

Memorandum

To: Programs, Projects and Operations Subcommittee

Subject: Fontenelle Nature Association – Request for Assistance

Date: March 24, 2008

From: Gerry Bowen

The District has received a request (see attached) for financial assistance from the Fontenelle Nature Association (FNA) to investigate potential solutions to gully erosion within Fontenelle Forest. Currently, three drainageways (Chiles Hollow, Mill Hollow, and Coffin Springs Hollow on the attached map) are severely eroding into and through the Forest and outletting at the base of the bluffs.

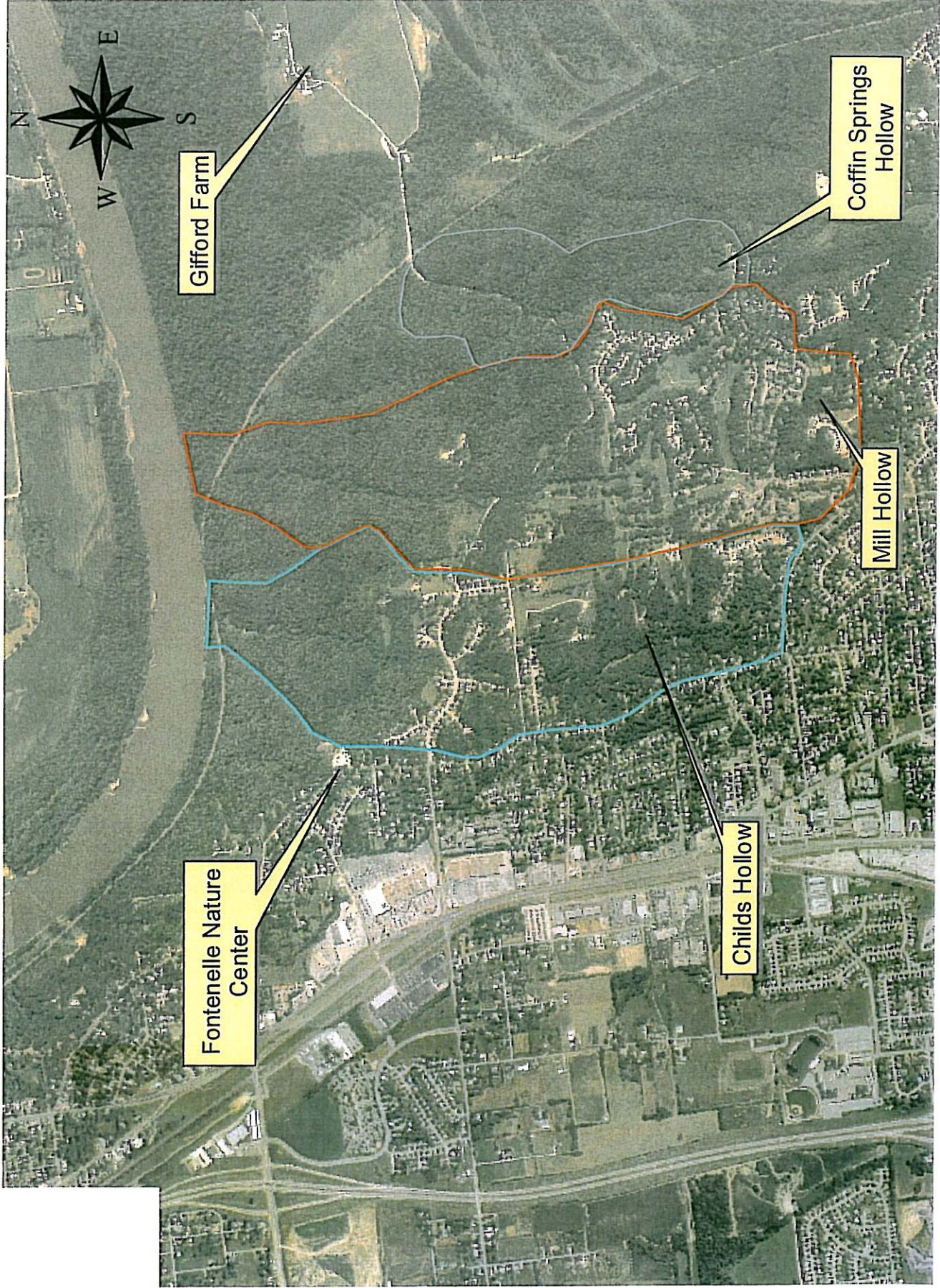
Sedimentation from this erosion is affecting the Great Marsh/Hidden Lake Project which was sponsored by the District and the Corps.

The investigation is estimated to take six months to complete and is estimated to cost \$159,760. The FNA proposes to work with the US Army Corps of Engineers on a Section 22 planning study to accomplish the project. In addition, FNA has applied for, and received approval from, the Nebraska Environmental Trust (NETF). The proposed breakdown of costs is as follows:

Corps of Engineers	\$79,880
NETF	\$49,880
FNA	\$10,000
City of Bellevue	\$10,000
P-MRNRD	\$10,000
Total	\$159,760

According to the request, the Corps funding has not yet been secured, but may be in their new fiscal year beginning October 1, 2008. Therefore, Management recommends approval contingent upon approval of Corps funding.

- **It is recommended that the Subcommittee recommend to the Board that the application from Fontenelle Nature Association be approved in the amount of \$10,000 to be included in the FY 2009 Budget, subject to approval of Corps of Engineers Section 22 funding.**



Fontenelle

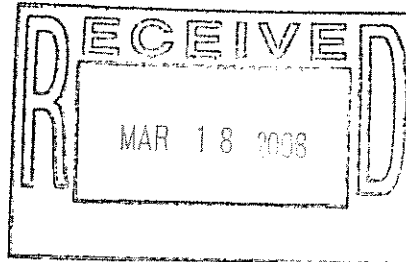
Nature Association

Fontenelle Forest Nature Center
1111 North Bellevue Blvd., Bellevue, NE 68005-4000
(402) 731-3140 fax (402) 731-2403

Neale Woods Nature Center
14323 Edith Marie Ave., Omaha, NE 68112
(402) 453-5615 fax (402) 453-0724

March 17, 2008

Gerry Bowen
Papio-Missouri NRD
8901 S. 154th St.
Omaha, NE 68138-3621



Dear Gerry;


Enclosed is a copy of the NET Watershed Study grant application for which the Fontenelle Nature Association has been awarded \$49,880. The grant is in effect until June 30, 2009.

