe joints, drill bits, and threaded casing.
Hydraulic System	A closed loop hydraulic system is used for the lower casing rotator. Variable displacement pumps are used for all other hydraulic systems.
Hoist System	The hoist feed is direct by hydraulic cylinder; no cables, sheaves, chains, or sprockets are used in the hoist system.
Carrier	Truck, trailer, crane carrier, or self-propelled track carrier.
Popular Options	RC drilling package, sandline winch, mud pumps, hydraulic welder, and cyclone separator.

DRILLING PENETRATION RATES (BASED ON INDEPENDENT THIRD-PARTY OBSERVATIONS)

	FOREMOST DR	CONVENTIONAL AIR ROTARY	AUGER	CABLE TOOL
Drilling Speed (1)				
Sand and Gravel	20 - 40 min	45 - 90 min	30 - 60 min	1 - 4 hrs
Till	30 - 60 min	45 - 90 min	30 - 120 min	2 - 8 hrs
Rock	30 - 90 min	30 - 90 min	N/A	N/A
Casing Integrity	Excellent	Moderate - Poor	N/A	Moderate
Split Spoon Sampling Ability	Moderate - Poor	Poor - None (3)	Excellent	Good
Cross-Contamination Prevention	Good - Excellent	Moderate - Poor	Moderate - Poor	Moderate - Poor
Versatility	Excellent	Good (3)	Moderate - Excellent	Poor
Air	Yes	Yes	(3)	No
Mud	Yes	Yes	(3)	(3)
Water	Yes	Yes	(3)	Yes
Other Advantages/ Disadvantages	• Casing removal simplified • Controlled discharge sampling • Good casing seat in bed-rock	• Poor casing seat by juttering and drive shoe removal	• Mobile rig for tough access	• Rig simplicity

(1) Drilling speed shown represents average time required to drill and install 20 feet over a 100 foot well depth. (2) N/A denotes Not Applicable (3) Rig type dependent. Reprinted with the permission of the National Ground Water Association. Copyright 1988.

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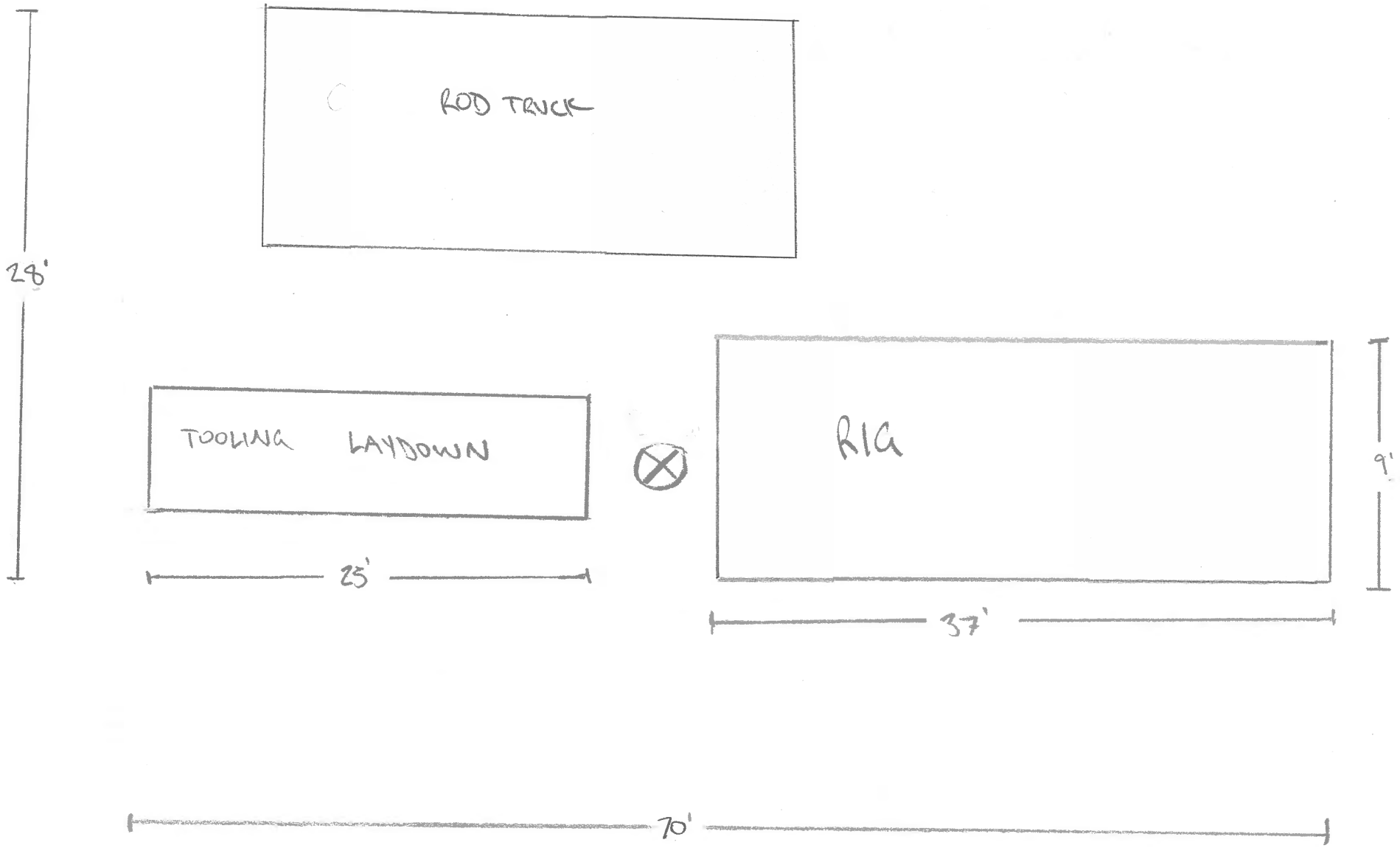

ROD TRUCK
28'
TOOLING LAYDOWN
25'
RIG
9'
37'
70'

APPENDIX D

Certificate of Insurance

Suite 1700, Calgary Place 1, 330 – 5th Avenue S.W., Calgary, Alberta T2P 0L4 Telephone: (403) 264-8600 Facsimile: (403) 264-8608

Certificate No. WATERES-01 17-058

Certificate Holder: **Urban Systems Ltd.**

Re: **Agreement for Subconsultant's Services**

Name of Insured: **Waterline Resources Inc.**
6415 – 10th Street S.E.
Calgary, Alberta T2H 2Z9

This certificate is issued as a matter of information only and confers no rights upon the certificate holder other than those provided in the policy. This certificate does not amend, extend or alter the coverage afforded by the policies listed herein.

This is to certify that the policies of insurance listed below have been issued to the insured named above for the policy period indicated, notwithstanding any requirement, term or condition of any contract or other document with respect to which this certificate may be issued or may pertain. The insurance afforded by the policies described herein is subject to all the terms, exclusions and conditions of such policies. Limits shown may have been reduced by paid claims/expenses.

