Estimating the Delaware Inland Bays Watershed Seasonal Population Using Wastewater Flows

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Outline

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  - Hypotheses
  - Goals
- Overview of previous estimates
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Introduction

- Questions:
  - How much does the population of the DIB watershed fluctuate seasonally?
  - What are the trends from year to year?
- Hypothesis:
  - Seasonal population increases from 1990 to 2005, relative to permanent residents.
- Goals:
  - Gather wastewater flow data from 1990, 2000, and 2005
  - Use OC, MD “demoflush” formula to calculate population
  - Graph monthly visitor population fluxes

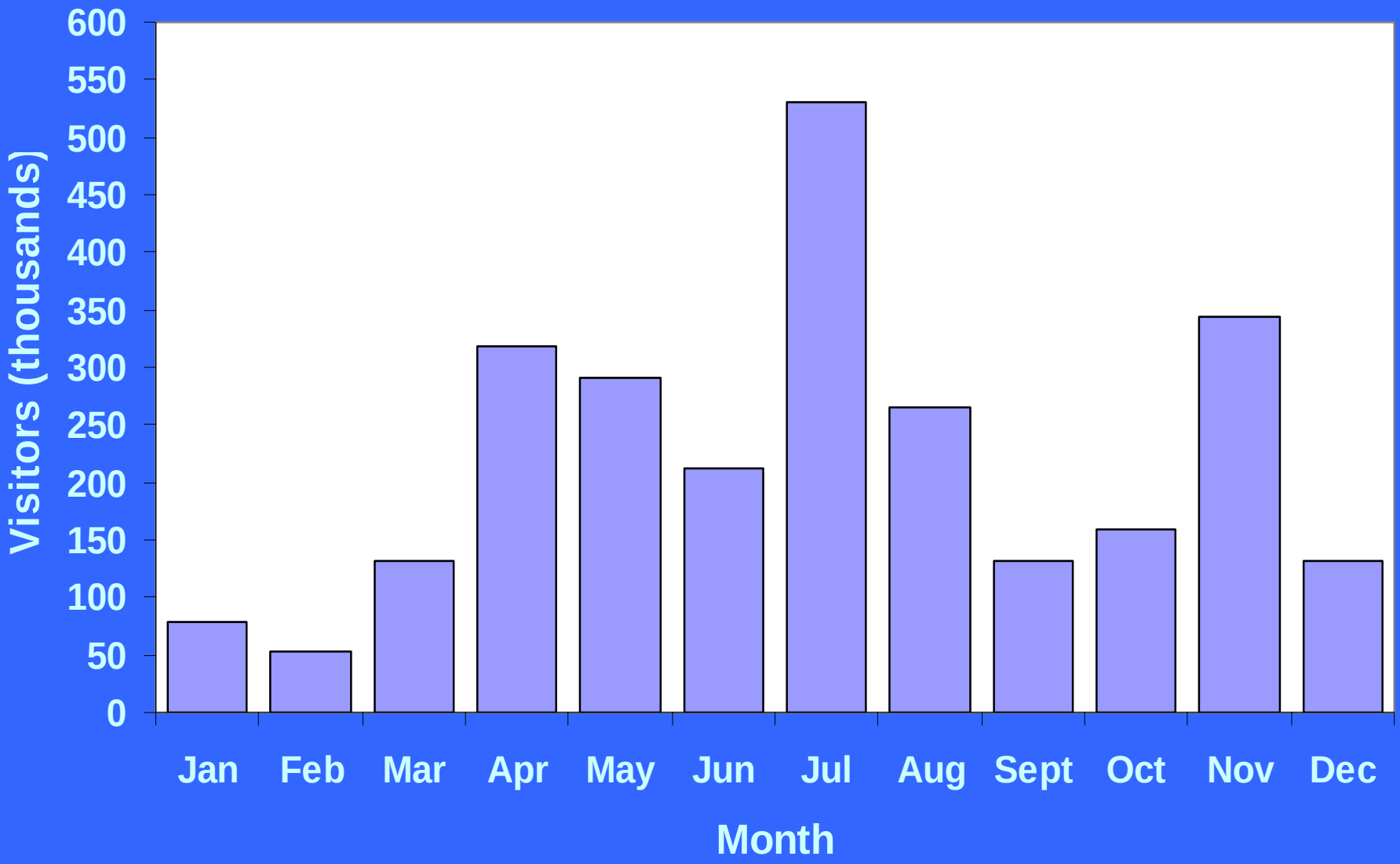
Why is this important?

