Guidelines for Developing an Integrated Resource Plan
Under the Delaware River Basin Commission
Southeastern Pennsylvania Ground Water Protected Area Regulations
September 25, 2002

A. Introduction

Integrated Resource Planning is a comprehensive approach to water resource management that evaluates water resources availability and demands on a watershed level. The process encourages planning to meet multiple objectives and evaluate competing uses of water resources. These Guidelines provide guidance on preparing an Integrated Resource Plan in accordance with the Delaware River Basin Commission's (DRBC) *Ground Water Protected Area Regulations for Southeastern Pennsylvania* (as amended). These guidelines may also be used for the preparation of Integrated Resource Plans in cases where such plans are not intended for submittal to DRBC. Appendix I contains a list of acronyms used in these guidelines. Appendix II includes an overview flowchart that depicts, in graphical form, the processes outlined in this guidance.

Disclaimer

The guidelines set forth in this document are not regulations, and the DRBC does not intend to give them that weight or deference. The DRBC reserves the discretion to deviate from these guidelines if circumstances warrant.

Purpose

Under the Delaware River Basin Commission's (DRBC) *Ground Water Protected Area Regulations for Southeastern Pennsylvania* (GWPAR), Integrated Resource Planning is a tool to:

1. Evaluate and develop management objectives and strategies on a subbasin basis to ensure that ground and surface water withdrawals are managed in a manner that protects both instream and withdrawal uses in the subbasin.

2. Evaluate the adequacy of existing ground and surface water resources to meet all existing and future needs in the subbasin, and assess options for meeting those needs.

3. Engage stakeholders as active participants in developing effective, long-term water resource management objectives and strategies.

4. Consider the inter-relationship of water quality and water availability for current and future water uses in a subbasin.

5. Assist planners to better integrate water resources protection in land use planning. Almost all land use decisions affect water resources. Growth is occurring in most subbasins of the Ground Water Protected Area. Integrated Resource Plans can assist in better managing *how* that growth occurs. The availability of ground or surface water, individually, may not be a

limiting factor for growth, since a combination of both or sources of water outside of the subbasin may exist. By evaluating all water resources options, existing and future needs may be met while simultaneously protecting the resources and supporting other uses including instream flow needs.

Regulatory Background

DRBC's GWPAR were adopted in 1980 in response to increasing ground water use and existing and potential ground water interference problems. The purpose of the GWPAR is to protect and to provide for the effective management of ground water resources, protect the just and equitable interests and rights of present and future lawful users of water resources, promote conservation and acquire additional information to more effectively plan and manage water resources. On February 9, 1998 and June 23, 1999, the Commission amended the GWPAR to establish numerical ground water withdrawal limits for the 76 subbasins in the Ground Water Protected Area. Each subbasin is a recognized watershed as defined by the USGS. The regulations set a maximum ground water withdrawal limit -- defined as the 1-year-in-25 average annual baseflow rate -- for each subbasin.

The regulations allow the Commission to consider lowering the withdrawal limits for any subbasin to provide additional protection to correspond with more stringent requirements of Integrated Resource Plans (IRPs). Any application for more stringent requirements should be based on sound scientific investigations and supported by the data, results and conclusions of the investigations. As a prerequisite for Commission consideration, the GWPAR require the IRPs to be adopted and implemented by all municipalities within a subbasin and must be incorporated into each municipality's Comprehensive Plan. To satisfy this requirement of the GWPAR, all the municipalities within a subbasin should: 1) officially adopt the IRP as part of their Comprehensive Plan and amend the Comprehensive Plan to be consistent with the land use planning and other elements of the IRP 2) officially adopt any ordinances necessary to implement the IRP and 3) implement the municipal component of the IRP. The regulations contain nine requirements to be included in an IRP. This document provides guidance for implementing these nine requirements.

The Role of DRBC and the Municipalities in the Integrated Resource Planning Process

Through the GWPAR, DRBC has introduced a process to encourage Integrated Resource Planning in Southeastern Pennsylvania. Under the GWPAR, DRBC's role in the Integrated Resource Planning process is to review IRPs for consistency with DRBC regulations and to consider requests for modifying withdrawal limits in accordance with the IRP and DRBC findings.

The responsibility for the development, adoption and implementation of IRPs lies with the local governments. The municipalities within the subbasin must adopt and implement the IRP and incorporate it into their Comprehensive Plans prior to final application to the Commission for lowering the withdrawal limit. An IRP process can be initiated within the subbasin by any entity.

While these guidelines are provided to assist local agencies in developing IRPs within the framework of the GWPAR, DRBC recognizes the value of IRPs independent of the GWPAR. DRBC will support any IRP process by providing guidance and technical assistance for improved water resource planning at the local level.