Schedule of Insurance(s)

Type of Insurance	Insuring Company and Policy Number	Policy Dates	Limit of Liability/ Amount of Coverage
Commercial General Liability	Royal & SunAlliance Insurance Company of Canada Policy # COM034730768	December 12, 2017 – December 12, 2018	CAD1,000,000 Bodily Injury & Property Damage – Each Occurrence CAD1,000,000 Products and Completed Operations – Each Occurrence and in the Aggregate for the Policy Period CAD1,000,000 General Aggregate CAD1,000,000 S.P.F 6 Standard Non-Owned Automobile
Automobile Insurance	Royal & SunAlliance Insurance Company of Canada Policy # IRC046753839	December 12, 2017 – December 12, 2018	CAD2,000,000 Combined Single Limit, Third Party Liability including Bodily Injury and Property Damage
Professional Liability	XL Insurance Company Limited Policy # PCN002491510 PCN002491509	December 12, 2017 – December 12, 2018	CAD1,000,000 each occurrence CAD1,000,000 aggregate limit

Terms and Conditions

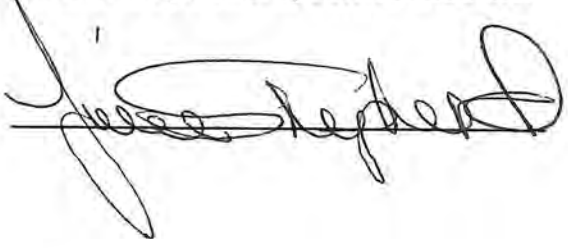
The Insurer will endeavour to provide the Holder of this Certificate with Thirty (30) days written notice of cancellation of this policy(ies); but failure to provide such notice to the Certificate Holder shall impose no obligation or liability of any kind upon the Insurer, its Agent or Representatives.

These statements have been made in good faith and are a summary of the insurance cover in force (which is subject to the full terms and conditions of the policy). We accept no responsibility whatsoever for any inadvertent or negligent act, error or omission on our part in preparing these statements or for any loss, damage or expense thereby occasioned to any recipient of this certificate.

Jardine Lloyd Thompson Canada Inc.

Date: August 7, 2018

Per:



Megson FitzPatrick
INSURANCE SERVICES

3561 SHELBOURNE STREET
VICTORIA, BC V8P 4G8

CERTIFICATE OF INSURANCE

To: Drillwell Enterprises Ltd.
Attn: David Slade

Date: November 27, 2018
Email: david@drillwell.com

This will certify that Insurance as described hereunder has been arranged on behalf of the herein Named Insured and that such Insurance, at the date hereof, is in full force and effect.

Policy Effective Date December 7, 2018	**Named Insured & Mailing Address** Drillwell Enterprises Ltd. 4994 Polkey Road, Duncan, BC V9L6W3
Policy Expiry Date December 7, 2019	
Policy Number 5A1263776	**Insurance Company** Intact Insurance Company

Effective: December 7, 2018

Commercial General Liability

Limits

$10,000,000	**Inclusive limit each occurrence Bodily Injury / Property Damage**
$10,000,000	**Aggregate limit Products & Completed Operations**
$500,000	**Tenants Legal Liability Broad Form**
$100,000	**Crane & Hoist Operators' Liability Endorsement**
$5,000,000	**Contractors Limited Pollution Coverage**

Including Non Owned Automobile Liability, Long Term Leased Automobiles Exclusion & Cross Liability, $1,000,000 Forest Fire Fighting Expense. Contingent Employers Liability.

Deductible

$2,500	**Bodily Injury / Property Damage each occurrence and Tenants Legal Liability**
10%	**Crane & Hoist Operators' Liability**

Conditions

As per Policy Terms, Conditions and Exclusions

THIS POLICY CONTAINS A CLAUSE(S) THAT MAY LIMIT THE AMOUNT PAYABLE. The Insurance described above is subject to the limitations, exclusions and conditions contained in the policies. This Certificate is issued as a matter of information only and confers no rights on the holder and imposes no Liability on the Insurer.

Megson FitzPatrick Insurance Services

Heather Anderson

Authorized Representative

WORK SAFE BC
WORKING TO MAKE A DIFFERENCE

Assessment Department
Mailing Address
PO Box 5350
Station Terminal
Vancouver BC V6B 5L5

Location
6951 Westminster Highway
Richmond BC
V7C 1C6
www.worksafebc.com

Clearance Section
Telephone 604 244 6380
Toll Free within Canada
1 888 922 2768
Fax 604 244 6390

Urban Systems Ltd.
550 - 1090 Homer Street
VANCOUVER, BC V6B 2W9

August 03, 2018

Person/Business : WATERLINE RESOURCES INC
Account number : 767218

This letter provides clearance information for the purposes of Section 51 of the *Workers Compensation Act*.

We confirm that the above-referenced firm is active, in good standing, and has met WorkSafeBC's criteria for advance clearance. Accordingly, if the addressee on this letter is the prime contractor, the addressee will not be held liable for the amount of any assessment payable for work undertaken by the above-referenced firm to January 01, 2019.

This firm has had continuous coverage with us since October 23, 2006.

Employer Service Centre
Assessment Department

Clearance Reference # : C130392794
CLRAAA

For more information about Section 51 and clearance letters visit WorkSafeBC.com

Please refer to your account number in your correspondence or when contacting the Assessment Department.
To alter this document constitutes fraud.

WORK SAFE BC
WORKING TO MAKE A DIFFERENCE

Assessment Department
Mailing Address
PO Box 5350
Station Terminal
Vancouver BC V6B 5L5

Location
6951 Westminster Highway
Richmond BC
V7C 1C6
www.worksafebc.com

Clearance Section
Telephone 604 244 6380
Toll Free within Canada
1 888 922 2768
Fax 604 244 6390

Drillwell Enterprises
4994 Polkey Rd
DUNVAN, BC V9L 6W3

January 10, 2019

Person/Business : DRILLWELL ENTERPRISES LTD
Account number : 304237

This letter provides clearance information for the purposes of Section 51 of the *Workers Compensation Act*.

We confirm that the above-referenced firm is active, in good standing, and has met WorkSafeBC's criteria for advance clearance. Accordingly, if the addressee on this letter is the prime contractor, the addressee will not be held liable for the amount of any assessment payable for work undertaken by the above-referenced firm to **April 01, 2019.**

This firm has had continuous coverage with us since January 01, 1983.

Employer Service Centre
Assessment Department

Clearance Reference # : C130658945
CLRAAA

For more information about Section 51 and clearance letters visit WorkSafeBC.com

Please refer to your account number in your correspondence or when contacting the Assessment Department.
To alter this document constitutes fraud.

APPENDIX E

Flowing Artesian Wells

Water Stewardship Information Series

BRITISH COLUMBIA
The Best Place on Earth

Table of Contents

This booklet contains general information on flowing artesian wells for well drillers, groundwater consultants and well owners in British Columbia. The booklet provides general guidelines on flowing artesian wells and does not replace professional knowledge or experience.

What's the difference between a flowing artesian well and an artesian well?

An **artesian well** is a well that taps into a confined aquifer (see Figure 1). Under artesian pressure, water in the well rises above the top of the aquifer, but does not necessarily reach the land surface. A **flowing artesian well** is one that has been drilled into an aquifer where the pressure within the aquifer forces the groundwater to rise above the land surface naturally without using a pump. Flowing artesian wells can flow on an intermittent or continuous basis and originate from aquifers occurring in either unconsolidated materials such as sand and gravels or bedrock, at depths ranging from a few meters to several thousand meters. All flowing wells are artesian, but not all artesian wells are flowing wells.

Why do wells flow?

Flowing artesian wells can be found in two types of situations:

- the aquifer is confined by impermeable materials (i.e., confined beds where the static water level is above the top of the aquifer and land surface); or
- the aquifer is not confined, but the static water level is above the land surface.

Static water level is the level to which water will naturally rise in a well without pumping. For flowing artesian wells, the groundwater level or static water level can be expressed as a head (e.g., artesian head) and reported as a length (feet or meters above ground level) or pressure (pounds per square inch or psi).