- Seasonal population numbers as environmental indicator
- Population as ecological stressor
- Seasonality of human impacts
- Data can inform legislation, future development, assessment of facilities

2005 Delaware Visitor Profile Study

- Quarterly tourism data for the 3 Counties
- On-going mail and internet survey
- Tracks American travel behavior
- 60,000+ households surveyed
- Margin of error of +/-0.4 percentage points
- Focus areas
  - Visitor volume
  - Trip characteristics
  - Demographics

2005 Delaware Survey, Monthly Visitor Volume of Sussex County



Correlates of Population

- Water pumped
- Wastewater flow
- Electricity consumption
- Volume of mail handled
- Sales tax revenue

Demoflush

- Ocean City, MD needed method of estimating seasonal population
  - Census data only described permanent residents
  - Peak summer population estimates had wide range
  - More accurate estimate needed for health services plan
- Why wastewater flow?
  - Specific for OC
  - Convertible to population
  - Less responsive to outside varia
  - Data easy to obtain

Application of Demoflush

- Demoflush model successful
- Delaware inland bays watershed similar to Ocean City resort community
  - Seasonal population flux
  - Neighboring Coastal communities
- Wastewater data attainable
- Larger scale
- Multiple wastewater facilities
- Multiple municipalities

Visitor Estimation Formula

$$z = (s-a-bv)/c$$

- z- mean total visitor population (in a given period)
- s- mean total wastewater flow (mgd)
- a- mean groundwater infiltration (gal/day)
- b- avg. wastewater per permanent resident (gal/day)
- c- avg. wastewater per visitor (gal/day)
- v- mean number of permanent residents=

Constant Values

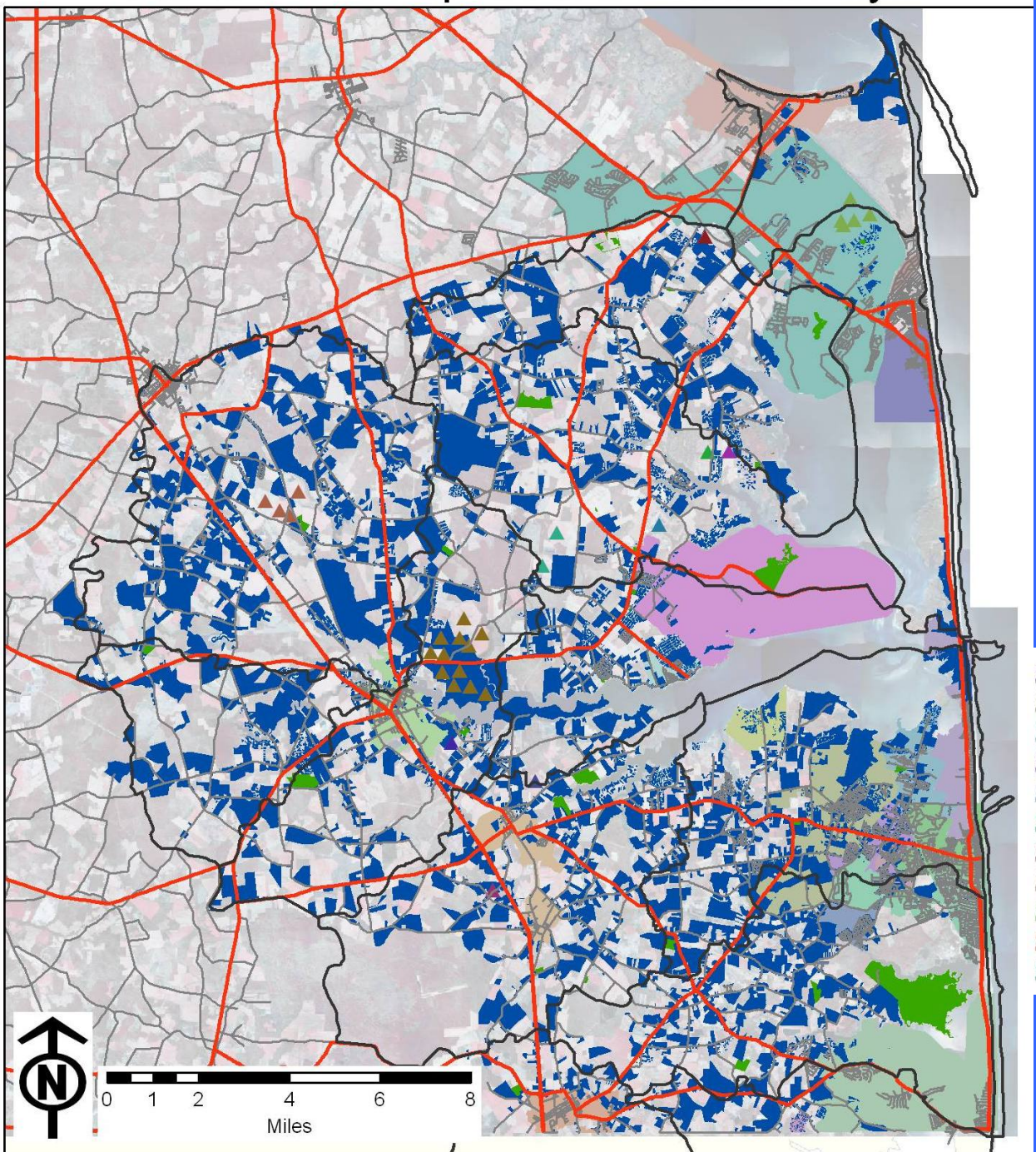
- a = 570,000 gal/day (infiltration)
- b = 70 gal/day (permanent resident)
- c = 36.04 gal/day (visitor)
- Values based on Ocean City's data

