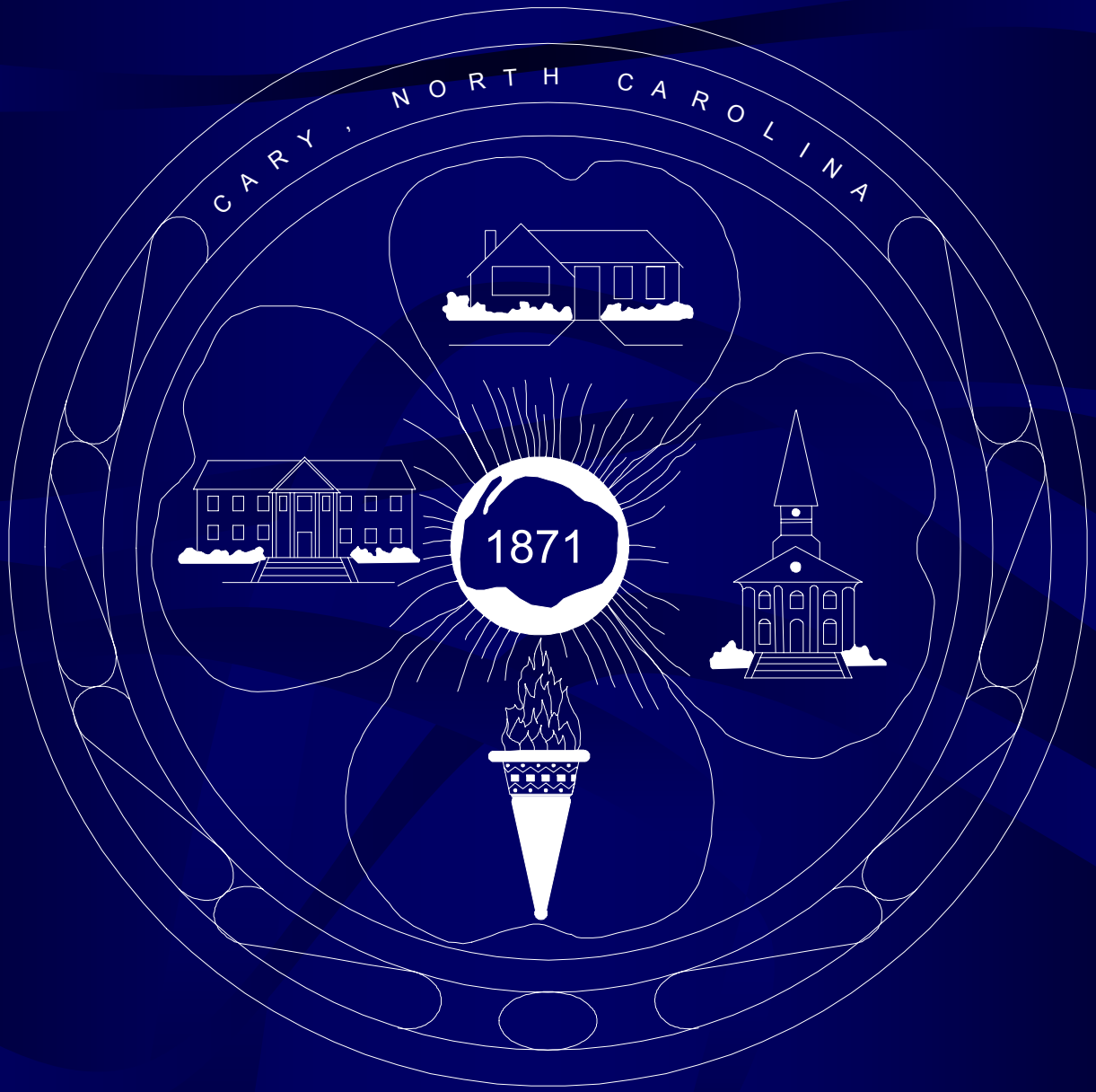
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Western Wake Communities Interbasin Transfer Requirements: Update on Analysis of Harris Lake as a Discharge Alternative

Towns of Apex, Cary, and Morrisville and Wake County (RTP South)

September 10, 2008

Presentation Topics

- Background on IBT Certificate requirements
- Discharge options
- Harris Lake model development process
- Model calibration status
- Preliminary results for discharge sensitivity
- Schedule for Project
- IBT Compliance
- Discussion

IBT Certificate

- Issued in July 2001
- Certificate holders include Towns of Cary, Apex and Morrisville and Wake County (RTP South)
- Requirements
  - Max day IBT of 24 mgd
  - Several conditions

Condition 1 of Western Wake Communities IBT Certificate

- After 2010, water supplied from the Haw Basin shall be returned to either the Haw or Cape Fear Basin
- Certificate includes a formula for calculating the required annual return amount

Presentation Topics

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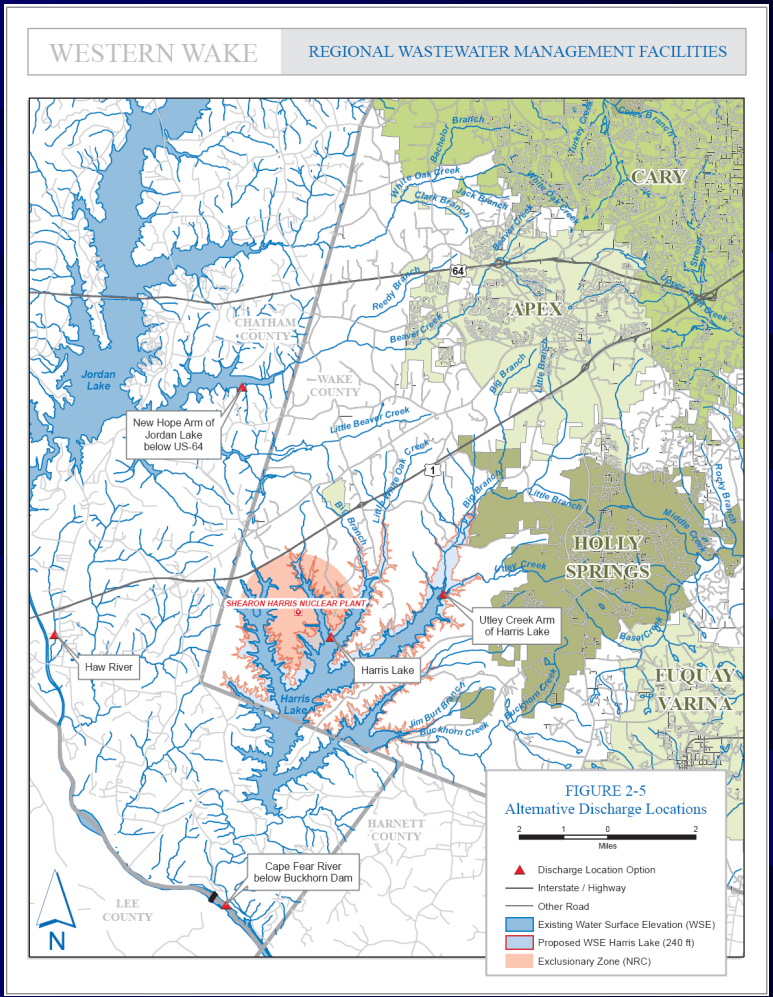
WRF Discharge Alternatives

- Discharge locations considered
  - Jordan Lake
  - Harris Lake
  - Cape Fear River
    - above Buckhorn Dam
    - below Buckhorn Dam
- Speculative permit limits received for Cape Fear River below Buckhorn Dam

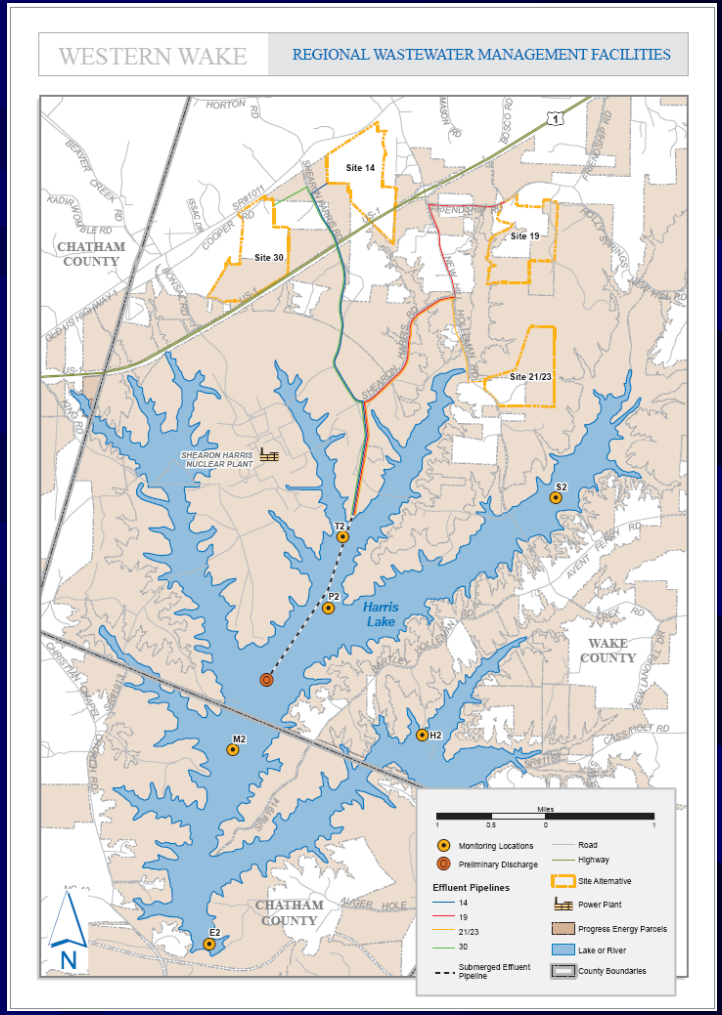


Potential Harris Lake Discharge

- Previously discouraged as a discharge option by DWQ
  - DWQ recommended removal of Holly Spring discharge from Utley Creek
  - Detailed nutrient response model required
- Issue has re-emerged due to
  - Drought
  - Partners' effluent line going to the Cape Fear River
- Progress Energy is working with the Partners to ensure protection of water quality