Artesian conditions can be generated by geological and topographical controls (see Figure 1) or by topographical controls alone (Figure 2). In the former, water in an artesian well rises upward due to the pressure confined in the aquifer. Artesian wells are found in inclined confined aquifers sandwiched between layers of rock or overburden that are impervious or have low permeability. Water enters the exposed portion of the aquifer at a high elevation and percolates down through interconnected pore spaces. The water held in these spaces is under pressure (confining pressure or hydrostatic head) due to the high elevation from which it originally came. If a well is drilled from the land surface through the overlying impervious layer, the pressure inside the aquifer will cause the water to rise in the well. In areas where the pressure of the aquifer is great enough, the water rises above ground level resulting in a flowing artesian well.

Hydrostatic head (or confining pressure) is the vertical distance between the water level in the well and the top of the aquifer and is expressed in feet or meters of water or pressure (psi).

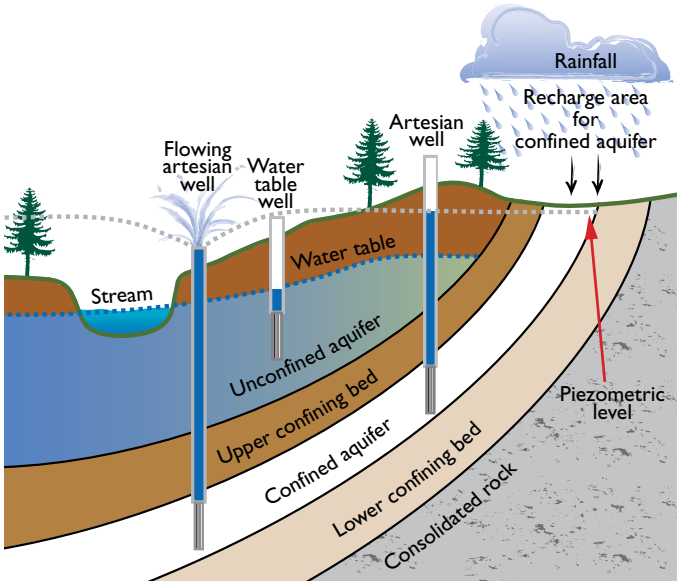


Figure 1. Geological and topographical controls affecting artesian and flowing artesian wells.

Topographical control situations can be found in unconfined aquifers where the well intake is deep enough to intercept a zone where the hydraulic head is higher than the land surface (see Figure 2). This situation typically occurs in groundwater discharge areas at lower elevations near rivers and lakes in valleys surrounded by steep slopes. The pressure of the groundwater typically increases with depth in the discharge areas where the slope of the water's

Hydraulic head is a measurement of the water level or total energy per unit weight above a datum such as sea level. It is commonly measured as water surface elevation in feet or meters.

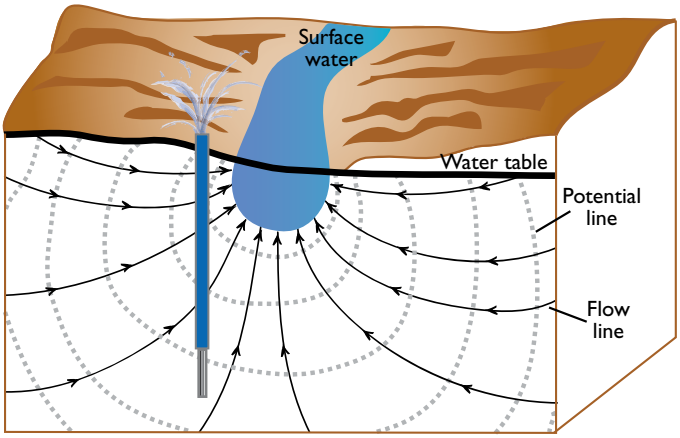


Figure 2. Topographically controlled flowing artesian well.

flow path and its pressure are controlled by the topography. As the groundwater moves along the flow path, it can migrate

deep below ground where it can lie beneath shallow non-artesian groundwater. When a well is drilled into a deeper zone of higher hydraulic head, the groundwater can move upwards inside the well casing to a level that is higher than the levels of the land surface, resulting in a flowing artesian well.

Why is stopping or controlling artesian flow important?

Flow from artesian wells should be controlled to prevent wasting groundwater. For instance, an uncontrolled artesian well flowing at 10 USgpm (55 m^3/day) wastes 14,400 USgallons (55 m^3) every day and 5.25 million USgallons (2.0 x 10^4 m^3) per year. An uncontrolled flow of 1 USgpm wastes enough water to supply four homes. Wasting water may lower the confining pressure in the aquifer so that the well no longer flows or flows at a reduced rate and affects the yield of neighbouring wells and springs.

Figure 3. Erosion caused by flowing artesian well.

When groundwater breaks out on the outside of the well casing, flooding, damage and/or subsidence and sinkhole formation can occur. Another reason to control flow is to prevent groundwater flowing from an aquifer under artesian pressure into an overlying aquifer(s). If the flowing well breakout is not promptly contained, silt, clay, gravel, sand, and drilling fluids can be carried along with the artesian groundwater to the ground surface and eventually reach surface water. The quality of the surface water and the habitat of aquatic organisms can be impacted.

Flowing artesian wells can also cause erosion (see Figure 3). Flowing water that accumulates into ponds can also contribute to mosquito problems.

How can flowing artesian conditions be determined before drilling?

Before a well is drilled, it is important for the person responsible for drilling the well (qualified well driller or qualified professional[1]) to do a pre-drilling assessment to determine the range of pressures and flows that might be found during drilling, i.e., whether flowing artesian conditions are likely to be encountered.

[3] Qualified professionals who are registered with the Association of Professional Engineers and Geoscientists of British Columbia with competency in hydrogeology or geotechnical engineering.

The pre-drilling assessment should include gathering information about geological conditions, static water levels and any history of flowing artesian wells in the area. This information can be obtained from:

- reviewing available local well construction reports;
- reviewing hydrogeologic information (e.g., maps on the Water Resource Atlas http://www.env.gov.bc.ca/wsd/data_searches/wrbc/index.html showing flowing artesian well coverage (see Figure 4) or reports on Ecocat http://www.env.gov.bc.ca/ecocat/);
- consulting with the Ministry of Environment regional hydrogeologists; and
- consulting with well drillers and professional hydrogeologists or geotechnical engineers with knowledge of the local area.

If this information is not available, the person responsible for drilling the well should consider the proposed well depth in relation to relevant topographic and geologic information about the site (i.e., whether the proposed well is going to be deep in a valley-bottom location). Geophysical logs or an electric survey can also be used to better understand subsurface conditions. When knowledge is limited, a precautionary approach should be taken and planning should assume that flowing artesian conditions will be present.

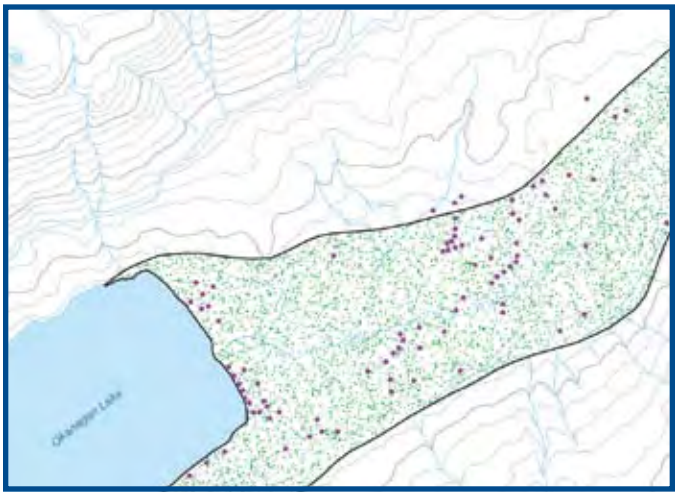


Figure 4. Map from the BC Water Resource Atlas showing provincial mapped and classified aquifers, contoured elevations and wells (purple dots) that were flowing artesian wells at the time drilling.

