BATTELLE

PACIFIC NORTHWEST LABORATORY RICHLAND CAMPUS

CAMPUS MASTER PLAN 2002

JULY 2002

ZIMMER GUNSUL FRASCA PARTNERSHIP
With
SCM Consultants, Inc.

Prepared by Zimmer Gunsul Frasca Partnership is association with SCM Consultants, Inc.

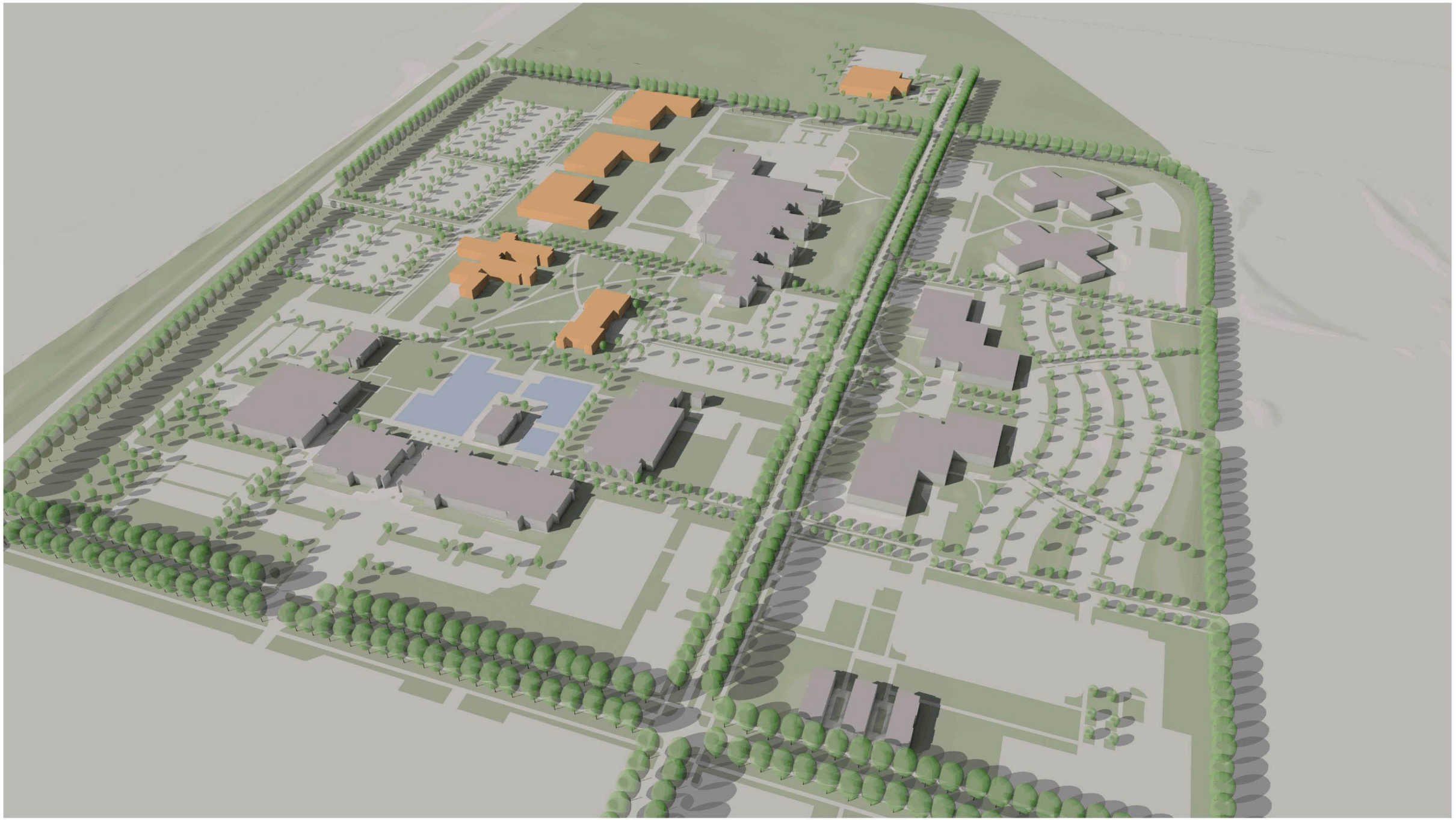
PREFACE

A master plan bounds campus development so its physical appearance and its functionality continue to reflect company values and embody management's vision as infrastructure is modified in providing solutions to business needs. This update to the 1994 campus facilities master plan is a forward look as guided by PNNL's 2010 vision. It incorporations modifications and new construction proposed in PNNL's Facility Strategic Plan.

The plan is responsive to the institution's intent to foster original and important research, development and technical transfer. It proposes a campus that can attract and retain the highest caliber of personnel available, implying the availability of state-of-the-art facilities, equipment and support. Both formal and informal interface between workers is important to the creation of such an intellectually fertile environment - as recognized by Battelle's intention to complement leading edge research facilities with the Research Support Building and an amenable out-door environment.

The campus plan establishes a strong sense of collegiality necessary to the realization of a community, to which even those whose work is essentially solitary belong, deriving encouragement and inspiration from membership. The configuration will promote movement between buildings and encourage inter-communication between departments and disciplines

TABLE OF CONTENTS

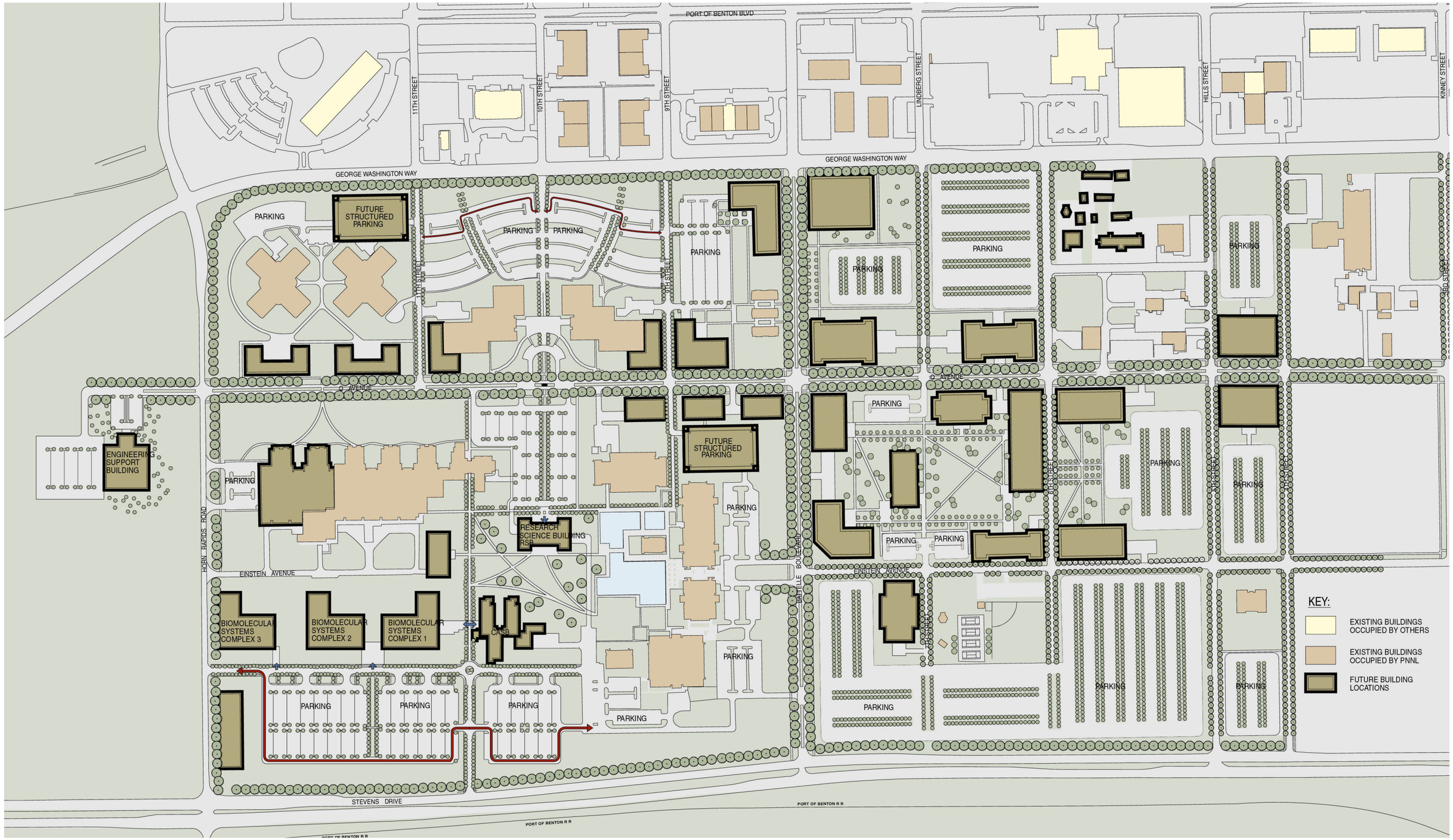


LONG RANGE CAMPUS FACILITIES MASTER PLAN

Zimmer Gunsul Frasca Partnership
July 2002

Battelle Pacific Northwest Campus
Master Plan Update
Richland, Washington

NEW FACILITIES NORTH OF BATTELLE BOULEVARD



LONG RANGE CAMPUS FACILITIES MASTER PLAN

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Master Plan Update
Richland, Washington

Notes:
1. The Washington State University Campus to the southeast of the Battelle Campus will be the site of the proposed Bio-Ag building.
2. Landscape materials are described in the Master Plan document.

0 100' 200' 400'

EXECUTIVE SUMMARY

The master plan document investigates the structure of the campus as it exists today and develops a flexible model for future growth, refreshment and sustainability. That flexibility demands a clearly understandable structure of access, circulation and proximities into which future facilities can be fitted harmoniously. This must be achieved without disrupting established relationships between activities and without unknowingly foreclosing important future improvement opportunities. Campus structure is concerned with functional relationships and should not be affected by differences in ownership or management of facilities within the campus. Careful examination of existing components of the campus and of well-defined future needs is thus the precursor to the master planning effort.

Campus organization is predicated on the principle that circulation between facilities should be convenient, safe and pleasant; consistent with development of a coherent research community and of the free exchange of ideas among experts which is the hallmark of the world's most successful research institutes. Thus the core of the campus is to be reserved for research and development activities, with the Research Support Building at its center. Parking is to be arrayed around the periphery, so that the diluting and isolating effects of scattered parking lots can be minimized and a safe and amenable campus core can be given over in large part to those on foot, moving freely between adjacent buildings.

Master Planning Assumptions
Some assumptions and directives that influence the master plan are as follows:

- Population on the campus is expected to increase from approximately 3,500 in year 2000 to approximately 4,500 in year 2010.This will be accompanied by an increase in total active building square footage from 2 million to approximately 2.7 million by year 2010.
- Battelle Boulevard is to remain the principal entrance to the campus, with Q Avenue the secondary entrance. Sites fronting Battelle Boulevard would therefore have the greatest visibility within the campus.
- Most of those who work on campus will continue to arrive by car. Walking is to become the preferred means of circulation in the campus core.
- Support and technology transfer facilities are generally to be located south of Sixth Street. Research and development facilities will occupy the campus north of Sixth.
- Security at the Battelle campus for the purpose of safeguarding information will continue to be maintained within the various buildings themselves. There is no attempt to limit access of persons onto the campus, although personal safety is clearly a concern to be addressed through both design and surveillance. It is anticipated that this general approach to security will continue as facilities expand.
- While drainage, soils and utilities pose the usual technical problems, none is expected to influence campus planning to an unusual degree.

Master Plan Recommendations

A set of recommended guidelines for future campus development is drawn as a conclusion from review of existing campus configuration and the institute's strategic planning documents. These guidelines are meant to be flexible to allow for the widest range of solutions to business needs, but at the same time restrictive enough to ensure the creation and preservation of the desired work environment. Keeping this in mind, it is critical for the appropriate campus planners, designers, engineers, and management to have a strong understanding of this Campus Master Plan, and that their decisions be consistent with the recommended guidelines.

Guidelines for Facility Siting

- Facilities should be sited in locations consistent with their needs relative to others for proximity to specific facilities on the campus;
- Buildings should be located and oriented, and their sites landscaped to encourage walking between buildings. Pedestrians should be able to walk conveniently to the sidewalk from any building without passing parked vehicles;
- Buildings should occupy sites no larger than necessary to accommodate immediate needs and modest future expansion. If additional expansion becomes necessary it can be accommodated by consolidation or relocation of parking;
- The quality of design, materials and execution of all development fronting Battelle Boulevard and Q Avenue should be uniformly high;
- Parking lots on adjacent sites should be interconnected for efficient accommodation of changing patterns of demand;
- Driveways should be located for efficient circulation, maximum safety and minimum interference with pedestrian circulation.

Guidelines for Campus Configuration

- Preserve and build on the established form of tree lined streets and boundaries;
- Adhere to established street alignments for future driveways and access points;
- Concentrate buildings along Battelle Boulevard and Q Avenue to form a cohesive campus core;
- Dispose parking around the periphery of the campus core using shared access drives to minimize conflicts with those on foot;
- Provide more perimeter access, in agreement with the City of Richland, directly off Stevens Drive, Horn Rapids Road and George Washington Way to reduce conflicts with pedestrians on Battelle Boulevard and Q Avenue;
- Accommodate safe and direct circulation between buildings on foot that is also convenient and agreeable to use.

Guidelines for Open Space and Landscape Form

- Plant a second row of street trees on both sides of the pavement on Battelle Boulevard and Q Avenue;
- Extend sycamore street tree plantings along Q Avenue using semi mature specimens;
- Develop a contrasting street tree pattern along secondary streets;
- Design open spaces as elements of a campus-wide system that confirms unity, identity and quality of the environment;
- Use sustainable landscape criteria to evaluate existing and future development;
- Spaces between buildings should be designed to accommodate direct and convenient footpaths with appropriate environmental protection against wind and sun, but providing solar access in the winter months;
- Spaces between buildings should be responsive in their design to their function as providers of a serene and thoughtful environment for those who walk through them and look out on them;
- Renovate existing parking lots to at least the required minimum landscape standards and develop future lots to this standard or better.

Guidelines for Sustainable Landscape

- Specify low water use trees and shrubs;
- Specify drought tolerant turf grasses such as fine fescues and Kentucky bluegrass;
- Use drip irrigation in planting beds;
- Perform an irrigation audit, to minimize water waste;
- Mow lawns higher and mulch the clippings;
- Use integrated pest management techniques to limit the need for pesticides;
- Use slow release fertilizers sparingly;
- Plant deciduous shade trees adjacent to the east and west facing windows to reduce low-angle solar heat gain in summer months;
- Plant deciduous shade trees to provide shade to parking areas and pavements.

Guidelines for Development

- Buildings should be oriented towards the campus core with parking behind them and vehicular access arranged to conflict as little as possible with pedestrian circulation;
- Sites flanking the campus entrance off George Washington Way at Battelle Boulevard should be reserved for large facilities of a quality consistent with their conspicuous gateway locations;
- Buildings should be configured with an economy of land in recognition of the limited availability of sites close to key facilities.

Guidelines for Campus Circulation

- Plan for vehicular circulation as the principal mode of access onto the campus and pedestrian circulation as the principal mode of circulation within it;
- Construct a safe and convenient circulation network that is an integral component of the campus landscape;
- Preserve the opportunity for direct access from adjacent streets to perimeter parking lots by aligning on-site driveways with existing and platted streets outside the campus;
- Channel pedestrian and bicycle traffic to street crossings with adequate sight distances and appropriate traffic control;
- Coordinate the design of vehicular circulation routes with the objectives of pedestrian and landscape design without compromising any of them;
- Restrict vehicular traffic in pedestrian areas to emergency, handicapped, and service vehicles;
- As the campus population increases, investigate the use of a campus shuttle vehicle circulating on Q Avenue and possibly including nearby off-campus destinations which would otherwise generate significant campus circulation and parking demand;
- Provide for future transit routes and stops that will give public transit priority over other vehicles;
- Should demand for proximity to certain facilities on campus outrun site availability, consider replacement of surface parking with strategically located parking structures.

Guidelines for Bicycle and Pedestrian Design

- Develop campus pedestrian and bicycle facilities that are parts of complete systems. Wherever major conflicts between cyclists and pedestrians are probable, systems should be separated;
- Construct paths with widths and materials that will accommodate expected uses. Paths adjacent to heavily used buildings, for example, may need to be larger than usual. Add width to accommodate site furnishings, lights, and other amenities that are placed on walkways. Add width where walkways are adjacent to curbs or buildings;
- Integrate all pathways with site contours and other landscape features;
- Avoid indirect connections that encourage shortcutting;
- Anticipate future expansion of pathways, but avoid dead ends;
- Connect both pedestrian and bicycle systems to the proposed Columbia Riverfront multiple-use trails;
- Provide convenient access to all adjacent developments;
- Provide secure and weather-protected bicycle racks at all major bicycle destinations;
- On bikeways, maintain sight distance clearances appropriate to design speeds for bicycle traffic;
- Provide bollards with lights or reflectors to prevent vehicular entry into pedestrian areas;
- All pedestrian crossings are to be at grade. Footbridges and pedestrian tunnels often involve out-of-direction travel, connote priority for automobiles and have the effect of discouraging walking.