According to our agreements the NRD, FNA and City of Bellevue were to contribute \$10,000 each in cash or in-kind. The Army Corps of Engineers was to contribute \$79,880 using Section 22 funds. In November, 2007, the FNA, City of Bellevue and the Army Corps signed a cost share agreement for Section 22 planning assistance.

Unfortunately the Army Corps has as yet been unable to secure these funds. We had hoped to complete the study this summer but it looks like that won't happen. The Corps' next fiscal year begins September 30 and we hope to get funds then and complete the study during the winter-spring. If this too is delayed I have the option of asking the NET to extend the grant.

For your purposes it is probably wise to get funding in the NRD's budget and hope for the best.

Sincerely,



Gary W. Garabrandt
Director of Science and Stewardship





NEBRASKA ENVIRONMENTAL TRUST FUND

H1. Project Sponsor: Fontenelle Nature Association and the City of Bellevue

H2. Project Name: Watershed Stabilization Study

3. County(s) where project is located: Sarpy

4. Nearest town: Bellevue

5. Total Amount Requested: \$49,880.25

6. Years of funding requested (select one): 1

Contact Person:

7. Name: Gary W. Garabrandt

8. Title: Director of Science and Stewardship

9. Organization: Fontenelle Nature Association

10. Address, City, State & Zip: 1111 Bellevue Blvd. No., Bellevue, NE 68005

11. Daytime Phone: (402) 731-3140

12. Alternate phone: 731-8504

13. Fax: (402) 731-2403

14. E-mail: ggarabrandt@fontenelleforest.org

15. Sponsor web page: www.fontenelleforest.org

16. Is this a continuation request for a project previously funded by the Trust:

YES ☐ NO ☒

Is this a resubmission of a project application previously not funded by the Trust:

YES ☐ NO ☒

17. Please indicate which category best describes the applicant:

Selections are: Individual ☒ City or County ☐ Natural Resources District ☐ Federal Agency ☐ Private for Profit ☐
☒ Private Nonprofit ☐ Consortium ☐ School, Irrigation, Power or Development District ☐ State Agency ☐ Other (specify):

18. Will this project receive federal funds or require a federal review or permit? YES ☐ NO ☒

If yes, identify the agency(s) and its role:

The U. S. Army Corps of Engineers will provide technical planning assistance under the Section 22 program.

19. Will this project receive other State of Nebraska funds or require a state review or permit? YES ☐ NO ☒

If yes, identify the agency(s) and its role:

20. In 300 words or less provide an overview of the project for which you seek funding. If you are asking the Trust to fund only a portion of the project, indicate the components for which you seek funding.

Fontenelle Forest Nature Center is a 1400 acre natural area in northern Sarpy County adjacent to the Missouri River and situated between the cities of Omaha and Bellevue. It is owned and managed by the Fontenelle Nature Association (FNA). Half the nature center property is deciduous floodplain forest and half is upland oak-hickory woodland. Within the upland are several drainage basins, or watersheds which drain in an easterly or northeasterly direction toward the river. Some of the watersheds are small and are contained within nature center borders, while three larger watersheds extend well beyond the center's boundaries.

Residential development in the upper reaches of these larger watersheds has changed the hydrology from its predevelopment conditions, resulting in erosion and siltation, loss of water quality, damage to wildlife habitat and public safety concerns. Damage has occurred both in Fontenelle Forest and on adjacent land within Bellevue city limits.

To address these issues we formed the "Bellevue Watershed Task Force" made up of representatives of Fontenelle Nature Association, City of Bellevue, Papio-Missouri NRD, Sarpy County Roads Department, U. S. Army Corps of Engineers and the owner of a private golf course. The task force is taking a "top to bottom" approach to the watersheds in order to fix existing damage and slow storm surges by employing innovative filtering and impounding methods. Potential fixes may include homeowner rain gardens, bioretention wetlands, impoundments and channel stabilization.



The Nebraska
Environmental Trust

preserving NATURAL NEBRASKA™ for future generations

NEBRASKA ENVIRONMENTAL TRUST FUND

H1. Project Sponsor: Fontenelle Nature Association and the City of Bellevue

H2. Project Name: Watershed Stabilization Study

As a first step the Army Corps of Engineers has prepared a proposal and cost estimate to perform a stabilization study for the three watersheds. The study will be completed under authority of the Section 22 Planning Assistance Program which requires a 50/50 federal and sponsor match. The Nebraska Environmental Trust is being asked to fund a portion of the match and FNA, the NRD and Bellevue are pledging monetary and in-kind contributions.

21. On behalf of the sponsor(s) named above, I hereby certify that the information contained in this application, including all attachments, is true, accurate and complete.

Gary W. Garabrandt
Authorized Signature of Sponsor Organization

Director of Science and Stewardship
Title

8-30-07
Date

Gary W. Garabrandt

Director of Science and Stewardship

Typed or Printed Name of Authorized Signatory

Typed or Printed Title

H1. Project Sponsor: Fontenelle Nature Association and the City of Bellevue

H2. Project Name: Watershed Stabilization Study

In five pages or less, provide a discussion of your project. Be sure to cover the points specified in the instructions.

Introduction: The setting for this grant application is in northeast Sarpy County and the proposal is for funding to enable the U. S. Army Corps of Engineers to complete a watershed stabilization study of three large drainage basins lying partly within the borders of Fontenelle Forest Nature Center and partly on adjacent lands within the city limits of Bellevue. (An aerial photo is attached.) Fontenelle Forest is a 1400 acre natural area owned and managed by the Fontenelle Nature Association (FNA), a private non-profit organization. Fontenelle Forest is registered by the U.S. Department of the Interior as both a National Natural Landmark and a National Environmental Education Landmark.

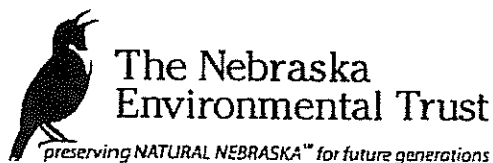
Background: Roughly half of Fontenelle Forest lies in the Missouri River floodplain and half is in the steep sided loess bluff formation that borders the river in many parts of Eastern Nebraska and Western Iowa. The floodplain is mostly a cottonwood-sycamore forest and also features a stream, a spring fed wetland known as Great Marsh and a river backwater called Hidden Lake. In the mid-1990's, Great Marsh and Hidden Lake were enlarged and dredged in a cooperative venture between FNA, Papio-Missouri NRD and the Corps of Engineers. Partial funding for this project included \$360,000 awarded by NETF to the NRD, which was the local sponsor.