What are the provincial regulatory requirements for controlling or stopping artesian flow?

The provincial regulatory requirements for controlling flowing artesian wells are outlined in section 77 of the *Water Act*. If artesian conditions are encountered when constructing or supervising construction of a well, the qualified well driller

or qualified professional must ensure the artesian flow is or will be stopped or controlled and advise the well owner (and the land owner, if applicable) of the steps taken to do so. It is also good practice to advise of any potential hazards associated with uncontrolled flow not being controlled (e.g., erosion, flooding, subsidence) and any associated costs. Agreement on these issues, prior to drilling can help prevent or minimize misunderstandings. For example, some issues can be addressed in a contract. If the qualified well driller or qualified professional fails to stop or control the flow, it is the well owner's responsibility to hire another qualified professional or qualified well driller to ensure that the flow is stopped or controlled. If the ownership of the well is not known, the land owner is responsible to have this done. If the flow cannot be controlled, the person responsible for drilling the well should advise the Ministry of Environment's regional hydrogeologist and must comply with any direction given.

A flowing artesian well must have a securely attached cap to provide access to the well, prevent entry of vermin and contaminants, and to prevent flow escaping from the well.

What does it mean to "control" artesian flow from a well?

A flowing artesian well is considered "under control" when the entire flow is through the production casing to the wellhead and the flow can be stopped indefinitely without leaking on the surface of the ground and with no leakage into any other aquifer penetrated by the well.

Will a flowing artesian well dry up if the flow is stopped or controlled?

Controlling the flow from a flowing artesian well should not stop the flow or dry up the well if the well has been properly constructed. In fact, the opposite is true as waste of artesian water will often eventually cause a decrease in artesian pressure. Controlling the flow from a flowing artesian well prevents unnecessary loss of groundwater from the aquifer upon which other wells rely.

Are there any water quality concerns with flowing artesian wells?

In general, the water quality of flowing artesian wells is excellent. However, some artesian waters may be very poor quality and cause serious damage on the surface or contaminate an overlaying aquifer. In general, water quality can be affected by the depth of the well, i.e., a deeper flowing artesian well may have poorer water quality than a shallower flowing well. Water from bedrock formations, such as deep sandstone formations, may contain concentrations of arsenic that could pose a health concern. Artesian wells with poor quality water should be permanently closed (see page 8).

Are there any other concerns with flowing artesian wells?

Most of the problems associated with flowing artesian wells result from improper discharge controls or improper well construction.

Casing corrosion (see Figure 5) and leakage can occur due to the constant flow of water, particularly if the water is corrosive

Figure 5. Corroded well casing.

or contains fine sand. Where artesian water is known to be corrosive, a smaller diameter flow pipe may be installed in the well. The pipe may be made of corrosion-resistant material or may be periodically replaced when it becomes corroded. Where the casing has been damaged, a slightly smaller diameter casing can be installed inside the old casing using packers if there is an existing surface seal and sealed in place with a cement grout. It is recommended to have the flowing artesian well checked periodically by a qualified well driller to verify the integrity of the well casing and to inspect the well screen, as the well can be difficult to repair once the casing has been corroded or breached. Thin-wall casing should not be used in flowing artesian wells.

Failure of the casing/surface seal during construction or decades after well completion can be costly and may result in the eruption of large volumes of silt, sand, clay or gravel, causing unstable conditions and potential flooding, damage to nearby structures through erosion and subsidence and harm to the habitat of aquatic organisms.

Well screens for flowing artesian wells can yield water with sand or become plugged with sand if the well is not properly developed. This is an issue when a flowing artesian well in a

fine-grained aquifer is shut off and the sand settles and clogs the area in and around the bottom of the casing. The screen size should be coarse enough to prevent pressure build-up in the aquifer and the well should be properly developed. Perforated casings for flowing artesian wells are not recommended. In some areas an unpleasant rotten egg smell (hydrogen sulphide gas) may be present and by reducing or stopping the artesian flow the smell can be brought under control.

What can be done with an existing flowing well?

Trying to stop or control the flow from older flowing wells may result in an uncontrolled discharge of water outside the well casing or at a distance from the well due to the lack of an adequate seal, a defective surface seal or corroded casings. If water does not appear to be flowing outside of the outer casing, then it may be advisable to leave the well alone and not restrict the flow. However, if water appears to be flowing outside the casing and/or the well is causing property or environmental damage, then the well should likely be closed. Alternatively, it may be possible to lower the water levels using a pump but care must be taken to keep the water flowing from the well relatively continuously to avoid additional uncontrolled discharge from occurring.

There are numerous special measures that may be applicable to controlling the flow of an existing flowing artesian well such as using well packers or a bridge to restrict the flow in the confining layer, adding polymers or plasticizers to keep the grout together during placement, using barite to reduce the confining pressure of the water, etc.

Any alteration to an existing flowing well to control the flow needs to be done in compliance with the *Water Act* and Ground Water Protection Regulation and any directions of a Ministry of Environment hydrogeologist. A qualified well driller or qualified professional must be hired. Before any work is done, the well owner should be made aware of the costs and complexities of the work involved with controlling the flowing artesian well, as well as the chances of successfully controlling the flow.

What if the flow is needed, for example, to increase the baseflow of a creek or stream?

In some instances, artesian flow is used to maintain water levels in ponds used for irrigation, fire protection, fish rearing, recreation or wetland enhancement. For existing wells, flow is permissible as long as property is not damaged and streams or aquatic habitats are not negatively impacted. If damage does or may occur, contact the local Ministry of Environment office (see back cover of this booklet).

Are there some general guidelines for constructing a flowing artesian well?

In constructing a well under flowing artesian conditions the potential pressure and flow and the permeability of the formation need to be taken into consideration. A pre-drilling assessment of local conditions may provide this information. If these conditions are known, the following provides general guidance for the design and construction of the well. If this information is not known the well should be designed conservatively for worse case conditions. Flowing artesian wells should not be constructed if the formation conditions are not favourable, i.e., in shallower situations where there is no suitable formation to seal into.

Green Zone (<5 psi)

If the pressure is or will be less than 5 psi (pounds per square inch), flow can usually be controlled by adding additional casing, except where permeability of the formation is extremely high, e.g., medium to coarse gravel. To determine the artesian head use the following conversion factors: 2.31 feet equals 1 psi, and one foot equals 0.3048 meters. For example, for a flowing well with 5 psi, there will be 11.6 ft or 3.5 meters of artesian head, therefore the casing would need to be extended more than 3.5 meters above the ground surface to contain all the artesian head. In general, a 30 per cent bentonite grout can be used for flowing well construction or repair.

Artesian head is the hydraulic pressure created within the confined aquifer that drives the water upward in a well to the piezometric level. The distance from the ground surface to the piezometric level, converted into equivalent pressure (expressed as pounds per square inch, or PSI), is the artesian head.