Guidelines for Personal Safety

- In the campus core and close to pathways, avoid creating dense plantings that may aid in concealment. [Even if no-one is likely to hide there, such places make the night-time environment feel unsafe.];
- Configure buildings and plantings to make all outdoor spaces visible to passersby;
- Provide appropriate lighting levels for streets, service areas, pedestrian paths, bicycle paths, building entrances, parking areas, and open spaces;
- Avoid over-illumination, since brightly lit areas intensify the darkness of unlit areas by contrast, reducing visibility and diminishing the sense of security for those on foot;
- Select cut-off light fixtures that prevent light pollution consistent with 'Dark Skies' standards. This will minimize potential negative effects for the Rattlesnake Mountain observatory
- Design a coordinated lighting system that unifies standards and luminaries for streets, walkways and parking areas. Install light poles in locations that are easily accessible for lamp replacement and maintenance, yet provide consistent levels of illumination;
- Select a light source that approximates daylight in color to improve recognition. [Yellow sodium light distorts colors and makes recognition difficult.]
- Coordinate tree plantings with light fixture locations, anticipating the effects of both summer foliage and winter conditions;
- Provide accent lighting on buildings, monuments, artworks, trees, water features, flagpoles, and anywhere else it is appropriate;
- Choose the colors and intensities of light carefully to avoid glare and harsh lighting.

Guidelines for Safety & Security

- Ensure good sight lines for pedestrians, bicyclists and vehicular traffic by day and at night;
- Use consistent, white light at sufficient but not excessive levels of illumination;
- Avoid opportunities for personal concealment near walkways;
- Separate vehicular and pedestrian traffic to the extent practicable, primarily by directing vehicular circulation to perimeter driveways and lots;
- Configure buildings to screen and protect service yards and equipment;
- Retain in-building security as the primary means of protecting intellectual and real property.

Guidelines for Access for the Disabled

- Adhere to all current Americans with Disabilities Act [ADA] standards;
- Provide barrier-free routes to all campus facilities;
- Design exterior walkways with grades and surfaces that permit wheelchair access;
- Provide edge definition on paths;
- Provide power-actuated opening devices at primary entrance doors.

Guidelines for Road & Driveway Design

- Design roads to encourage driving at speeds appropriate to an environment where pedestrians are present;
- Design roads and driveways to conform to campus character;
- Maintain sight distance clearances appropriate to design speeds for vehicular traffic;
- Use curb radiuses appropriate to slow moving vehicles on campus. Smaller radii lanes provide safer pedestrian environments and reduce the visual dominance of large paved areas at intersections.
- Provide driveways into parking lots directly from the City streets that surround the campus.
- Align driveways so that intersections with public streets coincide with established intersections (e.g. 9th Street and 11th Street).

Guidelines for Parking Facilities

- Provide convenient but inconspicuous parking;
- Provide landscape buffers to screen all parking areas from the campus core and from sensitive viewpoints. The buffers should be dense enough to screen headlights, but should not enable personal concealment;
- Provide walkways to campus buildings. Walkways should be safe and convenient by day and after dark;
- Coordinate parking lot layout and landscape design with overall campus landscape.

Guidelines for Service Yards

- Locate service roads and service areas so they do not create traffic hazards for other vehicles, pedestrians, or bicycles;
- Locate service areas for convenient access by large vehicles, but minimize conflicts with views, building functions, and other activities;
- Provide a fenced, paved yard for vehicular maneuvering, materials storage, and other uses adjacent to major shipping and receiving areas;
- Use earth mounds and landscaping to screen anticipated visual problems associated with service roads and service areas;
- Wherever possible, group buildings so that they can share and enclose service yards.

Guidelines for Sustainable Practices

- Evaluate materials and systems based on life cycle costs rather than on capital costs alone.
- Consider the use of natural ventilation, heating and cooling strategies to enhance the economical functioning of buildings' mechanical systems.
- Orient buildings to minimize solar gain and maximize useful daylight.
- Locate and select tree and plant species to enhance solar gain and daylight benefits.
- Use water-conserving plumbing fixtures in new buildings and remodels.
- Conserve storm run-off for subsequent irrigation use.
- Favor locally manufactured materials to limit transport-related costs.
- Specify materials manufactured using environmentally sound production processes and renewable material sources.
- Use materials that are durable, require limited maintenance, and are ultimately recyclable.
- Eliminate CFCs, HCFC, halons and volatile organic compounds from building materials and mechanical systems to ensure a healthy working environment.
- Accommodate reclamation and recycling of chemicals and solid waste in buildings.
- Encourage energy auditing by suppliers.
- Increase on-site effluent treatment from laboratories to protect the campus environment.
- Make consistent use of performance measures to determine the environmental and cost effectiveness of energy reduction and sustainability investments.
- Use a consistent and tested set of guidelines, such as LEED, to achieve project-wide sustainability in facilities improvements.

INTRODUCTION

Background and Content

The Battelle Memorial Institute, which operates the Pacific Northwest National Laboratory (PNNL) for the Department of Energy, became established at its present location, north of Richland, Washington, in 1965. The site was selected for its close proximity to the Hanford Reservation on which the PNNL government-owned buildings are located. Battelle joined Washington State University's Tri-City Campus and other neighboring businesses as members of the Tri-cities Science and Technology Park in 1990. Battelle has developed a substantial international reputation for original scientific research in a number of fields, in the process accumulating buildings and other facilities on its 280-acre campus and occupying supplementary buildings nearby.

The most significant group of buildings on the campus is the Battelle main Richland Research Complex (RRC) and EMSL, the Department of the Energy's Environmental Molecular Sciences Laboratory (EMSL), located north of Battelle Blvd and west of Q Avenue. Two Informational Sciences Buildings (ISB-1 and -2) are located near the intersection of Horn Rapids Road and George Washington Way. Immediately south of them are the National Security Building (NSB) [formerly named the Energy & Environmental Sciences Building (EESB)] and the Environmental Technology Building (ETB). The User Housing Facility (UHF) is located on the north side of Battelle Boulevard between Q Avenue and George Washington Way.

PNNL's *Facility Strategic Plan* published in 2001 envisions this as the best DOE Office of Science multi-program national laboratory with internationally recognized capabilities for systems biology and biotechnology research by 2010. PNNL will operate at the interfaces of the biological, computational, and physical sciences to deliver solutions to critical national and societal problems that cross all four of DOE's missions. The 2010 vision shifts Battelle's and the national laboratory's primary focus from environmental clean up of the Hanford Site to solving national and international scientific problems in the areas of biology, energy, security and environmental quality. The vision will be achieved through PNNL's outstanding staff, while PNNL demonstrates leadership in research management and operations, and delivers high value to its customers, community, and region.

This Campus Facilities Master plan updates the 1994 plan, which was prepared with the specific purpose of accommodating the Environmental Molecular Sciences Laboratory (EMSL) and an associated land transfer. EMSL is a Department of Energy national scientific user facility with a mission to provide facilities and equipment to the scientific community to further advances in fundamental research and to educate scientists. This update to the Campus Facility Master plan is driven by EMSL's success and PNNL's 2010 vision.

This revised plan acknowledges changes on the campus precipitated by the construction of EMSL and other recent building additions to the campus, and anticipates the needs of a number of planned new facilities. It acknowledges Battelle's stated business values of objectivity, creativity, integrity and impact; and commitment to growth, refreshment, renewal, and sustainability.

Purpose of the Master Plan

A Master Plan recognizes the extent and quality of existing resources at the campus; identifies those amenities, proximities and space needs that may have to be addressed in the future; and reconciles them into a rational strategy for progressive development of the campus as a whole. Without such broadly based forethought, it is probable that siting of each new building will foreclose important opportunities. A Master Plan demonstrates what those opportunities might be and provides a basis for comparison of alternative locations and orientation.

The primary purpose of this master plan update is to anticipate both the needs and opportunities that come with the introduction of new advanced research facilities envisioned in the PNNL *Facility Strategic Plan*, and to make provision for subsequent, and as yet unidentified improvements. Together, the research facilities and the campus that accommodates them must be capable of attracting and retaining some of the finest research talent worldwide. Thus the purpose of this master plan is to develop a strategy for development and improvement that will progressively transform the campus into an exceptional working environment that is reflective of Battelle's values.

Introduction of EMSL to the campus provided an opportunity to translate an already acclaimed research facility into one of only three major centers worldwide capable of conducting original condensed phase molecular level scientific research using state-of-the-art equipment. While the setting of the campus is open and spacious now, competition for favorable locations by new facilities will mount with each new building.

Facility Strategic Plan Projections

Steady growth in staff numbers and floor area is projected at the campus during the next eight years. Within five years, PNNL will be a hub for international, interdisciplinary science and engineering, delivering science-based solutions to some of our nation's most pressing challenges. Insights and solutions relevant to each of DOE's missions will be enabled by transformational science in systems biology, biotechnology, computational science, and nanotechnology. New facility capabilities to be accommodated include:

- User facilities for high throughput proteomics, microbial dynamics, and cellular and molecular imaging that will provide the scientific community with unique methods and instrumentation for post-genomic science.
- Topical computational centers that link the science of climate change, subsurface science, and computational biology together with advanced software and instrumentation capability to solve specific mission challenges.
- Expanded classified laboratory and office space.
- Pilot scale research and demonstration for energy programs expanding the practical use of bio-fuels and bio-products for a more secure and sustainable energy base.
- On-site conference facilities and other amenities to attract and accommodate scientific workshops and seminars, and to encourage research collaborations among staff.

Three facilities are needed immediately:

1) The Computational and Analytical Sciences Building (CASB). This will be an office and laboratory facility that will provide general growth space and collocate computational capability near primary customers in EMSL.

2) The Research Support Building (RSB). This will be a cafeteria and conferencing center, located central to the campus population, and serving as a portal to PNNL's research community.

3) The Systems Biology Research Centers (CASBs) will provide user capability in close association with ESML and CASB.

A more comprehensive program of anticipated improvements is provided later in this document. In order to accommodate EMSL on the PNNL campus, it was necessary to convey a parcel of land to DOE ownership. The need for additional DOE facilities on the campus as the environmental clean up of 300 Area on the Hanford Site is completed may further complicate the pattern of ownerships.

SITE ANALYSIS

A necessary antecedent to facilities master planning is an understanding of the natural and manmade qualities of the campus, and its evolution. These have been explored and documented under six topics:

- Campus Location;
- Campus Description;
- Landscape, Climate, and Orientation;
- Evolution of the Campus;
- Pedestrian Safety; and
- Campus Analysis and Development Density.

Text and illustrations on each can be found in the Appendix.

MASTER PLAN OBJECTIVES

Intent and Process

Since the precise nature of future facilities cannot be predicted, some assumptions must be made about probable needs. Some needs, such as proximity to existing facilities, are unlikely to change over time. Others, such as parking arrangements, are more flexible. A successful master plan will enable the developing campus to appear complete at every stage, yet will preserve the potential for progressive infill with new facilities during ensuing decades. Parking lots might, for example, be so dimensioned that they could one day be redeveloped to accommodate additional buildings, properly integrated with their neighbors, together with shared parking structures. The key is to surrender as little as possible in flexibility in use of the campus in the future without compromising the needs of the next project to be built, or of those already in operation. It is the goal of the master plan to provide an effective strategy for achievement of this purpose.

Some assumptions and directives that influence the master plan are as follows:

- Population on the campus is expected to increase from approximately 3,500 in year 2000 to approximately 4,500 in year 2010. This would be accompanied by an increase in total active building square footage from 2 million to approximately 2.7 million by year 2010.

- Battelle Boulevard is to remain the principal entrance to the campus, with Q Avenue the secondary entrance. Sites fronting Battelle Boulevard would therefore have the greatest visibility within the campus.

- Existing support and technology transfer facilities are located south of Seventh Street. Research and development facilities are currently located north of Battelle Boulevard. Open and underdeveloped land between these two zones will be allocated on the basis of need, conditioned by other considerations such as functional adjacencies and the character of Battelle Boulevard as the primary arrival street on the campus.

- Security at the Battelle campus for the purpose of safeguarding information is maintained within the various buildings themselves. There is no attempt to limit access of persons onto the campus, although personal safety is clearly a concern to be addressed through both design and surveillance. It is anticipated that this general approach to security will continue as facilities expand.

- While drainage, soils and utilities pose the usual technical problems; none is expected to influence campus planning to an unusual degree.

Objectives

Master plan objectives have been derived from the viewpoints of:

- Parking;
- Circulation and Campus Form;
- Pedestrian Environment;
- Landscape and Campus Form.

Text and illustrations related to these can be found in the Appendix.

Also in the Appendix is an annotated program of anticipated facility improvements, which describes the following:

- Computational and Analytical Sciences Building (CASB)
- Systems Biology Complex
- Research Support Building
- Engineering Research Laboratory
- 300 Area Facilities Replacement
- Bio-Ag Building
- User Housing
- Technology Transfer Facilities
- Major Research and Development Facilities
- Security
- Design and Siting Criteria, Incorporating Sustainability

Those not familiar with the campus and its history should refer to those sections included in the Appendix before proceeding to the Master Plan Analysis & Recommendations.

MASTER PLAN ANALYSIS AND RECOMMENDATIONS

Campus Structure

The structure of the existing campus is intermediate between a rural setting for independent groups of buildings, and a unified campus with perimeter parking. The strongest unifying elements are the boundary, Battelle Boulevard and Q Avenue, all of which are marked by rows of mature sycamore trees. The Richland Research Campus buildings, plazas and pools have a distinctive character, but their arrangement forms a discrete group, and does not suggest any particular pattern for future development of the campus as a whole. The more recent additions to the campus, EMSL, EESB, and ETB have formed a loose group north of Battelle Boulevard and have established Q Avenue as a principal entry street, with increasing numbers of pedestrians crossing it.

A primary function of this master plan is to assess the future development potential of the campus in its entirety and to recommend a structure that will make optimal use of resources. The purpose of the master plan is to enable creation of a physical environment that is inviting, memorable and a pleasant place in which to work, a positive asset in attracting and retaining quality employees at the campus, and in providing a quality environment conducive to creative thinking.

The mission of the institution is to foster original and important research, development and technical transfer. To achieve this, the campus must be able to attract and retain the highest calibre of personnel available, implying the availability of state-of-the-art facilities, equipment and support. Both formal and informal interface between workers is important to the creation of such an intellectually fertile environment -as recognized by Battelle's intention to complement leading edge research facilities with the Research Support Building and an amenable out-door environment.

A strong sense of community is necessary to the realization of this type of environment; a community to which even those whose work is essentially solitary belong, deriving encouragement and inspiration from membership. The configuration of buildings on campus can either promote or dilute this sense. A configuration in which movement between buildings is relatively easy and pleasant will encourage inter-communication between departments and disciplines. At the other extreme, buildings, which are so scattered that the automobile becomes the mode of choice, do little to promote a sense of close physical proximity or collegiality.

Among the campus resources to which the master plan must respond are: proximity to important research facilities and personnel, developable land, views and existing landscape features, future landscape improvements, streets and access, parking lots, service access and loading bays, utilities and other services.

One of the principal determinants of building proximity and the quality of spaces between them is parking. Three parking configurations are common in our society: distributed convenience parking, minimal and invisible parking, and perimeter parking. The first type disposes parking around each new development independently. This generally creates an environment of marginal quality with widely dispersed buildings; the antithesis

of what is described in the preceding paragraphs. This is the pattern that began to emerge with development of ISB-1 and ISB-2. The second configuration is suited to

dense urban situations, where land is completely developed. Perimeter parking is recommended as a pattern that can be developed from what exists already on the campus and can actively promote development of a cohesive core of campus buildings in a pleasant and uninterrupted environment. Both EESB and ETB responded to this directive in earlier campus master plans.

The following list summarizes master plan recommendations as they relate to campus structure:

- **Preserve and build on the established form of tree lined streets and boundaries;**
- **Adhere to established street alignments for future driveways and access points;**
- **Concentrate buildings along Battelle Boulevard and Q Avenue to form a cohesive campus core;**
- **Dispose parking around the periphery of the campus core using shared access drives to minimize conflicts with those on foot;**
- **Provide more perimeter access, in agreement with the City of Richland, directly off Stevens Drive, Horn Rapids Road and George Washington Way to reduce conflicts with pedestrians on Battelle Boulevard and Q Avenue;**
- **Accommodate safe and direct circulation between buildings on foot that is also convenient and agreeable.**

Open Spaces and Landscape Form

A complementary component of the cohesive campus core concept is a unifying system of open spaces landscaped to extend the quality of indoor environments throughout the center of the campus, both north and south of Battelle Boulevard. Appropriately designed landscape can provide protection from a harsh climate for those on foot and a tranquil outlook from work places. It can also provide a particular identity to certain spaces - the plazas and pools of the RRC are an example.

Taken together, the buildings and landscape between them should convey a sense of quality and care which justly reflect the aspirations of Battelle. The relationships between buildings and the treatment of spaces which separate them have played a significant role in the success of some academic and research institutions in the past through the interchanges they have occasioned; a precedent which should not be overlooked here. The landscape spaces are most effective when buildings form some degree of enclosure and the space becomes a common ground around which the buildings form a community. Such an outdoor 'room' or quad offers outlooks onto a green open space of lawn and trees that are beautiful and restful, easing work stress for building occupants. By providing outdoor areas without vehicles, they become safe, convenient ways for pedestrian travel between buildings, a place where relaxation is close at hand and casual social interaction can occur. Future development should pay particular attention to the opportunity for creation of these discrete open spaces.