Wastewater Facilities

- Rehoboth Beach
- Georgetown
- Lewes
- South Coastal Regional
- Millsboro
- Inland Bays Regional
- Piney Neck Regional
- Wolfe Neck Regional

(Wolfe Neck Regional WWTP)

Parcels with Septics in the Inland Bays



- Large Systems
- Parcels with Septics

Spray Irrigation Areas

- Allen's Hatchery, Inc.
- Angola Community Partners
- Baywood Greens
- Mountaire Farms of DE
- Pinnacle Foods Corp.
- Plantations
- SC Inland Bays WWTF
- SC Piney Neck WWTF
- SC Wolfe Neck WWTF
- Town of Georgetown
- Village at Herring Creek

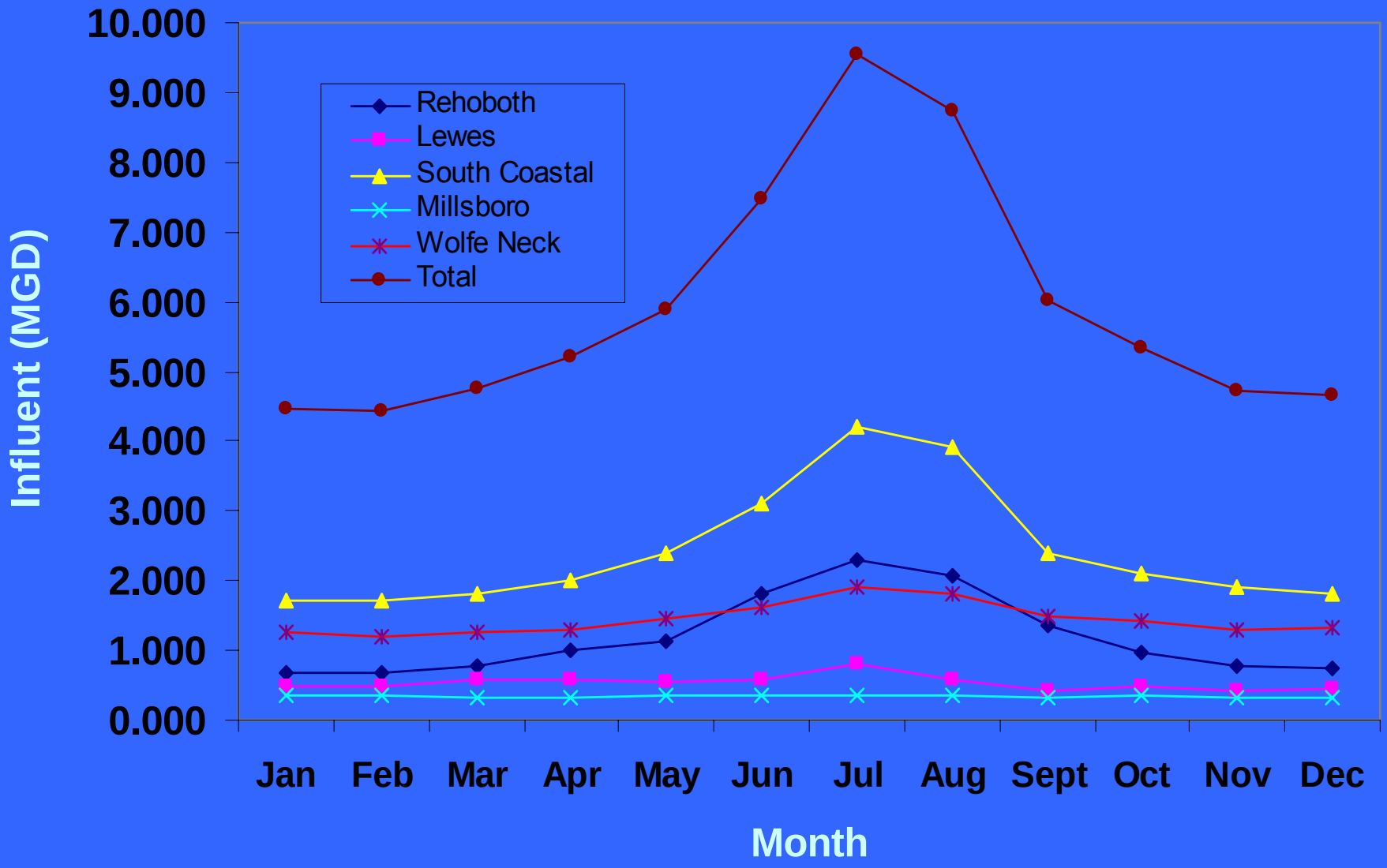
Sewered Areas

- BAY VIEW ESTATES SANITARY SEWER DISTRICT
- BETHANY BEACH SANITARY SEWER DISTRICT
- CEDAR NECK EXPANSION SANITARY SEWER DISTRICT
- DAGSBORO/FRANKFORD SANITARY SEWER DISTRICT
- DEWEY BEACH SANITARY SEWER DISTRICT
- FENWICK ISLAND SANITARY SEWER DISTRICT
- HENLOPEN ACRES SANITARY SEWER DISTRICT
- HOLTS LANDING SANITARY SEWER DISTRICT
- LONG NECK SANITARY SEWER DISTRICT
- MILLER CREEK SANITARY SEWER DISTRICT
- NORTH BETHANY EXPANSION OF THE BETHANY BEACH SANITARY SEWER DISTRICT
- NORTH MILLVILLE EXPANSION SANITARY SEWER DISTRICT
- OAK ORCHARD SANITARY SEWER DISTRICT
- OCEAN VIEW EXPANSION SANITARY SEWER DISTRICT
- SEA COUNTRY ESTATES SANITARY SEWER DISTRICT
- SOUTH BETHANY SANITARY SEWER DISTRICT
- SOUTH OCEAN VIEW SANITARY SEWER DISTRICT
- TOWN OF LEWES SEWER DISTRICT
- TOWN OF MILLSBORO SEWER DISTRICT
- TOWN OF SELBYVILLE SEWER DISTRICT
- WEST REHOBOTH EXPANSION OF THE DEWEY BEACH SANITARY SEWER DISTRICT