Yellow Zone (5 to 10 psi)

If the pressure is or will be between 5 and 10 psi, extending the well casing may reduce flow, but extreme care must be taken in highly permeable formations that produce significant volumes of water. Flows of 20 USgpm can potentially occur in this zone and the upward annular velocity resulting from this flow is high enough to begin separating grout mixtures as they are being pumped down. When the pressure is high and the formation highly permeable, it is recommended that an outer surface casing be installed before the permanent casing. The outer casing should end in the confining layer and should not penetrate the underlying artesian aquifer. Cement-type grout should be used.

Red Zone (>10 psi)

If the pressure is or will be greater than 10 psi, static head control or extending the well casing is not usually possible, especially in highly permeable, high-yielding formations. In this category the flow is great enough to make the grout placement very difficult. An outer casing or multiple casings should be installed before the production casing and set to

the confining layer so the production casing can be cemented within the outer casing. Cement or cement plus barite (or other weighting additives) should be used as grouting materials.

What are the key issues to be aware of when drilling a flowing artesian well?

Flowing artesian wells under high pressure and with high flow rates (yellow and red zones) are challenging to construct. Flowing wells that are drilled deep (≥200 feet or ≥60 meters) in unconsolidated deposits or drilled into bedrock are less prone to flow problems and are generally easier to deal with. In bedrock environments (see page 7 for more information on bedrock wells), the competent rock allows for easier installation of the seal (i.e., no casing to wash out or concerns about an eroded annulus).

Drilling a well into a confined aquifer disturbs the overlying geologic confining layer and provides a potential pathway for the upward movement of the pressurized artesian water. Well construction must include restoring any damage to the confining layer. In general, the closer the top of the artesian formation is to the ground surface and the higher the pressure, the more difficult it is to control the flow.

In certain conditions (e.g., soft clay/silt formations), the formation will squeeze back in and set up around the well casing over a period of time. If this condition is likely to occur, it is advisable to let the well flow for a week or two to give the formation a chance to settle in before stopping or controlling the flow. This will result in a seal around the casing at deeper depths than the surface seal.

It is good practice for the qualified well driller to observe the condition of the flowing artesian well head for one or two weeks after construction and check for leakages outside the surface casing or between casings.

Materials and Equipment

One of the key factors to successfully controlling the flow is being prepared with the right tools and materials at the job site. Suggested materials and equipment include:

- drilling mud and additives of sufficient weight to deal with the pressures in the aquifer,
- surface and production casing appropriate to the water quality and geological conditions,
- grouting and sealing materials appropriate to the artesian pressure and anticipated flow,
- tremmie pipes,
- pumps suitable for delivering the grouting and sealing materials,
- well screens with adequate transmitting capacity,
- valves,
- inflatable packers,
- surge block, and
- shale traps.

Drilling Muds

To determine the extra weight of drilling mud needed to counteract the pressures of the artesian aquifer during rotary drilling, the estimated artesian head and the depth to the top of the aquifer is needed. The following formula can be used to estimate the additional weight of drilling mud needed to control the flow during the drilling process:

$$\text{Additional mud weight} = \left(\frac{8.34\ \text{lbs/USgal} \times \text{height of water above ground level (ft)}}{\text{Depth to top of aquifer (ft)}}\right) + 0.4\ \text{lbs/USgal}$$

Where:
One USgallon of water weighs 8.34 pounds
0.4 lbs/USgallon is a safety factor

Example

If the depth to the top of the aquifer is 75 feet and the height of water above ground is estimated to be 10 feet, the additional weight of drilling mud needed would be (8.34 x 10/75) + 0.4 = 1.5 lbs/USgal.

Properly mixed, fresh drilling mud will normally weigh about 9 pounds per US gallon. Drilling mud can be made heavier by adding drilling clay, drilling gel and special solids such as barite. However, some drilling gels are treated with polymers to build viscosity and become difficult to pump before their weight significantly increases. Therefore, some drilling gels have limited ability for control of flows. Mud weights of up to 15 pounds per gallon can be achieved using weighting materials such as powdered barite.

Well Casings

Generally, in areas where flowing artesian conditions are known or suspected, at least one outer surface casing should be installed before installing the permanent/production casing or liner to allow for better control. It is not advisable to pull the surface casing within 20 feet (6 meters) of ground surface. Doing so may disturb the seals and cause water to flow around the surface casing as it is pulled, especially if bentonite is used. There should be at least a 4-inch (10 cm) gap or annulus between the outer surface casing and the production casing to allow for the insertion of a tremmie pipe to pump adequate grout volumes For example, if a 6-inch production casing is needed, a 14-inch outer surface casing would have to be installed to provide a 4-inch annulus.

In areas where the pressure is > 5 psi and the formation is highly permeable, a 4 to 6-inch (10 to 15 cm) annulus between the surface and permanent casing is recommended. Ensuring there is an adequate annulus is especially important where formations are highly permeable and high-density grout mixtures are required to adequately control the artesian flow.

Grouting Mixtures

Use of appropriate grouting material is key to constructing a flowing artesian well. Table 1 is useful for finding the hydrostatic

head pressure (in psi) and for understanding the relationship between drilling fluid or grout density and their ability to successfully control the flow during drilling, plugging, or repair. Table 1 shows that heavy grouts, such as neat cement/bentonite slurry or cement slurry with additives, have a distinct advantage for flowing well work. Mixing neat cement with bentonite is recommended to avoid cracks from occurring.

It is important to allow for sufficient time for the cement or cement grout mixture to set before proceeding with drilling. Use of the appropriate drilling method to minimize impacting the integrity of the seal is also important. In addition, the flowing artesian well should be gradually sealed or shut-in to prevent rupturing the seal(s).

TABLE 1
TOTAL PRESSURE ABOVE TOP OF CONFINED AQUIFER (HYDROSTATIC PRESSURE) FOR FLOWING ARTESIAN WELLS

Depth to Top of Flowing Aquifer (feet)	Artesian Head Above Ground Surface (feet)					
	5	10	15	20	25	30
10	6.5	8.7	10.8	13.0	15.2	17.3
20	10.8	13.0	15.2	17.3	19.5	21.7
30	15.2	17.3	19.5	21.7	23.8	26.0
40	19.5	21.6	23.8	26.0	28.1	30.3
50	23.8	26.0	28.1	30.3	32.5	34.6
75	34.6	36.8	39.0	41.1	43.3	45.5
100	45.5	47.6	50.0	52.0	54.1	56.3
125	56.3	58.4	60.6	62.8	65.0	67.1
150	67.1	69.3	71.4	73.6	75.8	78.0
175	78.0	80.1	82.3	84.4	86.6	88.7
200	88.7	91.0	93.1	95.2	97.4	99.6
225	99.6	101.7	104.0	106.0	108.2	110.4
250	110.4	112.5	115.7	117.0	119.0	121.2

Adapted from the Michigan Department of Environmental Quality, Water Bureau, Lansing, Michigan

Material	Weight	Hydrostatic Pressure
Barite Slurry:	18 - 22 lb/USgal	.96 - 1.1 psi/ft
Neat Cement and Bentonite @ 6 gal water/sack:	15.0 lb/USgal	.78 psi/ft
Bentonite Slurry Grout:	10.4 lb/USgal	.54 psi/ft
Bentonite Slurry Grout:	9.5 lb/USgal	.49 psi/ft

GROUTING MATERIAL SUITABILITY

	Heavy Enough To Overcome Hydrostatic Pressure	Not Heavy Enough To Overcome Hydrostatic Pressure
	Neat Cement @ 15 lb/USgal	All Bentonite Grouts
	Neat Cement @ 15 lb/USgal or Bentonite Grout @ 10.4 lb/USgal	Bentonite Grouts lighter than 10.4 lb/USgal
	All standard grouts have enough weight to overcome hydrostatic pressure of the flow.	

