

Job Demands Analysis

Worker's Occupation: Labourer in Water (LiW)

Prepared for: City of Richmond

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OVERVIEW OF POSITION

The Labourer in Water (LiW) is a manual labour position, which involves the preparation, installation, finishing and testing of fresh water supply lines to residential/commercial users and the City's fire hydrants.

WORK HOURS/WORK SCHEDULE

- Fulltime Hours: 9 hours/day
- Shift: 4 week days / week
- Breaks: one 60-minute lunch break
- Overtime: as required
- Frequency of overtime: varies depending on need

PERSONAL PROTECTIVE EQUIPMENT

- Hard hat
- Steel Toed Boots
- Gloves
- Overalls
- Knee Pads (Optional)
- Safety Glasses
- Hearing Protection (Task-specific)
- Respiratory Protection Equipment (Where required)

TOOLS AND EQUIPMENT

A LiW may use the following tools and equipment to perform their duties:

Up to 20 lbs:

- | | |
|----------------------------------|--------------------------------------|
| • Hammers | • Grinder |
| • Screwdrivers (hand/electrical) | • Shovel |
| • Wrenches | • Broom (hand/gas-powered) |
| • Saws (hand/electric) | • Rakes |
| • Measuring tape | • Portable hand tools (sander/drill) |
| • Crowbar | • Various sizes/lengths of piping |
| • Sledgehammer | • Various clamps and fasteners |

21-50 lbs:

- | | |
|-----------------------------------|------------|
| • Various sizes/lengths of piping | • Chainsaw |
| • Various clamps and fasteners | • Crowbar |

51-100 lbs:

- | | |
|-----------------------|-----------------------------------|
| • Portable generators | • Various sizes/lengths of piping |
| • Compactor | • Various pipe fittings |

100 lbs +:

- Various sizes/lengths of piping

WORK ORGANIZATION

Workers tend to operate in small crews and/or individually. An onsite leader typically the Pipe Layer in Water supervises each crew and their specific tasks for the day. A foreman supervises and organizes groups of crews.

REQUIRED EDUCATION & QUALIFICATIONS

- Class 5 driver's license
- General orientation courses as required by the City of Richmond eg) flagging, traffic control
- After 6 months - begin the BC Waterworks Certification process for levels 1 - 3.
- Every 2-3 years - complete a Level I first aide course
- Additional education (Chlorine Handling, etc ...) depending on duties and roles (Foreman)

ESSENTIAL - PHYSICAL DEMANDS

The essential tasks of a Labourer in Water (LiW) can be divided into two key jobs.

Job 1 – Laying Fresh Water Supply Lines

1. Preparing and transporting materials from the City Works Yard to the work site
2. Preparing the work site
3. Preparing the 'pit/trench' to ensure it is at the correct depth
4. Measuring, cutting and preparing the main line to fit the length of the 'pit/trench'
5. Carrying, dropping, and maneuvering the new main line in the 'pit/trench'
6. Securing the new line in the 'pit/trench' with clamps and fasteners
7. Applying bedding to the new main line
8. Compacting the new main line and cleaning up

In a typical day, a team of LiW will install up to 400 feet of new main lines.

Fresh water supply lines come in 3 different diameters: 4", 6", and 8". Each fresh water supply line is 20 feet in length. An 8" fresh water supply line weighs close to 185 lbs and can be carried by two adult men (Figure 1). A 6" line weighs close to 100 lbs and can be carried by one adult man. A 4" fresh water supply line can be awkward to carry because it flexes and bends. Occasionally, a fresh water supply main line needs to be measured and cut to size.



Figure 1

An 8" main line hub weighs 225 lbs. This is carried and dropped into place with an excavator / machine. LiWs however are required to maneuver / position the hub into place.

