

Water Use, Evaporation and Carryout in Professional Car Washes

By Chris Brown | CHRIS BROWN CONSULTING



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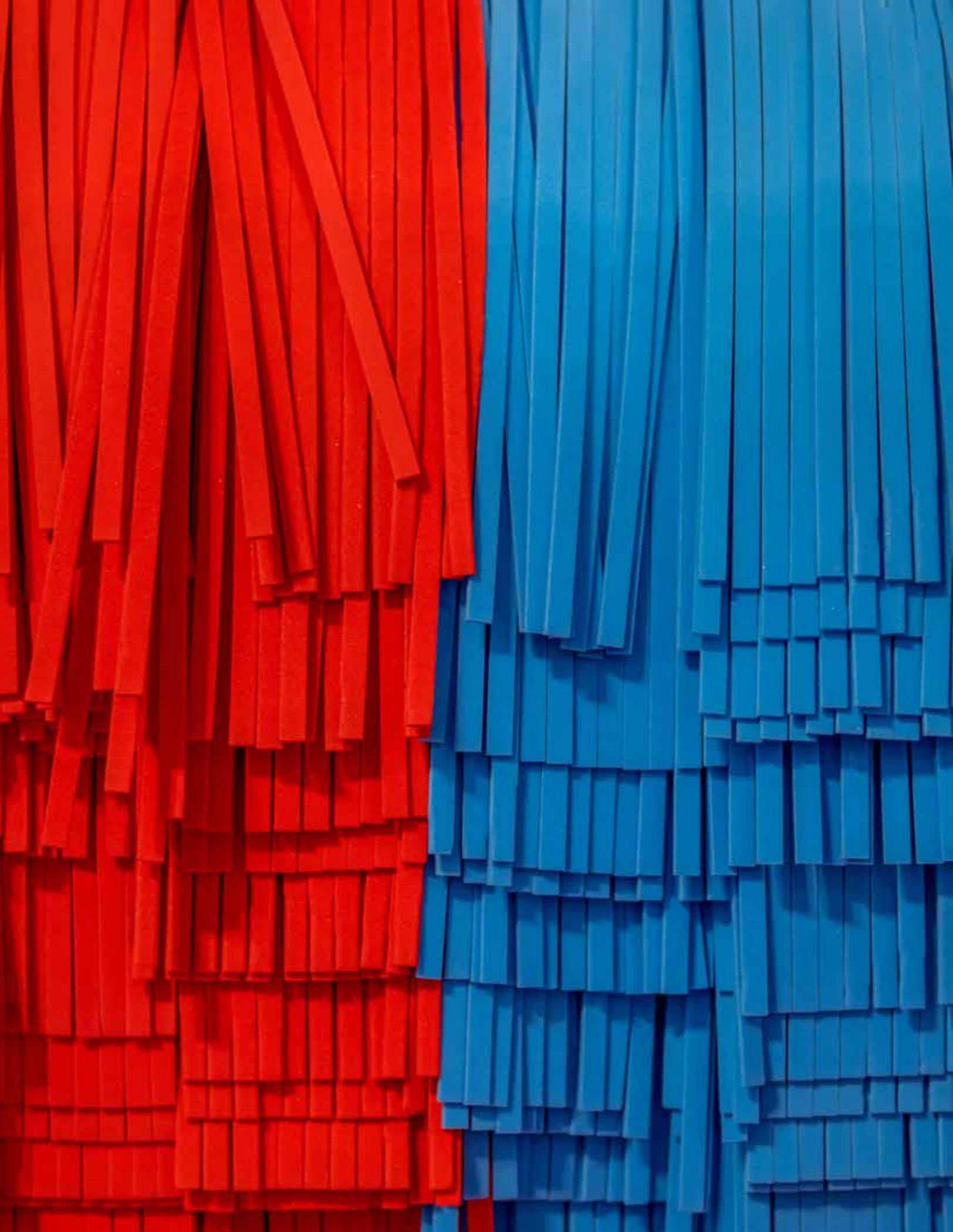


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INTRODUCTION

This study was performed on behalf of the International Carwash Association (ICA) for the purpose of providing a current look at water use, evaporation and carryout, and the use of reclaim water in professional vehicle washes. A study conducted in 2002 by the ICA¹ was the first field study done on professional car washes and has not yet been repeated. Since that time, car wash technology has changed, with several improvements to improve water efficiency. These improvements help provide financial benefits to the car wash owner/operator, assist in meeting regulatory requirements and allow the industry to improve its environmental profile. Specific requirements to meet limits in water consumption have also helped drive the use of reclaim systems in car washes, as well as a state law in California requiring the use of reclaim in car washes constructed after 2013.²

The data was collected at a dozen commercial car wash facilities in located in Northern California during the period of May 1 to November 1, 2017. Water use was monitored for a minimum of one week at each of six conveyor and six in-bay facilities. The results of the research at conveyor sites showed freshwater use at 30 gallons per vehicle, which could be used by operators as a benchmark for evaluating their overall efficiency. The In-Bay automatics were more variable due largely to onsite differences in operations, but there was a clear trend towards lower water use per vehicle for those which used reclaim water in more cycles within the wash.

The report is organized into an Executive Summary, a chapter each on Conveyor Car Washes and In-Bay Automatic Car Washes, recommendations, and appendices for the benefit of the ICA and its constituents. The two chapters on conveyors and in-bay automatics are intended for public use at the sole discretion of the ICA.

The facility management at each location was provided a report on their individual site results.

¹ Water Use in the Professional Car Wash, International Carwash Association, Brown, C.,2002

² AB-2230 Recycled Water: Car Washes, <https://leginfo.legislature.ca.gov>, California, 2012

EXECUTIVE SUMMARY

The purpose of the study was to take a snapshot of water use, evaporation and carryout (E&C) in two types of common car wash models, conveyors and in-bay automatics, fifteen years after the original ICA study. The study focused on calculating the amount and percentage of E&C to determine the amount of fresh water used that is discharged to the sewer. Reclaim water use was measured to determine the amount used per vehicle. Car wash freshwater use on average was expected to be lower than the previous study, where new equipment has been installed. This hypothesis was based on improved efficiency of new car wash systems, especially in in-bay automatic facilities, and the growth in the use of reclaim water systems in both the conveyor and in-bay models.

Over the years since the 2002 car wash water use study was published, a number of car wash operators have used it to show that not all potable water used in the wash process returns to the sanitary sewer for treatment to reduce their sewer bill. It is ICA's hope that the information in this report can be useful in demonstrating that a material amount of fresh water is not returned to sanitary sewers.

Since 2002, the use of reclaim systems in car washes has expanded, and the success of companies selling package reclaim systems, which are installed as a unit with all necessary filters and pumps, has resulted in the presumption that reclaim percentages have risen and are more consistent across the industry. It was evident in the original study that the reclaim systems being used at that time included a number of unique configurations built on-site at the facility, which contributed to the variation in the reclaim percentages observed.

Fresh water use averaged 30.0 +/-6.3 GPV at the conveyor washes in the study, and 44.8 +/- 15.7 GPV at the in-bay automatics.

Reclaim systems were installed at all the sites included in this study. The average amount of reclaim water used in conveyors ranged from 1.9 to 4.9 gallons of reclaim per gallon of freshwater. The range in in-bay automatics was found between .06 to .63 gallons of reclaim per gallon of freshwater.

Evaporation and carryout was measured at an average of:

- 6.3 GPV or 21.4 percent, at the conveyor washes in the study, and
- 8.7 GPV or 20.6 percent, at the in-bay automatics.

Water Use, Evaporation and Carryout

Conveyor Car Washes

The amounts found for E&C at Conveyor washes in this study are similar to the values (5.6 GPV) found in the 2002 study; while those at in-bay automatics were lower than the earlier study (13.2 GPV). In both cases the values measured in 2017 fell within the ranges of E&C found at the sites in 2002. Water Use, Evaporation and Carryout in Conveyor Car Washes

INTRODUCTION

This study was carried out on behalf of the International Carwash Association during the summer of 2017. Six conveyor car washes located in northern California volunteered the use of their facilities for the collection of data. At each facility potable water use and wastewater discharges were monitored and measured by use of meters. The use of reclaim water was evaluated based on the plumbing and timing of individual fixtures within each wash. On average the freshwater use was 30 gallons per vehicle and the evaporation and carryout was 6.3 gallons. In other words, 21 percent of fresh water used was not returned to the sanitary sewer system.

Conveyor car washes refer to professional vehicle washes in which the car is pulled underneath a series of arches with sprays or soft wash cloth materials that remove dirt from the vehicle. They are also sometimes called tunnels.

