

**Arizona University System  
Technology and Research Initiative Fund (TRIF)**

**Proposition 301 Business Plan**  
The University of Arizona

Water, Economic Development, and  
Sustainability Program  
(WEDSP)

December 2002

### EXECUTIVE SUMMARY

The University of Arizona (UA) has extensive and internationally recognized expertise in water-related research, sustainability planning, and technology development. This business plan for the Water, Economic Development, and Sustainability Program (WEDSP) is aligned with the goals of the Proposition 301 Technology and Research Initiative Fund (TRIF) to catalyze economic growth. WEDSP is seeking approximately \$8.8 M over five years to achieve the goals outlined in this document.

The mission of the WEDSP is to provide science-based technical, economic, legal, and policy expertise necessary for water development, use, and conservation in an increasingly urban state with sustained population growth. The WEDSP fundamental goal is to strengthen research, outreach, and education efforts in the water resource area at the University of Arizona to help ensure a sustainable, high-quality water supply for economic development and enhanced quality of life for all of Arizona.

WEDSP is leveraging its strengths in academia, research, and local environmental technology industries to create several outcomes, including: practical education for grades K-12 to create general awareness of issues, problems, and career-related training; internationally recognized research and technology transfer initiatives; a thriving industry cluster, which includes both private sector and public center entities, supported by a skilled workforce that is educated at the University of Arizona and related programs; and stronger relationships across disciplines within the University of Arizona, which will result in research innovations to create new business initiatives. These efforts build on the extensive expertise among UA faculty and staff in water-related issues and support UA efforts to be a national and global leader in research, technology development, and economic development.

It is important to note that many of the products associated with the research, outreach and education efforts of the WEDSP are more in the nature of public rather than private goods. Ensuring safe and sustainable water supplies and better management of water demand are necessary to support continued economic development in Arizona.

The infusion of Prop 301 monies will fill the gaps identified to maximize economic and educational impact and leverage existing strengths. Over 40 UA faculty and staff in the social and physical sciences recently declared water a primary area for research, teaching, and outreach. These faculty and staff include individuals from several key departments and colleges. What has been lacking in previous efforts is adequate funding for studying Arizona-specific problems, especially those that involve more than one discipline, and money for outreach and education.

An important and unique feature of WEDSP is that it proposes broad, internally competitive programs in years 3 to 5 in the areas of water sustainability, water quality, water and the environment, water and society, water and the economy, and water resources and climate variability. A critical component is its strategy to obtain funds to supplement Prop 301 monies through government grant program funding, affiliate organization sponsorships, and sponsored research funding.

The University of Arizona water sciences faculty and staff work with communities and industries across Arizona as they position themselves to support economic development and attract workers and companies. Such ties provide valuable links for further development of synergistic relationships among academia, industry, and the public sector.

In summary, making Arizona's water supply safer and sustainable is a key underpinning to Arizona's economic development and a critical component to enhancing our quality of life. Water is additionally a key infrastructure component for all technology companies operating in semi-arid Southern Arizona. Simply stated, water may be considered essential to all economic activity in Arizona.

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# Water, Economic Development, and Sustainability

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## SECTION 1 – CORE VISION/PROJECT DESCRIPTION

The University of Arizona (UA) has extensive and internationally recognized expertise in water-related research, sustainability planning, and technology development. This business plan for the Water, Economic Development, and Sustainability Program (WEDSP) is aligned with the goals of the Proposition 301 Technology and Research Initiative Fund (TRIF) to catalyze economic growth. WEDSP is seeking approximately \$8.8 M over five years to achieve the goals outlined in this document.

### 1.1 Brief Overview of Industry/Area Addressed by Initiative

Located in semi-arid Southern Arizona, the University of Arizona is especially well-situated as a leader in the water sciences. For example, the UA Department of Hydrology and Water Resources is internationally recognized as the best in its field, graduating more hydrology majors than any other university in the United States.