Factors to Consider in Developing an IRP

An Integrated Resource Planning process, by its nature, is flexible, innovative and adaptable to the particular needs of a subbasin. Just as every subbasin is unique in terms of its resources, issues and challenges, so too would each plan be unique in its approach. There is no prescribed process that must be followed other than complying with the requirements in the GWPAR if applicants anticipate that they will seek approval from DRBC to lower the ground water withdrawal limits in their subbasin.

An Integrated Resource Planning process offers the opportunity to comprehensively evaluate a broad range of issues related to water resource management. Water supply, water resource protection, water quality, and economic, environmental and social factors, are interrelated elements of water resource management and can all play a role in the development of an IRP.

Municipal Involvement
It is a most important up-front step to secure commitment from all municipalities in the subbasin to participate in the planning process.

Stakeholder Participation
A critical aspect of the IRP is active stakeholder participation. Stakeholders should be identified and brought into the process from the beginning. DRBC should be consulted concerning the stakeholders that will be part of the process. Any additional parties requested by DRBC should be included in the process. Since stakeholders represent a broad range of affected interests, their active participation in the process should lead to more enduring and acceptable decisions. Suggestions for involving stakeholders are discussed in Section B, below.

Water Supply
The IRP needs to consider both ground water and surface water options for meeting current and future needs of the involved communities, while protecting surface and ground water from over-withdrawal. A broad range of options can be considered such as: expanding water conservation programs, protecting stream flows through better management of stormwater and wastewater, treating and remediating impaired areas, developing new sources of supply and shifting land use patterns. One option that should be explored in the IRP is conjunctive use of surface and ground water. Conjunctive use can minimize impacts to ground and surface water and provide flexibility for water supply management

Water Resource Protection
Water resource protection is a particularly important consideration. Withdrawals for development and economic growth must be balanced with competing instream uses such as flow needed to maintain aquatic habitat and protect natural resources. Developing approaches to promote positive impacts and mitigate adverse impacts on water resources is a critical component of the IRP. Of particular significance are streams or stream segments designated by the Commonwealth of Pennsylvania or federal agencies as Special Protection Waters, such as High Quality, Exceptional Value, Wild and Scenic, Scenic, or Pastoral and other designated uses. These streams may be more sensitive and require higher degrees of protection.

The plan sponsors should examine whether the IRP is consistent with the more protective of the existing or designated use of the stream. Refer to 25 Pa. Code Chapter 93 to identify a stream's designated use. Streams with existing uses that are more protective than the current designated use are listed in the table Statewide Existing Use Classifications, which may be found on the DEP website at: http://www.dep.state.pa.us (direct link "existing use").

If, during development of an IRP, there is evidence suggesting that the current existing uses of the stream are more protective than the current designated use for the stream, then the plan sponsors should consider petitioning the Environmental Quality Board (EQB) for a stream re-designation.

Water Quality

Water quantity and water quality are interrelated. Contaminated water may be difficult and costly to remediate and may reduce or preclude the resource's potential use as a water source. Over-withdrawal of ground water or surface water reduces the potential of a stream to assimilate point and non-point source pollutant loads, thereby lowering water quality, and potentially impairing instream habitats and raw water supplies. Protecting existing and designated uses includes insuring that there is sufficient stream flow to protect the physical, chemical and biological characteristics of the stream. State and federal law require an evaluation of the effect of changes in water quantity on existing and designated uses as part of the decision on an application for a permit or approval.

The IRP should consider the inter-relationship of water quality and water availability for current and future water uses in a subbasin. It is recognized that a comprehensive evaluation of these factors may require extensive study. Municipalities are encouraged to maximize use of existing water quality information, and incorporate techniques for water quality protection.

Relationship to Other Planning Efforts

The IRP may be one of several independent planning efforts occurring in the subbasin. The IRP should acknowledge and coordinate with those efforts, describe their relationship to the IRP, the extent to which the IRP is or is not consistent with them and any current or proposed coordination activities. Examples of potential related planning efforts include: public water supply planning, Act 167 or other watershed stormwater management plans, Act 537 wastewater plans, source water protection plans, rivers conservation plans, wellhead protection plans, Total Maximum Daily Loads (TMDL), watershed plans, comprehensive and land use plans, Source Water Assessment and Protection Plans and other related utility planning efforts. Municipalities are encouraged to involve or coordinate with county planning agencies and state agencies in the development of the IRP.