Previous studies have shown that washes with the cloth fixtures, known as mitters, brushes or curtains, use less water than those that only have sprays. All of the six washes in this study had soft cloth fixtures as illustrated in Table C1. The washes studied were also exterior-only washes where the customer sits in the vehicle with the transmission in neutral while it is pulled through the tunnel. The individual facilities are designated by the letters CA to CF for the purpose of this report.

The use of reclaim systems by the car washes reduced the overall use of freshwater. The number of nozzles, water pressure, and timing were considered in estimating reclaim versus freshwater flow. For every gallon of freshwater applied, 2.9 GPV of reclaim water was used on average. This means that only 26 percent of the water used in during each car wash was, on average, fresh. Ratios are presented in this study as a means of demonstrating the range of gallons saved by use of reclaim.

METHODOLOGY

To begin each study a Doppler meter was inserted in the final discharge pipe from the car wash separation tank to the sanitary sewer system. The facilities' basic water uses in addition to the car wash were identified and accounted for so that only water going to the car wash was counted (e.g. rest rooms or irrigation). Metered water supply from the local municipal utility was tracked and compared to the discharge from the car wash.

Evaporation and Carryout was calculated by averaging the total freshwater purchased per vehicle versus the wastewater discharged per vehicle during the study period.

Reclaim values were determined by accounting for the number and type of water uses supplied by freshwater, reclaim water, and spot-free water. Spot-free reject discharge was also accounted for as a part of the reclaim stream, since all of the sites put the reject water into use within the wash to replace freshwater. Values are presented in ratios of gallons of reclaim to freshwater, as both are a separate inputs into the wash.

DISCUSSION

Freshwater use in the conveyor car washes studied was limited to the applications which require foams or additives for the finish of the car, or as the supply for the final rinse. In most cases deionization equipment or reverse osmosis is used for a spot-free rinse and foam applications. In this study, all of the sites had reverse osmosis equipment except one, site CB. Most of the water used in the wash for wetting of the vehicle, high pressure passes, initial rinses, and washing of the vehicle from the doors down is reclaim water, although it is important to note that each car wash facility has unique plumbing configurations and specific choices in the type and quantity of filtration dictate the final use of reclaim in each wash.

The following is a general list of processes found in a conveyor car wash. The specific wash may have slightly different configurations, but the list below is generally adequate for describing the steps that are found.

Water Using Steps In A Professional Conveyor Car Wash Process		
Pre-soak	An automated nozzle or hand held spray.	It was present in all of the washes in this study. It is not found in all car washes.
Wash	High-pressure spray or cloth material with detergent solution.	According to industry reports, almost all conveyors now use cloth features.
Rocker panel/undercarriage	Cloth material or high pressure sprays on sides and bottom of vehicle.	In a conveyor these may be operated on independent arms or carriages that spray upward from below or beside the vehicle. All sites used reclaim water.
First Rinse	Typically a high-pressure water rinse	Can use reclaim or freshwater. Not spot-free.
Wax/Sealers/Polishes	An optional surface finish is sprayed on the vehicle.	Typically freshwater, although in some cases, spot-free reject water, or highly treated reclaim water will be used.
Final Rinse	Low-pressure rinse	Spot-free rinse with fresh or membrane-filtered/deionized water.

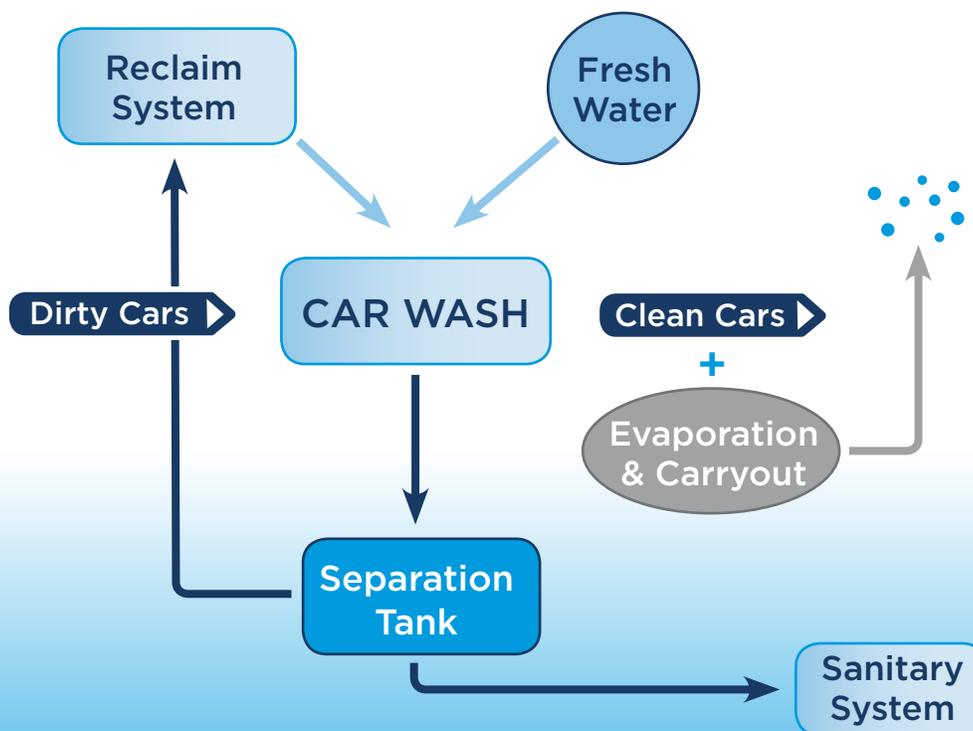
Most of the facilities used Reverse Osmosis (RO) to produce spot-free water to use in the final rinse cycle. The water is referred to as Spot-free water because dissolved (TDS) and suspended (TSS) minerals which could have left spots on the clean vehicle finishes, have been removed¹. In some cases, the water was pretreated with water softeners or deionization. This softened water was used in some of the wash solutions as well. Facility CB did not use an RO system to treat the freshwater for the final rinse as the TDS of its municipal source water was already low.

Reject water from the reverse osmosis systems was not wasted, but directed into the reclaim tanks where it could be used in the stages of the wash as part of the reclaim water. The tank where water flows from the wash trench for clarification and initial pumping to the reclaim system is referred to as the separation tank. In facility CA, the RO reject water was directed to a number of different pump tanks which fed the cleaning applications. As a result of replacing freshwater for use in these applications, this facility had the highest amount of reclaim per vehicle washed.

All of the sites used similar separation tank designs, common to commercial car washes, and pumped water from a partition in the separation tank which was located after the settling of grits and solids, and below the level at which oil would float. Separation of oil and grit is accomplished through the position of baffle walls and or pipes between tank sections which slow the water down and allow only water from which the grit has settled, and oil has floated above the flow path, to move forward to where it is pumped for reclaim. Excess water in this system is discharged to the sanitary sewer system.

¹ Total dissolved solids (TDS), and total suspended solids (TSS) are the formal terms for measuring the solids which are carried in water. See the glossary for full definitions.

Figure C 1 Water Uses in a Professional Car Wash



EVAPORATION AND CARRYOUT

In a professional car wash the consumptive use of water is referred to as Evaporation and Carryout (E&C). This includes water which evaporates, is blown out of the wash as a mist, or is carried out on the surface of the car. This amount of water is not directly measurable, but must be estimated based upon values which can be measured. The calculation for determining Evaporation and Carryout is water input - water outflow + change in storage. In this study the change in storage was not considered relevant because the R/O storage tanks included sensors to ensure they were topped up at the end of each day, and the separation tanks from which reclaim water is pulled and effluent is discharged were all full at the beginning and end of the study period.

The Evaporation and Carryout values from the six washes studied are reported in Table C1.

Table C1			
Freshwater Use, Evaporation and Carryout in Conveyor Car Washes (California, 2017)			
Car Wash	Freshwater GPV	GPV E & C	Percent E&C
CA	27.4	6.1	22.2
CB	23.3	5.7	24.5
CC	31.1	5.0	16.0
CD	23.7	6.1	25.9
CE	37.9	6.3	16.6
CF	36.5	8.5	23.3
Average	30.0	6.3	21.4
StDev	6.3	1.2	4.15

These values fall within the range reported in the 2002 ICA Study, Water Use and Wastewater in the Professional Car Wash. The average fresh water use per vehicle is lower than that found in the Orlando and Phoenix area samples, but 3.3 GPV higher than that found in the Boston area washes. The difference is well within the standard deviation of the California sample, except for the Phoenix sample which was higher. The one way this group does appear to be different is a slightly higher average E&C as measured by percentage. Again, as with the freshwater use, and the E&C in GPV, the variation in the sample overlaps the findings in the earlier study. The earlier study, in comparing the three regions, found no significant statistical separation based upon climate.

