EXHIBIT B

STORMWATER REUSE AS A WATER MANAGEMENT STRATEGY

SCOPE OF WORK AND TIMELINE

Background

As development of additional water supplies to meet the projected increases in population and demand in Texas becomes more difficult and costly, water planners and providers are looking to alternative practices, such as conservation and reuse, which efficiently use existing supplies. Storm water reuse, which involves harvesting and using storm water runoff from urbanized areas, is a water management strategy that is being used in other regions of the United States and internationally. In addition to being an efficient use of water resources, storm water reuse can contribute to reductions in potable water usage, reductions in storm water volumes and peak flows, and reduction of pollutant loads into downstream waterways. Furthermore, storm water reuse projects can provide aesthetic and recreational benefits to surrounding communities.

There are a number of issues related to implementation of storm water reuse in Texas that are not well documented or understood. These include legal issues associated with water rights, water quality and associated permitting as well as technical issues associated with evaluation of water availability, identifying potential users and quantifying demands, storage requirements, and treatment requirements. This study will assess these issues and provide the information necessary to evaluate the viability of storm water reuse as a water management strategy in Texas.

Storm water harvesting and reuse includes the collection, storage, treatment, distribution and use of storm water runoff for beneficial purposes. It can occur over a wide range of scales, beginning with rainwater harvesting, where water is collected from rooftops, and extending to capture and use of storm water in water supply reservoirs. Since the TWDB has recently developed guidelines for rainwater harvesting, the primary focus of this effort will be on storm water reuse for applications other than rainwater harvesting, primarily focusing on the use of runoff collected from drainage ways in urban areas. However, the tasks defined below will be related to and coordinated with the existing TWDB rainwater harvesting guidelines existing practices for rainwater harvesting.

The following sections describe the specific tasks to be performed as a part of this project.

Task 1: Literature Search

Storm water harvesting and reuse has been practiced in several other regions of the United States and internationally. A first step in evaluating storm water reuse as a management practice for Texas is to determine what practices and strategies have been

implemented in other areas and identify aspects of these strategies that were successful or that created concerns. In this task, a comprehensive review of existing literature related to collection, storage, treatment and distribution of storm water will be performed. Sources of information will include written materials such as technical papers, reports and guidance documents, as well as personal communication with experts and practitioners who have implemented storm water reuse projects in other areas. In addition, water quality information developed by the United States Environmental Protection Agency (USEPA) National Runoff Program (NURP) as well as sampling data collected for storm water permitting will be used to characterize storm water quality.

The literature search will also include a review of existing regulations and legal issues associated with storm water reuse systems. Water rights and water quality are anticipated to be key legal components of the review. However, existing regulations related to other aspects of collection, storage, treatment and distribution will also be summarized.

Task 2: Develop an approach for determining the probable quantities of historical and future storm water

Assessing the feasibility of storm water reuse, whether on a regional or local basis, requires estimation of the quantity of storm water that is available for capture and storage. Different methods may be used to estimate storm water availability, depending on whether the area of interest is of regional or local scale.[1]

An approach for using the Texas Commission on Environmental Quality (TCEQ) Water Availability Models (WAMs) to estimate regional storm water availability will be developed. The WAMs use extensive historical rainfall and runoff records and various assumptions about water demands, water rights, and wastewater return flows to project available quantities of water at different locations. The recommended approach will consider the following issues:

- Use of drainage areas, mean precipitation, and Soil Conservation Service (SCS) Curve Numbers in the WAMs
- Changes in runoff characteristics due to increased development[2] in the future
- Water right priority dates
- Antecedent soil moisture conditions
- Changes in runoff characteristics due to climate change

[1] A regional-scale area encompasses one or more drainage areas that correspond to control points in the WAMs. These areas are relatively large (from a fraction of a square mile to an entire river basin), and runoff characteristics for these areas can be represented with the SCS curve numbers specified in the WAMs. A local-scale area is a relatively small area where the WAM curve numbers may not accurately reflect local land cover and soil type.