Geographic Area

If the municipalities anticipate that they will apply to the DRBC to lower their subbasin withdrawal limit, then the IRP must be developed for a subbasin as defined in the regulations. However, the regulations do not preclude extending the plan to areas outside the subbasin. This can occur in several ways. (1) Several subbasins or municipalities may determine that regional approaches to water resource management are appropriate. (2) Potential or existing sources or users of supply may exist outside the subbasin, and the utility as well as the municipality or subbasin in which the supply source is located should participate in the process. (3) Since the political boundaries of municipalities may extend beyond those of the subbasin, the plan may need to consider those areas. The plan should describe limitations and uncertainties associated with sources of supply or uses outside of the jurisdiction and control of the municipalities within the subbasin.

Sound Principles of Hydrology
The GWPAR state that IRPs are to be developed according to "sound principles of hydrology." Due to the unique conditions in each subbasin and the wide range of potential management approaches, it is not possible to prescribe or recommend a specific methodology. In addition, models and analyses to evaluate water resources and watersheds are constantly evolving. The Integrated Resource Planning process by its nature is innovative and it is not beneficial to be overly prescriptive with regard to scientific methodology. However, it is important that the scientific analysis provided in the plan be defensible and based on documented and accepted scientific practice. As noted below, applicants are encouraged to consult with DRBC staff as they develop scientific methodologies for evaluating the impacts of the plan.

Coordination with DRBC
If municipalities anticipate that they may apply to the DRBC to lower their subbasin ground water withdrawal limit, they should closely coordinate with DRBC and DEP during the IRP process. Applicants are therefore encouraged to consult with DRBC and DEP as they develop their IRP and select methodologies for evaluating impacts. Coordination between DRBC, DEP and applicants should occur on a periodic basis at key decision points based on a schedule agreed upon between DRBC, DEP and the applicants at the initiation of the IRP process.

Upon completion of the Draft IRP, municipalities should submit to DRBC and DEP the Draft IRP along with their draft request for modification of the ground water withdrawal limit if the results of the IRP justify such a request. The draft should be signed by all municipalities within the subbasin and should include a summary of controversial issues, why they were controversial, and how or if they were resolved.

DRBC staff will provide comments to the municipalities on the Draft IRP and indicate whether the IRP provides sufficient justification for the proposed withdrawal limit. Municipalities are strongly encouraged to consider comments of DRBC staff prior to initiating their adoption processes. After DRBC staff provides comments, the municipalities will be afforded the opportunity to modify the IRP as appropriate and initiate their approval processes to adopt and implement the IRP and incorporate it into their Comprehensive Plans. The GWPAR provide that all the municipalities in a subbasin shall officially adopt and implement the IRP and incorporate the IRP into each municipality's Comprehensive Plan. To satisfy this requirement, each municipality should: 1) officially adopt the IRP as part of the Comprehensive Plan and amend the Comprehensive Plan to be consistent with the land use planning and other elements of the IRP 2) officially adopt any ordinances necessary to implement the IRP, and 3) implement the municipal component of the IRP. After all municipalities within the subbasin adopt and implement the IRP as described above, a final application signed by all municipalities within the subbasin should be submitted to the Commission for formal consideration of the proposed withdrawal limit.

Sources for Technical Assistance
This Guidance offers suggestions on how applicants preparing IRPs may satisfy DRBC's IRP requirements. There are several sources available that provide assistance on watershed and water resource planning. A partial list of information sources is provided in Appendix III of this document. Applicants should contact the County agencies, the U.S. Geological Survey, Pennsylvania Topographic and Geologic Survey, Pennsylvania Department of Environmental Protection, Pennsylvania Department of Conservation and Natural Resources, and Pennsylvania Fish and Boat Commission for relevant information and data.

B. IRP Requirements

Provided below is guidance on addressing each of the nine IRP requirements specified in the GWPAR. Sponsors who anticipate applying to the DRBC to lower their subbasin withdrawal limits should adhere as closely as possible to the guidance for each of these requirements.

Incorporate public participation.

Integrated Resource Planning is a participatory process. It is recommended that the municipalities and counties establish a committee or task force consisting of all municipalities and counties in the subbasin and representative stakeholders to guide the IRP process. The municipalities should initially determine the role of the committee and how decisions will be made.

Stakeholders representing all pertinent viewpoints should be actively involved in the process. Possible stakeholders may include: water/wastewater purveyors, watershed and conservation organizations, major water users, homeowners associations, developers, agricultural operations, relevant state agencies, among others. The committee should develop a plan to solicit community input and involvement throughout the IRP process. The draft IRP that municipalities send to DRBC for review and comment should be accompanied by a summary of controversial issues, why they were controversial, and how or if they were resolved

Assess water resources and existing uses of water.