The values in Table 1 correspond to the downhole head pressure (in psi) for different scenarios, e.g., if the depth to the top of the aquifer was 10 feet and the artesian head was 5 feet, the downhole head pressure will be 15 feet or 6.5 psi. To overcome the flow, the downhole grout pressure must be greater than the downhole head pressure.

The following example illustrates how Table 1 can be used to select drilling fluids or grout that are heavy enough to control the flow during drilling.

Example of how to use Table 1

Q. *The top of an artesian aquifer is found at 50 feet and wells in the area have about 15 feet of artesian head. What minimum weight drilling fluid would be needed to overcome the hydrostatic pressure during drilling?*

A. The following steps are used to solve the problem:

Step A: To determine the downhole hydrostatic head pressure look at **Table 1** and find the cell corresponding to depth of top of aquifer (50 ft) and artesian head (15 ft) which is 28.1 psi. This pressure represents the total head above the top of the confined aquifer (e.g., 15 + 50 = 65 ft or 28.1 psi).

Step B: Divide the downhole hydrostatic pressure (28.1 psi) by the depth to the top of the aquifer (50 ft) to determine the downhole grout pressure needed to equalize the flow (28.1 psi/50 ft = 0.56 psi/ft).

Step C: To determine the grout weight divide the downward pressure of the grout (0.56 psi/ft) by 0.052 (a factor to convert lb/USgal to psi/ft of depth). The minimum grout weight needed to control the flow is 10.8 lb/USgal.

Are there specific actions to avoid when flowing artesian conditions are present?

When a large volume, high pressure flow breaks out, the immediate situation can be serious and there is usually a concern to quickly move the drilling rig away from the borehole. Hastily made decisions can get in the way of successful future corrective actions. As up-flowing artesian water typically will erode fine sediments around a solid object that has been placed loosely below ground, the following actions should be avoided:

- dumping field stone or gravel into the annulus around the well casing as this can prevent the installation of grout pipes or a larger casing into the borehole and can collapse PVC well casing;
- pouring ready-mix concrete or bentonite chips into the annulus as it is likely that the concrete or bentonite will solidify above the depth where the flow is originating and

result in a plug that causes the flow to wash out around its perimeter; or

- jamming unopened bags of cement, bentonite chips, lumber, cardboard or other debris into the washed out annulus as these materials are ineffective and complicate further corrective action.

How can flowing artesian wells be constructed in bedrock aquifers?

When constructing an artesian well that is likely to flow in a **bedrock aquifer**, the final or outer well casing should be sealed at least 10 feet (0.3 meters) into competent bedrock. Figure 6 shows one possible method of completing a flowing artesian well in bedrock. Construction techniques and choice of sealant materials need to be determined by the qualified well driller based on site specific conditions, e.g., pressure and flow.

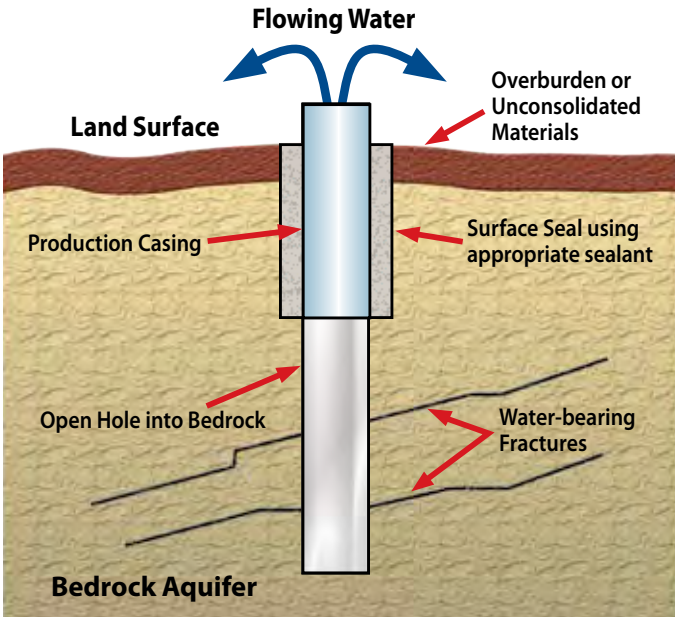


Figure 6. One possible method of completing a flowing artesian well in a bedrock aquifer.

How can flowing artesian wells be constructed in unconsolidated aquifers?

For **confined, unconsolidated aquifers** where flowing artesian conditions are likely, a cased oversized hole should be drilled into the confining layer, to allow a cement, or high solids bentonite seal to be placed between the final production casing and the outer casing (see Figure 7). This can be very complicated and expensive if the pre-drilling assessment indicates the confining layers are more than 100 ft (30 metres) deep. The size of the hole or casings and the depth of the seal must be determined on a site-by-site basis since choices are influenced by local geology and the specific artesian conditions encountered. A careful, conservative approach is recommended.

Figure 7. Bentonite cement grout seal between casings.

When constructing a well into a confined, unconsolidated flowing artesian aquifer, the appropriate sealant material between the outermost well casing and the confining layer must be of a sufficient depth and thickness to contain the flow.

Artesian conditions in **unconfined, unconsolidated aquifers** require special construction techniques such as using heavier drilling mud to counteract the pressure of the aquifer and a temporary surface casing to prevent hole collapse.

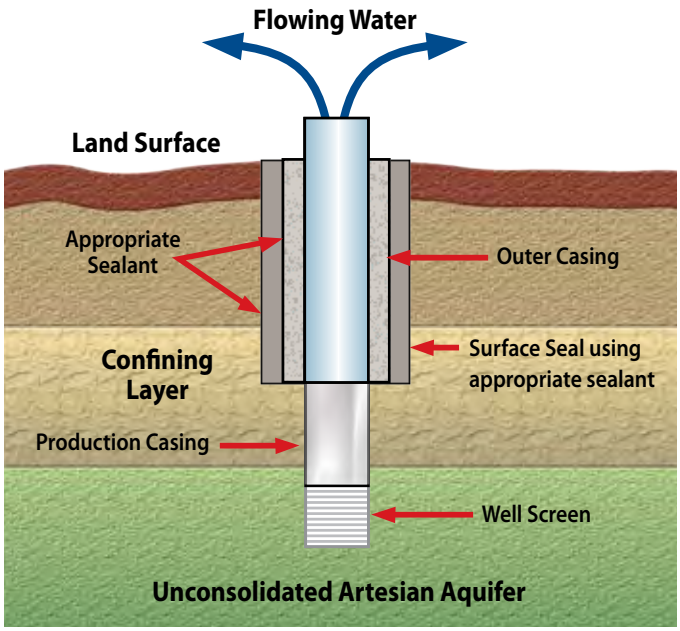


Figure 8. One possible method of completing a flowing artesian well in unconsolidated materials, e.g., sand and gravels.

What should be done if flowing artesian conditions are suddenly encountered?

When unexpected flowing artesian conditions are encountered (i.e., instant flow occurs), a qualified professional, or qualified well driller, should take control of the site and equipment should not be removed from the site until the artesian flow is under control. Contact the owner of the well and the land owner immediately

to report the situation and provide plans to control the flow (see below). Steps to take include:

- control the flow,
- secure the casing or borehole, and
- protect the drill rig.

The flow may be brought under control by:

- increasing the weight of the drilling mud,
- using plugs,
- using a surge-blocking to restrict flow, or
- installing a drillable packer.