[2] As the population within a watershed grows and development increases, it is anticipated the proportion of impervious land cover will increase. Increasing the amount of impervious land cover generally causes greater runoff volume, higher peak flows, more rapid drainage, increased flow frequency, and reduced groundwater recharge.

In addition, an approach for estimating local-scale storm water availability will be developed. The recommended approach will consider the following issues:

- Land cover type
- Soil type
- Antecedent soil moisture conditions
- Connectivity of impervious areas

Both of the approaches discussed above result in estimated volumes of available storm water, but do not consider peak flows or the hydrographs of individual storm events. It may not be economical to construct storm water storage to capture all runoff from a given storm. In addition, the appropriate volume of storage for a given project will depend on the available supply as dictated by the hydrologic conditions and water rights considerations, desired reliability of the storm water reuse supply, and the desired reduction in potable water demands (assuming that the demands would otherwise be met with potable water supplies), balanced with the cost of providing storage. An approach will be developed for estimating how much of the "available" storm water can be economically captured, taking these factors into consideration.

Task 3: Develop information regarding practices and technology for harvesting storm water, including health and reliability issues as a water supply.

Planning and implementation of any storm water reuse project should involve identification of potential risks to public health and safety, potential risks to the environment, and establishment of specific project goals related to factors such as reliability, water quantity, water quality, flow, aesthetics and financial constraints. Each of these is discussed in more detail below.

Public Health and Safety

There are a number of potential risks associated with storm water harvesting and reuse. Those associated with public health and safety include:

- Microorganisms (pathogens) in the storm water, including bacteria, viruses and protozoa;
- Chemical constituents in the storm water, including inorganic chemicals such as metals or nutrients and organic chemicals such as pesticides or hydrocarbons;
- Water storage hazards, such as drowning in lakes or ponds or embankment failure or overtopping.

Environmental Risks

In addition to public health and safety, storm water reuse can result in concerns related to environmental issues, such as:

- Over-utilization of storm water flows, resulting in reduced instream flows;

- Increased upstream flooding resulting from on-channel storage;
- Potential pollution of surface or groundwater used as part of the storm water reuse scheme;
- Potential soil contamination (for irrigation schemes)

As with other forms of water reuse, the APAI team advocates taking a preventative management approach to storm water reuse, such that risks are identified and managed proactively, and reactive management of problems can be minimized. Public health and safety should not be compromised under any circumstances.

The APAI team will develop information related to potential risks of storm water reuse projects and provide a framework and management approach for addressing these risks.

Water Supply Reliability

The reliability of any water supply is a function of the inflows, the demand and the available storage. This general relationship holds for storm water. However, there are some considerations related to storage and reliability that are particularly pertinent to a storm water reuse system. These include:

- Water rights issues may impose constraints on the amount of storm water that can be impounded and used.
- The storage may be used as part of the overall management scheme, and may include a treatment component, such as a wetland. Treatment goals may impose constraints on storage, operations and reliability. In addition, surface storage may also have other functions, such as flood mitigation and habitat, or may serve as a visual amenity.
- The optimum storage capacity will depend on the goals of the project. For example, for a given storage size, an increase in demand may result in an increased yield (use of a greater quantity of storm water), but less reliability (the storage may be empty more often). If backup supply is available (for example from potable sources), reliability may not be as important as maximizing the yield.
- In addition to surface storage, storm water can be stored in underground tanks, abandoned pipelines, or injected into aquifers using aquifer storage and recovery (ASR). ASR using storm water could also be used in conjunction with other water management goals, such as control of salt water intrusion or subsidence resulting from decreasing ground water levels.

The APAI team will define practices used to harvest and store storm water, for surface storage, underground storage and ASR systems. A procedure for determining storage requirements based on project goals for yield and reliability will be defined. In addition, considerations associated with other concurrent management goals will be addressed and summarized.