The loess upland is covered by oak-hickory woodland and the steep sided ridges and ravines form seven major drainage basins, or watersheds. Four of these watersheds are protected within Forest boundaries. They have a natural forest canopy cover and ground litter and maintain a natural hydrology with little erosion or siltation problems. However, the boundaries of two large and one small watershed extend outside the Forest's borders and their hydrology has been greatly altered in recent decades by residential development. These watersheds are bounded on the west and south by a high ridge line traversed by Bellevue Blvd. and Forest Drive. Drainage flows in a north or northeast direction toward the Forest boundary and through nature center property. Residential development in the area between Bellevue Blvd. and the Forest boundary began in the late 1960's and is ongoing. Prior to development the region was largely rural acreages with orchards and horse pastures and the hydrology was fairly natural due to the thick forest canopy and native ground cover. Post development conditions include large areas of impermeable surfaces such as roads, driveways and rooftops. The resulting increase in runoff and occasional severe storm surges has caused problems in lower parts of the watersheds such as erosion, siltation, public safety concerns, loss of wildlife habitat, debris accumulation and damage to private properties within city limits. The three watersheds experiencing problems are outlined on the attached aerial photo.

The westernmost, named **Childs Hollow** after pioneer landowner Charles Childs, extends 1.5 miles from its low point of 980 feet above sea level to 1200 feet elevation at Bellevue Blvd. It contains roughly 300 acres with about 100 acres at the north end within Forest boundaries. Spring seeps within the Forest flow year round and create ideal watering habitat for birds and other wildlife. At the very north end of the hollow all runoff flows through a culvert under the Burlington-Santa Fe railroad and directly into the Missouri River. Large scale residential development began in the watershed in the 1970's and is ongoing. There yet remain undeveloped parcels of rural land in the hands of aging landowners and there is potential for further development and increasing runoff problems. The attached labeled photos taken at the northernmost end of the watershed show a progression from the predevelopment condition in 1974, to an eroded ditch in 1990, and as the area looks today following a 1996 erosion control project.

In 1995 FNA received a \$160,000 grant from NETF to repair erosion damage at the north ends of Childs and adjacent Mill Hollows. The repair work in Childs Hollow consists of an earthen dam with an overflow structure of perforated piping and large rip-rap rock. The dam creates a silt basin which halts head cutting of the channel. The basin is gradually accumulating silt and rebuilding the ground level to nearer its predevelopment condition. Erosion today is occurring at higher elevations upstream from the silt basin as is indicated on the aerial photo. Erosion of course, is not the only issue in this and the other watersheds. Until recently subdivisions complied with the Clean Water Act by attempting to control the **quantity** of storm runoff. Today the emphasis is on maintaining water **quality** and the Section 22 study we hope to fund will be looking for locations where bioretention wetlands can be used to filter and improve the quality of runoff before it enters Fontenelle Forest and eventually the river.

The second watershed is **Mill Hollow** named for a steam powered sawmill operated by Charles Childs in the 1850's-60's. Remains of the mill, Childs' home and other outbuildings lie unexcavated and protected in Fontenelle Forest at the north end of the hollow near the railroad tracks. However, this historic site could be destroyed if severe head cutting develops as was the case in Childs Hollow. Mill Hollow also extends 1.5 miles from the river beginning at 980 feet in elevation to its upper end at 1200 feet where it is bounded by Bellevue Blvd. and Forest Drive. The Mill Hollow watershed contains roughly 450 acres with about 190 northernmost acres within Forest boundaries. The main subdivision in this watershed, which also encompasses a golf course, was developed in the 1960's-70's. A portion of the 1995 NETF grant to



NEBRASKA ENVIRONMENTAL TRUST FUND

H1. Project Sponsor: Fontenelle Nature Association and the City of Bellevue

H2. Project Name: Watershed Stabilization Study

FNA went toward a structure near the railroad tracks in Mill Hollow designed to prevent head cutting of the channel. Building an earthen dam was inappropriate for this site because doing so would have destroyed portions of the historic sawmill site. Instead we built a retention structure constructed of pre-fabricated metal panels ("bin walls") which when connected form boxes across the streambed. The boxes were then filled with rock for stability. Labeled photos are attached. A small diversion tube through the bin wall diverts spring water, which flows year round, toward a wetland area to the south and eventually into a stream and Great Marsh. Storm water flows over the low sections of the bin wall, through a culvert under the railroad and into the river.

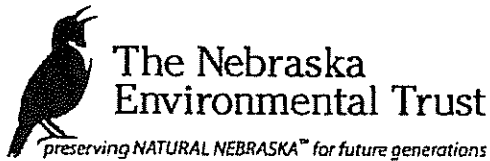
In May, 2007 a seven inch rainfall overnight washed out a berm separating the storm and spring water channels and spring water is currently flowing into the river instead of the wetlands. A pedestrian bridge is also being undermined and will have to be relocated. Severe storm surges may eventually cause failure of the bin wall. The areas of severe erosion upstream are indicated on the aerial photo. Erosion is damaging portions of a golf course, Fontenelle Forest, Camp Gifford Road and four private properties near the road.

The third watershed is called **Coffin Springs Hollow**, so named in the 1800's after a coffin-shaped outcropping of limestone near a spring at the Camp Gifford Road railroad crossing. It is less than a mile long and rises from 977 feet elevation near the railroad crossing to 1250 feet in Boy Scout Camp Wakonda near Forest Drive. It contains about 130 acres, 100 acres of which is within Fontenelle Forest. Although only a small portion of the Fontenelle Hills subdivision drains into Coffin Springs Hollow, the highly erosive loess soil combined with a steep gradient in the upper reaches of the watershed have contributed to create a deep head cut that measures roughly 25 feet deep by 20 feet wide and about 200 feet long. Sediment washed from this area flows alongside Gifford Road and accumulates on the floodplain east of the railroad. Silt laden water also reaches Great Marsh, jeopardizing the costly dredging project completed ten years ago. Accumulating silt also degrades wildlife habitat by burying native plants and promoting the spread of reed canary grass, a non-native species.

Objectives: As revealed in the above background information, there have already been costly, but effective measures to mitigate problems caused by storm runoff in the three watersheds; including dredging a marsh, building a silt basin and constructing a bin wall to blunt the effects of storm surges. However all of these remedies are at the lower end of the drainage basins. There is as of yet no comprehensive plan to control runoff where it begins, at the upper reaches of the basins. Until such a plan is devised and implemented, the runoff will continue as is, or worsen, and the life spans and effectiveness of the projects already in place are in jeopardy.

