APPENDIX C

Campus Groundwater Conservation Planning (CGCP) Protocol Training #1

WEDNESDAY, MAY 9TH, 2018

Agenda – 8:30 AM – 11:30 AM

8:30 – 8:35	Introductions – 5 minutes
8:35 – 8:50	CGCP introduction – 15 minutes
8:50 – 9:20	Protocol overview – 30 minutes
9:20 – 9:50	Promotion to campuses – 30 minutes
9:50 – 10:00	Break – 10 minutes
10:00 – 10:30	Initial data request – 30 minutes
10:30 – 11:15	Onsite data collection forms – 45 minutes
11:15 – 11:30	Spreadsheet introduction – 15 minutes

Desired Training Outcomes

Provide understanding of CGCP process and benefits

Prepare participants to engage in discussions with potential campus partners

Enable participants to solicit initial data requests from campuses

Prepare participants for on-site data collection

Important Notes

Opportunities to refine the protocol and reporting still remain

We will learn a lot through implementation of the protocol on a variety of campus types throughout the 11-county metro

We welcome ideas for improving and streamlining the protocol implementation and reporting

All files available on USB drives passed around room – also available via Google Drive link to be shared following training

Introductions

Name

SWCD

Role

Favorite pastime

CGCP Introduction

FINAL REPORT, TCMA GROUNDWATER OVERVIEW, GRANT DETAILS, WORK TO DATE, ULTIMATE GOAL, TRAINING LAYOUT

Final report

CAMPUS GROUNDWATER CONSERVATION PLANNING REPORT FOR MATOSKA INTERNATIONAL IB WORLD SCHOOL

PREPARED BY THE

ANOKA CONSERVATION DISTRICT AND Ramsey Conservation District

FUNDING PROVIDED IN PART BY THE CLEAN WATER FUND FROM THE CLEAN WATER, LAND, AND LEGACY AMENDMENT

CLEAN WATER LAND & LEGACY AMENDMENT

EXECUTIVE SUMMARY

The Campus Groundwater Conservation Planning (CGCP) protocol was implemented on the Matoska International IB World School campus for the purpose of identifying and ranking water conservation project opportunities. Of the 84 projects identified, 45 have an estimated payback period shorter than their estimated lifespan, which makes them feasible from a financial perspective. Implementation of these 45 potential water conservation projects results in an annual reduction in water use of 584,770 gallons, which corresponds to a reduction of $3,738.33 in annual costs associated with water and energy.

Of the 45 projects with a simple payback period less than the product's estimated lifespan, 35 of the projects have simple payback periods less than five years. Therefore, these projects would provide a return on investment within five years. Implementation of these top 35 projects would cost an estimated $6,285.80 and would result in an annual water use reduction of 506,668 gallons. Furthermore, factoring in the lifespan of these 35 projects and the initial replacement or maintenance costs, these 35 projects would result in a net savings (water + energy) of $25,429.52.

This report is not intended to serve as a prescription of projects that must be completed on the campus. Rather, it is intended to serve as a planning resource that allows campus decision makers and facility managers to pursue cost-effective water conservation projects.

Current water use for all equipment and fixtures was analyzed to determine the potential for water savings through either maintenance or replacement. Costs associated with each potential project were estimated and paired with estimated current use and potential reductions to calculate the simple payback period for each project. Projects were then ranked in order of increasing simple payback period.

Current water use is dominated by sanitary fixtures, more specifically toilet flushing. The absence of a cooling tower and irrigation system on the campus greatly reduce the total overall water use. Figure 1 shows a breakdown of current estimated water use on the Matoska International IB World School campus.

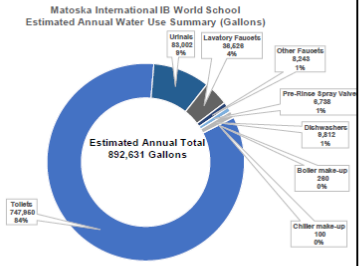


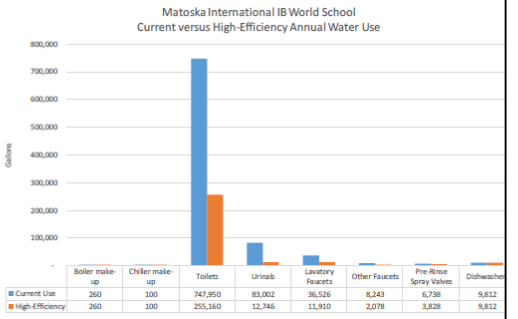
Figure 1: Current estimated campus water use.

The estimate of 892,631 gallons used annually is based on measurements and best available information for all water using equipment and fixtures on the campus. This amount is greater than the 2017 water bill data by 2.25% (19,654 gallons). Generally, up to a 10% discrepancy is considered acceptable. Considering the student and staff population sizes at the school, the campus uses a relatively low amount of water. Nevertheless, cost-effective water conservation opportunities were identified.

Based on the water using equipment on the campus, a variety of water conservation opportunities w identified. They included maintenance or replacement of:

- Toilets,
- Urinals,
- Lavatory faucets,
- Non-lavatory faucets, and
- Pre-rinse spray valves.

Figure 2 shows the potential water savings that could be achieved through a combination of maintenance and replacement for each of the main categories of water-using equipment on the Matoska International IB World School campus.



	Boiler make-up	Chiller make-up	Toilets	Urinals	Lavatory Faucets	Other Faucets	Pre-Rinse Spray Valves	Dishwashes
Current Use	260	100	747,950	83,002	36,526	8,243	6,738	9,812
High-Efficiency	260	100	255,160	12,746	11,910	2,078	3,828	9,812

Figure 2: Current use and potential use with high-efficiency equipment and fixtures for the main categories of water-usin equipment on the Matoska International IB World School campus.

Table 1 provides an overview of the 84 potential water conservation projects identified. Tables throughout the report provide additional detail on the potential projects. If all of the water conservation opportunities identified were implemented, significant reductions in water use could be achieved. However, funding limitations make immediate implementation of all projects unlikely. Rather, it is recommended that projects be installed in order of cost-effectiveness. Other factors, including a project's water saving potential, specific campus goals, urgency, educational value/visibility, or broader environmental impact also affect project installation decisions and need to be weighed by campus decision makers and facility managers when selecting projects to pursue.

Table 1: Summary of water conservation projects identified with estimated water and cost savings, sorted by estimated payback period. Projects with net savings (water + energy) less than zero (i.e. project lifespan less than estimated payback period) are shown in red text. Please note that while the projects with red text do not provide a financial benefit, they still have a potential reduction in water use. Continued on next page.

Project ID	Fixture Type	Location	Recomm. Action	Recomm. Action Cost ($)	Lifespan (years)	Annual Water Savings (gallons)	Water Savings Over Life of Product (gallons)	Net Savings (Water + Energy) over Life of Product ($)	Estimated Payback Period (years)
1	Toilet	Staff Bathroom: Male Office	Maintenance	$33.60	10	20,518	205,178	$2,232.30	0.20
2	Lavatory Faucet	2nd Floor Bradley - 1 by Room 230	Maintenance	$33.60	5	8,175	57,213	$454.33	0.47
3	Toilet	New Wing Girls - 4	Maintenance	$33.60	10	7,630	76,299	$447.33	0.66
4	Toilet	New Wing Girls - 2	Maintenance	$33.60	10	6,738	67,379	$395.77	0.75
5	Toilet	New Wing Girls - 5	Maintenance	$33.60	10	6,738	67,379	$395.77	0.75
6	Non-Lavatory Faucet	Staff Break Room	Maintenance	$33.00	5	4,910	24,553	$260.57	0.75
7	Toilet	First Floor Girls - 1	Replace	$316.00	10	60,188	601,880	$5,466.42	0.84
8	Toilet	New Wing Girls - 3	Maintenance	$33.60	10	5,856	58,560	$336.36	0.86
9	Lavatory Faucet	2nd Floor Bradley - 2 by Room 230	Maintenance	$33.00	5	4,337	20,798	$230.31	0.91
10	Toilet	Staff Restroom Adj. Room 100	Replace	$316.00	10	52,264	522,638	$2,967.95	0.96
11	Toilet	First Floor Girls - 2	Replace	$316.00	10	47,610	476,100	$2,694.70	1.05
12	Lavatory Faucet	1st Floor Bradley - 1	Maintenance	$33.00	5	2,818	13,723	$135.05	1.37
13	Lavatory Faucet	1st Floor Bradley - 2	Maintenance	$33.00	5	2,818	13,723	$135.05	1.37
14	Toilet	New Wing Girls - 1	Maintenance	$33.60	10	3,587	33,866	$181.39	1.45
15	Toilet	New Wing Boys	Maintenance	$33.60	10	3,175	31,747	$174.17	1.54
16	Toilet	Second Floor Girls - 6	Replace	$316.00	10	29,630	296,296	$1,708.05	1.73
17	Toilet	Staff Restroom 2nd Floor by Elevator	Replace	$316.00	10	24,171	241,711	$1,331.47	2.06
18	Toilet	Second Floor Girls - 5	Replace	$316.00	10	21,201	212,006	$1,020.76	2.36
19	Pre-Rinse Spray Valve	Kitchen wash station	Replace	$79.00	5	2,969	14,847	$66.40	2.65
20	Toilet	Second Floor Girls - 2	Replace	$316.00	10	18,424	184,243	$941.68	2.70
21	Toilet	First Floor Girls - 3	Replace	$316.00	10	18,160	181,600	$875.36	2.73
22	Toilet	Second Floor Girls - 4	Replace	$316.00	10	18,138	181,377	$823.47	2.77
23	Toilet	First Floor Staff Across from Room 104	Replace	$316.00	10	17,440	174,405	$792.30	2.88
24	Toilet	Nurses Bathroom	Maintenance	$33.60	10	1,695	16,949	$74.90	2.97
25	Lavatory Faucet	First Floor Staff Across from Room 104	Maintenance	$33.00	5	1,364	6,821	$46.90	2.93
26	Toilet	First Floor Boys - 2	Replace	$316.00	10	16,680	166,800	$730.82	3.02
27	Toilet	Second Floor Girls - 1	Replace	$316.00	10	15,558	155,581	$681.78	3.23
28	Toilet	Second Floor Girls - 3	Replace	$316.00	10	15,558	155,581	$668.38	3.23
29	Toilet	First Floor Boys - 1	Replace	$316.00	10	15,176	151,588	$638.80	3.32
30	Toilet	Second Floor Boys - 1	Replace	$316.00	10	14,552	145,522	$598.37	3.46
31	Toilet	Room 106	Replace	$316.00	10	13,968	139,638	$460.87	4.03
32	Toilet	Second Floor Boys - 2	Replace	$316.00	10	12,275	122,746	$459.26	4.30
33	Urinal	New Wing Boys - 1	Maintenance	$33.60	10	1,373	13,733	$90.75	4.33
34	Toilet	Second Floor Boys - 3	Replace	$316.00	10	11,653	116,533	$436.23	4.32
35	Urinal	New Wing Boys - 2	Maintenance	$33.60	10	1,178	11,775	$77.86	4.44
36	Toilet	Room 100	Replace	$316.00	10	8,041	80,417	$190.95	6.24
37	Urinal	First Floor Boys - 3	Replace	$360.00	10	8,039	80,391	$145.33	7.13
38	Urinal	First Floor Boys - 2	Replace	$360.00	10	8,039	80,391	$145.33	7.13
39	Urinal	Second Floor Boys - 1	Replace	$360.00	10	8,039	80,391	$145.33	7.13
40	Urinal	Second Floor Boys - 2	Replace	$360.00	10	8,039	80,391	$145.33	7.13
41	Urinal	Second Floor Boys - 3	Replace	$360.00	10	8,039	80,391	$145.33	7.13
42	Urinal	Second Floor Boys - 4	Replace	$360.00	10	8,039	80,391	$145.33	7.13
43	Urinal	Second Floor Boys - 5	Replace	$360.00	10	8,039	80,391	$145.33	7.13
44	Urinal	Second Floor Boys - 6	Replace	$360.00	10	8,039	80,391	$145.33	7.13
45	Lavatory Faucet	2nd Floor Staff Restroom by Elevator	Maintenance	$33.00	5	810	3,445	-$5.04	7.83
46	Lavatory Faucet	Room 104-1	Maintenance	$33.00	5	452	3,165	-$6.03	8.57
47	Toilet	Room 104	Replace	$316.00	10	5,738	57,383	$41.94	8.78

Summary

45 of 84 projects have an estimated payback period shorter than their estimated lifespan, which makes them feasible from a financial perspective

Installation of the 45 projects would reduce annual water use by 584,770 gallons (66% reduction), which corresponds to a reduction of $3,738.33 in annual costs associated with water and energy

35 of 45 projects have simple payback period of less than 5 years

Installation of the 35 projects would cost $6,285.80 and result in an annual water use reduction of 506,668 gallons (57% reduction) and a net savings (water + energy) of $25,429.52 over the lifespan of the projects

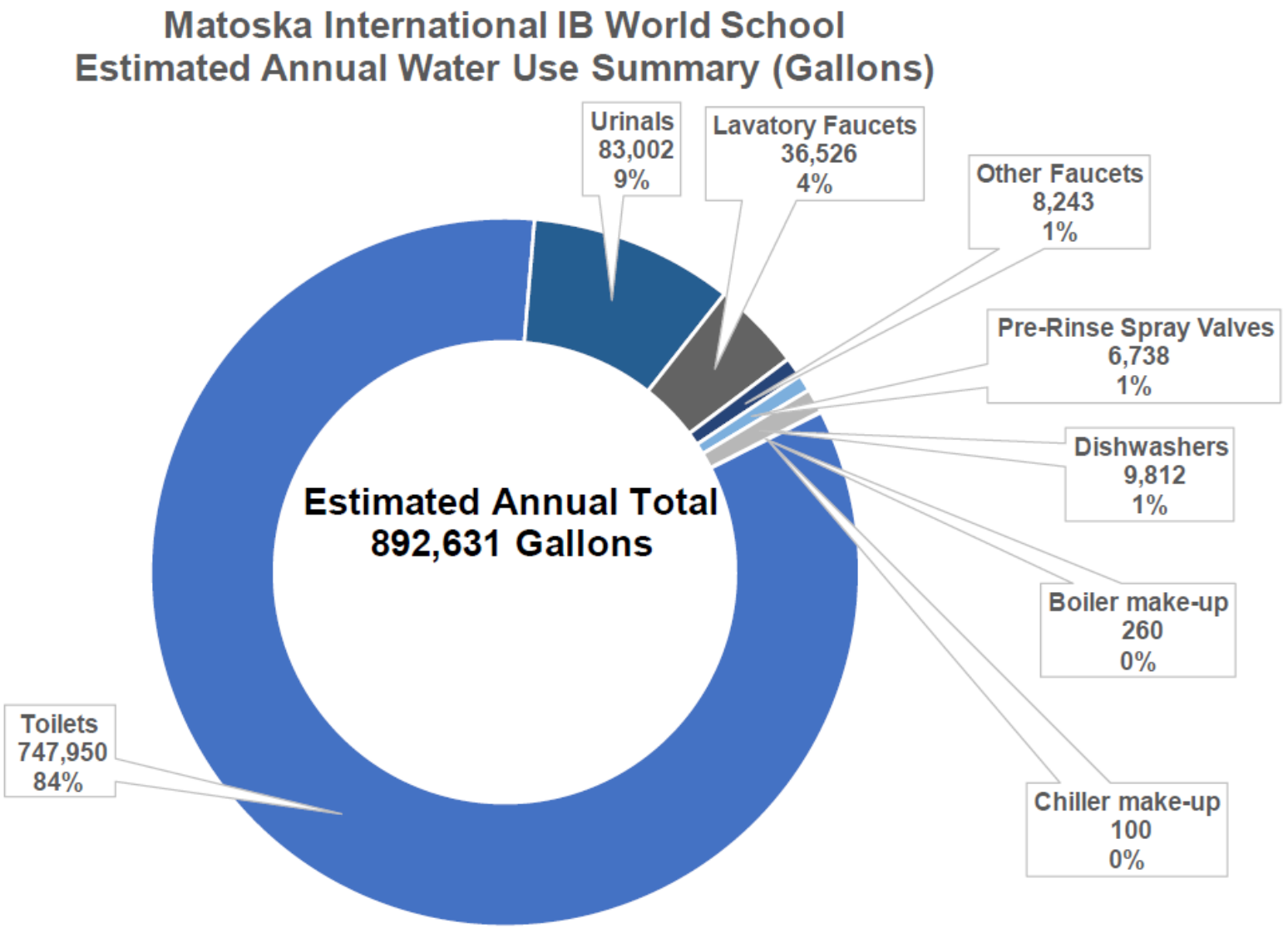
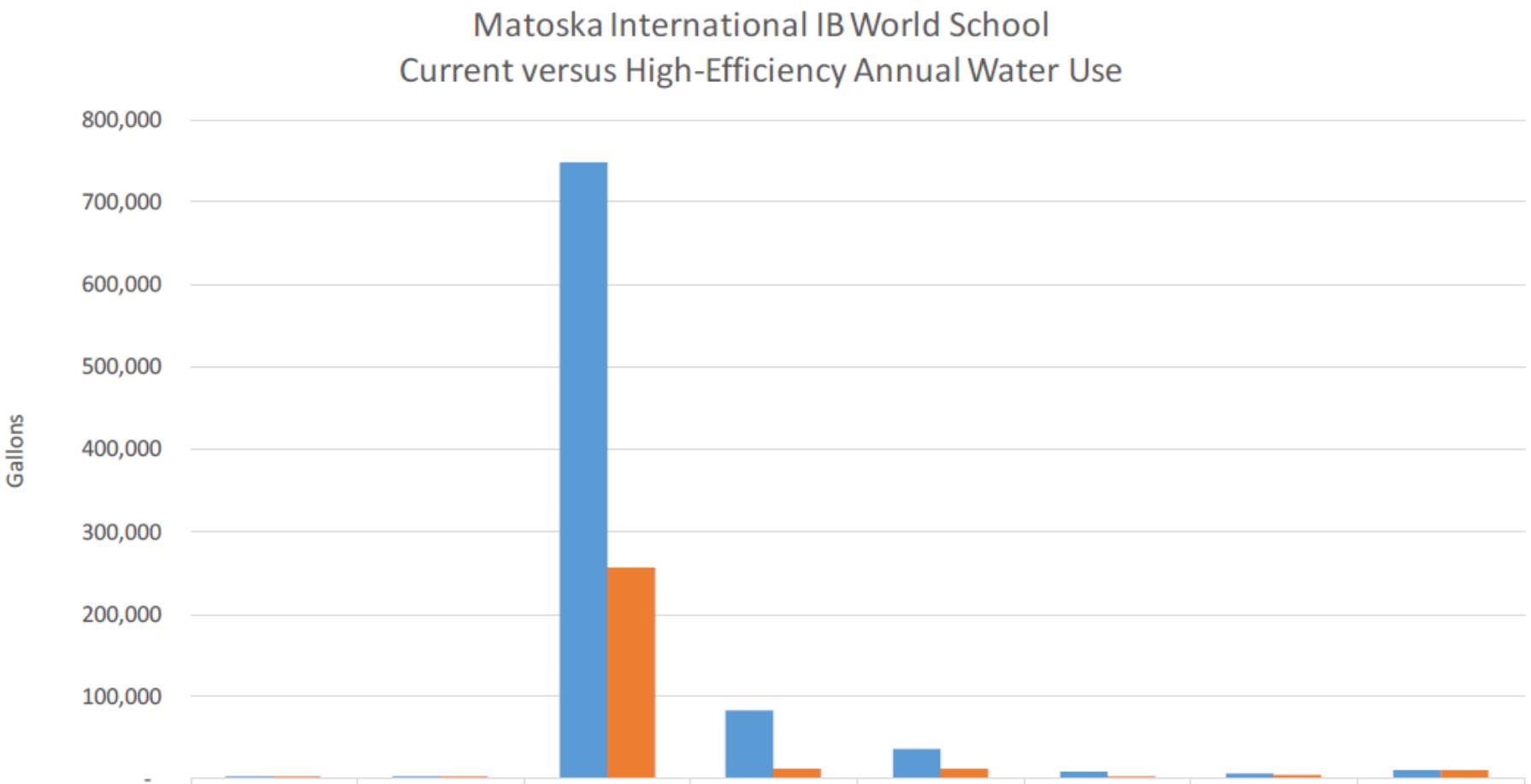


Figure 1: Current estimated campus water use.



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Current Use	260	100	747,950	83,002	36,526	8,243	6,738	9,812
High-Efficiency	260	100	255,160	12,746	11,910	2,078	3,828	9,812

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1	Toilet	Staff Bathroom Main Office	Maintenance	$31.60	10	20,513	205,129	$1,257.31	0.25
2	Lavatory Faucet	2nd Floor Bradley - 1 by Room 210	Maintenance	$33.00	7	8,173	57,213	$454.51	0.47
3	Toilet	New Wing Girls - 4	Maintenance	$31.60	10	7,620	76,199	$447.19	0.66
4	Toilet	New Wing Girls - 2	Maintenance	$31.60	10	6,738	67,379	$391.77	0.75
5	Toilet	New Wing Girls - 5	Maintenance	$31.60	10	6,738	67,379	$391.77	0.75
6	Non-Lavatory Faucet	Staff Break Room	Maintenance	$33.00	7	4,922	34,453	$260.57	0.79
7	Toilet	First Floor Girls - 1	Replace	$316.00	10	60,165	601,650	$3,464.42	0.84
8	Toilet	New Wing Girls - 3	Maintenance	$31.60	10	5,856	58,560	$336.36	0.86
9	Lavatory Faucet	2nd Floor Bradley - 2 by Room 210	Maintenance	$33.00	7	4,257	29,798	$220.91	0.91
10	Toilet	Staff Restroom Adj. Room 100	Replace	$316.00	10	52,264	522,638	$2,967.95	0.96
11	Toilet	First Floor Girls - 2	Replace	$316.00	10	47,915	479,150	$2,694.70	1.05
12	Lavatory Faucet	1st Floor Bradley - 1	Maintenance	$33.00	7	2,818	19,723	$135.05	1.37
13	Lavatory Faucet	1st Floor Bradley - 2	Maintenance	$33.00	7	2,818	19,723	$135.05	1.37
14	Toilet	New Wing Girls - 1	Maintenance	$31.60	10	3,387	33,866	$181.19	1.49
15	Toilet	New Wing Boys	Maintenance	$31.60	10	3,275	32,747	$174.17	1.54
16	Toilet	Second Floor Girls - 6	Replace	$316.00	10	29,030	290,295	$1,508.05	1.73
17	Toilet	Staff Restroom 2nd Floor by Elevator	Replace	$316.00	10	24,373	243,731	$1,215.47	2.06
18	Toilet	Second Floor Girls - 5	Replace	$316.00	10	21,291	212,906	$1,021.78	2.36
19	Pre-Rinse Spray Valve	Kitchen wash station	Replace	$75.00	5	2,909	14,547	$64.49	2.69
20	Toilet	Second Floor Girls - 2	Replace	$316.00	10	18,424	184,243	$841.68	2.73
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25	Lavatory Faucet	First Floor Staff Across from Room 104	Maintenance	$33.00	7	1,304	9,131	$44.80	2.97
26	Toilet	First Floor Boys - 2	Replace	$316.00	10	16,660	166,600	$730.82	3.02
27	Toilet	Second Floor Girls - 1	Replace	$316.00	10	15,558	155,581	$661.58	3.23
28	Toilet	Second Floor Girls - 3	Replace	$316.00	10	15,558	155,581	$661.58	3.23
29	Toilet	First Floor Boys - 1	Replace	$316.00	10	15,129	151,288	$634.60	3.32
30	Toilet	Second Floor Boys - 1	Replace	$316.00	10	14,552	145,522	$598.37	3.46
31	Toilet	Room 106	Replace	$316.00	10	12,364	123,638	$460.87	4.07
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33	Urinal	New Wing Boys - 2	Maintenance	$36.00	10	1,373	13,733	$50.29	4.17
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35	Urinal	New Wing Boys - 1	Maintenance	$36.00	10	1,278	12,775	$44.27	4.48
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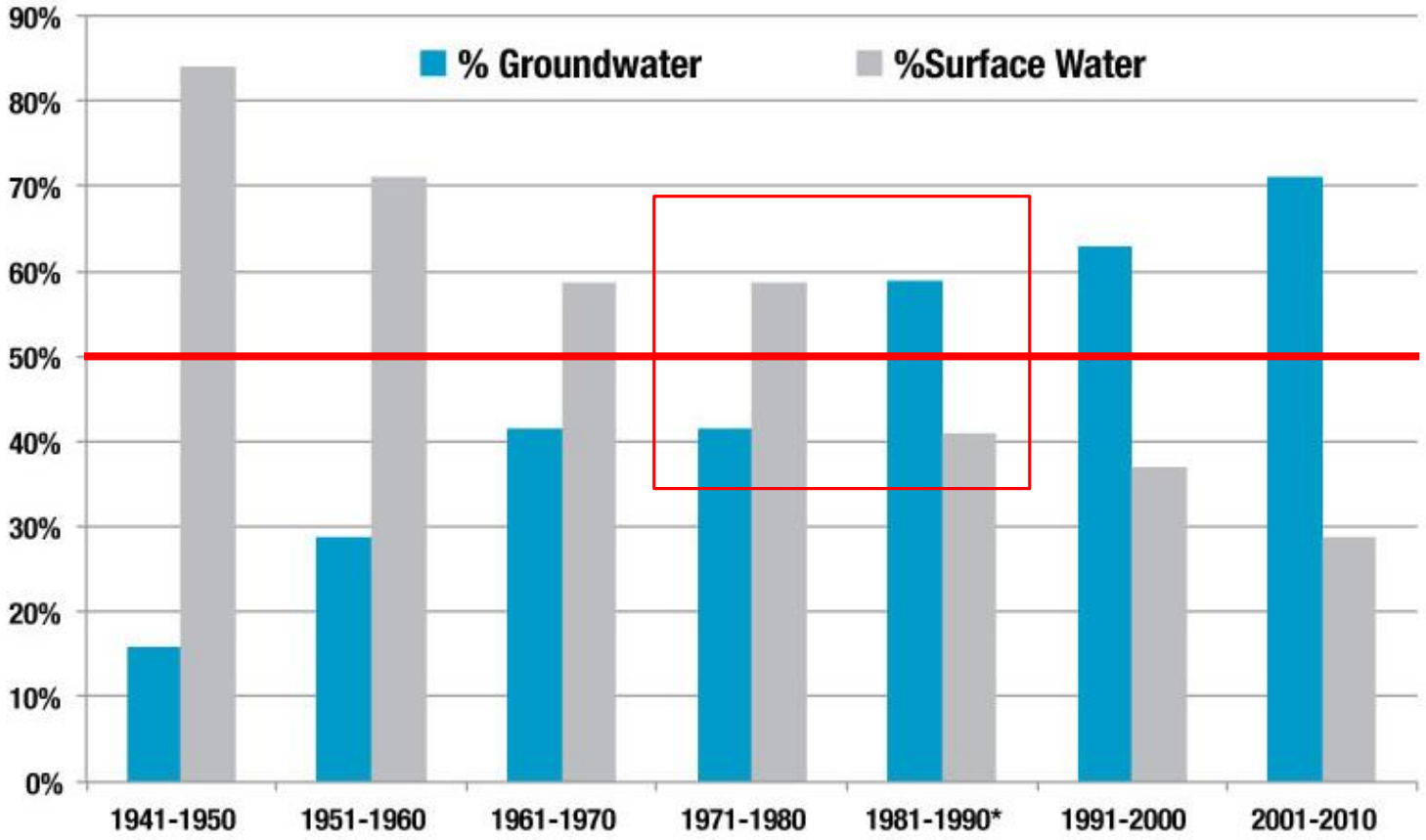
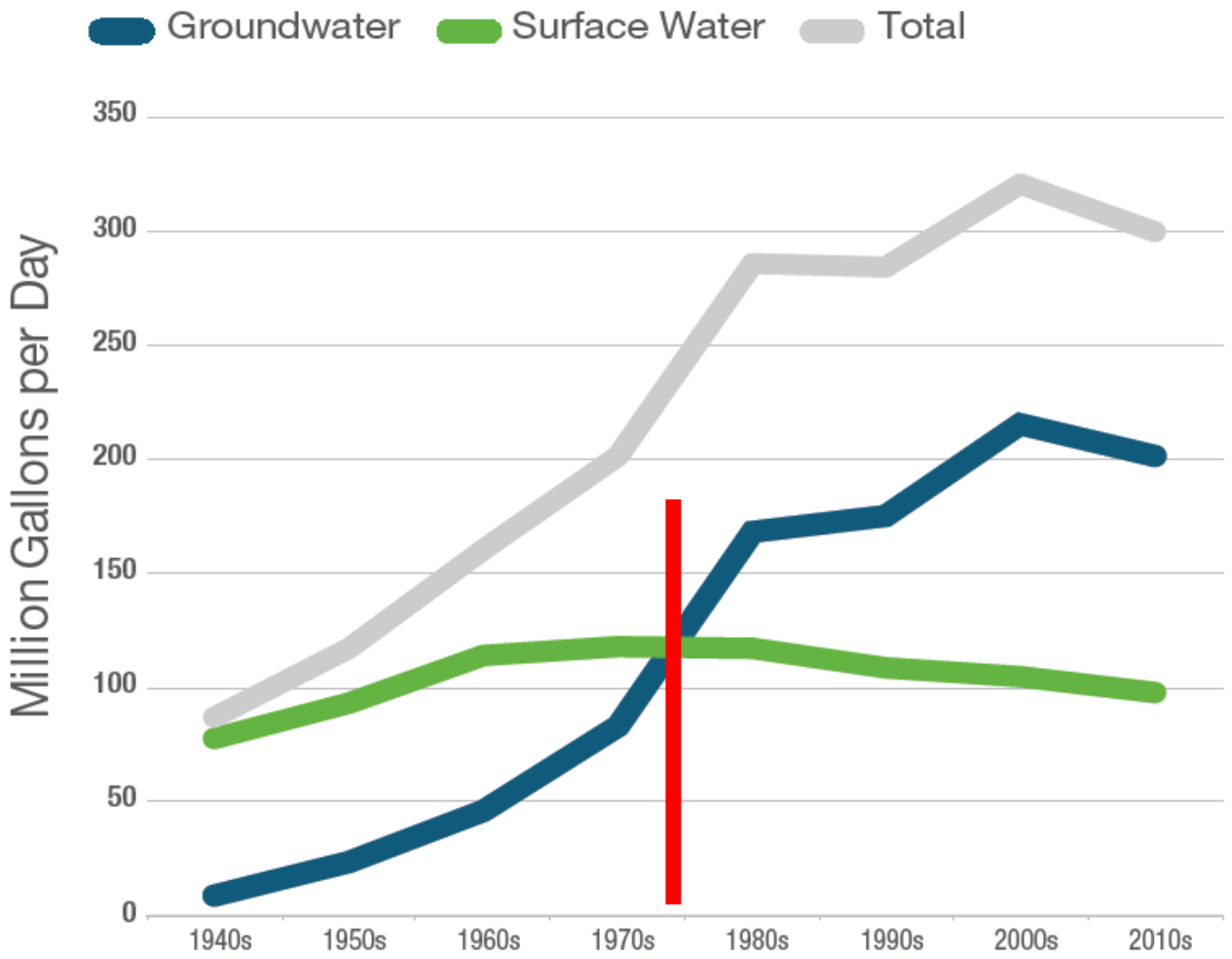
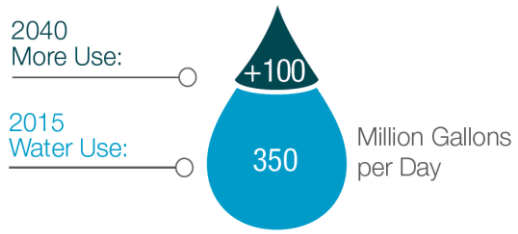
Municipal Water Use in Seven-County Twin Cities Metro Area

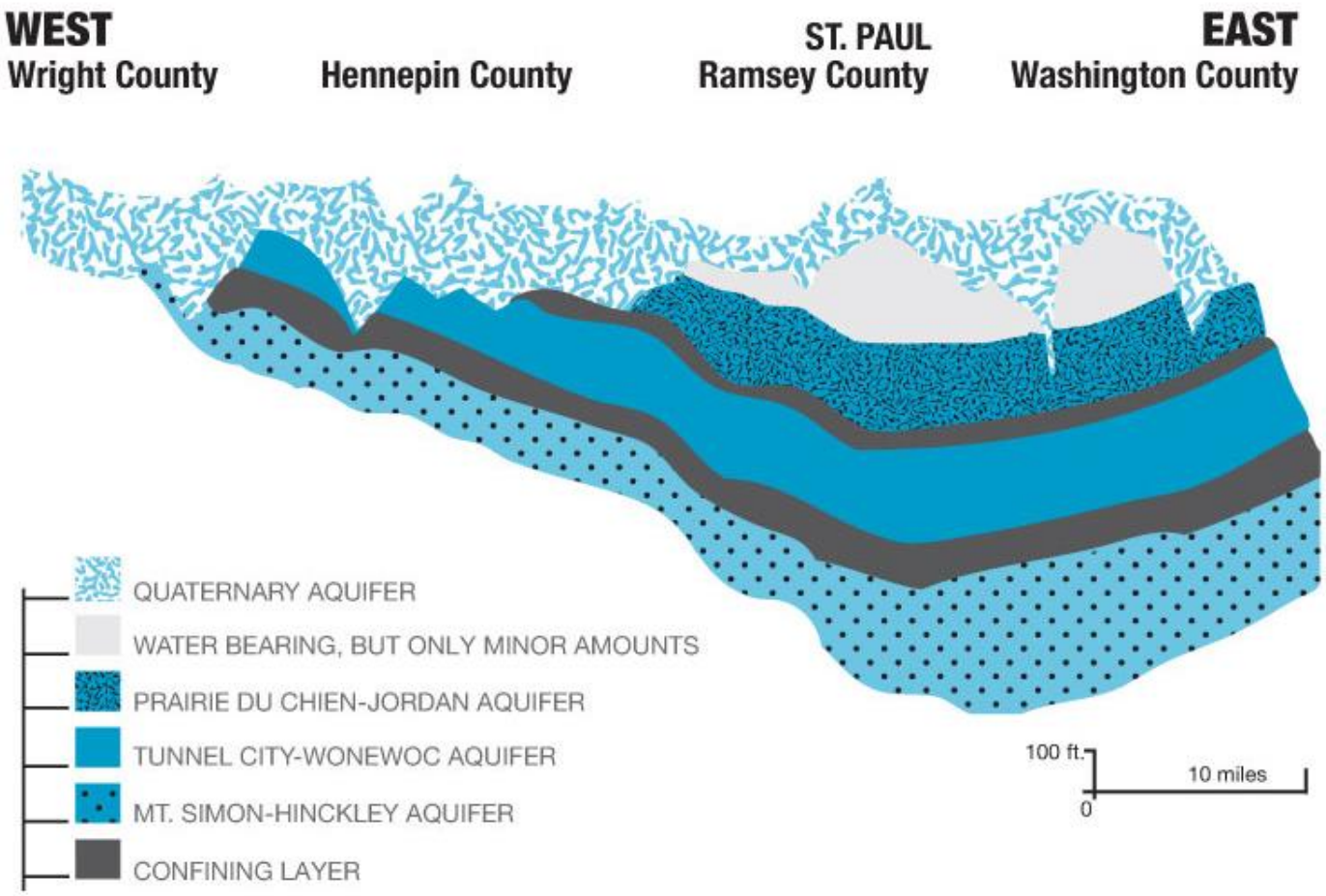


Now we use more groundwater compared to river water





Aquifers of the Twin Cities Metro Area



A) Drawdown in the Prairie du Chein-Jordan aquifer under average projected pumping.

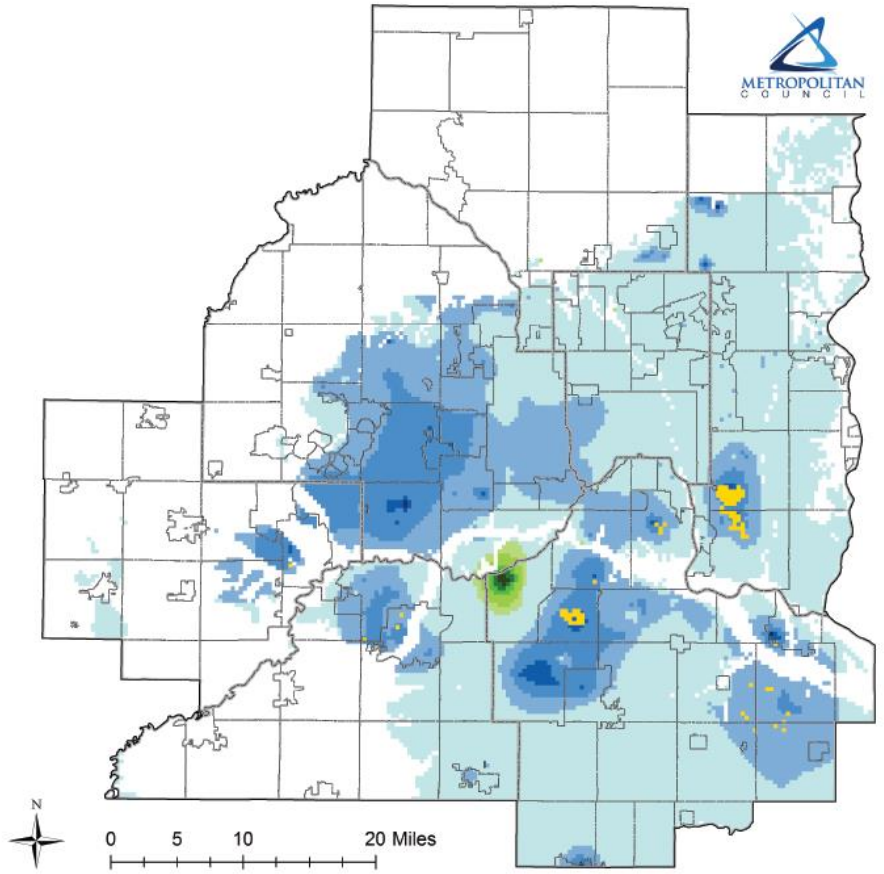


Figure 21: Potential groundwater level declines under projected 2040 pumping conditions, should future demand be met using current water supply sources. These results are based on regional groundwater flow modeling using Metro Model 3 for the Prairie du Chien-Jordan aquifer (figures 21A and 21B), the Tunnel City-Wonewoc aquifer (figures 21C and 21D), and the regional Water Table aquifer beneath potentially connected surface waters (figures 21E and 21F). The legend below applies to all maps in this figure set.

- > 40 feet of rebound
- 30 to 40 feet of rebound
- 20 To 30 feet of rebound
- 10 to 20 feet of rebound
- 5 to 10 feet of rebound
- Less than 1 meter (3.28 feet) of change
- 5 to 10 of drawdown
- 10 to 20 of drawdown
- 20 to 30 of drawdown
- 30 to 40 of drawdown
- > 40 feet of drawdown
- Drawdown exceeds 50% of available head

Figure 21: Potential groundwater level declines under projected 2040 pumping conditions, should future demand be met using current water supply sources. These results are based on regional groundwater flow modeling using Metro Model 3 for the Prairie du Chien-Jordan aquifer (figures 21A and 21B), the Tunnel City-Wonewoc aquifer (figures 21C and 21D), and the regional Water Table aquifer beneath potentially connected surface waters (figures 21E and 21F). The legend below applies to all maps in this figure set.

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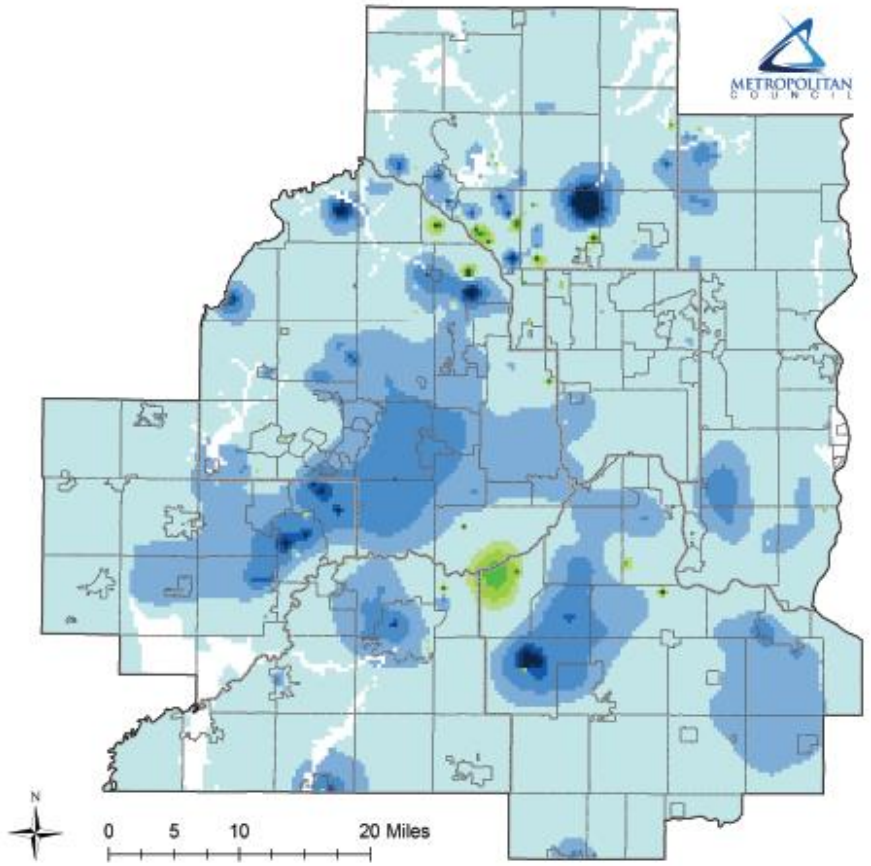
- 5 to 10 of drawdown
- 10 to 20 of drawdown
- 20 to 30 of drawdown
- 30 to 40 of drawdown
- > 40 feet of drawdown
- Drawdown exceeds 50% of available head

C) Drawdown in the Tunnel City-Wonewoc aquifer under average projected pumping.