The first step in plan development is to gather data and assess existing water resources and uses of water in the subbasin. The assessment should maximize the use of existing information.

<u>Existing Water Resources Assessment</u>

The water resources assessment should include an evaluation of the following:

Subbasin Water Resources

- All natural water sources (streams and aquifers) within the subbasin. Types of information that may be useful to consider include: yield, flows, location, extent, ground water maps, subbasin boundaries, etc.

- Existing hydrologic data for the subbasin. Types of information that may be useful to consider include:
  - Geology and water producing capabilities of the geological units and their potential use for water supply.
  - Streamflow data and statistics for the subbasin or nearby gaged watersheds of similar characteristics including estimates of mean daily flow, 1 in 25 year annual average baseflow and $Q_{7\text{-}10}$. Some of these data are available from the USGS and DRBC in GIS format for the GWPA.
  - Precipitation.
- Important natural resources and habitat in the subbasin. Types of resources and habitat may include: High Quality or Exceptional Value streams; federally or state identified threatened, rare or endangered species habitat; Exceptional Value or other wetlands, forest cover and undisturbed forested riparian buffers; PA state-designated Class A trout waters; naturally reproducing trout streams; PA Natural Diversity Index Sites; state or federally designated scenic, wild and scenic, or pastoral streams; first order stream drainage areas; and recreational waters.
- All existing and designated stream uses including recreation and aquatic resources, among others. Types of information that may be available on these uses include agency or volunteer monitoring data on aquatic resources, instream physical conditions and state water quality designations.
- Land uses within the subbasin - types and amounts of land in each.
- Sewage treatment systems within the subbasin. Types of information that may be useful to consider:
  - For wastewater discharges: locations; monthly average and peak flow volumes; permitted capacity; system capacity; effluent limits; pollutant loads; service area; inflow and infiltration (I/I) estimates; ground water recharge and land application sites; and Act 537 Plans.
  - For septic systems: community septic systems; areas with on-lot septic systems; areas with failing septic systems; estimated discharges and nutrient loads.
- Areas with large non-point discharges. Impervious cover should be estimated for the watershed. Types of information that may be useful to consider include Act 167 Plans for stormwater and any local ordinances pertaining to stormwater management.
- Areas of impaired water quality and the sources of impairments with the goal of assessing how these impaired areas affect water availability. These may include areas that do not meet water quality standards; streams listed by the state pursuant to Section 303(d) of the Federal Clean Water Act; severely eroded stream channels; CERCLA, RCRA, and LUST designated areas and areas of known ground and surface water contamination; areas with failing septic systems that threaten water quality; and other impairments. It is recommended that this assessment rely on the evaluation of existing data.

Subbasin Water Resources for Water Supply Purposes

- Existing sources of surface and ground water supply for the subbasin. These may include sources that originate either inside or outside the basin. Types of information that may be useful to consider include: available yields, intake/well locations, service areas, permitted allocation, available system capacity, current withdrawal volumes, etc.

Existing Water Use Assessment

Water Use for Water Supply Purposes
This section addresses existing water use for water supply purposes. The assessment should maximize the use of existing information.

The water use assessment should include an evaluation of the following:

- service areas and franchise areas of public water suppliers and amount of water use in these areas
- domestic and other self-supplied water users and the estimated amount of water use
- water use by category (i.e. residential, industrial, commercial, institutional, agriculture, non-agricultural irrigation, thermoelectric power, mining, bulk sales and unaccounted-for-water)
- interbasin transfers - imports to and exports from the subbasin including water supply and wastewater systems
- water use by supply sources: ground water and/or surface water
- per capita use
- major water users
- annual average, peak month, average month, peak daily and average daily water use
- existing water conservation programs and their effects and
- verification of compliance with existing mandated water conservation programs.

A large proportion of water withdrawals may be returned to the subbasin through septic systems, wastewater treatment systems, infiltration and other means. Water that is not returned to its source represents depletive use. Water can be lost through evaporation, evapotranspiration, product incorporation and exports from the basin. Depletive use should be estimated. Data on wastewater treatment plants and septic systems within the subbasin, as evaluated under Water Resources Assessment, Sewage Treatment Systems, above, may be needed to develop these estimates.

Water Use to Maintain Instream Needs
Instream uses and water needed to support those uses should be identified for streams and other surface waters within the subbasin. Such uses include protection of aquatic resources and recreational uses. The IRP should evaluate what level of water demand can be placed on the resources without adversely impacting instream uses.

It is recommended that the Pennsylvania Fish and Boat Commission, the U.S. Geological Survey, Pennsylvania Department of Environmental Protection and DRBC be contacted to obtain available data and consulted for guidance to evaluate flow needs for instream uses. Available data may include fish and macroinvertebrate sampling, flow measurements (including information on low flow conditions) and instream flow studies that have been conducted on streams in the subbasin.

