Evaluation of
Potential Best Management Practices
-
Vehicle Wash Systems

Prepared for

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V. Vehicle Wash Systems

1.0 Background

Commercial vehicle washes present a two-part opportunity for water conservation based both upon differences in construction and upon operator preferences. In this chapter, the functional difference between vehicle wash systems and categories are examined first, followed by a discussion of the operational measures employed by these businesses. The water savings potential and cost benefit estimates are presented for each of the different types of vehicle washes.

Commercial carwashes are categorized as either conveyor, in-bay automatic or self-serve, and include those carwashes that are available for public use at stand-alone carwash facilities, as well as those alongside convenience store, lube shops or gasoline stations. The three basic types of equipment within those categories are also used for truck and bus washing and for washing vehicles at dealerships and rental agencies. Some truck washes are available commercially, but many are for washing fleets and are typically located on private property. Conveyor and in-bay automatic carwashes can be constructed as friction or touch-less, which further affects water use. All these basic types of carwashes can be retrofitted for or built with water reclaim systems.

The International Carwash Association summarizes the "Steps in a Professional Car Wash Process"[1] that affect water use as follows:

- Pre-soak. An automated nozzle or hand held spray.
- Wash. High pressure spray or brushes with detergent solution.
- Rocker panel/undercarriage. Brushes or high pressure sprays on sides and bottom of vehicle.
- First Rinse. High pressure rinse.
- Wax and Sealers. An optional surface finish is sprayed on the vehicle.
- Final Rinse. Low pressure rinse - with fresh or membrane-filtered water.
- Air Blowers. Air is blown over the vehicle to remove water and assist in drying.
- Hand Drying. The vehicle is wiped down with towels or chamois cloths on site. In full-service washes these are then laundered in washing machines on-site.

To differentiate among the three categories, in a professional conveyor car wash, these steps are performed by separate spray arches and/or brushes. In the professional in-bay automatic, there is a set of nozzles through which all processes are performed, except in some cases where brushes may be used for the wash cycle. In professional self-service car washes there may be a brush for the wash cycle, but all other functions are performed through a hand-held wand.

[1] Brown, C., 2000. *Water Conservation in the Professional Carwash,* International Carwash Association.

In addition to the three basic carwash types, mobile washing services, detailing services including hand washing, and some industrial vehicle washing systems exist with unique challenges and opportunities for water-use efficiency. These will be dealt with at the end of this chapter.

1.1 Conveyor Carwash

The conveyor carwash is usually installed in a tunnel, and includes a series of cloth brushes or curtains and arches from which water is sprayed while the car is pulled through the tunnel on a conveyor chain. In some "touchless" carwashes, only spray nozzles are found. In full service conveyor carwashes, hand drying usually follows the conveyor, and often the pre-soak is done by hand-held wands like those found at self-service carwashes.

In friction carwashes, the wash cycle is accomplished with brushes or soft cloth curtains. Conveyors with friction components use less water than frictionless washes because the brushes or curtains pick up water and detergent from the pre-soak of cars as the day proceeds.[2]

The most recent national survey of carwash businesses reported that 73 percent of conveyors use friction components in the wash.[3] California specific data were not available and, thus, not separated out in the report.

Timing is a critical component in carwash water efficiency. In properly calibrated conveyors, nozzles are timed to turn on as the vehicle passes under the arch, and shut off as exits each arch. Each arch is on for a matter of seconds, as conveyors can process 90 or more cars an hour. Efficiency is also maintained by proper nozzle alignment and pressure.

Additional water efficiency is obtained by the orientation of blowers after the final rinse to push water back into the tunnel, or to construct a longer length of tunnel after the final rinse arch. Water that otherwise would be carried out of the tunnel can flow back into sump, and be reused in the carwash with a reclaim system.

In a full-service conveyor, towel-drying of the car is one of the services offered. In many older car washes, towel washing sinks are designed for a constant flow of water through the sink. Installation of a float ball valve to halt the flow of water when it reaches an optimum level is one water efficiency measure. Replacement of older flow-through sinks, or top loading washing machines with new front loading machines will cut water consumption by 40% or more. Some conveyor washes, referred to by the industry as "exterior-only," do not offer drying or detailing services, so visual confirmation of the existence of towel washing machines is necessary.

[2] Kobrick, J.D., et. al., 1997. *Water uses and conservation opportunities in automatic carwashes: A City of Phoenix study,* June.
[3] Billings, A., ed, 2000. *Almanac for the Year 2000,* Auto Laundry News, Vol. 48, No. 14.

1.2 In-Bay Automatic Carwash

In-bay automatics are characterized by a wash bay in which the customer stays in their car as the carwash equipment uses either spray nozzles or brushes, or a combination of both to process the individual cycles. The car remains stationary within the carwash bay during the process. The carwash machinery is moved over the car by a gantry. In-bay automatics also have the greatest variety in basic design with some machines comprising an entire moveable arch, others having vertical and horizontal arms suspended from the gantry, and yet other designs including spinning arms that are attached to the gantry.

