

**DRAFT FOR CONSIDERATION BY THE HIGHLANDS COUNCIL
AT THE JUNE 12, 2008 COUNCIL MEETING**

Part 3. Improvement of the Regional Master Plan

Subpart a. Water Resources and Ecosystem Science Agenda

Issue Overview

The Data and Analysis chapter of the RMP includes resource assessments for a multitude of natural resources, particularly water resources, based on a significant research effort by the Highlands Council. Much of that information represents one-of-a-kind data products using innovative methods and techniques. For example, water utility service areas maps developed by the Highlands Council remain a unique product in the State.

Implementing the Goals, Policies and Objectives of the RMP will require programs to guide the ongoing research agenda after its adoption. A major focus will be continued refinement, updating and research into new methods to improve the Council's understanding of the Highlands Region's resources.

Program Summary

The following components represent items for inclusion into a long-term science agenda for the Highlands Council, particularly as they related to water supply, water quality and watershed integrity. They represent a variety of research topics.

Some of the research efforts began during drafting of the RMP. Therefore, many of these components have already been started. Others will require a long-term effort and their initial development will begin after RMP adoption and in some cases after Plan Conformance.

RMP Policies And Objectives Addressed

Policy 1C1 To require that conforming municipalities and counties address the protection of forested portions of Forest Resource Areas and High Integrity Forest Subwatersheds in their master plans and development regulations.

Policy 1D1. To establish and maintain an inventory of Highlands Open Waters and their integrity.

Policy 1D2. To establish and maintain an inventory of Highlands Riparian Areas and their integrity.

Policy 1D3. To periodically review and update, as necessary, the Watershed Resource Value and Riparian Area Integrity Values.

Policy 1E1. To establish and maintain an inventory of steep slope areas with slopes equal to or greater than 10% that constitute the Steep Slope Protection Area.

Policy 2C1. To improve estimates of Net Water Availability over time, including testing, development and adoption of ecologically-based assessment techniques to evaluate the high and low flow needs of streams necessary to maintain the health of aquatic ecosystems, and the relationship between ground water recharge, ecological flow needs, consumptive water uses and estimates of water availability for both ground and surface water resources.

Policy 2C2. To evaluate potable water supply reservoir safe yield and passing flow requirements and examine the effects of upstream consumptive and depletive water uses on safe yields and of passing flows on Highlands Open Waters and recommend regulatory changes to NJDEP as appropriate.

Policy 2C3. To develop a more refined Hydrologic Unit Map using Light Detection and Ranging (LiDAR) technology and high resolution digital

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elevation modeling to support more detailed geographic estimates of water availability.

Policy 2C4. To develop more refined estimates of the effects on Net Water Availability regarding the exportation and importation of water and wastewater.

Policy 2J9. To ensure continued refinement and development of the Regional Master Plan.

Objective 2J9a. Implement a coordinated program with NJDEP to track ground water and surface water withdrawals and water allocations within the Highlands Region to maintain current estimates of net utility capacity and to fill critical missing data gaps.

Policy 2M1. To monitor and assess nitrate-related impacts to water resources within the Highlands Region.

Policy 2M2. To develop appropriate and innovative resource management programs to protect, restore, and enhance subwatersheds where existing ground water quality is impaired.

Objective 2M2a. Identify innovative technologies that may be appropriate for the design, installation, and maintenance of on-site wastewater treatment systems to minimize impairment to ground water or surface water quality due to elevated nitrate concentrations and other pollutant loads from septic systems providing the systems meet the minimum standards of N.J.A.C 7:9A.

**Ground Water
Capacity Estimates
And Ground Water
Availability
Thresholds**

The estimates of ground water capacity are critical in the RMP's water resource assessments. They serve as the measure of natural sustainability of the Highlands waters and quantify stream base flows that are critical for aquatic ecological integrity and water quality.

The Highlands Council investigated several methods to calculate ground water capacity. However, no accepted method provided a direct relationship between aquatic ecosystem integrity and stream flows. Therefore, the Highlands Council focused on the severity and duration of base flows as a reasonable surrogate for ecosystem and water supply impacts. Ultimately, the Highlands Council utilized the Low Flow Margin of Safety method, which is also being used by the New Jersey Department of Environmental Protection for the upcoming NJ Water Supply Plan.

Several other methods, which were not initially selected because of the limited schedule and lack of regional data available, may yet show promise for additional research in estimating the availability of water resources for human and ecological needs. Additional research may be warranted for the following methods: New Jersey Hydrologic Assessment Tool (Eco-flow goals), Range of Variability, R2Cross, or Wetted Perimeter method. To facilitate the research, a regional flow monitoring network consisting of observation wells and stream gauges will be explored. The network would augment existing ground water level and surface water flow datasets, respectively, in strategically selected areas.