The Battelle campus is endowed with a remarkable landscape feature in the rows of mature trees that line its borders and principal streets. This provides a strong framework to which subsequent landscape features can relate. A second row of street trees should be planted within the avenues lining Battelle Boulevard and Q Avenue. This will allow for succession as the original trees age. Between the tree rows a continuous sidewalk should be constructed, giving pedestrians a sense of protection. This planting will have an immediate and dramatic effect on the appearance of the principal campus streets. As new development occurs along north and south extensions of Q Avenue, these street tree plantings should be extended as well, to provide continuity and maintain clarity of the campus organization.

LANDSCAPE FRAMEWORK

Complementing the principal streets and boundaries, as part of a system of secondary streets, a distinct street tree species that contrasts in form with the sycamores should be used. The most intensely planted spaces would be those that inhabit the campus core: along Battelle Boulevard and Q Avenue, and gardens that relate directly to specific buildings. The next priority would be extensions of those spaces in the form of pedestrian routes into other parts of the campus: into buffer spaces between parking lots and the buildings they serve. Finally come the parking lots themselves, landscaped to relate them on the one hand to the campus core and on the other hand to the framework of mature sycamore trees which define the campus perimeter.

These established groves should be treated as principal elements in the landscape hierarchy. Other plantings should extend understandability of campus organization at various lesser scales. They should also extend shade and amenity to those on foot, especially along routes that are, or are expected to become primary pedestrian routes. As a leading research institution, Battelle sets an example in developing innovation. The facilities, including the landscape, should reflect this quality. Providing sustainable landscape practices will help to meet this goal. Sustainable landscapes are:

- Functional,
- Maintainable,
- Environmentally Sound,
- Cost Effective, and
- Visually Pleasing.

These criteria can be contradictory, so must be balanced to become sustainable in a way that satisfies the goals and aspirations of Battelle.

Given the importance of the existing landscape form to the campus, there are several ways in which the existing and future expansion of landscape can become more sustainable:

- **Specify low water use trees and shrubs;**
- **Specify drought tolerant turf grasses such as fine fescues and Kentucky bluegrass;**
- **Use drip irrigation in planting beds;**
- **Perform an irrigation audit, to minimize water waste;**
- **Mow lawns higher and mulch the clippings;**
- **Use integrated pest management techniques to limit the need for pesticides;**
- **Use slow release fertilizers sparingly;**
- **Plant deciduous shade trees adjacent to the east and west facing windows to reduce low-angle solar heat gain in summer months;**
- **Plant deciduous shade trees to provide shade to parking areas and pavements.**

Sustainable Landscapes

Footpaths should be closely integrated with landscaping, providing direct and understandable connections where they are needed. Landscaping along such routes should provide shade, wind protection and a safe and amenable environment, positively inviting use by those on foot by day and after dark. Note that prevailing winter winds blow from the southwest, the same direction from which the summer sun shines in the hottest part of the day. Thus footpath protection from the southwest should influence landscape design.

Existing parking on the campus is located in surface lots of substantial size. Some of the lots do not meet minimum landscape requirements. The net effect is a very harsh environment that is hot, vast and inhospitable. The unbroken extent of pavement also encourages speeding by cars, which can endanger pedestrians. Landscaping can provide needed shade, break up large expanses of asphalt and buffer views of parked automobiles. Existing lots should have landscape planters with trees, shrubs and groundcovers introduced, and future lots should be amply landscaped. Also footpaths should provide direct access to pedestrian destinations from and through parking lots, and should be generously landscaped. Landscaping should be designed to detain storm water and filter detritus from parking lot run-off in swales designed and planted for that purpose.

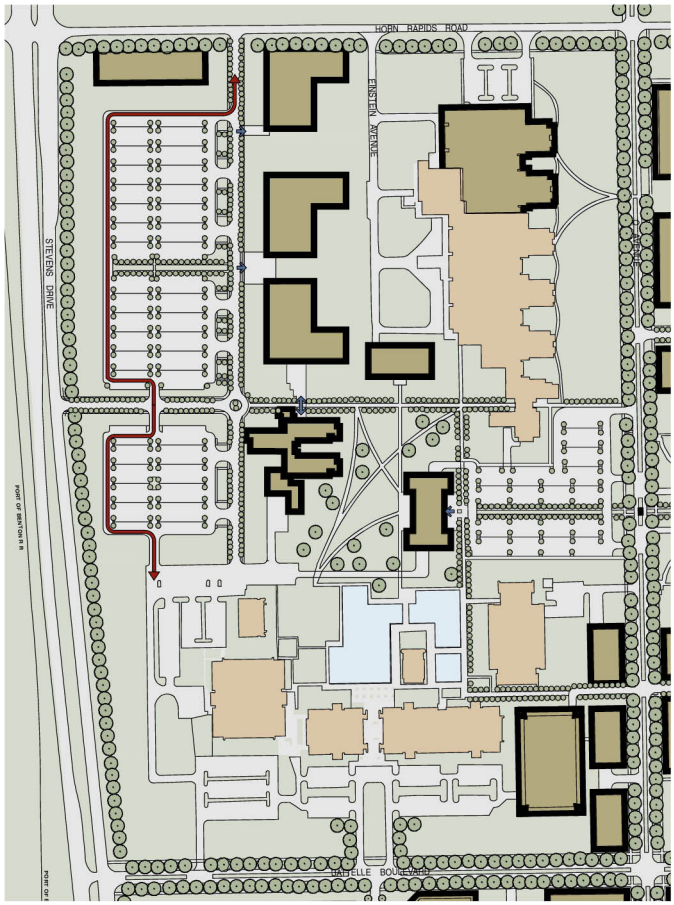
Finally, open spaces throughout the campus should be designed as related parts of a unified system, creating a clear overall image of quality and community consistent with the purpose of the campus as a center for excellence.

Recommendations relating to open space and urban form may be summarized as:

- **Plant a second row of street trees on both sides of the pavement on Battelle Boulevard and Q Avenue;**
- **Extend sycamore street tree plantings along Q Avenue using semi-mature specimens;**
- **Develop a contrasting street tree pattern along secondary streets;**
- **Design open spaces as elements of a campus-wide system that confirms unity, identity and quality of the environment;**
- **Use sustainable landscape criteria to evaluate existing and future development;**
- **Spaces between buildings should be designed to accommodate direct and convenient footpaths with appropriate environmental protection against wind and sun, but providing solar access in the winter months;**
- **Spaces between buildings should be responsive in their design to their function as providers of a serene and thoughtful environment for those who walk through them and look out on them;**
- **Renovate existing parking lots to at least the required minimum landscape standards and develop future lots to at this standard or better.**

Potential Development Configurations

The formal arrangement of the campus as expressed by the tree-lined streets and by established traffic patterns and entries respects the need to retain flexibility. Neither the size and number, nor the timing of new developments for different uses can be anticipated far into the future. The proposed campus structure will accommodate these, and will retain the opportunity for increased density of development over time without necessarily committing to any such change in the near future.

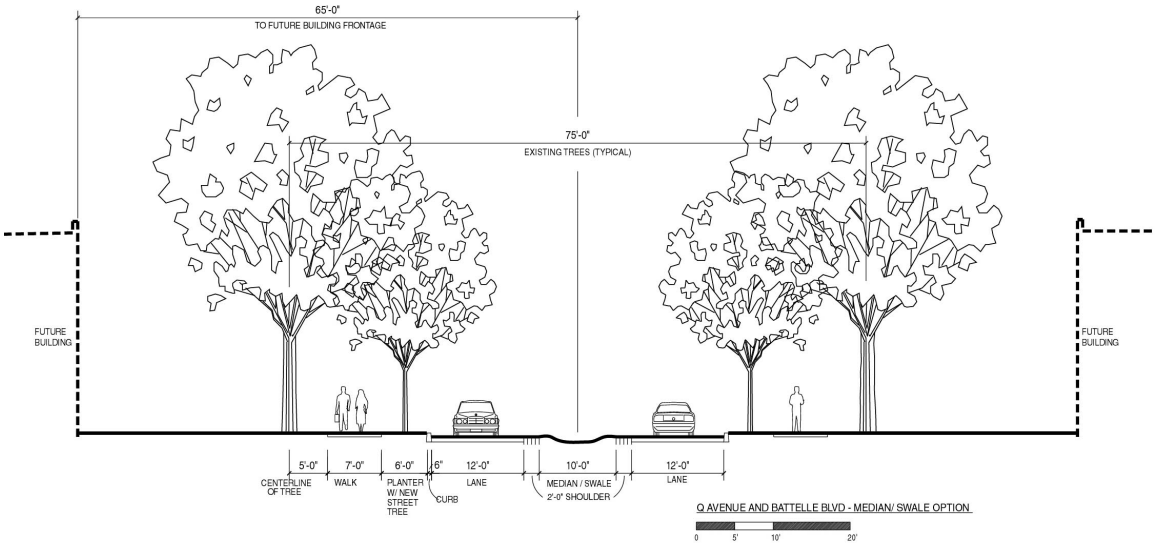


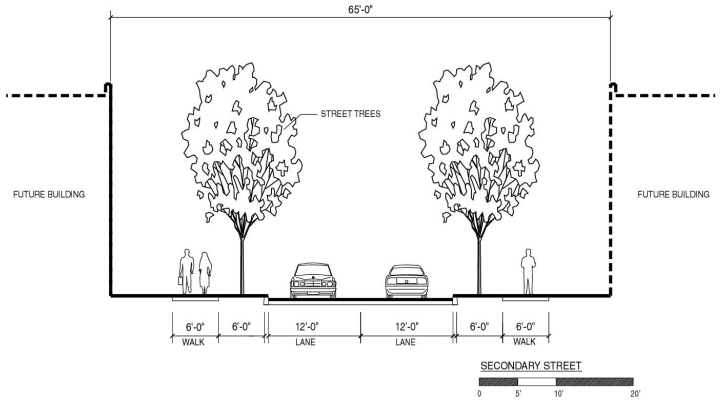
LONG RANGE CAMPUS FACILITIES MASTER PLAN

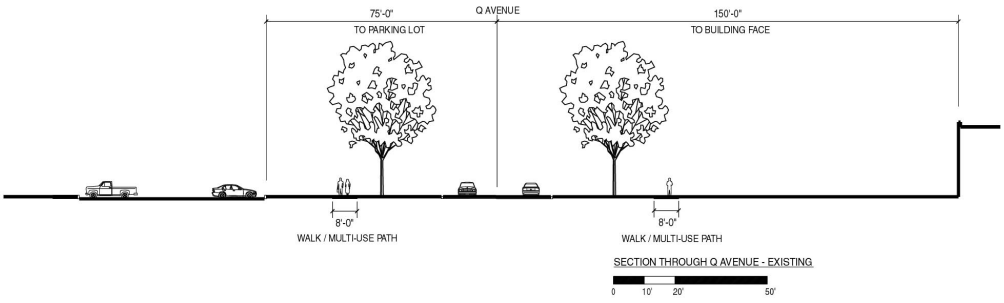
Each building, street and parking lot exerts some influence on how and where future improvements may occur. Without careful consideration, a seemingly expedient development may preclude a number of important opportunities for subsequent improvements. While certain anticipated facilities (described by name on the Long Range Campus Master Plan) north of Battelle Boulevard are shown sited with reasonable accuracy, little is known about what other kinds of buildings will be needed in future, except that they will vary in size and access requirements and may generally be classified as being either research and development related or support services related. Thus the foregoing analysis has focused on a number of siting objectives that do not rely on such specific knowledge.

A series of siting principles is recommended for potential development configurations:

- **Buildings should be oriented towards the campus core with parking behind them and vehicular access arranged to conflict as little as possible with pedestrian circulation;**
- **Sites flanking the campus entrance off George Washington Way at Battelle Boulevard should be reserved for large facilities of a quality consistent with their conspicuous gateway locations;**
- **Buildings should be configured with an economy of land in recognition of the limited availability of sites close to key facilities.**


65'-0"
TO FUTURE BUILDING FRONTAGE
75'-0"
EXISTING TREES (TYPICAL)
FUTURE BUILDING
FUTURE BUILDING
5'-0"
CENTERLINE OF TREE
7'-0"
WALK
6'-0"
PLANTER W/ NEW STREET TREE
6"
CURB
12'-0"
LANE
10'-0"
MEDIAN / SWALE
2'-0" SHOULDER
12'-0"
LANE
Q AVENUE AND BATTELLE BLVD - MEDIAN/ SWALE OPTION
0
5'
10'
20'


65'-0"
STREET TREES
FUTURE BUILDING
FUTURE BUILDING
6'-0"
WALK
6'-0"
12'-0"
LANE
12'-0"
LANE
6'-0"
6'-0"
WALK
SECONDARY STREET
0
5'
10'
20'


75'-0"
TO PARKING LOT
Q AVENUE
150'-0"
TO BUILDING FACE
8'-0"
WALK / MULTI-USE PATH
8'-0"
WALK / MULTI-USE PATH
SECTION THROUGH Q AVENUE - EXISTING
0
10'
20'
50'

Campus Circulation

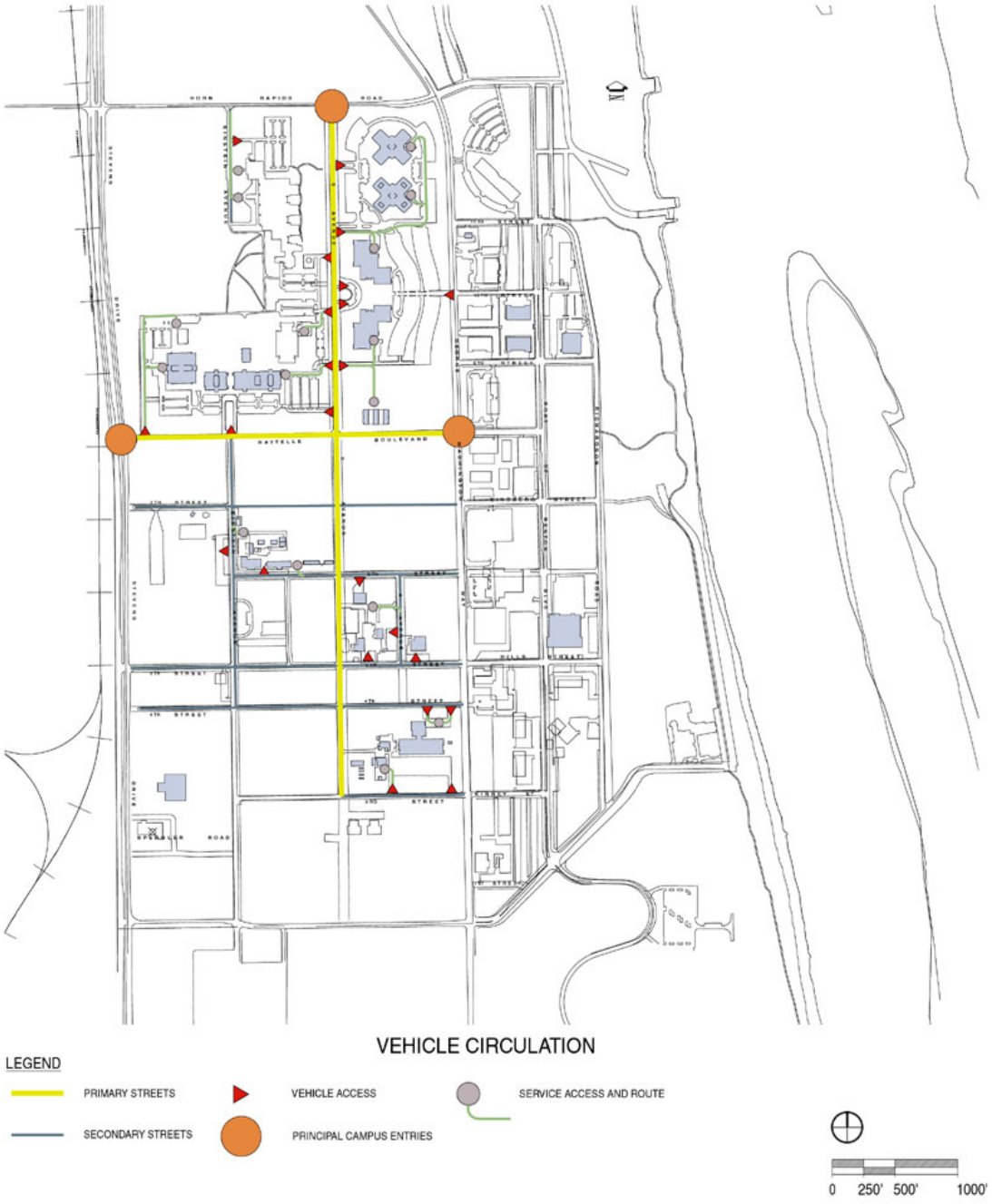
A clear objective of the master plan is to promote the mission of Battelle by strengthening the sense of a community of intellects within the campus. This can be achieved by directing the campus towards creation of a consistently agreeable environment that is conducive to creative thought. This implies, among other things, minimizing distractions and increasing opportunities for stimulating dialogue between members of the community. These two intentions translate directly into the recommendation that vehicular circulation be restricted primarily to campus access for both people and goods, and not be used for trips between campus facilities. Conversely, walking should be the principal circulation mode within the campus core. Pedestrian, bicycle, automobile, service and, eventually, transit traffic will all be important to the proper functioning of the campus, yet each type of transportation has the potential to conflict with the others. The Master Plan can encourage walking more than driving for trips within the campus by making footpaths convenient and pleasant to use.

