Chesapeake Bay Program
E3 and No-Action Scenario Descriptions

Water Quality Goal Implementation Team Conference Call
August 10, 2009

Attachment A

No-Action
Scenario Description

- The No-Action scenario is a "what-if" scenario of watershed conditions without or with minimal managed controls on load sources.
- It is used with the E3 scenario to define "controllable" loads, the difference between No-Action and E3 loads.
  - "Controllable" loads is a component of the methodology to allocate target loads needed to meet water quality standards to different regions of the Chesapeake Bay watershed.
  - Load allocations of target caps also take into consideration the relative impacts of load reductions from regions throughout the watershed on water quality standards.
- Differences between No-Action and E3 scenario loads provide equity among regions of the Chesapeake Bay watershed in that assumptions of point source controls and nonpoint source practice and program implementation levels for each scenario are spatially universal.
  - Differences among regions occur because of more "inherent" differences in, for example, animal and human populations, the number and types of point source facilities, agricultural land types and areas, urban land areas, atmospheric deposition, etc.
- No-Action and E3 scenario conditions can be determined for historic years (beginning 1985), current year, or projected future (through 2030).
- The No-Action condition is often the starting point for development of tributary strategies and implementation plans.
  - All past practices, programs and treatment upgrades that currently exist are credited toward the needed reductions from the No-Action "baseline".
- Relevant comments about the definition of the No-Action scenario during and since the 6/22/09 WQSC discussion and through 8/6/09 have been considered.
  - The following have provided comments: MDE, DNR, VA DCR, PA DEP, NY, the USWG, and Nutrient Subcommittee workgroup members.

No-Action Point Sources

- No-Action Significant municipal wastewater treatment facilities
  - Flow = Tributary Strategy flows where most are at design flows
  - Nitrogen effluent concentration = 18 mg TN/l
  - Phosphorus effluent concentration = 6 mg TP/l
  - BOD = 30 mg/l, DO = 4.5 mg/l and TSS = 15 mg/l
- No-Action Significant industrial dischargers
  - Flow = Tributary Strategy flows where most are at design flows
  - Highest Loads on record or Tributary Strategy loads if greater
  - BOD = 30 mg/l, DO = 4.5 mg/l and TSS = 15 mg/l

- No-Action Non-significant municipal wastewater treatment facilities
  - Flow = Tributary Strategy flows
  - Nitrogen effluent concentration = 18 mg TN/l
  - Phosphorus effluent concentration = 6 mg TP/l
  - BOD = 30 mg/l, DO = 4.5 mg/l and TSS = 15 mg/l

No-Action Combined Sewer Overflows

- Efforts underway to best determine loads from all permitted CSO outfalls in the Chesapeake Bay Watershed
- Presently, only DC CSO is in the Phase 5 model and No-Action loads are determined as follows:
  - Flow = current base condition flow
  - Nitrogen effluent concentration = 18 mg TN/l
  - Phosphorus effluent concentration = 6 mg TP/l
  - BOD = 200 mg/l, DO = 4.5 mg/l and TSS = 45 mg/l.

No-Action Septic Practices

- There are no nutrient and sediment control practices and programs in the No-Action scenario throughout the Chesapeake Bay watershed for on-site waste treatment.

No-Action Atmospheric Deposition

- WQGIT is considering using the same atmospheric deposition for both the E3 and No-Action scenarios in determining the "controllable" load.
  - Recommendation is to employ 2020 E3 atmospheric deposition in both E3 and No-Action.

No-Action Urban Practices

- There are no nutrient and sediment control practices and programs in the No-Action scenario throughout the Chesapeake Bay watershed for the urban sector.

No-Action Agricultural Practices

- There are no nutrient and sediment control practices and programs in the No-Action scenario throughout the Chesapeake Bay watershed for onsite wastewater management (septic) systems.

No-Action Forestry Practices

- There are no nutrient and sediment control practices and programs in the No-Action scenario throughout the Chesapeake Bay watershed on forest lands where there could be environmental impacts from timber harvesting and dirt & gravel roads.

