

Portland State University
Community Environmental Services
Metro Residential Recycling Campaign
Final Report



Prepared By
Melissa Tiefenthaler
Beth Cohen

February, 2009

Table of Contents

| | |
|--|----|
| Executive Summary | 2 |
| Campaign Summary..... | 3 |
| Protocol..... | 4 |
| Data Description | 5 |
| Campaign Activity | 6 |
| Findings..... | 10 |
| Baseline Findings..... | 10 |
| Impacts – Improvement of set-outs that Received Leave Behinds..... | 12 |
| Impacts – Plastic Bags | 12 |
| Impacts – Glass..... | 13 |
| Impacts – Grouped by Jurisdiction, Hauler, and Neighborhood | 16 |
| Comparison Group Experiment | 17 |
| Evaluation of Leave Behind Resources and Impacts..... | 17 |
| Field Observations | 18 |
| Obstacles Encountered..... | 18 |
| Recommendations..... | 19 |
| Recommendations for Roll Cart Monitoring Protocol..... | 19 |
| Recommendations for Haulers..... | 22 |
| Fiscal Summary | 22 |
| Appendix A - Leave Behind Materials | 23 |
| Appendix B – Campaign Observation Form | 25 |
| Appendix C - Miscellaneous Contaminant Category Guide..... | 26 |
| Appendix D-Neighborhood Analysis | 27 |
| Appendix E – Impact of Leave Behind Messaging (Phase I and Phase II) | 33 |
| Appendix F – Resident Letter | 37 |

Executive Summary

Metro Regional Government contracted with Community Environmental Services between January, 2008 and June 30, 2008 to deliver an educational residential recycling campaign to single family residents throughout the Portland metropolitan area. The goal of the Metro Residential Recycling Campaign (the Campaign) was to reduce contamination in single family residential curbside recycling set-outs by monitoring the contents of recycling set-outs and leaving fliers, called “leave behinds,” at the set-out to correct or reward the set-out preparation.

The Campaign reached set-outs at 31,878 different households. Community Environmental Services (CES) surveyed the set-outs at these households and distributed leave behind materials. Of these 31,878 set-outs, 14,685 set-outs were surveyed twice, once before receiving leave behinds (week one) and once after (week two) (see Figure 3). Set-outs that were surveyed in two different weeks were used to evaluate the effectiveness of leave behind messaging.

Of the set-outs that were surveyed twice, CES found that plastic bags were present in 22% of set-outs in week one. Sixty-three percent of the set-outs that received a leave behind about plastic bags in week one did not have plastic bags in week two

Of the set-outs that included glass in both weeks one and two, CES found that glass was improperly sorted in 44% of week one set-outs. Fifty-five percent of the set-outs that received a leave behind about improperly sorted glass in week one had properly sorted glass in week two.

Though the study was unable to have a control group, the dramatic drop in contamination for week two set-outs that received a corrective leave behind in week one suggests that leave behind messaging is an effective way to educate single family residents about proper set-out preparation.

This report summarizes the work and findings of Community Environmental Services (CES) on the Metro Residential Recycling Campaign from January 1, 2008 to December 15, 2008. The Metro Residential Campaign (the Campaign) began in January 2008 and has been conducted in two phases. Phase I occurred between January 2008 and June 30, 2008. Phase II was conducted between July 1, 2008 and January 31, 2009 with field work ending December 15, 2008.

Included are a campaign summary detailing protocol, findings, and field observations; a copy of the project data spreadsheet, and a fiscal summary. Also provided are evaluations and recommendations for leave behind resources and pilot tests. Campaign activity, defined by the amount of set-outs surveyed and leave behinds distributed, is summarized for both Phases I and II. Findings are presented for Phases I and II both separately and combined.

Campaign Summary

Metro contracted with Portland State University (PSU) Community Environmental Services (CES) to conduct a residential recycling campaign designed to reduce the presence of plastic bags, improperly sorted glass, and other contaminants in curbside recycling set-outs within the region. The Campaign addressed recycling practices with “point of activity” messaging delivered by Field Research Assistants through on route monitoring of recycling containers.

Goals of the Campaign

- reduce the incidence of plastic bags in curbside recycling
- reduce the amount of improperly set out glass in curbside recycling
- reduce the incidence of other obvious contaminants in curbside recycling
- evaluate the effectiveness of different types of point activity messaging
- make recommendations for the hauling community on best methods of conducting feedback activity

During Phase I, CES primarily surveyed curbside, bin set-outs. CES focused on surveying routes still with bins during Phase II and began surveying blue roll carts as well. CES surveyed both bins and carts in the same manner, by looking inside and shifting contents as necessary to create a better view. Though roll carts are much larger than bins, it was usually possible to see all or most of the contents in the roll carts with the exception of roll carts that were very full and tightly packed. In very full and tightly packed carts, the bottom 1/3 of the cart was obscured and a line of sight to the bottom could not be established.

Protocol

Field Research Assistants worked in teams of three people (the field team) to monitor 225-325 single family residential recycling set outs per recycling route. The field team surveyed the contents of the recycling set outs; removed plastic bags, improperly sorted (commingled) glass and miscellaneous contaminants; and corrected or rewarded recycling behavior by leaving the appropriate educational leave behind designed by Metro. Contaminants that were set aside by the field team were rejected by the hauling company to reinforce the message to the resident.

There are four types of leave behinds used for the Campaign (see Appendix A):

- a plastic bags flier (see Figure 9);
- a glass flier (see Figure 10);
- a sticker for miscellaneous contaminants (see Figure 11); and
- a recycling star flier for properly prepared recycling set-outs (see Figure 13).

CES also used a flier provided by the City of Gresham whenever roll carts in Gresham were placed too close to other objects or backward relative to the street. The Gresham flier contained general information about recycling set-out preparation and a specific message regarding appropriate placement of set-outs (see Appendix A, Figure 12). The message regarding appropriate spacing of roll carts appeared on the back of the flier and CES staff circled or highlighted the message to help it stand out.

CES sent the field team to each recycling route two weeks in a row to collect data before and after conducting point of activity feedback and to continue public outreach on route. The field team recorded the types of contaminants found by household and the corresponding leave behinds delivered at each set-out on a data sheet (see Appendix B). These observations were then entered by the field team into an excel spreadsheet that was analyzed by the Project Coordinator using Microsoft Excel, SPSS 16.0 (Statistical Package for the Social Sciences), and ArcGis 9.2. This dataset is used to evaluate the success of point of activity messaging using the protocol described above with the leave behinds designed by Metro.

To help the Campaign run smoothly on each route, the field team met with the recycling driver at 6AM unless requested to do otherwise by the hauler. These meetings were intended to reinforce the Campaign protocol and the expectation that the driver would reject the contaminants removed by the field team as well as garner any special directions from the driver. The haulers were overall supportive on route. The recycling driver normally reviewed the field team's map and indicated several areas the field team could work that were scheduled for collection during the later portion of the driver's shift. The field team then drove ahead of the hauler to the areas indicated in order to stay clear of the area the driver was servicing. On a recycling route of 500 customers, the field team could normally survey 225-325 set-outs before those households were serviced by the hauler.

The field team returned to the same area the following week and surveyed the same streets. Because households do not always set out their recycling two weeks in a row, not every house surveyed during week one was resurveyed in week two. Also, new set-outs are surveyed in week two which were not at curb during week one. Approximately 50% of the set-outs surveyed in week one were surveyed again in week two. Because not every set-out was surveyed during both weeks one and two, only the set-outs surveyed two weeks in a row are used for evaluating the impact of point of activity messaging.

During Phase II, the protocol for removing and recording miscellaneous contaminants was adjusted (contaminants other than plastic bags and commingled glass). This protocol change was adopted on September, 19 2008 and implemented on routes in Gresham and Clackamas. Changes included reserving the not recyclable stickers for only large, obvious contaminants such as Styrofoam blocks instead of applying a not recyclable sticker to each kind of contaminant found. Also, when the field team identified miscellaneous contaminants in a set-out, they began to specify its type by selecting one of eight categories of miscellaneous contaminants on the field observation form (Appendix B). The eight categories of contaminants, selected by Metro, were: paperboard (freezer boxes), deli containers/clamshells, food contaminated pizza boxes, blister packs, Styrofoam, plastic contaminated fiber, and glass/ceramics. Previously, miscellaneous contaminants were noted but not specified. The field team carried a field guide to help classify miscellaneous contaminants observed in set-outs (see Appendix C).

The field team was also asked by Metro during Phase I, to find more opportunities to award the recycling star. At the start of the Campaign, the field team awarded the recycling star 10 or less times per route. The recycling star was revised for Phase II in anticipation of surveying roll carts in which some of the contents might be obscured. The recycling star now states that “we spot-checked your roll cart for plastic bags and glass and did not find any. Way to go!” This allowed the field team to award the recycling stars to set-outs with a small amount of miscellaneous contaminants when the plastic bags were absent and glass was properly prepared. This change reduced the number of households that received no feedback at all due to miscellaneous contaminants.

Data Description

Data is provided for the work conducted during Phases I and II along with an analysis of the data collected during both Phases I and II. Findings for Phase I and Phase II are reported both separately and combined. Set-outs surveyed once were not included in the analysis, but are included in the summary of work conducted (see Table 1). The number of set-outs used for the plastic bag impact analysis is as follows. Phase I=7631 set-outs (see Figure 1), Phase II=7606 set-outs (see Figure 2), and Phase I and Phase II=14,685 set-outs combined (see Figure 3). For evaluating the impact of leave behind messaging on set-outs with glass, only set-outs that contained glass during weeks one and two were used. The number of set-outs used for the glass impact analysis is as follows. Phase I=2215 set-outs (see Figure 4), Phase II=1723 set-outs (see Figure 5), and Phase I and Phase II=3938 set-outs combined (see Figure 6).

Campaign Activity

In Phase I, CES surveyed 21,639 recycling set-outs in Washington County and Portland. Within these jurisdictions, CES worked with Waste Management, Arrow Sanitary, and Wacker Sanitary. The haulers' participation in the Campaign was voluntary and routes were chosen at the haulers discretion. In Phase I, CES distributed 3,579 plastic bag fliers, 3,818 glass fliers, 1,774 not recyclable stickers, and 3,718 recycling stars (see Table 1).

In Phase II, CES surveyed 24,494 recycling set-outs one or more times in Portland, Washington County, Fairview, Tualatin, Gresham, Wilsonville, and Clackamas. Within these jurisdictions, CES worked with Waste Management, Cornelius Disposal, 12-Mile Disposal, Allied Waste, Gresham Sanitary Services, Rockwood Solid Waste, Waste Connections, and Clackamas Garbage. In Phase II, CES distributed 6,078 plastic bag fliers, 3,627 glass fliers, 5,156 not recyclable stickers, 10,270 recycling stars, and 1,128 fliers from the City of Gresham (see Table 1). The number of leave behinds distributed for each jurisdiction in Phase I and Phase II is detailed in Table 1.

Table 1: Summary of Work Conducted and Leave Behinds Distributed During Phases I and II

| PHASE I | | | | | | | | | |
|------------------------------------|-------------|----------------------|---------------|-----------------|--------------|-------------------|------------------|-----------------|--|
| Jurisdiction/Hauler | Dates | Set-outs Surveyed | Bag Fliers | Glass Fliers | Stickers | Recycling star | Gresham Flier | Set-out Type | |
| <u>Portland</u> | | | | | | | | | |
| Waste Management | 04/41-09/29 | 11,789 | 1,842 | 2,496 | 1,740 | 3,637 | NA | Bins and Carts | |
| Arrow | 02/29-04/09 | 1,453 | 239 | 215 | 19 | 28 | NA | Bins | |
| Wacker | 03/11-04/09 | 2,461 | 364 | 314 | 15 | 46 | NA | Bins | |
| <i>Portland Subtotal</i> | | 15,703 | 2,445 | 3,025 | 1,807 | 3,711 | NA | | |
| <u>Washington County</u> | | | | | | | | | |
| Waste Management | 01/21-02/29 | 5,936 | 1,134 | 793 | 0 | 7 | NA | Bins and Carts | |
| Phase I Total | 01/21-09/29 | 21,639 | 3,579 | 3,818 | 1,774 | 3,718 | NA | | |
| PHASE II | | | | | | | | | |
| Jurisdiction/Hauler | Dates | Set-outs Surveyed | Bag Fliers | Glass Fliers | Stickers | Recycling star | Gresham Flier | Set-out Type | |
| <u>Clackamas</u> | | | | | | | | | |
| Clackamas Garbage | 11/17-12/10 | 549 | 166 | 14 | 13 | 345 | NA | Carts | |
| Waste Management | 08/28-12/10 | 1,290 | 316 | 334 | 377 | 419 | NA | Carts | |
| <i>Clackamas Subtotal</i> | | 1,839 | 482 | 348 | 390 | 764 | | | |
| <u>Fairview</u> | | | | | | | | | |
| 12-Mile | 06/22-08/11 | 2,254 | 597 | 758 | 582 | 549 | NA | Bins | |
| <u>Gresham</u> | | | | | | | | | |
| Gresham Sanitary Services | 09/29-11/04 | 3,186 | 1,063 | 184 | 52 | 1,883 | 355 | Carts | |
| Rockwood Solid Waste | 09/27-12/05 | 1,296 | 377 | 63 | 16 | 798 | 419 | Carts | |
| Waste Connections | 09/19-10/01 | 1,089 | 304 | 49 | 16 | 622 | 291 | Carts | |
| Waste Management | 11/19-11/26 | 512 | 188 | 24 | 74 | 265 | 63 | Carts | |
| <i>Gresham Subtotal</i> | | 6,083 | 1,932 | 320 | 158 | 3,568 | 1,128 | | |
| <u>Portland</u> | | | | | | | | | |
| Waste Management | 07/01-08/28 | 10,251 | 2,135 | 1,067 | 2,958 | 3,711 | NA | Bins and Carts | |
| <u>Tualatin</u> | | | | | | | | | |
| Allied Waste | 07/06-08/25 | 2,011 | 382 | 520 | 536 | 731 | NA | Bins | |
| <u>Washington County</u> | | | | | | | | | |
| Cornelius Disposal | 08/27-09/15 | 835 | 179 | 155 | 160 | 340 | NA | Bins | |
| <u>Wilsonville</u> | | | | | | | | | |
| Allied Waste | 09/05-09/25 | 1,651 | 371 | 459 | 372 | 607 | NA | Bins | |
| Phase II Total | 07/01-12/15 | 24,924 | 6,078 | 3,627 | 5,156 | 10,270 | 1,128 | | |
| PHASE I and PHASE II Totals | | 46,563 | 9,657 | 7,445 | 6,930 | 13,988 | 1,128 | | |