Task 4: Develop information regarding alternative practices and technologies for treatment and reuse of storm water.

Treatment of storm water for reuse should meet water quality goals that seek to minimize risks to public health and the environment. Specific water quality goals will depend on the anticipated level of human contact with the water, as well as the end-use of the water.

The APAI team will define specific water quality issues associated with categories of end-uses, including:

- Irrigation;
- Industrial uses;
- Augmentation of potable surface water supplies;
- Aquifer storage and recovery (ASR)

Following definition of the water quality issues, available treatment technologies to address water quality goals for each use category will be defined. Advantages and disadvantages of the technologies will be summarized as they relate to each category of use and water quality goals.

In addition to treatment technologies, the APAI team will define other issues related to reuse practices and storm water systems that may impact water quality and the choice of treatment methods. These include point sources of pollution, the presence of significant sanitary sewer overflows, and land use patterns that influence quality such as roads with high traffic volumes or highly industrialized areas.

Task 5: Define legal issues related to reuse of the historical and future storm water.

A number of regulatory and legal issues relate to implementation of storm water reuse projects in Texas. Attorneys in the Water Practice Group of Lloyd Gosselink Rochelle & Townsend, P.C., who are on the APAI team, have represented several clients across the state in evaluating and implementing legal strategies related to a variety of water rights and water supply projects. Several of these projects have involved an analysis of various legal issues, from both water rights and water quality perspectives, related to permitting and regulatory requirements associated with the impoundment, diversion, use and reuse of storm water and storm water runoff. These issues have significant yet distinct legal and regulatory foundations.

The state's water rights permitting programs, founded on Chapter 11 of the Texas Water Code, require permitting for the impoundment and diversion of water in streams, but they do not generally require permits for the capture of diffused surface waters or storm water runoff prior to entering streams. Such programs also require assessments of water availability and the impacts that proposed permitting may have to existing water rights and the environment. From a water rights perspective, familiarity with these regulatory requirements is integral to conducting the legal analyses associated with projects that rely on enhanced volumes of storm water in streams resulting from the physical

interconnection of non-contributing watersheds to such streams, enhanced storm water runoff due to increases in impervious ground cover in the watershed, and/or the capture of storm water prior to entering state streams. In this regard, identifying the extent to which storm waters have historically occurred, and the potential for future storm water flows to be generated in developing watersheds, may be integral to water rights permitting associated with storm water supply-related projects.

In addition to water rights issues related to the use and reuse of storm water, provisions of the federal Clean Water Act and Chapter 26 of the Texas Water Code may impact the feasibility of storm water projects, particularly in light of watershed protection considerations, including no-discharge requirements, and reuse limitations. These statutory foundations, and the regulations adopted by regulatory agencies have the potential to impact the quality of storm water discharges, as storm water runoff from various municipal, industrial and commercial activities is highly regulated. Additionally, the reuse of storm water will be implicated by regulatory protocol adopted by the State which limits the place of use, place of storage, and purpose of use of such supplies.

Understanding the legal and regulatory requirements associated with particular water management strategies, including strategies related to storm water projects, is integral to evaluating the viability of such strategies, and in assessing the possible need to correctly frame and then, if necessary, adjust the legal or regulatory foundations that may serve to impact such strategies. The APAI team will identify and summarize existing regulations that relate to storm water reuse, and define legal issues that currently may not have clear regulatory guidance.

Task 6: Define issues related to the potential impacts of reusing storm water on downstream ecology.

Storm water reuse projects can have significant impacts on downstream conditions, many of which are positive. Two important benefits of storm water reuse include:

- Reductions in runoff volume and peak flows entering the drainage system from urbanized areas, resulting in reduced stream erosion and mitigation of associated ecological impacts; and
- Reductions in pollutant loads entering local waterways.