The drill pipes can be left in place in cases where the uncontrolled flow occurs in an uncased drill hole, to indicate the exact location of the hole.

If the flowing artesian well is discharging water into a wetland or surface water body, contact the local Ministry of Environment office.

It is important for the well owner (and land owner if applicable) to develop a clear understanding, potentially in the form of a contract, with the drilling contractor on how the well will be repaired and/or the flow stopped or controlled before any work on the well commences to avoid or minimize potential misunderstandings when artesian flow is encountered.

What are the key factors in completing and equipping a flowing artesian well?

Flowing artesian wells, when properly constructed, should be equipped with a device to completely stop or control the artesian flow from the well (see Figure 9). After flow is stopped, there should be no leakage up the annulus between the outermost casing and the borehole. If water does escape, the annulus should be sealed.

Figure 9. Completed high pressure flowing artesian well.

Flowing artesian wells, like all wells, need to be vented. Well caps should be equipped with a two-way vent that allows the well to inhale and exhale air as the water level changes during pumping cycles. The vent will seal the well when the pump is not in use.

Determine the shut-in pressure (see below) and record the measurement on the well construction report. The wellhead should also be designed and equipped to prevent any backflow into the well.

Where freezing conditions may occur, the wellhead of the new flowing artesian well should be covered, insulated and heated, where necessary, to prevent damage of the flow control device leading to an uncontrolled flow situation.

How is the pressure or static water level for a flowing artesian well measured?

It is important to determine and record the hydrostatic pressure of the flowing artesian well for future pre-drilling assessments. There are several ways to measure the hydrostatic pressure or static water level of a flowing artesian well:

1. Extend the well casing, or a smaller diameter pipe through a well seal on the top of the casing, high enough above the ground surface until water no longer flows out the top (without pumping). The water level in the casing extension can then be measured using a water-level sounder. The distance from the piezometric water level in the casing to the ground surface is the artesian head of the aquifer – this can be converted to pressure.

   2.31 feet equals 1 psi or
   0.433 psi equals 1 foot

Example

A static water level of 30 feet is converted to pressure by dividing 30 feet by 2.31 feet/psi = 13 psi.

2. A pressure gauge installed on a well seal at the top of the casing will provide the pressure reading which can be multiplied by 2.31 to find the artesian head at the gauge elevation.

How should flowing artesian wells be closed?

A qualified well driller and/or qualified professional should be hired to close a flowing artesian well and ensure that the well is closed in such a manner that there is no leakage at the surface of the ground (see Figure 10). The driller must be prepared to handle the flow from the well and the discharge of any plugging materials immediately on removal of the flow control device(s). The work site can be dangerous if the flow is not properly diverted. Closing a flowing artesian well is simplified if the flow can be overcome by extending the well casing above the artesian head. Alternatively, insert an inflatable packer or expandable rubber plug at the bottom of the casing. Physically stopping the flow may make things worse, however, which is why the rapid loading of drilling gel is often a better approach.

Another effective approach is lowering the water level by pumping from adjacent wells. A leaking annulus should be sealed (if possible) before proceeding with grouting the production casing.

Pump a high density grout such as neat cement or concrete grout with bentonite through a PVC pipe or drill rod which is lowered to the bottom of the well. The cement mixture is pumped until it reaches the land surface. Pressure grouting with a packer may be required. It may also be good to pull or perforate some of the casing to allow the grout to flow from the casing into the annulus, although this is not critical if the casing is already perforated or corroded.

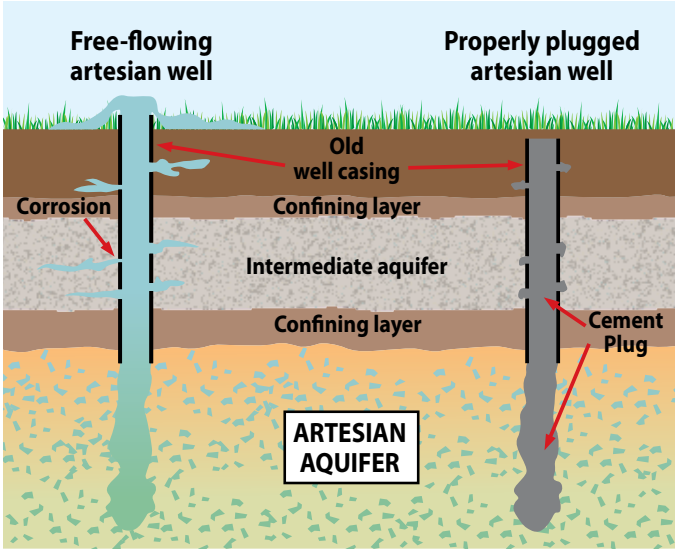


Figure 10. Example of a properly closed flowing artesian well.

How is a flowing artesian well disinfected?

Because of the protected nature of the confined artesian aquifer, flowing wells are generally less prone to bacterial contamination. Furthermore, the positive artesian pressure can minimize entry of surface contaminants into the well. Contamination introduced during the drilling process may be flushed out by the continuous discharge of water.

To disinfect a flowing well using chlorine, a temporary casing extension above the piezometric level or a tight well cap or seal can stop the flow and increase the chlorine contact time. A chlorine solution can also be pumped into the well via the secure well cap and hose connections. Once the casing extension or cap is removed, the well discharge will flush residual chlorine and inactivated bacteria from the well.

If the chlorinated water has a potential to harm the environment (e.g., fish), use an effective neutralizing agent, such as Vitamin C, to inactivate the chlorine. A solution of at least 1 per cent (by weight) of ascorbic acid is the most cost-effective form of Vitamin C. Added to the sump or a stream of chlorinated water, reaction time is nearly instantaneous.

Further Information

A registry of qualified well drillers can be found at: http://www.env.gov.bc.ca/wsd/plan_protect_sustain/groundwater/wells/applications/well_drillers_reg.pdf.

A listing of groundwater consultants (qualified professionals) can be found at: http://www.env.gov.bc.ca/wsd/plan_protect_sustain/groundwater/library/consultants.html.

Michigan Department of Environmental Quality, 2005. Flowing well handbook: http://www.michigan.gov/documents/deq/deq-wb-dwehs-wcu-flowwellhandbook_221323_7.pdf.

For further information on whether approvals are needed for discharging flowing artesian well water to surface water bodies, contact the local Ministry of Environment office:

Vancouver Island Region	Nanaimo	250-751-3100
Lower Mainland Region	Surrey	604-582-5200
Thompson and Cariboo Regions	Kamloops	250-371-6200
Kootenay and Okanagan Regions	Nelson	250-354-6333
	Penticton	250-490-8200
Omineca Peace and Skeena Regions	Prince George	250-565-6135

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The British Columbia Ground Water Association