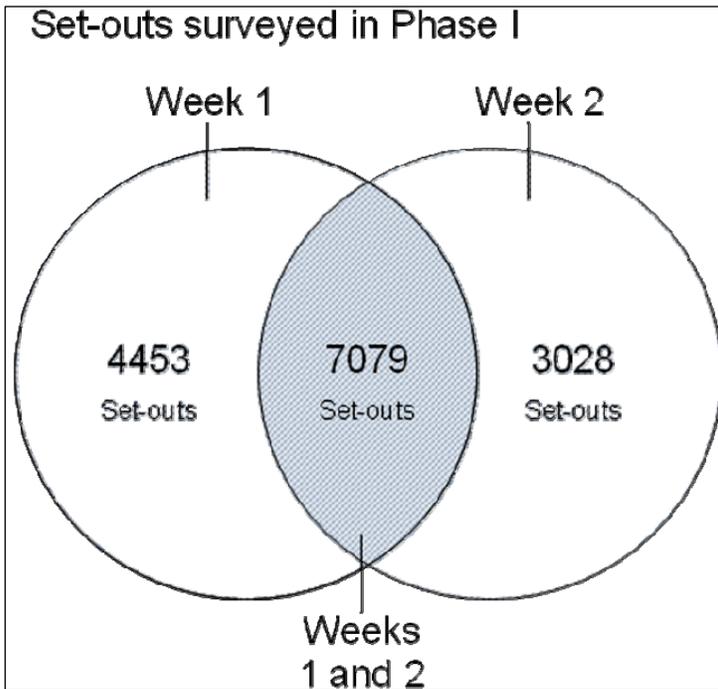


Figure 2: Set-outs Surveyed in Phase I.

The intersection of the two circles, 7079 set-outs, shows the set-outs that were surveyed in both weeks one and two and these set-outs were used for the plastic bag impact analysis (see Figure 20). The union of the two circles, $4453+7079+3028 = 14,560$, is the number of set-outs at different households surveyed in Phase I. $4453+7079+7079+3028$ equals 21,639, the total number of set-outs surveyed in Phase I (see Table 1).

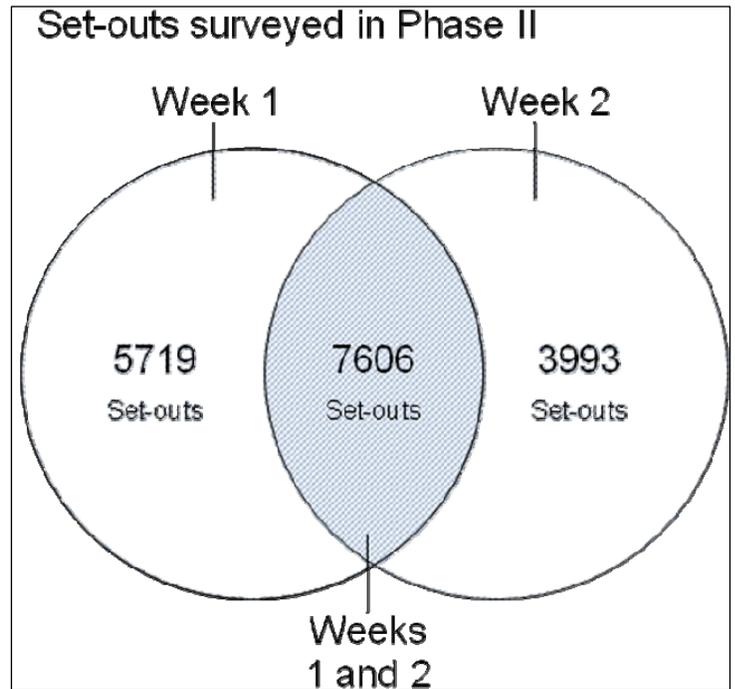


Figure 1: Set-outs Surveyed in Phase II.

The intersection of the two circles, 7606 set-outs, shows the set-outs that were surveyed in both weeks one and two and these set-outs were used for the plastic bag impact analysis (see Figure 21). The union of the two circles, $5719+7606+3993 = 17,318$, is the number of set-outs at different households surveyed in Phase II. $5719+7606+7606+3993$ equals 24,924, the total number of set-outs surveyed in Phase II (see Table 1).

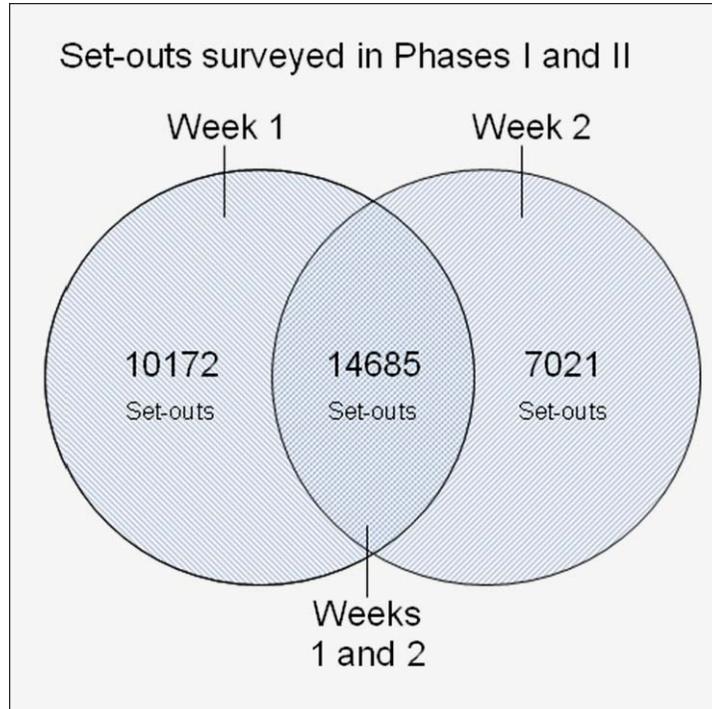


Figure 3: Set-outs Surveyed in Phases I and II.

The intersection of the two circles, 14,685 set-outs, shows the set-outs that were surveyed in both weeks one and two and these set-outs were used for the plastic bag impact analysis (see Figure 7). The union of the two circles, $10,172+14,685+7021 = 31,878$, is the number of set-outs at different households surveyed in Phases I and II. $10,172+14,685+14,685+7021$ equals 46,563, the total number of set-outs surveyed in Phases I and II (see Table 1).

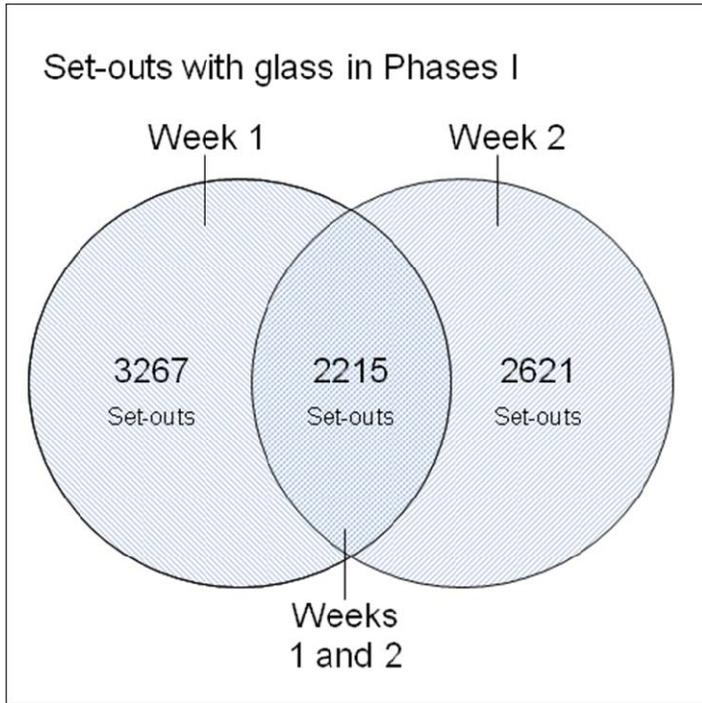


Figure 5: Set-outs with Glass Surveyed in Phase I. The intersection of the two circles represents the set-outs used for the glass impact analysis (see Figure 22).

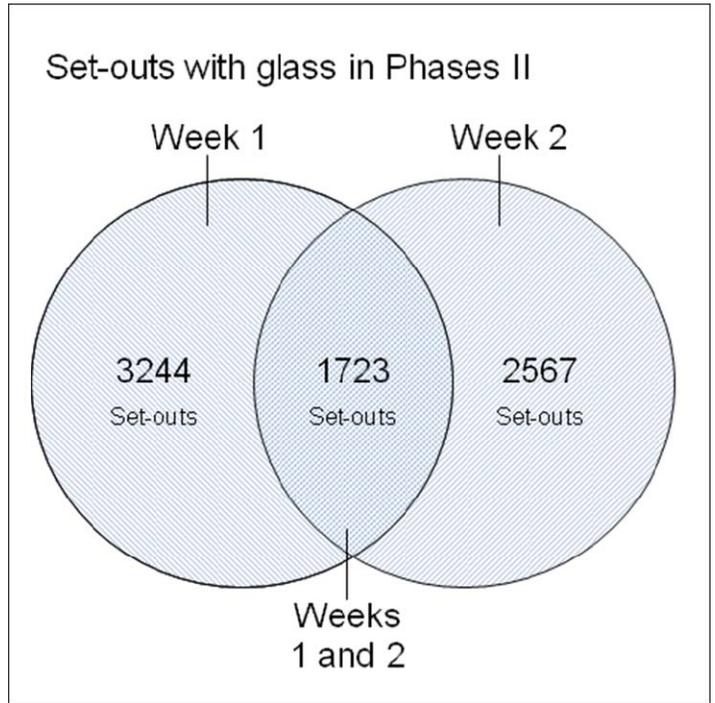


Figure 4: Set-outs with Glass Surveyed in Phase II. The intersection of the two circles represents the set-outs used for the glass impact analysis (see Figure 23).

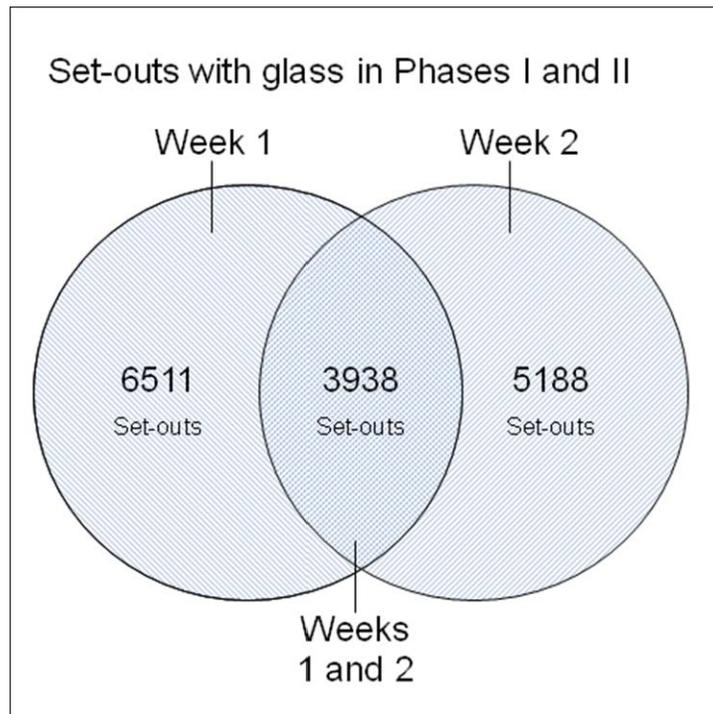


Figure 6: Set-outs Surveyed with Glass in Phases I and II. The intersection of the two circles represents the set-outs used for the glass impact analysis (see Figure 8).

Findings

Baseline Findings

Including plastic bags and commingling glass with other recyclables are the most common mistakes found to be made by single family households in preparing recycling set-outs. The percentage of set-outs that contain these contaminants during the first week of either phase is considered the Campaign baseline. This baseline number quantifies the extent to which contamination occurs in single family residential set-outs and can be compared to the percentage of set-outs with contamination during week two.

Using data from both Phases I and II, 44% of all set-outs that contained glass had improperly sorted glass during week one. Twenty-two percent of all set outs had plastic bags during week one at baseline (see Table 2). See Table 2 as well for baseline findings for detailing plastic bags and commingled glass in recycling set-outs by jurisdiction and hauler. These data are provided as a reference for each individual jurisdiction and hauler.

Baseline findings for plastic bags and glass by neighborhood are also provided in Appendix E. Figure 14 is an area overview map of the neighborhoods used for the analysis divided into subregions: Gresham, Portland, and Washington County. See Figure 15, Figure 16, and Figure 17 for the percent of set-outs with plastic bags during week one each neighborhood had in Gresham, Portland, and Washington County respectively. Figure 18 shows the baseline assessment for improperly sorted glass by neighborhood.