Grant Details

MCD FY 2016 CWF AIG – 3-year grant concludes 12/31/18 – grant agreement amendment approved

$250,000 project

- $200,000 CWF AIG
- $50,000 SWCD match

Match requirements

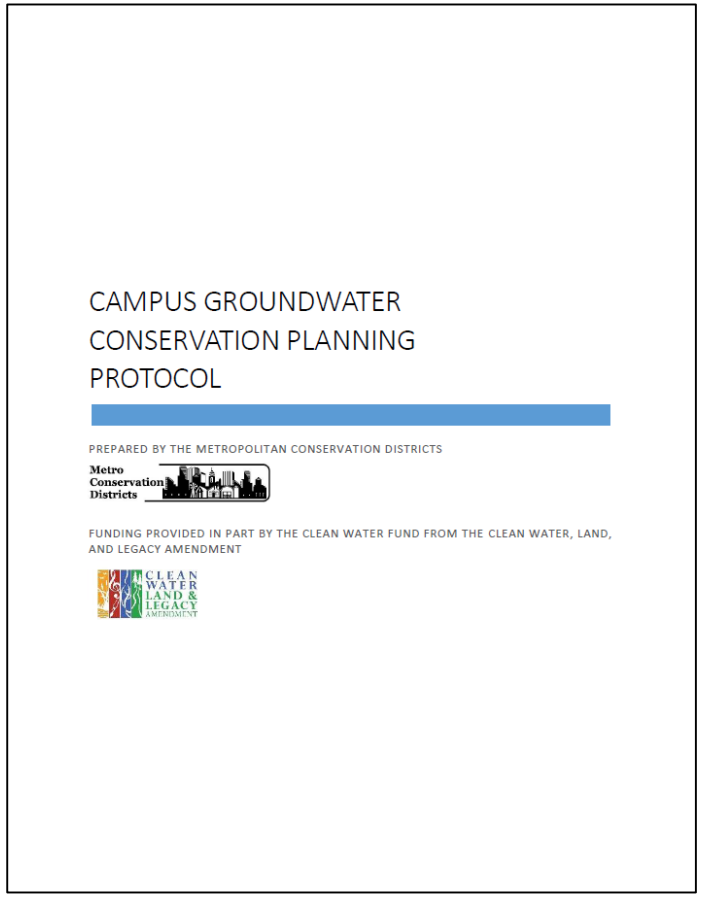
- Each member district must provide a 25% match of the grant funds
- Said another way, the required match is 20% of the total project cost (i.e. grant+match)
- Invoices must clearly show match and use BWSR-approved hourly rates

Deliverables

Protocol

Up to 11 CGCP reports (ideally one per county)

Final report compiling findings from 11 individual reports

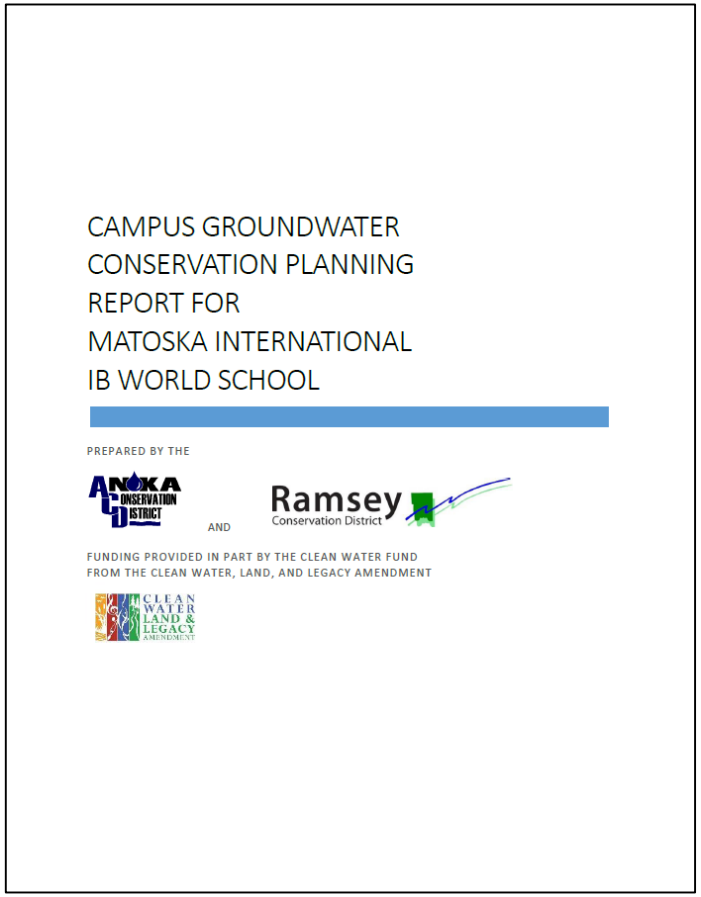

CAMPUS GROUNDWATER
CONSERVATION PLANNING
PROTOCOL

PREPARED BY THE METROPOLITAN CONSERVATION DISTRICTS

Metro Conservation Districts

FUNDING PROVIDED IN PART BY THE CLEAN WATER FUND FROM THE CLEAN WATER, LAND, AND LEGACY AMENDMENT

CLEAN WATER LAND & LEGACY AMENDMENT


CAMPUS GROUNDWATER
CONSERVATION PLANNING
REPORT FOR
MATOSKA INTERNATIONAL
IB WORLD SCHOOL

PREPARED BY THE

ANOKA CONSERVATION DISTRICT

AND

Ramsey Conservation District

FUNDING PROVIDED IN PART BY THE CLEAN WATER FUND
FROM THE CLEAN WATER, LAND, AND LEGACY AMENDMENT

CLEAN WATER LAND & LEGACY AMENDMENT

Member Structure

Fiscal agent – Scott Soil and Water Conservation District

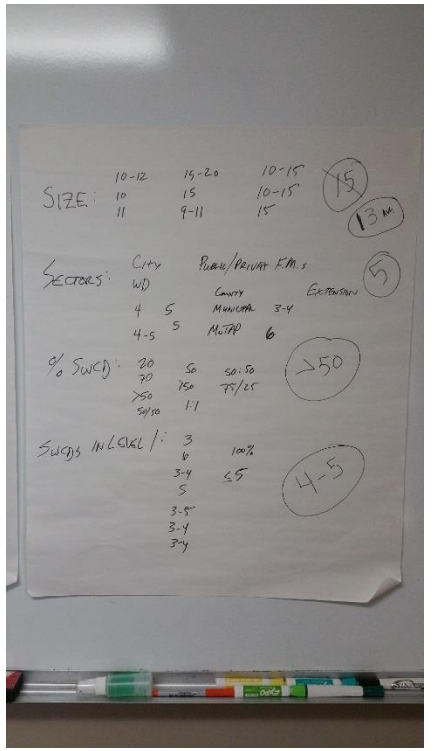
Host – Anoka Conservation District

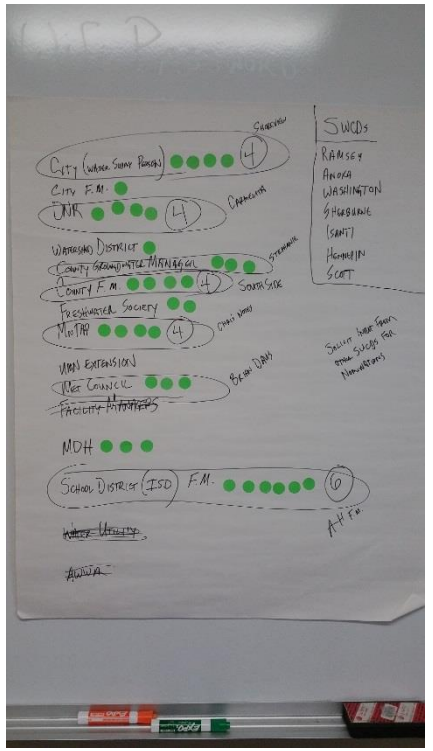
Participant –

- Level 1 - Anoka, Isanti, Ramsey, Scott, Sherburne, and Washington SWCDs
- Level 2 – 10 Metro SWCDs and Hennepin County Environmental Services

Partners – Task force members

Solicited interest from all SWCDs originally





Participant Levels

Level 1 – CGCP Protocol Development
- Actively participate in taskforce
- Develop CGCP protocols
- Literature review of BMPs
- Develop training for SWCD staff
- Training of Level 2 participants and campus facility managers

Level 2 – CGCP Implementation
- Identify and recruit campus participation
- Complete at least one CGCP including final report
- Reporting documentation provided to Host

Taskforce only
- Active participation in taskforce but does not assist with CGCP protocol work product development
  - MCD member
  - Non-MCD member

Task Force

Member Selection

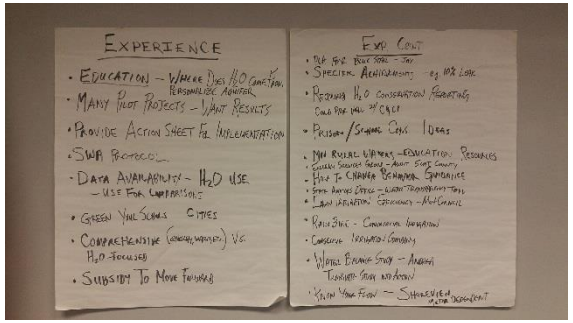
- Sectors represented
- SWCD and non-SWCD

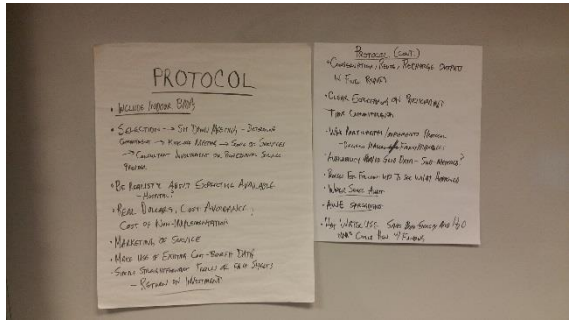
Level 1 SWCD CGCP Task Force Members		
SWCD	**Name**	**Title**
Anoka	Mitch Haustein	Conservation Specialist
Isanti	Tiffany Determan	District Manager
Ramsey	Andrea Prichard	Environmental GIS Technician
Scott	Troy Kuphal	District Manager
Sherburne	Daniel Cibulka	Water Resource Specialist
Washington	Jay Riggs	District Manager
Non-SWCD CGCP Task Force Members		
Organization	**Name**	**Title**
Anoka-Hennepin School District	Doug Bonar	Sites and Grounds Supervisor
Metropolitan Council	Brian Davis	Senior Engineer, Water Supply Planning
Minnesota Technical Assistance Program (MnTAP)	Mick Jost	Team Leader & Senior Scientist
Scott County	Tim McGovern	Facilities Manager
Minnesota DNR	Carmelita Nelson	Water Conservation Consultant
Washington County Department of Public Health & Environment	Stephanie Grayzeck Souter	Associate Planner
City of Woodbury	Jim Westerman	Utilities Supervisor/Environmental Resource Coordinator

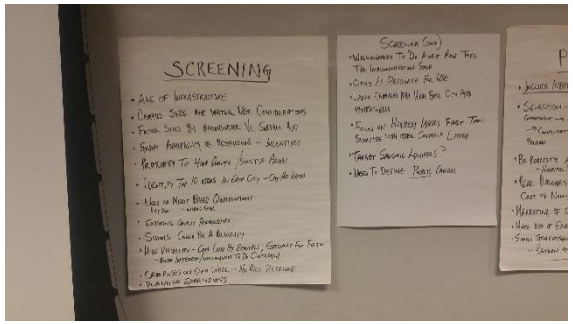
Task Force

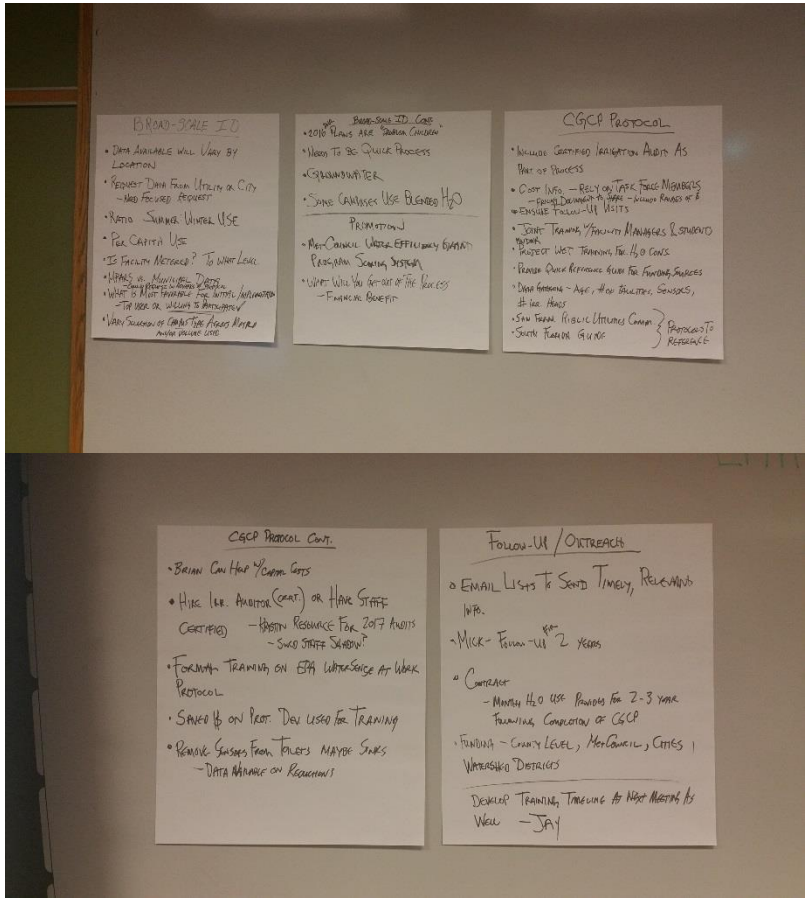
Two meetings to date

- Developed protocol concept
- Reviewed detailed outline of protocol









Work to Date

Protocol developed

- Included feedback from a variety of sectors
- Reviewed existing protocols
- Meetings with facilities managers and city utility providers
- Revised process
- Developed worksheets for on-site data collection
- Reviewed existing use and potential savings calculators

Pilot study completed at Matoska International IB World School in White Bear Lake

Report example generated

Grant Extension and Work Plan Revision

Amendment

- Original grant deadline 12/31/18
- Requested amendment to extend deadline to 12/31/19
  - Must complete up to 11 reports by September 2019 (ideally one per metro county)
  - Compile all results into final report for 12/31/19 deadline

Work Plan Revision

- Grant funds shifted from project development to implementation

Revised Budget – BWSR-Approved

Shifted $47,600 ($38,080 grant + $9,520 match) from 'Design/Production' to 'Implementation'

$15,000 per district ($12,000 grant + $3,000 match) for implementation of protocol

Project Activities	Fund Source	Current BWSR-Approved Work Plan Budget	Proposed Budget
Grant Administration and Reporting	Grant	$7,500.00	$7,500.00
	Match	$1,875.00	$1,875.00
Project Development	Grant	$15,000.00	$15,000.00
	Match	$3,750.00	$3,750.00
Campus Groundwater Conservation Plan program design and production	Grant	$83,060.00	***$44,980.00***
	Match	$20,765.00	***$11,245.00***
Campus Groundwater Conservation Plan designs	Grant	$93,920.00	***$132,000.00***
	Match	$23,480.00	***$33,000.00***
Supplies	Grant	$520.00	$520.00
	Match	$130.00	$130.00
Total	**Grant**	**$200,000.00**	**$200,000.00**
	Match	**$50,000.00**	**$50,000.00**

Overall CGCP Objectives

Develop a groundwater planning protocol to be implemented in 11-county metro for large-acreage, public campuses

Train staff on protocol implementation

Identify BMPs to conserve groundwater (reduce and/or supplement use) and encourage infiltration where it is appropriate

Complete up to 11 CGCP reports

Produce results (i.e. installation of identified projects and maintenance)

Position SWCDs state-wide to do this in a cost-effective manner

Training Layout

Training #1 – position SWCD staff to engage campuses and complete on-site data collection

- Steps 1-5 of 10 step protocol

Training #2 – enable staff to process collected data and generate CGCP report

- Steps 6-10 of 10 step protocol

Thank you RCD!

- Especially Ann and Andrea

Protocol Overview

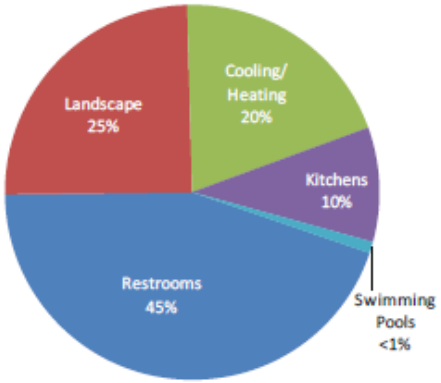
Protocol Overview

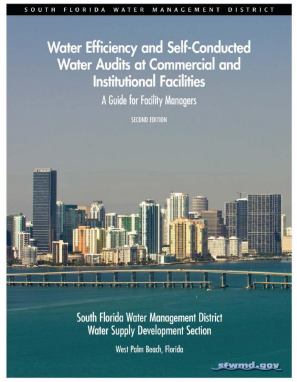
Reviewed existing protocols

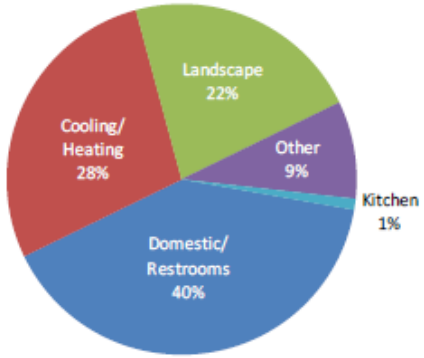
- SFWMD
- EPA's WaterSense at Work

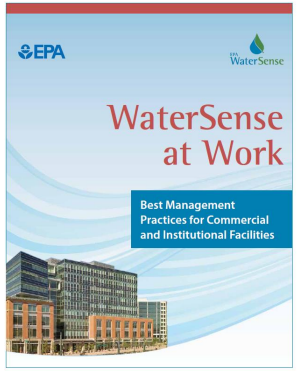
Common theme: emphasize need for thorough water audit to develop holistic understanding of facility water use in order to identify conservation opportunities

Protocols exist, but widespread application is limited







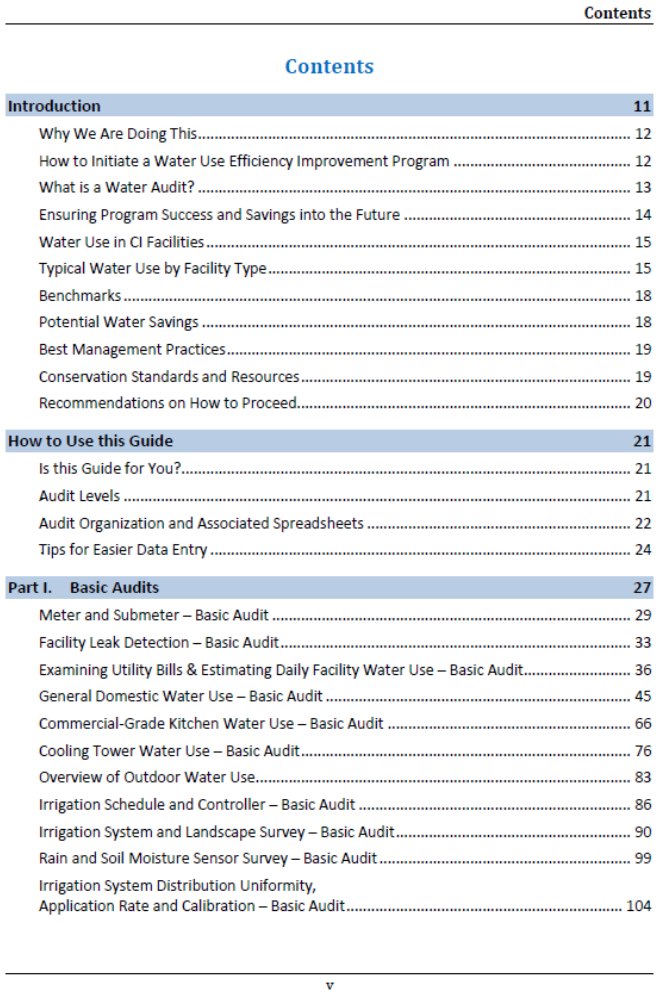


SFWMD

South Florida Water Management District Water Supply Development Section

- Water Efficiency and Self-Conducted Water Audits at Commercial and Institutional Facilities – A Guide for Facility Managers, Second Edition, July 2013

Open file and briefly review



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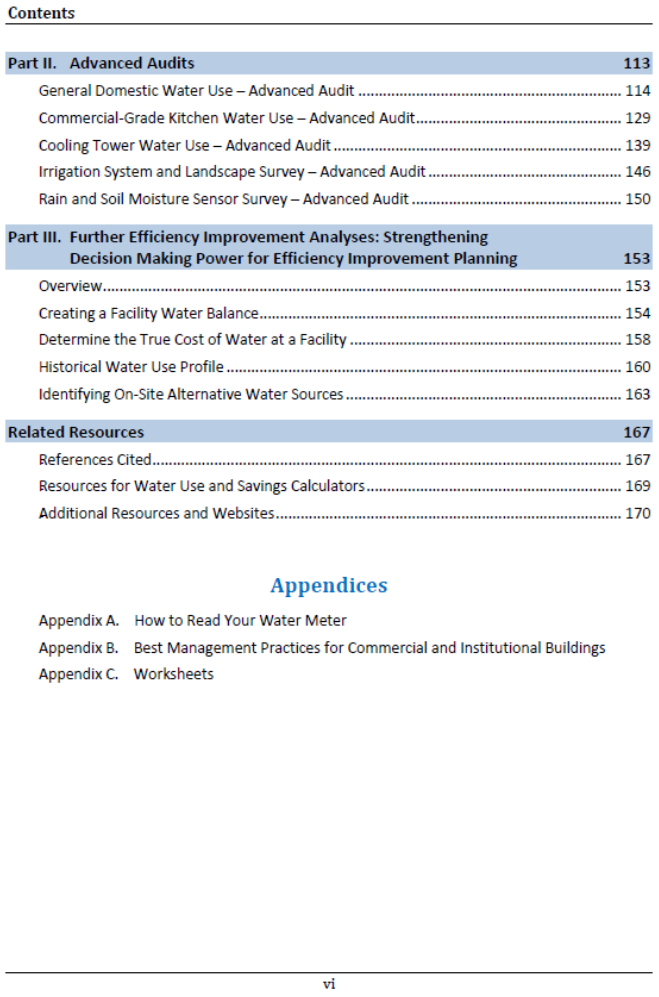


Appendices

WaterSense

EPA

- WaterSense at Work, Best Management Practices for Commercial and Institutional Facilities, October 2012

Open file and briefly review

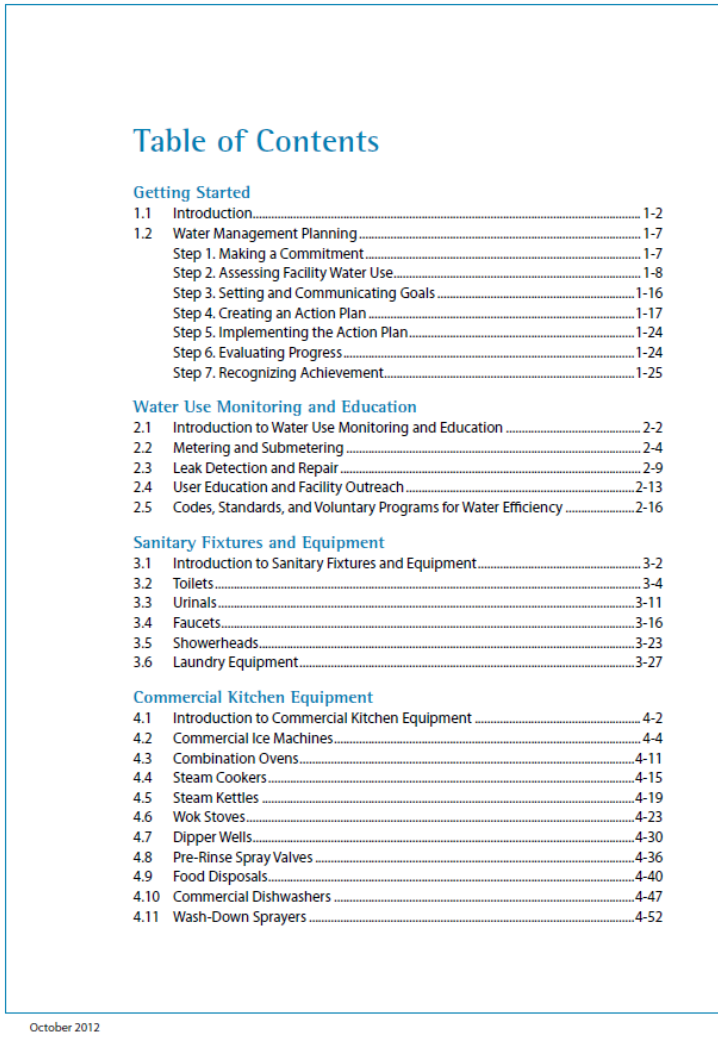
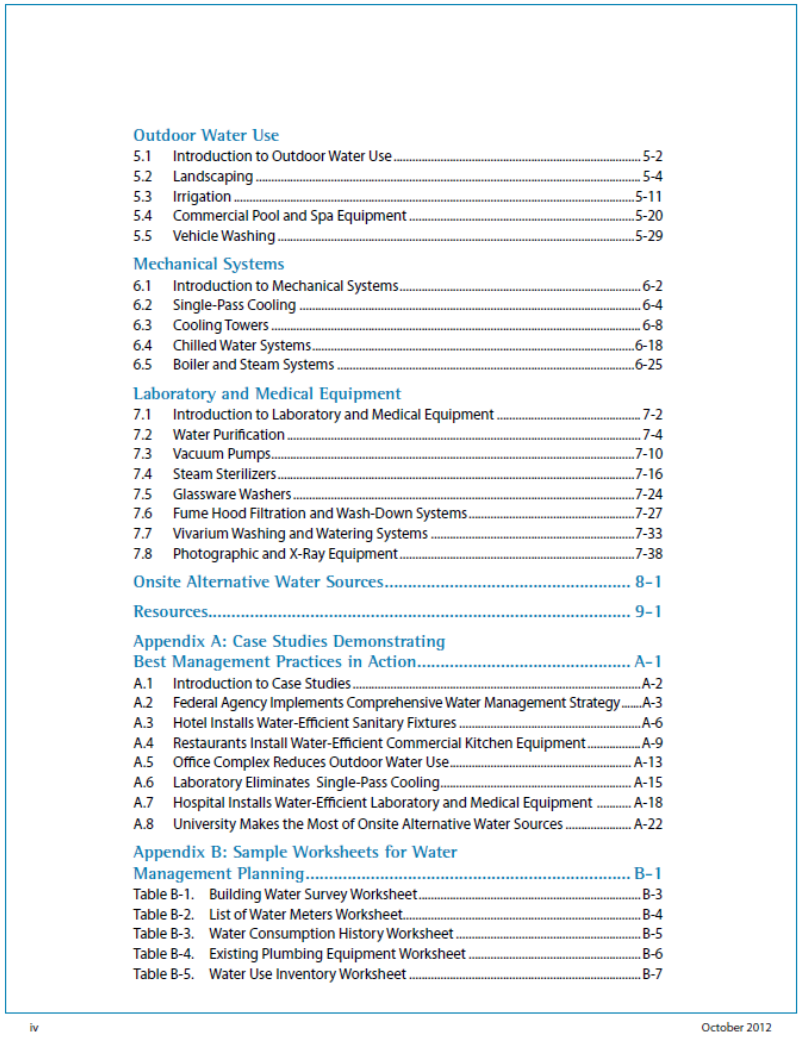


Table of Contents



Original Goals for Protocol Development

Analysis can be conducted in a reasonable timeframe (e.g. 150-200 hours) and still produce meaningful results

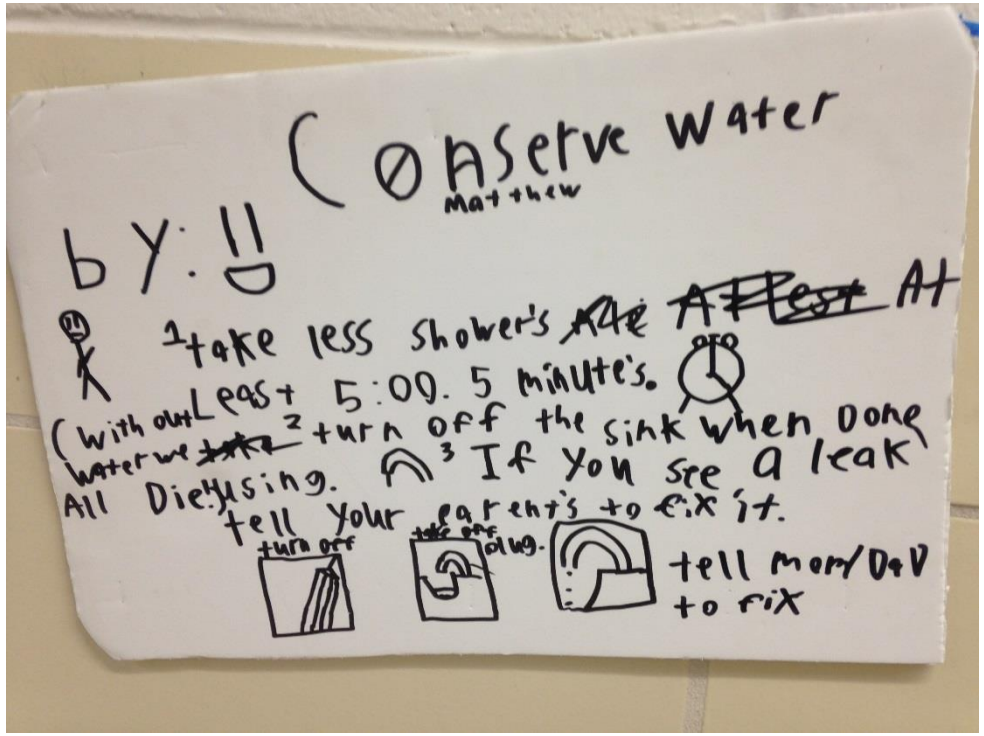
Adaptation of existing protocols

- Hours saved in development can be transferred to implementation of protocol

Water use reduction opportunities

- Reduce losses (leaks)
- Increase efficiency
- Educate employees and occupants – behavior modification
- Reuse onsite alternative water

Develop templates for reporting



CGCP Protocol Outline

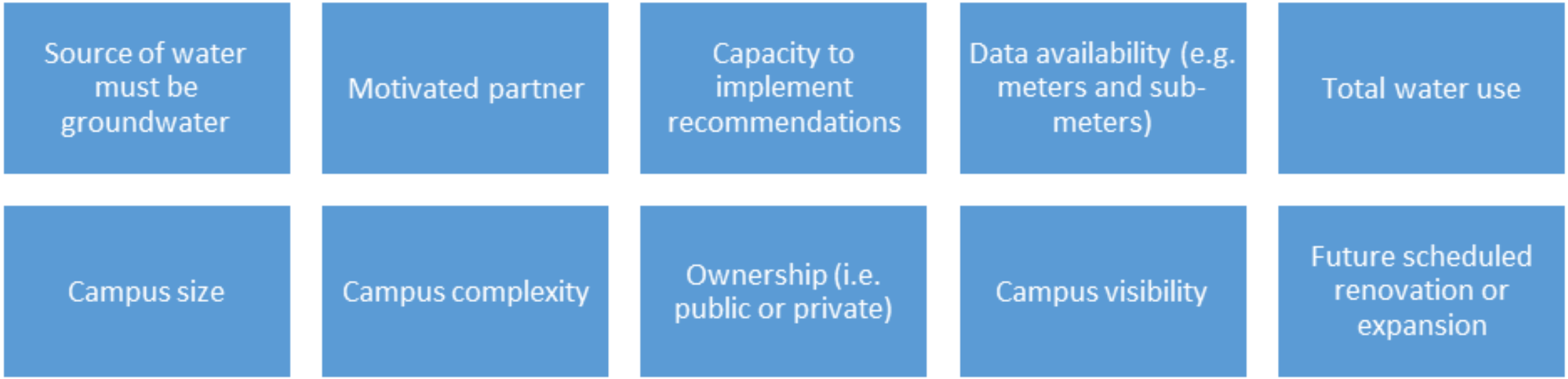
1. Campus selection (5 hours)
2. Desktop review (5 hours)
3. Kick-off meeting (10 hours)
4. Initial data request (5 hours)
5. On-site data collection (20 hours)
6. Process data and request any additional information (10 hours)
7. Identify possible projects and develop cost estimates (30 hours)
8. Analyze possible projects for cost-effectiveness (20 hours)
9. Generate final report (50 hours)
10. Follow-up support (5 hours)

Total: 160 hours

1 – Campus Selection

Current requirements are:

- Source of water for the campus is groundwater
- Public campus – currently clarifying with BWSR



1 – Campus Selection

Campuses on a private well will require a highly motivated partner because cost savings will likely not be significant (i.e. payback periods will be long)

Appendix B – promotional handout used in conjunction with talking points to right

Will review promotional handout later in training

Participation is entirely voluntary

- No regulatory requirements
- No commitment to implement recommendations, but implementation is encouraged

Save money and water

- Dual financial and environmental benefits

Campus staff time investment

- Approximately 20 hours, but depends greatly on campus size and complexity
- Additional detail provided in 'Kick-Off Meeting' section

Ranked water conservation opportunities

- Water conservation projects ranked based on cost-effectiveness and could facilitate future water conservation efforts

1 – Campus Selection

Appendix C – additional guidance for campus prioritization and selection

May become commonplace once CGCP initiative is well established

Use DOE FEMP worksheet to generate a qualitative summary of potential water conservation opporutnities.

Conduct a high-level analysis with information that can be easily gathered with minimal time investment from campus staff.

- Desktop review of campus including building footprints, campus area, and irrigated areas.
- 24 months of utility billing data
- Age of infrastructure
- Employee and visitor data

Thresholds for advancing to full protocol implementation could be required.

- Minimum campus size
- Minimum annual water use per day or per year

Subjective parameters could also be considered

- Visibility of campus
- Desire to implement change
- Capacity to implement changes (e.g. funding availability or planned construction or expansion)

2 – Desktop Review

Gain general understanding of campus in preparation for kick-off meeting

Completed in GIS

Focused on campus exterior but can be helpful for identifying potentially irrigated areas and infiltration opportunities

Generate list of questions for kick-off meeting

Generate overview map for note-taking

General campus layout and acreage

- Familiarization with the campus in advance of the kick-off meeting will ensure a productive meeting
- GIS data - recent aerial photographs and parcel data

Building footprint areas

- Understand count of buildings and footprints for future data entry
- GIS data - footprints manually digitized using recent aerial photographs or georeferenced building blueprints

Land uses

- Aid in the identification of potentially irrigated areas
- GIS data - recent aerial photographs, Metropolitan Council land use data or locally available land use data

Soils

- Identification of groundwater recharge opportunities is an element of the protocol, and understanding the potential for infiltration practices is a first step
- GIS data - county soil survey

Stormwater infrastructure

- Understanding where stormwater runoff is routed is important for identifying potential water reuse and groundwater recharge opportunities
- GIS data - storm sewer data

Topography

- Understanding where water drains on the campus is important for identifying potential water reuse and groundwater recharge opportunities
- GIS data - LiDAR

3 - Kick-Off Meeting

Meeting attendees

- Lead administrative staff for campus
- Campus facilities manager(s)

Focus on positivity (i.e. don’t attack a campus for wasting water)

Will provide more detail on suggested topics later in training

4 – Initial Data Request

Separate section of training dedicated to details of this step

Essentially, gather the data and populate the calculators to the extent possible – data gaps will remain – use them to guide the on-site data collection step

CGCP protocol analyzes both indoor and outdoor water use

Commercial and institutional water use divided into four general categories:

- Meters and leak detection
- Domestic indoor
- Non-domestic indoor (air cooling)
- Outdoor

5 – On-Site Data Collection

Separate section of training dedicated to review of data collection forms

Populate data collection forms (hard copy or digital)

Must measure all fixtures and equipment – one malfunctioning piece of equipment or fixture can represent a significant waste of water

Note any modifications to assumptions for sanitary fixtures

Larger equipment does not have general assumptions – gather detailed information from operators of the equipment

6 – Process Data

Enter data into CGCP calculators and identify any gaps that remain

Final request for information to facilities manager

For information not available, verify assumptions with facilities manager

7 – Identify Projects and Develop Cost Estimates

Calculators provide potential water conservation associated with using efficient fixtures and equipment

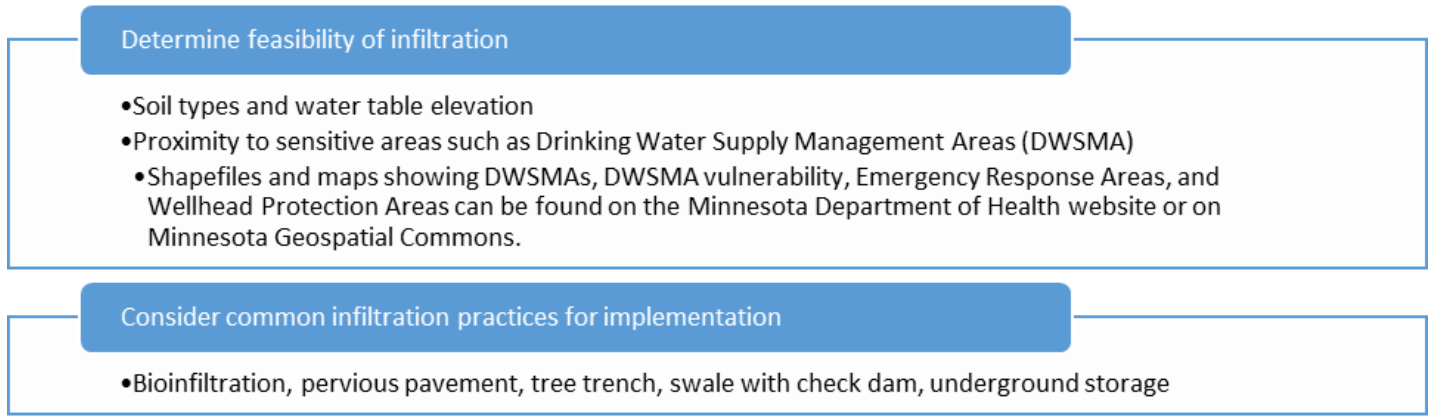
Estimated costs are entered into the calculators to estimate simple payback period

Verify estimated costs with facilities manager

- Some facilities may complete the work in-house whereas some may hire contractors

Appendix D – general guidance for groundwater recharge opportunities

- CWP Urban Retrofit Manual 3



8 – Analyze Recommendations for Cost-Effectiveness

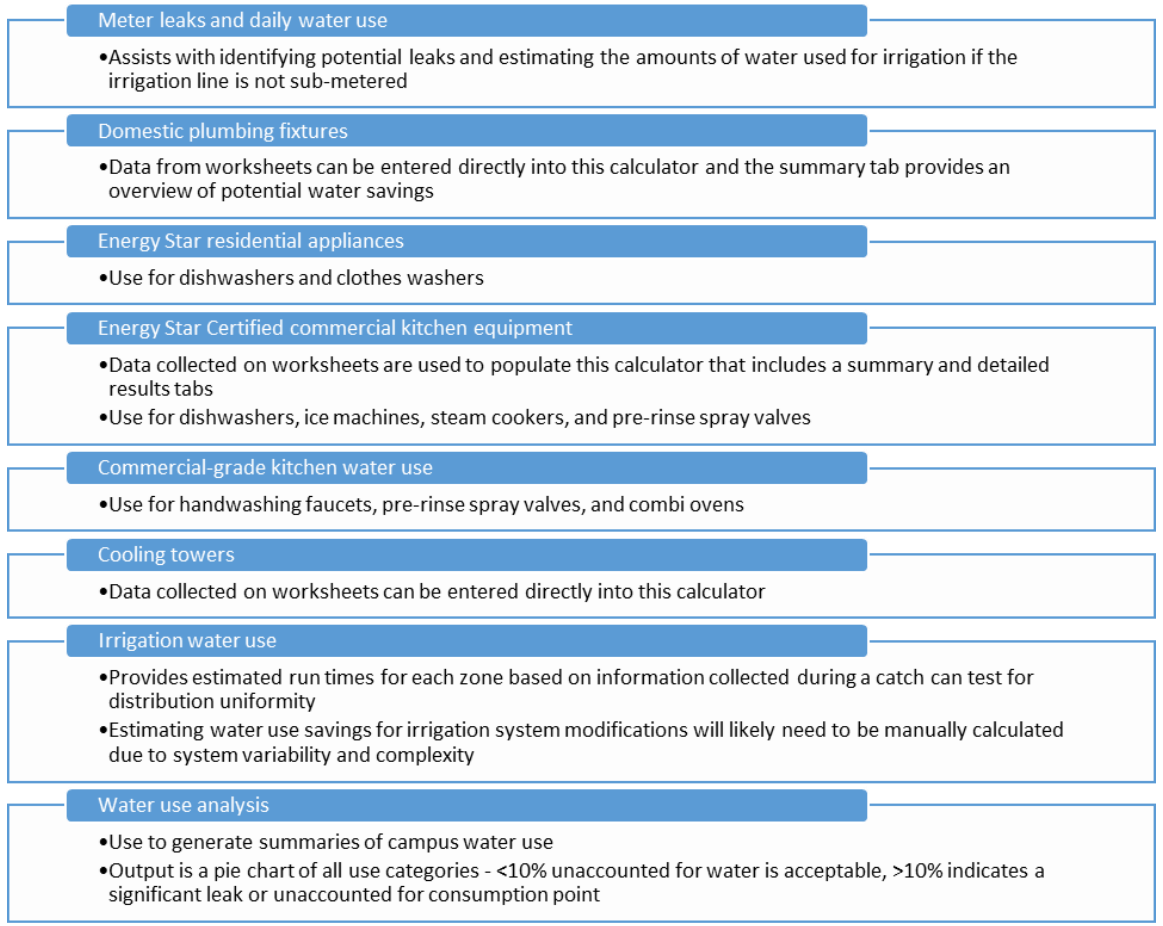
Overview of calculators

Simple payback period

Simple Payback Period = Project Cost ÷ (Water Savings · Cost of Water and Wastewater)

Where:

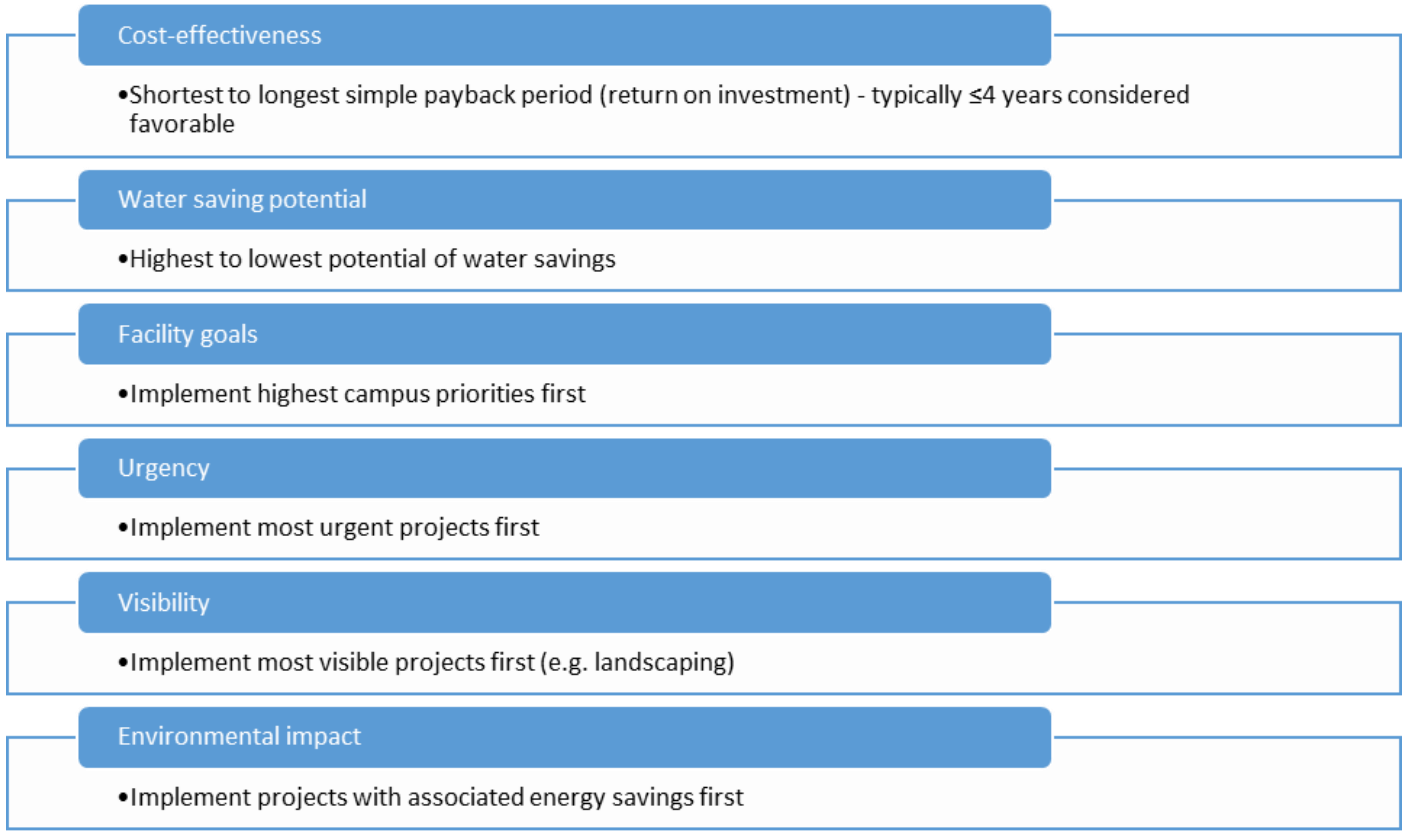
- Simple Payback Period (years)
- Project Cost (dollars)
- Water Savings (gallons per year)
- Cost of Water and Wastewater (dollars per gallon)
    - The true cost of water factors in costs associated with chemicals, electricity, and gas.
    - It is important to note that investments in water saving are paid back at the highest water utility block rate, thereby providing the greatest reduction in payback period, until total water use drops to the next tier.