Renewed Harris lake Discussions

- Partners and Progress Energy met and discussed options
- Potential benefit to a lake discharge
  - Reduced length of effluent lines
  - All facilities in Wake County
  - Reduced pumping for Progress in future
  - More options for water management
- DWQ has indicated a calibrated lake nutrient response model is required



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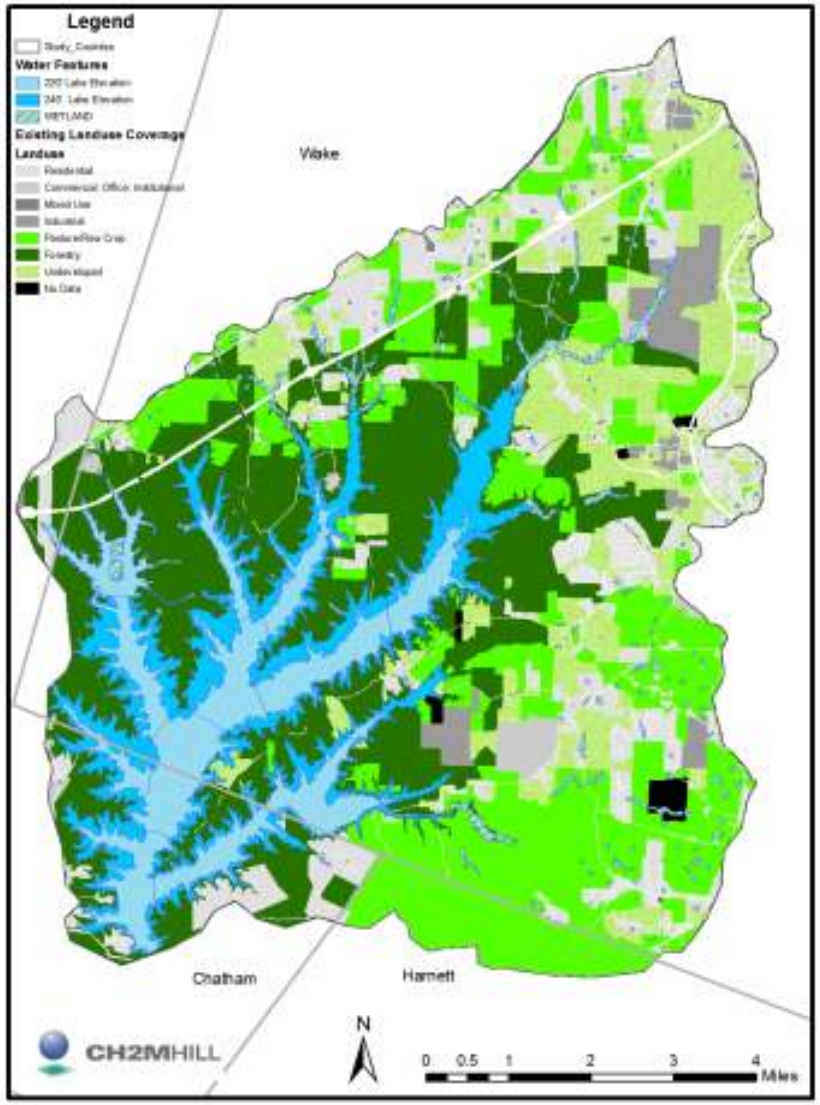
Overall Modeling Process

- *Modeling approach – Complete*
- *Modification of monitoring program – Complete*
- *Development of watershed and lake models – Complete*
- *Screening with BathTub model –- Complete*
- *Model Calibration – 2nd Draft Complete*
  - *Draft TM submitted – DWQ review meeting August 11*
  - *Comments received on August 19*
  - *Comment responses sent Sept 9*
- *Model Sensitivity to Discharge – Initial Analyses Completed*
- **Preliminary model report –Sep 08**
- **EMC Update on Harris Lake – Sep 08**
- **2008 Monitoring data available ~ Dec 08**
- **Updated model analyses and reports ~ Feb 09**

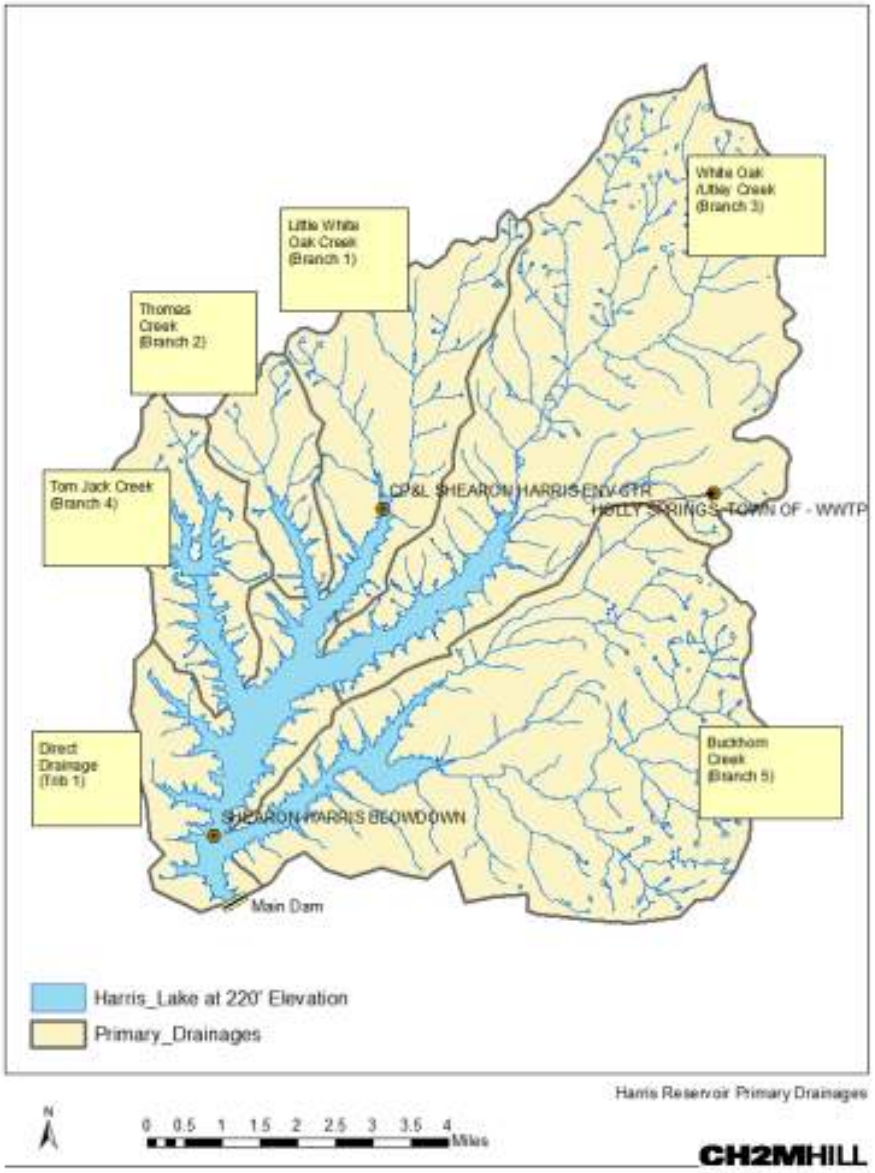
Model Development

- Preliminary Scenario Analysis based on BathTub
- Watershed Model
  - Adapted Utley Creek Generalized Watershed Loading Function (GWLF) model to estimate nonpoint source loading to Harris Lake
- CE-QUAL-W2 Model of the Lake
  - Based on Jan. 08 detailed bathymetric data
  - Divided lake into segments with similar characteristics
  - Processed GWLF and point source nutrient loadings for the period from 2001 – 2007
  - Developed meteorological inputs based on Harris Lake data collected by Progress Energy