Nozzle size, number and alignment, flow rates and timing all affect water use in the in-bay automatic carwashes. Since all water flows to one pit, and all chemicals mix together, reclaim systems can be more costly and a bigger challenge to maintain than in conveyor carwashes. In addition to water used in the pre-soak and wash cycles, many in-bay automatic operations offer a spot-free rinse. This is typically obtained with reverse osmosis (RO) or deionization (DI) equipment. A more detailed discussion of water treatment systems found in commercial carwashes is covered later.

As with the conveyor car wash, in-bay automatics that use brushes or cloth use less water than frictionless or "touch-free" car washes. Some in-bay automatics also reduce water use by employing laser sensors to identify the length of the vehicle being washed, and limiting the gantry movement and timing of wash based upon the sensor signals.

1.3 Self-Service Carwash

Self-service car washes are typically coin-operated with spray wands and brushes operated by the customer. The wash facility typically contains a central equipment room, in which water process equipment is housed, along with four to six wash bays. The customer controls whether and for how long low-pressure or high-pressure settings are used. Thus, the carwash owner/operator does not have direct control over the water use at the facility. But with a fixed pricing structure for the initial purchase of several cycles, plus the ability to purchase additional time (usually at a 25¢ per unit), the customer has a direct monetary incentive to move as quickly as possible, thus conserving water. Studies of car wash water use efficiency have shown that self-service carwashes use the least amount of water on average per vehicle.

In addition to water used in the pre-soak and wash cycles, many self-service operations also offer a spot-free rinse. Like the in-bay automatics, reject water from the RO unit can be utilized in landscape watering where landscape exists.[4] Because customers wash their own cars unattended, self-service operators sometimes find evidence of oil dumping, or organic materials in the waste water. These provide very difficult and expensive insults to filters, and are a disincentive to the use of reclaim in self-service washes.

[4] However, since reclaim is not typically used in self-service washes, except where required by law, reuse of RO reject water is not typically an option.

1.4 Truck, Bus and Fleet Washes

The type of equipment used to wash trucks, buses utility vehicles and heavy equipment is the same as described above except for scale. If in an industrial or construction-related use, potentially much greater amounts of dirt and grease must be removed. As such, water use per vehicle is higher than in a typical carwash. Some commercial truck wash operators are coin operated and charge customers by the length of the vehicle, usually at a unit cost per foot length. Due to differences in vehicle size and shape, hand held wands are prevalent in truck washes. One modified type of equipment is a drive through arch, similar to those found in conveyors, but where the driver controls the speed at which they move under the arch. These are referred to as "drive through tunnels", although sometimes the arch is found without a surrounding building. Electronic or magnet sensors are used to turn the arch on and off as the vehicle enters and leaves the arch. Thus the speed of the vehicle driving under the arch controls the amount of water used.

Fleet washing of light passenger vehicles (such as in an auto dealership or at a rental agency) is typically done with either in-bay automatic or hand held wands and brushes found at self-service facilities. The Irvine Ranch Water District (District) surveyed 24 automobile dealerships to determine the carwashing equipment being used.[5] They found that 87.5 percent of automobile dealers have on-site car wash facilities in their service areas. Examining the dealerships by type of carwashes found that 62.5 percent had self-service type wands, 20.8 percent had in-bay automatics or drive-through type washes[6] and 4.2 percent had conveyors. Fleet washes such as these were not included in the ICA Study, but could reasonably be estimated to use about the same amount of water per vehicle as their commercial counterparts.

Another technique, which is not well studied, includes the amount of water used by detailing or handwashing businesses. A survey of commercial car washes in 1999 found 5% of respondents operating hand washes.[7] Anecdotal observation suggests that hand washing and detailing businesses have grown as a sector of the carwash industry, although there are no firm numbers on water use or size of market.

Other equipment which is washed such as airplanes, boats, farm equipment, trailers, construction equipment such as dozers, backhoe loaders, excavators, dump trucks, and military equipment may also be considered for inclusion in this BMP, but like the examples above, water use has not been quantified.

[5] Sanchez, Fiona, 2006. Personal communication, Conservation Manager, Irvine Ranch Water District, April 28.
[6] No studies of water use in drive-through facilities have been published, but due to the slower speed of the vehicle proceeding through a drive-through arch, an industry representative anticipates water use to resemble an in-bay automatic more than a conveyor. Bill Sartor, former Chair of ICA, personal communication, April 2006.
[7] Billings, ibid, 2000.

1.5 Opportunities and Practices for Water-Efficiency

Two program approaches have been used by utilities seeking to promote efficiency in the car wash sector. One approach is to promote the use of reclaim systems, and the other is to promote the use of lower flow nozzles and other proven conservation practices. The second approach, sometimes combined with the first, is typically offered as a voluntary certification program for those carwash operators that agree to operate and maintain their facility to water efficiency standards. Both approaches to carwash water efficiency are examined here.