Continuity between on- and off-campus circulation poses some particular problems, since roads and pathways beyond the boundary are outside the control of Battelle. Crossings of George Washington Way and Horn Rapids Road are cases in point; it will be necessary to acknowledge current limitations in marked pedestrian crossings and anticipate future improvements that are consistent with accepted standards of safety on City and County streets.

Some portions of the circulation system will be shared by different modes of transportation; other portions will be exclusive to one mode. Where different modes cross or share a route, there is a potential for conflict. Roadways and paths should be designed and routed to minimize such conflicts without compromising the priorities outlined above.

Battelle Boulevard will continue to be the primary access street, but over time, secondary accesses to perimeter parking lots may be provided directly from adjacent streets. This is one reason why driveways within the campus should be aligned as far as reasonably possible with established streets; thus preserving the opportunity to create secondary access points in future without conflicting with intersections across adjacent streets. Such secondary points of access may become necessary when campus vehicle generation increases to the point that morning and evening peak flows can no longer be properly accommodated at Battelle Boulevard's signaled intersections.

Battelle Boulevard and Q Avenue (and its extension south of Battelle) will become primary streets for the campus with median and sidewalks. The medians may serve for storm water treatment as well as providing a location for pedestrian refuge. A system of smaller secondary streets, including sidewalks and street trees, should be developed to complement the primary streets. The extension of this secondary grid will provide maximum connectivity to development parcels, while relieving traffic pressures from primary streets and intersections.


VEHICLE CIRCULATION
LEGEND
PRIMARY STREETS
SECONDARY STREETS
VEHICLE ACCESS
PRINCIPAL CAMPUS ENTRIES
SERVICE ACCESS AND ROUTE
0 250' 500' 1000'

Driveways and service roads on the campus must be arranged to serve circulation needs effectively, but must also be arranged in concert with landscape and pedestrian precepts. Only with such close coordination between environmental design disciplines will the overall objectives of the master plan be realized.

Guidelines for the construction of campus circulation are as follows:

- **Plan for vehicular circulation as the principal mode of access onto the campus and pedestrian circulation as the principal mode of circulation within it;**
- **Construct a safe and convenient circulation network that is an integral component of the campus landscape;**
- **Preserve the opportunity for direct access from adjacent streets to perimeter parking lots by aligning on-site driveways with existing and platted streets outside the campus;**
- **Channel pedestrian and bicycle traffic to street crossings with adequate sight distances and appropriate traffic control;**
- **Coordinate the design of vehicular circulation routes with the objectives of pedestrian and landscape design without compromising any of them;**
- **Restrict vehicular traffic in pedestrian areas to emergency, handicapped, and service vehicles;**
- **As the campus population increases, investigate the use of a campus shuttle vehicle circulating on Q Avenue and possibly including nearby off-campus destinations which would otherwise generate significant campus circulation and parking demand;**
- **Provide for future transit routes and stops that will give public transit priority over other vehicles;**
- **Should demand for proximity to certain facilities on campus outrun site availability, consider replacement of surface parking with strategically located parking structures.**

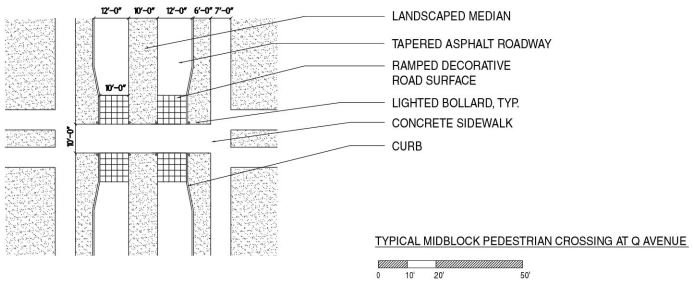
PROPOSED PEDESTRIAN CIRCULATION

Pedestrian and Bicycle Access

Priority will be given to those on foot, recognizing this to be a safe and environmentally responsible way to move around the campus. Expected pedestrian traffic patterns should determine the layout of walkways, taking into account the locations of major destinations for those on foot. Walkways should follow the most direct routes between building entrances and parking lots, channeling foot traffic to crosswalks at street crossings. Walkways should be constructed of a variety of materials compatible with their locations and functions as well as with accessibility requirements.

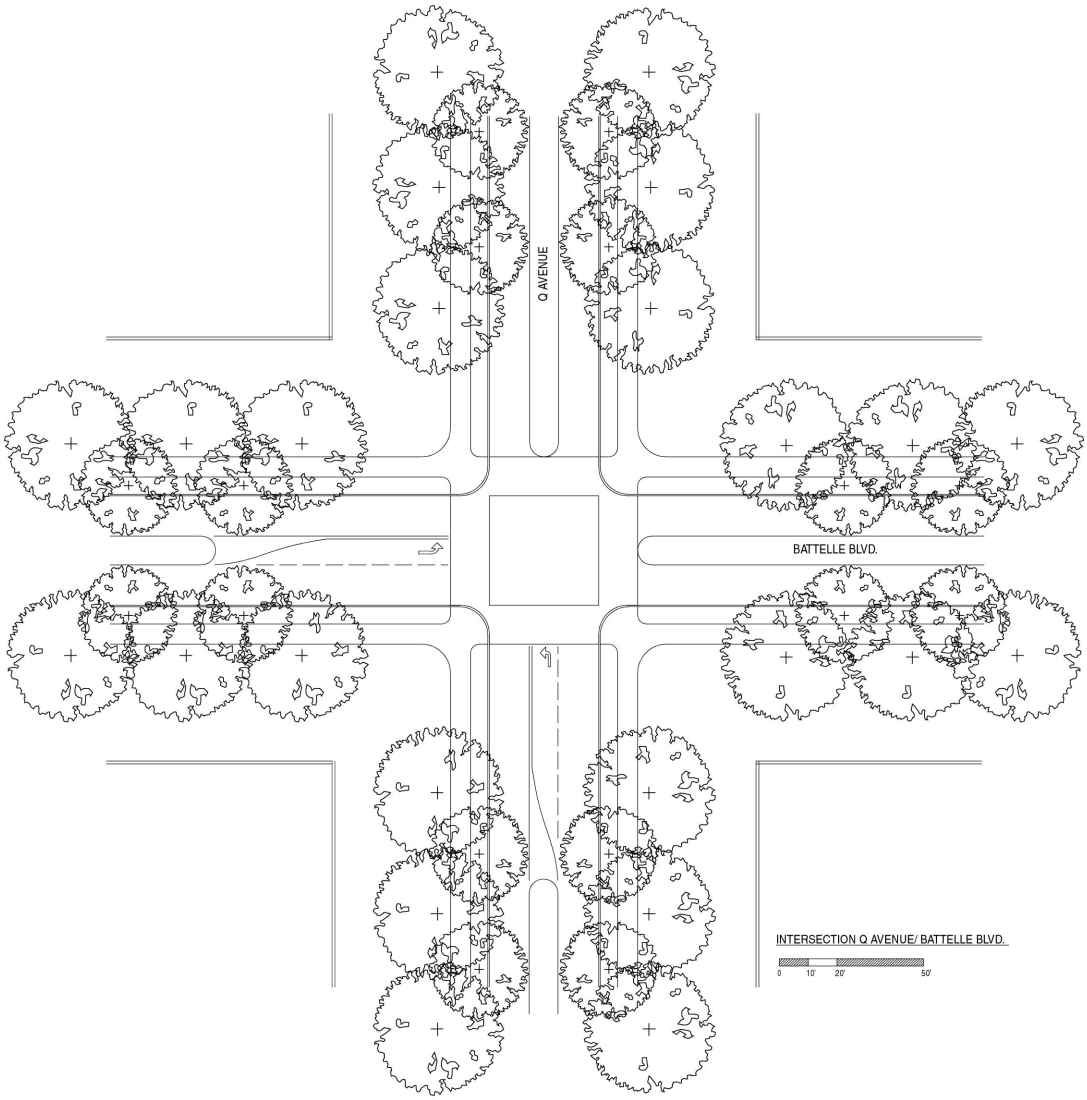
Sidewalks should be incorporated into the design of all streets on campus.

Bicycle use should be promoted as an alternative to automobile transportation. Recreational bicycle use may also be encouraged on the campus. Bicycle use may be accommodated on the campus street system or on sidewalks or walkways between campus buildings.



TYPICAL MIDBLOCK PEDESTRIAN CROSSING AT Q AVENUE

0 10' 20' 50'



INTERSECTION Q AVENUE/ BATTELLE BLVD.

0 10' 20' 50'

Guidelines for developing bicycle and pedestrian paths are as follows:

- **Develop campus pedestrian and bikeway systems. Wherever major conflicts between cyclists and pedestrians are probable, systems should be separated;**
- **Construct paths with widths and materials that will accommodate expected uses. Paths adjacent to heavily used buildings, for example, may need to be larger than usual. Add width to accommodate site furnishings, lights, and other amenities that are placed on walkways. Add width where walkways are adjacent to curbs or buildings;**
- **Integrate all pathways with site contours and other landscape features;**
- **Avoid indirect connections that encourage short-cutting;**
- **Anticipate future expansion of pathways, but avoid dead ends;**
- **Connect both pedestrian and bicycle systems to the proposed Columbia River-front multiple-use trails;**
- **Provide convenient access to all adjacent developments;**
- **Provide secure and weather-protected bicycle racks at all major bicycle destinations;**
- **On bikeways, maintain sight distance clearances appropriate to design speeds for bicycle traffic;**
- **Provide bollards with lights or reflectors to prevent vehicular entry into pedestrian areas;**
- **All pedestrian crossings are to be at grade. Foot bridges and pedestrian tunnels often involve out-of-direction travel, connote priority for automobiles and have the effect of discouraging walking.**

Nighttime Circulation

Increasingly, the PNL campus is supporting 24-hour activity with regular needs for access to the User Housing Facility and other destinations after dark. The security and appearance of the campus after dark will therefore be an increasingly important consideration in campus design. The campus should be both welcoming and safe at night. Plantings, lighting, and buildings should be designed to maximize safety, to provide orientation, and to create an inviting atmosphere after dark. The design and arrangement of lighting and signage should be coordinated to guide visiting researchers around the campus. In addition to providing security, exterior lighting should make a positive contribution to the campus appearance during the day and at night. Lighting should create a nightscape that is not only safe, but also attractive and vibrant. This will require accent lighting in addition to the illumination of walkways and building entries.

Guidelines for developing infrastructure for nighttime circulation:

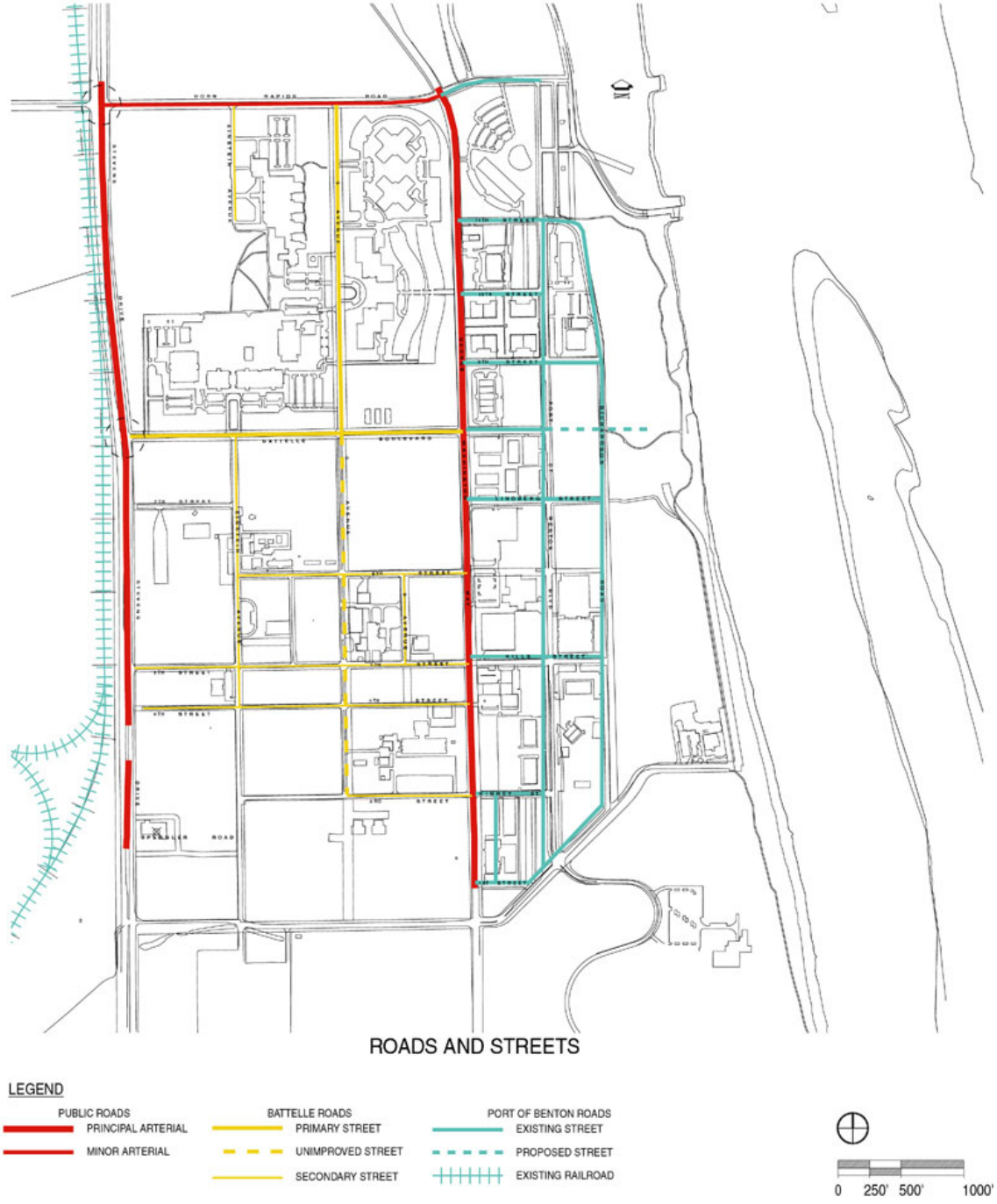
- **In the campus core and close to pathways, avoid creating dense plantings that may aid in concealment. [Even if no-one is likely to hide there, such places make the night-time environment feel unsafe.];**
- **Configure buildings and plantings to make all outdoor spaces visible to passersby;**
- **Provide appropriate lighting levels for streets, service areas, pedestrian paths, bicycle paths, building entrances, parking areas, and open spaces;**
- **Avoid over-illumination, since brightly lit areas intensify the darkness of unlit areas by contrast, reducing visibility and diminishing the sense of security for those on foot;**
- **Select cut-off light fixtures that prevent light pollution consistent with 'Dark Skies' standards. This will minimize potential negative effects for the Rattlesnake Mountain observatory**
- **Design a coordinated lighting system that unifies standards and luminaries for streets, walkways and parking areas. Install light poles in locations that are easily accessible for lamp replacement and maintenance, yet provide consistent levels of illumination;**
- **Select a light source that approximates daylight in color to improve recognition.[Yellow sodium light distorts colors and makes recognition difficult.]**
- **Coordinate tree plantings with light fixture locations, anticipating the effects of both summer foliage and winter conditions;**
- **Provide accent lighting on buildings, monuments, artworks, trees, water features, flagpoles, and anywhere else it is appropriate;**
- **Choose the colors and intensities of light carefully to avoid glare and harsh lighting.**

Access for the Disabled

All campus facilities must be accessible to the disabled. Carefully designed relationships among buildings, walkways, and the land should be the primary means of providing this access. In most cases, primary circulation routes rather than special facilities should provide access for the disabled. Mechanical devices, such as lifts, are permissible, but, because they have high maintenance requirements and are awkward for users, reliance on them should be minimized.

Guidelines for developing accessible paths for the disabled:

- **Adhere to all current Americans with Disabilities Act [ADA] standards;**
- **Provide barrier-free routes to all campus facilities;**
- **Design exterior walkways with grades and surfaces that permit wheelchair access;**
- **Provide edge definition on paths;**
- **Provide power-actuated opening devices at primary entrance doors.**


ROADS AND STREETS
LEGEND
PUBLIC ROADS
PRINCIPAL ARTERIAL
MINOR ARTERIAL
BATTELLE ROADS
PRIMARY STREET
UNIMPROVED STREET
SECONDARY STREET
PORT OF BENTON ROADS
EXISTING STREET
PROPOSED STREET
EXISTING RAILROAD
0 250' 500' 1000'

Roadways

Roadways will provide vehicular access throughout the campus. Battelle Boulevard and Q Avenue continue to provide primary vehicular access to some facilities, also providing access to the parking lots that serve buildings along the two axes. A secondary grid system of streets should be developed to provide maximum connectivity within the campus and to the perimeter streets.