The purpose in organizing the Bellevue Watershed Task Force was to bring together representatives from city, county, regional and federal governments along with non-profit and private interests in order to draft a comprehensive watershed plan, and then over time implement a series of projects to solve runoff problems from top to bottom. The implementation is likely to take place in a series of steps over many years. The agreed upon first step is the proposed watershed stabilization study to be completed by the Corps of Engineers under Section 22 authority. The Corps proposal and cost estimate is attached.

The Corps will develop a technical report including preliminary design drawings, quantity estimates, cost estimates and a construction schedule based on information gathered from four specific tasks. These tasks include **hydrology, detention storage, stable channel design and data collection**. Using a variety of statistical methods and techniques, the Corps will prepare a model of the pre-development, existing and future **hydrology** for each watershed to include the 2, 5, 10, 50 and 100 year flood events. Information from these models will be used to determine the need for **detention storage**. The Corps will use statistical modeling to determine the effectiveness of different storage alternatives in order to reduce peak flood discharge to pre-development conditions. Storage alternatives include homeowner rain gardens, bioretention wetlands, dry dams, ponds and combinations of all four. Many homeowners currently attach drain tubes to their rain gutter downspouts and direct runoff to the edge of their properties. Encouraging them to install and plant rain gardens is an attractive and vital first step in reducing runoff. A bioretention wetland is a soil and plant-based stormwater management best management practice employed to absorb and filter runoff from developed communities. It consists of a lined or unlined basin filled with a permeable mix of soil, sand and mulch. A stand of grasses, shrubs and small trees is established to promote evapotranspiration, maintain soil porosity, encourage biological activity, and promote uptake of some pollutants. Runoff from parking lots and streets contains salts, oils, nutrients, heavy metals and other pollutants. Studies at the University of Maryland show that bioretention wetlands are capable of reducing heavy metals concentrations by 90% and nutrients by as much as 80%. A series of bioretention wetlands installed terrace-like in the upper reaches of the watersheds would potentially slow storm runoff surges and greatly improve the quality of runoff before it reaches Fontenelle Forest and the river. Ponds similar to the basin constructed in Child Hollow or dry dams might also be employed in lower reaches of each watershed.



NEBRASKA ENVIRONMENTAL TRUST FUND

H1. Project Sponsor: Fontenelle Nature Association and the City of Bellevue

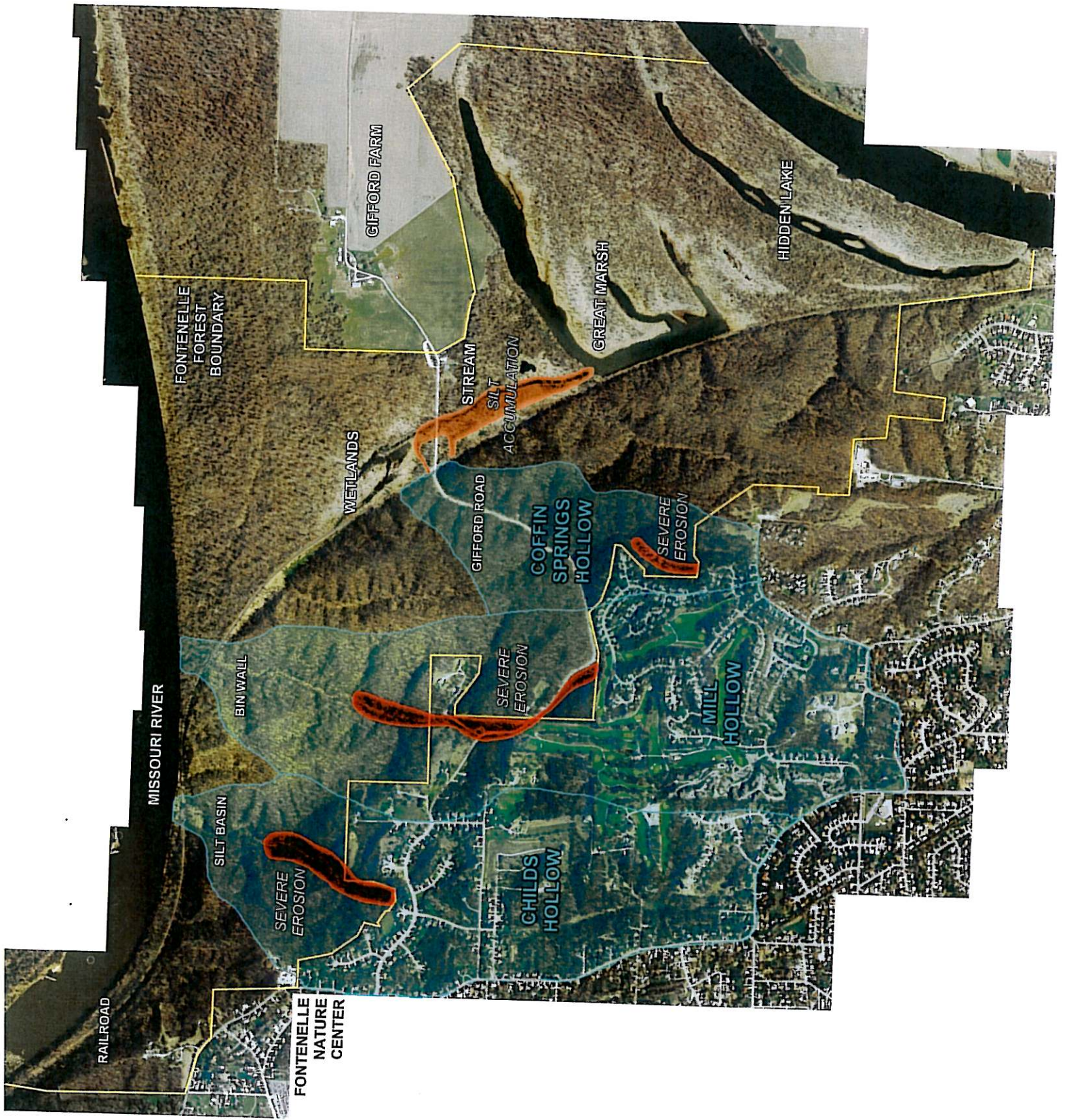
H2. Project Name: Watershed Stabilization Study

The Corps will also utilize models to develop alternatives for **stable channel design** which may include channel shaping, grade control structures, new culvert outlet design or a combination thereof. **Data collection** will include soil sampling to determine the erosion and transport characteristic of the soil, and surveying channel centerline profiles and channel cross sections for determining design elevations of detention/grade control structures. All of this information will be compiled in a technical report to include preliminary designs, quantity estimates and cost estimates. The attached estimate for the study shows a cost of \$159,760.50.