Determining flows in streams within the subbasin may be an important data need for the assessment. For ungaged streams, actual flow data may not be available. DRBC can provide 1 in 25 year annual average baseflow data for each subbasin in the GWPA. To estimate flows for streams within the subbasin, flow estimates can be apportioned on a per square mile basis.

Several factors should be considered in developing flow estimates. The location of water withdrawals may be different from wastewater discharges. Impacts on stream flow from these water transfers should be evaluated. In addition, stream flows for streams impacted by a reservoir release or a quarry discharge will need to be estimated on a case-by-case basis.

Where specific instream aquatic living habitat are to be used as the justification for reducing ground water withdrawal limits, detailed instream flow studies may be necessary to support the lowering of such withdrawal limits.

Estimate future water demands and resource requirements.

Water Use for Water Supply Purposes

This section discusses the projection of future water demand for water supply purposes. The assessment should maximize the use of existing information.

The water use assessment should include an evaluation of the following.

Planning Period
At a minimum, it is recommended that a 20-year planning period be evaluated. The projection year would vary depending on the type of alternatives being considered.
If possible, determine future water demands for different time intervals. For example:

- short-term demand <10 years
- medium-term demand 10-20 years
- long-term demand >20 years (may not be applicable)

Future population and water users in the subbasin
To the extent possible, the evaluation of future water use should consider all anticipated water uses (i.e. residential, industrial, commercial, institutional, agriculture, non-agricultural irrigation, thermoelectric power, mining, bulk sales and unaccounted-for-water). Future scenarios should be based on best available population and employment projections; county and local land use plans and ordinances, and development proposals. Full zoning build-out scenarios result in over-projection of growth and are not encouraged.

Location of future water use
The IRP should estimate where (geographically) development would likely occur in the subbasin and how future water use would be distributed within the subbasin. Patterns of distribution should reflect local comprehensive planning and zoning. Estimate future water use for industrial, irrigation, commercial and other uses as well as residential. Proposed plans for expansion of public water supply service areas should be taken into consideration.

Water Conservation
The IRP should estimate the effects of currently mandated water conservation programs, and other conservation measures that will be implemented through the IRP, on future water demand.

Uncertainties
Due to uncertainties associated with projecting water demand, consider developing a range of projections with high and low end estimates.

Results
This should include a projection of annual average, peak month and average month water use.

Based on the approach discussed above for Existing Water Use, the IRP should develop estimates for future net water demand. Future flows to wastewater treatment plants and septic systems within the subbasin may be needed to develop these estimates. Estimating future flows should consider other plans or proposals to expand wastewater treatment plants and service areas.

Water Use to Maintain Instream Needs

Projected impacts on instream uses should be identified for streams and other surface waters within the subbasin. The evaluation should consider how future withdrawals and discharges would affect stream flow. The location of withdrawals relative to discharges is an important component of the evaluation. This evaluation should include surface water impacts associated with projected ground water withdrawals.

Assess the capacity of the subbasin to meet present and future demands for withdrawal and nonwithdrawal uses such as instream flows.

The Integrated Resource Planning process is designed to evaluate multiple objectives. Demands on water resources for supply purposes must be balanced with protecting and maintaining instream flows necessary for the protection of aquatic resources, recreational use and other uses. In all cases, sufficient flows are required to protect and maintain existing and designated uses.

After completing the assessments of water resources and water use, available water resources should be compared to current and future water needs (both for water supply and instream uses) to determine if potential resource shortfalls and limitations may occur.

Evaluate supply-side and demand-side alternatives to meet withdrawal needs.

If limitations on current or future use of available water resources are identified, alternatives should be developed to meet future water and wastewater needs. Alternatives should be evaluated under different water demand scenarios and under normal and drought conditions. The evaluation should consider the environmental, economic/cost, regulatory, land use planning, engineering and social implications of the alternatives.

In addition to other alternatives being evaluated, the following alternatives should be considered:

- No action alternative
- Expanding water conservation beyond existing mandated programs (i.e. aggressive leak detection and repair program for utilities and users, conservation rate structures, toilet rebate program)
- Potential uses for reclaimed water and greywater
- Alternative sources of ground water and surface water and conjunctive use of surface water and ground water

- Modifying existing or planned stream intake and discharge locations to minimize impacts on stream flows. For example, diverting wastewater to upstream locations.
- Recharging wastewater and stormwater.
- Shifting future development patterns to protect headwater and other sensitive areas.
- Additional water treatment and remediation to increase available sources.