The following tasks from Job 1 are physically repetitive:

3. Preparing the 'pit/trench' to ensure it is at the correct depth
4. Measuring, cutting and preparing the main line to fit the length of the 'pit/trench'
5. Carrying, dropping, and maneuvering the new main line in the 'pit/trench'
6. Securing the new line in the 'pit/trench' with clamps and fasteners

Job 2 – Prepping and Testing Fresh Water Supply Lines

LiW are also required to prep and test supply lines to all residential/commercial users and the City's fire hydrants. Only LiWs who have the appropriate training can complete step 4. Essential duties of job 2 include:

1. Preparing the work site
2. Excavating the area around the fire extinguisher, junction box or water meter (Figure 2)
3. Installing a new water supply line under ground (asphalt/driveway/grass)
4. Chlorinating, testing and cleaning the new water supply lines
5. Disconnecting the old water supply line
6. Backfilling / covering the area around the fire extinguisher, junction box or water meter

In 4km section of main line piping, a team of LiW can typically install up to 192 supply lines to service residential/commercial users and/or fire hydrants.



Figure 2

A detailed description of each essential task follows in the next section.

Job 1 – Laying Fresh Water Supply Lines

1 - Preparing and Transporting

Labourer in Water (LiW) staff meet at the City Works Yard on Lynas Lane at the start of each work shift. Work tasks/schedules for the day are reviewed. Supplies and tools are loaded into City vehicles. LiWs drive to their designated work sites for the day.

2 - Preparing the Worksite

Labourer in Water (LiW) staff prepare the worksite. This may include the following:

- Diverting traffic and setting up traffic cones
- Transporting equipment
- Liaising with other City departments (Roads) or 3rd party providers

3 – Preparing the ‘Pit/Trench’

Working with a backhoe operator, a LiW will direct the operator with hand signals on the depth and direction of where the trench should be dug. Once the preliminary boundaries of the trench are unearthed, LiWs will enter the trench and manually inspect the depth, grade and width of the trench. Using hand shovels, a LiW will shovel dirt and soil to ensure that the edges of the trench are level. Dirt/soil is removed or added as required. A typical trench is narrow. The interior terrain of the trench can be wet and uneven (Figure 3).



Figure 3

4 – Measuring, Cutting and Preparing the Main Line

There are two key components in this process:

- i. Once the trench is prepared, the LiW will measure the appropriate length of piping for the trench (Figure 4). A tape measure and a grease pen are used. If required, the pipe will be cut with a portable handsaw (Figure 5). A portable sander is used to shape and finish the end of the pipe to ensure it fits into an adjacent section of piping (Figure 6).



Figure 4



Figure 5



Figure 6

- ii. Before the pipe is lowered into the trench, the LiW must attach any clamps and fasteners to the main line pipe (Figure 7). These clamps and fasteners are manually positioned into the appropriate place and secured with an adjustable wrench or a ratchet style wrench.



Figure 7

A LiW needs to exert approximately 90 lbs of push or pull force to secure the nut firmly (Figure 8). A portable drill is used to drill holes for the water supply lines within the trench (Figure 9).



Figure 8



Figure 9

5 – Carrying, Dropping and Manoeuvring the Main Line

Two LiWs are required to lift, carry and position the prepared main line into the trench. An 8" diameter of piping measuring 20 feet in length weighs close to 185 lbs (Figure 10). A third LiW can assist with the process by waiting within the trench to receive the pipe. Once the pipe is in the trench, two LiWs work in concert to lift and position the new section of piping into place. If required, LiWs may need to adjust the level of the pipe by adding or removing dirt/soil with a shovel.



Figure 10



6 – Securing the new line in the ‘pit/trench’ with clamps and fasteners

There are several steps in this process:

- i. Before the new line can be permanently secured, a LiW will need to apply an adhesive known as ‘soap’ to the opening of the new pipe and to the opening of the existing pipe. This adhesive is applied with a piece of cloth. The adhesive is identified within the red box and the red arrow points to where the ‘soap’ is applied (Figure 11).
- ii. To close the new section of pipe into an existing section of pipe, a LiW will use a rod as leverage and force both sections of piping together. This action requires the LiW to exert approximately 152 lbs of pull to secure both sections of piping together (Figure 12).



Figure 11



Figure 12

- iii. The new line is secured manually with a long bolt and a matching nut. A wrench and socket set are used to seal and close both sections of piping together (Figure 13).