Guidelines for developing roadways in the Battelle Campus:

- **Design roads to encourage driving at speeds appropriate to an environment where pedestrians are present;**
- **Design roads and driveways to conform to campus character;**
- **Maintain sight distance clearances appropriate to design speeds for vehicular traffic;**
- **Use curb radiuses appropriate to slow moving vehicles on campus. Smaller radii lanes provide safer pedestrian environments and reduce the visual dominance of large paved areas at intersections.**
- **Provide driveways into parking lots directly from the City streets that surround the campus.**
- **Align driveways so that intersections with public streets coincide with established intersections (e.g. 9th Street and 11th Street).**

EXISTING LANDUSE AND DEVELOPMENT SITES

LEGEND

BATTELLE OCCUPIED BUILDINGS

POTENTIAL DEVELOPMENT SITES

PARKING

0 250' 500' 1000'

Parking Facilities

Parking lots are to be located around the periphery of the campus core. Parking areas should be oriented to provide clear, safe, and convenient routes between parking spaces and campus buildings. Routes to and from parking lots should be designed for both day and night use. The safety and convenience of pedestrian routes through parking lots should not be compromised.

Guidelines for developing parking facilities:

- **Provide convenient but inconspicuous parking;**
- **Provide landscape buffers to screen all parking areas from the campus core and from sensitive viewpoints. The buffers should be dense enough to screen headlights, but should not enable personal concealment;**
- **Provide walkways to campus buildings. Walkways should be safe and convenient by day and after dark;**
- **Coordinate parking lot layout and landscape design with overall campus landscape.**

Service Areas and Access

Service routes in the central campus should form an autonomous system, conflicting with other uses as little as possible. Service areas should be shared by neighboring buildings whenever possible, and they should be separated from pedestrian routes.

Guidelines for developing service areas:

- **Locate service roads and service areas so they do not create traffic hazards for other vehicles, pedestrians, or bicycles;**
- **Locate service areas for convenient access by large vehicles, but minimize conflicts with views, building functions, and other activities;**
- **Provide a fenced, paved yard for vehicular maneuvering, materials storage, and other uses adjacent to major shipping and receiving areas;**
- **Use earth mounds and landscaping to screen anticipated visual problems associated with service roads and service areas;**
- **Wherever possible, group buildings so that they can share and enclose service yards.**

Safety and Security

Safety refers to the personal safety, both real and perceived, of campus users. Security refers to intellectual and physical property on the campus. Guidelines for former are addressed above in sections on Pedestrian and Bicycle Access and Nighttime Circulation.

Since the establishment of RRC, security of intellectual and physical property at the Battelle campus has been enforced only within buildings, so there has been no need for unsightly security fences or other paraphernalia. However, the security of facilities on campus remains a concern, and there are steps that can be taken in campus planning to enhance security. An example is the placement of proposed buildings to the west of EMSL, where they would encircle and group service yards around Einstein Avenue. This arrangement makes it possible to secure vulnerable facilities fairly easily and inconspicuously. It also accommodates sharing of facilities between research buildings, segregates service traffic from pedestrians and from other vehicular traffic, improving safety for all three, and screens service yards from view.

Guidelines for safety and security are:

- **Ensure good sight lines for pedestrians, bicyclists and vehicular traffic by day and at night;**
- **Use consistent, white light at sufficient but not excessive levels of ` illumination;**
- **Avoid opportunities for personal concealment near walkways;**
- **Separate vehicular and pedestrian traffic to the extent practicable, primarily by directing vehicular circulation to perimeter driveways and lots;**
- **Configure buildings to screen and protect service yards and equipment;**
- **Retain in-building security as the primary means of protecting intellectual and real property.**

Design and Sustainable Practices

Principles of sustainability permeate many of the preceding recommendations. While for many the motivation for sustainable or 'green' design may be ideological, it is presented here in the context of efficient and economical use of resources. In the past, decisions about facilities design and construction were often driven by consideration of initial capital costs alone, with the consequence of high energy and maintenance costs for the life of the building. By focusing instead on life cycle costs, initial costs can be balanced with operating and maintenance costs, resulting in lasting economic benefits.

There are instances in which building design can be made more economical by judicious orientation, to reduce solar gain or enable use of natural ventilation. Landscaping designed in concert with buildings can confer similar advantages, providing shelter from chill winter winds, and shade from afternoon sun in summer. These all translate directly into reduced energy needs to operate the buildings, and thus reduced operating costs.

Off-site energy use is only felt as an indirect cost, and in most cases is invisible to facilities managers. However, use of materials that consume disproportionate amounts of energy in their manufacture carry with them both current and future cost consequences. There may be good reasons to use such materials, but the decision to do so should be made with an awareness of the economic and environmental consequences.

Guidelines for sustainable development are:

- **Evaluate materials and systems based on life cycle costs rather than on capital costs alone.**
- **Consider the use of natural ventilation, heating and cooling strategies to enhance the economical functioning of buildings' mechanical systems.**
- **Orient buildings to minimize solar gain and maximize useful daylight.**
- **Locate and select tree and plant species to enhance solar gain and daylight benefits.**
- **Use water-conserving plumbing fixtures in new buildings and remodels.**
- **Conserve storm run-off for subsequent irrigation use.**
- **Favor locally manufactured materials to limit transport-related costs.**
- **Specify materials manufactured using environmentally sound production processes and renewable material sources.**
- **Use materials that are durable, require limited maintenance, and are ultimately recyclable.**
- **Eliminate CFCs, HCFC, halons and volatile organic compounds from building materials and mechanical systems to ensure a healthy working environment.**
- **Accommodate reclamation and recycling of chemicals and solid waste in buildings.**
- **Encourage energy auditing by suppliers.**

- **Increase on-site effluent treatment from laboratories to protect the campus environment.**
- **Make consistent use of performance measures to determine the environmental and cost effectiveness of energy reduction and sustainability investments.**
- **Use a consistent and tested set of guidelines, such as LEED, to achieve project-wide sustainability in facilities improvements.**

RECOMMENDED ACTIONS

Consequences of Master Plan Adoption

A master plan provides a shared vision of the future for the campus that can be helpful in framing decisions ranging beyond on-site improvements. It can be used by City agencies in planning future infrastructure improvements which may be remote from the property yet have a bearing on ultimate street and utility capacities at Battelle. The plan can also be useful in determining the future of activities in nearby leased facilities, by demonstrating some of the opportunities and consequences of moving them onto the campus.

Adoption of a master plan implies consensus among those affected on the appropriateness of the principles and concepts it embodies. The plan may thus be used as a common basis for decision making on issues that will affect the physical arrangement of facilities anywhere on the campus. It is not uncommon for such decisions to be made without exhaustive consultation of all those affected. While the master plan is no substitute for imperfect communication on such issues, it can enable certainty of coordination between improvements to the extent that it is adhered to by all concerned.

Perhaps the most important consequence of master plan adoption is formal recognition of the quality standards that must be attained if the stature to which Battelle aspires as a world-class research and development institute is to be realized. The physical environment of the campus is an important contributor to the quality of intellectual environment that can be achieved, and thus to the ability of Battelle to attract the highest caliber of scientists to work here. Quality equipment in a building that is no more than adequate and is isolated by sterile parking lots is no longer acceptable. The master plan recommends an approach to campus design that will preserve the best of the existing campus and dramatically improve the remainder; not necessarily through implementation of costly solutions, but through thoughtful coordination of the many competing factors which will shape the campus.

A specific example of the importance of this approach is in the procurement of new buildings by the build-lease process. The master plan provides common standards of siting buildings, arrangement, orientation, access, landscaping and quality that look beyond the immediate expedient of lowest bid price. Criteria and recommendations provide a basis upon which a comprehensive set of parameters can be constructed to ensure that any qualifying structure will be compatible with its neighbors and with the campus as a whole.

Phasing

The timing and sequence of construction of new buildings and other campus facilities improvements is driven by research needs, priorities, and funding. All of these change through a complex interaction between markets, Federal directives and other factors. The master plan must be capable of accommodating previously unanticipated facilities, sometimes of great size and complexity, as exemplified by EMSL. Thus a conventional approach to phasing of campus improvements is of little value. However, the need for collocation of certain types of facility suggests reservation of certain sites, while the need of potential user facilities to double their initial size suggests conservation of certain large sites for such purposes. The *Long Range Master Plan* at the beginning of the report has been compiled with these considerations in mind; but with limited information on the probable sequence of construction beyond the first few facilities west of EMSL.

Infrastructure improvements must, to some extent, make assumptions about the location, size and complexity of future facilities. One of the purposes of this master plan is to outline a probable scenario for expansion that embodies the best current intelligence from PNNL staff. In general, though guided by the master plan, infrastructure improvements will be made incrementally as components of an increasingly flexible system.

It is important that as significant increments of campus improvements are achieved, a qualitative performance review should be performed. Periodically, it will be necessary to update this master plan to accommodate unpredicted changes or new projections of facilities need. Updates should be frequent enough to maintain the master plan as a useful tool in decision-making, its primary purpose. This is addressed in the following section.

SUMMARY OF FINDINGS

Campus Organization and Planning Principles

Subsequent Updates of the Campus Master Plan
The master plan has been developed as a framework for decision-making rather than as a specific plan of intended improvements. This gives it greater longevity than a plan built around specific improvements that may be rendered obsolete by the implementation of a single non-conforming project. But even a framework master plan is vulnerable to such changes as a radical revision of research priorities or changes in City or State regulations.

Typically a master plan will serve its intended purpose for a few years, then as conditions change or new staff become involved in the planning process, it falls into disuse. The consequence can be compromise of the well-considered principles and concepts embodied in the master plan with consequent deterioration in achievement of agreed objectives.

Thus it is important that in adopting a master plan, a plan is also adopted for its periodic review and updating. Entropic decline into mediocrity can be averted if clear responsibility is assigned to the person occupying a position of some seniority in the oversight of campus improvements. It is recommended that the master plan be routinely reviewed whenever a significant addition or improvement to campus facilities is contemplated and that any apparent conflict between the needs of the project and the recommendations of the master plan trigger examination of the plan for necessary updating. An update should in any case be undertaken after the elapse of seven years. This plan is the second such update. The precedent should now be set for subsequent periodic reviews.

Campus Structure and Flexibility
The master plan investigates the structure of the campus as it exists today and develops a flexible model for future growth. That flexibility demands a clearly understandable structure of access, circulation and proximities into which future facilities can be fitted harmoniously. This must be achieved without disrupting established relationships between activities and without unknowingly foreclosing important future improvement opportunities. Campus structure is concerned with functional relationships and should not be affected by differences in ownership or management of facilities within the campus. Careful examination of existing components of the campus and of well-defined future needs is thus the precursor to the master planning effort.

Campus Quality
Campus organization is predicated on the principle that circulation between facilities should be convenient, safe and pleasant; consistent with development of a coherent research community and of the free exchange of ideas among experts, which is the hallmark of the world 's most successful research institutes. Thus the core of the campus is to be reserved for research and development activities, with the Research Support Building at its center. Parking is to be arrayed around the periphery, so that the diluting and isolating effects of scattered parking lots can be minimized and a safe and amenable campus core can be given over in large part to those on foot, moving freely between adjacent buildings.

Major Research and Development Facilities
Little can be anticipated about the specific needs of such facilities, but general criteria for their accommodation may be summarized as follows:

- Sites should be large enough to accommodate a medium to large research facilities with space for future expansion.
- Quick and convenient access to the Research Support Building, RRC and possibly EMSL on foot should be accommodated.
- Visibility may be important to certain users.
- Some research facilities may also have technology transfer aspects.

Critique of Past Campus Developments

Each building and campus improvement was to some extent a reflection of the values prevalent at that time of its design. Similarly, a retrospective critique of those projects is made in the context of today's values, as reflected in this updated campus master plan. In a sense, what follows is less a recital of past errors than a recognition of inconsistencies with today's values.

A case in point is ISB-1 and –2. When these were built, there was nothing else on the campus north of Battelle Boulevard except RRC, itself a self-contained complex. Nor was there any development to the east of it. The information sciences buildings (ISBs) were conceived of as independent clusters of facilities that were internally focused. Today, their ability to participate as active members of a maturing campus is severely impaired by their distance from Q Avenue, and by the traffic-dominated environment that insulates them from their neighbors. Furthermore, these small facilities use up a disproportionate area of the campus – not a consideration when they were built, but increasingly of concern as competition for sites on the north campus grows with each new project. We have suggested that in the long term, the parking lots fronting Q Avenue might support additional buildings, with new and displaced parking removed to structures between the ISBs and George Washington Way.

When EESB and ETB were built, their response to parking was much more compatible with the campus model than its neighbors to the north. However, the parking lots were not landscaped to meet even the basic needs of campus users. There is no shade in summer and no shelter in winter, and facilities for pedestrians walking to and from their cars are minimal. Today we would certainly include trees to limit the heat island effect, and would provide protected walkways that would discourage speeding vehicles from shortcutting through the outer lots. Swales would be graded to retain and cleanse storm run-off. Although these measures would greatly improve the appearance of the parking lots, their primary purposes would be functional.

Another cause for concern from today's perspective is the siting of the User Housing Facility (UHF) on the north side of Battelle Boulevard. Following construction of EESB and ETB, this was the only uncommitted large parcel on the north campus other than those west of EMSL. It was capable of accommodating a large-scale user facility with good visibility from George Washington Way and Battelle Boulevard at an important entrance to the campus. The site was capable of phasing so that an initial facility could be doubled in size. Though physically small, UHF has compromised that site so that it is capable only of accommodating relatively minor facilities. The *Long Range Campus Facilities Master Plan* demonstrates how buildings and parking could be disposed on the remnant site.

Something that is likely to become problematic in the future is the parking lot and service yard between LSL-2 and Q Avenue, as this will be at the heart of the pedestrian-dominated campus core. The *Long Range Campus Facilities Master Plan* suggests that eventually, new buildings may occupy the frontage of Q Avenue, with a parking structure behind them to accommodate displaced and new parking needs. What was originally the backside of the RRC has become a visible frontage, where pedestrian-vehicle conflicts are of concern. When and how this is reconciled will depend on specific programmatic needs on the campus in the future, but the principles of resolution are illustrated in the *Long Range Campus Facilities Master Plan.*

The founders of the campus showed great foresight in planting the rows of sycamore trees that mark the perimeter of the campus and distinguish Battelle Boulevard and the north part of Q Avenue give a special identity to the Battelle campus. Those ordered ranks of trees and the verdure of the campus within stand in dramatic contrast to the high desert sagebrush lands in which Battelle is located. Their heritage is a strong and recognizable framework for subsequent improvements to campus landscaping. Collectively, they give a clear signature to the campus in an otherwise arid landscape.

Thus, as stated earlier, to minimize undesirable deviations and outcomes, it is critical for the appropriate campus planning, designers, engineers, and management to have a strong understanding of this Campus Master Plan, and to adhere to the recommended guidelines.

APPENDIX

SITE ANALYSIS

Campus Location

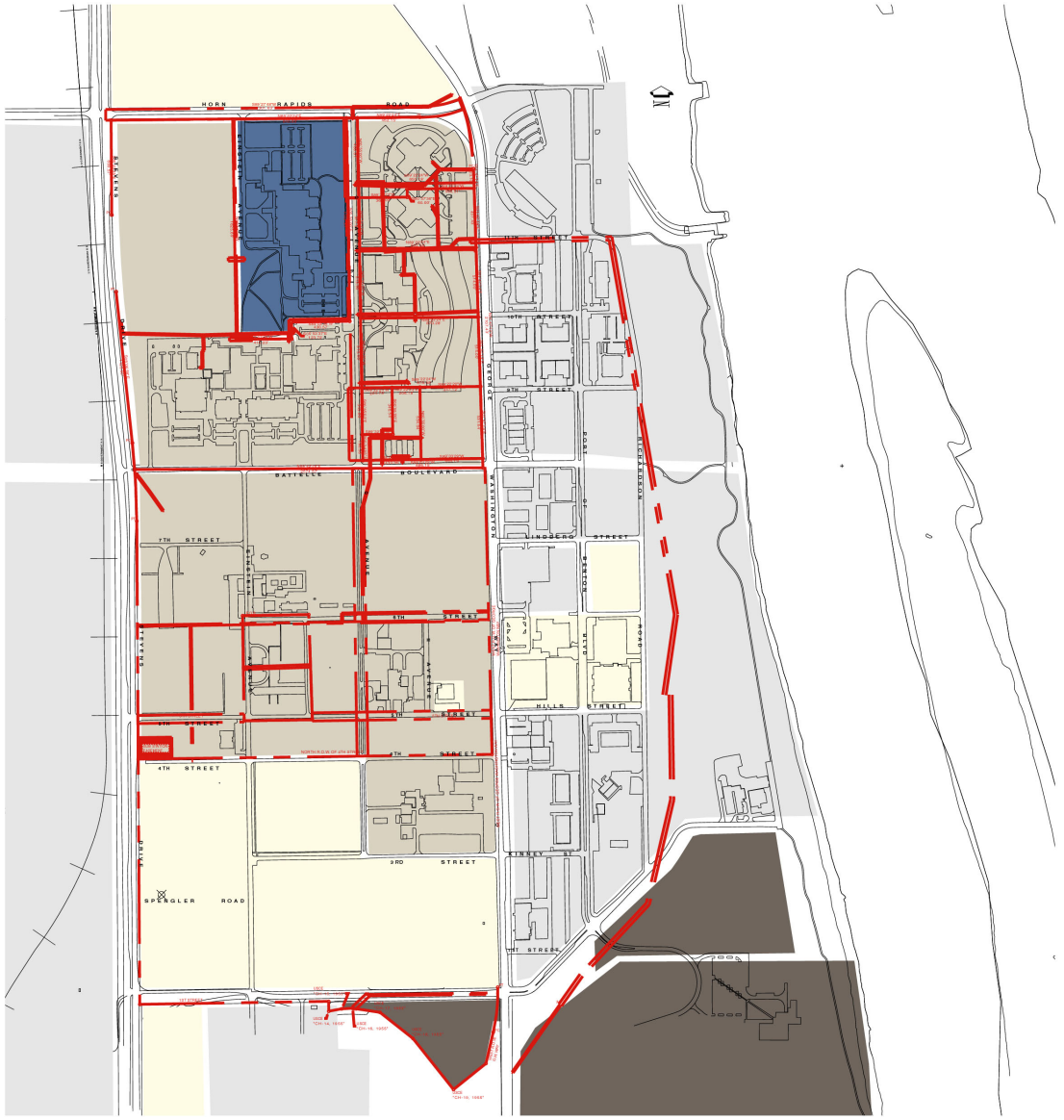
The Battelle campus is located near the west bank of the Columbia at the northern extremity of the City of Richland, Washington. This places it at the center of the Columbia Basin, a huge, predominantly flat expanse of sagebrush. The most notable natural feature on the skyline is the Rattlesnake mountain range to the northwest.