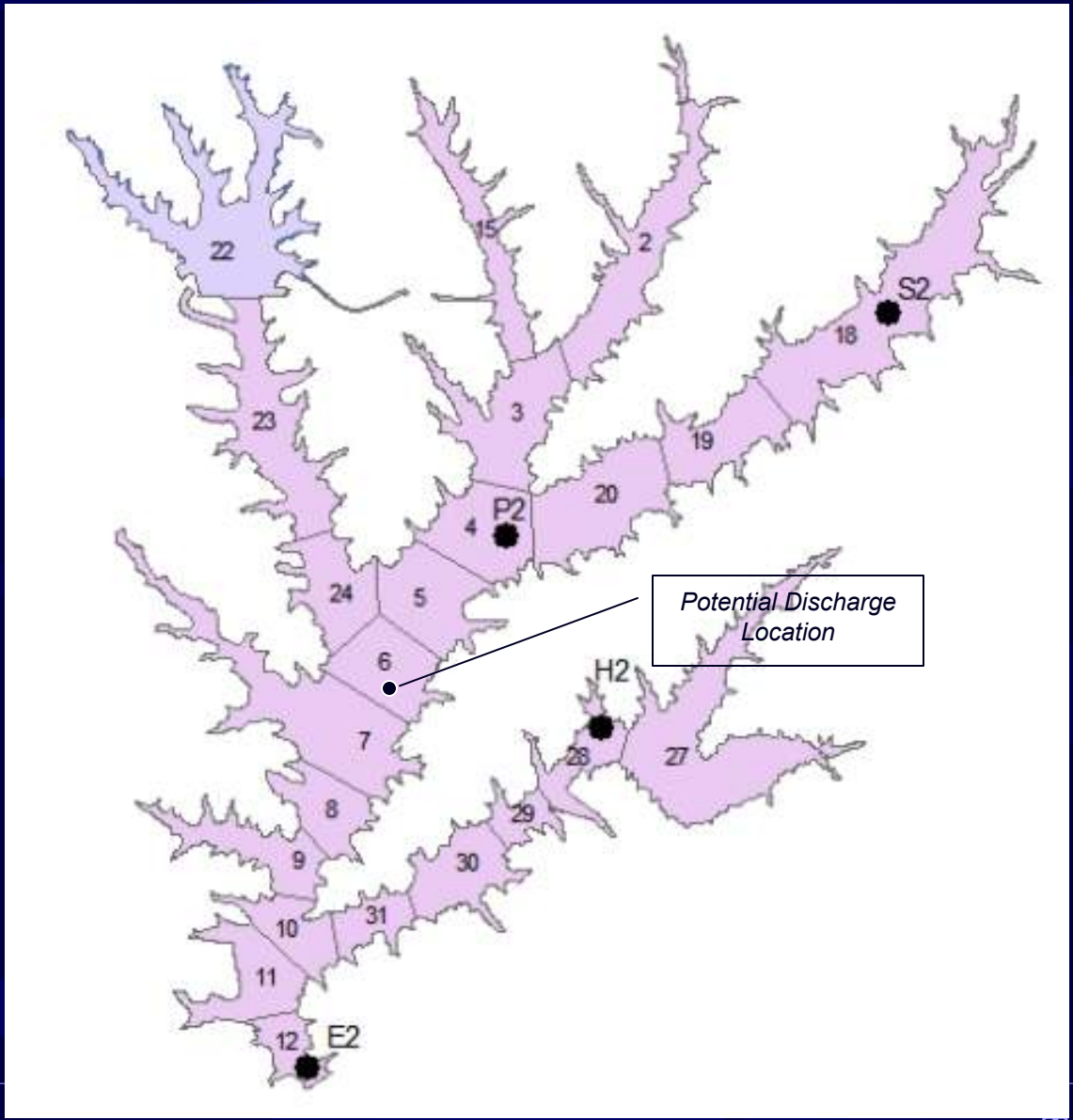
Existing Land Use



Harris Lake Watershed



Harris Lake Model Segmentation



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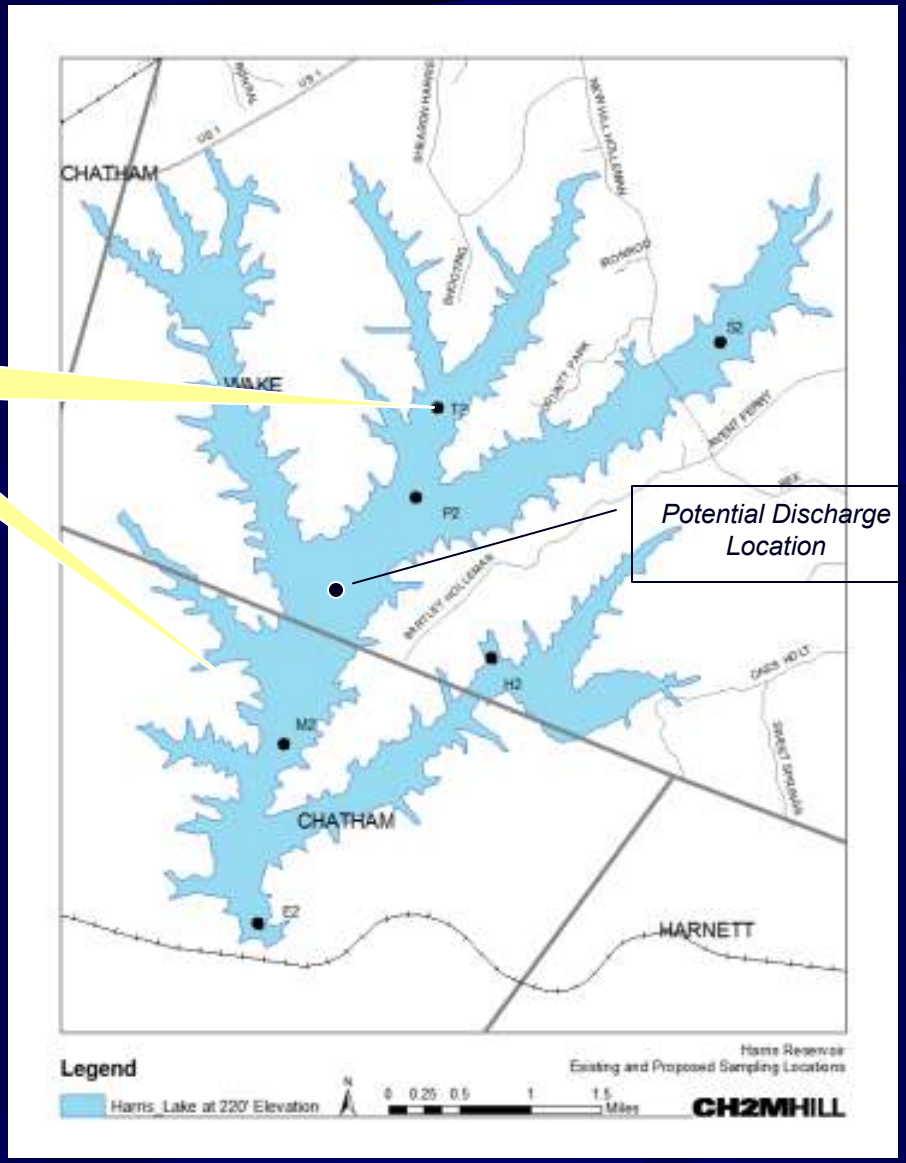
Lake Model Calibration Steps

- Check flow balance
- Calibrate temperature to profiles
- Evaluate balance of organic and inorganic nitrogen species (TKN, NH4, NO3)
- Calibrate total nitrogen and total phosphorus
- Calibrate chlorophyll *a*
- Calibrate dissolved oxygen to profiles

Calibration Status

- **Preliminary Calibration Completed**
  - **Based on Quarterly data at 4 stations**
    - Used 2006 for calibration & 2007 for verification
    - Examined predictions versus results for 2002 through 2007
  - **Draft TM submitted to Partners and DWQ**
  - **Review meeting held on August 11**
  - **Comments received on August 19**
  - **Responses sent on September 9**
- **Next Steps**
  - **Update calibration report**
  - **Complete preliminary discharge sensitivity analysis**
  - **Update model based on 2008 monitoring**
    - 2 additional stations
    - Increased collection frequency

Harris Lake Monitoring Locations



New in 2008

Potential Discharge Location

Calibration Observations

- NPS Nitrogen species are underestimated
  - Not critical because TN/TP ratios high
- Focused on NPS TP
- Temperature and DO predictions are generally very good
- Chlorophyll a simulation captures range and expected pattern of algal growth
  - Underestimates levels during non-growing season
  - Can be refined using temperature parameters

Presentation Topics

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Evaluation of Potential Scenarios

- Baseline – existing conditions
- Phase 1 – Initial WRF discharge
  - 220' lake elevation
  - Western Wake WRF discharge rate of 18 mgd
  - HS discharge rate of 6 mgd
  - Existing land use
  - Combined discharge and separate discharge
- Phase 2 – Long term WRF discharge
  - 220' and 240' lake elevation
  - WRF discharge rate of 30 mgd
  - HS discharge rate of 8 mgd
  - Future land use with BMPs