Environmental benefits: completing the watershed stabilization study is the necessary first step toward understanding and mitigating problems in the three watersheds. There are numerous environmental benefits. The design work will show us how and where to employ innovative techniques such as bioretention wetlands to slow and filter storm runoff surges. Reducing nutrients and metals in runoff water improves water quality in Great Marsh and other Forest wetlands and in the river as well. The study will also show us how to halt further soil loss, halt loss of property and wildlife habitat, and how to restore portions of the watersheds already damaged. We have already made expensive investments in watershed management such as dredging of Great Marsh and erosion control in Childs and Mill Hollows and the study will provide clear steps toward protecting and prolonging the lives of these investments.

Social and economic benefits: Those benefiting from this study include all parties and agencies of the "watershed task force" who can then use the study to work together and resolve mutual watershed problems. The roughly 90,000 school children and day use hikers who visit Fontenelle Forest annually will also benefit. Storm surges currently pile highly visible and unsightly masses of debris in the Fontenelle Forest portion of the watersheds which include twisted tree limbs, concrete, tires, glass and plastic containers, etc. Preventing storm surges will allow Forest staff to clean up the debris and keep the watersheds more litter free, greatly enhancing the visitor's experience. Storm surges also undermine trails and pedestrian bridges leading to unsafe conditions that are costly to repair, particularly in remote parts of Fontenelle Forest where construction access is difficult. Certain places on Camp Gifford Road, maintained by Sarpy County, are impacted by unstable crumbling banks and falling trees. This situation creates an extra maintenance burden and a safety hazard for road users. We don't know the number of private landowners in the watersheds whose properties are currently being degraded by present runoff conditions. It stands to reason that these people will also benefit. This study will provide the watershed task force agencies with clear direction in how to go about cleaning up and repairing the watersheds and bringing the hydrology into balance again.

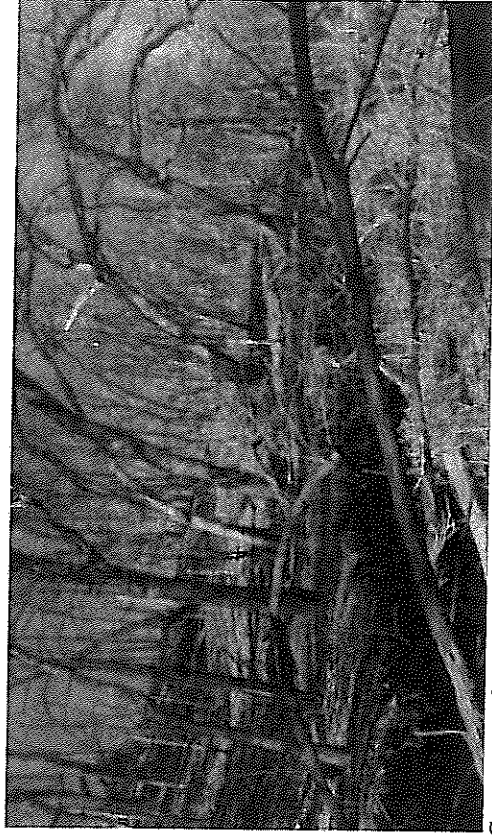
Contributors: The Bellevue Watershed Task Force is a contributing partnership. The Corps of Engineers is budgeting to match 50% of the study cost under Section 22 authorization. The Fontenelle Nature Association is pledging \$10,000 in monetary and in-kind support and Bellevue and the NRD are pledging equal amounts subject to city council and board approval. Within our respective organizations we have a great deal of environmental, engineering and construction experience and will provide our input to assist the Corps of Engineers in producing a thorough and professional study document, and we are resolved to implement the study's recommendations.



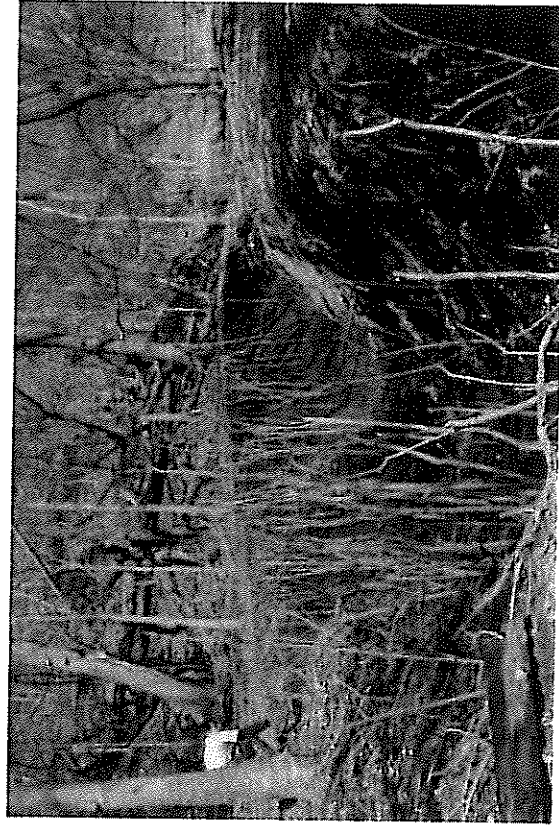
Erosion in Childs Hollow following development upstream and subsequent repair. The watershed stabilization study will recommend additional conservation and repair work in this and other watersheds.



North end of Childs Hollow in March, 1974.



Same area in 1985. Ditch is 20 feet deep, 30 feet wide.



Same area in 1990 during an unsuccessful attempt to slow erosion by planting and rooting dormant willows.



Same area in May, 2007. Silt accumulating behind earthen dam in background has raised channel bed to within 3 feet of original surface. Water is about 6" deep.

MILL HOLLOW BIN WALL STRUCTURE



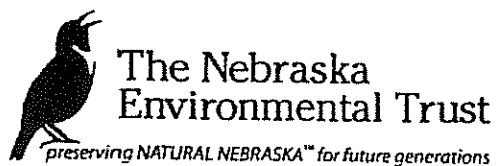
Looking south (upstream). Bin wall at north end of Mill Hollow nearing completion in 1997. Small tube at left diverts clean spring water toward wetland areas and storm water flows over low area in middle and toward the river. The historic sawmill site from the 1850's is about 60 feet to the left of the bin wall.