WEDSP is leveraging its strengths in academia, research, and local environmental technology industries to create several outcomes, including:

- Practical education for grades K-12 to create general awareness of issues, problems, and career-related training
- Internationally recognized research and technology transfer initiatives
- A thriving industry cluster, which includes both private sector and public center entities, supported by a skilled workforce that is educated at the University of Arizona and related programs
- Stronger relationships across disciplines within the University of Arizona, which will result in research innovations to create new business initiatives

These efforts build on the extensive expertise among UA faculty and staff in water-related issues and support UA efforts to be a national and global leader in research, technology development, and economic development.

### 1.2 Mission/Goals/Values/Vision of College, University, and Department Responsible

**Mission:** To provide science-based technical, economic, legal, and policy expertise necessary for water development, use, and conservation in an increasingly urban state with sustained population growth.

**Goal:** To strengthen research, outreach, and education efforts in the water resource area at the University of Arizona to help ensure a sustainable, high-quality water supply for economic development and enhanced quality of life for all of Arizona.

### 1.3 Products and Services Provided by WEDSP

Products and services provided by WEDSP fall into three categories: 1) research and technology development focusing on core technology research initiatives within the water sciences; 2) workforce development activities; and 3) technology transfer and outreach activities and improved water policy decision-making.

- (1) Research and Technology Development:  
The funding of research projects and/or gap funding to provide for prototyping and proof-of-concept regarding the following concerns:
  - Remediation and purification of industrial wastewater

- Detection and elimination of pathogens and contaminants in water, as related to human health
- Municipal and mining wastewater and biosolids
- Long-term impacts of groundwater use and recharge in urban and rural areas
- Ways to manage water demand to optimize the use of available water supplies
- Management needs for riparian areas to assure water supply and the necessary nutrients for vegetation
- Improved water planning, including the potential for water sustainability in various regions of the state
- Impacts of water quality on water supply calculations and improvement of drinking water quality
- Long-term impacts of replacement of agricultural water use by urban water use
- Management of water supplies that cross borders such as Indian lands and the Mexican-U.S. boundary
- Development of decision support tools, including hydrologic models that better link surface and ground water, and dynamic simulation models that link various aspects of water supplies and uses

(2) Workforce Development and Water Awareness:

- Expansion of student fellowship program to facilitate student training in water-related fields
- Expansion of the student internship program to give students practical experience in business, industry, and government
- Student-faculty research initiative will be implemented for the above research and technology development targeted projects
- Expanded water science training and curriculum development for K-12 teachers

(3) Technology Transfer and Outreach:

University of Arizona faculty will work to identify research products that have potential for technology transfer. UA faculty and staff will meet with industrial partners and others to identify technology transfer opportunities. They will use various outreach mechanisms to ensure the applicability of WEDSP activities for the private and public sectors and to keep those involved in WEDSP focused on achieving the program's goals. These goals include:

- Increase the number of world-class faculty in the water sciences
- Increase the number of major water research projects
- Establish technology outreach programs for water sciences-related businesses
- Develop non-technical publications and newsletters that will target the general public and be available in print and on related websites
- Publish research reports aimed at private businesses, government agencies, policy makers, and water providers. These will provide useful technical information on the research topics of WEDSP.
- Launch a series of educational programs for water professionals and policy makers, including an annual statewide conference
- Develop curriculum modules for an interdisciplinary semi-arid water resources course and assist high school science teachers in implementing it in the classroom
- Create Water Information Centers
- Implement water education programs for the K-12 and adult populations with the aim of improving understanding of the full range of water information
- Offer short courses to water resource professionals and policy briefings to decision-makers

It is important to note that many of the products associated with the research, outreach and education efforts of the WEDSP are more in the nature of public rather than private goods. For example, improved estimates of snow pack in the mountains and better predictions of runoff and recharge have great value, but are not likely to be patentable or marketable. The same is true of efforts to improve understanding of water quality threats, understanding how climate fluctuations affect urban and rural water supplies and demand, and of educating the public regarding water matters fundamental to the State's economic vitality and quality of life. This does not mean that there will be no marketable research products coming out of the water area, just that this is not the primary focus of much of the work. Ensuring safe and sustainable water supplies and better management of water demand are necessary to support continued economic development in Arizona, even if this work will not in itself trigger a great deal of development. Consider the following:

- **Surface water resources** have been affected and continue to be jeopardized by climate fluctuations. The Western Regional Governors conference has identified drought and its impacts, including wildfire, as top policy concerns. Recent fires in Arizona have harmed tourism, recreation, and forest products industries in ways that will take decades to recover. Burned watersheds, stripped of vegetation cover, are susceptible to soil erosion, making streams and reservoirs much more vulnerable to flash floods and silting. There is evidence that the Southwest may be entering into a decades-long period of increased likelihood of drought. This could impact other sectors; for instance, drought in Taiwan currently is threatening several chip industry plants with closure.
- **Groundwater levels** continue to decline in many heavily populated areas of the state, despite intensive water management. Development in large portions of north-central Arizona has long been stymied by the lack of groundwater supplies, with residents having to haul their water supplies great distances. Other communities relying on shallow aquifers are periodically seeing wells go dry in late summer and autumn.
- **Water quality issues** require our attention as well. Radon, arsenic, and pathogens that are resistant to most disinfectants threaten our municipal water supplies. Finding cost-effective treatment approaches or alternative supplies is a major challenge.
- **Water demands** are increasing as the state population grows. In addition, chip fabrication currently requires large amounts of ultra-pure water, and the next generation of copper-based chips will require even more. The new farm bill and other federal legislation has also raised the possibility of new crop markets in the state, while settlement of Indian water rights claims could potentially lead to significant increases in irrigated agriculture.
- The extent and effects of **climate change** are still poorly understood on the regional level, with leading models in serious disagreement over whether the Southwest may become wetter or dryer. At a finer resolution, urban heat island effects are well-documented in the metropolitan Phoenix area, and are beginning to appear in Tucson. Recent research indicates that urban heat islands not only increase water demand, but they impact precipitation patterns as well.

In summary, making Arizona's water supply safer and sustainable is a key underpinning to Arizona's economic development and a critical component to enhancing our quality of life. Thus, our business plan and the way we gauge success differs from most of the other Prop 301 funded areas. Water is additionally a key infrastructure component for all technology companies operating in semi-arid Southern Arizona. Simply stated, water may be considered essential to all economic activity in Arizona.

#### 1.4 Positioning

The University of Arizona is a Research One institution that performs world-class research and provides high quality education. The UA prides itself on developing a learning environment built on a 'culture of collaboration.' A similar positioning strategy defines its approach to attracting faculty and students. Education at the University of Arizona is nationally and internationally respected in the water sciences.

The University of Arizona water sciences faculty and staff work with communities and industries across Arizona as they position themselves to support economic development and attract workers and companies. Such ties provide valuable links for further development of synergistic relationships among academia, industry, and the public sector.

## 1.5 Competitive Advantage

The competitive advantage of the water community is evident in the history of collaboration and cooperation between university disciplines and both the public and private sectors. University research has provided technical and policy support required for sustainable, high-quality water supplies throughout the State.

The infusion of Prop 301 monies into the existing framework will fill the gaps identified to maximize economic and educational impact and leverage existing strengths.

Over 40 UA faculty and staff in the social and physical sciences recently declared water a primary area for research, teaching, and outreach. These faculty and staff include individuals from several key departments and colleges, including: Hydrology and Water Resources; Soil, Water and Environmental Science; Civil Engineering; Agricultural and Resource Economics; Geography; Chemical and Environmental Engineering; Renewable Natural Resources; the James E. Rogers College of Law; the Udall Center for Studies in Public Policy; the College of Medicine; the Cooperative Extension Service; and the Institute for the Study of Planet Earth (ISPE). These individuals currently are involved in some capacity in fostering the mission of WEDSP and will serve as the leadership core in implementing this program. Many of the aforementioned departments and colleges are active in bringing federal and private funds to the UA. Over the past five years this has resulted in the establishment of three National Science Foundation (NSF) sponsored centers: the Engineering Research Center for Environmentally Benign Semiconductor Manufacturing (ERC), the Center for Sustainability of Arid and semi-Arid Hydrology and Riparian Areas (SAHRA), and the Water Quality Center (WQC). Since 1954, the Water Resources Research Center (WRRC) has played an important coordinating role in water issues among the three state universities. What has been lacking in previous efforts is adequate funding for studying Arizona-specific problems, especially those that involve more than one discipline, and money for outreach and education.