The Columbia Basin extends from the Cascade Mountains in the west to the Rocky Mountains in the east; from the Okanogan Range in the north to the Blue Mountains to the southeast. The basin is a huge flatland formed by horizontal lava flows, the basaltic substrata now overlaid by sedimentary loess. Melting glaciers and millennia of seasonal snowmelt have eroded deep coulees into the loess, creating a pattern of exposed basaltic outcroppings. These give the landform its descriptive classification as scablands. Soils at the site are silty, fine sands. Very dense, course sandy gravel can be anticipated at depths varying from three to seven feet, with the water table at or below twenty feet.

Campus Description

The main campus is distinguished by an impressive grove of sycamore trees around its perimeter and on both sides of Battelle Boulevard and Q Avenue. These trees were planted in the late 1960s when the campus was first established. They have now achieved a stature and maturity which makes them the most significant natural feature in the environs of the site -besides the Columbia river which flows past the campus a quarter of a mile to the east. Land around the campus is predominantly flat and devoid of trees; sagebrush covering most undeveloped land.

Battelle Boulevard bisects the campus in an east-west direction and provides the principal entrance. Secondary access is via the other tree-lined street, Q Avenue that runs north and south. Stevens Drive is a divided arterial street, which carries in excess of 17,000 vehicles per day. George Washington Way is a four lane arterial with additional turning lanes. Horn Rapids Road is a major east west road with one lane in each direction connecting George Washington Way and Stevens Drive to State Route 240 (which in turn connects the Tri-Cities to Seattle). There have long been plans to upgrade Horn Rapids Road to a major highway serving a proposed new crossing of the Columbia. As yet, no final alignment has been selected and no funding has been allocated to either project. Recently, alternative sites for a river crossing have been put forward, but no definitive schedule exists for reaching a decision on alignment or for implementation. A railroad belonging to the Port of Benton parallels the west side of Stevens Drive, and a spur serving Port of Benton property east of the campus is planned. This rail spur would follow the north side of Horn Rapids Road, crossing it and turning south between George Washington Way and the River. No concrete plans for construction of this spur have been discovered.



SITE OWNERSHIP

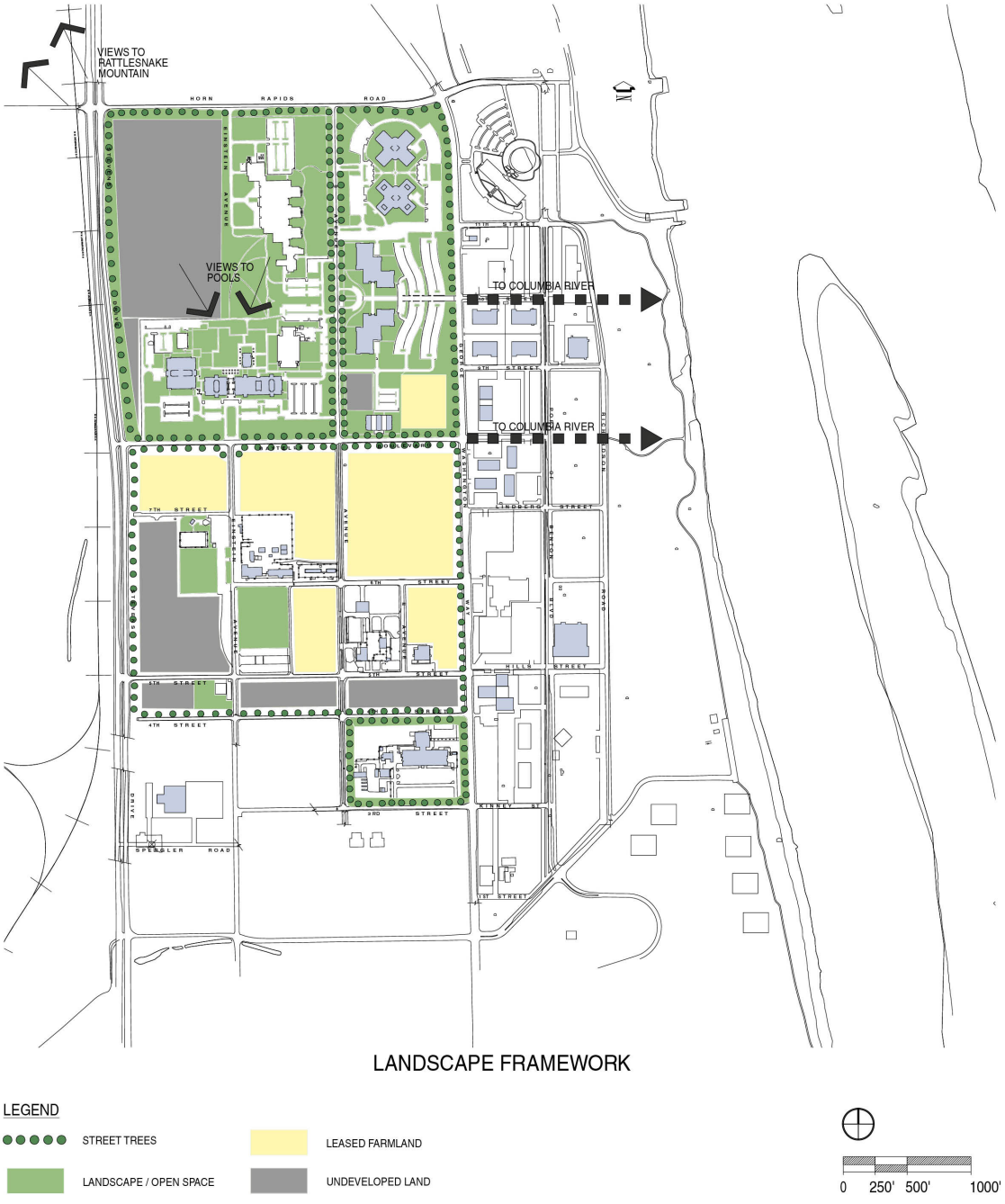
LEGEND

- DEPARTMENT OF ENERGY SITE
- BATTELLE MEMORIAL INSTITUTE
- PORT OF BENTON COUNTY
- WASHINGTON STATE UNIVERSITY
- UTILITY EASEMENT
- OTHER

0 250' 500' 1000'

Land to the north of the campus is in U.S. Government ownership and is undeveloped. Land to the south is also largely undeveloped, although various private ventures have been proposed. Land immediately west of Stevens Drive belongs to the Port of Benton, which plans industrial development related to the railroad. Land to the east of George Washington Way is predominantly in Port of Benton ownership.

Property between Second and Sixth Streets includes a building that accommodates incubator businesses, the Energy Technology Center and several Energy Northwest buildings, now in a variety of uses. Between Seventh Street and Battelle Boulevard are the Hanford Square buildings 1 through 4. Between Ninth and Eleventh Streets are the five buildings in the Sigma group. Otherwise the land between the campus and the Columbia River is undeveloped. The Port of Benton has plans for construction of loading docks and other maritime facilities on land close to the River. There are also development plans for property between 11th Street and Horn Rapids Road, near George Washing- ton Way.



LANDSCAPE FRAMEWORK

Landscape, Climate and Orientation

Despite the network of coulees that crisscrosses the Columbia Basin, direct precipitation is light, supporting only steppe region plant associations. The area around Richland is particularly dry, with only 7.5 inches of precipitation annually, two thirds of which falls during the Winter. It is classified specifically as Artemisia Steppe, supporting native sagebrush and blue bunch wheatgrass as predominant vegetation types.

Winds persist throughout the year, blowing predominantly from the southwest. On summer mornings, southeasterly winds are generated by the warming hinterland. With little cloud cover through the summer months, and mostly high cloud interrupting sun exposure during a quarter of the days in the winter, sun exposure at the campus can be severe. Average temperatures in the summer peak at 90 °F at about 4 pm. Both exposed sides of buildings and open spaces intended for frequent occupation should be oriented and landscaped to afford protection from prevailing winds and summer sun.

The sycamore trees, which mark the perimeter of the campus, have established a clear signature on the local landscape; a landmark that distinguishes the campus from surrounding lands. The green canopies of these trees, together with grasses and other cultivated plants on the campus, create an oasis-like relief from the parched sagebrush that borders it to the north and west. Knowledge that the Columbia River is nearby, though not generally visible to the east, makes a relevant intellectual connection between the verdure of the campus and the fertile riverbanks.

Sycamore trees not only circumscribe the campus, they also form avenues along Q Avenue and Battelle Boulevard and 4th Street. These avenues confer a strong sense of structure on the campus, making the arrangement of its principal access streets visible and understandable as one moves between buildings or as one approaches the campus. While a map can convey this information clearly, it is rare that one can gain it from a casual glance across the landscape. This unusual virtue is one that merits attention in any modification or addition to the campus landscape. Established groves should be treated as principal elements in the landscape hierarchy. Other plantings should extend understandability of campus organization at various lesser scales. They should also extend shade and amenity to those on foot, especially along routes that are, or are expected to become primary pedestrian routes.

In selecting plant materials, it would be prudent to adhere to principles of xeriscape: favoring those that are drought resistant and require a minimum of irrigation and other maintenance. Much of the campus is already served by an extensive irrigation system, which allows greater freedom in plant selections in those areas. Favoring xeriscape species does not preclude selection of other plant materials for special applications -at important building entrances, for example, where high maintenance can be justified and seasonal changes in plantings may be desired.

Evolution of the Campus

The disposition of buildings and infrastructure on the campus today is clearly the strongest determinant of its arrangement in the future. Thus it is important to understand the relative importance (and permanence) of existing features as well as the relationships that have developed between them. If established functional relation- ships cannot be clearly demonstrated, they can to some extent be inferred from existing proximities. In some cases, there may be no current reason for co-location. Rational expansion of those structures can be projected, enabling new facilities to be located and oriented to maximize their compatibility and complementarities with the campus as a whole.

Buildings currently influencing the campus can be characterized as belonging to three groups. The largest group is centered outside the campus on the east side of George Washington Way, comprising those buildings formerly associated with the WPPSS projects. These buildings, centered on Port of Benton Blvd at 5th Street, influenced the siting of two other groups of buildings to the north: the HS 1 through 4 buildings between Linburg Street and Battelle Blvd, and the Sigma laboratories at 9th and 10th streets. Collectively, these buildings exert an influence on the Battelle campus that varies with the number and location of buildings occupied by PNNL personnel. Currently, only the Sigma group is occupied by Battelle, so the 'center of gravity 'of this influence is close to 10th Street, and somewhat to the east of George Washington Way. Nonetheless, physical association for buildings in the southeast portion of the campus is strongest with non-Battelle facilities east of George Washington Way.

The most significant group of buildings is the Battelle main Richland Research Complex (RRC) and EMSL, located north of Battelle Blvd and west of Q Avenue. The two Informational Sciences Buildings (ISB-1 and -2) are located near the intersection of Horn Rapids Road and George Washington Way. To the south of them are the Energy & Environmental Sciences Building (EESB) and the Environmental Technology Building (ETB). The user housing facility (UHF) is located on the north side of Battelle Boulevard between George Washington Way and Q Avenue.

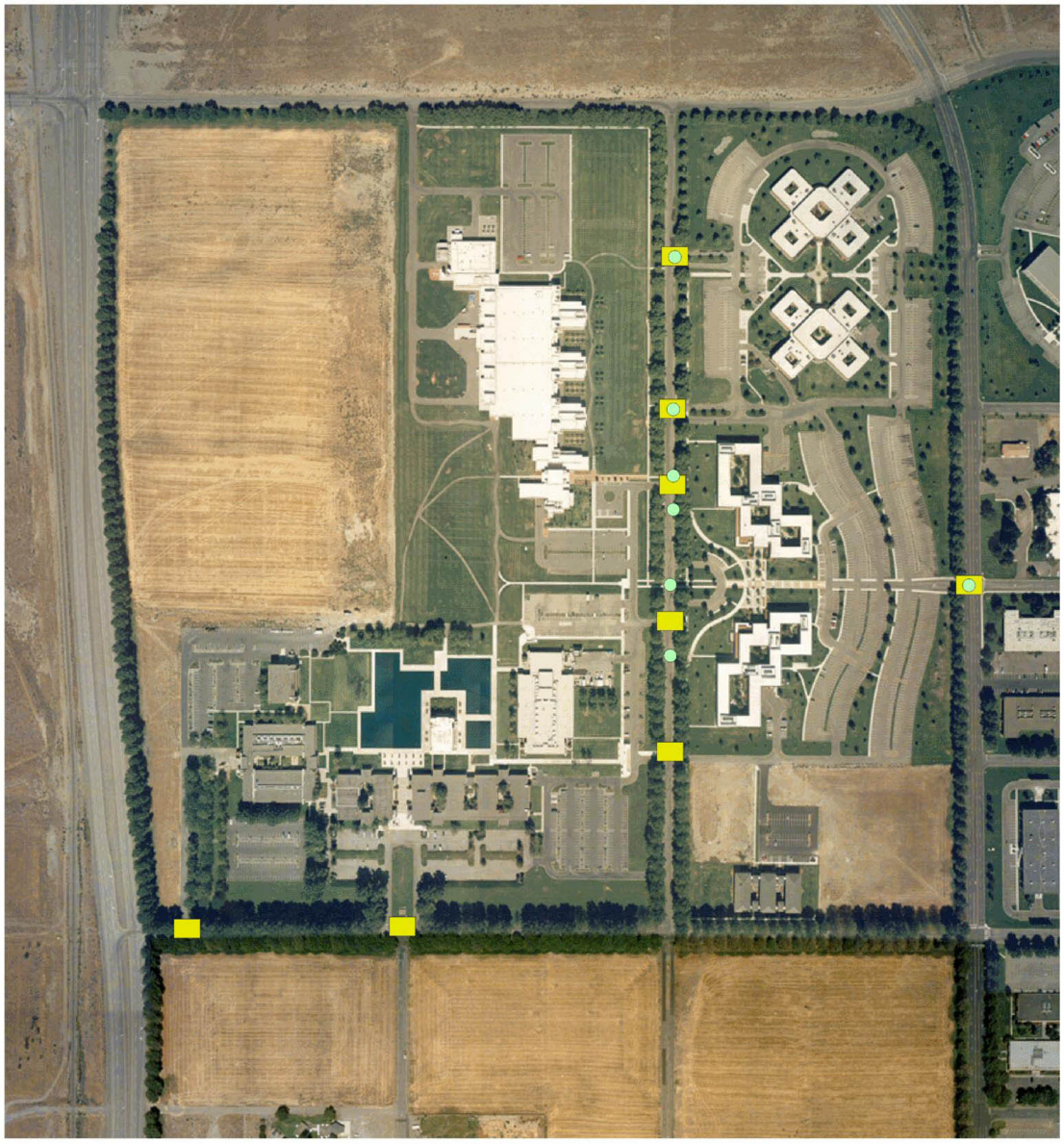
These building groups are now effectively merged into one with the Sigma group as a single research and development complex. The remainder will form a distinct group located mid-way between the Battelle group and the expanding WSU campus.

EMSL, EESB, and ETB establish the northern part of the Battelle campus as the larger and more active group with its geographic center near Q Ave at the 10th Street alignment. Simultaneously, it widens the perceived gap between facilities at the north and south ends of the Battelle campus. Stated another way, the Battelle 'campus proper' may be perceived as being located entirely north of Battelle Blvd, with only a loose association of facilities to the south. Meanwhile, expansion of the Washington State University campus to facilitate high level studies and research in associated fields would create a discrete group further to the south.

Research and development activities will continue to be centered north of Battelle Blvd and west of Q Ave with a sizeable satellite operation in the Sigma group east of George Washington Way. It is questionable, however, whether a formal geographical distinction should be made between research and development and technology transfer facilities, especially since the latter has been de-emphasized at the campus in recent years. Functional adjacency of kindred research activities may be a primary reason for new facilities to locate on this campus. That is certainly the case with the projected CASB and Biomolecular Systems Complex, both of which need proximity to EMSL. Whether accommodated in purpose-designed buildings or in informational science buildings, genuine functional needs should clearly take precedence over notional geo-graphic boundaries. Technology transfer facilities, while benefiting from proximity to research facilities, are typically much less reliant on specific adjacencies; they can be located more freely in the campus, or remote from the region. Their location may in fact be most strongly influenced by considerations of convenient access to established markets, which would tend to diminish their presence on campus.