These results reinforce the conclusion that Evaporation and Carryout is driven primarily by the structure of the conveyor wash, both by the length of tunnel, and number of blowers at the end of the tunnel blowing water back into the tunnel trench area where it can be reclaimed.

Table C2			
Conveyor Car Wash Values (2002 ICA Study)			
	Freshwater GPV	GPV E & C	Percent E&C
Orlando	34.3	5.2	15.1
Boston Area	26.7	4.3	16.1
Phoenix	43.8	7.3	16.7

RECLAIM AND CONSERVATION

All of the conveyor car washes in this sample used reclaim systems to reuse water in the wash, reducing their demand for freshwater. The principle advantage of using reclaim in a conveyor car wash is conservation of freshwater resources. If not for the reclaim system, all wash cycles would be supplied by freshwater, and the gallons per vehicle would be much higher.

The washes in the sample all used some sort of basket filter to remove larger suspended particles. Additional filtration was used to remove smaller sized suspended solids. After going through the reclaim system, reclaim water was pumped to a pump tanks or tanks within the wash depending upon the internal plumbing and the uses of reclaimed water within the wash. The washes in this sample all used manifolds to distribute fresh and reclaim water from their source to multiple uses in the wash. These may run simultaneously when multiple cars are entrained. Due to the proximity of each water feature, and the length of a vehicle, the front will trigger the start of one process while its rear is still being washed under the previous process. In this study we found that reclaim gallons per vehicle represented a range of 1.9 to 4.9 gallons of reclaimed water for every gallon of fresh water. Ratios are presented as a means of demonstrating the range of gallons saved by use of reclaim.

As a result of this configuration, once they've been used in the wash, reclaim and freshwater are practically inseparable within the conveyor wash and drain to the same trench. Thus some reclaim water may be circulated repeatedly through the wash before being discharged, or carried out of the wash. Also, some freshwater in the final rinse is almost certainly part of the evaporation and carryout on each vehicle.

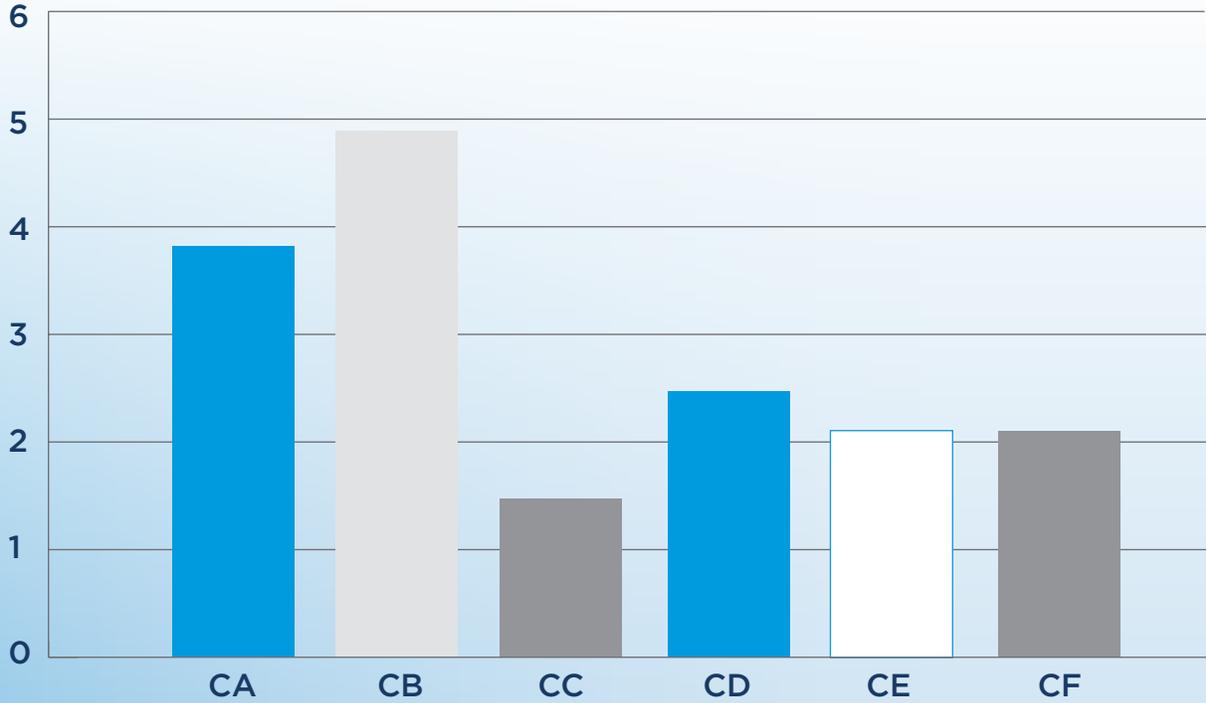
Figure 1 above illustrates the water use and flows in a car wash. From the figure it will be noted that the waste water which flows to the local wastewater treatment plant is from the same tank that the reclaim water is pulled from, and to which freshwater, already used at least once in the wash, also drains. There is no practical way to separate the fresh from the reclaim water once it has drained to the trench. Since reclaim water ends up back in the same tank it came from, any particular molecule could be repeatedly reused.

As a result, this study measures and reports the reclaim water as the number of gallons per gallon of freshwater used per vehicle. This avoids the confusion caused by different methods of calculating percentage as a reclaim versus freshwater, or reclaim as a percentage of all water used.

E&C are calculated as a percentage of the freshwater used in the wash. When reclaim is presented as percentage, it is as fraction of the total of both reclaim and freshwater applied per wash. This explains why percentages do not add up to 100 percent.



Reclaim to Freshwater Ratios (Gals/Gals) for Six Conveyor Car Washes



This sample had significantly higher amounts of reclaim per vehicle washed than the 2002 Study. Less than one half of the sites evaluated in 2002 used Reclaim water. Of those that did, the average value was about one gallon of reclaim used for every gallon of freshwater used.



IMPLEMENTING RECLAIM IN THE PROFESSIONAL CAR WASH

To successfully use reclaim water in a car wash, the owner needs to ensure that the reclaim system provides customer satisfaction, economic benefits and protects the environment.

A car wash reclaim system needs to meet the following goals of:

- Reliability
- Water quality
- Water savings
- Lower sewer bills
- Maintenance time and costs
- Meeting environmental goals



A key consideration in areas which have had, or are anticipating, droughts is reducing the potential for business interruptions due to water rationing.

The first thing to consider in choosing the correct type of reclaim system for a car wash is the amount of water and number of wash applications that the operator intends to use reclaim water to replace freshwater.

Limitations on reclaim are based on the filtration and water treatment equipment or the plumbing in the facility. All reclaim systems require regular maintenance, and are equipped with freshwater bypass valves. Some bypass valves are designed for automatic activation to protect the reclaim pumps from pressure transients, or to assist in maintenance. If the valve is left open it will reduce the amount of reclaim water.

The smaller the particles which are removed by filtration, the more wash applications in which reclaim can be used. Filters which remove all particles above 5 microns are considered sufficient for use in all applications except the spot-free rinse. If a filter allows particles greater than 25 microns to pass, the system operator will likely choose to use it only on passes from the wheels down in order to reduce the risk of impact on vehicle finishes.

Different filter types are used in car wash reclaim systems. These include cyclonic filters, to remove particles by weight, and bag, basket or sand filters to remove floating or suspended particles. They may be used in sequence in order to reduce maintenance time and costs, by using multiple filter types to remove the larger particles first.

In addition to removing sediment, the operator will need some form of odor control due to organics which are entrained in the car wash process. Odor control can be achieved by chemical additives or by aerating the water. Aeration techniques include recirculating the reclaim water, air sparging, and the use of ozone.

REJECT WATER FROM REVERSE OSMOSIS

In addition to reusing water after it has been through the wash cycle, there is an opportunity save water from the spot-free rinse process. If a facility is equipped with a reverse osmosis unit to produce spot-free water, some amount of water will be rejected.

There are several opportunities for reusing this reject water in a car wash. It can be directed to:

- the separation tank along with the reclaim water, and reused in reclaim cycles;
- the landscape to replace municipal water, as long as the plants are not sensitive to salts; or
- the pump tanks in the wash for cycles which are prior to the spot-free rinse, including wash applications which use solutions as long as the chemistry is tested and is compatible.

Reusing reject water instead of directing it to the sanitary sewer means less potable water is purchased and used in the wash.

CONCLUSION - CONVEYORS

Despite the length and large number of water using processes in a typical conveyor car wash, freshwater use per vehicle is relatively low. This is due both to the speed of the conveyor, and the use of Reclaim or RO reject recovery. At the facilities evaluated in this study vehicles were in and out of the wash process in less than two minutes, and most nozzles switched on and off in about 20 seconds. Most of the sprays, whether freshwater or reclaim, were low pressure applications, since all the washes used soft cloth friction as part of the cleaning process and many of the nozzles were used to wet the mitters or curtains. As noted above, the majority of the water used in this sample was reclaim water.