## 1.6 Outcomes Summary

WEDSP will strengthen the current water programs of these four centers and provide additional opportunities for UA faculty to focus on Arizona problems and priorities. During 2000 and 2001, Arizona Governor Jane Hull's Water Management Commission (GWMC) studied the Arizona Groundwater Management Act. The resulting studies and Final Report have underscored numerous essential questions that need to be addressed through additional research that is designed into WEDSP. The recommendations issued in December 2001 by the GWMC are expected to be the subject of legislative debate in the 2003 session and will be used to help focus grant programs on Arizona's needs. Other targeted research areas include methods for improving water quality and water availability in areas outside the active management areas that were examined by the GWMC.

An important and unique feature of WEDSP is that it proposes broad, internally competitive programs in years three to five in the areas of water sustainability, water quality, water and the

environment, water and society, water and the economy, and water resources and climate variability. A critical component is its strategy to obtain funds to supplement Prop 301 monies through government grant program funding, affiliate organization sponsorships, and sponsored research funding.

Water is essential to the health and well-being of local industries and its citizenry, and WEDSP activities can assist in ensuring the long-term availability of water in the State for industrial, municipal, and other uses. The connection of academia and industry through this initiative will result in the following outcomes:

- hydrology and related academic programs will provide a high-quality workforce for water resources companies and agencies;
- the general business community can provide the University of Arizona funding for future research projects and internships to give students real world science experience; and
- sponsored research projects and initiatives produce new technologies, which fuel growth and in some cases provide for new companies and therefore new jobs.

### SECTION 2 – THE MARKET

#### 2.1 Competitive Assessment

The competitive environment consists of three central components: 1) alternatives available to core participants, i.e., students and faculty; 2) alternatives to traditional degree programs and traditional methods of supplying water science education; and 3) direct rivals.

- (1) The attraction and retention of core participants in the greater water community is essential to enable the program of research and development to encourage career building and expanded awareness of career options. WEDSP will enable the University of Arizona to engage in outreach activities for faculty and students.
- (2) WEDSP will enable the UA to offer certification programs that will better prepare students for the emerging economy. New and expanded courses will be developed at both the undergraduate and graduate levels. Additions to the undergraduate curriculum will increase the number of students that can be trained in hydrology and related water resource areas and enhance options in various specialties, including environmental sciences, geosciences, and water related social sciences.
- (3) While other universities and research institutions are competitors, they also present unique opportunities for collaboration and additional research benefits. The University of Arizona's reputation in water sciences only enhances the opportunity for further cooperation and growth.

#### 2.2 Market Size and Trends

Key WEDSP constituencies include students, faculty, businesses, government agencies, and other members of the greater water community who are pursuing various water sustainability and quality goals. This complexity makes the market for WEDSP products difficult to quantify. However, it can simply be stated that water is essential to all economic activity and is critical to quality of life. The UA Office of Economic Development's *Industry Clusters in Southern Arizona: 2001 Status Report* lists the following "key findings" for the Environmental Technologies Cluster:

- Environmental technologies are regionally oriented
- The median company had six employees, with the largest firm, Tracer Research Corporation, having eighty-nine employees
- Over 50% of revenues were from local and state-wide sales
- Revenue per employee was approximately \$100,000, the lowest of the clusters reporting
- Annual revenues were estimated at \$114 million
- A high percentage were small start-up firms
- A high percentage of procurement budgets (51%) were spent locally

#### 2.3 Sales Forecast

Forecasting sales based on the viability of the Prop 301 initiative is not practical. An approximation in growth can be obtained from the periodic increase in cluster revenues, which would encapsulate existing company growth, new company relocation, and new company startup.

## **Water, Economic Development, and Sustainability**

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### SECTION 3 – OPERATIONAL STRATEGIES

#### 3.1 Development and Outcomes

##### 3.1.1 Development Status

Currently, the University of Arizona is in year two of the Commerce and Economic Development Commission (CEDC) initiative which has paved the way for WEDSP and general technology community building activities designed to impact the Arizona economy. Although quantitative key economic indicators are not a focus of this program, which seeks fundamental shifts in public awareness and development of sustainable water supplies to support Arizona's economy, substantial progress has been made to date toward strengthening research, outreach, and education efforts focusing on water sustainability and quality.