Figure 13

- iv. Individual fresh water supply lines (black piping) to residential or commercial users are secured to the main fresh water pipe (blue pipe). The black supply line is cut to size and secured to a clamp on the main fresh water pipe. A wrench is used to manually secure both lines together. A LiW needs to exert approximately 90 lbs of push or pull force to secure the nut firmly (Figure 14).



Figure 14

7 – Applying bedding to the new main line

Once the main fresh water line is installed and secured, a LiW will prepare the closure of the trench. Water is sprayed into the trench to reduce the spread of dust. A LiW will give hand signals to the backhoe operator as to the amount and direction of dirt to unload (Figure 15).

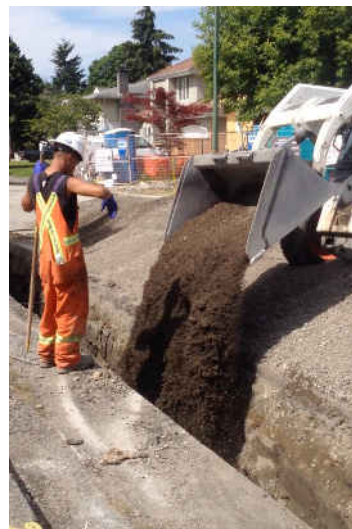


Figure 15

8 – Compacting the new main line and cleaning up

Once the trench is backfilled and covered, a LiW will use a compactor to compress and seal the trench (Figure 16). LiWs will clean up the surrounding environment by replacing their tools and sweeping up and discarding any debris (Figure 17). The appropriate City department, namely Roads or Concrete Finishers, will return the road to its original condition.



Figure 16



Figure 17

Job 2 – Prepping and Testing Fresh Water Supply Lines

1 - Preparing and Transporting

LiW staff meet at the City Works Yard on Lynas Lane at the start of each work shift. Work tasks/schedules for the day are reviewed. Supplies and tools are loaded into City vehicles. LiWs drive to their designated work sites for the day.

2 - Excavating the area around the fire extinguisher, junction box or water meter

A LiWs excavate the soil around a fire extinguisher, junction box or water meter to the appropriate depth. The 'pit' is covered with plywood till it is ready to be put into service.

3 - Installing a new water supply line under ground (asphalt/driveway/grass)

The LiW installs a fresh water supply line. This new supply line will be provide fresh water to an extinguisher, junction box or a residential/commercial water meter.

4 - Chlorinating, testing and cleaning the new water supply lines

LiWs or their leads with the appropriate chlorination certificates will test and check the new water supply lines. These lines are tested several times with litmus paper. Before these fresh water supply lines are finalized for use, they are flushed clean with a chemical mixture and compound ie) sodium sulfate

5 - Disconnecting the old water supply line

Once the residential/commercial fresh water supply lines are tested and secured, the old water supply lines, if appropriate, to the end user are disconnected permanently.

6 – Backfilling / covering the area around the fire extinguisher, junction box or water meter

The 'pit' is backfilled with dirt by a LiW. A compactor to compress and seal the 'pit' may be used. The 'pit' is contained by a lid / external container ie) concrete / green lid. LiWs will clean up the surrounding environment and return their tools to their trucks.

PHYSICAL DEMANDS OF WORK TASKS

The following guide/descriptors have been used to identify the frequency, and the load of the specific steps as outlined in the preceding pages (3-10) of this document.

Table ST1 - Physical Demand Characteristics Of Work (Dictionary of Occupational Titles - Volume II, Fourth Edition, Revised 1991)			
Physical Demand Level	OCCASIONAL	FREQUENT	CONSTANT
	0-33% of the workday	34-66% of the workday	67-100% of the workday
Sedentary	1 - 10 lbs.	Negligible	Negligible
Light	11 - 20 lbs.	1 - 10 lbs.	Negligible
Medium	21 - 50 lbs.	11 - 25 lbs.	1 - 10 lbs.
Heavy	51 - 100 lbs.	26 - 50 lbs.	11 - 20 lbs.
Very Heavy	Over 100 lbs.	Over 50 lbs.	Over 20 lbs.