Table 2: Baseline Assessment of Targeted Contaminants

| | <u>Included Plastic Bags</u> | <u>Improperly sorted Glass¹</u> | <u>Phase</u> | <u>Set-Out Type</u> |
|---------------------------------------|----------------------------------|--|--------------|---------------------|
| <u>Clackamas</u> | | | | |
| Clackamas Garbage Waste Management | 24% (n ² =54) | N/A | II | Carts |
| <i>Clackamas Subtotal</i> | 26% (n=466) | 69% (n=119) | II | Carts |
| <u>Fairview</u> | | | | |
| 12-Mile | 31% (n=720) | 92% (n=196) | II | Bins |
| <u>Gresham</u> | | | | |
| Gresham Sanitary Service | 41% (n=869) | 29% (n=79) | II | Carts |
| Rockwood Solid Waste | 36% (n=348) | 19% (n=37) | II | Carts |
| Waste Connections | 33% (n=275) | 25% (n=28) | II | Carts |
| Waste Management | 43% (n=89) | N/A | II | Carts |
| <i>Gresham Subtotal</i> | 38% (n=1581) | 26% (n=144) | | |
| <u>Portland</u> | | | | |
| Arrow Sanitary | 16% (n=459) | 42% (n=98) | I | Bins |
| Wacker Sanitary | 15% (n=837) | 30% (n=296) | I | Bins |
| Waste Management | 19% (n=7059) | 37% (n=2103) | I, II | Bins and Carts |
| <i>Portland Subtotal</i> | 19% (n=7896) | 36% (n=2497) | | |
| <u>Tualatin</u> | | | | |
| Allied Waste | 19% (n=695) | 63% (n=191) | II | Bins |
| <u>Washington County</u> | | | | |
| Cornelius Disposal | 22% (n=250) | 80% (n=25) | II | Bins |
| Waste Management | 20% (n=1974) | 40% (n=552) | I | Bins and Carts |
| <i>Washington County Subtotal</i> | 20% (n=2224) | | | |
| <u>Wilsonville</u> | | | | |
| Allied Waste | 26% (n=599) | 74% (n=201) | II | Bins |
| <i>Phase I Total</i> | 17% (n=7079) | 41% (n=2215) | I | Primarily Bins |
| <i>Phase II Total</i> | 27% (n=7606) | 47% (n=1723) | II | Bins and Carts |
| <i>Campaign Total</i> | 22% (n=14,685) | 44% (n=3938) | I, II | Bins and Carts |

In addition to plastic bags and improperly sorted glass, CES recorded miscellaneous contaminants observed in recycling set-outs during Phase II beginning September, 19th 2008 on routes in Gresham and Clackamas County (See Table 3). CES surveyed 5,189 set-outs in consecutive weeks using this protocol in these jurisdictions. Out of the categories of contaminants specified by Metro the most frequently observed categories of miscellaneous contaminants were paperboard, deli containers/clamshells, and food contaminated pizza boxes. Still, contaminants can be hard to classify. Nearly 14% of set-outs had contaminants that the field team could not assign to the provided categories of contaminants.

¹ For the glass column, n equals the number of week 1 set-outs that included glass.

² n=the number of set-outs surveyed in both weeks one and two

Table 3: Percent of Set-Outs with Miscellaneous Contaminants (n=5,189)

| | |
|----------------------------|-------|
| Other | 13.9% |
| Paperboard | 12.7% |
| Deli containers/Clamshells | 10.2% |
| Pizza Boxes | 7.5% |
| Blister Pack | 6.1% |
| Styrofoam | 4.6% |
| Fiber w/ Plastic | 5% |
| Glass/Ceramic | 0.6% |

Impacts – Improvement of set-outs that Received Leave Behinds

Recycling behavior improved for those households that received leave behind messaging from the Campaign. Observed changes in recycling behavior for Phases I and II combined is presented in Figure 7 for bags and Figure 8 for glass. See Appendix D for the impact of leave behind messaging for Phases I and II separately (see Figure 20 and Figure 21 for plastic bags, and Figure 22 and Figure 23 for glass).

The figures begin with the number of set-outs surveyed in both weeks one and two for plastic bags and with the number of set-outs that included glass in both weeks one and two for glass. Following the figure from top to bottom, the first branch shows the number of set-outs prepared correctly and incorrectly during week one. The second branch shows the type of leave behind distributed. The third branch shows the number of set-outs that were prepared correctly or incorrectly during week two. Adding the totals of any branch will equal the number of set-outs surveyed. There is a summary table in the bottom left corner of each figure that highlights the statistics most often discussed in this report.

Impacts – Plastic Bags

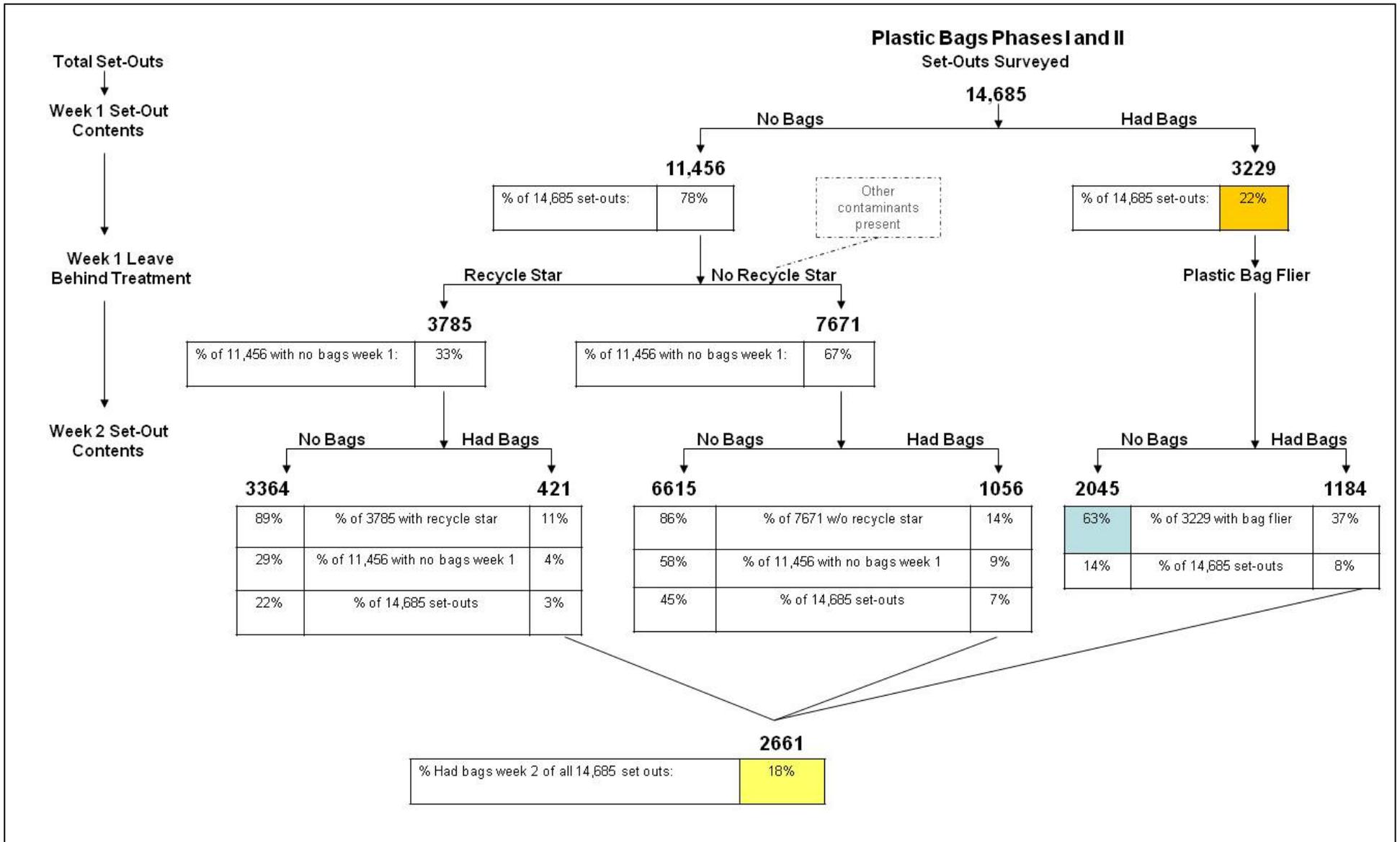
In Phases I and II combined, 22% of set-outs contained plastic bags in week one (see Figure 7 and Table 2). These set-outs received a corrective flier. Sixty-three percent of the set-outs that received the flier did not have plastic bags in week two. Of the set-outs that did not have plastic bags during week one, 33% received a recycling star and 67% did not receive a recycling star (meaning these set-outs had contaminants other than plastic bags) (see Figure 7). In week two, 89% of the set-outs that received a recycling star in week one did not have plastic bags in week two. Eighty-six percent of the set-outs that had plastic bags during week one but did not receive a recycling star did not have plastic bags. This suggests that the positive reinforcement helped keep plastic bags out of recycling set-outs in subsequent weeks. A small percentage of set-outs, 11%, received a recycling star and then included plastic bags in their recycling during week two. This percent is lower than in the group that did not receive the star (14%) and could be attributed to many variables. It is possible that different members of the household prepared the recycling set-out, the recycling star was lost or unnoticed, the recycling star

was misunderstood, or the resident that received the recycling star did not read English. Lastly, 18% of all the set-outs surveyed did not contain plastic bags (see Figure 7) during week two. This compares to the baseline finding of 22% (see Figure 7 and Table 2).

Impacts – Glass

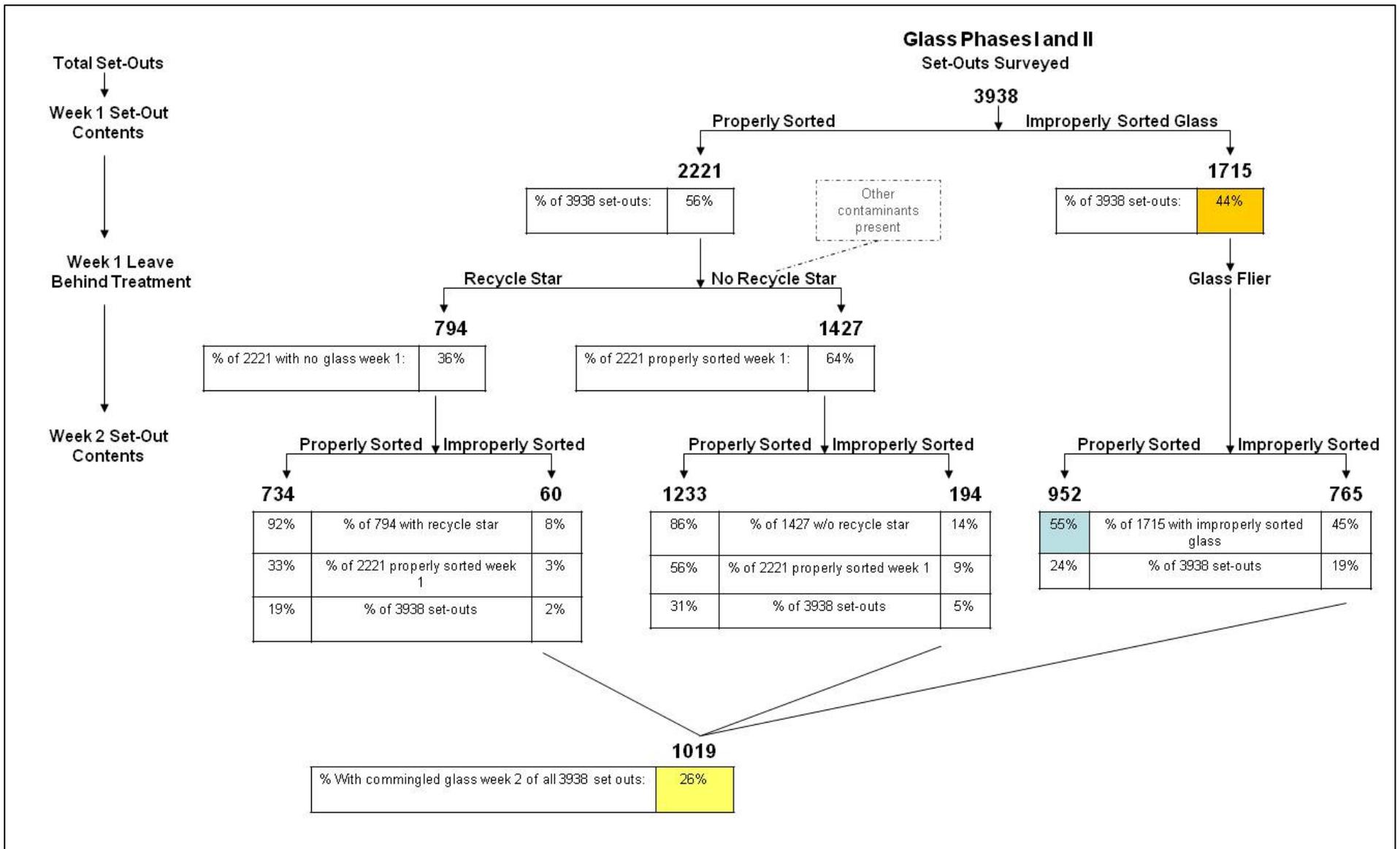
In Phases I and II combined, CES found that in 44% of set-outs that included glass, the glass was commingled with other recyclables (see Figure 8 and Table 2). These set-outs received a corrective flier. Fifty-five percent of the set-outs that received the flier and included glass in week two were properly prepared. Of the set-outs that had properly sorted glass during week one, 36% received a recycling star and 64% did not receive a recycling star (meaning these set-outs had other contaminants) (see Figure 8). During week two, 92% of the set-outs that received a recycling star in week one had properly sorted glass in week two. Of the set-outs that had properly sorted glass in week one but did not receive a recycling star, 86% properly sorted in week two. A small percentage of set-outs, 8%, received a recycling star and then contained commingled glass in their recycling set-outs during week two. This is a lower percent than in the group that did not receive the star (14%). Lastly, 26% of all the set-outs that included glass in both weeks one and two had commingled glass in week two (see Figure 8). This compares to the baseline finding of 44% (see Figure 8).