Another critical determinant in the net water availability analysis is determining the amount of ground water capacity that is available for human uses without adversely affecting aquatic ecological integrity. This parameter, known as ground water availability, is computed as a fraction (or threshold) of ground water capacity. The aforementioned models can aid in improving estimates of

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appropriate thresholds.

As a long-term objective, the Highlands Council will develop a program for improving estimates of ground water capacity and availability. This effort will consist of development, testing and adoption of ecologically-based models or techniques that characterize varying flow regimes in streams necessary to maintain the health of aquatic ecosystems.

The Highlands Council has already contracted with the USGS for additional support under this program. After RMP adoption, the Highlands Council and USGS will develop a specific scope of work for additional research under these water resource programs. Development and implementation of this program is anticipated to be an on-going, multi-year task.

**Protection Of
Downstream Water
Source/ Safe Yields**

NJDEP is currently updating its guidance for evaluating the safe yield and passing flow requirements for surface water systems with reservoirs. NJDEP is also reevaluating those safe yield values to reflect operational and infrastructure modifications in those systems while incorporating the new methodology.

The Highlands Council will coordinate with NJDEP as appropriate as surface water supply systems examine the effects of upstream consumptive and depletive water uses on safe yields and of passing flows under the new procedure. The Highlands Council will recommend regulatory changes as part of the ongoing process. Of specific interest will be methods to better ensure that passing flows from reservoirs are sufficient to maintain ecological integrity.

**Water and
Wastewater
Tracking**

The RMP calls for refined estimates on Net Water Availability. Of particular importance in the analysis regards the transfer of water and wastewater between subwatersheds (depletive uses). The import and export of these utilities have a significant effect on the estimate of consumptive and depletive water demands.

Understanding consumptive and depletive uses is a complex task, but is crucial to estimating Net Water Availability. Using its unique compilation of water and sewer service areas, and their associated demand/discharge data, the Highlands Council now has the ability to track water from its withdrawal point to its ultimate discharge. The tracking model will be conducted largely using GIS techniques, as have been utilized in the past the New Jersey Geological Survey (NJGS) and the New Jersey Water Supply Authority (NJWSA).

**Water and Wastewater
Use Data**

The Highlands Council utilized several forms of water and wastewater data from NJDEP and utility sources. These data sets include permitted water allocation withdrawals, reported wastewater discharges, and public community water system demand data. The data were incorporated into both the Utility Capacity and Net Water Availability analyses.

The information is typically collected and reported on an annual basis. However, the data must often be checked and validated before their use in regional capacity analyses. The most recent complete data set used by the Highlands Council was from the year 2003. Having the most up-to-date data is important for both capacity assessments.

The Council will implement an ongoing effort to update water and wastewater data as they become available on an annual basis. The data will be incorporated into resource assessments to provide the most accurate capacity analyses possible. The Highland Council has already contracted with the USGS for continued technical support and intends to develop a defined scope of work for

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Highlands Open Waters and Riparian Areas Inventory	<p>this program component. This program is anticipated to be an ongoing program.</p> <p>The Highlands Council will develop methods for continued development and refinement of Highlands Open Waters and Riparian Areas inventory with an emphasis on identification of headwater streams and headwater seeps and springs.</p>
Regional Stream Integrity Model	<p>A Regional Stream Integrity Model will aid in the evaluation of the protection, restoration and enhancement of streams within the Highlands Region. Regional integrity scores will be derived using a comprehensive stream and riparian functional assessment. The scores will be assigned to streams within a specific sub-watershed based upon measurement of the physical, biological and chemical integrity of a stream. The stream integrity model will serve as an aid in resource protection decision making and will provide a tool to set measureable management objectives for restoration and enhancement of impaired Highlands Open Waters and Riparian Areas.</p> <p>The Model will function to classify Highlands Region streams, which will aid in qualifying regional protection measures and restoration targets for water quality, aquatic community structure, and in-stream and riparian habitat enhancement. The data used to classify streams will also aid in evaluating existing State Water Quality Standards for stream classification, including identifying streams appropriate for petitioning NJDEP to upgrade streams to C1 status.</p>
Water Quality	<p>The Highlands Council will determine where water quality improvements are necessary or beneficial for the improvement of water quality, develop watershed-based plans to achieve such improvements, develop mechanisms, and identify funding sources to implement these plans. As part of this effort, the Council will determine in coordination with NJDEP and USGS the extent to which additional water quality monitoring stations are needed in the Highlands Region to better assess water quality in key watersheds. For more detail on this program, see the <i>Water Quality Restoration Program</i>.</p>
Ground Water Quality Management	<p>Nitrate has been selected as a surrogate for non-point source impacts to ground water quality, particularly for monitoring potential water quality degradation from on-site wastewater treatment systems, which can pose threats to human health and the environment.</p> <p>The Highlands Council proposes to improve existing monitoring networks and use additional data sources, in coordination with the NJGS and USGS, for monitoring and evaluating both natural conditions and anthropogenic factors in ground water quality. Particular emphasis will be placed on contaminants of interest, such as nitrates associated with septic systems in high density residential areas and agricultural areas, to more accurately characterize existing water quality conditions, land use impacts, and the efficacy of land planning and management practices. If possible, sampling should include potable wells in near proximity to different types of land uses so that a more representative characterization of potential health risks and their relation to land use can be achieved. Use of the Private Well Testing Act data, in a manner that fully complies with privacy provisions of that Act, will be explored.</p> <p>The Highlands Council has already contracted with the USGS for additional support under this program. After RMP adoption, the Highlands Council, NJGS, and USGS can develop a specific scope of work for defining an</p>