8 – Analyze Recommendations for Cost-Effectiveness

Ranking by a variety of factors

Clarify what is most useful for specific campus



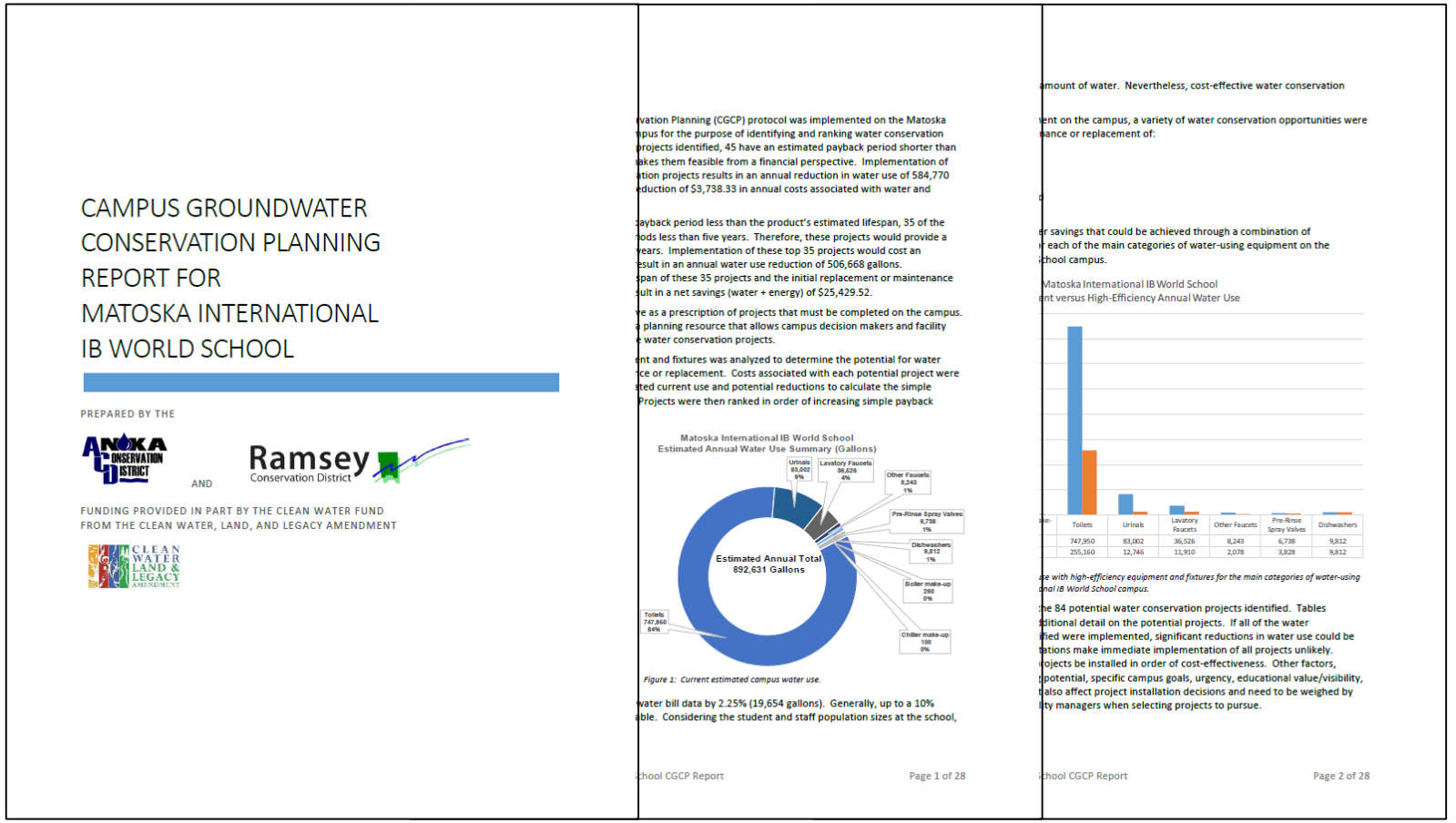
9 – Generate Final Report

Ensure report includes straightforward summary section

Meet with campus staff to present report

Complete draft report reviewed by Level 1 SWCD members

Final edits completed for Training #2



CAMPUS GROUNDWATER CONSERVATION PLANNING REPORT FOR MATOSKA INTERNATIONAL IB WORLD SCHOOL

PREPARED BY THE

ANOKA CONSERVATION DISTRICT AND Ramsey Conservation District

FUNDING PROVIDED IN PART BY THE CLEAN WATER FUND FROM THE CLEAN WATER, LAND, AND LEGACY AMENDMENT

CLEAN WATER LAND & LEGACY AMENDMENT

vation Planning (CGCP) protocol was implemented on the Matoska
pus for the purpose of identifying and ranking water conservation
projects identified, 45 have an estimated payback period shorter than
akes them feasible from a financial perspective. Implementation of
ation projects results in an annual reduction in water use of 584,770
eduction of $3,738.33 in annual costs associated with water and

ayback period less than the product's estimated lifespan, 35 of the
ods less than five years. Therefore, these projects would provide a
ears. Implementation of these top 35 projects would cost an
esult in an annual water use reduction of 506,668 gallons.
pan of these 35 projects and the initial replacement or maintenance
ult in a net savings (water + energy) of $25,429.52.

e as a prescription of projects that must be completed on the campus.
a planning resource that allows campus decision makers and facility
e water conservation projects.

ent and fixtures was analyzed to determine the potential for water
ce or replacement. Costs associated with each potential project were
ted current use and potential reductions to calculate the simple
Projects were then ranked in order of increasing simple payback

Matoska International IB World School
Estimated Annual Water Use Summary (Gallons)

Figure 1: Current estimated campus water use.

water bill data by 2.25% (19,654 gallons). Generally, up to a 10%
able. Considering the student and staff population sizes at the school,

mount of water. Nevertheless, cost-effective water conservation

ent on the campus, a variety of water conservation opportunities were
nance or replacement of:

er savings that could be achieved through a combination of
each of the main categories of water-using equipment on the
chool campus.

Matoska International IB World School
ent versus High-Efficiency Annual Water Use

e with high-efficiency equipment and fixtures for the main categories of water-using
nal IB World School campus.

he 84 potential water conservation projects identified. Tables
ditional detail on the potential projects. If all of the water
ified were implemented, significant reductions in water use could be
tations make immediate implementation of all projects unlikely.
rojects be installed in order of cost-effectiveness. Other factors,
potential, specific campus goals, urgency, educational value/visibility,
also affect project installation decisions and need to be weighed by
ity managers when selecting projects to pursue.

10 – Follow-Up Support

Implementation ideas

- Fix malfunctioning or leaking equipment
- Start with simple projects to create initial positive results
- Modify O&M protocols that can be little or no cost

Gauge installation of projects

Document water savings

Identify challenges to implementation

Promotion to Campuses

Potential Campus Types

From grant application:

The Metro Conservation Districts (MCD) propose to provide groundwater conservation planning protocols to member districts for implementation on large-acreage, public campuses (e.g. public schools, hospitals, and government facilities). These areas are targeted due to their educational benefits, likelihood of stakeholder buy in and implementation, magnitude of potential impact, and opportunity for school district-wide implementation.

Schools

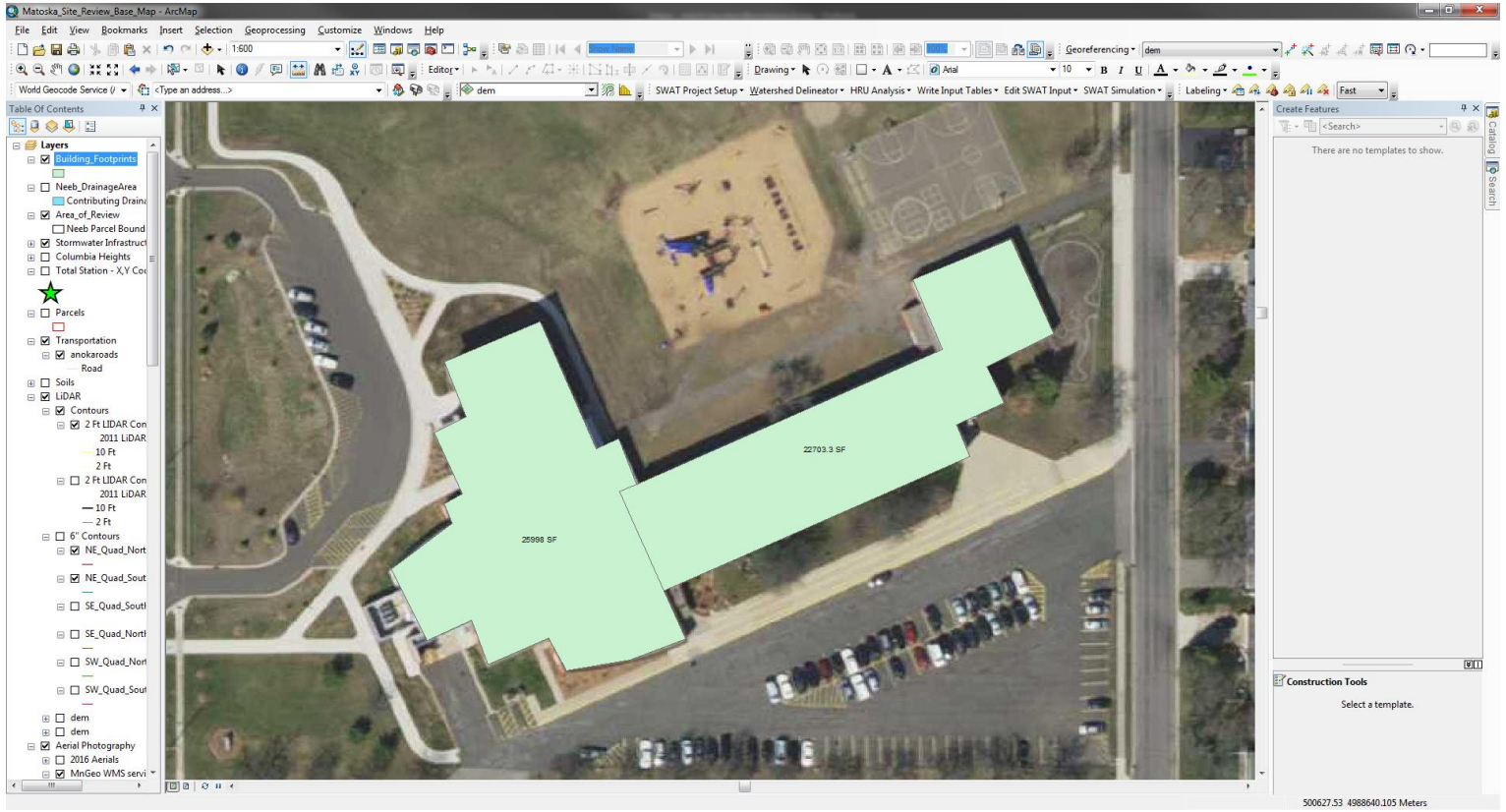
Colleges

City Halls

Public Works Buildings

Others

Desktop Review



Initial Contact

Ensure source of water is groundwater

Participation is entirely voluntary

Save money and water

Campus staff time investment estimate

Campus staff time investment estimates

- Kick-off meeting, initial campus tour - 2 hours
- Data gathering for initial request (e.g. utility billing data, list of water using equipment and readily available data, meter and sub-meter data) - 4 hours
- Coordination of access for on-site data collection - 8 hours (may vary based on campus size and complexity)
- Data gathering for follow-up request - 2 hours
- Meeting to review final report - 2 hours
- Total - 18 hours

Promotional Material - **Handout**

Overview of CGCP initiative

Benefits

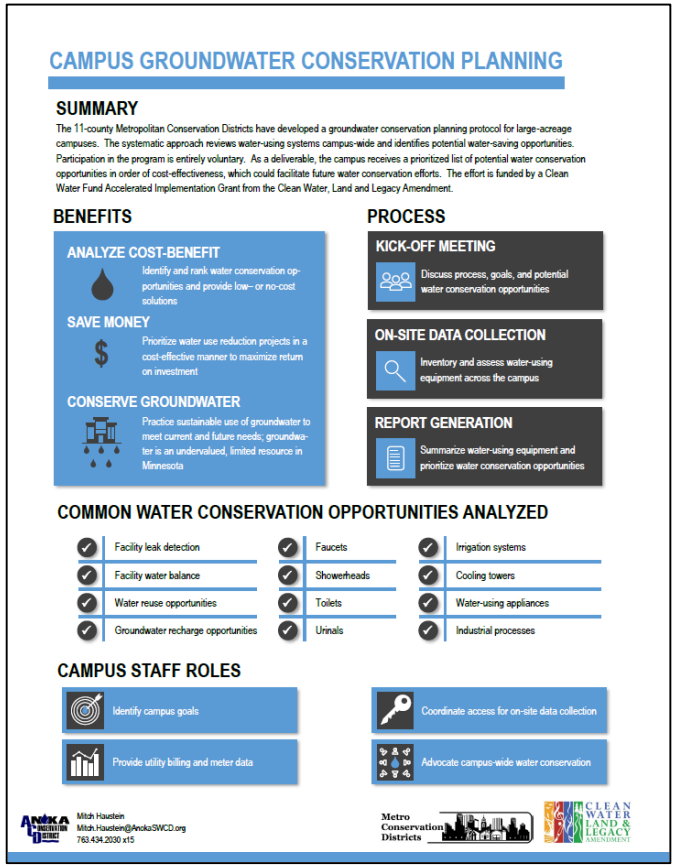
General process

Common equipment and fixtures analyzed

Roles of campus staff

MS Publisher file for SWCD-specific contact information

Please review and share initial reaction – pair and share



CAMPUS GROUNDWATER CONSERVATION PLANNING

SUMMARY

The 11-county Metropolitan Conservation Districts have developed a groundwater conservation planning protocol for large-acreage campuses. The systematic approach reviews water-using systems campus-wide and identifies potential water-saving opportunities. Participation in the program is entirely voluntary. As a deliverable, the campus receives a prioritized list of potential water conservation opportunities in order of cost-effectiveness, which could facilitate future water conservation efforts. The effort is funded by a Clean Water Fund Accelerated Implementation Grant from the Clean Water, Land and Legacy Amendment.

BENEFITS

ANALYZE COST-BENEFIT

Identify and rank water conservation opportunities and provide low- or no-cost solutions

SAVE MONEY

Prioritize water use reduction projects in a cost-effective manner to maximize return on investment

CONSERVE GROUNDWATER

Practice sustainable use of groundwater to meet current and future needs; groundwater is an undervalued, limited resource in Minnesota

PROCESS

KICK-OFF MEETING

Discuss process, goals, and potential water conservation opportunities

ON-SITE DATA COLLECTION

Inventory and assess water-using equipment across the campus

REPORT GENERATION

Summarize water-using equipment and prioritize water conservation opportunities

COMMON WATER CONSERVATION OPPORTUNITIES ANALYZED

- Facility leak detection
- Facility water balance
- Water reuse opportunities
- Groundwater recharge opportunities
- Faucets
- Showerheads
- Toilets
- Urinals
- Irrigation systems
- Cooling towers
- Water-using appliances
- Industrial processes

CAMPUS STAFF ROLES

- Identify campus goals
- Provide utility billing and meter data
- Coordinate access for on-site data collection
- Advocate campus-wide water conservation

Mitch Haustein
Mitch.Haustein@AnokaSWCD.org
763.434.2030 x15

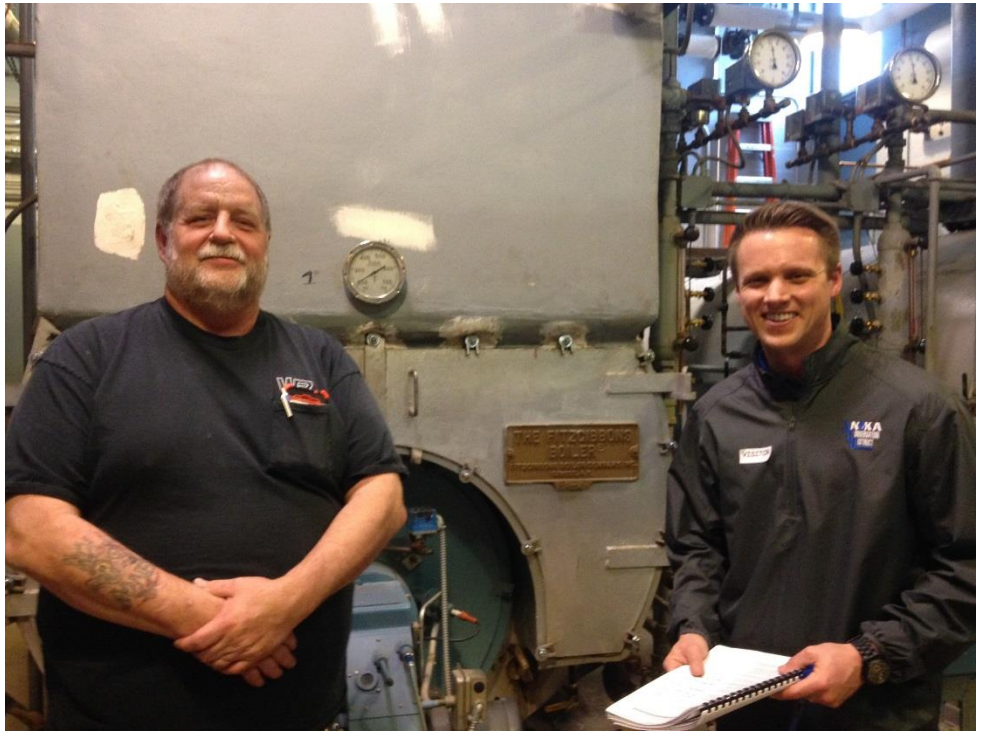
Metro Conservation Districts

CLEAN WATER LAND & LEGACY AMENDMENT

Kick-Off Meeting

Talking Points

- Save money, water, and energy
- Entirely voluntary
  - Non-regulatory
  - No requirements for installation, although highly encouraged
- Overview of campus water source (aquifer)
- CGCP process overview
- Identify campus-specific goals
- Existing water conservation efforts
- Complete DOE FEMP Water Project Screening Tool
- Campus staff time investment
- Introductory tour



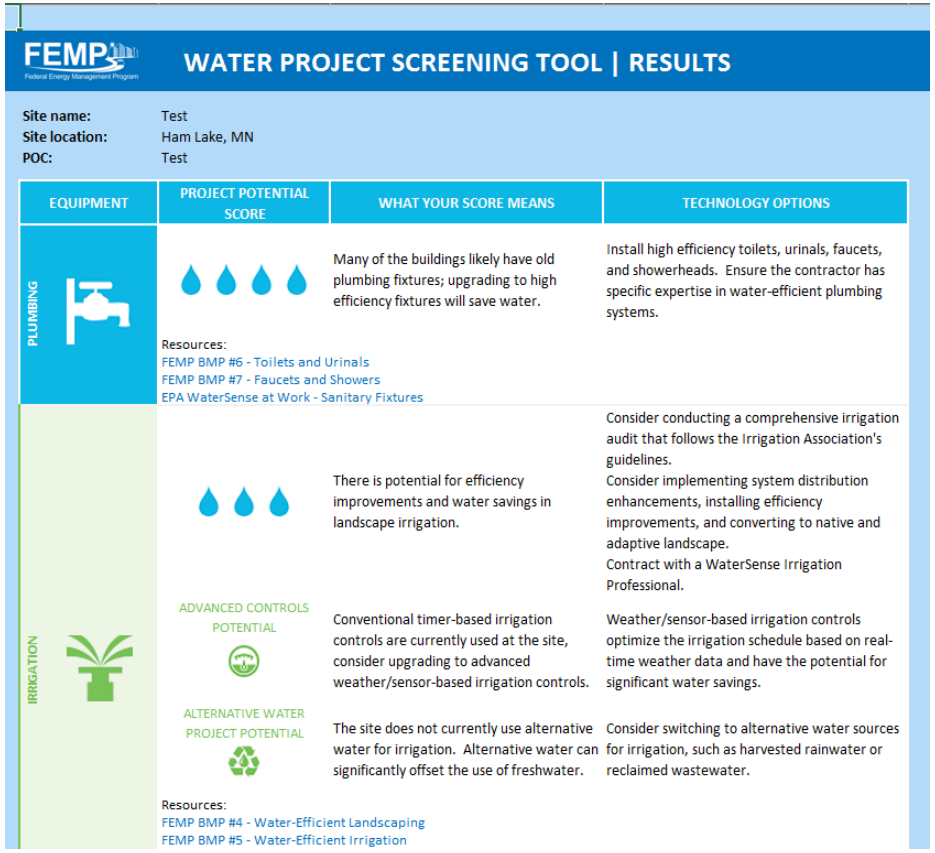
DOE FEMP Water Project Screening Tool - **Example**

Simple to populate

Readily available information

Provides general sense of water conservation potential

Populate spreadsheet



FEMP Federal Energy Management Program

WATER PROJECT SCREENING TOOL | RESULTS

Site name: Test
Site location: Ham Lake, MN
POC: Test

EQUIPMENT	PROJECT POTENTIAL SCORE	WHAT YOUR SCORE MEANS	TECHNOLOGY OPTIONS
PLUMBING	4 water drops	Many of the buildings likely have old plumbing fixtures; upgrading to high efficiency fixtures will save water.	Install high efficiency toilets, urinals, faucets, and showerheads. Ensure the contractor has specific expertise in water-efficient plumbing systems.
	Resources: FEMP BMP #6 - Toilets and Urinals; FEMP BMP #7 - Faucets and Showers; EPA WaterSense at Work - Sanitary Fixtures		
IRRIGATION	3 water drops	There is potential for efficiency improvements and water savings in landscape irrigation.	Consider conducting a comprehensive irrigation audit that follows the Irrigation Association's guidelines. Consider implementing system distribution enhancements, installing efficiency improvements, and converting to native and adaptive landscape. Contract with a WaterSense Irrigation Professional.
	ADVANCED CONTROLS POTENTIAL	Conventional timer-based irrigation controls are currently used at the site, consider upgrading to advanced weather/sensor-based irrigation controls.	Weather/sensor-based irrigation controls optimize the irrigation schedule based on real-time weather data and have the potential for significant water savings.
	ALTERNATIVE WATER PROJECT POTENTIAL	The site does not currently use alternative water for irrigation. Alternative water can significantly offset the use of freshwater.	Consider switching to alternative water sources for irrigation, such as harvested rainwater or reclaimed wastewater.
	Resources: FEMP BMP #4 - Water-Efficient Landscaping; FEMP BMP #5 - Water-Efficient Irrigation		

Introductory Tour

Gain general understanding of campus layout and water using equipment and fixtures

Not collecting detailed information at this point, but enables planning and estimating time investment necessary for on-site data collection step

Initial Data Request

Data to Collect

Facility manager contact information

Utility bills (water, gas, and electricity) – at least most recent 24 months

Sub-metered water equipment data – at least most recent 24 months

Count of existing sanitary fixtures and other water using equipment

Facility leak detection data

Building occupancy information

Irrigation system information

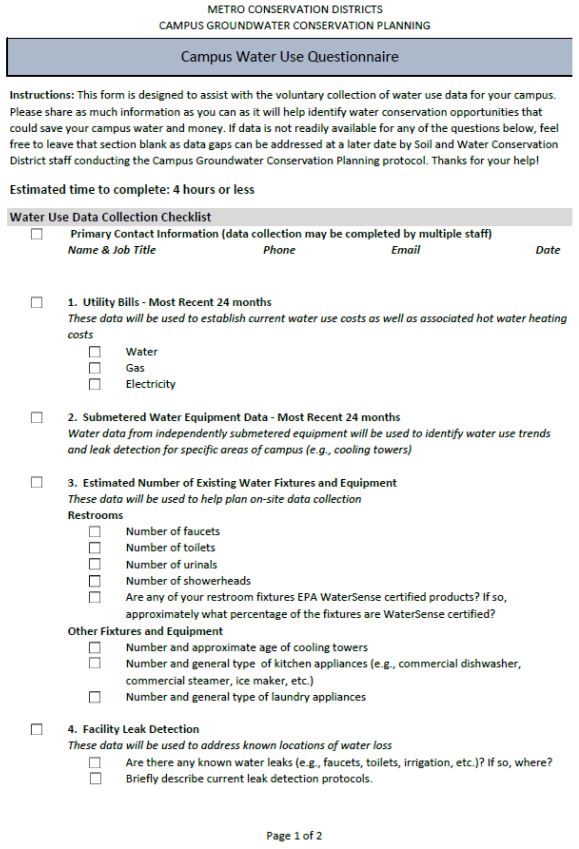
Educational efforts

Other

Request Form - **Handout**

Provide to campus facility manager after kick-off meeting

Review form – pair and share



METRO CONSERVATION DISTRICTS
CAMPUS GROUNDWATER CONSERVATION PLANNING

Campus Water Use Questionnaire

Instructions: This form is designed to assist with the voluntary collection of water use data for your campus. Please share as much information as you can as it will help identify water conservation opportunities that could save your campus water and money. If data is not readily available for any of the questions below, feel free to leave that section blank as data gaps can be addressed at a later date by Soil and Water Conservation District staff conducting the Campus Groundwater Conservation Planning protocol. Thanks for your help!

Estimated time to complete: 4 hours or less

Water Use Data Collection Checklist

☐ **Primary Contact Information (data collection may be completed by multiple staff)**
Name & Job Title *Phone* *Email* *Date*

☐ **1. Utility Bills - Most Recent 24 months**
These data will be used to establish current water use costs as well as associated hot water heating costs
- ☐ Water
- ☐ Gas
- ☐ Electricity

☐ **2. Submetered Water Equipment Data - Most Recent 24 months**
Water data from independently submetered equipment will be used to identify water use trends and leak detection for specific areas of campus (e.g., cooling towers)

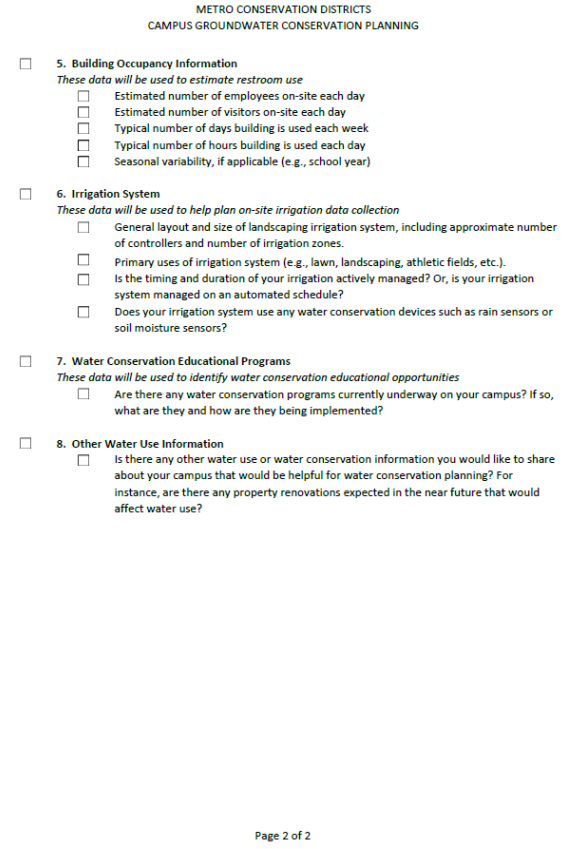
☐ **3. Estimated Number of Existing Water Fixtures and Equipment**
These data will be used to help plan on-site data collection

Restrooms
- ☐ Number of faucets
- ☐ Number of toilets
- ☐ Number of urinals
- ☐ Number of showerheads
- ☐ Are any of your restroom fixtures EPA WaterSense certified products? If so, approximately what percentage of the fixtures are WaterSense certified?

Other Fixtures and Equipment
- ☐ Number and approximate age of cooling towers
- ☐ Number and general type of kitchen appliances (e.g., commercial dishwasher, commercial steamer, ice maker, etc.)
- ☐ Number and general type of laundry appliances

☐ **4. Facility Leak Detection**
These data will be used to address known locations of water loss
- ☐ Are there any known water leaks (e.g., faucets, toilets, irrigation, etc.)? If so, where?
- ☐ Briefly describe current leak detection protocols.

Page 1 of 2



METRO CONSERVATION DISTRICTS
CAMPUS GROUNDWATER CONSERVATION PLANNING

☐ **5. Building Occupancy Information**
These data will be used to estimate restroom use
- ☐ Estimated number of employees on-site each day
- ☐ Estimated number of visitors on-site each day
- ☐ Typical number of days building is used each week
- ☐ Typical number of hours building is used each day
- ☐ Seasonal variability, if applicable (e.g., school year)

☐ **6. Irrigation System**
These data will be used to help plan on-site irrigation data collection
- ☐ General layout and size of landscaping irrigation system, including approximate number of controllers and number of irrigation zones.
- ☐ Primary uses of irrigation system (e.g., lawn, landscaping, athletic fields, etc.).
- ☐ Is the timing and duration of your irrigation actively managed? Or, is your irrigation system managed on an automated schedule?
- ☐ Does your irrigation system use any water conservation devices such as rain sensors or soil moisture sensors?

☐ **7. Water Conservation Educational Programs**
These data will be used to identify water conservation educational opportunities
- ☐ Are there any water conservation programs currently underway on your campus? If so, what are they and how are they being implemented?

☐ **8. Other Water Use Information**
- ☐ Is there any other water use or water conservation information you would like to share about your campus that would be helpful for water conservation planning? For instance, are there any property renovations expected in the near future that would affect water use?

Page 2 of 2

Process Data - Population

Matoska International IB World School Population Data
2017-2018 School Year (as of 08/30/2017)

STUDENTS

Grade	Boys	Girls	TOTALS
K	44	47	91
1	50	49	99
2	50	48	98
3	46	58	104
4	41	61	102
5	43	32	75
	274	295	**569**

FACULTY/STAFF

Group	Men	Women	TOTALS
Faculty/Staff	9	66	75

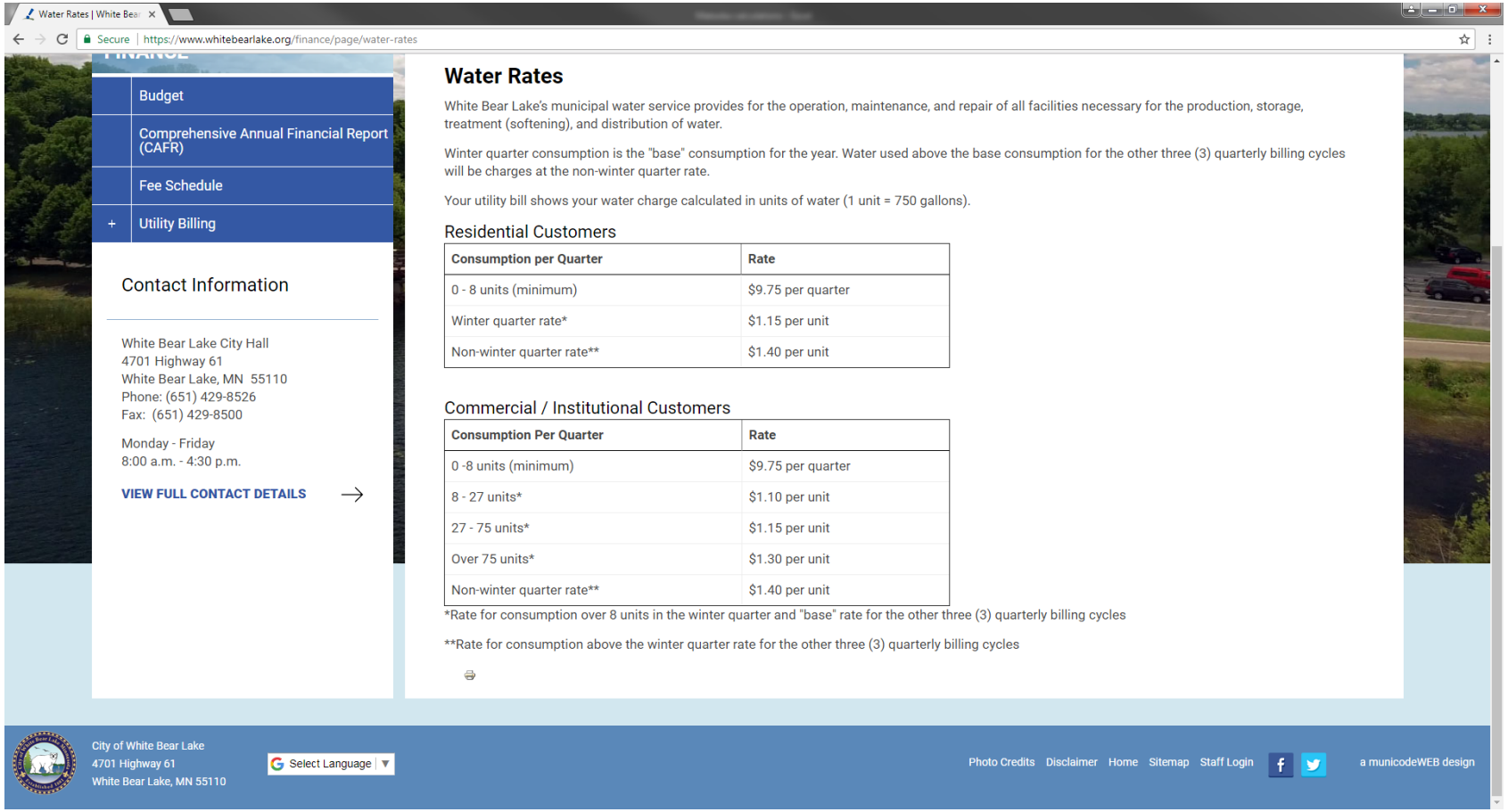
TOTAL POPULATION

	Population Size	Days/Week	Weeks/Year	Work Days/Year
Male	283	5	35	175
Female	361	5	35	175
TOTAL	644			

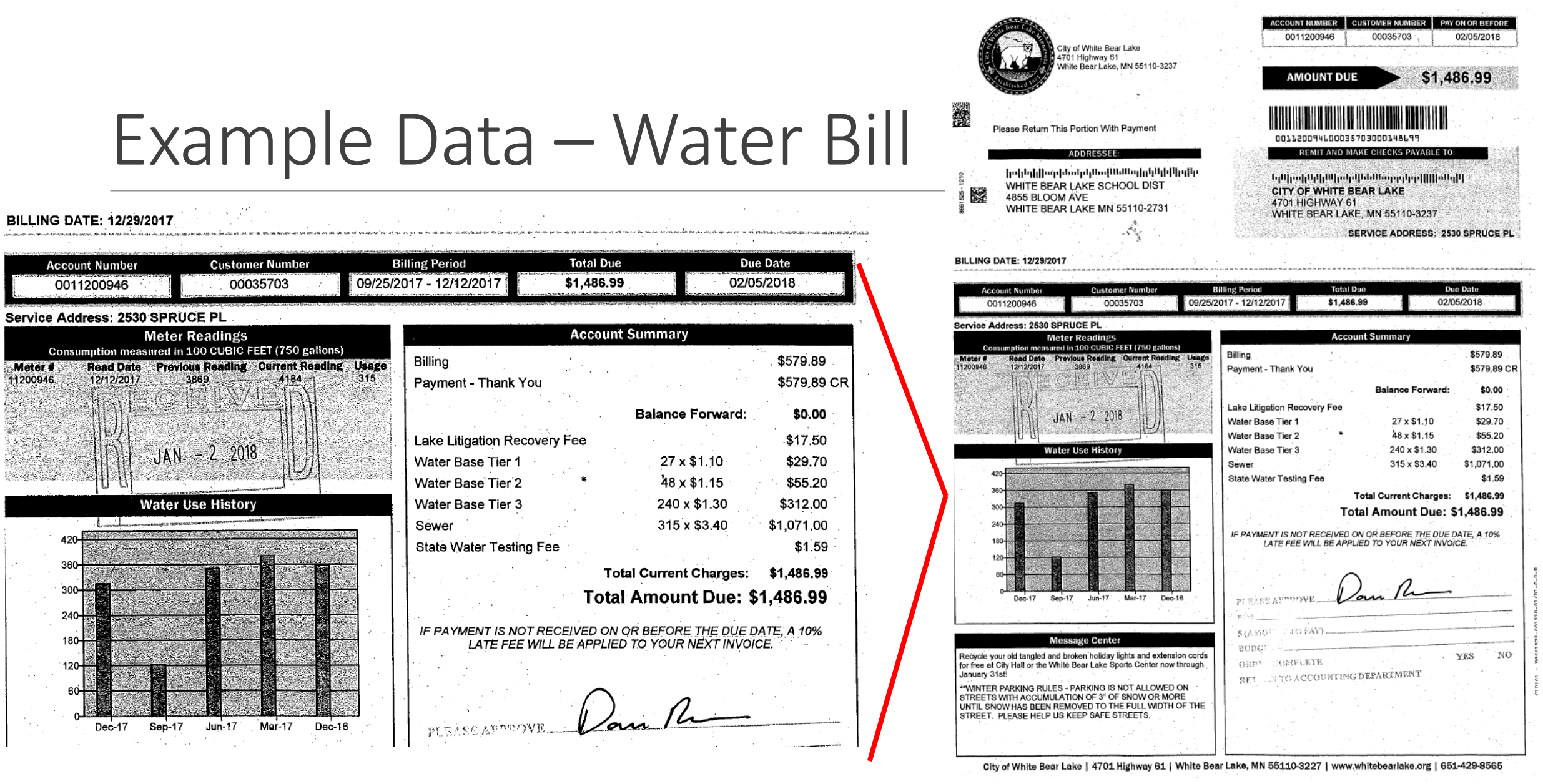
ESTIMATED SANITARY FIXTURE USE CALIBRATION CALCULATIONS

Days per year	175	
	Toilet use/day	Urinal use/day
Male Staff	1	2
Female Staff	3	0
Male Students	0.802	1.604
Female Students	2.406	0
TOTAL POPULATION (644)		
Expected Annual Toilet Uses	198,908	
Expected Annual Urinal Uses	80,070	
Expected Annual Lav. Faucet Uses	278,977	
STAFF (75)		
Expected Annual Toilet Uses	36,225	
Expected Annual Urinal Uses	3,150	
Expected Annual Lav. Faucet Uses	39,375	
STUDENTS (569)		
Expected Annual Toilet Uses	162,683	
Expected Annual Urinal Uses	76,920	
Expected Annual Lav. Faucet Uses	239,602	

Example Data – City Billing Rates



Example Data – Water Bill



City of White Bear Lake
4701 Highway 61
White Bear Lake, MN 55110-3237

ACCOUNT NUMBER	CUSTOMER NUMBER	PAY ON OR BEFORE
0011200946	00035703	02/05/2018

AMOUNT DUE $1,486.99

Please Return This Portion With Payment

ADDRESSEE:
WHITE BEAR LAKE SCHOOL DIST
4855 BLOOM AVE
WHITE BEAR LAKE MN 55110-2731

REMIT AND MAKE CHECKS PAYABLE TO:
CITY OF WHITE BEAR LAKE
4701 HIGHWAY 61
WHITE BEAR LAKE, MN 55110-3237
SERVICE ADDRESS: 2530 SPRUCE PL

BILLING DATE: 12/29/2017

Account Number	Customer Number	Billing Period	Total Due	Due Date
0011200946	00035703	09/25/2017 - 12/12/2017	$1,486.99	02/05/2018

Service Address: 2530 SPRUCE PL

Meter Readings
Consumption measured in 100 CUBIC FEET (750 gallons)

Meter #	Read Date	Previous Reading	Current Reading	Usage
11200946	12/12/2017	3869	4184	315

RECEIVED JAN - 2 2018

Water Use History

Account Summary

Billing		$579.89
Payment - Thank You		$579.89 CR
	Balance Forward:	**$0.00**
Lake Litigation Recovery Fee		$17.50
Water Base Tier 1	27 x $1.10	$29.70
Water Base Tier 2	48 x $1.15	$55.20
Water Base Tier 3	240 x $1.30	$312.00
Sewer	315 x $3.40	$1,071.00
State Water Testing Fee		$1.59
	Total Current Charges:	**$1,486.99**

Total Amount Due: $1,486.99

IF PAYMENT IS NOT RECEIVED ON OR BEFORE THE DUE DATE, A 10% LATE FEE WILL BE APPLIED TO YOUR NEXT INVOICE.

PLEASE APPROVE

Message Center

Recycle your old tangled and broken holiday lights and extension cords for free at City Hall or the White Bear Lake Sports Center now through January 31st!

**WINTER PARKING RULES - PARKING IS NOT ALLOWED ON STREETS WITH ACCUMULATION OF 3" OF SNOW OR MORE UNTIL SNOW HAS BEEN REMOVED TO THE FULL WIDTH OF THE STREET. PLEASE HELP US KEEP SAFE STREETS.

