

**Residential Demand Spreadsheet Tool:
Maximum Day Demand (MDD) & Peak Hourly Demand (PHD)
Calculator Based on the U.S. Department
of Housing and Urban Development Methodology**

Tab 1: **About** the Residential Demand Spreadsheet Tool & Tab Index

Tab 2: **Print** Summary Sheet

Tab 3: Residential MDD & PHD **Calculator**

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NOTE: This spreadsheet should be used in conjunction with the Department's Reasonably Anticipated Future Needs Municipal Water Rights Development Handbook. If you do not have this document please contact the Idaho Department of Water Resources, State Office.

DISCLAIMER: This spreadsheet tool was created for internal use by Department staff. However, the Department is not opposed to the use of this tool by the public. Public users should be aware that the use of this tool does not imply or guarantee review approval by the Department. Furthermore, this tool is provided with no warranty expressed or implied. The user has full responsibility to verify all assumptions, relationships, and calculations contained within.

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Created: September 20, 2011

Please contact Mathew Weaver for questions on use,
requests for added features, or required corrections to
the spreadsheet.

Residential Demand Summary

Applicant: **City of White Bird**

WR Number: **79-14053**

Summary of User Input

W = 2.7 (unit per acre) gross housing density
n = 75 number of residences or residential units

Q_{ADD} Method: Department Default

V₂₀₁₀ = N/A avg. market value of residential unit
Q_{ADD} = 250 (GPD) In-home demand

IDWR Region: Western Administrative region where the proposed community is located.

P_{def} = 0.35 (inches) Precipitation Deficit

L_s Method: User Input

LS = 0.00 (acres) average irrigated area per residential unit
Q_{IRR} = 0 (GPD) Irrigation demand
σ_{MDD} = 272 (GPD) MDD variability term
σ_{PHD} = 410 (GPD) PHD variability term

Maximum Day Demand Flow Rate (QMDD)

$$Q_{MDD} = Q_{ADD} + Q_{IRR} + 2(\sigma_{MDD})$$

Q_{MDD} = 795 GPD per residential unit

Q_{MDD} = 59,598 GPD total community

Q_{MDD} = 0.09 CFS total community

Peak Hour Demand Flow Rate (Q_{PHD})

$$Q_{PHD} = 334 + 2.02(Q_{MDD}) + 2(\sigma_{PHD})$$

Q_{PHD} = 2,760 GPD per residential unit

Q_{PHD} = 207,001 GPD total community

Q_{PHD} = 0.32 CFS total community

Notes:

W value is based on evaluation of sample block from aerial imagery.
Ls is based on evaluation of sample lots from aerial imagery. N based on field exam.

Citations

Demand Methodology: Linaweaver, F. P., et al. (1967) A Study of Residential Water Use. Johns Hopkins University, for the Federal Housing Administration and the Department of Housing and Urban Development.

Pdef Data: Allen, Richard G. and Clarence W. Robison, 2009. Evapotranspiration and Consumptive Irrigation Water Requirements for Idaho: Supplement updating the Time Series through December 2008,

Research Technical Completion Report, Kimberly Research and Extension Center, University of Idaho, Moscow, ID.

Step 1 - Input Required Data

READ ME

$W =$ (unit per acre) gross housing density

$n =$ number of residences or residential units

$\sigma_{MDD} =$ 272 (GPD) MDD variability term

$\sigma_{PHD} =$ 410 (GPD) PHD variability term

Step 2 - Calculation of In-Home Demand (Q_{ADD})

Select Q_{ADD} Calculation Method

☒ Department Default ☐ Calc. Based on Avg. Home Value

Input Average Current Market Price per Residential Unit

$V_{2010} =$ $V_{1965} =$ \$ 17,246

$Q_{ADD} =$ 250 GPD

Step 3 - Calculation of Irrigation Demand (Q_{IRR})

Select IDWR Administrative Region

Where Proposed Community is Located

☐ Eastern ☐ Southern
☐ Northern ☒ Western

$P_{def} =$ 0.35 inches

Select L_s Calculation Method

☒ User Input ☐ Calc. Based on Gross Housing Density (W)

Input Average Irrigated Area Per Residential Unit in Acres

Note, if a separate source provides irrigation water $L_s = 0$.