Since only set-outs that included glass are used to assess the impact of leave behind messaging on glass preparation, it is a better representation of changes in recycling behavior and Campaign impact than the plastic bag analysis. It is not possible to tell from the data available on plastic bags if households simply did not have plastic bags to include in week one or two but otherwise would have included them if they had them. Glass preparation is purposeful and by limiting this analysis to only set-outs that contained glass showed that 44% of set-outs had commingled glass during week one and only 26% had commingled glass during week two (see Figure 8). This is a great improvement.



- 22% of 14,685 set-outs had bags week 1.**
- 18% of 14,685 set-outs had bags week 2.**
- 63% of 3,229 set-outs that received a flier in week 1 did not have bags week 2**

Figure 7: Impact of Leave Behind Messaging on Plastic Bags (Phases I and II).



44% of 3938 set-outs had improperly sorted glass week 1.

26% of 3938 set-outs had improperly sorted glass week 2.

55% of 1715 set-outs that received a flier in week 1 had properly sorted glass week 2

Figure 8: Impact of Leave Behind Messaging on Glass (Phases I and II).

Impacts – Grouped by Jurisdiction, Hauler, and Neighborhood

Table 4 shows changes in the recycling behavior after leave behind messaging grouped by jurisdiction and hauler. The table reports the percentage of set-outs that were prepared correctly in week two after receiving a corrective leave behind for preparation mistakes in week one. The percentage of set-outs that received a plastic bag flier and did not include plastic bags during week two is presented by neighborhood in Appendix E, Figure 19. An analysis by neighborhood for glass was not possible due to small sample sizes.

Table 4: Percent of Set-outs Prepared Properly in Week Two after Receiving a Corrective Leave Behind in Week One

| | <u>Plastic Bags</u> | <u>Glass³</u> | <u>Phase</u> | <u>Set-Out Type</u> |
|------------------------------------|--------------------------|--------------------------|--------------|---------------------|
| <u>Clackamas</u> | | | | |
| Clackamas Garbage Waste Management | 77% (n ⁴ =13) | N/A | II | Carts |
| | 59% (n=120) | 50% (n=82) | II | Carts |
| <i>Clackamas Subtotal</i> | 61% (n=133) | 50% (n=82) | | |
| <u>Fairview</u> | | | | |
| 12-Mile | 64% (n=225) | 41% (n=180) | II | Bins |
| <u>Gresham</u> | | | | |
| Gresham Sanitary Service | 60% (n=353) | 61% (n=23) | II | Carts |
| Rockwood Solid Waste | 84% (n=126) | 86% (n=7) | II | Carts |
| Waste Connections | 34% (n=90) | 14% (n=7) | II | Carts |
| Waste Management | 40% (n=38) | N/A | II | Carts |
| <i>Gresham Subtotal</i> | 61% (n=607) | 70% (n=37) | | |
| <u>Portland</u> | | | | |
| Arrow Sanitary | 74% (n=72) | 59% (n=41) | I | Bins |
| Wacker Sanitary | 64% (n=125) | 78% (n=87) | I | Bins |
| Waste Management | 65% (n=1331) | 52% (n=777) | I, II | Bins and Carts |
| <i>Portland Subtotal</i> | 65% (n=1528) | 55% (n=905) | | |
| <u>Tualatin</u> | | | | |
| Allied Waste | 70% (n=134) | 48% (n=120) | II | Bins |
| <u>Washington County</u> | | | | |
| Cornelius Disposal | 70% (n=56) | 35% (n=20) | II | Bins |
| Waste Management | 55% (n=395) | 70% (n=222) | I, II | Bins and Carts |
| <i>Washington County Subtotal</i> | 57% (n=451) | 67% (n=242) | | |
| <u>Wilsonville</u> | | | | |
| Allied Waste | 67% (n=156) | 62% (n=149) | II | |
| <i>Campaign Total⁵</i> | 63% (n=3234) | 55% (n=1715) | I and II | Bins and Carts |

³ Glass must be set out in both weeks one and two to be included in the calculation.

⁴ n=the number of set-outs that received a corrective plastic bag or glass flier and was resurveyed in week two.

⁵ The figures presented in the Campaign Total row can also be found in Figure 7 and Figure 8 in the boxes with blue shading.

Comparison Group Experiment

To assess whether the observed positive behavior change is significant, CES conducted three comparison group experiments in Portland during Phase I. In the comparison group experiments, the field team simply observed and documented the contents of recycling set-outs on three recycling routes without intervening in any way. The field team did not separate the contaminants and did not leave any leave behind materials in week one. Since it would not change any results, the field team did separate contaminants and distribute leave behinds in week two for the purpose of simultaneously conducting public outreach while collecting data. The results of the comparison group routes are compared to intervention routes conducted during several weeks of surveys in Portland during Phase I. CES conducted this comparison group experiment to be able to gauge how much recycling behavior changes without intervention week one to week two. This information helps inform us how much recycling set-outs may vary due to other variables such as differences in the types of recyclables accumulated by the household week to week or different household members preparing the recycling each week.

The comparison group routes as compared to the intervention routes in Portland showed that a higher percentage of set-outs on intervention routes are prepared correctly. Using several weeks of data from intervention routes conducted in Portland in Phase I, 66% of set-outs that received a plastic bag flier did not have plastic bags in week two. Only 51% did not have bags in week two in the comparison group. Fifty-three percent of set-outs in Portland that received glass fliers prepared glass properly in week two. Only 29% of set-outs with glass had properly prepared glass in week two for the comparison group.

A z-test of two proportions shows that the percentage of residents who changed their recycling behavior is significantly higher on intervention routes for both plastic bags ($p > .05$). This means we are better than 95% certain that the higher percentage of set-outs are prepared correctly in week two after receiving corrective fliers.

Evaluation of Leave Behind Resources and Impacts

It is the evaluation of CES that the leave behind materials are well-designed and make an impact on the residents who receive them. CES has received multiple anecdotal reports that people have responded positively to the leave behinds. Residents that stopped to chat with the field team enjoyed receiving the recycling star. They also showed interest in the corrective fliers when issued personally by the field team.

After retrofitting the leave behinds with elastic bands, the leave behind materials now hang nicely from the handle of the curbside bin. The field team now either wraps the elastic band around the plastic bag or hangs the leave behind from the handle of the roll cart.

The stickers also work well for a variety of contaminants; however, their impact seems greatest for larger contaminants. Smaller contaminants that are set aside are often mistaken for garbage by residents even when marked with a sticker. The field team often found miscellaneous contaminants previously marked with stickers in the recycling set-outs during week two.

It is believed that leave behind messaging played a positive role in changing set-out preparation because a high percentage of set-outs do not have plastic bags and have properly prepared glass after receiving a corrective flier (see Figure 7 and Figure 8). Also, a higher percentage of set-outs that received a recycling star for proper preparation compared to proper set-outs that did not receive a recycling star were also properly prepared in week two.

Field Observations

Informal observations were made by CES about the most commonly encountered contaminants in the field and trends in the way set outs are improperly prepared.

Consistent with the focus of the Campaign, inclusion of plastic bags and improperly sorted glass stand out as the most common mistakes observed on single family recycling routes in the Portland Metro region.

There are several kinds of plastic bag contamination. Grocery bags are the most common type of plastic bag included in recycling set outs. Grocery bags are frequently included as bags of bags or used to contain other recyclables. Unopened newspapers still wrapped in their plastic bags are another way plastic bags are commonly included in set outs. Common also is plastic still wrapped around cardboard flats from warehouse-style stores such as Costco.

The two most common mistakes CES has observed that residents make when setting out their glass are commingling glass in one bin or in the roll cart with other materials and separating glass with a paper bag rather than a separate rigid container.

Some roll carts are extremely contaminated with miscellaneous contaminants. When roll carts are packed full of items that are not recyclable curbside, it is difficult to address the problem with the existing leave behinds if glass and plastic bags are not among the contaminants included. For small contaminants, the stickers are sometimes ignored or seem to go unnoticed. The field team did not remove all miscellaneous contaminants because this would create unsightly litter that is difficult to secure against the wind. Bags of contaminants that are indistinguishable from bags of household trash are also common in recycling set-outs.

Seasonal variation in contamination has also been observed in the field. The field team found a high number of set outs with plastic berry containers during the summer. The week after the 4th of July, the field team found many roll carts packed to the brim with the paper and cardboard residuals from discharged fireworks.

Obstacles Encountered

Though the field team encounters curious residents several times per route, they have usually been satisfied with their explanation of the Campaign and their affiliation with

PSU and Metro. The field team carries a letter of explanation which describes the Campaign and provides contact information for Metro and CES (see Appendix E). The resident letter normally diffuses tension well. CES has only received two phone calls with further inquiries about the Campaign. Metro has received some phone calls as well and the haulers have been contacted the most, though no contact information for individual haulers is provided in the resident letter.

The police have been summoned twice to respond to what appeared to residents to be suspicious activity but was from Campaign field work. The first visit, the officer easily accepted the field team's explanation of the Campaign, but the Campaign was not easily explained on the second visit to Clackamas County's Deputy-Sheriff. This occurred during mid-December before dawn on one of the shorter days of the year and the Deputy-Sheriff was especially concerned about pre-dawn Campaign activities. In future outreach efforts involving contract field work, CES recommends that the local jurisdiction or hauler contact the police department before beginning work to prevent misunderstandings and confrontations. Jurisdictions and haulers can also alert their residents/customers about field work to help alleviate concern. This may influence baseline findings, but the impact would likely be positive and may even improve the success of outreach conducted in the field.

Recommendations

Recommendations for Roll Cart Monitoring Protocol

It is believed that leave behind messaging delivered throughout the Campaign had a positive effect on recycling set-out preparation. This was observed in both Phases I and II and in both bins and carts. These findings lead CES to recommend leave behind messaging for future outreach efforts conducted by recycling haulers.

Throughout the Campaign, set-out preparation was assessed by a field team that physically looked and dug through each bin or cart. Contamination can also be identified with the aid of a camera mounted on the hopper of a recycling truck that captures images of the contents of each set-out as they are collected and displays these images on a monitor in the cab. Both methods have advantages and weaknesses (Table 5). For example, camera technology allows drivers to remain in the cab while identifying contaminants. This is especially time-saving when operating a fully-automated truck. Cameras can be useful for quickly identifying plastic bags and glass in recycling set-outs, but may miss other common contaminants such as paperboard, deli containers, and clamshells. Because trade-offs exist between human identification and camera identification of contaminants in recycling, CES recommends haulers use both methods and that further research is conducted on the pros and cons of each method. CES further recommends researching the effectiveness of cameras in identifying recycling contamination.

The ability to correctly identify all roll carts with contamination, identify a range of contaminants, and determine contamination severity with cameras is uncertain. Through camera demonstrations by haulers CES has observed that cameras can capture images of plastic bags and other large contaminants. Whether cameras capture images of plastic bags every time they are present in roll carts is not known. It is possible that cameras favor loose plastic bags that flutter in the camera's view as opposed to plastic bags that are bagged in to one bag. Cameras may also have a weakness in identifying contamination in a particular location in the roll cart. We assume that, depending on how full the roll cart is, a person looking in the cart cannot identify contamination at the bottom of the cart. It could also be the case that contamination at the top of the cart is hard to identify with cameras because it is quickly covered with items at the bottom of the cart. Lastly, wet-strength paperboard (found in 12.7% of set-outs), and deli containers (found in 10.2% of set-outs), and other small but prevalent contaminants may be difficult to identify by use of a camera which could limit future outreach efforts targeting these items (see Table 3).

Haulers using camera technology to identify contaminants interviewed by CES reported rates of contaminant identification far below that identified by MRC in Phase I & II using human observations. One hauler reported that contaminants were identified using camera technology for 0-5 households per route. This compares to data from 20 routes conducted during MRC Phase II in Gresham where the human observers identified contaminants warranting a corrective leave behind for an average of 55 households per route. Differences in the rates of contaminant identification may be due to the inability of cameras to truly allow for identification of certain materials and/or materials in certain parts of the roll cart. They may also be due to driver inability to consistently monitor hopper cameras when competing tasks demand attention. Conversations with drivers indicate that monitoring simultaneous activities surrounding the truck can compete with monitoring a hopper camera for recycling contaminants. Additionally, drivers may feel pressure to service a large number of households and may not feel they have the time to leave notices or call in instances of contamination. These barriers are worth understanding better so solutions can be suggested to haulers that are willing to invest in cameras to ensure cameras are fully utilized. CES recommends researching the barriers to camera usage and leave behind messaging that hauler's experience through a focus group.

To provide local jurisdictions with a thorough analysis on the pros and cons and ultimately costs and benefits of camera usage for recycling contaminant identification, these uncertainties should be researched more carefully and compared to other methods. This will allow local jurisdictions to provide their haulers a clear set of choices on ways to reduce contamination.