One of the functions of the master plan is to demonstrate a realistic development capacity for the campus. An opportunity for an orderly but more closely packed arrangement of buildings remains in the large parcels which flank Battelle Blvd at the main entry to the campus off George Washington Way. This would provide for a progression from relatively urban and formal areas of the campus at the entrance, through the tree-lined avenues into, for example, the semi- formal ponds court south of EMSL and thence into more park-like and informal spaces east of EMSL.

Collectively, this strategy is for accommodation of growth that respects established relationships, is consistent with the formal arrangement of the campus as expressed by the tree-lined streets and by established traffic patterns and entries, respects the need to retain flexibility in the proportion and succession of developments for different uses, and finally, will retain the opportunity for increased density of development over time without necessarily committing to any such change in the near future.



PEDESTRIAN VEHICLE SAFETY ZONES

LEGEND

AUTO ENTRANCES/EXITS

MAIN PEDESTRIAN CROSSING AREAS

Pedestrian Safety

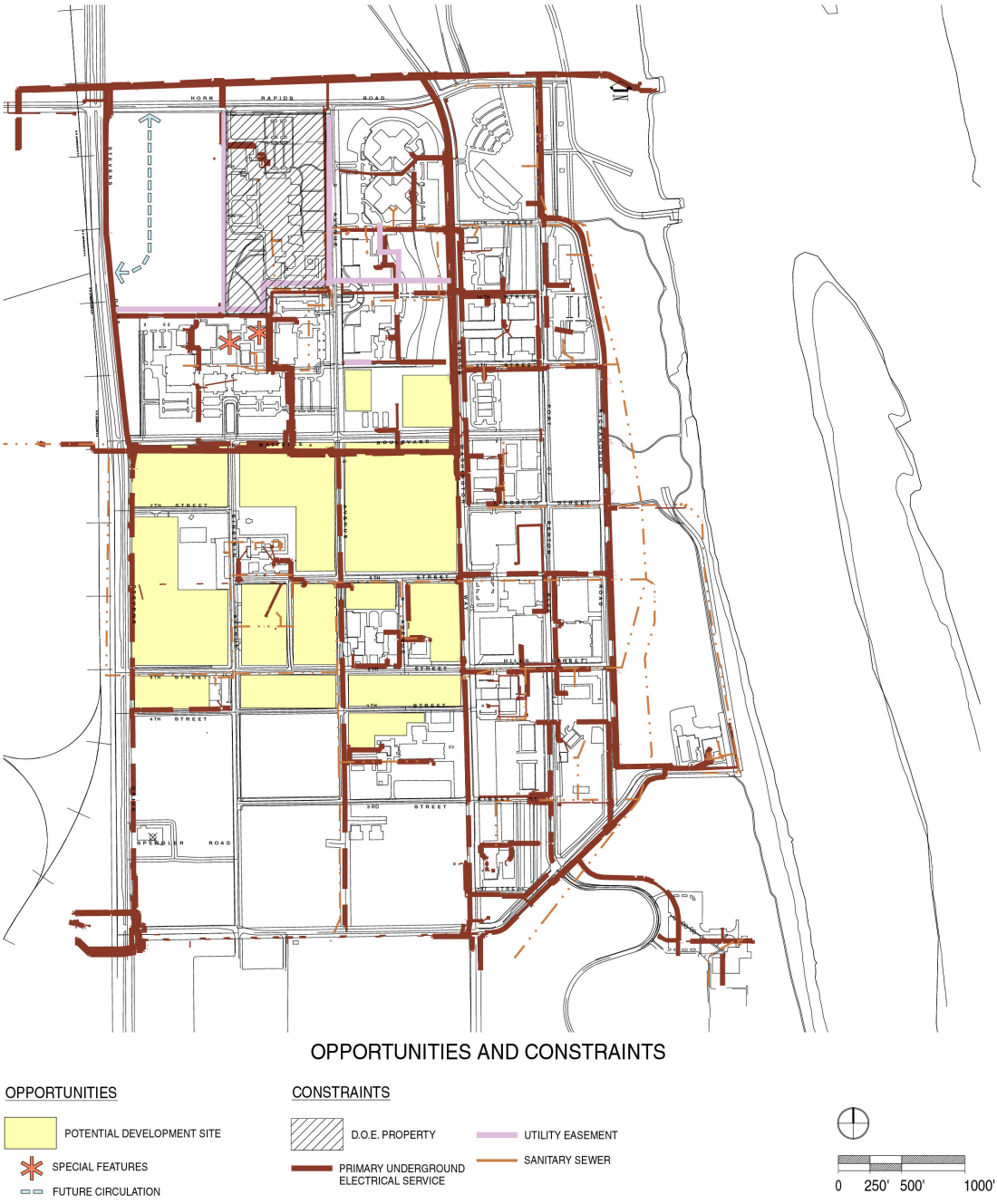
An important objective of the campus master plan is to assure a safe and enjoyable walking environment, especially in the vicinity of Q Avenue where building-to-building movements are expected to increase. Design of an appropriate pedestrian environment necessarily places the safety of those on foot as the highest priority. PNNL commissioned a study of existing pedestrian safety conditions, and in March, 2002, SCM Consultants presented the Battelle North Richland Complex Pedestrian Safety Study. This was prompted by concerns for pedestrian safety in relation to vehicles using Q Avenue and in the parking lots east of EESB and ETB. The major conclusions of the study are:

- Speed limits on Q Avenue are ineffective and traffic calming measures should be implemented; The existing speed bumps on Q Avenue do not reduce speeds, are hazardous and should be removed;
- Traffic volumes on Q Avenue are low and pedestrians can cross safely at most times of the day.
- Closure of Q Avenue to vehicular traffic would reroute some traffic through parking lots and should not be introduced without careful study of consequences;
- Parking areas are adequately dimensioned, however reorientation of drive aisles in relation to pedestrian desire lines would improve safety;
- Drivers and pedestrians on campus are generally inattentive to safety hazards;
- No enforcement mechanism exists to deter unsafe driving on campus; education and enforcement methods should be established;
- The design of Q Avenue and parking areas favors vehicle traffic over pedestrian traffic;
- Design modifications of vehicle pavements and pedestrian corridors could be made to encourage walking.

The study recommends the following actions:

1. Remove speed bumps on Q Avenue;
2. Provide education to encourage safe driving on campus and establish a campus policy for enforcing safe driving;
3. As part of the master planning process, model existing and anticipated traffic flows; do not modify Q Avenue without such analysis;
4. Provide traffic calming measures on Q Avenue and in parking areas to create a more pedestrian friendly campus;
5. Unless techniques are employed to limit random pedestrian crossings, modifications to the designated crossings do not appear warranted.

At present, conflicts between vehicles and pedestrians seem to be largely a matter of perception, and are not reflected in accident rates. In fact, the study referenced above notes that there are no recorded accidents involving pedestrians between 1993 and 2002,and only three minor vehicle accidents. However, as the campus grows, more users will increase the potential for conflict, so development of the master plan should use the recommendations as a basis for design.


OPPORTUNITIES AND CONSTRAINTS
OPPORTUNITIES
POTENTIAL DEVELOPMENT SITE
SPECIAL FEATURES
FUTURE CIRCULATION
CONSTRAINTS
D.O.E. PROPERTY
PRIMARY UNDERGROUND ELECTRICAL SERVICE
UTILITY EASEMENT
SANITARY SEWER
0
250'
500'
1000'

Capacity Analysis and Development Density

When the Richland Research Complex was built, it was the sole occupant of the 280-acre campus. It appeared as a self-sufficient community of buildings grouped around a series of ponds, set in a green oasis of irrigated alfalfa fields. Beyond the perimeter of young sycamore trees lay the hostile landscape of scablands and sagebrush. It was a place of quiet contemplation set in an open, rural landscape.

Today, remnants of the open, rural landscape persist on campus, but many more buildings, and acres of surface parking lots have transformed it. The preceding campus master plans of 1991 and 1994 sought to shape this piece- meal transformation by restricting parking lots to the perimeter of the campus, thus freeing the central areas for human activity -buildings and interconnecting footpaths. Earlier development, notably of ISB-1 and -2,had threatened to predicate the siting of buildings on parking convenience, with a consequent isolation of facilities from one-another, and an inherently low overall capacity for the campus. The campus perimeter parking model would allow progressive increases in density over time through infill development in the campus core, and eventual replacement of perimeter lots with parking structures. It is this model that remains fundamental to campus planning concepts developed in response to current projections of growth.

The siting of EMSL on the Battelle campus is the most far-reaching improvement since construction of the RRC. Not only is it a physically large complex, it is one that attracts other research facilities that depend on proximity to it. If allowance is made for eventual expansion of EMSL itself to the north edge of campus, then the only opportunities for adjacent building sites are south and west of it. In this area of the campus, still an irrigated alfalfa field today, the immanent pressure for denser development is already evident. The master plan must make optimal use of limited opportunities to site buildings close to EMSL. It must also acknowledge that for the foreseeable future, the majority of people using the campus will arrive by car, most of them as single occupants of their vehicles, so parking will continue to demand a lot of space.

As sole occupant of the campus north of Battelle Boulevard, RRC was set a generous distance away from it, with a wide swath of green between the boulevard and the parking lots. This precedent has been followed by EESB, ETB and EMSL. While setbacks of 150 ’to over 300 ’made sense in a sparsely developed campus of 280 acres, their appropriateness in a campus where desirable sites are already becoming limited must be questioned. One approach is to look at the streets themselves: at Battelle Boulevard and Q Avenue, to decide what their function and character should be as the campus matures. Later in the document is an analysis of possible street sections.

What this study can conclude is what an appropriate setback from each of those streets should be from the perspective of street users, and acknowledging the avenues of mature sycamores. By defining other no-build areas, such as the landscaped area around the ponds at RRC, and the alignments of the east-west streets between George Washington Way and Q Avenue, the extent of eventual buildable land can be recognized without knowing what facilities will be needed one or two generations from now, we can safely assume expansion or even replacement of some existing buildings. The value of the capacity study is to discover where new buildings can be sites and existing buildings be expanded without com- promising long-tern opportunities for introduction of additional facilities.

No end-state development pattern or density is supposed. The evolution of research complexes elsewhere suggests that eventual density and complexity may be far greater than anything that might seem reasonable today. The purpose of the campus capacity study is to influence a master plan of great flexibility, which safeguards the qualities of a safe and pleasant campus as it evolves.

APPENDIX

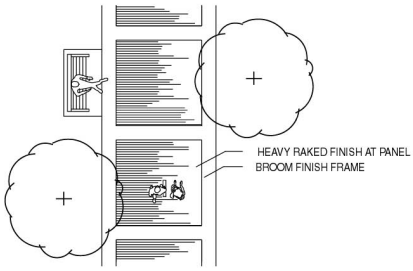
MASTER PLAN OBJECTIVES

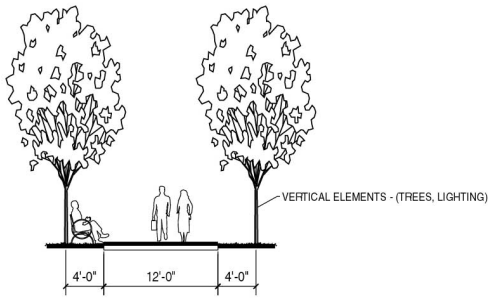
Intent and Process

Since the precise nature of future facilities cannot be predicted, beyond those listed in the organization's strategic plan and summarized below, some assumptions must be made about their probable needs. Some needs, such as proximity to existing facilities, are unlikely to change over time. Others, such as parking arrangements, are more flexible. A successful master plan will enable the developing campus to appear complete at every stage, yet will preserve the potential for progressive infill with new facilities during ensuing decades. Parking lots might, for example, be so dimensioned that they could one day be redeveloped to accommodate additional buildings, properly integrated with their neighbors, together with shared parking structures. The key is to surrender as little as possible in flexibility in use of the campus in the future without compromising the needs of the next project to be built, or of those already in operation. It is the goal of the master plan to provide an effective strategy for achievement of this purpose.

Some assumptions and directives that influence the master plan are as follows:

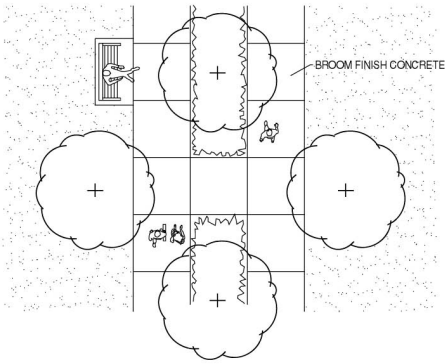
- Population on the campus is expected to increase from approximately 3,500 in year 2000 to approximately 4,500 in year 2010.This will be accompanied by an increase in total active building square footage from 2 million to approximately 2.7 million by year 2010.
- Battelle Boulevard is to remain the principal entrance to the campus, with Q Avenue the secondary entrance. Sites fronting Battelle Boulevard would therefore have the greatest visibility within the campus.
- Most of those who work on campus will continue to arrive by car. Walking is to become the preferred means of circulation in the campus core.
- Support and technology transfer facilities are generally to be located south of Sixth Street. Research and development facilities will occupy the campus north of Sixth.
- Security at the Battelle campus for the purpose of safeguarding information will continue to be maintained within the various buildings themselves. There is no attempt to limit access of persons onto the campus, although personal safety is clearly a concern to be addressed through both design and surveillance. It is anticipated that this general approach to security will continue as facilities expand.
- While drainage, soils and utilities pose the usual technical problems, none is expected to influence campus planning to an unusual degree.

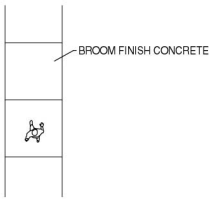


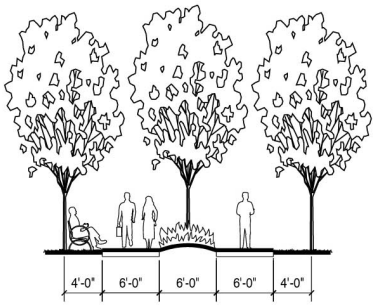


MAJOR PATHWAY

0 5' 10' 20'

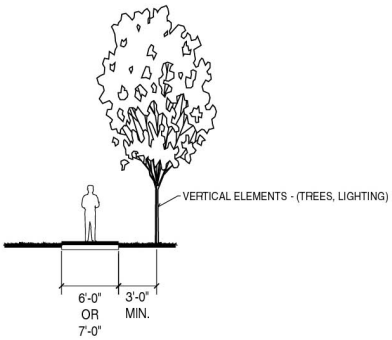






DIVIDED PATHWAY

0 5' 10' 20'



SIDEWALK

0 5' 10' 20'

Parking, Circulation and Campus Form

Most campus circulation, other than movement between adjacent buildings, is currently accomplished by automobile, with most cars carrying only the driver. This is partly attributable to the harsh climate, and partly to the fact that circulation on foot is often inconvenient. Most of those who work on campus arrive by car.

Currently, widespread use of single occupant automobiles on the campus is not problematic, since there is no real shortage of either parking space or traffic capacity on streets or at intersections. The campus is big enough to accommodate present demands without appearing to be dominated by them, except during peak periods of arrival and departure. Unfortunately, this luxury has accustomed those who visit the campus regularly to an expectation of parking convenience comparable to that which they might expect in a convenience retail center. As development on the campus increases, this level of convenience will become progressively more expensive to maintain. Either parking convenience must be diminished or the arrangement of new facilities and the capacity of the campus to accommodate them must be severely compromised.

Priorities here are clear. The inter-relationships between research and development and other functions of PNNL must be designed for optimal efficiency. While the storage of employees' automobiles is necessary and must be accommodated reasonably close to their places of work, parking cannot be permitted to interfere with the primary purposes of the campus.

The inevitable conclusion is that in order to optimize efficient communication and circulation between different facilities on campus, the siting and arrangement of new facilities must not be unduly influenced by existing parking arrangements. Furthermore, as more facilities are added to the campus, parking immediately adjacent to the entrance of each occupant 's building will become less practicable and should be relocated to the perimeter of the campus, except for short stay and handicapped parking.

Through its early years of development, Battelle Boulevard and Q Avenue provided sufficient traffic access to drive- ways serving each parking lot and service yard. As the campus matures, increasing numbers of people and vehicles must be accommodated, and a more flexible and capacious system of circulation becomes necessary.

Following the recommendations of earlier master plans, the area between Q Avenue and George Washington Way has been developed in a manner that respects the alignments of east west streets from 3rd Street through 11th Street. This has preserved the opportunity to establish a grid of secondary streets within the campus as the need for them arises. Furthermore, the grid is coordinated with street alignments on the east side of George Washington Way so that four-way intersections can be constructed if and when they are needed.

An objective of the master plan should be to preserve the opportunity to construct a secondary street grid over the rest of the campus, so that efficient circulation with limited dependence on busy intersections can be achieved as the campus becomes more populous.