If the alternatives selected for the IRP do not include a request for lowering the ground water withdrawal limit, municipalities are still encouraged to complete and implement the IRP as a useful planning tool.

Assess options for wastewater discharge to subsurface formations, streams and other surface waters

Conventional treatment of wastewater can result in impaired water quality and changes to flow patterns within a subbasin. For example, ground water supplies can be diminished when wastewater treatment plants discharge ground water withdrawals to surface water instead of recharging them. When wastewater is discharged at a downstream location, upstream flows are reduced. However, there are alternatives that are protective of stream flows.

In addition to evaluating conventional treatment systems -- such as wastewater treatment plants and on-lot septic systems -- and their effects on water resources, the IRP should consider reclaimed water use, land application or subsurface discharge of wastewater treatment plant effluent, and wastewater flow diversions (i.e. rerouting discharges to other areas within or, where necessary, outside the subbasin) to enhance surface and ground water resources.

As appropriate, for each of the above-referenced options being considered, the IRP should identify: potable and non-potable water use needs, available land area, conveyance distance, impact on stream flow conditions and water quality implications on upstream and downstream users. The assessment of water quality impacts should rely on existing information and scientific literature as it applies to site-specific conditions. The evaluation should consider the environmental, economic/cost, regulatory, land use planning, engineering and social implications of the alternatives.

Consider stormwater and floodplain management.

As development occurs and impervious surfaces expand within a subbasin, stormwater runoff rates and erosion and sedimentation increase. Vegetative cover, instrumental in removing pollutants from runoff, may be eliminated resulting in additional pollutant loadings to surface waters. Low-impact development designs, forested riparian buffers and stormwater best management practices control runoff rates and volume from impervious surfaces, increase infiltration and reduce pollutant loadings.

The IRP should consider the impacts of development on stormwater flows and floodplains as they relate to ground water and surface water resources. The assessment should evaluate:

- existing conditions in the watershed as they pertain to stormwater runoff and flooding;
- impacts of increased development and impervious surfaces on runoff volumes and rates and ground water infiltration;
- impacts to source waters for public water supplies;

- existing local, state and federal stormwater management and floodplain regulations including, but not limited to: local ordinances, Act 167, and NPDES Phase II and other federal Clean Water Act non-point source regulations; and
- enforcement of existing stormwater and floodplain ordinances;

After evaluating existing stormwater impacts and regulations, alternatives should be considered to improve stormwater management to better protect ground and surface water. Alternatives may include:

- revising existing or developing new stormwater and best management practices requirements;
- providing incentives for low-impact development designs, stormwater best management practices, and forested riparian buffer networks;
- revising existing local regulations that require unnecessary impervious cover;
- developing performance-based design and stormwater control standards (Performance-based standards are an alternative to prescriptive technology-based standards. They allow consideration of site-specific factors such as soil, slope, cover and geology in developing stormwater plans.);
- supporting implementation of agricultural BMPs to reduce stormwater impacts and encourage retention of agricultural operations; and
- identifying opportunities for restoring floodplains to their natural flood carrying capacities.

Other options to consider include: reuse of stormwater; identifying opportunities to finance stormwater management improvements; and transfer of development rights to encourage development in less sensitive areas of the subbasin and away from headwater areas.

Identify potential conflicts and problems and outline plans and programs to resolve conflicts and meet needs.

Selecting Alternatives and Considering Multiple Objectives

After developing alternatives and evaluating their impacts, the preferred alternative(s) must be selected and developed into a plan. Selecting a preferred alternative and plan may be challenging because it often requires consideration of multiple objectives that may conflict. Objectives can include maintaining an adequate water supply, protecting aquatic resources and minimizing costs. These potential conflicts are likely to be identified during the evaluation of the environmental, economic, regulatory, land use planning and engineering impacts of the alternatives.

Resolving these conflicts will require consensus building and collaboration of key stakeholders. There are many methods and tools available to support these efforts. Examples include: ranking alternatives by weighing criteria, decision tree analysis and cost/benefit analysis. The DRBC maintains references in its library that provide information on methods and tools that can be used to develop an IRP.

Even if the alternatives selected for the IRP do not include a request for lowering the ground water withdrawal limit, municipalities are still encouraged to complete and implement the IRP.

Developing Implementation Plans

It is the role of the municipalities within the subbasin to adopt and implement the IRP and

incorporate it into their Comprehensive Plans. The IRP should include a section detailing how the municipalities will implement the plan. To satisfy the requirements of the GWPAR, all the municipalities within a subbasin should : 1) officially adopt the IRP as part of their Comprehensive Plan and amend their Comprehensive Plan to be consistent with their land use planning and other elements of the IRP, 2) officially adopt any ordinances necessary to implement the IRP and 3) implement the municipal component of the IRP.