YES NO

TO ACCOUNTING DEPARTMENT

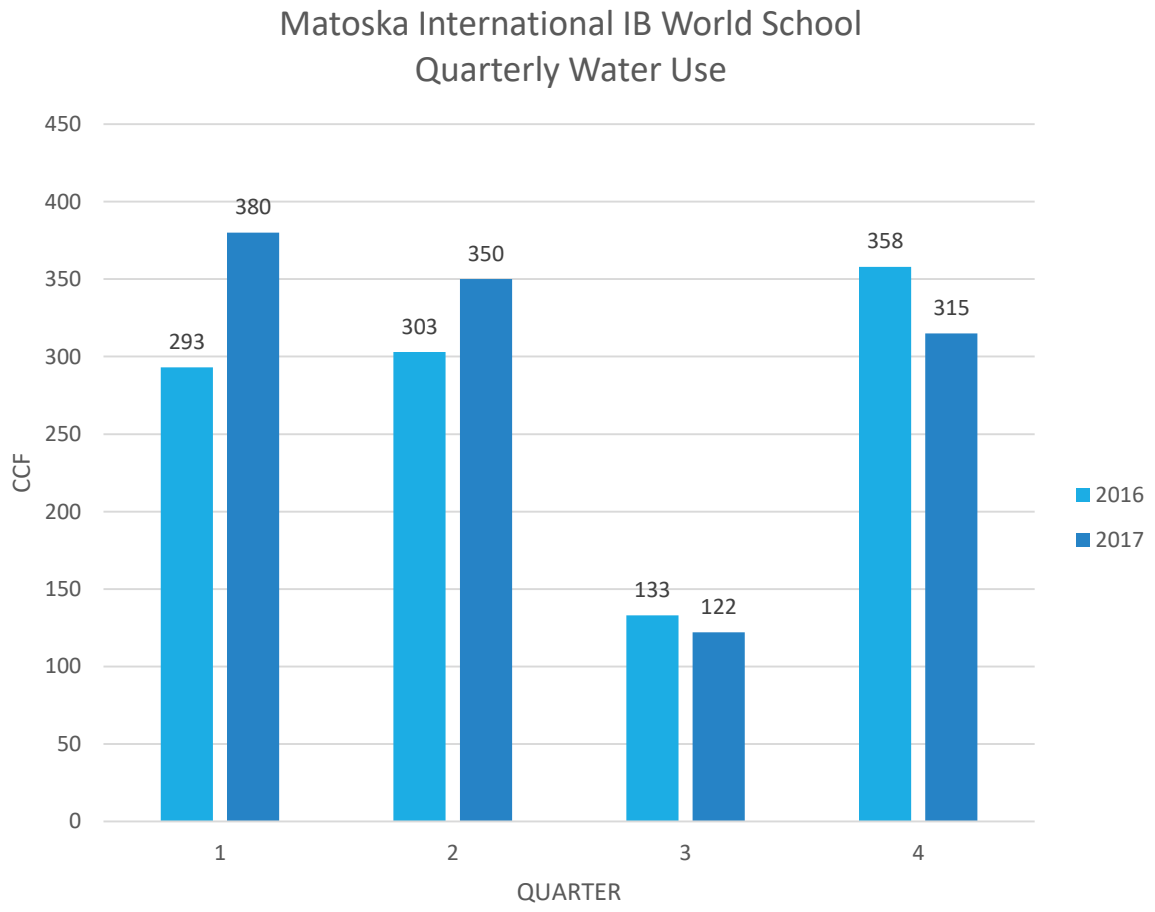
City of White Bear Lake | 4701 Highway 61 | White Bear Lake, MN 55110-3227 | www.whitebearlake.org | 651-429-8565

Process Data – Water Billing

Time Period	YEAR/QUARTER	QUARTER	Reading	Units Used
June - Sept 15	2015	3*	1596	
Sept15-Dec 15	2015	4	1930	334
Dec 15-Mar 16	2016	1	2223	293
Mar-June 16	2016	2	2526	303
June - Sept 16*	2016	3*	2659	133
Sept-Dec 16	2016	4	3017	358
Dec 16-Mar 17	2017	1	3397	380
Mar-June 17	2017	2	3747	350
June-Sep 17*	2017	3*	3869	122
Sep 17-Dec 17	2017	4	4184	315
*Summer months - no school in session				

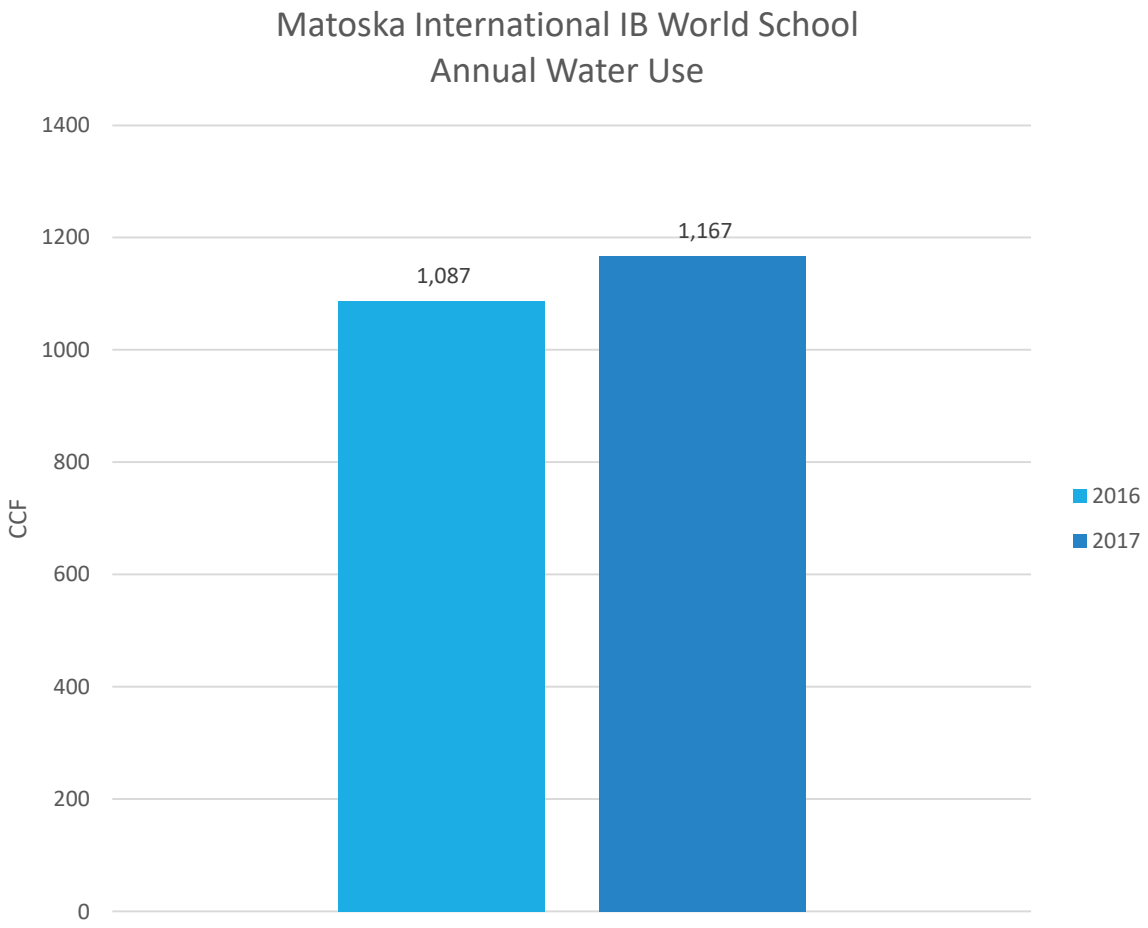
COST PER CFF (748.052 GALLONS)					
Sewer	$ 3.40				
Water	$ 1.30				
ANNUAL USE					
YEAR	CCF	GALLONS	$		
2016	1087	813133	$ 5,108.90		
2017	1167	872977	$ 5,484.90		
DIFFERENCE	80	59844	$ 376.00	7.36%	
SCHOOL-YEAR USE					
YEAR	CCF	GALLONS	$	%	
2015-2016	930	695688	$ 4,371.00		
2016-2017	1088	813881	$ 5,113.60		
DIFFERENCE	158	118192	$ 742.60	16.99%	
GALLONS PER PERSON PER DAY					
TIMEFRAME	CCF	GALLONS	POPULATION	DAYS	GALLONS/PERSON/DAY
2016	1087	813133	644	175	7.22
2017	1167	872977	644	175	7.75

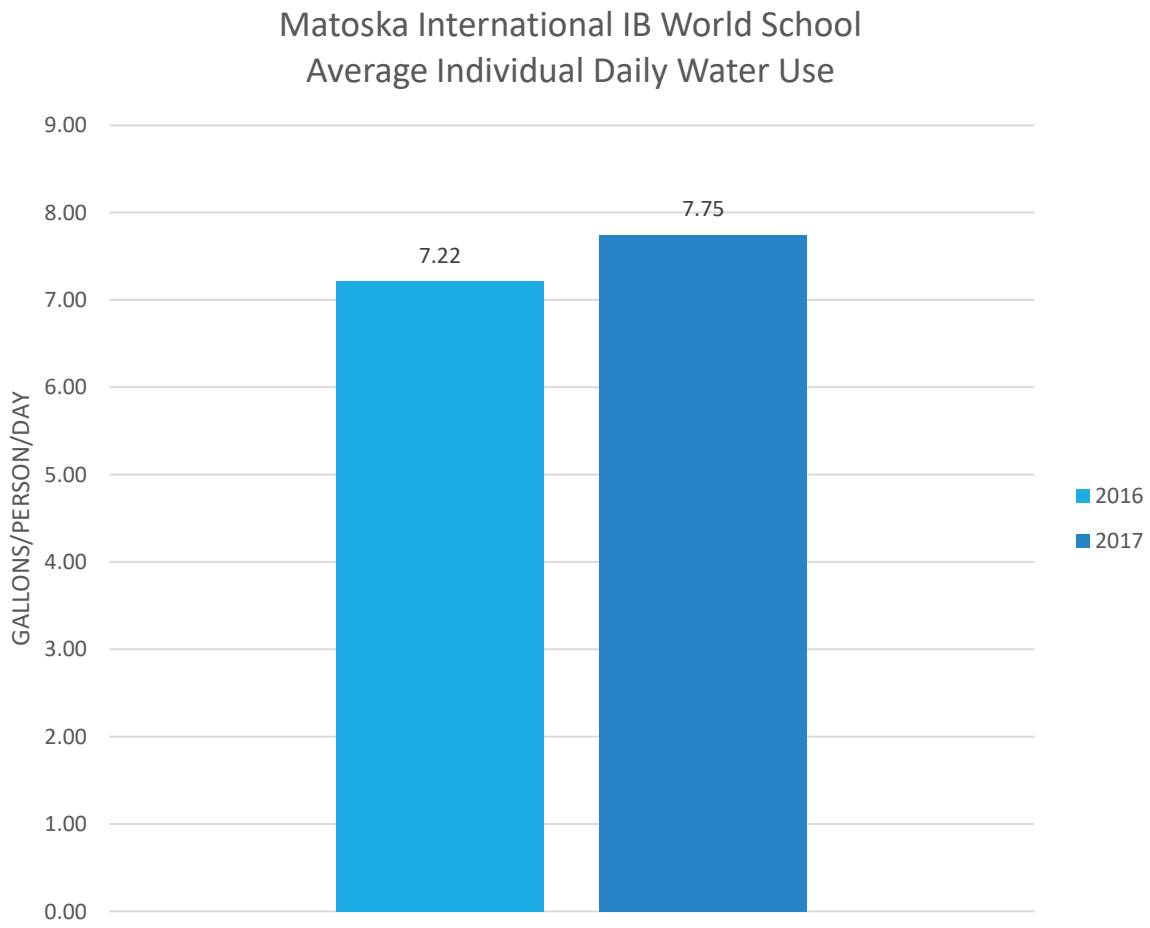
Existing Annual Water Budget



Annual benchmark: 1,700 – 2,700 gallons/student*

*Benchmarking Task Force Collaboration for Industrial, Commercial & Institutional Water Conservation, Colorado Water Wise Council, July 2007





On-Site Data Collection

On-Site Data Collection General Tips

Develop understanding of campus layout during introductory tour

Create route to follow during on-site data collection

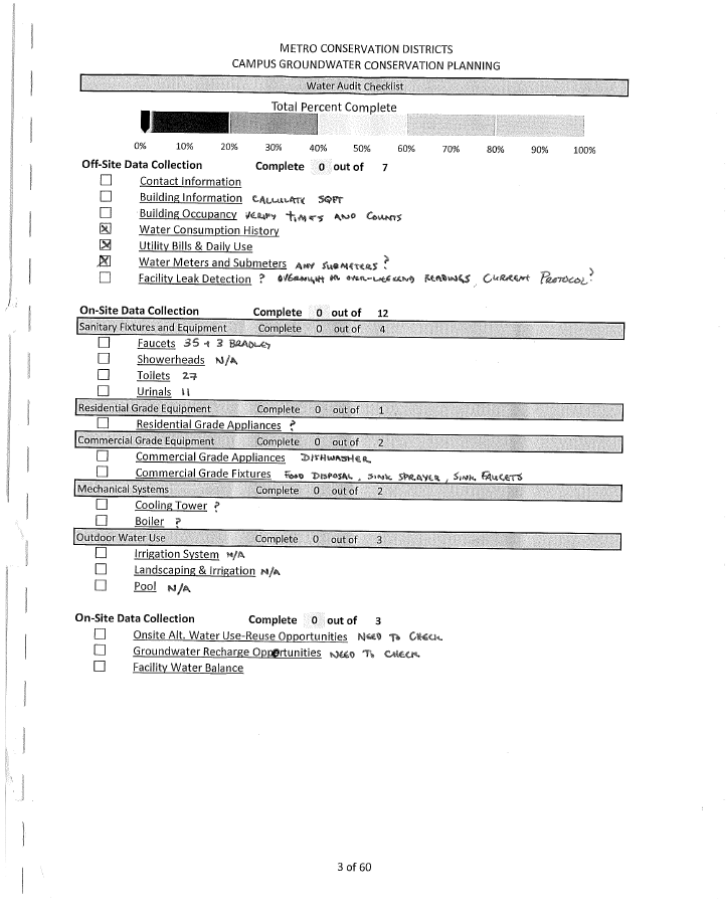
- Layout map could be necessary for more complicated campuses
- Work systematically through campus
- Consider schedule of building staff and visitors (e.g. don't collect data in the kitchen during lunch time)
- Notify entire staff prior to data collection in order to save time

Take detailed notes and lots of pictures

- Use room numbers for ID whenever possible

Take pictures of ID labels on larger equipment

On-Site Data Collection Example



METRO CONSERVATION DISTRICTS
CAMPUS GROUNDWATER CONSERVATION PLANNING

Water Audit Checklist

Total Percent Complete

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Off-Site Data Collection Complete 0 out of 7

- ☐ Contact Information
- ☐ Building Information CALCULATE SQFT
- ☐ Building Occupancy VERIFY TIMES AND COUNTS
- ☒ Water Consumption History
- ☒ Utility Bills & Daily Use
- ☒ Water Meters and Submeters ANY SUBMETERS ?
- ☐ Facility Leak Detection ? OVERNIGHT NO OVER-LOGGING READINGS, CURRENT PROTOCOL ?

On-Site Data Collection Complete 0 out of 12

Sanitary Fixtures and Equipment Complete 0 out of 4

- ☐ Faucets 35 + 3 BRADLEY
- ☐ Showerheads N/A
- ☐ Toilets 27
- ☐ Urinals 11

Residential Grade Equipment Complete 0 out of 1

- ☐ Residential Grade Appliances ?

Commercial Grade Equipment Complete 0 out of 2

- ☐ Commercial Grade Appliances DISHWASHER
- ☐ Commercial Grade Fixtures FOOD DISPOSAL, SINK SPRAYER, SINK FAUCETS

Mechanical Systems Complete 0 out of 2

- ☐ Cooling Tower ?
- ☐ Boiler ?

Outdoor Water Use Complete 0 out of 3

- ☐ Irrigation System N/A
- ☐ Landscaping & Irrigation N/A
- ☐ Pool N/A

On-Site Data Collection Complete 0 out of 3

- ☐ Onsite Alt. Water Use-Reuse Opportunities NEED TO CHECK
- ☐ Groundwater Recharge Opportunities NEED TO CHECK
- ☐ Facility Water Balance

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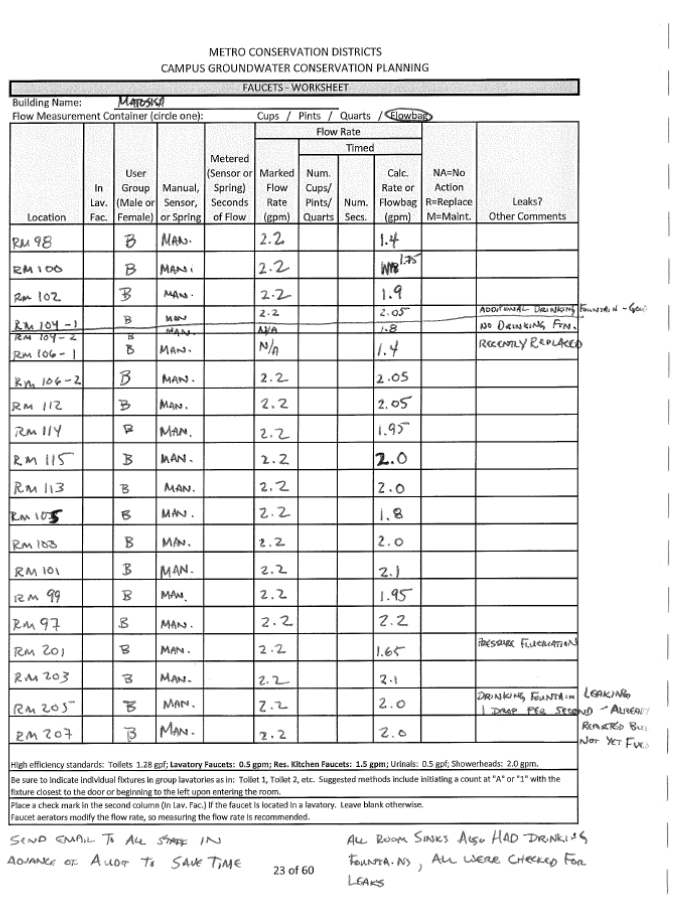

METRO CONSERVATION DISTRICTS
CAMPUS GROUNDWATER CONSERVATION PLANNING

FAUCETS - WORKSHEET

Building Name: MADISON
Flow Measurement Container (circle one): Cups / Pints / Quarts / <Flowbag>

Location	In Lav. Fac.	User Group (Male or Female)	Manual, Sensor, or Spring	Metered (Sensor or Spring) Seconds of Flow	Flow Rate: Marked Flow Rate (gpm)	Flow Rate: Timed: Num. Cups/ Pints/ Quarts	Flow Rate: Timed: Num. Secs.	Flow Rate: Timed: Calc. Rate or Flowbag (gpm)	NA=No Action R=Replace M=Maint.	Leaks? Other Comments
RM 98		B	MAN.		2.2			1.4		
RM 100		B	MAN.		2.2			NR 1.75		
RM 102		B	MAN.		2.2			1.9		
RM 104-1		B	MAN		2.2			2.05		ADDITIONAL DRINKING FOUNTAIN - GOOD
RM 104-2		B	MAN.		N/A			1.8		NO DRINKING FTN.
RM 106-1		B	MAN.		N/A			1.4		RECENTLY REPLACED
RM 106-2		B	MAN.		2.2			2.05		
RM 112		B	MAN.		2.2			2.05		
RM 114		B	MAN.		2.2			1.95		
RM 115		B	MAN.		2.2			2.0		
RM 113		B	MAN.		2.2			2.0		
RM 105		B	MAN.		2.2			1.8		
RM 103		B	MAN.		2.2			2.0		
RM 101		B	MAN.		2.2			2.1		
RM 99		B	MAN.		2.2			1.95		
RM 97		B	MAN.		2.2			2.2		
RM 201		B	MAN.		2.2			1.65		PRESSURE FLUCTUATIONS
RM 203		B	MAN.		2.2			2.1		
RM 205		B	MAN.		2.2			2.0		DRINKING FOUNTAIN LEAKING 1 DROP PER SECOND - ALREADY REPORTED BUT NOT YET FIXED
RM 207		B	MAN.		2.2			2.0		

High efficiency standards: Toilets 1.28 gpf; **Lavatory Faucets: 0.5 gpm; Res. Kitchen Faucets: 1.5 gpm;** Urinals: 0.5 gpf; Showerheads: 2.0 gpm.

Be sure to indicate individual fixtures in group lavatories as in: Toilet 1, Toilet 2, etc. Suggested methods include initiating a count at "A" or "1" with the fixture closest to the door or beginning to the left upon entering the room.

Place a check mark in the second column (In Lav. Fac.) if the faucet is located in a lavatory. Leave blank otherwise.

Faucet aerators modify the flow rate, so measuring the flow rate is recommended.

SEND EMAIL TO ALL STAFF IN ADVANCE OF AUDIT TO SAVE TIME

ALL ROOM SINKS ALSO HAD DRINKING FOUNTAINS, ALL WERE CHECKED FOR LEAKS

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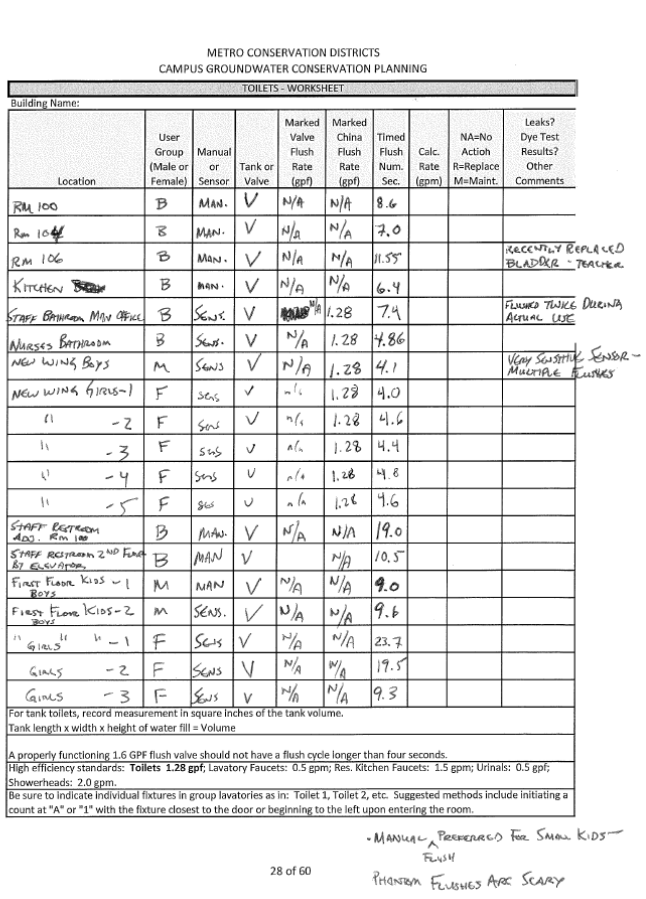

METRO CONSERVATION DISTRICTS
CAMPUS GROUNDWATER CONSERVATION PLANNING

TOILETS - WORKSHEET

Building Name:

Location	User Group (Male or Female)	Manual or Sensor	Tank or Valve	Marked Valve Flush Rate (gpf)	Marked China Flush Rate (gpf)	Timed Flush Num. Sec.	Calc. Rate (gpm)	NA=No Actioh R=Replace M=Maint.	Leaks? Dye Test Results? Other Comments
RM 100	B	MAN.	V	N/A	N/A	8.6			
RM 104	B	MAN.	V	N/A	N/A	7.0			
RM 106	B	MAN.	V	N/A	N/A	11.55			RECENTLY REPLACED BLADDER - TEACHER
KITCHEN	B	MAN.	V	N/A	N/A	6.4			
STAFF BATHROOM MAIN OFFICE	B	SENS.	V	N/A	1.28	7.4			FLUSHED TWICE DURING ACTUAL USE
NURSES BATHROOM	B	SENS.	V	N/A	1.28	4.86			
NEW WING BOYS	M	SENS	V	N/A	1.28	4.1			VERY SENSITIVE SENSOR - MULTIPLE FLUSHES
NEW WING GIRLS-1	F	SENS	V	n/a	1.28	4.0			
" -2	F	SENS	V	n/a	1.28	4.6			
" -3	F	SENS	V	n/a	1.28	4.4			
" -4	F	SENS	V	n/a	1.28	4.8			
" -5	F	SENS	V	n/a	1.28	4.6			
STAFF BATHROOM 2ND. RM 100	B	MAN.	V	N/A	N/A	19.0			
STAFF RESTROOM 2ND FLOOR BY ELEVATOR	B	MAN	V		N/A	10.5			
FIRST FLOOR KIDS - 1 BOYS	M	MAN	V	N/A	N/A	9.0			
FIRST FLOOR KIDS - 2 BOYS	M	SENS.	V	N/A	N/A	9.6			
" GIRLS " - 1	F	SENS	V	N/A	N/A	23.7			
GIRLS -2	F	SENS	V	N/A	N/A	19.5			
GIRLS -3	F	SENS	V	N/A	N/A	9.3			

For tank toilets, record measurement in square inches of the tank volume.
Tank length x width x height of water fill = Volume

A properly functioning 1.6 GPF flush valve should not have a flush cycle longer than four seconds.

High efficiency standards: **Toilets 1.28 gpf**; Lavatory Faucets: 0.5 gpm; Res. Kitchen Faucets: 1.5 gpm; Urinals: 0.5 gpf; Showerheads: 2.0 gpm.

Be sure to indicate individual fixtures in group lavatories as in: Toilet 1, Toilet 2, etc. Suggested methods include initiating a count at "A" or "1" with the fixture closest to the door or beginning to the left upon entering the room.

- MANUAL PREFERRED FOR SMALL KIDS FLUSH

PHANTOM FLUSHES ARE SCARY

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Review of Data Collection Forms and Methodologies – **Handout/Laptop**

Review forms in MS Excel

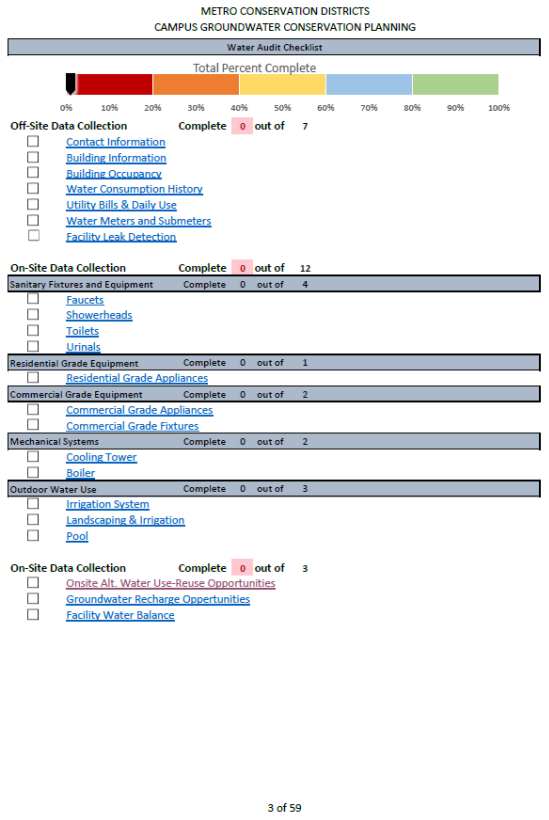
45 tabs – easy to rearrange

Right-click on arrows at bottom left to quickly navigate to desired tab

Greatest complexity/uncertainty in cooling towers and irrigation systems

Measure flow rates of toilets and fixtures

- Distribute stopwatches (3 each) and flow bags (4 each)



METRO CONSERVATION DISTRICTS
CAMPUS GROUNDWATER CONSERVATION PLANNING

Water Audit Checklist

Total Percent Complete

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Off-Site Data Collection Complete 0 out of 7

- Contact Information
- Building Information
- Building Occupancy
- Water Consumption History
- Utility Bills & Daily Use
- Water Meters and Submeters
- Facility Leak Detection

On-Site Data Collection Complete 0 out of 12

Sanitary Fixtures and Equipment Complete 0 out of 4

- Faucets
- Showerheads
- Toilets
- Urinals

Residential Grade Equipment Complete 0 out of 1

- Residential Grade Appliances

Commercial Grade Equipment Complete 0 out of 2

- Commercial Grade Appliances
- Commercial Grade Fixtures

Mechanical Systems Complete 0 out of 2

- Cooling Tower
- Boiler

Outdoor Water Use Complete 0 out of 3

- Irrigation System
- Landscaping & Irrigation
- Pool

On-Site Data Collection Complete 0 out of 3

- Onsite Alt. Water Use-Reuse Opportunities
- Groundwater Recharge Oppertunities
- Facility Water Balance

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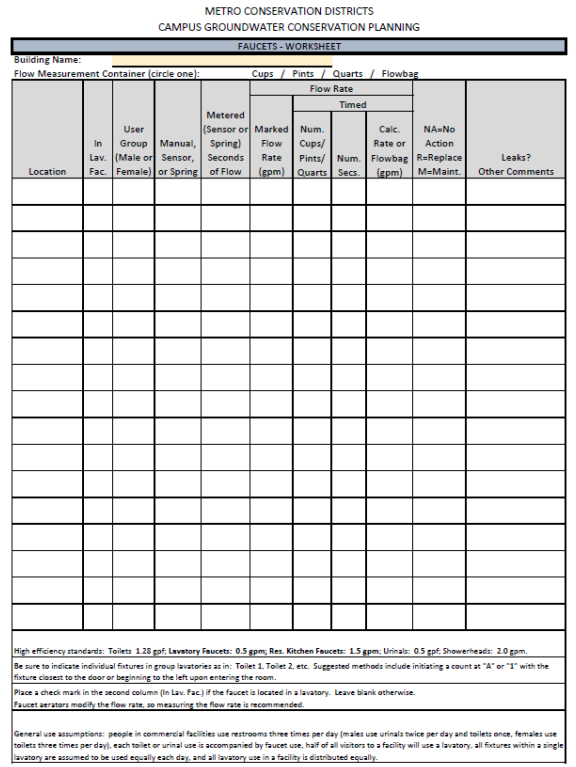

METRO CONSERVATION DISTRICTS
CAMPUS GROUNDWATER CONSERVATION PLANNING

FAUCETS - WORKSHEET

Building Name:

Flow Measurement Container (circle one): Cups / Pints / Quarts / Flowbag

Location	In Lav. Fac.	User Group (Male or Female)	Manual, Sensor, or Spring	Metered (Sensor or Spring) Seconds of Flow	Flow Rate				NA=No Action R=Replace M=Maint.	Leaks? Other Comments
					Marked Flow Rate (gpm)	Timed				
						Num. Cups/ Pints/ Quarts	Num. Secs.	Calc. Rate or Flowbag (gpm)		

High efficiency standards: Toilets 1.28 gpf; Lavatory Faucets: 0.5 gpm; Res. Kitchen Faucets: 1.5 gpm; Urinals: 0.5 gpf; Showerheads: 2.0 gpm.

Be sure to indicate individual fixtures in group lavatories as in: Toilet 1, Toilet 2, etc. Suggested methods include initiating a count at "A" or "1" with the fixture closest to the door or beginning to the left upon entering the room.

Place a check mark in the second column (In Lav. Fac.) if the faucet is located in a lavatory. Leave blank otherwise.
Faucet aerators modify the flow rate, so measuring the flow rate is recommended.

General use assumptions: people in commercial facilities use restrooms three times per day (males use urinals twice per day and toilets once, females use toilets three times per day), each toilet or urinal use is accompanied by faucet use, half of all visitors to a facility will use a lavatory, all fixtures within a single lavatory are assumed to be used equally each day, and all lavatory use in a facility is distributed equally.

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Spreadsheet Calculator Introductions

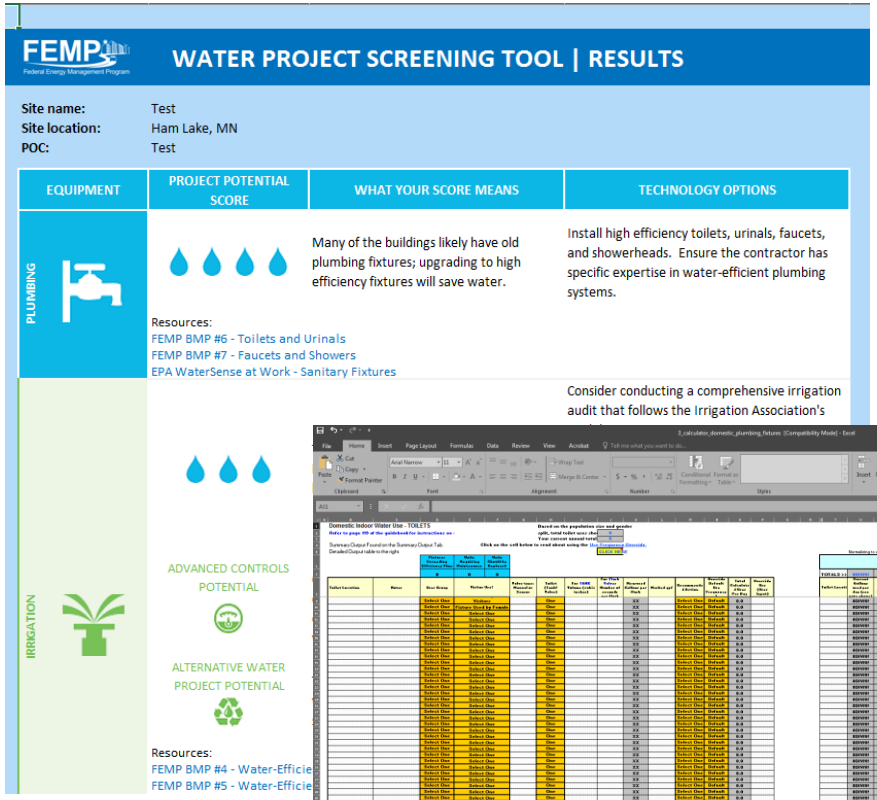
Calculator Overviews

Reviewed existing calculators available from a variety of entities

9 calculators selected for CGCP

- 6 from SFWMD
- 2 from Energy Star
- 1 from DOE FEMP

Detailed guidance provided in Training #2 and in reference manuals



End of Training #1

THANKS

Campus Groundwater Conservation Planning (CGCP) Protocol Training #2

WEDNESDAY, MAY 23RD, 2018

Agenda – 8:30 AM – 11:30 AM

8:30 – 8:40	Answer remaining questions from training #1
8:40 – 8:50	Review on-site data collection forms
8:50 – 9:00	Standardize protocol for sanitary fixture data collection
9:00 – 9:05	Daily water use calculator
9:05 – 9:50	Sanitary fixture calculator
9:50 – 10:00	Break – 10 minutes
10:00 – 10:15	Residential appliance and commercial kitchen calculators
10:15 – 10:25	Cooling tower calculator
10:25 – 10:35	Irrigation calculator
10:35 – 11:10	Water use analysis and cost estimation calculators
11:10 – 11:30	Review completed report
11:30	End

Questions from Training #1

GENERAL PROTOCOL QUESTIONS, KICK-OFF MEETING, ON-SITE DATA COLLECTION FORMS

CAMPUS GROUNDWATER CONSERVATION PLANNING

PROTOCOL SUMMARY

1—CAMPUS SELECTION
Considerations: water source must be groundwater, motivated partner, capacity to implement recommendations, data availability (e.g. meters and sub-meters), total water use, campus size, campus complexity, ownership (i.e. public or private), campus visibility, and future scheduled renovation or expansion

2—DESKTOP REVIEW
Review should include: campus layout and acreage, building footprint areas, land uses, soils, stormwater infrastructure, and topography

3—KICK-OFF MEETING
Talking points with campus staff should include: emphasize potential for energy, water, and cost savings, participation is voluntary, address the importance of groundwater, review the CGCP process, identify campus-specific water conservation goals, complete the DOE FEMP worksheet, estimate campus staff time investment, and conduct a campus tour

4—INITIAL DATA REQUEST
General information to request: inventory of all water-using fixtures and equipment, 24 months of utility billing (i.e. water, gas, and electricity), 24 months of water meter and sub-meter data, staff and visitor information, irrigation system layout, mechanical blueprints or as-built plan sets for water-using systems

5—ON-SITE DATA COLLECTION
Detailed data for campus and water using systems including: point person contact information, general building information, occupancy information, water consumption history, water use summary, meter and sub-meter data, leak detection, utility bills and daily use, faucets, showerheads, toilets, urinals, residential-grade appliances, commercial-grade appliances, commercial-grade appliances, commercial-grade fixtures, cooling tower, boiler, pool, irrigation system, landscaping, onsite alternative water use opportunities, groundwater recharge opportunities, and complete facility water balance

6—PROCESS DATA
Data collected in Step 5 should be entered into existing water use and potential conservation spreadsheets. If data gaps remain, an additional request should be made to the campus facilities manager.

7—IDENTIFY POTENTIAL PROJECTS AND DEVELOP COST ESTIMATES
The spreadsheets used to process the data will provide potential reductions in water use if water efficient upgrades or maintenance are implemented. Cost estimates should be developed for the upgrades and maintenance.

8—ANALYZE RECOMMENDATIONS FOR COST-EFFECTIVENESS
Calculate cost-effectiveness based on ranking criteria (e.g. simple payback period) desired by campus staff.

9—GENERATE FIINAL REPORT
Compile data into report for campus staff. Report should provide a straightforward summary of potential water conservation projects.

10—FOLLOW-UP SUPPORT
Approximately 6-12 months following delivery of the report, a check-in with campus staff is recommended to gauge implementation and provide potential troubleshooting support.

Metro Conservation Districts

CLEAN WATER LAND & LEGACY AMENDMENT

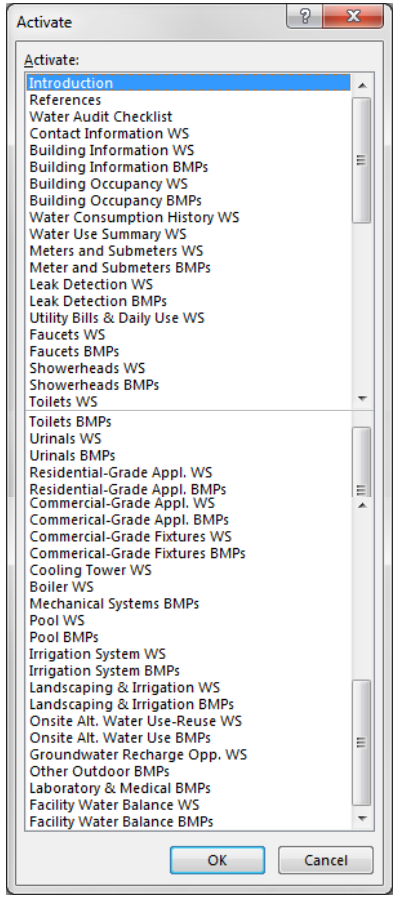
On-Site Data Collection Forms

EMPHASIZE MOST USEFUL FORMS

On-Site Data Collection Forms

45 tabs

Worksheet (WS) versus BMPs



Most useful

- Leak Detection
- Faucets
- Showerheads
- Toilets
- Urinals
- Residential-Grade Appl.
- Commercial-Grade Appl.
- Commercial-Grade Fixtures
- Cooling Tower
- Irrigation System
- Landscaping & Irrigation

Leak Detection

FACILITY LEAK DETECTION - WORKSHEET

Note: Digital water meters may show real time flow rates for leak detection.

Meter Location: _____

Meter Type: _____

Date and Time	Initial Meter Reading	Date and Time	End Meter Reading	Known Water Consumption During Shutdown	Leaks/Other Observations

Faucets

FAUCETS - WORKSHEET										
Building Name:										
Flow Measurement Container (circle one):					Cups / Pints / Quarts / Flowbag					
					Flow Rate					
						Timed				
Location	In Lav. Fac.	User Group (Male or Female)	Manual, Sensor, or Spring	Metered (Sensor or Spring) Seconds of Flow	Marked Flow Rate (gpm)	Num. Cups/ Pints/ Quarts	Num. Secs.	Calc. Rate or Flowbag (gpm)	NA=No Action R=Replace M=Maint.	Leaks? Other Comments

Showerheads

SHOWERHEADS - WORKSHEET						
Building Name:						
Flow Measurement Container (circle one): Cups / Pints / Quarts / Flowbag						
Location	Flow Rate				NA=No Action R=Replace M=Maint.	Leaks? Other Comments
	Marked Flow Rate (gpm)	Timed				
		Num. Cups/ Pints/ Quarts	Num. Secs.	Calc. Rate or Flowbag (gpm)		

Toilets

TOILETS - WORKSHEET									
Building Name:									
Location	User Group (Male or Female)	Manual or Sensor	Tank or Valve	Marked Valve Flush Rate (gpf)	Marked China Flush Rate (gpf)	Timed Flush Num. Sec.	Calc. Rate (gpm)	NA=No Action R=Replace M=Maint.	Leaks? Dye Test Results? Other Comments

Urinals

URINALS - WORKSHEET							
Building Name:							
Location	Manual or Sensor	Marked Valve Flush Rate (gpf)	Marked China Flush Rate (gpf)	Timed Flush Num. Sec.	Calc. Rate (gpm)	NA=No Action R=Replace M=Maint.	Leaks? Other Comments

Residential-Grade Appliances

RESIDENTIAL-GRADE APPLIANCES - WORKSHEET								
DISHWASHER		Low Temp.		High Temp.				
Location		Make/Model	Quantity	Racks washed per day	Building hot water fuel type	Booster water heater fuel type	Operating days per year	ENERGY STAR Qualified?
	Under Counter							
	Door Type							
	Single Tank Conveyor							
	Multi-Tank Conveyor							
Leaks or other comments:								

ICE MACHINE							
Location		Make/Model	Quantity	Havest rate (pounds ice per day)	Potable water use (gallons per 100 pounds of ice)	Operating days per year	ENERGY STAR Qualified?
	Ice Making Head						
	Remote Condensing Unit/Split System						
	Self Contained Unit						
Leaks or other comments:							

CLOTHES WASHER							
Location	Water heat source	Make/Model	Quantity	Average number of loads per week	Type of clothes dryer	Electric or gas dryer	ENERGY STAR Qualified?
	Electric Heat						
	Gas Heat						
Leaks or other comments:							

Commercial-Grade Appliances

COMMERCIAL-GRADE APPLIANCES - WORKSHEET

DISHWASHER		Low Temp.		High Temp.				
Location		Make/Model	Quantity	Racks washed per day	Building hot water fuel type	Booster hot water fuel type	Operating days per year	ENERGY STAR Qualified?
	Under Counter							
	Door Type							
	Single Tank Conveyor							
	Multi-Tank Conveyor							
Leaks or other comments:								

ICE MACHINE							
Location		Make/Model	Quantity	Havest rate (pounds ice per day)	Potable water use (gallons per 100 lbs ice)	Operating days per year	ENERGY STAR Qualified?
	Ice Making Head						
	Remote Condensing Unit/Split System						
	Self Contained Unit						
Leaks or other comments:							

STEAM COOKER								
Location		Make/Model	Quantity	Pounds cooked per day per unit	Number of pans per unit	Operating hours per day	Operating days per year	ENERGY STAR Qualified?
	Electric							
	Natural Gas							
Leaks or other comments:								

COMBI OVEN						
Location		Make/Model	Quantity	Operating hours per day	Operating days per year	Pounds cooked per day per oven
	Electric Heat					
	Gas Heat					
Leaks or other comments:						

CLOTHES WASHER							
Location	Water heat source	Make/Model	Quantity	Average number of loads per week	Type of clothes dryer	Electric or gas dryer	ENERGY STAR Qualified?
	Electric Heat						
	Gas Heat						
Leaks or other comments:							

Commercial-Grade Fixtures

COMMERCIAL-GRADE FIXTURES - WORKSHEET

Flow Measurement Container (circle one): Cups / Pints / Quarts / Flowbag

Location	Hand Faucet	Pre-Rinse Spray Valve	Marked Flow Rate (gpm)	Timed			Leaks? Comments
				Num. Cups/ Pints/ Quarts	Num. Secs.	Calc. Rate or Flowbag (gpm)	

Cooling Tower - Basic

COOLING TOWER - BASIC AUDIT WORKSHEET

Cooling Tower General Observations

1) Cooling tower location
2) Tons of cooling capacity (if known)
3) Are flow meters or submeters present on feedlines (circle one)? YES / NO
4) Are flow meters or submeters present on drainlines (circle one)? YES / NO
5) Is the tower a closed loop (not once through) (circle one)? YES / NO
6) At how many cycles is the tower currently run at?
(you may have to consult with your maintenance vendor). _____

7) Looking at Table 14 (below), what percentage of total water use would be saved if the cycles of concentration were increased from the current level to five or six? _____
8) Inidicate the visible condition of the cooling tower:

	None	Very little*	Some	A lot	Where?
Noticeable leaks					
Noticeable corrosion					
Mineral precipitate scaling on the heat exchangers, condenser tubes, or elsewhere					
Algae or slime (biofouling)					
Drift (misting)					

*This would account for a small amount at the interface where the air hits the corrugated heat exchangers, condenser tubes, etc.

Cooling Tower - Advanced

COOLING TOWER - ADVANCED AUDIT WORKSHEET

Table Set 1: Use if the cooling tower is equipped with makeup and bleed-off meters.