$L_s =$ acres

$C =$ 27,152 unit conversion coefficient

$Q_{IRR} =$ 0 GPD

Maximum Day Demand Flow Rate (Q_{MDD})

$$Q_{MDD} = Q_{ADD} + Q_{IRR} + 2(\sigma_{MDD})$$

$Q_{MDD} = 795$ GPD per residential unit

$Q_{MDD} = 59,598$ GPD total community

$Q_{MDD} = 0.09$ CFS total community

Peak Hour Demand Flow Rate (Q_{PHD})

$$Q_{PHD} = 334 + 2.02(Q_{MDD}) + 2(\sigma_{PHD})$$

$Q_{PHD} = 2,760$ GPD per residential unit

$Q_{PHD} = 207,001$ GPD total community

$Q_{PHD} = 0.32$ CFS total community

Table of Historical Inflation Rates (%) by Month and Year (1965-2011)*

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Avg.
1965	1.0	1.0	1.3	1.6	1.6	1.9	1.6	1.9	1.6	1.9	1.6	1.9	1.6
1966	1.9	2.6	2.6	2.9	2.9	2.5	2.8	3.5	3.5	3.8	3.8	3.5	2.9
1967	3.5	2.8	2.8	2.5	2.8	2.8	2.8	2.4	2.8	2.4	2.7	3.0	3.1
1968	3.6	4.0	3.9	3.9	3.9	4.2	4.5	4.5	4.5	4.7	4.7	4.7	4.2
1969	4.4	4.7	5.2	5.5	5.5	5.5	5.4	5.7	5.7	5.7	5.9	6.2	5.5
1970	6.2	6.1	5.8	6.1	6.0	6.0	6.0	5.4	5.7	5.6	5.6	5.6	5.7
1971	5.3	5.0	4.7	4.2	4.4	4.6	4.4	4.6	4.1	3.8	3.3	3.3	4.4
1972	3.3	3.5	3.5	3.5	3.2	2.7	2.9	2.9	3.2	3.4	3.7	3.4	3.2
1973	3.6	3.9	4.6	5.1	5.5	6.0	5.7	7.4	7.4	7.8	8.3	8.7	6.2
1974	9.4	10.0	10.4	10.1	10.7	10.9	11.5	10.9	11.9	12.1	12.2	12.3	11.0
1975	11.8	11.2	10.3	10.2	9.5	9.4	9.7	8.6	7.9	7.4	7.4	6.9	9.1
1976	6.7	6.3	6.1	6.0	6.2	6.0	5.4	5.7	5.5	5.5	4.9	4.9	5.8
1977	5.2	5.9	6.4	7.0	6.7	6.9	6.8	6.6	6.6	6.4	6.7	6.7	6.5
1978	6.8	6.4	6.6	6.5	7.0	7.4	7.7	7.8	8.3	8.9	8.9	9.0	7.6
1979	9.3	9.9	10.1	10.5	10.9	10.9	11.3	11.8	12.2	12.1	12.6	13.3	11.3
1980	13.9	14.2	14.8	14.7	14.4	14.4	13.1	12.9	12.6	12.8	12.6	12.5	13.5
1981	11.8	11.4	10.5	10.0	9.8	9.6	10.8	10.8	11.0	10.1	9.6	8.9	10.3
1982	8.4	7.6	6.8	6.5	6.7	7.1	6.4	5.9	5.0	5.1	4.6	3.8	6.2
1983	3.7	3.5	3.6	3.9	3.5	2.6	2.5	2.6	2.9	2.9	3.3	3.8	3.2
1984	4.2	4.6	4.8	4.6	4.2	4.2	4.2	4.3	4.3	4.3	4.1	3.9	4.3
1985	3.5	3.5	3.7	3.7	3.8	3.8	3.6	3.3	3.1	3.2	3.5	3.8	3.6
1986	3.9	3.1	2.3	1.6	1.5	1.8	1.6	1.6	1.8	1.5	1.3	1.1	1.9
1987	1.5	2.1	3.0	3.8	3.9	3.7	3.9	4.3	4.4	4.5	4.5	4.4	3.6
1988	4.0	3.9	3.9	3.9	3.9	4.0	4.1	4.0	4.2	4.2	4.2	4.4	4.1
1989	4.7	4.8	5.0	5.1	5.4	5.2	5.0	4.7	4.3	4.5	4.7	4.6	4.8
1990	5.2	5.3	5.2	4.7	4.4	4.7	4.8	5.6	6.2	6.3	6.3	6.1	5.4
1991	5.7	5.3	4.9	4.9	5.0	4.7	4.4	3.8	3.4	2.9	3.0	3.1	4.2
1992	2.6	2.8	3.2	3.2	3.0	3.1	3.2	3.1	3.0	3.2	3.0	2.9	3.0
1993	3.3	3.2	3.1	3.2	3.2	3.0	2.8	2.8	2.7	2.8	2.7	2.7	3.0
1994	2.5	2.5	2.5	2.4	2.3	2.5	2.8	2.9	3.0	2.6	2.7	2.7	2.6
1995	2.8	2.9	2.9	3.1	3.2	3.0	2.8	2.6	2.5	2.8	2.6	2.5	2.8
1996	2.7	2.7	2.8	2.9	2.9	2.8	3.0	2.9	3.0	3.0	3.3	3.3	3.0
1997	3.0	3.0	2.8	2.5	2.2	2.3	2.2	2.2	2.2	2.1	1.8	1.7	2.3