##### 3.1.2 Process

The process by which local economic stimulus will be generated is as following:

- Phase 1 – Prop 301 dollars will be leveraged to continue and enhance support for collaborations and research initiatives already in process;
- Phase 2 – Prop 301 dollars will be used in an ongoing series of activities encouraging research and technology development, workforce development and building awareness, and technology transfer/outreach;
- Phase 3 – Prop 301 dollars will be matched by affiliate company sponsorships, large science and research grants, and the ongoing attainment of federal project and other grants.

##### 3.1.3 Cost of Development

The cost of developing and maintaining this process will rely primarily on in-kind contributions from existing academic units and, over time, private industry and other external sources.

Other costs include expenditures related to the creation and maintenance of WEDSP programs and research. Additional details are available in Section 6 of the business plan.

##### 3.1.4 Labor Requirements

Specific labor requirements of implementing the program of activities are detailed in the budget information provided in Section 6.

##### 3.1.5 Expenses and Capital Requirements

See Section 6 for detailed information on the projected expenditures and capital requirements for implementation and maintenance of the program of activities.

#### 3.2 Marketing and Promotion

### 3.2.1 Strategy

The primary strategy for marketing to students and faculty is the quality of education that can be obtained at the University of Arizona for a comparatively low cost. The UA offers technical and practical training that can accommodate the career goals of graduates, whether it is in research and technology and working with collaborators, additional education through non-degree certificate programs, or through enrollment in a university graduate program.

The four University Centers receiving WEDSP funding are involved in a number of outreach efforts, through which information regarding the University of Arizona and the WEDSP is disseminated.

The marketing strategy of the greater environmental community is a well-planned and executed program of activities. Through the Environmental Technologies Industry Cluster (ETIC), a Tucson area marketing effort is currently underway that is designed to attract new companies, talent, intellectual property, and capital support.

### 3.2.2 Promotion Mix

The promotion mix will utilize existing channels for advertising, direct marketing, personal selling, and public relations. These channels are outlined below in Section 3.2.3.

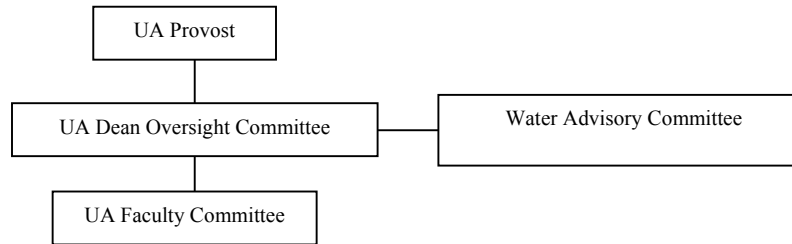
### 3.2.3 Advertising & Promotion Methods

The marketing strategy will utilize existing channels for advertising, public relations, and promotion. Among these are:

- Advertising:
  - ◆ Websites
  - ◆ Print
    - Research reports aimed at private businesses, government agencies, and policy makers
    - Non-technical newsletters
  - ◆ Water Information Centers
- Direct Marketing
  - ◆ Annual Water Conference and other educational programs for water professionals and policy makers
  - ◆ Education programs for K-12 students and teachers and others throughout Arizona
  - ◆ Web-based hydrology course for non-degree seeking and degree-seeking individuals
- Personal Selling
  - ◆ WEDSP personal outreach activities
  - ◆ Word-of-mouth support
  - ◆ Environmental Technologies Industry Cluster (ETIC) activities
- Public Relations
  - ◆ Website
  - ◆ Annual Cluster Industry Report, UA Office of Economic Development
  - ◆ Ad hoc forum participation

### 3.3 Project Management

#### 3.3.1 Organizational Chart



The organizational management structure behind this initiative includes a faculty committee, consisting of the four water center directors as the executive committee, plus selected faculty members, that reports directly to a dean’s oversight committee, which in turn reports to the provost.