1. Enter average or typical load in tons	
2. Enter hrs/day of operation	
3. Enter days/month operation	
4. Enter the percent reduction in water consumption that would occur if the concentration ratio was increased from the current level to at least five (see Table 14 on 'Cooling Tower - Basic Audit' sheet).	

Meter Data Input Table

Water Consumption Calculations	Date	Time	Hours between readings		Make-up meter reading	Bleed-off meter reading
Day 1				Begin		
				End		
Day 2				Begin		
				End		
Day 3				Begin		
				End		

Table Set 2: Use if the cooling tower is equipped with conductivity meters or another means to calculate dissolved solid concentrations in make-up and bleed-off water.

1. Enter tons of cooling	
2. Enter hrs/day of operation	
3. Enter days/month operation	
4. Enter the percent reduction in water consumption that would occur if the concentration ratio was increased from the current level to at least five (see Table 14 on 'Cooling Tower - Basic Audit' sheet).	

Water Consumption Calculations	Date	Make-up concentration (TDS)	Bleed-off concentration (TDS)

Cooling towers should be sub-metered to avoid paying unnecessary sewer charges. Sub-meters cost $1,800-$4,500 and can have a payback period of less than one year.

Irrigation System – Zone Information

IRRIGATION SYSTEM - BASIC AUDIT WORKSHEET

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Permitted Irrigation (Hours)							
Current Setting (Hours)							

Is the current run schedule in accordance with local permitted watering days? YES / NO

Zone/Station Number	Type of Head (rotor, spray, micro)	Runtime Duration (minutes)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		

Zone/Station Number	Type of Head (rotor, spray, micro)	Runtime Duration (minutes)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		

Irrigation System – Rain and Soil Moisture Sensors

RAIN AND SOIL MOISTURE SENSOR SURVEY WORKSHEET		
Rain Sensor Survey - Basic Audit		
Rain sensors should not be located under anything which could impede rainfall or allow water from sources other than rain to fall upon it.		
The cork should be fresh and spongy. They typically last between two and three years. The wires should be connected, unfrayed, and protected from the elements.		
Rain sensor location:		
Is the sensor located away from all building eves, gutter downspouts, trees, or other structures that would impede rainfall?	Yes	No
Is the sensor located close to an air conditioning condensate line or another source of water that may saturate the sensor?	Yes	No
Sensor Visual Inspection		
Does the cork look fresh and soft, not brittle and dry?	Yes	No
Do the wires look intact?	Yes	No
Rain Sensor Survey - Advanced Audit		
Did the sensor successfully interrupt the irrigation event?	Yes	No

Soil Moisture Sensor Survey - Basic Audit		
Soil moisture sensors should not be located in an area where rainfall could be impeded or where water from a source other than rain could cause soil moisture in the immediate area to increase.		
Soil moisture sensors should be located near the mid-point of any on-site slope in an open area among vegetation with the highest watering requirements.		
Soil moisture sensors should be located equidistant from sprinkler heads.		
Soil moisture sensor location:		
Is the sensor located away from all building eves, gutter downspouts, trees, or other structures that would impede rainfall?	Yes	No
Is the sensor located close to an air conditioning condensate line or another source of water that may saturate the sensor?	Yes	No
Is the sensor located at or near the mid-point of an on-site slope?	Yes	No
Is the sensor located equidistant from the closest group of sprinkler heads?	Yes	No
Soil Moisture Sensor Survey - Advanced Audit		
Did the sensor successfully interrupt the irrigation event?	Yes	No

All 'No' responses should be reviewed for corrective action.

Landscaping & Irrigation

IRRIGATION AND LANDSCAPE FIELD AUDIT WORKSHEET												
	Irrigation Need	If Tree/Shrubs			General Plant Type		Sprinkler Types				Sprinkler Functionality	
Note	1	2-4			5		6-8				9	
Zone	Does this zone need irrigation?	Trees/ shrubs recently installed?	Is there adequate mulch (3")?	Is micro-irrigation used?	Turf, annual/ perennial, or trees/ shrubs	More than one plant type in zone?	Indicate type: rotor, sprayhead, or micro	All same type throughout zone?	All same brand throughout zone?	Sprinkler type matches plants?	Indicate clogged, tilted, obstructed, or broken heads	Wetting pattern covering only the intended area?
1												

IRRIGATION AND LANDSCAPE FIELD AUDIT WORKSHEET				
	Prudent use of turf?		Plants in plantbeds	
	10			
Zone	Does the zone contain turf?	If turf is present, does it serve a purpose (e.g. swale, recreation, erosion control)?	Do all plants in this zone have similar light and irrigation needs?	Additional Notes
1				

Sanitary Fixture Data Collection Protocol

STANDARDIZE METHODOLOGY

Sanitary Fixture Data Collection Methodology

Toilets/Urinals

- Timed flush
  - Differentiate between the time water flows through the valve and the entire flush cycle
    - Begins when flush lever is activated
    - Ends when water stops flowing through valve – may require multiple flushes to determine
    - https://www.youtube.com/watch?v=Na680lb1QRY

Faucets/Showerheads

- Flow bag
  - Measure maximum flow rate
    - May need to adjust washing time or apply correction factor to flow rates (e.g. 80%) in order to calibrate estimated volumes with billing record volumes

Calculators

GENERAL TIPS, ENTERING DATA, REVIEWING POTENTIAL SAVINGS

Calculators Available

1 – DOE FEMP Water Project Screening Tool

2 – Daily Water Use Calculator

3 – Domestic Plumbing Fixtures

4 – ENERGY STAR Residential Appliances

5 – ENERGY STAR Commercial-Grade Kitchen Equipment

6 – Commercial-Grade Kitchen Equipment

7 – Cooling Towers

8 – Irrigation

9 – Water Use Analysis

General Tips

On-site data collection forms used to populate calculators

Unprotect sheets to add comments or modify cells

Must enter a recommended action in order for payback period to be calculated

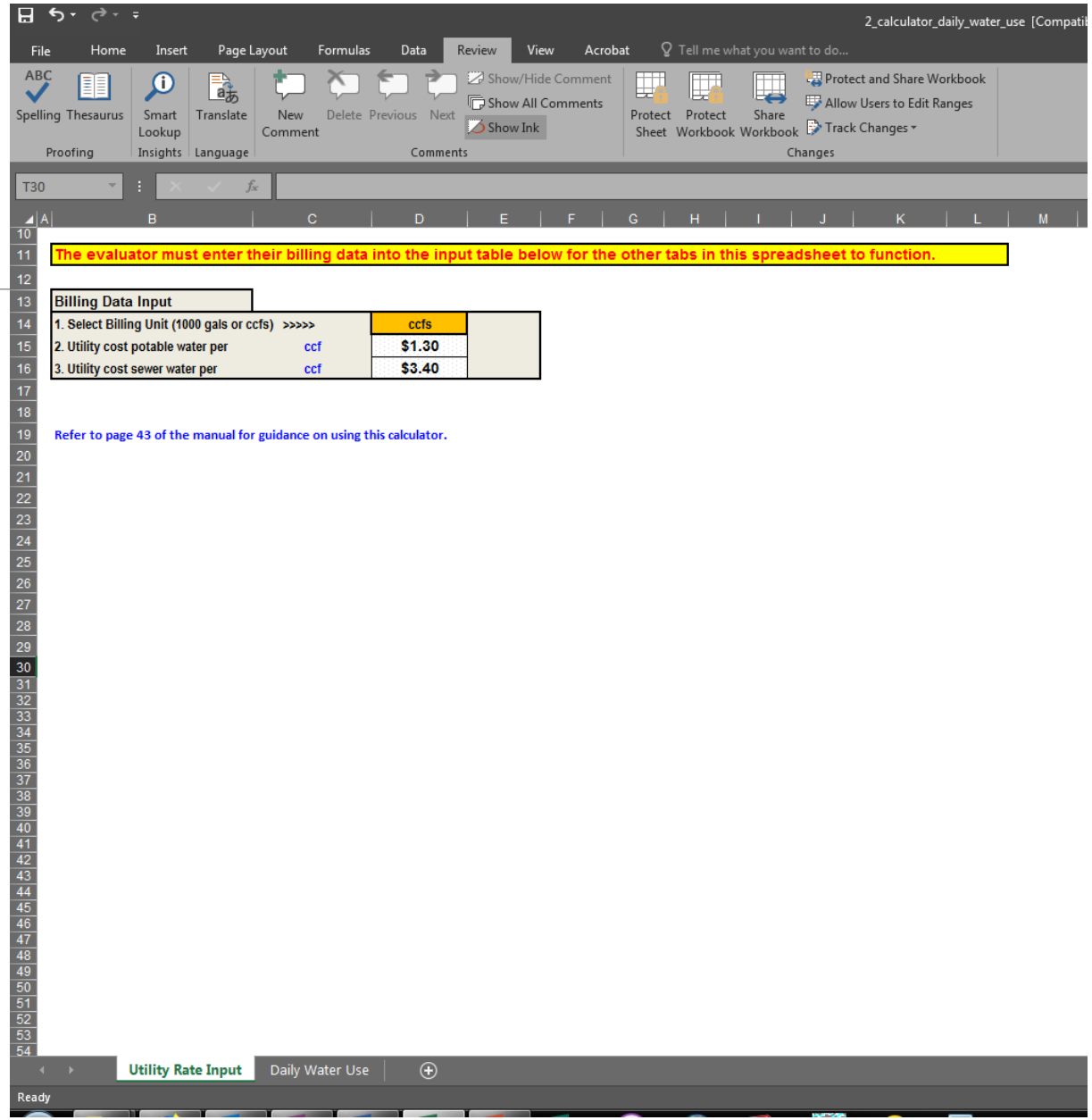
2 - Daily Water Use Calculator

DETERMINING UN-METERED IRRIGATION SYSTEMS

Utility Rate

Utility rate input tab

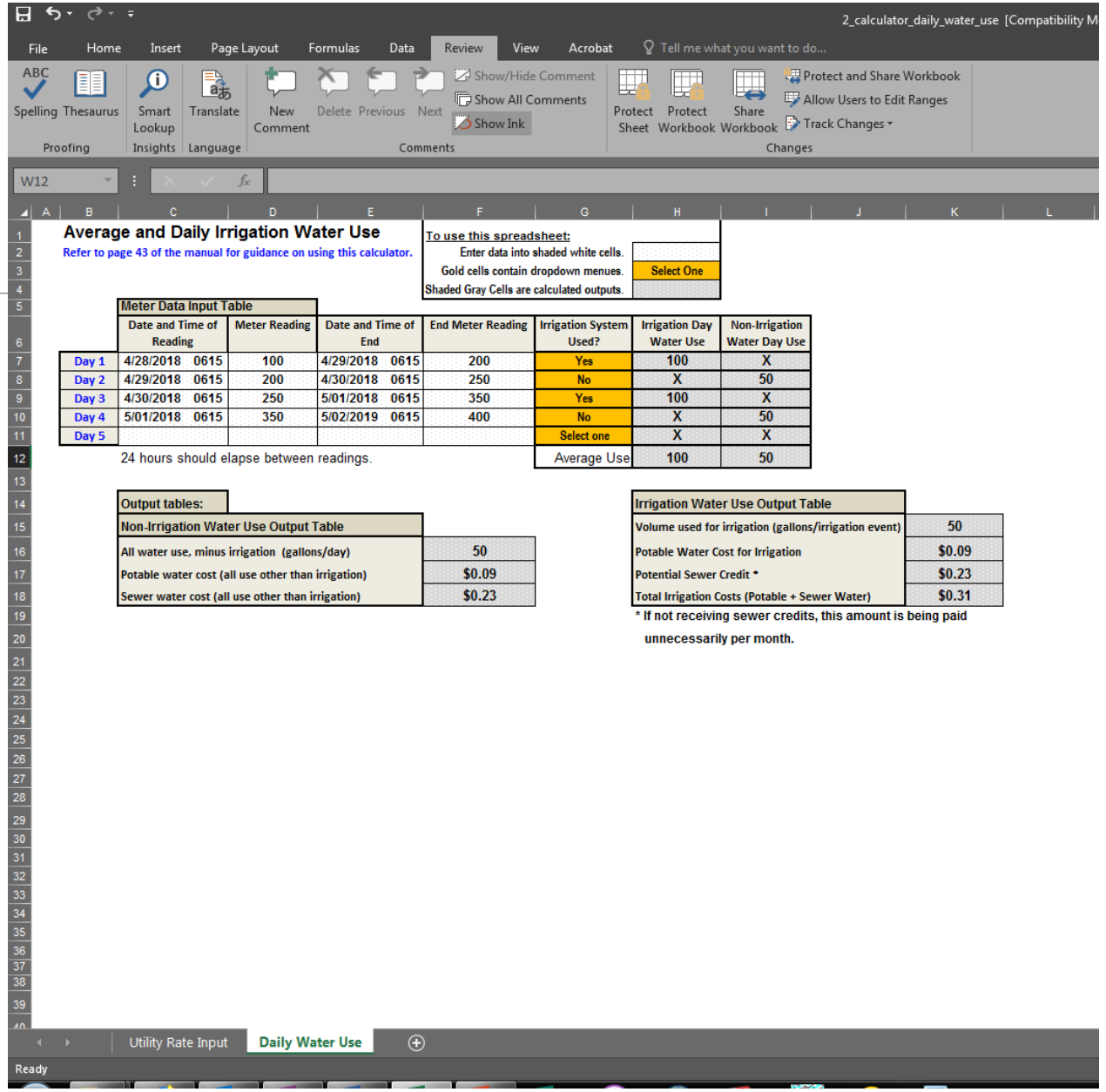
- Select CCFs or 1000 gals
- Enter rate structure for water and sewer



Daily Water Use

Daily water use tab

- Enter paired meter readings, each separated by 24 hours
  - Meter reading values in gallons
- Output tables for non-irrigation and irrigation water use
  - Average gallons/day
  - Total potable water and sewer water costs



3 - Sanitary Fixture Calculator

TOILETS, URINALS, AND FAUCETS

Utility Rate & Population Data

The evaluator must enter their billing and population data into the input tables below for the other tabs in this spreadsheet to function.

Refer to page 116 of the guidebook for instructions on using this calculator.

1)

Billing Data Input			
1. Select Billing Unit (1000 gals or ccfs) >		ccfs	
2. Utility cost potable water per	ccf	$1.30	
3. Utility cost sewer water per	ccf	$3.40	
4. Select Water Heat Type	Gas Heat		
5. Enter Gas Cost per Therm	$0.46	Xcel Energy Rate (summed Dist., Cost, and Aff.)	
5. Enter Electric Cost per kWh	$0.06	Xcel Energy Rate (summed Energy and Fuel)	
6. Heater Efficiency:	Gas	59.0	%
Suggested default heat efficiencies:			
Gas	59 %	Elect.	92.7 %

2)

Facility Population Data Input						
Enter Name Population Group 1	Teachers/Staff	Population Size	Days/week on site	Weeks/year on site	Work Days per Year	
Enter Name Population Group 2	Students					
Enter Number of	MALE Teachers/Staff	9	5	35	175	
Enter Number of	FEMALE Teachers/Staff	66	5	35	175	
Enter Number of	MALE Students	274	5	35	175	
Enter Number of	FEMALE Students	295	5	35	175	
Enter Number of	VISITORS				0	
	Percentage of female VISITORS [1]					
Restroom uses/day/FULL-TIME person [2]	3.0					
Common (unisex) restroom uses/day	3.00	per	individual Teachers/Staff			
Common (unisex) restroom uses/day	0.13	per	individual Students			Estimated by

1. Default is 50 (percent).

2. Default is 3. This is the number of times each fixture in these restrooms will be used.

You are indicating all restroom uses by this group are done in common restrooms.

3)

Efficiency Fixture Properties (see table below for efficiency rates)	Toilets	Urinals	Lavatory Faucets	Non-Lavatory Faucets	Shower-heads	
	gals/flush	gals/flush	gals/min	gals/min	gals/min	
Enter High Efficiency Water Use Rate	1.28	0.125	0.50	0.50	1.50	
Replacement Cost	$316	$360	$330	$330	$65	
Adjustment/ Maintenance Cost	$32	$36	$33	$33	$7	10% of replacemer
Do these faucetsuse hot water? Select Y or N			Y	Y	Y	
Select the size of the cup used to measure flow of this fixture. *			Flowbag	Flowbag	Flowbag	

Select "Flowbag" if one was used.

Water Use Rates for Efficient Fixtures		
Toilets	gals/flush	1.28, 1.1, 0.8
Urinals	gals/flush	0.5, 0.125
Lav Faucets	gals/min	1.0, 0.5
Non-Lav Faucets	gals/min	1.0, 0.5
Showerheads	gals/min	2.0, 1.75, 1.5

Expected Use

ESTIMATED SANITARY FIXTURE USE CALIBRATION CALCULATIONS

Days per year	175		
	Toilet use/day	Urinal use/day	Notes
Male Staff	1	2	Assumed a total of 3 uses per day because staff are on campus for 8 hours.
Female Staff	3	0	Assumed a total of 3 uses per day because staff are on campus for 8 hours.
Male Students	0.802	1.604	Students are on campus for 6 hours 25 minutes per day. Therefore, assumed a total of 2.40625 uses per day (i.e. 3/8 [3 uses per 8 hours] * 6 hours 25 minutes = total
Female Students	2.406	0	Students are on campus for 6 hours 25 minutes per day. Therefore, assumed a total of 2.40625 uses per day (i.e. 3/8 [3 uses per 8 hours] * 6 hours 25 minutes = total
TOTAL POPULATION (644)			
Expected Annual Toilet Uses	198,908		
Expected Annual Urinal Uses	80,070		
Expected Annual Lav. Faucet Uses	278,977		
STAFF (75)			
Expected Annual Toilet Uses	36,225		
Expected Annual Urinal Uses	3,150		
Expected Annual Lav. Faucet Uses	39,375		
STUDENTS (569)			
Expected Annual Toilet Uses	162,683		
Expected Annual Urinal Uses	76,920		
Expected Annual Lav. Faucet Uses	239,602		

Expected Use

May need to override use frequency based on knowledge of building

Lavatory faucet use associated with specific toilets and/or urinals should be adjusted to match

Visitor use can only be assigned as male or female use – creates issue for common use toilets

Open Calculator 3

Toilets – Data Entry

Domestic Indoor Water Use - TOILETS

Refer to page 119 of the guidebook for instructions on using this calculator.

Summary Output Found on the Summary Output Tab.
Detailed Output table to the right.

WARNING: your adjustments to the caluclate

Based on the population size and gender split, total toilet uses should be: 246,355 (131614.4262)
Your current annual total is: 199,343
Click on the cell below to read about using the Use Frequency Override.
CLICK HERE

ADJUSTED
staff
students

Fixtures Exceeding Efficiency Flow	Units Requiring Maintenance	Units Should be Replaced
29	8	21

Toilet Location	Notes	User Group	Visitor Use?	Valve type: Manual or Sensor	Toilet (Tank/ Valve)	For TANK Volume (cubic inches)	For Flush Valves Number of seconds per flush	Measured Gallons per flush	Marked China gpf	Recommended Action	Override Default Use Frequency?	Total Calculated Uses Per Day	Override Use (User Input)
Room 100		Common Students	No Visitor Use	Manual	Flush Valve		8.6	3.58		Replace	Override	8.9	9.6
Room 104		Common Students	No Visitor Use	Manual	Flush Valve		7.0	2.92		Replace	Override	8.9	9.6
Room 106	Recently replaced bladder - teacher correspondence	Common Students	No Visitor Use	Manual	Flush Valve		11.6	4.81		Replace	Override	8.9	9.6
Kitchen		Common Teachers/Staff	No Visitor Use	Manual	Flush Valve		6.4	2.67		Replace	Override	21.6	4.3
Staff Bathroom Main Office	Flushed twice during actual use	Common Teachers/Staff	No Visitor Use	Sensor	Flush Valve		7.4	3.08	1.28	Maintenance	Override	21.6	31.2
Nurses Bathroom		Common Students	No Visitor Use	Sensor	Flush Valve		4.9	2.03	1.28	Maintenance	Override	8.9	6.2
New Wing Boys	Very sensitive sensor - flushed multiple times during testing	MALE Students	No Visitor Use	Sensor	Flush Valve		4.1	1.71	1.28	Maintenance	Override	20.9	20.9
New Wing Girls - 1		FEMALE Students	No Visitor Use	Sensor	Flush Valve		4.0	1.60	1.28	Maintenance	Override	29.0	29.0
New Wing Girls - 2		FEMALE Students	No Visitor Use	Sensor	Flush Valve		4.6	1.92	1.28	Maintenance	Override	29.0	29.0
New Wing Girls - 3		FEMALE Students	No Visitor Use	Sensor	Flush Valve		4.4	1.83	1.28	Maintenance	Override	29.0	29.0
New Wing Girls - 4		FEMALE Students	No Visitor Use	Sensor	Flush Valve		4.8	2.00	1.28	Maintenance	Override	29.0	29.0
New Wing Girls - 5		FEMALE Students	No Visitor Use	Sensor	Flush Valve		4.6	1.92	1.28	Maintenance	Override	29.0	29.0
Staff Restroom Adj. Room 100		Common Teachers/Staff	No Visitor Use	Manual	Flush Valve		19.0	7.92		Replace	Use Default	21.6	
Staff Restroom 2nd Floor by Elevator		Common Teachers/Staff	No Visitor Use	Manual	Flush Valve		10.5	4.38		Replace	Use Default	21.6	
First Floor Boys - 1		MALE Students	No Visitor Use	Manual	Flush Valve		9.0	3.75		Replace	Override	20.9	16.8
First Floor Boys - 2		MALE Students	No Visitor Use	Sensor	Flush Valve		9.6	4.00		Replace	Override	20.9	16.8
First Floor Girls - 1		FEMALE Students	No Visitor Use	Sensor	Flush Valve		23.7	9.88		Replace	Override	29.0	19.2
First Floor Girls - 2		FEMALE Students	No Visitor Use	Sensor	Flush Valve		19.5	8.13		Replace	Override	29.0	19.2
First Floor Girls - 3		FEMALE Students	No Visitor Use	Sensor	Flush Valve		9.3	3.88		Replace	Override	29.0	19.2
Second Floor Girls - 1		FEMALE Students	No Visitor Use	Sensor	Flush Valve		8.5	3.54		Replace	Override	29.0	18.8
Second Floor Girls - 2		FEMALE Students	No Visitor Use	Sensor	Flush Valve		9.5	3.96		Replace	Override	29.0	18.8
Second Floor Girls - 3		FEMALE Students	No Visitor Use	Sensor	Flush Valve		8.5	3.54		Replace	Override	29.0	18.8
Second Floor Girls - 4		FEMALE Students	No Visitor Use	Sensor	Flush Valve		9.4	3.92		Replace	Override	29.0	18.8
Second Floor Girls - 5		FEMALE Students	No Visitor Use	Sensor	Flush Valve		10.5	4.38		Replace	Override	29.0	18.8
Second Floor Girls - 6		FEMALE Students	No Visitor Use	Sensor	Flush Valve		13.2	5.50		Replace	Override	29.0	18.8
Second Floor Boys - 1		MALE Students	No Visitor Use	Sensor	Flush Valve		10.1	4.21	3.50	Replace	Override	20.9	13.6
Second Floor Boys - 2		MALE Students	No Visitor Use	Sensor	Flush Valve		9.0	3.75		Replace	Override	20.9	13.6
Second Floor Boys - 3		MALE Students	No Visitor Use	Sensor	Flush Valve		8.7	3.63		Replace	Override	20.9	13.6
First Floor Staff Across from Room 104		Common Teachers/Staff	No Visitor Use	Sensor	Flush Valve		8.4	3.50		Replace	Use Default	21.6	

Toilets – Potential Water Savings

Detailed Output Table									
TOTALS >>>>>>	4,274	1,458	747,950	255,160		$4,700	$1,603	$3,096	26.7
Toilet Location	Current Gallons used per day (see note above)	Gallons used per day with Efficient Fixture	Annual Total Gals. Used Per Year	Annual Gals. Used with High-Eff. Fixture	Current Cost per Flush	Current Annual Cost	Annual Cost with High-Eff. Fixture ($$)	Annual Savings with High-Eff. Fixture ($$)	Estim. Payback Period (in months)
Room 100	72	26	12,542	4,480	$0.023	$79	$28	$51	74.9
Room 104	58	26	10,208	4,480	$0.018	$64	$28	$36	105.4
Room 106	96	26	16,844	4,480	$0.030	$106	$28	$78	48.8
Kitchen	24	12	4,200	2,016	$0.017	$26	$13	$14	276.3
Staff Bathroom Main Office	200	83	35,073	14,560	$0.019	$220	$91	$129	2.94
Nurses Bathroom	26	17	4,607	2,912	$0.013	$29	$18	$11	35.6
New Wing Boys	75	56	13,061	9,786	$0.011	$82	$61	$21	18.4
New Wing Girls - 1	97	77	16,933	13,546	$0.010	$106	$85	$21	17.8
New Wing Girls - 2	116	77	20,284	13,546	$0.012	$127	$85	$42	9.0
New Wing Girls - 3	111	77	19,402	13,546	$0.012	$122	$85	$37	10.3
New Wing Girls - 4	121	77	21,166	13,546	$0.013	$133	$85	$48	7.9
New Wing Girls - 5	116	77	20,284	13,546	$0.012	$127	$85	$42	9.0
Staff Restroom Adj. Room 100	356	58	62,344	10,080	$0.050	$392	$63	$328	11.5
Staff Restroom 2nd Floor by Elevator	197	58	34,453	10,080	$0.027	$216	$63	$153	24.8
First Floor Boys - 1	131	45	22,969	7,840	$0.024	$144	$49	$95	39.9
First Floor Boys - 2	140	45	24,500	7,840	$0.025	$154	$49	$105	36.2
First Floor Girls - 1	395	51	69,125	8,960	$0.062	$434	$56	$378	10.0
First Floor Girls - 2	325	51	56,875	8,960	$0.051	$357	$56	$301	12.6
First Floor Girls - 3	155	51	27,125	8,960	$0.024	$170	$56	$114	33.2
Second Floor Girls - 1	139	50	24,363	8,805	$0.022	$153	$55	$98	38.8
Second Floor Girls - 2	156	50	27,229	8,805	$0.025	$171	$55	$116	32.8
Second Floor Girls - 3	139	50	24,363	8,805	$0.022	$153	$55	$98	38.8
Second Floor Girls - 4	154	50	26,943	8,805	$0.025	$169	$55	$114	33.3
Second Floor Girls - 5	172	50	30,096	8,805	$0.027	$189	$55	$134	28.3
Second Floor Girls - 6	216	50	37,835	8,805	$0.035	$238	$55	$182	20.8
Second Floor Boys - 1	120	36	20,913	6,361	$0.026	$131	$40	$91	41.5
Second Floor Boys - 2	106	36	18,635	6,361	$0.024	$117	$40	$77	49.2
Second Floor Boys - 3	103	36	18,014	6,361	$0.023	$113	$40	$73	51.8
First Floor Staff Across from Room 104	158	58	27,563	10,080	$0.022	$173	$63	$110	34.5

Urinals – Data Entry

Domestic Indoor Water Use - URINALS

Refer to page 121 of the guidebook for guidance using this calculator.

Summary Output Found on the Summary Output Tab.
Detailed Output table to the right.

Based on the population size and gender split, total toilet uses should be 91,745

Your current annual total is 101,970 Drastically different because entire urinal bank flushes with every use on the first and second floors of the older wing

Click on the cell below to read about using the Use Frequency Override.

CLICK HERE

ADJUSTED
staff
students

Fixtures Exceeding Efficiency Flow	Units Requiring Maintenance	Units Should be Replaced
11	2	9

Urinal Location	Notes	User Group	Visitor Use	Manual or Sensor	Valve Type	Marked gpf	Number of seconds per flush	Timed Flush Rate (gpf)	Recommended Action	Override Default Use Frequency?	Total Calculated Uses Per Day	Override Use (User Input)
New Wing Boys - 1		MALE Students	No Visitor Use	Sensor		0.125	0.9	0.23	Maintenance	Override	25.1	35.0
New Wing Boys - 2		MALE Students	No Visitor Use	Sensor		0.125	0.9	0.23	Maintenance	Override	25.1	35.0
First Floor Boys - 1	The urinals in those bathrooms are on a motion sensor and timer. They flush about every five minutes or so as long as there is motion. once the motion stops, the flushers quit flushing. -Jerry Mundell	MALE Students	No Visitor Use	Sensor			4.0	1.00	Replace	Override	25.1	25
First Floor Boys - 2		MALE Students	No Visitor Use	Sensor			4.0	1.00	Replace	Override	25.1	25
Second Floor Boys - 1		MALE Students	No Visitor Use	Sensor			4.0	1.00	Replace	Override	25.1	25
Second Floor Boys - 2		MALE Students	No Visitor Use	Sensor			4.0	1.00	Replace	Override	25.1	25
Second Floor Boys - 3		MALE Students	No Visitor Use	Sensor			4.0	1.00	Replace	Override	25.1	25
Second Floor Boys - 4		MALE Students	No Visitor Use	Sensor			4.0	1.00	Replace	Override	25.1	25
Second Floor Boys - 5		MALE Students	No Visitor Use	Sensor			4.0	1.00	Replace	Override	25.1	25
Second Floor Boys - 6		MALE Students	No Visitor Use	Sensor			4.0	1.00	Replace	Override	25.1	25
First Floor Staff Across from Room 104		MALE Teachers/Staff	No Visitor Use	Sensor			5.0	1.25	Replace	Override	0.0	8

Urinals – Potential Water Savings

Detailed Output Table									
Totals>>>	227	35	83,002	12,746		$522	$80	$441	90.0
Urinal Location	Current Gallons used per day (See note above)	Gallons used per day with Efficient Fixture	Current Annual Total Gals. Used	Annual Gals. Used with High-Eff. Fixture	Current Cost per Flush	Current Annual Cost	Annual Cost with High-Eff. Fixture ($$)	Annual Savings with High-Eff. Fixture ($$)	Estim. Payback Period (in months)
New Wing Boys - 1	16	9	2,874	1,597	$0.001	$18	$10	$8	53.8
New Wing Boys - 2	17	9	2,970	1,597	$0.001	$19	$10	$9	50.1
First Floor Boys - 1	53	7	9,188	1,148	$0.006	$58	$7	$51	85.5
First Floor Boys - 2	53	7	9,188	1,148	$0.006	$58	$7	$51	85.5
Second Floor Boys - 1	53	7	9,188	1,148	$0.006	$58	$7	$51	85.5
Second Floor Boys - 2	53	7	9,188	1,148	$0.006	$58	$7	$51	85.5
Second Floor Boys - 3	53	7	9,188	1,148	$0.006	$58	$7	$51	85.5
Second Floor Boys - 4	53	7	9,188	1,148	$0.006	$58	$7	$51	85.5
Second Floor Boys - 5	53	7	9,188	1,148	$0.006	$58	$7	$51	85.5
Second Floor Boys - 6	53	7	9,188	1,148	$0.006	$58	$7	$51	85.5
First Floor Staff Across from Room 104	21	2	3,657	365	$0.008	$23	$2	$21	208.8

Lavatory Faucets – Data Entry

Domestic Indoor Water Use - LAVATORY FAUCETS

Refer to page 121 of the guidebook for guidance using this calculator.

Summary Output Found on the Summary Output Tab.

Based on the population size and gender

WARNING: your adjustments to th split, total toilet uses should be 338,100

Your current total is 278,926

Click on the cell below to read about using the Use Frequency Override.

ADJUSTED
staff
students

Average seconds per use for MANUAL faucets >>>>>>	5

Fixtures Exceeding Efficiency Flow	Units Requiring Maintenance	Units Should be Replaced
12	15	1

Lavatory Faucets Location	Notes	User Group	Visitor Use	Marked gpm	Manual or Metered Faucet?	METERED Faucet Flow TIME (in seconds)	Measuring Cup: DO NOT Use this Column. You indicated FLOWBAG used.	Flowbag Column: Enter FLOWBAG Measured gallons/ minute	Time-Calculated Flow (gpm)	Recommended Action	Override Default Use Frequency?	Total Calculated Uses Per Day	Override Use (User Input)
Room 100		Common Students	No Visitor Use	2.2	Manual			1.75	See Prev. Colmn.	Maintenance	Override	5.1	9.6
Room 104-1	Additional drinking fountain	Common Students	No Visitor Use	2.2	Manual			2.05	See Prev. Colmn.	Maintenance	Override	5.1	9.6
Room 106-1	Recently replaced - teacher correspondence	Common Students	No Visitor Use		Manual			1.40	See Prev. Colmn.	Maintenance	Override	5.1	9.6
Kitchen Bathroom	Measured with both hot and cold on full	Common Teachers/Staff	No Visitor Use	2.2	Manual			2.20	See Prev. Colmn.	Maintenance	Override	21.6	4.3
Staff Restroom Main Office		Common Teachers/Staff	No Visitor Use	2.2	Metered	12		0.65	See Prev. Colmn.	Maintenance	Override	21.6	31.2
Nurses Restroom		Common Students	No Visitor Use	1.5	Manual			1.40	See Prev. Colmn.	Maintenance	Override	5.1	6.2
New Wing Bradley - 3		Common Students	No Visitor Use		Metered			0.40	See Prev. Colmn.	Maintenance	Override	5.1	78.6
New Wing Bradley - 2		Common Students	No Visitor Use		Metered			0.40	See Prev. Colmn.	Maintenance	Override	5.1	78.6
New Wing Bradley - 1		Common Students	No Visitor Use		Metered			0.40	See Prev. Colmn.	Maintenance	Override	5.1	78.6
Staff Restroom Adjacent to Room 100	Broke attempting to install aerator - Jerry will fix	Common Teachers/Staff	No Visitor Use		Manual			5.50	See Prev. Colmn.	Replace	Use Default	21.6	
2nd Floor Staff Restroom by Elevator		Common Teachers/Staff	No Visitor Use	2.0	Manual			1.25	See Prev. Colmn.	Maintenance	Use Default	21.6	
2nd Floor Bradley - 1 by Room 210	Observed running for extended periods of time	FEMALE Students	No Visitor Use		Metered			2.90	See Prev. Colmn.	Maintenance	Override	203.0	112.0
2nd Floor Bradley - 2 by Room 210	Observed running for extended periods of time	MALE Students	No Visitor Use		Metered			1.75	See Prev. Colmn.	Maintenance	Override	188.5	112.0
1st Floor Bradley - 1	Observed running for extended periods of time	FEMALE Students	No Visitor Use		Metered			1.65	See Prev. Colmn.	Maintenance	Override	203.0	80.5
1st Floor Bradley - 2	Observed running for extended periods of time	MALE Students	No Visitor Use		Metered			1.65	See Prev. Colmn.	Maintenance	Override	188.5	80.5
First Floor Staff Across from Room 104		Common Teachers/Staff	No Visitor Use	2.2	Manual			1.95	See Prev. Colmn.	Maintenance	Override	21.6	29.6

Lavatory Faucets – Potential Water Savings

Detailed Output Table

* Normalizing to one year shows the use and savings over one calendar year, rather than the number of days the facility is open/operating in one year.

TOTALS >>>>>>		100	38	36,526	11,910		230	75	155	55	47
Lavatory Faucets Location	Current Gallons per use	Current Gallons used per day (See *note above)	Gallons used per day with Efficient Fixture	Annual Gallons Used Currently	Annual Gals. Used with High-Eff. Fixture	Current Cost per minute	Current Annual Water Cost	Annual Cost (Water) with High-Eff. Fixture ($$)	Annual Savings (Water) with High-Eff. Fixture ($$)	Annual Savings (Energy) with High-Eff. Fixture ($$)	Estim. Payback Period in Months
Room 100	0.15	3	1	510	146	$0.001	$3	$1	$2	$1	127.5
Room 104-1	0.17	3	1	598	146	$0.001	$4	$1	$3	$1	102.8
Room 106-1	0.12	2	1	408	146	$0.001	$3	$1	$2	$1	177.0
Kitchen Bathroom	0.18	2	0	289	66	$0.001	$2	$0	$1	$0	208.3
Staff Restroom Main Office	0.13	8	8	1,480	1,480	$0.001	$9	$9	$0	$0	0.0
Nurses Restroom	0.12	2	1	265	95	$0.001	$2	$1	$1	$0	272.4
New Wing Bradley - 3	0.03	5	5	957	957	$0.000	$6	$6	$0	$0	0.0
New Wing Bradley - 2	0.03	5	5	957	957	$0.000	$6	$6	$0	$0	0.0
New Wing Bradley - 1	0.03	5	5	957	957	$0.000	$6	$6	$0	$0	0.0
Staff Restroom Adjacent to Room 100	0.46	21	2	3,609	328	$0.003	$23	$2	$21	$7	141.6
2nd Floor Staff Restroom by Elevator	0.10	5	2	820	328	$0.001	$5	$2	$3	$1	94.4
2nd Floor Bradley - 1 by Room 210	0.24	56	10	9,876	1,703	$0.002	$62	$11	$51	$18	5.7
2nd Floor Bradley - 2 by Room 210	0.15	34	10	5,960	1,703	$0.001	$37	$11	$27	$10	10.9
1st Floor Bradley - 1	0.14	23	7	4,043	1,225	$0.001	$25	$8	$18	$6	16.5
1st Floor Bradley - 2	0.14	23	7	4,043	1,225	$0.001	$25	$8	$18	$6	16.5
First Floor Staff Across from Room 104	0.16	10	3	1,754	450	$0.001	$11	$3	$8	$3	35.6

Non-Lavatory Faucets – Data Entry

Domestic Indoor Water Use - NON-LAVATORY FAUCETS

Refer to page 121 of the guidebook for guidance using this calculator.

Summary Output Found on the Summary Output Tab.
Detailed Output table to the right.

		Fixtures Exceeding Efficiency Flow	Units Requiring Maintenance	Units Should be Replaced										
		31	31	0				Measuring Cup	Flowbag Column					
Non-Lav. Faucet Location	Notes	User Group	Visitor Use		Manual or Sensor	Number Seconds per Use or Number of Seconds of Auto-flow (sensor or spring)	Marked gpm	DO NOT Use this Column. You indicated FLOWBAG used.	Enter FLOWBAG Measured gallons/minute	Time-Calculated Flow (gpm)	Number Work-days per year	Number of Fixture Uses Per Day	Recommended Action
Room 98		Common Students	No Visitor Use		Manual	5.0	2.20		1.40	See Prev. Column	175	2	Maintenance
Room 102		Common Students	No Visitor Use		Manual	5.0	2.20		1.90	See Prev. Column	175	2	Maintenance
Room 104-2	No drinking fountain	Common Students	No Visitor Use		Manual	5.0			1.80	See Prev. Column	175	2	Maintenance
Room 106-2		Common Students	No Visitor Use		Manual	5.0	2.20		2.05	See Prev. Column	175	2	Maintenance
Room 112		Common Students	No Visitor Use		Manual	5.0	2.20		2.05	See Prev. Column	175	2	Maintenance
Room 114		Common Students	No Visitor Use		Manual	5.0	2.20		1.95	See Prev. Column	175	2	Maintenance
Room 115		Common Students	No Visitor Use		Manual	5.0	2.20		2.00	See Prev. Column	175	2	Maintenance
Room 113		Common Students	No Visitor Use		Manual	5.0	2.20		2.00	See Prev. Column	175	2	Maintenance
Room 105		Common Students	No Visitor Use		Manual	5.0	2.20		1.80	See Prev. Column	175	2	Maintenance
Room 103		Common Students	No Visitor Use		Manual	5.0	2.20		2.00	See Prev. Column	175	2	Maintenance
Room 101		Common Students	No Visitor Use		Manual	5.0	2.20		2.10	See Prev. Column	175	2	Maintenance
Room 99		Common Students	No Visitor Use		Manual	5.0	2.20		1.95	See Prev. Column	175	2	Maintenance
Room 97		Common Students	No Visitor Use		Manual	5.0	2.20		2.20	See Prev. Column	175	2	Maintenance
Room 201	Pressure fluctuations during test	Common Students	No Visitor Use		Manual	5.0	2.20		1.65	See Prev. Column	175	2	Maintenance
Room 203		Common Students	No Visitor Use		Manual	5.0	2.20		2.10	See Prev. Column	175	2	Maintenance
Room 205	approximately 1 drop per second -	Common Students	No Visitor Use		Manual	5.0	2.20		2.00	See Prev. Column	175	2	Maintenance
Room 207		Common Students	No Visitor Use		Manual	5.0	2.20		2.00	See Prev. Column	175	2	Maintenance
Room 209		Common Students	No Visitor Use		Manual	5.0	2.20		1.95	See Prev. Column	175	2	Maintenance
Room 211		Common Students	No Visitor Use		Manual	5.0	2.20		2.00	See Prev. Column	175	2	Maintenance
Room 214		Common Students	No Visitor Use		Manual	5.0	2.20		2.00	See Prev. Column	175	2	Maintenance
Room 212		Common Students	No Visitor Use		Manual	5.0	2.20		1.95	See Prev. Column	175	2	Maintenance
Room 210	Pressure fluctuations during test	Common Students	No Visitor Use		Manual	5.0	2.20		1.90	See Prev. Column	175	2	Maintenance
Room 208		Common Students	No Visitor Use		Manual	5.0	2.20		2.00	See Prev. Column	175	2	Maintenance
Room 206		Common Students	No Visitor Use		Manual	5.0	2.20		1.90	See Prev. Column	175	2	Maintenance
Room 204		Common Students	No Visitor Use		Manual	5.0	2.20		2.00	See Prev. Column	175	2	Maintenance
Room 202		Common Students	No Visitor Use		Manual	5.0	2.20		1.85	See Prev. Column	175	2	Maintenance
Room 107	Pressure fluctuations during test	Common Students	No Visitor Use		Manual	5.0	2.20		1.80	See Prev. Column	175	2	Maintenance
Kitchen Open Area		Teachers/Staff	No Visitor Use		Manual	5.0			1.55	See Prev. Column	175	2	Maintenance
Staff Break Room		Teachers/Staff	No Visitor Use		Manual	15.0	2.20		2.00	See Prev. Column	175	75	Maintenance
Nurses Room		Common Students	No Visitor Use		Manual	5.0	2.20		1.75	See Prev. Column	175	2	Maintenance
Media Center		Teachers/Staff	No Visitor Use		Manual	5.0	2.20		2.00	See Prev. Column	175	2	Maintenance
2nd Floor Custodial by Room 210	retrofits, no leaks	Teachers/Staff	No Visitor Use		Manual					See Prev. Column	175		No Action

Non-Lavatory Faucets – Potential Water Savings

Detailed Output Table												
Totals >>>>>>>>>	24	47	12	8,243	2,078		$52	$13	$39	$14	$1,023	233.7
Non-Lav. Faucet Location	TOTAL Daily Minutes of Fixture Use at Location	Current Gals. Used Per Day (Normalized to level Full time and Visitor use)*	Gals. Used per Day with High-Eff. Fixture (Normalized to level Full time and Visitor use)*	Annual Gallons Used Currently	Annual Gals. Used with High-Eff. Fixture	Current Cost per minute	Current Annual Water Cost	Annual Cost (Water) with High-Eff. Fixture ($$)	Annual Savings (Water) with High-Eff. Fixture ($$)	Annual Savings (Energy) with High-Eff. Fixture ($$)	Item cost	Estim. Payback Period in Months
Room 98	0.2	0.23	0	41	15	$0.009	$0	$0	$0	$0	$33	1770.4
Room 102	0.2	0.32	0	55	15	$0.012	$0	$0	$0	$0	$33	1138.1
Room 104-2	0.2	0.30	0	53	15	$0.011	$0	$0	$0	$0	$33	1225.7
Room 106-2	0.2	0.34	0	60	15	$0.013	$0	$0	$0	$0	$33	1028.0
Room 112	0.2	0.34	0	60	15	$0.013	$0	$0	$0	$0	$33	1028.0
Room 114	0.2	0.33	0	57	15	$0.012	$0	$0	$0	$0	$33	1098.9
Room 115	0.2	0.33	0	58	15	$0.013	$0	$0	$0	$0	$33	1062.3
Room 113	0.2	0.33	0	58	15	$0.013	$0	$0	$0	$0	$33	1062.3
Room 105	0.2	0.30	0	53	15	$0.011	$0	$0	$0	$0	$33	1225.7
Room 103	0.2	0.33	0	58	15	$0.013	$0	$0	$0	$0	$33	1062.3
Room 101	0.2	0.35	0	61	15	$0.013	$0	$0	$0	$0	$33	995.9
Room 99	0.2	0.33	0	57	15	$0.012	$0	$0	$0	$0	$33	1098.9
Room 97	0.2	0.37	0	64	15	$0.014	$0	$0	$0	$0	$33	937.3
Room 201	0.2	0.28	0	48	15	$0.010	$0	$0	$0	$0	$33	1385.5
Room 203	0.2	0.35	0	61	15	$0.013	$0	$0	$0	$0	$33	995.9
Room 205	0.2	0.33	0	58	15	$0.013	$0	$0	$0	$0	$33	1062.3
Room 207	0.2	0.33	0	58	15	$0.013	$0	$0	$0	$0	$33	1062.3
Room 209	0.2	0.33	0	57	15	$0.012	$0	$0	$0	$0	$33	1098.9
Room 211	0.2	0.33	0	58	15	$0.013	$0	$0	$0	$0	$33	1062.3
Room 214	0.2	0.33	0	58	15	$0.013	$0	$0	$0	$0	$33	1062.3
Room 212	0.2	0.33	0	57	15	$0.012	$0	$0	$0	$0	$33	1098.9
Room 210	0.2	0.32	0	55	15	$0.012	$0	$0	$0	$0	$33	1138.1
Room 208	0.2	0.33	0	58	15	$0.013	$0	$0	$0	$0	$33	1062.3
Room 206	0.2	0.32	0	55	15	$0.012	$0	$0	$0	$0	$33	1138.1
Room 204	0.2	0.33	0	58	15	$0.013	$0	$0	$0	$0	$33	1062.3
Room 202	0.2	0.31	0	54	15	$0.012	$0	$0	$0	$0	$33	1180.3
Room 107	0.2	0.30	0	53	15	$0.011	$0	$0	$0	$0	$33	1225.7
Kitchen Open Area	0.2	0.26	0	45	15	$0.010	$0	$0	$0	$0	$33	1517.5
Staff Break Room	18.8	37.50	9	6,563	1,641	$0.013	$41	$10	$31	$11	$33	9.4
Nurses Room	0.2	0.29	0	51	15	$0.011	$0	$0	$0	$0	$33	1274.7
Media Center	0.2	0.33	0	58	15	$0.013	$0	$0	$0	$0	$33	1062.3
2nd Floor Custodial by Room 210	0.0	0	0	0	0	$0.000	$0	$0	$0	$0	$0	0.0

Showerheads – Data Entry

Domestic Indoor Water Use - Showerheads

Refer to page 122 of the guidebook for guidance using this calculator.