E3 (Everything, Everywhere by Everyone)
Scenario Description

- The E3 scenario is a "what-if" scenario of watershed conditions with theoretical maximum levels of managed controls on load sources.
  - There are no cost and few physical limitations to implementing BMPs for point and non-point sources in E3.
- It is used with the No-Action scenario to define "controllable" loads, the difference between No-Action and E3 loads.
  - "Controllable" loads is a component of the methodology to allocate target loads needed to meet water quality standards to different regions of the Chesapeake Bay watershed.
  - Load allocations of target caps also take into consideration the relative impacts of load reductions from regions throughout the watershed on water quality standards.
- Differences between No-Action and E3 scenario loads provide equity among regions of the Chesapeake Bay watershed in that assumptions of point source controls and nonpoint source practice and program implementation levels for each scenario are spatially universal.
  - Differences among regions occur because of more "inherent" differences in, for example, animal and human populations, the number and types of point source facilities, agricultural land types and areas, urban land areas, atmospheric deposition, etc.
- Generally, E3 implementation levels and their associated reductions in nutrients and sediment could not be achieved for many practices, programs and control technologies when considering physical limitations and participation levels.
- E3 includes most technologies, practices and programs that have been reported by jurisdictions as part of annual model assessments, Tributary Strategies, and Milestones.
  - For most non-point source BMPs, it was assumed that the load from every available acre of the relevant land area was being controlled by a suite of existing or innovative practices. In addition, management programs converted landuses from those with high-yielding nutrient and sediment loads to those with lower.
  - E3 does not include the entire suite of practices due to the goal of achieving maximum load reductions. The BMPs that are fully implemented have been estimated to produce greater reductions than alternative practices that could be applied to the same land base.
  - The current definition of E3 includes a greater number of types of practices than historic E3 scenarios.
  - E3 load reductions could be exceeded through greater effectiveness of practices and technologies in the future because of, for example, employment of new technologies and greater efforts on operation and maintenance.
- For point sources, nutrient control technologies are assumed to apply to all dischargers.
- No-Action and E3 scenario conditions can be determined for historic years (beginning around 1985), current year, or projected future (through 2030).
- Relevant comments about the definition of the E3 scenario have been considered during and since the 6/22/09 WQSC discussion and through 8/6/09, including the following: MDE, DNR, VA DCR, PA DEP, NY, the USWG, and Nutrient Subcommittee workgroup members.

E3 Point Sources

- E3 Significant municipal wastewater treatment facilities
  - Flow = Tributary Strategy flows where most are at design flows
  - Nitrogen effluent concentration = 3 mg TN/l
  - Phosphorus effluent concentration = 0.1 mg TP/l
  - BOD = 3 mg/l, DO = 6 mg/l and TSS = 5 mg/l
- E3 Significant industrial dischargers
  - The wastewater workgroup recommends applying the percentage of equivalent reduction from Tributary Strategy to E3 level for significant municipal facilities by state to significant industrial facilities.
- E3 Non-significant municipal wastewater treatment facilities
  - Flow = Design or 2006 flow if design is not available
  - Nitrogen effluent concentration = 8 mg TN/l or Tributary Strategy concentration if less
  - Phosphorus effluent concentration = 2 mg TP/l or Tributary Strategy concentration if less
  - BOD = 5 mg/l, DO = 5 mg/l and TSS = 8 mg/l
- E3 Non-significant industrial wastewater treatment facilities
  Most non-significant industrial wastewater treatment facilities are in the phase 5.2 model and will be included in the phase 5.3 model. The wastewater workgroup recommend applying the percentage of equivalent reduction from TS to E3 for non-significant municipal facilities by state to non-significant industrial facilities

E3 Combined Sewer Overflows

- Long Term Control Plan Full Implementation for all CSOs.
- Presently, only DC CSO is in the Phase 5.2 model. It is anticipated that 50+ more CSOs will be incorporated in the phase 5.3 model.

E3 Septic Practices

- E3 Septic connections
  - 10% of septic systems connected to wastewater treatment facilities.
- E3 Septic denitrification and maintenance
  - Remaining septic systems after connections employ denitrification technologies and are maintained through regular pumping to meet an edge-of-septic-field TN concentration of 10 mg/L or 2.3 lbs TN per person-year.or to achieve 50% reduction in TN load from the edge-of-septic-field, whichever is the greater reduction.
  - Septic systems are maintained by a responsible management entity or in perpetuity through a maintenance contract.

E3 Atmospheric Deposition

- E3 atmospheric deposition uses the Bay Program's air scenario that shows the maximum reductions in deposition – a projection to 2020.
- The 2020 scenario represents incremental improvements and control options (beyond 2020 CAIR) that might be available to states for application by 2020 to meet a more stringent ozone standard (stricter than 0.08 ppm, i.e., the new 0.075 ppm ozone standard of March 2008).