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**Models for
Establishing Septic
Density**

improved ambient ground water quality monitoring network.

Existing USGS logistical regression models for estimating septic densities based on median nitrate concentrations can be further tested and refined with additional data collected and modeling. Additionally, logistical regression models could be developed to assess the impacts of specific land use types, such as agricultural, residential, and undeveloped areas, and different hydrogeologic setting, such as limestone and unconsolidated.

These models could not only better quantify septic densities for areas characteristic of varying land use types and settings, but increase an understanding of various land use factors and other conditions that influence water quality, which can lead to improve land planning and wastewater management practices.

Development of this program is anticipated to be performed in conjunction with NJGS and USGS during design of the improved ambient ground water quality modeling network.

**Expand Ambient
Biological Monitoring
Network In Highlands
Region**

The Ambient Biological Monitoring Network (AMNET) program, initiated by NJDEP in 1992, established sampling stations in every subwatershed of the state to evaluate the health of instream benthic macroinvertebrate communities. There are approximately 200 AMNET stations within the Highlands Region.

The Highlands Council (in cooperation with Rutgers-Center for Remote Sensing and Spatial Analysis and the New Jersey Water Supply Authority) performed statistical analyses to assess correlations between key watershed characteristics and AMNET scores for the Region's streams. The analysis did not yield sufficiently strong statistical correlations for assigning scores to non-assessed watersheds.

The intent of this program component is to coordinate with NJDEP to expand and establish a consistent AMNET to include additional stations in the Highlands Region. The Highlands Council will use the data as input into the continued development of a Regional Stream Integrity model to further refine protection requirements of Highlands Open Waters based on biological and water quality indicators.

Forest Sustainability

The Highlands Council will implement a long term forest sustainability program that will entail proactive management of deer populations and non-native invasive species and reductions in the rate of forest fragmentation. Criteria and indicators will be developed to measure the sustainability of the forest resource. Data will be collected to assess long term sustainability. Valuation methods will be developed for carbon sequestration, invasive species control, and management activities tied to forest health improvement and the intrinsic societal values of forests including water quality protection. See the Forest Resource Management and Sustainability Program.

**Digital Terrain
Modeling And
Determination of
Hydrologic Units and
Steep Slopes**

Many of the resource assessments in the RMP, including all hydrologic and many ecological assessments, are performed using the HUC14 subwatershed as the standard areal unit. HUC14s are the smallest standardized hydrologic drainage unit commonly used in water resource analysis. Delineation of HUC14 boundaries is only as accurate as the topographic mapping, typically developed using aerial photographs.

The Highlands Council has contracted for the use of Light Detection and

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Ranging (LiDAR) technology to generate high-resolution digital elevation modeling. This will enable the Council to develop more accurate topographic information that is necessary to refine HUC14 mapping. In addition, the LiDAR data could be used to map drainage areas at a smaller scale (HUC17) than the current subwatershed, if its utility warrants that effort.

The Highlands Council also will establish and maintain an inventory of steep slope areas in the Highlands Region showing slopes that are a minimum of 5,000 square feet and: a) 10% or greater, but less than 15%, b) 15% or greater, but less than 20%, and c) 20% and greater. The Highlands Council will apply (LiDAR) to develop a 2-foot interval contour topographic map as a basis for refining the identification of Steep Slope Protection Areas. Development of this program is already underway.