Summary Output Found on the Summary Output Tab.
Detailed Output table to the right.

Fixtures Exceeding Efficiency Flow	Units Requiring Maintenance	Units Should be Replaced
12	15	1

Showerhead Location	Notes	User Group	Visitor Use	Number Minutes per Use	Marked gpm	Measuring Cup: DO NOT Use this Column. You indicated FLOWBAG used.	Flowbag Column: Enter FLOWBAG Measured gallons/minute	Time-Calculated Flow (gpm)	Number Work-days per year	Number of Fixture Uses Per Day	Recommended Action
		Select One	Select One					See Prev. Column			Select One
		Select One	Select One					See Prev. Column			Select One
		Select One	Select One					See Prev. Column			Select One
		Select One	Select One					See Prev. Column			Select One
		Select One	Select One					See Prev. Column			Select One
		Select One	Select One					See Prev. Column			Select One
		Select One	Select One					See Prev. Column			Select One
		Select One	Select One					See Prev. Column			Select One
		Select One	Select One					See Prev. Column			Select One
		Select One	Select One					See Prev. Column			Select One
		Select One	Select One					See Prev. Column			Select One
		Select One	Select One					See Prev. Column			Select One
		Select One	Select One					See Prev. Column			Select One
		Select One	Select One					See Prev. Column			Select One
		Select One	Select One					See Prev. Column			Select One
		Select One	Select One					See Prev. Column			Select One
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		Select One	Select One					See Prev. Column			Select One
		Select One	Select One					See Prev. Column			Select One
		Select One	Select One					See Prev. Column			Select One
		Select One	Select One					See Prev. Column			Select One
		Select One	Select One					See Prev. Column			Select One
		Select One	Select One					See Prev. Column			Select One

Showerheads – Potential Water Savings

Detailed Output Table												
Totals >>>>	0	0	0	0	0		$0	$0	$0	$0	$0	0.0
owerhead Locati	TOTAL Daily Minutes of Fixture Use at Location	Current Gals. Used Per Day	Gals. Used per Day with High-Eff. Fixture (Normalized to level Full time and Visitor use)*	Annual Gallons Used Currently	Annual Gals. Used with High-Eff. Fixture	Current Cost per minute	Current Annual Water Cost	Annual Cost (Water) with High-Eff. Fixture ($$)	Annual Savings (Water) with High-Eff. Fixture ($$)	Annual Savings (Energy) with High-Eff. Fixture ($$)	Item cost	Estim. Payback Period in Months
0	0.0	0	0	0	0	$0.000	$0	$0	$0	$0	$0	0.0
0	0.0	0	0	0	0	$0.000	$0	$0	$0	$0	$0	0.0
0	0.0	0	0	0	0	$0.000	$0	$0	$0	$0	$0	0.0
0	0.0	0	0	0	0	$0.000	$0	$0	$0	$0	$0	0.0
0	0.0	0	0	0	0	$0.000	$0	$0	$0	$0	$0	0.0
0	0.0	0	0	0	0	$0.000	$0	$0	$0	$0	$0	0.0
0	0.0	0	0	0	0	$0.000	$0	$0	$0	$0	$0	0.0
0	0.0	0	0	0	0	$0.000	$0	$0	$0	$0	$0	0.0
0	0.0	0	0	0	0	$0.000	$0	$0	$0	$0	$0	0.0
0	0.0	0	0	0	0	$0.000	$0	$0	$0	$0	$0	0.0

Summary Output Table

Summary Output Table										
Fixture	Fixtures Exceeding Efficiency Flow	Units Require Maintenance	Units Should be Replaced	Total Replacement Costs	Total Mainenance Costs	Total Cost Estimate (Repairs + Maint.)	Annual Potential Savings (gallons)	Annual Potential Water Savings ($$)	Annual Potential Energy Savings ($$)	Payback Period (in months)
Toilets	29	8	21	$6,636	$253	$6,889	492,790	$3,096	N/A	26.7
Urinals	11	2	9	$3,240	$72	$3,312	70,256	$441	N/A	90.0
Lavatory Faucets	12	15	1	$330	$495	$825	24,616	$155	$55	47.2
Non-Lav. Faucets	31	31	0	$0	$1,023	$1,023	6,164	$39	$14	233.7
Showerheads	0	0	0	$0	$0	$0	-	$0	$0	0.0
					Totals	$12,049	593,826	$3,731	$69	38.0

Data Entry Exercise – Utility Rate & Population Data

1)

Billing Data Input			
1. Select Billing Unit (1000 gals or ccfs) >		ccfs	
2. Utility cost potable water per	ccf	$1.30	
3. Utility cost sewer water per	ccf	$3.40	
4. Select Water Heat Type	Gas Heat		
5. Enter Gas Cost per Therm	$0.46	Xcel Energy Rate (summed Dist., Cost, and Aff.)	
5. Enter Electric Cost per kWh	$0.06	Xcel Energy Rate (summed Energy and Fuel)	
6. Heater Efficiency:	Gas	59.0 %	
Suggested default heat efficiencies:			
Gas	59 %	Elect.	92.7 %

2)

Facility Population Data Input					
Enter Name Population Group 1	Teachers/Staff	Population Size	Days/week on site	Weeks/year on site	Work Days per Year
Enter Name Population Group 2	Students				
Enter Number of	MALE Teachers/Staff	9	5	35	175
Enter Number of	FEMALE Teachers/Staff	66	5	35	175
Enter Number of	MALE Students	274	5	35	175
Enter Number of	FEMALE Students	295	5	35	175
Enter Number of	VISITORS				0
	Percentage of female VISITORS [1]				
Restroom uses/day/FULL-TIME person [2]	3.0				
Common (unisex) restroom uses/day	3.00	per	individual Teachers/Staff		
Common (unisex) restroom uses/day	0.13	per	individual Students		

1. Default is 50 (percent).

2. Default is 3. This is the number of times each fixture in these restrooms will be used.

You are indicating all restroom uses by this group are done in common restrooms

3)

Efficiency Fixture Properties (see table below for efficiency rates)	Toilets	Urinals	Lavatory Faucets	Non-Lavatory Faucets	Shower-heads
	gals/flush	gals/flush	gals/min	gals/min	gals/min
Enter High Efficiency Water Use Rate	1.28	0.125	0.50	0.50	1.50
Replacement Cost	$316	$360	$330	$330	$65
Adjustment/ Maintenance Cost	$32	$36	$33	$33	$7
Do these faucetsuse hot water? Select Y or N			Y	Y	Y
Select the size of the cup used to measure flow of this fixture. *			Flowbag	Flowbag	Flowbag

Select "Flowbag" if one was used.

10% of replacement

Water Use Rates for Efficient Fixtures		
Toilets	gals/flush	1.28, 1.1, 0.8
Urinals	gals/flush	0.5, 0.125
Lav Faucets	gals/min	1.0, 0.5
Non-Lav Faucets	gals/min	1.0, 0.5
Showerheads	gals/min	2.0, 1.75, 1.5

Data Entry Exercise – Fixture Data

TOILETS - WORKSHEET

Building Name:

Location	User Group (Male or Female)	Manual or Sensor	Tank or Valve	Marked Valve Flush Rate (gpf)	Marked China Flush Rate (gpf)	Timed Flush Num. Sec.	Calc. Rate (gpm)	NA=No Action R=Replace M=Maint.	Leaks? Dye Test Results? Other Comments
New Wing Girls - 1	Female students	Sensor	Valve			4.0			
First Floor Girls - 1	Female students	Sensor	Valve			23.7			
Second Floor Girls - 6	Female students	Sensor	Valve			13.2			

URINALS - WORKSHEET

Building Name:

Location	Manual or Sensor	Marked Valve Flush Rate (gpf)	Marked China Flush Rate (gpf)	Timed Flush Num. Sec.	Calc. Rate (gpm)	NA=No Action R=Replace M=Maint.	Leaks? Other Comments
First floor staff 104	Sensor			5.0			
New wing boys - 1	Sensor		0.125	0.9			

FAUCETS - WORKSHEET

Building Name:

Flow Measurement Container (circle one): Cups / Pints / Quarts / Flowbag

Location	In Lav. Fac.	User Group (Male or Female)	Manual, Sensor, or Spring	Metered (Sensor or Spring) Seconds of Flow	Flow Rate				NA=No Action R=Replace M=Maint.	Leaks? Other Comments
					Marked Flow Rate (gpm)	Timed				
						Num. Cups/ Pints/ Quarts	Num. Secs.	Calc. Rate or Flowbag (gpm)		
Staff Restroom 100	Yes	Common	Manual					5.5		
New Wing Bradley - 1	Yes	Common	Sensor	On-demand				0.4		

4 - Residential Appliance and 5 & 6 - Commercial Kitchen Calculators

CLOTHES WASHER, DISHWASHER, AND PRE-RINSE SPRAY VALVES

4 – Residential Appliances (ENERGY STAR)

Air purifier

Clothes washer

Dehumidifier

Dishwasher

Refrigerator

Compact refrigerator

Freezer

PROCESS

- Enter simple data on ‘INPUTS’ tab
- Modify assumptions on ‘Calcs’ tabs
- View Results

TIPS

- ‘About This Calculator’ tab has links to ENERGY STAR information about each equipment type

Clothes Washer

Clothes Washer Calculations for the ENERGY STAR Appliance Calculator

Inputs - *to edit these values go to the INPUTS tab*

	DEFAULT	USER ENTRY
Average number of loads per week	32.0	5.0
Building hot water fuel type	-	natural gas
Type of dryer	-	none
Capacity	3.64	3.64
Modified energy factor (MEF)	2.43	2.43
Water factor (WF)	4.02	4.02
Incremental cost	$150	$150

Assumptions - *users can edit the highlighted values to modify the assumptions*

ENERGY STAR model rated unit electricity consumption		159	kWh/year
Conventional model	Rated unit electricity consumption	470	kWh/year
	Capacity	3.64	cubic feet
	Loads per week	5.0	
	Modified energy factor (MEF)	1.26	
	Water factor (WF)	9.50	

Percentage of washer loads dried in machine		100%	
Gas water heater efficiency		75%	
Annual weeks of use		39	weeks
Equipment lifetime		7	years
Energy conversion (constant)		0.0341	therm/kWh
Portion of rated unit electricity consumption	Machine	20%	
	Water heating	80%	

Residential	Default loads per year		295
	Reference loads per year		392
Commercial	Default/reference loads per year	Multifamily	1,241
		Laundromat	2,190

Calculations

	Conventional		ENERGY STAR	
Loads per year	195		195	
Adjusted rated unit electricity consumption	234		79	
Total electricity (based on electric dryer)	563		292	
	Electricity	Gas	Electricity	Gas
Machine energy	47	-	16	-
Water heating energy	0	8.5	0	2.9
Dryer energy	0	0.0	0	0.0
	kWh	therms	kWh	therms

Annual energy & water consumption per clothes washer system

	Conventional	ENERGY STAR	Savings	
Electricity consumption	47	16	31	kWh
Gas consumption	9	3	6	therms
Water consumption	6,743	2,853	3,890	gallons

References

INPUTS | RESULTS | Air Purifier Calcs | Clothes Washer Calcs | Dehumidifer Calcs | Dishwasher Calcs | Refrigerator Calcs | Compact Refrigerator Calcs

Dishwasher

Dishwasher Calculations for the ENERGY STAR Appliance Calculator

Inputs - *to edit these values go to the INPUTS tab*

	DEFAULT	USER ENTRY
Type	-	standard
Average number of cycles per week	4.0	4.0
Building hot water fuel type	-	natural gas
Rated unit electricity consumption (kWh/year)	273	273
Rated water consumption (gallons/cycle)	3.75	3.75
Incremental cost	$10	$10

Assumptions - *users can edit the highlighted values to modify the assumptions*

Conventional model	**Rated unit electricity consumption**	355	kWh/year
	Rated water consumption	6.50	gallons/cycle

Annual weeks of use	52	
Portion of dishwasher energy used for water heating	56%	
Gas water heater efficiency	75%	
Equipment lifetime	10	years
Default cycles per year	215	
Energy conversion (constant)	0.0341	therm/kWh

Calculations

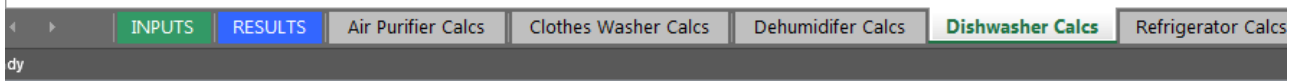
Conventional use per cycle			ENERGY STAR use per cycle		
Machine energy (kWh)	**Water heater energy (kWh)**	**Water heater energy (therm)**	**Machine energy (kWh)**	**Water heater energy (kWh)**	**Water heater energy (therm)**
0.73	0.00	0.04	0.56	0.00	0.03

Annual energy & water consumption per dishwasher

	Conventional	ENERGY STAR	Savings	
Electricity consumption	151	116	35	kWh
Gas consumption	8.7	6.7	2.0	therms
Water consumption	1,352	780	572	gallons

References

Energy & water consumption:	- ENERGY STAR - EPA research on available models, 2012 - Conventional - Federal standard, Code of Federal Regulations, Title 10, Part 430, Subpart C
Cycles per year:	- DOE Federal Test Procedure, Code of Federal Regulations, Title 10, Part 430, Subpart B, Appendix C
Gas water heater efficiency:	- DOE Federal Test Procedure, Code of Federal Regulations, Title 10, Part 430, Subpart B, Appendix C
Equipment lifetime:	- Appliance Magazine, Market Research Report, January 2011
Incremental cost:	- EPA research on available models, 2012



5 – Commercial Kitchen Equipment (ENERGY STAR)

Dishwasher

Freezer

Fryer

Griddle

Hot food handling cabinet

Ice machine

Oven

Refrigerator

Steam cooker

Pre-Rinse spray valve

PROCESS

- Enter simple data on ‘INPUTS’ tab
- Modify assumptions on ‘Calcs’ tabs
- View Results

TIPS

- ‘About This Calculator’ tab has links to ENERGY STAR information about each equipment type

Dishwasher

Dishwasher		Quantity	Racks washed per day	Building hot water fuel type	Booster water heater fuel type	Operating days per year	Additional cost per unit for ENERGY STAR model	Optional: utility incentive amount
Low Temperature	Under Counter	0	68	natural gas	electric	195	$770	$0
	Stationary Single Tank Door	0	68	natural gas	electric	195	$770	$0
	Single Tank Conveyor	0	68	natural gas	electric	195	$770	$0
	Multi Tank Conveyor	0	68	natural gas	electric	195	$770	$0
High Temperature	Under Counter	0	68	natural gas	electric	195	$770	$0
	Stationary Single Tank Door	1	68	natural gas	electric	195	$770	$0
	Single Tank Conveyor	0	68	natural gas	electric	195	$770	$0
	Multi Tank Conveyor	0	68	natural gas	electric	195	$770	$0
	Pot, Pan, and Utensil	0	68	natural gas	electric	195	$770	$0

Assumptions - *users can edit the highlighted values to modify the assumptions*

	Water Heater Efficiency		Inlet Water Temperature Increase (°F)
	Electric	Gas	
Building Water Heater	98%	80%	70
Booster Water Heater	98%	80%	40

Specific Heat of Water	1.0	Btu/pound/°F
Density of Water	8.2	pounds/gallon

	Average daily operation (hours)	Typical Wash Time (minutes)		Water Use per Rack (gallons)		Idle Power Draw (kW)		Equipment lifetime (years)
		Conventional	ENERGY STAR	Conventional	ENERGY STAR	Conventional	ENERGY STAR	
Low Temperature								
Under Counter	18	2.0	2.0	1.73	1.19	0.50	0.50	10
Stationary Single Tank Door	18	1.5	1.5	2.10	1.18	0.60	0.60	15
Single Tank Conveyor	18	0.3	0.3	1.31	0.79	1.60	1.50	20
Multi Tank Conveyor	18	0.3	0.3	1.04	0.54	2.00	2.00	20
High Temperature								
Under Counter	18	2.0	2.0	1.09	0.86	0.76	0.50	10
Stationary Single Tank Door	8	1.0	1.0	0.74	0.89	0.55	0.70	15
Single Tank Conveyor	18	0.3	0.3	0.87	0.70	1.93	1.50	20
Multi Tank Conveyor	18	0.2	0.2	0.97	0.54	2.59	2.25	20
Pot, Pan, and Utensil	18	3.0	3.0	0.70	0.58	1.20	1.20	10

Ice Machine

Ice Machine		Quantity	Harvest rate (pounds ice per day)	Potable water use (gallon per 100 pounds ice)	Operating days per year	Additional cost per unit for ENERGY STAR model	Optional: utility incentive amount
Batch	Ice Making Head	0	650	18.3	365	$0	$0
	Remote Condensing Unit	0	1,150	18.0	365	$0	$0
	Self Contained Unit	0	170	19.5	365	$0	$0
Continuous	Ice Making Head	0	680	12.0	365	$0	$0
	Remote Condensing Unit	0	1,170	12.0	365	$0	$0
	Self Contained Unit	0	240	12.0	365	$0	$0

Assumptions - *users can edit the highlighted values to modify the assumptions*

		Duty cycle	Ice harvest rate (pounds/day)	Potable water use (gallon/ 100 pound ice)	Annual production (pounds of ice)		Energy consumption rate (kWh/100 pounds ice)		Equipment lifetime
			Conventional	Conventional	Conventional	ENERGY STAR	Conventional	ENERGY STAR	
Batch	Ice Making Head	75%	650	21.8	177,938	177,938	6.2	5.5	8
	Remote Cond./ Split System	75%	1,150	20.1	314,813	314,813	5.1	4.7	8
	Self Contained Unit	75%	170	30.1	46,538	46,538	10.0	9.2	8
Continuous	Ice Making Head	75%	680	12.0	186,150	186,150	7.3	6.3	8
	Remote Cond./ Split System	75%	1,170	12.0	320,288	320,288	6.1	5.4	8
	Self Contained Unit	75%	240	12.0	65,700	65,700	9.5	8.9	8

Steam Cooker

Steam Cooker

	Quantity	Pounds of food cooked per day per unit	Number of pans per unit	Operating hours per day	Operating days per year	Additional cost per unit for ENERGY STAR model	Optional: utility incentive amount
Electric	0	100	3	12	365	$630	$0
Natural Gas	0	100	6	12	365	$870	$0

Assumptions - *users can edit the highlighted values to modify the assumptions*

	Electric			Gas		
	Conventional	ENERGY STAR		Conventional	ENERGY STAR	
Type	steam generator	boilerless		steam generator	boilerless	
Water Use	40	3	gallons/hour	40	3	gallons/hour
Time in constant steam mode	40%	40%		40%	40%	
Cooking energy efficiency	30%	50%		18%	38%	
Production capacity per pan	23.3	16.7	pounds/hour	23.3	20	pounds/hour
Idle energy rate	1,200	400	W	18,000	12,500	Btu/hour
ASTM energy to food	30.8		Wh/pound	105		Btu/pound
Equipment lifetime	12		years	12		years

6 – Commercial Kitchen Equipment (SFWMD)

Utility billing data

Handwashing faucets

Pre-rinse spray valves

Combi oven

PROCESS

- Enter utility billing data
- Populate corresponding equipment tab with collected data
- View results

Pre-Rinse Spray Valves

Kitchen Hand Faucets and PreRinse Spray Valves

Refer to page 134 of the guidebook for instructions on how to use this calculator.

	Efficiency Fixture Properties	
1.	Enter High Efficiency Water Use Rate >>	1.25 gals/min
	Possible Rates: 1.6 gals/min, 1.25 gals/min	
2.	Replament Cost	$75
	Adjustment/ Maintenance Cost	$8
3.	Does this device use hot water? Enter Y or N	Y
4.	Select timed flow measuring cup size	Flowbag

To use this spreadsheet:

Enter data into shaded white cells.	
Gold cells contain dropdown menues.	Select One
Shaded Gray Cells are calculated outputs.	

Summary Output Table

Fixture	Fixtures Exceeding	Total Replacement Costs	Total Mainenance Costs	Total Cost Estimate	Annual Potential Savings (gallons)	Annual Potential Water Savings ($$)	Annual Potential Energy Savings ($$)	Payback Period (in months)
PreRinse	1	$75	$0	$75	2,909	$18	$10	32.3
	0	Require Maintenance						
	1	Should be Replaced						

Detailed output table at RIGHT

5. **Fixture Use DataTables**

Location	Marked gpm	Seconds Used per Rack	Number Racks per Hour	Number Hours of Use per Day	Number Work-days per year	Do not enter Meaure-Cup Data Below. Use Next Column.	Enter FLOWBAG Measured gallons/minute	Time-Calculated Flow (gpm)	Recommended Action
Kitchen wash station		15	70	1	175		2.2	See Prev. Column	Replace
								See Prev. Column	Select one
								See Prev. Column	Select one
								See Prev. Column	Select one
								See Prev. Column	Select one
								See Prev. Column	Select one
								See Prev. Column	Select one
								See Prev. Column	Select one
								See Prev. Column	Select one
								See Prev. Column	Select one
		Totals							

TOTAL Minutes of fixture use at location	Current Gals. Used Per Day	Gals. Used per Day with High-Eff. Fixture	Annual Gallons Used Currently	Annual Gals. Used with High-Eff. Fixture	Current Water Cost per minute	Current Annual Water Cost	Annual Cost (Water) with High-Eff. Fixture ($$)	Annual Savings (Water) with High-Eff. Fixture ($$)	Annual Savings (Energy) with High-Eff. Fixture ($$)	Estim. Payback Period in Months
17.5	39	22	6,738	3,828	$0.014	$42	$24	$18	$10	32.3
0.0	0	0	0	0	$0.000	$0	$0	$0	$0	0.0
0.0	0	0	0	0	$0.000	$0	$0	$0	$0	0.0
0.0	0	0	0	0	$0.000	$0	$0	$0	$0	0.0
0.0	0	0	0	0	$0.000	$0	$0	$0	$0	0.0
0.0	0	0	0	0	$0.000	$0	$0	$0	$0	0.0
0.0	0	0	0	0	$0.000	$0	$0	$0	$0	0.0
0.0	0	0	0	0	$0.000	$0	$0	$0	$0	0.0
0.0	0	0	0	0	$0.000	$0	$0	$0	$0	0.0
0.0	0	0	0	0	$0.000	$0	$0	$0	$0	0.0
18	39	22	6,738	3,828		$42	$24	$18	$10	32.3

Additional Notes for Calculators 4 - 6

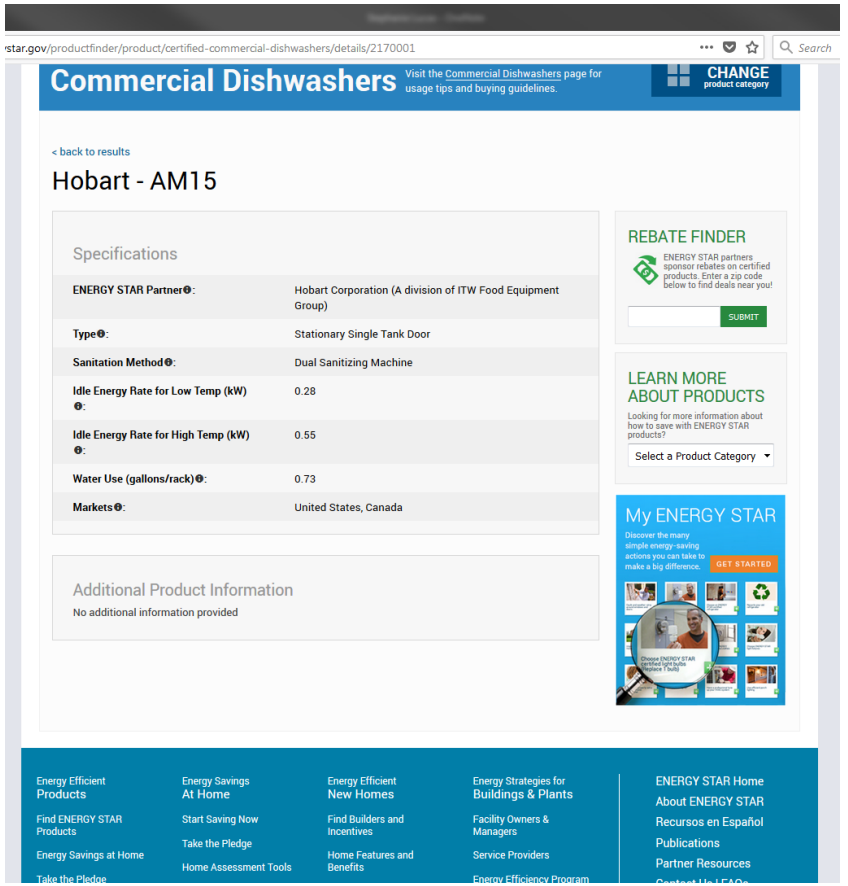
Data to request for pre-rinse spray valves

- Number of seconds used per rack
- Number of racks per hour and number of hours per day

Use Calculator 6 for pre-rinse spray valves, not Calculator 5

Search ENERGY STAR website for equipment specifications

- https://www.energystar.gov/productfinder/



7 – Cooling Tower Calculator

FLOW METER OR CONDUCTIVITY METERS

Utility Rates and Cooling Tower Operation Tab

Refer to page 142 of the guidebook for instructions on how to use this calculator.

This file contains two tabs for use with the Water Efficiency Improvement Self-Assessment Guide for Office Building Facility Managers.
The Flow Meters tab is used if the the cooling tower is equipted with meters measuring make-up and bleed (blow-down).
The Conductivity Meters tab is used if the cooling tower is equipped with conductivity meters used to measure total disolved solids.
Step-by-step directions for these tabs are located in the Cooling Tower section of the manual.

The evaluator must enter their billing data into the input table below for the other tabs in this spreadsheet to function.

Utility Rate Input Table			
1. Select Billing Unit (1000 gals or ccfs) >>>>>		Select one	
2. Utility cost potable water per	unit	$0.00	
3. Utility cost sewer water per	unit	$0.00	

To use this spreadsheet:	
Enter data into shaded white cells.	
Gold cells contain dropdown menues.	Select One
Shaded Gray Cells are calculated outputs.	

Refer to page 92 of the manual for guidance using this calculator.

Cooling Tower Operational Use Times		
4. Enter average or 'typical' load in tons >>>		
5. Enter hrs/day of operation>>>		
6. Enter days/month operation		
7. Enter number of months/year operation		

*Refer to page # in the manual to see the percent reduction in water consumption
that would occur if the concentration ratio was increased from current levels to at least 5.
8. Enter that percentage here >>>>> %

If your cooling tower does not have any meters you are aware of, use the "Flow Meter" tab after you have entered data above.

Click on the sheet below which matches your meter types (flow meters or conductivity).

Increasing COCs

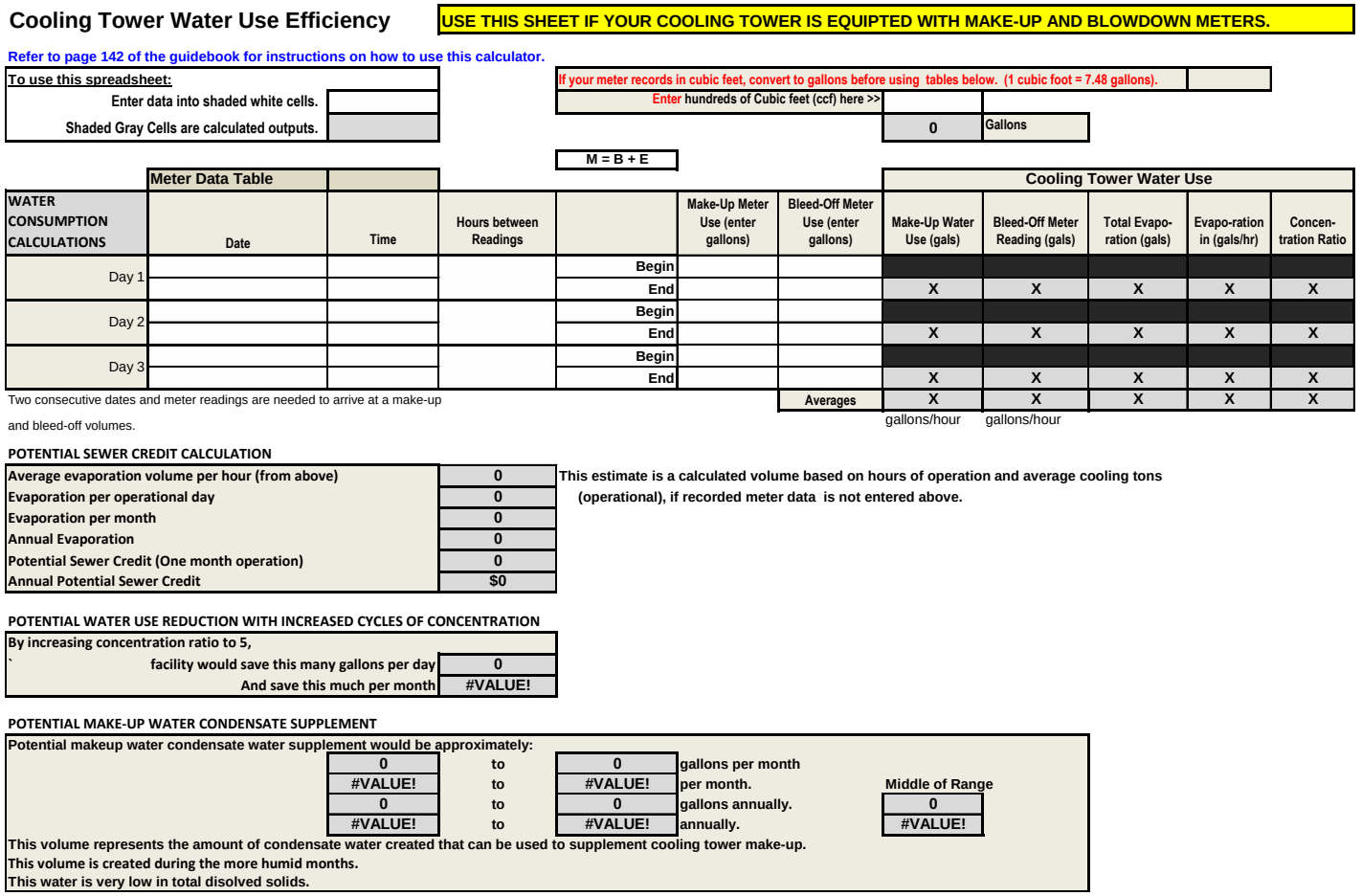
Page 79 of SFWMD manual

Table 14. Water savings from increased concentration ratios in cooling towers.

Before Increasing Cycles	Concentration Ratio After Increasing Cycles											
	2	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**12**	**15**	**20**
1.5	33%	50%	56%	58%	60%	61%	62%	63%	63%	64%	64%	65%
2		25%	33%	38%	40%	42%	43%	44%	44%	45%	46%	47%
3			11%	17%	20%	22%	24%	25%	26%	27%	29%	30%
4				6%	10%	13%	14%	16%	17%	18%	20%	21%
5					4%	7%	9%	10%	11%	13%	14%	16%
6						3%	5%	6%	7%	9%	11%	12%
7							2%	4%	5%	6%	8%	10%
8								2%	3%	5%	6%	8%
9									1%	3%	5%	6%
10										2%	4%	5%
12											2%	4%
15												2%

Increases are expressed as a percentage of total cooling tower water use (Vickers 2001).

Flow Meter Tab



Cooling Tower Water Use Efficiency

USE THIS SHEET IF YOUR COOLING TOWER IS EQUIPTED WITH MAKE-UP AND BLOWDOWN METERS.

Refer to page 142 of the guidebook for instructions on how to use this calculator.

To use this spreadsheet:
Enter data into shaded white cells.
Shaded Gray Cells are calculated outputs.

If your meter records in cubic feet, convert to gallons before using tables below. (1 cubic foot = 7.48 gallons).
Enter hundreds of Cubic feet (ccf) here >> 0 Gallons

M = B + E

WATER CONSUMPTION CALCULATIONS	Meter Data Table: Date	Time	Hours between Readings		Make-Up Meter Use (enter gallons)	Bleed-Off Meter Use (enter gallons)	Cooling Tower Water Use: Make-Up Water Use (gals)	Bleed-Off Meter Reading (gals)	Total Evapo-ration (gals)	Evapo-ration in (gals/hr)	Concen-tration Ratio
Day 1				Begin							
				End			X	X	X	X	X
Day 2				Begin							
				End			X	X	X	X	X
Day 3				Begin							
				End			X	X	X	X	X
				Averages			X	X	X	X	X
							gallons/hour	gallons/hour			

Two consecutive dates and meter readings are needed to arrive at a make-up and bleed-off volumes.

POTENTIAL SEWER CREDIT CALCULATION

Average evaporation volume per hour (from above)	0
Evaporation per operational day	0
Evaporation per month	0
Annual Evaporation	0
Potential Sewer Credit (One month operation)	0
Annual Potential Sewer Credit	$0

This estimate is a calculated volume based on hours of operation and average cooling tons (operational), if recorded meter data is not entered above.

POTENTIAL WATER USE REDUCTION WITH INCREASED CYCLES OF CONCENTRATION

By increasing concentration ratio to 5,
` facility would save this many gallons per day: 0
And save this much per month: #VALUE!

POTENTIAL MAKE-UP WATER CONDENSATE SUPPLEMENT

Potential makeup water condensate water supplement would be approximately:

0	to	0	gallons per month	
#VALUE!	to	#VALUE!	per month.	Middle of Range
0	to	0	gallons annually.	0
#VALUE!	to	#VALUE!	annually.	#VALUE!

This volume represents the amount of condensate water created that can be used to supplement cooling tower make-up.
This volume is created during the more humid months.
This water is very low in total disolved solids.

Conductivity Meter Tab

Cooling Tower Water Use Efficiency

USE THIS SHEET IF YOUR COOLING TOWER IS EQUIPTED WITH CONDUCTIVITY METERS.

Refer to page 142 of the guidebook for instructions on how to use this calculator.

To use this spreadsheet:	
Enter data into shaded white cells.	
Shaded Gray Cells are calculated outputs.	

Enter Meter Input Data			Cooling Tower Water Use			
Date	Make-Up Concen-tration (TDS)	Bleed-off Concen-tration (TDS)	Concen-tration Ratio	Evaporation in gpd	Bleed-off in gpd	Make-up in gpd
			X	X	X	X
			X	X	X	X
			X	X	X	X

POTENTIAL WATER USE REDUCTION WITH INCREASED CYCLES OF CONCENTRATION

By increasing concentration ratio to 5,	
the facility would save this many gallons per day	0
And save this much per month	X

POTENTIAL SEWER CREDIT CALCULATION

Evaporation per operational day	0	This estimate is a calculated volume based on hours of operation and average cooling tons
Evaporation per month	0	(operational), if recorded meter data is not entered above.
Annual Evaporation	0	
Potential Sewer Credit (One month operation)	X	
Potential Sewer Credit (Annual)	X	

POTENTIAL MAKE-UP WATER CONDENSATE SUPPLEMENT

Potential makeup water condensate water supplement would be approximately

					Middle of Range
gallons per month or	0	to	0	per month.	
	X	to	X	per month.	
	0	to	0	gallons annually.	0
	X	to	X	annually.	X

This volume represents the amount of condensate water created that can be used to supplement cooling tower make-up.
This volume is created during the more humid months. In Florida, this would be May through September.
This water is very low in total disolved solids.

8 – Irrigation System Calculator

CATCH CAN RESULTS VERSUS ESTIMATION

Catch Can - Application Rate Calibration

Irrigation System Application Rate Calibration

Refer to page 107 of the manual for guidance using this calculator.

To use this spreadsheet:	
Enter data into shaded white cells.	
Gold cells contain dropdown menues.	Select One
Shaded Gray Cells are calculated outputs.	

Use this calculator if you are determining the irrigation application rate.

1 - Select the Desired Application Depth in cell F:16 (below).
3- Select the number of Minutes of runtime for each zone in the "Catch-Can Irrigation Rate Determination" table below.
2 - Using the "Inches to Decimal" table at the left (below) identify the decimal value for the average measured depth.
4- Enter the average water depth in the catch-cans in the "Catch-Can Irrigation Rate Determination" table below.

Water depth should have been measured at least to the eighth of an inch.

1. Select the Desired Application Depth: 1/2 Inch

2.

Catch-Can Irrigation Rate Determination				
	Minutes of runtime for this zone*	Average water depth in catch-can (in inches)	Application Rate (inches per hour)	Set the Zone to Run for this Time (Mins)
Zone 1	15	3/8	1.5	20
Zone 2	30	3/8	0.8	40
Zone 3	Select One	Select One	X	X
Zone 4	Select One	Select One	X	X
Zone 5	Select One	Select One	X	X
Zone 6	Select One	Select One	X	X
Zone 7	Select One	Select One	X	X
Zone 8	Select One	Select One	X	X
Zone 9	Select One	Select One	X	X
Zone 10	Select One	Select One	X	X
Zone 11	Select One	Select One	X	X
Zone 12	Select One	Select One	X	X

*This is how long the zone was running while the cups were filling with water.

Manual Calculations – Estimate ideal use and compare with actual

Determine ideal irrigation volume (e.g. 1”/week) for time period that data is available

Determine area irrigated

Multiply area by desired application to determine necessary volume

Compare necessary volume with actual use

- Sub-meter or Calculator 2

Unit conversions

Example

- 1” per week desired over 2 acres = (1/12)*(43,560 SF * 2) = 7,260 CF/week
- 7,260 CF/week = 54,309 gallons/week
- Compare with actual application

Other Efforts

Requested resources from Rain Bird for estimating potential water savings

Contacted UMN Extension (Sam Bauer) for estimating potential water savings

Literature values

- Rain sensors – 13 – 34% under various weather conditions
- Soil moisture sensors – 69 – 92% under various weather conditions
- All maintained acceptable turf grass quality
  - Cardenas-Lailhacar and Dukes 2008; Cardenas-Lailhacar et al., 2008; Cardenas-Lailhacar et al., 2010

9 – Water Use Summary Calculator

SFWMD AND CUSTOM VERSIONS

9 – Water Use Summary Calculator

Utility rate data input

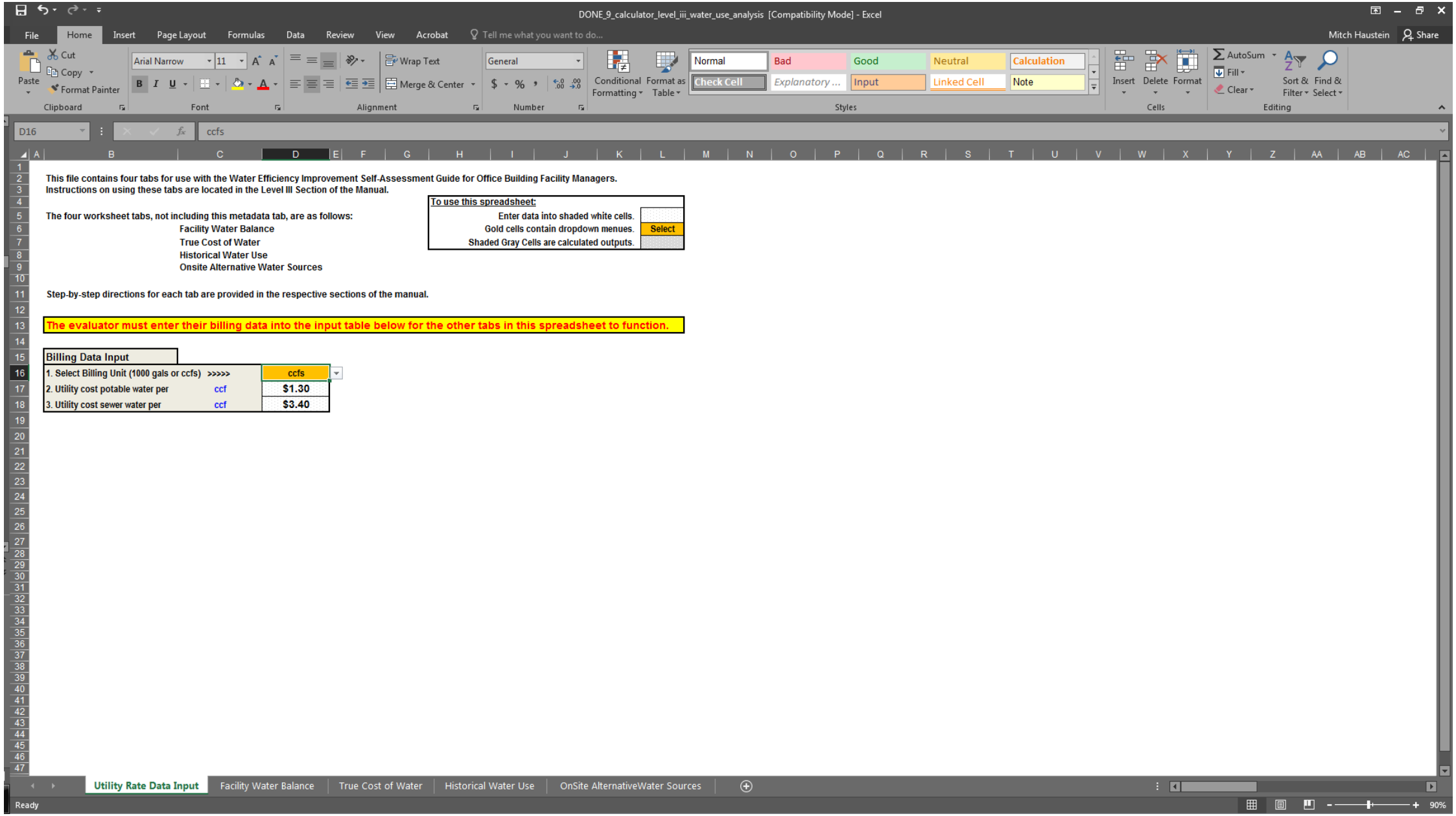
Facility water balance

True cost of water

Historical water use

On-site alternative water sources

- Cooling tower condensate water
- Rainwater harvesting from rooftops
  - Need to add local annual rainfall value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AutoSum
Fill
Clear
Sort & Filter
Find & Select
Editing
D16
ccfs
This file contains four tabs for use with the Water Efficiency Improvement Self-Assessment Guide for Office Building Facility Managers.
Instructions on using these tabs are located in the Level III Section of the Manual.
To use this spreadsheet:
Enter data into shaded white cells.
Gold cells contain dropdown menues.
Select
Shaded Gray Cells are calculated outputs.
The four worksheet tabs, not including this metadata tab, are as follows:
Facility Water Balance
True Cost of Water
Historical Water Use
Onsite Alternative Water Sources
Step-by-step directions for each tab are provided in the respective sections of the manual.
The evaluator must enter their billing data into the input table below for the other tabs in this spreadsheet to function.
Billing Data Input
1. Select Billing Unit (1000 gals or ccfs) >>>>>
ccfs
2. Utility cost potable water per
ccf
$1.30
3. Utility cost sewer water per
ccf
$3.40
Utility Rate Data Input
Facility Water Balance
True Cost of Water
Historical Water Use
OnSite AlternativeWater Sources
Ready
90%

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Facility Water Balance

Refer to page 154 of the guidebook for instructions on how to use this calculator.