Reclaim Systems

Water reclamation in the professional carwash covers a wide range of practices and equipment. Numerous manufacturers produce full reclaim systems with all components included, or operators can instead purchase filtration and de-odorizing components and construct a site-specific system for their facility. Treatment levels need to be appropriate to the number and level of cycles in which reclaim water is used. The least amount of filtration is needed for the water used to wash dirt and grime from the undercarriage and lower parts of the vehicle carriage (rocker panel). As wash and rinse cycles are added to the list of cycles using reclaim water more filtration and water quality treatment measures are required. Additional challenges exist in in-bay automatic and self-service washes. The general process of reclaim and some of the challenges common to many systems are explained below. Information specific to a particular manufacturer's product or reclaim approach is not included.

Prior to filtering water and reusing it in the carwash, grit, oil and grease must be removed from the wash water. This can be accomplished in a series of tanks or separate compartments within a large separator tank. Settling and separation tanks must be large enough to allow water flow to slow and large particles to settle to the bottom of the tank. The first separation step is to remove oil and grease, allowing water to flow under a baffle or through a pipe placed low in the tank wall, with its upstream aperture open toward the bottom of the tank. The settling compartment is next, and water will flow over a barrier, or through a pipe located near the top of this compartment to the third compartment from which reclaim water is pumped for reuse or further filtration and treatment before reuse.

Some reclaim systems use the water after the separation tank with no further treatment. In these systems the water may be used in an under carriage or a rocker panel cycle, and to wash down the carwash tunnel or bay. Some reclaim system use simple cyclonic filtration systems to remove suspended particles in order to protect pumps and the finish of vehicles. Such systems can use the reclaim water in initial pre-soak cycles. Where reclaim water is to be used more extensively in the wash, additional filtration and treatment are performed. These can include bag or media filtration to remove particles above 10 microns in size, so the reclaim water may be used with high pressure pumps to perform the wash cycle. Filter media can include sand, diatomaceous earth, glass, or olivine. Absorption filters used in this stage of the wash process include cloth, paper or other synthetic materials. Carwash employees must be trained and regularly maintain the filter media.

Such filtration allows the reuse of water which would otherwise cause a variety of problems for the carwash operator. Larger suspended particles can scratch the vehicle's finish while smaller particles, including dissolved solids, can cause spotting. For operators wishing to recycle a larger percentage of their water, or who are restricted from discharging to the sewer, more sophisticated

treatment is needed. Oils, soaps and finish products entrained in the wash water that are not caught by the multi-media filter require additional treatment steps. For example, an activated charcoal filter can remove organic compounds including hydrocarbons from the water prior to return to the wash system.

Most modern carwash reclaim systems do not bother with separate flocculation chambers, pulling water from the clarifier section of the carwash separation tank after baffles have intercepted most of the floating and sinking waste. Some reclaim systems may use additives to assist in flocculation of suspended particles. Simple bag or media filtration or cyclonic separators may be used to remove additional contaminants before reuse.

Filter maintenance is crucial, for either particle or cloth media. Backwashing cleans and reactivates granular media. Closed loop systems direct the backwash water into the separation tank of the car wash. If available and permitted, the reclaim system may send the backwash water to the sanitary sewer system. Overflow from some reclaim systems is also piped to the sanitary sewer system where available.

Carwash operators occasionally have problems with reclaim water, including issues of odor and color. In in-bay automatics, or in a self-service environment, where the customer is more likely to come into contact with the water, these can create perception concerns. On the other hand, when the customer is not exposed to the reclaim water (as in a conveyor wash where the customer is not in the vehicle), this issue is less critical.

Color and odor problems with reclaim water may be caused by bacterial or algal growth, or from hydrocarbons washed off the vehicles. Oxidation is the solution to this problem. Several methods of treating for color and odor are available: aeration, including running air through the tanks; recirculating the water after filtration; chemical solutions such as chlorine or chlorinated products; or, in some cases, a deodorant may be used to mask the odor.[8] Some systems use ozone.

Since ozone can be hazardous, and is very reactive, it needs to be used in such a way as to prevent exposure to carwash operators. The oxidizing reaction neutralizes the ozone while removing the odor and color problems.[9]

A technology growing in use in commercial car washes in the United States, and found in Europe and in industrial settings is enzyme technology. Known as bio-systems or biological control, it requires a reaction tank where organic contaminants can be digested.[10] These systems are already in use in reclaim systems found in some industrial settings in the U.S. The industrial setting permits aerobic bacteria to do the job, as tanks can be left open to the air when sited at a distance from public access. Closed systems have been developed for use in facilities where the public may be nearby.

Whatever type of reclaim system is used, several practices must be implemented by the operator to prevent fouling and/or failure of the system. Cleaning and finish products need to be chosen

[8] Anderson, Shane, 1999. Gin-San, Personal communication, September 27.
[9] Pero, S, 1999. *A declaration for water reclamation,* Carwashing & Detailing, August.
[10] Duplantis, J., 1998. *Where ozone meets your water,* Carwashing & Detailing, March.

for compatibility with each other and with the reclaim systems components to prevent entraining of emulsified oil, and fouling of filters. The employees responsible for operating the equipment must be properly trained and regular maintenance must be performed on all reclaim system components. Failure to perform any of the above practices will lead to problems with the reclaim system, and possible abandonment of its use.