Evaporation and carryout was in the same range as earlier study, but represented a higher than average percentage of freshwater inputs because the average water use per vehicle was lower. This suggests that car wash operators seeking credit on their sanitary sewer rate charges for water which does not flow to the sanitary sewer may wish to report such flows in gallons per vehicle rather than as a percentage. This study found E&C at Conveyors, on average to be 6.3 GPV. This would require sharing the number of vehicles washed per billing period with the local water treatment utility.



Water Use, Evaporation and Carryout

In-Bay Car Washes

This study was carried out on behalf of the International Carwash Association during the summer of 2017. Six in-bay automatic car washes volunteered the use of their professional facilities for the collection of data. At each facility, potable water use and wastewater discharges were monitored and measured by use of meters. The use of reclaim water was evaluated based upon the plumbing and timing of individual fixtures within each wash. On average the freshwater use was 44.8 gallons per vehicle and the evaporation and carryout was 8.7 gallons per vehicle. In other words, 21 percent of fresh water used was not returned to the sanitary sewer system.

The use of reclaim systems by the car washes reduces the overall use of freshwater. All of the in-bay automatic car washes evaluated in this study had reclaim systems. In four of the facilities, reclaim was used only in the undercarriage cycle. In the other two locations, reclaim water was used for the high pressure cycle as well.

At each facility spot-free water was used for the final rinse cycle, and a reverse osmosis system was used to remove dissolved and suspended minerals which could have left spots on the clean vehicle finishes. Spot-free water was produced by the use of Reverse Osmosis (RO), and in some cases, pretreated with water softeners. Reject water from the reverse osmosis systems was not wasted, but directed into the reclaim pits where it could be used in the stages of the wash as part of the reclaim water.

METHODOLOGY

To begin each site evaluation a Doppler meter was inserted in the final discharge pipe from the car wash separation tank to the sanitary sewer system. The facilities' basic water uses in addition to the car wash were identified and accounted for so that only water going to the car wash was counted. Metered water supply from the local municipal utility was tracked and compared to the discharge from the car wash.

Evaporation and Carryout was calculated by averaging the total freshwater purchased per vehicle versus the wastewater discharged per vehicle during the study period.

Reclaim values were determined by accounting for the number and type of water uses supplied by freshwater, reclaim water, and spot-free water. Spot-free reject discharge was also accounted for as a part of the reclaim stream, since all of the sites put the reject water into use within the wash to replace freshwater. Values are presented in ratios of gallons of reclaim to freshwater, as both are separate inputs into the wash.

Evaporation and Carryout was calculated by averaging the total freshwater purchased per vehicle versus the wastewater discharged per vehicle during the study period.

Reclaim values were determined by accounting for the number and type of water uses supplied by freshwater, reclaim water, and spot-free water. Spot-free reject discharge was also accounted for as a part of the reclaim stream, since all of the sites put the reject water into use within the wash to replace freshwater. Values are presented in ratios of gallons of reclaim to freshwater, as both are a separate inputs into the wash.

DISCUSSION

The driver pulls into the bay and parks the vehicle, which remains stationary while a machine moves back and forth over the vehicle to clean it. Professional in-bay car washes fall into two general categories, friction and touchless, but have different specific features based upon manufacturer and model. Friction washes use soft cloth or similar material which spins on vertical axes to wash the sides of the vehicles, and on a horizontal axis to wash the top, hood, and rear of the vehicle. Touchless equipment uses spray nozzles to perform all aspects of the wash. Each cycle uses either fresh, reclaim or spot-free water, and may use different cleaning solutions or finish products.

Car Wash Elements In-Bay Automatics		
Pre-soak	Initial low pressure pass.	Contains solutions to help lift dirt off vehicle surface.
Wash	High-pressure pass in the touchless washes— or—cloth brushes, which are watered with low pressure sprays.	May use reclaim water.
Hub Scrub	A circular brush which removes dirt and shines the hubcaps and tires—or—a high pressure spray.	When equipment is present.
First Rinse	Typically low pressure.	To remove solutions still on the vehicle surface.
Clear Coat	Low pressure spray.	Contains solutions to protect the vehicle finish.
Final Rinse	Low pressure. Spot-free water.	Treated to remove small suspended solids which can leave spots as the vehicle dries.

Water used in the wash drained into separation tanks through a perforated manhole cover located beneath the vehicle. The separation tanks were designed such that oil and floating debris was caught in one section of the tank, and grit and heavier particles sank to the tank floor prior to the Reclaim intake pipe. Each of the sites had at least four access points. The final manhole cover was located at the end of a series of manhole access to the separation tanks and contained the discharge pipe to the sanitary sewer. All of the sites in this study had four inch diameter discharge pipes. In two of the sites the discharge point was under the driveway leading to the wash bay, and in the rest it was located within the wash bay floor.

EVAPORATION AND CARRYOUT

In a professional car wash the consumptive use of water is referred to as Evaporation and Carryout. This includes water which evaporates, is blown out of the wash as a mist, or is carried out on the surface of the car. This amount of water is not directly measurable, but must be estimated based upon values which can be measured. The calculation for determining Evaporation and Carryout is water input - water outflow + change in storage. In this study the change in storage was not considered relevant because the R/O storage tanks included sensors to ensure they were topped up during the day, every day; and the separation tanks from which reclaim water is pulled and effluent is discharged were all full at the beginning and end of the study period.

The Evaporation and Carryout values from the six washes studied are reported in Table I-1.

Table I-1			
Freshwater Use, Evaporation and Carryout (California, 2017)			
Car Wash	Freshwater GPV	GPV E & C	Percent E&C
IA	45.3	9.8	21.7
IB	50.1	10	20.6
IC	26.8	7.1	26.4
ID	29.9	7.8	26.1
IE	70.5	11	15.6
IF	46.2	6.0	13
Average	44.8	8.7	20.6
StDev	15.7	1.99	5.4

These values fall within the range reported in the 2002 ICA Study, Water Use and Wastewater in the Professional Car Wash. The average fresh water use per vehicle is at the low end of the range of values (7.3 to 23.8 gallons per vehicle) found in the previous study. As a percent of freshwater used per vehicle, the California sample is lower than the other three regions. Again, as with the freshwater use, and the E&C in GPV, the variation in the sample overlaps the findings in the earlier study, which found greater variation by site. The earlier study, in comparing the three regions, found no significant statistical separation based upon climate.

These results reinforce the conclusion that Evaporation and Carryout is driven primarily by the structure of the in-bay wash. Shorter than a conveyor wash tunnel, there is a higher likelihood that water will blow outside the tunnel as mist, especially on high pressure passes and the undercarriage pass that is located at the entrance to the wash. All but one of these washes used touch-less systems in which high pressure sprays make up the major part of water used in the wash. That facility, F, had the lowest Evaporation and Carryout consumption at 6 GPV.

Table I-2
In-Bay Automatic Car Wash Values (2002 ICA Study)

	Freshwater GPV	GPV E & C	Percent E&C
Orlando	24.6	7.3	29.8
Boston Area	40.0	11.4	28.6
Phoenix	72.5	23.8	32.8

RECLAIM AND CONSERVATION

All of the in-bay car washes in this sample used reclaim systems to reuse water in the wash, reducing their demand for freshwater. All of the sites used similar separation tank designs, common to commercial car washes, and pumped water from the separation tank from a separate partition after the initial settling of grits and solids, and after the water had passed under a baffle or through a pipe designed to leave oil floating on the surface in an earlier section of the tank. Reclaim water was pumped from the separation tank and filtered prior to reuse within the wash as part of the undercarriage wash. The reclaim systems in all the facilities in the sample used a basket filter and cyclonic separators to remove larger suspended particles. Some included air spargers and others had ozone treatment for odor control.

Water which did not evaporate, get blown out of the bay as mist, or was not carried out on the surface of the vehicle, drained to the same separation tank, whether it was already reclaim water or freshwater. Once used, reclaim and freshwater are inseparable within the in-bay wash and drain to the same pit. Thus, some reclaim water may be circulated repeatedly through the wash before being discharged or carried out of the wash. Also, some freshwater in the final rinse is almost certainly part of the evaporation and carryout on each vehicle. This being acknowledged, the principle advantage of using reclaim in an in-bay car wash is conservation of freshwater resources. If not for the reclaim system, all wash cycles would be supplied by freshwater and the gallons per vehicle would be much higher.