#### 3.3.2 Advisory Board and Oversight

The Water Advisory Committee (WAC) is the primary entity for business and external oversight and is comprised of eight industry members plus two ex officio state agency officials. The WAC is charged with providing periodic feedback and review of the initiative, including input on areas of research, possible funding partners, ways of strengthening the program, and mechanisms for information dissemination to the public.

#### 3.3.3 Support Services

- University Administration – Office of the Vice President for Research and Graduate Studies, Office of Technology Transfer, Office for Research and Contract Analysis, Sponsored Projects Services, and the Office of Economic Development.
- Technology Start-up – Tucson Technology Incubator, TechBizLaunchPad
- Research & Development – UA Science and Technology Park
- Marketing – Economic Development offices, Chambers of Commerce, other
- Publicity – *The Arizona Daily Star*, *Tucson Citizen*, *Arizona Republic*, and other media
- Technology Finance – Beach Fleischman, Venture Capital Firms
- Technology Law – Snell and Wilmer, UA Attorney’s Office, UA Office of Technology Transfer

### 3.4 Risk and Strategy to Overcome Risks

#### 3.4.1 Legal Risks/Means to Minimize Risks

Litigation associated with technology transfer from university to the marketplace.

- Creating positive relationships between the Office of Technology Transfer and the principal investigators minimizes litigation
- Developing and presenting seminars on intellectual property and technology transfer issues and the expanded outreach programs with the UA College of Law will create a system for prevention and quick resolution of legal conflicts

#### 3.4.2 Regulatory Problems/Means to Minimize Risks [Not applicable]

3.4.3 Political Risks/Means to Minimize Risks  
[Not applicable]

3.4.4 Business Risks (Supply and Demand) and Plans to Address Them

There is significant and growing demand for water resources research, education and outreach. Resolution of water quantity and quality issues is requisite to continued economic growth and vitality and the sustainability of Arizona's quality of life. University of Arizona faculty and staff are uniquely qualified to address water resources issues. They have developed and will continue to develop internal and external partnerships, so that water resources research, education and outreach activities can be sustained. The high quality of water science research at the University of Arizona is well recognized. It will be important for the University to be able to retain and recruit the personnel necessary for continuing and expanding this high quality effort. Proposition 301 funding, especially as it increases in Fiscal Year 2004, will enable increased emphasis on Arizona-specific water issues.

3.4.5 Competitive Risks and Strategy for Addressing Them

Demand for water resources research, education and outreach is not particularly sensitive to economic cycles. Therefore, the risks that demand for these services will diminish are not significant. The WEDSP enables the University of Arizona to increase its ability to focus on Arizona-specific water resources issues. Through partnerships with the private and public sectors, the programs funded through the WEDSP should experience sustained and growing demand. Although other universities and organizations also work on these matters, increased WEDSP activity will enhance of the University of Arizona's reputation for excellence and comprehensiveness in water resources research, education and outreach.

3.5 Sustainability

3.5.1 Anticipated Funding Sources for On-going Support

The WEDSP is funded by Proposition 301 sales tax revenues, the level of which is sensitive to some extent to external economic conditions. It is expected that this funding will continue to be leveraged by funding from the private and public sectors, including governmental units that operate water utilities.

3.5.2 Timeline for Transitioning Away from TRIF Support

As noted, many of the products associated with the research, outreach and education efforts of the WEDSP are more in the nature of public rather than private goods. Ensuring safe and sustainable water supplies and better management of water demand are necessary to support continued economic development in Arizona. The infusion of Proposition 301 monies will increase economic and educational impact and leverage existing strengths. The program will be further leveraged with funding from sources external to the University of Arizona. The WEDSP research, outreach and education activities are expected to be of high value to the people of Arizona, thereby justifying continued Proposition 301 and external funding over time. The extent of water resources research, education and outreach will depend on the level of funding. Because TRIF funding for the WEDSP is increasing from the Fiscal Year 2002 and 2003 budgeted level of \$500,000 to Fiscal Year 2004 budgeted amount of \$2,000,000, the WEDSP will expand its research, education and outreach – and leveraging – activities considerably in Fiscal Year 2004. It is difficult to establish a timeline for transitioning away from TRIF support at this time.