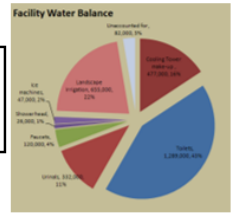
To use this spreadsheet:

Enter data into shaded white cells.

Shaded Gray Cells are calculated outputs.

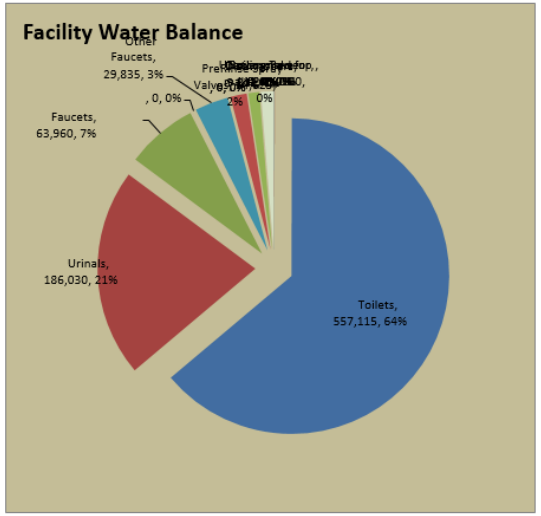
1. Enter the number of gallons used for each use category in the table below.
The graph below will be created as table is populated.

Your chart will resemble the example at the right after you have entered values into the table at the left.



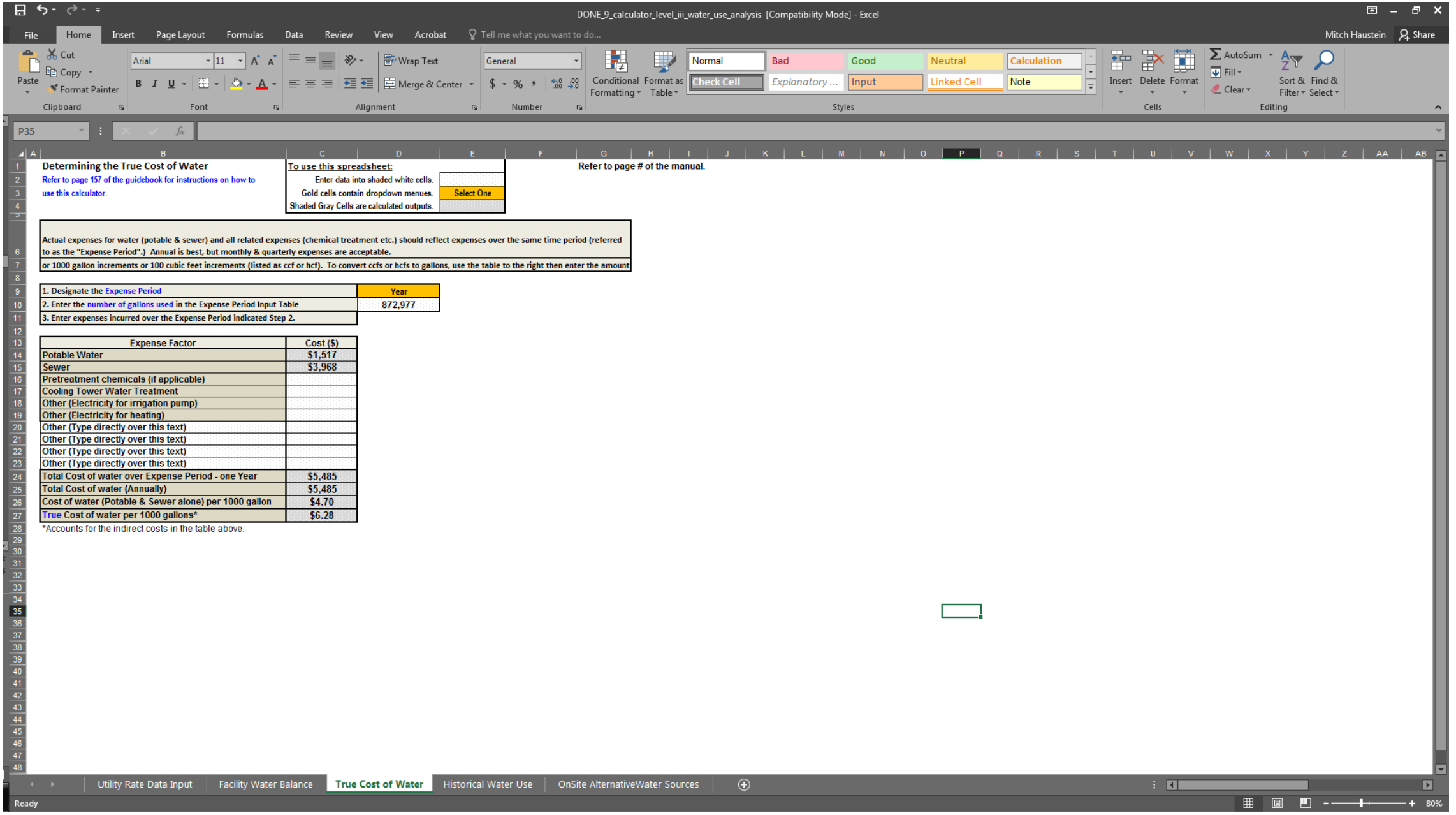
Water Use	Gallons per year	
Boiler make-up	260	5 gal/week
Cooling Tower make-up	100	
Processes and equipment Operations		
Steamcleaning	0	
Materials transport	0	
Domestic (restrooms, breakrooms)		
Toilets	557,115	
Urinals	186,030	
Faucets	63,960	
Showerhead	0	
Other Faucets	29,835	
Residential Dishwasher	0	
Commercial-Grade Kitchen		
PreRinse Spray Valves	14,625	
Dishwashers	9,812	
Steam Cookers	0	
Combination Ovens	0	
Ice machines	0	
Commercial Clothes washers	0	
Vehicle fleet wash	0	
Once-through cooling	0	
Landscape Irrigation	0	
Breakroom water use	0	
Other (Type directly over this text)		
Other (Type directly over this text)		
Other (Type directly over this text)		
Other (Type directly over this text)		
Other (Type directly over this text)		
Other (Type directly over this text)		
Other (Type directly over this text)		
Other (Type directly over this text)		
Known leaks	0	
Total	861,737	
*Water purchased + well pumpage	872,977	
Unaccounted for	11,240	1.29%

*Enter Metered Volume



Utility Rate Data Input | Facility Water Balance | True Cost of Water | Historical Water Use | OnSite AlternativeWater Sources

Ready


DONE_9_calculator_level_iii_water_use_analysis [Compatibility Mode] - Excel
Determining the True Cost of Water
Refer to page 157 of the guidebook for instructions on how to use this calculator.
To use this spreadsheet:
Enter data into shaded white cells.
Gold cells contain dropdown menues.
Select One
Shaded Gray Cells are calculated outputs.
Refer to page # of the manual.
Actual expenses for water (potable & sewer) and all related expenses (chemical treatment etc.) should reflect expenses over the same time period (referred to as the "Expense Period".) Annual is best, but monthly & quarterly expenses are acceptable.
or 1000 gallon increments or 100 cubic feet increments (listed as ccf or hcf). To convert ccfs or hcfs to gallons, use the table to the right then enter the amount
1. Designate the Expense Period
Year
2. Enter the number of gallons used in the Expense Period Input Table
872,977
3. Enter expenses incurred over the Expense Period indicated Step 2.
Expense Factor
Cost ($)
Potable Water
$1,517
Sewer
$3,968
Pretreatment chemicals (if applicable)
Cooling Tower Water Treatment
Other (Electricity for irrigation pump)
Other (Electricity for heating)
Other (Type directly over this text)
Other (Type directly over this text)
Other (Type directly over this text)
Other (Type directly over this text)
Total Cost of water over Expense Period - one Year
$5,485
Total Cost of water (Annually)
$5,485
Cost of water (Potable & Sewer alone) per 1000 gallon
$4.70
True Cost of water per 1000 gallons*
$6.28
*Accounts for the indirect costs in the table above.
Utility Rate Data Input
Facility Water Balance
True Cost of Water
Historical Water Use
OnSite AlternativeWater Sources
Ready

DONE_9_calculator_level_iii_water_use_analysis [Compatibility Mode] - Excel

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Clipboard Font Alignment Number Styles Cells Editing

D13 315

Historical Water Use Profile

Refer to page 160 of the guidebook for instructions on how to use this calculator.

To use this spreadsheet:	
Enter data into shaded white cells.	
Shaded Gray Cells are calculated outputs.	

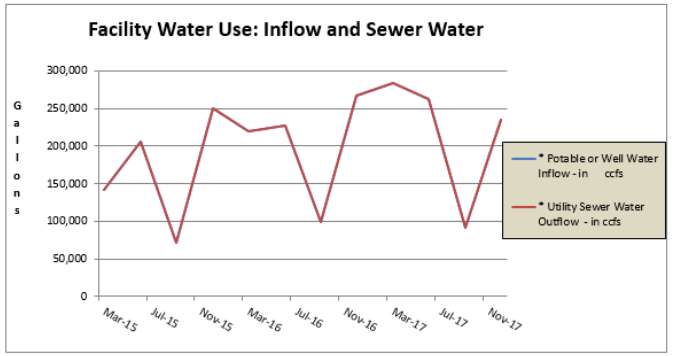
1. Enter data for all columns for which information can be acquired into the Historical Water Use Data Input Table.	
3. Enter the name of your water-related expenses	Campus
2. Examine the graphs below the tables.	

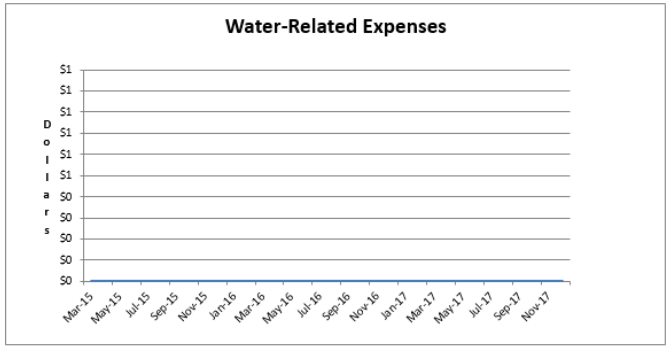
Enter consumption directly from your bill, either in ccfs or 1000 gallon increments. The output in the charts will be in gallons.

Historical Water Use Data Input

*^Date	* Potable or Well Water Inflow - in ccfs	* Utility Sewer Water Outflow - in ccfs	Campus
Dec-17	315	315	
Sep-17	122	122	
Jun-17	350	350	
Mar-17	380	380	
Dec-16	358	358	
Sep-16	133	133	
Jun-16	303	303	
Mar-16	293	293	
Dec-15	334	334	
Sep-15	96	96	
Jun-15	276	276	
Mar-15	189	189	

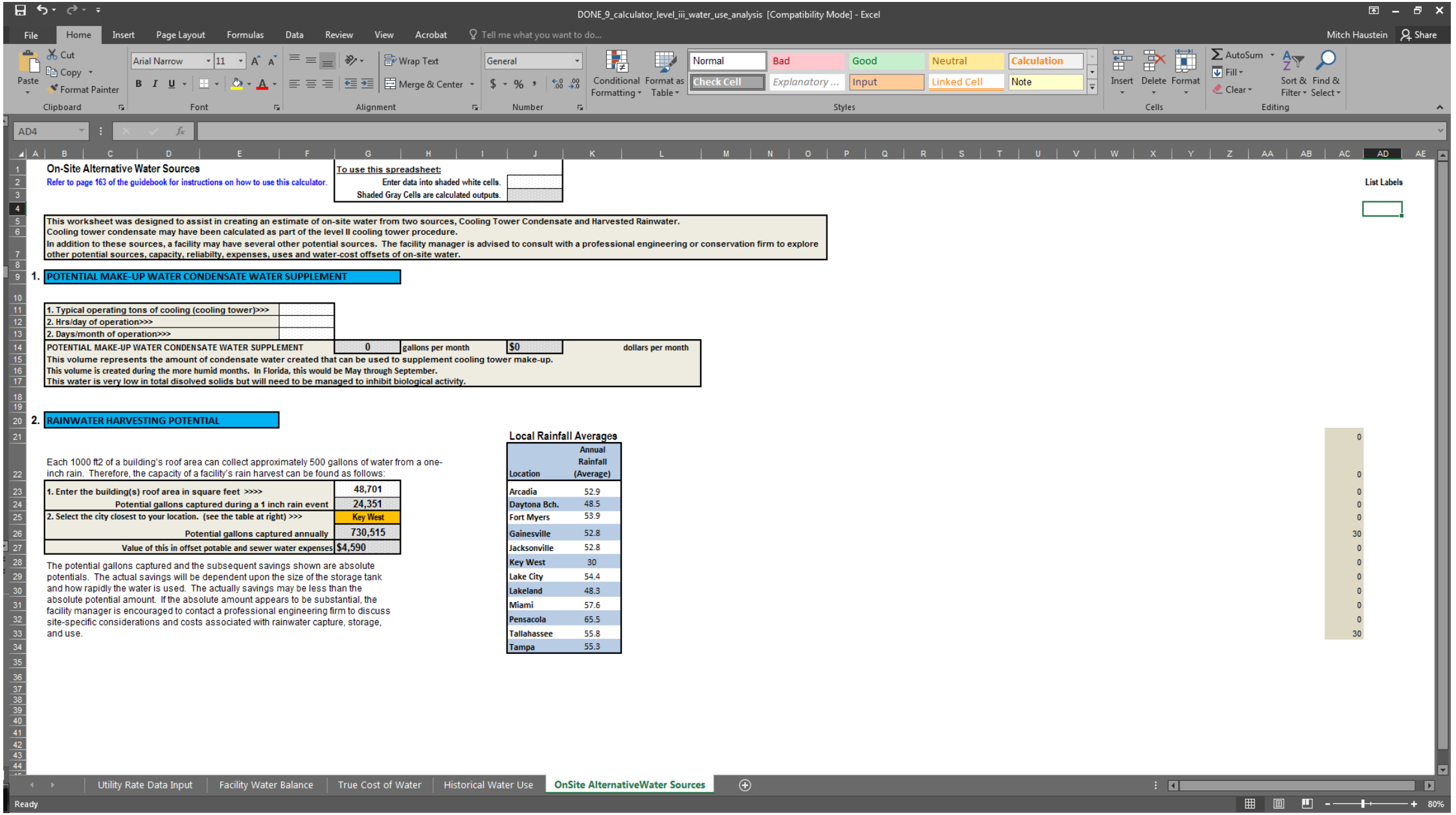
*Required columns.
^ Date must be entered as a three-letter month abreviation and two-digit year. Example Mar-08





Utility Rate Data Input | Facility Water Balance | True Cost of Water | Historical Water Use | OnSite AlternativeWater Sources

Ready Average: 292 Count: 4 Sum: 1,167 80%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AD4
On-Site Alternative Water Sources
Refer to page 163 of the guidebook for instructions on how to use this calculator.
To use this spreadsheet:
Enter data into shaded white cells.
Shaded Gray Cells are calculated outputs.
List Labels
This worksheet was designed to assist in creating an estimate of on-site water from two sources, Cooling Tower Condensate and Harvested Rainwater.
Cooling tower condensate may have been calculated as part of the level II cooling tower procedure.
In addition to these sources, a facility may have several other potential sources. The facility manager is advised to consult with a professional engineering or conservation firm to explore other potential sources, capacity, reliabilty, expenses, uses and water-cost offsets of on-site water.
1. POTENTIAL MAKE-UP WATER CONDENSATE WATER SUPPLEMENT
1. Typical operating tons of cooling (cooling tower)>>>
2. Hrs/day of operation>>>
2. Days/month of operation>>>
POTENTIAL MAKE-UP WATER CONDENSATE WATER SUPPLEMENT
0
gallons per month
$0
dollars per month
This volume represents the amount of condensate water created that can be used to supplement cooling tower make-up.
This volume is created during the more humid months. In Florida, this would be May through September.
This water is very low in total disolved solids but will need to be managed to inhibit biological activity.
2. RAINWATER HARVESTING POTENTIAL
Each 1000 ft2 of a building's roof area can collect approximately 500 gallons of water from a one-inch rain. Therefore, the capacity of a facility's rain harvest can be found as follows:
1. Enter the building(s) roof area in square feet >>>>
48,701
Potential gallons captured during a 1 inch rain event
24,351
2. Select the city closest to your location. (see the table at right) >>>
Key West
Potential gallons captured annually
730,515
Value of this in offset potable and sewer water expenses
$4,590
The potential gallons captured and the subsequent savings shown are absolute potentials. The actual savings will be dependent upon the size of the storage tank and how rapidly the water is used. The actually savings may be less than the absolute potential amount. If the absolute amount appears to be substantial, the facility manager is encouraged to contact a professional engineering firm to discuss site-specific considerations and costs associated with rainwater capture, storage, and use.
Local Rainfall Averages
Location
Annual Rainfall (Average)
Arcadia 52.9
Daytona Bch. 48.5
Fort Myers 53.9
Gainesville 52.8
Jacksonville 52.8
Key West 30
Lake City 54.4
Lakeland 48.3
Miami 57.6
Pensacola 65.5
Tallahassee 55.8
Tampa 55.3
0
0
0
0
30
0
0
0
0
0
30
Utility Rate Data Input
Facility Water Balance
True Cost of Water
Historical Water Use
OnSite AlternativeWater Sources
Ready
80%

Custom Version

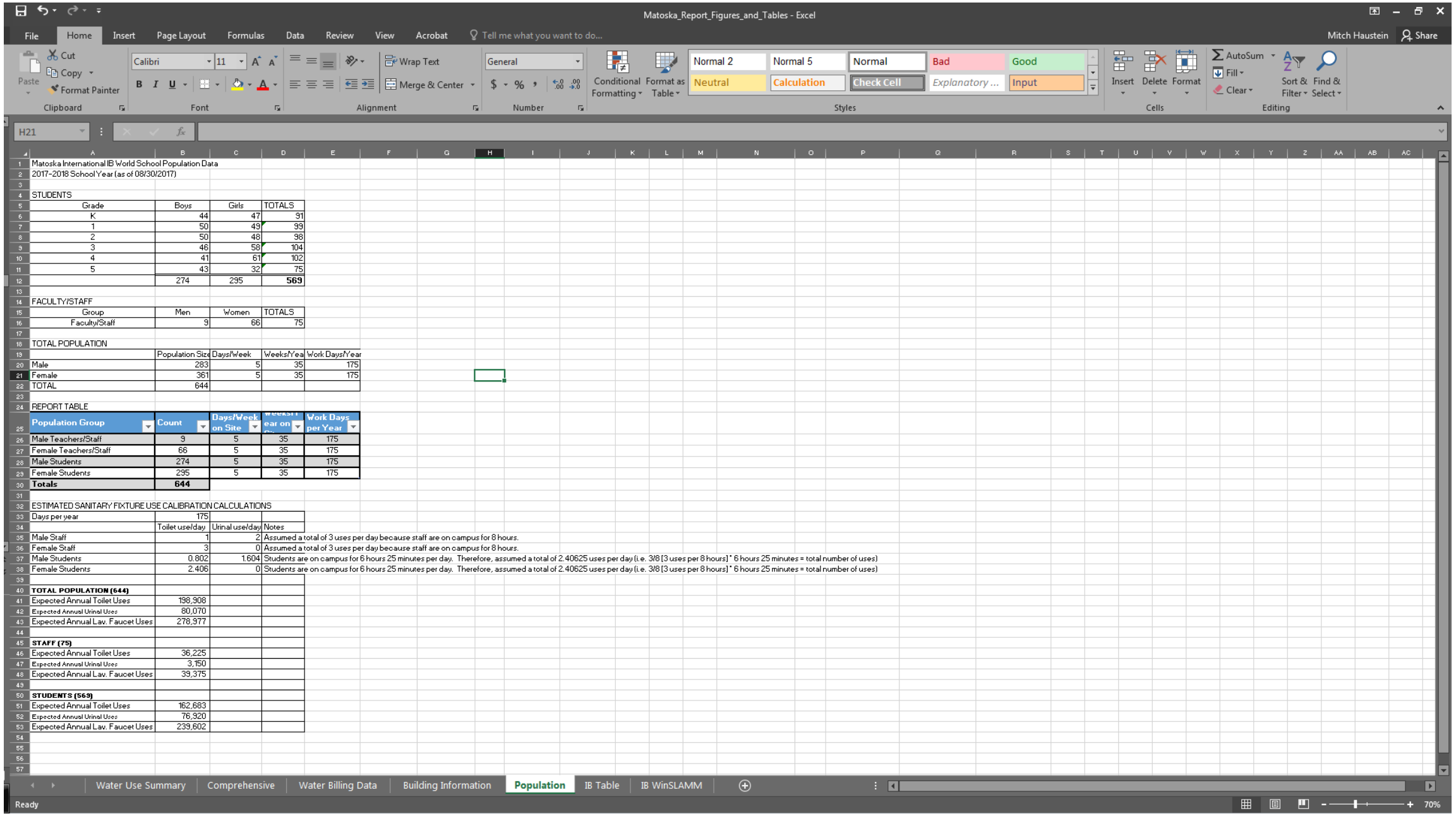
Population data

Building information

Water billing data

Comprehensive ranking table

Water use summary



Matoska_Report_Figures_and_Tables - Excel

Matoska International IB World School Population Data
2017-2018 School Year (as of 08/30/2017)

STUDENTS

Grade	Boys	Girls	TOTALS
K	44	47	91
1	50	49	99
2	50	48	98
3	46	58	104
4	41	61	102
5	43	32	75
	274	295	**569**

FACULTY/STAFF

Group	Men	Women	TOTALS
Faculty/Staff	9	66	75

TOTAL POPULATION

	Population Size	Days/Week	Weeks/Year	Work Days/Year
Male	283	5	35	175
Female	361	5	35	175
TOTAL	644			

REPORT TABLE

Population Group	Count	Days/Week on Site	Weeks/Year on Site	Work Days per Year
Male Teachers/Staff	9	5	35	175
Female Teachers/Staff	66	5	35	175
Male Students	274	5	35	175
Female Students	295	5	35	175
Totals	**644**			

ESTIMATED SANITARY FIXTURE USE CALIBRATION CALCULATIONS

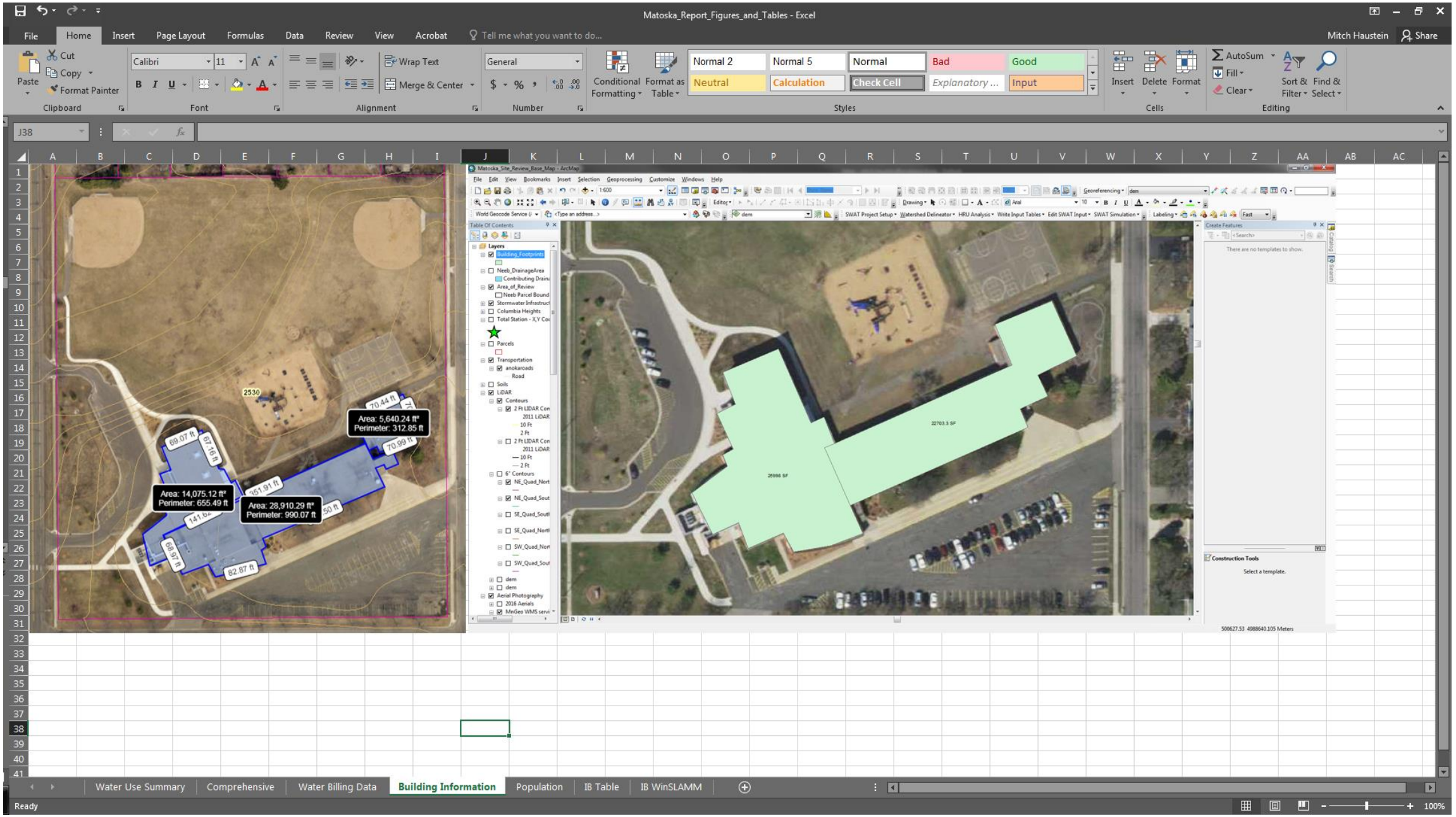
Days per year: 175

	Toilet use/day	Urinal use/day	Notes
Male Staff	1	2	Assumed a total of 3 uses per day because staff are on campus for 8 hours.
Female Staff	3	0	Assumed a total of 3 uses per day because staff are on campus for 8 hours.
Male Students	0.802	1.604	Students are on campus for 6 hours 25 minutes per day. Therefore, assumed a total of 2.40625 uses per day (i.e. 3/8 [3 uses per 8 hours] * 6 hours 25 minutes = total number of uses)
Female Students	2.406	0	Students are on campus for 6 hours 25 minutes per day. Therefore, assumed a total of 2.40625 uses per day (i.e. 3/8 [3 uses per 8 hours] * 6 hours 25 minutes = total number of uses)

TOTAL POPULATION (644)	
Expected Annual Toilet Uses	198,908
Expected Annual Urinal Uses	80,070
Expected Annual Lav. Faucet Uses	278,977
STAFF (75)	
Expected Annual Toilet Uses	36,225
Expected Annual Urinal Uses	3,150
Expected Annual Lav. Faucet Uses	39,375
STUDENTS (563)	
Expected Annual Toilet Uses	162,683
Expected Annual Urinal Uses	76,920
Expected Annual Lav. Faucet Uses	239,602

Water Use Summary | Comprehensive | Water Billing Data | Building Information | Population | IB Table | IB WinSLAMM

Ready


Matoska_Report_Figures_and_Tables - Excel
Area: 5,640.24 ft²
Perimeter: 312.85 ft
Area: 14,075.12 ft²
Perimeter: 655.49 ft
Area: 28,910.29 ft²
Perimeter: 990.07 ft
Water Use Summary
Comprehensive
Water Billing Data
Building Information
Population
IB Table
IB WinSLAMM
Ready

Matoska_Report_Figures_and_Tables - Excel

Time Period	YEAR/QUARTER	QUARTER	Reading	Units Used
June - Sept 15	2015	3*	1596	
Sept15-Dec 15	2015	4	1930	334
Dec 15-Mar 16	2016	1	2223	293
Mar-June 16	2016	2	2526	303
June - Sept 16*	2016	3*	2659	133
Sept-Dec 16	2016	4	3017	358
Dec 16-Mar 17	2017	1	3397	380
Mar-June 17	2017	2	3747	350
June-Sep 17*	2017	3*	3869	122
Sep 17-Dec 17	2017	4	4184	315

*Summer months - no school in session

COST PER CFF (748.052 GALLONS)

Sewer	$ 3.40
Water	$ 1.30

ANNUAL USE

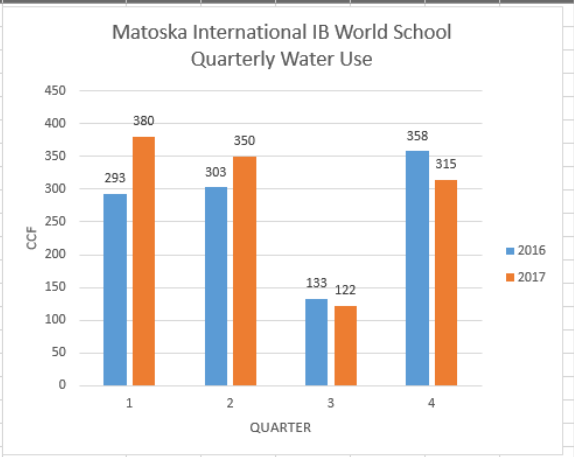
YEAR	CCF	GALLONS	$	
2016	1087	813133	$ 5,108.90	
2017	1167	872977	$ 5,484.90	
DIFFERENCE	80	59844	$ 376.00	7.36%

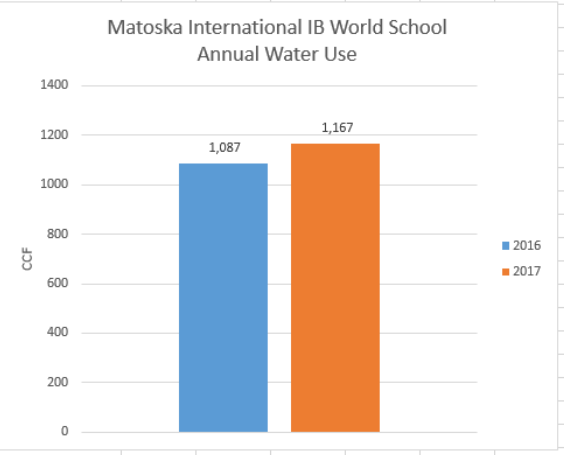
SCHOOL-YEAR USE

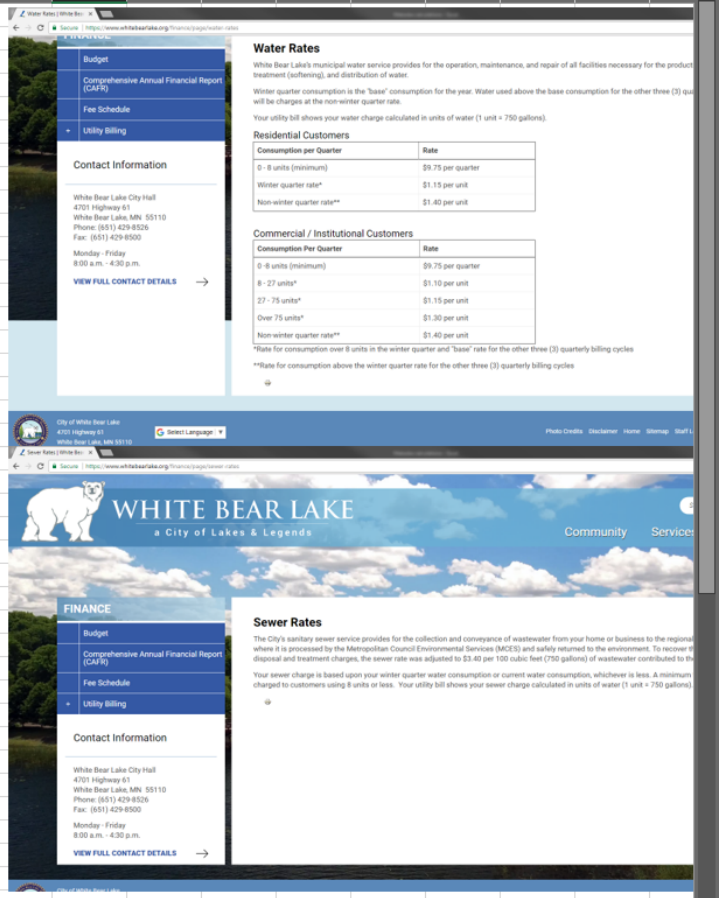
YEAR	CCF	GALLONS	$	%
2015-2016	930	695688	$ 4,371.00	
2016-2017	1088	813881	$ 5,113.60	
DIFFERENCE	158	118192	$ 742.60	16.99%

GALLONS PER PERSON PER DAY

TIMEFRAME	CCF	GALLONS	POPULATION	DAYS	GALLONS/PERSON/DAY
2016	1087	813133	644	175	7.22
2017	1167	872977	644	175	7.75

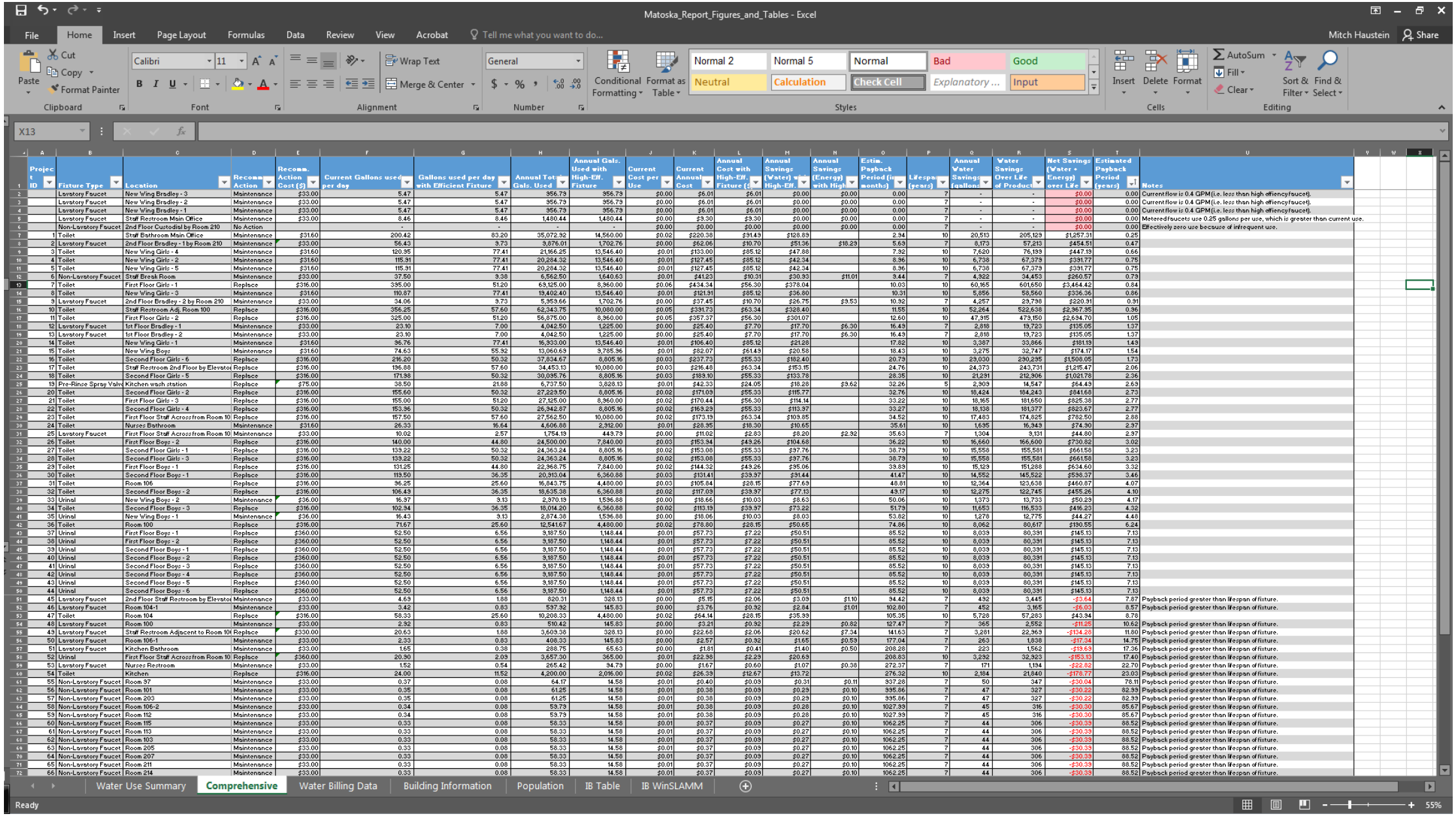






Water Use Summary | Comprehensive | Water Billing Data | Building Information | Population | IB Table | IB WinSLAMM

Ready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11
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General
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Input
Insert
Delete
Format
AutoSum
Fill
Clear
Sort & Filter
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Clipboard
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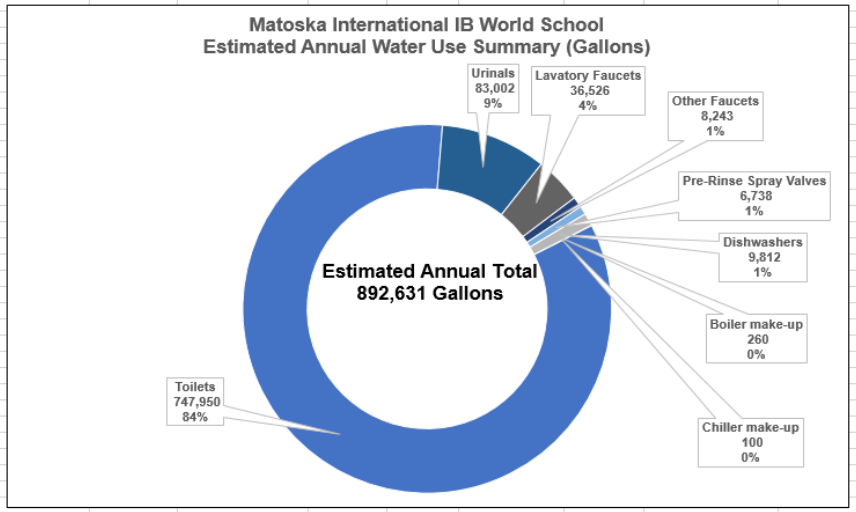
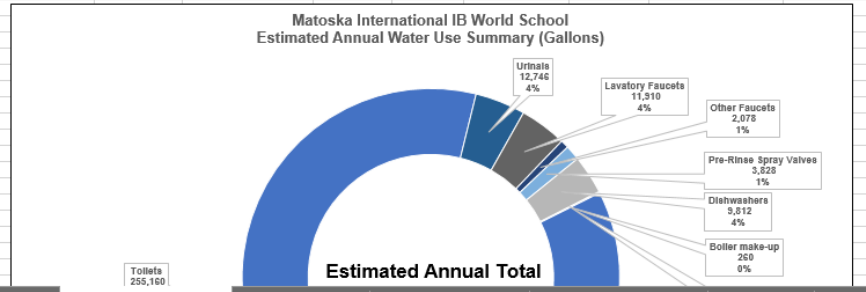
Number
Styles
Cells
Editing
X13
Water Use Summary
Comprehensive
Water Billing Data
Building Information
Population
IB Table
IB WinSLAMM
Ready
55%

Matoska_Report_Figures_and_Tables - Excel

	Boiler make-up	Chiller make-up	Toilets	Urinals	Lavatory Faucets	Other Faucets	Pre-Rinse Spray Valves	Dishwashers	TOTAL
CALIBRATED	260	100	747,950	83,002	36,526	8,243	6,738	9,812	892,631
	Boiler make-up	Chiller make-up	Toilets	Urinals	Lavatory Faucets	Other Faucets	Pre-Rinse Spray Valves	Dishwashers	TOTAL
HIGH-EFFICIENCY	260	100	255,160	12,746	11,910	2,078	3,828	9,812	295,894





Column1	Column2
2017 Water Bill Total (gallons)	872,977
Estimated Total (gallons)	892,631
Unaccounted for (gallons)	(19,654)
% Unaccounted for	-2.25%

Sep 17 - Dec 17	315
June-Sep 17	122
Mar-June 17	350
Dec 16-Mar 17	380
Total CCF	1167
Total Gallons	872977

School hours are 9:15 AM - 3:40 PM
Office hours are 7:45 AM - 4:15 PM

Therefore,
Students on campus 6 hours 25 minutes
Staff on campus 8 hours 30 minutes

Average number of times a restroom is used (urinal + toilet) per day (8 hour day) is 3.0

Therefore,
Students use restroom 2.40625 times per day
Staff use restroom 3 times per day (assume not all staff are there for the full 8.5 hours)

CALIBRATION OPTIONS

Modify number of uses
Modify flushing time on toilets by correction factor
Modify number of urinal uses to reflect entire bank of flushing urinals

CALIBRATION CALCULATIONS		
	Toilet use/day	Urinal use/day
Male Staff	1	2
Female Staff	3	0
Male Students	0.802083333	1.604166667
Female Students	2.40625	0
TOTAL POPULATION		
Expected Annual Toilet Uses	198908	
Expected Annual Urinal Uses	80070	
Expected Annual Lav. Faucet Uses	278977	
STAFF		
Expected Annual Toilet Uses	36225	
Expected Annual Urinal Uses	3150	
Expected Annual Lav. Faucet Uses	39375	
STUDENTS		
Expected Annual Toilet Uses	162683	
Expected Annual Urinal Uses	76920	
Expected Annual Lav. Faucet Uses	239602	

Water Use Summary | Comprehensive | Water Billing Data | Building Information | Population | IB Table | IB WinSLAMM