E&C are calculated as a percentage of the freshwater used in the wash. When reclaim is presented as percentage, it is as fraction of the total of both reclaim and freshwater applied per wash. This explains why percentages do not add up to 100 percent.

IMPLEMENTING RECLAIM IN THE PROFESSIONAL CAR WASH

To successfully use reclaim water in a car wash, the owner needs to ensure that the reclaim system provides customer satisfaction, economic benefits and protects the environment.

A car wash reclaim system needs to meet an owner's goals for

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- Water quality
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The first thing to consider in choosing the correct type of reclaim system for a car wash is the amount of water and number of wash applications that the operator intends to use reclaim water to replace freshwater.

Limitations on reclaim are based on the filtration and water treatment equipment or the plumbing in the facility. All reclaim systems require regular maintenance, and are equipped with freshwater bypass valves. Some bypass valves are designed for automatic activation to protect the reclaim pumps from pressure transients, or to assist in maintenance. If the valve is left open it will reduce the amount of reclaim water.

The smaller the particles which are removed by filters, the more wash cycles in which reclaim can be used. Filters which remove all particles above 5 microns are considered sufficient for use in all cycles except the spot-free rinse. If a filter allows particles greater than 25 microns to pass, the system operator will likely choose to use it only on passes from the wheels down in order to reduce the risk of impact on vehicle finishes.

Different filter types are used in car wash reclaim systems. These include cyclonic filters, to remove particles by weight, and bag, basket or sand filters to remove smaller particles. They may be used in sequence in order to reduce maintenance time and costs, by using multiple filter types to remove the larger particles first.

In addition to removing sediment, the operator will need some form of odor control due to organics which are entrained in the car wash process. Odor control can be achieved by chemical additives or by aerating the water. Aeration techniques include recirculating the reclaim water, air sparging, and the use of ozone.

REJECT WATER FROM REVERSE OSMOSIS

In addition to reusing water after it has been through the wash cycle, there is an opportunity save water in the Spot-free rinse process. If a facility is equipped with a reverse osmosis unit to produce spot-free water, some amount of water will be rejected.

There are several opportunities for reusing this reject water in a car wash. It can be directed to:

- the separation tank along with the reclaim water, and reused in reclaim cycles;
- the landscape to replace municipal water, as long as the plants are not sensitive to salts; or
- the pump tanks in the wash for cycles which are prior to the spot-free rinse, including wash cycles which use solutions as long as the chemistry is tested and is compatible.

Reusing reject water instead of directing it to the sanitary sewer means less potable water is purchased and used in the wash.

In this study we found that reclaim gallons per vehicle on average represented a range of less than 1.9 to 17.7 gallons of freshwater per gallon of reclaim. Ratios are presented as a means of demonstrating the range of gallons saved by use of reclaim. Previous studies and most literature presents reclaim as a percentage of water used, without explanation of how the percentage is calculated. This has created some confusion as to whether the percent reclaim and the percent evaporation and carryout are calculated as fractions of the same whole, or if the units are different.



Figure I-1 Water Flows in the In-Bay Wash

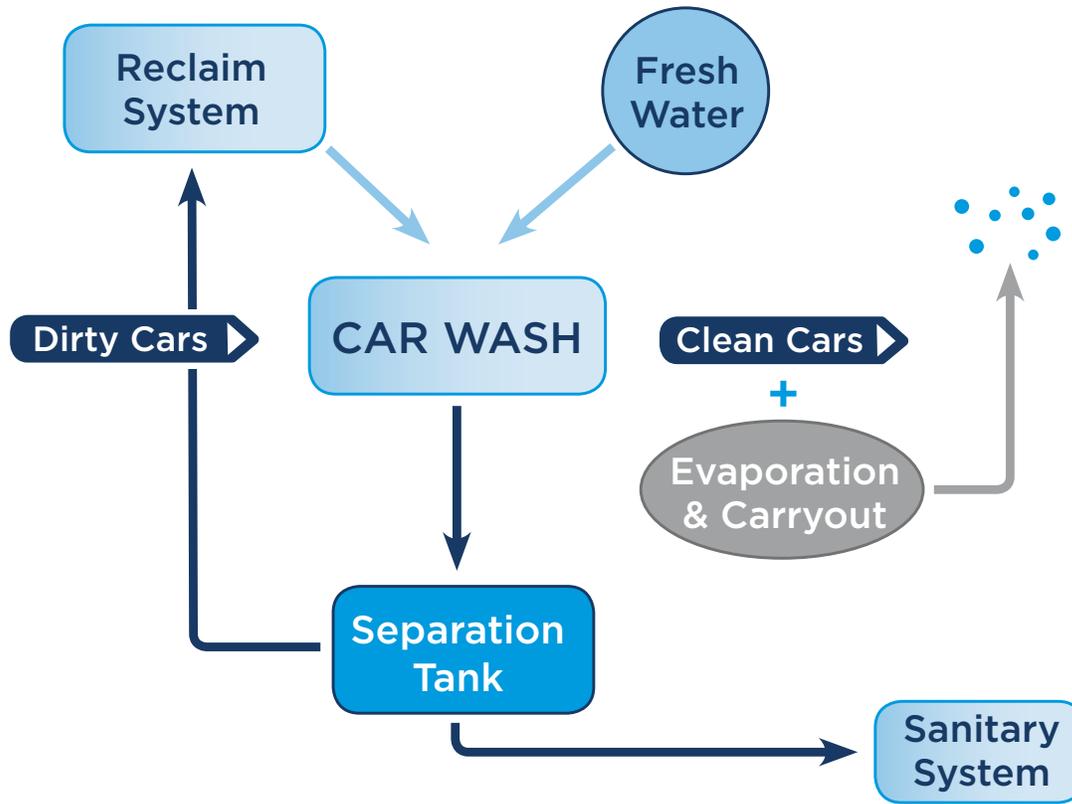
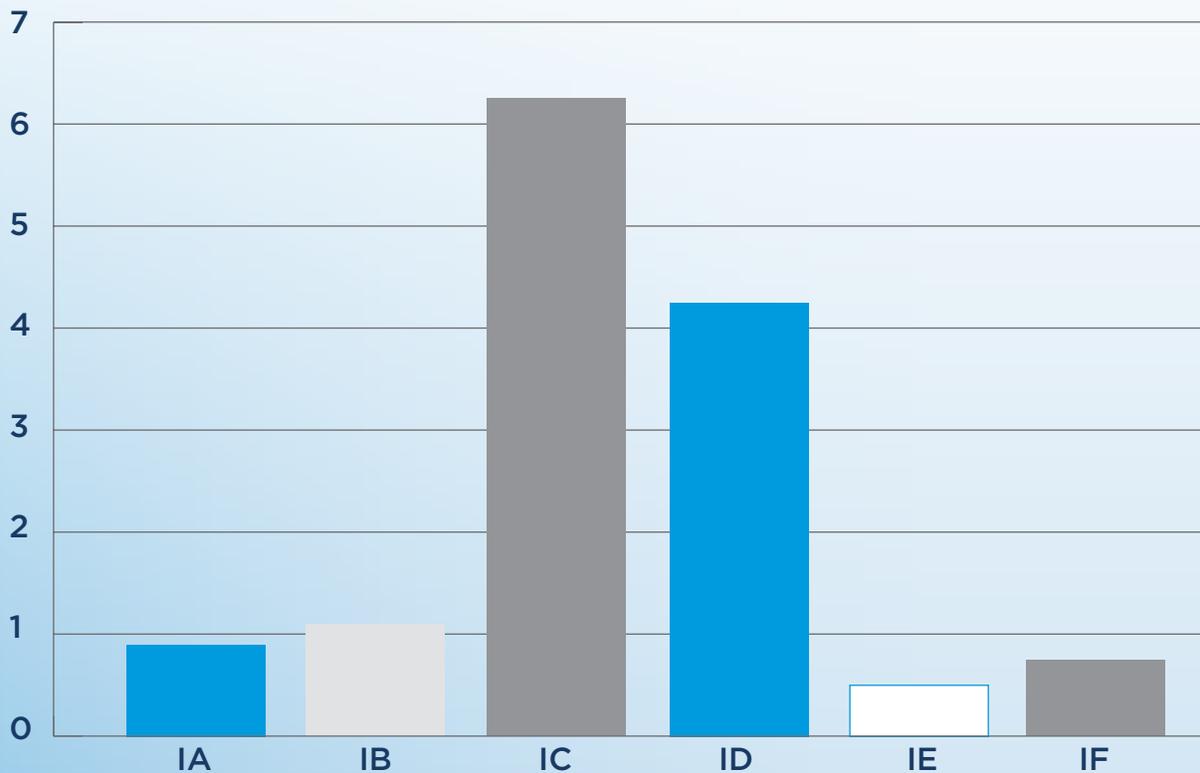


Figure 1 above illustrates the water use and flows in a car wash. From the figure it will be noted that the waste water which flows to the local wastewater treatment plant is from the same tank that the reclaim water is pulled from, and which freshwater, already used at least once in the wash also drains. There is no practical way to separate the fresh from the reclaim water once it has drained to the trench. Since reclaim water ends up back in the same tank it came from, any particular molecule could be repeatedly reused.