Pedestrian Environment

The culture of a small, walkable campus environment was established with construction of the Richland Research Campus (RRC), but was largely lost when new facilities were added too far away to walk to with convenience. An important objective is to restore walkability within the campus, not only because it is efficient to do so, but because it can contribute significantly to the quality of life for those who spend a lot of time there.

It is a truism that much important research work is accomplished outside the laboratory. Often what that means is that important leaps in thinking occur during moments of quiet contemplation. Almost every culture has its examples of gardens designed for this purpose, and in our culture, an attractively landscaped campus that encourages strolling from building to building can accomplish this. That landscape should be freed of such hazards as fast-moving vehicles, and obstacles such as parking lots and service yards. On the Battelle campus, the intention is to upgrade the core of the campus around Q Avenue to provide a safe and attractive pedestrian environment, with vehicular trips mostly ending on the outer edges of the campus.

Landscape and Campus Form

The rows of sycamore trees that mark the perimeter of the campus and distinguish Battelle Boulevard and the north part of Q Avenue give a special identity to the Battelle campus. Those ordered ranks of trees and the verdure of the campus within stand in dramatic contrast to the high desert sagebrush lands in which Battelle is located. Although the Columbia River is only a quarter mile to the east of the campus, it is not immediately visible. Yet the river is such a dominant feature of the area that one is always conscious of its presence, and of the preciousness of the water it carries in this desert region. For these reasons, the verdure of the campus relates it directly to the river and identifies it as an outpost of the riverine environment in the surrounding desert.

The foresight of those who planted the trees on the campus at its foundation is to be commended. Their heritage is a strong and recognizable framework for subsequent improvements to campus landscaping. The rows and avenues of trees clearly describe the primary arrangement of the campus: its boundaries and principal streets. Collectively, they give a clear signature to the campus and suggest a hierarchy of lesser landscape features that extend expression of the arrangement of the campus at a lower order.

A specific landscape objective is, therefore, continuation of the avenue of trees flanking Q Avenue south of Battelle Boulevard to 4th Street. Another is to ensure that tree planting elsewhere on the campus does not conflict with or confuse the clarity of perimeter plantings; if secondary avenues are to be planted, then species with smaller canopies than the sycamore trees should be selected and contrasting branch forms and foliage should be considered.

The prevailing image of the campus at present is of mature trees in parkland; the stems and canopies of equally spaced sycamore trees being visible in their entirety above an open plain of green ground cover. Extensive shrub plantings would obscure this relationship and may also interfere with understandability of campus arrangement conferred by the simple avenues and perimeter plantings. Shrub plantings should thus be of low growing varieties or should be close to buildings. Shrubs should not be planted near the rows of sycamore trees.

In 1999, Murase Associates produced the Battelle Campus Landscape Master Plan. The goal was to identify opportunities to create a unified landscape image. Key recommendations from this report are:

- Maintain an urban, cultivated landscape character for core campus areas;
- Enhance streetscapes, including the development of a double row primary street tree pattern and development of a contrasting secondary street tree pattern;
- Create landscape buffers to screen unsightly views;
- Enhance pedestrian circulation routes;
- Develop gateways at key locations.

These recommendations should inform future landscape development on the Battelle campus.

ANTICIPATED FACILITY IMPROVEMENTS

LEGEND

APPROXIMATE BUILDING LOCATIONS

Program of Anticipated Facility Improvements

Computational and Analytical Sciences Building
The Computational and Analytical Sciences Building (CASB) will support a number of research functions across the campus, so should have good pedestrian access to the Biomolecular Systems Complex, PSL, LSL II, and Math as well as EMSL. The service yard for CASB will be grouped with EDL.CASB will have limited service needs compared to some research buildings.

Systems Biology Complex
Systems Biology Complex (SBC) may comprise multiple buildings, size to be determined, depending on the configuration and location of component operations. NMRs are likely to be used, so the building will be vibration sensitive and proximity to EMSL is essential.

Research Support Building
The Research Support Building (RSB) will be the primary destination for visitors as they arrive on campus. It will also be the location for a number of events and small to large conferences, often in association with the nearby Auditorium. It will be a central meeting place for those who work on campus, and will include meeting facilities, a cafeteria and a wellness center. People will walk here from all over the campus, so it will be centrally located in a landscape that favors walking over driving. There will, however, be short-term visitor parking and handicapped parking near the entrance. Service access will be via the existing depressed service drive along the north side of the ponds.

Recreation facilities focused on a ‘wellness ’program will be intended for everyone working in Battelle ’s owned and leased buildings. The facility will accommodate various Battelle activities including many which currently use the foyer of the Auditorium for lack of a more suitable venue. It is also planned to accommodate special management groups, technical societies, staff association events, visiting university science and engineering student events together with other organizations and civic groups that are in keeping with Battelle’s charter.

Past estimates suggest that the dining area should be large enough to feed about 500 persons during a two hour lunch period. It is to be equipped with full food service facilities including bakery and catering capabilities. The dining area will be configured so that parts of the space could be isolated for conferences, training sessions and special activities during non-meal times. Dedicated conference rooms and a large meeting room will also be provided. Recreation facilities, including locker rooms, showers and rooms for weight training, ærobics and other activities will be located in the basement. The size of each element clearly depends on the size of the population to be served. Battelle facilities in Seattle and Columbus provide useful models for comparison.

Engineering Research Laboratory
The Engineering Research Laboratory (ERL) has yet to be programmed and sited. One possibility is on the south side of Battelle Boulevard opposite RRC. Another would be north side of Horn Rapids opposite the EMSL building. It will consolidate and expand engineering research facilities from other locations into a single, state of the art facility.

300 Area Facilities Replacement
PNNL personnel and facilities will be displaced from their current accommodation to the north in the 300 Area, and will need a replacement facility close to the campus. An extension of Q Avenue north of Horn Rapids Road would access a site that is clear of easements along the north side of that street for utilities and a planned railroad spur to the Port of Benton.

Bio-Ag Building
A new Bio-Ag research facility is planned in collaboration with the Tri-Cities campus of WSU, on which the new building would be sited. Programs may also share PNNL facilities on the Battelle campus. No detailed programming has been undertaken, and no specific site for the research building has been identified. However, WSU has initiated the request to the state for capital funding for the project.

User Housing
It is envisioned that the existing user housing on the north side of Battelle Boulevard will eventually need to be supplemented. One option would be to expand the existing complex. Alternatively, depending on the timing of development, there may be preferable siting options, located closer to future facilities south of Battelle Boulevard. As the northwest quadrant of the campus is built out, sites along Battelle Boulevard will be sought after for research facilities that can benefit from high visibility, so the balance of undeveloped land between Battelle Boulevard and the ETB site should be reserved for these primary users, each of which will want room to expand in future.

Technology Transfer Facilities
When the 1994 campus master plan was developed, there was an expectation of heavy demand for technology transfer facilities on campus. Since then, the trend has changed to one of remote locations such as the APEL facility and Port of Benton for product development and manufacture. However, the concern remains that prime research sites on campus should not be occupied by technical transfer facilities. Consequently, sites at the south end of the campus are reserved for these users. In this location, unpredictable and sometimes heavy service traffic, together with outside storage and indifferent architecture will not disrupt the quality of the maturing research campus to the north.

Major Research and Development Facilities

This is a broad and somewhat indeterminate class of possible users. It includes facilities that Battelle may find it necessary to provide for its own use in the future; it also includes a variety of outside research and development entities which may find immediate proximity to other facilities on the campus beneficial. It may be assumed that Battelle will select potential candidates for consistency of pro- posed activities with the Battelle mission, on environmental compatibility, financial and other considerations. It may also be assumed that among these candidates, some will be considered by Battelle to be very positive assets to the campus community, and for these, as few obstacles to their accommodation as possible should exist. Since little can be anticipated about the specific needs of such facilities, only general criteria for their accommodation can be drawn:

- Sites should be large enough to accommodate a medium to large research facilities with space for future expansion.
- Quick and convenient access to the Research Support Campus, RRC and possibly EMSL on foot should be accommodated.
- Visibility may be important to certain users.
- Some research facilities may also have technology transfer aspects.

The campus has four major parcels of approximately twenty acres each that meet the above criteria to varying degrees and may suit different entities accordingly. The parcel south of Battelle Blvd bounded by Q Ave and George Washington has high visibility from George Washington Way and flanks the principal entrance to the campus. It will be important to ensure that any facility selected to occupy this site responds fully to considerations of orientation and design appropriate to its location and that high standards of execution are maintained, using quality building and landscape materials. The site immediately north of it is interrupted by the User Housing facility, so is less flexible but equally conspicuous. The other two high visibility parcels are on the south side of Battelle Boulevard.

Security

Since the establishment of RRC, security of intellectual and physical property at the Battelle campus has been enforced within buildings, so there has been no need for unsightly security fences or other paraphernalia. However, the security of facilities on campus remains a concern, and there are steps that can be taken in campus planning to enhance security. An example is the placement of proposed buildings to the west of EMSL, where they would encircle and group service yards around Einstein Avenue. This arrangement makes it possible to secure vulnerable facilities fairly easily and inconspicuously. It also accommodates sharing of facilities between research buildings, segregates service traffic from pedestrians and from other vehicular traffic, improving safety for all three, and screens service yards from view.

Design and Siting Criteria

The preceding section has examined in some detail the anticipated needs of different types of facility on the campus. The overall success of the master plan will depend on reconciling these needs with one-another and with broader objectives requiring coordination of circulation, landscape, service and parking access as well as the image of Battelle as communicated by the appearance of the campus as a whole.

Evident throughout the Recommendations sections of this master plan are criteria for sustainable design - from use of drought-tolerant plants, to orientation and configuration of buildings to minimize solar gain and exposure to cold winter winds, to awareness of life-cycle costs and energy entrainment in the selection of materials and systems. These 'green' values are advocated for sound economic reasons as well as for reasons of environmental responsibility. In addition to these, urban design standards and guidelines frame campus development so that the objectives described above can be realized progressively with each improvement. The evolving character of streets on campus, for example, is traced and projected into the future when the campus becomes more populous and competition for building sites becomes more acute. Specific set-backs are identified so that new buildings, existing tree lines, replacement plantings, traffic needs and a pedestrian friendly environment can all be accommodated without compromise. Adherence to these design and siting criteria will ensure consistency and quality in the maturing campus.

An overall form for the campus, which responds to identified needs, is one in which buildings are grouped together for ease of inter-communication and shared use of service yards; strong orientation towards Battelle Blvd and Q Avenue; parking arranged near the buildings served around the perimeter of the campus. The siting criteria that follow are intended to be responsive to the full range of responsibilities cited above.

- Facilities should be sited in locations consistent with their needs relative to others for proximity to specific facilities on the campus;
- Buildings should be located and oriented and sites landscaped to encourage trips between buildings to be made on foot. Pedestrians should be able to walk conveniently to the sidewalk from any building without passing parked vehicles;
- Buildings should occupy sites no larger than necessary to accommodate immediate needs and modest future expansion. If additional expansion becomes necessary it can be accommodated by consolidation or relocation of parking;
- The quality of design, materials and execution of all development fronting Battelle Blvd and Q Avenue should be uniformly high;
- Parking lots on adjacent sites should be interconnected for efficient accommodation of unusual peaks in demand;
- Driveways should be located for efficient circulation, maximum safety and minimum interference with pedestrian circulation.

APPENDIX

CITY PLANNING CONSIDERATIONS

Planning Context

The Battelle campus is situated within the jurisdiction of the City of Richland and is subject to policies adopted under Ordinance No.12-02 and contained in the City of Richland Comprehensive Plan. These policies are implemented through the City of Richland Zoning Ordinance, Title 23 of the city Code.

Horn Rapids Road marks the northern limit of the Richland Urban Planning Area. Land to the west of the campus between Stevens Drive and Horn Rapids Ditch is largely in Port of Benton and other public ownership. That entire area was the subject of the Horn Rapids Community Plan, which was prepared in 1981 to augment the Base Comprehensive Plan and is still recognized as relevant.

Legislation adopted by the State of Washington in 1990 requires development of specific urban growth management strategies. This instrument is largely concerned with expansions beyond existing urbanized areas and with the efficient use of land, infrastructure and other resources in general. No conflict is anticipated between this legislation and the recommendations contained in the master plan.

Proposals and recommendations made in this master plan appear to be entirely consistent with all relevant policies included in the adopted Comprehensive Plan.

Land Use and Zoning Regulations

In the spring of 2002, the City of Richland's Comprehensive Plan re-designated the entire campus as Business Research Park. Section 23.46.020 of the Zoning Ordinance regulates uses within Business Research Park Use District (B-RP). Under this section the following uses, among others, are permitted outright: general or corporate offices; research, development, and testing; and science related research, development and testing facilities. Other permitted uses include: administrative and office facilities to accommodate professional and technical staff; restaurants with on-site dining; retail and service uses intended to support essential uses; light manufacturing in conjunction with other primary or essential uses; and storage in enclosed building. The uses allowed by issuance of a special permit by the Planning Commission include extended stay type lodgings and dormitories; high density residential uses, and day-care centers and preschools.

The Zoning Ordinance stipulates performance standards that stipulate that: all uses shall be conducted entirely within enclosed buildings; on and off-site hazardous waste treatment and storage facilities shall be located a minimum of three hundred feet from surface water, residential zones and public gathering places; public pedestrian access around and through a site is encouraged and should include clearly marked travel pathways from the public street, through parking areas, to primary building entries; development of a trail system through landscaped areas is encouraged and should,

where possible, connect to trail systems on adjacent sites; and no more than ten percent of the total number of acres in the B-RP zone or within a specific business park shall be developed with commercial uses.

Section 23.46.050 of the Zoning Ordinance for minimum building requirements allows that there is no maximum or minimum lot area required for the uses anticipated in the campus master plan. The setback required for a public street is a minimum of twenty-five feet, and is to be landscaped. Maximum building height shall not exceed fifty feet in a B-RP district. Private communications facilities may exceed the height limitation. For minimum landscaping at least 30% of a site shall be landscaped. Landscaped areas may incorporate pedestrian amenities such as meandering pathways or trails, street furniture such as benches, public art features or similar features. Fences are not allowed any closer to the street right of way than the building setback requirement of twenty-five feet

The minimum on-site parking requirement in the Zoning Ordinance is based on 4 spaces per 1000 SF of building area. A ten percent reduction in parking spaces is permitted in respect of joint use parking lots. Parking lots are to be paved, lit, dimensioned and landscaped in conformance with stipulations contained in Sections 23.74.160 through 195. Perimeter landscaping of parking lots is generally required to be at least 10 feet wide along public streets and 5 feet wide along other boundaries. Interior landscaping for lots accommodating ten or more parking spaces is to cover at least five percent of the lot area. Specific planting criteria must be achieved.

Motorcycle parking is to be provided at the rate of one space per 25 required automobile spaces. A minimum of five bicycle parking spaces is to be provided. Bicycle facilities are to be lockable, accessible, paved and lit during normal business hours.

Transportation

Most vehicles arrive at the Battelle campus from Richland and further south via George Washington Way (GWW) or Stevens Drive, entering the campus via Battelle Boulevard. Some also use Horn Rapids Road (HRR), or enter directly from GWW at 10th Street. Battelle Boulevard and Q Avenue, the main campus streets, are private roads.

GWW is a five-lane road with a signal at its intersection with Battelle Boulevard, and a two-way stop at HRR, which is a two-lane road that gives access to Q Avenue and to Einstein Avenue. HRR's intersection with Stevens Drive is controlled by a stop sign.

Stevens Drive is a four to six lane divided highway. Currently its intersection with Battelle Boulevard is controlled by a stop sign, but a traffic signal is planned by the City of Richland for installation in 2003.This is the only access to the campus north of Fifth Street.

Battelle Boulevard is the most heavily used road on campus, used by vehicles accessing Port of Benton property to the east as well as Battelle campus users. It is paved with two lanes and shoulders with no curbs. Sidewalks are intermittent on the north side only. Q Avenue is also a paved, two lane private road. It has paved shoulders of varying width and no curbs. Sidewalks are set back behind the avenue of mature sycamores. Five striped crosswalks are located at principal footpath intersections. Traffic is light, except at the beginning and end of the workday, when parking lots fill and empty. Despite speed bumps, vehicles tend to exceed the posted speed limit, raising concerns for pedestrian safety.

Traffic Counts
City of Richland traffic counts indicate that Battelle Boulevard carries approximately 3,300 ADTs (average daily traffic) west of Q Avenue, and 2,000 ADT east of Q Avenue. HRR carries approximately 1,100 ADT between Stevens Drive and GWW. Recent counts mid way along Q Avenue were 900 ADT. All intersections to and within the campus, with the exception of Stevens Drive at Battelle Boulevard and HRR, appear to operate at acceptable levels of service.

Projected growth of employees on campus between 2000 and 2010 is 1,000,which suggests up to 2,770 additional trips each day. However, it is anticipated that Commuter Trip Reduction regulations will take effect in Benton County in the near future. Program goals are reduction in the number of single occupant vehicles (SOVs) and reduction of vehicle miles traveled (VMT) by employees. Prescribed reductions over base year figures are 15%after two years, 20%after four years,25%after six years, and 35%after twelve years. Benton County will appoint a CTR Coordinator to oversee administration of the rules.

Traffic Patterns
Most employees enter the campus via Battelle Boulevard, and about half use Q Avenue to access their parking lots, so it serves largely as a collector, not as a through street.