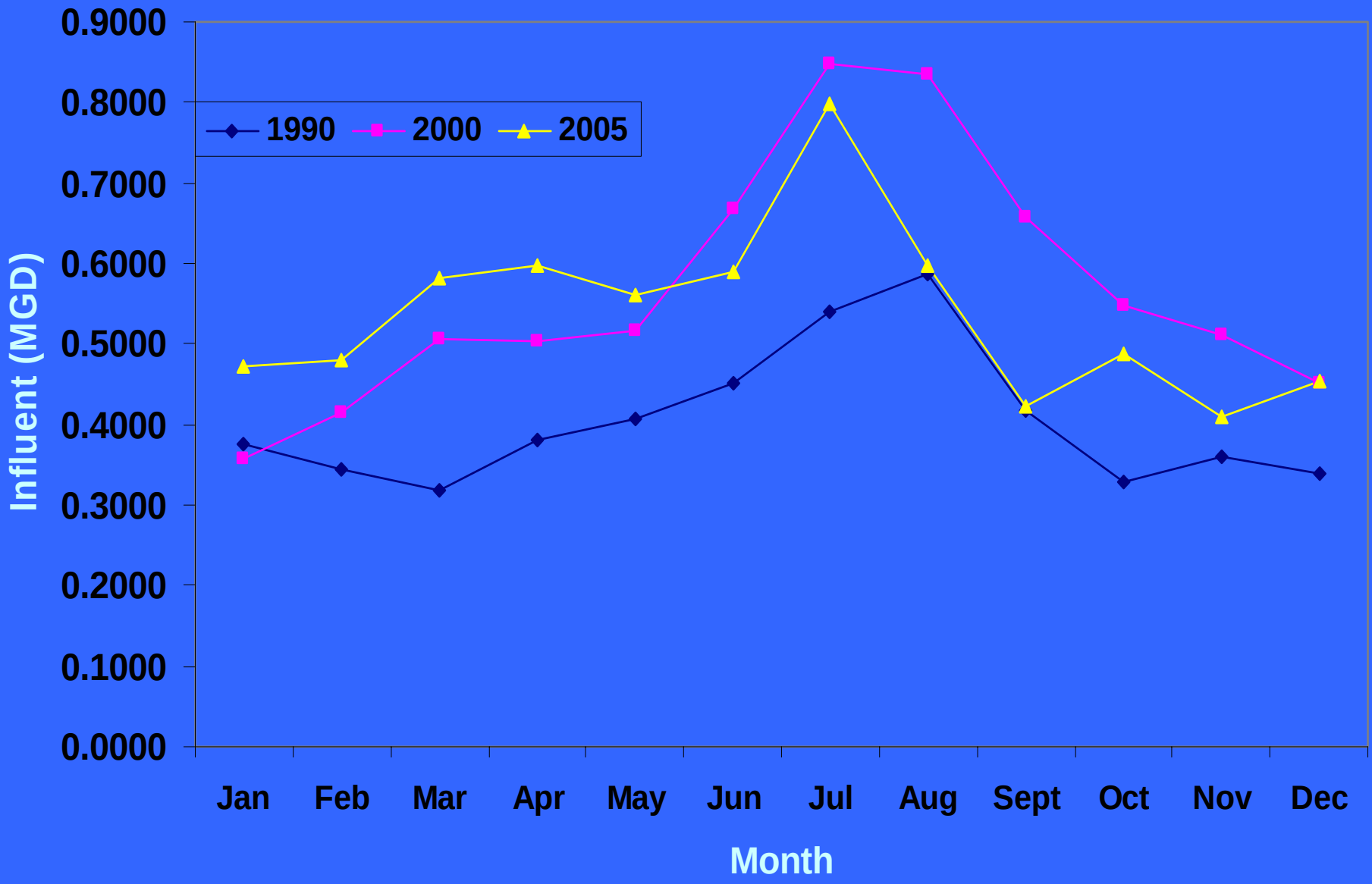
Assumptions

- No differentiation between day visitor and overnight visitor (simplified formula)
- Permanent residents stay year-round
- Infiltration is the same for each facility and same as Ocean City's
- 2005 population estimates reliable
- Service area of Rehoboth is same as Rehoboth census data

