7.0 OPERATING PROCEDURES

The following Procedures should be used in conjunction with the advice and physical Instruction that was provided during numerous training sessions. During the first twelve months of operation it is a condition of Warranty that all Plant Operators have been trained by either Trisley's Hydraulic Services or by a member of Darwin City Waterfront Wave Pool Centre staff who are suitably qualified to operate the plant.

If future staff changes dictate that further training is required, this service is available from Trisley's or our local service agent on a commercial hourly rate basis. These procedures should also be read in full context with all other Instructions provided within the various Volumes that form part of this Manual.

7.1 Preparation for Plant Start-Up

This procedure should be used when there is a need to restart the plant after a pool shut down, or after there has been an interruption to the main power supply, etc., Each of the steps within this Procedure must be checked and witnessed by a second Operator, ie, the plant should never be started by just one person.

The preparatory procedures for plant start-up are:-

- All switches on the electrical control board must be switched to the OFF position
- All main isolating valves must be fully opened (ie; both flow & return lines) (N/O)
- All filter inlet valves to be open (N/O)
- All filter outlet valves to be open (N/O)
- All pump discharge valves to be closed (N/C)
- All filter diversion valves to be closed (N/C)
- All filter backwash valves to be closed (N/C)
- All ancillary valves for chemical dosing, feature pump & boost pumps etc., are closed

VALVE LABEL LEGEND

N/C – NORMALLY CLOSED
N/O – NORMALLY OPEN

7.2 Bringing the Pre-coat (UFF) Plant Back On-Line

Before bringing the pre-coat systems back on-line double check that all main isolating valves are truly open and that the position of the valves on the filters are set in “filter” mode. The procedures are:-

1. Start filter pump and slowly open pump discharge valve. Remember the “No Flow” Flow Switches are set for 20sec.
2. Check over system to ensure operating correctly
3. Bleed out any air through top air release if required
4. Repeat steps 1,2 & 3 for each filter until the plant has reached the desired flow rate
5. Open valves to sample cells for chemical dosing
6. Start up & open boost pumps and any other equipment offline

The pre-coat filter should now be operating and filter pressures will come up to the normal operating conditions. Monitor all pressure and vacuum gauges, during this procedure. Abort the procedure if any anomalies are detected and double check for possible problems such as wrong valve status etc. Do not proceed if there is an inherent fault or if the Operator is not totally comfortable with the conditions and or the operations. In the latter case, seek phone help!

7.3 Backwashing UFF Filters

The frequency of backwashing can be controlled by using three criteria;

Load related
The Pool Operator should backwash the filters when the filter pressure differential exceeds 50kpa on a regular basis. The operator should be re-generating every 2-3 days to extend the filter cycle but once the 50kpa differential recurs after say 2 days, the filters require backwashing.

This is the preferred method as it provides maximum efficiency for the filter media and uses the least amount of water.

Time related
The operator can carry out a backwash after say every three weeks. The timing should be reviewed if the filters are still performing well as this method will consume more waste water.

TDS related
As solid particles, contaminants & chlorine are added to the water, the TDS level will rise. It is industry practice to dump pool water if the TDS level in the pool rises 1500ppm over the incoming level of TDS in the mains water.

When the UFF filters become dirty, the pressure gauge found on the individual filters will indicate a pressure rise above the clean start-up pressure. The pressure rise for backwashing should never consistently exceed 50 kPa above the clean start-up pressure.

- Select the filter to be backwashed according to an approved timetable/schedule.

- Record the filter's operating pressure in the Log Book

- Check backwash tank indication light is ready ***(green light)***

- Shut down the pump on the filter to be backwashed. ***(Refer to specific procedures)***

- Set the filter valves to the backwash position.