Ready

Cost Estimation Spreadsheet

Review with facility manager

Large equipment will require custom cost estimates

Category	Project	Description	Materials Cost ($)	Labor (hrs)	Labor Cost ($)	Total Cost ($)	Lifespan (years)
Boiler		wide range of costs				$0	
Commercial-Grade	Clothes Washer		$4,000			$4,000	
Commercial-Grade	Combination Oven					$0	
Commercial-Grade	Dipper Well		$150			$150	10
Commercial-Grade	Dishwasher	conveyor dishwasher - wide cost range	$15,000	3	$180	$15,180	10
Commercial-Grade	Food Disposal		$1,200			$1,200	10
Commercial-Grade	Ice Machine	Commercial Undercounter - wide cost range	$2,500			$2,500	
Commercial-Grade	Pre-Rinse Spray Valve		$60	0.25	$15	$75	5
Commercial-Grade	Steam Cooker	wide cost range	$5,000			$5,000	
Commercial-Grade	Steam Kettle	wide cost range	$6,000			$6,000	
Commercial-Grade	Wash-Down Sprayer		$120			$120	
Commercial-Grade	Wok Stove					$0	
Cooling Tower		huge range of costs	$50,000			$50,000	
Outdoor	Irrigation Audit	EPA WaterSense-Certified irrigation audit	$2,000	6.25	$375	$2,375	
Outdoor	Irrigation Controller	EPA WaterSense-Certified irrigation controller	$529			$529	
Residential-Grade	Clothes Washer	DOE EnergyStar-Certified Clothes Washer	$679			$679	10
Residential-Grade	Dishwasher		$700			$700	10
Residential-Grade	Ice Machine		$1,000			$1,000	
Sanitary	Faucet	EPA WaterSense-Certified faucet	$300	0.5	$30	$330	7
Sanitary	Faucet Aerator	EPA WaterSense-Certified Faucet Aerator	$4	0.1	$10	$14	7
Sanitary	Showerhead	EPA WaterSense-Certified showerhead	$50	0.25	$15	$65	10
Sanitary	Toilet	EPA WaterSense-Certified toilet	$256	1	$60	$316	10
Sanitary	Urinal	EPA WaterSense-Certified urinal	$300	1	$60	$360	10

Review Completed Matoska International IB World School Report

EXAMPLE REPORT

Report Organization

Executive Summary

CGCP Overview

Campus Description

Screening Tool Results

Current Water Use Analysis

Potential Water Conservation Projects

Water Conservation Opportunity Summary

On-Site Groundwater Recharge Opportunities

On-Site Water Reuse Opportunities

Conclusion

References

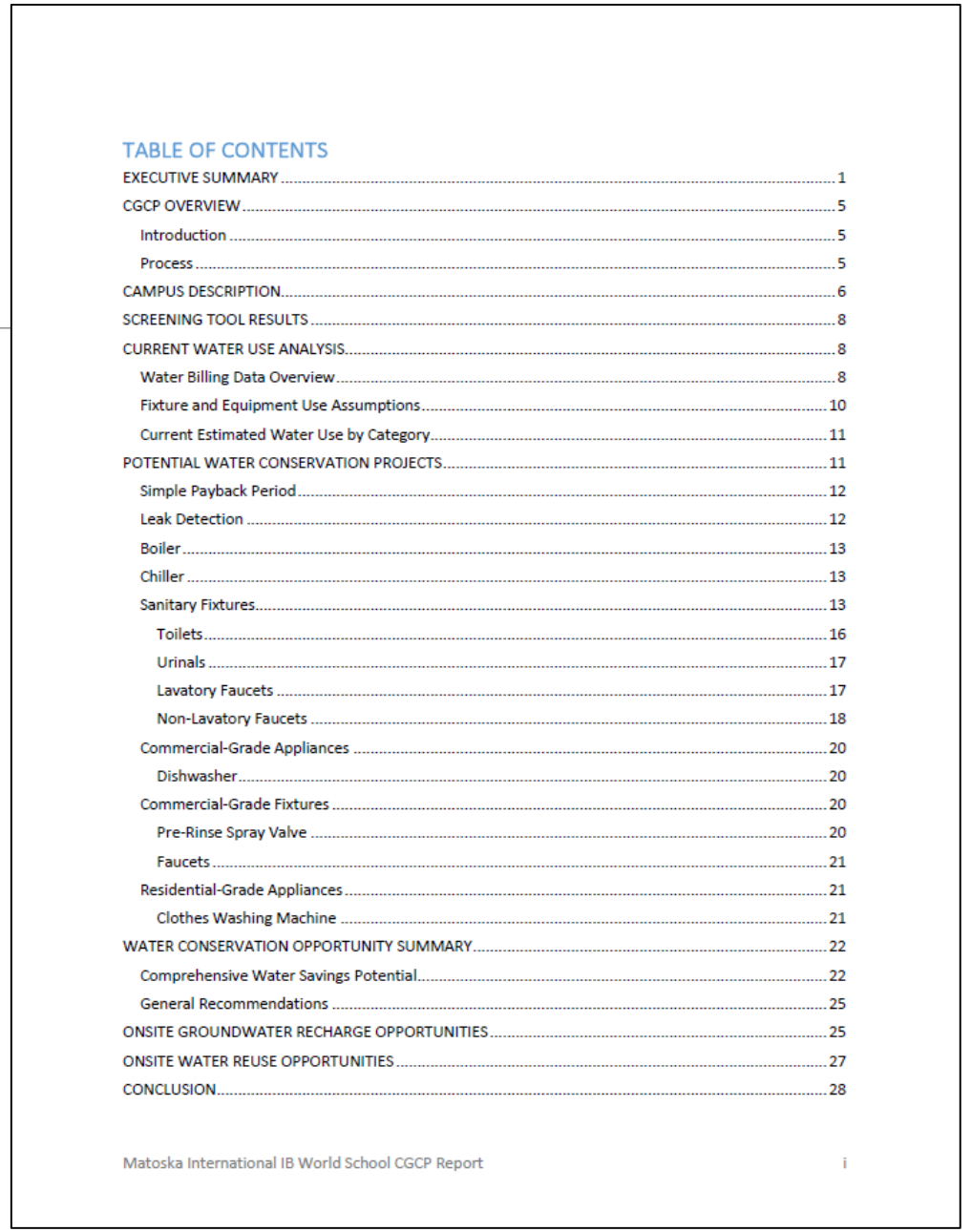


TABLE OF CONTENTS

Other Potential Deliverables

On-site data collection forms

Spreadsheet calculators

- Case-by-case basis
- Brief introduction/training provided to staff interested in using spreadsheets

Pictures

Invoicing Note

EXAMPLE INVOICE

CGCP Invoicing

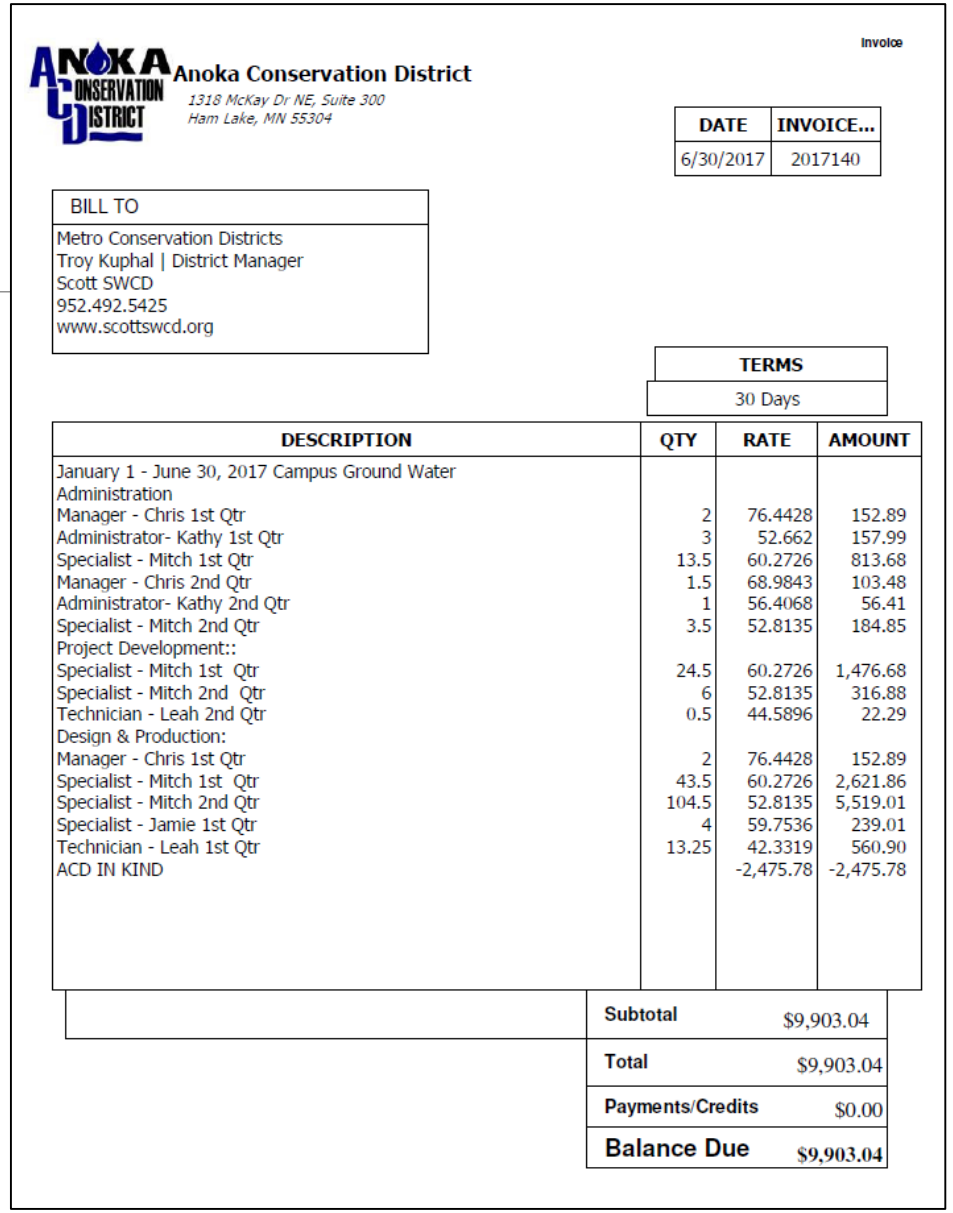
Submit invoices to ACD

Invoices addressed to Scott SWCD because they are the fiscal agent (ACD is the host)

Rates determined by BWSR rate calculator

Follow example invoice format

- Include staff name – simplifies future grant reconciliation
- Include grant activity (i.e. Program Implementation)
- Document match – 20% of total amount (or 25% of the grant funds)



Invoice

Anoka Conservation District
1318 McKay Dr NE, Suite 300
Ham Lake, MN 55304

DATE	INVOICE...
6/30/2017	2017140

BILL TO
Metro Conservation Districts
Troy Kuphal | District Manager
Scott SWCD
952.492.5425
www.scottswcd.org

TERMS
30 Days

DESCRIPTION	QTY	RATE	AMOUNT
January 1 - June 30, 2017 Campus Ground Water			
Administration			
Manager - Chris 1st Qtr	2	76.4428	152.89
Administrator- Kathy 1st Qtr	3	52.662	157.99
Specialist - Mitch 1st Qtr	13.5	60.2726	813.68
Manager - Chris 2nd Qtr	1.5	68.9843	103.48
Administrator- Kathy 2nd Qtr	1	56.4068	56.41
Specialist - Mitch 2nd Qtr	3.5	52.8135	184.85
Project Development::			
Specialist - Mitch 1st Qtr	24.5	60.2726	1,476.68
Specialist - Mitch 2nd Qtr	6	52.8135	316.88
Technician - Leah 2nd Qtr	0.5	44.5896	22.29
Design & Production:			
Manager - Chris 1st Qtr	2	76.4428	152.89
Specialist - Mitch 1st Qtr	43.5	60.2726	2,621.86
Specialist - Mitch 2nd Qtr	104.5	52.8135	5,519.01
Specialist - Jamie 1st Qtr	4	59.7536	239.01
Technician - Leah 1st Qtr	13.25	42.3319	560.90
ACD IN KIND		-2,475.78	-2,475.78

Subtotal	$9,903.04
Total	$9,903.04
Payments/Credits	$0.00
Balance Due	**$9,903.04**

End of Training #2

THANKS

Campus Groundwater Conservation Planning (CGCP) Protocol Review and Refinement Meeting

MONDAY, FEBRUARY 25TH, 2019

1:00 – 1:10 **CGCP Update**
- Selected campuses
- Budget status
- Discuss allocation of remaining funds

1:10 – 1:20 **General Successes and Recommendations**
- On-site data collection
- Data processing - spreadsheets

1:20 – 2:30 **General Challenges**
- Preparing for on-site data collection
- Utility rates
- Leak tests
- Estimating population/usage and calibrating calculators
- Fixtures and equipment (e.g. drinking fountains and dual-flush toilets)
- Maintenance versus replacement
- Cooling towers
- Irrigation systems
- Infiltration opportunities

2:30 – 3:00 **Specific Questions**

3:00 **End**

CGCP Update

Selected Campuses

5 government campuses

2 community colleges

2 high schools

4 elementary schools

County	Campus	City	Grant Funds	Match Funds
Anoka	Anoka-Ramsey Community College	Coon Rapids	$12,000.00	$3,000.00
Carver	Carver County Government Center	Chaska	$12,000.00	$3,000.00
Chisago	Rush City High School	Rush City	$12,000.00	$3,000.00
Dakota	Dakota County Western Service Center	Apple Valley	$12,000.00	$3,000.00
Hennepin	Hopkins High School	Minnetonka	$9,697.50	$3,232.50
Isanti	Anoka-Ramsey Community College	Cambridge	$9,000.00	$2,250.00
Isanti	City of Isanti City Hall and Community Center	Isanti	$3,000.00	$750.00
RCD	Matoska International IB World School	White Bear Lake	$2,984.02	$746.01
RCD	Vadnais Heights Elementary School	Vadnais Heights	$9,015.98	$2,254.00
Scott	Jordan Elementary	Jordan	$5,880.32	$1,470.08
Scott	Eagle Creek Elementary	Shakopee	$5,880.32	$1,470.08
Sherburne	Elk River Municipal Buildings	Elk River	$5,000.00	$1,250.00
WCD	Central Park and R.H. Stafford Library	Woodbury	$12,000.00	$3,000.00
Wright	TBD	TBD	$12,000.00	$3,000.00

Budget Update

County	Remaining Grant Funds	Remaining Match Funds
Anoka	$0.00	$0.00
Carver	$0.00	$0.00
Chisago	$0.00	$0.00
Dakota	$0.00	$0.00
Hennepin	$2,302.50	-$232.50
Isanti	$0.00	$0.00
RCD	$0.00	$0.00
Scott	$239.36	$59.84
Sherburne	$7,000.00	$1,750.00
WCD	$0.00	$0.00
Wright	$0.00	$0.00
TOTAL	**$9,541.86**	**$1,577.34**

Remaining Funds

Do any counties have additional campuses to analyze?

Suggestions for determining allocation of funds

Successes and Recommendations

General Successes Shared

On-site data collection

- Relatively quick
- Staff have been accommodating and interested
- Flow bag measurement accuracy
- Others?

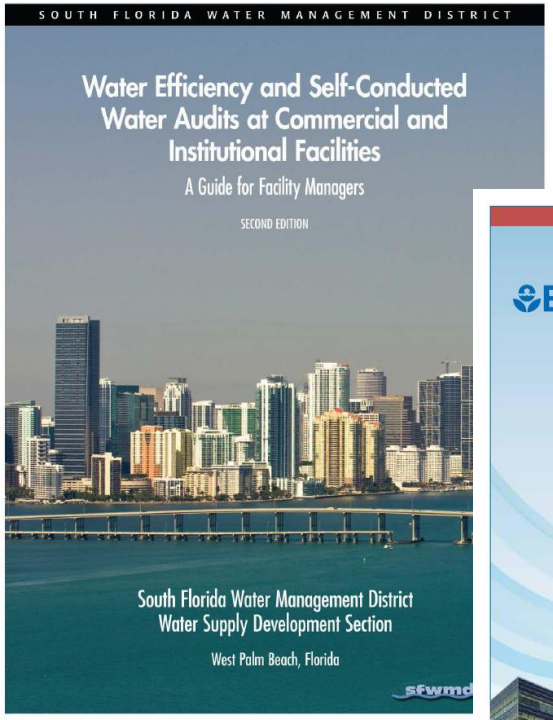
General Successes Shared

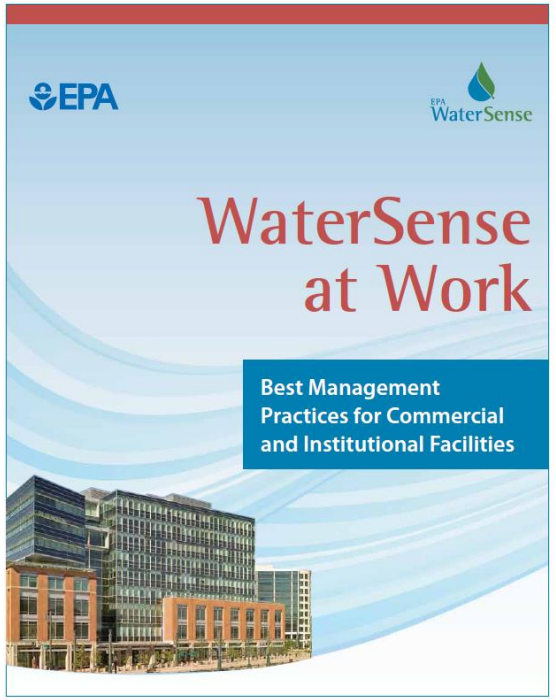
Guidance documents helpful

- South Florida Water Management District Water Supply Development Section's *Water Efficiency and Self Conducted Water Audits at Commercial and Institutional Facilities: A Guide for Facility Managers, Second Edition* (2013)
  - Spreadsheet calculator guidance
- EPA's *WaterSense at Work: Best Management Practices for Commercial and Institutional Facilities* (2012)
  - Additional detail on water-using equipment

Data processing – spreadsheets

- Anyone?
- Bueller?
- Bueller?

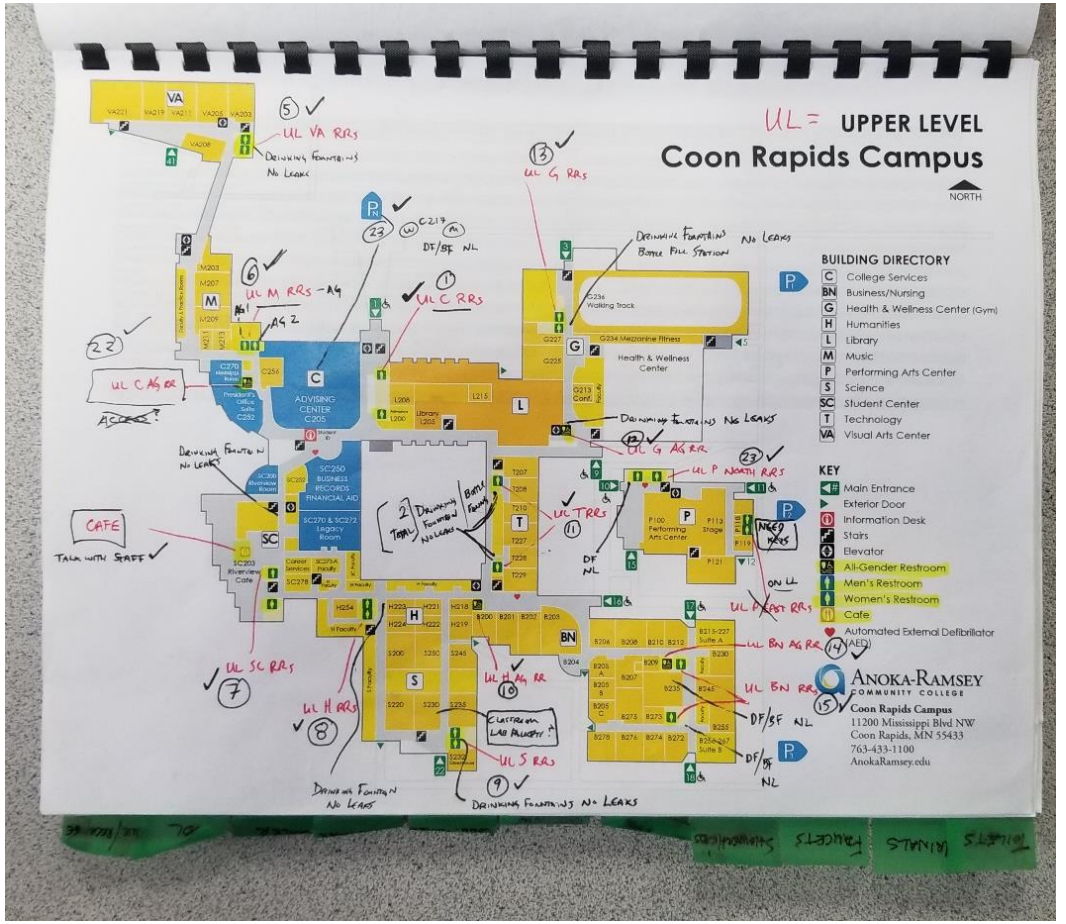




Challenges and Protocol Refinement

On-Site Data Collection Preparation

- Notify all staff in advance – saves time on questions
- Develop naming convention based on campus map
- Print data collection sheets and add tabs
- 2-3 people makes data collection easier
- Signage and/or door patrol
- Facility staff for locker rooms



Utility Rate Information

Identifying rates
- Utility bills
- City website

Cost tiers
- Use highest tier – water savings will begin at highest rate

Additional fees on bills
- Ignore
- Only water use will be affected by conservation projects

Water, Sewer & Storm Drain Rates

These rates are in effect as of the May 1, 2015 bill. Residential water bills for have a base fee of $16 per account.

Usage Type	Fee Per 1,000 Gallons
Tier 1 Residential (Less than 20,000 gallons)	$2.00
Tier 2 Residential (20,001 to 80,000 gallons)	$2.45
Tier 3 Residential (More than 80,001 gallons)	$2.65
Commercial or Industrial Use (Multiple Units)	$2.00
Sprinkling Meters (Multiple Units)	$2.65

Sewer Rates

Sewer rates include the base fee plus winter quarter (or less) consumption.

Type of Residence	Base Fee	Min	Max	Fee Per 1,000 Gallons
Single Family (SF)	$25.50	$49	$101.10	$3.15
SF Seniors Eligible Prior to 1997	$25.50	$43	$101.10	$3.15
Duplex (Per Unit)	$20	$43.63	$95.60	$3.15
Townhouses, Condos, Mobile Homes (Per Unit)	$12.25	$35.88	$87.85	$3.15
Apartments or Units (Sewer Only)	$45.50	N/A	N/A	N/A
Unmetered residential accounts	$68.25	N/A	N/A	N/A
Townhouses, Condos, Apartment Common Meter (Per Unit)	$8.50	N/A	N/A	$3.15
Commercial	$57	N/A	N/A	$3.45
Industrial and Institutional	$82	N/A	N/A	$3.45
Restaurants	$85	N/A	N/A	$3.45

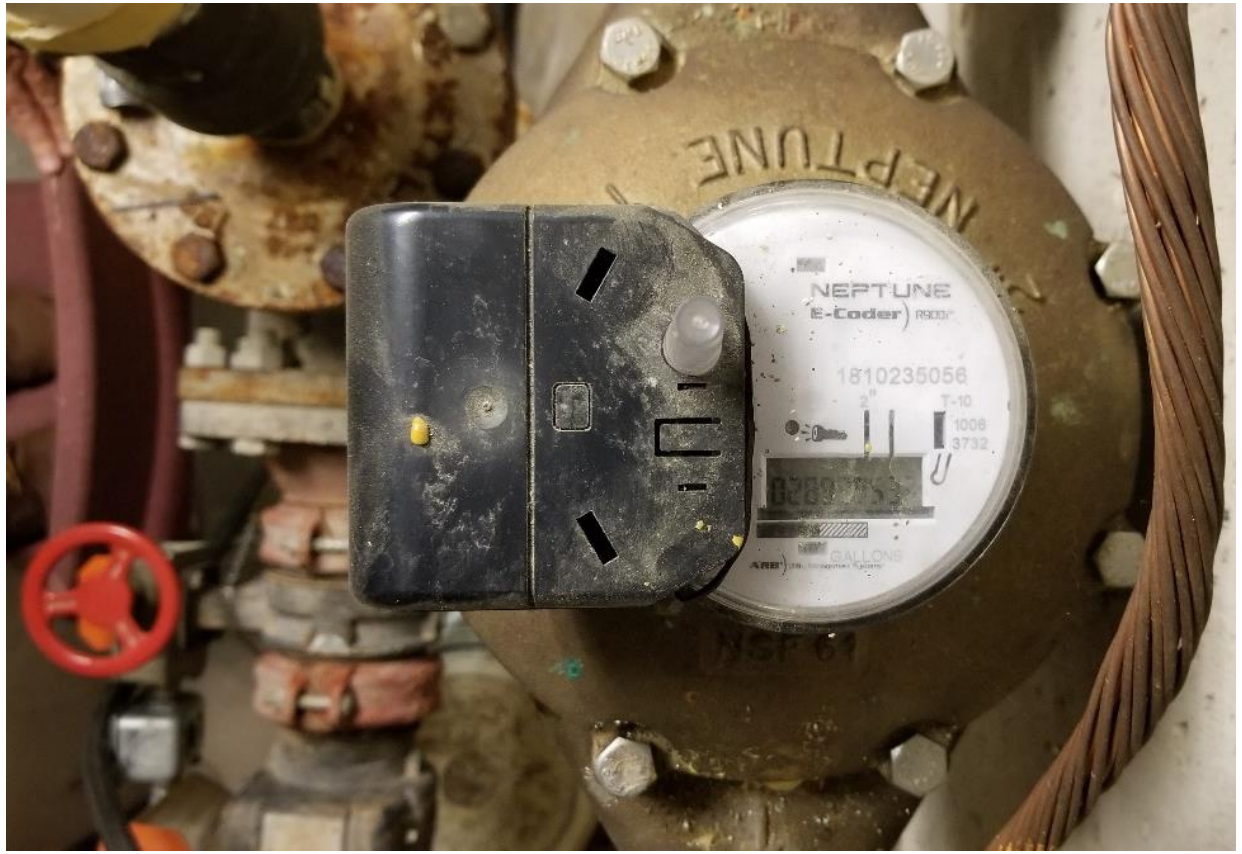
Leak Detection Test

Conduct during period with no expected water use (e.g. weekend)

Challenging on campuses with 24/365 activity (e.g. fire department)

Compare estimated water budget with utility billing data

- >10% difference likely indicates leak or unaccounted for consumption point



Estimating Population and Usage

Limited calculator options for visitor populations, weekday versus weekend staff, seasonal staff, etc.

- Generate an annual estimate of uses based on available data
- Distribute estimated uses across entire year

Calculator calibration

- Modifications and/or overrides should be justifiable
- Best professional judgement
  - Document all deviations and provide justification

Calculators Available

1 – DOE FEMP Water Project Screening Tool

2 – Daily Water Use Calculator

3 – Domestic Plumbing Fixtures

4 – ENERGY STAR Residential Appliances

5 – ENERGY STAR Commercial-Grade Kitchen Equipment

6 – Commercial-Grade Kitchen Equipment

7 – Cooling Towers

8 – Irrigation

9 – Water Use Analysis

4 – Residential Appliances (ENERGY STAR)

Air purifier

Clothes washer

Dehumidifier

Dishwasher

Refrigerator

Compact refrigerator

Freezer

PROCESS

- Enter simple data on ‘INPUTS’ tab
- Modify assumptions on ‘Calcs’ tabs
- View Results

TIPS

- ‘About This Calculator’ tab has links to ENERGY STAR information about each equipment type

5 – Commercial Kitchen Equipment (ENERGY STAR)

Dishwasher

Freezer

Fryer

Griddle

Hot food handling cabinet

Ice machine

Oven

Refrigerator

Steam cooker

Pre-Rinse spray valve

PROCESS

- Enter simple data on ‘INPUTS’ tab
- Modify assumptions on ‘Calcs’ tabs
- View Results

TIPS

- ‘About This Calculator’ tab has links to ENERGY STAR information about each equipment type

6 – Commercial Kitchen Equipment (SFWMD)

Utility billing data

Handwashing faucets

Pre-rinse spray valves

Combi oven

PROCESS

- Enter utility billing data
- Populate corresponding equipment tab with collected data
- View results

Fixtures and Equipment

Drinking fountains and water filling stations

- Inspect for leaks
- Ask for estimated use on bottle filling stations, use digital counter to estimate use, or make assumptions

Safety equipment (e.g. eye wash and shower stations)

- Inspect for leaks
- Negligible use and maintenance flushing, no need to account for use in calculators

Fixtures and Equipment

Dual-flush toilets

- Use usage assumptions
  - Women's
    - 3 times/day (2 small flushes, 1 large flush)
      - =((2*4.81)+(1*5.6))/3
  - Men's
    - With urinals in restroom, 1 time/day (1 large flush)
    - Without urinals in restroom, 3 times/day (2 small flushes, 1 large flush)

Valve leaks

- Noted on data collection form
- Difficult to estimate additional volume

Fixtures and Equipment

Urinal flush timing

- Issue: two rates – one following initial flush followed by slower rate after flush
  - Only run timer for period that water is actively flowing through the valve – may need to flush several times in order to hear the flow
  - The second rate could be caused by a valve failing to close or by water that takes longer to filter through the china structure (I haven't personally seen this).

Visitor restroom use

- School setting – student or staff restrooms?
  - Depends on layout of school – what would you do as a visitor?

Fixtures and Equipment

Calculator 3 questions

- Metered use – see most recent Matoska spreadsheet
  - 12 seconds metered = 8 gallons use
  - Process as non-metered, assumes 5 seconds of use = 4 gallons use
  - Increase number of significant figures for more detail
- ‘No Action’ items
  - Need to manually enter current and efficient values
- Override use (user input)
  - If entering daily use, need to correct for 365 days
    - For example, elementary school has 175 days of use, bathroom used 9 times per day, enter ‘=(9*175)/365’, because total annual toilet use is calculated as 365 * ‘uses per day’ in the calculator
- Expected use numbers on ‘Urinals’ and ‘Lav. Faucets’ tabs are titled ‘toilet uses’, although the numbers are correct
- Feel free to hide and/or delete columns to make the calculators more user-friendly

Fixtures and Equipment

Calculator 3 correction

- ‘PopulationCALCS’ tab (hidden) cell references to ‘UtilityRate&PopulationData’ tab corrected
- Corrected use of each fixture per day calculation
- Issue arose when ‘Work days per year’ differed between populations
- Thanks, Thomas!

I’ll email an updated calculator

Fixtures and Equipment

Communal faucets

- Enter as common use
- Could also split use and enter separate rows for male and female uses

Non-lavatory faucets

- Estimate use based on best available information

Fixtures and Equipment

Pre-rinse spray valves

- Data to request
  - Number of seconds used per rack
  - Number of racks per hour and number of hours per day
- Use Calculator 6 for pre-rinse spray valves, not Calculator 5

Fixtures and Equipment

Commercial appliances

- Google
- Visit manufacturer's website for specifications

Search ENERGY STAR website for equipment specifications

- https://www.energystar.gov/productfinder/

Maintenance Versus Replacement

Maintenance versus replacement threshold

- If measured water usage exceeds high efficiency rate:
- Toilets and urinals
  - Maintenance if china and valve are high efficiency, rare based on my experience
  - Replacement if china and valve are not high efficiency
- Faucets
  - Always maintenance (i.e. aerator installation) unless other issues are obvious (e.g. cracked or malfunctioning)
- Pre-rinse spray valves
  - Replacement if flow exceeds high efficiency rate
- Appliances
  - Replacement if equipment is not ENERGY STAR or WaterSense Certified

Maintenance costs

- Estimates are a combination of research and recommendations of ~10%
- Best method is verification from facility manager
  - Allow facility manager to review cost assumptions for both replacement and maintenance

Cooling Towers

Conductivity records of make-up and blowdown water

Volume records of make-up and blowdown water

Vendor

Equation 6-4. Cooling Tower Cycles of Concentration

= Conductivity of Blowdown Water ÷ Conductivity of Make-Up Water

Where:

- Conductivity of Blowdown Water (parts per million of TDS)
- Conductivity of Make-Up Water (parts per million of TDS)

Equation 6-5. Cooling Tower Cycles of Concentration

= Make-Up Water ÷ Blowdown Water

Where:

- Make-Up Water (gallons)
- Blowdown Water (gallons)

Increasing COC

Page 79 of SFWMD manual

Table 14. Water savings from increased concentration ratios in cooling towers.

Before Increasing Cycles	Concentration Ratio After Increasing Cycles											
	2	3	4	5	6	7	8	9	10	12	15	20
1.5	33%	50%	56%	58%	60%	61%	62%	63%	63%	64%	64%	65%
2		25%	33%	38%	40%	42%	43%	44%	44%	45%	46%	47%
3			11%	17%	20%	22%	24%	25%	26%	27%	29%	30%
4				6%	10%	13%	14%	16%	17%	18%	20%	21%
5					4%	7%	9%	10%	11%	13%	14%	16%
6						3%	5%	6%	7%	9%	11%	12%
7							2%	4%	5%	6%	8%	10%
8								2%	3%	5%	6%	8%
9									1%	3%	5%	6%
10										2%	4%	5%
12											2%	4%
15												2%

Increases are expressed as a percentage of total cooling tower water use (Vickers 2001).

Irrigation Systems

Usage estimate

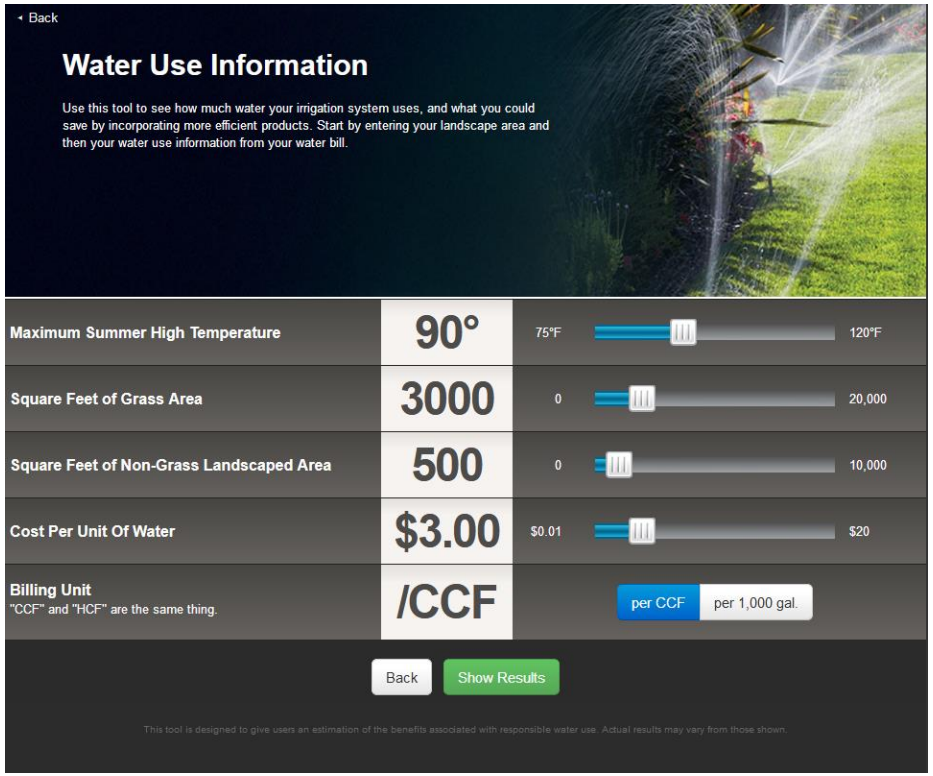
- Meter data
- At the crudest level, if you know the irrigated area, and assume the application of 1” of water per week, you could estimate a maximum amount of water use that should be used by the irrigation system. Ideally less than 1” of irrigation water per week will be used because of natural precipitation.

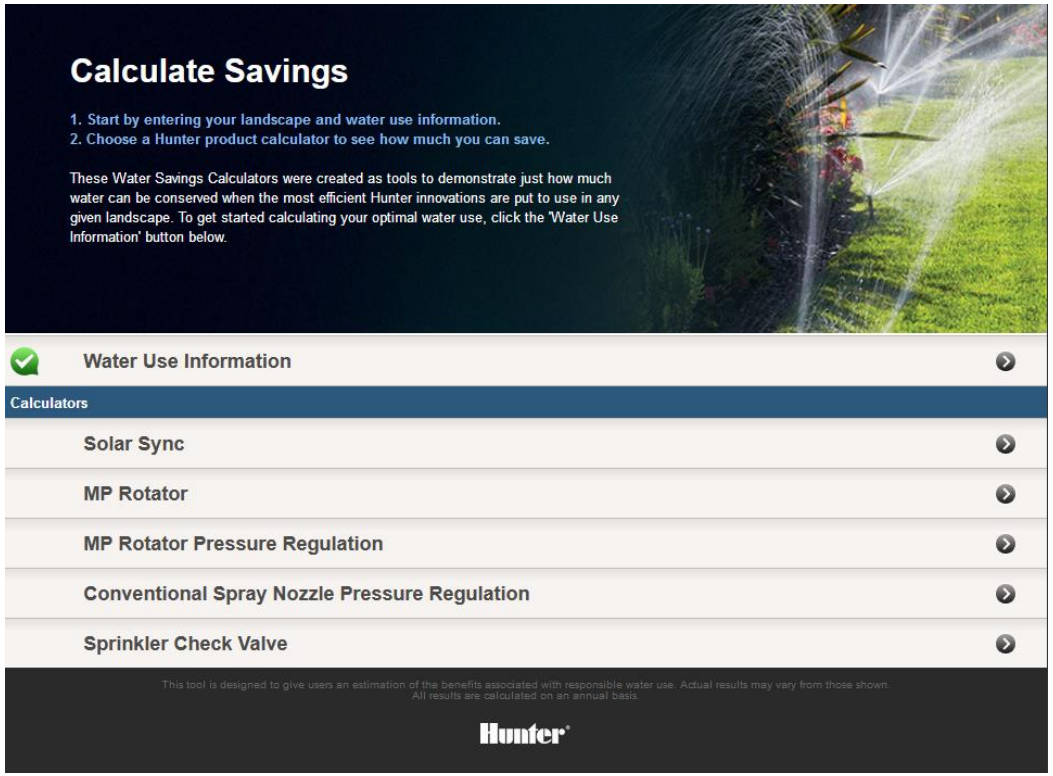
Unnecessarily irrigated areas

Smart Irrigation controllers can reduce use by 15% - 50%

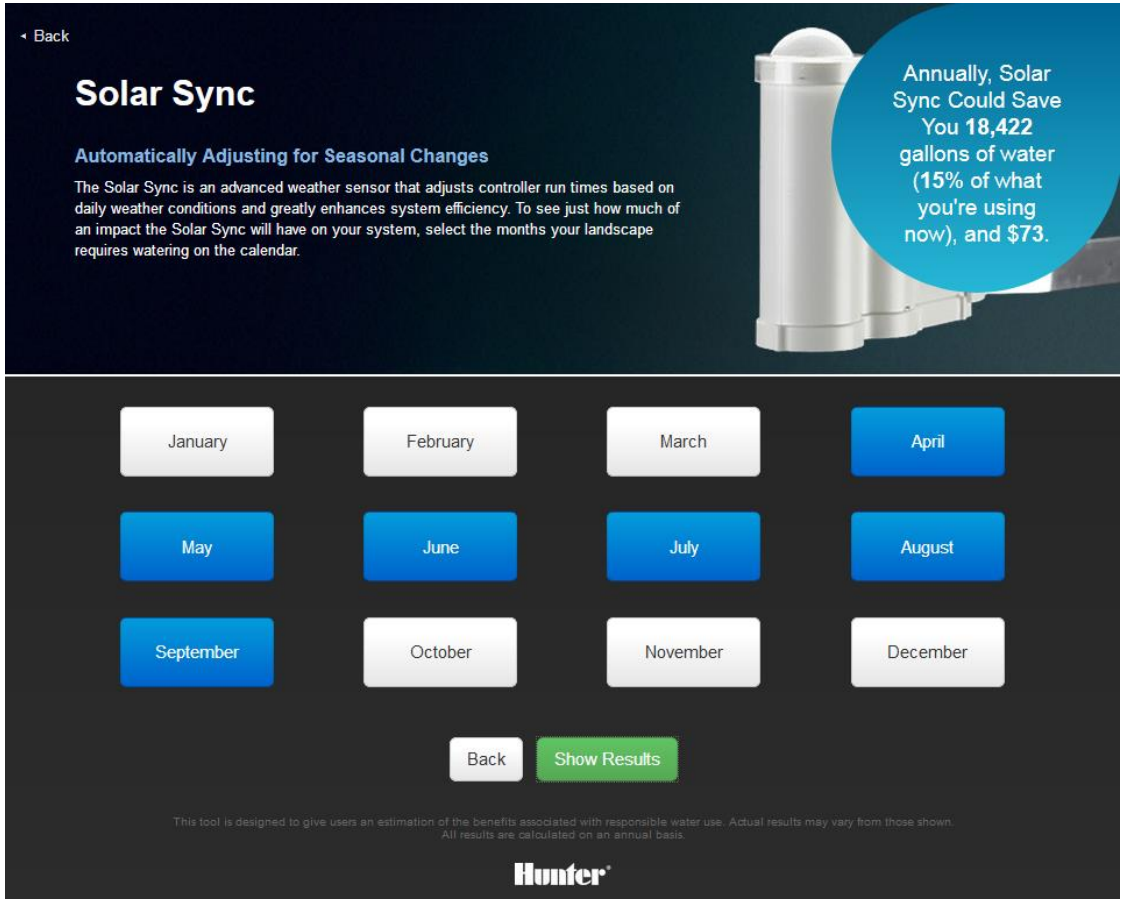
Irrigation Systems

https://www.hunterindustries.com/main/water-savings-calculator





Irrigation Systems



Infiltration Opportunities

Present water conservation and infiltration opportunities separately

- The value of a gallon of water saved versus the value of a gallon of water infiltrated is not equal

Calculate 30-year cost-effectiveness

Table 13: Infiltration volumes, estimated cost, and 30-year average cost per acre-foot for multiple sizes of infiltration basins.

Scenario	Total Runoff Volume (AC-FT)	Infiltrated Volume (AC-FT)	Infiltrated Volume (GAL)	Estimated Cost	Annual O&M	Estimated Lifespan	30-yr Avg. Cost/AC-FT
Existing	1.01	N/A	N/A	N/A	N/A	N/A	N/A
250 SF Basin	0.72	0.29	94,988	$11,310.00	$225.00	30	$2,065.14
500 SF Basin	0.49	0.52	167,885	$20,060.00	$225.00	30	$1,734.53
750 SF Basin	0.35	0.66	215,604	$28,810.00	$225.00	30	$1,791.45
1,000 SF Basin	0.24	0.77	250,096	$37,560.00	$225.00	30	$1,924.39
1,250 SF Basin	0.18	0.83	271,707	$46,310.00	$225.00	30	$2,121.11
1,500 SF Basin	0.15	0.86	280,564	$55,060.00	$225.00	30	$2,392.90

*Indirect Cost: 20 hours at $80/hour

**Direct Cost: ($30/sq-ft for materials and labor) + (12 hours at $80/hour for design) + $5/sq-ft for construction costs related to bituminous removal

***($150/year for rehabilitations at years 10 and 20) + ($75/year for routine maintenance)

Specific Questions

Campus-Specific Topics

Error messages in calculators

End of Meeting

THANKS