As a result, this study measures and reports the reclaim water as the number of gallons per gallon of freshwater used per vehicle. This avoids the confusion caused by different methods of calculating percentage as a reclaim versus freshwater, or reclaim as a percentage of all water used.

All of the in-bay car washes in this study had reclaim system. However, as can be seen from Chart 1 below there was a large amount of variation in the amount of reclaim used. In two washes, C & D, the reclaim was being used in the initial High Pressure pass as well as the undercarriage pass. On the others, reclaim was only used in the Undercarriage cycle. Since undercarriage was only included in the top wash package at these facilities, not all vehicles were washed with reclaim water.

Reclaim to Freshwater Ratios (Gals/Gals) for Six In-Bay Car Washes



California, 2017

CONCLUSION - IN-BAYS

This study showed that Evaporation and Carryout account for about 1 in 5 of every gallon of freshwater used in an In-Bay wash. This could represent significant savings in a sewer bill in areas where sewer billing is based upon gallons of freshwater purchased, and 100 percent of the freshwater is applied to the sewer bill. Evaporation and Carryout represents a consumptive use of the water in a business. Some sanitary sewer districts do apply a deduction based upon consumptive uses of water in a business. This suggests that car wash operators seeking credit on their sanitary sewer rate charges for water which does not flow to the sanitary sewer may wish to report such flows in gallons per vehicle rather than as a percentage. This would require sharing the number of vehicles wash per billing period with the local water treatment utility.

When used in more than just the undercarriage wash cycle, Reclaim water represented a much greater proportion of overall water use. In the two washes which did use reclaim in the high pressure pass, the total freshwater uses was below 30 GPV, as compared to an average of 44.8 GPV for the entire sample.

General Discussion and Conclusions

This section looks at comparative data between the two types of car washes studied: conveyor and in-bays. It also looks at current data in comparison with the data reported in 2002 in the ICA's *Water Use in the Professional Car Wash* study.

WATER USE

Freshwater use values in this study showed that conveyors are using a few gallons per vehicle less than those found in the 2002 study. The average use per vehicle was 30.0 gpv in 2017 as compared to 34.0 in 2002. The In-Bay automatics in this sample used 44.8 gpv on average versus 42.9 gpv in the 2002 study. Neither of these values was significantly different than the earlier study, falling well within the standard deviation of the sample studied.

WATER USE IN CONVEYORS

In this study, all of the conveyor sites used friction apparatus to wash the vehicles. Although the specific configurations were different, the use of friction is predicted to use less water per vehicle and this was the case. That being said, the water use per vehicle was not significantly different, as the average values in 2017 fell within the variation of water use observed in 2002.

All of the sites in 2017 used reclaim, as compared to five of eight sites studied in Boston and Orlando area. Reclaim water made up more than 50 percent of all the water applied in the California based conveyors, while three of the previously studied sites had wash packages in which less than 50% of water applied was reclaimed. This most certainly contributed to the lower freshwater use per vehicle at conveyors measured in the current study

WATER USE IN IN-BAYS

In this study, four of the In-Bay sites only used reclaim on the undercarriage rinse. The other two used reclaim on the initial high pressure pass as well as the undercarriage. This reinforces the importance of reclaim in conserving freshwater. The two sites (IC and ID) which used reclaim water in the high pressure cycle used less than 26.8 gpv and 29.9 gpv respectively, as compared to the overall average of 44.8 gpv freshwater for all In-Bay sites.

In the 2002 study, six of twelve sites used reclaim, and the average freshwater water use was lower than the current sample. Two explanations for this include: first, the fact that half the earlier sites used reclaim representing more than 50 percent of water used in the wash; and second, that both studies had high coefficients of variation, so that either value, 42.9 gpv or 44.8 gpv, falls within the 95% confidence estimate of the true mean.

EVAPORATION AND CARRYOUT

Many sanitary sewer providers charge for service based upon the volume of water which passes through the freshwater meter. This is because the possibility of entrained solids in the effluent makes metering the actual sewage flow difficult if not impossible in the long term due to the fouling or blocking of mechanical meters, and the expense of flow meters which use electronic or magnetic resonance to measure flow. Because much of the water use in municipal service areas does not return to the sewer, there are different policies which reduce the amount charged. These are typically implemented to allow for outdoor water use in residential or recreational situations, or to account for the use of water in industrial or commercial uses where water is used in a process, and is not discharged to the sewer. The evaporation and carryout losses associated with professional car washes fall into this latter category.

Not all sanitary sewer providers provide discounts. But among those that do, anecdotal evidence indicates that the acceptance of Evaporation and Carryout losses as a reasonable deduction from sanitary sewer rate charges has been inconsistent.

A noticeable difference between in-bay automatics and conveyor washes in this study was the amount of evaporation and carryout per vehicle with average evaporation and carryout of 8.7 GPV for in-Bays as compared to 6.3 GPV E&C for conveyors.

This difference most likely has to do with three factors:

- The area of the trench versus the manhole which recovers water. The trench in the center of a conveyor runs for almost the entire length of the wash, from 90' to 150' in this sample, and is about 3' wide, as compared to the perforated manhole in the in-bays which was open area of a circle of about 24" in diameter.
- The fact that low pressure cycles in the conveyor are typically at the beginning and end of the wash, with less water being aerosolized. In In-Bays, the wash equipment moves the entire length of the car, and more mist from the high pressure cycles can be felt exiting the bay. We made no effort to measure the water in a mist phase.
- All of the conveyors evaluated had more blow dryers at the end of the wash as compared to the in-bays which have less area in which to install them. While more blowers could create greater amount of mist, in all cases they were oriented to blow water back into the tunnel where it could drain to the separation tanks.



RECLAIM

The use of reclaim in commercial car washing has also been recognized for its water quality benefits. Dirty cars have a mix of oil, grit, and metals, which could make their way into local surface water if washed into the gutter or a driveway which drains to the street. Programs and policies encouraging or requiring customers to intercept and treat used car wash water before it drains to the storm sewer results in more people using commercial car washes and less pollution in the environment. Toronto Water and the San Antonio Water System both have regulations and education programs to motivate people to use commercial car washes for these benefits.¹

Reclaim water systems, with filters, pumps, and pump tanks, take up significant space in an equipment room. All of the conveyor washes in this sample had plenty of room for their reclaim equipment, with space left over. In the in-bay automatics studied, the use of a reclaim system that was designed as small package plant, with all the pieces in a cabinet, was used in all the sites, but necessary in four of the six sites in this study, because there was no equipment room. All of the reclaim and reverse osmosis equipment at these sites was along the side of the interior wall of the bay, out of the way of the moving parts of the wash gantry. The two sites which used the reclaim water in the high pressure wash cycle, had their reclaim and reverse osmosis equipment in the bay

Literature about reclaim has recognized that historically some in-bay automatic operators installed reclaim equipment but did not use it.² Some skepticism about the use of reclaim in in-bay automatics was expressed by at least one of the interviewees. The reasons for this almost certainly vary, but one clear difference between in-bay automatic operations and conveyor operations is the presence of staff throughout the operating hours of the wash. All repairs or maintenance of equipment at the in-bay sites needed to be performed when maintenance personnel were available, which could mean a delay of hours or possibly to the following day, depending upon when an equipment outage occurred.

Both of the factors, space for equipment, limiting the type and numbers of filters, and availability of staff on site to address maintenance issues with the reclaim system certainly contribute to the higher amount of reclaim water used in conveyor car washes.

CONCLUSIONS

The most notable results from this study compared to the earlier work was the smaller amount of variation in the average fresh water use per vehicle in conveyors. The equipment was different at the sites, some of which used high pressure spray guns to wash the tires and undercarriages, and others which only used low pressure sprays throughout. The two factors that contributed to the overall consistency were the use of friction in all washes and the use of reclaim for more than 50 percent of all water delivered in the wash.

Otherwise, the research reaffirmed earlier research which showed that reclaim systems do save water. The in-bays, on average use higher amount of freshwater per vehicle than conveyors, despite the intuitive sense that with far more fixtures, the tunnel would use more. This is driven both by the speed of the conveyor belt and the use of reclaim.

Evaporation and Carryout represent a consumptive use of about 20 percent of the freshwater used in the professional car wash. For areas in which sanitary sewer prices are dictated by return flow to the sewer, this could result in significant savings for some operators.