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ISBN 978-0-7726-7034-2

APPENDIX F

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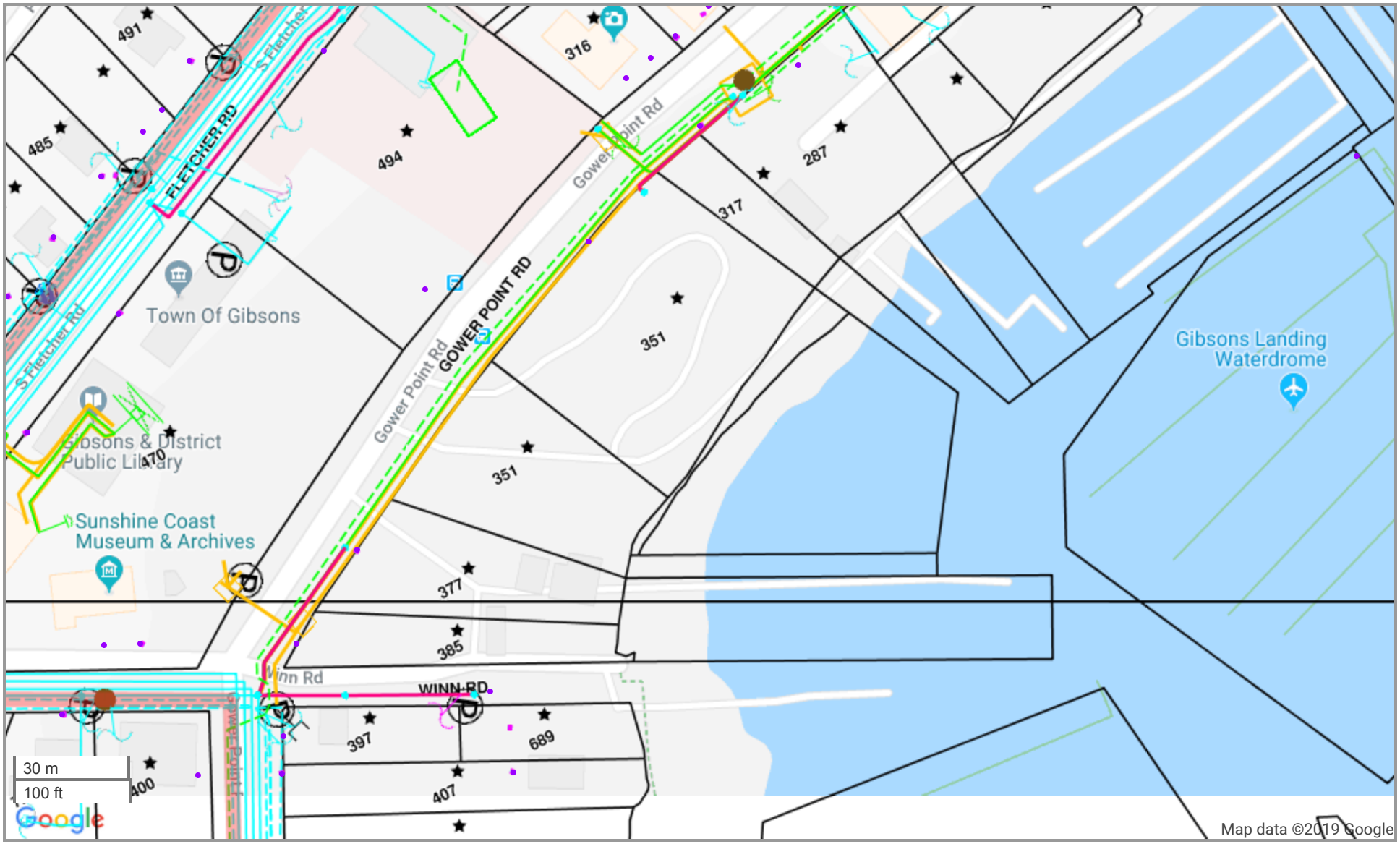

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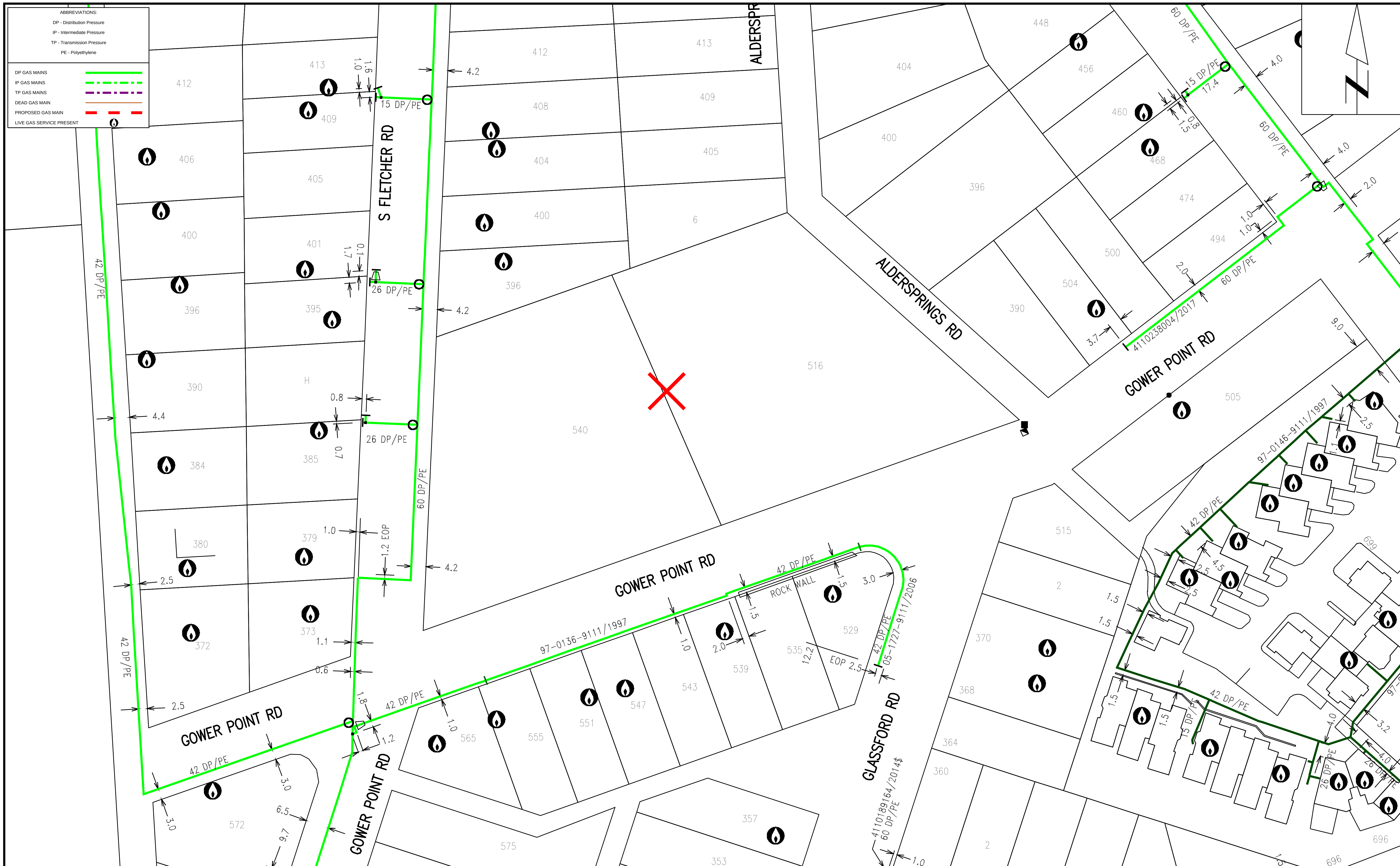

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GOWER POINT RD, GIBSONS

TICKET # 2019021555

 2019/01/09

ABBREVIATIONS:
DP - Distribution Pressure
IP - Intermediate Pressure
TP - Transmission Pressure
PE - Polyethylene

DP GAS MAINS
IP GAS MAINS
TP GAS MAINS
DEAD GAS MAIN
PROPOSED GAS MAIN
LIVE GAS SERVICE PRESENT

SARGENT RD
S FLETCHER RD
PERIWINKLE LANE
GOWER POINT RD
MOLLYS LANE
SCHOOL RD

42 DP/PE
26 DP/PE

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