Conveyors and Reclaim

In conveyor systems, the length of the tunnels can provide opportunities to reclaim rinse water separately from wash water, necessitating different levels of treatment. This can create more cost-effective reclaim opportunities. For example, more difficult-to-treat chemicals, such as those in waxes or finish products, which are used in small quantities, are routed away from the principal reclaim system, which picks up water from earlier in the wash. Final rinse water can also be reclaimed and reused with less treatment. The wide variety of ways that reclaim can be performed in conveyor carwashes results in a broad range of reclaimed water usage measured as a percentage of total water used per vehicle in the 2002 ICA study. The lowest amount of reclaim water used in a conveyor wash with reclaim was 9 percent per wash and the highest was 74 percent. The 2002 study also found that 56 percent of conveyor washes in the United States have a reclaim system[11].

In Bay Automatics and Reclaim

Reclaim equipment companies generally acknowledge that in-bay automatics provide a more expensive challenge to reclaim systems, since all chemical products, from cleaning to finish, as well as oil and grease, and contaminants from the road, winds up in the same separator tank. The water needs to be treated to remove all constituents that would interfere with its eventual reuse in the wash. The 2002 ICA water use study also found a wide variation in reclaim usage rates in in-bay automatics with a low of 12 percent per wash and a high of 82 percent per vehicle washed. The 2002 study found that 25 percent of in-bay automatic washes in the United States have a reclaim system[12].

Self Serve and Reclaim

Reclaim systems are not usually used by self-service carwashes due to the relatively few gallons per vehicle used by self-service customers. However, a closed loop reclaim system is used in self-service carwashes where no discharge to sanitary sewer is available, and all discharge is restricted.[13] In these situations, it is not uncommon for the self-service to be staffed on-site in order to prevent misuse of the facility by customers dumping contaminants in the pits.

Large Vehicles and Reclaim

Reclaim also has an important role in industrial uses and for large vehicles as noted above. The controlled access to such facilities allows for more innovative treatment of the water, such as longer residence times, and use of enzymes, with lower cost systems. Rainfall can be captured to replenish systems, and thus closed loop systems can approach 100 percent nonpotable water use.

[11] Brown, C., 2002. *Water Use in the Professional Carwash Industry,* International Carwash Association.
[12] Brown, ibid., 2002.
[13] Anderson, ibid., 1999.

A bus wash reclaim system in Seattle, for example, which was partially funded by the Seattle Public Utilities, achieved in excess of 80 percent efficiency and saved more than 200 gallons per vehicle. Similar results could be expected for other large vehicle reclaim systems, but studies on this sector have not been performed.

Water Softeners and Spot-Free Rinse Equipment

Water softeners and additional filters for spot-free rinses are found in carwashes where hardness or high TDS levels in the water supply can cause spotting as the vehicle dries. Softening can also reduce the need for detergents in the wash process, and spot-free rinse leads to lower costs for treatment in a reclaim system. Because conveyor washes often use hand-drying, water softening and spot-free rinse equipment are more often found instead at in-bay automatic or self-service facilities. Two of the more common means of achieving a spot-free rinse are the use of reverse osmosis (RO) and deionized (DI) water systems. A 1999 survey of the carwash industry found that 60 percent of self-service carwashes have water softeners, 48 percent offer spot-free rinse with RO and 7 percent offer spot-free rinse with DI[14].

All three of these processes have potential impacts on water quality and water quantity, both of which need to be considered as part of either a certification program or a reclaim system. Reject water from the RO unit can be utilized in landscape irrigation where a car wash operation has landscaping, or can be discharged to the carwash reclaim system. DI ion beds require periodic regeneration, and the process must be performed properly to avoid producing excessive contaminants in the carwash discharge stream. Water softeners place salts into the discharge water, and use water in backwashing the ion bed. Recharging of both water softeners and DI systems should be performed based upon the amount of water treated, not upon a fixed time schedule. During a site compliance review, the machinery should be examined to determine if a timer or a meter is used to trigger regeneration.

Certification

Certification of carwash businesses has been pursued in a number of cities in the west and southwest, Denver and San Antonio being the largest. Certification involves an initial audit to determine compliance with typical carwash best management practices (BMPs), followed by annual inspections to determine continued eligibility. Certification incentives have included: signage, promotion by the utility, ordinance provisions requiring charity car washes be performed at certified facilities (provides businesses with an opportunity to self-promote while helping non-profits), and relief from certain drought provisions as in day-of-week or time-of-day operating restrictions.