1998	1.6	1.4	1.4	1.4	1.7	1.7	1.7	1.6	1.5	1.5	1.5	1.6	1.6
1999	1.7	1.6	1.7	2.3	2.1	2.0	2.1	2.3	2.6	2.6	2.6	2.7	2.2
2000	2.7	3.2	3.8	3.1	3.2	3.7	3.7	3.4	3.5	3.4	3.4	3.4	3.4
2001	3.7	3.5	2.9	3.3	3.6	3.2	2.7	2.7	2.6	2.1	1.9	1.6	2.8
2002	1.1	1.1	1.5	1.6	1.2	1.1	1.5	1.8	1.5	2.0	2.2	2.4	1.6
2003	2.6	3.0	3.0	2.2	2.1	2.1	2.1	2.2	2.3	2.0	1.8	1.9	2.3
2004	1.9	1.7	1.7	2.3	3.1	3.3	3.0	2.7	2.5	3.2	3.5	3.3	2.7
2005	3.0	3.0	3.1	3.5	2.8	2.5	3.2	3.6	4.7	4.3	3.5	3.4	3.4
2006	4.0	3.6	3.4	3.5	4.2	4.3	4.1	3.8	2.1	1.3	2.0	2.5	3.2
2007	2.1	2.4	2.8	2.6	2.7	2.7	2.4	2.0	2.8	3.5	4.3	4.1	2.8
2008	4.3	4.0	4.0	3.9	4.2	5.0	5.6	5.4	4.9	3.7	1.1	0.1	3.8
2009	0.0	0.2	-0.4	-0.7	-1.3	-1.4	-2.1	-1.5	-1.3	-0.2	1.8	2.7	-0.4
2010	2.6	2.1	2.3	2.2	2.0	1.1	1.2	1.1	1.1	1.2	1.1	1.5	1.6
2011	1.6	2.1	2.7	3.2	3.6	3.6	3.6	3.8					

*Historical inflation data were calculated using the Current Consumer Price Index published monthly by the Bureau of Labor and Statistics
downloaded on September 20, 2011 from www.usinflationcalculator.com.

$$FV = PV \cdot (1 + i)^n$$

i = 4.40 average inflation from 1965-2010

FV = \$ 300,000 future value (enter current avg. home value in 2010)

n = 46 number of years

PV = \$ 41,390 present value (avg. home value in 1965)