There are numerous tools available to municipalities to protect their water resources under the Municipalities Planning Code, including multi-municipal plans and ordinances.. Municipalities may want to consider the following:

- Revising their Comprehensive Plan to reflect watershed characteristics and needs. This may involve re-examining how the existing Comprehensive Plan encourages development patterns and modifying the Comprehensive Plan to shift these development patterns away from sensitive watershed areas that cannot support them.
- Revising subdivision and land development ordinances and zoning ordinances to reflect development patterns encouraged by the revised Comprehensive Plan. Zoning tools such as transferable development rights (to allow for increased density in certain areas of the watershed in exchange for removing development rights from more sensitive areas) can also be considered.
- Developing new or revising existing ordinances and incentives to: improve stormwater management; minimize impervious cover; protect floodplains; protect, expand and create riparian buffer networks; discourage development on steep slopes; and encourage on-lot septic system clean-out and maintenance.
- Providing public outreach and education.
- Undertaking land acquisition, conservation easements and preservation of agricultural uses.

Other tools available to municipalities to protect their water resources include Act 537 plans for wastewater treatment and Act 167 stormwater management plans for stormwater control. Municipalities can encourage conservation easements to protect buffers along riparian areas. Cooperative agreements to preserve and protect the watershed can be made between the participating municipalities.

The municipalities will implement certain elements of the plan, while other elements may be outside the control of the municipalities. The plan should identify the roles of the key stakeholders in plan implementation and which tasks each will implement. The plan should discuss the roles of the water and wastewater utilities. Uncertainties associated with implementing elements of the plan that are not under the control of the municipalities should be discussed. These uncertainties can include elements of the plan that are under the control of State agencies or water and wastewater utilities and water supply sources outside the jurisdiction of the implementing municipalities.

Certain elements of the plan may require approval from other agencies such as the Pennsylvania Department of Environmental Protection or Public Utility Commission. It is important to involve these agencies in the IRP process and to gain their input and concurrence on the elements of the plan that are subject to their approval.

The implementation plan should include a schedule detailing when each component of the plan will be implemented. The draft IRP should also include a proposed schedule for adoption of the IRP into

the Comprehensive Plan and adoption of ordinances necessary to implement the IRP. The final IRP should include the Comprehensive Plan amendments and ordinances adopted.

The IRP will be based on conditions and data that are likely to change over time. To the extent feasible, the plan should be flexible enough to adapt to changing conditions such as different demand scenarios and growth patterns. It is recommended that the plan incorporate a schedule for periodic review and plan updates. Any updates or revisions to the plan should be coordinated with DRBC to ensure consistency with any formal decision by the Commission approving the revised withdrawal limit.