## Water, Economic Development, and Sustainability

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### SECTION 4 – GOALS/ OUTCOMES

#### 4.1 Goals and Outcomes

##### 4.1.1 Return on Investment

WEDSP's purpose is to strengthen research, outreach, and education efforts in the water area at the University of Arizona to help ensure a sustainable, high-quality water supply for economic development and the quality of life. Its main goal is to provide science-based technical, economic, legal, and policy expertise necessary for development and use of water in our increasingly urban state. The nature of the purpose and goals of WEDSP for supporting economic development and sustainability of water resources makes the quantitative tracking of progress difficult.

##### 4.1.2 Technology Transfer

Technology transfer, although not a significant indicator of success for WEDSP, will occur through WEDSP programs, including a statewide water conference designed to transfer knowledge from the UA regarding water resources sustainability and development. Additionally, invention disclosures and patents applied for through the Office of Technology Transfer on behalf of WEDSP will be tracked.

##### 4.1.3 Companies Relocating

The work of the ERC specifically addresses water quality, treatment, and reuse issues related to the semi-conductor industry. In addition, the water quality work of the water centers and others at the UA is pertinent to the relocation considerations of many companies. Furthermore, resolving water quantity issues is important generally to companies considering locating in Arizona. There is the potential for research institutes and related organizations to relocate for strategic partnerships, and the progress and execution of these will be tracked.

##### 4.1.4 Work Force Contributions

Work force contributions result from two sources: 1) increases in worker populations due to proactive non-education activities like company relocation; and 2) growth in graduate and undergraduate enrollment in expanded program efforts at the University of Arizona. The first source is comprised of workforce contributions from relocating organizations, expansions among those organizations, and the related attraction of faculty experts. The second source consists of those participating in expanded research opportunities.

##### 4.1.5 Specific Curriculum Innovations

WEDSP's overall educational goal is increasing water science literacy at the K-12 and higher education levels, and among policy makers and the general public. Curriculum innovations include: SPLASH (Student-centric Program for Learning About Semi-arid Hydrology), an interdisciplinary high school curriculum being developed by a team of science teachers for implementation in Fall of 2002; expanding Project WET (Water Education for Teachers, which develops and disseminates classroom-ready teaching aids for K-12 students) to Maricopa County; rural water resource centers for educators outside Maricopa and Pima counties; and cross-training of educators statewide.

A critical factor for making the educational program more effective is integrating it with research efforts. A prime example is Project GLOBE (Global Learning and Observations to Benefit the Environment), where K-12 students gather field data in hydrology and related disciplines, collaborate with scientists and other students around the world, and report their data on the Internet. Such integration helps make WEDSP's research, outreach, and education efforts greater than the sum of their parts.

#### 4.1.6 Partnerships/Collaborations

Partnerships and collaborations will be developed and built upon in order to attain financial sponsorship and to expand the reach and interconnectedness of university-originated programs under WEDSP. These will be measured in absolute terms as the number of affiliate organizations obtained. The following lists are illustrative of collaborations that have been developed and are typical of those that will be sought under WEDSP:

<b>University of Arizona Collaborators</b>	<b>External Collaborators</b>
Agricultural and Resource Economics Dept.	Arizona Dept. of Environmental Quality
Arizona Graduate Program in Public Health	Access Business Group
Chemical and Environmental Engineering Dept.	Audubon Society
Civil Engineering and Engineering Mechanics Department	Carollo Engineering
Climate Assessment of the Southwest	Central Arizona Project
Cooperative Extension	City of Peoria
College of Law	City of Tucson
Engineering Research Center for Environmentally Benign Semiconductor Manufacturing (ERC)	Cochise County
Environmental Research Laboratory	Errol L. Montgomery & Associates
Geosciences Dept.	HDR Engineering
Global Learning and Observation to Benefit the Environment (GLOBE)	Jim Click Automotive Team
Hydrology and Water Resources Department	Los Alamos National Laboratory
Institute for the Study of Planet Earth (ISPE)	The Nature Conservancy
Landscape Architecture Dept.	Pima County Wastewater
Office of Arid Land Studies	Public school teachers
School of Business and Public Administration	Orange County Sanitation Water Quality Assn
School of Planning and Architecture	Raytheon Corporation
School of Renewable Natural Resources	Sandia National Laboratories
Soil, Water, and Environmental Science Department	Tohono Chul Park
Sustainability of semi-Arid Hydrology and Riparian Areas (SAHRA)	Tonto National Forest
Udall Center for Studies in Public Policy	United States Army Corps of Engineers
Water Conservation Alliance of Southern Arizona (Water CASA)	United States Bureau of Reclamation
Water Education for Teachers (WET)	United States Dept. of Agriculture
Water Quality Center (WQC)	United States Geological Survey
Water Resources Research Center (WRRC)	United States National Weather Service