Requirements for certification have included an average freshwater (potable water) gallons per vehicle usage ceiling, specific nozzle size requirements, regular replacement of nozzles, prompt repair of leaks, and/or the use of reclaim water. Due to the variability in water use based upon differences in carwash configuration and equipment, the limits of freshwater usage per vehicle have typically been 40 to 50 gallons per vehicle (gpv) range. By establishing upper limits on freshwater use per vehicle, it has avoided situations in which utilities could be accused of favoring one brand of equipment over another. The 2002 ICA water use study has had an impact

[14] Billings, ibid., 2000.

on manufacturer perception of the need to reduce water use, causing them to redesign some in-bay automatic equipment to increase efficiency. However, that study was performed without identification of specific branded equipment; as a result, utility conservation staff do not currently have a brand-specific source of normative data similar to studies of toilets and other water using equipment.

The 2002 ICA study also showed that freshwater use is held to ≤30 gpv in in-bay automatics and conveyors with most equipment and with the use of a reclaim system.[15] Since self-service facilities rarely approach the use of 30 gpv and the actual gallons used is at the discretion of the customer, a 3.0 gpm nozzle is required in San Antonio. (Since a number of the cycles in a self-service wash are at low-pressure, this limitation leads to a gpv of less than 14.5 gallons on average.)

Certification programs can also require RO reject water to be recycled or used in landscape irrigation where local regulations allow. One of the benefits of a reclaim system is the reduction of waste constituents in the discharge to the sewer. Where sanitary sewer fees include surcharges based upon water quality, the local staff of the wastewater treatment utility should be consulted to determine if they would like to participate in design and implementation of a car wash certification program in order to provide incentives to reclaim water.

Municipal Ordinances and State Regulation

A number of cities and the state of Florida have used legal restrictions on carwashes to achieve greater efficiency goals. The city of El Paso, Texas requires all new car wash facilities constructed after June 2002 to use no more than 50 gpv of freshwater, but does not specify reclaim systems as a requirement. The state of Florida, the cities of San Antonio, Texas, Denver and Centennial, Colorado and a number of California cities, all require new in-bay and conveyor carwashes to be constructed with reclaim systems. The State of Florida is concerned about discharges and maintaining water quality in the state's ground and surface water systems. The Florida Administrative code requires an industrial general permit for all carwashes that recycle water[16]. One result of this approach has been to limit the number of self-service facilities constructed in Florida since the law was passed, because self-service sites with reclaim systems need staffing 24 hours per day to prevent customers from dumping motor oil or other materials that would foul the filters.

Florida's Division of Environmental Protection has published a best management practice focused on water quality to assist carwash operators with the zero discharge requirement.[17] The BMP deals with truck washing as well as car washing issues. "Residential" carwashes in Florida that use less than 4,000 gallons per week are exempt from the reclaim requirement.

The Florida BMP focused on water quality points out another potential avenue for designing a vehicle wash conservation BMP. Vehicle wash facilities are typically regulated as to their type and quantity of discharge. The separation tanks, which are essential to properly operating reclaim

[15] Brown, ibid, 2002..
[16] Section 62-660.803
[17] Florida Department of Environmental Protection, 2005. *Guide to Best Management Practices: 100% Closed-Loop Recycle Systems at Vehicle and Other Equipment Wash Facilities,* Industrial Wastewater Section, October.

systems, are also a requirement for operations discharging to publicly owned water treatment works (POTW). Federal and state limits on discharge are also imposed by regulators, especially if a facility discharges to surface or ground water rather than a POTW. Reclaim systems assist reducing discharge quantities by removing more contaminants from the waste stream. Local water quality personnel should be consulted to determine if common BMPs for carwashes can be developed which assist in reducing contaminant discharges as well as reducing water use.

System Retrofits

Adding a reclaim system to an existing carwash can be cost-prohibitive, in large part due to problems with the configuration of the existing building and plumbing. This includes issues such as: separation tanks being too small for additional storage, insufficient room for additional storage tanks, key pipes running through walls or beneath concrete or asphalt floors and driveways where connections to the reclaim system need to be added, and similar impediments. As a result, the costs to renovate the facility can be quite high. For this reason, some communities have required reclaim systems on new carwashes only, and have not addressed retrofit of existing car washes.

The difficulty in quantifying retrofit potential in existing carwashes stems from three separate factors, relating to location, equipment, and costs. These factors result in site-specific constraints on accurate estimating costs and potential water savings. For example, some fully skid-mounted reclaim systems exist (with all significant components included) and are marketed to carwash operators. However, due to equipment room configurations, these systems do not fit all carwashes. Therefore, it is necessary for some carwash operators to retrofit with a reclaim system by separately installing the each of the system components required, e.g., filtration, pump and treatment equipment. In addition, some systems require additional water storage capacity for the treated reclaim water, for which there may not be room in either the original facility building or within the facility's property boundary.

As a result of these facility-specific circumstances, a utility considering funding retrofits may be faced with: some customers who are unable to retrofit without major renovation to facility buildings and plumbing; others who are able to use all-in-one skid mounted systems; and yet others who can only install some of the necessary equipment – thus limiting the amount of water they can successfully reclaim. This results in an inability to accurately estimate the quantity of water saved through reclaim retrofits in the scale of this analysis. At a utility scale, each facility would need to be analyzed on a case-by-case basis for the cost-effectiveness of a proposed rebate or other subsidy.[18]

The data from the 2002 ICA study showed that the lowest amount of water recycled in a carwash was 9 percent of total gpv, with the highest being 82 percent of water used per vehicle[19]. This large range of reclaim water percentages demonstrates the difficulty in providing accurate estimates without more detailed on the type s of reclaim systems anticipated, and the associated costs of modifications to the existing facility.