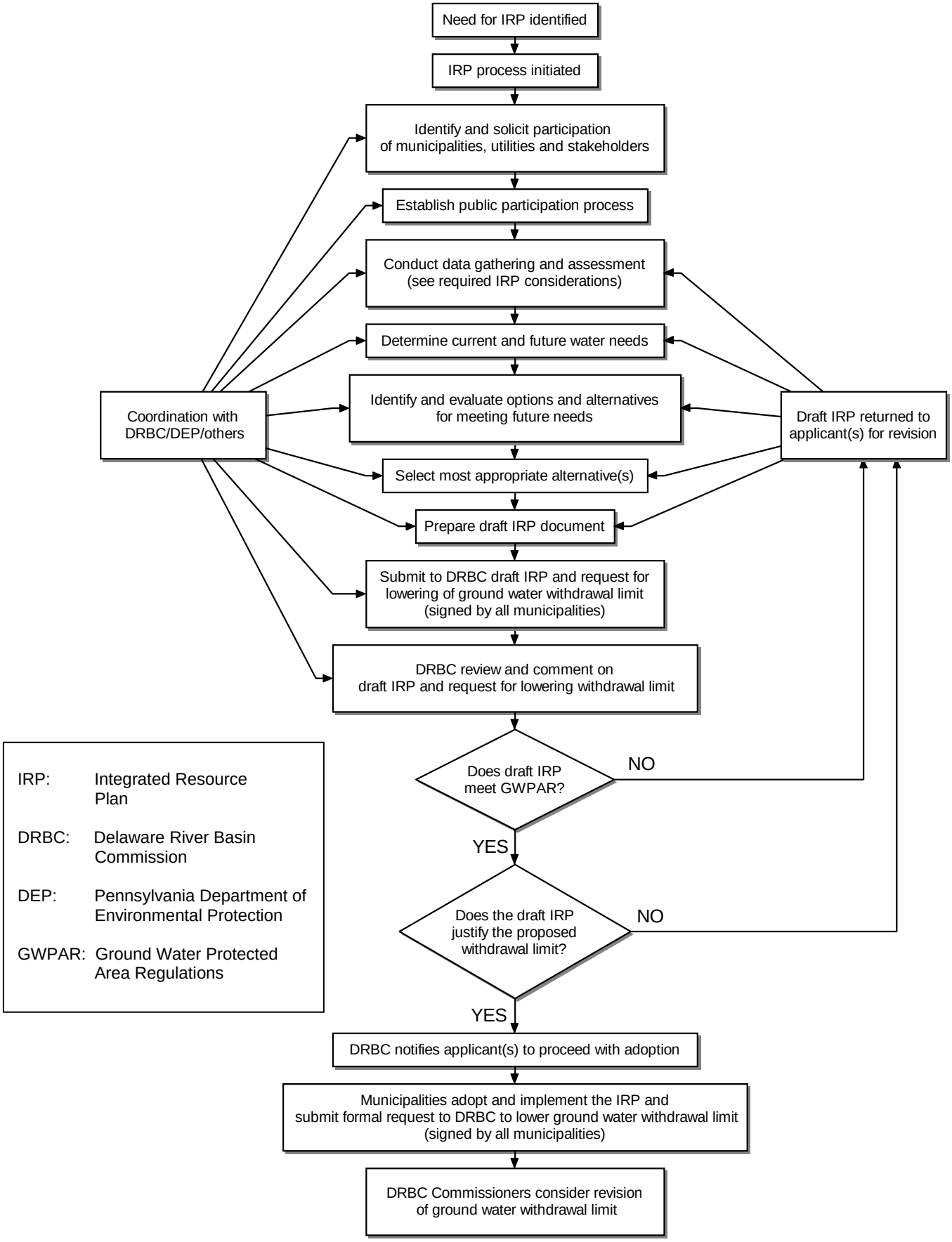
Appendix I
List of Acronyms

BMP	***Best Management Practice***
CERCLA	***Comprehensive Environmental Response, Compensation and Liability Act***
DRBC	***Delaware River Basin Commission***
DEP	***Department of Environmental Protection***
GIS	***Geographic Information System***
EQB	***Environmental Quality Board***
GWPA	***Ground Water Protected Area***
GWPAR	***Ground Water Protected Area Regulations***
IRP	***Integrated Resource Plan***
LUST	***Leaking Underground Storage Tank***
NPDES	***National Pollutant Discharge Elimination System***
$Q_{7\text{-}10}$	***Lowest flow for seven consecutive days with a one-in-ten-year recurrence***
RCRA	***Resource Conservation and Recovery Act***
TMDL	***Total Maximum Daily Load***
USGS	***United States Geological Survey***

Appendix II

Process Overview Flow Chart

Overview of Integrated Resource Plan Development Process for Reduction of Ground Water Withdrawal Limit



Appendix III
Sources of Information

The following represents a partial listing of data that may be available from various entities. There may be other sources of these data as well.

County Agencies

- Land Use Planning Information
- Land Use Mapping and Statistics
- FEMA Flood Plain Maps
- Wetlands Maps
- Population Data and Projections
- Topographic Maps
- GIS Data Layers
- Soils Maps
- Municipal Contact Information
- General Water Resources Information

Pennsylvania Fish and Boat Commission

- Listings of wild trout streams
- Fish Data and Reports for Surveyed Streams

Delaware River Basin Commission

- Surface Water Withdrawals
- Ground Water Withdrawals
- Discharges on the Delaware River
- Political Boundaries

Chester County Water Resources Authority

- Hydrologic and Hydrogeologic Data
- Watershed Maps
- Subbasin Water Balance Data
- Watershed Management Techniques
- Best Management Practices Information
- Nonpoint Source Pollutant Loadings/Discharges Data
- Recharge Data
- Utility Service Area Information and Maps
- Watershed Data and Statistics

Helpful Websites

- Delaware River Basin Commission (http://www.state.nj.us/drbc/)
- US Army Corps of Engineers, Philadelphia District (http://www.nap.usace.army.mil)
- US EPA BASINS 3.0 (http://www.epa.gov/ost/ftp/basins/system/BASINS3/areadb3.htm)
- Philadelphia Weather Data (http://www.fi.edu/weather/data/index.html)
- National Wetlands Inventory (http://www.nwi.fws.gov)
- United States Geological Survey (http://water.usgs.gov/)
- Pennsylvania Department of Environmental Protection (http://www.dep.state.pa.us/)