#### 4.2 Timeline for Achievement of Goals

##### YEAR 1

- Accelerate research program with a university-wide coordinated approach that will provide water-related topics of great significance to Arizona

- Survey the significant water supply and water quality issues and information needs throughout the state

#### YEAR 2

- Establish the external advisory committee
- Develop grants program
- Develop fellowship and internship programs
- Enhance existing outreach programs

#### YEAR 3 and continuing

- Implement competitive research grant program
- Implement fellowship and internship programs
- Implement a variety of water resources education and outreach programs, including programs for K-12 teachers, for building general and career awareness

### 4.3 Early Proof of Performance

#### 4.3.1 Implementation Goals for First Three Years

WEDSP is leveraging its strengths in academia, research, and local environmental technology industries to create several outcomes, including: practical education for grades K-12 to create general awareness of issues, problems, and career-related training; internationally recognized research and technology transfer initiatives; a thriving industry cluster, which includes both private sector and public center entities, supported by a skilled workforce that is educated at the University of Arizona and related programs; and stronger relationships across disciplines within the University of Arizona, which will result in research innovations to create new business initiatives. These efforts build on the extensive expertise among UA faculty and staff in water-related issues and support UA efforts to be a national and global leader in research, technology development, and economic development.

The connection of academia and industry through this initiative will result in the following outcomes:

- academic programs will provide a high-quality workforce for water utilities and water resources companies and agencies;
- the general business community can provide the University of Arizona funding for research projects and internships to give students real world science experience; and
- sponsored research projects and initiatives produce new technologies, which fuel growth and in some cases provide for new companies and therefore new jobs

In addition, the WEDSP will work with the Arizona Legislature and government agencies in Arizona, including the Arizona Department of Environmental Quality and the Arizona Department of Water Resources, so as to better incorporate the needs of Arizona in WEDSP efforts.

Several things were accomplished during the first year of the program, some of which are listed in the next subsection. During this second year of funding, the grant program to be implemented in the third year is to be developed and implemented.

#### 4.3.2 Special Efforts to Produce Rapid Results

The directors of the four centers funded through the WEDSP have coordinated their efforts, including establishment of a joint water education program. Research projects have included efforts to assess the quality of municipal drinking water and the ability to use recycled water in the electronics industry. The Water Resources Research Center

hired an Associate Director to be a key navigator of WEDSP activities. In addition, a water education specialist was hired to enhance the WEDSP's presence in Maricopa County. The development of K-12 education programs, funded research efforts and multi-faceted outreach activities position WEDSP to be on track to meet or exceed all of its objectives.

**SECTION 5 – PRO FORMA FINANCIALS/FUNDING REQUEST**

- 5.1 Cash Flow Statement (not available)
- 5.2 Income Statement (not available)
- 5.3 Water, Economic Development and Sustainability Program Funding Request and Expenditures

<b>The University of Arizona</b>					
<b>PROP 301/Technology and Research Initiative Funding Request</b>					
<b>Water, Economic Development and Sustainability Program</b>					
	<i>FY 2002</i>	<i>FY 2003</i>	<i>FY 2004</i>	<i>FY 2005</i>	<i>FY 2006</i>
Personal Services	224,047	518,431	1,419,247	1,615,900	2,443,515
ERE	43,690	107,380	276,753	315,100	476,485
Other Operating (incl equipment)	232,263	316,269	304,000	369,000	580,000
Modify Other Operating-revenue shortfall	(15,185)				
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	484,815	942,080	2,000,000	2,300,000	3,500,000