

CRITICAL WATER PLANNING AREAS

The Critical Water Planning Area Designation Process

The Water Resources Planning Act⁷³ established a process to designate “Critical Water Planning Areas” (CWPAs). CWPAs are areas of the commonwealth where existing or future demands exceed or threaten to exceed the safe yield of available water resources. The Act also outlined a process for identifying CWPAs and provided the authority to prepare “Critical Area Resource Plans” (CARPs) for any watershed or watersheds within a CWPA. Required components of a CARP include assessments of water availability and quality, water uses, conflicts among users and consideration of stormwater and floodplain issues. A CARP must also identify practical alternatives for assuring an adequate supply of water to satisfy existing and future reasonable and beneficial uses.

During the early stages of updating the current *State Water Plan*, the Statewide Water Resources Committee formed a Critical Water Planning Area Subcommittee and initially tasked it with assisting DEP in the development of a formal guidance that would define the CWPA designation process. This effort resulted in DEP issuing the “Guidelines for Identification of Critical Water Planning Areas (Guidelines)” on September 30, 2006. The Guidelines, presented in Appendix E, supply necessary detail on the statutory basis, the criteria and process for identifying CWPAs; and describe a five-stage process for nominating, reviewing, recommending and designating CWPAs.

- Stage 1 Nomination
- Stage 2 Initial screening and prioritization
- Stage 3 Data verification, development and review
- Stage 4 Review and recommendations by Regional Committees

- Stage 5 Review and designation by Statewide Committee and DEP secretary

Baseline Information and Assessment Tools

The following describes how water use data were collected and managed, how the Water Analysis Screening Tool (WAST) was developed, and how the screening tool is being employed to identify potential CWPAs.

Water Use Data System

The “backbone” of the *State Water Plan* is the water use data that are supplied to the USGS-developed WAST to assist in the preliminary identification of potential CWPAs. DEP has maintained a database of water resources information since the 1970’s. This Water Use Data System (WUDS) includes information on water withdrawals, uses and discharges. Documentation of water resource use had previously been collected on a periodic basis from public water suppliers as part of their annual water withdrawal reporting, as part of water allocation permitting and reporting, and from annual metering reports required by the Delaware River Basin Commission (DRBC). The WUDS records, however, did not encompass all water use sectors to the extent necessary to adequately run the WAST model.

DEP used the existing WUDS as a basis for a more comprehensive system to gather, process and distribute information on the availability, extent, quality and use of water resources. The updated system includes a water use registration program, required by the Act, which provides the level of water use data demanded to perform the watershed assessments and related work necessary to identify potential CWPAs.

Registration Program

The Act requires registration of all water withdrawals and uses greater than 10,000

⁷³ 27 Pa. C.S. §3101 et seq.

gallons per day averaged over any 30-day period and of all public water supply and hydropower facilities. This level of informational detail, when accumulated, adequately represents water withdrawals and their influence within a given watershed.

In 2003, DEP established paper and web-based options for registering water use. Several outreach efforts were then conducted that targeted water use sectors expected to fall within the registration requirements. Using a Department of Labor and Industry mailing list, DEP contacted major water users across the state of their likely obligation to register their water use. With the assistance of the Department of Agriculture, an agriculture work group was created in 2003 to inform the farming community of the registration requirements and to encourage their water use registration. Also in 2003, direct mailings were made to farmers and agricultural businesses by several of the participating agriculture advocacy agencies. In addition, a teleconference was held by the College of Agriculture at the Pennsylvania State University to disseminate information on the Act and its water use registration provisions to conservation districts and Agricultural Extension Services. During this same period, DEP contacted all public water suppliers through mailings to remind them of their obligation under the Act to register their water uses. These efforts resulted in 2003 being selected as the base year for water withdrawal and use information.