Action	Weight / Force (Lb.)	Travel Distance	Frequency	Task Parameters (Essential/non-essential)
Lifting				
Floor to Waist	11-20 lbs	0-36 Inches	Frequent	Essential – screwdrivers, wrenches, measuring tape, shovel, sander. Steps 1-8. Figs 3-9, 11, 13, 14 & 17.
	21-50 lbs	0-36 Inches	Frequent	Essential – various sizes/lengths of piping, clamps and fasteners. Steps 1-8. Figs 3, 8, 10, & 15.
	51-100 lbs	0-36 Inches	Occasional	Essential – various sizes/lengths of piping, clamps and fasteners and force in lbs to secure clamps and fasteners. Steps 1-8. Figs 3, 8, 10, & 15.
	100+ lbs	0-36 Inches	Occasional	Essential – various sizes/lengths of piping and force in lbs to secure pipes, clamps and fasteners. Figs 8, 10, 12, 13, & 14.
Waist to Shoulder	11-20 lbs	0-36 Inches	Frequent	Essential – screwdrivers, wrenches, measuring tape, shovel, sander. Steps 1-8. Figs 3-9, 11, 13, 14 & 17.
	21-50 lbs	0-36 Inches	Frequent	Essential – various sizes/lengths of piping, clamps and fasteners. Steps 1-8. Figs 3, 8, 10, & 15.
	51-100 lbs	0-36 Inches	Occasional	Essential – various sizes/lengths of piping, clamps and fasteners and force in lbs to secure clamps and fasteners. Steps 1-8. Figs 3, 8, 10, & 15.
	100+ lbs	0-36 Inches	Occasional	Essential – various sizes/lengths of piping and force in lbs to secure pipes, clamps and fasteners. Figs 8, 10, 12, 13, & 14.
Shoulder to Overhead	11-20 lbs	0-36 Inches	Occasional	Non-essential – light demand.

Action	Weight / Force (Lb.)	Travel Distance	Frequency	Task Parameters (Essential/non-essential)
Carrying				
Bilateral Carrying	11-20 lbs	0-36 Inches	Occasional	Essential – shovels, saws, sledgehammer, drills, wrenches, grinder, portable sander, various sizes/lengths of pipes, clamps and fasteners. Steps 1-8. Figs 3-9, 11, 13, 14 & 17.
	21-50 lbs	0-36 Inches	Occasional	Essential – shoveling, various sizes/lengths of piping, clamps and fasteners. Steps 1-8. Figs 3, 7, & 15.
	51-100 lbs	0-36 Inches	Occasional	Essential – shoveling, various sizes/lengths of piping, clamps and fasteners. Steps 1-8. Figs 3, & 10.
	100+ lbs	0-36 inches	Occasional	Essential – various sizes/lengths of piping up to 160 lbs and clamps and fasteners up to 125 lbs. Steps 1-8. Figs 8-10.
Unilateral Carrying – Right / Left	11-20 lbs	0-36 Inches	Frequent	Essential – shovels, saws, sledgehammer, drills, wrenches, grinder, portable sander, various sizes/lengths of pipes, clamps and fasteners. Steps 1-8. Figs 3-9, 11, 13, 14 & 17.
	21-50 lbs	0-36 Inches	Occasional	Essential – various sizes/lengths of piping, clamps and fasteners, chainsaw, and crowbar. Steps 1-8. Figs 3, 8, 10, & 15.

Action	Weight / Force (Lb.)	Travel Distance	Frequency	Task Parameters (Essential/non-essential)
Push / Pull				
Static / Dynamic Pushing & Pulling	11-20 lbs	0-36 Inches	Frequent	Essential – push/pulling/lifting tools. Steps 4, 6 & 8. Figs 4, 6, 7, 11, 13, 14, & 16.
	21-50 lbs	0-36 Inches	Frequent	Essential – push/pulling/lifting tools. Steps 4, 6 & 8. Figs 4, 6, 7, 11, 13, 14, & 16.
	51-100 lbs	0-36 Inches	Occasional	Essential – static pull or push of 90 lbs of force with a wrench to fasten a nut/bolt. Step 4ii. Figs 8, 13 & 14.
	100+ lbs	0-36 Inches	Occasional	Essential – static pull of 152.5 lbs of force with a crowbar to align two sections of piping together. Step 6ii. Fig 12.