Filter Inlet	CLOSED
Filter Outlet	CLOSED
Diversion	OPEN
Backwash	OPEN
Isolation	OPEN ***(Wading Pool Only)***

- Turn on the filter's recirculation pump & open the pump discharge valve. The filter is now backwashing. The backwash cycle should take approximately 2 minute. Backwash until wastewater in backwash sight glass becomes clear or for at least 2 minute.

- Isolate pump discharge valve & turn pump off

- The waste wash water is discharged to the main backwash tank.

- The backwash procedure has now been completed. Set the filter valves as per **7.4 Lower Backwash Procedure *(Rinse Cycle)***

7.4 Lower Backwash Procedure (UFF Filters)

After the backwash procedure is complete, the filter should be rinsed to flush any spent DE powder out of the tank. This is called a lower backwash. The procedure is as follows;

- Select the filter for a lower backwash
- Ensure the recirculation pump is shut off
- Set the filter valves to the lower backwash position

Filter Inlet	OPEN
Filter Outlet	CLOSED
Diversion	CLOSED
Backwash	OPEN
Isolation	OPEN ***(Wading Pool Only)***

- Turn on the recirculation pump & open pump discharge valve. The filter is now rinsing. The rinsing cycle should take approximately 1 minute. Rinse until wastewater in backwash sight glass becomes clear or for at least 1 minute.

The solid waste will be sent through to the backwash tank. The backwash water will now sit in the tank allowing the DE to separate from the water before the sump pump activates and empties the tank through the DE Separation Tank.

- Isolate pump discharge valve & turn pump off
- Press the De Separation Pump start button on the wall, ensure valves are open *(pump is on a 24hr delay start timer)*
- The rinse procedure has now been completed. Set the filter valves as per **7.5 Vacuum Feed System for Precoating UFF Filters**

7.5 Use of the Vacuum Feed system for Pre-coating UFF Filters

After the lower backwash procedure is complete, the filter should now be backwashed & rinsed with all spent DE powder out of the tank. This filter is now ready for the Vacuum Feeding of the DE call Pre-coating.

The procedure is as follows;

- Ensure the recirculation pump is shut off

- Set the filter valves for the draining prior to the Pre coating

Diversion	CLOSED
Filter Inlet	CLOSED
Filter Outlet	CLOSED
Backwash	OPEN
Filter Air Release	OPEN
Drain Line	OPEN

- Let filter completely drain out through Drain Line located on Backwash Line at rear of Filter 5.

- When the filter is completely empty,

Diversion	CLOSED
Filter Inlet	CLOSED
Filter Outlet	CLOSED
Backwash	CLOSED
Filter Air Release	CLOSED
Drain Line	CLOSED

- Open the Filter media box and cut open the inner plastic bags.

Note: Each filter requires 33kgs of filter media.

- Connect Vacuum Hose to De Feed Valve

OPEN

Vacuum suction Valve *(Yellow Pipework)*
DE Feed Valve *(Cam-lock Fitting)*

- Open and check Vacuum Filter Cannister, clean out & dry any water from inside prior to operating. Close drain valve on DE Vacuum line.

- Start up the blower and vacuum the filter media from the bag/s.

NOTE - To operate blower behind wading pool pump/filter, you will need to isolate & turn off as an electrical interlock does not allow it to operate if this pump/filter is running

- When all the filter media has been educted into the filter

- Clean-up any mess, vacuum the floor using the clear hose if necessary.

- Turn off vacuum/s at switches

CLOSE

Vacuum suction Valve *(Yellow Pipework)*
DE Feed Valve *(Cam-lock Fitting)*

- Remove Vacuum Hose from De Feed Valve

- Open drain valve on DE Vacuum Line

The pre-coating process is now complete and you can start up the filter as per normal procedures.

The replacement of the filter media, after each and every backwash, is a condition of warranty. Failure to replace filter media after backwashing will damage the filter candles and result in expensive and unnecessary service.

It is important to use the prescribed quantity of filter media. Adding more than the required amount will only shorten the filter cycle. Adding less filter media will cause long term damage to the filter's internal elements. When handling dry powdery media's, the operator is required to wear an approved dust mask.