Water Analysis Screening Tool (WAST)

Also in 2003, DEP entered into an agreement with the U.S. Geological Survey, Pennsylvania Water Science Center in New Cumberland, Pa. to develop a way to manage and analyze the extensive water resource information that is required to assess current and future statewide water use and availability. The result was a Geographic Information System (GIS) based model, the WAST.

The WAST is a sophisticated planning tool that compares net water withdrawals (withdrawals minus discharges/returns) against designated criteria (percent of the low flow [7Q10]) to measure the influence of the net withdrawals on

aquatic resources. The graphical output features of the model are used in conjunction with local information and with knowledge provided by DEP's technical partners (DRBC, SRBC, ICPRB and USGS) and the regional water planning committees, to screen for potential CWPA watersheds. The watersheds identified will then undergo more rigorous analyses to determine whether existing or future water use demand is expected to exceed or threaten to exceed the availability of water resources.

[Click here for an animation of the WAST Process](#)

For more information on stream flow statistics, methodologies, assumptions, limitations and use of the tool as described by USGS, please refer to the Appendix D.

Demand Forecasting and Gap Filling

Accurate estimates of existing and future water demands are essential in the screening process to evaluate the current and future adequacy of water supplies. DEP, USGS and DRBC, with assistance from the firm Camp Dresser & McKee (CDM), developed the methodologies that would be used to supplement withdrawal data that could not be captured through registration (Appendix I). The methodology for forecasting future water use demand was also developed by this group.

Estimates of agricultural water withdrawals and use not reported through the registration process and forecasts of future agricultural water use, were important to the success of the screening process. An additional study by Dr. Albert R. Jarrett, Ph.D., P.E., P.L.S., professor of agricultural engineering at the Pennsylvania State University, provided valuable information on animal and irrigation water uses in Pennsylvania that was used to fill in the missing information (Appendix M).

Population Projections

Using the previous state water plan population forecasts as a baseline, DEP had continued to maintain statewide population projections that are integral to making water allocation permit decisions. For this update, a new set of projections was constructed that reflected 2000 census data. A full explanation of the

methodologies and steps taken to develop the updated population projections is provided in Appendix R.

Discharges and Returns

In addition to an accurate and relatively complete set of water withdrawal data, information describing discharges and returns was critical to the screening process. The return flow data were primarily obtained from discharge monitoring reports (DMRs) that facility owners submit to DEP under the National Pollutant Discharge Elimination System (NPDES) permit system. The Susquehanna River Basin Commission (SRBC) and DRBC helped DEP collect and consolidate DMR records from DEP's six regional offices. After verification, the records were entered into an electronic database where they became accessible to the WAST. A more complete description of DMR data collection and verification procedures may be obtained from the documents listed in Appendix Q.

CWPA Designation Stage 1: Nominations

Under the Guidelines, CWPAs may be identified through the planning process as a regional plan component or in advance of formal adoption of a regional plan based on information revealed during the planning process. Potential CWPAs may be nominated by a regional committee, a committee member, or any other person or entity, or initiated by DEP. As of December 2008, two nominations have been presented to DEP: 1) York and Adams counties submitted a nomination for a portion of both the Conewago Creek and South Branch Codorus Creek watersheds, and 2) The Chestnut Ridge Chapter of Trout Unlimited submitted a nomination for the Laurel Hill Creek watershed in Somerset County. Both nominations met the completeness requirements of the Guidelines and were distributed to their respective regional committees.

Thirty other watersheds identified by an initial statewide screening effort are going through a data verification process to confirm potential regional committee-generated nominations.

Data for the two submitted nominations are also being checked. Upon completion of this verification work, DEP will review the results with the regional committees to recommend which of the thirty-two watersheds should be supported nominations and moved to the Statewide Water Resources Committee as CWPA candidates for designation by DEP.

CWPA Designation Stage 2: Screening for the Identification of CWPAs

Pilot Projects

During the late summer of 2006, the WAST was tested on two pilot watersheds by comparing it against the initial screening criteria specified within the Guidelines. The results of the pilot projects, including data checks and corrections performed as part of the analyses, were used to launch a statewide CWPA screening effort required by the Water Resources Planning Act. Information from the statewide screening would be provided to the Regional and Statewide Water Resources Committees to support CWPA nominations generated by the committees and used to assist in reviewing nominations made by other parties.