Action	Force Required	Frequency	Task Parameters (Essential/non-essential)
Gripping			
Right Hand & Left Hand	11-20 lbs	Constant	Essential – all hand tools, equipment, fasteners and clamps. Steps 1-8. Figs 3, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14 & 15.
	21-50 lbs	Frequent	Essential – all hand tools, equipment, fasteners and clamps. Steps 1-8. Figs 3, 8, 10, 12, 13, & 14.

Action	Force Required	Frequency	Task Parameters (Essential/non-essential)
Fine Finger Movement			
Right Hand & Left Hand	11-20 lbs	Frequent	Essential – manipulating all hand tool and equipment toggles and switches, and nuts/bolts on fasteners and clamps. Steps 1-8. Figs 4, 7 11, 13, 14, 16 & 17.

The table in the subsequent page highlights the frequency of the most common movement patterns performed by the City of Richmond's Labourers in Water (LiW).

The numeral in the "Task #" column refers to these tasks in Job 1 - Laying Fresh Water Supply Lines.

1. Preparing and transporting materials from the City Works Yard to the work site
2. Preparing the work site
3. Preparing the 'pit/trench' to ensure it is at the correct depth
4. Measuring, cutting and preparing the main line to fit the length of the 'pit/trench'
5. Carrying, dropping, and maneuvering the new main line in the 'pit/trench'
6. Securing the new line in the 'pit/trench' with clamps and fasteners
7. Applying bedding to the new main line
8. Compacting the new main line and cleaning up

The "Frequency" column is described as follows:

N = Not required, R = Rarely (<2%), O = Occasional (3-33%), F = Frequent (34-66%), C = Constant (67-100%)

PHYSICAL DEMAND	TASK #	FREQUENCY					DESCRIBE ACTIVITY Note distances, durations and surfaces	
		N	R	O	F	C		
MOBILITY								
Walking	1-8	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Walking ~ 70% of time - 125 metre area. Over paved and gravel/uneven terrain Standing ~ 90% of time. - Obtaining/operating tools, conversing with peers. - Over paved/uneven terrains (trench/pit). Sitting ~ 10% of time - Securing fasteners/clamps on pipes Driving ~ 5% of time - Operating city trucks between work sites and roving vehicles	
Standing	1-8	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
Sitting	4	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Crawl	-	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Driving (Forklift/Vehicle/Other)	1,2	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
POSTURE – Back								
Bending Forward	1-7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Forwards/Twisting ~ 67% of time - Shoveling soil/dirt - Securing fasteners/clamps to pipes - Lifting/carrying pipes, clamps, fasteners and tools - Obtaining tools	
Bending Backwards	1	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Twisting	1-8	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
POSTURE – Reaching								
Note forward and/or side reach distances								
Above Shoulder Level	1,2,3,5	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Both	Above ~ 20% - end range to obtain tools, shoveling. Chest to shoulder ~ 70% - obtain tools, shoveling Below chest ~ 70% - shoveling and/or cleaning soil/dirt - securing fasteners/clamps to pipes - drilling
Chest to Shoulder Level	1-8	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Both	
Below Chest Level	1-8	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Both	
Behind Body	1-8	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Both	
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
POSTURE – Elbow/Forearm/Wrist								
Elbow Flexion/Extension	1-8	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Both	Elbow / wrists ~ 75% - mid to end range for tasks. - shoveling - securing fasteners/clamps/nuts/bolts - tool use (wrench, drills) - applying adhesives 'soap'
Wrist Flexion/Extension	1-8	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Both	
Wrist Rotation	1-8	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Both	
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
POSTURE – Neck								
Forward Bending/Flexion	1-8	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Forwards ~ 90%	- neutral to end range - shoveling, securing nuts/bolts/fasteners - securing piping Twisting/ turning ~ 70% - checking the position of the pipes / fasteners
Backward Bending/Ext.	1-8	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Twisting/Turning/Tilting	1-8	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
POSTURE – Hip/Knee/Ankle/Foot								
Crouching/Squatting	1-8	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Crouch / Squat ~ 70%	- mid to end range for tasks - climbing in/out of the trench - positioning to secure nuts/bolts/clamps - applying 'soap' on piping - carrying supplies and pipes to the worksite / trench Climbing ~ 70% - climbing in/out of the trench
Kneeling	-	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Climbing (Stairs/Other)	3-6	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
Jumping	-	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Foot Pedal/Action	1, 2	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
N = Not required, R = Rarely (<2%), O = Occasional (3-33%), F = Frequent (34-66%), C = Constant (67-100%)								