Note and record the filter's new pressure gauge reading in the Log Book.

7.6 Emergency Shut Down

In an emergency situation, disregard all protocol and turn off the main switch on the ECB.

Although the need for an emergency shutdown is unlikely, possible reasons could include a major malfunction with plant and or equipment, plant room flooding, etc., An emergency shut down as a harsh procedure and it should not be undertaken without due need.

7.7 Cleaning Pre-Pump Strainers

Under normal operating conditions, the vacuum gauge reading on the pre-pump strainers should be somewhere between 0 to - 25 kPa. Readings will vary depending upon the amount of debris collected within the strainer. As debris is collected in the strainers the vacuum pressure will rise. Any vacuum reading above - 25kPa should be immediately investigated. Rather than rely on vacuum gauge readings, all pre-pump strainers should be cleaned on a weekly basis.

Whilst it is not essential to manually shut down the related plant *(eg:- Chemical Dosing Plant, etc)* the Operator should physically and routinely check that this does occur when the re-circulating pumps are shut down. This check will confirm that the flow switches and the various plant interlocks are fully operational. The pre-pump cleaning procedure is as follows:-

- Close the pump discharge valve. Once the valve(s) have been closed, switch off the pump at the remote stop/start switch ***(located beside each pump).*** An electrical interlock in the ECB will automatically switch off all ancillary equipment if you turn off ***all*** pumps. Ensure all ancillary equipment has turned off in this situation.

- Close actuator Pump Suction Valve by hand by adjusting the switch from automatic to manual and then turning the wheel till closed.

- Open the air release on the strainer lid.

- Open the drain valve located under the strainer.

- Undo the strainer's toggle bolts; remove the lid; lift out and clean the basket of any debris. Note even small amounts of debris can detract from pump performance. The size and area of this basket has been designed for minimum pressure drop. Do not expect the basket to be full of debris. This should never be allowed to happen!

- Make sure that the Lid ‘O’ ring seal is completely clean, replace the basket, refit the strainer’s lid and secure the toggle bolts. Make sure that the lid is properly seated and fastened down. Do not over-tighten or force the toggle bolts. If a problem is encountered, check, clean, and or replace the o ring seal.

- The installation is of a “flooded suction” design, which should keep the strainers full of water. If the strainers drain out, this will mean that the suction line is either blocked or there is insufficient water in the balance tank. A service is recommended if this happens. The recirculation pumps need to be primed for the pumps to work properly.

- Open actuator Pump Suction Valve by moving the switch from manual to automatic, the valve will automatically reopen.

- Bleed air out through air release valve, close when air is removed from strainer.

- When convinced that the pre-pump strainer has been primed, start the recirculation pump and gradually open the pump discharge valve to the notch plate setting that establishes normal full flow. Progressively start other pumps in the same fashion. Ancillary equipment within this circuit will be brought on line automatically. Carefully monitor all gauge readings throughout this step and check for any anomalies.

- Check all ancillary equipment has restarted.

7.8 Placing the Precoat (UFF) Filters in Normal Filtration Mode.

The UFF filter systems have a series of valves fitted that enable the filters to be placed in either a filter, backwash or rinse mode. Valve markings are as follows;

FILTER INLET	Allows water to enter through the bottom of the filter to commence the filtering process.
FILTER OUTLET	Once water has been filtered it leaves the filter via this valve.
FILTER DIVERSION	This valve is used to direct water for either filtering, backwashing or rinsing.
BACKWASH	Used to allow water to escape to the backwash holding tank in either backwash or rinse mode.