[18] Such as would be the case in evaluating process water system improvements in certain unique applications, such as in the manufacturing or commercial laundry sectors.
[19] Brown, ibid., 2002, p. 39.

On the other hand, adding an RO system to an existing car wash can be accomplished very easily - most systems require little room and in a crowded equipment room can be installed on the wall. The associated storage tanks, however, need sufficient space and this can prove to be difficult in some circumstances. RO systems increase the amount of water used in final rinse, due to their reject water. However, in a vehicle wash with a reclaim system, the reject water can be used in initial pre-wash rinse or undercarriage cycles in the wash.

2.0 California Potential Water Savings

Due to the nature of the sample and survey data – small sample size and market data based upon voluntary survey response – the results of the water savings analyses are presented here with caution. Census data typically only identifies conveyor type systems as carwash businesses. In-bay automatics, on the other hand, are typically linked with combined convenience store/gasoline station businesses or with lube shops and, as such, do not show up in the census data. Furthermore, self-serve operations are typically owned by businesses or proprietors with other primary business activities, and without an office on site.[20] Thus, they, too, are uncounted in the census.

For this analysis, conveyor carwashes are considered to be represented by U.S. census data for California, which counted 1,555 such businesses in 2002[21]; this constituted 11.1 percent of total carwash businesses listed in the U.S. Economic Census.

The estimated number of self-service carwashes was determined by multiplying the national estimates of self-serves by 11.1%, which results in approximately 1,600 such facilities in California in 2002. Potential growth in the conveyor and self-service sectors is based upon growth from 1997 to 2002 in these business sectors in California.

In-bay automatics were estimated at a similar percentage of the total estimated in-bay facilities in the U.S. as estimated by the carwash industry in 2000. This calculation results in approximately 2,700 in-bay automatics in California in 2002. However, growth in the in-bay market is estimated based upon growth rates in gasoline stations, since most in-bay automatics are co-located with gasoline/convenience store businesses. In 2002, the 2,700 in bay automatics estimated for California represented 46.7 percent of the gasoline stations reported by the U.S. Census Bureau for California.

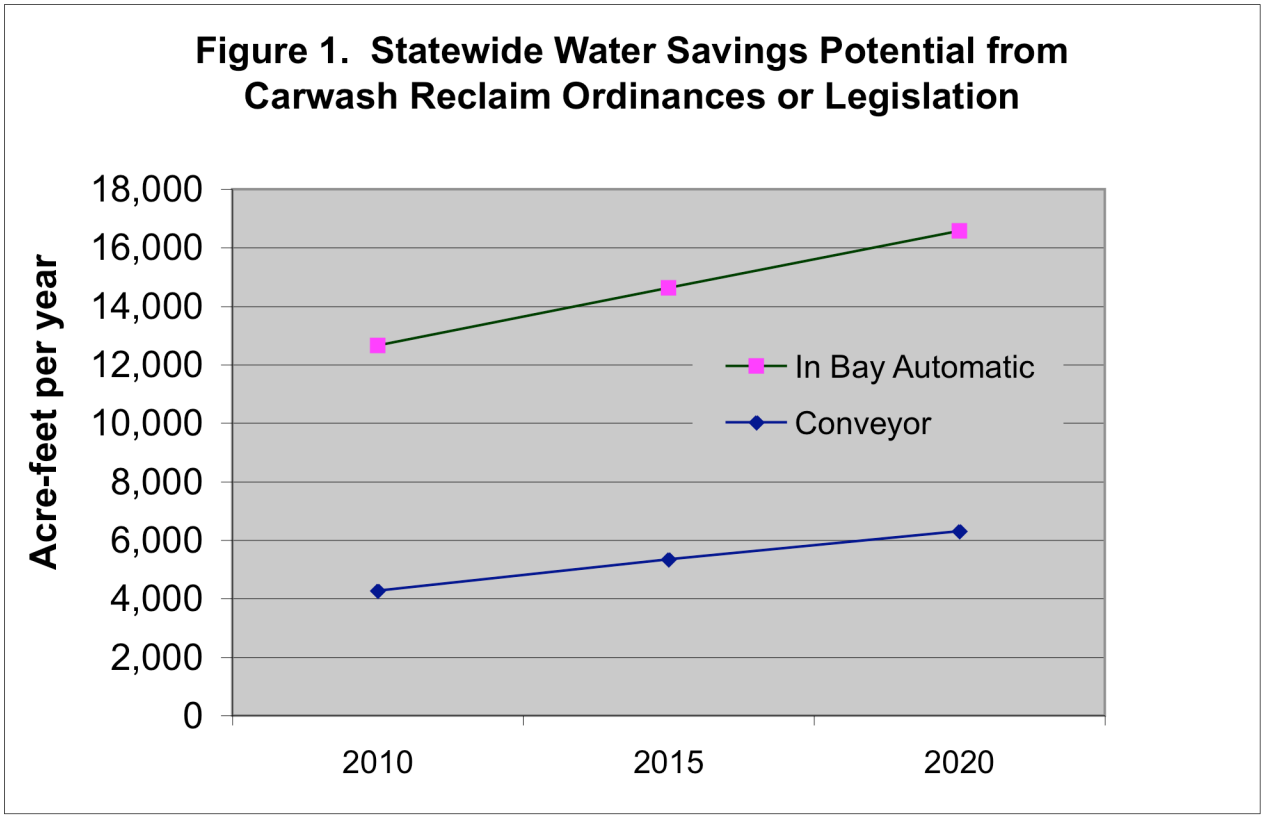
The number of estimated vehicles washed is based upon a 2002 market study performed by the ICA. An annual average of 82,019 vehicles were washed in conveyor-type systems, 54,184 in in-bay automatics, and 92,093 at self-service carwashes.[22] Water use estimates for both the freshwater and reclaim water use per vehicle were derived from the ICA's *Water Use in the Professional Carwash Study*.[23]