ESSENTIAL – NON-PHYSICAL DEMANDS

Labourer in Waters (LiWs) is required to account for environmental variables. These variables (wind, warm or cool temperatures, and weather) can impact the rate and effectiveness of a LiWs work.

LiWs are also required to demonstrate their understanding of the following:

- Knowledge of the occupational hazards
- Knowledge of the safety precautions
- Converse, instruct, follow and direct work as required

These demands (environment, hazards, safety, administrative) require the following range of cognitive and sensory skills.

Attention/concentration

- Sustained - attending to the environment, traffic, power tools and heavy machinery
- Divided - conversing with crew, lying pipes, minding traffic and heavy machinery.
- Alternating - conversing with equipment operators, directing traffic, and other tasks

Memory

- Procedural - knowledge of methods, materials, tools, equipment and use of same
- Immediate and delayed visual - written directions, location of materials/piping, and tools
- Immediate and delayed auditory - verbal directions, conversations with crew/leader
- Prospective - project timelines, schedules, meeting times

Executive Functioning

- Initiation - beginning task/project
- Working memory - short term directions/changes, one off instructions
- Sequencing - identifying and/or following an order of activities/actions
- Problem solving - identifying and/or addressing unexpected issues
- Termination - completing a task/project

Sensory

- Vision - observation of the immediate environment and task at hand
- Hearing - attending to sounds within the environment
- Touch - to hold and manipulate tools/equipment

The table in the subsequent page summarizes the key environmental conditions that may influence and impact a LiWs ability to do their job.

ENVIRONMENTAL/PSYCHOSOCIAL FACTORS:

ENVIRONMENTAL & OTHER CONDITIONS	YES	NO	TASK DESCRIPTION
Inside Work Location		X	
Outside Work Location	X		
Electronic		X	
Mechanical	X		Various hand tools ranging in size. See page 6 – figures 4, 5, 6, 7 for examples.
Fumes, Gases or Odours	X		Various smells ranging from organics (soil, mud, water) to inorganics (burning plastic, chlorine, diesel, adhesives, exhaust smoke).
Dust	X		Soil/ground and plastics
Toxic Conditions		X	
Explosives		X	
Wet/Humid	X		Below and above grade level water
Noise	X		Traffic, immediate environment, and various tools
Vibration	X		From various tools such as handsaws, hand sanders and/or compressors.
Exposure to Changes in Temperature	X		Sun, rain, and wind while working above and below street level.
Confined and/or Awkward Spaces	X		Depends on task. See page 5 – figure 3 for examples.
Talking	X		Interacting with co-workers, public, managers.
Hearing	X		Interacting with co-workers, public, managers
Near Vision	X		Reading schedules/timelines and phones. Securing bolts/screws, and applying glues
Far Vision	X		Directing traffic. Driving City vehicles.
Depth Perception	X		Preparing, setting, and finishing piping.
Reading	X		Signage, materials handling, written directions/memos, or emails.
Writing		X	
Driving	X		City vehicles to and from worksites.
Operating Hand/Foot Controls	X		Driving City vehicles to and from worksites.
Travel	X		Driving City vehicles to and from worksites.
Deadline Pressures	X		At the direction of the foreman.
Work Alone	X		Specific tasks/steps while laying concrete.
Work in Group	X		Within crews to complete the tasks.