- The emissions projections for the 2020 scenario assumes the following:
  - EGUs: lower ozone season nested emission caps in OTC states; targeting use of maximum controls for coal fired power plants in or near non-attainment areas.
  - Non-EGU point sources: new supplemental controls, such as low NOx burners, plus increased control measure efficiencies on planned controls and step up of controls to maximum efficiency measures, e.g., replacing SNCRs (Selective Non-Catalytic Reduction) with SCRs (Selective Catalytic Reduction) control technology.
  - Area (nonpoint area) sources: switching to natural gas and low sulfur fuel.
  - On-Road mobile sources: increased penetration of diesel retrofits and continuous inspection and maintenance using remote onboard diagnostic systems.
  - Non-Road mobile sources: increased penetration of diesel retrofits and engine rebuilds.
  - Reduced NOx emissions from marine vessels in coastal shipping lanes.
- Request has been sent to obtain a new emissions data set that would better reflect of a Limit-Of-Technology scenario; however, work is extensive as requirements are for potential emissions for the entire U.S.
- WQGIT is considering using the same atmospheric deposition for both the E3 and No-Action scenarios in determining the "controllable" load.
  - Recommendation is to employ the above 2020 E3 atmospheric deposition in both E3 and No-Action.

E3 Urban Practices

- E3 Forest conservation & urban growth reduction
  - All projected loss of forest from development is retained or planted in forest.
- E3 Controls on extractive (active and abandoned mines) – Abandoned mine reclamation
  - Extractive landuse is assumed to be protected to the level of loads associated with pervious urban.
- E3 Riparian forest buffers on urban
  - All riparian areas without natural vegetation (forests and wetlands) associated with urban lands are buffered as forest.
  - The area and location of un-buffered riparian land is determined using the best available data 1) 1:24K National Hydrography Dataset, and 2) 2001 land cover.
- E3 Tree planting on urban
  - Forest conservation and urban growth reduction account for additional upland tree plantings in the urban sector.
- E3 Environmental site design / low-impact development on new development
  - Environmental site design / low-impact development practices (or equivalent) applied to all urban growth.
  - Environmental site design and low-impact development practices are designed to reduce TN by 50%, TP by 60%, and SED by 90% from a pre-BMP condition.
- E3 Stormwater retrofits on existing urban
  - All old and recent development retrofitted with a suite of practices at 60% stormwater quality and quantity management where nutrient and sediment reduction effectiveness is TN = 27%, TP = 40%, and TSS = 65% or to 2007 Stormwater Management Act requirements of forest in good condition up to 1-year storm – whichever yields the greater benefit.
- E3 Erosion & sediment controls
  - Nutrient and sediment runoff from all bare-construction landuse is reduced 70%.

- E3 Nutrient management on urban
  - All pervious urban acres are under nutrient management.
- E3 Stream restoration on urban
  - Tributary Strategy levels of implementation

E3 Agricultural Practices

- E3 Conservation tillage
  - All row crops (high-till and low-till) are conservation-tilled
- E3 Enhanced nutrient management applications
  - All agricultural land is under enhanced nutrient management – the hybrid of reduced application rate and decision agriculture
  - Long-term, adaptive management approach with continuous improvement.
- E3 Riparian forest buffers on agriculture
  - All riparian areas without natural vegetation (forests and wetlands) associated with agricultural lands are buffered as forest.
  - The area and location of un-buffered riparian land is determined using the best available data 1) 1:24K National Hydrography Dataset, and 2) 2001 land cover.
  - Current implementation of riparian grass buffers is considered converted to riparian forest buffers.
- E3 Carbon sequestration / alternative crops
  - 5% of the available row crop acres but the combined implementation of riparian forest buffers and carbon sequestration is not to exceed 25% of available row crops.
  - Program is replacement of row crops with long-term grasses that serve as a carbon bank.
- E3 Wetland restoration
  - The percent of wetland restoration on pasture land is 25% of the total pasture area less the acres converted to riparian forest buffers on pasture.
  - The percent of wetland restoration on crops (row crops + hay + alfalfa) is 25% of crop acres less the combined implementation of riparian forest buffers and carbon sequestration on crops.
- E3 Agricultural land retirement
  - Retirement of highly erodible land is considered in the E3 practices of riparian forest buffers, wetland restoration, and carbon sequestration practices which have equal or greater environmental benefits.
- E3 Tree planting on agriculture
  - Tree planting is considered in the E3 practice of riparian forest buffers which have greater environmental benefits.
- E3 Conservation Plans (non-nutrient management)
  - Conservation Plans are fully implemented on all agricultural land (row crops, hay, alfalfa, and pasture).
- E3 Cover crops and commodity cover crops / small grain enhancement
  - Early-planting cover crops on all relevant row crops.
  - Early-planting commodity cover crops associated with small-grain production.
- E3 Stream protection fencing and prescribed grazing (dairy precision feeding and forage management)
  - Exclusion fencing is assumed to protect the stream corridor area designated as the degraded landuse and the area between the stream bank and fence is converted to and is part of agricultural forest buffer determination.