Same view in August, 2007. Repeated storm surges have stripped rip rap and erosion control netting from base of bin wall and the island dividing spring water and storm water is eroding away allowing the spring water to flow into the river. Storm surges may eventually undercut or circumvent the bin wall and endanger the saw mill site. The watershed study will develop plans for further upstream structures to prevent sudden storm surges and prolong the life of this project.



This pedestrian bridge is 40 feet downstream from the bin wall. The earth under the center support is washing away and the bridge will have to be dismantled and a new bridge built elsewhere. The watershed study will provide plans for stabilizing erosion and will improve public safety and eliminate the need for costly trail and bridge repairs.



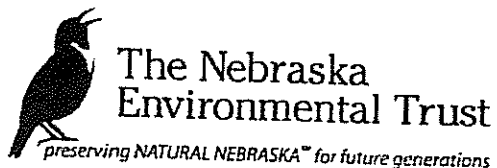
NEBRASKA ENVIRONMENTAL TRUST FUND APPLICATION BUDGET SUMMARY

H1. Project Sponsor: Fontenelle Nature Association and the City of Bellevue

H2. Project Name: Watershed Stabilization Study

BUDGET YEAR: SUMMARY/1 YEAR ONLY

Column A	Column B	Column C	Column D	Column E	Column F
1. Source of Funds ►	Nebraska Environmental Trust	U.S. Army Corps of Engineers	Fontenelle Nature Association and Papio-Missouri NRD	City of Bellevue	TOTALS ▼
2. Budget Category ▼					
3. Watershed Stabilization Study	\$49,880.25	\$79,880.25	*\$20,000	\$10,000	\$159,760.50
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18. TOTALS ►	\$49,880.25	\$79,880.25	*\$20,000	\$10,000	\$159,760.50



NEBRASKA ENVIRONMENTAL TRUST FUND

APPLICATION BUDGET JUSTIFICATION

H1. Project Sponsor: Fontenelle Nature Association and the City of Bellevue

H2. Project Name: Watershed Stabilization Study

1. Have other sources of funding not listed in the Budget Worksheet been approached for project support? If yes, name them and explain the outcome of your request.

No other sources have been approached.

2. Are all of the matching funds in the Budget Worksheet confirmed? If not, please identify those entities and list the date when confirmation is expected. Explain how you will implement the project if these sources do not confirm participation.

The NRD Board and Bellevue City Council meet in September and we fully expect their confirmation. The Army Corps budget is expected to be finalized in October, 2007. Successful completion of this project is contingent on these funds being available.

3. If any of the project costs identified in Column B of the Budget Worksheet have been expended or if debt has been incurred for these costs or a sponsor or partner is obligated for these costs in any other way: List these costs here. Explain clearly why Trust grant funds are requested for these costs.

No funds have been expended.

4. For each line item in column A of the Budget Worksheet, justify the basis for the dollar amount indicated for that item.

CATEGORY/COMPONENT (from Column A of the Budget Worksheet)	BASIS USED TO DETERMINE COST	Attachment? Y or N	ATTACHMENT LABEL
3. Watershed Stabilization Study	Army Corps of Engineers estimate	Yes	Scope of Work Watershed Stabilization Study
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REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, OMAHA DISTRICT
106 SOUTH 15TH STREET
OMAHA NE 68102-1618
August 27, 2007

Planning, Programs, and Project Management Division

Mr. Gary Garabrandt
Director of Science and Stewardship
Fontenelle Nature Association
1111 Bellevue Blvd
Bellevue, Nebraska 68005

Dear Mr. Garabrandt:

Enclosed please find the revised scope of work and the draft cost-share agreement for the Fontenelle Forest and City of Bellevue Watershed Stabilization Study. As we discussed, the Corps proposes to conduct this study under the Section 22 Program, which requires a 50-50 cost-share match with a non-Federal sponsor. A qualifying non-Federal sponsor must have the ability to levee taxes.

The Omaha District has added this study to the list of needs for fiscal year 2008. We will not know if this study is funded until we receive our work allowance. Although the Federal fiscal year begins on October 1, 2007, agencies often operate under Continuing Resolution Authority until later on in the calendar year or even into the next calendar year.

If Fontenelle Forest and the City of Bellevue are interested in signing a cost-share agreement, it would put the proposed watershed project in a better situation to receive Section 22 monies once they become available (i.e. signed agreements take some precedence). The sponsor's (your) side of the 50-50 cost share could be cash, in-kind work, or a combination of the two.

Please review the revised scope of work and the draft cost-share agreement. We welcome your comments and suggestions. If you do have any questions, please feel free to contact Mr. John Remus at (402) 221-4620 or me at (402) 221-3070.

Thank you.

Sincerely,

A handwritten signature in black ink, reading "Rebecca J. Shipman", is written over the typed name.

Rebecca J. Shipman
Project Manager
Planning Branch

Enclosures

U.S. Army Corps of Engineers Scope of Work
Fontenelle Forest and City of Bellevue Watershed Stabilization Study
July 2007

1. **Introduction:** The following study plan outlines the tasks needed to develop stabilization plans for three drainage basins within Fontenelle Forest and Bellevue city limits that are experiencing grade stability problems. The basins are Childs Hollow, Mill Hollow, and Coffin Springs Hollow. All are located in northeastern Sarpy County with upper reaches in Bellevue and lower portions in Fontenelle Forest. See Figure 1.