Potential adverse impacts to stream ecology are highly dependent on the specific implementation scheme and local conditions. Some examples of potential negative impacts include:

- Environmental impacts of surface storage ponds, including barriers to the passage of fish and other aquatic species, disruption of natural geomorphology processes, and increased potential of upstream flooding.
- Reduction of stream flow below pre-urbanization levels or modification of the flow regime, which may adversely impact habitat and aquatic life.

The APAI team will provide information related to these and other potential ecological impacts, both positive and negative, associated with storm water reuse applications. Each potential impact will be defined in terms of its relevance to different types of applications. Strategies for avoiding or mitigating potential negative impacts will be discussed.

Task 7: Identify regions in Texas with the greatest potential for storm water reuse projects.

The viability of storm water reuse as a water management strategy will depend on both the available supply of storm water and the projected demand. Regions with the greatest potential for storm water reuse projects will be in areas where available runoff quantities are sufficient to make storage volume requirements economically feasible and demands are high enough to provide adequate economy of scale in construction and operation of the conveyance and treatment infrastructure. Other factors will also enter into the feasibility of storm water reuse, including benefits related to reduced downstream pollutant loadings, reductions in peak flows, achieving water conservation targets, and visual amenities.

The APAI team will use the TWDB water planning regions as the basis for evaluating the potential for storm water reuse projects. Each region will be categorized and ranked based on an evaluation of factors determined to be important predictors of storm water reuse feasibility. The results of previous tasks will be used to identify these factors, which will include consideration of hydrologic conditions, water availability (both historical and future), projected population growth, changes in land use, projected demands, local water quality issues, and legal issues. A map (or series of maps) will be developed showing the categorization and ranking of water planning regions for storm water reuse potential.

Task 8: Discuss the issues and implications associated with various scales and forms of storm water reuse strategies.

Based on the results of previous tasks, the APAI team will prepare a review of specific issues associated with storm water reuse. This review will be presented in the form of a guidance document that can be used by planners to help evaluate the feasibility of storm water reuse and develop strategies for implementation in cases where it is found to be feasible. The guidance document will provide information related to the following topics:

- Overview of storm water harvesting and reuse
- Legal and regulatory considerations
    - Water rights issues
    - Permitting issues
- Planning considerations
    - Defining project objectives
    - Management of potential risks
    - Evaluation of site and catchment basin characteristics
    - Determination of storm water availability

  - Identification of potential users and demands
  - Evaluation of storage requirements and options
  - Water quality and treatment requirements and options
  - Distribution options
  - Public Education and Awareness
  - Evaluation of costs and benefits
- Design considerations
  - Collection
  - Storage
  - Treatment
  - Distribution System
- Operational considerations
  - Administrative issues
  - Operations and management
  - Maintenance
  - Monitoring and reporting

The guidance document will address different scales of storm water reuse applications and review several case studies where storm water reuse has been implemented successfully in other areas.

Task 9: Project administration and meetings

This task includes preparation of monthly progress reports and invoices, preparation for and participation in meetings and communications with the TWDB, team progress meetings, quality control, and other administrative tasks associated with management and coordination of the project.

TEXAS WATER DEVELOPMENT BOARD
STORM WATER REUSE AS A WATER MANAGEMENT STRATEGY
PROJECT TIMELINE

TASK	Description	Dec 08				Jan 09				Feb 09				Mar 09				Apr 09				May 09				Jun 09				Jul 09				Aug 09				Sep 09				Oct 09			
1	*Literature search*																																												
2	*Approach for determining storm water quantities*																																												
3	*Practices and technology for harvesting*																																											
4	*Practices and technology for treatment/reuse*																																											
5	*Define legal issues*																																											
6	*Impacts on downstream ecology*																																												
7	*Identify regions with greatest potential*																																											
8	*Guidance document*																																												
	Draft to consultant team for review																																												
	Draft to TWDB																																												
	TWDB review period																																												
	Address TWDB Comments																																												
	Final Report to TWDB																																												
9	*Project administration*																																												
Meetings	*Kickoff meeting*																																												
	Intermediate progress meeting																																												
	Final progress meeting																																												