The Wissahickon Creek watershed and the Codorus Creek watershed were chosen as the two pilot watersheds because they collectively exhibited a number of attributes that would ensure thorough testing of the WAST and enable a critical review of its results. The list of preferred characteristics included:

- Watershed size – each less than 300 square miles
- Presence of stream gauges
- Presence of unregistered, estimated withdrawals within the DEP data sets
- Presence of registered withdrawals from varying sectors
- Presence of DMRs from NPDES permit holders
- Existence of water resources studies

DEP managed the work on the Wissahickon Creek watershed and USGS oversaw the Codorus Creek watershed initiative. The two agencies coordinated their efforts and regularly discussed progress and problems encountered during the pilot work.

Initiation of Initial Data Checking and Correction Projects

While working on the pilot projects, it became apparent that having accurate and complete water withdrawal, discharge and locational data was crucial. Two levels of critical data checks and corrections were identified as being necessary prior to conducting a statewide screening with WAST. At this broad level, errors that could be more easily identified within large tables of data would need to be corrected. On an individual watershed scale, more complete and locally unique data would need to be identified and verified or corrected.

With this understanding, DEP developed a data check and correction plan for the remainder of the state. DEP carried out the work through agreements with DRBC for the Delaware Basin, the Interstate Commission for the Potomac River Basin (ICPRB) for the Potomac Basin and USGS, on behalf of SRBC, for the Susquehanna Basin. USGS was also responsible for the statewide data checking and correction work. In addition, USGS became the repository for the original and modified data sets while providing quality assurance and quality control for the information. DEP coordinated the overall effort and provided assistance when needed.

The original work plan included provisions to account for flow mitigation by reservoirs within the watersheds, conservation releases and other regulated conditions such as pass-by requirements before the Regional and Statewide Water Resources Committees prioritized the CWPA evaluations. It soon became evident that completing such a large scope of work for all potential CWPA watersheds would be time and cost prohibitive. As an alternative, the data check and correction process was applied statewide, but the more detailed data evaluations were performed only on selected watersheds where there was a reasonable expectation that work would be completed by the fall of 2007. DEP, in consultation with its technical partners,

developed a process for determining where to direct the detailed data analysis efforts.

Selection of Watersheds for Initial Data Checking

Candidate watersheds for the detailed data analysis were drawn from several informational sources:

- The 2004 inventory of potentially stressed watersheds or areas compiled from regional committees and river basin commission responses
- Preliminary runs of the WAST that were used to elevate watersheds showing net withdrawals exceeding the screening criteria
- Recommendations from DRBC and SRBC that introduced commission perspective and knowledge into the selection process
- Advice from DEP regional office personnel and DEP representatives sitting on the regional committees
- Discussions with USGS that narrowed and finalized the list of watersheds that would undergo verification

The following 22 watersheds were selected for full evaluation:

Delaware Basin

Jordan Creek
Unami Creek
Maiden/Sacony Creeks
Brodhead Creek

Upper/Middle Susquehanna Basin

Moshannon Creek
Marsh Creek
Spring Creek
Toby Creek

Lower Susquehanna Basin

Plumb/Halter Creeks
Conewago Creek
Swatara Creek (Upper parts in Lebanon and Berks Counties)
Octararo Creek

Potomac Basin

Antietam Creek
Marsh Creek
Toms/Middle Creeks
Rock/Alloway/Piney Creeks

Great Lakes Basin

Elk Creek
Walnut Creek

Ohio Basin

Buffalo Creek
Raccoon Creek
Loyalhanna Creek
Blacklick Creek

An assessment of the 22 selected watersheds focused efforts on defining procedures and determining levels of effort necessary for checking and correcting data, and on preliminary WAST results. Mitigation due to reservoir storage, pass-by flows and conservation releases were not considered. The analysis of mitigation was to be accomplished on select watersheds later in the screening process.