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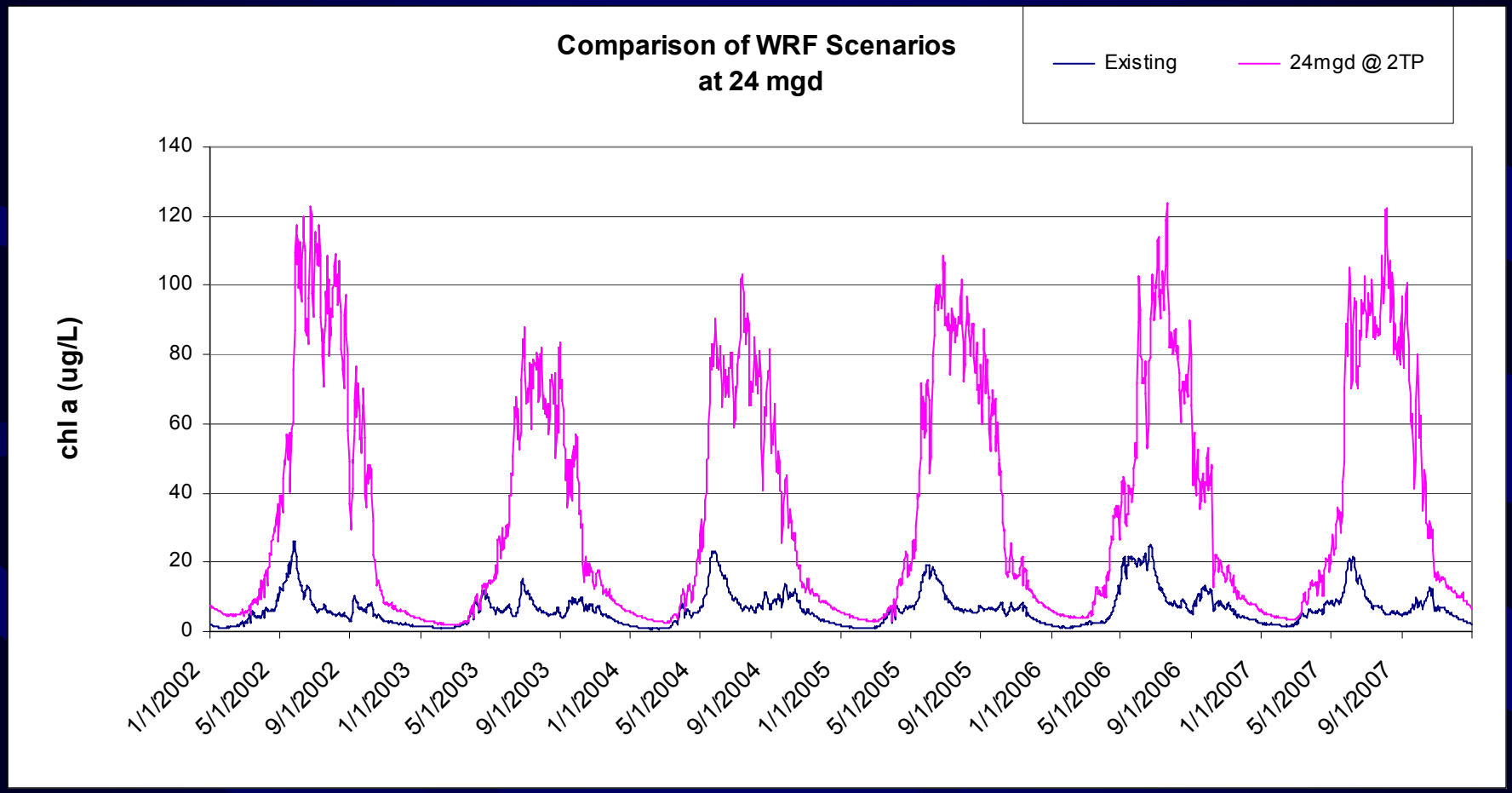
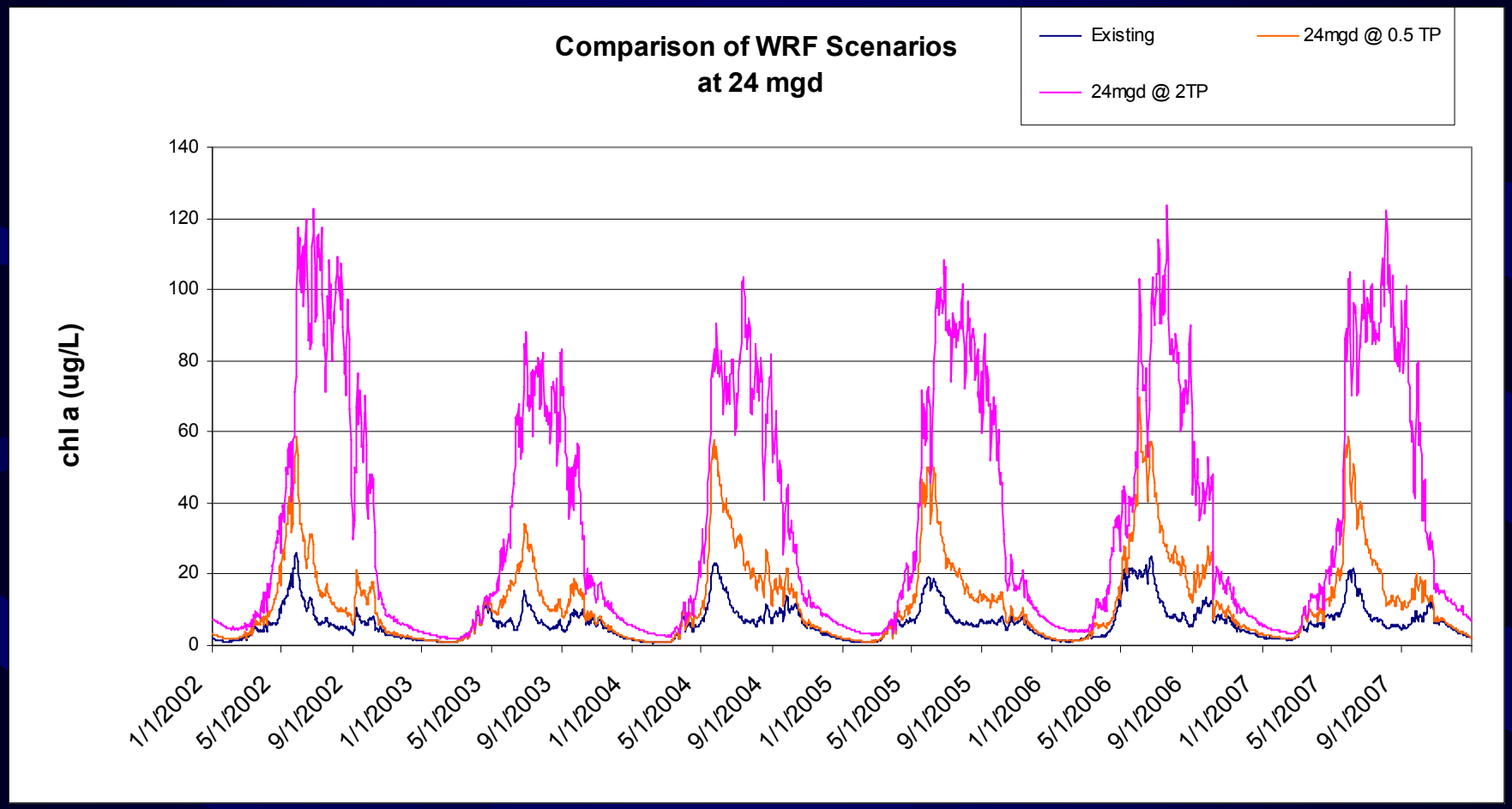
Comparison of chlorophyll a concentrations above the Main Dam @ 220'
Baseline and 24 mgd at 2 mg/L TP



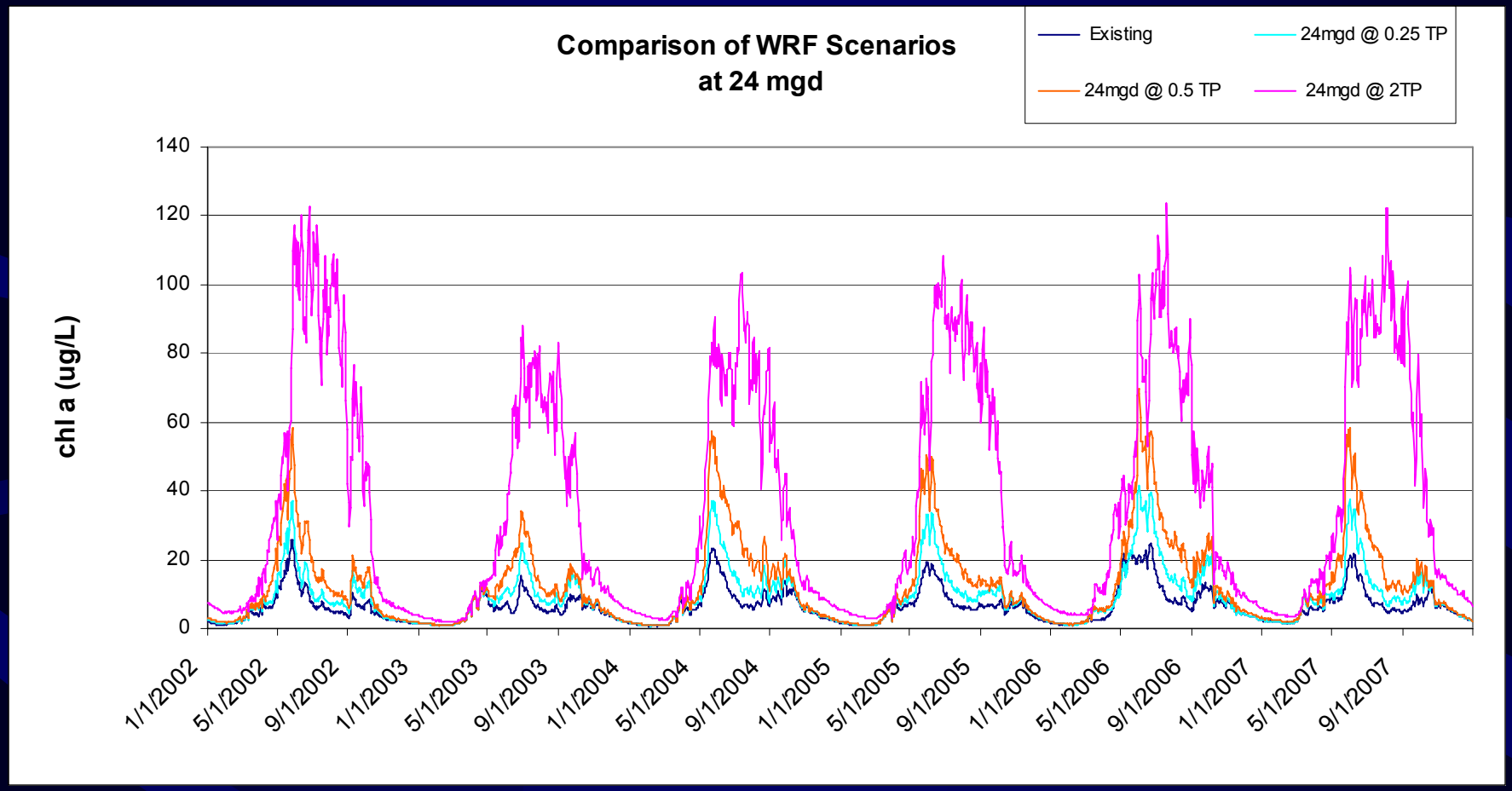
Comparison of chlorophyll a concentrations above the Main Dam @ 220'

Baseline and 24 mgd at 2 & 0.5 mg/L TP



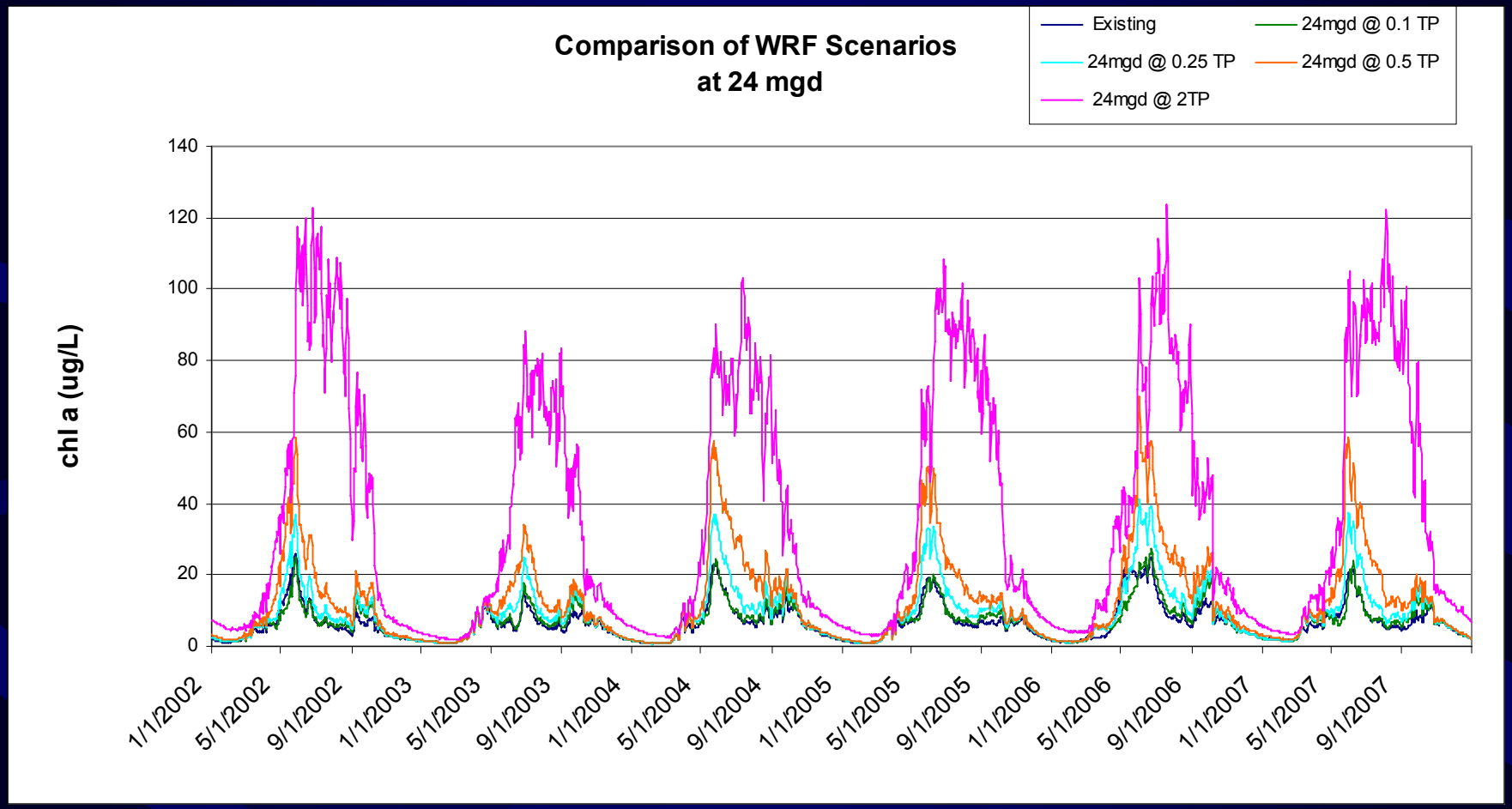
Comparison of chlorophyll a concentrations above the Main Dam @ 220'