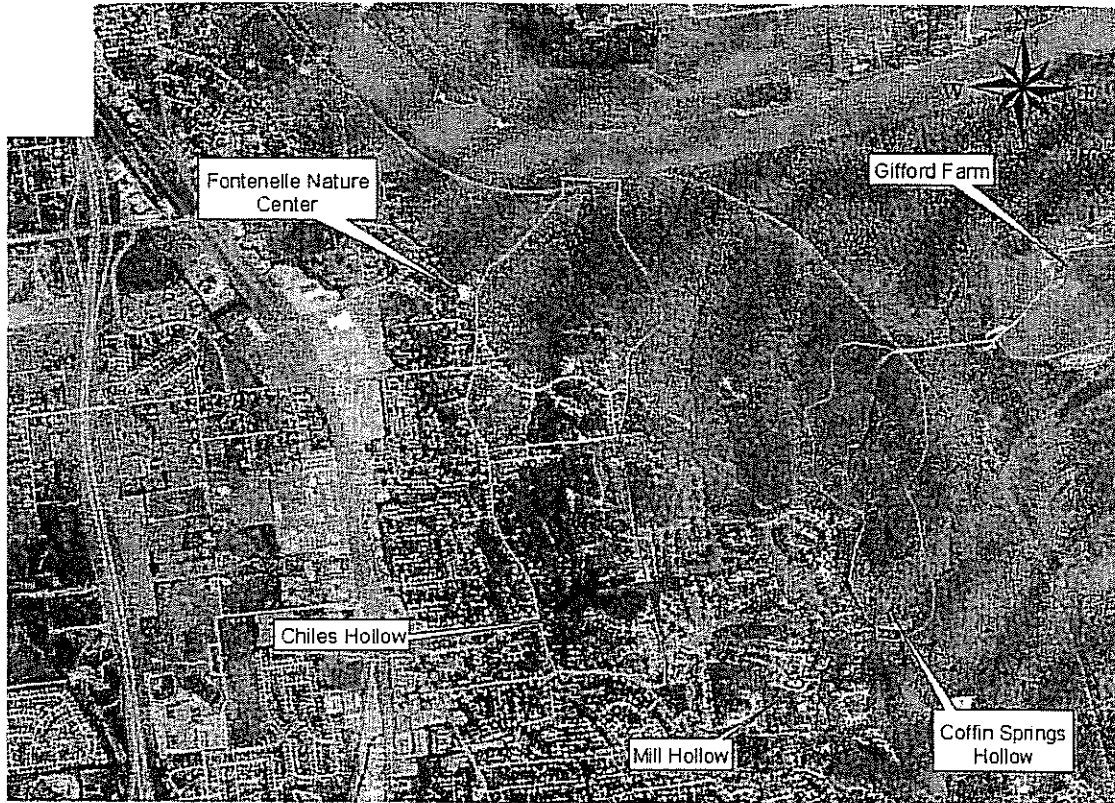


Figure 1. Approximately location of Drainage Basins.

2. **Background:** The headwaters of these three drainages have undergone and/or are continuing to experience considerable residential development. As a result, the hydrology has changed from the pre-development condition, and has resulted in channel instability (degradation, head cutting, etc.) in the lower ends of these basins. This degradation ranges from just a few feet to several feet, and is causing a number of problems including loss of habitat and public safety.

3. **Objective:** The objective of the study is to develop a plan that the Fontenelle Nature Association and City of Bellevue can implement by working through Federal, state and local government, that will bring the system into balance again.

4. **Tasks:** The following tasks that will be completed are as follows:

a. Hydrology. Pre-development, existing and future hydrology will be developed for each of the basins. This will include development of the 2, 5, 10, 50 and 100 year flood events. Peak discharges and flood hydrographs for these events will be developed using the rainfall-runoff hydrologic model HEC-HMS. A site reconnaissance will be conducted to review the physical features of the basins and streams and to collect hydrologic data for inclusion into the hydrologic model. Particular attention shall be focused on drainage channels, soil characteristics, ponding areas, culverts and other basin features that could impact flow conditions. Rainfall-frequency data for input into the hydrologic model will be based on NWS Hydro-35 and TP-40. Infiltration losses will be simulated with the Green-Ampt method. Rainfall excess to runoff transformation will be based on the Kinematic Wave method. Channel routing will use the Muskingum Cunge method. The model will be initially set up with existing conditions land use and impervious areas. It will be modified to remove the current development to evaluate the historic or pre-development conditions. Future land use will be determined based on consultation with MAPA and other local planning authorities. Once the future land use is determined, the hydrologic model will be modified by adding future impervious areas to determine impact on the flow frequency relationship for each basin. Results of the model simulations will be compared to other methods including the rational method, regional equations, and the Omaha Storm Drainage Criteria Manual.

b. Detention Storage. Working with the Fontenelle Forest and Bellevue staff, potential detention storage will be identified and analyzed using the information developed in task a. The types of detention storage will include Bioretention Wetlands, dry dams, ponds, and combinations of all three. Elevation-Storage-Outflow relationships will be computed for each storage alternative evaluated and input into the hydrologic model using the modified puls routing method to determine the effectiveness of each alternative in reducing existing and future flood discharges. On stream and off stream storage will be evaluated. Amounts of storage required to reduce peak flood discharge to pre-development conditions will be identified for each alternative.

c. Stable Channel Design. With the information generated in tasks a and b, three different stable channel design alternatives will be developed. These alternatives may include channel shaping, grade control structures, new culvert outlet design, or a combination thereof. This analysis will utilize models such as SAM or SIAM.

d. Data Collection. The study will use existing data for the most part. However there will be a limited data collection effort. Data to be collected include:

i. Soil Samples. Within each basin soil samples will be gathered from the bed and banks, and analyzed to determine the erosion and transport characteristic of the soil. This information will be used in the SAM/SIAM models.

ii. Channel Centerline Profiles. The centerline of each channel will be surveyed for use in the SAM/SIAM models and for determining design elevations of any detention/grade control structure.

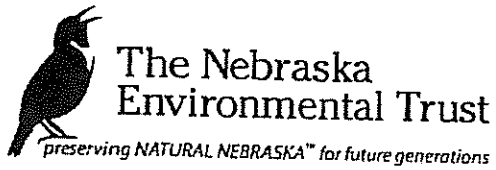
- iii. Channel Cross Sections. Representative channel cross sections will be gathered for use in the SAM/SIAM models and for determining design elevations of any detention/grade control structures.
 - e. Selected Plan Development. In coordination with Fontenelle Forest and Bellevue staff, a selected plan will be developed using the information developed in tasks a-d. The Selected plan will include preliminary design drawings, quantity estimates and cost estimates. The plan will also include a construction schedule that will identify the sequence that features should be installed in order to realize maximum project benefits.
5. **Report:** A technical report will be provided to the Fontenelle Nature Association and City of Bellevue. This report will include all technical appendices, maps, plates and tables.
6. **Costs Estimate:** See Attached
7. **Schedule:** To be determined

Fontenelle Forest Watershed Stabilization Study
Cost Estimate - Summer Data Collection