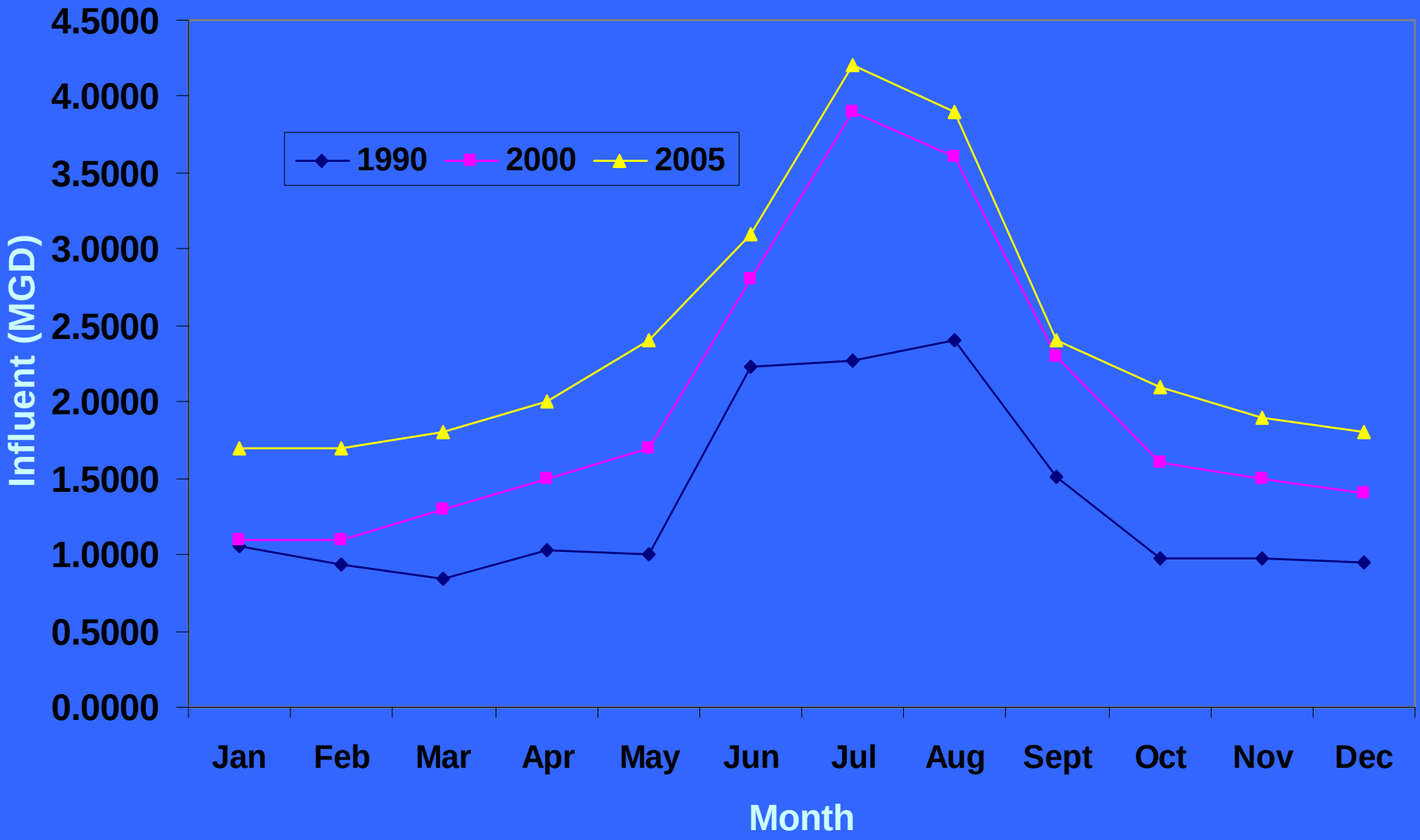
2005 Wastewater Flows for Five Treatment Facilities