- All upland pasture area is assumed to be under prescribed grazing management.
- The nutrient content of manure of all dairy cows is reduced by 24% for nitrogen and 25% for phosphorus from a pre-feed management condition and management approaches may include increased productivity and use of on-farm grass forage.
- Horse pasture management benefits are the same as those for fencing and prescribed grazing practices for livestock in general.

- E3 Animal waste management / runoff control
  - There is minimal runoff of manure nutrients from the production area of animal feeding operations.
  - Model landuse acres designated for runoff from animal feeding operations are converted to grassland without fertilizer nutrient applications.
- E3 Poultry phytase
  - The phosphorus content in the manure of all poultry is reduced by 32% from a pre-feed management condition.
- E3 Swine phytase
  - The phosphorus content in the manure of all swine is reduced from a pre-feed management condition.
- E3 Manure transport
  - Data is being developed for regional applicability of the practice including alternative use of manure where nutrients are removed from the balance.
- E3 Ammonia emissions reductions
  - It is assumed that 58% of the ammonia emissions attributable to confined animals is managed through litter treatment, biofilters on housing ventilation systems, and covers on animal waste storage or treatment facilities.

E3 Forest Harvest Practices

- E3 Forest harvesting practices
  - It is assumed that forestry BMPs designed to minimize the environmental impacts from timber harvesting , such as road building and cutting/thinning operations, are properly installed on all harvested lands with no measurable increase in nutrient and sediment discharge.
  - Model landuse acres designated for harvested forest are converted to forest.

Full Program Implementation
(aka Full Funding – Full Regulatory)
Scenario Purpose and Information Sources

- The Full Program Implementation scenario is an effort to try to quantify the 'do-ability' of achieving various nutrient controls in the Chesapeake Bay watershed.
  - Many stakeholders questioned feasibility, especially in response to E3 – including PSC.
- A working qualitative definition of the Full Program Implementation scenario is suggested as: the amount of nutrient and sediment controls for different source sectors that can be expected to be employed on a large scale. Full Program Implementation may include limit-of-technology for some sources sectors but is, perhaps, less than limit of technology for all nonpoint source sectors. Do-ability can be expressed at several levels, including:
  - Technical achievability – the maximum of current technology to reduce nutrients
  - Operational achievability – the maximum tolerance for individuals and society to support nutrient controls. For example, will society support large-scale conversion of cropland to forest? Can operators of small package WWTP operate sophisticated plants designed to achieve low levels of nutrients?
  - Financial achievability- the maximum cost burden on individuals or society to reduce nutrients
- While it is, admittedly, difficult to separate the financial achievability from the rest of this analysis, the Full Program Implementation analysis only address the first two levels of do-ability.
- Full Program Implementation scenario could be used to:
  - place a 'do-ability' perspective on the draft Bay nutrient loading budget as well as final loadings expressed in the Chesapeake Bay TMDL.
  - do an affordability assessment
- Nonpoint source practices and programs will not be universal to jurisdictions – only if considered in a jurisdiction's annual model assessment, Tributary Strategy, or Milestones.

- Levels of implementation and control technologies for the Full Program Implementation scenario will take the following into consideration:
  - Tetra Tech March 18, 2009 literature review for EPA.
  - CBP workgroup, subcommittee, and implementation team (jurisdictional) responses to assigned task for Full-Funding Full-Regulatory
  - Implementation levels in historic and current annual model assessments, Tributary Strategy and E3 scenarios.
  - Historic documentation of scenario "Full Voluntary Program Implementation".
  - EPA perspectives.