Baseline and 24 mgd at 2, 0.5, & 0.25 mg/L TP



Comparison of chlorophyll a concentrations above the Main Dam @ 220'

Baseline and 24 mgd at 2, 0.5, 0.25, & 0.1 mg/L TP



Preliminary Conclusions from Scenarios

- Exceedances of chlorophyll a standard likely at discharge TP concentrations above 0.25 mg/L
- Removal of Holly Springs WWTP from Utley Creek provides little benefit to Harris Lake
  - If Holly Springs meets same TP levels as WW WRF
  - Impacts to Utley Creek not evaluated

Preliminary Conclusions (Continued)

- Increase to 38 mgd has minimal impact at the 0.25 mg/L TP level
  - Increased flushing and reduced residence time outweighs higher TP load
- Higher lake level (240 elevation) could provide significant buffering capacity

Harris Lake Outflow Predictions

Flow Information	Existing Outflow	Outflow with 24 mgd Discharge	Outflow with 38 mgd Discharge
Average Flow for 2001-2007 (cfs)	32.0 (20.7 mgd)	66.6 (43.0 mgd)	87.2 (56.3 mgd)
Average Summer Flow for 2001-2007 (cfs)	12.7 (8.2 mgd)	35.9 (23.1 mgd)	55.0 (35.5 mgd)
Median Summer Flow for 2001-2007 (cfs)	1.4 (0.9 mgd)	26.8 (17.3 mgd)	46.2 (29.8 mgd)
Total Days below 7Q10 (2001-2007)	406.0	45.0	0.0

Presentation Topics

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Schedule (with Cape Fear River Discharge)

2007-2009

- Development of Environmental Impact Statement by USACE including:
  - Public comment period on Draft EIS
  - Public hearing
  - Publication of Final EIS
  - Record of Decision

2008-2009

- Application for and receipt of permits:
  - NPDES permit issued by NCDENR
  - 401 Certification issued by NCDENR
  - 404 Wetlands permit issued by USACE
  - Authorization to Construct permits issued by NCDENR

2010-2013

- Construction

2013

- Operation of facilities begins

Schedule (with Harris Lake Discharge)

2007-2009

- Development of Environmental Impact Statement by USACE including:
  - Public comment period on Draft EIS
  - Public hearing
  - Publication of Final EIS
  - Record of Decision

2009-2010

- EA or EIS for IBT Certificate Changes
  - Notice to DWR
  - Initial public notice and scoping meetings
  - EA/EIS review process

2009-2011

- IBT Process by EMC

2008-2009

- Application for and receipt of permits (except IBT):
  - NPDES permit issued by NCDENR
  - 401 Certification issued by NCDENR
  - 404 Wetlands permit issued by USACE
  - Authorization to Construct permits issued by NCDENR

2010-2013

- Construction

2013??

- Operation of facilities begins

Presentation Topics

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IBT Certificate Compliance Actions

- Return of Water to Haw or Cape Fear Basin after 2010
  - Cary has ILA with Durham County for up to 5 mgd of capacity at the Triangle WWTP
  - Projected required average return for 2011 of 2.1 mgd
- Reclaimed water master plan
  - Average day reclaimed water use of 1.3 mgd
  - Max day reclaimed water use of 4.8 mgd
- Max day IBT compliance is an issue
  - Exacerbated by delay in Western Wake WRF
  - Options to address issues are being considered

Continued Compliance

- Condition 1 of Certificate
  - Return of reclaimed water to Haw River subbasin via Durham Co. WRF meets condition requirements
- Max day IBT compliance options
  - Purchase water from Neuse Basin utility
  - Build facilities to transfer water on max day
  - Request modification of IBT certificate