The assessment of the impact of leave behind messaging can be strengthened by designing a time-series comparison group experiment similar to the experiment conducted in Portland in Phase I.⁶ Using a time-series design, the field team would monitor changes in recycling behavior for two consecutive weeks before introducing leave behind messaging and for two consecutive weeks after introducing leave behind messaging. If the groups

⁶ Campbell, D. and Stanley, J., 1963. *Experimental and Quasi-experimental Designs for Research* by D.T. Campbell and J.C. Stanley, Chicago: Rand McNally, 1963.

that receive leave behind messages experience a higher percentage of change than the groups that did not receive leave behind messages then the claim that that leave behind messaging has a positive effect on recycling behavior will be strengthened. This was the outcome of the comparison group experiment performed in Portland in Phase I, but this experiment compared many different routes in Portland rather than using a time-series design.

Table 5: CES Summary of Human vs. Camera Identification of Recycling Contaminants

Advantages and disadvantages of identifying contaminants by physically looking and with cameras that can be quantified through Phase III research.

| | Physically Looking | Camera |
|--|--|---|
| Accuracy | <p>Benefits: All types of contamination, even deli containers, wet-strength paperboard, and plastic wrapped flats can be identified by directly looking in the roll cart.</p> <p>Drawbacks: Items in the bottom 1/3 of the roll cart may be missed when the cart is very full.</p> | <p>Benefits: Glass is very easily identified especially with cameras equipped with microphones. Loose bags are easy to spot.</p> <p>Drawbacks: It may be difficult to spot a large variety of contaminants. Wet-strength paperboard (freezer boxes) would be impossible to distinguish.</p> |
| Time | <p>Benefits: This method is more time consuming, but is still applicable for drivers with semi-automated routes or for a small portion of any route. A team in a separate vehicle could also provide these checks as a service.</p> <p>Drawbacks: This method, if performed by the driver with the expectation to issue notices for every instance of contamination could double the time a driver with a fully-automated truck spends on route.</p> | <p>Benefits: Driver does not need to leave cab to identify contamination.</p> <p>Drawbacks: Driver still must leave the cab to leave notices or take time calling in contaminated set-outs. Drivers might not make time for direct education or documentation.</p> |
| Benefit to Materials Recovery Facility (MRF) | <p>Benefit: Contaminants can be removed while inspecting the roll cart and diverted from the MRF.</p> | <p>Drawbacks: Driver must climb in the hopper to remove contamination. Only the largest, most obvious contaminants are removed.</p> |
| Educational Value | <p>Benefit: Contamination can be removed by the driver and left to the side of the roll cart. This visual aid can strengthen educational messages.</p> | <p>Benefit: Images of contamination can be mailed or emailed to the customer.</p> |

Recommendations for Haulers

Haulers can use a combination of cameras, if they have them available, and physical examination of the recycling set-outs. Since 18% of roll carts are placed at the curb with incorrect spacing, this presents a good opportunity for even drivers of fully automated recycling trucks to take a physical look at the contents some roll carts. Further, roll carts that were improperly placed had a higher rate of plastic bag contamination (22% compared to 16% in properly placed roll carts).

Haulers can develop their own field teams or send a route supervisor to walk a sample of streets to check recycling set-outs for problems. This would allow the drivers to work quickly without the responsibility of checking set-outs for recycling or by relying solely on a camera for contamination identification if available. This allows the field team or supervisor to collect detailed information on recycling set out preparation and conduct time-consuming direct education. Chula Vista, CA relies on a method like this to keep contamination levels low and it is also a best practice recommended by Kinsella and Gertman in their 2007 publication “Single Stream Recycling Best Practices Implementation Guide.”⁷

Fiscal Summary

The Campaign was initially funded through a cost reimbursable contract for \$76,000 with work to be conducted from January 1, 2008 to June 30, 2008. Those funds were allocated with roughly: 70% for personnel; 10% for vehicles, travel, and supplies; and 20% for administrative costs. Phase I funds were under expended by roughly \$23,000.

Additional funds in the amount of \$74,000 were added to the Campaign as Phase II funds and the project was extended to run until January 31, 2009. Those funds were again budgeted at roughly: 70% for personnel; 10% for vehicles, travel, and supplies; and 20% for administrative costs. Phase II funds were over expended by roughly \$4500. Reasons for over expending were over-estimating the number of routes that could be surveyed within the budget. Routes were also located further from PSU during Phase II than in Phase I which resulted in an unanticipated increase of vehicle costs.

⁷ Kinsella, S and Gertman, R. (2007) *Single Stream Recycling Best Practices Implementation Guide*.
www.conservatree.com/learn/SolidWaste/BestPracticesGuide021407.pdf.

Appendix A - Leave Behind Materials

Keep Plastics Bags Off the Curb

Oops!
Plastic bags are recyclable — just not at the curb.



Why?
Plastic bags get tangled in recycling sorting equipment and reduce its effectiveness.

To keep things running smoothly, please do not put plastic bags in your curbside recycling.

Take your bags to a local grocery store or call Metro Recycling Information at **503-234-3000** to find a recycling center near you or check out RecycleAtHome.org.

Thanks for recycling plastic bags at locations other than the curb. Together our efforts won't go to waste.

 Metro | *People places. Open spaces.*
Printed on 100% post-consumer recycled content paper.

1." gluestick

**PLASTIC BAGS
NOT RECYCLABLE
CURBSIDE**

Keep glass on the side

Oops!
Please keep glass on the side.



Place your glass in a separate bin or rigid container beside your recycling cart or bin.

Why? Glass breaks. And if mixed with other recyclables, broken glass damages equipment at paper mills and ends up as garbage.

Because of your efforts, our region's recycling programs are among the best in the nation. Together our efforts won't go to waste.

For more information, call your garbage and recycling hauler or your city or county recycling program.

 Metro | *People places. Open spaces.*
Printed on 100% post-consumer recycled content paper. 08392 mdr

**KEEP GLASS
ON THE SIDE**

Figure 9: Plastic Bags Flier

Figure 10: Glass Flier



Figure 11: Not Recyclable at the Curb Sticker



Way to go!
Your recycling set-out looks great.

Portland metropolitan area residents have a great recycling ethic. In fact, more than 780,000 tons of recycling was collected from the Metro area in 2006, saving energy and natural resources and supporting the local economy.

Recycling works best when materials are set out right and problem materials are avoided. Please remember to keep glass in a separate container and to recycle plastic bags at recycling centers or your local grocery store, not at the curb.

Today, we spot-checked your roll cart for plastic bags and glass and didn't find any. Way to go! Thanks to your efforts, our region's recycling programs are among the best in the nation!

If you have questions about recycling or would like other waste-reduction ideas, call Metro Recycling Information at 503-234-3000 or check out www.RecycleAtHome.org.

Together our efforts won't go to waste.

 Metro | People places. Open spaces.
Printed on 100% post-consumer recycled content paper. 08392mdw

Figure 13: Recycling star

How to Recycle with Your New Cart
Refer to the other side of this card for recycling instructions.

Keep glass bottles and jars out of the cart.

Unacceptable materials

- Paper cups & plates
- Napkins & paper towels
- Food-soiled paper
- Frozen food boxes
- Styrofoam blocks & packing peanuts
- Plastic bags
- Motor oil
- Hazardous waste bottles
- Plastic clamshells & trays

Important Tips!

- Put your small scrap paper items and shredded paper in a paper bag before placing in the cart. This will help reduce litter when the cart is emptied on windy days.
- You don't need to put your recycling cart out for collection every week. Put it out only when it is full. That saves you time and energy, and makes the collection system more efficient.
- Your recyclables, garbage and yard debris should be out on the curb by 6:00 a.m. on collection day.
- Place cardboard boxes inside the cart. Flatten and cut boxes to a size that will fit.

Setting out your recycling, garbage and yard debris
Please leave a space of 3 feet between your cans and carts, and, when possible, leave a space of 10 feet between your cart and cars, trees and basketball hoops.

Plastic tubs added to program
You may now recycle plastic tubs 6 ounces or larger in size, such as yogurt and margarine. You can also recycle rigid plastic nursery pots that are 4 inches across or larger, and plastic buckets.

What to do with your extra Curby bin
Keep one of your bins for storing and setting out your glass bottles and jars. You may put the other out on collection day for pick-up by your hauler. Please put a note that says "Hauler – please take" on the bin you want removed.

More information
Contact your hauler for service questions

| | |
|-------------------------|--------------|
| Arrow/American Sanitary | 503-257-1331 |
| Gresham Sanitary | 503-665-2424 |
| Hoodview Disposal | 503-666-8300 |
| Rockwood Solid Waste | 503-666-3488 |
| Waste Management | 503-249-8078 |

Contact the City of Gresham Recycling Program for general information
503-618-2656
E-mail: recycle@ci-gresham.or.us
www.ci.gresham.or.us

RECYCLE IN CART

PLASTIC
Plastic bottles & tubs 6 ounces or larger
Rigid plastic nursery plant pots 4" across or larger
Plastic buckets

PAPER
Flattened cardboard
Magazines & phone books
Cereal, cracker & shoe type boxes
Mail & office paper
Newspapers
Paper egg cartons
Paper bags

METAL
Clean metal cans & lids
Clean full items
Empty aerosol cans
Other small metal items

NO GARBAGE **NO YARD DEBRIS**

NEAR CART
MOTOR OIL IN JUG
GLASS BOTTLES IN BIN

Place items in their appropriate containers on the ground next to this cart.

Figure 12: Gresham Flier

Appendix B

Residential Recycling Campaign Observation Form

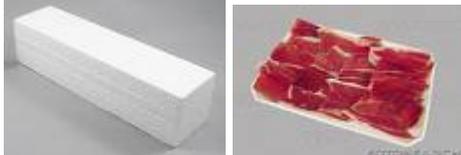
Route #: _____ Date: _____
 City/County: Gresham Check if route is complete (225-325)

Staff: _____

Data Entry: _____
 Hauler: _____
 Route Manager: _____
 Office Number: _____
 Cell Number: _____

| Address | | Recycling Observations | | | | | | | | | | | | | | | Remarks | | | | | | |
|-------------------------------------|-------------|--|----------------|----------------|-----------------|-----------------|--------------------|----------------|------------------------|---------|-----------|--------|---------|------------------------|---------|------------|---------|------------------|------------|---------------|-----------|-------|--|
| House # | Street Name | Plastic Bags | | Glass | | | Other Contaminant? | | Intervention Type | | | | | Minor Contaminant Type | | | | | | | | | |
| | | N ₀ | Y ₁ | N ₀ | PS ₁ | MS ₂ | N ₀ | Y ₁ | Flier(s) | Sticker | Way to Go | Verbal | Spacing | Styrofoam | Blister | Delif/Clam | | Fiber w/ plastic | Paperboard | Glass/Ceramic | Pizza box | Other | |
| | | N ₀ | Y ₁ | N ₀ | PS ₁ | MS ₂ | N ₀ | Y ₁ | F | S | W | V | SP | S | B | D | FP | PB | G | PZ | O | | |
| | | N ₀ | Y ₁ | N ₀ | PS ₁ | MS ₂ | N ₀ | Y ₁ | F | S | W | V | SP | S | B | D | FP | PB | G | PZ | O | | |
| | | N ₀ | Y ₁ | N ₀ | PS ₁ | MS ₂ | N ₀ | Y ₁ | F | S | W | V | SP | S | B | D | FP | PB | G | PZ | O | | |
| | | N ₀ | Y ₁ | N ₀ | PS ₁ | MS ₂ | N ₀ | Y ₁ | F | S | W | V | SP | S | B | D | FP | PB | G | PZ | O | | |
| | | N ₀ | Y ₁ | N ₀ | PS ₁ | MS ₂ | N ₀ | Y ₁ | F | S | W | V | SP | S | B | D | FP | PB | G | PZ | O | | |
| | | N ₀ | Y ₁ | N ₀ | PS ₁ | MS ₂ | N ₀ | Y ₁ | F | S | W | V | SP | S | B | D | FP | PB | G | PZ | O | | |
| | | N ₀ | Y ₁ | N ₀ | PS ₁ | MS ₂ | N ₀ | Y ₁ | F | S | W | V | SP | S | B | D | FP | PB | G | PZ | O | | |
| | | N ₀ | Y ₁ | N ₀ | PS ₁ | MS ₂ | N ₀ | Y ₁ | F | S | W | V | SP | S | B | D | FP | PB | G | PZ | O | | |
| | | N ₀ | Y ₁ | N ₀ | PS ₁ | MS ₂ | N ₀ | Y ₁ | F | S | W | V | SP | S | B | D | FP | PB | G | PZ | O | | |
| Include the prefix and street type. | | Circle one choice in every column per row. | | | | | | | Circle all that apply. | | | | | | | | | | | | | | |

Appendix C - Miscellaneous Contaminant Category Guide

| Category | Description |
|---------------------|---|
| Styrofoam | <p>Blocks and meat trays.</p>  |
| Blister Pack | <p>Plastic blister packaging generally refers to preformed plastic attached to a paperboard or foil backing. Examples include unit-dose packaging for pills, packaging for pens, and packaging for some children's toys.</p>  |
| Deli/Clam | <p>Includes items such as plastic deli containers, plastic clamshells (often for food, toys, or electronics), and plastic berry containers.</p>  |
| Fiber w/ Plastic | <p>Fiber (paper/cardboard/cardstock) must be separated from plastic packaging. Flats of bulk purchases must be free of their plastic wrap. Cereal boxes must be free of the inner plastic bag. (Plastic windows in envelopes are okay).</p>  |
| Paperboard | <p>Wet-strength or wax-coated paperboard can not be recycled. It often comes from the refrigerator/freezer. (Our write-in-the-rain paper is not recyclable).</p>  |
| Glass/Ceramic | <p>Non-recyclable glass items include Pyrex (brand name glassware from the kitchen), drinking glasses, and window glass. Mugs and other ceramics are also not recyclable.</p>  |
| Pizza Box | <p>Grease-stained pizza boxes can not be recycled. Non-greasy portions of the box may be recycled.</p> |
| Other | <p>Any other non-recyclable item can be classified as "other."</p> |