¹ Toronto Water: www.toronto.ca/services-payments/water-environment/water-sewer-related-permits-and-bylaws/sewers-by-law/washing-cars-outdoors-surfaces/; San Antonio Water System: <http://www.saws.org/conservation/commercial/carwash/>

² Borchard, C., Water Reclamation and Regulation, Auto Laundry News, 2014



Facility Descriptions

This appendix includes summary descriptions of each individual facility that was studied for this report. It includes a basic description of water using features, and where and how much reclaim and RO water use and reject water, when applicable. Each facility is identified by an acronym which designates the site and type of wash. E.g., Conveyor site A, is designated CA; while in-bay automatic site C, is designated IC.

CA

The facility has one 90 foot long conveyor car wash tunnel. The facility is open 12 hours a day in the summer months and 10 hours a day in the winter months, 7 days a week. Required maintenance is performed by facility staff.

The car wash is categorized as an exterior conveyor. It is equipped with a number of spray arches and brushes, curtains, or mitters. Arches and cloth features are activated based upon the vehicle passing a sensor and most run for about 20 seconds on average. The undercarriage sprays are located within the wash tunnel and operate when the vehicle passes over them.

The car wash utilizes a wash water reclaim system and a reverse osmosis system to produce spot-free rinse water. Reject water from the reverse osmosis system is directed to a number of pump tanks in the wash equipment room and then used in various processes prior to the final rinse. Reclaim and spot-free reject water make up the majority of the wash water applied to the vehicles.

Over the course of the study the average freshwater use per vehicle was 27.4 gallons. The wash used 3.8 gallons of reclaim water for every 1 gallon of freshwater. Evaporation and carryout was measured at an average of 6.1 gallons per vehicle.

CB

The facility has one 115 foot long conveyor car wash tunnel. The facility is open 11 hours a day, 7 days a week. Required maintenance is performed by facility staff.

The car Wash is categorized as an exterior conveyor. It is equipped with a number of spray arches and brushes, curtains, or mitters. Each vehicle is pulled by a conveyor through the wash tunnel, under the various arches and cloth features, while the driver sits inside with the transmission in neutral. Multiple vehicles can be entrained on the conveyor at any one time.

Arches and cloth features are activated based upon vehicle activating a sensor and most run for about 20 seconds on average. The undercarriage sprays are located within the wash tunnel and operate when the vehicle passes over them.

The car wash utilizes a wash water reclaim system. Due to the low TDS freshwater supply, freshwater is used in the final rinse. Reclaim water makes up the majority of the wash water applied to the vehicles. Over the course of the study 2,327 vehicles were washed. The average freshwater use per vehicle was 23.3 gallons. At the CB facility a filtration system is used to produce high quality reclaim which is used for the majority of wash applications. This wash facility uses 4.9 gallons of Reclaim water for every 1 gallon of freshwater. Evaporation and carryout was calculated at an average of 5.7 gallons per vehicle.

CC

The facility has one 100 foot long conveyor car wash tunnel. The facility is open 12 hours a day, Monday through Saturday, and 11 hours on Sundays.

The car wash is categorized as an exterior conveyor. It is equipped with a number of spray arches and brushes, curtains, and/or mitters. Each vehicle is pulled by a conveyor through the wash tunnel, under the various arches and cloth features, while the driver sits inside with the transmission in neutral.

Arches and cloth features are activated based upon vehicle passing a sensor and most run for about 20 seconds on average. The undercarriage sprays are located within the wash tunnel and operate when the vehicle passes over them. Each vehicle takes less than two minutes to wash, from initial arch to final rinse.

The car wash utilizes a wash water reclaim system and a reverse osmosis system to produce spot-free rinse water. Reject water from the reverse osmosis system is directed to the separation tanks where it is available for reclaim. Reclaim water makes up the majority of the wash water applied to the vehicles.

Over the course of the study the average freshwater use per vehicle was 31.1 gallons.

At this facility a filtration system is used to produce high quality reclaim water from the separation tank. This reclaim water is used for the initial arch, and all parts of the vehicle from the doors down including the undercarriage. This wash facility uses 1.4 gallons of reclaim water for every 1 gallon of freshwater. At this facility, evaporation and carryout was measured at 17,243 gallons during the study. This is an average of 5.0 gallons per vehicle.

CD

The facility has one 100 foot long conveyor car wash tunnel. The facility is open 12 hours a day, Monday through Saturday, and 11 hours on Sundays.

The car wash is categorized as an exterior conveyor. It is equipped with a number of spray arches and brushes, curtains, or mitters. Arches and cloth features are activated based upon the timing of the vehicle passing under them and most run for about 20 seconds on average. The undercarriage sprays are located within the wash tunnel and operate when the vehicle passes over them. Each vehicle takes less than two minutes to wash, from initial arch to final rinse.

The car wash utilizes a wash water reclaim system and a reverse osmosis system to produce spot-free rinse water. Reject water from the reverse osmosis system is directed to the separation tanks where it is available for Reclaim.

Reclaim water makes up the majority of the wash water applied to the vehicles. Over the course of the study the average freshwater use per vehicle was 23.7 gallons. The wash used 2.4 gallons of reclaim water for every 1 gallon of freshwater. Evaporation and carryout was calculated an average of 6.1 gallons per vehicle during the study.

CE

The facility has one 100 foot long conveyor car wash tunnel. The facility is open 12 hours a day, Monday through Saturday, and 11 hours on Sundays.

The car wash is categorized as an exterior conveyor. It is equipped with a number spray arches and brushes, curtains, and mitters. Each vehicle is pulled by a conveyor through the wash tunnel, under the various arches and cloth features, while the driver sits inside with the transmission in neutral.

Arches and cloth features are activated based upon the timing of the vehicle passing under them and most run for about 20 seconds on average. The undercarriage sprays are located within the wash tunnel and operate when the vehicle passes over them. Each vehicle takes less than two minutes to wash, from initial arch to final rinse.

The car wash utilizes a wash water reclaim system, as well as a reverse osmosis system to produce spot-free rinse water. Reject water from the reverse osmosis system is directed to the separation tanks where it is available for reclaim.

Reclaim water makes up the majority of the wash water applied to the vehicles. The average freshwater use per vehicle was 37.9 gallons. This wash facility uses 2.1 gallons of Reclaim water for every 1 gallon of freshwater. Evaporation and carryout was measured at 16,475 gallons during the study. This is an average of 6.3 gallons per vehicle.

CF

The facility has one 100 foot long conveyor car wash tunnel. The facility is open 12 hours a day.

The car wash is categorized as an exterior conveyor. It is equipped with a number of spray arches and soft cloth fixtures, known as brushes, curtains or mitters. Arches and cloth features are activated based upon the timing of the vehicle passing a sensor and most run for about 20 seconds on average. The undercarriage sprays are located within the wash tunnel and operate when the vehicle passes over them. Each vehicle takes less than two minutes to wash, from initial arch to final rinse.

The car wash utilizes a wash water reclaim system, as well as a reverse osmosis system to produce spot-free rinse water. Reject water from the reverse osmosis system is directed to the separation tanks where it is available for reclaim.

Reclaim water makes up the majority of the wash water applied to the vehicles. Over the course of the study the average freshwater use per vehicle was 36.5 gallons. The filtration system is used to produce high quality reclaim water from the separation tank which is used for the initial wetters, wheel cleaning, undercarriage, a pre-soak cycle, and the initial rinse cycle. This wash facility uses 2.1 gallons of Reclaim water for every 1 gallon of freshwater. Evaporation and carryout was calculated at an average of 8.5 gallons per vehicle.

IA

The car wash is equipped with a touch free vehicle wash system with a movable gantry that runs along rails and all water spray nozzles except for undercarriage sprays are contained within the gantry.

The gantry moves back and forth based upon the length of the vehicle being washed and the spray nozzles used to wash the front and back of the vehicle are mounted on a moveable arm which lowers and rotates to apply wash, or rinse cycles to the top, front and back the vehicle. A separate set of nozzles along the sides of the gantry washes the sides of the vehicle. The undercarriage sprays are located within the entrance to the wash and operate when the vehicle passes over them.

The car wash utilizes a water reclaim system and a reverse osmosis system. Spot-free water is produced by use of a reverse osmosis filter. The filter reject water is discharged to the same separation as the wastewater from the wash and is available for reclaim.

Freshwater makes up the majority of the wash water applied to the vehicles. The average freshwater use was 45.3 gallons per vehicle. This wash facility uses 10.7 gallons of freshwater for every 1 gallon of reclaim water. Evaporation and carryout was measured at an average of 9.8 gallons per vehicle.

IB

The car wash is equipped with a touch free vehicle wash system with a movable gantry that runs along rails and all water spray nozzles except for undercarriage sprays are contained within the gantry.