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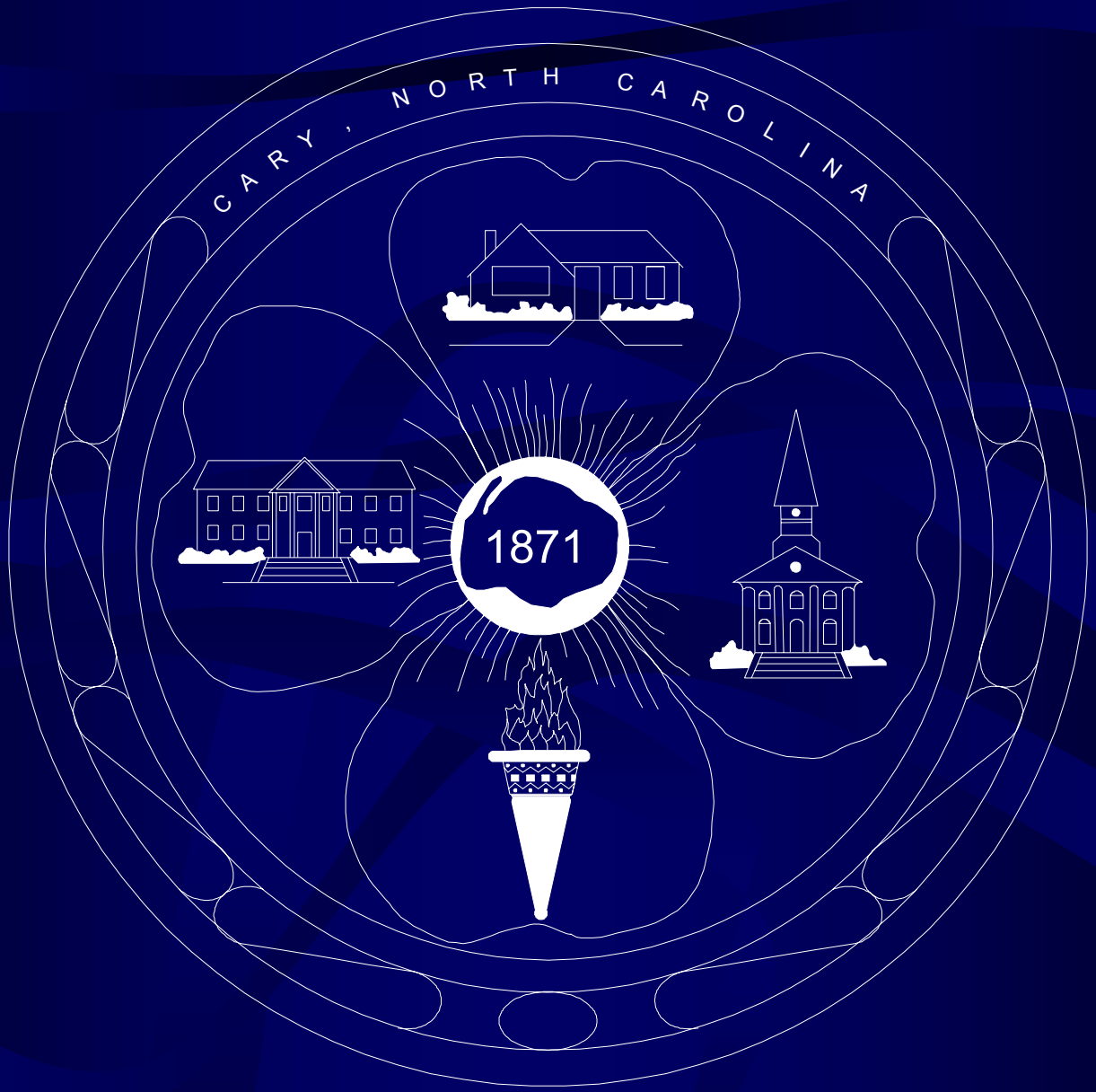
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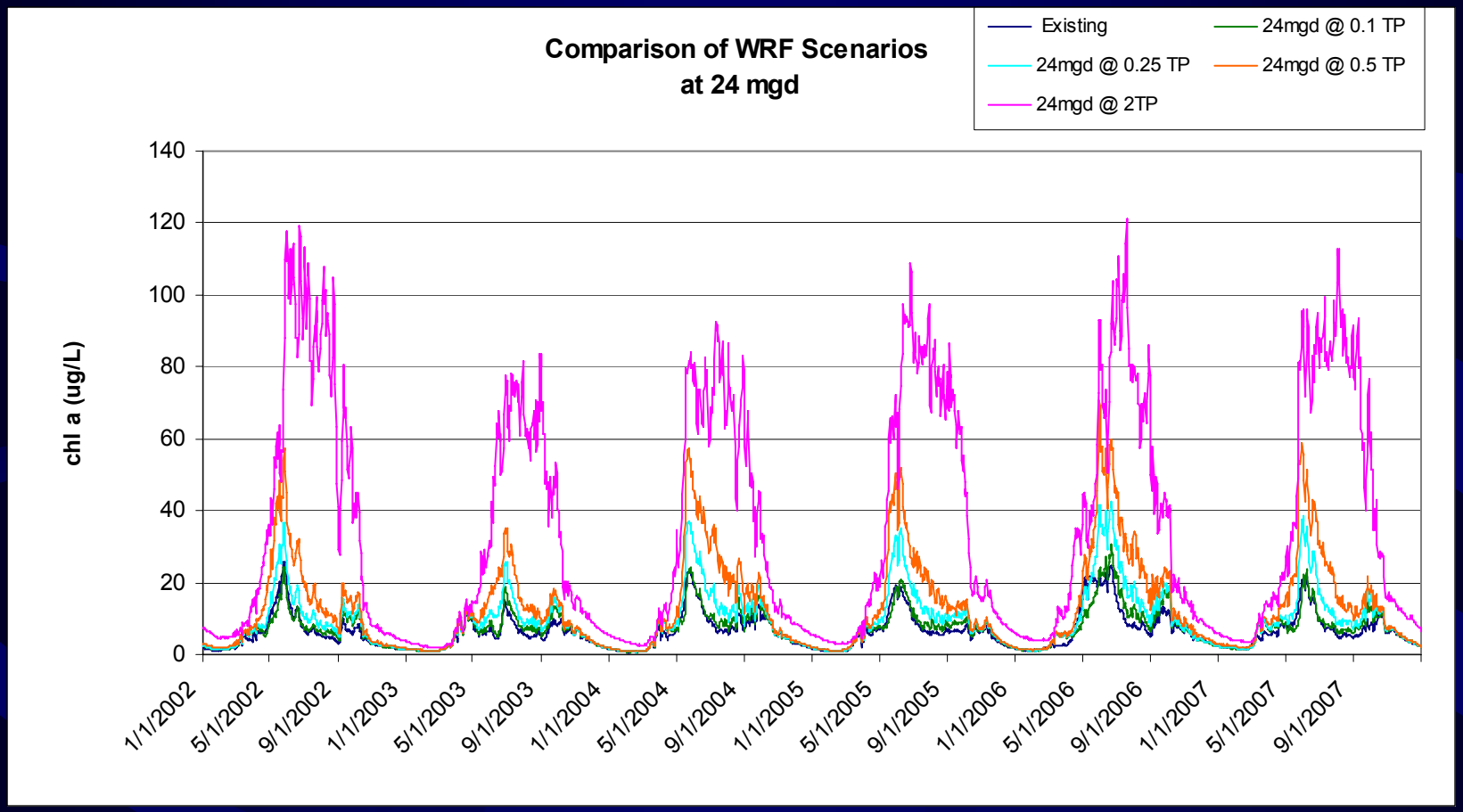
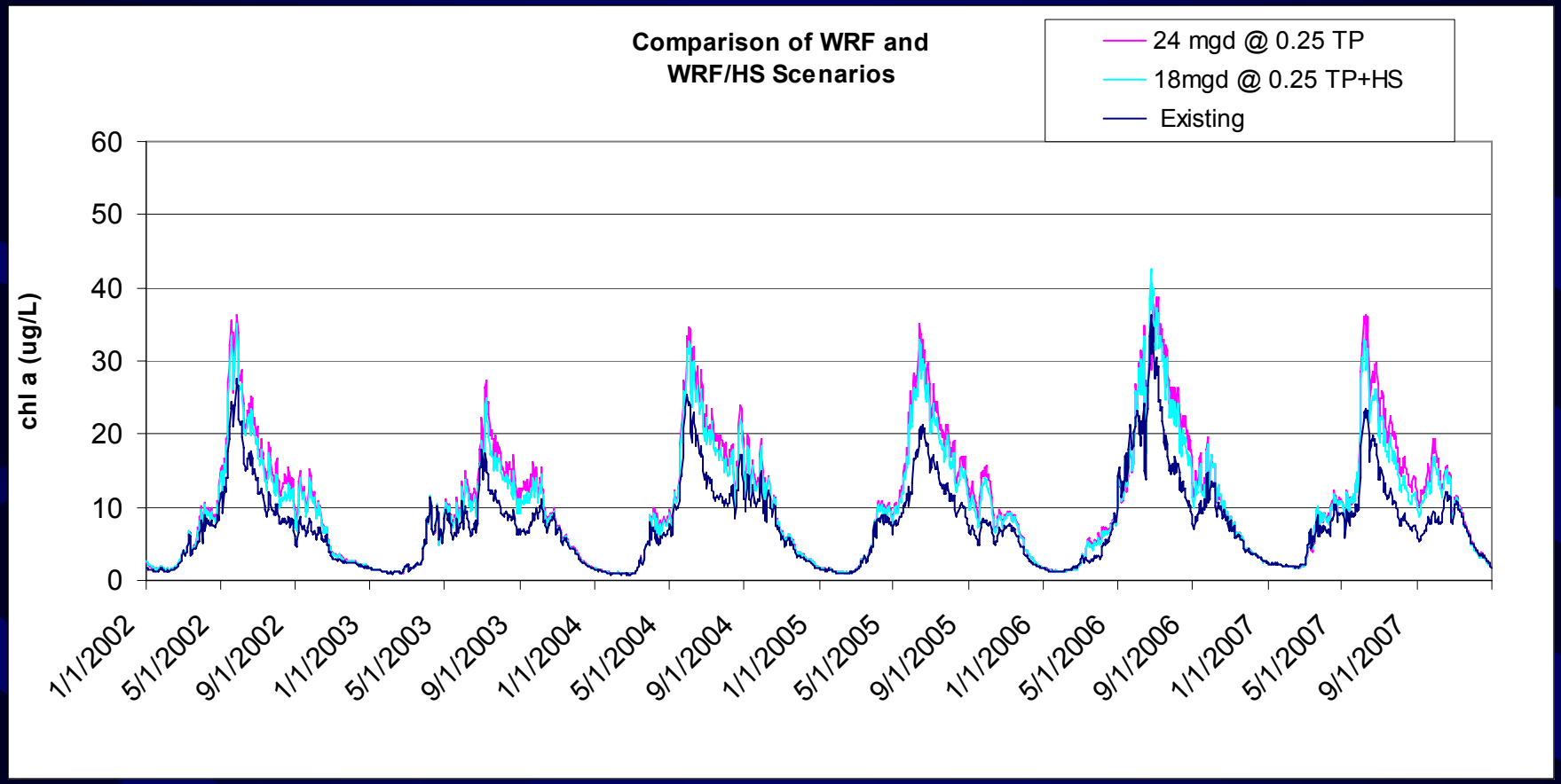
Extra Slides for Potential Questions

Comparison of chlorophyll a concentrations at discharge location @ 220'

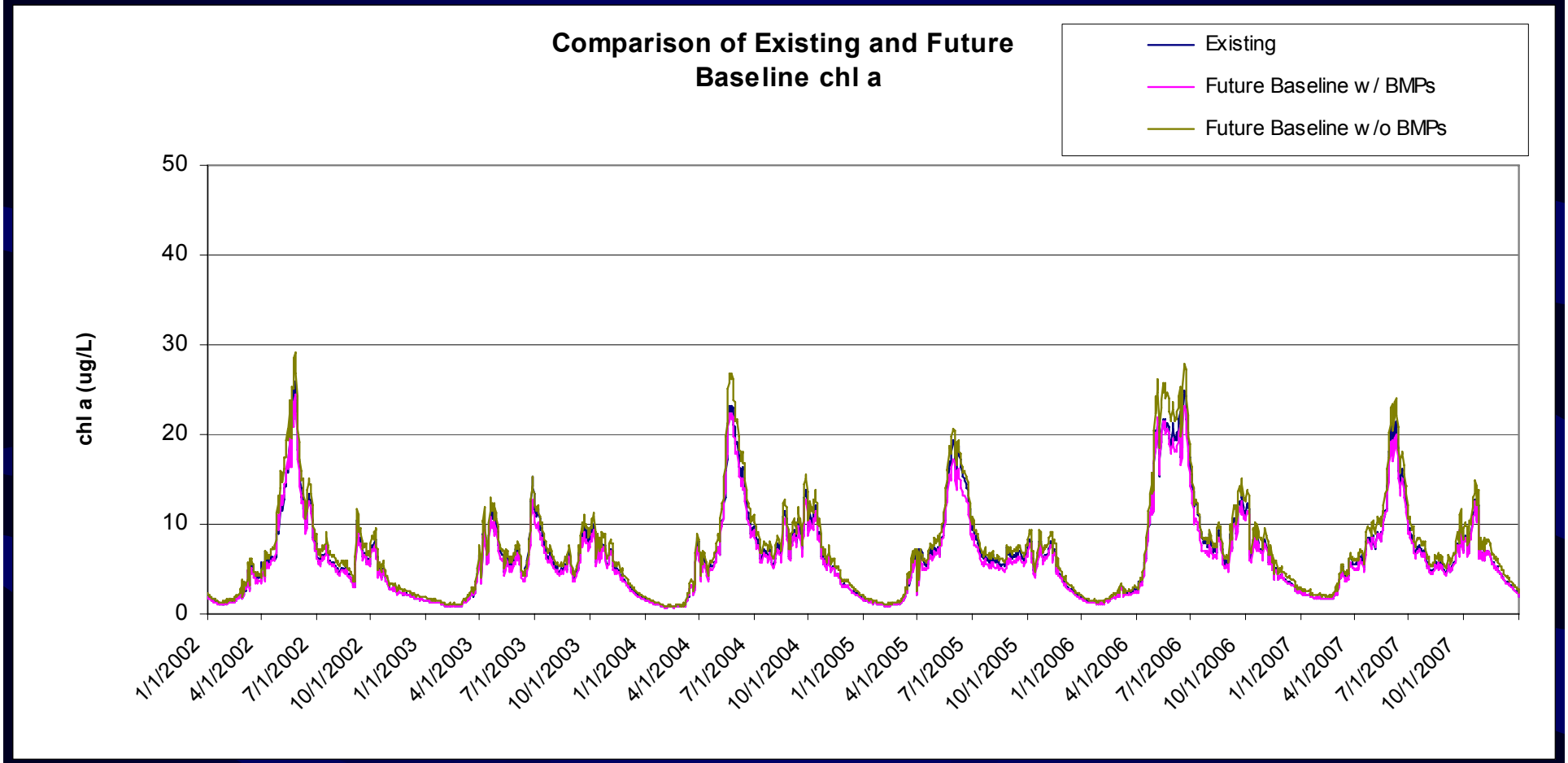
Baseline and 24 mgd at 2, 0.5, 0.25, & 0.1 mg/L TP