MRC Neighborhood Analysis: Bags Baseline Study Area

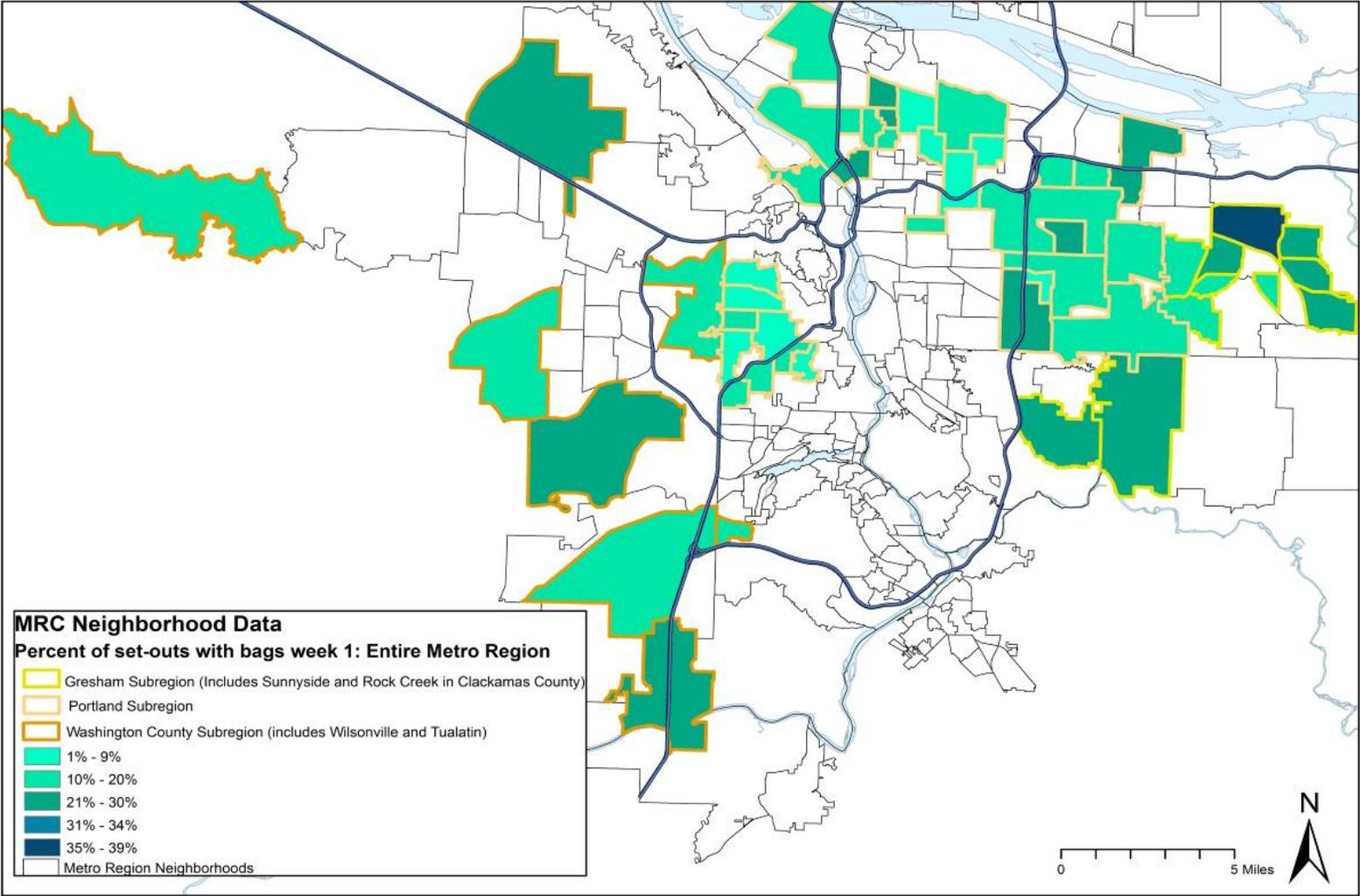


Figure 14: Neighborhood Subregion Area Map

MRC Neighborhood Analysis: Bags Baseline Gresham Subregion

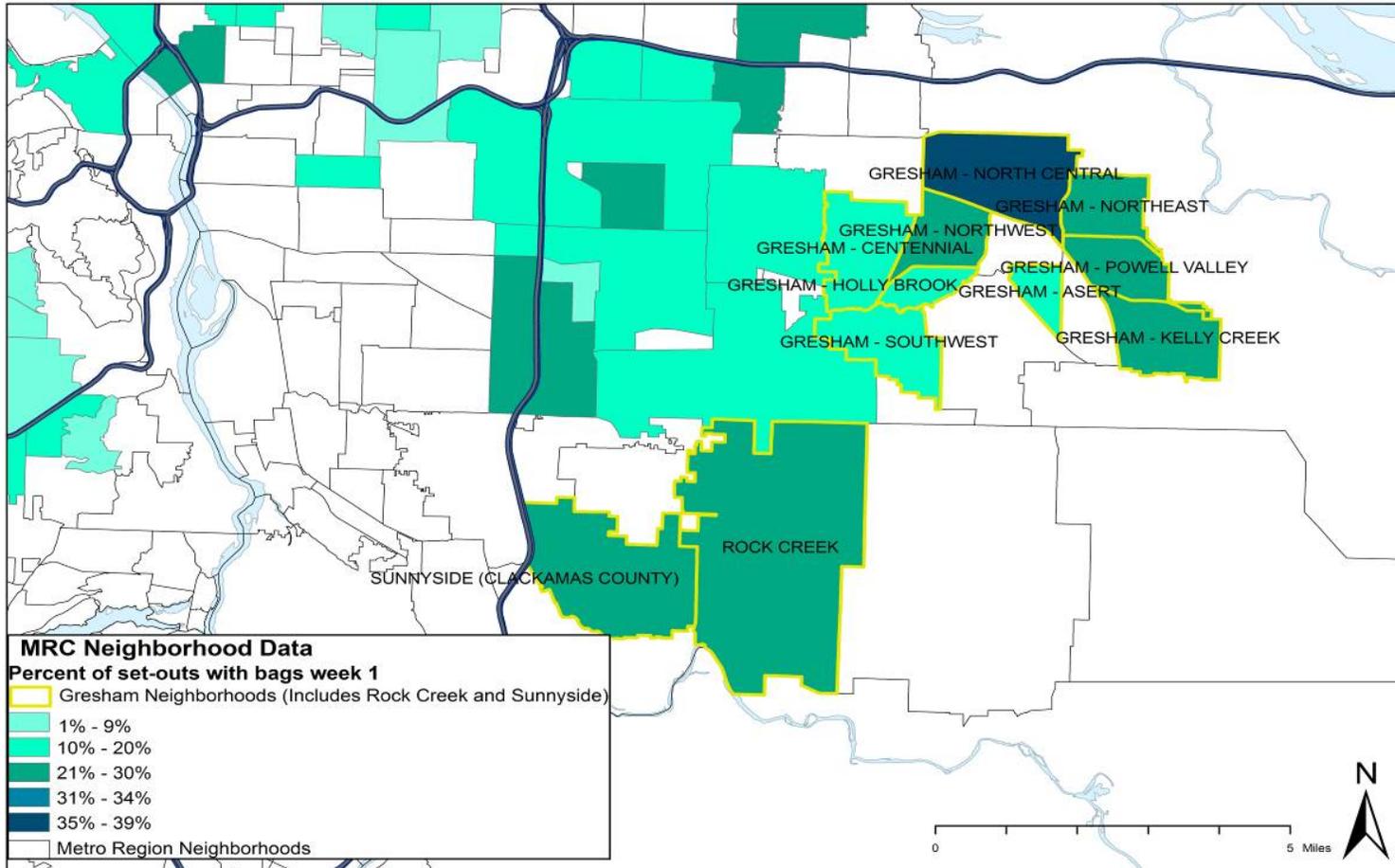


Figure 15: Percent of Set-outs with Bags Week One by Neighborhood (Gresham Subregion)

MRC Neighborhood Analysis: Bags Baseline Portland Subregion

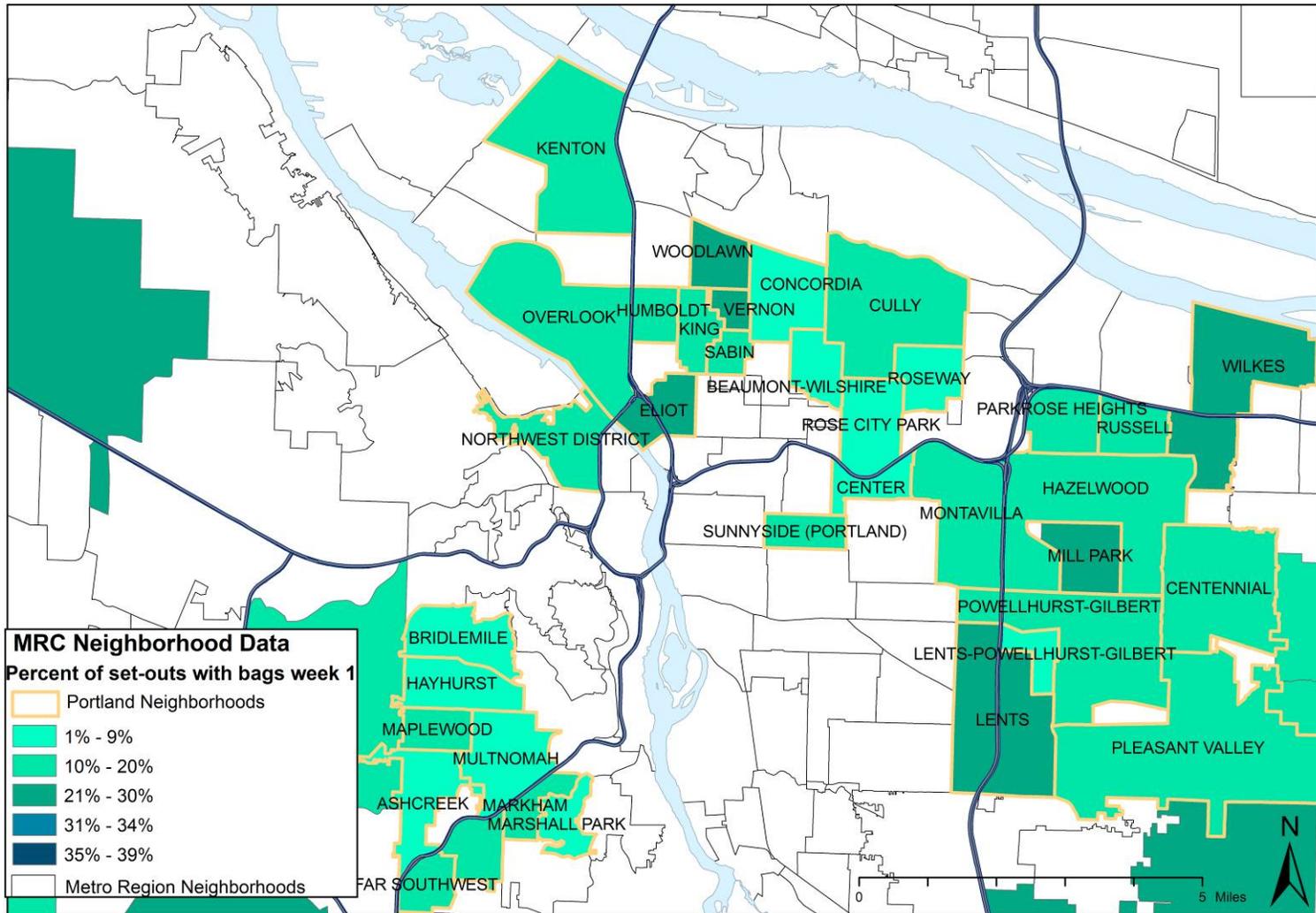


Figure 16: Percent of Set-outs with Bags Week One by Neighborhood (Portland Subregion)