Results of Data Checking and Correction

For each of the watershed data verification and correction projects, withdrawal and discharge data were examined to reveal discrepancies. Errors commonly found included incorrect coordinates, incorrectly coded use type or units, missing withdrawals or discharges and inaccurately reported withdrawals or discharges. In the twenty-four watersheds examined, approximately 700 changes were made to records within the data sets -- about 400 changes related to quantity values and 300 related to spatial or locational changes. Many other data corrections were also made for

withdrawals and discharges located outside of the twenty-four watersheds that were specifically studied. The changes improved the level of confidence in the accuracy of the screening process enough to run the WAST statewide.

Statewide Screening

During the fall of 2007, DEP used the information generated by its technical partners to run the WAST statewide. This process screened out 90% of the state and focused attention on the remaining 10% for further data verification and evaluation of mitigation effects.

The initial statewide screening results were given to the technical subcommittees of each of the six regional water resource committees in November 2007. The individual subcommittees then assisted in making recommendations to each full regional committee in January 2008.

CWPA Designation Stage 3: Data Verification, Development and Review

Criteria established by the regional committees were applied in reviewing the results of the statewide screening to establish a shortlist of thirty-two watersheds for which DEP and its technical partners would conduct a yet higher level of data verification and analyze potential mitigating factors such as reservoirs, pass-by flows and conservation releases. Among the thirty-two watersheds selected for verification were the two watersheds that were submitted to DEP in 2007 in accordance with the Guidelines as nominations for CWPA outside the statewide screening and verification process. The selected watersheds are presented on the following page.

Selected Watershed	Planning Region	Watershed Area (sq. mi.)
Brodhead Creek	Delaware	144
Little Lehigh Creek		190
Neshaminy Creek		233
Macoby Creek		17
West Branch Brandywine Creek		135
Hay Creek		22
Toby Creek	Upper	35
Spring/Nittany Creeks	Susquehanna	76
Anderson Creek		59
Sugar Creek		189
Little Catawissa Creek		17
Conestoga River	Lower	475
Chiques Creek	Susquehanna	126
Swatara Creek		572
Beaverdam Branch		87
Conewago Creek / Codorus Creek		581
Deer Creek		13
East Branch Antietam Creek	Potomac	52
Alloway Creek		16
Toms Creek		37
Rock Run / Marsh Creek		143
Conococheague Creek		494
Crooked Creek	Ohio	291
Indian Creek		125
North Branch Blacklick Creek		69
Connoquenessing Creek		333
Beaver Run		55
Laurel Hill Creek		125
Temple Creek	Great Lakes	15
Sixmile Creek		19
Elk Creek		98
Fourmile Creek		12

As of December 2008, work is underway to complete these watershed verifications.

CWPA Designation Stage 4: Review and Recommendations by Regional Committees:

After the verifications have been completed, regional committees will employ a review and decision making process, including public hearings, to recommend CWPA designations to the Statewide Committee. The findings will be summarized, and recommendations will be made as to which watersheds, if any, meet the criteria for CWPA designation.

CWPA Designation Stage 5: Review and Designation by Statewide Committee and DEP

The final stage of the CWPA designation process involves the Statewide Water Resources Committee receiving individual regional committee recommendations, holding a Statewide Water Resources Committee Meeting to discuss the recommendations and approving and forwarding recommendations to the DEP secretary for concurrence and final designation decisions. The DEP secretary will approve or reject recommendations, provide notifications of decisions, publish notice of the decisions in the *Pennsylvania Bulletin* and post results to the DEP website.