NOTE
After performing a backwash, open the filter inlet & outlet valves on the filter to allow water to enter prior to starting the pump back up. Water will start to fill the filter, utilize the air releases on the side and top of the filters to bleed any excess air. Once you have enough water in the filter you can restart the pump ***(as per 7.2Bringing the Pre-coat (UFF) Plant Back On-Line)***

7.9 Cleaning the DE Separation Bag Filter

The solid waste from the backwash water will now sit in the tank allowing the DE to separate from the water before the sump pump activates and empties the tank through the DE Separation Tank.

Most of the DE will remain in the Backwash Tank and will require to be pumped out on a regularly basis ***(at least annually)*****.** The removal and disposal of spent DE will need to be performed by an accredited qualified waste removal company.

Once the pump has emptied the water from the backwash tank you will need to empty the De Separation bag of any excess DE.

- Ensure pump is turned off
- Close all isolation valves on system
- Open the air release on the separation tank lid.
- Undo the separation tank's toggle bolts; remove the lid; lift out and clean the bag of DE. Dispose of any excess DE from bag.
- Replace the bag and re-secure the lid with the toggle bolts.
- Close the air release on the separation tank lid.
- Open all isolation valves on system

The system is now ready for the next backwash cycle.

7.10 Salt Chlorination – Acid Cleaning Procedure

7.10.1 Overview

Depending on the water hardness, salt quality and duty cycle of the machines it is expected that acid cleaning will be required once every 2 - 6 months ***(Wading Pool machine)*** and once every 7 – 21 days ***(Wave Pool machine).***

Make up a solution of 5 % Hydrochloric Acid in the acid cleaning tank by adding concentrated HCl **(30 – 35 %)** to water in the ratio 1 part acid to 5 parts water. i.e. add 10L HCl **(30 – 35 %)** to 50L water. Always carefully add acid to water and make sure all relevant safety procedures are followed.

Note:
This procedure must be carried out with care in a well ventilated area. Read and observe the relevant Material Safety Datasheet ***(MSDS)*** and always wear Hydrochloric Acid resistant protective clothing, gloves, a face shield and mask. Observe all relevant OH & S procedures.

Note:
Before acid cleaning ensure acid cleaning tank is at 200L mark.

Note:
The electrolyser cells must never be energized when acid cleaning is in progress or when any acid is present in the cells.

Note:
Never leave 5 % Hydrochloric Acid in contact with the cells for any more than 30 minutes or permanent damage to the electrodes may occur.

7.10.2 Acid Cleaning Procedure – Wading Pool Salt Chlorinator

1. Make sure acid cleaning tank is at 200L mark
2. Turn off power to cells on wading pool chlorinator control board
3. Turn off power to cells on wave pool chlorinator control board
4. Turn off wading pool chlorine boost pump on main pool ECB
5. Turn off wading pool salt chlorinator on main pool ECB
6. Turn off wave pool chlorine boost pump on main pool ECB
7. Turn off wave pool salt chlorinator on main pool ECB
8. Slowly close control valves V1 and then V2
9. Fit drain assembly to drain line
10. Drain the cells by opening drain valve V3 and then vent valve V4 to allow the water to drain from the system
11. Once the cells have drained close drain valve V3 and then vent valve V4
12. Open acid inlet valveV5 and acid return valve V6
13. Turn on acid cleaning pump switch ***(located adjacent to acid cleaning pump)***
14. Activate acid cleaning pump by pressing the green "on" button on acid cleaning pump control box
15. Allow the acid to circulate for 10 – 20 minutes during which time all calcium and magnesium deposits should dissolve. **Note:** Return to the acid cleaning tank to check that acid is returning to the tank
16. Turn off acid cleaning pump by pressing the red "off" button on the acid cleaning pump control box
17. Turn off acid cleaning pump switch ***(located adjacent to acid cleaning pump)***
18. Close acid line valves V5 and V6
19. Slowly open valve V2 and then V1
20. Turn on wading pool chlorine boost pump on main pool ECB and wait for 2 minutes to allow acid to flush through the system
21. Turn on wading pool salt chlorinator on main pool ECB
22. Turn on wave pool chlorine boost pump on main pool ECB
23. Turn on wave pool salt chlorinator on main pool ECB
24. Turn on power to cells on wading pool chlorinator control board
25. Turn on power to cells on wave pool chlorinator control board
26. Log Acid Cell Cleaning onto your Daily Log Sheet