MRC Neighborhood Analysis: Bags Baseline Washington County Subregion

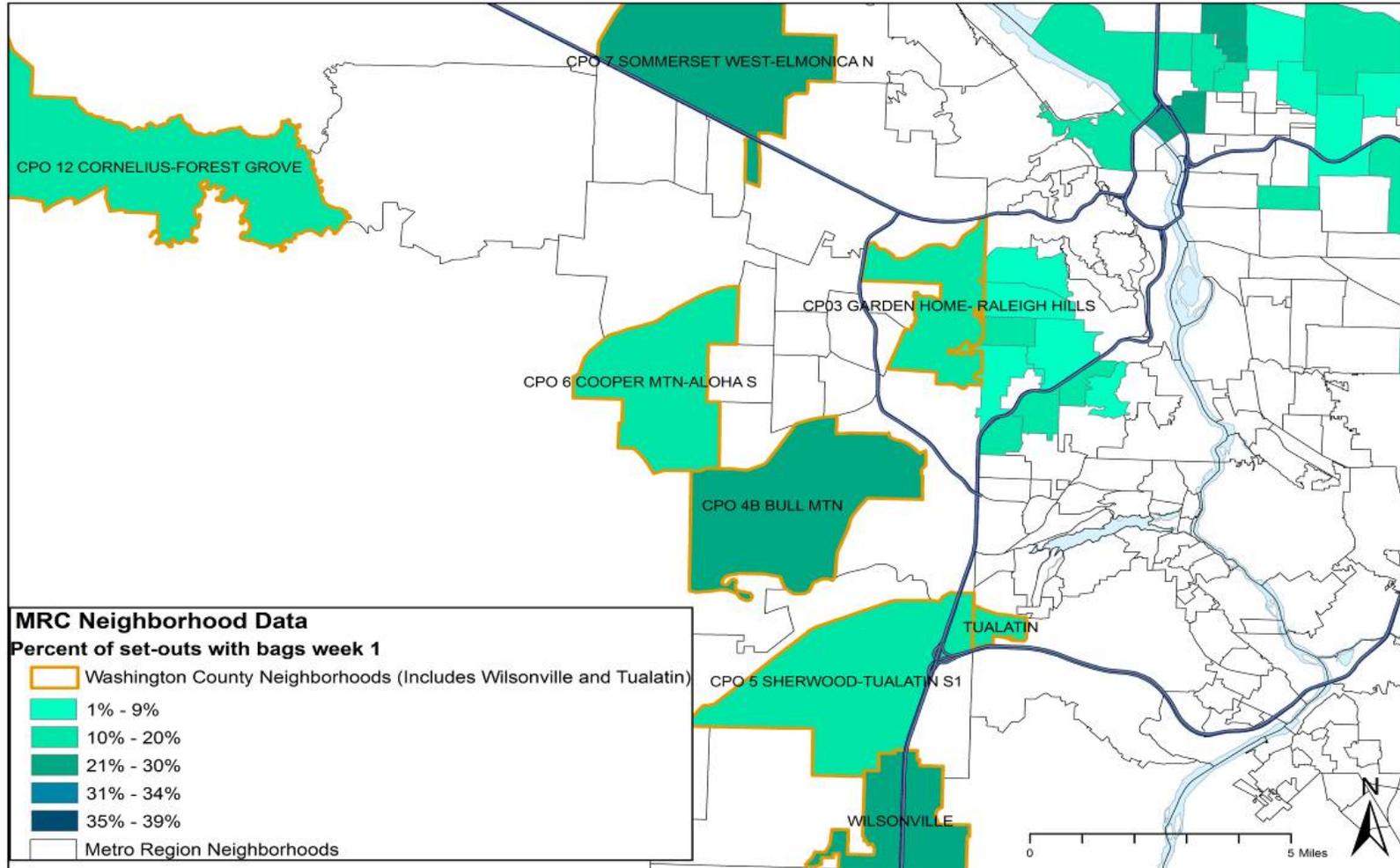


Figure 17: Percent of Set-outs with Bags Week One by Neighborhood (Washington County Subregion)

MRC Neighborhood Analysis: Glass Baseline Presence of Improperly Sorted Glass Week One

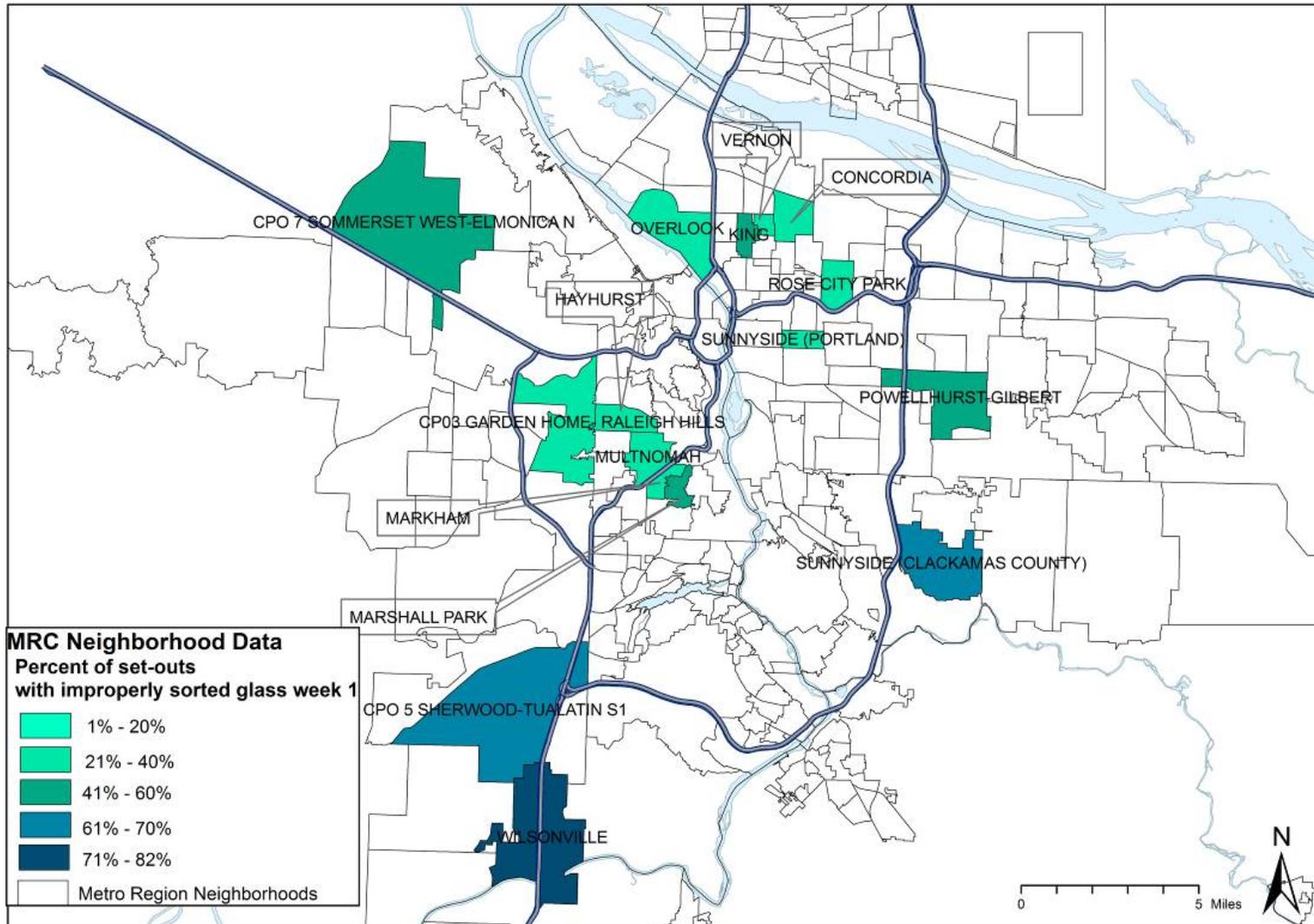


Figure 18: Percent of Set-outs with Improperly Sorted Glass Week One.

MRC Neighborhood Analysis: Improvement in Bags From Week One to Week Two

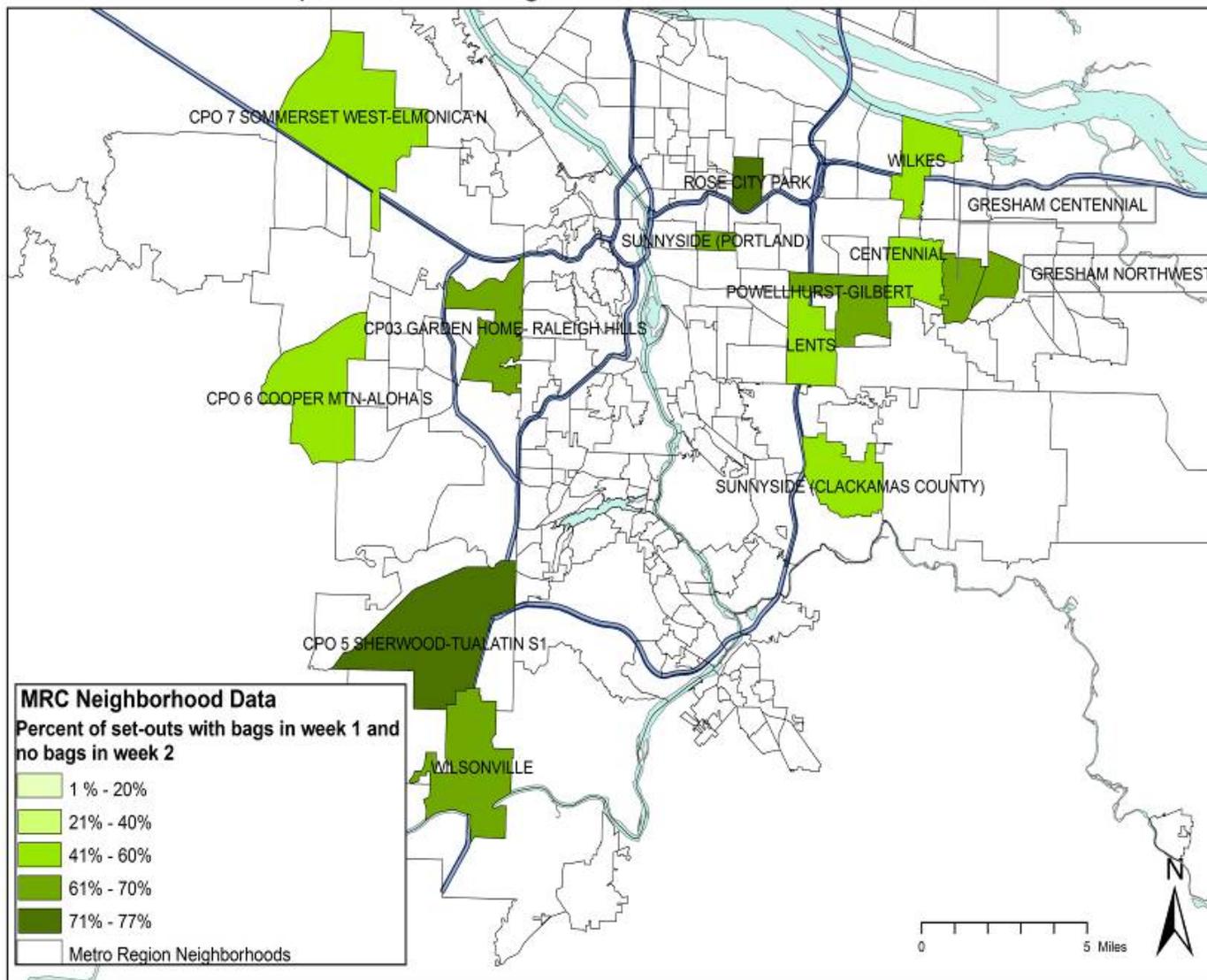
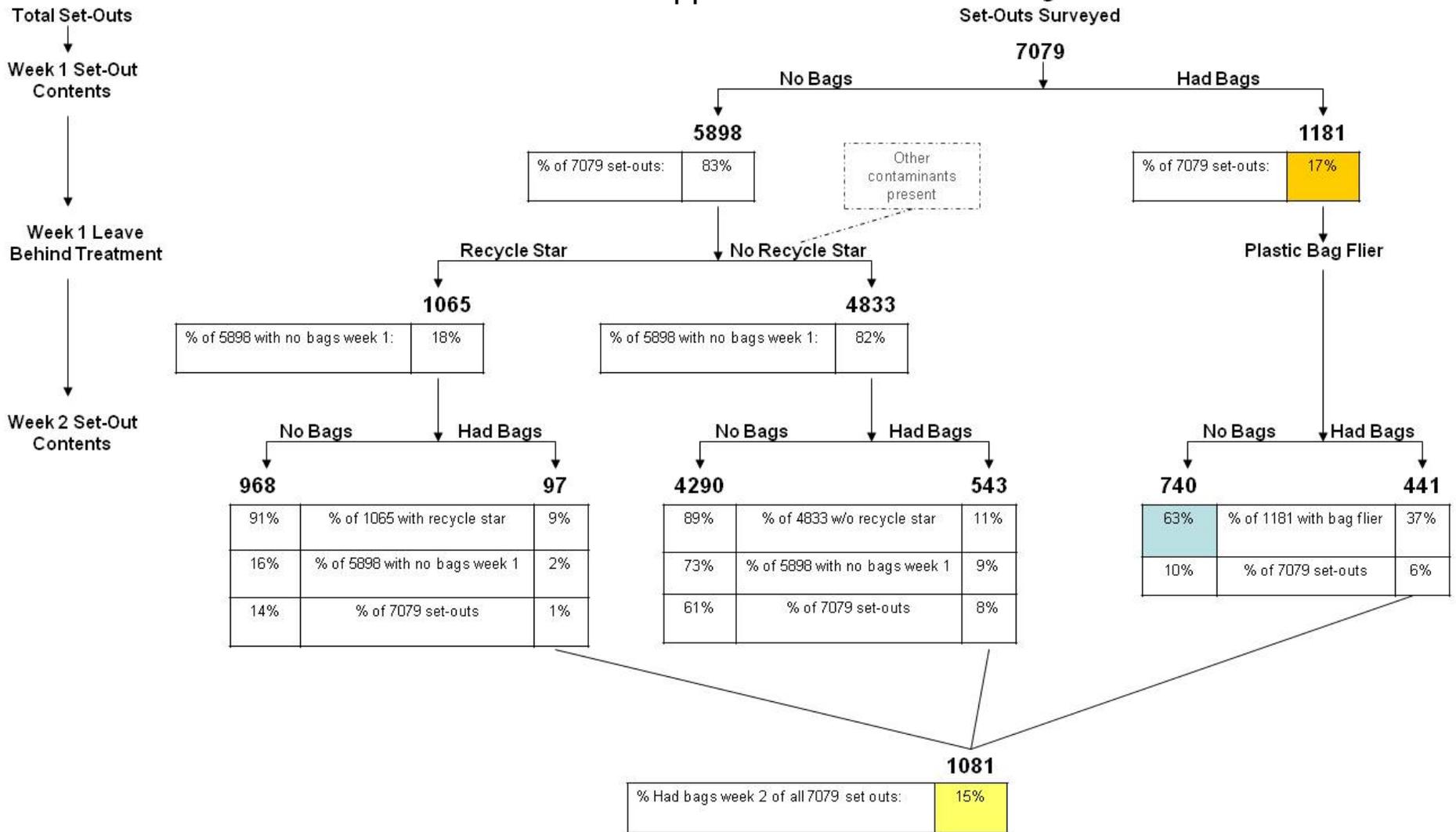


Figure 19: Percent of Set-outs with Bags in Week one and No Bags in Week two.