Development of Critical Area Resource Plans

Following designation of a CWPA, the Act states that a Critical Area Resource Plan (CARP) may be prepared for any watershed or watersheds within the designated CWPA. CARPs should address the key problem or problems identified during the CWPA designation process. CARPs will consist of a detailed investigation of water availability and current and future demands for water in the designated CWPA. They will also include assessments of water quality, stormwater and floodplain management problems and current or potential water use conflicts among water users. Finally, they will identify practical solutions to the problems encountered by assessing supply-side and demand-side alternatives intended to ensure an adequate supply of water to satisfy existing and future water uses. The relevant regional committee will establish a Critical Area Advisory Committee to guide DEP in developing each CARP. Each Critical Area Advisory Committee will be comprised of a cross section of local interests and will advise the regional committee and DEP throughout the process. Once adopted, CARPs become a component of the *State Water Plan* and may be implemented voluntarily.



Appendix A

Glossary

7-day-10year low flow – The lowest consecutive 7-day mean flow expected to occur once every ten years.

Adequate supply – The quantity of water necessary to sustain reasonable and beneficial uses over the planning horizon.

Class A trout stream – Stream reaches designated by the Pennsylvania Fish and Boat Commission as streams that support a population of naturally produced trout of sufficient size and abundance to support a long term and renewable sport fishery. These stream sections are managed solely for the perpetuation of the wild trout fishery with no stocking.

Conjunctive Management Programs – Programs that maximize water availability and minimize resource damage by balancing and optimizing the combined use of water supply sources, including ground and surface sources and interconnections.

Consumptive Use – The loss of water from a source through a manmade conveyance system, transpiration by vegetation, incorporation into products during their manufacture, evaporation, diversion out of a basin, or any other process to the extent that the water withdrawal is not returned to the waters of a basin.

Critical Area Resource Plan – A water resources management plan established for a Critical Water Planning Area that identifies practicable supply-side and demand-side alternatives for assuring an adequate supply of water to satisfy existing and future reasonable and beneficial uses.

Critical Water Planning Area – Any significant hydrologic unit where existing or future demands exceed or threaten to exceed the safe yield of available water resources.

DEP – Department of Environmental Protection of the commonwealth.

Discharge Monitoring Report (DMR) – A report submitted periodically to DEP by an NPDES permit holder that documents the quantity and quality of their authorized discharge.

Future – A planning horizon that serves as the basis for evaluating water supply adequacy. Considering that the *State Water Plan* will be updated every five years, and considering the accuracy of projections beyond fifteen years, a planning horizon beyond fifteen years is likely to introduce substantial uncertainty into the evaluation and is therefore considered appropriate.

Groundwater – Water beneath the surface of the ground within a zone of saturation, whether or not flowing through known and definite channels or percolating through underground geologic formations, and regardless of whether the result of natural or artificial recharge, the term includes water contained in aquifers, artesian and non-artesian basins, underground watercourses and other bodies of water below the surface of the earth.

High hazard dam -- Any dam so located as to endanger populated areas downstream by its failure.

HUC-10 – HUCs (Hydrologic Unit Code) are drainage basins that are referenced by the number of digits in the code. More digits indicate a finer level of scale. HUC-10s generally encompass watersheds with drainage areas ranging from 62 to 390 square miles.

National Pollutant Discharge Elimination System (NPDES) – The national program for issuing, modifying, revoking and reissuing, terminating, monitoring, and enforcing permits, and imposing and enforcing pretreatment requirements, under the federal Clean Water Act. Facilities subjected to NPDES permitting regulations include operations such as municipal wastewater treatment plants and

industrial waste treatment facilities. NPDES permits in Pennsylvania are issued by the Department of Environmental Protection under a delegation agreement with the Environmental Protection Agency.

Net withdrawals – The total volumetric withdrawals from a watershed minus the total discharges.

Nonwithdrawal uses – The functions of, or activities in, water that is not withdrawn from a water resource, including, but not limited to, navigation, instream hydropower production, recreation, fish and wildlife habitat and the aquatic environment.