Note:
Wading Pool cells have now been acid washed. Both Wading Pool Salt Chlorinator and Wave Pool Salt Chlorinator are back on line

7.10.3 Acid Cleaning Procedure – Wave Pool Salt Chlorinator

1. Make sure acid cleaning tank is at 200L mark
2. Turn off power to cells on wave pool chlorinator control board
3. Turn off power to cells on wading pool chlorinator control board
4. Turn off wave pool chlorine boost pump on main pool ECB
5. Turn off wave pool salt chlorinator on main pool ECB
6. Turn off wading pool chlorine boost pump on main pool ECB
7. Turn off wading pool salt chlorinator on main pool ECB
8. Slowly close control valves V1 and then V2
9. Fit drain assembly to drain line
10. Drain the cells by opening drain valves V7, V8, V9, V3 and then vent valve V4 to allow the water to drain from the system
11. Once the cells have drained close drain valve V7, V8,V3 and then vent valve V4 leaving V9 open
12. Open acid inlet valves V5, V12 and acid return valve V6
13. Turn on acid cleaning pump switch ***(located adjacent to acid cleaning pump)***
14. Activate acid cleaning pump by pressing the green "on" button on acid cleaning pump control box
15. Allow the acid to circulate for 10 – 20 minutes during which time all calcium and magnesium deposits should dissolve. **Note:** Return to the acid cleaning tank to check that acid is returning to the tank
16. Turn off acid cleaning pump by pressing the red "off" button on the acid cleaning pump control box
17. Turn off acid cleaning pump switch ***(located adjacent to acid cleaning pump)***
18. Close acid line valves V5, V12, V9 and V6
19. Slowly open valve V2 and then V1
20. Turn on wave pool chlorine boost pump on main pool ECB and wait for 5 minutes to allow acid to flush through the system
21. Turn on wave pool salt chlorinator on main pool ECB
22. Turn on wading pool chlorine boost pump on main pool ECB
23. Turn on wading pool salt chlorinator on main pool ECB
24. Turn on power to cells on wave pool chlorinator control board
25. Turn on power to cells on wading pool chlorinator control board
26. Log Acid Cell Cleaning onto your Daily Log Sheet

Note:
Wave Pool cells have now been acid washed. Both Wave Pool Salt Chlorinator and Wading Pool Salt Chlorinator are back on line

7.11 Preparation of Water Balance Chemicals

As further detailed in Section 9:-

8Kgs of Sodium Bicarbonate for every 100m3 of pool water will raise the TA by 50ppm
1.5Kgs of Calcium Chloride for every 100m3 of pool water will raise hardness by 10ppm

7.12 OPERATOR DUTIES

The following checks should be carried out daily apart from the normal water chemistry tests carried out through the day. This is a condensed version of Operators Duties. A more detailed explanation can be found in section 2.3.6 of the operating manual.

Apart from filter backwashing and some aspects in maintaining the water treatment plant the following requirements form part of the normal day to day requirements:-

(a) Vacuum clean pools
(b) Testing of Pool Water as per Northern Territory Health Department regulations
(c) Check water temperature and adjust temperature controls as deemed necessary
(d) Check display of Indicator Lights on all Control Boards
(e) Check contents of all Solution Containers
(f) Monitor all vacuum and pressure gauge readings
(g) Monitor Cl2 and pH readouts and compare to physical testing
(h) Check stock of chemical supply
(i) Check strainer baskets by gauge readings
(j) Conduct a visual and audible check of all items of plant and equipment
(k) When doing a filter backwash check the effectiveness of the pump-out system
(l) Check and clean gutter screens, as required.