2.1 Reclaim Ordinance Scenario

The reclaim ordinance scenario assumes that, beginning in year 2010, ordinances statewide will require all new in-bay automatic and conveyor carwashes to install reclaim systems, that growth in the industry is reflective of growth found in California from 1997 to 2002, and that there is a natural replacement rate of 30 years for a commercial car wash. To eliminate overestimation of savings due to changes in ordinances, existing reclaim rates for the two types of carwashes (25 percent for in-bay automatics and 56 percent for conveyors) were deducted from the potential savings. With an average 30-year physical or economic life of carwash equipment, an estimated 3.33 percent of the carwash equipment existing in 2010 will be replaced with new equipment

[20] Billings, ibid., 2000
[21] 2002 Economic Census, http://www.census.gov/econ/census02, U.S. Census Bureau
[22] Smith-Bucklin, 2003. 2002 Cost of Doing Business Report, International Carwash Association.
[23] Brown, ibid., 2002.

each year in this scenario. Figure 1 shows a potential water savings totaling 22,877 acre-feet per year (AFY) in 2020. In-bay automatics make up more than two-thirds of the potential savings at 16,580 AFY, and conveyors represent 6,297 AFY potential savings, in 2020. Because of difficulties in the use of reclaim systems in self-service carwashes as discussed earlier, this category is not included in this scenario.