Task	Labor Man-hours	Costs (\$)				Schedule		
		Labor (\$)	Travel	Misc	Total	Duration (days)	Begin Date	End Date
1. Hydrology¹								
File Search/Data Gathering	8	\$760.00			\$760.00	2	TBD	TBD
Site Reconnaissance	8	\$760.00	\$50.00		\$810.00	2	TBD	TBD
Landuse/Impervious area	12	\$1,140.00			\$1,140.00	3	TBD	TBD
Rainfall Frequency	8	\$760.00			\$760.00	2	TBD	TBD
Setup HMS	24	\$2,280.00			\$2,280.00	6	TBD	TBD
Develop Existing Conditions	16	\$1,520.00			\$1,520.00	4	TBD	TBD
Pre-Development Conditions	8	\$760.00			\$760.00	2	TBD	TBD
Future Conditions	12	\$1,140.00			\$1,140.00	3	TBD	TBD
Comparison with Other method	16	\$1,520.00			\$1,520.00	4	TBD	TBD
Prepare graphs and maps	24	\$2,280.00			\$2,280.00	6	TBD	TBD
Subtotal	136	\$12,920.00	\$50.00	\$0.00	\$12,970.00	34		
2. Detention Storage Design¹								
Develop Elev-Stor-Q	16	\$1,520.00			\$1,520.00	4	TBD	TBD
Simulate alternatives	40	\$3,800.00			\$3,800.00	10	TBD	TBD
Prepare graphs and maps	24	\$2,280.00			\$2,280.00	6	TBD	TBD
Subtotal	80	\$7,600.00	\$0.00	\$0.00	\$7,600.00	20		
3. Stable Channel Design								
Childs Hollow								
Determine Stable Slope	40	\$3,800.00		\$250.00	\$4,050.00	10	TBD	TBD
Grade Control Layout	60	\$5,700.00			\$5,700.00	15	TBD	TBD
Culvert Design	20	\$1,900.00			\$1,900.00	5	TBD	TBD
Channel Design	20	\$1,900.00			\$1,900.00	5	TBD	TBD
Subtotal	140	\$13,300.00	\$0.00	\$250.00	\$13,550.00	35		
Mill Hollow								
Determine Stable Slope	40	\$3,800.00		\$250.00	\$4,050.00	10	TBD	TBD
Grade Control Layout	40	\$3,800.00			\$3,800.00	10	TBD	TBD
Culvert Design	20	\$1,900.00			\$1,900.00	5	TBD	TBD
Channel Design	20	\$1,900.00			\$1,900.00	5	TBD	TBD
Subtotal	120	\$11,400.00	\$0.00	\$250.00	\$11,650.00	30		
Coffin Springs Hollow								
Determine Stable Slope	40	\$3,800.00		\$250.00	\$4,050.00	10	TBD	TBD
Grade Control Layout	30	\$2,850.00			\$2,850.00	6	TBD	TBD
Culvert Design	20	\$1,900.00			\$1,900.00	5	TBD	TBD
Channel Design	20	\$1,900.00			\$1,900.00	5	TBD	TBD
Subtotal	110	\$10,450.00	\$0.00	\$250.00	\$10,700.00	26		
4. Data Collection²								
Obtain Rights of Entry³	16	\$1,520.00	\$0.00	\$0.00	\$1,520.00	4	TBD	TBD
Childs Hollow								
Soil Samples	16	\$1,760.00	\$50.00	\$500.00	\$2,310.00	4	TBD	TBD
Channel Profiles	24	\$5,400.00	\$100.00		\$5,500.00	6	TBD	TBD
Channel Cross Sections	64	\$14,400.00			\$14,400.00	16	TBD	TBD
Subtotal	104	\$21,560.00	\$150.00	\$500.00	\$22,210.00	26		
Mill Hollow								
Soil Samples	12	\$1,320.00	\$50.00	\$500.00	\$1,870.00	3	TBD	TBD
Channel Profiles	24	\$5,400.00	\$100.00		\$5,500.00	6	TBD	TBD
Channel Cross Sections	48	\$10,800.00			\$10,800.00	12	TBD	TBD
Subtotal	84	\$17,520.00	\$150.00	\$500.00	\$18,170.00	21		
Coffin Springs Hollow								
Soil Samples	12	\$1,320.00	\$50.00	\$500.00	\$1,870.00	3	TBD	TBD
Channel Profiles	24	\$5,400.00	\$100.00		\$5,500.00	6	TBD	TBD
Channel Cross Sections	32	\$7,200.00			\$7,200.00	8	TBD	TBD
Subtotal	68	\$13,920.00	\$150.00	\$500.00	\$14,570.00	17		
5. Selected Plan Development								
Initial Plan	40	\$3,800.00		\$500.00	\$4,300.00	10	TBD	TBD
Field Verification	24	\$2,280.00			\$2,280.00	6	TBD	TBD
Coordination	16	\$1,520.00			\$1,520.00	4	TBD	TBD
Final Plan	24	\$2,280.00			\$2,280.00	6	TBD	TBD
Subtotal	104	\$9,880.00	\$0.00	\$500.00	\$10,380.00	26		

Fontenelle Forest Watershed Stabilization Study
Cost Estimate - Summer Data Collection

6, Report Writing								
Draft Report	64	\$7,360.00		\$250.00	\$7,610.00	12	TBD	TBD
Final Report	24	\$2,760.00			\$2,760.00	6	TBD	TBD
Subtotal	88	\$10,120.00	\$0.00	\$250.00	\$10,370.00	18		
Meetings	48	\$5,040.00		\$250.00	\$5,290.00	NA	TBD	TBD
QA/QC	16	\$1,840.00			\$1,840.00	NA	TBD	TBD
Supervision	165	\$18,940.50			\$18,940.50	NA	TBD	TBD
Totals	1279	\$156,010.50	\$500.00	\$3,250.00	\$159,760.50	257		
1- Once the hydrology models are set up for one of the basins, the additional cost to analyze additional basins is minimal.								
2 - Assumes summer data collection when the leaves are on.								
3 - This will likely be an in-kind service performed by the sponsor.								



NEBRASKA ENVIRONMENTAL TRUST FUND PROJECT SPONSOR FINANCIAL INFORMATION

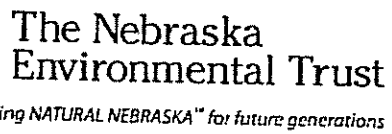
H1. Project Sponsor: Fontenelle Nature Association and the City of Bellevue

H2. Project Name: Watershed Stabilization Study

Please see the instructions for section C-3. Attachments to this document may be necessary to complete this section. Include these attachments with your hard copy submission.

Fontenelle Nature Association summary form 990 and City Budget information are attached.

NOT INCLUDED
IN FILE COPIES

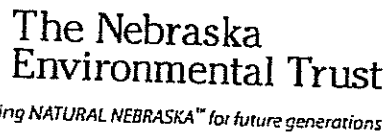


TIMELINE

H2. Project Name: Watershed Stabilization Study

See instructions for section D.

[illegible]



PARTNERS

H2. Project Name: Watershed Stabilization Study

Please see the instructions for filling out section E. Letters of confirmation should be included with your hard copy submission.

[illegible]

~~Sponsor~~

particular letters not

INCLUDED IN FILE COPIES