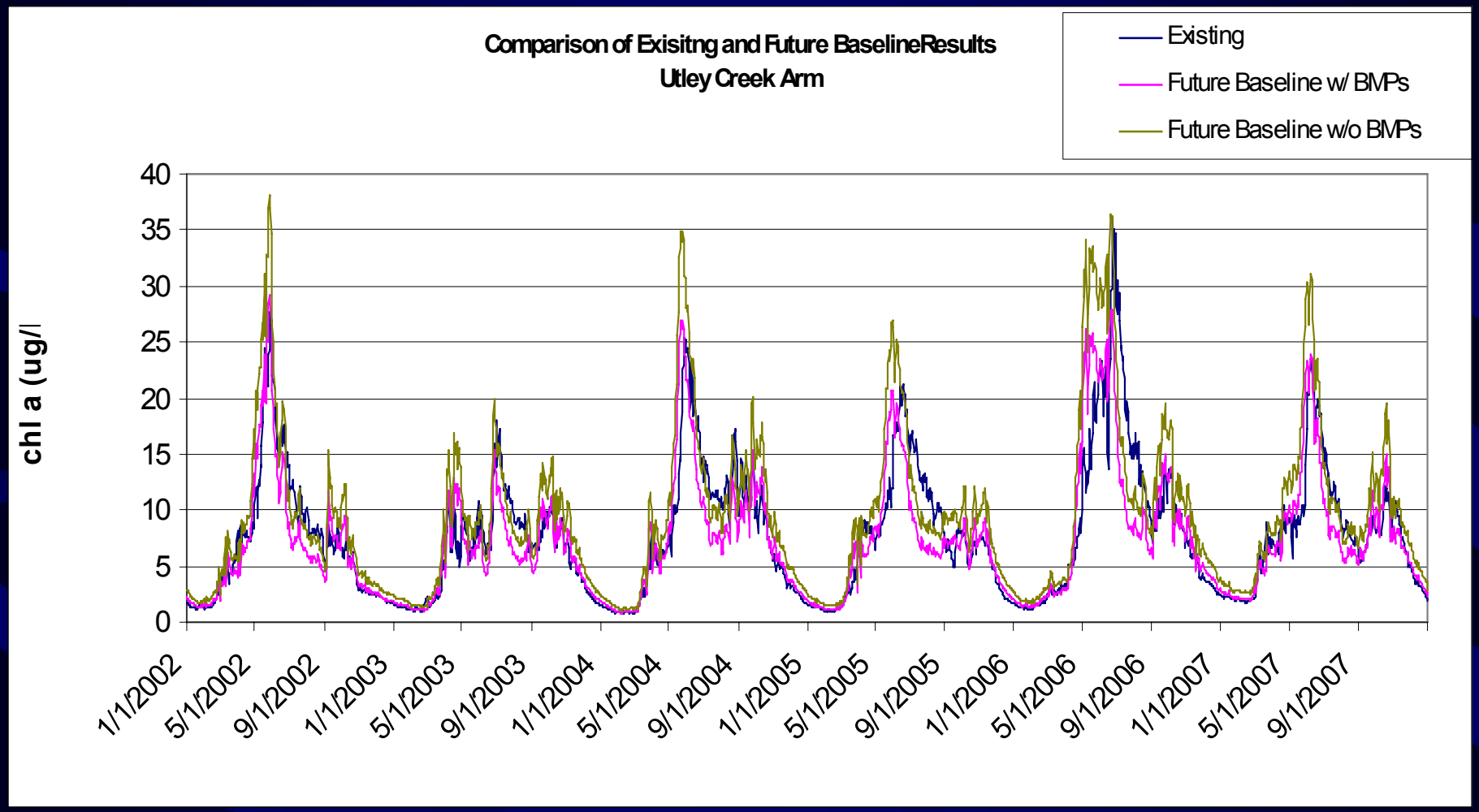
Comparison of chlorophyll a Concentrations in Utley Creek Combined Discharge vs Separate WRF and Holly Springs Discharge



Comparison of Current and Future Land Use Baseline Results at the Main Dam

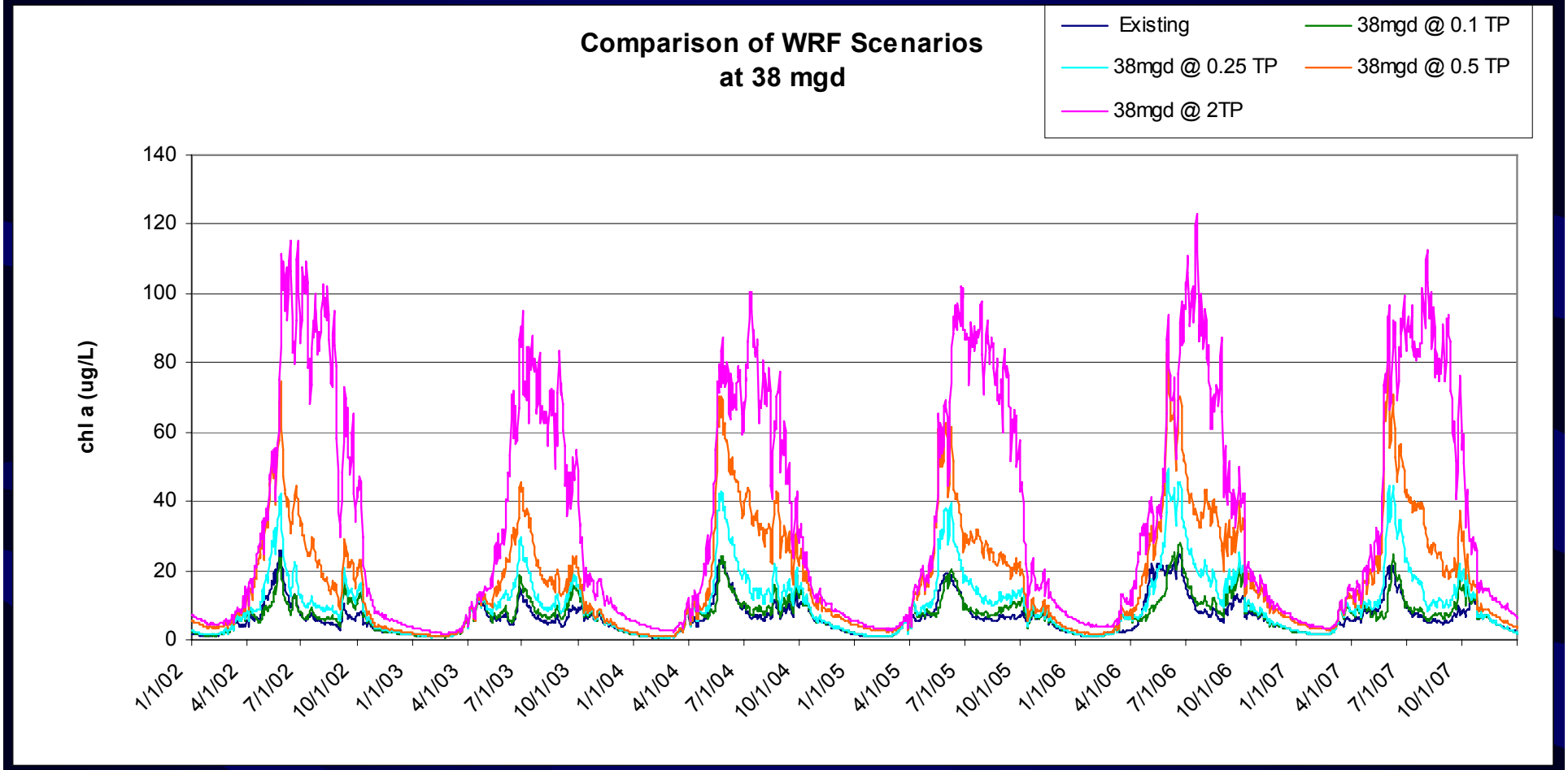


Comparison of Current and Future Land Use Baseline Results in the Utley Creek Arm