Appendix E

Plastic Bags Phase I Set-Outs Surveyed

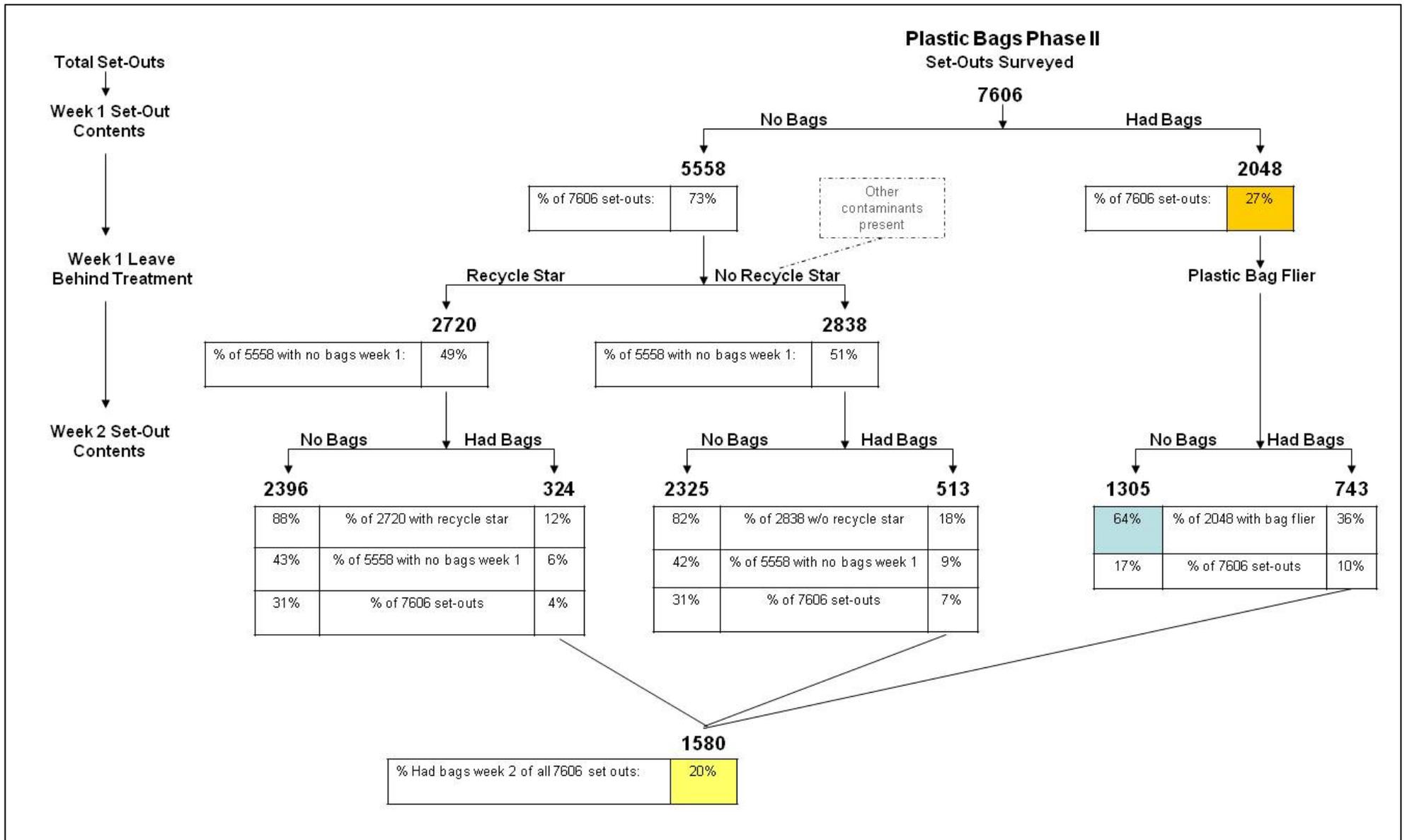


17% of 7079 set-outs had bags week 1.

15% of 7079 set-outs had bags week 2.

63% of set-outs that received a flier in week 1 did not have bags week 2

Figure 20: Impact of Leave Behind Messaging on Bags (Phase I).

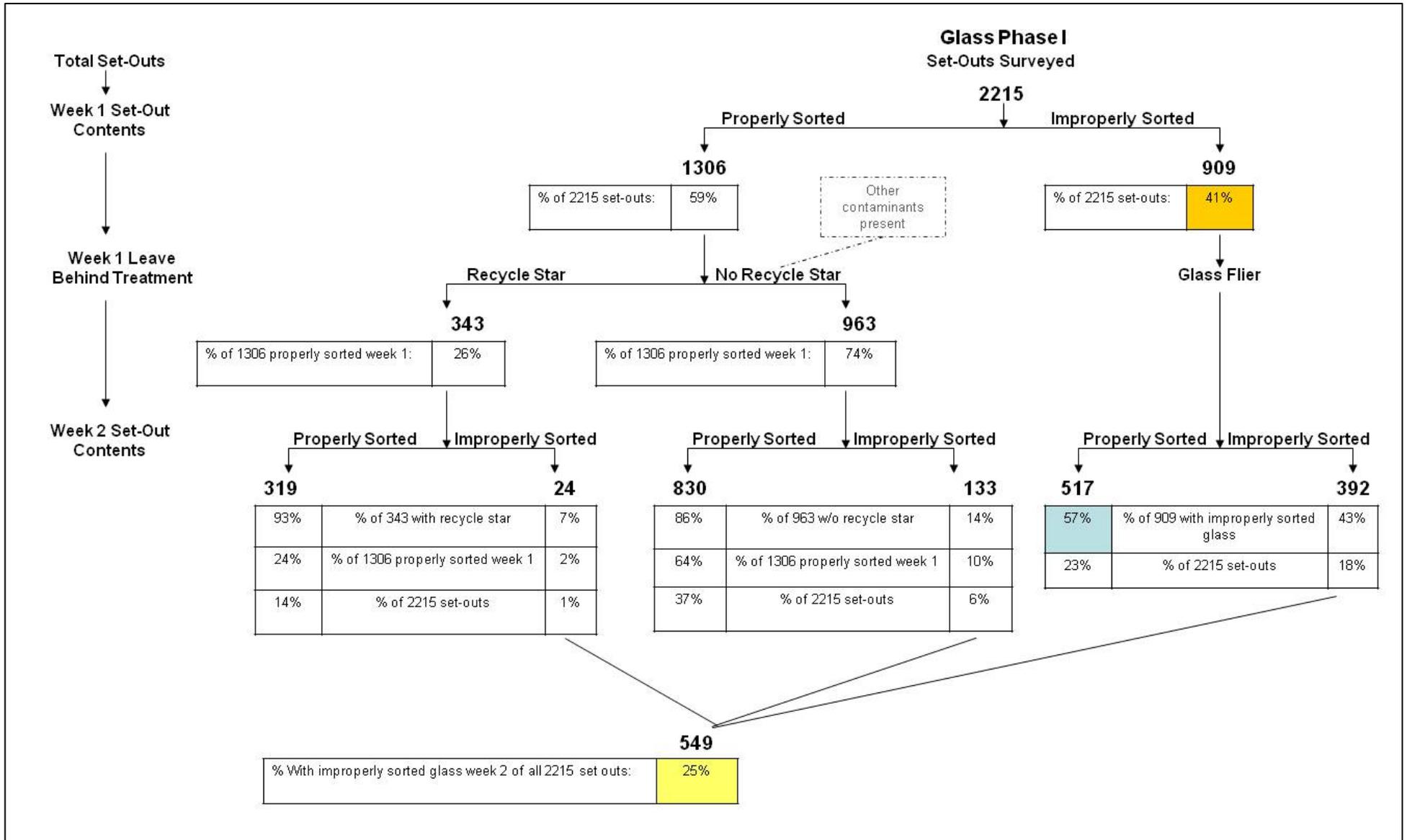


27% of 7606 set-outs had bags week 1.

20% of 7606 set-outs had bags week 2.

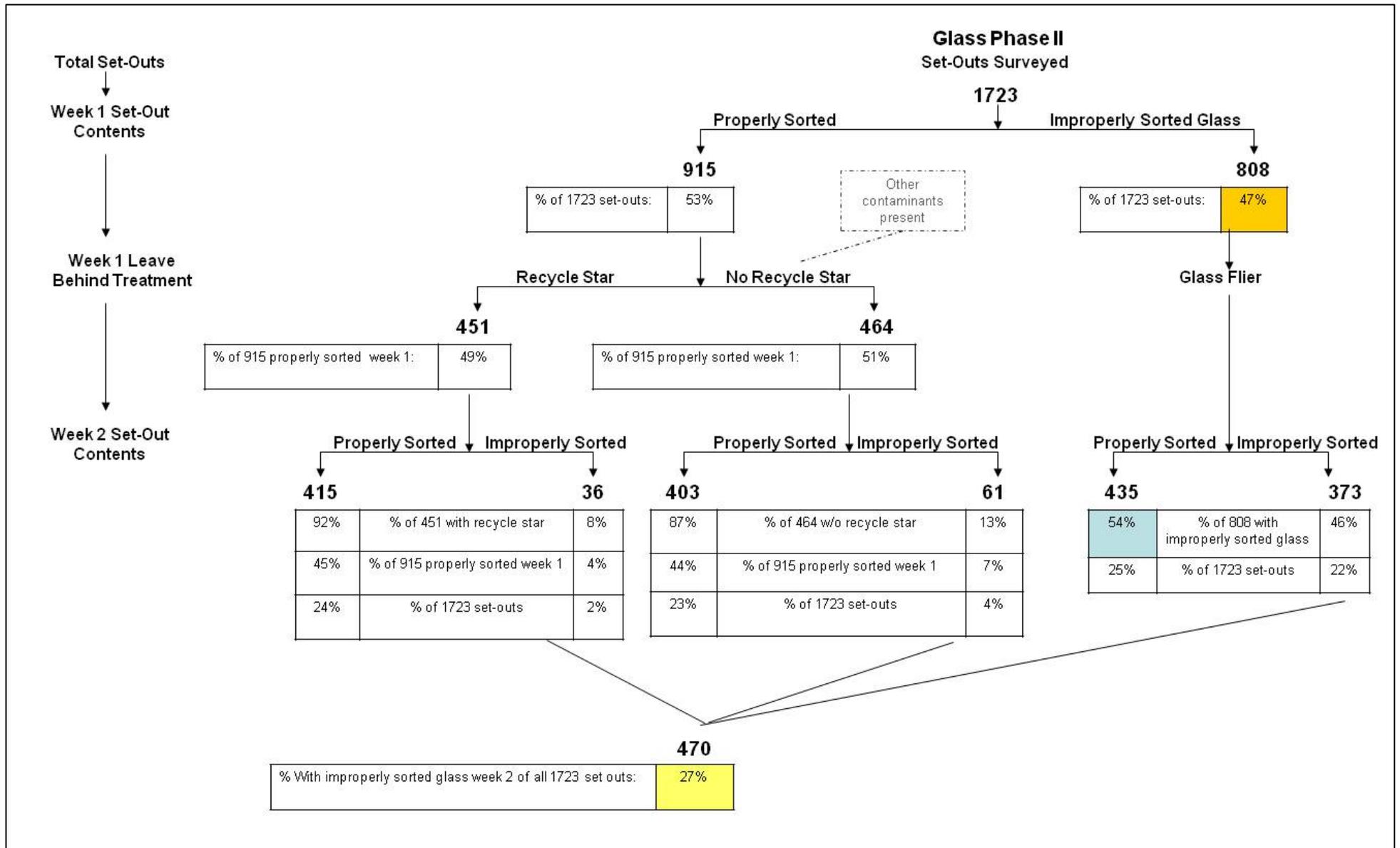
64% of 2045 set-outs that received a flier in week 1 did not have bags week 2

Figure 21: Impact of Leave Behind Messaging on Bags (Phase II)



- 41% of 2215 set-outs had improperly sorted glass week 1**
- 25% of 2215 set-outs had improperly sorted glass week 2**
- 57% of 909 set-outs that received a flier in week 1 had properly sorted glass week 2**

Figure 22: Impact of Leave Behind Messaging on Glass (Phase I).



44% of 3938 set-outs had improperly sorted glass week 1.

26% of 3938 set-outs had improperly sorted glass week 2.

55% of 1715 set-outs that received a flier in week 1 had properly sorted glass week 2

Figure 23: Impact of Leave Behind Messaging on Glass (Phase II).

Appendix F – Resident Letter

Oct. 16, 2008

Dear Resident:

Metro has contracted with Portland State University (PSU) to conduct curbside recycling education in your neighborhood. This phase of this educational campaign will continue through the end of December 2008. The campaign is being conducted to educate residents who have recycling set-outs that contain problem materials. The goal is to improve the quality of recyclable materials being sent to markets, which contributes to an efficient and effective recycling collection system for the region's residents.

You can be assured that the PSU team is working within professional standards. The teams have been instructed to observe recycling set-outs at the curb for houses in your neighborhood. For set-outs that have improperly prepared materials or non-recyclable materials included, educational notes will be left and problem materials will be set aside. Data collected will remain confidential and will be combined with data from over 500 other houses. Information pertaining to your individual household recycling set-out will be kept confidential.

If you have any further questions, please do not hesitate to call me at 503-725-8207. The contact for the project at Metro is Vicki Kolberg at 503-797-1514.

Thank you for your interest in this study.

Sincerely,

Shanna Eller
Program Manager
Community Environmental Services