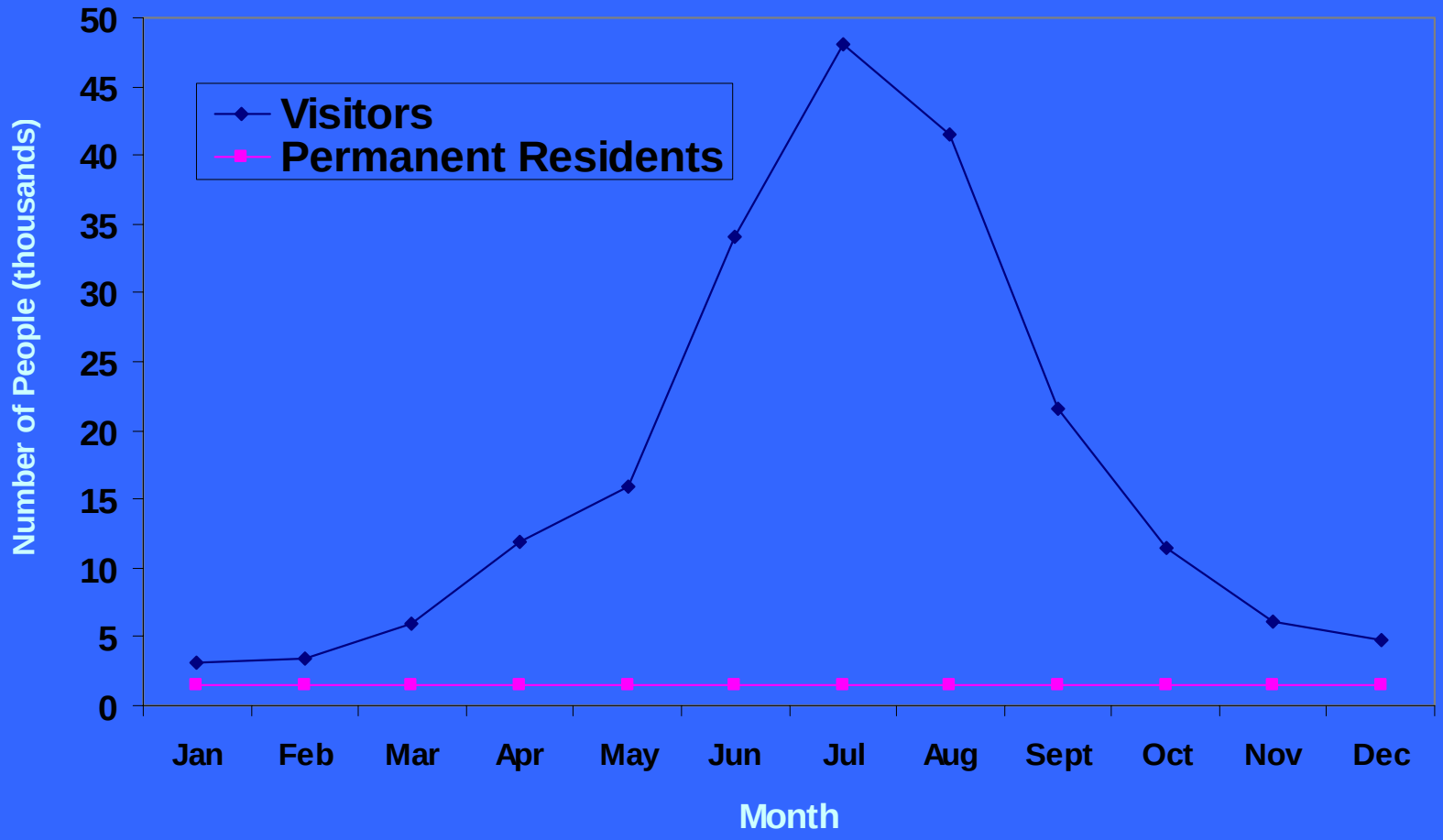
Wastewater Flows for Lewes 1990-2005



Wastewater Flow for South Coastal Regional Wastewater Plant 1990-2005



Estimated Number of Visitors to Rehoboth Beach in 2005

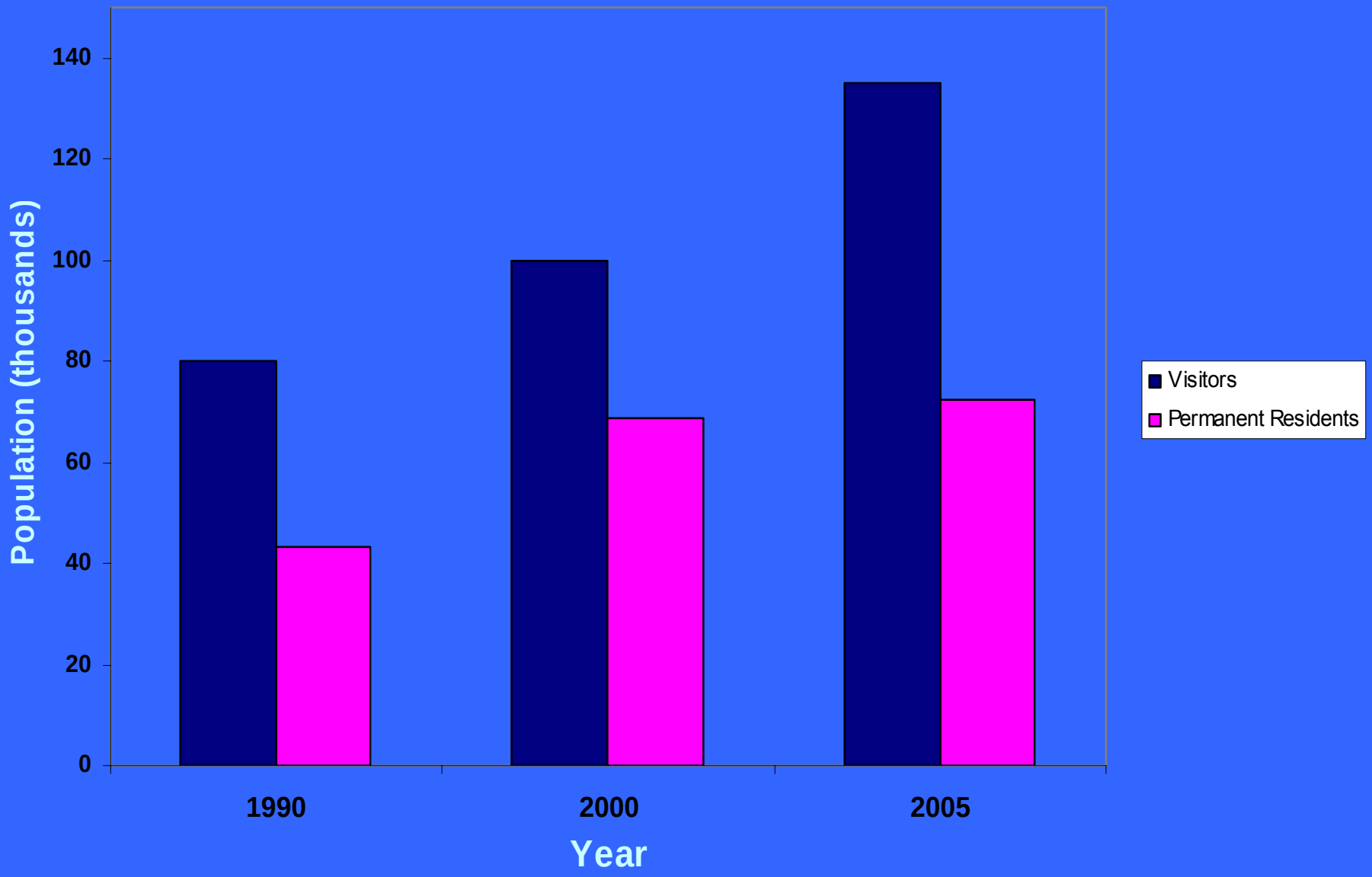


- Permanent residents: 1,556
- Peak # of visitors: July, 48,056
- Oct. - Mar.: 5,830 avg. visitors
- Apr. - Sept.: 28,832 avg. visitors

Potential Next Steps

- Must consider WW flow of septics.
- Day vs. overnight visitor?
- Specific infiltration for each facility?
- Seasonal water use rates?
- Determine service area of each facility still needed.

Total Summer Population of Inland Bays Watershed, 1990-2005



Conclusions

- Wastewater flows increase during summer months at most facilities; suggest drastic fluctuation in population
- 2005 has greater wastewater flows than 1990, showing increase in population from year to year
- Seasonal population of entire watershed will be estimated

Indicator	Land Use and Nutrient Load Changes
Type	Condition and communication (not stressor b/c doesn't show cause and effect relationship
Spatial Scale	Entire wetland
Temporal Scale (min) (rpt)	Once every 5 years to compare seasonal changes
Validity	Medium
Defensibility	High
Communicability	High
Potential for Public Involvement	Medium
Existing Data	Time period- 15 years Additional data- low
Funding Reliability	High
Reference (now) (future)	Now- no Future- yes (carrying capacity)
Merit	High

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Questions?