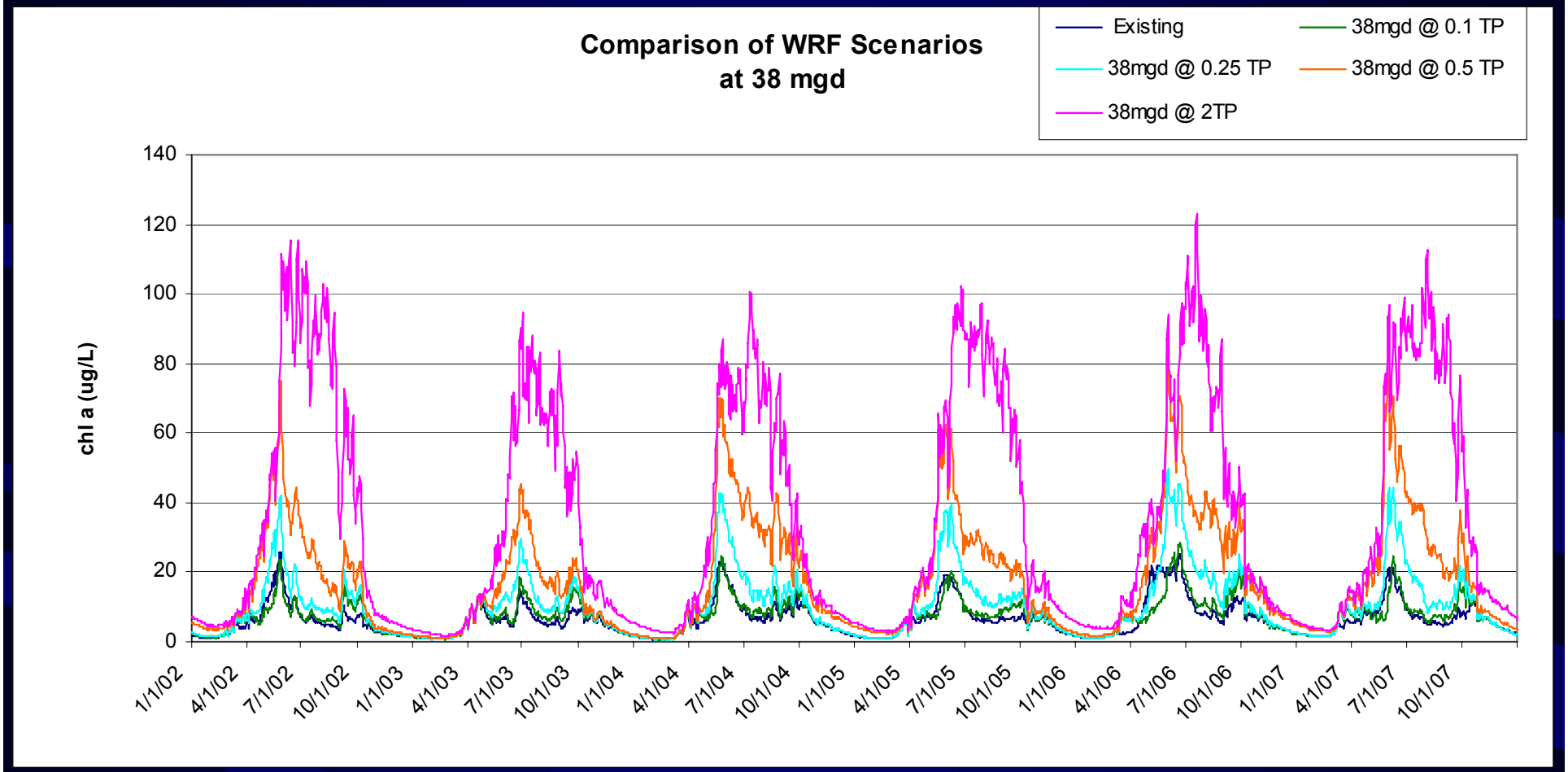
Comparison of chlorophyll a concentrations above the Main Dam @ 220'

Baseline and 38 mgd at 2, 0.5, 0.25, & 0.1 mg/L TP



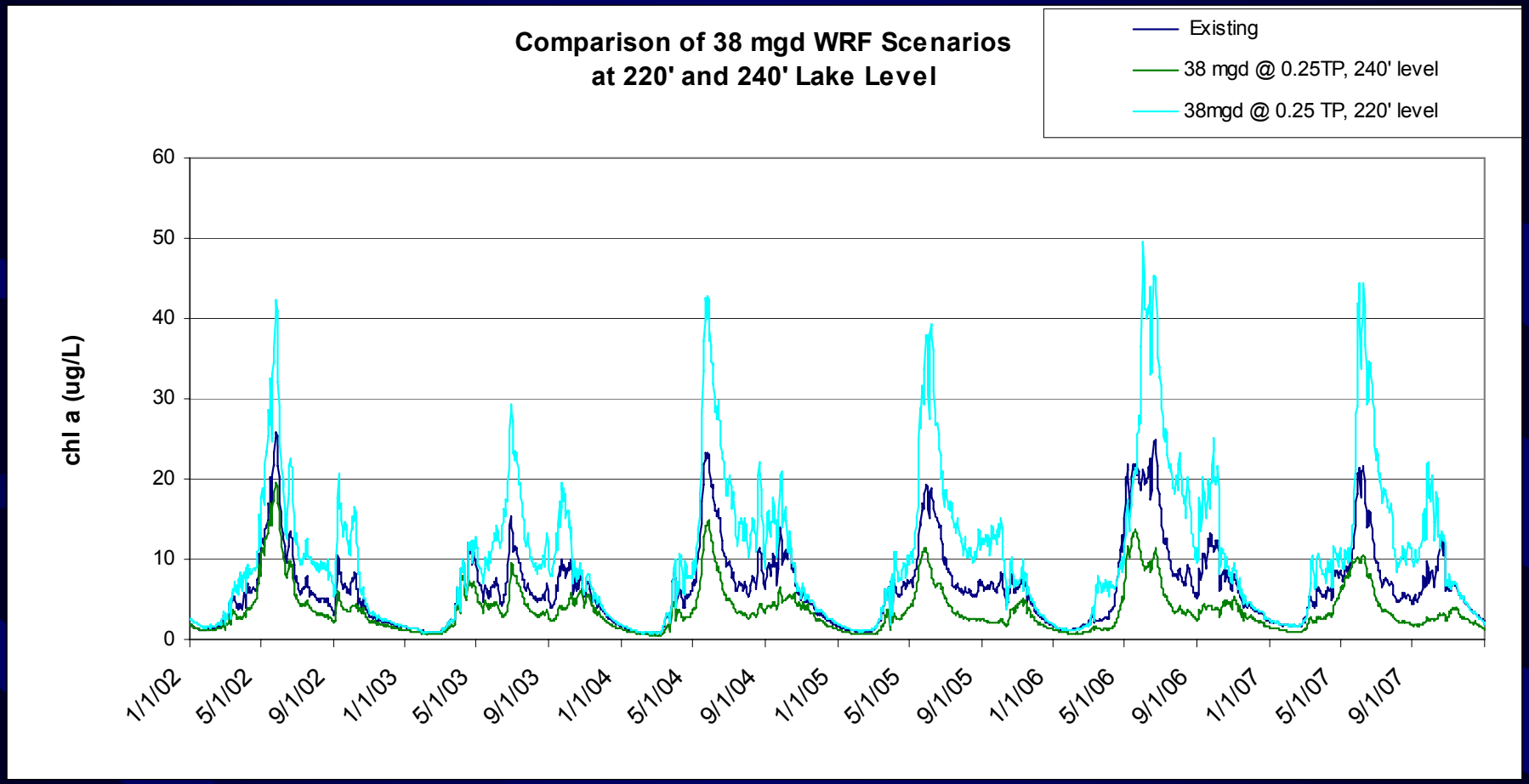
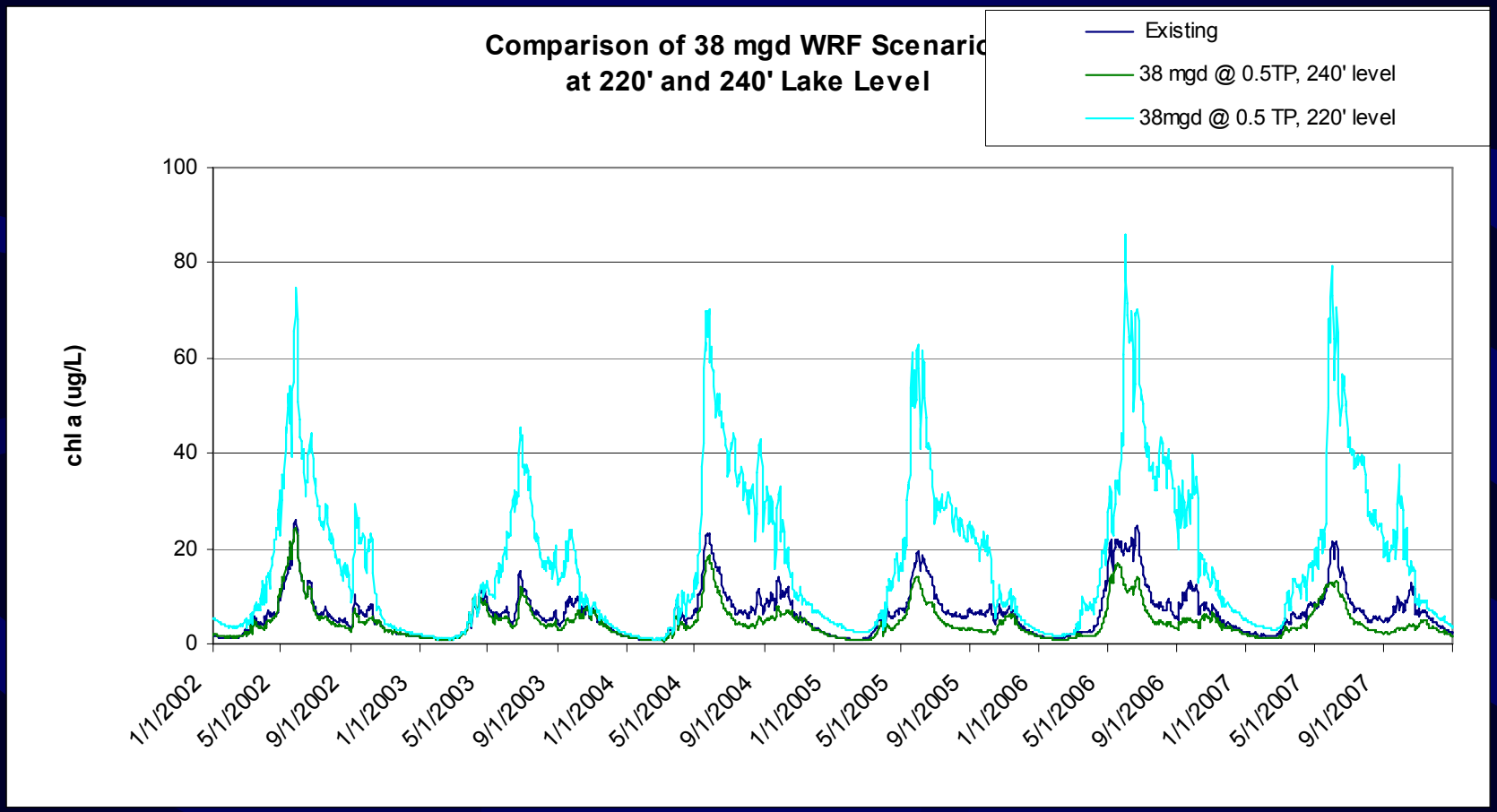
Comparison of chlorophyll a concentrations at Discharge Location @ 220'

Baseline and 38 mgd at 2, 0.5, 0.25, & 0.1 mg/L TP



Comparison of chlorophyll a concentrations at 220' and 240' Elevation Above the Main Dam

Baseline and 38 mgd discharge @ 0.25 mg/L TP



Comparison of chlorophyll a concentrations at 220' and 240' elevation
Baseline and 38 mgd discharge @ 0.5 mg/L TP