Reasonable and beneficial uses – The use of water for a useful and productive purpose, which is reasonable considering the rights of other users and consistent with the public interest, in a quantity and manner as necessary for efficient utilization. The term includes withdrawal and nonwithdrawal uses.

Recharge – Addition of water to an aquifer by infiltration of precipitation through the soil, by seepage from streams other bodies of surface water, by flow of groundwater from another aquifer, or by pumping water into an aquifer through recharge wells; also, the water added by these processes.

Safe Yield – The amount of water that can be withdrawn from a water resource over a period of time without impairing the long-term utility of a water resource such as dewatering of an aquifer; impairing the long-term water quality of a water resource; inducing a health threat; or causing irreparable or unmitigated impact upon reasonable and beneficial uses of the water resource. Safe yield of a particular water source is primarily to be determined based upon the predictable rate of natural and artificial replenishment of the water source over a reasonable period of time.

Surface Water – Water on the surface of the earth, including water in a perennial or intermittent watercourse, lake, reservoir, pond, spring, wetland, estuary, swamp or marsh, or diffused surface water, whether such body of water is natural or artificial. The term does not include recirculated process water or wastewater stored in an off-stream impoundment, pond, tank or other device unless such water or wastewater is withdrawn and used by a person other than the person who initially withdrew the water from a water resource or obtained such water from a public water supply agency.

Total Maximum Daily Loads (TMDLs) – The maximum amount of a pollutant allowed to enter a waterbody by law so that the waterbody will meet and continue to meet the water quality standards for that particular pollutant. TMDLs are used as planning tools to develop specific methods or controls used to meet water quality standards in the impaired waterbody.

Water conservation – A beneficial reduction in water use or water waste/losses to wisely manage, preserve, or save water.

Water use efficiency – Achieving the same result or accomplishing a function, task, or process using less water or a minimal amount of water.

Withdrawal uses – Any use of water that is withdrawn, including but not limited to, domestic, municipal, public, commercial, industrial, energy development and production, and agricultural water supply. The term includes the use of water transferred through interconnections but does not include transfer of water within a system operated by the same public water supply agency.

Appendices B-S are available at www.depweb.state.pa.us

[Appendix B](#)

Statewide Water Resources Committee Members

[Appendix C](#)

Regional Water Resources Committee Members

[Appendix D](#)

Development of the Water Analysis Screening Tool Used in the Initial Screening for the Pennsylvania *State Water Plan* Update 2008

[Appendix E](#)

Guidelines for Identifying Critical Water Planning Areas

[Appendix F](#)

Guidelines for Developing Critical Area Resource Plans

[Appendix G](#)

Regulations Establishing Requirements for the Registration, Periodic Reporting and Recordkeeping of Withdrawals (Chapter 110 – Water Resources Planning)

[Appendix H](#)

Pennsylvania Aquatic Species List

[Appendix I](#)

Methodology for Statewide Water Demand Forecast with Pilot Study, CDM, Nov. 2005

[Appendix J](#)

Water Use Factor Analysis, DEP

[Appendix K](#)

Residential Consumptive Use Analysis, DRBC

[Appendix L](#)

Outline of Water Use Analysis Process, Demand Side Analysis, DEP

[Appendix M](#)

Animal and Irrigation Water Use in Pennsylvania in 2002, 2010, and 2030, Albert R. Jarrett, Ph.D., P.E., P.L.S

[Appendix N](#)

Methodology for Establishing Golf Course Inventory for Pennsylvania and Water Use Estimates, DRBC

[Appendix O](#)

Integrated Water Quality Monitoring and Report

Appendix P

Low Flow, Base Flow and Mean Flow Regression Equations for
Pennsylvania Streams, USGS 2006

Appendix Q

Act 220 Discharge Flow Compilation (Discharge Monitoring Report
[DMR]) Procedures and Database Users Manual, SRBC

Appendix R

Population Projection Methodology for the Act 220 Water Plan

Appendix S

Assessment Matrix for Water Supply Alternatives

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