The gantry moves back and forth based upon the length of the vehicle being washed and the spray nozzles used to wash the front and back of the vehicle are mounted on a moveable arm which lowers and rotates to apply wash, or rinse cycles to the top, front and back the vehicle. A separate set of nozzles along the sides of the gantry washes the sides of the vehicle. The undercarriage sprays are located within the entrance to the wash and operate when the vehicle passes over them.

The car wash utilizes a water reclaim system and a reverse osmosis system. Spot-free water is produced by use of a reverse osmosis filter. The filter reject water is discharged to the same separation as the wastewater from the wash and is available for reclaim.

Freshwater makes up the majority of the wash water applied to the vehicles. The average freshwater use was 50.1 gallons per vehicle. This wash facility uses 8.7 gallons of freshwater for every 1 gallon of reclaim water. Evaporation and carryout was measured at an average of 10.3 gallons per vehicle.

IC

The car wash is equipped with a touch free vehicle wash system with a movable gantry that runs along rails and all water spray nozzles except for undercarriage sprays are contained within the gantry.

The gantry moves back and forth based upon the length of the vehicle being washed and the spray nozzles used to wash the front and back of the vehicle are mounted on a moveable arm which lowers and rotates to apply wash, or rinse cycles to the top, front and back the vehicle. A separate set of nozzles along the sides of the gantry washes the sides of the vehicle. The undercarriage sprays are located within the entrance to the wash and operate when the vehicle passes over them.

The car wash utilizes a water reclaim system and a reverse osmosis system. Spot-free water is produced by use of a reverse osmosis filter. The filter reject water is discharged to the same separation as the wastewater from the wash and is available for reclaim.

Freshwater makes up the majority of the wash water applied to the vehicles. The average freshwater use was 26.8 gallons per vehicle. This wash facility uses 1.9 gallons of freshwater for every 1 gallon of freshwater. Evaporation and carryout was measured at an average of 7.1 gallons per vehicle.

ID

The car wash is equipped with a touch free vehicle wash system with a movable gantry that runs along rails and all water spray nozzles except for undercarriage sprays are contained within the gantry.

The gantry moves back and forth based upon the length of the vehicle being washed and the spray nozzles used to wash the front and back of the vehicle are mounted on a moveable arm which lowers and rotates to apply wash, or rinse cycles to the top, front and back the vehicle. A separate set of nozzles along the sides of the gantry washes the sides of the vehicle. The undercarriage sprays are located within the entrance to the wash and operate when the vehicle passes over them.

The car wash utilizes a water reclaim system and a reverse osmosis system. Spot-free water is produced by use of a reverse osmosis filter. The filter reject water is discharged to the same separation tank as the wastewater from the wash and is available for reclaim. Freshwater makes up the majority of the wash water applied to the vehicles. The average freshwater use was 29.9 gallons per vehicle. This wash facility uses 2.4 gallons of freshwater for every 1 gallon of reclaim water. Evaporation and carryout was measured at an average of 7.8 gallons per vehicle.

IE

The car wash is equipped with a touch free vehicle wash system with a movable gantry that is suspended from the ceiling, and all water spray nozzles except for undercarriage sprays are contained within an arm, referred to as an arch, which allows the top and one side of the vehicle to be washed at the same time.

As each cycle of the wash proceeds the gantry moved down the length of the vehicle on one side, swivels to spray the front or back, and returns to its starting position along the opposite side of the vehicle, so that all four sides and the top are treated. The undercarriage sprays are located within the entrance to the wash and operate when the vehicle passes over them.

The car wash utilizes a reclaim system and reverse osmosis system. Spot-free water is produced by use of a reverse osmosis and the filter reject water is discharged to the same separation as the wastewater from the wash and is available for reclaim.

Freshwater makes up the majority of the wash water applied to the vehicles. The average freshwater use was 70.5 gallons per vehicle. This wash facility uses 17.7 gallons of freshwater for every 1 gallon of reclaim water. Evaporation and carryout was measured at an average of 11 gallons per vehicle. Water use at this facility was higher than similar washes observed in other studies. The higher levels of water use had to do with the longer than usual RO recovery phase after the final rinse was complete. Internal valve and solenoid settings may have also contributed to the water use, but these were not evaluated as part of the study.

IF

The car wash is equipped with a friction vehicle wash system with a movable gantry that runs along rails and all water spray nozzles except for undercarriage sprays are contained within the gantry.

The gantry moves back and forth based upon the length of the vehicle being washed. In the pre-wash and rinse phases the water is applied by sprays; and in the soft wash phases, rotating brushes which move along the top and sides of the vehicle. The brushes are wetted by low or mid pressure sprays, depending upon the wash cycle. The undercarriage high pressure sprays are located within the entrance to the wash and operate when the vehicle passes over them.

The car wash utilizes a water reclaim system and a reverse osmosis system. Spot-free water is produced by use of a reverse osmosis system for use during the final rinse cycle. The filter reject water is discharged to the same separation as the wastewater from the wash and is available for reclaim.

Freshwater makes up the majority of the wash water applied to the vehicles. The average freshwater use was 46.2 gallons per vehicle. This wash facility uses 12.3 gallons of freshwater for every 1 gallon of freshwater. Evaporation and carryout was measured at an average of 6.0 gallons per vehicle.

Glossary

Spot-Free Rinse: Spot-free rinses are offered in many car washes due to the presence of dissolved materials in the water supply which will leave small spots on the finish of the vehicle as it dries. Minerals and other ions, which have been dissolved, are removed by de-ionization or reverse osmosis.

Reclaim: Reclaim is the term used in the professional car wash industry for water recycling systems designed to treat and reuse car wash water. The first step is clarification using the separation or sedimentation tank to remove heavier grit and oil from the water. The reclaim system then removes smaller particles down to 5 microns in diameter, and the water is treated for odor control through one of a number of systems including aeration, ozone, or use of a disinfection product.

Freshwater: Freshwater is the term used for potable water supply. In case of self-supplied facilities using a well, the groundwater may be used directly with additional treatment to potable standard. Typically freshwater refers to the potable water purchased from a local water purveyor.

Reverse Osmosis: Reverse Osmosis (RO) works by using pressure to force water containing solutes through a semi-permeable membrane. Pure water results on the side of the membrane supplying the spot-free rinse, while the reject side is disposed or reclaimed.

Reject water: Reject water is the term used for the water which is left after a RO system forces water through the membrane for use in the spot-free rinse. This water is higher in total dissolved solids than the freshwater supply, but often pure enough for use in other wash processes, or by combining with the wash water in the separation tank, can be used as a supply for the reclaim system.

Process water: Process water or product water is the pure water forced through a semipermeable barrier which is produced by a RO system for use in the spot-free rinse.

Total Dissolved Solids (TDS): A measure of the combined content of all inorganic and organic substances contained in a liquid in: molecular, ionized or micro-granular suspended form. Generally the operational definition is that the solids must be small enough to survive filtration through a filter with two-micrometer pores.

Total Suspended Solids (TSS): A water quality parameter that is defined as the quantity of material suspended in a known volume of water that is trappable in a filter.





References

- AB-2230 Recycled Water: Car Washes, <https://leginfo.legislature.ca.gov>, California, 2013
- Arizona Department of Water Resources, Owning and Operating a Water Efficient Professional Car Wash, 2009
- Borchard, C., Water Reclamation and Regulation, Auto Laundry News, 2014
- Borchard, C., Call, G. & Laughlin, D., Keller, J., Pazz, A., and Wise, C., Water Savers Guide to Reclaim, Modern Car Care, 2007.
- Brown, C., Water Conservation in the Professional Car Wash Industry, International Car Wash Association, 2000.
- Brown, C., Water Use in the Professional Car Wash Industry, International Car Wash Association, 2002.
- Chan, A., Conserving Water at the Car Wash, LA Times, Jul 11, 2015
- Georgia Environmental Protection Division, Water Conservation Certification Program for Permanent Facility Car Washes, 2016
- Gorgos, D. Reclaim Your Way to Savings, Professional Carwashing & Detailing, Volume 33, Issue 3 – March, 2009
- San Antonio Water System, Flat Rate Sewer Program, 2015
- Toronto, Canada, Sewer Related Bylaws, Washing Cars, www.toronto.ca/services-payments/water-environment/water-sewer-related-permits-and-bylaws/sewers-by-law/washing-cars-outdoors-surfaces/, version cited, 2017.
- Personal Interviews with: Jack Anthony, 7 Flags Car Wash; Mike Black, Valet Car Wash; Garry Dennis, Flex Serve Car Wash; Jim Mulholland, Busy Bee Car Wash; and Frank Taubenkraut, Rockhill Car Wash, April-May, 2017.



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