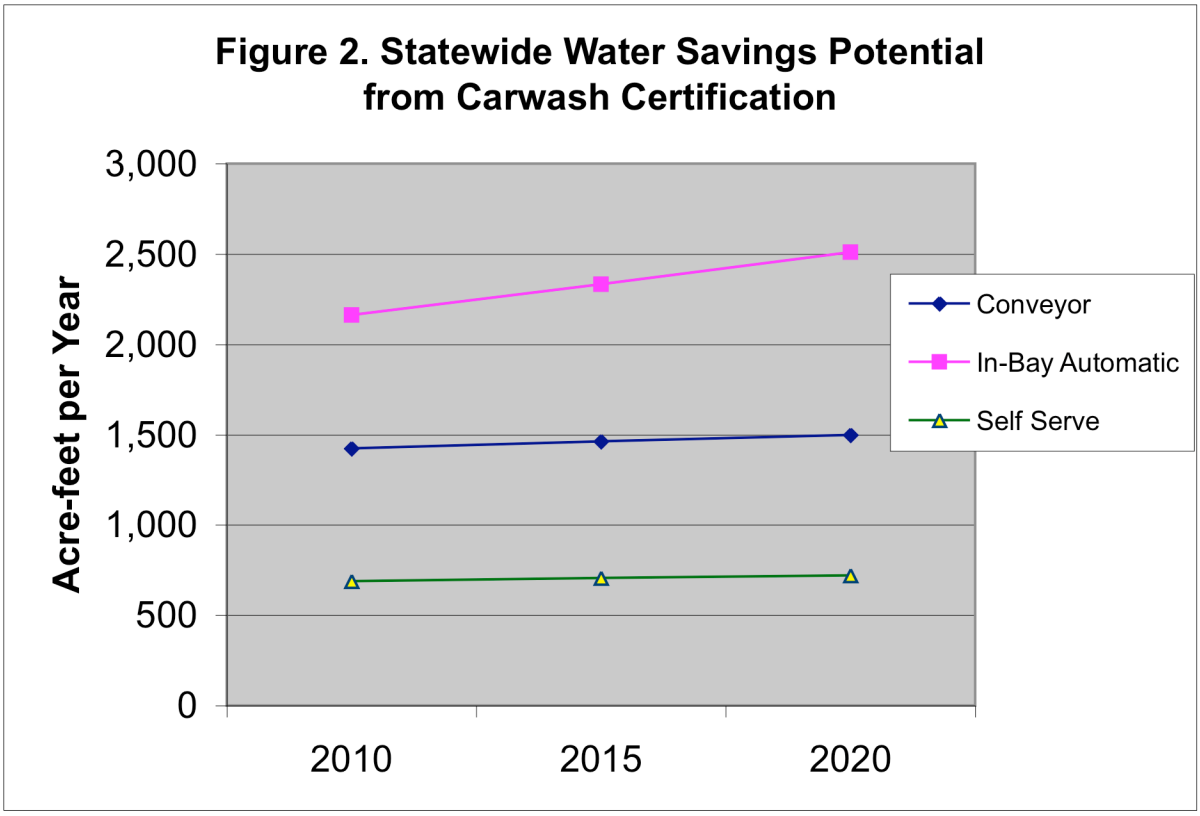


2.2 Carwash Certification Scenario

The carwash certification scenario assumes an approximate 10 percent savings from all three types of carwashes. This figure is derived from water savings calculated by the City of Denver in 2005. That year saw a 25 percent reduction in total water use by all 247 carwashes that participated in the certification program. However, Denver's program is not voluntary and was first implemented in 2002 during a critical drought period. The mandatory aspect of the Denver program requires a 10 percent reduction in water use overall, and after discussion with local carwash owners, the Denver staff that implemented the program estimated that additional savings were obtained as a result of reduced use of the carwashes by the public, probably related to public awareness of the need to reduce citywide water consumption.[24] Due to these two factors, a lower estimate of savings has been chosen to represent potential water savings for this California scenario.

[24] Reed, Jim, 2006. Personal communication, carwash conservation certification coordinator, Denver Water, May.

The water savings estimate includes only the three types of commercial carwashes that are represented by the professional industry and does not include fleet or truck and bus washing facilities. The annual water savings in 2020 for the 10 percent savings scenario from carwash certification is estimated as totaling approximately 4,700 acre-feet per year for all three types of car washes. In-bay automatics make up more than one-half the potential savings at 2,549 acre-feet per year, while conveyor systems represent 1,497 acre-feet potential annual savings, and self-service car washes represent 722 acre-feet of potential savings in 2020. Refer to Figure 2.



3.0 Cost-Benefit Analysis

In both of the above scenarios, minimal costs would be incurred on the part of the water utility. In the ordinance/legislation and the certification scenarios, annual site visits are necessary to ensure that compliance is maintained. Such visits should be accomplished in less than three hours per site, paperwork included. Enforcement structures for ordinance violations such as fines should be designed to pay for the cost of enforcement. In certification programs, an annual fee charged to all participants in the program can pay for signage and promotional expenses on the part of the utility. A certification fee of $25 to $50 per year per facility could provide enough funds to produce both attractive signage, and paid media placements such as radio spots or newspaper adds encouraging utility customers to use the water saving carwash facilities. The ordinance approach would avoid this fee, but would also not require the utility to promote certified carwashes through the media. The monetary value of advertising in the certification model is market specific, and is not estimated in this report.

The cost per visit is estimated at a value of $51 per hour or approximately $153 per visit based upon utility conservation staff performing the visits. Using these assumptions, the average annual cost per acre-foot of water saved in 2010 in the reclaim ordinance/legislation approach is $42 and in the certification program is estimated at $225.

4.0 Additional Considerations

Additional challenges for water efficiency and storm water management include (a) mobile carwash systems, almost all of which use pressure wash machines with wands similar to self-service carwashes; and (b) detail shops that offer “hand-washing”. In some communities, strict discharge prohibitions have led to the creation of mobile reclaim systems.

Another type of vehicle wash that is not well quantified is the industrial or commercial wash systems for trucks. Some, such as cement and concrete trucks require daily cleaning and have strict prohibitions on discharge. This has led to creation of wash water recycle systems using hoses with spray nozzles, and external reclaim pits designed to capture and separate all wash water. If the wash pads at these sites are properly designed, rainwater also collects in the pits and can serve to replenish water lost to evaporation and drag-out on the trucks. Construction sites and quarries also include tire-washing systems that typically recycle water from a catchment basin or pond as a truck exits the site. Driven by air quality regulations that prohibit particulate emissions from dirty tires, these systems are almost all recirculating and use non-potable water. This use of non-potable water suggests another potential resource management tool for future water efficiency in the use of non-potable water for vehicle washing.

As mentioned earlier, the ICA water use study was the first comparison of car wash water use by type and region to use data collected in the field. The study did not reveal the make and manufacturer of the carwash equipment. However, the wide variability of in-bay automatic data (mean = 43gpv, Stdev = 26gpv) suggests that differences in equipment as well as operation may be responsible for higher than average water use in some facilities. Utility-funded studies of specific equipment may be of some use in implementing a BMP, similar to MaP testing studies of toilets, by identifying carwash equipment that performs at or better than the industry average. For conveyor carwashes (mean = 34gpv, Stdev =15gpv), studies that identify the length, timing, use of reclaim, and type of equipment in a multivariate approach would assist in clearer

guidelines for efficiency and would assist greatly in the drafting of a clearly defined and fair BMP.